16. COMMISSION POUR L'ETUDE PHYSIQUE DES PLANETES ET DES SATELLITES

PRESIDENT : R. Wildt.
SECRETARY: J.H. Focas.

Commission 16 met at Prague during the following Sessions.
Administrative Session I: General business, resolutions, invited papers.
Administrative Session II: Activities of the Committee 'International Cooperation for The Observation of Planets'.
Administrative Session III: Martian nomenclature.
Scientific Session I: Communications on Venus, Mars, Jupiter.
Scientific Session II: Communications on Venus, Mars, Jupiter.

Administrative Session I

The President announces the death of the following members of the Commission:

Dr B.M. Peek, he was one among the most distinguished visual observers of Jupiter. His extensive work is summarized in his classical book *Jupiter* published in 1958.

Professor V.V. Sharonov; he was a great pioneer in the physical study of the planets, by photometry, colorimetry and comparative laboratory investigations on terrestrial substances.

The Draft report was accepted with no modifications.

Resolutions: At the request of *Dr G. de Vaucouleurs*, the following Resolution was accepted by the Commission:

Resolution 1—'Commission 16 recommends that the revised Physical Ephemeris of Mars by V. Meiller in U.S. Naval Observatory Circular N° 98, 1964, the basis of which was explained by G. de Vaucouleurs in *Icarus*, **3**, 236, 1964, be recommended for adoption in the National Ephemerides and that it should be used henceforth by all concerned with Martian Mapping and exploration'.

Résolution 1—'La Commission 16 recommande que les 'Physical Ephemeris' de Mars révisées par V. Meiller dans la Circulaire N° 98, 1964 du Naval Observatory, dont la base a été expliquée par G. de Vaucouleurs dans *Icarus*, **3**, 236, 1964, soient recommandées pour adoption dans les "National Ephemerides" et utilisées dorénavant par toute personne concernée en cartographie Martienne et exploration'.

At the request of *Dr A. Dollfus*, President of the Committee 'International Cooperation for the Observation of Planets', the following Resolution was accepted by the Commission:

Résolution 2—'La Commission 16 demande le renouvellement de la subvention de \$2000 pour 3 ans, destinée à faciliter le fonctionnement des centres de Données sur les Planètes et l'étude par des astronomes de visite, des clichés qui y sont groupés'.

Resolution 2—'Commission 16 asks for the renewal of the subvention of \$2000 for 3 years, destined to facilitate the functioning of the Planetary Data Centers and the study, by visiting astronomers, of the photographic documents collected'.

INVITED DISCUSSIONS

Report on Mariner-Mars Television Experiment
R.B. Leighton

The pictorial data from the Mariner IV television experiment, corrected for (1) the intensity and spectral transfer characteristics of the camera system, (2) the geometric distortions due to non-linear TV line-scan, (3) the modulation transfer function of the camera, and (4) scattered light, are presented.

The resulting pictures show more than 300 craters and an additional 300 possible craters, as compared with less than 100 identified in the preliminary pictures previously published. The principal processes that modify martian surface relief are suggested to be meteoroidal pelting and rubble mantling, covering by wind-blown dust, and thermal creep of loose surface debris. Crater wall slopes up to 12° were found. Large scale (10 km) slopes and albedo fluctuations, measured statistically, are found to be 3° rms and 2% rms, respectively.

Spectres infrarouges planétaires et stellaires par spectroscopie de Fourier
J. et P. Connes

Le principe de la spectroscopie par transformation de Fourier est dû à Michelson mais ses avantages actuels du point de vue du rapport signal sur bruit n'ont été établis que récemment par Felgett et Jacquinot.

Les principales difficultés techniques ont été résolués au cours d'un programme poursuivi en collaboration avec le Jet Propulsion Laboratory, de Pasadena (Californie).

Des spectres de Vénus, Mars, Jupiter et quelques étoiles froides ont été obtenus entre 1 et 2,5 μ. Le gain de résolution par rapport aux meilleurs spectres existant préalablement est égal ou supérieur à 100. Les résultats déjà acquis comprennent la détection de CO sur Mars et Vénus et celle de HCl et HF sur Vénus; ils sont exposés dans 3 Articles déjà parus: *JOSA*, **56,** 896, 1966; *Astrophys. J.* **147,** N° 3, 1230, 1967; et *J. Phys.* **28,** C2, 120, 1967. Leur extension nécessite—et justifie—la réalisation de grands collecteurs de lumière spécialisés pour ce travail. La construction d'un prototype a été entreprise à Bellevue.

Administrative Session II

Dr A. Dollfus, President of the Committee 'International Cooperation for the Observation of Planets' points out that this Committee has two purposes: (1) to organize programs of planetary observations on an international scale, (2) to coordinate the work of the two Planetary Data Centers. The general outline of the programs developed as above and the most part of the results obtained, are given in Part A. of these Proceedings (Comm. 16) Supplementary data having reached the Committee and the Data Centers after release of the Draft Report, are given in the following.

The President invites Dr W. Baum, Director of the Lowell Data Center, and Dr J. H. Focas, Director of the Meudon Data Center, to make a restatement on the development and activities of the two centers since 1964.

W. A. Baum: In accordance with a resolution passed by the IAU Executive Committee at Berkeley in 1961, a center for the collection of Planetary photographs and planetary data has been established at Lowell Observatory. The construction and operation of this new Center has been generously supported by the National Aeronautics and Space Administration. Astronomers wishing to use these facilities should communicate with the director, Dr William A. Baum, Planetary Research Center, Lowell Observatory, Flagstaff, Arizona 86001, USA.

Equipment at the Flagstaff Center includes modern darkrooms with automatic control of water temperature, an automatic film-processing machine, an IBM 1130 electronic computer, a laboratory for the design and construction of electronic instruments, and various instruments for the assessment of planetary observations.

The first undertaking of the Planetary Research Center was to organize and catalogue the large collection of planetary photographs obtained at Lowell Observatory during the past 60 years. This collection includes about 10000 plates and films with more than 300000 planet images. Historical collections from several other observatories, including Lick Observatory, have also been copied and catalogued. Duplicates of everything are being supplied to the Meudon Center. As of August 1967, about 6700 film copies (two from each original plate) have been sent from Flagstaff to Meudon. About 1270 of these were made from composites, while the rest were contact copies.

The Flagstaff Center has also received and catalogued the following planetary film copies (two from each original) produced by other NASA-supported observatories and by the Meudon Center:

Meudon Center Composites	776
New Mexico State University	1974
Table Mountain Observatory	762

The photographic observation of the planets at Lowell Observatory is being continued by the staff of the Planetary Research Center, using a new electronically controlled 35-mm film camera that takes 30-cm-long filmstrips in place of the array of images formerly distributed on a photographic plate. More than 500 filmstrips of Mars were obtained in various colors on 85 nights in 1967 with the 24-inch Lowell refractor. Films were calibrated with a new sector-disk sensitometer designed at the Center. Work is in progress on a more sophisticated planet camera that utilizes a two-stage image-converter tube with magnetic deflection coils to compensate rapidly for the turbulent motions of a planet image due to atmospheric disturbances.

Another portion of the work of the Flagstaff Center is the systematic study of the Lowell plate collection. This work currently includes a statistical analysis of the distribution of cloudiness on Mars, and it is supported in part by the Jet Propulsion Laboratory. A special optical projector was designed and built for such studies in order that planet images can be superimposed optically with a coordinate reticle. Areas of Mars where surface features are obscured can thus be identified, coded, and recorded on IBM cards. Computer programs have been written for mapping cloudiness indices and for sorting out seasonal and diurnal effects.

Much of the effort of the Flagstaff Center is devoted to the design and construction of optical and electronic instruments for making physical observations of the planets. One of the recently completed instruments is a two-channel photoelectric polarimeter for simultaneously reading two planes of polarization while the entrance aperture is scanned repeatedly across a planet image. Another instrument is a combination photoelectric area scanner and spectrum scanner with an output signal that is accumulated in a multichannel analyzer, where each channel corresponds to a point along the line of scan.

J.H. Focas: A total of approximately 10000 documents are now available for consultation at the Meudon Data Center, under the form of original negatives, counter-copies of original negatives, negative and positive composites, reproduction on film or paper, etc.... To these, planetary maps and drawings as well as many thousands of polarimetric determinations on the major planets, should be added.

The Meudon Center is attached administratively to the Service 'Physique du Système Solaire', the director of which is Dr A. Dollfus. The permanent staff of the Center consists of a Scientific Director, (Dr J.H. Focas), a documentalist, two photographers and a computer.

Routine work, as a rule, comprises: (*a*) evaluation of documents for compositing, photometry, positional work, i.e., triangulation, rotations, flattening, etc...; (*b*) computing the geometrical data of the planets; (*c*) listing by planets and apparitions; (*d*) preparing data for computer cards; (*e*) preparing composite images; (*f*) mounting composites for consultation, labelling, coding, filing and boxing them by planets and apparitions. Two photographic dark-rooms are available.

Research work on documents ready for consultation is carried out at the Center. Visiting collaborators participate in the research. Laboratory and observational work is made through instruments kindly placed at the Center's disposal by the 'Physique du Système Solaire' Service. The Milano-Merate Astronomical Observatory, under the direction of Professor F. Zagar, kindly assumed the publication of the photographic maps of Mars, prepared at the Meudon Center, covering the period 1905–1967. Number of such maps appeared in the *Pubblicazioni del l'Osservatorio Astronomico di Milano-Merate—Nuove Series.*

Results concerning the research made at the Meudon Center or obtained through the International Cooperation for the observation of the Planets, not included in Part A of the Proceedings, are the following:

MERCURY

Rotation et cartographie de la planète Mercure
A. Dollfus

L'analyse des photographies et dessins recueillis au Pic-du-Midi depuis 1942 par H. Camichel et A. Dollfus donne une période de rotation de 58·67 ± 0·03 jours qui sont exactement les 2/3 de la période de révolution. Un planisphère complet des taches de la surface est dressé (publié dans *C. R. Acad. Sci. Paris*, **264**, 1765, 1967. A paraître dans *Icarus*.

VENUS

Ultra-violet photographic survey of clouds in Venus' Atmosphere
A. Dollfus

Report about the results of the International Cooperation organized in 1959 and 1962 by the present Committee. Eight observatories obtained altogether several hundreds of U.V. pictures of Venus, achieving several sequences of uninterrupted observations during several tenths of hours. Venusian atmosphere can evolve quickly. Clouds are not likely composed of solid dust, but of particles capable of condensation and evaporation. Motions of the clouds indicate a slight tendency for an overall drift similar to a rotation of the whole atmosphere in 3 to 5 days. Report in press in *Proceedings of the Conference on Atmospheres of Mars and Venus, Tucson* 28–30 *Feb.* 1967.

Motions of Ultraviolet clouds on Venus
B.A. Smith

Measured drift rates of Ultraviolet clouds infer a retrograde rotation period of 113 ± 5 hours for the planet's atmosphere, in sharp contrast to the 244 day (radar) rotation period for the solid globe.

La rotation rétrograde en 4 *jours de l'atmosphère nuageuse de Vénus*
P. Guérin (in cooperation with H. Camichel and Ch. Boyer)

Toutes les séries de photographies ultraviolettes de Vénus obtenues au Pic-du-Midi à l'élongation du matin (1966) et celle du soir (1967) pendant 4 à 10 heures d'affilée, montrent une rotation d'ensemble rétrograde des taches nuageuses (un tour en 4 jours environ). Il ne s'agit pas d'une reconstitution sur place, ni de vents symétriques par rapport au méridien subsolaire. On suspecte des fluctuations de la vitesse instantanée.

MARS

G. de Mottoni

Martian photographic maps prepared till now allow a detailed study of the seasonal variations of the dark areas of the planet. They moreover show the evolution of secular variations which occurred during the period 1907–1954 in the areas of Cyclopia, Margaritifer Sinus, Oxia Palus, Thymiamata S., Nilosyrtis and Moeris Lacus, Nepenthes-Thoth-Casius.

J.H. Focas
Photovisual map of Mars 1967 *based on observations made through the* 83 *cm Refractor of the Meudon Observatory*

The map contains items up to 0″.2 size. The projection used allows the study of the phenomena occurred in the north circumpolar and polar areas and their fine structure.

A. Dollfus

Presentation of a selection of high quality martian photographs obtained in different observatories in the scheme of the International Cooperation in 1965 and 1967, and available at the IAU Data Center.

JUPITER

Evidence of vorticity in the great Red Spot on Jupiter
B.A. Smith

Observations of the interaction of small dark features with the periphery of the Red Spot show the latter to have a counter-clockwise vortical motion with a *nine-day* rotation period.

International Cooperation for the Photographic Observation of Jupiter
J.H. Focas

This campaign was organized by the Committee 16-C since 1964, on the purpose to collect observational data allowing hydrodynamical investigations allied with the zonal and the meridian circulation, to which the cataclysmic epigenic activity in the atmosphere of Jupiter should be added. Such observational data refer in principle to: (*a*) the revision of the rotation period of the planet determined by single rotations in one and the same night, to avoid the effect of the proper motions of the atmospheric markings; (*b*) the evolution and repartition of bright and dark matter; (*c*) the study of the proper motions of the markings and mixing conditions of the atmospheric currents allied with vertical and vortical motions of bright and dark matter; (*d*) The periodic drift of the belts in latitude related with the variation of their intensity considered to be the criteria of meridian circulation in the atmospheric cells; (*e*) the cycles of atmospheric activity.

SATURN

V. Bobrov (communicated by A. Dollfus)

The present Committee organized an international cooperation for the observation of the Saturn ring during the crossing of its plane by the Earth in 1966. Several hundreds of plates and measurements were sent or reported to the Committee at Meudon Observatory. Measurements of the plates are undertaken at the original observatories, or at the Meudon IAU Data Center. Preliminary results give a thickness of the order of 1 km for the Saturn ring.

Thickness of the Ring
Kiladze

Photometric measurements of the plates of Saturn taken at Abastumani, Georgia S.S.R., gave the precise time of the two Earth transits in the plane of the ring: 1966, Oct. 28, 23, h2 $\pm$ 1h. U.T. and 1966, Dec. 18, 05 h 3 $\pm$ 3h, 3 U.T. The thickness of Saturn's ring is 0·92 km.

Découverte d'un nouveau satellite de Saturne
A. Dollfus

Un nouveau satellite de Saturne a été découvert sur les clichés obtenus au Pic-du-Midi les 15, 16 et 17 Décembre 1966. Il a été retrouvé sur un cliché du 18 Décembre obtenu par Walker au Naval Research Observatory U.S.A., et sur quatre clichés obtenus par Texereau à McDonald Observatory U.S.A., le 29 Octobre 1966. L'orbite est pratiquement circulaire et dans le plan equatorial, son rayon vaut 2·65 fois le rayon équatorial de Saturne, la période vaut 17 h, 975. Une plus grande élongation à l'Est s'est produite le 15 Décembre 1966 à 18 h 20 m. La magnitude est voisine de 14. Le nom proposé est 'Janus'. (Cf. *C.R. Acad. Sci. Paris*, **264,** 822, 1967).

Administrative Session III

MARTIAN NOMENCLATURE

A Working Group comprising Professor G. P. Kuiper, Professor J. S. Hall, and Dr A. Dollfus was appointed by Comm. 16 to work out the martian nomenclature, after the Mariner IV Experiment.

Professor G.P. Kuiper, President of the Group, summarized the developments occurred in this line before the Space Era and the necessity of paving the way for securing a nomenclature of martian features, satisfying the requirements created after the first photographs of craters and finer details of the surface of the planet were taken by Mariner IV. Such requirements are expected to grow with increasing resolution of photographs to be taken in the future. In this spirit the Working Group proposed the following resolution which was accepted by Commission 16.

Resolution III
Guide Lines for Naming Martian Craters

(1) The 1958 I.A.U. Martian Nomenclature (Trans. IAU, X, 259–263, 1958) is hereby reaffirmed with the understanding that 'features' refers to telescopically observed spots, dark and bright, not to craters. The approx. 120 names of dark and bright areas are regarded as 'provinces' whose boundaries may be defined more precisely as a result of increased image resolution.

(2) Within these 'provinces', bright and dark, craters and other tectonic structures occur. The most prominent of these may be named after deceased scientists and members of other suitable professions, as is customary for lunar craters.

(3) The number of names should be held reasonably small.

(4) Among the appropriate professional categories are: astronomers, mariners, geologists and geophysicists, physicists, mathematicians, biologists, chemists, astronauts, engineers, philosophers, artists and historians. Since only 10–20 categories will be introduced versus some 120 provinces, groups of adjacent provinces may be combined as larger districts in the assignments of crater names. An effort may be made to relate in an interesting manner professional groups to major surface features.

(5) Craters not named may be designated by coordinates or—as on the Moon—by reference to a nearby major crater, with an appropriate letter attached.

(6) The large area of Mare Sirenum (Areographic Longitude 163°, Latitude −33°) allows one category names only. Five craters are named (Figs. 1–4):

(a) Mariner IV picture 8: Ejriksson (50 km dia.).
(b) Mariner IV picture 10: Columbus (110 km dia.).
(c) Mariner IV picture 10: Magelhaens (110 km dia.).
(d) Mariner IV picture 11: Mariner (160 km dia.). Symbolic name.
(e) Mariner IV picture 16: Nansen (90 km dia.).

Résolution III
Directives pour la nomination des cratères de Mars

(1) La Nomenclature Martienne établie en 1958 par l'U.A.I. (*Trans. I.A.U.*, X, 259–263, 1958) est réaffirmée ici, entendu que les 'accidents' se réfèrent à des taches sombres et claires observées téléscopiquement, et pas à des cratères. Les 120 noms environ, de régions sombres et claires sont considérés comme des 'provinces' dont les limites pourraient se définir avec une plus grande précision avec l'augmentation de la résolution des images.

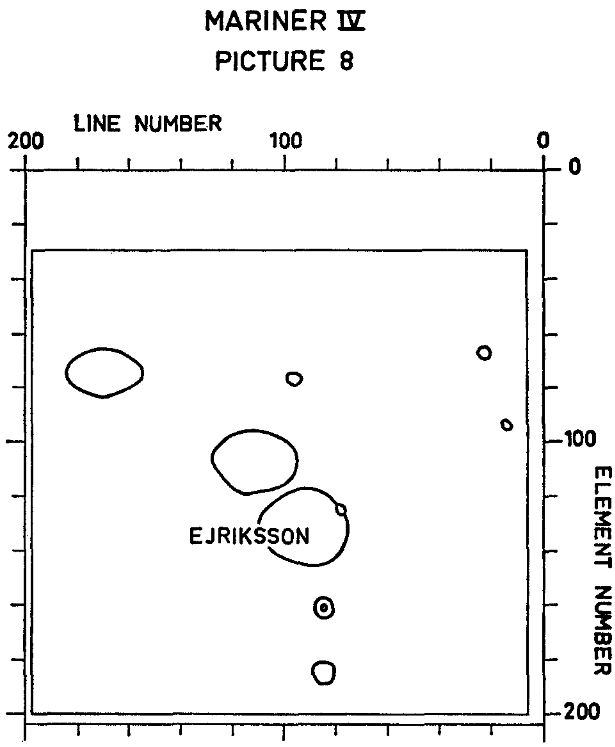

FIG. 1. Crater Ejriksson.

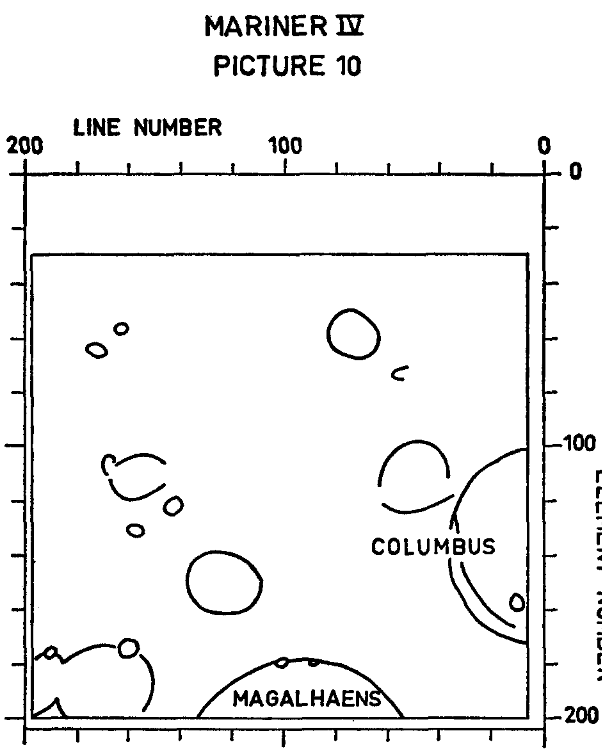

FIG. 2. Craters Columbus and Magelhaens.

https://doi.org/10.1017/S0251107X00015704 Published online by Cambridge University Press

MARINER IV
PICTURE 11

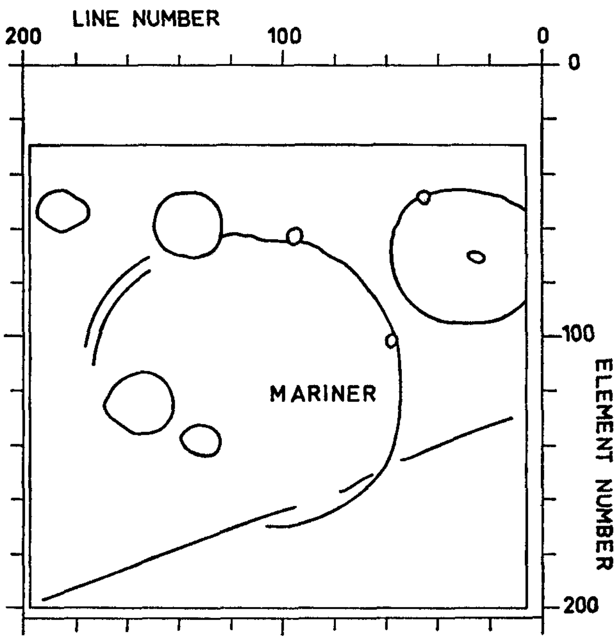

FIG. 3. Crater Mariner.

MARINER IV
PICTURE 16

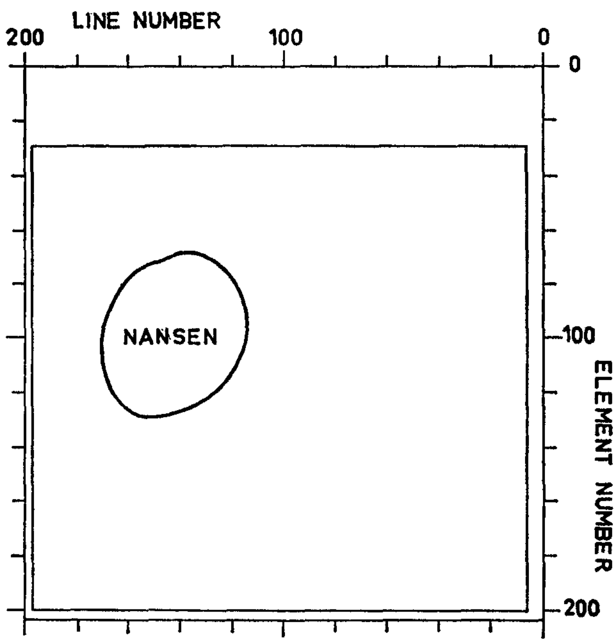

FIG. 4. Crater Nansen.

https://doi.org/10.1017/S0251107X00015704 Published online by Cambridge University Press

(2) Parmi ces 'provinces', claires et sombres, il y a des cratères et d'autres structures tectoniques. Les plus saillants d'entre eux peuvent être nommés d'après des scientifiques décédés et des personnes d'autres professions appropriées, comme c'est l'habitude pour les cratères lunaires.

(3) Le nombre des noms doit être raisonnablement restreint.

(4) Parmi les catégories des professions appropriées se trouvent celles des: Astronomes, Navigateurs, Géologues et Géophysiciens, Physiciens, Mathématiciens, Biologues, Chimistes, Astronautes, Ingénieurs, Philosophes, Artistes et Historiens. Puisque 10–20 catégories seront introduites contre 120 'provinces', des groupes de provinces adjacentes peuvent être combinées en districts plus vastes dans la désignation de noms de cratères. Un effort pourrait être fait pour rapporter d'une manière intéressante des groupes professionnels à des accidents majeurs de la surface.

(5) Des cratères non nommés peuvent être désignés par des coordonnées ou—comme sur la Lune—par référence à un plus grand cratère voisin avec une lettre appropriée attachée.

(6) La large région de Mare Sirenum (Longit. Aréographique 163°—Latitude − 33°) ne permet qu'une catégorie de noms seulement. Cinq cratères ont été nommés (figs. 1–4):

(a) Mariner IV Photo 8: Ejriksson (50 km. diam.)
(b) Mariner IV Photo 10: Columbus (110 km. diam.)
(c) Mariner IV Photo 10: Magelhaens (110 km. diam.)
(d) Mariner IV Photo 11: Mariner (160 km. diam.). Nom symbolique.
(e) Mariner IV Photo 16: Nansen (90 km. diam.).

Commission 16 decides the continuation of the life of the Working Group 'Martian Nomenclature' under the following form: G. P. Kuiper—Chairman; A. Dollfus, J. S. Hall, R. B. Leighton—Members.

Scientific Sessions I and II

The following scientific papers were presented:

F. Link—Sur la parenté des Circulations Atmosphériques Terrestre et Jovienne.

C. Sagan et J. Pollack—Elevation differences on Mars.

J. Pollack and C. Sagan—A wind-blown dust model of the surface and seasonal changes of Mars.

W.M. Irvine, T.H. Simon and D.H. Menzel—Multicolor Photoelectric Photometry of Venus, Mars and Jupiter.

L.A. Bugajenko, I.K. Koval, A.V. Moroženko (communicated by D.Y. Martynov—*Photoelectric observation of Mars in* 1967.

V.V. Avramchuk (communicated by D.Y. Martynov)—*On the distribution of methane absorption in the band* 6190 Å *over the disc of Jupiter.*

O.I. Bugajenko, I.K. Koval, E.G. Janovitsky (communicated by D.Y. Martynov)—*The effect of turbulent image motion on photometric observation of planets.*

M. Combes—Etude de haute atmosphère de Jupiter.

P.B. Boyce—Wavelength Dependance of the Brightness of the Individual Martian Features determined by Area Scanning Spectrophotometry.

T. Gehrels—Polarimetry of Planets.

Correction to Draft Report, Commission 16—*Page* 300—*Line* 8

Instead of:
'that the value of the abundance of molecular hydrogen ranges between 75 and 150 km/atm.—(66)',
to read:
'that the value of the abundance of molecular hydrogen ranges between 25 and 45 km/atm. and that of helium 75 and 150 km/atm.'