

DIVISION III

PLANETARY SYSTEMS SCIENCES

Division III gathers astronomers engaged in the study of a comprehensive range of phenomena in the solar system and its bodies, from the major planets via comets to meteorites and interplanetary dust.

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BOARD

M.F. A'Hearn	Past President Division III
J. Baggaley	Past President Commission 22
E. Bowell	President Commission 20
S. Bowyer	President Commission 51
D. Cruikshank	President Commission 16
C. de Bergh	Past President Commission 16
H. Keller	President Commission 15
P. Lamy	President Commission 21
V. Porubcan	President Commission 22
J. Watanabe	
I. Williams	Past President Commission 22
V. Zappala	Past President Commission 15

PARTICIPATING COMMISSIONS

COMMISSION 15: PHYSICAL STUDY OF COMETS AND MINOR PLANETS
COMMISSION 16: PHYSICAL STUDY OF PLANETS AND SATELLITES
COMMISSION 20: POSITIONS AND MOTIONS OF MINOR PLANETS, COMETS AND SATELLITES
COMMISSION 21: LIGHT OF THE NIGHT SKY
COMMISSION 22: METEORS, METEORITES AND INTERPLANETARY DUST
COMMISSION 51: BIOASTRONOMY: SEARCH FOR EXTRATERRESTRIAL LIFE

DIVISION III: PLANETARY SYSTEMS SCIENCES *(SCIENCES DES SYSTEMES PLANETAIRES)*

PRESIDENT: Michael F. A'Hearn

BOARD: W. J. Baggaley, C. de Bergh, S. Bowyer, M. S. Hanner, C. Leinert,
M. Marov, H. Rickman, J. Tarter, I. P. Williams, V. Zappalà

Commission 15: Physical Study of Comets, Minor Planets, and Meteorites

Commission 16: Physical Studies of Planets and Satellites

Commission 20: Positions and Motions of Minor Planets, Comets, and Satellites

Commission 21: Light of the Night Sky

Commission 22: Meteors and Interplanetary Dust

Commission 51: Bioastronomy: Search for Extraterrestrial Life

1. Organization

The meeting was called at 14:00 on 12 August, 2000 by the President. Over the course of the meeting 59 members and consultants of the Division attended. Guy Consolmagno served as secretary to record the proceedings of the meeting.

A proposed plan of organization for the Division had been posted on the web and was presented. It was approved by acclamation. The plan (edited to show the relevant IAU rules) is as follows:

- The Division will be managed by the elected President of the Division and a Board consisting of 12 members. (IAU rules currently specify a maximum of 12 members on the Board.)
- The President of the Division is officially elected by the IAU General Assembly on the recommendation of the EC. The Division's nominee as next President will be elected by the current Divisional Board. This election will be organized by the current President of the Division.
- The Board members will include the Presidents of all Commissions within the Division and the outgoing President of the Division. (IAU working rules require that all current Commission Presidents be members of the Board.)
- Additional Board members (currently an additional five) will be elected by the membership of the Division at the triennial business meeting.
 - These additional members will include at least two outgoing Commission Presidents to provide continuity and corporate memory.
 - These additional members will include at least two people not outgoing Commission Presidents to provide breadth of viewpoint and geographic diversity.

- The President will submit a slate of nominees to the Division. This slate may contain either the required number of candidates or a larger number.
 - All nominees on this slate will have agreed to serve before being nominated.
 - Additional nominees may be proposed from the floor at the General Assembly, provided the nominee has expressed a willingness to serve.
- The Division may create Working Groups or Committees for specific purposes as it sees fit (with permission of the EC as required by IAU working rule 38). This may be done at the triennial business meeting or it may be done by the Board during the triennium.
 - During the triennium, the Board will act for the Division. Any decisions by the Board during the triennium may be brought up for discussion by the membership of the Division at the immediately succeeding General Assembly.

2. Officers

In accordance with this newly adopted plan, a slate of officers for the 2000-2003 triennium was elected. Five candidates were nominated by the outgoing President, and nominations from the floor were opened; two more names were placed in nomination. The candidates thus were Kaare Aksnes, W. Jack Baggaley, Catherine de Bergh, Jill Tarter, Jun-Ichi Watanabe, Iwan Williams, and Vincenzo Zappalà. Following a written ballot, Baggaley, de Bergh, Watanabe, Williams, and Zappalà were elected. In accordance with the new rules, those elected included three immediate past Commission Presidents and two who are not immediate past Presidents.

3. Divisional Organization

The Division considered two issues involving the organization of Commissions within the Division. The Presidents of Commissions 15 and 22 jointly proposed (with the support of their Commissions) that the subject of meteorites be transferred from Commission 15 to Commission 22. This was approved unopposed, pending drafting of suitably revised charters and names. The officers were instructed to help insure that meteorite scientists formerly in Commission 15 would be assisted as needed to insure that they could now join Commission 22. (Due to scheduling issues, this could not be prepared for presentation to the EC before the end of the GA and official submission is anticipated at the next meeting of the EC.)

The President of Commission 51 proposed (with the support of his Commission) that the name of the Commission be changed to "Bioastronomy: Search for Extrasolar Planets and Extraterrestrial Life." It was noted that the connection between Commission 51 and the search for extrasolar planets, while mentioned in its original charter, was mostly historical and may not represent a current description of work in the field. Members of the Division noted that many of those active in the search for extrasolar planets are not now members of Commission 51; indeed, many are not even members of Division III. In addition, fears were expressed that this name change might be seen as a usurpation of the function of the WG on Extra-Solar Planets (see below). Though sympathy was expressed at the right of a Commission to determine its own name, the general consensus seemed to be that given the rate the field is changing, this might not be an appropriate time to change the name of Commission 51. The motion to approve the name change was defeated, 8-24.

4. IAU Organization

The Division held a general discussion of organizational issues raised by the EC with the Division and Commission Presidents. Although no votes were taken, the sense of the Division was that any publication of full proceedings of Joint Discussions under IAU auspices (as opposed to summaries in the IAU Transactions) should ensure that the papers in such proceedings were carefully refereed and that the reputation and visibility of the IAU be enhanced by whatever would be published. Similarly, the Division supported moves to increase the involvement of Division Presidents, even moving toward making them the equivalent of Vice Presidents as members of the EC, while noting the possible difficulty of maintaining geographic balance in this procedure. Finally, the Division noted the importance of involving the Division Presidents in organizing the business meetings of the various units so as to provide orderly reporting of Commissions to Divisions while minimizing conflicts.

5. Working Groups

5.1. Working Group on Near Earth Objects

Working Group chairman David Morrison reported on the extensive effort by this WG, dealing with public concerns about the possible impact hazards and the steps the IAU has taken both to disseminate reliable information about hazards in general, and to provide a means of refereeing reports of potential impactors within a short time following their discovery. He presented a proposed charter explaining the charge of the Working Group (see the WG report) to which the Division suggested, and he accepted, an additional charge to make certain that relevant data on the status of the search for Near Earth Objects be available to the general public; and to include physical studies of NEOs to the studies mentioned in his charter that the Working Group will work to disseminate to IAU, its officers, and the general public. Morrison suggested, as the Working Group already consists of more than 50 people, that an organizing committee of a dozen members plus the officers of Chair, Vice Chair, and Secretary, be approved by the Division. As officers, the nominees were Morrison as Chair, Andrea Milani as Vice Chair, and Richard Binzel as Secretary. The Division asked that the suggested organizing committee be expanded to include scientists from the southern hemisphere, and more active observers. Appropriate names were added (see the WG report). The officers and committee, as amended, were then approved by the Division.

5.2. Working Group on Extra-Solar Planets

This group had been formed, by the direction of the EC in May 1999, by Division President A'Hearn, Commission 16 President de Bergh, and Commission 51 President Bowyer. However, the group never formally met until this GA, and at that time only a third of the 12 members were present. The Working Group had been charged by the EC "... to act as a focal point for international research on extrasolar planets and organize IAU activities in the field, building on the preparatory work done by Commission 51. In particular, it should organise comparative reviews of techniques used to detect extrasolar planets and establish criteria for detections of varying degrees of certainty. As part of this activity, it is authorized to maintain lists of objects satisfying these criteria; if it so wishes, this responsibility may be delegated to a technical subgroup appointed by the WG Chair."

It was noted by members of the WG present that a strong consensus existed among the extrasolar planet community of the necessity of having an active researcher in the field direct this group, and they strongly urged the selection of Alan Boss, previously not a member of this WG, to be its chairman. The Division discussed this at great length, with many members noting that they felt uncomfortable assigning a chair to the WG, and preferring to let the WG select its own chair once the membership had been constituted by the Division. Thus, the Division voted 20-17 to add Alan Boss to the WG, but to leave the position of Chair open. The membership of the WG thus becomes A. Boss, S. Bowyer, P. Butler,

W. Hubbard, P. Ianna, M. Kürster, J. Lissauer, M. Mayor, F. Mignard, A. Penny, A. Quirrenbach, J. Tarter, and A. Vidal-Madjar. A. Boss was subsequently appointed chairman by the IAU officers.

5.3. Committee on Small Body Nomenclature

The new terms of reference for the Committee, as defined by the EC in February 2000, were briefly discussed, particularly the role of Division III in dealing with appeals, and thus final approval, of names assigned or declined by the Committee. These new procedures will come into full effect during the coming triennium.

One appeal was considered as a test of the procedures that will be applicable in the next triennium. An asteroid name "Denso" had been proposed by its discoverer, a Japanese amateur who worked for the auto parts company of that name and who, according to his citation, wished to honor the corporation with which he had been associated for many years. As explained by A'Hearn, the CSBN had expressed reservations about naming an asteroid for a commercial entity; though there has been precedent in the past (Swissair being an example) it had never been for a company to whom the discoverer owed his livelihood. On the other hand, there was no specific guideline against commercial names. The naming had been thus held in abeyance until the GA, at which time the CSBN again met and decided to refer the issue to the Division; the CSBN had declined to make a rigid prohibition of commercial names part of its guidelines. In the discussion that followed, the issue at question to the Division was fear that the appearance of a quid-pro-quo existed, or that the circumstances could be hiding an activity that might violate the existing guideline against the buy or selling of names. On the other hand, great sympathy was shown for the rights of an amateur to honor a person or group who had been supportive of his/her efforts. After considerable discussion, the appeal to overturn the decision of the CSBN (which the CSBN would have reconsidered in any case), and thus approve the new name of Denso, was approved by an 18-16 vote.

The slate of members and officers proposed by the CSBN (see their report) was approved without opposition.

5.4. Working Group on Planetary System Nomenclature

The WG has new terms of reference from the EC, which are parallel to the new terms of the CSBN. The WG noted that 216 new names will be submitted to the GA for approval, and that in future GA's the Division will be asked to decide appeals of any future controversial names.

The proposed slate of members was presented. Members of the Division noted that the proposed membership of the WG was very narrow geographically, consisting primarily of members from the United States and Russia. This is due to the fact that historically these were the countries whose space missions led to the images and maps for which names were needed. Members also noted the importance of increasing diversity in other ways, both in gender and in bringing in younger members of the IAU, particularly in view of the high visibility of naming as an activity of the IAU. Current members of the WG pointed out that the task of this WG is quite specialized, requiring significant experience, and that change in the WG should thus occur slowly. They also pointed out that within the WG great efforts had been made to be culturally sensitive in choice of names, and that members of the Task Forces of the WG were indeed more balanced in age, gender, and national origin.

The Division then voted to approve the slate for WG membership as presented (see the WG report), with the proviso that the Division request the EC and the President of the WG to consider how best to add at least two new members to the WG, to respond to the concerns of diversity.

Michael F. A'Hearn
President of the Division

TERMS OF REFERENCE: IAU WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE

1. The IAU Working Group on Planetary System Nomenclature (WGPSN)

The Working Group is appointed by *IAU Division III* under similar procedures as Divisional Working Groups (IAU Working Rules 38). It reports to the General Assembly through the President of Division III. For necessary meetings, the Working Group is eligible for travel support from the IAU.

2. The membership of the Working Group includes:

- A President of the WGPSN and a minimum of 8 other *members of IAU Division III*, including all the chairpersons of the Task Groups (see item g), representing a diversity of geographical and cultural backgrounds.
- The *President of IAU Division III*. The President may delegate the divisional representation to another Division member.
- The President of *IAU Commission 16, Physical Study of Planets and Satellites*, or his/her representative.
- The *Chairperson of the IAU Committee on Small Body Nomenclature*, or his/her representative.
- Additional members up to a maximum of 15, including a maximum of 3 consultants who possess special expertise but are not IAU members.
- A member may be in more than one of the above categories.
- The Working Group may appoint *Task Groups* of up to six members, including a Chairperson, to assist in the nomenclature work for the various celestial bodies, as the need arises.

3. Appointment and Terms of Service:

The members, including the President, will be appointed for three years at each General Assembly by Division III, upon the advice of the outgoing Working Group. The Working Group may appoint or dismiss Task Group members at any time. Continuity in the work is important, so Working Group and Task Group members are encouraged to serve through several triennia.

4. Names and Guidelines

- The Working Group will develop, maintain, and publish guidelines for naming natural satellites of major and minor planets and surface features on all of these bodies plus comets, based on the established guidelines. Significant changes in the guidelines should be submitted by the Working Group to Division III for discussion and approval at a General Assembly before being put into effect. Minor changes may be approved by the Division President and reported at the General Assembly.

- The Working Group will periodically approve lists of new nomenclature, with accompanying explanatory notes. Such lists will be promptly made public through such channels as decided by the Working Group.
- At the beginning of the year of each General Assembly, the Working Group will submit to the IAU General Secretary, through the Division, a list of all names approved in the immediately preceding three calendar years. In the IAU Information Bulletin for January of that year, IAU members will be invited to inspect this list. Any objections based on significant, substantive problems with these names must be forwarded in writing to the President of Division III at least three months prior to the start of the General Assembly. Valid reasons do not include personal preferences of the discoverers or other individuals.
- Any appeals of decisions by the Working Group will be considered by Division III at the following General Assembly. The Division will submit a report to the General Assembly, indicating the absence or resolution of any appeals. This report and the list of new names as possibly amended will be published in the Proceedings of the General Assembly (or may be cited there if a suitable external reference is available).

January 19, 2000

TERMS OF REFERENCE: IAU COMMITTEE ON SMALL BODY NOMENCLATURE

1. The IAU Committee on Small Body Nomenclature

The Committee is appointed by *IAU Division III* under similar procedures as Divisional Working Groups (IAU Working Rules 38). It reports to the General Assembly through the President of Division III. For necessary meetings, the Committee is eligible for travel support from the IAU.

2. The membership of the Committee includes:

- A Chairperson and a minimum of 8 other *members of IAU Division III*, representing a diversity of geographical and cultural backgrounds.
- The *President of Division III*. The president may delegate the divisional representation to another Division member.
- The *Director of the IAU Minor Planet Center*, who will also serve as Secretary of the committee.
- The *Chairperson of the IAU Working Group on Planetary System Nomenclature* or his/her representative.
- Additional members up to a maximum of 15, including a maximum of 3 consultants who possess special expertise but are not IAU members.
- A member may be in more than one of the above categories.

3. Appointment and Terms of Service

The members, including the Chairperson, will be appointed for three years at each General Assembly by Division III, upon the advice of the outgoing Committee. Continuity in the work of the Committee is important, so members are encouraged to serve through several triennia.

4. Names and Guidelines

- The Committee will develop, maintain, and publish guidelines for naming minor planets and comets, based on the established guidelines. Significant changes in the guidelines should be submitted by the Committee to Division III for discussion and approval at a General Assembly before being put into effect. Minor changes may be approved by the Division President and reported at the General Assembly.
- The Committee will periodically approve lists of newly named bodies, with accompanying citations in the case of Minor Planets. Such lists will be promptly made public by the *Minor Planet Center*.
- At the beginning of the year of each General Assembly, the Committee will submit to the IAU General Secretary, through the Division, a list of all names approved in the immediately preceding three calendar years. In the IAU Information Bulletin for January of that year, IAU members will be invited to inspect this list. Any objections

based on significant, substantive problems with these names must be forwarded in writing to the President of Division III at least three months prior to the start of the General Assembly. Valid reasons do not include personal preferences of the discoverers or other individuals.

- Any appeals of decisions by the committee will be considered by Division III at the following General Assembly. The Division will submit a report to the General Assembly, indicating the absence or resolution of any appeals. This report and the list of new names as possibly amended will be published in the Proceedings of the General Assembly (or may be cited there if a suitable external reference is available).

February 2000

COMMISSION 15: PHYSICAL STUDY OF COMETS, MINOR PLANETS AND METEORITES

(L'ETUDE PHYSIQUE DES COMETES, DES PETITES PLANETES ET DES METEORITES)

PRESIDENT: Vincenzo Zappalà

VICE-PRESIDENT: H. Uwe Keller

SECRETARY: Karri Muinonen

ORGANIZING COMMITTEE: M. Bailey, R.P. Binzel, M.T. Capria, P.D. Feldman, J. Fernández, C.-I. Lagerkvist, A.-C. Levasseur-Regourd, K. Meech, J. Watanabe, R.M. West

1. Meeting Opening

The President opened the business meeting, welcoming members, consultants, and other interested audience. There were 16 in attendance. The agenda as presented by the President was adopted.

2. Deceased Members

The members stood for a moment in silence in honour of the six distinguished members of the Commission that had died: D. Beard, F. Dossin, P. Farinella, S. Grudzińska, G. Herzberg, and F. Miller.

3. New Commission Officers

The Commission elected the following officers for the new triennium: President - H. U. Keller (Germany), Vice-President - E. Tedesco (USA), Secretary - Gabriele Cremonese (Italy), Chair of the Working Group for Comets - W. Huebner (USA), Chair of the Working Group for Asteroids - A. Cellino (Italy), and Members of Organizing Committee - M. T. Capria (Italy), A. Harris (Germany), N. Kiselev (Ukraine), L.-A. McFadden (USA), K. Meech (USA), T. Michałowski (Poland), K. Muinonen (Finland), M. V. Sykes (USA), J. Watanabe (Japan), and R. M. West (Germany).

4. New Members and Consultants

The Commission elected 28 new members: K. Altwegg (Switzerland), I. Belskaya (Ukraine), P. Colom (France), G. Cremonese (Italy), J. Davies (USA), C. De Sanctis (Italy), E. Dotto (Italy), M. Grady (UK), P. Gronkowski (Poland), D. Hestroffer (France), M. Kaasalainen (Finland), M. Kidger (Spain), J. Klacka (Slovak Republic), P. Korsun (Ukraine), P.-O. Lagage (France), M. Lazzarin (Italy), G. Longo (Italy), J. Luu (Netherlands), W. Merline (USA), J. Piironen (Finland), S. Russell (UK), N. Samarashinha (USA), R. Schultz (Netherlands), Y. Sizonenko (Ukraine), J. Tao (China PR), G. Tozzi (Italy), P. Vazquez Sada (Mexico), and J. Yang (Korea PR). The Commission further elected six new consultants: J. Benkhoff (Germany), W. Bottke (USA), P. Israelevich (Israel), S. Kim (Korea), R. Orosei (Italy), and P. Tanga (Italy).

5. Rules for Triennial Report

The Commission decided to prepare the Triennial Report as earlier: the research descriptions will be included in the printed version, while the references will be made available on the Commission WWW-site.

6. Commission Working Groups

6.1. Working Group for Asteroids

As proposed by E. Tedesco (chair), the name of the 'Working Group for Minor Planets' was changed to 'Working Group for Asteroids' (WGA). WGA is formed by voluntary membership by those, who, e.g., wish to contribute to the Triennial Report. The chairman suggested a possible waveband change of the asteroid absolute magnitude system from V to R: a preliminary vote was in favor by 12 to 0, with three abstentions. A. Cellino (new chair) and E. Tedesco agreed that the WGA web site would remain at http://www.terrasys.com/SSRD/IAU.C15_WGA/.

6.2. Working Group for Comets

The Working Group for Comets (WGC), chaired by W. F. Huebner, compared water gas production rates from different telescopic observations ranging from the microwave through the IR, visible, to the UV (i.e., H₂O, OH, etc. observations) of Comet Hale-Bopp (C/1995 O1) over large heliocentric distance ranges. The conclusion, based on the sum of pre- and post-perihelion observations, is that all observations are in reasonable agreement. Thus, no special calibration appears to be necessary. The study will be continued to investigate the pre- and post-perihelion observations separately, as the full complement of data becomes available.

7. Other

The restructuring of Commissions 15 and 22, i.e., transferring meteorites from the former to the latter and the resultant change in the name of Commission 15 to 'Physical Studies of Asteroids and Comets' were approved at the Division III Business Meeting provided the Commission 15 members approved these changes at their Business Meeting. The Commission 15 business meeting unanimously approved the changes.

P. Feldman presented new HST images of the disrupted Comet LINEAR, and called for increased scientific activity for the Commission during the upcoming triennium, with the possibility of organizing IAU Colloquia/Symposia on topical themes. H. U. Keller requested that the Commission members contact him with ideas how this could be accomplished. R. Schultz pointed out the upcoming second Comet Hale-Bopp meeting on Canary Islands, and G. Tancredi brought up South-American meetings on asteroids and comets. E. Tedesco requested that, in the future, Commission 15 and 20 business meetings not be organized in parallel. Furthermore, the Division III business meeting should take place after the first Commission business meetings.

Vincenzo Zappalà
President of the Commission

COMMISSION 16: PHYSICAL STUDY OF PLANETS AND SATELLITES

(ETUDES PHYSIQUES DES PLANETES ET DES SATELLITES)

PRESIDENT: Catherine de Bergh

VICE-PRESIDENT: Dale Cruikshank

ORGANIZING COMMITTEE: M. Belton, C. Blanco, G. Consolmagno, A. Coradini, D. Gautier, M. Marov, M. McGrath, K. Noll, T. Owen, V. Tejfel, A. Woszczyk

The meeting was held on August 11, 2000, at 6 p.m., with 11 people in attendance. The meeting was conducted by C. de Bergh, President of Commission 16, with D. Cruikshank serving as secretary.

The President reported on the activities of the Organizing Committee for 1997-2000. Briefly summarized, those activities consisted of the approval of various meetings for sponsorship, assistance in the organization of the Symposium on "Planetary Systems in the Universe" in Manchester, and the organization of a Joint Discussion on "Highlights of Planetary Exploration from Space and from Earth" also in Manchester. In addition, the Commission published its report of highlights of planetary science during the last three years of its activity.

The Commission also participated in discussions about the status of Pluto and in the creation of a Working Group on Extrasolar Planetary Systems. Commission participation in the WG for Planetary System Nomenclature and the WG on Cartographic Coordinates and Rotational Elements of Planets and Satellites continued as in previous years.

The President warmly thanked the members of the Organizing Committee for their very valuable help during her term, noting that they had been very responsive to her communications and requests.

The Commission elected new officers and a new Organizing Committee for 2000-2003. The following officers were elected:

D. Cruikshank (USA) as President

R. Courtin (France) as Vice-President

G. Consolmagno (Vatican) as Secretary.

Other members of the Organizing Committee elected are:

M. Belton (USA), C. Blanco (Italy), C. de Bergh (France), A. Coradini (Italy), L. Ksanfomalita (Russia), M. McGrath (USA), K. Noll (USA), T. Owen (USA), V. Tejfel (Kazakhstan), J. Spencer (USA).

A number of incoming IAU members have asked for membership in Commission 16. This list included : B. Bézard (France), F. Billebaud (France), G. Burba (Russia), Z. Dlugach (Ukraine), C. Ferrari (France), L. Lara (Spain), J. Luu (The Netherlands), J. Mihalov (USA), J. Spencer (USA), and A. Vidmachenko (Ukraine). It appeared that J. Luu's application had been sent to the wrong Commission. All other applications were accepted.

A few items of unfinished business were reported by the President. Specifically, she noted that attempts to set up a web page for Commission 16 in time for the Manchester

General Assembly had failed, although some preparatory work had been done some time before. Furthermore, she noted her regret that the list of electronic mail addresses of Commission members is incomplete. She expressed her wish that the next Executive Committee would complete work on these two matters.

At the request of the General Secretary of the IAU, the President solicited opinions about the publication of proceedings of Joint Discussions and Colloquia, as well as thoughts about the organization of Commissions and Divisions, and the composition of the IAU Executive Committee.

Catherine de Bergh
President of the Commission

COMMISSION 20: POSITIONS & MOTIONS OF MINOR PLANETS, COMETS & SATELLITES

(POSITIONS & MOUVEMENTS DES PETITES PLANETES, DES COMETES & DES SATELLITES)

PRESIDENT: H. Rickman

VICE-PRESIDENT: E.L.G. Bowell

ORGANIZING COMMITTEE: K. Aksnes, J.E. Arlot, A. Carusi, A. Lemaître, B.G. Marsden, V.A. Shor, G.B. Valsecchi, D.K. Yeomans, J.-X. Zhang

1. Introduction

This is the report of Commission 20 business meetings and associated WG meetings which took place on August 10, 14, 15, and 16, 2000 during the IAU General Assembly in Manchester (England).

The C20 meetings were chaired by H. Rickman (outgoing President). This report is based on notes taken by G.B. Valsecchi (incoming Vice-President), J.E. Arlot (Chair, WG on Natural Satellites) and E.L.G. Bowell (Chair, MPC & IAA Consultative Group).

2. 1st Business Meeting, August 10

The following list of new members was approved.

Piotr	Dybczyński	Poland
Brian	Fraser	South Africa
Anatoly	Kazantsev	Ukraine
Guangyu	Li	PR China
Robert	McMillan	USA
Mario	Melita	Argentina
Zdeňek	Moravec	Czech Republic
L'uboš	Neslusan	Slovak Republic
Petr	Pravec	Czech Republic
Rongchuan	Qiao	PR China
Isao	Sato	Japan
Grant	Stokes	USA
William	Thuillot	France
Janá	Tichá	Czech Republic
Gareth	Williams	USA
Qiang	Zhang	PR China

The following list of new consultants was approved.

Andrea	Boattini	Italy
Steven	Chesley	USA
Brett	Gladman	France
David	Jewitt	USA
Joel	Parker	USA
James	Rhode	USA
Timothy	Spahr	USA

A moment of silence was held in commemoration of the following deceased members.

Luis E.	da Silva Machado	Brazil
Martinez	de Pascual	Spain
Boris	Garfinkel	USA
Vladimir A.	Izvekov	Russia
Stanley M.	Milbourn	UK
Michèle	Moons	Belgium
Nathalie S.	Samojlowa-Jachontowa	Russia
Sergio	Vaghi	Netherlands

The following members, and functions, were approved for the new Organizing Committee of Commission 20.

Kaare	Aksnes	Norway	
Jean-Eudes	Arlot	France	WG Nat. Sat. Chair
Edward L.G.	Bowell	USA	C20 President
Andrea	Carusi	Italy	
Julio A.	Fernández	Uruguay	C20 Secretary
Anne	Lemaître	Belgium	
Brian G.	Marsden	USA	MPC Director
Hans	Rickman	Sweden	Past C20 President
Viktor A.	Shor	Russia	IAA Liaison
Giovanni B.	Valsecchi	Italy	C20 Vice-President
Donald K.	Yeomans	USA	2nd Past C20 President
Jia-Xiang	Zhang	PR. China	

A.W. Harris proposed that terms in the OC should last no longer than 6 years, to allow renewal of membership. The proposal was seconded.

J.E. Arlot reported on the activities of the WG on Natural Satellites in the past triennium. After discussion, it was decided to add G. Williams to the members of the WG to ensure liaison with the MPC, so the new membership is:

Kaare	Aksnes	Norway
Jean Eudes	Arlot	France, Chair
Carlo	Blanco	Italy
Nikolai V.	Emelianov	Russia
Robert A.	Jacobson	USA
Jay H.	Lieske	USA
Tsuko	Nakamura	Japan
Dan	Pascu	USA
Michel	Rapaport	France
P. Kenneth	Seidelmann	USA
Donald B.	Taylor	UK
Roberto	Vieira-Martins	Brazil
Gareth	Williams	USA

The following work description was approved for the WG on Natural Satellites.

The WG was created in 1973 and dedicated to the motions of the natural planetary satellites. A considerable work was made in order to build theories and ephemerides. In 1991, a resolution was taken by Commission 20 to create a Data Center gathering all the astrometric data on Natural Satellites.

At the present time, accurate ephemerides are available only for a part of the natural satellites. The data base NSDC provides a large amount of data for the ephemerides builders

and for the analysis of data. A work is still engaged to make available the data from the countries of the former Soviet Union (thanks to N. Emelianov who replaced V. Shor as member of the working group).

The present purposes of the working group are:

- to continue to feed and maintain the data base and to promote the observations of the natural planetary satellites (these objects are fast moving and observations are necessary to maintain the accuracy of the ephemerides);
- to promote the building of theories of motion (most of the newly discovered satellites have their motion modeled only as an ellipse with some precession added, which is not sufficient for accurate ephemerides).
- The natural planetary satellites are goals of space missions. They are also references for the observations of the planets. A purpose of the working group is to coordinate and encourage studies in that branch and to make available the data necessary for theoretical work and the construction of ephemerides.

G.B. Valsecchi reported on the last triennium of the WG on Comets. There has been practically no activity, so that the WG might be discontinued; however, given the rising importance of issues concerning distant Solar System objects of asteroidal appearance, and the obvious links that these objects have with comets, it is proposed to modify the name of the WG into 'Comets and Distant Objects', with new membership and charter. It is proposed that the new WG be chaired by B.G. Marsden.

The charter for the new WGCDO was discussed and with a few additions, the following wording was approved.

The WGCDO focuses on comets and objects in the outer Solar System; i.e., members of the Transneptunian Belt (a.k.a. as the Kuiper Belt and Edgeworth-Kuiper Belt), together with Centaurs and Scattered Disk Objects. Its tasks are:

- to advise on observational procedures regarding the distinction between low-activity comets and asteroids, and on extending the range of heliocentric distances where comets are observed;
- to advise on ways of improving knowledge of the distribution of orbits in the outer Solar System by augmenting the sample of distant objects with well-determined orbits and ensuring optimal treatment of the resulting data;
- to consider methodological issues concerning numerical modelling of the dynamics in the outer planetary region and of objects on unstable, planet-crossing orbits in general;
- to consider methodological issues concerning astrometric observations of distant objects, and to help in providing guidelines (in particular, to secure adequate follow-up observations of Transneptunian Objects);
- to advise the President of Commission 20 on related scientific and organizational matters, including the provision of an updated reference list to recent work on the C20 web page, and summaries for the triennial reports of the IAU Transactions;
- to reexamine procedures for predicting cometary magnitudes and to produce a set of absolute nuclear magnitudes for the numbered periodic comets; and

- to recommend terminology for the distant-object population and its subsets.

The following membership of the WG on Comets and Distant Objects was approved.

Michael F.	A'Hearn	USA
Mark	Bailey	UK
Alan	Gilmore	New Zealand
Brett	Gladman	France
Daniel	Green	USA
Syuzo	Isobe	Japan
David	Jewitt	USA
Brian G.	Marsden	USA, Chair
Karri	Muinsonen	Finland
Syuichi	Nakano	Japan
Joel	Parker	USA
Elizabeth	Roemer	USA
Grzegorz	Sitarski	Poland
Alan	Stern	USA
Gonzalo	Tancredi	Uruguay
Giovanni B.	Valsecchi	Italy
Christian	Veillet	France
Donald K.	Yeomans	USA

The WG was established for three years, with any possible extension beyond 2003 being considered only if there are both tangible results and a clear need for that extension.

B.G. Marsden presented the triennial MPC report. Finally, two scientific presentations were made: A.W. Harris (JPL) on 'The population of NEAs', and D. Tholen on 'Low elongation observations'.

3. Report of the MPC and IAA Consultative Group

The Consultative Group (hereafter CG) considered a broad range of scientific and operational issues affecting the Minor Planet Center (MPC) and Institute of Applied Astronomy (IAA) and the work they carry out on behalf of Commission 20.

Astrometry. Methods should be devised to quantify the uncertainty of submitted astrometric data of asteroids and comets. Now that star catalogs based on the high-accuracy Hipparcos reference frame are available, systematic astrometric errors can be reduced. Observers should use approved star catalogs. It may be possible to correct zonal position errors in previously published astrometric measurements.

Orbit computation. To the extent possible, orbit computation procedures should be standardized. For example, ephemerides and masses used for perturbing planets could be recommended by the MPC and adopted by orbit computers. The incorporation of relativistic effects for some asteroids is encouraged, as is data weighting. The CG is divided on the need to provide covariance matrices, useful for computing ephemeris uncertainties, along with orbital elements.

Photometry. It is important that astrometric observers learn to report accurate brightness measurements of asteroids and comets. Systematic errors in photometry affect diameter estimates and lead to erroneous size-frequency distributions. A dense, all-sky, multi-band stellar photometric reference catalog will soon be available. Observers must report brightness measurements in one of the standard bands, preferably *V* or *R*. A method of correcting systematic errors in previously published photometry of asteroids has already been devised; it should be kept up to date and used widely.

The role of amateurs. The CG recognizes the seminal contributions of amateur astronomers, especially in the provision of astrometry of newly discovered near-Earth aster-

oids (NEAs). However, most NEAs are over-observed, resulting in wasted effort on the part of amateurs. Ways to improve the coordination of amateur effort should be adopted.

The Institute of Applied Astronomy publishes the Ephemerides of Minor Planets (EMP) annually. The volume contains orbital elements, photometric parameters, and ephemerides of numbered asteroids. Because of the rapid increase in the numbered asteroid population, it is becoming increasingly difficult to publish the EMP in its established form (the 2001 volume is more than 5 cm thick). More seriously, the EMP's contents are incomplete even at the date of publication. The CG urges the IAA to move toward web-based and frequently updated dissemination of data on numbered asteroids.

Overview. The CG recognizes that a revolution in data acquisition and dissemination has been taking place over the past few years. Thus, it is no longer feasible to distribute paper products in a timely way, with the result that they have already largely been supplanted by machine-readable databases downloadable via the world wide web. Many asteroid- and comet-related databases are updated daily or even more frequently, a process that is bound to become more widespread in future. At the same time, methods of data analysis have been changing quickly, too, so it is becoming largely impractical to impose community-wide protocols by means of Commission resolutions, as was done in the past. Clearly, however, it is important to avoid confusion, to which end the CG urges that the methods used to create and maintain databases be well documented and published, preferably in the refereed literature. Quite a few of the tasks suggested by the CG require more effort than can be undertaken by busy Commission members. Perhaps students can be encouraged to take them on as thesis projects.

Edward Bowell

4. 2nd Business Meeting, August 14

E.L.G. Bowell presented the outcome of the meeting of the MPC/IAA CG (see above).

H. Rickman introduced the discussion of the MPC Terms of Reference, presenting the history and current status of the issue. B.G. Marsden proposed to adopt the ToR as they currently stand; this was approved. As a result, it was necessary to appoint members of the MPC Advisory Committee, as prescribed by the ToR.

Rickman proposed 6 members. The need was felt that, in addition, a member from Japan should be included; after some discussion, Y. Kozai was proposed.

The following membership was approved, noting that it will be possible to add one further member in the future, if needed.

Paul	Chodas	USA
Eleanor	Helin	USA
Yoshihide	Kozai	Japan
Petr	Pravec	Czech Republic
Viktor A.	Shor	Russia
Giovanni B.	Valsecchi	Italy, Chair
Richard	West	Denmark

Various issues regarding the MPC were discussed; no decisions were taken.

5. Session of the WG on Natural Satellites, August 15

J.E. Arlot gave some news from the Natural Satellite Data Center (NSDC) especially of the database designed to provide astrometric observations, theoretical models of the motions and ephemerides of the Natural Planetary Satellites through the Web server: <http://www.bdl.fr/nsdc.html>.

During the past triennium, the data base was mainly fed with old and recent observations made in the countries of the former SU thanks to N. Emelianov and not yet made available

to the astronomical community. Improvements have also been made to the ephemerides service. Projects are now to evaluate the accuracy of the observations and the precision of the ephemerides and also to provide a standard reduction procedure for the astrometric observations.

Activities and projects in some countries were also presented. D. Pascu, from USNO, reviewed the satellites observable from the ground and detailed the observations made at USNO. A. Andrei presented a report made by R. Vieira Martins from Rio de Janeiro. Most of the natural planetary satellites were observed with the LNA 1.6-m telescope and observations will be continued. R.A. Jacobson, from JPL, T. Nakamura from Japan and N. Emelianov from Moscow were not able to attend the GA and a report on their activities was provided to the participants: R.A. Jacobson reviewed the sources of the ephemerides used at JPL, T. Nakamura reported on the observations made at Kiso Observatory with a Schmidt telescope and on theoretical work on the motion of Nereid and N. Emelianov reported on the observations of satellites made in the observatories of the FSU. J.E. Arlot presented the activities in France: reduction and publication of the results of the campaigns of observation of the mutual events of the Saturnian satellites in 1995 and of the Galilean satellites in 1997 and of the astrometric observations of the outer satellites of Jupiter and Saturn; theoretical works on the satellites of Neptune N1, N2 and N3. G. Williams, from the MPC, who was coopted as a new member of the working group, gave information on the newly discovered satellite of Jupiter by Spacewatch: the object was first supposed to be a minor planet but the orbit appears to be Jovicentric instead of heliocentric. In order to help the observers of minor planets, the elements of the orbit were published under the MPC format.

At last, a discussion ensued around several questions:

- How to avoid that observations remain unpublished? Or published without any sufficient explanations on the observation technique and on the reduction procedure?
- J.E. Arlot invited the observers to avoid a reduction procedure using the ephemerides of the observed satellites themselves: it introduces biases in the scale and orientation of the field and the models fitted on these observations will have their accuracy degraded.

J.E. Arlot

6. 3rd Business Meeting, August 16

Various issues from the previous Business Meetings were completed (C20 membership, charter of WGCDO).

For the WGCDO, it was decided that one third of the membership of the WG should change in the next triennium, if the group is to continue. The current membership was approved.

Finally, there were four science presentations: A. Milani on 'Asteroid identifications', K. Muinonen on 'Initial orbital ranging and collision assessment for 1998OX₄', J. Tatum on 'Anserine pursuits', and J. Tichá on 'NEO astrometric follow-up program at Klet'.

H. Rickman
President of the Commission

COMMISSION 21: LIGHT OF THE NIGHT SKY (LUMIERE DU CIEL NOCTURNE)

PRESIDENT: Stuart Bowyer

VICE-PRESIDENT: Philippe Lamy

**ORGANIZING COMMITTEE: E. Dwek, B.Å.S. Gustafson, M. Hanner,
A.-C. Levasseur-Regourd, J. Mikhail, I. Mann, T. Mukai, T. Matsumoto**

The following is a report of the business meeting of our Commission. Unfortunately, the listing of the time for our business meeting was confusing. The number that appeared in the schedule (the number 1) for our meeting was not, in fact, a statement that the time of our meeting was at 1:00, as most people thought, but instead was a notation which was only explained in an entirely different publication and meant we were to meet at 8:00. In any case three members showed up for the meeting at 8 o'clock, and about 8 or 10 (including the President) showed up at 1:00.

The actions that were taken at the GA meeting were the following:

We first addressed the questions that I sent the membership asking for their opinions.

The first question was, "Should we limit terms on the Organizing Committee to three successive terms?" Almost 90% of the members responding voted yes on this issue and the members present at the meeting voted unanimously to approve this. We also adopted the resolution that one third of the Organizing Committee be replaced at each IAU assembly. It was pointed out that this is typical for most Commissions of the IAU.

Three quarters of the membership that responded to my query asking if a summary report rather than a full report for the IAU triennial publication was desirable replied this was desirable, and this was approved.

The Vice President, Philippe Lamy, moved to the Presidency, and the Past President, Stuart Bowyer, moved to a final term on the Organizing Committee as per standard IAU policies.

The Organizing Committee which had been published on our web-site was brought up for adoption. Adolph Witt expressed interest in serving on the Organizing Committee and he was unanimously approved. This resulted in an Organizing Committee which was one member larger than the nominal limit, but this was not regarded as a problem. Subsequent to the meeting, Mike A'Hearn, our Divisional Chair, stated that although it was not a problem that we had one extra person, it was a problem that we had too many US representatives. He suggested that Steve Price be asked to withdraw to provide an Organizing Committee which had less US representatives. This issue will have to be resolved by our next President and the IAU General Secretary.

The Commission 21 Organizing Committee adopted was the following (the year after the name is the year first appointed)

S. Bowyer	(USA) 1988	I. Mann	(Germany) 2000
E. Dwek	(USA) 1997	T. Mukai	(Japan) 1997
J.M. Greenberg	(Netherlands) 2000	S. Price	(USA) 2000
B. Gustafson	(USA) 1994	W. Reach	(USA) 2000
M. Harwit	(USA) 2000	A. Witt	(USA) 2000
R. Henry	(USA) 2000		

The election of the Vice President was then addressed. In addition to those people who had been nominated early on, and whose names had been posted on our web site for a vote by the membership, Tadashi Mukai was nominated by several people.

Martin Harwit had well over twice as many votes by the general membership as any other candidate (not surprising since he is very well known and was the Chief Organizer of our Commission sponsored Symposium at the IAU). Regretably, Dr. Harwit declined the nomination because of other pressing work. Dr Greenberg recieved almost as many votes as Dr. Harwit, and he was approved as our next Vice President.

A general discussion followed centered mainly on the topic of how our Commission could better serve the majority of our members, who are primarily interested in the Galactic and extra-Galactic background, rather than the Solar System background. This will be a challenge for our next President to address.

S. Bowyer
President of the Commission

COMMISSION 22: METEORS AND INTERPLANETARY DUST (*METEORES ET POUSSIERE INTERPLANETAIRE*)

PRESIDENT: William J. Baggaley

VICE-PRESIDENT: Vladimír Porubčan

ORGANIZING COMMITTEE: P.B. Babadzhanov, J. Borovička, W.G. Elford, I. Hasegawa, R.L. Hawkes, P. Jenniskens, J. Jones, I. Mann, P. Spurný, I. P. Williams

Business Meeting of Commission 22, August 11, 2000, at 14:00

Prof. Baggaley, president of the commission, was in the chair. Prof. Iwan Williams was elected secretary for the meeting.

Present: Asher, Babadzhanov, Baggaley, Elford, Hasegawa, Keay, Mann, Porubčan, Steel, Tatum, Tomita, Watanabe, Williams, Zhu.

Apologies: Hawkes, Jenniskens.

The meeting stood in silent tribute to: Beard, Bibarsov and Kaiser.

Report on commission activities (Baggaley). This had been on the Internet and was adopted without discussion.

Report of Pro-Am working group was distributed and adopted.

WGNEO, now a Division Working Group, would present its report on August 14th.

After some discussion - with all in support - the commission agreed that meteorites (presently under Commission 15) should be added to Commission 22's area with subsequent title change. This motion to be advised to Division 3 business meeting.

Four new members were elected subject to confirmation of election by IAU: Asher, Kokhirova, Nakamura, and Voloschuk. Three IAU members had indicated a desire to join Commission 22 and were elected, namely, Svoreň, Valsecchi, and Zhu. In addition any members affected by the proposed change in the areas of responsibility from Commissions 15 to 22 were also deemed to be transferred if they so wished. Consolmagno and Grady were particularly identified.

Thanks were expressed to Baggaley, Hawkes, Hasegawa, Elford, and Babadzhanov.

Elections: President - Porubčan; Vice-President - Mann; Secretary - Baggaley

Scientific Organising Committee: Porubčan, Mann, Baggaley, Borovička, Spurný, Jenniskens, Hawkes, Watanabe, Asher, Steel, Yano, Williams, Grady.

WG Pro-Am: The membership list specified in the working group report by its chair (Jenniskens) was discussed and adopted.

Consultants: Appropriate personnel to represent areas of expertise was discussed.

It was announced that a meeting "Meteors 2001" would be held in 2001 August 6-10 in Kiruna, Sweden. The chair announced that in future the triennial report could be of any length between 4 and 14 pages, not either 4 or 14 as specified in previous report.

The meeting concluded at 15:00.

W. J. Baggaley
President of the Commission

COMMISSION 51: BIOASTRONOMY: SEARCH FOR EXTRATERRESTRIAL LIFE

(BIOASTRONOMIE: RECHERCHE DE LA VIE EXTRATERRESTRE)

PRESIDENT: Stuart Bowyer

VICE-PRESIDENT: Stuart Bowyer

**ORGANIZING COMMITTEE: I. Almar, F. Colomb, F. Drake, J. Heidmann,
A. Leger, M. Mayor, T. Owen, W. Sullivan, J. Tarter, K. Wellington**

The following is a report of the Business Meeting of our Commission. The actions that were taken at the IAU meeting were the following:

The Commission 51 Organizing Committee which had been proposed was adopted (the year after the name is the year first appointed):

Fabrizio Capaccioni	(Italy) 2000	Michel Mayor	(Switzerland) 1997
Carlos Eiroa	(Spain) 2000	Karen Meech	(USA) 2000
William Hubbard	(USA) 2000	Ray Norris	(Australia) 2000
David Latham	(USA) 2000	Jill Tarter	(USA) 1988
Eduardo Martin	(USA) 2000		

The question of the location of the next bioastronomy conference was discussed. The only proposal received was from Professor Carol Oliver from the University of Western Sydney, MacArthur, who proposed the meeting be held at Hamilton Island, Australia. Fortunately, the proposal was outstanding and it was unanimously agreed to accept this invitation.

The question of rotation of the Organizing Committee membership was addressed. The membership agreed to a policy (which is in fact the policy of most of the Commissions of the IAU) that membership on the Committee will be for a maximum of 9 years with one third of the members being replaced at each General Assembly.

We were asked by Dr. Andersen, the General Secretary of the IAU, to resubmit our request that we change the name of Commission 51 to "Bioastronomy: Search for Extrasolar Planets and Extraterrestrial Life". We took this as a positive sign since we had been turned down when we had made this request earlier. Accordingly, we formally re-submitted this request and it appeared that all was well. However, at the Division 3 meeting which was to formally approve our name change, the incoming General Secretary announced that he was against this name change. This obviously affected a fair number of people who had to vote on this issue and we lost our request for a name change. It is not clear why we were asked to resubmit our request without being told that the incoming General Secretary was opposed to this change and would publicly oppose it.

The election of the Vice President was then addressed. Karen Meech, who was the only person who had been nominated for this position and whose name was listed on our web-site, was unanimously approved as our next Vice President.

S. Bowyer
President of the Commission

WORKING GROUP ON NEAR-EARTH OBJECTS

(GROUPE DE TRAVAIL POUR LES OBJETS PROCHES DE LA TERRE)

CHAIRPERSON: David Morrison

Minutes for WGNEO Meeting, IAU General Assembly, Manchester, UK, 14 August 2000

The meeting for the IAU Division III Working Group on Near-Earth Objects (WGNEO) convened in Roscoe 3.2 on the University of Manchester campus. David Morrison, Chairman, called the meeting to order at 16:00 and presented the agenda. These agenda items are indicated below by *.

***Report of Chair**

Morrison reviewed recent activities of the WGNEO. These included the Torino IMPACT meeting in June 1999 and community discussions of the lessons learned from recent episodes such as 1997 XF11 and 1999 AN10. Most importantly, the voluntary review policy for objects falling on the Torino Scale with a value of 1 or higher has been approved by the Executive Committee. This policy is appended to this report (APPENDIX A). Mike A'Hearn encouraged the committee to see that reports from this review process also give some indication, for each specific object, of the dates as to when the next set of critical observations capable of improving the collision prediction would be obtainable. The Working Group has had substantial interaction with and interest from the IAU General Secretary. An additional aspect of the working group has been to encourage discussion on proper public communication on impact hazards, including the Torino Scale, which is published in the refereed literature and is available for use on a voluntary basis.

Next meeting: The next meeting for the WGNEO was proposed to occur in Palermo during the "Piazzì" conference to be held 11–16 June, 2001. Contact: piazzì2001@alpha4.ct.astro.it

***Approval of the Organizing Committee (OC)**

Morrison proposed a list of 12 names, including three officers for the OC of the WGNEO. It was noted that any member of the IAU (or IAU Consultant) was welcome to join the WGNEO. Discussion ensued on the appropriate number of OC members and up to eight additional members were proposed. A'Hearn encouraged the group to achieve a broad perspective of experience within the OC, including members with expertise on risk analyses and public communication as well as NEO observers and dynamicists. No immediate consensus emerged on the OC membership issue. A halt was called to the discussion, which resumed at the end of the meeting.

***Report on the UK Spaceguard Program**

David Williams gave a brief background on a report expected to be released by the UK government in mid-September on their proposed program for Near-Earth objects. No details could be released at this time.

***Report on Spaceguard Foundation**

Andrea Carusi gave a report on the current status and goals for the Spaceguard Foundation.

***Survey Status**

Don Yeomans and Alan W. Harris (JPL) gave separate analyses on the status of the current survey efforts toward completing the Spaceguard Goal of 90% of all >1km NEOs within 10 years (by 2008). The consensus was that the clock began ticking with Congressional testimony by Carl Pilcher of NASA on May 21, 1998. Both Yeomans and Harris came to similar conclusions that the survey may be approaching one-half completion in number, but still requires many years toward completion due to an expected (but not yet seen) fall off in the rate of discovery.

***Collision Warning Times**

Syuzo Isobe gave a report on the nearing completion of the Japanese Spaceguard Survey telescope and offered to host an NEO observers meeting in Japan in the fall of 2001. Isobe also presented an analysis of likely collision warning times.

***European Space Missions**

Andrea Milani presented information on European Space Missions that are taking into account possible NEO detection or science goals that may be accomplished in conjunction with the primary mission for the spacecraft. He proposed that if space missions use the NEO impact hazard as part of their justification, we should ensure that they actually do contribute to NEO studies when they are launched.

***Approval of the Organizing Committee (OC)**

The meeting returned to the topic of the OC membership. A revised list was proposed consisting of 15 members, including three officers. This list was approved by a majority vote and is appended below (APPENDIX B).

***Discussion and Adjournment**

After a short discussion on the need to proceed cautiously with any NEO announcement, the meeting adjourned at 17:43.

Richard P. Binzel, Secretary, 2000 August 21

**APPENDIX A
VOLUNTARY REVIEW PROCEDURES FOR NEAR-EARTH OBJECT
IMPACT PREDICTIONS**

<http://www.ss.astro.umd.edu/IAU/div3/wgneo/TechComm.html>

The IAU, recognizing its responsibility to encourage timely and responsible communication with the public and the press concerning possible impact hazards, has established the following procedures to be available to the members of the astronomical community in case of discovery and/or theoretical analysis leading to the prediction of impacts.

The following IAU review procedure is available on a voluntary basis to all scientists involved in any prediction of possible NEO impacts. It is meant to apply to any prediction that is at level 1 or higher on the Torino scale of impact risk, a scale that runs from 0 to 10. A prediction of a possible impact at Torino level 0 is of such little significance that no such review is needed. Level 1 corresponds to events that are at least as probable as a random, unpredicted occurrence. Further details of the Torino scale are available at (<http://impact.arc.nasa.gov/torino/index.html>).

The information leading to an impact prediction, consisting of an evaluation of the case and all data and computational details necessary to understand and reproduce the studies carried out by the authors, should be transmitted for confidential review to the chair of the IAU Working Group for Near Earth Objects (WGNEO), the President of IAU Division III, and the General Secretary of the IAU, and the members of the NEO Technical Review Team (see below), before any announcement and/or written document on the subject be made public via any potentially nonprivate communication medium, including the World Wide Web. The individual members of the NEO Technical Review Committee members shall review the work for technical accuracy and shall communicate within 72 hours the results of their reviews to the chair of the WGNEO and directly to the authors of the report or manuscript.

If the consensus of the above review supports the conclusion that there is a significant impact risk, the results of this analysis will be posted on the IAU webpage at <http://www.iau.org/> for public access. If the review disagrees with the original analysis or if there is not a consensus among the reviewers, the confidential results of the review will be given to the authors so they can revise or improve their work, as they see fit. The news posted on the IAU webpage shall represent the official position of the IAU; no further information will be provided by the WGNEO, unless important updates become necessary.

The authors of the work are encouraged to refer the media to this IAU position if they choose to make a public release of their conclusions. If so requested officially (e.g., by NASA or ESA), the IAU will also inform the responsible officials of relevant agencies of the results of the WGNEO review.

The NEO technical review team consists of:

Paul Chodas *Paul.W.Chodas@jpl.nasa.gov*
Andrea Milani *milani@dm.unipi.it*
Karri Muinonen *Karri.Muinonen@Helsinki.Fi*
Giovanni Valsecchi *giovanni@ias.rm.cnr.it*
Don Yeomans *donald.k.yeomans@jpl.nasa.gov*

In addition, information copies are requested to be sent to

David Morrison *dmorrison@arc.nasa.gov*, Chair, WGNEO
Richard Binzel *rpb@mit.edu*, Secretary, WGNEO
Mikhail Marov *marov@applmat.msk.su*, President, IAU Division III
Brian Marsden *marsden@cfa.harvard.edu*, Director, Minor Planet Center
Hans Rickman *hans@astro.uu.se*, General Secretary, IAU

All the above agree to keep the prediction documentation confidential, and to honor the right of the author(s) of the discovery or prediction to publish the results and to make them public, at their discretion, and in the manner they choose.

APPENDIX B
ORGANIZING COMMITTEE OF THE WGNEO

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 Andrea Milani, Vice-Chairman *milani@dm.unipi.it*
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APPENDIX C
MEMBERSHIP OF THE WGNEO (INCLUDING OC)

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Chairperson of the Working Group

WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

*(GROUPE DE TRAVAIL POUR LA NOMENCLATURE DU SYSTEME
PLANETAIRE)*

PRESIDENT: Kaare Aksnes

MEMBERS: M. A'Hearn, M. E. Davies, C. de Bergh, M. Ya. Marov, B. G. Marsden, P. Moore, T. C. Owen, V. V. Shevchenko, B. A. Smith

CONSULTANTS: J. Blue, G. A. Burba, L. Gaddis, P. Masson

1. New organization and operation

The WGPSN held two sessions on 14 August 2000 during the 24th General Assembly in Manchester. The first session was held jointly with the Committee on Small Body Names (CSBN). The main issue was whether or not to join the two WG's into one WG. Although both deal with nomenclature of Solar system bodies, it was agreed that the modes of operation of the WG's are so different that nothing would be gained by joining them. Furthermore, the current membership rules ensure that at least two of the members belong to both WG's and can therefore serve as liaison between the groups.

In the second session, "Terms of Reference" which had been proposed for the WGPSN by the General Secretary in consultation with Division III and WGPSN, were discussed and found to be acceptable. The most important changes in the way that the WGPSN operates are that henceforth (i) the WG reports to Division III instead of to the Executive Committee, and (ii) the WG may release provisional names immediately upon approval by the WG, but these names are subject to final approval by a General Assembly.

The WGPSN has been criticised for having a poor international distribution of its members and for lacking young astronomers. The problem is that to serve on this WG, one should be well familiar with planetary spacecraft mapping which rather few nations are involved with. The nomenclature work also requires continuity which speaks for serving on the WG for several triennia. But there is a need for rejuvenation of the WG, and this will be achieved by bringing in more young members in the Task Groups from which the WG members are usually recruited.

2. Members of WGPSN for the triennium 2000 – 2003

PRESIDENT: K. Aksnes

MEMBERS: G. A. Burba, D. Cruikshank, M. E. Davies, M. Ya. Marov, B. G. Marsden, P. Moore, T. C. Owen, V. V. Shevchenko, B. A. Smith

CONSULTANTS: J. Blue, L. Gaddis, P. Masson

3. Changes to approved nomenclature 1997 – 2000

VENUS:

Add feature type *astrum/astra*: Radial-patterned features

Change *Drena* to *Dena*

Change *Vigier Lebrun* to *Vigée-Lebrun*

Change Zverine Chasma to Žverine Chasma
 Change Ludjatakó Mons to Ludjatakó Corona
 Change Niola Mons to Nijole Mons
 Change Hikuleo Tesseræ to Tushita Tesseræ (Hikuleo was a duplicate name, Hikuleo Fluctus).
 Change Citlalpul Valles to Citlalpul Vallis
 Change Kumsong Vallis to Kǔmsong Vallis
 Change Poranica Vallis to Poranica Valles
 Drop Lilinau Corona, Hariasa Linea, Vihansa Linea, Seshat Mons, Carrier Patera, and Woodhull Patera

MOON:

Change Armínski to Armińsky
 Change Bernouilli to Bernoulli
 Change Koval'skij to Koval'skiy
 Change Mackin-Ápollo to Mackin
 Change MacLauren to Maclauren
 Change Mohoróvič to Mohorovičić
 Change Niépce to Niepce
 Change Nüsl to Nušl
 Change Šafárik to Šafařik
 Change Shulejkin to Shuleykin
 Change Walter to Walther
 Change Widmanstátten to Widmannstátten
 Drop Vinogradov and Rimæ Hæse

MARS:

Change Páros to Paros

GANYMEDE:

Change Dendera Facula to Dendera (crater)

4. New nomenclature 1997 – 2000

NAME	LAT	LON	DIAM (km)	DESCRIPTION
VENUS				
CRATERS				
Batten	15.2N	217.4E	65.0	Jean; New Zealand aviatrix (1909–1982).
Blanche	9.3S	157.0E	12.3	French first name.
Clara	37.5S	235.3E	3.2	First name from Latin.
Dena	20.7S	337.7E	2.4	Bulgarian first name (changed from Drena).
Dheepa	21.6S	176.3E	4.7	First name from India.
Hamuda	62.9N	2.5E	15.8	Hebrew first name.
Jasmin	15.6N	61.6E	15.1	Arabic first name.
Leona	3.1S	169.0E	3.0	Greek first name.

NAME	LAT	Lon	DIAM (km)	DESCRIPTION
VENUS (cont.)				
CRATERS				
Nanichi	44.8S	337.8E	19.0	Taino (Puerto Rico) first name.
Nuriet	20.6N	245.6E	17.9	Adygan (N. Caucasus) first name.
Oma	42.7S	329.1E	7.6	Sioux first name.
Polenova	45.5S	335.5E	41.0	Elena; Russian painter, folk crafts trustee (1850-1898).
Romola	9.3N	54.2E	17.5	Italian first name.
Saodat	2.9S	344.6E	3.7	Uzbek first name.
Shirley	31.5N	55.4E	18.0	English first name.
Solace	35.9N	317.2E	5.3	Latin first name.
Sovadi	44.8S	225.5E	12.4	Khmer (Cambodia) first name.
CHASMATA				
Dewi Ratih Chasma	6.5S	359.7E	1000.0	Bali (Indonesia) moon goddess.
Rabie Chasma	10.5S	267.0E	950.0	Wemale (E. Indonesia) moon goddess.
COLLES				
Migazesh Colles	49.0S	198.0E	230.0	Adygan (N. Caucasus) daughter of sea goddess.
CORONAE				
Asomama Corona	23.3N	21.6E	180.0	Quechua potato goddess.
Branwen Corona	27.0N	35.0E	320.0	British goddess of love.
Changko Corona	10.9N	6.2E	200.0	Kachin (Burma/Myanmar) mother of all humans.
Chuku Corona	23.5S	265.5E	380.0	Igbo (Nigeria) creator goddess.
Dilga Corona	18.7S	250.4E	220.0	Karadjeri (NW Australia) Earth goddess.
Ixcuina Corona	47.5S	207.5E	150.0	Aztec Earth & fertility goddess.
Kapenopfu Corona	21.7S	271.0E	200.0	Angami-Naga (Burma/Myanmar) creator goddess.
Khabuchi Corona	11.0S	173.0E	285.0	Avarian/Andalalan (Daghestan) childbirth deity.
Lalohonua Corona	24.0S	250.5E	460.0	The first woman in Hawaiian mythology.
Ludjatakona Corona	12.5S	250.5E	300.0	Creek (SE USA) giant turtle deity. Name changed from Ludjatakona Mons.
Masateotl Corona	53.0S	244.0E	180.0	Aztec goddess of love & fertility.
Mirizir Corona	66.4S	185.0E	70.0	Kassitan (Babylonia) Earth & fertility goddess.
Miti Corona	3.5S	259.8E	180.0	Koryak & Itelmen (Kamchatka) the Raven's (world creator) wife.
Nanen Corona	69.9N	198.5E	50.0	Brazilian Earth & nature goddess.
Nang Pao Corona	47.0S	204.5E	160.0	Laotian goddess of rice.

148 WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

NAME	LAT	Lon	DIAM (km)	DESCRIPTION
VENUS (cont.)				
CORONAE				
Nirmali Corona	6.3S	172.3E	60.0	Nuristan (NE Afghanistan) childbirth goddess.
Persephone Corona	36.0S	304.6E	120.0	Greek underworld goddess, daughter of corn goddess Demeter.
Rabzhima Corona	4.9N	11.0E	100.0	Tibetan great mother goddess.
Samdzimari Corona	11.0S	339.5E	260.0	Georgian (Caucasus) abundance deity.
Sulis Corona	44.3N	14.2E	136.0	British goddess of springs & healing waters.
Sus-Khotin Corona	54.0S	241.0E	110.0	Tajik & Uzbek fertility & rain goddess.
Tunehakwe Corona	33.4S	303.6E	290.0	Onondaga/Iroquois deities of crops ("The Three Sisters").
Whatitiri Corona	83.0S	140.0E	300.0	Maori ancestor goddess, great mother.
Zaramama Corona	22.0S	240.5E	240.0	Quechua (Peru) maize deity.
DORSA				
Arev Dorsa	52.0S	216.0E	420.0	Armenian female solar deity.
Dudumitsa Dorsa	13.5S	358.0E	980.0	Bulgarian rain deity.
Menkerot Dorsa	20.0S	351.5E	770.0	Ancient Egyptian goddess, mother of the sun.
Nichka Dorsa	10.0S	354.0E	550.0	Ukrainian night deity.
Odzerchen Dorsa	72.0S	152.0E	300.0	Tibetan goddess of boundless light.
Vetsorgo Dorsum	6.5S	163.0E	700.0	Mordovian/Erzya (Volga Finn) daughter of the supreme sky god Nishke.
FLUCTUS				
Ilaheva Fluctus	42.5S	84.0E	900.0	Tonga (Polynesia) worm goddess.
Kaapaau Fluctus	66.5S	181.0E	350.0	Polynesian goddess of sharks.
Kasogonaga Fluctus	18.0S	268.0E	850.0	Chaco tribes/Guarani (Argentina) female rain spirit.
Kunkubey Fluctus	50.0S	207.0E	350.0	Yakutian/Sakha goddess, wife of supreme god Yuryung.
Merisa Fluctus	20.5N	9.0E	630.0	Adygan (N. Caucasus) beekeeping goddess.
Mert Fluctus	50.5S	230.5E	250.0	Egyptian goddess of music & singing.
Mortim-Ekva Fluctus	1.0N	334.0E	1250.0	Mansi (Ob River Ugra) mistress of "Bird's country".
Naunet Fluctus	81.0S	136.0E	200.0	Ancient Egyptian (Heliopolis) sky goddess.

NAME	LAT	LOH	DIAM (km)	DESCRIPTION
VENUS (cont.)				
FLUCTUS				
Ney-Anki Fluctus	37.0S	105.0E	950.0	Khanty (Ob River Ugra) mother of fire.
Oilule Fluctus	22.0S	79.0E	900.0	West Bulgarian wife of thunder god.
Syvne Fluctus	36.0S	72.0E	900.0	Nenets (Samoyed) winter maiden.
Vut-Ami Fluctus	38.0S	67.0E	1300.0	Chuvash (Volga Region) fire goddess.
Yagami Fluctus	80.6S	152.0E	260.0	Japanese goddess, bride of god O-kuninusi.
FOSSAE				
Namjyalma Fossae	2.5N	2.7E	560.0	Tibetan victorious mother.
Zheztyrnak Fossae	67.5S	182.0E	180.0	Kazakh evil deity, "copper claw" maiden.
LABYRINTHUS				
Radunitsa				
Labyrinthus	8.9S	351.3E	100.0	Ancient Slavic goddess, keeper of souls of the deceased.
MONS				
Spandarmat Mons	16.5S	255.0E	400.0	Iranian mother goddess.
PATERAE				
Bers Patera	66.7S	183.0E	17.0	Sofya Andreyevna (Tolstaya); wife & copyist for Leo Tolstoy (1844-1919).
Mezrina Patera	33.3S	68.8E	60.0	Anna; Russian clay toy sculptor (1853-1938).
Tenisheva Patera	1.4S	254.8E	80.0	Mariya; Russian painter & art collector (1867-1928).
Viardot Patera	7.0S	254.3E	55.0	(Viardot-Garcia) Pauline; French singer & composer (1821-1910).
Wilde Patera	21.3S	266.3E	75.0	Lady Jane Francesca; Irish poet (1821-1891).
REGIO				
Laufey Regio	7.0N	315.0E	2100.0	Norse giantess.
TESSERAE				
Tushita Tesserae	42.0S	54.0E	1400.0	Hindu deity of resignation to fate. Name changed from Hikuleo Tesserae.
THOLI				
Dröl-ma Tholus	24.2N	6.3E	40.0	Tibetan goddess of compassion.
Grechukha Tholi	8.6S	255.8E	200.0	Ukrainian field deity.
Narina Tholi	25.8S	80.0E	55.0	Australian wild bird goddess.
Neegyauks Tholus	68.6S	200.0E	30.0	Tlingit (SE Alaska) volcano woman & frog princess.
Norterma Tholus	77.0S	188.0E	15.0	Tibetan wealth-giving goddess.

150 WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

NAME	LAT	LON	DIAM (km)	DESCRIPTION
VENUS (cont.)				
THOLI				
Padma Tholi	34.7S	68.3E	100.0	Hindu lotus goddess.
Perynya Tholus	0.7S	353.2E	110.0	Slavic goddess, wife of thunderstorm god Perun.
Rosna Tholi	25.5S	73.3E	130.0	Chimalateco/Chinanteco (Mexico) mountain goddess.
Shamiram Tholus	6.9S	335.2E	10.0	Armenian goddess of love.
Sumerla Tholi	13.8S	252.2E	90.0	E. Slavic underworld goddess.
Turi Tholus	66.9S	222.3E	15.0	Polynesian goddess, created islands' relief.
Yurt-Ava Tholus	13.8S	341.5E	15.0	Mordovian (Volga Finn) "home's mother" deity.
VALLES				
Ahsabkab Vallis	24.0S	79.0E	700.0	Mayan name for morning Venus.
Alajen Vallis	3.3S	337.1E	200.0	Talysh (Caspian Sea, SW coast) river deity.
Bastryk Vallis	7.5S	347.5E	190.0	Kumyk (Daghestan) river deity.
Dilbat Vallis	55.0S	184.0E	420.0	Assyro-Babylonian name for planet Venus.
Fara Vallis	1.2S	345.5E	260.0	Malagasy (Madagascar) water goddess.
Kimtinh Vallis	46.5S	67.0E	550.0	Vietnamese word for planet Venus.
Laidamlulum Vallis	73.0S	151.0E	2700.0	Maidu (California) name for morning Venus.
Nommo Valles	40.7S	87.3E	200.0	Dogon (Mali) water deities.
Vesper Vallis	59.3S	180.0E	610.0	Latin name for evening Venus.
MOON				
CRATERS				
Bliss	53.0N	13.5W	30.0	Nathaniel; English Astronomer Royal, (1700-1764)
Debus	10.5S	99.6E	20.0	Kurt Heinrich; German physicist (1908-1983).
de Gerlache	88.5S	87.1W	32.4	Adrien; Belgian Antarctic explorer (1866-1934).
Harlan	38.5S	79.5E	65.0	Harlan J. Smith; American astronomer (1924-1991).
Shoemaker	88.1S	44.9E	50.9	Eugene Merle; American astrogeologist (1928-1997).

NAME	LAT	Lon	DIAM (km)	DESCRIPTION
MOON (cont.)				
CRATERS				
Sverdrup	88.5S	152.0W	35.0	Otto; Norwegian polar explorer (1855-1930).
MARS				
CRATERS				
de Vaucouleurs	13.5S	189.2W	275.0	Gerard Henri; American astronomer (1918-1995).
McMurdo	84.4S	359.0W	17.0	American station in Antarctica.
Palos	2.6S	249.3W	55.0	Town in Spain.
Rahe	25.2N	97.4W	32.8	Jurgen; American astronomer & NASA program director (1940-1997).
Sagan	11.0N	31.0W	95.0	Carl E.; American astronomer (1934-1996).
Tuscaloosa	0.0N	331.4W	60.0	Town in Alabama, USA.
COLLES				
Acidalia Colles	50.6N	23.5W	360.0	From classical albedo feature name.
FOSSAE				
Gordii Fossae	15.0N	128.5W	350.0	From classical albedo feature name.
MENSA				
Acidalia Mensa	47.2N	25.4W	225.0	From classical albedo feature name.
VALLES				
Tinto Vallis	4.2S	248.7W	150.0	River in Spain.
Verde Vallis	0.4S	330.2W	95.0	River in Arizona, USA.
(253) MATHILDE				
CRATERS				
Aachen	9.2N	60.9W	4.8	German coal basin.
Baganur	14.6N	191.6W	16.4	Mongolian coal basin.
Benham	19.0N	247.2W	2.2	Coal mine in Kentucky, USA.
Clackmannan	18.9N	260.8W	2.8	Scottish coal basin.
Damodar	73.0N	263.8W	28.7	Largest Indian coal basin.
Enugu	15.3S	151.6W	5.9	Nigerian coal field.
Ishikari	66.2S	186.9W	29.3	Largest Japanese coal field.
Jerada	42.1N	177.3W	2.5	Largest Moroccan coal basin.

152 WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

NAME	LAT	LON	DIAM (km)	DESCRIPTION
(253) MATHILDE (cont.)				
CRATERS				
Jixi	12.3S	256.5W	19.9	Chinese coal basin.
Kalimantan	7.7S	123.7W	2.7	Coal field on Borneo, Indonesia.
Karoo	33.5N	98.4W	33.4	South African coal basin.
Kuznetsk	45.9S	88.9W	28.5	Russian coal basin.
Lorraine	48.1N	142.5W	4.1	Largest French coal basin.
Lublin	55.3N	156.8W	6.5	Polish coal basin.
Maritsa	44.6N	151.5W	2.4	Bulgarian coal field.
Matanuska	27.3N	217.3W	2.9	Alaskan coal field, USA.
Mulgildie	57.7N	176.1W	2.5	Australian coal basin.
Oaxaca	38.7N	186.3W	5.2	Mexican coal fields.
Otago	23.7N	164.5W	7.9	Largest New Zealand coal field.
Quetta	45.6N	165.5W	3.2	Pakistani coal field.
Similkameen	13.5S	104.7W	3.4	Canadian coal field.
Teruel	28.1S	142.7W	7.6	Spanish coal field.
Zulia	39.5S	30.9W	12.3	Largest Venezuelan coal field.
IO				
CATENA				
Tvashtar Catena	62.8N	123.0W	290.0	Indian sun god & smith who forged the thunderbolt of the thunder god Indra.
FLUCTUS				
Arinna Fluctus	31.4N	149.3W	120.0	Hittite sun goddess.
Donar Fluctus	21.8N	187.3W	250.0	Teutonic god of thunder.
Lei-zi Fluctus	14.7N	45.0W	365.0	Chinese goddess of thunder.
MENSAE				
Capaneus Mensa	16.0S	121.0W	290.0	The great blasphemer in Dante's "The Inferno."
Telegonus Mensae	53.0S	115.0W	325.0	Egyptian king whom Io married.
MONTES				
Hi'iaka Montes	5.0S	80.0W	390.0	Sister of Hawaiian volcano goddess Pele.
Mongibello Mons	22.3N	66.6W	180.0	Name for Mt. Etna, site of Vulcan's forge in Dante's "The Inferno." Thunderbolts from here killed Capaneus, the great blasphemer.
Ot Mons	4.3N	216.0W	165.0	Mongolian fire & marriage goddess.
Seth Mons	10.6S	134.0W	140.0	Egyptian thunder god.

NAME	LAT	LON	DIAM (km)	DESCRIPTION
IO (cont.)				
MONTES				
Shamshu Mons	12.0S	71.0W	170.0	Arabian sun goddess.
Zal Montes	37.5N	76.3W	422.0	Iranian sun god.
PATERAE				
Belenus Patera	2.9N	157.7W	30.0	Celtic fire & sun god.
Camaxtli Patera	16.0N	137.0W	80.0	Aztec thunder, tornado, & war god.
Chaac Patera	11.0N	158.0W	95.0	Mayan thunder & rain god.
Cuchi Patera	1.0S	145.0W	70.0	Australian snake demon whose growl is thunder.
Ekhi Patera	28.0S	88.0W	55.0	Basque sun goddess.
Gabija Patera	52.0S	203.0W	70.0	Lithuanian fire & household goddess.
Girru Patera	22.0N	240.0W	70.0	Babylonian fire god.
Haokah Patera	20.9S	186.7W	65.0	Sioux thunder god.
Itzamna Patera	16.0S	99.0W	150.0	Mayan sun, sky, wind & rain god.
Kami-Nari Patera	8.0S	234.0W	60.0	Japanese god of rolling thunder.
Kinich Ahau Patera	49.0N	311.0W	90.0	Mayan sun god.
Namarrkun Patera	10.5N	177.0W	100.0	Aboriginal god who made lightning & thunder by striking clouds with stone axes attached to his elbows & knees.
Ot Patera	1.0S	218.0W	55.0	Mongolian fire & marriage goddess.
Savitr Patera	48.0N	123.0W	155.0	Hindu sun god.
Seth Patera	5.0S	131.0W	70.0	Egyptian thunder god.
Shango Patera	32.0N	100.0W	110.0	Yoruba thunder god.
Surya Patera	22.5N	151.0W	130.0	Hindu sun god.
Susanoo Patera	22.0N	220.0W	65.0	Japanese storm & thunder god.
Tawhaki Patera	3.6N	76.0W	60.0	Maori lightning god.
Wayland Patera	32.0S	226.0W	85.0	Anglo-Saxon legendary smith.
EUROPA				
CRATERS				
Áine	43.0S	177.0W	5.0	Celtic goddess of love & fertility.
Amergin	14.0S	230.0W	17.0	Legendary Irish druid & poet.
Angus	13.0S	74.0W	4.5	Beautiful Celtic god of love.
Avagddu	1.2N	170.0W	8.0	Celtic storm deity, ill-fated son of Tegid the Bald.
Balor	53.0S	94.0W	4.6	Celtic god of the night whose evil eye caused the death of those on whom it glanced.

154 WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

NAME	LAT	LOX	DIAM (km)	DESCRIPTION
EUROPA (cont.)				
CRATERS				
Brigid	11.0N	80.0W	9.0	Celtic goddess of healing, smiths, fertility & poetry.
Camulus	27.0S	79.0W	4.7	Gaelic war god.
Clíodhna	3.0S	75.0W	3.0	Celtic goddess of beauty who was lured asleep by music, then swept away by a great wave.
Cormac	37.0S	86.0W	4.0	Cormac Mac Art, High King of Ulster in Irish myths.
Deirdre	65.0S	208.0W	4.3	The most beautiful woman in Irish myths.
Diarmuid	61.0S	97.0W	8.0	Handsomen Irish mythological warrior, husband of Grainne.
Dylan	55.0S	82.0W	5.2	Celtic sea god.
Elathan	31.6S	78.0W	2.6	Celtic king, father of sun god Bres.
Gráinne	60.0S	95.0W	13.0	Daughter of mythical King of Ulster.
Gwydion	61.0S	79.0W	4.8	Celtic poet, one of the children of the mother goddess Don.
Llyr	1.7S	221.5W	1.1	Celtic sea god.
Mael Dúin	17.0S	197.9W	2.0	Celtic hero.
Maeve	58.0N	75.0W	18.0	Mythological Irish queen of Connacht province.
Math	26.0S	183.0W	14.0	Celtic god of wealth & treasure.
Niamh	21.0N	217.0W	5.0	Golden-haired daughter of the Celtic sea & fertility god Manannan.
Oisín	52.0S	214.0W	6.0	Mythical Irish warrior.
Pryderi	66.0S	159.0W	1.7	Son of Pwyll, Celtic god of the underworld.
Uaithne	49.0S	88.0W	6.5	The harpist for Dagda, the father of all gods in Celtic myths.
LINEAE				
Androgeos Linea	12.8N	278.8W	645.0	Son of Minos in Greek mythology.
Autonoë Linea	17.0N	164.5W	1340.0	Daughter of Cadmus in Gr. mythology.
Katreus Linea	39.5S	215.5W	245.0	Son of Minos in Greek mythology.
Onga Linea	38.8S	209.6W	806.0	Phoenician name for Athene.
GANYMEDE				
CRATERS				
Anzu	62.9N	61.6W	200.0	Gigantic lion-headed bird-like figure, the Sumerian Thunderbird.

NAME	LAT	LON	DIAM (km)	DESCRIPTION
GANYMEDE (cont.)				
CRATERS				
Apophis	8.0S	275.9W	65.0	Egyptian gigantic serpent symbolizing chaos or nonexistence.
Atra-hasis	22.3N	254.0W	140.0	'Exceedingly wise' hero of Akkadian myth, survived the great flood.
Dendera	1.1S	255.3W	80.0	Town where Hathor was chief goddess. (Name changed from Dendera Facula.)
Harakhtes	36.0N	99.8W	115.0	"Horus of the Two Horizons", form of Egyptian god Horus who represents the path of the sun.
Haroeris	28.3N	297.1W	70.0	Egyptian sky god whose eyes are the sun & the moon, a form of Horus.
Hedetet	32.9S	251.0W	110.0	Egyptian scorpion goddess.
Hershef	47.1N	268.8W	120.0	Egyptian ram-headed god.
Humbaba	55.4S	67.4W	40.0	Babylonian terrifying guardian of the cedar forests.
Lagamal	64.2N	243.3W	145.0	Son of Babylonian god Ea.
Nah-Hunte	17.8S	85.2W	45.0	Elamite god of light & justice.
Tashmetum	39.7S	264.4W	155.0	Assyro-Babylonian goddess who invented writing with her husband Nabu.
We-ila	12.6S	290.1W	45.0	Akkadian god from whom the hero Atra-hasis was created.
Wepwawet	70.2S	60.2W	90.0	Ancient Egyptian jackal deity.
CATENA				
Terah Catena	6.9N	276.9W	295.0	Phoenician moon god who battled with Keret in Negeb.
FACULA				
Bigeh Facula	28.8N	94.1W	235.0	Island where Hapi, Egyptian Nile god, resided.
SULCI				
Larsa Sulcus	4.0N	250.0W	1200.0	Sumerian town.
Shuruppak Sulcus	20.0S	232.0W	2800.0	Assyro-Babylonian town on the banks of the Euphrates River where the gods planned the great flood.
Umma Sulcus	5.0N	252.0W	1400.0	Sumerian town.

156 WORKING GROUP ON PLANETARY SYSTEM NOMENCLATURE (WGPSN)

NAME	LAT	LON	DIAM (km)	DESCRIPTION
CALLISTO				
CRATER				
Heimdall	64.0S	357.0W	345.0	God of light, guardian of the great bridge Bifr\ost in Norse mythology.
LARGE RING FEATURE				
Utgard	45.0N	134.0W	610.0	Home of giants in Norse mythology.
THEBE				
CRATER				
Zethus	10.0N	175.0W	40.0	Husband of Thebe in Greek myths.
PHOEBE				
REGIO				
Leto Regio	60.0N	20.0W	95.0	Daughter of Phoebe in Greek mythology.
SATELLITES OF URANUS				
S/1997 U1 = Uranus XVI	=	Caliban		Slave in Shakespeare's 'The Tempest'
S/1997 U2 = Uranus XVII	=	Sycorax		Caliban's mother in Shakespeare's 'The Tempest'.
S/1999 U3 = Uranus XVIII	=	Prospero		Duke in Shakespeare's 'The Tempest'.
S/1999 U1 = Uranus XIX	=	Setebos		Character in Shakespeare's 'The Tempest'.
S/1999 U2 = Uranus XX	=	Stephano		Butler in Shakespeare's 'The Tempest'
SATELLITE OF (45) EUGENIA				
S/1998(45)1 = Petit Prince				Main character in Saint-Exupery's 'Petit Prince'.

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