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THE GEODESIST'S HANDBOOK

1984

LE MANUEL DU GÉODÉSIEN

Editor
C. C. TSCHERNING

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GEODESIST'S HANDBOOK

SOMMAIRE

FOREWORD

The Executive Committee of the International Association of Geodesy has decided to publish after every General Assembly a special issue of Bulletin Géodésique devoted to a detailed description of the Association. The first *"Geodesist's Handbook–1980"* was published after the Canberra General Assembly in 1979. This is the *"Geodesist's Handbook – 1984".* It aims at providing all the practical informations on the Association, supplemented with information of importance for the international scientific cooperation.

The first part refers to the history of the Association and to its present place and activities within the International Union of Geodesy and Geophysics, Statutes and By–Laws. As the quadrennial General Assembly is a very important date in the administrative and scientific life of the Association, the second part of the book contains the reports of the last General Assembly which was held in Hamburg (F.R.G), *August 1983.* These reports deal with the activities during the preceding four–year period, with the decisions taken during the Assembly and their administrative and scientific consequences. The third part is mainly devoted to the review of the basic constituents of the Association, the Sections, the Commissions and the Special Study Groups, namely their structure and program of activities for the coming period 1983 – 1987. The important information on the Geodetic Reference System 1980 is reprinted from the 1980–edition of the Handbook and is found in the fourth part. Here is also included some new information of importance for the scientific cooperation, namely a list of major international and national data centers and scientific publication series.

Finally the Handbook contains information for contributors to the Bulletin Géodésique and – maybe most important – a list of adresses.

The Executive Committee has discussed whether to include other practical information such as adresses of geodetic research and educational institutions, or information on regional or national geodetic datums. This has not been included, since this information was not readily available, and it would be important to know whether the readers think such information would be useful.

The Handbook has been compiled by the Central Bureau of the Association. Here corrections, updates, suggestions and proposals for improvements of the Handbook should be sent.

C.C. Tscherning

AVANT – PROPOS

Le Comité Exécutif de l'Association Internationale de Géodésie a pris la décision de publier après chaque Assemblée Générale un numéro spécial du Bulletin Géodésique consacré à une description détaillée de l'Association. Le premier ***"Manuel du Géodésien – 1980"*** fut publié après l'Assemblée Générale de Canberra en 1979. Ceci est le ***"Manuel du Géodésien – 1984".*** Le but de cette publication est de fournir tous renseignements pratiques sur l'Association, et également toutes les informations concernant la coopération scientifique internationale.

La première partie traite de l'histoire de l'Association, de sa place actuelle et de ses activités au sein de l'Union Géodésique et Géophysique Internationale, de ses Statuts et de son Règlement Intérieur. L'Assemblée Générale étant une étape importante dans la vie scientifique et administrative de l'Association, la deuxième partie comprend les comptes rendus de la dernière Assemblée Générale qui s'est tenue à Hambourg (R.F.A.) en ***Août 1983.*** Ces comptes rendus se rapportent aux activités de la période quadriennale précédente, ainsi qu'aux décisions prises pendant l'Assemblée Générale et aux conséquences administratives et scientifiques qui en découlent. La troisième partie est principalement consacrée à la présentation des constituants de base de l'Association, les Sections, les Commissions et les Groupes Spéciaux d'Etudes, notamment leur structure et leur programme d'activités pour la période quadriennale 1983–1987. L'importante note sur le Système Géodésique de Référence 1980 a été reprise de l'édition 1980 et figure dans la quatrième partie de l'ouvrage. Dans cette partie on trouve également des renseignements liés à la coopération scientifique, notamment une liste des principaux centres de données internationaux et nationaux et des principales publications scientifiques régulières.

Enfin le Manuel contient des informations nécessaires aux auteurs d'articles pour le Bulletin Géodésique, et – peut–être le plus important – une liste d'adresses.

Le Comité Exécutif a aussi discuté de l'éventualité d'inclure d'autres informations pratiques telles que les adresses des instituts géodésiques de recherche et de formation, ou des informations sur les références géodésiques régionales ou nationales. Cela n'a pas été possible car ces informations n'étaient pas immédiatement disponibles ; il serait néanmoins important de savoir si les lecteurs pensent que de telles informations seraient utiles dans cet ouvrage.

Le Manuel du Géodésien a été préparé par le Bureau Central qui serait heureux de recevoir toutes corrections, mises à jour, suggestions et propositions afin d'en améliorer le contenu.

C.C. Tscherning

A NOTE ON THE HISTORY OF THE INTERNATIONAL ASSOCIATION OF GEODESY

Prof. P.–V. Angus–Leppan, President of I.A.G.

The International Association of Geodesy can trace its roots back to the early 19th century, a time of great progress in geodesy, when Bessel and Gauss made important contributions to the science. One of Bessel's pupils was J.J. Baeyer, who later became an officer of the Prussian General Staff. In 1861 General Baeyer wrote a report suggesting that the states of Europe should work together on the measurement of the size and shape of the earth and proposing methods to achieve this aim. The King of Prussia accepted the report and invited the countries concerned to subscribe to the plan.

By 1862 the following countries had agreed to participate : Denmark, Saxe–Gotha, the Netherlands, Russia (for Poland), Switzerland, Baden, Saxony, Italy, Austria, Sweden, Norway, Bavaria, Mecklenburg, Hanover and Belgium (15).

The first ***International Geodetic Conference*** met at Berlin in 1864. The conference set up a structure and made decisions whose influence is still to be seen in the I.A.G. statutes of today. The conference established two powerful bodies, the ***Permanent Commission*** and the ***Central Bureau.*** The Permanent Commission was to be the "supreme, standing scientific agency of the international geodetic association". The Central Bureau, the executive agency of the Permanent Commission, was to receive reports each year from member states on the results of the work as well as proposals for new projects, and to submit them to the Permanent Commission "for evaluation and approval". The Central Bureau was to compile the individual reports into a single general report, and to perform the work and conduct the negotiations to achieve uniformity in geodetic and astronomical measurements. The Conference also made a number of scientific recommendations, amongst others, measures to establish Bessel's toise as the fundamental length standard and to encourage measurement of levelling networks with properly determined datum points. A ***Permanent Committee*** of seven members was appointed.

The Central Bureau was set up in 1866 at the expense of the Prussian state, within the Geodetic Institute at Berlin. General Baeyer, Director of the Institute, was also appointed Director of the Bureau. In 1867, at the Second General Conference, the association's name, previously ***Mitteleuropäische Gradmessung,*** was changed to ***Europäische Gradmessung,*** with the acceptance of Spain and Portugal as members. This Conference also dealt with weights and measures, recommending the adoption of the metric system and the establishment of an international bureau of weights and measures. [General Baeyers' death in 1885 marked the end of an era. His successor was the geodesist Dr. F.R. Helmert. There had been many changes since 1862. The German states had come together under the German Empire, while in the association the expenses of the Central Bureau were constantly increasing and the number of member states was

growing. A new convention was drawn up, signed by 20 European states, to come into force for ten years from the beginning of 1887. The Central Bureau was to be supported by contributions from the member states. The convention conferred intergovernmental status on the association.]

The Eleventh General Conference held in Berlin in 1895 drew up a new ***International Geodetic Convention.*** By this time other countries had joined, in particular the United States and Japan. Under the convention the Central Bureau was retained, still attached to the Geodetic Institute at Berlin, and the contributions for its support were increased . The Permanent Commission was abolished, replaced by a more representative ***General Conference.*** According to the convention the "supreme body of the Geodetic Association shall be the General Conference of the delegates of the Governments concerned."

The text of the convention was ratified by 21 member countries at the General Conference in Stuttgart in 1898. In 1907 it was extended for a further ten years. The 50th anniversary of the association was celebrated at the Seventeenth General Conference held in Hamburg in 1912. The scientific work of the association continued to be summarized in the reports of the Director of the Central Bureau. It is interesting to see the list of some of the topics reported on by Helmert in the report submitted to the 1912 conference.

– scientific research, theoretical (Helmert, Bruns, Villarceau).

– scientific publications including a bibliography of geodesy (Börsch).

– coordination of geodetic triangulation, particularly scientific arc measurements.

– coordinating determinations of the deviation of the vertical in Europe.

– variations in the axis of rotation of the earth, and the International Latitude Service.

– gravity measurements, the first world gravity network, and measurements at sea.

Only two years later, in 1914, World War I broke out and halted the scientific cooperation among geodesists. Of the signatories of the convention, only seven remained neutral. These were dark years for geodesy.

Although the convention extended to the end of 1916, war had been raging for eighteen months, by then, and scientific relations had been severed. Many officers of the association had died, including the President Général Bassot of France, in 1917 ; the Vice–President Sir George Darwin (Britain) in 1912 and his successor O. Backlund (Russia) in 1916 ; and Helmert, who had been Director of the Central Bureau since 1885, in 1917.

It is remarkable that the association managed to survive and it did so mainly through the efforts of two geodesists from neutral nations : R. Gautier of Switzerland and H.G. van de Sande Bakhuyzen of the Netherlands, who had been secretary of the association since 1900. After consultation between the seven neutral members, the ***Reduced Geodetic Association among Neutral Nations*** was established, with Gautier as President and van de Sande Bakhuyzen as Secretary.

The Reduced Association aimed to continue the work of the old association and to prepare for its reestablishment after the war. The permanent tasks such as the International Latitude Service were continued and some scientific work was pursued.

One of the arrangements of the Reduced Association was to keep up contact with the Central Bureau, still housed with the Geodetic Institute of Prussia, now in Potsdam. The Bureau continued to operate at a reduced level.

Some of the belligerents opposing Germany took exception to this arrangement, and set out, in 1918, to establish a new international geodetic association. C. Lallemand sent to the delegates of all countries of the Entente a draft convention for a new association, along with a letter complaining vehemently against the continued connection between the Reduced Association and the Central Bureau behind a "neutral façade". Gautier responded in reasoned fashion, arguing against the exclusion of Germany, Austria and their allies.

However at the conferences in 1918 and 1920 which led to the creation of International Scientific Unions, no one listened to Gautier, or even consulted the Reduced Geodetic Association. Severe obstacles were erected against the membership of Germany and her allies, that delayed their admission for many years.

The concept of closer international cooperation of scientific bodies had been discussed before World War I. Even before the war had ended a series of conferences was held, culminating in the Constitutive Assembly of the International Research Council in Brussels in 1919. This set up the Council and a number of constituent international scientific unions. Besides the ***International Union of Geodesy and Geophysics*** (IUGG) there were Unions covering astronomy, chemistry, physics, radio science, biology, mathematics and others. For each of these unions, every member country was to set up a National Committee.

In the IUGG, Geodesy was one of six sections. An interim Bureau was set up, to hold office until the first General Assembly, which was set for April 1922, in Rome. A seventh section, hydrology, was added at that Assembly. The Geodesy Section also made amends for the unjustified accusations made previously against the Reduced Association. Gautier was elected Vice–President and in this position was able successfully to transfer the assets and operations of the Reduced Association to the new Geodesy Section.

The initial statutes, adopted for the twelve years 1919–1931, had stipulated that only Allied and neutral nations could join the International Research Council or its Unions. In 1926 these membership restrictions were lifted, but serious damage had already been done : Germany only applied for admission to IUGG in 1937.

The new statutes which came into force after 1931 changed the name of the International Research Council to the ***International Council of Scientific Unions*** (ICSU). Within the IUGG, the sections became Associations. By 1936 the Association of Geodesy and others were commonly referred to as International Associations, but this was not formally ratified until new Union statutes were adopted in 1946. Since then our association has been, officially, the ***International Association of Geodesy,*** I.A.G. (Association Internationale de Géodésie, A.I.G.).

The structure of the Geodesy Section of the IUGG which emerged after the General Assembly in Rome in 1922, had many features similar to the I.A.G. structure of today. The Secretariat was instructed to prepare a set of statutes to present to the next General Assembly in Madrid in 1924. In the pre–war Geodetic Association, the scientific activities had centred on one agency, the Prussian Geodetic Institute, and on one person, its Director. The new organization, though its administration and coordination was handled by a central secretariat, was to have its scientific activities decentralized. The

Scientific Commissions were composed of delegates from member countries ; they elected their own presidents.

The 1924 Statutes set up the following structure :

– the Bureau, comprising the President, Vice–President and Secretary (as at present).

– the Secretariat, responsible for the office administration, correspondence, arrangements for meetings.

– the Executive Committee, more or less in the form of the present Executive.

– the Scientific Commissions (now replaced by Special Study Groups and Commissions, whose functions are described below).

– the Permanent Commission comprising one delegate from each member country (in the present structure called the Council).

– the General Assembly, comprising all delegates from member countries ; it was given important powers of voting on finance on elections, and on scientific activities.

During the General Assemblies there were three types of presentation : General Reports on matters of wide interest, which now would perhaps be covered by Commissions ; National Reports, to be published later in the Travaux (Proceedings) ; and scientific papers by individuals.

The role of the Section, later the Association of Geodesy had changed from the pre–World War I period. The original concept was that of a central office directing and coordinating geodetic projects through a quasi–governmental association. Since 1922 the role has been to promote projects rather than direct them and to ensure good communications between geodesists of different nations.

Activities of the organization between 1922 and 1939 included publishing the ***Bulletin Géodésique*** regularly, as well as ***General Reports, National Reports*** and an ***International Bibliography of Geodesy.*** Important advances were made in the scientific sphere. Field work encouraged by the I.A.G. included geodetic connections between countries, and continental and intercontinental geodetic chains. Hayford's spheroid, the first international reference surface was adopted in Madrid in 1924. There were advances, theoretical and practical, in physical geodesy. **Buchwaldt** pointed out the importance of Stokes ' theorem, enabling the shape of the earth to be determined from gravity. Methods for measuring gravity at sea were developed by **Vening Meinesz**, gravimeters made their appearance, and isostatic theory was developed. Simultaneously, **de Graaff–Hunter** and **Vening Meinesz** developed expressions for deflections of the vertical in terms of gravity anomalies.

All this activity was again interrupted by war. The I.A.G. was perhaps more fortunate this time, as the Seventh General Assembly of IUGG was convening in Washington when World War II broke out. Many of those attending had to return home in haste, but the Association was able to make one important decision, namely to extend the term of the President for the duration of the war. The Bureau members were **F. Vening–Meinesz** (Netherlands), President ; **W.D. Lambert** (U.S.), Vice President ; and **G. Perrier** (France), Secretary. Activity was restricted during the war, but publications, notably the Bulletin Géodésique, were continued.

After the war an Extraordinary General Assembly of the Union was called in July 1946, to consider new statutes and by–laws. These were ratified at the first full

General Assembly in Oslo in 1948. The IUGG and the I.A.G. have separate sets of Statutes and By–Laws, but they have always been consistent, and similar in structure. The statutes and by–laws were further amended at the General Assembly in Brussels in 1951. They set out the composition and functions of the ***Bureau,*** the ***Executive Committee,*** the ***Council*** (the new name by which the former Permanent Commission was to be known) and the ***General Assembly.*** A new provision was to limit the term of office–bearers to one period between Assemblies. Between 1920 and 1946 the Association had only two office–bearers in each of its main offices. There were only two presidents, for example : W. Bowie (U.S.) from 1920 to 1933 and F.A. Vening–Meinesz (Netherlands) from 1933–1946. Since 1948, the terms of presidents and other officers have been limited to one period of three or four years, from one General Assembly to the next.

There were some minor organizational changes :

– the name of the Secretariat was changed to the ***Central Bureau.*** This is an unfortunate name as it can be confused with the Bureau. The Central Bureau is the Secretariat, serving particularly the Bureau and the Executive Committee.

– the ***Executive Committee*** was enlarged and given greater responsibilities, relating to the organization and the scientific activities of the Association.

– the Permanent Commission was renamed the ***Council.*** This body still comprised one delegate per member country, and was given special tasks in relation to administrative and financial questions.

– the ***General Assembly,*** comprising all delegates from member countries, retained its important voting powers.

A major innovation of the By–Laws was to divide the scientific activities of the I.A.G. into five ***Sections.*** Each Section covered a defined part of geodesy. In 1952 the Section titles were : Triangulation, Precise levelling, Geodetic astronomy, Gravimetry and Study of the geoid. The aim was to focus on the main interests of geodesy and with the number of participating geodesists constantly on the increase, to bring together those who shared special interests. Each Section has a President and two or more Secretaries. The Section Presidents are members of the Executive and the Secretaries may attend the meetings "with voice but without vote."

Within a Section there are normally several Commissions and Special Study Groups (SSGs). Commissions are established to cover broad general topics, which will be the subject of activity for an extended period, while SSGs are formed to study specific scientific topics of current interest. They exist normally for only one or at most two four–year periods.

In 1971 at the General Assembly in Moscow, the statutes and by–laws were revised and new definitions of the Sections drawn up to reflect the changing scope of activities. Again, in 1983, the statutes and by–laws, after a long and careful review, were again modified.

The most significant change in 1983 was a shift in responsibility from the General Assembly to the Council, which now has important voting, elective and financial powers. This change stemmed from a desire to ensure that all countries have equitable voting rights on important issues. Under the earlier rules it was conceivable that the wishes of the majority of countries could be frustrated in the General Assembly by a large block of voters from a single country.

The I.A.G. has seen an ever–increasing volume of scientific activity and innovation in the years since 1945. Particularly since the advent of earth satellites the pace of progress has increased . This progress has been aided by the tremendous advances in technology and in computers. To give an example, satellites have yielded a model of the earth's gravity field of unprecedented precision and detail. The remarkable precision in position fixing has created a new relationship between geodesist and geophysicist, in which the geodetic observations are of prime importance in geodynamic interpretations. Theory has not been neglected and remarkable progress has been made in a number of theoretical areas such as mathematical methods, collocation, gravity field models and statistical methods.

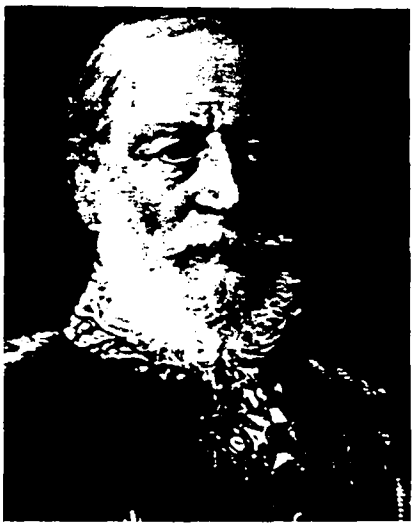
In this brief note it is not possible to summarize the scientific achievements of modern geodesy. What is of significance is to note that the I.A.G. is aware of the tempo of progress and is constantly adapting to reflect the current needs. Mention has already been made of new statutes and by–laws in 1952, then 1971, then 1983. Provision has already been made for the next Cassinis Committee, named after the I.A.G. President of 1957–1960, to sit in 1987–1991 and to report on further changes in 1991. Not only this, but the SSGs, the "cutting edge of geodetic science", are reviewed and renewed every four years, so that they can fulfil precisely the current needs.

This historical note has been summarized from a more detailed account written by J.J. Levallois, who was Secretary General of the Association from 1960 to 1975. Readers are referred to this account, which is available in the ***Geodesist's Handbook of 1980*** (pp. 249–313). For details of the current structure and activities of the Association, readers are referred to the contents of this Handbook which includes lists of officers, as well as lists and descriptions of Sections, Commissions and Special Study Groups. It is over 120 years since the association of geodesy was first established. The association has known successes and setbacks in its time, but has always remained steadfast in its objectives of fostering the science of geodesy and the dissemination of information on geodesy. The key role of the I.A.G. is in bringing together geodesists from all countries, from east and west, from undeveloped and developed countries. The friendly atmosphere of a geodetic meeting, whether a full General Assembly or a small symposium, and the sharing scientific interests, lead to mutual respect and enduring friendship. These relationships and the fruitful exchanges of ideas which they create are powerful forces for progress in geodesy.

PAST OFFICERS
OF THE INTERNATIONAL ASSOCIATION OF GEODESY

1. Presidents.

– Johann Jakob BAEYER, Lieutenant–general (1794–1885).



Director of the *Central Bureau* and *President* of the *Permanent Commission* of the "Europäische Gradmessung" (1867–1885).

. born on 05.11.1794, in Müggelheim (near Berlin), Prussia.
. died on 11.09.1885, in Berlin, Germany.

Baeyer in his early youth became enthusiastic for the ideas of the War of Liberation and joined the Prussian army in 1813, where he did service till 1857 finally as Lieutenant–general and member of the Prussian General Staff. In this career he became aquainted with the importance of surveying and cartography and devoted his life–work to fundamental geodetic studies. Under his leadership triangulations and arc measurements of high quality were performed, the most famous of them became the Eastern Prussian arc measurement 1831 – 1836 together with Bessel, the trigonometric levelling suggested by A.v. Humboldt between the Baltic Sea and Berlin 1835 and the baseline measurements near Berlin (1846) and Bonn (1847)

In 1861 Baeyer submitted the Prussian Ministry of war a study entitled "Entwurf zu einer mitteleuropäischen Gradmessung", in which he pointed out the scientific benefits of an official cooperation among states of Central Europe to study the shape of the Earth. At the same time he presented his scientific study "Über die Grösse und Figur der Erde".

In 1864 as a result of Baeyer's proposal the first international Geodetic Conference met in Berlin and founded an international organization named ***"Mitteleuropäische Gradmessung"*** with a ***Permanent Commission*** and a ***Central Bureau,*** which was set up 1866 with Baeyer as director. In 1867 the scientific organization was enlarged to the ***Europäische Gradmessung,*** the predecessor of the present International Association of Geodesy. When 1870 the Prussian Geodetic Institute officially was set up it was Baeyer's merit and he was its director till he died in 1885. In 1865 Baeyer was appointed honorary member of the Berlin Academy of Sciences.

-- Friedrich Robert HELMERT, Prof. Dr. phil. Dr. Ing. E.h. (1843–1917).

Director of the *Central Bureau* of the "Europäische Gradmessung" (1886--1887) and of the "Internationale Erdmessung" (1887–1917).

. born on 31.07.1843 , in Freiberg (Saxony).

. died on 15.06.1917 , in Potsdam (Germany).

Helmert studied Surveying at Dresden and later Mathematics and Physics at Leipzig and graduated 1868 with the thesis "Studien über rationelle Vermessungen im Gebiet der höheren Geodäsie". 1863 – 1866 he took part in the Saxon first--order--triangulation under Nagel and 1869 – 1870 he was Observator at the Hamburg Observatory. 1870 – 1886 Helmert held a chair at the Technische Hochschule Aachen and was appointed Professor in 1872. Even then he wrote the famous books "Die mathematischen und physikalischen Theorien der höheren Geodäsie".

In 1886, after the death of J.J. Baeyer, Helmert was appointed director of the Geodetic Institute Potsdam as well as director of ***the Central Bureau of the "Europäische Gradmessung",*** from 1887 ***"Internationale Erdmessung",*** the predecessor of the present International Association of Geodesy. From 1887 he held the chair of "Höhere Geodäsie" at the Berlin University and in 1900 he was appointed Member of the Berlin Academy of Sciences.

During the three decades at Potsdam Helmert performed together with other eminent scientists like Albrecht, Bruns, Galle, Hecker, Kühnen, Wanach, theoretical and empirical research work of lasting importance in a wide field of Geodesy in close connection with Geophysics and Astronomy : triangulations, deflection of the vertical, arc measurements, Earth rotation and polar motion, gravity and tides, studies on isostasy. Under his leadership Kühnen and Furtwängler performed 1900 – 1906 absolute gravity measurements of highest precision which became the base of the first gravity world net with the reference point at the Geodetic Institute Potsdam.

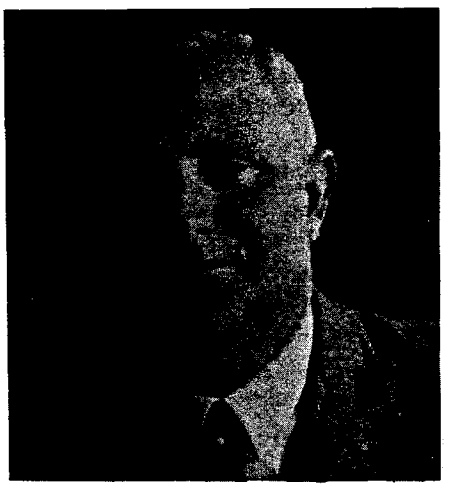
– William BOWIE (1872–1940).

President of the *Section Geodesy* of the IUGG (1920 – 1933).
President of the *International Union of Geodesy and Geophysics* (1933 – 1936).

W. Bowie was born May 6, 1872, near Annapolis, Maryland, died August 28, 1940 at Washington, D.C., and was buried in Arlington National Cemetery. He entered the U.S. Coast and Geodetic Survey in 1895 and served as its Chief of the Division of Geodesy from 1909 to his retirement at the end of 1936.

In 1913 he persuaded the geodetic agencies of Canada and Mexico to join the United States in establishing a continental network for mapping – the North American Datum. A few years later, this network was readjusted to form the North American Datum of 1927. Bowie had been a delegate to the 1912 Hamburg IGA Assembly, had followed closely the work of the Reduced Association and took an active role in the formation of IUGG and I.A.G. Also, in 1919, he was one of the leaders in the United States to bring together the seven major disciplines of geophysics to form the American Geophysical Union, very comparable to IUGG. Bowie was elected to the U.S. National Academy of Sciences in 1927. Among other honors he received were ScD's from Trinity College (his alma mater) 1919, Lehigh University, 1922; George Washington University, 1937, and Doctor of Laws, University of Edinburgh, 1936. In 1939, the AGU awarded him the first William Bowie Medal, which continues to be the AGU's highest annual award.

– Felix Andries VENING MEINESZ, Prof. dr. ir. (1887–1966).

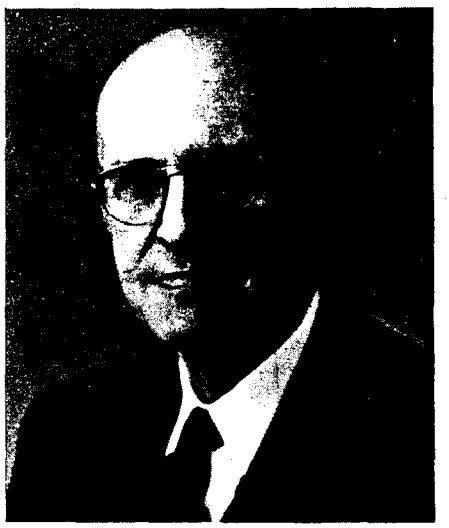


President of the *International Association of Geodesy* (1933–1946).
President of the *International Union of Geodesy and Geophysics* (1948–1951).
Professor of Geodesy and Geophysics at the University of Utrecht (1927–1957).
Professor of Physical Geodesy at the Technological University of Delft (1938–1957).

Felix Andries Vening Meinesz was educated in Amsterdam (his father was mayor of this town) and at the Delft University of Technology. Requested by the Netherlands Geodetic Commission he made a gravity survey of the Netherlands from

1911–1920. He developed a method for making accurate pendulum measurements on the mobile ground in the western and northern parts of his country. Thereafter he developed a method for making accurate gravity measurements at sea, in a submarine, based on the principle of a fictitious pendulum as the difference of the angular displacements of a pair of pendulums, swinging in the same plane. From 1923–1938 he made eleven submarine expeditions covering more than 120 000 miles. Through the results the application of Stokes' theorem (1849) for determining the geoid from gravity became possible at sea and in coastal regions. Strongly connected with these instrumental inventions and applications Vening Meinesz made fundamental theoretical investigations, both in geodesy and in geophysics. His formulae expressing the deflections of the plumbline in gravity anomalies (derived from Stokes' theorem) and his theories about the isostatic equilibrium of the earth's crust and of convection currents in the mantle of the earth are known worldwide.

– Walter Davis LAMBERT (1879–1968).



Vice–President of the *International Association of Geodesy* (1933–1946).
President of the *International Association of Geodesy* (1946–1951).

W.D. Lambert was born January 12, 1879, in New Brighton, New York, died October 27, 1968, in Washington, D.C., and is buried in Salisbury, Connecticut. Following his graduation from Harvard University in 1900, with highest honors in mathematics, magna cum laude, he continued graduate study at Harvard (MA–1901), taught at Purdue University, 1901–1902, at University of Maine, 1902–1904 and entered the U.S. Coast and Geodetic Survey in 1904 where he remained until his retirement in 1949. Lambert served I.A.G. in many capacities, scientifically and administratively. A unique record is his 30–years as "International Reporter for Earth Tides", 1924–1954. In 1949 he was honored by election to the U.S. National Academy of Sciences and was awarded the William Bowie Medal by the American Geophysical Union. In 1950 he was invited by Prof. Heiskanen, the Director of the Institute of Geodesy at the Ohio State University, to join their research group. This fortunate association continued for several years. In 1957, OSU conferred on Lambert the degree of Doctor of Science.

– Carl Fridolin BAESCHLIN (1881–1961).

President of the *International Association of Geodesy* (1951–1954).

Professor C.F. Baeschlin, citizen of Schaffhausen and Glarus, was born on 5th August 1881 in Glarus, Switzerland. Already at the age of 26 he was given, as an engineer of the Federal Office of Topography, the extraordinary task to lay out the Lötschberg railway tunnel, since after a terrible break–in of water and mud the straight line of the tunnel had to be abandoned. 1908 he was elected Professor of the Swiss Federal Institute of Technology, where he taught until 1947 many hundreds of civil engineers and surveyors in geodesy and topography and where he was also rector from 1935 to 1939.

1912 he was appointed member of the Swiss Geodetic Commission, which he presided in the years 1932 – 1958. After that long period he was elected honorary president of the Commission.

He accomplished an important scientific work and, in addition, was personnally engaged in the integration of the world–wide geodetic community. Especially after World War II, at the meeting of the Permanent Commission of the I.A.G. in 1946, his voice of a citizen of a neutral country was of great importance. He then was elected Vice–President of the I.A.G. At the General Assembly 1951 in Brussels he was an engaged promotor of the adoption of the Federal Republic of Germany as a member of the IUGG. In the period from 1951 to 1954 (General Assembly in Rome) he acted as President of the I.A.G. He died on 6th December 1961 in Zollikon, near Zürich.

– James de GRAAFF–HUNTER (1882–1967).

President of the *International Association of Geodesy* (1954–1957).

J. de Graaff–Hunter, CIE, ScD, FRS took first class honours at the University of Cambridge both in Mathematics in 1903 (12th Wrangler) and in Mechanical Sciences in 1904. He then became private secretary and scientific assistant to Lord Kelvin and in 1907 was appointed Mathematical Adviser to the Survey of India.

His early work in India was concerned with atmospheric refraction and geodetic computation. After two years of military service in World War I as a captain, surveying in Mesopotamia and Western Persia, he

returned to India where he constructed the first chart of the geoid in India in 1922, using astro–geodetic observations. He was also concerned with field–work, constructing *inter–alia* an analogue computing device for assessing the strength of triangulation figures, and the "Hunter shutter", an impersonal device for field astronomical observations for time. In 1928 he was promoted Director of the Geodetic Branch of the Survey of India.

On retirement in 1932 he worked on Stokes' theorem and its practical application. During World War II he returned to India where he was Assistant Surveyor–General and Director of War Research, retiring for a second time in 1946. His final years were spent in further study of the most suitable form of gravity reduction for determining the irregularities of the geoid, devising the "de Graaff–Hunter Model Earth".

– Gino **CASSINIS** (1885–1964).

Gino Cassinis a été ***Président*** de ***l'Association Internationale de Géodésie,*** 1957–1960, après avoir toujours joué un rôle d'une extrême importance dans l'Association depuis 1922. Né à Milan le 27 janvier 1885, il est mort le 13 janvier 1964 à Rome.

Il était Professeur à l'Ecole Polytechnique de Milan depuis 1932, puis Recteur de 1944 à 1960. Président de la Commission Géodésique Italienne depuis 1940, Membre du Conseil Supérieur de l'Instruction de la République Italienne de 1945 à 1954, du Conseil National des Recherches depuis 1927, du Conseil Supérieur des Travaux Publics de de 1954 à 1957, Gino Cassinis avait été élu Membre de l'Académie Nationale dei Lincei en 1936. Il en a été pendant trois ans le Président assidu et dévoué. Il était aussi President de la Commission Italienne de Métrologie ; Membre du Comité International des Poids et Mesures depuis 1946, comme représentant de l'Italie, Secrétaire en 1952 ; Membre ou correspondant de très nombreuses Académies, soit dans son propre pays, soit dans le monde entier, il avait été élu le 13 juin 1955 correspondant de l'Académie des Sciences de l'Institut de France pour les Divisions des Académiciens libres et des Applications de la Science à l'Industrie. Dans le même temps il était aussi Adjoint au Maire de Milan depuis 1931, et Maire depuis 1961. Tout cela a été possible grâce à son jugement clair et son exceptionnelle connaissance des hommes : toutes qualités essentielles dans la direction de toutes les organisations possibles, qu'elles soient nationales, municipales ou internationales.

Ses études personnelles ont porté depuis 1907, sur tous les domaines de la Géodésie, de la Topographie, du Calcul numérique, de la Métrologie et de la Photogrammétrie.

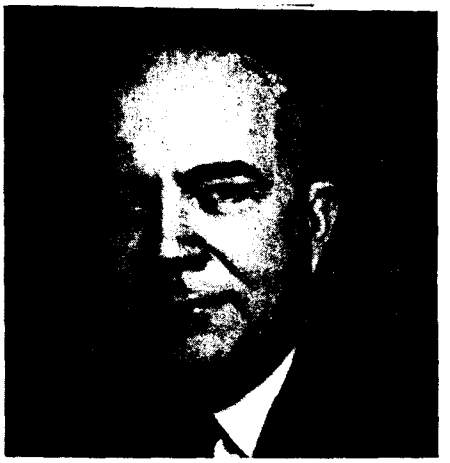
En Géodésie, le nom de Gino Cassinis reste indissolublement lié aux progrès considérables réalisés en Gravimétrie, qu'il s'agisse de Gravimétrie théorique ou de mesures expérimentales. La formule internationale dite de la pesanteur normale, adoptée par l'Association Internationale de Géodésie en 1931, est en grande partie son oeuvre. Et les tables d'application de cette formule sont et restent "les tables de Cassinis". Son oeuvre expérimentale n'est pas moins importante, qu'il s'agisse de nombreuses déterminations

relatives auxquelles il a procédé lui–même, ou des croisières gravimétriques en sous–marin dans le bassin de la Méditerranée qu'il a dirigées en 1931 et en 1935.

Son esprit essentiellement pratique l'avait directement amené à s'intéresser à réglementer et à discipliner le Calcul numérique : son oeuvre est importante et durable, ses études et ses leçons sur les Calculs numériques sont condensées dans un Traité qui fait autorité.

Très important était aussi son rôle dans la Photogrammétrie aérienne, où il fut Président de la Société Internationale de Photogrammétrie de 1934 à 1938, et où son influence est demeurée considérable jusqu'au bout. A partir de 1923, ses articles scientifiques théoriques et expérimentaux alternèrent avec une oeuvre fervente de propagande, de divulgation, d'appui en faveur de la photogrammétrie et de ses pionniers. Mais tout autant que le Savant, c'était l'Homme et le Chef qui étaient remarquables en Gino Cassinis, Chef à l'autorité d'autant plus incontestée qu'elle était plus souriante et bienveillante. Tout autant que l' "esprit de géométrie", il possédait au plus haut point cet "esprit de finesse" que Pascal plaçait si haut.

– Charles A. WHITTEN



President of the *International Association of Geodesy* (1960–1963).

Dr. Charles A. Whitten was born in Redfield, South Dakota, U.S.A., and graduated from Carthage College, Illinois in 1930. He then began his long career with the U.S. Coast and Geodetic Survey (USC & GS), predecessor of the National Ocean Service, a component of the National Oceanic and Atmospheric Administration. He served in various positions within USC & GS including Chief, Triangulation Branch and Chief Geodesist. He has been recognized for his worldwide leadership in geodesy, especially for advancing new concepts to improve understanding of crustal motion. His methods for analyzing precise geodetic measurements have made significant contributions to the investigation of large–scale seismic mechanisms.

Dr. Whitten has been active in the International Organizations, serving as President of the International Association of Geodesy from 1960 to 1963 and on the Finance Committee of the International Union of Geodesy and Geophysics from 1963 to 1979. He has also been a member of the American Geophysical Union (AGU) since 1934, serving as the President of the Section of Geodesy from 1965 to 1967 and as General Secretary of AGU from 1967 to 1974. For his work within the U.S. Department of Commerce, he was awarded the Department's Silver Medal in 1949 and Gold Medal in 1972. He has also received honorary Sc.D.'s from Carthage College, 1965, and the University of New Brunswick, 1974. The University of Karlsruhe conferred an honorary Doctor of Engineering on him in 1975. Other honors include the first Levallois Medal of the I.A.G. in 1979 and the William Bowie Medal of the AGU in 1980. His many scientific writings and positions of leadership in major national and international geodetic organizations have brought to a sharp focus the interdependency of all the earth sciences.

– Guy BOMFORD

President of the *International Association of Geodesy* (1963–1967).

G. Bomford was born in 1898, the younger son of Sir Gerald Bomford, KCIE, Surgeon General of the Indian Medical Service.

He was educated at Marlborough College and the Royal Military Academy, Woolwich from which he was commissioned into the Royal Engineers in 1917. He served in World War I and later went to Queens' College, Cambridge. He joined the Survey of India in 1921, gravitating towards the Geodetic Branch where he worked with Dr. James de Graaf – Hunter, FRS. He contributed to the Annual Geodetic Reports from 1926–1939 and was the author of several of the Survey's Professional Papers, including a "Readjustment of the Indian Triangulation", published in 1939.

During the 2nd World War he served with the 14th Army in Burma becoming Director of Survey for South East Asia Command and rising to the rank of Brigadier.

He retired from the Army after the war and was appointed Reader in Surveying and Geodesy at the University of Oxford in 1948, where he became a Doctor of Science in 1953. Here he stayed until retirement in 1966. The period from 1948–1980 saw the production of the 4 editions of "Geodesy", each substantially re–written as the subject rapidly evolved. He was particularly interested in the geoid, published many papers on it, became President of Section V of the I.A.G. in 1951 and then President of the I.A.G. 1963–1967.

– Antonio MARUSSI (1908–1984).

President of the *International Association of Geodesy* (1967–1971).

Born in Trieste 12 oct. 1908, died 26.04.1984. Doctor degree in Mathematics at the University of Bologna in 1932, has begun his scientific career at the Geophysical Institute of Trieste, for passing very soon at the Istituto Geografico Militare as Geographical Engineer. Here started his geodetic interest, from the big geodetic and astro - geodetic surveys (in Italy and in Ethiopia, Albania and Greece) to the solution of the main theoretical geodetic problems. Full professor of Geodesy at the University of Trieste from 1951, created in the Faculty

of Science the Istituto di Geodesia e Geofisica, which became soon the best geodetic school in Italy, well known also abroad. His main contribution was in the field of physical geodesy, where he introduced the "intrinsic geodesy", free from the conventional reference systems and based only on the geometric and mechanical quantities having physical reality and therefore accessible at least in principle to be observed.

Other important contributions are pertinent to the extension to the third dimension of the classical principles of Mathematical Cartography. He studied the structure of a microgravitational field as existing in the interior of a spatial vehicle considering its eventual rotation, and has made application to the case of a gravitationally stabilized satellite. Application has been made to the "thetered satellite" proposed for the study of the microgravity field.

In the experimental field, he created the well known Earth Tide Station at Grotta Gigante, near Trieste, designed and constructed tiltmeters and also, in collaboration with the National Physical Laboratory of Teddington and the Cavendish Laboratory of the Cambridge University, U.K., conceived and constructed an apparatus for the measurement of the gravitational constant and organized and led some relevant Italian geo–expeditions to Karakorum and Hindu Kush.

– Youri Dimitri BOULANGER

President of the *International Association of Geodesy* (1971–1975).

Born in 1911, Prof. Y.D. Boulanger is corresponding Member of U.S.S.R. Academy of Sciences, Professor and Head of Gravimetric and Geodetic Departments of Institute of Physics of the Earth of the Academy of Sciences, President of Astrogeodetic Society of U.S.S.R. for many years. He has established fundamental gravity networks covering whole territory of U.S.S.R. and their intercontinental gravity connections; he inspired for years activity of I.A.G. in absolute and relative fundamental gravity observations on world–wide scale. He initiated establishment and was vice – president of Permanent International Commission on Earth Tides and also initiator, vice--president and president 1971–1983 of Commission on Recent Crustal Movements.

– Tauno J. KUKKAMÄKI

President of the *International Association of Geodesy* (1975–1979).

Born October 11, 1909 in Heinola, Finland. Studied mathematics, physics, and astronomy at Turku University. Doctoral dissertation 1933 on Väisälä interference method. Since 1935 in Finnish Geodetic Institute, 1963--1976 its Director.

Main research areas : establishment of standard base lines (Argentina 1953, Holland 1957, U.S.A. 1966), spatial triangulation, precision leveling (well–known Kukkamäki formulas on leveling refraction), Fennoscandian land uplift. Leader of solar eclipse expeditions to Gold Coast (1947) and Greenland (1954). 1958 as UN expert in Burma. Member of Finnish Academy of Science and Letters since 1951, and of Academy of Technical Sciences since 1959.

Secretary and Chairman, IUGG Finance Committee. I.A.G. Study Group Chairman, Section Secretary, Section President, Vice–President, and President. I.A.G. Honorary President since 1979.

-- Helmut MORITZ

President of the *International Association of Geodesy* (1979--1983).

Born November 1, 1933 in Graz, Austria. Studied surveying and geodesy at Technical University, Graz. Doctoral dissertation 1959 on error theory in Hilbert space. 1958–1961 with Austrian Federal Geodetic Survey, 1962–1963 at Ohio State University, 1964 Docent, TU Hannover, 1964–1971 Professor, TU Berlin, since 1971 TU Graz.

Main research areas : theoretical, especially physical geodesy, earth rotation. Since 1969 Adjunct Professor, Ohio State University. Member, Austrian, Finnish, Hungarian and Italian Academy of Sciences. 1981 Honorary Doctorate, TU München.

I.A.G. Study Group Chairman, Section President, Vice–President, and President. I.A.G. Honorary President and IUGG Bureau Member since 1983.

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2. General Secretaries

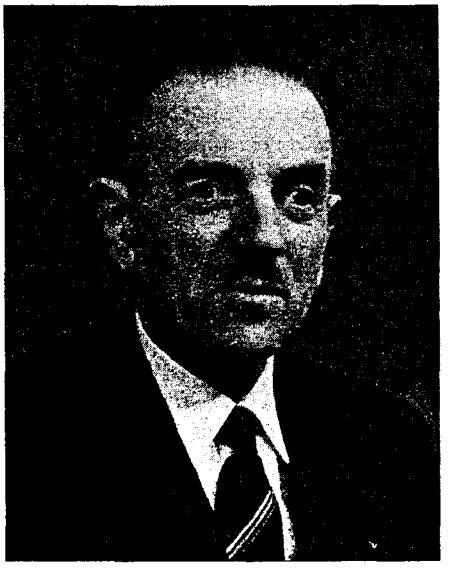
– Georges PERRIER (1872–1946).

Secrétaire Général de la *Section de Géodésie* de l'Union Géodésique et Géophysique Internationale (1920–1933), et de *l'Association Internationale de Géodésie* (1933–1946).

A sa sortie de l'Ecole Polytechnique G. Perrier choisit la carrière d'artilleur qui lui permettra de bientôt rejoindre le Service Géographique de l'Armée pour y poursuivre l'oeuvre de son père. Ainsi dès 1898 le Lieutenant G. Perrier est détaché à ce Service dans la Section de Géodésie et d'Astronomie. Ses qualités d'homme de science et d'organisateur infatigable ont trouvé là l'occasion de se manifester pleinement. Jeune officier il participe à tous les travaux géodésiques délicats et notamment à la reprise de la mesure de l'arc méridien en Equateur. Il se donne à fond de 1901 à 1906 dans les travaux de terrain de cette mission, puis rentré en France il assure lui–même les calculs, la rédaction et la discussion des travaux de la mission. En 1919 il est nommé chef de la Section de Géodésie du Service Géographique de l'Armée et doit réorganiser complètement cette Section cruellement éprouvée par la guerre. Il formera alors une nouvelle pépinière d'officiers géodésiens qui iront mettre en pratique en France et dans les colonies françaises de l'époque les idées de leur chef.

Les talents d'organisateur de G. Perrier se sont manifestés aussi sur le plan international. Dès 1900 il participe très activement à l'Assemblée Générale de l'Association Géodésique Internationale tenue à Paris. Et après la guerre il est l'un des artisans de la renaissance de cette Association qui deviendra une Section, puis une Association au sein de l'Union Géodésique et Géophysique Internationale. Il en est nommé le Secrétaire Général en 1920 et le restera jusqu'à sa mort en 1946. Il a créé le Bulletin Géodésique (1922), la Bibliographie Géodésique Internationale et a beaucoup oeuvré pour l'adoption de références internationales (ellipsoïde, formule de pesanteur, exécution des triangulations primordiales, compensation d'ensemble du réseau géodésique européen, ...). Il a été l'ami et le guide de toute une génération de géodésiens.

– Pierre TARDI (1897–1972).



Secrétaire Général de *l'Association Internationale de Géodésie* (1946–1960).

Né à Bastia (Corse) le 4 juin 1897 et mort à Paris le 5 Août 1972. Le lieutenant **Pierre Tardi** rejoint le Service Géographique de l'Armée en 1918. En 1920 il est affecté à la Section de Géodésie et devient l'élève et le disciple de **Georges Perrier**. Tout en participant à de nombreuses missions de terrain, il s'initie à la géodésie théorique et poursuit des études supérieures à la Faculté des Sciences. En 1934 il publie son premier traité de Géodésie qui lui vaut un prix de l'Académie des Sciences. En 1942 il est nommé Directeur de l'Ecole Nationale des Sciences Géographiques du jeune Institut Géographique National qui a remplacé le Service Géographique de l'Armée. Ses qualités d'organisateur et de pédagogue trouvent là l'occasion de s'exprimer pleinement. Il fut également professeur d'astronomie à l'Ecole Polytechnique, correspondant du Bureau des Longitudes ; élu membre de la Section de Géographie et Navigation de l'Académie des Sciences, il devient président de cette Académie en 1970.

Sur le plan international il consacra son énergie et son sens de l'organisation et du contact humain à l'amélioration du fonctionnement de l'Association Internationale de Géodésie. Elu secrétaire général en 1946 à la disparition de son maître G. Perrier, il s'attacha à faire revivre l'Association après l'interruption due à la deuxième guerre mondiale. Il prit une part très active à l'élaboration des nouveaux Statuts et Règlement Intérieur adoptés en 1952 qui, avec les retouches nécessaires, restent toujours les règles de fonctionnement de notre Association.

– Jean–Jacques LEVALLOIS

Secrétaire Général de *l'Association Internationale de Géodésie* (1960–1975).

Né le 26 juin 1911, J.J. Levallois est ingénieur de l'Ecole Polytechnique (1931–1933), diplômé du certificat d'Etudes supérieures d'astronomie approfondie. Il a eu une carrière d'enseignant, Professeur de topométrie et géodésie supérieure et appliquée (1947–1962), Examinateur pour l'Astronomie à l'Ecole Polytechnique (1958–1976), parallèle à sa carrière à l'Institut Géographique National où il fut notamment Directeur de la Géodésie de 1961 à 1974, Ingénieur Général Géographe depuis 1963, il est aussi Membre Correspondant du Bureau des Longitudes depuis 1961 et de l'Académie des Sciences depuis 1974.

Dans le domaine des activités de recherche on peut citer : Méthodes de calculs et de compensations des grands réseaux géodésiques ; études sur la réfraction terrestre dans les mesures zénithales, sur le potentiel terrestre, sur le géoïde européen. Nombreuses publications scientifiques dont les ouvrages sur la réfraction géodésique (1953), Cours sur la Théorie des erreurs accidentelles et les Méthodes de compensation, Cours de Topométrie, et surtout "Géodésie Générale" (1968–1970) en 4 volumes : ouvrage fondamental qui aborde tous les domaines de la géodésie traditionnelle et de la géodésie moderne.

Parallèlement à ses activités professionnelles et de recherche, J.J. Levallois a su mener une brillante carrière internationale : Secrétaire adjoint, puis Secrétaire Général de l'Association Internationale de Géodésie (1960–1975) et Secrétaire Général Honoraire depuis 1975, Directeur du Bureau Gravimétrique International (1975–1979), Président du Groupe Spécial d'Etude : "Histoire de la Géodésie" (1979–1983).

En 1979 fut créée la ***Médaille Levallois*** pour récompenser les géodésiens qui ont oeuvré pour le rayonnement de l'Association Internationale de Géodésie. Cette récompense rend particulièrement hommage à l'oeuvre immense accomplie par J.J. Levallois pour l'A.I.G.

INTRODUCTION TO THE STRUCTURE AND ACTIVITIES OF THE I.A.G.

P.–V. Angus–Leppan

The International Association of Geodesy is an organisation devoted to the study of scientific problems of geodesy, and the promotion of international cooperation in this field.

It is one of seven associations forming the International Union of Geodesy and Geophysics (IUGG) (see *Figure 1*). The Union, along with other International Unions, is a member of ICSU, the International Council of Scientific Unions.

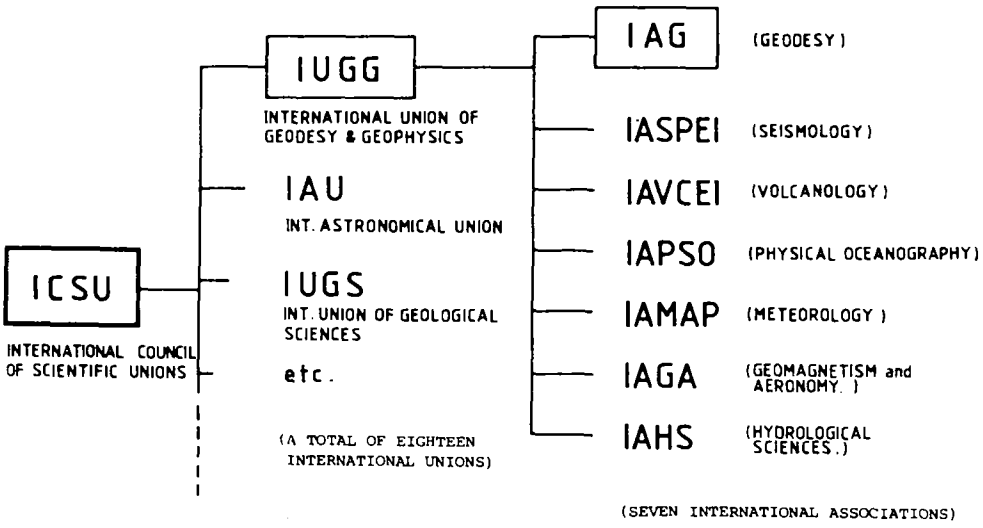


Fig. 1 — Structure–International Organizations

The I.A.G. has a long tradition and can trace its origins back to the great mathematicians and geodesists of the early 19th century. In 1862, General Baeyer, who had been a pupil and disciple of Bessel, proposed an international geodetic meeting in Prussia, which led to the formation of the ***Mitteleuropäische Gradmessung*** (literally, the Central European Degree Measurement). The expansion in the geographical and scientific scope of the organisation is mirrored in the changes of its title :

1864 Mitteleuropäische Gradmessung
1871 Europäische Gradmessung
1889 International Geodetic Association
1920 Geodesy Section, International Union of Geodesy and Geophysics
1946 International Association of Geodesy, IUGG.

The I.A.G. which is the oldest Association in the Union took a leading role in the establishment of the IUGG. The ***Bureau*** of the I.A.G. consists of the President, Secretary General and First Vice-President. The ***Executive*** comprises the Bureau members, the two other Vice Presidents, the Presidents of the Sections and the immediate Past President, with other officers of the Association in attendance. The ***Council,*** which is the most important deliberative body, consists of the chief delegates from each of the member countries of the Union, with the Executive members in attendance. Decisions of the Council, for example amendments to the Statutes and By-Laws, must be transmitted to the ***General Assembly,*** a body comprising all the delegates from member countries accredited to the Association, at a particular General Assembly of the Union (see ***Figure 2***).

For its scientific activities the Association is divided into five Sections. The present Sections, adopted at the General Assembly in 1983, are :

I Positioning
II Advanced Space Technology
III Determination of the Gravity Field
IV General Theory and Methodology
V Geodynamics.

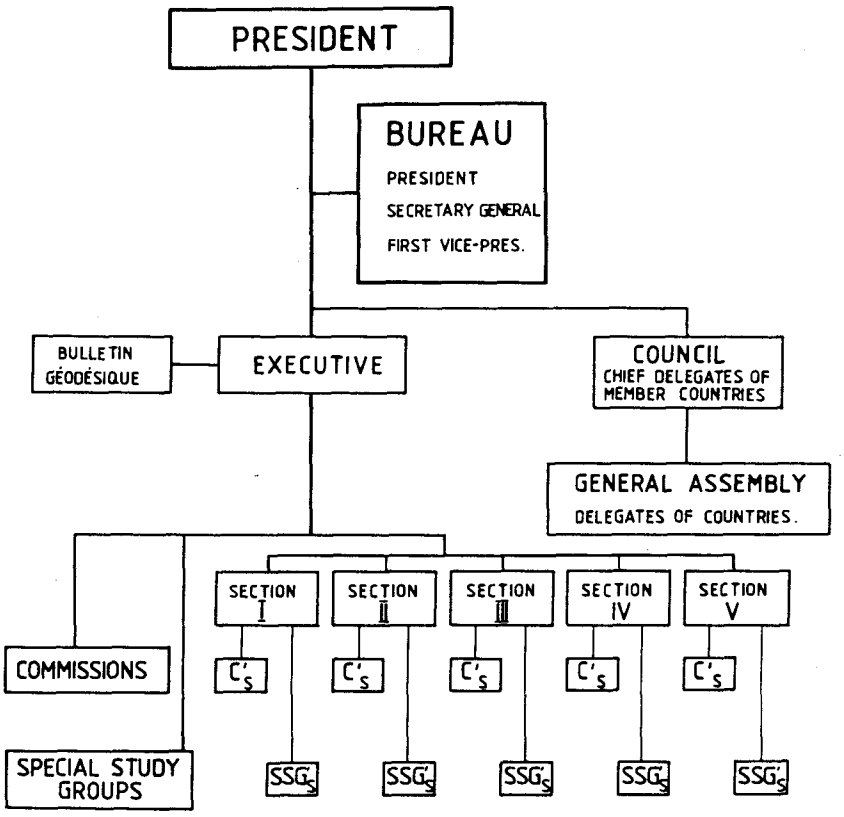


Fig. 2 – I.A.G. Structure

The function of the division into Sections is to bring together scientists with common interests, but it is not possible, nor is it desirable, to avoid interests overlapping from one Section into another. Each Section has a President and two or three Secretaries.

For more details on the structure of the Association and the function of its components, reference should be made to the Statutes and By–Laws, printed hereafter is this Handbook.

The scientific working areas of the Association are the Commissions and Special Study Groups, each assigned to one of the Sections, or in a few cases to the Association. Commissions are established to cover broad and long term matters. Each member country is entitled to nominate a representative to a Commission. Special Study Groups (SSG's) are established to cover topical scientific questions, with the intention that they should be intensively investigated and reported on, generally within one four–year period. Each SSG has a President and a maximum of twenty members who are specialists in the topic. In addition an SSG may have correspondents, who are kept fully informed of its activities.

The Association participates in the IUGG General Assemblies which are held every four years. The next is in ***August 1987,*** in Vancouver, Canada. At each General Assembly, besides administrative meetings, the Association is involved in the Union's interdisciplinary symposia, as well as its own program of scientific meetings.

In between General Assemblies, the Association sponsors Symposia, each of which covers the topic area of more than one SSG or Commission, while SSG's can arrange workshops in their topic areas.

The Association publishes the quarterly journal, the Bulletin Géodésique, which contains scientific papers and administrative reports on the Association. The two official languages of the Association are English and French.

The Association has close links with FAGS (Federation of Astronomical and Geophysical Services, an agency of ICSU), which receives an annual grant from UNESCO. FAGS is responsible for a number of services which are of direct interest to geodesy such as the International Gravimetric Bureau. The Association participates in the work of numerous Inter–Association and Inter–Union bodies, such as COSPAR (Committee on Space Research).

The Association publishes the Geodesist's Handbook every four years. This gives full details of the activities and lists of its office–bearers.

Scientists interested in participating in I.A.G. activities are welcome to attend its meetings and symposia, and to contact Presidents of Sections, Commissions or Special Study Groups covering their special areas of interest.

UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE
ASSOCIATION INTERNATIONALE DE GEODESIE

STATUTS
ET REGLEMENT INTERIEUR

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STATUTES
AND BY – LAWS

Adoptés à la XVIII[e] Assemblée Générale de l'U.G.G.I., Hambourg, Août 1983.

I – STATUTS

I – *Définition et mission de l'Association Internationale de Géodésie*

1. ***L'Association Internationale de Géodésie,*** ci–après désignée ***l'Association,*** est l'une des associations constituant ***l'Union Géodésique et Géophysique Internationale,*** ci–après désignée ***l'Union.***

2. L'Association a pour ***mission :***

a) de promouvoir l'étude de tous les problèmes scientifiques de la géodésie et d'encourager la recherche géodésique ;

b) de prendre toute initiative pour faciliter et coordonner la coopération internationale dans ce domaine ;

c) d'assurer, sur le plan international, la discussion et la publication des résultats des études, recherches et travaux mentionnés aux paragraphes a) et b) ci–dessus.

3. Pour atteindre ces objectifs, l'Association comprend un petit nombre de Sections, chacune d'entre elles traitant une partie distincte de la géodésie. Des Commissions et des Groupes Spéciaux d'Etudes peuvent être créés selon des formes précisées dans le Règlement Intérieur.

4. Chaque pays adhérent à l'Union ***(Pays Membre)*** est admis à se faire représenter à l'Association par des Délégués.

II – *Administration*

5. ***L'Assemblée Générale*** de l'Association est constituée par les Délégués des Pays Membres, dûment accédités par l'Organisme Adhérent de chaque pays, tel que défini par les Statuts de l'Union.

6. Le ***Conseil*** de l'Association est constitué par les Délégués, appelés Délégués au Conseil, désignés et dûment accrédités par les Organismes Adhérents des Pays Membres pour les représenter à chacune des réunions du Conseil, à raison d'un Délégué par Pays Membre. Aucun membre du Bureau de l'Association ne peut être choisi comme Délégué au Conseil d'un Pays Membre. Le Président de l'Association préside les réunions du Conseil, sans participer aux votes, sauf dans le cas d'égalité de voix comme précisé à l'article 16 ci–après.

7. La ***responsabilité*** de la direction des affaires de l'Association est dévolue au Conseil de l'Association. Les décisions prises par le Conseil sont présentées à l'Assemblée Générale. Si une majorité à l'Assemblée Générale est en désaccord avec les décisions du Conseil, celui–ci doit reconsidérer sa position et prendre la décision finale.

I – STATUTES

I – *Definition and objectives of the International Association of Geodesy*

1. The *International Association of Geodesy,* hereafter called the *Association,* is one of the constituent associations of the *International Union of Geodesy and Geophysics,* hereafter called the *Union.*

2. The *objectives* of the Association are :

a) to promote the study of all scientific problems of geodesy and encourage geodetic research ;

b) to promote and coordinate international cooperation in this field ;

c) to provide, on an international basis, for discussion and publication of the results of the studies, researches and works indicated in paragraphs a) and b) above.

3. To achieve these objectives, the Association shall comprise a small number of Sections, each of which deals with a distinct part of geodesy. Commissions and Special Study Groups may be formed as provided in the By–Laws.

4. Every country adhering to the Union *(Member Country)* may be represented by Delegates to the Association.

II – *Administration*

5. The *General Assembly* of the Association shall consist of the Delegates of the Member Countries duly accredited by the corresponding Adhering Bodies, as defined in the Statutes of the Union.

6. The *Council* of the Association shall consist of the Delegates, known as Council Delegates, designated for meetings of the Council and formally accredited by the Adhering Body of Member Countries on the basis of one Delegate for each Member Country. No member of the Bureau of the Association shall serve as a Council Delegate of a country. The President of the Association shall preside over the Council meetings, without vote, except in the case of a tie as provided in article 16 hereafter.

7. *Responsibility* for the direction of the Association affairs shall be vested in the Council of the Association. Decisions of the Council shall be reported to the General Assembly. In the case that the majority of those present at a General Assembly meeting disagrees with the decisions of the Council, the Council shall reconsider the question, and make a final decision.

8. Dans l'intervalle des réunions du Conseil, la gestion des affaires de l'Association est dévolue au ***Bureau*** et au ***Comité Exécutif*** dont la composition et les attributions respectives sont définies ci–après.

9. Le ***Bureau*** de l'Association est constitué par le ***Président,*** le ***Premier Vice–Président*** et le ***Secrétaire Général,*** tous trois élus par le Conseil. Le rôle du Bureau est d'administrer l'Association conformément aux présents Statuts et Règlement Intérieur et aux décisions du Conseil et du Comité Exécutif.

10. Le ***Comité Exécutif*** de l'Association est constitué par le Bureau, le Président sortant, les Vice–Présidents de l'Association, et les Présidents des Sections.

Les Présidents et Secrétaires Généraux honoraires de l'Association, les Secrétaires des Sections, les Secrétaires adjoints de l'Association et le Rédacteur en Chef du Bulletin Géodésique peuvent assister, à titre consultatif, à toute réunion du Comité Exécutif de l'Association.

Le rôle du Comité Exécutif est de guider les Sections et autres organismes scientifiques de l'Association vers la réalisation de leurs aspirations scientifiques, en assurant entre eux une coordination efficace et en formulant les règles générales nécessaires au bon déroulement des travaux scientifiques de l'Association.

Les membres du Comité Exécutif participent, à titre consultatif, à toutes les délibérations du Conseil.

III – *Droit de vote*

11. Un Délégué au Conseil ne peut être le Délégué que d'un seul Pays Membre.

Un Pays Membre non représenté à une réunion du Conseil peut voter par correspondance sur toute question bien précisée à l'ordre du jour définitif distribué à l'avance aux Pays Membres, pourvu que les débats n'aient introduit d'importants aspects nouveaux de cette question, ni modifé sa substance, et pourvu que le bulletin de vote considéré soit parvenu au Président avant l'ouverture du vote.

12. Pour que les délibérations du Conseil soient valables, la présence effective au Conseil de la moitié au moins des Délégués des Pays Membres représentés à l'Assemblée Générale de l'Union est nécessaire.

13. Pour toutes les questions n'ayant aucune incidence financière, le vote au Conseil se fait par Pays Membre, chaque Pays Membre ayant une voix, à condition qu'il ait payé ses cotisations à l'Union jusqu'à la fin de l'année civile qui précède le vote.

14. Pour toutes les questions financières, le vote au Conseil se fait par Pays Membre, à condition également que le pays considéré ait payé ses cotisations à l'Union jusqu'à la fin de l'année civile qui précède le vote. Le nombre de voix attribuées à chaque Pays Membre est alors égal au numéro de la catégorie dans laquelle le Pays adhère à l'Union.

15. Avant un vote en Conseil, il revient au Président de décider si la question prise en considération est d'ordre financier ou non, et si la procédure du vote par correspondance s'applique.

16. Les décisions au Conseil sont prises à la majorité simple, sauf dans les cas spécialement mentionnés dans les présents Statuts. Si, au cours d'un vote au Conseil, il y a

8. Between meetings of the Council , the direction of the affairs of the Association shall be vested in the ***Bureau*** and the ***Executive Committee,*** the respective composition and responsibilities of which are defined hereafter.

9. The ***Bureau*** of the Association shall consist of the ***President,*** the ***First Vice–President*** and the ***Secretary General,*** all of whom shall be elected by the Council. The duties of the Bureau shall be to administer the affairs of the Association in accordance with these Statutes and By–Laws and with the decisions of the Council and the Executive Committee.

10. The ***Executive Committee*** shall consist of the Bureau, the immediate past President and the Vice–Presidents of the Association, and the Presidents of the Sections.

The Honorary Presidents and the Honorary General Secretaries of the Association, the Secretaries of the Sections, the Assistant Secretaries of the Association and the Chief Editor of the Bulletin Géodésique may attend any meeting of the Executive Committee of the Association, with voice but without vote.

The duties of the Executive Committee shall be to further the scientific objectives of the Sections and other scientific bodies of the Association through effective coordination and through the formulation of general policies to guide the scientific work of the Association.

The members of the Executive Committee shall attend meetings of the Council, with voice but without vote.

III – *Voting*

11. A Council Delegate may represent only one Member Country.

A Member Country which is not represented at a Council meeting may vote by correspondence on any specific question, provided that the matter has been clearly defined on the final agenda distributed in advance to the Member Countries and that the discussion thereon has not produced any significant new considerations or changed its substance, and provided that the said vote has been received by the President prior to the voting.

12. In order that the deliberations of the Council shall be valid, the number of the Council Delegates present must be at least half of the Member Countries represented at the General Assembly of the Union.

13. On questions not involving matters of finance, the voting in Council shall be by Member Countries, each Member Country having one vote, provided that its Union subscriptions shall have been paid up to the end of the calendar year preceding the voting.

14. On questions involving finance, the voting in Council shall be by Member Countries, with the same provision that a voting country shall have paid its Union subscriptions up to the end of the calendar year preceding the voting in Council. The number of votes allotted to each Member Country shall then be equal to the number of its category of membership as defined by the Union.

15. Before a vote in a Council meeting, the President shall decide whether or not the matter under consideration is financial in character and whether the procedure of voting by correspondence applies.

16. Decisions of the Council shall be taken by a simple majority, except as otherwise

égalité de voix, la décision appartient au Président. La majorité simple ou la majorité des deux–tiers sont déterminées par la proportion des votes affirmatifs à la somme de tous les votes (affirmatifs, négatifs, abstentions). Les bulletins blancs, les bulletins non valables et les votes non exprimés par les délégués présents sont décomptés comme abstentions.

IV – *Généralités*

17. Les propositions formulées en vue de la modification d'un article des Statuts de l'Association doivent parvenir au Secrétaire Général au moins six mois avant la date fixée pour la réunion du Conseil au cours de laquelle elles seront examinées. Le Secrétaire Général devra faire connaître à tous les Pays Membres, au moins quatre mois avant la date fixée pour la réunion du Conseil, toutes les propositions reçues à ce sujet.

18. Les Statuts de l'Association ne peuvent être modifiés que par un vote du Conseil à la majorité des deux tiers.

Les présents Statuts, ou toute modification ultérieure, prennent effet à la clôture de la réunion du Conseil à laquelle ils ont été approuvés.

19. Dans le cadre des Statuts de l'Association le Conseil a pouvoir d'adopter un Règlement Intérieur.

Ce Règlement Intérieur ne peut être modifié que par un vote du Conseil à la majorité simple.

Ce Règlement Intérieur, ou toute modification ultérieure, prend effet à la clôture de la réunion du Conseil à laquelle il (ou elle) a été approuvé(e).

20. En cas de dissolution de l'Association ses avoirs sont cédés à l'Union.

21. Sauf au cas où les Statuts, ou le Règlement Intérieur, en décideraient autrement, les réunions de travail seront conduites selon les règles : "Robert's Rules of Order".

22. Les présents Statuts et le Règlement Intérieur sont établis en Français et en Anglais.

Leur validité ne peut être mise en cause par toute erreur de caractère formel ou accidentel.

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specified in these Statutes. If a tie should occur in a Council vote, the President shall cast the decisive vote. Simple and two–thirds majorities are determined by the proportion of affirmative votes to the sum of all votes (affirmative, negative and abstention). Blank and invalid ballots and votes not cast by delegates present are counted as abstentions.

IV – *General*

17. Proposals for a change of any article of the Statutes of the Association must reach the Secretary General at least six months before the announced date of the Council meeting at which it is to be considered. The Secretary General shall notify all Member Countries of any proposed change at least four months before the announced date of the Council meeting.

18. The Statutes of the Association may not be modified except by the approval of a two–thirds majority of votes cast at a Council meeting.

These Statutes or any further modification of them shall come into force at the close of the Council meeting at which they are approved.

19. The Council shall have the power to adopt By–Laws within the framework of the Statutes of the Association.

These By–Laws may not be modified except by a simple majority of votes cast at a Council meeting.

These By–Laws or any further modification of them shall come into force at the close of the Council meeting at which they are approved.

20. In the event of the dissolution of the Association, its assets shall be ceded to the Union.

21. Conduct of meetings : Except as otherwise provided in the Statutes or By–Laws, business meetings shall be conducted according to Robert's Rules of Order.

22. These Statutes and the By–Laws of the Association are set out in French and in English.

The validity of these rules shall not be vitiated by any error of a formal or accidental nature.

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II – REGLEMENT INTERIEUR

I – *Structure de l'Association.*

1. Les travaux scientifiques de l'Association Internationale de Géodésie sont répartis dans les *Sections* dont les attributions respectives sont décidées par le Conseil sur recommandation du Comité Exécutif. La structure de ces Sections est revue tous les huit ans (soit deux périodes) par un Comité, appelé Comité Cassinis, qui présente ses propositions au Comité Exécutif. En raison des relations complexes entre les différentes activités de l'Association, des interactions entre les Sections sont nécessaires.

L'Association comprend actuellement les *cinq* Sections ci–après :

– Section I : *Détermination de position.*

. réseaux horizontaux et verticaux de précision ;

. méthodes spatiales de positionnement ;

. méthodes inertielles de positionnement ;

. astronomie géodésique ;

. positionnement en mer ;

. réfraction.

– Section II : *Technologie spatiale avancée.*

. développement des techniques spatiales en géodésie, telles que : techniques radioélectriques de poursuite de satellite, techniques radio–interférométriques, mesures de distance laser terre–satellite et terre–lune, altimétrie par satellite, poursuite de satellite par satellite, gradiométrie par satellite, mesures géodésiques depuis l'espace ;

. calculs d'orbites ;

. résultats géodésiques directement issus de ces techniques ;

. techniques géodésiques pour la lune et les planètes.

– Section III : *Détermination du champ de pesanteur.*

. mesures terrestres absolues et relatives de pesanteur ;

. variations de pesanteur non liées aux marées ;

. détermination du champ extérieur de pesanteur et du géoïde à l'aide de la gravimétrie, de la gradiométrie, de l'astronomie géodésique, des techniques spatiales et inertielles ;

. réduction et estimation des paramètres du champ de pesanteur.

– Section IV : *Théorie Générale et Méthodologie.*

. modèles mathématiques généraux en géodésie ;

. analyse statistique et numérique ;

II – BY – LAWS

I – *Structure*

1. The scientific work of the International Association of Geodesy is allocated to *Sections,* the respective responsibilities of which are decided by the Council on recommendation of the Executive Committee. The structure of these Sections shall be reviewed every eight years (two periods) by a Committee, called the Cassinis Committee, which shall make proposals to the Executive Committee. Because of the complex interrelations among various activities of the Association, interactions between the individual sections are implied.

There are at present *five* sections which are the following :

– Section I : *Positioning.*

. high precision horizontal and vertical networks ;

. satellite and spatial positioning ;

. inertial positioning ;

. geodetic astronomy ;

. marine positioning ;

. refraction.

– Section II : *Advanced Space Technology.*

. development of space techniques for geodesy, such as : satellite radio–tracking techniques, radio–interferometric techniques, satellite and lunar laser ranging, satellite altimetry, satellite – to – satellite tracking, satellite gradiometry, geodetic measurements from space ;

. orbital computations ;

. direct results of such techniques ;

. planetary and lunar geodetic techniques.

– Section III : *Determination of the gravity field.*

. absolute and relative terrestrial gravity measurements ;

. non tidal gravity variations ;

. determination of the external gravity field and the geoid from gravimetry, gradiometry, geodetic astronomy, space and inertial techniques ;

. reduction and estimation of gravity field quantities.

– Section IV : *General Theory and Methodology.*

. general mathematical models for geodesy ;

. statistical and numerical analysis ;

. traitement et gestion des données ;

. méthodes d'optimisation ;

. méthodes des moindres carrés ;

. théories différentielle et intégrale du champ de pesanteur ;

. théorie de l'estimation, l'approximation et la représentation du champ de pesanteur.

– Section V : *Géodynamique.*

. systèmes de référence ;

. observation et étude des phénomènes variant avec le temps tels que : mouvement du pôle, rotation terrestre, marées terrestres, mouvements récents de l'écorce terrestre, variations de la pesanteur, topographie de la surface marine, y compris le niveau moyen des mers ;

. aspects géodésiques de projets géodynamiques internationaux tels que le "Projet Lithosphère" ;

. interprétation géophysique de la pesanteur et des données s'y rapportant.

2. Des ***Commissions*** peuvent être créées pour certaines activités qui nécessitent une coopération ou une organisation internationale importante, en particulier pour les problèmes de longue durée ou les activités intéressant de vastes territoires.

Chaque Pays Membre de l'Union a le droit de nommer un représentant dans chaque Commission, excepté dans celles traitant de zones géographiques particulières ; dans ce dernier cas, seuls les pays membres situés dans la zone géographique considérée peuvent nommer un représentant dans la Commission.

Normalement une Commission fait partie d'une Section. Chaque Commission peut s'organiser selon des exigences qui lui sont propres tout en respectant les Statuts et Règlement Intérieur de l'Association et en se soumettant à l'approbation du Comité Exécutif ; elle peut par exemple créer des Sous–Commissions régionales.

3. Des ***Groupes Spéciaux d'Etudes*** peuvent être créés pour étudier des problèmes scientifiques particuliers d'étendue limitée mais qui requièrent une coopération étroite entre les spécialistes de différents pays.

Normalement un Groupe Spécial d'Etudes fait partie d'une Section.

4. La création et la dissolution des Commissions et des Groupes Spéciaux d'Etudes sont décidées par le Comité Exécutif qui précise également si la Commission ou le Groupe Spécial d'Etudes est placé sous l'autorité directe de l'Association ou de l'une de ses Sections.

La liste des Commissions et des Groupes Spéciaux d'Etudes est publiée dans le Manuel du Géodésien à l'issue de chaque Assemblée Générale.

5. L'Association peut aussi prendre part aux activités d'organismes scientifiques communs avec d'autres Associations de l'Union Géodésique et Géophysique Internationale ou, représentant l'Union, avec d'autres Unions. Ces organismes sont administrés suivant des règles spécifiques découlant des relations avec les autres groupes, mais ils présentent un rapport sur leurs activités scientifiques aux Assemblées Générales de l'Association.

Le Comité Exécutif de l'Association décide si la participation à un tel organisme

. data processing and management ;

. optimization methods ;

. least squares methods ;

. differential and integral theories of the gravity field ;

. theory of estimation, approximation and representation of the gravity field.

– Section V : *Geodynamics.*

. reference systems ;

. monitoring and study of time – dependent phenomena such as : polar motion, Earth rotation, Earth tides, recent crustal movements, variations of gravity, sea–surface topography including mean–sea level ;

. geodetic aspects of international geodynamic projects such as the Lithosphere Project ;

. geophysical interpretation of gravity and related data.

2. ***Commissions*** may be formed for activities for which close international cooperation or organization is necessary, in particular for long term problems or activities relating to large regions.

Every Member Country of the Union is entitled to nominate one representative to each Commission, except those dealing with specific geographical areas ; to the latter Commissions, only Member Countries of the Union in the geographical area in question are entitled to nominate one representative each.

A Commission is normally assigned to one Section.

Each Commission may be organized according to its own requirements in compliance with the Statutes and By–Laws of the Association and subject to approval by the Executive Committee, for instance through the formation of regional Sub–Commissions.

3. ***Special Study Groups*** may be formed to study specific scientific problems of limited scope which require close cooperation between specialists from different countries.

A Special Study Group is normally assigned to a particular Section.

4. The setting–up and dissolution of the Commissions and of the Special Study Groups are decided by the Executive Committee which also specifies whether the Commission or the Special Study Group is to be placed under the direct authority of the Association or of one of its Sections.

The list of Commissions and Special Study Groups shall be published in the Geodesist's Handbook after each General Assembly.

5. The Association may also participate in joint scientific bodies with other Associations of the International Union of Geodesy and Geophysics, or, representing this Union, with other Unions. These bodies shall be administered according to specific rules proceeding from their relations with other agencies, but they shall report on their scientific work at each General Assembly of the Association.

The Executive Committee of the Association shall decide whether the

commun doit être placée sous la responsabilité de l'Association ou de l'une des Sections : cette responsabilité inclut la désignation des représentants à ces organismes et le choix de leurs activités futures.

II – *Elections.*

6. Les élections sont faites par le Conseil de l'Association au cours de l'Assemblée Générale Ordinaire de l'Association.

Le Président en exercice désigne un Comité de Nomination formé de quatre personnes chargé de proposer au Conseil un candidat pour chacun des postes soumis à élection. Outre les propositions de ce Comité de Nomination, tout Délégué au Conseil a la possibilité de présenter d'autres candidats avant ou pendant la séance des élections.

Les élections ont lieu au scrutin secret.

Une même personne ne peut occuper en même temps plus d'un des postes suivants : Président de l'Association, Vice–Président, Président de Section et Président de Commission.

7. L'intervalle de temps séparant les clôtures de deux Assemblées Générales Ordinaires successives de l'Association est appelé *"période"*.

8. Le ***Président*** de l'Association est élu pour une période. Il n'est pas immédiatement rééligible à ce poste, mais le Conseil peut le nommer Président honoraire.

9. Le ***Premier*** et le ***Second Vice–Présidents*** sont élus pour une période et ne sont pas immédiatement rééligibles aux mêmes postes.

10. Le ***Troisième Vice–Président*** est nommé par le Conseil sur recommandation de l'Organisme adhérent du pays où aura lieu la prochaine Assemblée Générale de l'Union. Au cas où cette procédure de nomination n'est pas réalisable, le Conseil délègue cette nomination au Bureau de l'Association.

En liaison avec le Bureau Central le Troisième Vice–Président a la charge de préparer cette prochaine Assemblée Générale. Cependant, si le Président, le Premier ou le Second Vice–Président, ou le Secrétaire Général appartient à la nation invitante, il n'y a pas de Troisième Vice–Président.

11. Le ***Secrétaire Général*** est élu initialement pour deux périodes. Il est ensuite rééligible par périodes successives, la durée de ses mandats ne dépassant pas quatre périodes au total.

12. Ces mêmes règles (art. 11) s'appliquent aux ***Secrétaires adjoints*** et au ***Rédacteur en Chef du Bulletin Géodésique.***

13. Les membres du Bureau et du Comité des Finances de l'Union ne peuvent occuper les postes de Président, Premier Vice–Président ou Secrétaire Général de l'Association.

14. Si le poste de Président devient vacant dans l'intervalle entre deux Assemblées Générales Ordinaires, les fonctions en sont assurées jusqu'à la fin de l'Assemblée Générale Ordinaire suivante par le Premier Vice–Président. De la même façon, les fonctions du Premier Vice–Président reviennent alors au Second Vice–Président.

relationship with any such common body is to be placed under the responsibility of the Association or of one specific Section. This responsibility includes the appointment of representatives to these common bodies and the influence on their future activities.

II – *Elections.*

6. Elections shall be made by the Council of the Association during the Ordinary General Assembly of the Association.

The President in office shall appoint a Nominating Committee consisting of four persons to propose to the Council a candidate for each position to be filled by election in the Council. Besides the proposals of the Nominating Committee it is possible for Council Delegates to make other nominations before or during the session where these officers are elected.

Elections shall be by secret ballot.

No person may hold more than one of the following offices at the same time : President of the Association, Vice–President, President of a Section and President of a Commission.

7. The time interval between the closures of two successive Ordinary General Assemblies of the Association is called here a ***period.***

8. The ***President*** of the Association is elected for one period. He may not be re–elected to this office, but the Council may appoint him as Honorary President.

9. The ***First*** and ***Second Vice–Presidents*** are elected for one period and may not be immediately re–elected to the same office.

10. The ***Third Vice–President*** is appointed by the Council on recommendation of the Adhering Body of the country in which the next General Assembly of the Union will take place. If this procedure is not feasible, the Council may delegate the appointment to the Bureau.

In cooperation with the Central Bureau, the Third Vice–President has special responsibility for the preparation of that General Assembly. However, if the President, or the First or the Second Vice–President, or the Secretary General belongs to the host country, no third Vice–President shall be appointed.

11. The ***Secretary General*** is elected for two periods initially. He may then be re–elected for two additional single periods only.

12. The same rules as in art. 11 apply to ***Assistant Secretaries*** and to the ***Chief Editor of the Bulletin Géodésique.***

13. A member of the Bureau or of the Finance Committee of the Union may not occupy the post of President, of First Vice–President or of Secretary General of the Association.

14. Should the position of President become vacant in the interval between two Ordinary General Assemblies, his duties devolve to the First Vice–President until the closure of the next Ordinary General Assembly. In the same way the duties of the First Vice–President then devolve on the Second Vice–President.

Si le poste de Secrétaire Général devient vacant, le Président charge immédiatement le Comité Exécutif d'élire par correspondance un remplaçant de façon à assurer la continuité de fonctionnement du Bureau Central. Cette élection n'a d'effet que jusqu'à la fin de l'Assemblée Générale Ordinaire suivante.

15. Les ***Présidents des Sections*** sont élus pour une période et ne sont pas immédiatement rééligibles aux mêmes postes.

16. Les ***Secrétaires des Sections*** sont élus pour une période et sont rééligibles pour une autre période.

17. Si un poste de Président de Section devient vacant entre deux Assemblées Générales Ordinaires, le Comité Exécutif désigne un président intérimaire qui tient le poste jusqu'à la fin de la prochaine Assemblée Générale.

Dans le cas d'autres vacances, le Comité Exécutif peut désigner des intérimaires.

18. Le ***Président d'une Commission*** est élu par le Conseil de l'Association pour une période et est immédiatement rééligible pour une nouvelle période.

19. Le ***Président d'un Groupe Spécial d'Etudes*** est nommé par le Comité Exécutif pour une période seulement.

20. Une même personne ne peut être président de plus d'une Commission ou d'un Groupe Spécial d'Etudes à la fois.

III — *Assemblées Générales.*

21. L'Association tient ses propres Assemblées Générales Ordinaires en liaison avec celles de l'Union, à la même date et dans le même pays.

22. Avant chaque Assemblée Générale le Bureau de l'Association prépare un ordre du jour détaillé. Pour ce qui concerne les travaux scientifiques, l'ordre du jour est établi par le Comité Exécutif. Cet ordre du jour est envoyé aux pays membres et à tous les officiels de l'Association de façon à leur parvenir au moins deux mois avant la date de l'Assemblée. En principe seules les questions qui figurent à l'ordre du jour sont prises en considération pendant les sessions ; il peut en être décidé autrement par un vote acquis à la majorité des deux tiers soit en Conseil, soit au Comité Exécutif.

23. A chaque Assemblée Générale le Président de l'Association présente un rapport détaillé sur les activités scientifiques de l'Association pendant la période de sa présidence. Le Secrétaire Général présente, pour la même période, un rapport détaillé concernant les activités administratives et les finances de l'Association. Ils soumettent chacun des propositions sur les activités à entreprendre au cours de la période à venir dans la mesure où les ressources envisagées le permettent.

Ces rapports sont remis aux Délégués présents à l'Assemblée Générale avant l'ouverture de cette Assemblée.

24. Les réunions scientifiques ont généralement lieu par Section, mais l'étude de certaines questions peut nécessiter des réunions communes à plusieurs Sections ou des symposiums placés sous la responsabilité de présidents désignés par le Comité Exécutif.

Should the post of Secretary General become vacant, the President shall arrange without delay for the Executive Committee to elect a replacement by correspondence so as to ensure the continuity of the work of the Central Bureau. This election has effect until the closure of the next Ordinary General Assembly.

15. The ***Presidents of Sections*** are elected for one period and may not be immediately re–elected to the same office.

16. The ***Secretaries of Sections*** are elected for one period but may be re–elected for one further period.

17. Should the position of President of Section become vacant between two Ordinary General Assemblies, the Executive Committee shall appoint an interim member to take office until the closure of the next General Assembly.

Should other vacancies occur, the Executive Committee may make interim appointments.

18. The ***President of a Commission*** is elected by the Council of the Association for one period and may be immediately re–elected for one further period.

19. The ***President of a Special Study Group*** is appointed by the Executive Committee for one period only.

20. A person may be the President at the same time of no more than one of the bodies covered in Arts. 18 and 19.

III – *General Assemblies.*

21. The Association shall hold its own Ordinary General Assemblies in conjunction with the Ordinary General Assemblies of the Union, at the same time and in the same country.

22. Before any General Assembly, a detailed agenda is prepared by the Bureau of the Association. As far as the scientific work is concerned, the agenda is drawn up by the Executive Committee. This agenda is sent to the member countries and to all the officers of the Association so as to reach them at least two months prior to the Assembly. In principle, only matters on the agenda may be considered during the sessions, unless a decision to do otherwise is passed by a two–thirds majority in the Council or in the Executive Committee.

23. At each General Assembly, the President of the Association shall present a detailed report on the scientific work of the Association during his tenure. The Secretary General shall present a detailed report on the administrative work and on the finances of the Association for the same period. They both should submit proposals regarding work to be undertaken during the coming period, within the limits of expected resources.

These reports are handed to the delegates attending the General Assembly before the opening of the Assembly.

24. The scientific meetings generally take place Section by Section, but the study of some questions may require joint meetings of several Sections or Symposia under chairmen appointed by the Executive Committee.

Des symposiums communs couvrant des sujets intéressant au moins deux Associations de l'Union peuvent être organisés.

25. A chaque Assemblée Générale, les travaux de chaque Section font l'objet d'un rapport présenté par son Président assisté de son (ses) Secrétaire (s). De même, les travaux des Commissions et Groupes Spéciaux d'Etudes sont présentés par leurs Présidents.

26. L'inscription de communications scientifiques à l'ordre du jour des séances d'une Assemblée Générale est décidée par un comité constitué par les Présidents des Sections.

27. Les communications scientifiques individuelles sont reproduites par leurs auteurs. Elles sont distribuées aux Délégués par le Bureau Central avant la séance à laquelle elles doivent être présentées. Elles peuvent être publiées dans le Bulletin Géodésique sous réserve d'en satisfaire la politique d'édition.

IV — *Publications.*

28. L'Association soutient et subventionne une revue périodique indépendante gérée par un Rédacteur en Chef élu par le Conseil de l'Association sur recommandation du Comité Exécutif. Cette revue, publiée à intervalles réguliers, est appelée ***"Bulletin Géodésique"***. C'est un organe de diffusion scientifique qui vise à établir une liaison entre les géodésiens des différents pays ; il publie des contributions scientifiques originales intéressant la géodésie au sens large, des rapports et des informations sur les activités de l'Association.

Une partie des ressources nécessaires à cette publication périodique provient de la publicité et du produit des abonnements dont le tarif est fixé par le Conseil de l'Association qui arrête en même temps le nombre d'exemplaires — au moins un — fournis gratuitement à chaque Pays Membre.

Après chaque Assemblée Générale, il est publié un numéro spécial du Bulletin Géodésique appelé le ***"Manuel du Géodésien"***. Cette publication a pour but de fournir des informations détaillées sur l'Association, sa structure, ses activités scientifiques et bien d'autres informations à caractère technique ou administratif.

29. A l'issue de chaque Assemblée Générale, l'ensemble des rapports présentés par les Sections, Commissions et Groupes Spéciaux d'Etudes est publié sous le nom de ***"Travaux de l'Association Internationale de Géodésie"***. Cette publication est adressée gratuitement aux Officiels de l'Association et aux Organismes Adhérents des Pays Membres.

30. L'Association assure également ***des publications spéciales*** qui présentent les références recommandées en géodésie.

31. A chaque Assemblée Générale les Pays Membres de l'Union sont invités à fournir un certain nombre d'exemplaires de leur ***Rapport National*** sur les travaux géodésiques effectués depuis la précédente Assemblée Générale. Ces Rapports Nationaux, dans la mesure où ils sont disponibles, sont distribués comme les "Travaux de l'Association" par le Bureau Central de l'Association.

Joint Symposia covering topics interesting two or more Associations within the Union may be arranged.

25. At each General Assembly, the work of each Section shall be reported by its President assisted by his Secretary (ies). Similarly, the work of each Commission or Special Study Group shall be reported by its President.

26. The inclusion on the agenda of scientific papers for presentation at sessions of a General Assembly is decided by a committee consisting of the Presidents of Sections.

27. Individual authors are responsible for the reproduction of their scientific papers. These papers are distributed to the delegates by the Central Bureau prior to the meeting where they are presented. They may be published in the Bulletin Géodésique subject to its editorial policy.

IV – *Publications.*

28. The Association supports and subsidizes an independent periodical managed by a Chief Editor elected by the Council of the Association on recommendation of the Executive Committee. This periodical published at regular intervals is called ***"Bulletin Géodésique".*** It is a scientific publication which aims at establishing contacts between geodesists of various countries ; it publishes original scientific contributions of broad geodetic interest, reports and news items related to the activities of the Association.

The funds required for this periodical publication derive in part from advertising and from paid subscriptions, the rates of which are decided by the Council of the Association, which at the same time decides the number of copies, at least one, to be supplied free of charge to each Member Country.

After each General Assembly, a special issue of the Bulletin Géodésique shall be published under the name of ***"Geodesist's Handbook".*** This issue aims at providing detailed information on the Association, its structure and scientific activities, and other relevant technical and administrative information.

29. After each General Assembly, a collection of the reports presented by the Sections , Commissions and Special Study Groups shall be published in the ***"Travaux de l'Association Internationale de Géodésie".*** This publication is supplied free of charge to the Officers of the Association and to the Adhering Body of each Member Country.

30. The Association also issues ***special publications*** which contain information on recommended standards in geodesy.

31. At every General Assembly each Member Country of the Union is invited to supply an adequate number of copies of its National Report on geodetic work done since the previous General Assembly. These National Reports, as far as available, are distributed by the Central Bureau of the Association in the same manner as the "Travaux de l'Association".

V – *Administration.*

32. Le ***Conseil*** de l'Association :

a) – examine les questions de politique scientifique générale ou d'administration dans les affaires de l'Association et désigne, à cet effet, les Comités qui, le cas échéant, peuvent être jugés nécessaires ;

b) – élit les membres du Bureau et du Comité Exécutif, les Secrétaires adjoints de l'Association, les Secrétaires des Sections, les Présidents des Commissions et le Rédacteur en Chef du Bulletin Géodésique ;

c) – reçoit les rapports du Secrétaire Général et examine, pour approbation, les décisions ou mesures prises par le Bureau et le Comité Exécutif depuis la dernière réunion du Conseil ;

d) – désigne les trois membres du comité ad hoc créé pour l'examen des finances de l'Association, étudie ses recommandations et adopte le budget définitif ;

e) – examine les propositions de modification des Statuts et du Règlement Intérieur.

Le Conseil se réunit sur convocation du Président de l'Association. Il se réunit normalement pendant les Assemblées Générales Ordinaires.

33. Le ***Comité Exécutif*** de l'Association :

a) – prend les mesures nécessaires à l'accomplissement des missions scientifiques de l'Association ;

b) – comble toute vacance de poste qui pourrait survenir, entre deux Assemblées Générales, selon les règles des Statuts et du Règlement Intérieur ;

c) – crée et dissout les Commissions et Groupes Spéciaux d'Etudes ;

d) – nomme les Présidents des Groupes Spéciaux d'Etudes ;

e) – nomme les membres du Comité Cassinis ;

f) – présente des recommandations au Conseil sur les questions de politique générale de l'Association.

Le Comité Exécutif se réunit sur convocation du Président de l'Association. Il se réunit au cours des Assemblées Générales et ses membres participent, à titre consultatif, aux réunions du Conseil. Il se réunit également au moins une fois entre deux Assemblées Générales, un an avant l'Assemblée Générale pour préparer le programme des activités scientifiques et le projet d'emploi du temps de cette Assemblée Générale.

Lors d'une réunion du Comité Exécutif, aucun membre ne peut se faire représenter par quiconque, sauf un Président de Section qui peut être représenté par un Secrétaire de sa Section. Les délibérations du Comité Exécutif sont déclarées valides si au moins la moitié des membres sont présents ou représentés.

L'ordre du jour de chaque réunion du Comité Exécutif est préparé par le Bureau et adressé aux membres au moins trois mois avant la réunion.

V – *Administration.*

32. The ***Council*** of the Association shall :

a) – examine questions of general scientific policy or administration in the business of the Association and appoint such Committees as may from time to time be deemed necessary for this purpose ;

b) – elect the members of the Bureau and of the Executive Committee, the Assistant Secretaries of the Association, the Secretaries of Sections, the Presidents of Commissions, and the Chief Editor of the Bulletin Géodésique ;

c) – receive reports from the Secretary General and consider for approval the decisions or actions taken by the Bureau and the Executive Committee since the last Council meeting ;

d) – appoint the three members of the ad hoc committee created for examining the finances of the Association, consider its recommendations and adopt the final budget ;

e) – consider proposals for changes in the Statutes and By–Laws.

The Council is convened by the President of the Association. It shall normally meet during the Ordinary General Assemblies.

33. The ***Executive Committee*** of the Association shall :

a) – initiate actions, as required, to guide the Association towards the achievement of its scientific objectives ;

b) – in accordance with the present Statutes and By–Laws fill vacancies occuring between General Assemblies ;

c) – set up and dissolve Commissions and Special Study Groups ;

d) – appoint Presidents of Special Study Groups ;

e) – appoint members of the Cassinis Committee ;

f) – make recommendations to the Council on matters of general policy of the Association.

The Executive Committee is convened by the President of the Association. It shall meet at General Assemblies and its members shall attend the meetings of the Council, with voice but without vote. It shall also meet normally at least once between General Assemblies, one year ahead of the General Assembly, in order to prepare the scientific agenda and the time–table during the next General Assembly.

At a meeting of the Executive Committee, no member may be represented by any other person, except a President of a Section who may be represented by a Secretary of his Section. In order that the deliberations of the Executive Committee shall be valid, half at least of its members must be present or represented.

The agenda for each meeting of the Executive Committee shall be prepared by the Bureau and sent to the members at least three months prior to the meeting.

34. Le *Bureau* de l'Association :

a) – établit les programmes des réunions du Conseil et du Comité Exécutif ;

b) – assure l'administration de l'Association.

Il se réunit normalement avant chaque réunion du Comité Exécutif.

35. Le *Président* de l'Association :

a) – représente l'Association dans ses relations avec les Organisations ou Institutions nationales ou internationales ;

b) – convoque et préside les Assemblées Générales et toutes les réunions du Conseil, du Comité Exécutif et du Bureau ;

c) – présente à l'Assemblée Générale le rapport sur les activités scientifiques de l'Association pendant la période de sa présidence.

Il est membre du Comité Exécutif de l'Union. En cas d'indisponibilité du Président, le *Premier Vice–Président* le remplace.

36. Le *Secrétaire Général* de l'Association :

a) – assume les fonctions de secrétaire de l'Assemblée Générale, du Conseil, du Comité Exécutif et du Bureau ; il organise leurs réunions, prépare et diffuse promptement l'ordre du jour et les procès–verbaux de toutes ces réunions ;

b) – remplit les fonctions de Directeur du Bureau Central ;

c) – gère les affaires de l'Association, se charge de la correspondance et assure la conservation des archives ;

d) – distribue toutes les informations concernant l'Association ;

e) – prépare les rapports d'activité de l'Association, en particulier il présente à l'Assemblée Générale le rapport sur l'administration et les finances de l'Association pour la période en cours ;

f) – accomplit toutes autres tâches qui lui sont confiées par le Bureau.

37. Pour aider le Secrétaire Général dans l'accomplissement de ses tâches, l'Association dispose d'un organisme permanent, le ***Bureau Central,*** comportant un nombre variable d'employés rétribués sur les ressources de l'Association.

Le Secrétaire Général est également assisté d'un petit nombre de ***Secrétaires adjoints,*** dont l'un d'eux réside dans la même localité que le Secrétaire Général. Ces fonctions sont gratuites et ne peuvent donner lieu qu'au remboursement des frais occasionnés par ces charges.

VI – *Activités des Sections, Commissions et Groupes Spéciaux d'Etudes.*

38. Le ***Président d'une Section*** a la responsabilité du développement scientifique dans le cadre des activités de sa Section, il représente sa Section au Comité Exécutif de l'Association. Il encourage, guide et coordonne les travaux des Commissions et Groupes Spéciaux d'Etudes de sa Section, assure un échange satisfaisant de l'information, et en particulier rend compte annuellement des activités de sa Section aux officiels de la Section ainsi qu'aux membres du Bureau de l'Association.

34. The ***Bureau*** of the Association shall :

a) – draw up the programmes of the meetings of the Council and the Executive Committee ;

b) – ensure the adequate administration of the Association.

It shall normally meet before each meeting of the Executive Committee.

35. The ***President*** of the Association shall :

a) – be the representative of the Association in its dealing with National or International Organizations or Institutions ;

b) – convene and preside over the General Assembly and over all meetings of the Council, Executive Committee and Bureau ;

c) – submit a report to the General Assembly on the scientific work of the Association during his tenure.

He is a member of the Executive Committee of the Union. In case of his absence, the ***First Vice–President*** shall act.

36. The ***Secretary General*** shall :

a) – serve as secretary of the General Assembly, the Council, the Executive Committee and the Bureau ; arrange for meetings of these bodies, prepare and distribute promptly the agenda and the minutes of all their meetings ;

b) – act as Director of the Central Bureau ;

c) – manage the affairs of the Association, attend to correspondence, preserve the records ;

d) – circulate all appropriate information related to the Association ;

e) – prepare the reports on the Association's activities, especially report to the General Assembly on the administration and the finance of the Association during the current period ;

f) – perform such other duties as may be assigned to him by the Bureau.

37. To assist the Secretary General in the performance of his duties to the Association, the Association comprises a permanent agency, the ***Central Bureau*** including a variable number of employees paid out of Association funds.

The Secretary General is also assisted by a small number of ***Assistant–Secretaries,*** one of whom is located in the same office as the Secretary General. All these functions are unpaid and only expenses incurred in connection with them are repayable.

VI – *Activities of Sections, Commissions and Special Study Groups.*

38. The ***President of a Section*** is responsible for the scientific development within the area of his Section and is the representative of his Section on the Executive Committee of the Association. He shall encourage, guide and coordinate the work of the Commissions and Special Study Groups within his Section, maintain a satisfactory exchange of information, and in particular keep the officers of his Section as well as the Bureau of the Association informed of the Section's activities, on an annual basis.

Le Président d'une Section, ou, à défaut, l'un de ses Secrétaires, doit assister à chaque symposium concernant la Section.

Avant chaque Assemblée Générale, le Président d'une Section reçoit les rapports d'activité des Commissions et Groupes Spéciaux d'Etudes rattachés à sa Section, il prépare alors le rapport sur les activités de la Section. Il reçoit, coordonne et transmet au Comité Exécutif les suggestions de création de nouveaux Groupes Spéciaux d'Etudes pour la période à venir.

Le ***Secrétaire de Section*** assiste le Président de Section dans ses fonctions.

39. Le ***Président d'une Commission ou d'un Groupe Spécial d'Etudes*** a la responsabilité de promouvoir et de diriger les travaux et de recruter les membres. La répartition des membres d'un Groupe Spécial d'Etudes doit refléter une bonne coopération internationale sur le sujet d'étude et leur nombre est limité (maximum 20) pour assurer une meilleure efficacité.

40. Après chaque Assemblée Générale le Président d'une Commission ou d'un Groupe Spécial d'Etudes établit une brève description du travail à accomplir et une liste des membres, pour publication dans le Manuel du Géodésien.

Afin d'assurer les liaisons et la coopération au sein des Commissions et Groupes Spéciaux d'Etudes, les membres sont tenus informés, annuellement, des résultats obtenus et des problèmes en cours.

41. Le Président de l'Association, le Bureau Central et le Président de la Section concernée reçoivent copie des correspondances officielles des Commissions et Groupes Spéciaux d'Etudes.

42. Les rapports d'activité de chaque Commission et Groupe Spécial d'Etudes doivent être transmis au Président de la Section concernée au moins trois mois avant chaque Assemblée Générale. Ces rapports ainsi que les rapports des Sections sont publiés dans les "Travaux de l'Association Internationale de Géodésie".

43. La période d'activité de chaque Groupe Spécial d'Etudes prend normalement fin à l'Assemblée Générale Ordinaire. Dans le cas exceptionnel où une poursuite d'activité est jugée nécessaire, le Président du Groupe Spécial d'Etudes soumet à son Président de Section trois mois avant l'Assemblée Générale une proposition écrite bien argumentée, y compris une suggestion pour la désignation de son successeur. Le Président de Section présente alors une recommandation au Comité Exécutif.

44. Les Commissions et Groupes Spéciaux d'Etudes non rattachés à une Section particulière sont placés sous la responsabilité du Président de l'Association.

45. Les Présidents des Commissions et Groupes Spéciaux d'Etudes réunissent leurs membres à leur convenance. S'ils désirent organiser des symposiums scientifiques, ils doivent suivre la procédure d'approbation des symposiums prévue par l'Association. Des symposiums ne peuvent être organisés que si le sujet traité déborde du cadre d'une Commission ou d'un Groupe Spécial d'Etudes.

It is desirable that the President of a Section, or else one of the Secretaries of the Section, should attend each of the Symposia related to the Section.

Before each General Assembly the President of a Section shall receive the reports of the Commissions and Special Study Groups within his Section and prepare a report on the activities of the Section to be presented at the General Assembly. He shall receive, coordinate and transmit to the Executive Committee suggestions for new Special Study Groups for the forthcoming period.

The ***Section Secretary*** assists the Section President in his duties.

39. The ***President of a Commission or a Special Study Group*** is responsible for initiating and directing its work and for appointing its members. Special Study Group membership should be balanced so as to reflect international cooperation in the subject and shall be limited to a number not exceeding 20, so as to ensure maximum efficiency.

40. The President of each Commission and Special Study Group shall issue a brief description of the work to be performed and a list of members to be published in the Geodesist's Handbook after each General Assembly.

To assist communication and cooperation within the Commissions and Special Study Groups, members should be kept informed, on an annual basis, of results achieved and of outstanding problems.

41. The President of the Association, the Central Bureau and the President of the relevant Section should receive copies of all official correspondence of Commissions and Special Study Groups.

42. The reports of each Commission and Special Study Group should reach the President of each relevant Section at least three months before each General Assembly. These reports and the reports of the Sections are published in the "Travaux de l'Association Internationale de Géodésie".

43. The period of work of each Special Study Group normally ends at an Ordinary General Assembly. In the exceptional case that a continuation of the work is deemed necessary, the Special Study Group President shall submit in writing a well–grounded proposal, including a suggestion for his successor, to his Section President, at least three months before the General Assembly. The Section President shall then make a recommendation to the Executive Committee.

44. Commissions and Special Study Groups not assigned to one Section shall be under the responsibility of the President of the Association.

45. Commissions and Special Study Groups are free to hold working meetings of their members. If they wish to arrange scientific Symposia, these are subject to the usual approval procedure for Symposia of the Association. Symposia should be arranged only if the topic transcends the frame of one Commission or one Special Study Group.

VII – *Symposiums.*

46. L'Association peut organiser des symposiums scientifiques pour étudier des problèmes particuliers d'intérêt général.

Le Comité Exécutif a la responsabilité de veiller au choix judicieux des symposiums, de façon à garantir une équitable représentation par sujet et une bonne répartition géographique et aussi à éviter des doubles emplois, des recouvrements et une fréquence injustifiée.

Les symposiums parrainés par l'Association sont ouverts à tous les scientifiques, selon les règles du Conseil International des Unions Scientifiques.

47. Les propositions de symposiums pour la période entre deux Assemblées Générales Ordinaires sont normalement soumises par les Organisateurs au Secrétaire Général, avant l'Assemblée Générale précédant cette période. Au cours de cette Assemblée Générale d'autres propositions peuvent être soumises au Secrétaire Général au plus tard deux jours avant la dernière réunion du Conseil.

Le Conseil, sur recommandation du Comité Exécutif, décide si l'Association doit parrainer tel ou tel symposium.

Dans des cas très exceptionnels, le Comité Exécutif peut donner son accord à des demandes faites hors des délais normaux. De telles demandes ne peuvent être faites moins de 18 mois avant la date proposée pour le symposium.

48. L'Organisateur d'un symposium doit envoyer une annonce officielle au Bulletin Géodésique au moins un an à l'avance, ou immédiatement après l'approbation par l'Association ; la date annoncée ne doit plus changer ensuite.

49. Moins de trois mois après le symposium, l'Organisateur est tenu de fournir un rapport pour le Bulletin Géodésique. Ce rapport doit indiquer si les Actes du symposium seront publiés, et où, et quand ils le seront. Les Actes du symposium, ou au moins une copie de chaque communication présentée, doivent être adressés au Bureau Central de l'Association.

50. Le parrainage d'un symposium par l'Association signifie une reconnaissance officielle mais n'implique pas un soutien financier.

VIII – *Coopération scientifique internationale.*

51. L'Association peut coopérer à des travaux scientifiques de caractère international ou interdisciplinaire, elle peut également les entreprendre directement ou en surveiller la réalisation. En principe, l'Association est représentée aux Congrès, réunions internationales, Assemblées Générales , etc..., des organismes scientifiques internationaux dont l'activité est en rapport avec la sienne propre. Le Président de l'Association ou son délégué représente l'Association à ces réunions.

Les frais de voyage et de séjour du représentant de l'Association peuvent être mis en totalité ou partiellement à la charge de l'Association. Un compte rendu de ces réunions est publié dans le Bulletin Géodésique, il doit insister plus particulièrement sur les discussions en rapport avec la géodésie.

VII – *Symposia.*

46. The Association may organize scientific Symposia to study particular questions of wide interest.

The Executive Committee is responsible for a balanced selection of Symposia, to ensure a representative coverage of subjects and a good geographical distribution and to avoid duplication, overlap and undue frequency.

Symposia sponsored by the Association shall be freely open to all scientists, in accordance with ICSU regulations.

47. Normally applications for Symposia to be held in the period between two Ordinary General Assemblies should be submitted by the Host Organization to the Secretary General before the General Assembly preceding that period. During this General Assembly other applications may be submitted to the Secretary General at least two days before the last meeting of the Council.

The Council, on recommendation of the Executive Committee, shall decide whether the Symposium in question will be sponsored by the Association.

In exceptional cases, the Executive Committee may approve late applications. Such applications must be submitted at least 18 months before the proposed date for the Symposium.

48. The Symposium Organizer must send an official announcement of the Symposium to the Bulletin Géodésique at least one year in advance or immediately after the approval by the Association ; the announced date of the Symposium must not be changed later.

49. Within three months after the Symposium the Symposium Organizer shall provide a report to be published in the Bulletin Géodésique. This report should indicate whether, where, and when the Proceedings will be published. A copy of the Symposium Proceedings, or else one copy of each paper presented at the Symposium, shall be sent to the Central Bureau of the Association.

50. Sponsorship by the Association means only official recognition and does not imply financial support.

VIII – *International Scientific Cooperation.*

51. The Association may undertake directly, supervise or cooperate in scientific work of an international or interdisciplinary character. As a matter of principle, the Association should be represented at Congresses, International Meetings, General Assemblies, etc... of scientific organizations whose activities are connected with its own. The President of the Association or his designate will be the representative of the Association at these meetings.

Travelling and accommodation expenses of the Delegate of the Association may be charged in whole or in part to the Association. A report of these meetings should be published in the Bulletin Géodésique, in particular the discussions relating to geodesy.

L'Association peut aussi représenter l'Union au sein de Commissions inter-Unions ou de Comités spéciaux communs traitant de sujets en rapport avec ses propres études.

La désignation des représentants de l'Association ou de l'Union à ces organismes permanents est faite par le Comité Exécutif. Ces représentants sont élus pour une période de quatre ans et ne peuvent être réélus que pour une période supplémentaire.

IX – *Finances.*

52. Les ***ressources*** de l'Association proviennent :

a) – des cotisations des pays membres de l'Union dont une partie, déterminée par le Conseil de l'Union sur recommandation de son Comité des Finances, est versée à l'Association par le Trésorier de l'Union ;

b) – de la vente des publications ;

c) – de toute autre origine (par exemple : dons, fonds non utilisés à un symposium, intérêts, ...).

53. Le Secrétaire Général reçoit du Bureau et du Conseil de l'Association la responsabilité de gérer ces ressources conformément aux Statuts et Règlement Intérieur, ainsi qu'aux décisions du Conseil et aux recommandations du Comité des Finances de l'Union.

En ce qui concerne chaque compte bancaire de l'Association, l'un des Secrétaires adjoints reçoit délégation de signature, mais seul le Secrétaire Général est responsable des opérations financières de l'Association.

54. A chaque Assemblée Générale Ordinaire de l'Association, le Secrétaire Général présente la proposition de budget pour la période à venir et la soumet au Conseil pour approbation.

Ce budget voté par le Conseil est ensuite exécuté par le Secrétaire Général.

A l'Assemblée Générale Ordinaire suivante, le Conseil examine si les dépenses engagées sont conformes aux propositions antérieurement approuvées. Il délègue à un Comité ad hoc le soin d'effectuer ces vérifications dans le détail.

De plus, cette comptabilité, préalablement vérifiée par un comptable qualifié, est soumise au Trésorier de l'Union, ainsi qu'il est prescrit à l'article 20 du Règlement Intérieur de l'Union.

The Association may also represent the Union in inter–Union Commissions or special joint committees dealing with topics that are related to its own studies.

Elections of Association or Union geodetic representatives on those permanent bodies are made by the Executive Committee. These representatives are elected for one quadrennium and may be re–elected for not more than one further quadrennium.

IX – *Finance.*

52. The ***funds*** of the Association derive from :

a) – the contributions of the member countries of the Union of which a proportion, determined by the Council of the Union on recommendation of its Finance Committee, is paid to the Association by the Treasurer of the Union ;

b) – the sale of publications ;

c) – any other source (for instance : grants, funds remaining after a symposium, interest, ...).

53. The Secretary General is responsible to the Bureau of the Association and to the Council for managing the funds in accordance with the Statutes and By–Laws, with the decisions of the Council and with the recommendations of the Finance Committee of the Union.

To each Bank Account of the Association, one of the Assistant Secretaries shall also have access, but the Secretary General alone shall be responsible for control of the financial operations of the Association.

54. At each Ordinary General Assembly of the Association the budget proposal for the ensuing period shall be presented by the Secretary General and submitted for approval to the Council.

This budget voted by the Council shall be implemented by the Secretary General.

During the next Ordinary General Assembly the Council shall examine all expenditures to ensure that they are in accordance with the proposals previously approved. It appoints an ad hoc committee for carrying out this examination in detail.

In addition, these accounts, previously audited by a qualified accountant, are reported to the Treasurer of the Union, as prescribed in Article 20 of the By–Laws of the Union.

XVIII th GENERAL ASSEMBLY

I.A.G. PRESIDENTIAL ADDRESS

H. Moritz

The I.A.G. is very glad and grateful to have been invited to hold, together with other Associations of the IUGG, its General Assembly in the beautiful and interesting city of Hamburg. By having our Assembly here we are also able to pay our tribute to the glorious tradition of geodesy in Germany, a tradition which, originating with Carl Friedrich Gauss, has lead continuously and with ever increasing strength to the present day. Let me mention only the name of Friedrich Robert Helmert, equally great as a scientist and as an international scientific organizer, who was one of the leaders in the International Geodetic Association before World War I.

By the way, the first international geodetic conference took place in 1864 in Berlin, where, on the initiative of General Johann Jakob Baeyer the "Mitteleuropäische Gradmessung" was founded. Later it became the "Europäische Gradmessung", and in 1887 it was called "International Geodetic Association" (Internationale Erdmessung, Association Géodésique Internationale). The last General Assembly of this Association took place precisely at Hamburg in 1912. So it is wonderful to be here again after such a long time.

Geodesists are conscious of tradition. My distinguished predecessor **T.J. Kukkamäki**, our Honorary President, has given to the I.A.G. this remarkable gavel of the I.A.G. President, where the home of each President in its history has been marked by a golden nail. The first nail is in Potsdam, General Baeyer having been the first President. **Prof. Kukkamäki** notes that these nails are concentrated in a rather small area. This is understandable historically but should change in the future.

Looking around, I see many good friends present. However, some of our old friends have left us since our last General Assembly in Canberra. Especially tragic is the death when it strikes at an early age and suddenly stops a flourishing scientific career. This has been the case with our dear colleagues **Ferenc Halmos** from Sopron, **Wojciech Krzemiński** from Warsaw and **Peter Meissl** from Graz. One of the grand old men of international geodesy is no longer with us : **Ivan D. Zhongolovich** from Leningrad. We shall miss **Walter Grossmann** from Hannover, **Karl Ramsayer** from Stuttgart, **Lajos Homorodi** from Budapest and **Lucien Bragard** from Belgium. Very recently, **P.L. Baetslé** from Brussels, who has done so much for our Association, has left us. I ask you to honor in silence the memory of all our dear friends who have passed away.

The I.A.G. President is supposed to say a few words of science as well. A systematic presentation would be out of place. Some general ideas to give the background for the technical discussions in this Assembly may be appropriate, however. Being in a country with an incomparable geodetic tradition, we should not completely forget the past over the present. Thus, let me give you some remarks entitled.

Past and Present in Geodesy

Positioning.

More than hundred years ago, Friedrich Robert Helmert defined geodesy as "the science of measuring and mapping the surface of the earth". This is an excellent definition, which is valid even today. More precisely, it is a definition of what is called "geometrical geodesy", or by a modern term, "positioning".

The classical way of determining a net of control points is, of course, triangulation, including trilateration. In our European countries, such triangulations are so complete and accurate that many people consider them nearly perfect, sufficient for all practical purposes.

Compared with the perfection of classical triangulation, the first European attempts in satellite triangulation looked rather modest indeed. Now, of course, Doppler positioning competes in accuracy with triangulation, can control it, connect various national triangulations and relate them to a geocentric global system. Very crudely and generally speaking, terrestrial triangulation may have a relative accuracy on the order of 10^{-5} (1 cm per km), whereas Doppler can be better than 10^{-6}, especially over distances on the order of 1000 km.

Laser observations to satellites and very–long–baseline interferometry (VLBI) may reach accuracies of 10^{-8} (a few centimeters over a distance of several thousand kilometres), accuracies which are of interest, above all, for geodynamics as I shall mention later. For the ordinary requirements of the practical geodesist or the surveyor, Doppler is sufficient in accuracy and definitely superior at present to laser and VLBI in speed and practical applicability. Radio interferometry to satellites may in the future become a serious competitor to Doppler or even become its factual successor. In fact, the US Navy TRANSIT system is being phased out and replaced by the GPS (Global Positioning System). Unfortunately, the most precise GPS code may not be generally available, so that radio interferometry to GPS satellites, which is largely independent of classification, may be the thing of the future for the general user.

Nevertheless, let me take the opportunity here to appeal once more to the authorities in charge of GPS to make this fundamental system fully available for scientific purposes, thus continuing the generous support of international geodesy provided by TRANSIT for which we are truly grateful.

Another most interesting recent development in surveying technology is inertial geodesy. Such an instrument is installed in an automobile or a helicopter, accelerations are measured and integrated twice to give coordinate differences. Accuracies are on the order of a few decimeters for loops up to 100 km.

In the face of these technological developments, do classical triangulation and trilateration have a chance to survive? In the last years, we have heard extreme opinions of every kind, so let us beware of simplifications. In fact, the situation looks completely different for different regions and different countries. It looks different for a country with a highly developed technology but still with many unsurveyed regions, different for an old continent with complete dense and accurate classical surveys but with a somewhat less progressive technology, and again different for a developing country which has great geodetic, photogrammetric and surveying tasks but at the same time also should advance its own industry, reducing its dependence on foreign technology.

Gravity field.

According to another famous definition given by Heinrich Bruns in 1878, also more than a hundred years ago, the task of geodesy is the determination of the geopotential, or the determination of the earth's gravity field. This is rather an academic definition, or it was largely academic until the advent of artificial satellites. Then, specialists were needed to study and to take into practical consideration the gravity field, and geodesists proved to be such specialists : Bruns' prophetic definition was vindicated 80 years later.

In fact, Helmert's and Bruns' definitions complement each other, as geometrical and physical geodesy do.

Regarding actual determination we may say that, similarly as in geometry, satellite techniques provide a global reference whereas for details, conventional gravimetry and astrogeodesy fully retain their importance, at least on the continents. The oceans, long the stepchild of geodesy, have become the areas where the geoid and hence the gravity field have become known much better than on the continents, at least regarding detailed resolution. This surprising feat is the achievement of satellite altimetry, the more remarkable as satellite altimeters have been working only over relatively short periods.

The large features of the global gravity field are very well known from satellite data (Doppler, laser, etc..) in combination with terrestrial gravity measurements and it seems that in this respect we are close to the limit achievable by these methods. An essential breakthrough in improving the resolution would be the use of new methods such as satellite–to–satellite tracking and satellite gradiometry. NASA and ESA have excellent plans in this respect, but the present economic situation may not be favorable to such plans

Still, the finest details of the continental gravity field can only be determined by terrestrial gravimetry and astrogeodesy. But here, the relatively slow speed of such measurements is as detrimental to a global coverage as is the fact that gravity data are classified in several countries (I don't quite understand why).

Since terrestrial gravimetry is rather slow and sea gravimetry is extremely slow, faster ways of determining the gravity field would be of utmost importance. Experiments with aerial gravimetry, conducted some 15 years ago, have not furnished the desired accuracy and have been discontinued. Aerial gradiometry (alone and in connection with aerial gravimetry) looks very promising in principle, but will require a highly advanced technology and may then not be widely accessible.

Reference Systems and Geodynamics.

Geodetic constants such as the parameters of the earth ellipsoid are now known to an accuracy considerably better than 10^{-6} : for instance, we have reasons to think that the semimajor axis of the Geodetic Reference Ellipsoid 1980, $a = 6\,378\,137$ m is accurate to ± 1 or 2 meters . This is the level of empirical determination achievable at present and in the forseeable future ; so there is hope that the Geodetic Reference System 1980 will serve for some time to come.

Regarding geocentric position and orientation of coordinate axes, future requirements on global coordinate systems will be higher, on the decimeter (or even centimeter) level. To this accuracy, however, the earth can no longer be considered rigid. Movements of continental plates will become accessible to geodetic measurement over

large distances, using satellite laser and VLBI observations. The precise practical determination of a global terrestrial reference frame will require a corresponding determination of polar motion, again by laser and VLBI and, somewhat less accurate, by Doppler. The theoretical and numerical study of elastic and liquid–core effects on nutation and polar motion will require cooperation between astronomers, geodesists, and geophysicists.

As a conclusion we may say that geodesy has always provided a solid basis for geophysics and geosciences in general. With the new precise, especially spatial, measuring techniques, this role will even considerably increase, and the I.A.G. is fully prepared to expand its efforts along these lines.

After these rather general remarks on the state of our science let me finally report briefly about some items of work of the I.A.G. during the last four years.

According to our statutes, the scientific work of our Association is done by the five Sections. The Section Presidents will report about their work and their problems much better than I could ever do, so let me here only present our thanks to them for their excellent work : to **Alwyn Robbins**, President of Section I, Control Surveys ; to **Leendert Aardom**, President of Section II, Space Techniques ; to **Jim Tanner**, President of Section III, Gravimetry ; to **Leonid Pellinen**, President of Section IV, Theory and Evaluation, and to **Erik Grafarend** who has been acting for **Prof. Pellinen** during his illness ; and to **Richard Rapp**, President of Section V, Physical Interpretation.

Most Commissions and Special Study Groups belong to one Section. There are, however, a few of them which transcend the frame of a particular section, and I must say a few words about them.

Commission VI, International Geodetic Bibliography, presided by **Horst Peschel**, has been working steadily and efficiently. Now the transition to computerized bibliography presents a new challenge.

Commission IX, Education in Geodesy, is presided by **Karl Rinner**. In this field, as well as in bibliography, cooperation with sister organizations such as the Fédération Internationale des Géomètres, the International Society of Photogrammetry and Remote Sensing, the International Cartographic Association, and the International Society for Mine Surveying, is particularly important. Fruitful work has been done in this respect.

Commission X, Geodesy in Africa, under the presidency of **Oluwole Coker**, has been very active in organizing meetings and promoting geodetic operation on the great African continent.

The only Special Study Group outside sections is on History of Geodesy, chaired by our dear Honorary Secretary General, **J.–J. Levallois**. It reminds us that our present work is firmly rooted in the past.

Let me also not forget the official journal of the I.A.G., the Bulletin Géodésique. Under the efficient editorship of **Ivan Mueller** it renders essential service to our science.

An important task is the revision of the structure of our Association. Thiswas done during the last four years by the Cassinis Committee chaired by **T.J. Kukkamäki**. It has done its best to carefully consider various alternative structures and to provide a fresh start. The result will be presented to this General Assembly for discussion and adoption. At a first glance, the proposed new structure does not differ very much from the present one, but we hope there are essential improvements.

There is no time here to speak about the many symposia that have taken place

during the last four years. Let me make one important exception : a chain of symposia was held under the title General Meeting of the I.A.G. in Tokyo, ***May 7–20, 1982.*** Together with the General Assembly in Canberra, the last two largest meetings of the I.A.G. thus took place outside of Europe and North America, which I consider a very promising start. In fact, if we want to be truly international, we urgently need the active cooperation of the countries on the continents of Africa, Asia, and Latin America. Promoting such a cooperation has been one of the main tasks of our Association, and we shall continue to do so to the best of our possibilities.

Let me also say few words on the relation of I.A.G. to our Union, the IUGG. The scientific cooperation between geodesy and geophysics is increasing. As I mentioned before, precise geodetic measurements are getting increasingly important for geodynamics. Therefore , in the new structure of our Association , Section V will be called "Geodynamics", meaning, of course, the geodetic aspects of geodynamics. Six of the IUGG resolutions in Canberra have been related to geodesy. Usually, about one third of the IUGG council members are geodesists.

On the other hand, our financial share in the IUGG keeps decreasing. In 1950 we still had 43 % of the total association allocations ; since 1977 we are down to 19 % . This is not sufficient if we are to fulfil our task of furnishing basic precise data to other branches of geophysics at the pace at which the new spatial observational techniques are being developed, and also our task of meeting the greatly increased needs and interests of developing countries in geodesy.

Finally, it is my pleasant duty to thank our General Secretary Michel Louis for his efficient work in directing the I.A.G. Central Bureau, and our First Vice President, Peter Angus–Leppan for his constant support and helpful advice in difficult matters. It has been a great experience for me to cooperate with the IUGG and to see how President Garland and General Secretary Melchior managed to combine objectivity with helpfulness.

In the beginning I have said that looking around I am glad to see many old friends present. I am equally glad to see here so many young faces. If you look forward to getting exciting new information, I am sure you will not be disappointed. Don't hesitate to actively participate in the discussions, don't be afraid to ask questions, use the opportunity to meet persons you only know from the literature. It depends on you to make this, not an Assembly of Generals, but a true General Assembly.

Wishing you two busy weeks of successful scientific work, I declare the XVIII General Assembly of the International Association of Geodesy opened.

RAPPORT DU SECRETAIRE GENERAL

M. Louis

Le Secrétaire Général de l'Association Internationale de Géodésie a l'honneur de soumettre à la XVIIIè Assemblée Générale le rapport qu'il a établi pour les quatre années écoulées depuis la XVIIè Assemblée Générale.

Le rapport se subdivise en trois parties :

- une partie concernant l'activité scientifique de l'Association ;
- une partie concernant l'administration de l'Association ;
- une partie concernant les finances de l'Association.

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I. — Activité scientifique de l'Association.

L'activité scientifique de l'Association Internationale de Géodésie se traduit par la variété des sujets traités dans l'ensemble du domaine des sciences géodésiques. Les Commissions et Groupes Spéciaux d'Etudes sont la preuve vivante du développement continuel de la géodésie. Depuis la dernière Assemblée Générale, 8 Commissions et 32 Groupes Spéciaux d'Etudes ont fonctionné. Les résultats de ces activités font l'objet de ***Comptes Rendus*** qui seront présentés au cours des différentes séances scientifiques de cette Assemblée Générale.

Un aspect concret de l'activité de l'Association est la tenue des ***symposiums*** patronnés par l'Association. Pour la période 1980—1983, ils ont été au nombre de 27, répartis comme suit :

Année 1980 :

. *Geodesy and Physics of the Earth* (4th International Symposium), Karl—Marx Stadt., G.D.R. ***12—17 May.***
Report in : B.G. 54—4.
Proceedings from (1981). : Akademie der Wissenchaften der DDR. Zentral Institut für Physik der Erde, DDR 15, Potsdam.

. *Problems related to the redefinition of North American vertical geodetic networks* (2nd International Symposium), Ottawa, Canada, ***26—30 May.***
Report in : B.G. 54—4.

Proceedings available from : Canadian Institute of Surveying
(1980). Box 4378, Station "F"
Ottawa, Canada K2C 3J1

. *Reference coordinate systems for earth dynamics* (2nd International Symposium–IAU Colloquium n° 56), organized with IAU : Warsaw, Poland, ***8–12 September.***
Report in B.G. 54–4.
Proceedings published by : D. Reidel Publishing Company.
(1981).

. *Space geodesy and its applications,* organized with COSPAR, Cannes, France, ***17–21 November.***
Proceedings from : Annales de Géophysique du CNRS (Tome 37)
(1981). 15 Quai Anatole France, 75007 – Paris.

Année 1981 :

. *Crustal movements in Africa* (1st International Symposium), Addis Ababa, ***5–10 May.***
Report in : B.G. 56–3.
Proceedings from : UNECA, Addis Ababa, Ethiopia. (in preparation).

. *High–precision earth rotation and earth–moon dynamics : lunar distance and related observations* (IAU Colloquium N° 63), organized with IAU ; Grasse, France, ***22–27 May.***
Proceedings by : D. Reidel Publishing Company.

. *Inertial technology for geodesy and surveying* (2nd International Symposium), Banff, Canada, ***1–5 June.***
Report in : B.G. 55–4.
Proceedings in B.G. 55–4 (partly), and from :
(1981). The Canadian Institute of Surveying,
Ottawa. Canada.

. *Earth tides* (9th International Symposium), New–York, U.S.A., ***17–22 August.***
Report in : B.G. 56–3.
Proceedings from : E. Schweizerbart' sche Verlags–buchhandlung
Stuttgart, F.R.G.

. *Management of geodetic data,* Copenhagen, Denmark, ***24–26 August.***
Report in : B.G. 56–2.
Proceedings from : Danish Geodetic Institute
(1981). Gamlehave Alle 22,
DK–2920 Charlottenlund, Denmark.

. *Geodetic networks and computations* (6th International Symposium), Munich, F.R.G., ***31 August – 5 September.***
Report in : B.G. 56–1.
Proceedings from : German Geodetic Commission
(1982). Arcisstrasse 21,
D–8000 München 2, F.R.G.

. *Mathematical geodesy* (5th Hotine Symposium), Como, Italy, ***7–9 September.***
Report in : B.G. 56–2.
Proceedings from : Prof. F. Sansò
(1983). Istituto di Topografia, Fotogrammetria e Geofisica
Piazza Leonardo da Vinci 32,
20133 Milano, Italy.

. *Geodesy in Africa* (2nd International Symposium), Nairobi, Kenya, ***9–20 November.***
Proceedings : in preparation.

Année 1982 :

. *Satellite Doppler positioning* (3rd International Symposium), Las Cruces, U.S.A., ***8–12 February.***
Report in : B.G. 57–2.
Proceedings from : Third International Doppler Symposium –
(1982). Physical Science Laboratory,
New Mexico State University,
Box 3548
Las Cruces, New Mexico 88003, U.S.A.

. *Modern methods in geodesy and astronomy* (Zhongolovitch Symposium), Leningrad, USSR, ***22–25 February.***
Proceedings : in preparation.

. *Geoid in South Europe and Mediterranean area* (2nd International Symposium), Roma, Italy, ***13–17 September.***
Proceedings from : Istituto Geografico Militare Italiano
(1983). 50100 Firenze, Italy.

. *Use of artificial satellites for geodesy and geodynamics* (3rd International Symposium), Ermioni, Greece, ***20–25 September.***
Report in : B.G. 57–2.
Proceedings from : National Technical University,
K. Zografou 9,
624 Athens, Greece.

. *Education in geodesy* (Joint International Symposium with IAG, ISPRS, FIG, ICA, ISM and UNESCO), Graz, Austria, ***27–29 September.***
Report in : B.G. 57–1.
Proceedings from : Prof. K. Rinner,
(1983). Technical University Graz,
Rechbauerstrasse 12,
A–8010 Graz, Austria.

Au cours de cette année 1982 s'est tenue à Tokyo, Japon, une ***Réunion Générale de l'A.I.G.*** (General Meeting of I.A.G.) au cours de laquelle ont été organisés les symposiums suivants (le rapport sur l'ensemble des réunions est publié dans le B.G. 56–4).

1. *Strategies for solving geodetic problems in developing countries*, Tokyo, ***13 May.***
   Proceedings from : General Meeting of I.A.G.
   c/o Geophysical Institute, Kyoto University,
   Sakyo–ku, Kyoto 606, Japan.

2. *Geodesy for global geodynamics*, Tokyo, ***11 May.***
   Proceedings from : General Meeting of I.A.G. (as above, 1).

3. *Recent crustal movements and phenomena associated with earth quakes and volcanism*, Tokyo, ***12–13 May.***
   Proceedings from : Tecnophysics
   (1983). Elsevier.

4a. *Results of high–precision gravity measurements, absolute and relative*, Tokyo, ***14 May.***
   Proceedings from : General Meeting of I.A.G. (as above, 1).

4b. *Geoid definition and determination*, Tokyo, ***13–15 May.***
   Proceedings from : General Meeting of I.A.G. (as above, 1).

4c. *Advances in geodetic refraction*, Tokyo, ***14 May.***
   Proceedings from : Springer -- Verlag Monograph (invited papers)
   General Meeting of I.A.G. (as above, 1) (contributed papers).

4d. *Marine geodesy including sea gravimetry*, Tokyo, ***14–15 May.***
   Proceedings from : Marine Geodesy – Crane Russak
   (1983). 3 East 44th Street, New York, NY 10017. U.S.A.

4e. *Space geodetic activities with international implications*, Tokyo, ***14 May.***
   Reports published in : CSTG Bulletin n° 4.

5. *Geodetic applications of radio interferometry*, Tokyo, ***7–8 May.***
   Proceedings from : NOAA Technical Report
   National Geodetic Information Branch, NOS/NOAA
   Rockville, Md. 20852, U.S.A.

Année 1983 :

. *Point positioning in marine geodesy*, Maracaibo, Venezuela, ***23–27 February.***
   Proceedings from : Prof. H. Henneberg,
   (1984). Apartado 6
   Maracaibo, Venezuela.

Il faut encore citer parmi les réunions scientifiques patronnées par l'A.I.G. :

Third International Summer School in the Mountains on Geodesy and global Geodynamics, organized by the Technical University at Graz, ***30 August–10 September, 1982,*** Admont, Austria.
Report in : B.G. 57–1.
Proceedings from : Institut für Theoretische Geodäsie
(1983). Technische Universität Graz
Steyrergasse 17, A–8010 Graz, Austria.

Ce ne sont là que les réunions les plus importantes dépassant le cadre des travaux d'un simple groupe d'études ou d'une sous–commission. Les réunions de ces organismes n'ont pas manqué non plus et elles démontrent bien la vitalité de toutes les unités qui composent l'Association : on en trouvera le détail dans les rapports des Commissions et Groupes Spéciaux d'Etudes.

Pour terminer ce bref tour d'horizon, je voudrais mettre l'accent sur l'universalité de la géodésie et les activités de notre Association dans toutes les parties du monde, par deux exemples. Le premier concerne une meilleure répartition géographique de nos réunions. Après l'Assemblée Générale de Canberra en 1979, nous avons eu une Réunion Générale, parfaitement organisée par nos collègues japonais, à ***Tokyo*** en mai 1982, et aussi deux symposiums en ***Afrique*** et un autre en ***Amérique du Sud.*** Ainsi la géodésie sort des limites du vieux continent européen et de l'Amérique du Nord. Le deuxième exemple est très lié au premier puisqu'il montre l'intérêt accru de notre Association pour l'essor de la géodésie dans les pays en développement. Le symposium organisé à Tokyo sur les stratégies pour résoudre les ***problèmes géodésiques dans les pays en développement*** et ceux organisés en ***Afrique*** et ***Amérique du Sud*** montrent bien que tous les géodésiens sont conscients de cette nécessaire ouverture.

II. — Activité administrative de l'Association.

Pendant cette période quadriennale l'activité administrative de l'Association s'est surtout concentrée sur l'élaboration de nouveaux Statuts et Réglement Intérieur, tâche qui fut confiée au Comité Cassinis.

1. *Travaux du Comité Cassinis.*

Au cours de la dernière Assemblée Générale il a été décidé de confier à un comité spécial, le Comité Cassinis, l'étude des éventuelles modifications à apporter aux Statuts et Réglement Intérieur de l'A.I.G. pour les rendre compatibles avec ceux de l'Union, nouvellement modifiés à cette Assemblée Générale, et aussi pour les adapter à l'évolution normale du fonctionnement de l'Association. Ce Comité fut créé par le Comité Exécutif en mai 1980, il comprenait sept membres : le Bureau (Président, Premier Vice–Président et Secrétaire Général), l'ancien Président et trois membres choisis en raison de leurs connaissances du fonctionnement de l'Association : MM. S. Kryński, U. Uotila et K. P. Schwarz . L'ancien Président, Prof. Kukkamäki, assura la présidence du Comité et le Secrétaire Général, M. Louis, le secrétariat.

Le Comité travailla de mai 1980 à mai 1982 : après des échanges de correspondance entre les membres et aussi avec les membres du Comité Exécutif, il se réunit à Munich les 2, 3 et 4 Septembre 1981 et mit au point une première version des nouveaux textes. Elle fut ensuite soumise aux membres du Comité Exécutif qui, après l'avoir discutée et amendée, la ratifia au cours des réunions tenues à Tokyo en mai 1982 (cf. B.G. 56–3 p. IV et V).

La rédaction définitive de ces Statuts et Réglement Intérieur a ensuite été diffusée à tous les Comités Nationaux et est soumise au cours de cette Assemblée Générale à l'approbation du Conseil et de l'Assemblée.

Les Statuts ont subi juste les modifications nécessaires pour les rendre compatibles avec ceux de l'Union : pouvoirs de décision du Conseil, modalités de vote. Les modifications du Réglement Intérieur concernent davantage la façon de gérer les activités de l'Association. Après maintes discussions et étude des avantages et inconvénients de différentes solutions la structure en Sections a été conservée, mais le contenu de chaque Section a été revu et le rôle d'animation de la Section et de son Président a été reconnu et spécialement décrit. Il a été proposé que tous les huit ans, le Comité Cassinis réexamine ce problème de structure et y apporte les retouches nécessaires. Les titres des cinq nouvelles Sections sont les suivants :

- section I : détermination de position, (positioning),
- section II : technologie spatiale avancée, (advanced space technology),
- section III : détermination du champ de pesanteur, (determination of the gravity field),
- section IV : théorie générale et méthodologie, (general theory and methodology),
- section V : géodynamique, (geodynamics).

L'existence de Commissions et de Groupes Spéciaux d'Etudes a été maintenue : il appartiendra au Comité Exécutif, au cours de cette Assemblée Générale, de décider quels doivent être ces Commissions et Groupes Spéciaux d'Etudes et à quelles sections ils seront rattachés.

2. *Réunions du Comité Exécutif.*

Deux séries de réunions du Comité Exécutif ont été organisées, l'une à Paris en mai 1980, la seconde à Tokyo pendant la Réunion Générale de l'A.I.G. en mai 1982.

L'ordre du jour de ces réunions comprenait notamment la préparation des programmes scientifiques de la Réunion Générale de Tokyo (C. E. Paris) et de l'Assemblée Générale de Hambourg ainsi que l'étude du rapport du Comité Cassinis (C. E. Tokyo) et les problèmes de fonctionnement des Commissions et Groupes Spéciaux d'Etudes, (cf. B.G. 54–4 et B.G. 56–3). Le travail ainsi fait par le Comité Exécutif permet au Bureau et plus particulièrement au Secrétaire Général d'assurer ensuite une bonne gestion des affaires de l'Association.

Les Présidents des Sections et le Bureau se sont également réunis à Paris en avril 1983 pour passer en revue et sélectionner les communications scientifiques à présenter à cette Assemblée Générale.

3. *Publications.*

3.1. *Bulletin Géodésique.*

Une fois de plus l'accent sera mis sur les difficultés financières permanentes auxquelles la rédaction doit faire face. Grâce à l'accord qui a été donné par la dernière Assemblée Générale nous pouvons chaque année adapter les tarifs de souscription aux prix de revient de publication. Mais ces tarifs ne font que croître d'année en année — au moins en francs — et cela explique peut—être une stagnation du nombre des abonnés autour de 610 . Il serait souhaitable que ce nombre atteigne au moins 650 pour obtenir un équilibre budgétaire sans un accroissement exagéré des tarifs. Un appel pressant est adressé à tous les géodésiens pour augmenter ce nombre d'abonnés.

Pour diminuer les frais relatifs au Bulletin Géodésique, on a réduit quelque peu le nombre des exemplaires gratuits servis aux Comités Nationaux : chaque comité national reçoit au moins un exemplaire gratuit, ou plus en fonction de la catégorie de son pays dans le classement de l'Union.

3.2. *Le Manuel du Géodésien.*

A la suite de la décision approuvée à la dernière Assemblée Générale un numéro spécial du Bulletin Géodésique a été transformé en Manuel du Géodésien *(B.G. 54—3).* Il a été publié dans l'année qui a suivi l'Assemblée Générale et il essaie de fournir au géodésien tous les renseignements dont il a besoin pour se familiariser avec l'Association Internationale de Géodésie : administration et finances, activité scientifique avant, pendant et après l'Assemblée Générale.

Dans l'ensemble, ce Manuel a été bien accueilli et peu de critiques nous ont été adressées. Nous souhaiterions cependant faire mieux pour le prochain numéro, aussi nous vous demandons de nous faire part très rapidement de vos suggestions et remarques. Le sommaire sera établi par le Comité Exécutif au cours de cette Assemblée Générale.

3.3. *Travaux de l'Association Internationale de Géodésie.*

Après chaque Assemblée Générale le Bureau Central publie les rapports des Sections, Commissions, Groupes Spéciaux d'Etudes, Services permanents, présentés à l'Assemblée Générale. La recherche d'une solution économique pour cette publication après l'Assemblée de Canberra a entraîné des délais fort longs et une qualité moindre de la publication. Nous nous en excusons et nous avons pris les mesures nécessaires pour que ces inconvénients ne se reproduisent plus. Notamment un effort a été demandé aux auteurs des rapports pour une présentation permettant une reproduction photographique directe ; une limitation de la longueur des textes et des bibliographies a aussi été recommandée.

III. — Rapport financier.

Le rapport financier quadriennal présenté ci— après nécessite quelques remar— ques.

1. *Recettes.*

Celles—ci proviennent essentiellement de la subvention versée par l'U.G.G.I. aux différentes Associations. Par rapport à la période précédente on note une très faible augmentation (4 % environ) , mais l'Union ne pouvait mettre plus à la disposition des associations en raison de la non augmentation de la cotisation de base des pays membres.

Certains pays ayant augmenté leur catégorie les recettes de l'Union ont progressé légèrement et celles des Associations par voie de conséquence. Si le taux de cotisation augmente, comme cela est prévu, la subvention versée à notre Association croîtra au cours de la prochaine période, au moins dans la même proportion.

Au cours de cette période nous avons eu quelques autres recettes :

– des subventions de l'Unesco, de l'UG.G.I. et de COSPAR pour aider des géodésiens à participer à des réunions scientifiques, dont notamment la Réunion Générale à Tokyo,

– un don du comité d'organisation du symposium "technologie inertielle en géodésie", (Calgary, Canada) qui a reversé à l'Association le reliquat des frais d'inscription non utilisé par le symposium. Cette somme a servi à aider d'autres géodésiens à participer à d'autres symposiums. Nous remercions encore ce comité d'organisation et souhaitons que son exemple soit suivi.

2. *Dépenses.*

Les dépenses pour l'administration ont été maintenues à un niveau convenable, mais celles relatives aux publications ont encore augmenté de près de 20 % par rapport à la période précédente et restent encore bien supérieures aux recettes correspondantes. L'effort déjà entrepris pour atteindre l'équilibre doit être maintenu : hausse annuelle des tarifs, réduction des dépenses, augmentation du nombre d'abonnés.

Les dépenses concernant les aides aux réunions scientifiques ont également augmenté, mais moins que ce qu'il aurait été souhaitable de faire. Les demandes sont toujours nombreuses et peu sont pleinement satisfaites.

En conclusion, la période passée a été particulièrement difficile sur le plan financier et l'Association n'a pu faire face à ses besoins qu'en puisant dans ses réserves. Pour la période à venir il faut nécessairement accroître les recettes, subvention de l'U.G.G.I. et ventes de publications, et essayer de freiner l'accroissement des dépenses.

3. *Prix Bomford.*

Pour plus de clarté nous avons présenté séparément les comptes relatifs au Prix Bomford . Les intérêts de la réserve déposée en banque à Washington servent à récompenser le lauréat de ce prix scientifique : ils se maintiennent à un niveau convenable.

Bomford Fund for the period 1979 – 1982

		U.S. $
1)	Reserves on Jan. 1, 1979	1 479.63
	Interests during the period	415.41
	Total	1 895.04
2)	Remittance of the Bomford Prize 1979	250.00
	Reserves on Dec. 31, 1982	1 645.04
	Total	1 895.04

INTERNATIONAL ASSOCIATION OF GEODESY

Financial Report for the Period : 1979 – 1982

Amounts in USA dollars, Exchange rate 1 U.S. $ = 6.725 FF

(FORM 1)

	RECEIPTS	I.U.G.G.	GRANTS & CONTRACTS (2)
15	I.U.G.G. ALLOCATION	94 050.00	
2	UNESCO GRANTS	–	1 783.80
3	OTHER GRANTS (IUGG-COSPAR etc..)	3 545.40	4 381.16
4	CONTRACTS WITH ~~UNESCO,~~ IUGG–Publ. Office etc	2 339.92	–
5	SALES OF PUBLICATIONS	95 411.94	–
6	MISCELLANEOUS (1)	6 348.82	–
7	TOTAL RECEIPTS	201 696.08	6 164.96
8	CASH ON HAND AND IN BANKS *(Jan. 1 , 1979)*	38 913.26	–
9	INVESTMENTS & RESERVES *(Jan. 1 , 1979)*	11 183.80	–
10	TOTAL	251 793.14	6 164.96

	EXPENDITURES	I.U.G.G.	GRANTS & CONTRACTS (2)
11	ADMINISTRATION		
11.1	*Personnel*	35 819.89	
11.2	*Quarters (rents and services)*	–	
11.3	*Supplies and Equipment*	4 306.32	
11.4	*Communications*	1 994.73	
11.5	*Travel (administrative only)*	–	
11.6	*Miscellaneous*	515.73	
12.	PUBLICATIONS		
12.1	*Proceedings of Assemblies*	1 267.11	
12.2	*Proceedings of Symposia*	–	
12.3	*Periodicals*	105 570.16	
12.4	*Others*	25 475.06	
13	ASSEMBLIES		
13.1	*Organization*	402.73	
13.2	*Travel*	6 753.10	
14	SYMPOSIA & SCIENTIFIC MEETINGS		
14.1	*Organization*	1 366.34	
14.2	*Travel*	24 207.44	2 720.58
16	GRANTS *(Permanent Services, etc.)*	3 025.81	
17	CONTRACTS WITH ~~UNESCO,~~ IUGG–Publ. Office etc	2 087.65	
18	MISCELLANEOUS (1)	15 719.65	
19	TOTAL EXPENDITURES	228 511.72	2 720.58
20	CASH ON HAND AND IN BANKS *(Dec. 31 , 1982)*	23 238.71	3 444.38
21	INVESTMENTS & RESERVES *(Dec. 31 , 1982)*	42.71	–
22	TOTAL	251 793.14	6 164.96

(1) – *Gain and loss due to the variable exchange rate of the U.S. Dollar are included here.*

(2) – *The sums concerning the Bomford Fund are not included.*

XVIII[th] General Assembly of the International Association of Geodesy

(Hamburg, *15–27 August 1983*)

REPORT ON THE MEETINGS

of the Executive Committee
Council
General Assembly

During this General Assembly,

. the *Executive Committee* met six times : ***15, 16, 19, 22*** and ***23 August,*** and ***25 August*** (new Committee),

. the *Council* met twice : ***17*** and ***24 August,***

. the *General Assembly* met twice : ***15*** (opening session), ***25*** (closing session).

According to the Statutes and By–Laws the ***old Executive Committee*** consisted of the President, the immediate past President and the Honorary Presidents, the Vice–Presidents, the Director of the Central Bureau, the Presidents of Section and the immediate past Presidents, the Assistant Secretaries and the Section Secretaries (in a consultative capacity), the Editor in Chief of the Bulletin Géodésique, whereas the ***new Executive Committee*** consists of the Bureau (President, First Vice–President and Secretary General) , the immediate past President and the Vice–Presidents of the Association, and the Presidents of the Sections. The Honorary Presidents and the Honorary General Secretaries of the Association, the Secretaries of the Sections, the Assistant Secretaries of the Association and the Chief Editor of the Bulletin Géodésique may attend any meeting of the Executive Committee, with voice but without vote.

The ***Council*** consists of the "Delegates to the Council" from member countries. At those meetings the following countries (39) were represented : Australia, Austria, Belgium, Bulgaria, Canada, China, Czechoslovakia, Denmark, Egypt, Ethiopia, Finland, France, German Dem. Rep., Fed. Rep. of Germany, Greece, Hungary, Indonesia, Italy, Ivory Coast, Japan, Kenya, Luxembourg, Netherlands, New–Zealand, Nigeria, Norway, Poland, Romania, South Africa, Sudan, Sweden, Syria, Thailand, Tunisia, Turkey, United Kingdom, U.S.A., U.S.S.R., Venezuela.

The ***General Assembly*** is constituted by all accredited delegates of member countries.

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During these meetings topics concerning the activities and administrative affairs of the Association were treated, decisions or conclusions were drawn as follows.

1. Finances

1.1. Approval of the financial report of the Secretary General

The financial report for the period 1979 – 1982 was presented by the Secretary General during the opening session of the General Assembly. An Audit Committee was then nominated to examine in detail the accounts of the Association and the following report was adopted by the Council :

"Report of the Audit Committee of the Council of the I.A.G."

At its first session, the Council of the I.A.G. elected the following committee to audit the accounts of the Association from 1979 to 1982 : J.Y. Chen, J. Kakkuri (chairman), and H. Kautzleben.

The Audit Committee has met twice, making sample checks of the accounts in considerable depth, and it makes the following comments :

(a) The accounts were very complete, easy to follow, and, in general, very clear. A few queries were clarified by M. Louis.

(b) Recommendations made by the Audit Committee 1979 were taken into consideration as well as practically possible, e.g., the accounts for the Guy Bomford prize were recorded separately.

(c) The major receipts of the I.A.G. arise from the allocations from the IUGG and from the sales of publications. The major expenditures arise from the costs of publications which exceed receipts from sales by 39 % (compared with 67 % in 1975 – 1978).

(d) The deficit between total receipts and expenditures is 23371 US $ for the period 1979 – 1982 (compared with 5456 US $ for 1975 – 1978).

(e) Estimates of Income and Expenditure prepared for the period 1979 – 1982 were very well followed. Those for the period 1983 – 1986 are realistically prepared.

(f) The I.A.G. must be grateful to the Institut Géographique National of France for providing the accommodations free of rent and telephone charges.

The Audit Committee recommends to the General Assembly that the Executive Committee of the I.A.G. urgently examine new ways and means to increase its income, and that appreciation be expressed to the Bureau of the I.A.G. for its excellent work in endeavoring to improve the financial situation.

J.Y. Chen — J. Kakkuri (chairman) — H. Kautzleben

1.2. Bulletin Géodésique

The new rates of subscription for 1984 :

. 233 FF, for public institutions, offices, libraries,

. 210 FF, for booksellers,

. 160 FF, for private geodesists,

were accepted. It was also agreed to accept payment in any transferable currency for private geodesists. For the future normal increase in the rate of subscription was accepted on an annual basis according to the corresponding increase of the expenses.

1.3. Financial relations to the IUGG

The main part of the funds of the Association derives from the allocation of the I.U.G.G. There was some rumor concerning the sharing of this allocation between the Associations. The I.A.G. now receives 19 % of the total amount allocated by the Union, in the past this ratio was larger.

The Executive Committee and Council considered that the share of I.A.G. should be increased : a decrease must be strictly avoided.

Our Association has some important reasons to support its position :

i) the amount of activities in developing countries as well as in small countries ;

ii) the participation in several international cooperative projects (MERIT, ICL, ADOS, . . .) ;

iii) the regular publication of an international scientific journal, the price of which is kept at a low level to facilitate its distribution in developing countries ;

iv) the lack of any other income from national or international sources.

Finally the Council of the Union decided to keep the statu quo concerning the allocation and approved the increase of the unit of subscription proposed by the Finance Committee, i.e., from $ 800 to $ 850 in 1985, and to $ 900 in 1986. The allocation to our Association will grow accordingly.

2. Adoption of the new Statutes and By--Laws

New Statutes and By—Laws had been elaborated by the Cassinis Committee and presented for discussion at the Executive Committee in Tokyo, May 1982. After amendments and approval the new version was distributed to the National Committees, December 1982, and it was finally approved by the Council and the General Assembly in Hamburg, *August 1983.* These new Statutes and By—Laws came into force at the close of the Council meeting at which they were approved, *17 August 1983.*

3. Commissions and Special Study Groups

According to the By—Laws the Executive Committee had to review the existing Commissions and Special Study Groups and to decide which should be continued, which should be cancelled and which new ones should be created. In principle, Commissions may continue for long term periods but the Presidents shall be changed at least every two periods. It was decided to keep all existing Commissions and to create two new sub—commissions for Commission X (Continental Networks) : one

for the Indian sub – Continent and one for Western Asia. Some new Presidents for sub – Commissions were also appointed and the Council elected Presidents of Commissions.

As regards Special Study Groups most of them were terminated, although few were kept on request of Presidents of Sections, and a lot of new ones was created. The Executive Committee decided to which Section they belong and appointed Presidents for all of them, since Presidents of Special Study Groups cannot serve for more than one period.
(Details on these Commissions and Special Study Groups for the period 1983 – 1987 are given in this Handbook).

4. Symposia and other scientific meetings for the period 1984 – 1986

The following list (*) of symposia and scientific meetings was approved by the Executive Committee and the Council for sponsorship of the International Association of Geodesy :

1984 :

- Symposium : "Recent Crustal Movements (**) of the Pacific Region", Wellington, New Zealand, ***February 9–14.***
- Symposium : "Space Techniques for Geodynamics", Sopron, Hungary, ***July 9–13.***
- Symposium : "Longitude Zero", (with the International Union for the History and Philosophy of Science and the International Astronomical Union), Greenwich, England, ***July 9–13.***
- Symposium : "Geodesy and Physics of the Earth", Magdeburg, German Dem. Rep., ***September 23–29.***
- Symposium : "Recent Crustal Movements (**) in Africa", Cairo, Egypt, ***November 26 – December 3.***
- International School of Geodesy : "Optimization and Design of Geodetic Networks", Erice, Italy, ***April 25 – May 10.***
- International Summer School : "Local Gravity Field Approximation", Beijing, China, ***August 21 – September 4.***
- Workshop : "Laser Ranging Instrumentation", Hertsmonceux Castle, England, ***September 10–14.***

1985 :

- Symposium : "Recent Crustal Movements (**) in Central and South America", Maracaibo, Venezuela, ***February 10–16.***
- Symposium : "GPS Techniques and Results", Washington, U.S.A., ***April 15–19.***

(*) – this list has been updated after the meeting of the Executive Committee, Paris, ***February 1984.***

(**) – all Symposia on Recent Crustal Movements are organized in coordination with Working Group n° 1 of the Inter–Union Commission on the Lithosphere (ICL).

- Symposium : "Problems Related to the Redefinition of North American Vertical Geodetic Networks",
  Washington, U.S.A., ***April 22–26.***
- Symposium : "Mathematical Geodesy – 6th Hotine Symposium",
  Roma, Italy, ***June 3–6.***
- Symposium : "Colloquium on Surveying and Mapping Education",
  Fredericton, Canada, ***June 11–14.***
- Symposium : "Geodetic Computations",
  Cracow, Poland, ***June 18–21.***
- Symposium : "Inertial Survey Systems",
  Banff, Canada, ***September 16–20.***
- Symposium : "Earth Tides",
  Madrid, Spain, ***September 23–28.***
- Symposium : "High–Precision Gravity Measurements",
  U.S.S.R.
- Symposium : "Recent Crustal Movements (**) in Karpathean Region",
  Budapest, Hungary.
- Workshop : "Geodetic Gravimetry",
  Miramare, Italy, ***January***
- International Comparison of Absolute Gravity Measurements,
  Paris–Sèvres, France, ***May – June.***
- Workshop : "Absolute Gravity Measurements",
  Paris, France, ***June.***
- Workshop : "Density distribution of the Lithosphere : static and dynamic models",
  Zürich, Switzerland, ***May.***
- Workshop : "MERIT",
  Columbus, U.S.A., ***July 28 -- August 2.***
- International Training Seminars on "Artificial Satellite Techniques for Geodesy",
  . Yamoussoukro, Ivory Coast, ***March.***
  . Nairobi, Kenya, ***May.***

1986 :

- Symposium : "Geodesy in Africa",
  Yamoussoukro, Ivory Coast, ***March – April.***
- Symposium : "Gravimetry",
  Toulouse, France , ***September.***
- Symposium : "Recent Crustal Movements (**)",
  U.S.S.R.
- Symposium : "Use of Artificial Satellite for Geodesy and Geodynamics",
  Greece.
- Symposium : "Earth's Rotation and Reference Frames for Geodesy and Geodynamics",
  (with the International Astronomical Union),
  Washington, U.S.A., ***June.***

- Symposium : "The European and Mediterranean Geoid", Italy, *April* or *May.*
- Symposium : "Figure and Dynamics of the Earth, the Moon and Planets", Praha, Czechoslovakia, *August 25–30.*
- International Summer School in the Mountains : "Mathematical and Numerical Methods in Physical Geodesy", Admont, Austria, *August 25 – September 5.*

5. Next General Assembly

The I.A.G. will hold its next General Assembly in 1987 in conjunction with the ordinary General Assembly of the Union, at Vancouver, Canada, *August.*

The Executive Committee confirmed once more its opposition to holding a Special General Assembly in between General Assemblies of the Union. It was pointed out that individual Symposia on specific topics were most efficient for the scientific work and that it was easier for scientists to get facilities to attend short meetings once or twice a year than for a longer Assembly.

6. Proceedings of the I.A.G. – Symposia at the Hamburg General Assembly

Responding to a proposal of the Reidel Publishing Company (Dordrecht, Holland) to publish the proceedings of several I.A.G. – Symposia, the Executive Committee decided :

i) the Proceedings of the I.A.G. – Symposia at the XVIIIth General Assembly should be published by the I.A.G. itself in an economic way ;

ii) some selected papers could be published in the Bulletin Géodésique, in this case they would not be included in full in the volumes of Proceedings but only summaries ;

iii) authors and conveners should be requested to prepare good manuscripts ready for camera reproduction not later than *December 31st, 1983.*

iv) an inquiry to know the interest of participants at the General Assembly should be made before people leave (the results were encouraging : a great majority was interested in receiving the Proceedings and many were ready to pay $ 30).

Prof. I.I. Mueller then accepted to take care of this publication which will be available early in 1984.

7. The Geodesist's Handbook 1984

The Executive Committee confirmed the need to publish a Geodesist's Handbook every four years. The next one shall be published about mid–1984 and take place of B.G. Vol. 58, n° 2 , or n° 3.

It should have roughly the same Table of Contents as the previous one.

C.C. Tscherning was nominated to act as Editor in Chief for this Handbook in close connection with the Central Bureau in Paris.

8. Elections

The elections took place in the Council on *August 24* and concerned only those positions subject to re–election at the end of this period. They gave the following results :

– President	:	P.–V. Angus–Leppan	(Australia)
– 1st Vice–President	:	I.I. Mueller	(U.S.A.).
– 2nd Vice–President	:	M. Burša	(Czechoslovakia)
– 3rd Vice–President	:	G. Lachapelle	(Canada) (*)
– Secretary General	:	M. Louis	(France)
– Assistant Secretaries	:	C. Boucher	(France)
		J. Kryński	(Poland)
– Section Presidents	:		
I	:	J.D. Bossler	(U.S.A.)
II	:	R. Anderle	(U.S.A.)
III	:	W. Torge	(Fed. Rep. of Germany)
IV	:	E. Grafarend	(Fed. Rep. of Germany)
V	:	H. Kautzleben	(German Dem. Rep.)
– Section Secretaries	:		
I	:	H. Henneberg	(Venezuela)
	:	M. Prilepin	(U.S.S.R.)
	:	J.Y. Chen	(China)
II	:	B. Kolaczek	(Poland)
	:	P. Wilson	(Fed. Rep. of Germany)
III	:	C.C. Tscherning	(Denmark)
	:	I. Nakagawa	(Japan)
IV	:	K.–P. Schwarz	(Canada)
	:	F. Sansò	(Italy)
V	:	H.–G. Kahle	(Switzerland)
	:	D. McCarthy	(U.S.A.)
– Commission Presidents	:		
III	:	J.G. Tanner	(Canada)
V	:	J.T. Kuo	(U.S.A.)
VI	:	L. Stange	(German Dem. Rep.)
VII	:	P. Vyskočil	(Czechoslovakia)
VIII	:	C. Reigber (**)	(Fed. Rep. Germany)
IX	:	E. Krakiwsky	(Canada)
X	:	J. Kakkuri	(Finland)
XI	:	A. Cissé	(Ivory Coast)

The immediate past President, H. Moritz (Austria) was nominated Honorary President of I.A.G.

(*) – the next General Assembly taking place in Canada.

(**) – I.I. Mueller will remain in position till next COSPAR meeting, *July 1984,* and then C. Reigber will take office.

9. Appointment of I.A.G. representatives in other scientific bodies

9.1. — U.N. Cartographic Office :

J. Kakkuri (President of Commission X — Continental Networks)

For U.N. regional cartographic conferences I.A.G. should be represented by presidents of the subcommissions of Commission X concerned.

9.2. — IUGG — Committee for Developing Countries :

members of the Committee :

A.M. Wassef (Egypt)
A. Cissé (President of Commission XI — Geodesy in Africa).

9.3. — Scientific Committee for Antarctic Research (SCAR) :

Mr. Con Veenstra (Australia), to replace Mr. A.G. Bomford (Australia).

10. Honorary Members of Council

A proposal was made to nominate as Honorary Members of Council scientists who have given distinguished and outstanding contributions to the Association and to the development of Geodesy. Those members would hold office for life and their number would not exceed five. They would attend meetings of the Council, with voice but without vote.

Though such nominations have occured in the past (see Compte Rendu XIII^{e} Assemblée Générale, Lucerne 1967) the Executive Committee did not accept this proposal but recommended further investigation to find a solution to honour distinguished geodesists.

11. Bomford Prize

The third Bomford Prize was awarded to :

Dr. J. Wahr (U.S.A.)

for his outstanding contribution to geodesy. The Prize was handed over to him during the opening session of the General Assembly by the President of the Association and Dr. A.R. Robbins, representative of the British National Geodesy Subcommittee founder of the Prize.

12. Levallois Medal

During the opening session the medal number one was delivered to the first awardee, Dr. Ch. Whitten.

At the end of this General Assembly the Council awarded the second Levallois Medal to :

Prof. R. Sigl (Fed. Rep. of Germany)

for his long period of valuable services brought to geodesy.

XVIIIth General Assembly of the International Association of Geodesy

(Hamburg, *15–27 August 1983*)

LIST OF PARTICIPANTS

(chief delegates are indicated by : *)

ALGERIA

Khattar, K. (*)
Kout, M.
Lalileche, B.

ARGENTINA

Restelli, A.
Varona, V. (*)

AUSTRALIA

Angus–Leppan, P.
Dewing, B.
Lambeck, K. (*)
Rizos, C.
Sheard, M.L.

AUSTRIA

Bretterbauer, K. (*)
Chesi, G.
Erker, E.
Gerstbach, G.
Hofmann–Wellenhof, B.
Höggerl, N.
Moritz, H.
Pesec, P.
Steinhauser, P.
Weber, R.
Zahradnik, D.

BELGIUM

Dehant, V.
Ducarme, B.
Melchior, P.
Paquet, P.
Poitevin, C.
Prils, H.
Smets, E.
Van den Herrewegen, M. (*)
Van Twembeke, U.

BRAZIL

Albuquerque Mello, R.
Fischer, E.U.
Gemael, C. (*)
De Seixas, I.T.
Silva, F.

BULGARIA

Georgiev, N.
Zlatanov, G. (*)

CANADA

Delikaraoglou, D.
Helgason, J.
Jensen, O.
Lachapelle, G. (*)
Loncarevic, B.
Saastamoinen, J.
Schwarz, K.P.
Tanner, J.G.
Vaníček, P.
Wells, D.E.

CHILE

Gonzales–Ferran, O.
Villanueva, V. (*)

CHINA

Chang, Ruey–Gang
Chen, J.Y. (*)
Fang Jun
Jinsheng, Ning
Li, De Xi
Li, Xian Fu
Li, Xiqi
Liu, ZuHui
Liu, Tung Sheng
Lu, Fu
Lu, Zhong–Lian
Peng, Guan Yu
Shyu, Chuen–Tien
Wang, Bao Can
Wei Jian, Zhang
Wu, Qirni
Xu, Ju Sheng
Xu, X.Z.
Zhao, Xucai
Zheng, Wenzhen
Zhu, Changsheng
Zhu, Sheng–Yuan

CZECHOSLOVAKIA

Burša, M. (*)
Holota, P.
Hradilek, L.
Klokoćnik, J.
Kukuča, J.
Šimoň, Z.
Vyskočil, P.
Vyskočil, V.

DENMARK

Andersen, O.B.
Kejlsø , E. (*)
Nielsen, L.
Poder, K.
Remmer, O.
Sharma, P.V.
Tscherning, C.C.

EGYPT

Habib, A.F. (*)
Migahid, A.H.
Riad, S.
Wassef, A.M.

ETHIOPIA

Asfaw, L.M. (*)

FINLAND

Kakkuri, J. (*)
Kiviniemi, A.
Kukkamäki, T.J.
Pamm, T.

FRANCE

Balmino, G.
Bulot, A.
Calame, O.
Comolet–Tirman, A.
Dufour, H.M. (*)
Feissel, M.
Gervaise, J.
Guillaume, A.
Guinot, B.
Laclavère, G.
Louis, M.
Louis, P.
Nouel, F.
Ogier, M.
Pirazzoli, P.A.
Piuzzi, A.
Sakuma, A.
Sarrailh, M.
Villecrose, J.

GERMAN DEM. REP.

Goehler, H.
Huether, G.
Kautzleben, H.
Peschel, H. (*)

FEDERAL REPUBLIC OF GERMANY

Augath, W.
Barth, W.
Bauer, M.
Bäumker, M.
Beckers, Y.
Bill, R.
Boedecker, G.
Bosch, W.
Brosche, P.
Caspary, W.F.

Challa, S.
Clasen, S.
Cuno, J.
Dallüge, U.
Dow, J.
Drewes, H.
Egge, D.
Eisseller, B.
Enslin, H.
Farkas – Jandl, T.
Freeden, W.
Fritsch, D.
Gauthier, W.
Georgiadou, R.
Gerstenecker, C.
Gessler, J.
Gleine, U.
Gleixner, H.
Graeff, H.
Grafarend, E.
Grimhardt, H.
Grosse, H.
Groten, E.
Hallermann, L.
Hausch, W.
Heck, B.
Hein, G.
Heineke, U.
Hinze, H.
Hirsch, O.
Hornik, H.
Ilk, H.
Illner, M.
Jürgensen, D.
Kahmen, H.
Kaniuth, K.
Karsten, A.
Kelm, R.
Kleusberg, A.
Kohlstock, P.
Konecny, G.
Kremers, H.
Krieffal, H.–J.
Krumm, F.W.
Kuntz, E.
Ladstätter, P.
Lelgemann, D.
Leonhard, J.
Lindner, K.
Linkwitz, K.
Lorenzen, K.
Lübker, M.S.
Maelzer, H.
Marquart, G.
Massmann, F.H.
Messerschmidt, E.
Miller, A.
Mouka, F.M.
Müller, Hartmut
Müller, Horst
Müller, V.
Niemeier, W.
Ochse, G.
Pavlis, E.C.
Pelzer, H.
Posorske, W.
Reigber, C.
Reinhart, E.
Ries, H.
Rietkötter, H.
Richter, B.
Röder, R.
Rudloff, R.
Rüffer, J.
Rumpf, W.E.
Scheuke, H.W.
Schlichting, R.
Schmitt, G.
Schnädelbach, K.
Schödlbauer, A.
Schüller, K.
Schulz, H.
Schulze, H.
Seeber, G.
Seeger, H.
Seemüller, W.
Sigl, R. (*)
Stock, B.
Tilk, U.
Van Mierlo, J.
Weber, G.
Wende, W.
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Wenzel, H.G.
Wildermann, E.
Wildner, H.
Wilson, P.
Witte, B.U.
Wölpert, D.
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Zschau, J.

GREECE

Antonopoulos, A.
Arabelos, D.
Doufexopoulou, M.
Livieratos, E. (*)
Mavridis, L.N.
Veis, G.

HUNGARY

Bartha, C.
Birð, P.
Hoffer, I.
Joð, I.
Mentes, G.
Sarközy, F.
Somogyi, J. (*)
Szabo, Z.
Varga, P.

ICELAND

Björnsson, A.
Eysteinsson, H. (*)

INDIA

Arur, M.G. (*)

INDONESIA

Rais, J. (*)
Kahar, J.

IRAN

Amoui, T.
Farahani, H.
Kamal Beik, S.M.
Najafi Alamdari, M. (*)
Sharifi, A.A.

ITALY

Arca, S.
Barzaghi, R.
Benciolini, B.
Betti, B.
Birardi, G.
Bonasia, V.
Caporali, A.
Casotto, S.
Crosilla, F.
Morelli, C. (*)
Mussio, L.
Sacerdote, F.
Sansò, F.
Unguendoli, M.
Zerbini, S.

IVORY COAST

Abla, J.
Cissé, A. (*)

JAPAN

Fujimoto, H.
Hagiwara, Y.
Kasahara, K.
Nakagawa, I. (*)
Okubo, S.
Ooe, M.
Seto, T.
Suzuki, H.
Tanaka, M.
Yokoyama, K.
Yumi, S.

KENYA

Chodota, M.W.L.
Rostom, R.S. (*)

LIBYA

El Gammudi, M.
Unis, M. (*)

LUXEMBOURG

Flick, J. (*)

MALAYSIA

Mohamed, A.M. (*)

NETHERLANDS

Aardoom, L. (*)
Ambrosius, Boudewyn
Brouwer, F.
Colombo, O.L.
Denekamp, J.
Richardus, P.
Rietveld, H.
Rummel, R.
Van Gelder, B.H.

NEW–ZEALAND

Dibble, R. (*)

NIGERIA

Ajakaiye, D.E.
Coker, O. (*)
Ezeigbo, C.
Fajemirokun, F.A.
Fubara, D.M.

NORWAY

Bakkelid, S. (*)
Blankenburgh, J.C.
Danielsen, J.S.
Harsson, B.C.
Midtsundstad, A.
Plag, H.S.

POLAND

Baran, L.W.
Galas, R.
Kolaczek, B.
Kryński, J.
Kryński, S.
Ney, B. (*)
Odlanicki–Poczobutt, M.
Platek, A.
Sledziński, J.
Swiatek, K.
Szacherska, M.K.
Zielinski, J.B.

PORTUGAL

Agria Torres, J.M.
Casaca, J. (*)

ROMANIA

Dragomir, V. (*)
Ghitau, D.
Rotaru, M.

SOUTH AFRICA

Fitschen, E.
Merry, C.
Rousseau, D.P. (*)
Van Gysen, H.
Wonnacott, R.

SPAIN

Chueca Castedo, R.M.
Herrero, R. (*)
Mas, S.
Miguel, J.S.
Romero Perez, M.
Vieira Diaz, R.

SUDAN

Salih, A.B. (*)

SWEDEN

Anderson, A.J.
Becker, J.–M.
Bjerhammar, A.
Ekman, M.
Eliasson, L.
Fang Peng
Haller, L.A.
Scherneck, H.G.
Sjöberg, L.E.
Tang, Guogiang
Tengström, E. (*)

SWITZERLAND

Brunner, F.
Elmiger, A.
Gurtner, W.
Jeanrichard, F.
Kahle, H. (*)
Klingelé, E.
Werner, D.

SYRIA

Ahmar, A.R.
Kadri, A.
Safi, A.M. (*)

THAILAND

Pamchimkul, S. (*)
Phiphitkun, P.

TUNISIA

Charfi, M. (*)

TURKEY

Aksoy, A. (*)
Demirkol, O.
Gürkan, O.
Sarbanoglu, H.

UNITED KINGDOM

Agrotis, L.
Ashkenazi, V.
Calvert, C.E.
Critchley, J.
Cross, P.A.
Dodson, A.
Edge, R.T.
Grist, S.N.
Haworth, R.T.
Hipkin, R.
Howard, P.D.
Khan, M. Aftab
Knight, J.A.
Leppard, N.A.
Miles, P.P.
Moore, T.
Olliver, J.
Parker, D.
Robbins, A.R.
Searle, R.
Thomas, P.
Weightman, J.A.
Wilkins, G.A. (*)

U.S.A.

Anderle, R.
Babcock, A.
Bilham, R.
Bock, Y.
Bose, S.C.
Bossler, J.
Carter, W.E.
Chovitz, B.
Christodoulidis, D.
Clarke, R.
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Daugherty, K.I.
Dickey, J.O.
Dunn, P.
Faller, J.
Goad, C.C.
Hardy, R.L.
Hatch, R.R.
Heller, W.G.
Herring, T.A.
Jekeli, C.
Kaula, W.M.
Khan, M.A.
Kivioja, L.A.
Kumar, M.
Kuo, J.J.
Laubscher, R.E.
McCarthy, D.
Macomber, M.
Marsh, J.G.
Meertens, C.
Melbourne, W.G.
Meyers, H.
Mueller, I.I. (*)
Murphy, S.P.
Odom, H.
Prescott, W.U.
Rapp, R.
Rundle, J.
Saxena, N.
Schwiderski, E.W.
Senus, W.
Wahr, J.
Warburton, R.
Ware, R.
Whalen, C.
Whitten, C.A.
Wilcox, L.E.

U.S.S.R.

Boulanger, Y. (*) Prilepin, M.

VENEZUELA

Henneberg, H.Z. (*)

YUGOSLAVIA

Colić, K. (*) Živković, A.

ZIMBABWE

Podmore, P. (*)

. **Guests**

Hieber, S. (European Space Agency)

Fezzani, C. (African Association of Cartography)

Ali Bada (United Arab Emirates).

RESOLUTIONS

as proposed by the International Association of Geodesy
and endorsed by the International Union of Geodesy and Geophysics

VOEUX

proposés par l'Association Internationale de Géodésie
et approuvés par l'Union Géodésique et Géophysique Internationale

VOEU N° 1

L'Union Géodésique et Géophysique Internationale,

considérant l'importance scientifique, technique et économique de la campagne ADOS (Géodésie Doppler en Afrique), et

notant l'apport de ce programme à l'amélioration de la connaissance de la figure de la Terre et dans la coordination des différents réseaux géodésiques en Afrique,

notant aussi que deux séminaires de formation sur les techniques Doppler vont être organisés en collaboration avec l'Association Internationale de Géodésie en 1985 en même temps que doit se tenir le troisième Symposium International sur la Géodésie en Afrique,

demande aux organisations internationales et nationales de coopération d'apporter leurs concours à ces activités.

VOEU N° 2

L'Union Géodésique et Géophysique Internationale,

considérant l'importance extraordinaire du système des Etats Unis dit "NAVY NAVIGATION SATELLITE SYSTEM", à la fois pour la science géodésique et pour les levés topographiques civils et

notant que :

1) ce système a une durée de vie limitée,

2) d'autres systèmes de positionnement radioélectrique précis tels que GPS (système de positionnement mondial des Etats Unis) et GLONASS (système de navigation mondial de l'URSS) sont en cours de développement ou de conception,

demande instamment aux autorités concernées de rendre accessible à la communauté internationale scientifique et civile l'information permettant d'obtenir de ces systèmes le maximum de précision.

VOEU N° 3

L'Union Géodésique et Géophysique Internationale,

notant que l'un des buts du Projet MERIT (mesure de la rotation terrestre et comparaison des techniques) est une évaluation comparative des informations sur la rotation de la Terre obtenues par diverses techniques au cours d'une campagne consacrée à ce projet, et

considérant que des normes détaillées sont en cours de préparation à cet effet,

recommande que tous les résultats de MERIT se conforment à ces normes, et

engage tous les participants au projet à utiliser les constantes, les modèles et les systèmes de référence, selon les règles qui seront définies dans le recueil final des normes MERIT.

RESOLUTION N° 1

The International Union of Geodesy and Geophysics,

considering the scientific, technical and economic importance of the African Doppler Survey (ADOS),

noting the significance of this program for improving the knowledge of the figure of the Earth and for coordinating the various geodetic networks in Africa,

noting that two training seminars on Doppler techniques are to be organized in collaboration with the I.A.G. as well as the Third International Symposium on Geodesy in Africa in 1985,

requests the international and national cooperative organizations to support these activities.

RESOLUTION N° 2

The International Union of Geodesy and Geophysics,

considering the extraordinary international importance of the U.S. Navy Navigation Satellite System, both to the science of geodesy and to civil surveying in this field,

noting that

1) this system is due to be discontinued, and

2) other precise satellite–based radio positioning systems such as U.S. Global Positioning System (GPS) and the USSR Global Navigational Satellite System (GLONASS) are being developed or conceived,

strongly urges the appropriate authorities to make available to the international scientific and civil community the information necessary to obtain maximum position accuracy from the new systems.

RESOLUTION N° 3

The International Union of Geodesy and Geophysics,

noting that a goal of Project MERIT (measurement of Earth's rotation and intercomparison of techniques) is to complete a comparative evaluation of the Earth rotation results obtained by different techniques during a dedicated campaign,

considering that detailed standards are being prepared to accomplish this goal,

recommends that all MERIT results be referred to these standards, and

urges that all participants in the Project adhere to the constants, models and reference frames and to the protocols for their use as will be defined in the final MERIT Standard Document.

VOEU N° 4

L'Union Géodésique et Géophysique Internationale,

considérant que le transfert de moment cinétique entre les océans, l'atmosphère et la partie solide de la Terre est rapidement apparu comme un problème d'une grande importance scientifique en raison de la signification de ce mécanisme de couplage pour les études fondamentales de géodésie et de géophysique de la partie solide de la Terre,

tenant compte du fait que la compréhension de la rotation de la Terre et du mouvement du pôle dépend de la compréhension de l'effet de l'atmosphère et des océans sur la partie solide de la Terre,

recommande que les efforts de recherche coopérative soient encouragés dans tous les pays afin d'acquérir les données convenables et de réunir les scientifiques de toutes disciplines pour l'étude multidisciplinaire du transfert de moment cinétique entre la partie solide de la Terre, les océans et l'atmosphère.

VOEU N° 5

L'Union Géodésique et Géophysique Internationale,

notant la démonstration récente que le transfert de moment cinétique entre l'atmosphère et la Terre solide constitue une contribution essentielle aux variations à court terme de la durée du jour et du mouvement du pôle,

considérant que la campagne principale du Projet MERIT apportera, pendant la période du 1er septembre 1983 au 31 octobre 1984, la résolution la plus fine et les mesures les plus précises de la rotation terrestre jamais réalisées jusqu'à présent,

demande que l'Organisation Météorologique Mondiale (OMM) fasse un effort particulier, durant cette campagne et plus particulièrement d'avril à juin 1984 où la densité d'observations sera la plus grande, pour collecter l'ensemble le plus complet possible de données de vent et de pression et pour les réduire de manière cohérente afin d'obtenir la meilleure valeur du moment angulaire atmosphérique et la fonction d'excitation du mouvement du pôle.

VOEU N° 18

L'Union Géodésique et Géophysique Internationale,

considérant l'importance des mesures absolues de pesanteur de haute précision pour la recherche géodésique et géophysique et leurs applications,

reconnaissant que les comparaisons futures entre les divers appareils de mesure absolue sont nécessaires pour l'étude des sources d'erreurs systématiques,

demande l'appui du BIPM (Bureau International des Poids et Mesures) pour organiser une campagne internationale pour la comparaison des appareils de mesure absolue, et

demande à tous les pays possédant un appareil absolu transportable de participer à cette campagne et aux réductions et analyses qui en découleront.

RESOLUTION N° 4

The International Union of Geodesy and Geophysics,

noting that the transfer of angular momentum between the oceans, atmosphere, and solid Earth is rapidly emerging as a problem of great scientific importance and in view of the significance of this coupling mechanism to fundamental studies in geodesy and solid–Earth geophysics,

recognizing that understanding the Earth's polar motion and rotation depends on an understanding of the effect of the atmosphere and oceans on the solid Earth,

recommends that cooperative research efforts be encouraged in all countries in order to acquire relevant data and to bring together scientists from all disciplines in multidisciplinary studies of the momentum transfer between the solid Earth, the oceans, and the atmosphere.

RESOLUTION N° 5

The International Union of Geodesy and Geophysics,

noting the recent demonstration that angular momentum transfer between the atmosphere and solid Earth makes a major contribution to short term variations in the length of the day and polar motion,

considering that the Main Campaign of Project MERIT, during the period September 1, 1983 to October 31, 1984, will produce the highest resolution and most accurate measurements of Earth rotation ever achieved,

requests that the World Meteorologic Organization (WMO) make every effort to collect the most complete possible set of global wind and pressure data and reduce these data in a consistent manner in order to obtain the highest quality atmospheric angular momentum and polar motion excitation function throughout this period, and especially during April through June 1984, concurrent with the period of high intensity MERIT observations.

RESOLUTION N° 18

The International Union of Geodesy and Geophysics,

considering the importance of highly accurate absolute gravity measurements for geophysical and geodetic research and applications,

recognizing that future comparisons of different absolute gravity apparatus are necessary to study sources of systematic error,

requests the support of the Bureau International des Poids et Mesures (BIPM) (International Bureau of Weights and Measures) in hosting an international campaign to compare absolute apparatus, and

requests all countries having transportable apparatus to take part in the campaign and the subsequent data reduction and analysis.

RESOLUTIONS

adopted by the International Association of Geodesy

VOEUX

adoptés par l'Association Internationale de Géodésie

VOEU N° 1

L'Association Internationale de Géodésie,

reconnaissant sa responsabilité pour fournir à la communauté scientifique des estimateurs représentatifs des paramètres géodésiques fondamentaux, et

ayant décidé d'actualiser à chaque Assemblée Générale les valeurs numériques en vigueur,

recommande que les valeurs numériques suivantes soient considérées comme des estimateurs représentatifs en vigueur :

– vitesse de la lumière dans le vide	$c = (299\,792\,458 \pm 1{,}2)\ \mathrm{ms}^{-1}$
– constante Newtonienne de la gravitation	$G = (6\,673 \pm 1) \times 10^{-14}\ \mathrm{m}^3\ \mathrm{s}^{-2}\ \mathrm{kg}^{-1}$
– vitesse angulaire de la Terre (valeur arrondie)	$\omega = 7\,292\,115 \times 10^{-11}\ \mathrm{rad.\ s}^{-1}$
– constante géogravitationnelle incluant l'atmosphère	$GM = (39\,860\,044 \pm 1) \times 10^{7}\ \mathrm{m}^3\ \mathrm{s}^{-2}$
– constante géogravitationnelle de l'atmosphère seulement	$GM_A = (35 \pm 0{,}3) \times 10^{7}\ \mathrm{m}^3\ \mathrm{s}^{-2}$
– coefficient harmonique du second degré (en excluant la déformation permanente de marée)	$J_2 = (1\,082\,629 \pm 1) \times 10^{-9}$
– rayon équatorial terrestre	$a = (6\,378\,136 \pm 1)\ \mathrm{m}$
– pesanteur équatoriale	$\gamma_e = (978\,032 \pm 1) \times 10^{-5}\ \mathrm{ms}^{-2}$
– aplatissement (f)	$1/f = (298\,257 \pm 1) \times 10^{-3}$
– potentiel du géoïde	$W_0 = (6\,263\,686 \pm 2) \times 10\ \mathrm{m}^2\ \mathrm{s}^{-2}$
– paramètres triaxiaux (valeurs arrondies) :	
. aplatissement équatorial (f_1)	$1/f_1 = 90\,000$
. longitude du grand axe de l'ellipse équatoriale	$\lambda_1 = 15°$ West

La valeur de c et de son écart–type sont extraites du système des Constantes Physiques 1973 de CODATA. Les autres écarts–type doivent représenter des estimateurs réalistes de précision, et la valeur de ω est exacte au nombre de chiffres donnés.

On remarque que de plus amples détails sur les paramètres géodésiques de base sont donnés dans le rapport du G.S.E. 5–39 présenté à cette Assemblée Générale.

On doit particulièrement insister sur le fait que ces valeurs sont des estimateurs actualisés, et qu'à des fins de référence il faut utiliser le système Géodésique de Référence 1980, tel qu'il a été adopté par l'U.G.G.I. à la XVII^{ème} Assemblée Générale.

RESOLUTION N° 1

The International Association of Geodesy,

recognizing its responsibility for providing representative estimates for fundamental geodetic parameters to the scientific community, and

having decided to update current numerical values at each General Assembly,

recommends that the following numerical values be considered currently representative estimates :

– velocity of the light in vacuo	$c = (299\,792\,458 \pm 1.2)\ ms^{-1}$
– Newtonian gravitational constant	$G = (6\,673 \pm 1) \times 10^{-14}\ m^3\ s^{-2}\ kg^{-1}$
– angular velocity of the Earth (rounded value)	$\omega = 7\,292\,115 \times 10^{-11}\ rad.\ s^{-1}$
– geocentric gravitational constant including the atmosphere	$GM = (39\,860\,044 \pm 1) \times 10^7\ m^3\ s^{-2}$
– geocentric gravitational constant of the atmosphere only	$GM_A = (35 \pm 0.3) \times 10^7\ m^3\ s^{-2}$
– second degree harmonic coefficient (free from permanent tidal deformation)	$J_2 = (1\,082\,629 \pm 1) \times 10^{-9}$
– equatorial radius of the Earth	$a = (6\,378\,136 \pm 1)\ m$
– equatorial gravity	$\gamma_e = (978\,032 \pm 1) \times 10^{-5}\ ms^{-2}$
– flattening (f)	$1/f = (298\,257 \pm 1) \times 10^{-3}$
– geoidal potential	$W_0 = (6\,263\,686 \pm 2) \times 10\ m^2\ s^{-2}$
– triaxility parameters (rounded values)	
. equatorial flattening (f_1)	$1/f_1 = 90\,000$
. longitude of major axis of equatorial ellipse	$\lambda_1 = 15°$ West

The value of c and its standard error are taken from the CODATA System of Physical Constants of 1973. The other standard errors are intended to represent realistic estimates of accuracy, and the value of ω is accurate to the given digits.

It is remarked that more details on basic geodetic parameters are found in the Report of S.S.G. 5.39 presented at this General Assembly.

It is particularly emphasised that these values are current estimates, whereas for reference purposes the Geodetic Reference System 1980, as adopted by the I.U.G.G., at the XVII General Assembly, should be used.

VOEU N° 2

L'Association Internationale de Géodésie,

reconnaissant l'importance, dans les zones de montagne, d'une détermination précise du géoïde à partir de mesures astrogéodésiques, gravimétriques ou d'autres données

notant les progrès réalisés en ce domaine dans diverses régions ainsi que le développement de nouvelles méthodes d'observation et de nouvelles théories,

recommande que ce travail soit activement poursuivi et encouragé par les autorités nationales.

VOEU N° 3

L'Association Internationale de Géodésie,

notant l'existence de programmes scientifiques globaux et régionaux utilisant les techniques spatiales de positionnement, tels que MERIT/COTES et le projet "Crustal Dynamics" développé par la NASA, et

reconnaissant l'intérêt essentiel de ces programmes pour les recherches à long terme, cinématiques et dynamiques, concernant la Terre et son environnement, et

considérant que :

1. le succès de tels programmes est conditionné par l'établissement et l'entretien de réseaux de stations d'observation terrestre et que

2. ces stations pourraient être occupées temporairement par divers instruments pour une durée d'expérimentation totale pouvant atteindre plusieurs décennies ou davantage,

demande instamment que les pays qui ont en charge l'établissement et l'entretien de ces stations consacrent un soin particulier à leur sélection, leur matérialisation, leur conception géodésique, afin de permettre aux occupations successives de se faire sans ambiguïté, avec une précision compatible avec les objectifs scientifiques des programmes.

VOEU N° 4

L'Association Internationale de Géodésie,

notant :

1. qu'une meilleure connaissance du champ de pesanteur est essentielle à la prochaine génération de satellites altimétriques destinée à l'étude de la dynamique des océans, et

2. qu'aucune mesure gravimétrique n'existe dans plusieurs parties du globe, notamment dans certaines régions de grande importance pour la compréhension de la structure et de l'évolution de la terre,

3. que plusieurs autres parties du globe n'ont pas de couvertures gravimétriques suffisantes,

considérant que cette meilleure connaissance du champ de pesanteur peut être le plus facilement obtenue à l'aide de missions spatiales avancées, fondées sur l'utilisation de la poursuite de satellite à satellite ou de la gradiométrie,

recommande que tous les pays ayant des programmes spatiaux placent une grande priorité sur de telles missions.

RESOLUTION N° 2

The International Association of Geodesy,

recognizing the importance in mountain areas of precise geoid determination by a combination of astrogeodetic, gravimetric and other data, and

noting the progress achieved in this respect in various regions, and the development of new observational and theoretic methods,

recommends the active continuation of this work and its support by national authorities.

RESOLUTION N° 3

The International Association of Geodesy,

noting the existence of global and regional scientific programmes using space techniques for positioning, such as MERIT / COTES and the "Crustal Dynamics" project initiated by NASA, and

recognizing the significance of such programmes for long term kinematic and dynamic investigations of the Earth and its environment, and

considering that :

1. the success of such programmes critically depends on the establishment and maintenance of networks of terrestrial observing stations, and

2. such stations may be intermittently occupied by a variety of instrumentation over a total time span of possibly several decades or longer,

strongly urges the countries involved in such establishment and maintenance to devote utmost care to station selection, monumentation and survey strategy, so as to enable unambiguous reoccupation to an accuracy compatible with the scientific objectives of the programmes.

RESOLUTION N° 4

The International Association of Geodesy,

noting that :

1. a better knowledge of the gravity field is essential for the application of the next generation of altimetric satellites to the study of ocean dynamics, and

2. many areas of the world have no gravity survey, including areas of great importance to the understanding of the earth's structure and evolution, and

3. many other areas do not have adequate gravity cover,

considering that such improved gravity field information can most practically be obtained from advanced satellite missions using satellite–to–satellite tracking or gravity gradiometry,

recommends that all countries involved with space programmes give high priority to such satellite missions.

VOEU N° 5

L'Association Internationale de Géodésie,

reconnaissant le rôle important que joueront les systèmes globaux de poursuite de satellites par méthodes radio et laser dans le calcul d'orbites précises pour les futurs satellites géodésiques et océanographiques, et

notant que les sujets d'intérêt principaux pour les analyses d'orbites sont la détermination :

1. des systèmes de référence terrestres appropriés pour décrire les emplacements de stations de poursuite,

2. des emplacements précis de chaque station de poursuite dans ces systèmes de référence,

3. des systématismes d'échelle et / ou d'origine relative, dans les systèmes de référence indépendants, déduits des données de poursuite radio et laser, et

considérant le besoin de données groupées par sites géodésiques déduites de tels systèmes, afin de résoudre tout systématisme d'échelle et / ou d'origine,

recommande que des efforts particuliers soient faits pour grouper par sites des systèmes de poursuite radio et laser pendant les futures campagnes internationales, en insistant sur la réalisation d'une couverture globale de ces colocations.

VOEU N° 6

L'Association Internationale de Géodésie,

reconnaissant le besoin général d'établir des orbites précises pour les satellites altimétriques en vue de développer des recherches géodésiques et océanographiques, et

notant :

1. les contributions particulières que de tels satellites altimétriques comme ERS–1, POSEIDON et TOPEX peuvent apporter à la compréhension de la circulation générale des océans, et

2. qu'il est prévu que tous ces satellites soient sur orbite à la même époque (1987–1991),

recommande que des campagnes globales de poursuite soient organisées en coopération pour fournir des ensembles de données pour les calculs d'orbites précises des satellites.

VOEU N° 7

L'Association Internationale de Géodésie,

reconnaissant l'importance croissante des systèmes de positionnement spatiaux de précision, tels que ceux fondés sur les techniques laser et interférométriques à longue base, pour les recherches en cinématique et dynamique de la terre et de son environnement,

recommande que les autorités nationales concernées accroissent leur aide au développement et à l'opération de tels systèmes.

RESOLUTION N° 5

The International Association of Geodesy,

recognizing the important role that global satellite laser and radio tracking systems will have in the computation of precise orbits for future geodetic and oceanographic satellites, and

noting that topics of central concern to orbit analysis are the determination of :

1. the appropriate terrestrial reference frames for describing the tracking stations locations,

2. the precise locations of the individual tracking stations in these reference frames,

3. any scale and / or relative origin bias in the independent reference frames of the laser and radio tracking data, and

considering the need for data from such systems grouped at common sites to resolve any scale and / or origin bias,

recommends that particular efforts be made to group radio and laser tracking systems at common sites during future international tracking campaigns with emphasis on achieving global coverage for the colocated systems.

RESOLUTION N° 6

The International Association of Geodesy,

recognizing the general need for establishing orbits for altimeter satellites in support of investigations in geodesy and oceanography, and

noting :

1. the particular contributions that such altimeter satellites as ERS–1, POSEIDON and TOPEX may make to efforts to understand the general ocean circulation, and

2. that all these satellites are planned to be in orbit during the same period (1987–1991),

recommends that cooperative global tracking campaigns be organized to provide the data sets for precise orbit computations for the satellites.

RESOLUTION N° 7

The International Association of Geodesy,

recognizing the increasing importance of precise space–related positioning systems, such as those of laser ranging and very long baseline interferometry (VLBI), for investigations of the kinematics and dynamics of the Earth and its environment,

recommends that national authorities extend their support for the development and operation of these systems.

VOEU N° 8

L'Association Internationale de Géodésie,

reconnaissant que l'étude de nombreux phénomènes géophysiques dans la bande des longueurs d'onde (200 – 2000 km) est sévèrement handicapée par les insuffisances de données dans la couverture gravimétrique, particulièrement sur les terres émergées,

demande à tous les pays de rendre accessibles leurs mesures gravimétriques à la communauté scientifique via le Bureau Gravimétrique International ; si des intérêts nationaux s'opposent à la cession des données détaillées, les agences nationales sont invitées à fournir les valeurs moyennes $1^\circ \times 1^\circ$ des anomalies à l'air libre et des altitudes, qui sont d'importance fondamentale pour la réalisation de programmes globaux scientifiques.

VOEU N° 9

L'Association Internationale de Géodésie,

reconnaissant le haut niveau de précision actuellement atteint, à la fois, par des gravimètres absolus et relatifs,

considérant la nécessité d'apporter des corrections standardisées aux observations gravimétriques, de façon à permettre des comparaisons entre les mesures à différentes époques,

recommande :

1. que la correction de marée appliquée aux observations gravimétriques suive les recommandations finales du comité de la "Marée Terrestre Standard" (Standard Earth Tide Committee) telles qu'elles ont été présentées à la XVIII^{ème} Assemblée Générale,

2. que les corrections de pression atmosphérique soient référées à la même Atmosphère Standard, le coefficient de sensibilité étant de $0.3 \cdot 10^{-10}$ m s^{-2}/Pa , à moins qu'il soit déterminé par des recherches spéciales, auquel cas, la valeur utilisée devra être publiée en même temps que les résultats. La formule finie pour le calcul de cette Atmosphère Standard sera publiée dans une édition future du Bulletin d'Information du BGI avec les tables numériques correspondantes et le code de programmation.

3. que les *corrections de gradient de pesanteur* soient publiées avec le gradient local adopté et/ou la différence d'altitude adoptée de telle façon que les valeurs d'origine puissent être retrouvées.

VOEU N° 10

L'Association Internationale de Géodésie,

reconnaissant que les techniques de mesures relatives répétées de la pesanteur ont atteint une plus grande précision et ont été utilisées :

1. comme un outil rapide et efficace pour la détection et l'étude des changements de pesanteur associés aux mouvements récents de la croûte,

2. en conjonction avec d'autres techniques, telles que le nivellement et l'interférométrie à longue base afin de mieux connaître les processus dynamiques internes, et

3. comme outil lors de recherches sur la prédiction des tremblements de terre, et

notant le succès de récentes campagnes dans différentes parties du monde,

recommande qu'une haute priorité soit donnée à cette recherche.

RESOLUTION N° 8

The International Association of Geodesy,

recognizing that the study of many geophysical phenomena in the 200 – 2000 km range of wavelength is severely handicaped by large gaps in the available surface gravity coverage, especially over land,

urges all countries to release their land gravity measurements to the scientific community via the International Gravity Bureau ; if national interests prevent the release of detailed data, national agencies are requested to release $1^\circ \times 1^\circ$ mean values of free air gravity anomalies and elevations, which are of fundamental importance for global scientific pursuits.

RESOLUTION N° 9

The International Association of Geodesy,

recognizing the high level of accuracy of both absolute and relative gravity measurements recently attained,

considering the necessity to adopt standard corrections to gravity observations in order to allow intercomparisons between measurements at different epochs of time,

recommends :

1. that the *tidal correction* applied to the gravity observations follow the final recommendations of the Standard Earth Tide Committee as presented at the XVIII IUGG General Assembly,

2. that the *atmospheric pressure corrections* refer to a common Standard Atmosphere, the sensitivity coefficient being $0.3 \cdot 10^{-10}$ m s^{-2} / Pa (0.3 microgal / mbar) , unless it is determined by special investigations, in which case the value used must be published together with the results. The closed formula for the computation of this Standard Atmosphere will be published in a future issue of the Bulletin d'Information du Bureau Gravimétrique International with the corresponding numerical tables and the programming code.

3. that the *gravity gradient corrections* be published with the adopted local gradient and / or the adopted height difference so that the original values may be recovered.

RESOLUTION N° 10

The International Association of Geodesy,

recognizing that techniques of repeated relative gravity measurement have achieved increased accuracy and have been applied :

1. as a fast and efficient tool to detect and investigate gravity changes associated with recent crustal movements,

2. in combination with other techniques such as levelling and VLBI to give a deeper insight into the underlying dynamic processes,

3. as an element in earthquake prediction research, and

noting the success of recent campaigns in various parts of the world,

recommends that high priority be given to this research.

VOEU N° 11

L'Association Internationale de Géodésie,

reconnaissant que l'interprétation physique des variations temporelles des coordonnées naturelles, altitude par rapport au niveau de la mer, latitude et longitude astronomiques exigent la connaissance de la variation temporelle du champ de pesanteur terrestre, et

considérant que ce dernier peut être déterminé par un réseau mondial de stations gravimétriques établi par des observations précises et répétées de la pesanteur absolue et de l'altitude par rapport à l'actuel niveau moyen des mers,

recommande que des efforts soient faits pour observer et réobserver un grand nombre de telles stations favorablement distribuées autour du globe.

VOEU N° 12

L'Association Internationale de Géodésie,

reconnaissant l'importance de l'optimisation des réseaux géodésiques à une, deux ou trois dimensions,

recommande que la recherche dans les domaines suivants soit encouragée :

— développement des matrices de critères,

— recherche de fonctions mathématiques du coût, permettant d'apprécier les coûts réels d'observation des réseaux géodésiques,

— réalisation de logiciels opérationnels.

VOEU N° 13

L'Association Internationale de Géodésie,

reconnaissant le rôle fondamental des problèmes aux limites en géodésie, lors des calculs d'approximation du champ de pesanteur, à partir de concepts théoriques corrects ainsi que lors de la préparation de solutions de premier ordre rapides et stables, et

notant les progrès réalisés dans ce domaine,

recommande :

1. que l'analyse de problèmes fondamentaux tels que le problème de Molodensky soit poursuivie afin d'obtenir des solutions raisonnables en incluant les cas non linéaires,

2. que les nouveaux problèmes de conditions mixtes, spécialement ceux rencontrés en altimétrie–gravimétrie soient étudiés à l'aide d'exemples numériques afin de déterminer les conditions d'application des solutions,

3. que les études de condition aux limites en géodynamique commencées au cours des récentes années soient maintenant poursuivies afin de modéliser la mécanique de la Terre dans une théorie de champ unifiée.

RESOLUTION N° 11

The International Association of Geodesy,

recognizing that the physical interpretation of time variations of the natural coordinates, height above sea level, and astronomic latitude and longitude, requires knowledge of the time variation of the earth's gravity field, and

considering that this latter can be determined by a world–wide net of gravity stations with repeated precise observations of absolute gravity and height above the current mean sea level,

recommends that efforts be made to observe and reobserve a large number of such stations favourably distributed around the globe.

RESOLUTION N° 12

The International Association of Geodesy,

recognizing the importance of the optimal design of geodetic networks in one, two or three dimensions,

recommends that research in the following fields be encouraged :

– development of criterion matrices,

– investigation of mathematical cost functions reflecting real costs of observing geodetic networks,

– realization of operational software.

RESOLUTION N° 13

The International Association of Geodesy,

recognizing the fundamental role of the Geodetic Boundary Value Problems in establishing gravity field approximations on a sound theoretical basis as well as in producing quick and stable first order solutions, and

noting the progress made in this field,

recommends :

1. that analysis of fundamental problems such as the Molodensky problem be pursued to a reasonable conclusion, including nonlinear cases,

2. that newly defined mixed boundary value problems, especially those of altimetry–gravimetry , be investigated with numerically examples to establish the applicability of solutions,

3. that geodynamic boundary value studies, begun over the last few years, now model the mechanics of planet Earth in a unified field theory.

VOEU N° 14

L'Association Internationale de Géodésie,

reconnaissant les études récentes des propriétés mathématiques locales du champ de pesanteur de la Terre utilisant des méthodes différentielles, permettant d'inclure des implications géodynamiques,

considérant l'existence d'études similaires dans les autres associations de l'U.G.G.I.,

recommande que ces études soient intensifiées et que des contacts appropriés interdisciplinaires soient établis.

VOEU N° 15

L'Association Internationale de Géodésie,

reconnaissant l'importance et la faisabilité de différentes sortes de recherches qui pourraient conduire à de grands progrès dans le domaine interdisciplinaire du frottement des marées et de la rotation de la Terre,

recommande :

1. que des modèles théoriques de paléo-marée soient calculés par intervalles de temps aussi petits que possible (10 millions d'années ou moins pour le Phanérozoïque), en utilisant les résultats récents de la dérive continentale pendant le Protérozoïque pour des modèles approchés, et en explorant, pour les temps plus anciens, la variabilité totale du couple de marée avec différents schémas géométriques des océans,

2. que malgré le rôle dominant des marées océaniques durant les dernières ères géologiques, la rhéologie de la Terre soit soigneusement étudiée dans les zones pour lesquelles une "vieille" Terre pourrait sensiblement différer de la Terre actuelle,

3. que des recherches géodésiques, astronomiques et géologiques futures soient encouragées, de façon à agrandir la base de données pour l'étude de la rotation de la Terre.

VOEU N° 16

L'Association Internationale de Géodésie,

reconnaissant la nécessité d'un traitement uniforme des corrections de marées à apporter aux diverses quantités géodésiques telles que la pesanteur et les positions des stations,

considérant les rapports du "Standard Earth Tide Committee" et du G.S.E. 2.55 (méthodes de prédiction pour les techniques spatiales) présentés à la XVIII^{ème} Assemblée Générale,

recommande que :

1. le modèle de la "Terre rigide" soit celui de Cartwright – Tayler – Edden avec des constantes additionnelles spécifiées par le Centre International des Marées Terrestres,

2. le modèle de Terre élastique soit celui décrit par Wahr utilisant le modèle terrestre 1066 A de Gilbert et Dziewonski,

3. l'effet indirect dû à la déformation permanente de la Terre ne soit pas retranché, et

4. que les effets de charge des océans soient calculés en utilisant les cartes de marées océaniques et les données fournies par Schwiderski comme valeurs standard de travail.

RESOLUTION N° 14

The International Association of Geodesy,

recognizing recent studies of the local mathematical properties of the earth's gravity field using differential methods in such a way that geodynamical implications are included, and

considering similar studies in the other associations of the International Union of Geodesy and Geophysics,

recommends that these studies be intensified and appropriate interdisciplinary contacts established.

RESOLUTION N° 15

The International Association of Geodesy,

recognizing the importance and feasibility of several kinds of investigations, which could lead to major progress in the interdisciplinary field of Tidal Friction and Earth's Rotation,

recommends :

1. that theoretical models of paleo—tides be computed in as narrow time steps as possible (10 million years or smaller for the Phanerozoic), using recent results for continental drift in the Proterozoic for approximate models, and exploring, for earlier times, the total variability of the Tidal torque, with different schematic geometries of the oceans,

2. that despite the dominating role of oceanic tides within the last aeons, the rheology of the solid Earth be carefully searched for areas in which an "old" Earth could differ remarkably from the present Earth,

3. that further geodetic, astronomical and geological investigations be encouraged in order to enlarge the data base for the study of the Earth's rotation.

RESOLUTION N° 16

The International Association of Geodesy,

recognizing the need for the uniform treatment of tidal corrections to various geodetic quantities such as gravity and station positions, and

considering the reports of the Standard Earth Tide Committee and S.S.G. 2.55, Predictive Methods for Space Techniques, presented at XVIII General Assembly,

recommends that :

1. the rigid Earth model be the Cartwright — Tayler — Edden model with additional constants specified by the International Centre for Earth Tides,

2. the elastic Earth model be that described by Wahr using the 1066 A model Earth of Gilbert and Dziewonski,

3. the indirect effect due to the permanent yielding of the Earth be not removed , and

4. ocean loading effects be calculated using the tidal charts and data produced by Schwiderski as working standards.

VOEU N° 17

L'Association Internationale de Géodésie,

reconnaissant l'organisation excellente de l'Assemblée Générale de Hambourg et l'efficacité de l'organisation administrative qui ont constitué une inestimable contribution à son succès scientifique,

exprime les remerciements les plus vifs à ses hôtes allemands pour leurs efforts qui ont assuré le succès de cette réunion, à la fois agréable et profitable au monde scientifique.

RESOLUTION N° 17

The International Association of Geodesy,

recognizing the excellent organisation of the Hamburg General Assembly, and the efficient administrative arrangements which made an invaluable contribution to its scientific success,

expresses its grateful thanks to their German hosts for their successful efforts in making its meeting so pleasant and scientifically profitable.

STRUCTURE
OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS
FOR THE PERIOD 1983–1987

1. BUREAU

President	:	Prof. Devendra Lal (India)
Vice–President	:	Prof. Carl Kisslinger (U.S.A.)
Secretary General	:	Prof. Paul Melchior (Belgium)
Treasurer	:	Dr. O.B. Andersen (Denmark)
Members	:	Prof. James C.I. Dooge (Ireland)
		Prof. V.I. Keilis Borok (U.S.S.R.)
		Prof. Helmut Moritz (Austria)
Assistant Secretary General	:	Prof. Paul Paquet (Belgium)
Assistant Treasurer	:	Dr. S. Gregersen (Denmark).

2. EXECUTIVE COMMITTEE

- The Bureau
- The Past President : Prof. G.D. Garland (Canada)
- The Presidents of the Associations :

– International Association of Geodesy :

President	:	Prof. P.V. Angus–Leppan (Australia)
(Secretary General	:	Ing. Michel Louis (France))

– International Association of Seismology and Physics of the Earth's Interior :

President	:	Prof. Z. Suzuki (Japan)
(Secretary General	:	Dr. R.D. Adams (United Kingdom))

– International Association of Volcanology and Chemistry of the Earth's Interior :

President	:	Prof. I.G. Gass (United Kingdom)
(Secretary General	:	Prof. H.–U. Schmincke (F.R.G.))

– International Association of Geomagnetism and Aeronomy :

President	:	Prof. D.I. Gough (Canada)
(Secretary General	:	Dr. M. Gadsden (United Kingdom))

– International Association of Meteorology and Atmospheric Physics :

President	:	Prof. H.–J. Bolle (Austria)
(Secretary General	:	Mr. S. Ruttenberg (U.S.A.))

– International Association for the Physical Sciences of the Ocean :

President	:	Prof. W.M. Krauss (F.R.G.)
(Secretary General	:	Dr. E.C. Lafond (U.S.A.))

– International Association of Hydrological Sciences :

President	:	Dr. G. Kovacs	(Hungary)
(Secretary General	:	Dr. J.C. Rodda	(United Kingdom))

(The Secretary Generals of the Associations may attend any meeting of the Executive Committee of the Union in an advisory capacity).

3. FINANCE COMMITTEE

President	:	Prof. J.O. Cardus	(Spain)
Secretary	:	Dr. A.E. Maxwell	(U.S.A.)
Members	:	Prof. A. Ashour	(Egypt)
		Prof. J. Rais	(Indonesia)
		Prof. J. Somogyi	(Hungary)

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STRUCTURE
OF THE INTERNATIONAL ASSOCIATION OF GEODESY
FOR THE PERIOD 1983–1987

1. BUREAU

President : P.–V. Angus–Leppan (Australia)
First Vice–President : I.I. Mueller (U.S.A.)
Secretary General : M. Louis (France)

2. EXECUTIVE COMMITTEE

– The Bureau
– The Past President : H. Moritz (Austria)
– The Presidents of the Sections :

. Section I : *Positioning*

President : J.D. Bossler (U.S.A.)
(Secretaries : H. Henneberg (Venezuela)
M. Prilepin (U.S.S.R.)
J.Y. Chen (China))

. Section II : *Advanced Space Technology*

President : R. Anderle (U.S.A.)
(Secretaries : B. Kolaczek (Poland)
P. Wilson (F.R.G.))

. Section III : *Determination of the Gravity Field*

President : W. Torge (F.R.G.)
(Secretaries : C. Tscherning (Denmark)
I. Nakagawa (Japan))

. Section IV : *General Theory and Methodology*

President : E. Grafarend (F.R.G.)
(Secretaries : K.–P. Schwarz (Canada)
F. Sansò (Italy))

. Section V : *Geodynamics*

President : H. Kautzleben (G.D.R.)
(Secretaries : H. Kahle (Switzerland)
D. McCarthy (U.S.A.))

– The Vice Presidents :

Second : M. Burša (Czechoslovakia)
Third : G. Lachapelle (Canada)

3. OTHER OFFICIALS

Assistant Secretaries of the Association

C. Boucher (France)
K. Daugherty (U.S.A.)
J. Kriński (Poland)

Editor in Chief of the Bulletin Géodésique

I.I. Mueller (U.S.A.)

Honorary Presidents

C.A. Whitten (U.S.A.)
G. Bomford (United Kingdom)
Y. Boulanger (U.S.S.R.)
T.J. Kukkamäki (Finland)
H. Moritz (Austria)

Honorary Secretary General

J.–J. Levallois (France)

(The Secretaries of the Sections and the Other Officials may attend any meeting of the Executive Committee of the Association in an advisory capacity).

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International Association of Geodesy

Review of Sections, Commissions and Special Study Groups

for the period 1983–1987

SECTION I

POSITIONING – DETERMINATION DE POSITION

President	:	J.D. Bossler (U.S.A.)
Secretaries	:	H. Henneberg (Venezuela)
		M. Prilepin (U.S.S.R.)
		J.Y. Chen (China)

Objectives

Section I is responsible for the positioning aspects of the geodetic sciences within I.A.G. The objectives of Section I are to :

. Advance geodetic sciences and related fields and to establish a central source of reference for its members,

. Speak on the international level as the collective voice of the scientific disciplines embodied within I.A.G.,

. Encourage improvement of college curricula for the teaching of geodetic sciences,

. Honor the leaders in geodetic sciences and related fields, and

. Support a program of publications that will represent the geodetic sciences interests.

Activities

Section I activities include :

. Sponsorship of and participation in meetings and symposia,

. Individual and collective research and development projects, and

. Scientific reports including the annual and quadrennial Section I reports.

Structure

Section I is composed of nine Special Study Groups which foster the development of geodetic sciences pertaining to positioning. The emphasis areas of the study groups include :

. Geodetic network design, (S.S.G. 1–59)
. Marine positioning, (S.S.G. 1–72)
. Integrated geodesy, (S.S.G. 1–73)
. Evaluation of leveling errors, (S.S.G. 1–74)
. Vertical reference systems, (S.S.G. 1–75)
. Global Positioning System, (S.S.G. 1–76)

. Inertial techniques, (S.S.G. 1–77)
. Atmospheric effects, (S.S.G. 1–78), and
. Optical interferometric techniques, (S.S.G. 1–79).

Section I also includes Commission X, Continental Networks, responsible for promoting uniform systems of geodetic control through establishment of worldwide fundamental geodetic networks. The Commission includes seven sub–commissions responsible for particular areas of the globe.

– Commission X

Continental Networks – Réseaux Continentaux

President : J. Kakkuri (Finland)
Secretary : J. Gergen (U.S.A.)

A. Task

1. Promotion of scientific and practical activities for the establishment of uniform systems of geodetic control points (fundamental geodetic networks).

2. The issuing of recommendations for the establishment of a uniform model system of fundamental points for worldwide geodetic and geophysical operations.

B. Activities

1. To support scientific relations between national geodetic control survey agencies and other interested organisations.

2. To submit requests to the national geodetic control survey agencies to provide assistance in making new measurements needed for strengthening continental networks and achieving a worldwide reference system.

3. To make procedures for the analysis and reduction of observation data as well as observation methods as uniform as possible for making the continental networks more homogeneous.

4. To keep contacts to the Sub–commissions for providing them with the coordination, guidance and assistance necessary for the establishment of a worldwide reference system.

5. To recommend the use of spatial techniques when strengthening continental and regional networks as well as when connecting various continents and regions.

6. To contact all the I.A.G. member countries and organisations that not yet belong to any Sub–commission for making the world geodetic net as large as possible.

C. Membership – Structure

Commission for Continental Networks

President : J. Kakkuri (Finland)
Secretary : J. Gergen (U.S.A.)

Sub–commission for European Triangulation (RETRIG)

President : K. Poder (Denmark)
Secretary : Deutsches Geodätisches Forschungsinstitut
Abt. I, Munich (F.R.G.)

Sub–commission for European Levelling (UELN)

President : A. Waalewijn (Netherlands)
Secretary : E. Gubler (Switzerland)

Sub–commission for North America

President : J. Gergen (U.S.A.)
Secretary : R. Steeves (Canada)

Sub–commission for South America

President : D. Ferrari (Brasil)
Secretary : J. Mutiz (Chile)

Sub–commission for South–East Asia and the Pacific

President : C. Veenstra (Australia)
Secretary : J. Rais (Indonesia)

Sub–commission for South Asia (Indian Subcontinent)

President : M.G. Arur (India)
Secretary :

Sub–commission for West Asia

President : R. Majali (Jordan)
Secretary :

D. Manner of procedure, meetings

1. The full commission will meet at the time of general or scientific assemblies.

2. Sub–commissions will have their own meetings called together by the presidents. These meetings can be arranged whenever convenient, such as at annual meetings of geodetic societies in member countries of the Sub–commission.

3. Each Sub–commission is requested to make all relevant publications available to Commission X.

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– Special Study Group 1–59.

Computer assisted design of geodetic networks

Conception de réseaux géodésiques assistée par ordinateur

President : W. Baran (Poland)

Program of Activities

– development of criterion matrices that reflect all properties of desirable networks,

– development of second order design techniques that are flexible with respect to the manner in which the precision criteria are stated and which are also able to take account of reliability,

– determination of cost functions that can both reflect the true costs of geodetic networks and be incorporated in analytical design procedures,

– further development of interactive graphics, in particular the complete or partial automation of the process of selecting alternative observation schemes,

– investigation of the design problems associated with networks in which stochastic and functional models reflect systematic observational errors,

– design of networks to solve problems that are especially relevant to modern geodesy, for instance, networks for monitoring crustal movements and combined satellite and terrestrial networks,

– investigation of the design problems associated with GPS networks.

Membership

W. Baran	(Poland), *president.*	E. Krakiwsky	(Canada)
J. Casaca	(Portugal)	D. Milbert	(U.S.A.)
P.A. Cross	(United Kingdom)	G. Schmitt	(Fed. Rep. of Germany)
A.V. Frank	(U.S.A.)	C. Tsouros	(Greece)
D. Fritsch	(Fed. Rep. of Germany)	M. Unguendoli	(Italy)
J. Gaździcki	(Poland)	G. Zlatanov	(Bulgaria)

– Special Study Group 1–72.

Marine Positioning

Détermination de position en mer

President : D.E. Wells (Canada)

Program of Activities

– study of the use of global satellite navigation systems for static and dynamic marine positioning,

– characterization of the factors which affect the performance of such systems and investigation of techniques which alleviate the influence of these factors,

– formulation of recommendations concerning these factors and techniques, as well as further work to be done, for presentation at the General Assembly,

– consideration of the following topics :

. effect of incomplete constellations, area and time limitations, applications and uses under these conditions,

. clock performance influence, use of atomic clocks with receiver,

. ephemeris error effects, techniques for overcoming ephemeris errors,

. feasibility of tracking carrier phase or phase rate at sea, applications to velocity and vessel attitude determination,

. differential techniques for marine positioning, applications,

. integration with inertial positioning, applications to 3–dimensional seismic and to determination of sea surface motion,

. integration with acoustic positioning, applications to seafloor referenced positioning,

. results of field trials,

. assembly of test data sets.

– organization of one symposium (with published proceedings) on marine positioning,

– preparation of a bibliography on marine positioning,

– production of a monograph on marine positioning, if appropriate.

Membership

D.E. Wells	(Canada), *president.*	V.V. Kostoglodov	(U.S.S.R.)
J.P. Allenou	(France)	J.L. Labrecque	(Canada)
K. Colic	(Yugoslavia)	S. Mira	(Indonesia)
C.C. Counselman	(U.S.A.)	G. Seeber	(Fed. Rep. of Germany)
J.C. de Munck	(Netherlands)	F.N. Spiess	(U.S.A.)
C.C. Goad	(U.S.A.)	G. Veis	(Greece)
O. Granheim	(Norway)	R.V.C. Wong	(Canada)
M. Hoyer	(Venezuela)	L.E. Young	(U.S.A.)
R.M. Kalafus	(U.S.A.)		

– Special Study Group 1–73.

Integrated Geodesy

Géodésie intégrée

President : G.W. Hein (F.R.G.)

Program of Activities

– development of observation equations in 3–dimensional integrated models for satellite geodesy, for inertial geodesy, and for geophysical and geological parameters,

– investigation of the choice–of–norm problem of the general model,

– investigation of the datum problem,

– consideration of the topography,

– inclusion of time–dependent effects for establishing a general 4–dimensional integrated model,

– improvements and extensions of existing adjustment models with regard to the integrated model,

– establishment of software,

– construction of artificial data sets,

– collection of real data sets,

– comparison of methods using artificially generated test data sets as well as real observations, test computations,

– recommendations for existing software and models.

Membership

G.W. Hein	(Fed. Rep of Germ.), *president.*	T. Krarup	(Denmark)
V. Ashkenazi	(United Kingdom)	J. Neyman	(U.S.S.R.)
C. Boucher	(France)	J. Rais	(Indonesia)
K. Bretterbauer	(Austria)	W. Reilly	(New Zealand)
J. Chen	(China)	R. Rummel	(Netherlands)
A. Dermanis	(Greece)	F. Sansò	(Italy)
E. Grafarend	(Fed. Rep. of Germany)	G. Schmitt	(Fed. Rep. of Germany)
H. Hsu	(China)	H. Sünkel	(Austria)
H. Kahle	(Switzerland)	T. Vincenty	(U.S.A.)
R. Kelm	(Fed. Rep. of Germany)		

– Special Study Group 1–74.

Comparison of Methods of Analysis and Evaluation of Levelling Errors

Comparaison de méthodes d'analyse et d'évaluation des erreurs dans les nivellements

President : A.M. Wassef (Egypt)

Program of Activities

– review of the present state of knowledge of the physical sources of errors in levelling (including motorized levelling),

– examination of the physical foundation and mathematical structure of the methods which have been proposed for the analysis of levelling errors and the detection of non–random effects,

– identification or development of a system of evaluating accuracy that meets the requirement of high reliability over long levelling lines,

– investigation and classification of optical instruments and rods,

– experiments, field tests, and numerical analyses as may be necessary to test the validity of the results of theoretical investigations.

Membership

A.M. Wassef	(Egypt), *president.*	S.R. Holdahl	(U.S.A.)
M.G. Arur	(India)	F.Z.A. Messih	(Egypt)
E.I. Balazs	(U.S.A.)	W. Niemeier	(Fed. Rep. of Germany)
J. Chen	(China)	M.K. Szacherska	(Poland)
R.C. Gunn	(Canada)		

– Special Study Group 1–75.

World Vertical Reference System

Système mondial de référence altimétrique

President : R.H. Rapp (U.S.A.)

Program of Activities

– development of methods for achieving a world vertical reference system considering the role of the following :

- sea surface topography ,
- tides ,
- altimeter data ,
- laser tracking,
- levelling and gravity data,

– development of recommendations for implementation procedures.

Membership

R.H. Rapp	(U.S.A.), *president.*	D. Pugh	(United Kingdom)
V. Brovar	(U.S.S.R.)	C. Rizos	(Australia)
D. Cartwright	(United Kingdom)	H. Stoughton	(U.S.A.)
O.L. Colombo	(U.S.A.)	P. Vaníček	(Canada)
D. Lelgemann	(Fed. Rep. of Germany)	C. Whalen	(U.S.A.)
		D. Christodoulidis	(U.S.A.)

– Special Study Group 1–76.

Positioning with Global Positioning System (GPS)

Détermination de position à l'aide du système de positionnement global (GPS)

President : C. Goad (U.S.A.)

Program of Activities

– integration of GPS data and techniques with other information,

– study of optimization of equipment,

– review of specifications for geodetic networks,

– study of maximum base line lengths,

– review of ephemeris computations and distribution,

– recommendations for data exchange and format procedures.

Membership

C. Goad	(U.S.A.), *president.*	C. Boucher	(France)
R. Adler	(Israel)	F. Brunner	(Switzerland)
V. Ashkenazi	(United Kingdom)	C. Counselman	(U.S.A.)
Y. Bock	(U.S.A.)	D. Delikaraoglou	(Canada)

J. Kouba	(Canada)	S. Mihaly	(Hungary)
G. Lachapelle	(Canada)	A. Stolz	(Australia)
D. Larden	(Australia)	C. Tscherning	(Denmark)
D. Lelgemann	(Fed. Rep. of Germany)	D. Wells	(Canada)
R. Merrell	(U.S.A.)	J. Zielinski	(Poland)

– Special Study Group 1–77.

Utilization of Inertial Techniques for Geodesy

Utilisation des techniques inertielles pour la géodésie

President : K.–P. Schwarz (Canada)

Program of Activities

– alternative formulations of the inertial approximation problem ; non–linear differential equations as error models ; frequency domain analysis,

– estimability of gravity field components ; real time models of the local gravity field ; refinement of the internal gravity model ; geophysical applications,

– blunder detection ; filtering, curve fitting, spectral decomposition ; adjustment models and array filtering ; reliability analysis ; requirements for optimal data flow,

– economy of field procedures ; stability of calibration parameters ; preanalysis of field procedures ; standards and specifications,

– requirements for "ideal" ISS hardware ; mechanization concepts ; identification and classification of major error sources ; cutoff effects in electronic firmware (e.g. filters and integrators) ; new sensor developments,

– GPS–aided inertial system for photogrammetry and airborne gravimetry ; airborne inertial–laser profiling system ; integration of gravity gradiometers into the inertial concept ; use of ISS in boreholes, pipelines, and shafts.

Membership

K.P. Schwarz	(Canada), *president.*	M. van den Herreweghen	(Belgium)
G. Babbage	(Canada)	J.R. Huddle	(U.S.A.)
G. Bartha	(Hungary)	A. Mancini	(U.S.A.)
H. Baussus von Luetzow	(U.S.A.)	I.I. Maslov	(U.S.S.R.)
G. Boedecker	(Fed. Rep. of Germany)	D.G. Milbert	(U.S.A.)
P.A. Cross	(United Kingdom)	I.I. Mueller	(U.S.A.)
K. Eichholz	(Fed. Rep. of Germany)	L. Pfeifer	(U.S.A.)
R. Forsberg	(Denmark)	T.M. Rueger	(Australia)
E.W. Grafarend	(Fed. Rep. of Germany)	M.S. Todd	(U.S.A.)
J.E. Hagglund	(Canada)	Z. Zhang	(China)

— Special Study Group 1–78.

Atmospheric Effects on Terrestrial Geodetic Measurements

Effets atmosphériques sur les observations géodésiques terrestres

President : H. Kahmen (F.R.G.)

Program of Activities

— research on refractive index formulae ; questions regarding absolute accuracy ; testing and intercomparison of refractive index formulae,

— research on levelling refraction of importance to redefinition of national vertical networks and work on recent crustal movements ; recommendations for further field tests to study the magnitude of the effect and the various correction solutions,

— research on angular dual wavelength methods ; absolute testing and intercomparison of different prototypes,

— research on multiple wavelength EDM equipment,

— research on the existing deterministic and stochastic models of the atmospheric effects on geodetic measurements with absolute testing and intercomparison of the different models.

Membership

H. Kahmen	(Fed. Rep. of Germany), *president.*		
P.V. Angus–Leppan	(Australia)	S. Meier	(German Dem. Republic)
G. Bahnert	(German Dem. Republic)	W. Niemeier	(Fed. Rep.of Germany)
F.K. Brunner	(Switzerland)	M.T. Prilepin	(U.S.S.R.)
Dabroski	(Poland)	O. Remmer	(Denmark)
A.H. Dodson	(United Kingdom)	G.M. Resch	(U.S.A.)
S.R. Holdahl	(U.S.A.)	W. Strange	(U.S.A.)
L. Hradilek	(Czechoslovakia)	K. Schnädelbach	(Fed. Rep. of Germany)
J. Kakkuri	(Finland)	D.C. Williams	(United Kingdom)
L.N. Mavridis	(Greece)	B. Witte	(Fed. Rep. of Germany)

— Special Study Group 1–79.

Optical Long Base Interferometry for Geodesy and Geodynamics

Interférométrie optique à longue base pour la géodésie et la géodynamique

President : M.T. Prilepin (U.S.S.R.)

Program of Activities

— estimation of possibilities of optical long base interferometers (OLBI) using stars as objects of observations for solution of certain problems in geodesy and geodynamics,

— justification of the basic parameters of such interferometers and elaboration on recommendations for design and manufacture of interferometers,

— comparative assessment of long base interferometry methods in radio and optical ranges of the spectrum,

– geometric optimization for determination of the Pole coordinates and variations in the earth's rotation rate, and for detection of tectonic plate motions by OLBI methods,

– study of local crustal deformations by OLBI methods,

– use of terrestrial long base laser interferometer for recording free oscillation of the earth and crustal tides,

– development of the approaches to compensate for proper motions of stars,

– estimation of atmospheric effects on OLBI methods.

Membership

M.T. Prilepin	(U.S.S.R.), *president.*	J. Kääriänen	(Finland)
F. Brunner	(Switzerland)	H. Kahmen	(Fed. Rep. of Germany)
J. Cuno	(Fed. Rep. of Germany)	J. de Munck	(Netherlands)
A. Dodson	(United Kingdom)	L. Slater	(U.S.A.)
M. Dubrov	(U.S.S.R.)	T. Tanaka	(Japan)
J. Gervaise	(France)	E. Tengström	(Sweden)
G. Graczka	(Hungary)		

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SECTION II

ADVANCED SPACE TECHNOLOGY

GÉODÉSIE SPATIALE AVANCÉE

President : R.J. Anderle (U.S.A.)
Secretaries : B. Kolaczek (Poland)
P. Wilson (F.R.G.)

The Advanced Space Technology Section is responsible for the development of space techniques for geodesy such as satellite radio–interferometric techniques, satellite and lunar laser ranging, satellite altimetry, satellite–to–satellite tracking, satellite gradiometry, or any geodetic measurements from space. The work includes

1. the development of orbit computations,
2. the evaluation of the direct results of space techniques, and
3. the development of planetary and lunar geodetic techniques.

Since geodetic results are often obtained in the course of the development of new systems, the Executive Committee makes a determination at each General Assembly of which aspects of such systems are still in the development stage, and therefore within the province of Section II, and which aspects are yielding geodetic results on position, gravity field or geodynamics, and therefore within the provinces of Sections I, III or V, respectively. Special study groups in each Section are then organized to carry out studies in accordance with the decisions of the Executive Committee. Similarly, the introduction of new systems may require the further development of new analytic techniques normally within the province of Section IV or one of the other sections. The Executive Committee will decide whether it is more appropriate for further development of the technique to be carried out by Section II in connection with the new system or for it to remain in another Section.

In addition to studies of new systems carried out by the special study groups as those described below for the 1983–1987 quadrennium, Commission VIII for the International Coordination of Space Techniques for Geodesy and Geodynamics (CSTG) is also attached to Section II. The Commission is also an Interdisciplinary Scientific Sub–Commission of the Committee on Space Research (COSPAR).

– Commission VIII

International Coordination of Space Techniques for Geodesy and Geodynamics

Coordination internationale des techniques spatiales pour la géodésie et la géodynamique

President : I.I. Mueller (U.S.A.) (to July 1984)
C. Reigber (F.R.G.) (from July 1984)

1. Presentation and program of activities

The Commission on International Coordination of Space Techniques for Geodesy and Geodynamics (CSTG) was established during XVII General Assembly of the IUGG in Canberra. It is Commission VIII of the International Association of

Geodesy, and is the reorganized successor to the former IAG Commission on Satellite Geodesy. The charter of the Commission is the following :

Develop links between various groups engaged in the field of space geodesy and geodynamics by various techniques, coordinate work of these groups, elaborate and propose projects implying international cooperation, follow their progress and report on their advancement and results.

The general structure of the Commission is as follows :

1. Representatives nominated by countries interested in CSTG activities. Representatives of countries which adhere to IUGG/COSPAR constitute the voting membership.

2. A Steering Committee consisting of the chairmen of the relevant IAG SSG's, representatives of existing cooperative programs, e.g., EDOC, GRGS, EROS, MEDOC, EROLD, MERIT, Intercosmos, representatives of other IUGG associations, COSPAR ISC's, etc.

3. Executive Committee.

In accordance with the Canberra IUGG Resolution No. 11, COSPAR was approached to include the CSTG formally within COSPAR. As a result, at the 23rd COSPAR Plenary Meeting in Budapest, the CSTG was incorporated as COSPAR Interdisciplinary Scientific Sub–Commission B.2 with the above charter as terms of reference.

The role of the newly organized Commission is to facilitate the activities of national and international groups through the collection and dissemination of information within the groups and the member countries mainly through correspondence and also through international or regional meetings. It is not the goal of the Commission to set up projects on its own or to conduct scientific investigations. The individual contacts necessary to establish scientific cooperation are properly maintained through the present and future Study Groups, Panels, or Projects. Some of these, where international cooperation / coordination has administrative implications, may become subcommissions of the CSTG, if this is considered advantageous. As examples, the Projects MERIT and MEDOC have already been established as subcommissions during the IUGG General Assembly in Canberra. Another example is the Subcommission on Standards, recently formed.

As the first step to develop the above–mentioned links between the various groups engaged in space Geodesy and Geodynamics, it is planned to publish the ***CSTG Bulletin*** at irregular intervals, once or twice a year, depending on the intensity of activities. The ***Bulletin*** contains up–to–date information on the activities of the various groups, especially regarding their status, progress, and results. It is planned to include items regarding new instrument developments for the information of the member countries. The ***Bulletin*** is distributed through the representatives of the member countries who in turn will disseminate the information to interested groups in their respective countries. The ***Bulletin*** is published in English and Spanish.

It is planned that future issues will also disseminate news and other information on cooperative activities, projects and instrument developments. Anyone wishing to contribute to future issues is encouraged to do so in the format printed on the last page of the ***Bulletin.*** This procedure is necessary since the ***Bulletin*** is reproduced from author–produced typescripts suitable for direct reproduction.

The ***Bulletin*** is distributed free of charge through the CSTG Representatives in each country.

II. Structure of the Commission – membership

– **Executive Committee** (as from 9 July, 1984).

Christoph Reigber, President,		Suria K. Tatevjan	(U.S.S.R.)
Ivan I. Mueller	(U.S.A.)	Yoshihide Kosai	(Japan)

– **Steering Committee** (as from 9 July, 1984)

L. Aardoom (Netherlands), EROS ; M. Bonatz (F.R.G.), Journées Luxembourgeoises de Géodynamique ; C. Boucher (France), GRGS & Subcommission on Standards; W. E. Carter (U.S.A.), Subcommission IRIS ; M. Feissel (France), Bureau International de l'Heure ; C. Finley (U.S.A.), NASA Crustal Dynamics Project ; E. A. Flinn (U.S.A.), ICL, NASA HQ ; A. Giesecke (Peru), IPGH Geophysics Commission & CERESIS ; P. Hartl (F.R.G.), ISPRS Commission I ; S. Hieber (France), ESA – Coordinator of Solid Earth Missions ; J. Kovalevsky (France), Hipparcos Project ; M. Lefebvre (France) Subcommission MEDOC; R. Leitinger (Austria), URSI – Commission G ; M. M. Macomber (U.S.A.), DMA ; A. G. Massevitch (U.S.S.R.), Intercosmos ; P. Melchior (Belgium), IUGG Associations other than IAG ; P. Paquet (Belgium), SEWG/ESA ; M. R. Pearlman (U.S.A.), NASA/Wegener liaison ; P. Pesec (Austria), WEDOC ; J. Rais (Indonesia), IAG Sub–commission Southeast Asia and Pacific ; R. Rodriguez (Argentina), IPHG Committee on Geodesy ; M. Schneider (F.R.G.), SFB 78 ; B. A. Sikilo (Kenya), ADOS ; D. E Smith (U.S.A.), GSFC ; B. D. Tapley (U.S.A.), UTEX ; K. Wakker (NL), COSPAR Panel on Artificial Satellites ; G. A. Wilkins (U.K.), Subcommission MERIT ; P. Wilson (F.R.G.), Subcommission DOTS.

– **Representatives by Country**
(Members of IUGG and/or COSPAR).

Argentina, D. A. Restelli, R. O. Malberti; Australia, A. Stolz ; Austria,K. Rinner; Belgium, P. Paquet ; Bolivia, A. V. Benavides, Hernan A.Cortez , Brazil, E. O. Giacaglia , A.J. Pavan; Bulgaria, N.I. Georgiev ; Canada, J. Kouba; Chile, E.Kausel, C.Carvallo Yanez; China, W. Hong Sheng . Colombia, A. Gonzalez Fletcher ; Costa Rica, C. V. Rodriguez ; Czechoslovakia, M. Burša ; Denmark, F. Madsen ; Ecuador, J. A. Arostegui Caceres ; El Salvador, R. L. Meyer ; Ethiopia, Ethiopian Mapping Agency ; Finland, J. Kakkuri ; France, C. Boucher ; Federal Republic of Germany, G. Seeber ; German Democratic Republic, H. Montag ; Greece, G. Veis ; Guatemala, J.M. A. Guillioli ; Haiti, J. W. Simeon ; Hungary, G. Alpar ; India, K. L. Khosla ; Indonesia, J. Rais ; Italy, ;Japan , A. Tsuchiya ; Jordan, R. Majali ; Kenya, J. D. Obel ; Republic of Korea, Chul–Ho Ahn ; Luxembourg, P. Paquet; Madagascar, S. Andriamihaja; Malaysia, A. M. Mohamed; Mexico, J. M. Espindola , M. Mena ; Netherlands , L. Aardoom ; Nicaragua , R. A. Arauz, A. A. Quesada ; New Zealand, N. C. Sutherland ; Nigeria, F. A. Fajemirokun ; Norway, J. Sundsby ; Panama , T. R. Carrillo , B. J. Shelton ; Peru , J. L Samanez Casas, G. L. Pérez del Aguila ; Philippines, G. T. Marzan ; Poland, J. B. Zielinski . Portugal, A. de Almeida Sobreiro, L. A. Mendes Victor ; Senegal, S. MB. Thiam ; South Africa, H. S. Williams ; Spain, R. H. Garcia ; Sweden, A. J. Anderson ; Switzerland, I. Bauersima; Syria , A. M. Safi ; Thailand , S. Pachimkul , S. Ming–Samon ; Turkey, H. Balkan ; U.S.S.R., M. Prilepin ; United Kingdom, J. A. Weightman ; U.S.A., C. C. Goad ; Uruguay, A. L. Pigni, J. E. Acuna ; Venezuela, A. A. Fonseca Antunez ; Yugoslavia, M. Solaric ; Zimbabwe, C. C Worrall .

Representatives to CSTG are solicited from member countries of IUGG and/or COSPAR who have not yet appointed them. Correspondence in this regard should be

addressed to the CSTG President.

– CSTG Subcommissions

- *Deployment of Transportable Systems – DOTS*

Edward A. Flinn	(U.S.A.)
William E. Carter	(U.S.A.)
Leendert Aardoom	(Netherlands)
Peter Wilson	(F.R.G.), *Chairman.*

- *Standards*

C. Boucher	(France), *Chairman.*	H. Montag	(German Dem. Republic)
W.E. Carter	(U.S.A.)	C.R. Schwarz	(U.S.A.)
L.D. Hothem	(U.S.A.)	C.C. Tscherning	(Denmark)
J. Kakkuri	(Finland)	J.I. Vette	(U.S.A.)
H. Linder	(U.S.A.)	O. Bulygina	(U.S.S.R.)
W.G. Melbourne	(U.S.A.)		

- *Project MERIT, IAU/IUGG Joint Working Group on the Rotation of the Earth*

Steering Committee :

G.A. Wilkins	(United Kingdom), *Chairman.*	M. Lefebvre	(France)
Ivan I. Mueller	(U.S.A.), *Vice–Chairman.*	W.G. Melbourne	(U.S.A.)
O. Calame	(France)	B.E. Schutz	(U.S.A.)
W.E. Carter	(U.S.A.)	P. Wilson	(F.R.G.)
M. Feissel	(France)	K. Yokoyama	(Japan)
W.J. Klepczynski	(U.S.A.)		

- *MEDOC – Motion of the Earth by Doppler Observing Campaign*

A. Piuzzi	(France)
M. Lefebvre	(France)
C. Boucher	(France)

- *IRIS – International Radio Interferometric Surveying*

James Campbell	(F.R.G.)	Goran Lundqvist	(Sweden)
William E. Carter	(U.S.A.), *Chairman.*	Ye Shu–Hua	(China)
Nobuhiro Kawajiri	(Japan)		

- *COTES, IUGG/IAU Joint Working Group on the Establishment and Maintenance of a Conventional Terrestrial Reference System*

E.M. Gaposchkin	(U.S.A.)	W.G. Melbourne	(U.S.A.)
B. Guinot	(France)	P. Melchior	(Belgium)
B. Kolaczek	(Poland)	K. Yokoyama	(Japan)
J. Kovalevsky	(France)	I.I. Mueller	(U.S.A.), *Chairman.*
D.D. McCarthy	(U.S.A.)		

– Special Study Group 2–54.

Satellite radio--tracking techniques

Techniques de poursuite radioélectrique de satellites artificiels

President : B.E. Schutz (U.S.A.)

I. Terms of Reference

Radio tracking of artificial satellites has made significant contributions since the first applications in 1957–58. One highly successful application of radio tracking has been the NAVSAT system which was originally planned for ship navigation, but it has proven to have wide applications in surveying using commercially available receivers.

In the period from 1985–90, the Global Positioning System (GPS) will become operational and will provide numerous opportunities for geodetic applications. While the point positioning applications are approaching maturity with geodetic receivers now available or close to marketing, several techniques for utilizing the GPS signals are under study for other geodetic, geophysical and geodynamic applications. These techniques are, to varying extents, dependent on the nature of the GPS ephemeris errors for relative and absolute positioning as influenced by clock / oscillator errors and uncertainties in the spacecraft force model. The use of GPS receivers and / or transmitters on other satellites has been proposed (for example, aboard the planned TOPEX oceanographic satellite), and the benefits for geodetic determinations such as the gravity field, polar motion / earth rotation and positioning of base stations are being investigated. Several of the receivers are also capable of utilizing signals from the GLONASS navigation satellite system for relative positioning applications.

In addition to techniques based on GPS, other techniques which produce measurables related to range and / or range–rate have been proposed, such as DORIS and PRARE. Furthermore, other navigation satellite systems (such as the ESA NAVSAT) have been proposed which could contribute to the previously mentioned applications.

II. Program of Activities

With the diversity of satellite radio–tracking techniques currently available and proposed, Special Study Group 2–54 will undertake the following :

1. Collect the descriptions of the various radio tracking techniques, including the mathematical model for the measurement and estimates for the measurement precision ;

2. Identify the measurement sensitivity to geodetic, geophysical and geodynamic parameters (geo–parameters) of interest, including orbit determination applications ;

3. Quantify the hardware resources required (e.g., number of receivers and / or transmitters) for the respective techniques applied to the determination of the geo–parameters of interest ;

4. Identify the complexity of measurement utilization (e.g., simultaneous multiple satellite orbit determination, computer requirements) ;

5. Investigate and propose standards, where appropriate ;

6. Identify the error sources associated with each technique, including estimates of difficult to model or unmodelable corrections.

It is expected that as the SSG evolves, other study areas will be introduced. The SSG plans to produce a draft document which addresses the above areas by the end of 1984 and to incorporate new areas as required. The SSG will meet as required or convenient and will host a general meeting before the next IUGG meeting, if deemed appropriate.

III. List of Members

B. Schutz	(U.S.A.), *president.*	J. O'Toole	(U.S.A.)
M. Ananda	(U.S.A.)	C. Reigber	(Fed. Rep. of Germany)
I. Fejes	(Hungary)	B. Remondi	(U.S.A.)
V. Gubanov	(U.S.S.R.)	W. Schleuter	(Fed. Rep. of Germany)
R.W. King	(U.S.A.)	A. Stolz	(Australia)
J.G. Marsh	(U.S.A.)	K. Wakker	(Netherlands)
W. Melbourne	(U.S.A.)	J.B. Zielinski	(Poland)
F. Nouel	(France)		

— Special Study Group 2–80.

Lunar laser ranging

Mesures de distance terre–lune par laser

President : R.W. King (U.S.A.)

I. Terms of Reference

The objectives of the SSG include the initiation, maintenance, and coordination of lunar laser ranging as a viable observation technique for geophysical studies, especially investigation of variations in the rotation of the earth and the dynamics of the earth–moon system.

II. Program of Activities

In order to accomplish these objectives, the following activities are proposed :

1. Facilitate the exchange of operational software and information regarding hardware improvements among lunar ranging stations.

2. Encourage the upgrading of operational stations to achieve the highest possible accuracy.

3. Encourage the distribution of software and accurate ephemerides so that stations can compute quick–look values of earth rotation parameters.

4. Hold meetings and workshops at the time of related international scientific meetings in order to discuss current problems and advances in lunar ranging data analysis.

III. List of Members

R.W. King	(U.S.A.), *president.*	J. Gaignebet	(France)
V.K. Abalakin	(U.S.S.R.)	J. Wen Jing	(China)
O. Calame	(France)	Y.L. Kokurin	(U.S.S.R.)
W.E. Carter	(U.S.A.)	Y. Kozai	(Japan)
J.O. Dickey	(U.S.A.)	L.S. Macknik	(U.S.A.)
P.J. Morgan	(Australia)	J.G. Williams	(U.S.A.)
P.J. Shelus	(U.S.A.)	P. Wilson	(Fed. Rep. of Germany)
D.E. Smith	(U.S.A.)		

– Special Study Group 2–81.

Specification of Methods for Handling Systematic Errors arising from Satellite Laser Ranging Instrumentation

Méthodes de traitement des erreurs systématiques dans l'instrumentation pour les mesures de distance laser terre–satellites artificiels

President : J. Gaignebet (France)

I. Terms of Reference

Satellite laser ranging has produced remarkable results, particularly for the LAGEOS and Starlette satellites. For these satellites, residuals of observations from computed orbits are approaching possible systematic errors in the instruments. Evaluation of the errors is further complicated by the great variety of instruments in use. The study group will address the methods to be used for evaluation and also carry out the evaluations. The work will be coordinated with SSG 2–80 (lunar satellite ranging), 2–82 (data compression and smoothing) and 2–84 (atmospheric refraction effects).

II. Program of Activities

– calibration procedures ;

– study of stability of stations during the tracking of satellites and follow up of calibrations ;

– specification of the targets and of their influence on quality of observations (calibration targets as well as satellites) ;

– problems associated with use of multi–wavelength stations.

III. List of Members

J. Gaignebet	(France), *president.*	R. Neubert	(German Dem. Rep.)
F. Gomez Armario	(Spain)	M. Paunonen	(Finland)
Y. Boudon	(France)	M. Pearlmann	(U.S.A.)
O. Calame	(France)	L. Shtirberg	(U.S.S.R.)
J. J. Degnan	(U.S.A.)	A. T. Sinclair	(United Kingdom)
K. Hamal	(Czechoslovakia)	A. Tsuchiya	(Japan)
G. Kirchner	(Austria)	E. Vermaat	(Netherlands)
D. Matveev	(U.S.S.R.)		

– Special Study Group 2–82.

Compression and Smoothing of Data Obtained from Space Techniques

Compression et lissage des données issues des techniques spatiales

President : D. Lelgemann (Fed. Rep. of Germany)

I. Terms of Reference

Modern observation techniques as used in space geodesy produce masses of raw data although for most of the geodetic objectives (i.e., determination of coordinates and baselines, earth rotation and gravity field) aggregated data sets would be sufficient. This will require, however, standardized or at least compatible data compression and smoothing techniques, well documented to meet the requirements of the users.

All of the individual data sets are given in form of time series. The data compression techniques have therefore a common mathematical background, the analysis and treatment of time series of (non–equally spaced) data. An optimal aggregation technique will depend on our a priori knowledge of the desired signal and of the systematic, gross and random errors as well as on our possibilities to detect them.

Different data aggregation techniques have already been developed in the past for checking and compression of e.g., Doppler data, laser ranging data, GPS–data, as well as for the smoothing and combination of results, e.g., Earth rotation parameters (universal time and polar motion) and temporal variations of station coordinates. The requirements on the input (type of data) and on the output (e.g., the proper resolution of the compressed data and (correlated)error estimates) has finally governed the design of the individual pre–processing techniques. Restrictions on computer size and costs have led to acceptable compromises.

II. Program of Activities

To understand all aspects of the application of the aggregation techniques the topics to be considered by the study group include

– Collection of general and specific criteria of time series analysis as used for checking, smoothing and compression of space data ;

– Description of the methods presently used for data compression, including input and output requirements pointing out the advantages and possible disadvantages of the method ;

– Comparison of the results of different smoothing programs using non–optimal distributed data sets (e.g., non–equally spaced data with large gaps and containing gross errors).

If possible, the study group should make recommendations about expedient criteria and techniques to be used after collection, comparison and discussion of the results of the various methods.

III. List of Members

D. Lelgemann	(Fed.Rep. Germany), *presid.*†	B. Kolaczek	(Poland)
R.J. Anderle	(U.S.A.)	J. Kouba	(Canada)
C. Boucher	(France)	H. Montag	(German Dem. Rep.)
D. Christodoulidis	(U.S.A.)	J. O'Toole	(U.S.A.)
T.M. Eubanks	(U.S.A.)	E. Pavlis	(Fed. Rep. of Germany)
M. Feissel	(France)	B. Schutz	(U.S.A.)
D. Gambis	(France)	A. Stolz	(Australia)
C. Goad (*)	(U.S.A.)	R. Verbeiren	(Belgium)
L.D. Hothem	(U.S.A.)	E. Vermaat	(Netherlands)
R.W. King	(U.S.A.)	J. Vondrak	(Czechoslovakia)
C. Koblinsky	(U.S.A.)	P. Wilson	(Fed. Rep. of Germany)

(*) – corresponding member.

– Special Study Group 2–83.

Data Analysis Methods for Satellite–to–Satellite Tracking and Satellite Gradiometry

Méthodes d'analyse des données pour la poursuite satellite–satellite et la gradiométrie par satellite

President : R. Rummel (Netherlands)

I. Terms of Reference

Since the publication of the Williamstown report, 14 years have elapsed and a dedicated gravitational satellite mission is yet flying. The main reasons may be factors such as the high costs for such a mission, insufficiently convincing arguments of the user groups, or the complications with the technological realization of such a mission. But discussions in recent years indicate that the analysis methodology for methods such as low–low satellite–to–satellite tracking (SST) and satellite gradiometry is still not settled and that no complete and conclusive simulations are available. Since it is expected that in the early 90's a dedicated gravity mission shall be realized, it is due time to think in detail about the problem involved in the efficient analysis of this type of data.

II. Program of Activities

To provide a platform for an exchange of ideas on all aspects related to the analysis of low–low SST and satellite gradiometry (including high resolution gravity field recovery, orbit determination, orbit requirements, tailored perturbation theory, fast algorithms, etc.).

To stimulate the definition and computation of a simulation of a full mission (with realistically defined orbit characteristics and a high resolution gravity model), that can be used to test the analysis methods.

The gravity determination should include global as well as regional gravity parameter recovery.

III. List of Members

R. Rummel	(Netherlands), *president.*	W.M. Kaula	(U.S.A.)
G. Balmino	(France)	S.M. Klosko	(U.S.A.)
F. Barlier	(France)	J. Kryński	(Poland)
P.L. Bender	(U.S.A.)	F.J. Lerch	(U.S.A.)
J.V. Breakwell	(U.S.A.)	R.H. Rapp	(U.S.A.)
B. Chovitz	(U.S.A.)	Ch. Reigber	(Fed. Rep. of Germany)
O.L. Colombo	(U.S.A.)	B. Schutz	(U.S.A.)
C.C. Goad	(U.S.A.)	W.L. Sjögren	(U.S.A.)
K.–H. Ilk	(Fed. Rep. of Germany)	C.A. Wagner	(U.S.A.)

– Special Study Group 2–84.

Atmospheric Effects on Geodetic Space Measurements

Effets atmosphériques sur les observations géodésiques spatiales

President : F.K. Brunner (Switzerland)

I. Terms of Reference

It has been recognized that one of the major limitations to further improve the accuracy of geodetic space measurements is the effect of the propagation medium. The term geodetic space measurements encompasses satellite microwave ranging and its rate of change, satellite laser ranging, VLBI, baseline measurements using GPS, satellite to satellite ranging, and satellite altimetry. The propagation medium exhibits two different regions, the ionosphere and the neutral atmosphere. The propagation effects in these

two regions depend further on the frequencies of the electromagnetic waves where microwaves behave differently to light waves. Furthermore it is of importance to distinguish between the single path situation and the differential effect on adjacent paths.

II. Program of Activities

In general the task of SSG 2–84 is to study the nature of the atmospheric effects on various geodetic space measurements and to develop remote sensing techniques and accurate models for these effects including statements about the range of applicability and their inherent limitations.

The following topics will be of foremost interest : (a) models and limitations ; (b) GPS baseline measurements ; (c) residual ionospheric effects ; (d) water vapour delay ; and (e) spatial variation of meteorological parameters.

In order to have a lively participation of and communication between the members, the following activities are proposed :

1. Hold special workshop meetings during various international symposia ;
2. Organize one symposium on the topic of SSG 2–84 ;
3. Circulate reports, preprints and papers within the SSG ;
4. Send all relevant information of the chairman for inclusion in the Circular Letters.

III. List of Members

F.K. Brunner	(Switzerland), *president.*	T. Herring	(U.S.A.)
P.V. Angus–Leppan	(Australia)	D.C. Hogg	(U.S.A.)
P.L. Bender	(U.S.A.)	R. King	(U.S.A.)
C. Boucher	(France)	J. Kouba	(Canada)
W.E. Carter	(U.S.A.)	R. Leitinger	(Austria)
R.K. Crane	(U.S.A.)	G.M. Resch	(U.S.A.)
J.R. Clynch	(U.S.A.)	T.A. Spoelstra	(Netherlands)
A.F. Dravskikh	(U.S.S.R.)	G. Teleki	(Yugoslavia)
P. Dunn	(U.S.A.)	D. Wells	(Canada)
C.S. Gardner	(U.S.A.)	J.C. Wyngaard	(U.S.A.)
G.K. Hartmann	(German Dem. Rep.)		

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SECTION III

DETERMINATION OF THE GRAVITY FIELD

DÉTERMINATION DU CHAMP DE PESANTEUR

President : W. Torge (Fed.Rep.Germany)

Secretaries : I. Nakagawa (Japan)
[responsible for Gravimetry (SSG 3–85, 3–86, 3–87, 3–89)]

C. Tscherning (Denmark)
[responsible for Gravity field estimation (SSG 3–88, 3–90)]

Terms of Reference

According to the By Laws Section III is responsible for :

– absolute and relative terrestrial gravity measurements,

– non–tidal gravity variations,

– determination of the external gravity field and the geoid from gravimetry, gradiometry, geodetic astronomy, space and inertial techniques,

– reduction and estimation of gravity field quantities.

The earth's gravity field contains significant information for different fields of application, such as geodesy, geophysics, and navigation. The determination of the gravity field is based on various types of measurements distributed in space and time. Observed quantities are the gravity potential and its first and second order derivatives, or linear combinations of them. They are provided by techniques such as levelling, satellite altimetry, gravimetry, geodetic astronomy, gradiometry, and space and inertial techniques. The observations are the basis for modelling the external gravity field and the geoid, using various mathematical techniques for the reduction, prediction and combination of the data. With an observation accuracy reaching now 10^{-9} g , the study of non–tidal gravity variations becomes an increasing importance for geodynamic studies.

– Commission III

International Gravity Commission

Commission Gravimétrique Internationale

President	:	J.G. Tanner	(Canada)
Secretaries	:	C. Morelli	(Italy)
		D. Ajakaiye	(Nigeria)
Vice–Presidents	:	S. Kryński	(Poland)
		H.T. Hsu	(China)

1. Program of Activities

1.1. The I.G.C., as a Commission of the IAG, promotes scientific investigation of the gravity field of the Earth, its relationship to the form and processes of the Earth's interior and exterior and its variations with time. It does so through the concerted action of its

members to acquire homogeneous gravity anomaly coverage of the earth. It regulates the operation of Bureau Gravimétrique International, the operational agency of the IAG, established to promote the free exchange of gravity data among the member countries for the benefit of not only geodesists but also geophysicists and geologists.

1.2. The Commission shall seek to collaborate with all international and national organizations concerned with the work of the I.G.C., particularly for the benefit of the developing countries.

1.3. The Commission will encourage and promote special campaigns to develop and compare gravity instrumentation, techniques of operation and procedures for the adjustment of the results of surveys.

1.4. The Commission will review its functions from time to time to ensure that its activities are commensurate with the needs of the geodetic community.

2. Functions

The functions of the I.G.C. shall be to :

(a) find solutions to problems requiring international cooperation in gravity research and review the results of such investigations ;

(b) recommend and coordinate international programmes for scientific investigation in gravity and related services which call for concerted action by its members and interested organizations ;

(c) make recommendations to international organizations in matters which relate to the Commission's programme ;

(d) promote and make recommendations for the exchange of gravity data and the publication and dissemination of results of scientific investigations ;

(e) make recommendations to strengthen education and training programmes in gravity and its technology ;

(f) make recommendations for assisting developing countries in gravity–related research and technology development ;

(g) promote scientific investigation of gravity on behalf of the international community, taking into account special interests and rights of countries concerning scientific research in the zones under their jurisdiction.

In carrying all its functions, the I.G.C. shall bear in mind the special needs and interests of developing countries.

3. Cooperation

The I.G.C. shall give due attention to supporting the objectives of the international organizations with which it collaborates and which may request the I.G.C. to act, as appropriate, as the medium for discharging certain of their responsibilities in matters relating to gravity investigations. The I.G.C. may also request these organizations to take its requirements into account in planning and executing their own programmes.

4. Organization

4.1. The Assembly of the I.G.C. shall be its principal organ and, without prejudice

to the previsions of paragraph 3 of this Article, shall make all decisions necessary to fulfill the functions of the I.G.C.

4.2. In accordance with the By–laws of the I.A.G., the President of the Commission is appointed by the Council of the I.A.G. Every four years the Assembly shall elect two Vice–Presidents and a Secretary at its ordinary session. They, along with the President, shall constitute the Executive Board. The President may appoint a second Secretary to assist with the operation of the Commission.

4.3. The Executive Board shall exercise the responsibilities delegated to it by the Assembly and act on its behalf in the implementation of decisions of the Assembly.

4.4. The Executive Board shall review the effectiveness of the operating structure of the Commission and make recommendations to the Assembly on structural or other changes where necessary.

5. Working Procedures

5.1. The Assembly shall be convened in ordinary session every four years. Extraordinary sessions may be convened at the discretion of the Executive Board or at the request of at least five National Committees.

5.2. Each Country belonging to the I.A.G. and represented at the Assembly shall have one vote, but may accompany its representative to sessions of the Assembly with alternates and advisers as it deems necessary.

5.3. The I.G.C. either through its Assembly or by Executive action subject to the approval of the Assembly may create, for the examination and execution of specific projects, working groups or other subsidiary bodies composed of experts interested in such projects.

6. Financial Support

6.1. The programmes endorsed and coordinated by the I.G.C. and recommended to its Member Countries for their concerted action shall be carried out with the aid of the resources of participating Member Countries, in accordance with the obligations that each Country is willing to assume.

6.2. The expenditures of the I.G.C. shall be financed from funds appropriated for this purpose by the I.A.G. or other organizations of the International Union of Geodesy and Geophysics.

6.3. Contributions to the Commission from outside the structure of the I.U.G.G. may be accepted and established as trust funds in accordance with the financial regulations of the I.A.G. Such funds will be allocated to programmes of the Commission in accordance with any special wishes of the donor or decisions of the Assembly or the Executive Board.

6.4. Funds so allocated shall be expended by a Secretary of the Commission who will be accountable in this matter to the Central Bureau of the I.A.G.

7. Sub–Commissions

7.1. The Commission is divided into the following Sub–Commissions :

Sub–Commission	*Coordinator*	
North Pacific Region	I. Nakagawa	(Japan)
South–West Pacific Region	I. Reilly	(New Zealand)
North America	C. Goad	(U.S.A.)
Central and South America	E. Kausel	(Chile)
Africa	R.O. Coker	(Nigeria)
Western Europe	G. Boedecker	(Fed. Rep. Germany)
Eastern Europe and U.S.S.R.	Yu. D. Boulanger	(U.S.S.R.)
India and Arab Countries	M.G. Arur	(India)

7.2. The terms of reference for the Sub–commissions are :

a) To act as a regional centre for maintaining a catalogue of information of IGSN 71 and other gravity base stations in the area, including marine gravity bases, and to facilitate the supply of this information to the Bureau Gravimétrique International.

b) To coordinate the maintenance, revision and extension of the network of international gravity base stations in the region.

c) To collaborate with, and where necessary to coordinate assistance to, countries in the area wishing to set up and maintain national gravity reference networks.

d) To assist the B.G.I. in obtaining a good regional coverage of surface gravity data in the area.

e) To undertake, in consultation with the President of I.G.C., other activities as required in the pursuit of the objectives of the Commission.

f) To act as a regional Agency of I.G.C.

7.3. The coordinators are requested to organize the Bureau of each Sub–Commission as appropriate, based on regional support by parent Agencies.

7.4. Membership of each Sub–Commission is envisaged to comprise :

a) Representatives of member countries of I.A.G. in the area concerned, as provided in the I.A.G. Rules for Commissions.

b) Representatives of countries in the area who are not members of I.A.G., to be appointed in consultation with representatives of member countries.

7.5. Communication and Reporting

a) The Sub–commission shall communicate to its members by circular letters, with information copies to President I.G.C., Director B.G.I., President I.A.G., Section III, and Presidents of eventual other Commissions of I.A.G. interested.

b) The Sub–commission shall report to the President I.G.C. as required.

8. Work to be Performed

8.1. B.G.I.

Support the continuing operation of the B.G.I. in Toulouse with the emphasis on expanding its data base to include national areas for which no data have been released and to improve coverage in the oceans.

8.2. Absolute measurements

a) Intercomparison of the newly developed transportable apparatuses (in Sèvres in 1985).

b) Development and implementation (to be done through SSG 3–87) of a plan to establish a world–wide absolute network.

c) Extension of International Gravity Standardization Net to remote areas where no absolute values are available.

d) Collection of new absolute measurements, regional and local network connections and adjustments.

e) Develop and implement a plan to assist African countries in the observation and adjustment of an African Standardization Net.

8.3. International Gravity Standardization Net

Improvements and extensions.

New Regional adjustments as necessary.

Comparison of IGSN 71 with absolute measurements.

8.4. Marine gravity data

Connection of harbour sites to IGSN 71.

Comparisons with satellite altimetry data.

8.5. Activities and Organization

a) At its next Assembly, in Toulouse during September 1986, the Commission will review its organization in the light of the new responsibilities of Section III to see whether changes in structure or terms of reference are warranted.

b) The Executive Board will review the format for the Assembly and attempt to insert one or two sessions involving applications of gravity data to problems in geodesy, geophysics, geology, etc.

– International Gravimetric Bureau
Bureau Gravimétrique International

Director : G. Balmino (France)

1. Objectives and Terms of Reference

The main task of B.G.I. is to collect, on a worldwide basis, all gravity measurements and pertinent informations about the gravity field of the Earth, to compile them and store them in a computerized data base in order to redistribute them on request to a large variety of users for scientific purposes. The data consist of : gravimeter observables (mainly location –three coordinates, gravity value, corrections, anomalies ...), mean free air gravity values, mean topographic heights, gravity maps, reference station descriptions, spherical harmonic coefficients of global geopotential models, publications dealing with Earth's gravity. B.G.I. also has at its disposal (mainly for geophysical analysis and validation of marine gravity observations) through one of his host agencies, satellite

altimetry derived geoid heights, presently from the Geos 3 and Seasat missions.

B.G.I. has been developing various algorithms and softwares for data validation and analysis, as well as its own data management system. A large number of services are offered to the users, such as data retrieving, data evaluation, geophysical modeling of sources, contoured maps.

All kinds of gravity data can be sent to B.G.I., with or without restrictions of redistribution to be specified by the contributors, sometimes in the form of a protocole of usage.

2. Structure and Membership

— B.G.I. is one of the offices of the Federation of Astronomical and Geophysical Services (FAGS). It may also be considered as an executive office of the International Gravity Commission.

— It has a Directing Board composed of the following members :

Ex–officio members :	W. Torge	(F.R.G.)	C. Tscherning	(Denmark)
	G. Balmino	(France)	J.G. Tanner	(Canada) Chairman
Nominated members :	J. Woodside	(Canada)	C. Morelli	(Italy)
	I. Nakagawa	(Japan)	J. Krynski	(Poland)

Since the XVIIth IUGG General Assembly (Canberra, Dec. 1979), B.G.I. has been taken over by the Groupe de Recherches de Géodésie Spatiale, G.R.G.S., (Toulouse, France) and the Bureau de Recherches Géologiques et Minières, B.R.G.M. (Orléans, France), which also are its host agencies. The offices are therefore located :

(a) in Toulouse, in the building of the Observatoire du Pic du Midi de Toulouse, where it has the major support of the Centre National d'Etudes Spatiales, C.N.E.S., (Space Center in Toulouse),

Address : 18, Avenue Edouard Belin — 31055 Toulouse Cedex — France.
Tél. (61) 27.40.72 ; Telex : 531081 F.

(b) in Orléans, within the Geophysic Department and Data Base Department of BRGM.

Address : B.P. 6009 — 45018 Orléans Cedex — France
Tél. : (38) 63.80.01 ; Télex : BRGM A 780258 F

The resources of B.G.I., besides the annual FAGS grant, are provided by CNES and IGN through GRGS, by BRGM and by INAG (Institut National d'Astronomie et de Géophysique). There exists a covenant between CNES, BRGM and INAG to guarantee their support to B.G.I.

— Four Working Groups have been established to help B.G.I. in different tasks :

. ***WG 1 :*** Collection of gravity data

Chairman :	R.K. McConnell	(Canada)		
Members :	J. Tanner	(Canada)	L. Wilcox	(U.S.A.)
	A. Gérard	(France)	W. Strange	(U.S.A.)
	J.P. Leprêtre	(France)		

. ***WG 2 :*** Gravity standards — Networks

Chairman :	U. Uotila	(U.S.A.)		
Members :	R.K. McConnell	(Canada)	W. Torge	(F.R.G.)
	B. Szabo	(U.S.A.)	L. Wilcox	(U.S.A.)

. *WG 3 :* World gravity maps 1° x 1° and 5° x 5° means

Chairman :	Y.D. Boulanger	(U.S.S.R.)		
Members :	H. Kautzleben	(G.D.R.)	O. Williams	(U.S.A.)
	R.H. Rapp	(U.S.A.)		

. *WG 4 :* Gravity anomaly prediction

Chairman :	L. Wilcox	(U.S.A.)		
Members :	C. Aiken	(U.S.A.)	C.L. Merry	(South Africa)
	M.G. Arur	(India)	R. Patterson	(Australia)
	G. Balmino	(France)	R.H. Rapp	(U.S.A.)
	E. Groten	(F.R.G.)	N.J. Simmons	(U.S.A.)
	R.L. Hardy	(U.S.A.)	W. Strange	(U.S.A.)
	G. Lachapelle	(Canada)	C.C. Tscherning	(Denmark)

3. Program of Activities for the Next four Years

– Continue publication of the Bulletin d'Information.

– Continue data collection, evaluation, archiving and distribution : emphasis will be on those countries which have not, or seldom, contributed to the B.G.I. data bank

– Set up techniques for computing mean gravity anomalies from various geodetic quantities (measurements of gravity, geoid heights, deflections of vertical, spherical harmonic coefficients) – with the help of WG. 4.

– Assist I.G.C. in setting up the worldwide network of absolute gravimeters, and assist in the intercomparisons of instruments.

– Digitize the worldwide bathymetric GEBCO maps so as to : (1) help the geophysicists in the interpretation of oceanic gravity anomalies, (2) serve as the basic material for the next series of these maps.

– Assist in promoting satellite techniques to improve our global knowledge of the Earth gravity field : satellite–to–satellite tracking, satellite gradiometry, etc ...

– Special Study Group 3–85.

Comparison of high–precision relative gravimetry techniques

Comparaison des techniques de mesures relatives gravimétriques de haute précision

President : E. Groten (Federal Republic of Germany)

I. Program of activities

1. Improving present accuracies of relative gravimetry.

2. Combination of various gravimetric techniques in order to compensate in this way the deficiencies of specific techniques :

a) classical gravity meters ;

b) classical gravimeters in combination with absolute gravity meters ;

c) classical gravimeters with inertial platforms.

3. Application of relative gravimetry to geodetic problems :

a) earthquake prediction ;

b) uplift– and subsidence studies ;

c) cavity studies ;

d) general geodynamics.

4. Study of perturbing effects on precise gravimetry :

a) theory and modelling ;

b) cryogen gravimeters.

5. Evaluation of LaCoste–Romberg model D–Meter campaign results and subsequent error modelling of relative gravimetry.

6. Relative Gravimetry Campaigns for detecting secular gravity changes :

a) Continuation of observation in Fennoscandia ;

b) Continuation of Prof. Kiviniemi's subgroup (goal is world–wide observation of " + 50° N parallel " profile) ;

c) Continuation of Rhinegraben testnet repeated observation ;

d) First observations of the La Paz – Santiago de Chile – San Juan (Argentina) profile in fall 1984 ;

e) Continuation of gravity network reobservation along North–Anatolian fault.

In connection with the international absolute gravimetry campaign, a workshop of SSG 3–85 and 3–86 is planned in Paris, June / July 1985. An international Symposium on high–precision gravity measurements is planned in the fall 1985 (1986) in the U.S.S.R.

II. List of members

E. Groten (Fed.Rep. of Germany), *president*	Yu. Boulanger (U.S.S.R.)
D. Ajakaiye (Nigeria)	H. Dragert (Canada)
Ahmet Aksoy (Turkey)	Claus Elstner (German Dem. Republic)

Gao Xi Ming (China)
Y. Hagiwara (Japan)
L.A. Haller (Sweden)
M. van den Herrewegen (Belgium)
Roger Hipkin (United Kingdom)
Aimo Kiviniemi (Finland)
A. Lambert (Canada)
H. Baussus v. Luetzow (U.S.A.)
I. Marson (Italy)
Age Midtsundstad (Norway)
Michel Ogier (France)
B. Richter (Fed. Rep. of Germany)
R. Röder (Fed. Rep. of Germany)
Jim Whitcomb (U.S.A.)
Derek Woodward (New Zealand)

– Special Study Group 3–86.

Evaluation of absolute gravity measurements

Evaluation des mesures absolues de la pesanteur

President : Yu. D. Boulanger (U.S.S.R.)

I. Program of activities

To evaluate the actual accuracy of gravity measurements at a given site, the main problems which should be discussed during 1984 to 1987 are as follows :

1. thorough analysis of systematic errors of absolute gravimeters under laboratory conditions.

2. simultaneous calibration of a large number of absolute gravimeters will permit evaluation of actual accuracy of recent absolute gravity determinations. Such calibration is planned to be carried out in june–july, 1985, in Sèvres.

3. evaluation of the effects of non–linearity of the gravity field when combining absolute and relative gravity measurements.

4. investigation of various effects causing gravity changes, especially :

a) tidal effects, including indirect effects ;

b) gravity changes due to atmospheric shifts, including non–linear isobaric surfaces and kinetic effects in the atmosphere ;

c) subsidence of the earth's surface under the effect of atmospheric pressure changes ;

d) polar motion effect ;

e) effect due to the non–homogeneity of the earth ;

f) effect of the deep and ground water migration ;

g) effect caused by vertical crustal movements, subcrustal mass transportation, migration of the earth's mass center, etc ...

In connection with the international absolute gravimetry campaign, a workshop of SSG 3–85 and 3–86 is planned in Paris, june / july 1985. An international symposium on high–precision gravity measurements is planned in the fall 1985 (1986) in the U.S.S.R.

II. List of members

Yu. D. Boulanger	(U.S.S.R.), *president.*	I. Nakagawa	(Japan)
M. Burša	(Czekoslovakia)	N. Pariisky	(U.S.S.R.)
G. Cerutti	(Italy)	C. Poitevin	(Belgium)
C. Elstner	(German Dem. Republic)	M. Sagitov	(U.S.S.R.)
J. Faller	(U.S.A.)	A. Sakuma	(France)
E. Groten	(Fed. Rep. of Germany)	P. Steinhauser	(Austria)
Meng Nim	(China)		

– Special Study Group 3–87.

Development of a New World Absolute Gravity Network

Développement d'un nouveau réseau gravimétrique absolu mondial

President : G. Boedecker (F.R.G.)

I. Program of activities

1. Definition of the objectives of the net ;

Zero order gravity references net, geodynamics monitoring in combination with geometric nets, instrument testing and calibration.

2. Network design ;

Consideration of global distribution according to the objectives, collocation with geometric stations and earth tide observatories, geological stability, etc...

3. Station installation ;

Hope of support from respective regions, concerned agencies.

4. Observation campaign ;

Timing and harmonizing of observation activities of the owners of absolute gravity meters.

II. List of members

G. Boedecker	(F.R.G.), *president.*	H. Hanada	(Japan)
D.E. Ajakaiye	(Nigeria)	A. Kiviniemi	(Finland)
B. Barlow	(Australia)	K. McConnell	(Canada)
P. Birò	(Hungary)	C. Morelli	(Italy)
Y. Boulanger	(U.S.S.R.)	C. Poitevin	(Belgium)
H. Drewes	(Fed. Rep. of Germany)	B. Richter	(Fed. Rep. of Germany)
C. Elstner	(Germ. Dem. Republic)	A. Sakuma	(France)
J. Faller	(U.S.A.)	P. Steinhauser	(Austria)
C. Gemael	(Brazil)	U. Uotila	(U.S.A.)

— Special Study Group 3–88.

Determination of the geoid in Europe

Détermination du géoïde en Europe

President : G. Birardi (Italy)

I. Program of activities

1. Completing the collection of new data from the European and Mediterranean Countries.

2. Completing the screening of the collected data.

3. Determination of an "integrated" geoid (or equivalent surface) in the European and Mediterranean area, with a possible decimeter accuracy.

4. Symposium to be held in Florence, Italy, *Spring 1986.*

II. List of members

President : G. Birardi (Italy)
Secretaries : S. Arca (Italy)
U. Giannoni (Italy)

D. Arabelos	(Greece)	J.C. Olliver	(United Kingdom)
E. Groten	(Fed. Rep. of Germany)	D. Lelgemann	(Fed. Rep. of Germany)
B. Bürki	(Switzerland)	R. Rummel	(Netherlands)
C. Le Cocq	(France)	H. Sünkel	(Austria)
E. Livieratos	(Greece)	H.–G. Wenzel	(Fed. Rep. of Germany)
L. Mussio	(Italy)		

— *National correspondants*

Algeria	: N.H. Larbi	Italy	: F. Sansò
Austria	: K. Bretterbauer	Jordan	: R. Majali
Denmark	: C. Tscherning	Portugal	: A. de Almeida Sobrero
Finland	: O. Ojanen	Spain	: J. Morencos
France	: C. Boucher	Sweden	: L. Petterson
F.R.G.	: E. Reinhardt	Switzerland	: W. Gurtner
Greece	: D. Balodimos	Syria	: A.M. Safi
Great Britain	: J.A. Weightman	U.S.S.R.	: Y. Boulanger
Hungary	: I. Joò	Yugoslavia	: A. Muminagic
Israel	: R. Adler		

— Special Study Group 3–89.

Observation and adjustment procedures in dynamic gravimetry

Méthodes d'observation et de compensation en gravimétrie dynamique

President : J. Makris (F.R.G.)

I. Program of activities

1. Standardization of survey procedures and deployment of shipborne gravity meters.

2. Instrumental comparison and technical development of shipborne gravity meters.

3. Investigation of airborne gravimetric systems and standardization of airborne survey procedures.

II. List of members

J. Makris	(Fed. Rep. Germany) *president.*	M.R. McQuillin	(United Kingdom)
G. Balmino	(France)	C. Morelli	(Italy)
Y. Boulanger	(U.S.S.R.)	R. Riddihough	(Canada)
C. Bowin	(U.S.A.)	B. Ruppel	(U.S.A.)
S. Hammer	(U.S.A.)	H.–U. Schlüter	(Fed. Rep. of Germany)
R. Hipkin	(United Kingdom)	Y. Tomoda	(Japan)
R. Howarth	(United Kingdom)	D. Voppel	(Fed. Rep. of Germany)
H.T. Hsu	(China)	G. Weber	(Fed. Rep. of Germany)
B.D. Loncarevic	(Canada)		

– Special Study Group 3–90.

Evaluation of local gravity field determination methods

Evaluation des méthodes de détermination du champ de pesanteur local

President : C.C. Tscherning (Denmark)

I. Program of activities

1. Study available methods for local gravity field determination, their efficiency, stability, range of applicability and their inherent limitations.

2. Execute numerical experiments using common sets of real or artificially generated values of gravity anomalies, deflections of the vertical, quasi–geoidal heights and gravity gradients.

3. Compare methods with respect to their accuracy and stability.

4. Study related error–estimation procedures and possibilities for incorporating information about topographic, geophysical or geological information.

II. List of members

C.C. Tscherning	(Denmark), *president.*	W. Kearsley	(Australia)
D. Arabelos	(Greece)	G. Lachapelle	(Canada)
F. Barthelmes	(German.Dem.Rep.)	A. Mainville	(U.S.A.)
B. Benciolini	(Italy)	C. Merry	(South Africa)
S.C. Bose	(U.S.A.)	R. Rapp	(U.S.A.)
J. Chen	(China)	K.P. Schwarz	(Canada)
C. Goad	(U.S.A.)	L. Sjöberg	(Sweden)
H. Hauck	(Fed. Rep. of Germany)	G. Strang van Hees	(Netherlands)
G. Hein	(Fed. Rep. of Germany)	H. Sünkel	(Austria)
C. Jekeli	(U.S.A.)	M. Vermeer	(Finland)
S.K. Jordan	(U.S.A.)		

SECTION IV

THEORY AND METHODOLOGY – THÉORIE ET MÉTHODOLOGIE

President : E. Grafarend (F.R.G.)
Secretaries : F. Sansò (Italy)
K.–P. Schwarz (Canada)

Terms of reference

Section IV deals with general theory and methodology within experimental geodesy and also interpretation with respect to geodynamics. In particular it tries to set up general mathematical models for geodesy, to present a statistical and numerical analysis of geodetic measurements, to discuss geodetic data processing and data management, to develop experimental design of geodetic networks, to investigate least squares methods, to compare and develop differential and integral theories of the gravity field. Special emphasis is placed on the estimation, approximation and representation of the gravity field.

The wide scope of research topics is reflected in 10 Special Study Groups ranging from the differential geometry of the gravity field (4.56), the boundary and convergence problems in physical geodesy (4.57), statistical methods for estimation and testing of geodetic data (4.60), geodetic data base management (4.66), optimal design problems (4.71), local and global gravity field approximation (4.91 and 4.92), wave propagation in refractive media (4.93), theory of geodetic reference frames (4.94), the multibody force function (4.95), and models for time–dependent geodetic positioning (4.96).

– Special Study Group 4–56.

Differential Geometry of the Gravity Field

Géométrie différentielle du champ de pesanteur

President : E. Livieratos (Greece)

[Subgroup on "Relativistic Aspect of Differential Geodesy", C. Boucher, *Chairman*]

Program of Activities

1. Transformation between geometry and gravity space.
2. Telluroid mappings.
3. Holonomic and anholonomic variables.
4. Deformation analysis (stress–strain analysis).
5. Relativistic aspects of differential geodesy.

Numerical and algorithmic problems concerning 3–d rigorous and computer efficient adjustments will also be of the SSG 's interest.

List of members

E. Livieratos	(Greece), *president.*	E. Groten	(Fed. Rep. of Germany)
G. Bakker	(Netherlands)	E. Osada	(Poland)
F. Bocchio	(Italy)	W.I. Reilly	(New Zealand)
C. Boucher	(France)	F. Sansò	(Italy)
B. Chovitz	(U.S.A.)	H. Sünkel	(Austria)
A. Dermanis	(Greece)	P.J.G. Teunissen	(Netherlands)
B. Heck	(Fed. Rep. of Germany)	R. Teisseyre	(Poland)
G. Hein	(Fed. Rep. of Germany)	P. Vaníček	(Canada)

– Special Study Group 4–57.

Boundary Value and Convergence Problems in Physical Geodesy

Problèmes de valeur aux limites et de convergence en géodésie physique

President : P. Holota (Czekoslovakia)

Program of Activities

1. Analysis of the main geodetic boundary value problems like the classical problems of Molodensky (linear and nonlinear formulation) or the mixed altimetry - gravity problems.
2. Time dependent boundary value problems.
3. Basis functions for approximate solutions.
4. Convergence of spherical harmonic expansion.

5. Convergence of collocation solution.

6. Analysis of other approximation methods (variational methods, perturbation methods, etc.).

7. Analytical continuation.

8. Inverse gravitational problem.

List of Members

P. Holota	(Czekoslovakia), *president.*	Yu. M. Neyman	(U.S.S.R.)
H. Baussus von Luetzow	(U.S.A.)	M.S. Petrovskaya	(U.S.S.R.)
A. Bjerhammar	(Sweden)	F. Sacerdote	(Italy)
A. Dermanis	(Greece)	F. Sansò	(Italy)
W. Freeden	(Fed. Rep. of Germany)	L. Sjöberg	(Sweden)
B. Heck	(Fed. Rep. of Germany)	S.L. Svensson	(Sweden)
W. Keller	(German Dem. Republic)	C.C. Tscherning	(Denmark)
T. Krarup	(Denmark)	K.J. Witsch	(Fed.Rep. Germany)
A.N. Marchenko	(U.S.S.R.)	M.I. Yurkina	(U.S.S.R.)
G.A. Meshcheryakov	(U.S.S.R.)		

– Special Study Group 4–60.

Statistical Methods for Estimation and Testing of Geodetic Data

Méthodes statistiques d'estimation et de validation des données géodésiques

President : D. Fritsch (F.R.G.)

I. Program of Activities

1. Statistical analysis of measurements, with emphasis on Bayesian estimation, hypothesis testing for network deformations, outlier detection, time series analysis.

2. Estimation of variance–covariance components, with special regard to efficient computing formulas.

3. Models for estimating unknown parameters.

4. Application of time–invariant and dynamic system theory in solving stochastic and non–stochastic differential (difference) equations.

II. List of Members

D. Fritsch	(Fed.Rep.Germany) *president.*	R. Kelm	(Fed. Rep. of Germany)
V. Ashkenazi	(United Kingdom)	K.R. Koch	(Fed. Rep. of Germany)
G. Beutler	(Canada)	E. Krakiwsky	(Canada)
J. Casaca	(Portugal)	M. Molenaar	(Netherlands)
W. Caspary	(Fed. Rep. of Germany)	L. Mussio	(Italy)
A. Dermanis	(Greece)	B. Schaffrin	(Fed. Rep. of Germany)
A.H. Dodson	(United Kingdom)	M.K. Szacherska	(Poland)
W. Förstner	(Fed. Rep. of Germany)	J. van Mierlo	(Fed. Rep. of Germany)
G.W. Hein	(Fed. Rep. of Germany)	W. Welsch	(Fed. Rep. of Germany)
L. Jokl	(Czechoslovakia)		

— Special Study Group 4–66.

Geodetic Data Base Management

Gestion des bases de données géodésiques

President : A.U. Frank (U.S.A.)

I. Program of Activities

1. Database theory, data models on different levels of abstraction, methods to describe integrity constraints.

2. Data models for geodetic data, characteristics of geodetic data, principles of encoding these types of data.

3. Standardization of data structure, database query language and data formats.

4. Exchange of information about practical experience in all of the above fields.

5. Recommendations to include database management theory into university curricula.

II. List of Members

A.U. Frank	(U.S.A.), *president.*	J. Gergen	(U.S.A.)
D. Alger	(U.S.A.)	J. Isner	(U.S.A.)
C. Boucher	(France)	H. Kremers	(Fed. Rep. Germany)
R. Conzett	(Switzerland)	L. Niklasz	(Hungary)
K. Degerstedt	(Sweden)	K. Poder	(Denmark)
W. Ehrensperger	(Fed. Rep. Germany)	C. Poitevin	(Belgium)
F.A. Fajemirokun	(Nigeria)	A. Sazonov	(U.S.S.R.)
J. Gazdzicki	(Poland)	C.R. Schwarz	(U.S.A.)
L. Gründig	(Fed. Rep. of Germany)	C.C. Tscherning	(Denmark)

— Special Study Group 4–71.

Optimal Design Problems

Problèmes de conception optimale

President : G. Schmitt (F.R.G.)

I. Program of Activities

1. Extension of classical network analysis to modern positioning techniques.

2. First order design : optimal design for point positioning, monitoring crustal movements, earth rotation.

3. Second order design : choice of objective functions and criterion matrices ; realisation of operative software.

4. Third order design.

5. Formulation of appropriate criterion matrices for different tasks.

II. List of Members

G. Schmitt	(Fed. Rep. Germany), *president*	A. Dermanis	(Greece)
J.S. Allman	(Australia)	H. Heister	(Fed. Rep. of Germany)
T. Ayan	(Turkey)	E.J. Krakiwsky	(Canada)
J. Balandynowicz	(U.S.S.R.)	D. Milbert	(U.S.A.)
B.P. Banov	(Bulgaria)	W. Niemeier	(Fed. Rep. of Germany)
G. Boedecker	(Fed. Rep. of Germany)	T. Ninkov	(Yugoslavia)
K. Borre	(Denmark)	F. Sarközy	(Hungary)
J. Casaca	(Portugal)	B. Schaffrin	(Fed. Rep. of Germany)
P.A. Cross	(United Kingdom)	R.R. Steeves	(Canada)
F. Crosilla	(Italy)		

– Special Study Group 4–91.

Local Gravity Field Approximation

Approximation du champ de pesanteur local

President : H. Sünkel (Austria)

I. Program of Activities

1. Use of finite elements and splines.
2. Frequency domain methods.
3. Flat earth methods.
4. Hybrid solutions.
5. Local applications of integral formulas.
6. Treatment of data clusters.
7. Collocation with integrated covariance parameter estimation.
8. Use of terrain and geological information.
9. Criteria for "good" gravity field approximations.
10. Solution updates.

II. List of Members

H. Sünkel	(Austria), *president.*	G. Lachapelle	(Canada)
V.V. Brovar	(U.S.S.R.)	D. Lelgemann	(Fed. Rep. Germany)
A. Dermanis	(Greece)	E. Livieratos	(Greece)
W. Freeden	(Fed. Rep. of Germany)	R. Rummel	(Netherlands)
A. Geiger	(Switzerland)	F. Sansò	(Italy)
G. Gerstbach	(Austria)	K.–P. Schwarz	(Canada)
G. Hein	(Fed. Rep. of Germany)	M. Sideris	(Canada)
B. Hofmann-Wellenhof	(Austria)	L. Sjöberg	(Sweden)
C. Jekeli	(U.S.A.)	C.C. Tscherning	(Denmark)
S.K. Jordan	(U.S.A.)	J. Zavoti	(Hungary)
J. Krynski	(Poland)		

– Special Study Group 4–92.

Global Gravity Field Approximation

Approximation du champ de pesanteur global

President : L. Sjöberg (Sweden)

I. Program of Activities

1. The weighting problem in combining heterogeneous data to global solutions.

2. The effect of topography and the role of isostasy.

3. Systematic effects due to inconsistencies between sets of observations, rotation of reference systems, incomplete data coverage, etc.

4. Time varying effects.

5. Correlations between the global gravity field and other geophysical parameters.

6. The development and investigation of alternative global gravity field representations.

II. List of Members

L. Sjöberg	(Sweden), *president.*	J. Klokocnik	(Czechoslovakia)
G. Balmino	(France)	M. Petrovskaya	(U.S.S.R.)
W. Freeden	(Fed. Rep. of Germany)	R.H. Rapp	(U.S.A.)
E. Groten	(Fed. Rep. of Germany)	Ch. Reigber	(Fed. Rep. of Germany)
B. Heck	(Fed. Rep. of Germany)	Ch. Rizos	(Australia)
M. Jarosch	(Fed. Rep. of Germany)	F. Sansò	(Italy)
A.H.W. Kearsley	(Australia)	H.–G. Wenzel	(Fed. Rep. of Germany)

– Special Study Group 4–93.

Wave propagation in refractive media

Propagation d'onde en milieu réfringent

President : P. Forsyth (Canada)

– Information not available –

– Special Study Group 4–94.

Theory of Geodetic Reference Frames

Théorie des systèmes de référence géodésiques

President : J. Wahr (U.S.A.)

I. Program of Activities

1. Observational realization of geodetic reference frames.
2. Modelling of geodetic observations in terms of geodetic and geophysical effects.
3. Capabilities and limitations of different observational techniques.
4. Geophysical modelling of reference frame related effects.

II. List of Members

J. Wahr	(U.S.A.), *president.*	I. Mueller	(U.S.A.)
P. Bender	(U.S.A.)	X. Nakiboglu	(Canada)
C. Boucher	(France)	K. Pec	(Czechoslovakia)
T. Herring	(U.S.A.)	T. Sasao	(Japan)
H. Kinoshita	(Japan)	G. Wilkins	(United Kingdom)
D. Lelgemann	(Fed. Rep. of Germany)	Ya. S. Yatskiv	(U.S.S.R.)
J. Merriam	(Canada)	C. Yoder	(U.S.A.)
H. Moritz	(Austria)	S.Y. Zhu	(China)

– Special Study Group 4–95.

Multibody Force Function : Geodetic Aspects of Astrodynamics

Fonction de force pour plusieurs corps : aspects géodésiques de l'astrodynamique

President : K.H. Ilk (F.R.G.)

I. Program of Activities

1. Consistent system of field and balance equations for the dynamics of the earth / moon system.

   i) models of material theories of the interacting bodies ;

   ii) solution of the field and balance equations.

2. Metric structure of the earth / moon system.

   – sensitivity of observables and measurement balance plans.

II. List of Members (preliminary).

K.H. Ilk	(Fed. Rep. Germany), *president.*	M. Burša	(Czechoslovakia)
A.J. Anderson	(Sweden)	G.E. Giacaglia	(Brazil)
L. Ballani	(German Dem. Republic)	M. Sidlichovsky	(Czechoslovakia)
G. Balmino	(France)	E. Tengström	(Sweden)
C. Boucher	(France)		

– Special Study Group 4–96.

Models for Time–dependent Geodetic Positioning

Modèles pour les déterminations de position géodésique variable avec le temps

President : P. Vaníček (Canada)

I. Program of Activities

1. Strategies for positioning on the surface of the deforming earth.

2. Models for global tectonic movements, creep movements due to seismic activity, ground subsidence, etc.

3. Collection of available information on existing models.

4. Representation of four–dimensional positioning information.

5. Temporal variations of mean sea level, the geoid, and gravity as it pertains to positioning.

II. List of Members

P. Vaníček	(Canada), *president.*	J. Mäkinen	(Finland)
R. Coleman	(Australia)	C.L. Merry	(South Africa)
P. Cross	(United Kingdom)	S.L.P. Ndyetabula	(Tanzania)
C. Gemael	(Brazil)	L.E. Sjöberg	(Sweden)
J. Hannah	(New Zealand)	R. Snay	(U.S.A.)
L. Hradilek	(Czechoslovakia)	R. Steeves	(Canada)
R. Kelm	(Fed. Rep. of Germany)	M. Tanaka	(Japan)
D. Lelgemann	(Fed. Rep. of Germany)	Jiangwen Zhou	(China)
E. Livieratos	(Greece)	D. Zilkoski	(U.S.A.)

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SECTION V

GEODYNAMICS – GEODYNAMIQUE

President : H. Kautzleben (G.D.R.)

Secretaries : H.–G. Kahle (Switzerland)
D.D. McCarthy (U.S.A.)

Terms of reference

According to the new By–Laws of the I.A.G. approved by the Council of the Association during the XVIIIth General Assembly, Hamburg, ***August 1983,*** the Section V "Geodynamics" deals with the following topics :

. reference systems ;

. monitoring and study of time–dependent phenomena, such as polar motion, Earth rotation, Earth tides, recent crustal movements, variations of gravity, sea–surface topography including mean–sea level ;

. geodetic aspects of international geodynamic projects, such as the Lithosphere project ;

. geophysical interpretation of gravity and related data.

The objectives of the Section V are :

a) to promote the study of all scientific problems mentioned above and to encourage the research in these fields ;

b) to promote and coordinate international cooperation in this field ;

c) to provide, on an international basis, for discussion and exchange of the results of the studies, researchs and works indicated in paragraphs a) and b) above ;

d) to involve as many active geodesists as possible in the program of the Section V and to make them enthusiastic supporters ;

e) to promote the cooperation with other international organizations working in the field of geodynamics.

Structure

The following commissions, international centres, permanent services, and special study groups are assigned to Section V.

– Commission V : ***Earth Tides.***
President : J.T. Kuo (U.S.A.)
Secretary : P. Melchior (Belgium)

– International Centre of Earth Tides (affiliated to FAGS)
Director : P. Melchior (Belgium)

– Commission VII : ***Recent Crustal Movements.***
President : P. Vyskočil (Czechoslovakia)
Secretary : E. Gubler (Switzerland)

– International Centre of Recent Crustal Movements
Director : P. Vyskočil (Czechoslovakia)

– Bureau International de l'Heure (affiliated to FAGS)
Director : B. Guinot (France)

– International Polar Motion Service (affiliated to FAGS)
Director : K. Yokoyama (Japan)

– Permanent Service of Mean–Sea Level (affiliated to FAGS)
Director : D.T. Pugh (United Kingdom)

Special Study Groups :

– 5–97 : *Gravity anomalies and geodynamics of mountain belts.*
President : H.–G. Kahle (Switzerland)

– 5–98 : *Atmospheric excitation of Earth's rotation.*
President : J.O. Dickey (U.S.A.)

– 5–99 : *Tidal friction and Earth's rotation.*
President : M. Burša (Czechoslovakia)

– 5–100 : *Parameters of common relevance of astronomy, geodesy and geodynamics.*
President : B.H. Chovitz (U.S.A.)

– Commission V

Earth Tides – Marées terrestres

President : J.T. Kuo (U.S.A.)
Secretary : P. Melchior (Belgium)

Program of Activities in 1984–1987

The goal of the Commission is to cultivate the spirit of cooperation in Advancing Earth Tides and its related studies, more specifically :

– to promote establishment of Earth tidal stations in regions where Earth tidal stations are still few ;

– to develop close communications and mutual assistance of various investigators among countries in identifying problems and searching for solutions in Earth tidal studies ;

– to relate Earth tidal studies to interdisciplinary fields, particularly in geodesy, geophysics, and astronomy.

The Commission will continue to encourage and support the activities of the International Centre for Earth Tides (ICET) in collecting and analysing the results of Earth tidal measurements and publishing the accumulated results.

The 10th International Symposium on Earth Tides (including Ocean Tides) will be held in Madrid (Spain) in *summer 1985,* with Prof. Torroja as convenor.

The two working groups of the Commission are planning to hold a scientific meeting on *October 3–5, 1984,* at the University of Bonn (F.R.G.) in cooperation with Prof. Bonatz.

Membership

President	:	J.T. Kuo	(U.S.A.)
Vice–President	:	B.P. Pertsev	(U.S.S.R.)
Secretary	:	P. Melchior	(Belgium)
Honorary Member	:	R. Lecolazet	(France)

– *National representants :*

G. Lennon	(Australia)	J. Rais	(Indonesia)
B. Barlow	(Australia)	C.L. Pekeris	(Israel)
H. Lichtenegger	(Austria)	I. Nakagawa	(Japan)
A. Venedikov	(Bulgaria)	J. Flick	(Luxemburg)
D. Bower	(Canada)	T. Chojnicki	(Poland)
T. Fang	(China)	D. Zugravescu	(Rumania)
D. Simon	(Czechoslovakia)	R.W. Green	(South Africa)
J. Kääriäinen	(Finland)	R. Vieira	(Spain)
M. Bonatz	(Fed. Rep. of Germany)	H.G. Scherneck	(Sweden)
M. Schneider	(Germ.Dem.Republic)	T.F. Baker	(United Kingdom)
P. Varga	(Hungary)	K. Colić	(Yugoslavia)

– Working group I : (dissolved)

– Working group II : *Acquisition, processing, and analysis of Earth tidal data*
Chairman : G. Jentzsch (F.R.G.)

– Working group III : *Worldwide drive of ocean tides measurements*
Chairman : J.T. Kuo (U.S.A.)

-- International Centre of Earth Tides

Centre International des Marées terrestres

Director : P. Melchior

Location : Observatoire Royal de Belgique
Avenue Circulaire 3
1180 Bruxelles, Belgium.

Directing Board : R. Lecolazet (France), *chairman*
M. Bonatz (F.R.G.)
J.T. Kuo (U.S.A.)
J. Picha (Czekoslovakia)

Activities

The tasks ascribed to ICET as a FAGS Centre are basically :

1. to collect all available measurements of earth tides (which is its task as World Data Centre C),

2. to evaluate these data by convenient methods of analysis in order to reduce the very large amount of measurements to a limited number of parameters which should contain all the desired and needed geophysical information,

3. to compare these parameters with any other geophysical information, in particular oceanic cotidal maps, earth rotation parameters, etc...

4. to compare the data from different instruments and different stations distributed all over the world, evaluate their precision from the point of view of internal errors as well as external errors,

5. to help to solve the basic problem of calibrations and to organize reference stations or build reference calibration devices,

6. to fulfil gaps in informations or data as far as possible, in particular by assisting the Developing Countries in organizing observations,

7. to ensure a broad dissemination of the results and informations to all interested laboratories or individual scientists and in particular a transfer of technology towards the Developing Countries.

8. to continue the edition of the Bulletin d'Information.

– Commission VII

Recent Crustal Movements – Mouvements récents de l'écorce terrestre

President : P. Vyskočil (Czechoslovakia)
Secretary : E. Gubler (Switzerland)

Program of Activities in 1984–1987

– to compile the maps of vertical movements at the territory of Central Europe and selected parts of the North American Continent ;

– to promote and coordinate the national and regional studies of vertical as well as horizontal movements, and especially to establish the program of the crustal movements research in Africa and Central and South America ;

– to promote the program to monitor the crustal movements by means of space technique.

The results of local, regional as well as global studies of recent crustal movements will be discussed at the International Symposia in Wellington, Potsdam, Cairo (1984), Maracaibo , Budapest (1985) and Moscow (1986). The proper information will be stored in the ICRCM. All activities of CRCM will be coordinated with the activity of the WG 1 of the Interunion Committee on Lithosphere (ICL).

Membership

President	: P. Vyskočil	(Czechoslovakia)
1st Vice–president	: K. Kasahara	(Japan)
2nd Vice–president	: S.R. Holdahl	(U.S.A.)
Member of Exec. Committee	: C.A. Whitten	(U.S.A.)
	Yu. D. Boulanger	(U.S.S.R.)
Secretary	: E. Gubler	(Switzerland)

– *Subcommissions :*

Nordic	:	A. Kiviniemi	(Finland)
Western Europe	:	W. Augath	(Fed. Rep. of Germany)
Eastern Europe	:	I. Joó	(Hungary)
North America	:	S.R. Snay	(U.S.A.)
Central and South America	:	H.G. Henneberg	(Venezuela)
West Pacific	:	K. Kasahara	(Japan)
South Asia	:	M.G. Arur	(India)
Africa	:	A.M. Wassef	(Egypt)

– *Working Groups :*

Instruments and Methods	:	J. Kakkuri	(Finland)
Interpretation	:	V.A. Magnitskij	(U.S.S.R.)
Earthquake Predictions	:	not nominated	

– *Operational Agency :*

International Center on Recent Crustal Movements (ICRCM) :
(see hereafter.)

– *National representants :*

A. Introcaso	(Argentina)	H. Rietveld	(Netherlands)
A. Stolz	(Australia)	P. Wood	(New Zealand)
N. Höggerl	(Austria)	S. Bakkelid	(Norway)
B. Ducarme	(Belgium)	M. Bashir	(Pakistan)
J. Argollo	(Bolivia)	T. Wyrzykowski	(Poland)
P. Vaníček	(Canada)	L.M. Victor	(Portugal)
A. Kiviniemi	(Finland + Denmark)	M.C. Manansala	(Philippines)
A.M. Wassef	(Egypt)	A.R. Ahmar	(Syria)
H.L. Tebickie	(Ethiopia)	D.P. Rousseau	(South Africa)
H. Mälzer	(Fed.Rep. of Germany)	C.S. Calota	(Rumania)
G. Lorenz	(German Dem. Repub.)	D.G.V. Pascual	(Spain)
R.G. Carrera	(Guatemala)	L. Svensson	(Sweden)
I. Joó	(Hungary)	M. Ekman	(Sweden)
J. Kahar	(Indonesia)	E. Gubler	(Switzerland)
C. Morelli	(Italy)	S.J. Saburi	(Tanzania)
T. Tanaka	(Japan)	C.P. Phiphitkun	(Thailand)
R. Majali	(Jordan)	M. Charfi	(Tunisia)
J. Flick	(Luxemburg)	A. Dodson	(United Kingdom)
J.A. Labokoson	(Madagascar)	S.R. Holdahl	(U.S.A.)
S.Y. Khoon	(Malaysia)	Yu. D. Boulanger	(U.S.S.R.)
A. Vatrican	(Monaco)	K. Colić	(Yugoslavia)

– International Centre on Recent Crustal Movements

Centre International des Mouvements récents de l'Ecorce terrestre.

– *Structure*

Director : Dr. P. Vyskoćil (Czechoslovakia)

Administration : 2 permanent co–workers,
2 temporary co–workers (computor service)

Scientific board : Dr. P. Vyskoćil
Dr. A. Zeman
Dr. J. Kostelecky
Dr. V. Vyskoćil (repr. of National Committee)

Address : 250 66 Zdiby 98 (Czechoslovakia)

Direction board : Prof. Ju. D. Boulanger (USSR) – *Chairman*
Prof. H. Mälzer (F.R.G.)
Prof. Stange (G.D.R.)
Dr. N. Pavoni (Switzerland) – repr. of IASPEI
Prof. V.A. Magnickij (U.S.S.R.)
Dr. P. Vyskoćil – ex-officio.

Geographical or scientific groups and membership :

ICRCM is closely connected with the secretariat of the Commission on Recent Crustal Movements. All members of the CRCM included the members of geographically divided subcommissions cooperate with the ICRCM by means of scientific consultations, by sending their publications etc. The ICRCM Bulletin issued twice in year at least is the medium of information within the CRCM.

– *Objectives*

The International Centre on Recent Crustal Movements acts within the framework of the Commission on Recent Crustal Movements as a central agency for collection and distribution of information on recent crustal movements obtained by geodetic methods. According to its needs the ICRCM takes necessary measures for collection, summarization, registration and distribution of the mentioned data.

– *Activities*

The ICRCM supplies informations to the institutes and individual scientists working in various fields of the Earth sciences, by means of :

a) establishing contacts with scientists and scientific organizations dealing with studies of recent crustal movements with the aim of :

– collection of main data studies of recent crustal movements and also the world bibliography on this subject,

– summarization of these data by individual or collective requests from the I.U.G.G. members,

b) compilation of the catalogue of recent crustal movements in the whole world, including some specific or having more precise data at their disposal, those of local

character including. From the mentioned centres the data are transfered to the organizations or persons concerned only through the ICRCM,

c) consultation or other services rendered to other centres, engaged in collection of similar data,

d) compilation of new programmes of studies or data processing with the aim of their more effective utilization,

e) cooperation with the Working Groups of CRCM and other international organizations with the aim of coordinated utilization of registered data,

f) compilation and publication of main data in the form of lists or maps of recent crustal movements,

g) compilation of a list of publications by the content connected with studies of data on recent crustal movements,

h) organization of administrative and other undertakings necessary for the CRCM and its Working Groups as well as publication of CRCM issues containing special and administrative data, information connected with the activity CRCM and its cooperation with other international organizations.

Program of activities for the forthcoming four year period :

The activity of the ICRCM will be focused especially :

– at the extending of the collection of numerical as well as bibliographical data, and their utilization by requests,

– at the establishment of the scientific programmes for monitoring recent crustal movements in developing countries (in Egypt starting 1984), providing the scientific help and consultations and organizing trainings for the scientists interested,

– at the scientific coordination to compile the map of vertical crustal movements in Central Europe,

– at the co–organizing of the CRCM symposia and exchange of experiences to cover by the crustal movement studies of the African and South American continent.

The extension of the recent crustal movement studies to cover all continents by dense data is the long–termed process. The ICRCM shall keep the contact with the national agencies, regional CRCM Sub–commissions and national and international agencies where the terrestrial as well as space technique is available.

— Bureau International de l'Heure

Director : B. Guinot (France)

The Bureau International de l'Heure (BIH) was founded in 1911 with the task of standardizing time. The measure of time was then provided by the rotation of the Earth but later, starting in 1955, it was based on the data of atomic clocks. Consequently, the BIH has two chief responsabilities :

- the establishment of atomic time scales,
- the evaluation of the Earth's rotation parameters.

The BIH is a member of the Federation of Astronomical and Geophysical Services (FAGS). Its parent scientific unions are IAU, IUGG and URSI. The BIH maintains also close connexions with the International Radio Consultative Committee (CCIR) and with the International Committee of Weights and Measures (CIPM).

The BIH is located at the Paris Observatory since its creation and is placed presently under the directorship of B. Guinot. A Directing Board is chaired by P. Pâquet (Observatoire Royal de Belgique) and comprises representatives of IAU, IUGG, URSI, CCIR, CIPM. This board is mainly concerned by scientific matters and meets once a year.

Activities and services

1 – Unification of time

The BIH establishes the International Atomic Time, TAI, which is the official basis of all the time measurements since it recognition by the 14th General Conference on Weight and Measures (CGPM), in ***October 1971.***

For practical reasons, the actual reference for the clock synchronization is not TAI, but another time scale : the Universal Coordinated Time, UTC, which differs from TAI by a variable integral number of seconds, in order to conform approximatively with the Earth's rotation. The BIH is also in charge of UTC.

These activities are based on a worldwide cooperation. All the laboratories equipped with atomic clocks (in general cesium clocks) and which are linked together by precise ($\pm 0.2\,\mu s$) and operational time comparisons send their clock data to BIH. After processing, the BIH publishes the clock corrections to be added to each participating clock in order to get TAI and UTC.

The scientific activities associated to this program include researches on statistics, on the space techniques for time comparisons. The improvement of TAI is limited by the lack of precision of the existing time links, but a substantial progress is being accomplished by the use of the GPS / NAVSTAR capabilities.

This activity on the atomic time is developped jointly with the Bureau International des Poids et Mesures (BIPM), by arrangements concluded in accordance with the resolutions of the 14th CGPM. An increased participation of BIPM is expected for the forthcoming years.

2 – Evaluation of the Earth's Rotation Parameters

Until about 1970, the optical observation of stars was the only source of data on the Earth's rotation. For the first time, the BIH developped a method which uses

simultaneously the individual measurement of latitude and universal time made by all the instruments on the Earth. It was thus possible to derive raw five–day values of the coordinates of the pole and of UT1, with very short delays. In addition, through the use of an algorithm based on sequencial adjustment, the reference for these parameters was kept with an excellent stability. This powerful method was also fitted for the new measurement techniques based on satellite tracking, ranging to the Moon and VLBI. It was thus possible to include the data of these techniques, as soon as they became operational, in the BIH evaluation.

The current series of the BIH Earth's rotation parameters is given by the monthly circular D with a delay on the observations ranging from 30 to 60 days. This series is used as a standard reference. More precise values are given in the BIH Annual Report. On the other hand, the BIH disseminates weekly evaluations, with a delay of 4 to 11 days, mainly for the needs of space navigation (under a contract from JPL).

As stated previously, the maintainance of a terrestrial system of reference has always been an important activity of the BIH, since x and y, UT1 are referred to this system. But this problem has gained much more importance with the techniques of measurement which refer to the figure of the Earth instead of the direction of the plumb–line. In cooperation with the French Institut Géographique National, the BIH has begun to work on the establishment and maintainance of a terrestrial reference frame, the basic idea being that the Earth rotation networks, where there is a permanent monitoring of relative positions of stations, should be the main elements of a primary reference frame.

Data management

The BIH maintains a data base with all the results on the Earth rotation and some other data such as the angular momentum of the atmosphere.

List of publications

1. The main publications are the monthly Circular D and the Annual Report.

. ***Circular D*** (650 copies) contains the current results for the BIH evaluations of TAI and of the Earth rotation and, when necessary, some informations related to these data.

. ***The BIH Annual Report*** (750 copies) gives more refined results and provides some informations on the methods of evaluations, including, for instance, the statistical weights, the station coordinates, the various corrections applied to the received data.

The Report contains an important section which gives the raw results obtained independently from each of the techniques measuring the Earth rotation.

It also gives a list of time signals, updated yearly, with their main characteristics.

2. The other publications are more specialized.

. ***Circular A*** (yearly, 130 copies) gives a conventional expression of the seasonal variation of UT1.

. ***Circular B/C*** (monthly, 60 copies) gives an extrapolation of the coordinates of the pole and related quantities.

. ***Circular E*** (irregular, 250 copies) announces the 1 second steps of UTC.

. ***Circular F*** (irregular, 60 copies) announces the values of DUT1, to be broadcasted with the time signals.

. *Weekly report* gives a rapid evaluation of coordinates of the pole and UT1. These results are made available through the GE Mark III system and also sent by telex to a few correspondents.

In addition, discontinuous predictions of the coordinates of the pole and of UT1 are sent to some users.

3. During the MERIT campaign of 1983/84, the BIH issues a MERIT Monthly Circular (150 copies are sent). Also, a document "Connection of Reference frames", based on a wide cooperation, has been distributed.

Although the distribution by printed documents is still important, the BIH encourages the access to its results by other techniques such as the reading of files maintained on worldwide computing systems. For this reason, and also because the publications are often reproduced, the number of distributed copies does not represent the true dissemination of the BIH results.

Address

Bureau International de l'Heure
61, avenue de l'Observatoire
75014 Paris – France.
Telephone : 320.12.10
Telex : 270776 Obs Paris.

– Permanent Service for Mean Sea Level

Service permanent du niveau moyen des mers.

Director : D.T. Pugh (United Kingdom)

The Permanent Service for Mean Sea Level is a member of the Federation of Astronomical and Geophysical Services (FAGS) established by the International Council of Scientific Unions. Under the aegis of the International Association for the Physical Sciences of the Ocean, PSMSL is charged with the collection, dissemination and analysis of mean sea level data. Financial support is received from UNESCO through FAGS and through the Inter–governmental Oceanographic Commission, and from the United Kingdom Natural Environment Research Council. Directed by Dr. D.T. Pugh, the service is guided by its Advisory Committee which comprises Dr. D.E. Cartwright (Chairman), T. Barnett and C.J. Garrett.

In its role of collating data on a global basis, the PSMSL continues to access data from additional stations and maintains an up–to–date data bank. Requests for data are met with either computer listings or data on magnetic tape in internationally approved formats. Information and advice on measuring sea levels is given also on data reduction.

These activities will continue in the future. An inventory of known sea level records is now being compiled while plans for the longer term include the preparation of a comprehensive data tape for general release. The development of a more coordinated global network, jointly with the Inter–governmental Oceanographic Commission, is planned to enhance the quality and distribution of data available.

— International Polar Motion Service

Service International du Mouvement du Pôle.

Director : K. Yokoyama (Japan)

Scientific Council (Transactions of the IAU, vol. XIIA p. 232)

B. Guinot	(President) Bureau International de l'Heure
E.P. Fedorov	(Representative of the IAU)
W. Markowitz	(Representative of the IUGG)
P. Melchior	(Representative of the IUGG)
K. Yokoyama	(Director of the IPMS)

Scientific Group

The staff members of the Tokyo Astronomical Observatory and the Japan Hydrographic Department formed a scientific group in 1982 to support the activities of the IPMS.

Members :

S. Aoki (Chairman)
Tokyo Astronomical Observatory,
H. Kinoshita, M. Soma,
Tokyo Astronomical Observatory,
T. Fukushima, K. Inoue,
Japan Hydrographic Department.

Staff Members of the IPMS and Electronic Computer

K. Yokoyama (Director)
Scientific staff :

K. Tanikawa, S. Manabe	(development of analysis techniques on
Y. Wako	optical astrometry, SLR, VLBI, etc..)
T. Sasao	(geophysics)
Y. Kaneko	(statistical mathematics)

Data management : H. Ishii, I. Sato
Key punchers : 3 part–timers,
Secretary : 1 part–timer.
Electronic computer : MELCOM–COSMO 900 II
memory size ; 8 M–bytes, speed ; 4–5 mips,
disk units ; 4 x 635 M–bytes, other peripheral equipments.

Objectives of the Service (Transactions de l'UAI, vol. XIB, pp. 258–259)

The IPMS is an organization formed under the authority of the FAGS and is in charge of carrying out the following tasks :

(a) to advance the study of all the problems related to the motion of the pole,

(b) to collect astronomical observations which can be used to determine the motion of the pole,

(c) to analyse and synthesize them,

(d) to calculate the coordinates of the pole,

(e) to disseminate the data on request,

(f) to publish the initial data and the results obtained.

Program of Activities for the Forthcoming four Years

(a) To develop an algorithm to determine variations of the station coordinates simultaneously with Earth orientation parameters, using optical astrometry observations. This is one of the most important problems left unsolved. The results are planned to be presented at the MERIT Workshop to be held in 1985.

(b) To regularly disseminate the results of atmospheric angular momentum change based on the data of the Japan Meteorological Agency. This work started recently in cooperation with the JMA.

(c) To improve the reduction program of satellite laser ranging which was originally developed at the Smithsonian Astrophysical Observatory based on analytical method. Aimed goal is to achieve the accuracy comparable to that obtained by the method of numerical integration.

(d) To develop a reduction program of VLBI observations for the use by general purpose computers.

(e) To review the results of optical astrometry observations and reform the observational network for the future monitoring of Earth rotation.

(f) To interpret irregularities in the rotation of the Earth from geophysical and astronomical points of view, primarily based on atmospheric and oceanic data.

(g) To investigate differences of reference frames of various techniques, and to develop method to unify them.

– Special Study Group 5–97.

Gravity anomalies and geodynamics of mountain belts

Anomalies gravimétriques et géodynamique des chaînes de montagne

President : H.–G. Kahle (Switzerland)

I. Program of Activities

– update and establish the relationships between p wave velocity and density ;

– interpret gravity anomalies in terms of density contrasts referred to an average or standard lithosphere ;

– correct the gravity anomalies for density differences in the thrust cover ;

– perform "crustal stripping", i.e., correct for geophysically determined, deep structures and masses that are not directly connected to the generally deep–seated geodynamic processes ;

– interpret the remaining residual gravity anomalies in terms of geodynamics of mountain belts ;

– define the requirements of gravity data accuracy as a function of wavelength for solving outstanding geophysical problems in relation to the stress field distribution and driving mechanism of mountain.

II. Membership

H.–G. Kahle	(Switzerland), *president.*	Y. Hagiwara	(Japan)
M.Y. Artemjev	(U.S.S.R.)	R.T. Haworth	(United Kingdom)
M.G. Arur	(India)	E. Klingelé	(Switzerland)
N.I. Christensen	(U.S.A.)	E. Livieratos	(Greece)
D.H. Chung	(U.S.A.)	M. McNutt	(U.S.A.)
K. Colić	(Yugoslavia)	H.W. Oliver	(U.S.A.)
A. Dehghani	(Fed. Rep. of Germany)	P. Scandone	(Italy)
D. Dyrelius	(Sweden)	P. Steinhauser	(Austria)
L. Fleitout	(France)	V. Vyskočil	(Czechoslovakia)
P. Giese	(Fed. Rep. of Germany)	Menghua Wei	(China)
R.W. Girdler	(United Kingdom)		

– Special Study Group 5–98.

Atmospheric excitation of the Earth's rotation

Excitation atmosphérique de la rotation terrestre

President : J.O. Dickey (U.S.A.)

I. Program of Activities

– encourage multidisciplinary studies on the transfer of angular momentum between the oceans, atmosphere, and solid Earth, and its contribution to short–term variations in the length of day, advocate improvements in the measurement techniques ;

– strive for improved communication and data flow between the atmospheric and geodetic communities, pursue the establishment of data base and the associated documentation, and stress greater interaction on models and application of results ;

– request that all meteorological data centers collect the most complete possible set of global meteorological data and reduce these data in a consistent manner throughout the Main Campaign of Project Merit.

II. Membership

J.O. Dickey	(U.S.A.), *president.*	J. Petty	(U.S.A.)
M. Eubanks	(U.S.A.)	G. Philander	(U.S.A.)
M. Feissel	(France)	R. Rosen	(U.S.A.)
L. Fu	(U.S.A.)	D. Salstein	(U.S.A.)
R. Hide	(United Kingdom)	N.S. Sidorenkov	(U.S.S.R.)
H. Jochmann	(Germ. Dem. Republic)	D. Smith	(U.S.A.)
R. King	(U.S.A.)	D.E. Smylie	(Canada)
J. Miller	(U.S.A.)	B. Tapley	(U.S.A.)
P. Morgan	(Australia)	J. Vondrak	(Czechoslovakia)
A. Oort	(U.S.A.)	J. Wahr	(U.S.A.)

– Special Study Group 5–99.

Tidal friction and the Earth's Rotation

Frottement des marées et rotation terrestre

President : M. Burša (Czechoslovakia)

I. Program of Activities

– Theory of dynamics of the Earth–Moon–Sun system ; non–conservative process of tidal friction ;

– Effect of resonances on the tidal evolution ;

– Tidal friction parameters from satellite observations ;

– Determination of apparent orbital acceleration of the Moon in the pre–AT– period on the basis of telescopic observations (transits of inferior planets, occultations by the Moon) and non-telescopic observations (mainly historical records) ;

– Determination of the actual secular acceleration of the Earth's rotation and its accuracy on the basis of different kinds of data (including the paleontological evidence) ;

– Examination of the oceanic tidal friction theory ; effect on the Earth's rotation ;

– Influence of the continental drift on tidal friction ;

– Balance problems in tidal computations ;

– Orbital acceleration of the Moon and secular variations in the semi–major axis of its orbit ;

– Relations among the acceleration of the Earth's rotation, the orbital acceleration of the Moon and the variations in the semi–major axis of the Lunar orbit.

II. Membership

M. Burša	(Czechoslovakia), *president.*	S.M. Molodenskij	(U.S.S.R.)
J.N. Avsjuk	(U.S.S.R.)	L.V. Morrison	(United Kingdom)
P. Brosche	(Fed. Rep. of Germany)	N.N. Parijskij	(U.S.S.R.)
A. Cazenave	(France)	J.D.A. Piper	(United Kingdom)
B.A. Conway	(U.S.A.)	E. Schwiderski	(U.S.A.)
J.O. Dickey	(U.S.A.)	M. Sidlichovsky	(Czechoslovakia)
B.A. Kagan	(U.S.S.R.)	F.R. Stephenson	(United Kingdom)
J. Kostelecký	(Czechoslovakia)	J. Sündermann	(Fed. Rep. of Germany)
J. Kovalevsky	(France)	P. Varga	(Hungary)
P. Melchior	(Belgium)	J. Zschau	(Fed. Rep. of Germany)
F. Mignard	(France)		

– Special Study Group 5–100.

Parameters of common relevance of astronomy, geodesy, and geodynamics

Paramètres communs à l'astronomie, la géodésie et la géodynamique

President : B.H. Chovitz (U.S.A.)

I. Program of Activities

– review the most current information available on the values of physical quantities which are fundamentally important in the fields of astronomy, geodesy, and geodynamics ;

– reconcile this available information into a uniform, compatible set ;

– recommend to the 1987 General Assembly the publication of a set of most up–to–date representative values ;

– consider the status of the Geodetic Reference System 1980, and if any changes in this reference system should be recommended to the General Assembly.

II. Membership

B.H. Chovitz	(U.S.A.), *president.*	R. Rapp	(U.S.A.)
R. Anderle	(U.S.A.)	E. Buschmann	(German Dem. Republic)
G. Veis	(Greece)	A. Bjerhammar	(Sweden)
D. Smith	(U.S.A.)	M. Burša	(Czechoslovakia)
B.L. Decker	(U.S.A.)	L. Pellinen	(U.S.S.R.)

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OUT OF SECTION

– Commission VI

International Geodetic Bibliography

Bibliographie géodésique internationale

President : L. Stange (G.D.R.).

I. Program of activities

The Permanent Commission VI of the I.A.G., "International Geodetic Bibliography", has to register all scientific publications of special periodicals, institutional bulletins and other sources (dissertations, patent specifications, etc.) on the field of geodesy in form of a bibliography. For the most important publications the bibliographic annotations are completed by short abstracts. These annotations and abstracts are published in English, annually in 6 volumes of the periodical "bibliographia geodaetica" by the Centre of International Geodetic Documentation of the Technical University, Dresden (G.D.R.).

For the solution of this task each I.A.G. member country nominates by its National Committee for Geodesy and Geophysics its national correspondent (NC) for the "International Geodetic Bibliography" who is at the same time member of the Permanent Commission VI.

Among the 78 member countries 46 countries have already nominated their NC. By the Dresden Centre the national correspondents were informed about the manner of their work for the International Geodetic Bibliography. They were asked to send bibliographic data and abstracts to the Dresden Centre monthly.

The continuity of the cooperation of the NC determines the topicality and the size of the IGB. The bibliographic data prove the activity of geodetic scientists in the different member countries and explain the international recognition of the results obtained.

II. Structure of the Commission – membership

President	:	L. Stange	(G.D.R.)
Vice–president	:	H. Finger	(G.D.R.)
Secretary	:	C. Boucher	(France)

Members :

The National Correspondents for the International Geodetic Bibliography of the following member countries :

Argentina	: R.C. Rodriguez	Denmark	: F. Madsen
Australia	: J. Gilliland	F. R. Germany	: W. Satzinger
Austria	: E. Erker	Finland	: R. Konttinen
Belgium	: Van den Herrewegen	France	: J. Villecrose
Bulgaria	: N. Georgiev	German Dem. Rep.	: H. Finger
Canada	: A. Mainville	Greece	: L. Mavridis
Chile	: H. Ponce Gerlach		D. Balodimos
Czechoslovakia	: J. Šimek	Hungary	: M. Verö
Dem. People's Rep. Korea	: Yun Chel Jong	Iceland	: R. Árnason

Indonesia	:	R.W. Matindas	Senegal	: S. Diatta
Ireland	:	R. Kirwan	South Africa	: C.L. Merry
Italy	:	E. Vitelli	Spain	: T. Miguel Lafuente
Japan	:	K. Nagasawa	Sudan	: A.B. Salih
Kenya	:	G.O. Wayumba	Sweden	: P. Hodacs
Korea	:	Ki Seoug Kim	Switzerland	: W. Fischer
Libya	:	A. Siala	United Kingdom	: M.O. Cotter
Madagascar	:	A. Razafinakanga	Tanzania	: D. Kifanga
Netherlands	:	J.H. ten Haken	Thailand	: S. Pachimkul
New Zealand	:	J.B. Mackie	Tunisia	: M. Charfi
Norway	:	L. Bockmann	Turkey	: E. Özbenli
Pakistan	:	M.Q. Bari	U.S.A.	: S.W. Henriksen
Philippines	:	C.M. Santos	U.S.S.R.	: J. Dobrochotov
Poland	:	A. Luczynska	Zimbabwe	: C. Worall
Portugal	:	F. Franco Vicoso		

– Commission IX

Education in Geodesy – *Enseignement de la Géodésie*

President : E.J. Krakiwsky (Canada)

I. Program of Activities

Over this quadrennium (1983–1987) the task of I.A.G. Commission IX is to implement the resolutions arising from the International Symposium "Education in Geodesy" held ***September, 1982*** at Graz, Austria. The symposium proceedings were prefaced by addresses from the Presidents of : FIG (Fédération Internationale des Géomètres), ICA (International Cartographic Association), ISM (International Society of Mining) and ISPRS (International Society of Photogrammetry and Remote Sensing), which signified the support of the several international associations involved in education in geodesy. Furthermore, the resolutions had the tacit support of the sister organizations.

The resolutions summarized below are recorded in ***Proceedings of the International Symposium "Education in Geodesy",*** September 27–29, 1982. K. Rinner, symposium director. Graz, Austria : Mitteilungen der geodätischen Institute der Technischen Universität Graz, Folge 42, and reported to the XVIII I.U.G.G.–I.A.G. General Assembly in Hamburg, 1983, (see also B.G., Vol. 57, n° 1).

In ***Resolution 1*** the Symposium recommends that :

– cooperation between FIG, IAG, ICA, ISM, ISPRS and UNESCO in this field be continued,

– every effort be used to publicize to each other and to all interested bodies the report of studies already made of educational systems by the sister organizations in the field of education and practice, in particular, of the report of the regional working groups of IAG, and of Commission 2 of FIG, and of Commission VI of ISPRS.

In ***Resolution 2*** the Symposium recommends that :

– the Joint Board between the sister organizations, FIG, IAG, ICA, ISM and ISPRS be given official status by the participating societies with appointed members and regularly scheduled meetings.

In *Resolution 3* the Symposium strongly recommends

– the creation of an International Coordinating Committee on Education in surveying and mapping composed of representatives from each of the sister organizations.

In *Resolution 4* the Symposium urges

– that the Coordinating Committee on Education in surveying and mapping to be created, includes among its objectives :

1) the collection of information on the various educational systems ;

2) the transformation of this information into computer readable form and the storage of such information in a computer data base ;

3) the enhancement, dissemination and making accessible this information to member countries ; and

4) the creation of a glossary of educational and professional terms used by the profession.

II. Membership of the Commission

President	:	E.J. Krakiwsky	(Canada)
Secretaries	:	L. Hradilek	(Czekoslovakia)
		M. Kumar	(U.S.A.)
		H.J. Matthias	(Switzerland)

III. Regional Coordinators

Europe	:	W. Welsch	(Fed. Rep. of Germany)
Asia	:	J. Rais	(Indonesia)
Australia	:	L.A. White	(Australia)
North America	:	F. Doyle	(U.S.A.)
South America	:	B. Lugnani	(Brazil)
Africa	:	F.A. Fajemirokun	(Nigeria)

– Commission XI

Geodesy in Africa – *Géodésie en Afrique*

President : J. Abla * (Ivory Coast)

(* At the XVIIIth General Assembly, A. Cissé, Ivory Coast, was elected president of the Commission. But after his sudden death in January 1984, the Executive Committee appointed J. Abla to take office until the end of the XIXth General Assembly).

I. Objectives of the Commission

1. To make an inventory of the status of geodetic work in Africa and to update and maintain such an inventory ;

2. To stimulate and sustain interest of survey organisations in Africa in geodetic work with a view to organising geodetic control and gravity networks for scientific and cartographic purposes ;

3. To encourage education in geodesy and to advise on curriculum development in geodetic sciences in Africa ;

4. To establish and maintain data banks with a view to making geodetic information in Africa available nationally and internationally ;

5. To organise meetings, seminars, symposia and training courses in order to promote the objectives of the Commission ;

6. To foster international cooperation in geodetic projects and to coordinate bilateral and multilateral aids in geodetic projects in Africa ;

7. To encourage African scientists to cooperate in the various study groups and commissions of the I.A.G. and attend the various meetings arranged by the Association ;

8. To establish contacts between African geodesists and geodesists from countries outside Africa ;

9. To maintain close collaboration and cooperation with the U.N. / Economic Commission for Africa, U.N. Cartographic Section and other U.N. and African Agencies on geodetic matters.

II. Structure of the Commission

A. Bureau

President	:	J. Abla	(Ivory Coast)
Vice–presidents	:	Eby	(Sudan)
		M. Charfi	(Tunisia)
Secretary	:	O. Fadahunsi	(Nigeria)
Assistant secretary	:	K. Konan	(Ivory Coast)

B. Committees

1. Coordinating Committee for Inter African Geodetic Projects :

   Chairman : O. Adebekun (Nigeria)

2. Committee on the Definition of African Geoid and Datum

   Chairman : A.M. Wassef (Egypt)

3. Committee on Data Bank :

   Chairman : F.A. Fajemirokun (Nigeria)

4. Committee on Publication and Education :

   Chairman : R.S. Rostom (Kenya)

5. Committee on Gravity Network

   Chairman : D.E. Ajakaiye (Nigeria)

These committees shall continue under the present chairmen up to the next Symposium on Geodesy in Africa, Yamoussoukro (Ivory Coast), ***1985*** or ***1986.***

C. Executive Committee. It consists of :

- the Bureau
- the immediate past president, R.O. Coker (Nigeria)
- the chairmen of the Committees,
- one of the immediate past secretaries, S. Andriamihaja (Madagascar).

– Special Study Group 0–67.

History of Geodesy – *Histoire de la Géodésie*

President : C.A. Whitten (U.S.A.)

I. Program of Activities

This study group was formed soon after the Canberra Assembly and has functioned under very broad terms of reference. Various members have contributed special papers of a historical nature describing particular aspects of geodetic history. The group will continue to function in this manner with the individual members submitting papers (or series of papers) for publication in the Bulletin Géodésique or other journals having broad circulation.

In the discussion at the Hamburg Assembly it was suggested that this group give special attention to our "geodetic heritage". Therefore, as a first step, we are endeavoring to collect biographical data for those who have made internationally recognized contributions to geodesy.

After some preliminary exchange of correspondence with a few members of the study group, it is recommended that the initial phase of this effort be the publication in the Bulletin Géodésique of a one page biography with suitable photograph of the Presidents, General Secretaries and Directors of Central Bureau from 1867.

A second phase would be a similar collection for the Section and Commission officers.

The study group will endeavor to compile a reasonably complete list of these scientists and engineers and, in as far as possible, assemble a set of the biographical data from which photocopies might be made upon request.

II. Membership

C.A. Whitten	(U.S.A.), *president.*	J. Lévy	(France)
E. Andersen	(Denmark)	M.R. Szacherska	(Poland)
W. Baarda	(Netherlands)	G. Strasser	(Switzerland)
B. Chovitz	(U.S.A.)	A. Tarczy–Hornoch	(Hungary)
I. Fischer	(U.S.A.)	J.A. Weightman	(United Kingdom)
T.J. Kukkamäki	(Finland)	H. Wolf	(Fed.Rep.of Germ.)
J.–J. Levallois	(France)		

GEODETIC REFERENCE SYSTEM 1980

by H. MORITZ

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1 Definition

The *Geodetic Reference System 1980* has been adopted at the XVII General Assembly of the IUGG in Canberra, December 1979, by means of the following

"RESOLUTION N° 7

The International Union of Geodesy and Geophysics,

recognizing that the Geodetic Reference System 1967 adopted at the XIV General Assembly of IUGG, Lucerne, 1967, no longer represents the size, shape, and gravity field of the Earth to an accuracy adequate for many geodetic, geophysical, astronomical and hydrographic applications and

considering that more appropriate values are now available,

recommends

a) that the Geodetic Reference System 1967 be replaced by a new *Geodetic Reference System 1980,* also based on the theory of the geocentric equipotential ellipsoid, defined by the following conventional constants :

. equatorial radius of the Earth :

$a = 6378\,137\ \mathrm{m}$,

. geocentric gravitational constant of the Earth (including the atmosphere) :

$GM = 3986\,005 \times 10^{8}\ \mathrm{m^3\,s^{-2}}$,

. dynamical form factor of the Earth, excluding the permanent tidal deformation :

$J_2 = 108\,263 \times 10^{-8}$,

. angular velocity of the Earth :

$\omega = 7292\,115 \times 10^{-11}\ \mathrm{rad\,s^{-1}}$,

b) that the same computational formulas, adopted at the XV General Assembly of IUGG in Moscow 1971 and published by IAG, be used as for the Geodetic Reference System 1967, and

c) that the minor axis of the reference ellipsoid, defined above, be parallel to the direction defined by the Conventional International Origin, and that the primary meridian be parallel to the zero meridian of the BIH adopted longitudes " .

For the background of this resolution see the report of IAG Special Study Group 5.39 (Moritz, 1979, sec. 2).

Also relevant is the following IAG resolution :

"RESOLUTION N° 1

The International Association of Geodesy,

recognizing that the IUGG, at its XVII General Assembly, has introduced a new Geodetic Reference System 1980,

recommends that this system be used as an official reference for geodetic work, and

encourages computations of the gravity field both on the Earth's surface and in outer space based on this system".

2. The Equipotential Ellipsoid

According to the first resolution, the Geodetic Reference System 1980 is based on the theory of the equipotential ellipsoid. This theory has already been the basis of the Geodetic Reference System 1967 ; we shall summarize (partly quoting literally) some principal facts from the relevant publication (IAG, 1971, Publ. Spéc. n° 3) .

An equipotential ellipsoid or level ellipsoid is an ellipsoid that is defined to be an equipotential surface. If an ellipsoid of revolution (semimajor axis a , semiminor axis b) is given, then it can be made an equipotential surface

$$U = U_0 = \text{const.}$$

of a certain potential function U , called normal gravity potential. This function U is uniquely determined by means of the ellipsoidal surface (semiaxes a , b) , the enclosed mass M and the angular velocity ω , according to a theorem of Stokes–Poincaré, quite independently of the internal density distribution. Instead of the four constants a , b , M and ω , any other system of four independent parameters may be used as defining constants.

The theory of the equipotential ellipsoid was first given by Pizzetti in 1894 ; it was further elaborated by Somigliana in 1929. This theory had already served as a base for the International Gravity Formula adopted at the General Assembly in Stockholm in 1930.

Normal gravity $\gamma = |\,\text{grad}\, U\,|$ at the surface of the ellipsoid is given by the closed formula of Somigliana,

$$\gamma = \frac{a\gamma_e \cos^2\phi + b\gamma_p \sin^2\phi}{\sqrt{a^2\cos^2\phi + b^2\sin^2\phi}} ,$$

where the constants γ_e and γ_p denote normal gravity at the equator and at the poles, and ϕ denotes geographical latitude.

The equipotential ellipsoid furnishes a simple, consistent and uniform reference system for all purposes of geodesy : the ellipsoid as a reference surface for geometric use, and a normal gravity field at the earth's surface and in space, defined in terms of closed formulas, as a reference for gravimetry and satellite geodesy.

The standard theory of the equipotential ellipsoid regards the normal

gravitational potential as a harmonic function outside the ellipsoid, which implies the absence of an atmosphere. (The consideration of the atmosphere in the reference system would require an ad–hoc modification of the theory, whereby it would lose its clarity and simplicity.)

Thus , in the same way as in the Geodetic Reference System 1967, the computations are based on the theory of the equipotential ellipsoid without an atmosphere. The reference ellipsoid is defined to enclose the whole mass of the earth, including the atmosphere ; as a visualization, one might, for instance, imagine the atmosphere to be condensed as a surface layer on the ellipsoid. The normal gravity field at the earth's surface and in space can thus be computed without any need for considering the variation of atmospheric density.

If atmospheric effects must be considered, this can be done by applying corrections to the measured values of gravity ; for this purpose, a table of corrections will be given later (sec. 5).

3. Computational Formulas

An equipotential ellipsoid of revolution is determined by four constants. The IUGG has chosen the following ones :

a ... equatorial radius,

GM ... geocentric gravitational constant,

J_2 ... dynamical form factor,

ω ... angular velocity.

The equatorial radius a is the semimajor axis of the meridian ellipse ; the semiminor axis will be denoted by b . The geocentric gravitational constant GM is the product of the Newtonian gravitational constant, G , and the total mass of the earth, M . The constant J_2 is given by

$$J_2 = \frac{C - A}{Ma^2} ,$$

where C and A are the principal moments of inertia of the level ellipsoid (C ... polar, A ... equatorial moment of inertia) .

We shall also use the first excentricity e , defined by

$$e^2 = \frac{a^2 - b^2}{a^2} ,$$

and the second excentricity e' , defined by

$$e'^2 = \frac{a^2 - b^2}{b^2} .$$

Closed computational formulas are given in sec. 3 of (IAG, 1971, Publ. Spéc. n° 3); we shall here reproduce this section practically unchanged.

The derivation of these formulas is found in the book (Heiskanen and Moritz, 1967) sections 2 – 7 to 2 – 10. Reference to this book is by page number and number of equation.

Computation of e^2 .

The fundamental derived constant is the square of the first excentricity, e^2, as defined above.

From p. 73, equations (2–90) and (2–92′), we find

$$J_2 = \frac{e^2}{3}\left(1 - \frac{2}{15}\,\frac{me'}{q_0}\right).$$

This equation can be written as

$$e^2 = 3J_2 + \frac{2me'e^2}{15\,q_0} \quad .$$

with

$$m = \frac{\omega^2 a^2 b}{GM}$$

(p. 69, eq. (2–70)) and with $be' = ae$ it becomes

$$e^2 = 3J_2 + \frac{4}{15}\,\frac{\omega^2 a^3}{GM}\,\frac{e^3}{2q_0} \quad .$$

This is the basic equation which relates e^2 to the data a, GM, J_2 and ω. It is to be solved iteratively for e^2, taking into account

$$2q_0 = \left(1 + \frac{3}{e'^2}\right) \textit{arctan}\, e' - \frac{3}{e'}$$

$$= \sum_{n=1}^{\infty} \frac{4(-1)^{n+1}\,n}{(2n+1)(2n+3)}\, e'^{2n+1}$$

with

$$e' = e\,(1-e^2)^{-\frac{1}{2}} \qquad \text{(second excentricity)}$$

(p. 66, eq. (2–58) ; p. 72, second equation from top).

Geometric Constants

Now the other geometric constants of the reference ellipsoid can be computed by the well–known formulas :

$b = a\sqrt{1-e^2}$ (semiminor axis) ,

$f = \dfrac{a-b}{a}$ (flattening) ,

$E = \sqrt{a^2 - b^2}$ (linear excentricity) ,

$c = \dfrac{a^2}{b}$ (polar radius of curvature) .

The arc of meridian from equator to pole (meridian quadrant) is given by

$$Q = c \int_0^{\pi/2} \frac{d\phi}{(1+e'^2 \cos^2 \phi)^{3/2}}$$

where ϕ is the geographical latitude. This integral can be evaluated by a series expansion :

$$Q = c\frac{\pi}{2}\left(1 - \frac{3}{4}e'^2 + \frac{45}{64}e'^4 - \frac{175}{256}e'^6 + \frac{11025}{16384}e'^8\right).$$

Various mean radii of the ellipsoid are defined by the following formulas :

arithmetic mean :

$$R_1 = \frac{a+a+b}{3} = a\left(1 - \frac{f}{3}\right);$$

radius of sphere of the same surface :

$$R_2 = c\left[\int_0^{\pi/2} \frac{\cos\phi}{(1+e'^2\cos^2\phi)^2}\, d\phi\right]^{1/2}$$

$$= c\left(1 - \frac{2}{3}e'^2 + \frac{26}{45}e'^4 - \frac{100}{189}e'^6 + \frac{7034}{14175}e'^8\right);$$

radius of sphere of the same volume :

$$R_3 = \sqrt[3]{a^2 b}.$$

Physical Constants.

The reference ellipsoid is a surface of constant normal potential, $U = U_0$. This constant U_0, the normal potential of the reference ellipsoid, is given by

$$U_0 = \frac{GM}{E}\arctan e' + \frac{1}{3}\omega^2 a^2$$

$$= \frac{GM}{b}\left[1 + \sum_{n=1}^{\infty}(-1)^n \frac{e'^{2n}}{2n+1} + \frac{1}{3}m\right]$$

(p. 67, eq. (2–61)) .

The normal gravitational potential V (gravity potential U minus potential of centrifugal force) can be developed into a series of zonal spherical harmonics :

$$V = \frac{GM}{r}\left[1 - \sum_{n=1}^{\infty} J_{2n}\left(\frac{a}{r}\right)^{2n} P_{2n}(\cos\theta)\right],$$

where r (radius vector) and θ (polar distance) are spherical coordinates. The coefficient

J_2 is a defining constant; the other coefficients are expressed in terms of J_2 by

$$J_{2n} = (-1)^{n+1} \frac{3e^{2n}}{(2n+1)(2n+3)} \left(1 - n + 5n \frac{J_2}{e^2}\right)$$

(p. 73, eqs. (2–92) and (2–92′)) .

Normal gravity at the equator, γ_e , and normal gravity at the poles, γ_p , are given by the expressions

$$\gamma_e = \frac{GM}{ab} \left(1 - m - \frac{m}{6} \frac{e' q_0'}{q_0}\right)$$

$$\gamma_p = \frac{GM}{a^2} \left(1 + \frac{m}{3} \frac{e' q_0'}{q_0}\right)$$

with

$$q_0' = 3\left(1 + \frac{1}{e'^2}\right)\left(1 - \frac{1}{e'} \arctan e'\right) - 1$$

and

$$m = \frac{\omega^2 a^2 b}{GM}$$

(p. 69, eqs. (2–73) and (2–74) ; p. 68, eq. (2–67)) .

The constant

$$f^* = \frac{\gamma_p - \gamma_e}{\gamma_e} \qquad \text{(gravity flattening)}$$

is also needed.

A check is provided by the closed form of Clairaut's theorem for the equipotential ellipsoid :

$$f + f^* = \frac{\omega^2 b}{\gamma_e} \left(1 + \frac{e' q_0'}{2 q_0}\right)$$

(p. 69 ; eq. (2–75)) .

The Gravity Formula

Somigliana's closed formula for normal gravity is

$$\gamma = \frac{a \gamma_e \cos^2 \phi + b \gamma_p \sin^2 \phi}{\sqrt{a^2 \cos^2 \phi + b^2 \sin^2 \phi}} .$$

For numerical computations, the form

$$\gamma = \gamma_e \frac{1 + k \sin^2 \phi}{\sqrt{1 - e^2 \sin^2 \phi}}$$

with

$$k = \frac{b\gamma_p}{a\gamma_e} - 1$$

is more convenient.

The conventional abbreviated series expansion is

$$\gamma \doteq \gamma_e \left(1 + f^* \sin^2 \phi - \frac{1}{4} f_4 \sin^2 2\phi\right)$$

with

$$f_4 \doteq -\frac{1}{2} f^2 + \frac{5}{2} fm$$

(p. 77, eqs. (2–115) and (2–116)) .

More generally, the above closed formula for normal gravity may be expanded into the series

$$\gamma = \gamma_e \left(1 + \sum_{n=1}^{\infty} a_{2n} \sin^{2n} \phi\right)$$

where

$$a_2 = \frac{1}{2} e^2 + k \,, \qquad a_6 = \frac{5}{16} e^6 + \frac{3}{8} e^4 k \,,$$

$$a_4 = \frac{3}{8} e^4 + \frac{1}{2} e^2 k \,, \qquad a_8 = \frac{35}{128} e^8 + \frac{5}{16} e^6 k \,.$$

The average value of gravity over the ellipsoid is

$$\bar{\gamma} = \int_0^{\pi/2} \frac{\gamma \cos\phi \, d\phi}{(1 - e^2 \sin^2 \phi)^2} : \int_0^{\pi/2} \frac{\cos\phi \, d\phi}{(1 - e^2 \sin^2 \phi)^2}$$

$$= 1 + \frac{1}{6} e^2 + \frac{1}{3} k + \frac{59}{360} e^4 + \frac{5}{18} e^2 k +$$

$$+ \frac{2371}{15120} e^6 + \frac{259}{1080} e^4 k + \frac{270229}{1814400} e^8 + \frac{9623}{45360} e^6 k \,.$$

4. Numerical Values

The following derived constants are accurate to the number of decimal places given. In case of doubt or in those cases where a higher accuracy is required, these quantities are to be computed from the defining constants by means of the closed formulas given in the preceding section.

Defining Constants (exact)

$a = 6378\,137$ m	semimajor axis
$GM = 3\,986\,005 \times 10^8$ m^3 s^{-2}	geocentric gravitational constant
$J_2 = 108\,263 \times 10^{-8}$	dynamical form factor
$\omega = 7\,292\,115 \times 10^{-11}$ rad s^{-1}	angular velocity

Derived Geometrical Constants

$b = 6\,356\,752.3141$ m	semiminor axis
$E = 521\,854.0097$ m	linear excentricity
$c = 6\,399\,593.6259$ m	polar radius of curvature
$e^2 = 0.006\,694\,380\,022\,90$	e = first excentricity
$e'^2 = 0.006\,739\,496\,775\,48$	e' = second excentricity
$f = 0.003\,352\,810\,681\,18$	flattening
$f^{-1} = 298.257\,222\,101$	reciprocal flattening
$Q = 10\,001\,965.7293$ m	meridian quadrant
$R_1 = 6\,371\,008.7714$ m	mean radius $R_1 = (2a+b)/3$
$R_2 = 6\,371\,007.1810$ m	radius of sphere of same surface
$R_3 = 6\,371\,000.7900$ m	radius of sphere of same volume.

Derived Physical Constants

$U_0 = 6\,263\,686.0850 \times 10$ m^2 s^{-2}	normal potential at ellipsoid
$J_4 = -0.000\,002\,370\,912\,22$	spherical–harmonic coefficients
$J_6 = 0.000\,000\,006\,083\,47$	spherical–harmonic coefficients
$J_8 = -0.000\,000\,000\,014\,27$	spherical–harmonic coefficients
$m = 0.003\,449\,786\,003\,08$	$m = \omega^2 a^2 b / GM$
$\gamma_e = 9.780\,326\,7715$ ms^{-2}	normal gravity at equator
$\gamma_p = 9.832\,186\,3685$ ms^{-2}	normal gravity at pole
$f^* = 0.005\,302\,440\,112$	$f^* = (\gamma_p - \gamma_e)/\gamma_e$
$k = 0.001\,931\,851\,353$	$k = (b\gamma_p - a\gamma_e)/a\gamma_e$

Gravity Formula 1980

Normal gravity may be computed by means of the closed formula

$$\gamma = \gamma_e \frac{1 + k \sin^2 \phi}{\sqrt{1 - e^2 \sin^2 \phi}} ,$$

with the values of γ_e , k , and e^2 shown above.

The series expansion, given at the end of sec. 3, becomes

$$\begin{aligned} \gamma = \gamma_e (1 &+ 0.005\,279\,0414 \sin^2 \phi \\ &+ 0.000\,023\,2718 \sin^4 \phi \\ &+ 0.000\,000\,1262 \sin^6 \phi \\ &+ 0.000\,000\,0007 \sin^8 \phi) ; \end{aligned}$$

it has a relative error of 10^{-10} , corresponding to $10^{-3}\ \mu m\ s^{-2} = 10^{-4}$ mgal .

The conventional series

$$\gamma = \gamma_e (1 + f^* \sin^2 \phi - \frac{1}{4} f_4 \sin^2 2\phi)$$

$$= 9.780\,327 (1 + 0.005\,3024 \sin^2 \phi - 0.000\,0058 \sin^2 2\phi)\ m\ s^{-2}$$

has only an accuracy of $1\ \mu m\ s^{-2} = 0.1$ mgal . It can, however, be used for converting gravity anomalies from the International Gravity Formula (1930) to the Gravity Formula 1980 :

$$\gamma_{1980} - \gamma_{1930} = (-16.3 + 13.7 \sin^2 \phi) \text{ mgal} ,$$

where the main part comes from a change of the Potsdam reference value by -14 mgal ; see also (IAG, 1971, Publ. Spéc. n° 3, p. 74).

For the conversion from the Gravity Formula 1967 to the Gravity Formula 1980, a more accurate formula, corresponding to the precise series expansion given above, is

$$\gamma_{1980} - \gamma_{1967} = (0.8316 + 0.0782 \sin^2 \phi - 0.0007 \sin^4 \phi) \text{ mgal} .$$

Since former gravity values are expressed in the units "gal" and "mgal" , we have, in the conversion formulas, used the unit $1\ \text{mgal} = 10^{-5}\ m\ s^{-2}$.

Mean values of normal gravity are

$\overline{\gamma} = 9.797\,644\,656\ m\ s^{-2}$ average over ellipsoid,

$\gamma_{45} = 9.806\,199\,203\ m\ s^{-2}$ γ at latitude $\phi = 45°$.

The numerical values given in this section have been computed independently by Mr. Chun–Yung Chen, using series developments up to f^5, and by Dr. Hans Sünkel, using the formulas presented in sec. 3.

5. Atmospheric Effects

The table given here is reproduced from (IAG, 1971, Publ. Spéc. n° 3, p. 72). It shows atmospheric gravity corrections δg as a function of elevation h above sea level. The values δg are to be added to measured gravity. The effect of this reduction is to remove, by computation, the atmosphere outside the Earth by shifting it vertically into the interior of the geoid.

Atmospheric Gravity Corrections δg

(to be added to measured gravity)

h [km]	δg [mgal]	h [km]	δg [mgal]
0	0.87	10	0.23
0.5	0.82	11	0.20
1.0	0.77	12	0.17
1.5	0.73	13	0.14
2.0	0.68	14	0.12
2.5	0.64	15	0.10
3.0	0.60	16	0.09
3.5	0.57	17	0.08
4.0	0.53	18	0.06
4.5	0.50	19	0.05
5.0	0.47	20	0.05
5.5	0.44	22	0.03
6.0	0.41	24	0.02
6.5	0.38	26	0.02
7.0	0.36	28	0.01
7.5	0.33	30	0.01
8.0	0.31	32	0.01
8.5	0.29	34	0.00
9.0	0.27	37	0.00
9.5	0.25	40	0.00

6. Origin and Orientation of the Reference System

IUGG Resolution No. 7, quoted at the beginning of this paper, specifies that the Geodetic Reference System 1980 be geocentric, that is, that its origin be the center of mass of the earth. Thus, the center of the ellipsoid coincides with the geocenter.

The orientation of the system is specified in the following way. The rotation axis of the reference ellipsoid is to have the direction of the Conventional International Origin for Polar Motion (CIO), and the zero meridian as defined by the Bureau International de l'Heure (BIH) is used.

To this definition there corresponds a rectangular coordinate system XYZ whose origin is the geocenter, whose Z–axis is the rotation axis of the reference ellipsoid, defined by the direction of CIO, and whose X–axis passes through the zero meridian according to the BIH.

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W.A. HEISKANEN, and H. MORITZ (1967) : Physical Geodesy. W.H. Freeman, San Francisco.

International Association of Geodesy (1971) : Geodetic Reference System 1967. Publ. Spéc. n° 3 du Bulletin Géodésique, Paris.

H. MORITZ (1979) : Report of Special Study Group No. 5.39 of I.A.G., Fundamental Geodetic Constants, presented at XVII General Assembly of I.U.G.G., Canberra.

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Editor's Note : Additional useful constants can be obtained from : "United States Naval Observatory, Circular No. 167, December 27, 1983, Project MERIT Standards".

GEODETIC DATA CENTERS

This section covers international and national data centers. A major reference is the CODATA **Directory on Geodesy** (CODATA Bull. n° 52).

International Data Centers

- Bureau Gravimétrique International
  c/o CNES–GRGS, 18 avenue Edouard Belin,
  31055 Toulouse Cedex, France.

- Bureau International de l'Heure
  61, avenue de l'Observatoire,
  75014 Paris, France.

- Central Bureau of the International Polar Motion Service
  International Latitude Observatory of Mizusawa,
  Mizusawa–shi, Iwate–ken, 023 Japan.

- Commission for Geodesy in Africa
  Com. XI, c/o I.G.C.I.
  01. B.P. 3862, Abidjan 01, Côte d'Ivoire.

- Commission on International Coordination of Space Techniques for Geodesy and Geodynamics
  c/o Deutsches Geodätisches Forschungsinstitut, Marstallplatz 8,
  D–8000 München 22, Federal Republic of Germany.

- Commission on International Geodetic Bibliography
  National Committee for Geodesy and Geophysics,
  George Bähr Strasse 7, 8027 Dresden, German Democratic Republic.

- Committee on Space Research (COSPAR)
  51, Boulevard de Montmorency, 75016 Paris, France.

- Federation of Astronomical and Geophysical Services (FAGS)
  C. Boucher (Secretary) – IGN/SGNM
  2, Avenue Pasteur, 94160 Saint–Mandé, France.

– Fundamental Geodetic Constants
c/o Bureau Central de l'Association Internationale de Géodésie (A.I.G.),
39 ter Rue Gay–Lussac, 75005 Paris, France.

– ICSU Panel on World Data Centers
Dr. E.R. Dyer, Honorary Secretary, National Academy of Sciences,
2101 Constitution Avenue, Washington, D.C. 20418, U.S.A.

– INTERCOSMOS
c/o Soviet Astronomical Council,
Pjatniskaja ul. d. 48, 109017 Moscow, U.S.S.R.

– International Association of Geodesy (I.A.G.)
Bureau Central, 39 ter Rue Gay–Lussac, 75005 Paris, France.

– International Centre for Earth Tides
c/o Observatoire Royal de Belgique,
3, Avenue Circulaire, 1180 Brussels, Belgium.

– International Center on Recent Crustal Movements
250 66 Zdiby, C. 98, Okr, Praha–Východ (Prague), Czechoslovakia.

– Inter–Union Commission on the Lithosphere (ICL)
Geodynamics Program Office,
Mail Code ERG–2, NASA, Washington, D.C. 20546, U.S.A.

– NASA Geodynamics Program
Geodynamics Branch,
Code ERG–2, NASA Headquarters, Washington, D.C., 20546, U.S.A.

– North American Datum
National Geodetic Survey, NOAA/NOS,
6001 Executive Bld., Rockville, Maryland 20852, U.S.A.

– Permanent Service for Mean Sea Level
Institute of Oceanographic Sciences,
Bidston Observatory, Birkenhead, L43 7RA Merseyside, United Kingdom.

– Project MERIT
Royal Greenwich Observatory,
Herstmonceux Castle, Hailsham, BN 27 IRP, East Sussex, England, United King.

– Special Study Group on the Geoid in Europe
G. Birardi, President. Università–Facoltà di Ingegneria,
via Eudossiana, 18, 00184 Rome, Italy.

– Sub–Commission on European Leveling
c/o Meetkundige Dienst Rijkswaterstaat,
Kanaalweg 3, 2600 GA Delft, Netherlands.

– Sub–Commission for the Readjustment of the European Triangulation (RETRIG)
c/o Deutsches Geodätisches Forschungsinstitut,
Marstallplatz 8, Munich 22, Federal Republic of Germany.

– Sub–Commission on North America Geodetic Network
c/o J. Gergen, National Geodetic Survey, NOAA/NOS,
Rockville, Maryland 20852, U.S.A.

– Sub–Commission on Standards for Space Techniques
c/o Institut Géographique National,
2, Avenue Pasteur, 94160 Saint–Mandé, France.

– World Data Center A
Rotation of the Earth
U.S. Naval Observatory, Time Service Division,
Washington, D.C. 20390, U.S.A.

– World Data Center for Solid Earth Geophysics
325 Broadway, Boulder, Colorado 80803, U.S.A.

– World Data Center B2
Gravity Field
Soviet Geophysical Committee,
Molodezhnaya 3, Moscow 117296, U.S.S.R.

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National Data Centers

Algeria

- Service de Traitement des Données Géodésiques
  Institut National de Cartographie,
  123, Rue de Tripoli, Hussein–Dey, Alger, Algeria.

Australia

- Bureau of Mineral Resources, Geology and Geophysics
  P.O. Box 378, A.C.T. 2601, Canberra City, Australia.

- Department of Survey Information
  National Mapping
  P.O. Box 31, A.C.T. 2616, Belconnen, Australia.

- National Mapping
  P.O. Box 31, A.C.T. 2616, Belconnen, Australia.

Austria

- Bundesamt für Eich– und Vermessungswesen
  Schiffamtsgasse 1–3, Postfach 50, A – 1025 Wien, Austria.

- Technical University of Wien
  Gusshausstrasse 27–29, A – 1040 Wien, Austria.

- Technical University of Graz
  Rechbauerstrasse 12, A–8010 Graz, Austria.

- Geodetic Department, Observatory Lustbühel
  Lustbühelstrasse 46, A – 8042 Graz, Austria.

Belgium

- Département d'Astronomie Fondamentale et de Géodynamique
  Observatoire Royal de Belgique,
  Avenue Circulaire 3, 1180 Brussels, Belgium.

– Department of Geodesy
Direction de la Géodésie, Institut Géographique National,
Abbaye de la Cambre, 13, 1050 Brussels, Belgium.

Canada

– Division of Seismology and Geomagnetism, Earth Physics Branch, Department of Energy, Mines and Resources
1 Observatory Crescent, Ottawa, Ontario, Canada, K1A 0Y3.

– National Geodetic Data File
Department of Energy, Mines and Resources, Surveys and Mapping Branch,
Geodetic Survey Division,
615 Booth Street, Ottawa K1A 0E9, Ontario, Canada.

– National Gravity Data Base
Department of Energy, Mines & Resources, Earth Physics Branch,
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