STATUS REPORT NO. 21 - NGR-03-003-001
July 1, 1973, thru December 31, 1973

PURPOSE OF GRANT

"Studies in planetology, including the collection and interpretation of planetary information."

Submitted: 29 March 1974

William A. Baum
William A. Baum
Principal Investigator

Robert L. Millis
Robert L. Millis
Co-Investigator

Edward L. G. Bowell
Co-Investigator

PERSONNEL

W. A. Baum, Director of the Planetary Research Center and Principal Investigator
R. L. Millis, Astronomer and Co-Investigator
E. L. G. Bowell, Astronomer and Co-Investigator
L. A. Riley, Research Associate, part-time
D. T. Thompson, Observer and Film Analyst
H. S. Horstman, Research Assistant and Secretary
J. H. Chastain, Electronics Technician
H. W. Culp, Instrument Maker
N. O. Cook, Photographic Technician
S. Marzano, Photographic Assistant, part-time through August 31
R. L. Padilla, Maintenance, part-time
H. J. Scheele, Bookkeeper, part-time

In addition to the preceding staff under NGR-03-003-001, there are several other people working directly on Planetary Research Center projects, especially the International Planetary Patrol Program, funded under NGR-03-003-007. Through December 31st these have included S. E. Jones, Chief Technician; L. J. Martin, Observer and Patrol Film Editor; J. L. Inge, Observer and Cartographer; C. F. Capen, Observer and Film Analyst; H. M. Ferguson, Photographic Assistant; and K. L. Williams, Computing Assistant, part-time. L. L. Castillo was here temporarily for the summer as a Film Editing Assistant. Other Observatory employees, such as J. S. Hall, H. L. Giclas, O. G. Franz, and D. Shanks, have participated in some of the observations, analyses, or instrumentation mentioned in this report.

SUMMARY

Photographic research programs: Most of our photographic analyses were based on films obtained under the International Planetary Patrol Program discussed in detail in a concurrent status report under NGR-03-003-007. Mars and Jupiter were photographed at six Patrol stations throughout nearly all of this report period, and Venus was photographed from late July through early December at the three reflectors having best access to the southern sky.

Martian clouds were mapped on an hourly basis in four colors for about half of the pre-storm portion of the 1971 apparition. The build-up of the 1971 global dust storm and of an earlier 1971 dust cloud were mapped and analyzed, revealing a daily pattern of regeneration. A morning-afternoon asymmetry of Martian regional contrasts was discovered, and it was interpreted in terms of an afternoon brightening of the light areas. Martian albedo features were mapped together with Mariner 9 topography, and the relationships between them were discussed. The 1969 distribution of the north polar hood was summarized

statistically. Jovian cloud motions were measured on red images obtained near opposition in 1972. Experiments were made in the computer processing of Patrol images of Jupiter. Techniques for producing superior color pictures of planets were refined. Statistics of Patrol station performance are being analyzed.

Photoelectric research programs. Extensive UBV photometric observations were made of the Galilean satellites of Jupiter, and of selected satellites of Saturn. Eleven eclipse reappearances of Io were recorded, none of which showed post-eclipse brightening. Many mutual occultations and eclipses of the Galilean satellites were observed at Lowell, Perth, and Cerro Tololo. Mutual event data from observatories around the globe have been included in the data bank which we are operating. Polarization and intensity scans of Jupiter, Saturn, and Saturn's rings were made. Two new polarimetric programs on Venus and Mars were started. The polarization of Venus appears to show time variation of period 5.4 days. A program of narrow-band photometry of Mars was completed.

Outside use of the Center: Guest investigators and visiting scientists have been received as usual, and planetary photographs have been supplied to various outside investigators. Seven publications appeared during this six-month report period, and five more were in press as of December 31.

PHOTOGRAPHIC RESEARCH PROGRAMS

The International Planetary Patrol Program. Six observatories participated in the Patrol during this period: Mauna Kea in Hawaii, Lowell in Arizona, Cerro Tololo in Chile, Perth in Australia, Republic in South Africa, and Kavalur in India. Hourly photography of Mars was scheduled at all stations on every night throughout this six-month report period. A major dust storm occurred on Mars and was well photographed. The 1973 Jupiter Patrol was also continuous throughout the report period except for the last ten days of December. For a 13-day interval centered on the Pioneer 10 flyby of Jupiter on December 4th, stations were instructed to give top priority to Jupiter in order to obtain good ground-based imaging support of the mission. Usable Jupiter Patrol sequences were obtained on all dates during that interval despite below-average weather conditions. Venus, being a southern object during this period, was photographed in the ultraviolet between July 23 and December 3 at Mauna Kea, Perth, and Cerro Tololo; the refractor at Republic could not, of course, be used in the ultraviolet. Atmospheric features on Venus were generally of lower contrast this year than in 1972. Following an unsuccessful attempt in December to photograph the nucleus of Comet Kohoutek with our F/75 Patrol telescopes, we added an image intensifier to the camera and will report the result next time. Altogether, 16,425 fourteen-frame Patrol sequences of

usable quality were obtained during this report interval, 51 percent being of Mars. The relative productivities of the six Patrol stations were in the order they are listed above, Mauna Kea being the best and Lowell being second. A complete breakdown of productivity figures for each station and each planet is given in our concrrent status report for the Patrol grant, NGR-03-003-007.

Martian clouds. By the end of this report period, cloud distributions in four colors had been mapped by Martin for 33 days of the 1971 apparition. This is about half the total number of days earmarked for 1971 cloud mapping so as to cover an interval comparable with the 69 days of the 1969 apparition that were mapped earlier. After 1971 is finished, similar four-color mapping of 1973 clouds is planned, and the long-range aim of the project is to identify the seasonal pattern of Martian cloud activity.

Martin completed a paper entitled "The Major Martian Yellow Storm of 1971," which was submitted to Icarus during this report period, and a copy of the abstract is attached. In it he has mapped the positions of brightened areas (clouds) on an hourly basis for 24 days during the build-up of the 1971 global storm, and he reports the discovery of diurnal regeneration during the build-up of the storm. Martin is engaged in a preliminary mapping of the 1973 storm, which differed from the 1971 storm in place of origin, greater speed of spread, and smaller extent when matured.

Capen studied the mature phase of the 1971 global storm and has inferred that the degree of dust obscuration was fairly homogeneous. He also completed a study of a minor dust storm which arose 74 days prior to the onset of the global storm of 1971. A paper entitled "A Martian Yellow Cloud--July 1971" has been prepared for submission to Icarus, and a copy of the abstract is attached.

Contrast variations on Mars. After having completed a photographic analysis of 1971 contrast variations in four regions of Mars, described in Status Report No. 20, Thompson has selected 1973 Patrol sequences in order to extend the seasonal coverage of this study. His 1971 study, which appeared in the September issue of Icarus, reported the discovery of a diurnal contrast increase that he interprets as an afternoon brightening of light areas, as could occur if dust is raised each afternoon in those areas.

Martian albedo features and topography. Inge has prepared a Mercator projection map of Mars showing albedo features and topography. This map was published in the Lowell Observatory Map Series in September 1973. The comparison of Martian albedo features with topography was discussed by Inge and Baum in the July issue of Icarus.

Inge has selected Mars images from the Planetary Research Center collection to be used in the preparation of an albedo map for the Martian season when the Viking spacecraft will arrive. Ultimately, we plan to construct maps for all Martian seasons in order to determine the pattern of seasonal differences.

Martian polar caps and hoods. McKinney has made a statistical summary of the north polar hood boundary during a 69-day period in 1969, based on daily maps of Martin and Smith. Frequency isopleths reveal the distribution of the hood down to latitude +30°. Further work on this is tentatively planned for next summer. The study of seasonal variation of polar cap boundaries was not worked on during this report period.

Cloud motions in the Jovian atmosphere. Having completed a study of rotation period versus zenographic latitude for blue-light features (published in the September issue of Icarus), Inge undertook the more difficult problem of the measurement of red-light photographs. System I features have been measured over a 25-day interval on 1972 images. Approximately three times more measurements were taken for red features than for blue features. Preliminary examination of the results appears to indicate a slightly different rotation-versus-latitude profile for red features than for blue.

Ultimately, we are interested in the possible detection of circulation cells or of latitudinal motions in order to discriminate among the dynamic modes proposed theoretically for the Jovian atmosphere. We have undertaken some computer experiments to enhance and rectify Patrol images, in collaboration with Laurence Soderblom and Kathy de Witt at the USGS Center of Astrogeology in Flagstaff. During 1974 we intend to pursue this problem, either by the computer approach or by reactivating development of an optical image rectifier.

Color compositing. Jones and Cook have devised and refined a technique for producing color pictures from Patrol image sequences photographed originally on black-and-white film through red, green, and blue filters. This color restoration process has two distinct advantages over direct color photography at the telescope: problems associated with differential atmospheric refraction and extinction are bypassed, and there is greater control over image contrast and color balance. A short paper was submitted to Sky and Telescope.

International Planetary Patrol performance survey. Ferguson compiled Patrol station performance statistics based on about 32,000 hours of Mars and Jupiter observations in 1971 and 1972. By reason of its modus operandi, the Planetary Patrol provides an exceptionally unbiased long-term comparison of image quality at some of the world's most renowned observing sites. Statistics for 1973 will be added before results are summarized.

PHOTOELECTRIC RESEARCH PROGRAM

Mutual occultations and eclipses of the Galilean satellites. Plans outlined in our previous status report were implemented during the present reporting period. Two new photometers and their data systems were put into operation on the Patrol telescopes at Perth and Cerro Tololo by Millis and White, respectively, who spent about ten days at each station testing the equipment and training the local observers. Thompson spent nearly a month at Cerro Tololo in September in order to insure coverage of a particularly favorable series of events. Many mutual events were routinely recorded by Millis and Thompson at Lowell, and two were simultaneously observed in the near infrared by White. Franz observed four events with the area scanner. We also loaned equipment to Dr. Robert Pavlis at the College of the Virgin Islands and to Dr. Robert Brinkmann, who observed from the Canary Islands.

The numbers of events observed during the reporting period at the above sites are listed in the following table:

Lowell (Millis and Thompson)	21
Lowell (White - IR measures)	2
Lowell (Franz - area scanner)	4
Perth	19
Cerro Tololo	11
Canary Islands (Brinkmann)	7
Virgin Islands (Pavlis)	6

Reduction of the observations is now underway and will continue well into the next reporting period. We have been hindered somewhat by an electronic problem in an interface to our PDP-11 computer, but are confident that the problem can be fixed.

Preliminary results indicate that predictions of the times of the events by Aksnes were mostly accurate to within two minutes and are more accurate than Brinkmann's, particularly when J3 or J4 is involved. However, some predictions of the depths of the light curves by Aksnes deviate considerably from what was observed, resulting partly from the use of old values for satellite albedos, partly from over-simplified modeling of the eclipses, and no doubt partly from albedo features on the satellites, as well as uncertainties in their diameters and ephemerides. The report of a pole cap on Europa by Murphy and Aksnes was probably premature.

We have received mutual event observing reports and actual data from many observatories around the globe for inclusion in the data bank which we are operating. These reports, when combined with our

own observations, indicate that at least 84 of a possible 174 events were observed between June 6 and December 21, 1973.

Satellite Photometry.

Jovian satellites: UBV observations of the Galilean satellites were obtained throughout the report period by Millis and Thompson using the Patrol telescope at Cerro Tololo and various telescopes at Lowell. Io was observed on 30 nights, Europa on 34 nights, Ganymede on 41 nights, and Callisto on 50 nights. Our data, when combined with the less extensive observations of the Morrisons and Lazarewicz in Hawaii and of Blanco and Catalano in Sicily, will give a rather complete description of the photometric behavior of these satellites as a function of orbital position and solar phase angle. Such information is vital to the mutual event reductions.

Photometry of eclipse reappearances of Io was conducted from Perth, Cerro Tololo, and Lowell during the report period in order to test the models recently proposed by Cruikshank and Murphy and by Sinton. Both models predicted post-eclipse brightening would occur in 1973, but we obtained 12 reappearance light curves, all with negative results. These measurements were made by Millis, Thompson, Franz, and the Perth observers, using the new satellite photometers and the area-scanning photometer.

Satellites of Saturn: Millis obtained UBV measurements of Iapetus on six nights with the 72-inch, 42-inch, and 24-inch reflectors at Lowell. These observations, which were made when Iapetus was near its elongations, will be combined with observations from the 1971-72 and 1972-73 apparitions to determine the phase coefficients for the dark and bright hemispheres of the satellite.

Franz used the area-scanning photometer at the 72-inch telescope to make UBV measurements of Enceladus, Tethys, and Dione on 15 nights. These observations are being used by Franz and Millis to refine the preliminary light curves which they obtained last year.

Polarization measurements of Mars. From July through October, Bowell made photoelectric whole-disk measurements of the linear polarization of Mars in five colors, working with Dollfus at the Paris Observatory. Preliminary results indicate the presence of aerosols in the Martian atmosphere fully three months prior to the major 1973 storm. Hall and Riley undertook some scanning polarimetry of Mars at Lowell in August 1973.

Polarization measurements of Venus. The linear polarization of the illuminated disk of Venus was monitored photoelectrically on a near-daily basis during August and September of 1973 by Bowell,

working at Paris Observatory. Day-to-day changes in polarization were detected, consistent with a variation of period 5.4 days. The amplitude appears to depend on wavelength, being 2.4×10^{-3} at 3500 A, diminishing to 0.9×10^{-3} in the blue at 4400 A, and becoming undetectable ($< 0.5 \times 10^{-3}$) in the green. Preparations got underway to make similar observations using the scanning polarimeter at Lowell during the summer 1974 elongation of Venus.

Polarization measurements of Jupiter and Saturn. Hall and Riley have used their scanning polarimeter in the ultraviolet to measure linear polarization and to form intensity profiles of Jupiter, Saturn, and Saturn's rings. North-south scans of Jupiter along the central meridian at different longitudes may reveal variations or anomalies in polarization in specific zones or regions of the planet. Polarization and intensity measurements of Saturn were made near opposition in December 1973 in order to estimate the transparency of ring B.

Narrow-band photometry of Mars. A paper entitled "Mars 1971: Photometric Behavior of the Martian Dust" was completed by Boyce and submitted to Icarus. Some regional Minnaert coefficients were derived. A copy of the abstract is attached.

NASA TEAMS AND COMMITTEES

Baum has continued to serve on the Viking Orbiter Imaging Science Team, with some assistance from Thompson. Baum also served on the NASA Shuttle Astronomy Working Group, the National Academy of Sciences summer study on Scientific Uses of the Space Shuttle, and the LST Detector Committee; and he was a consultant to the LST Camera Instrument Definition Team. When appropriate, committee and team activities have been funded separately.

INSTRUMENTATION

The two new photometer systems for observing mutual satellite events at Perth and Cerro Tololo were tested and put into operation by Millis and White. Millis assembled the photometer system loaned to Pavlis for use in the Virgin Islands, and Baum assisted Brinkmann in assembling another for use in the Canary Islands. A device to align planetary images when producing color restorations was designed by Jones and built by Culp. Our darkroom compositing stage was also modified. Minor structural modifications to the scanning polarimeter were made in preparation for its use on Venus in 1974. A simple image-intensifier camera head was temporarly adapted to a Patrol camera for subsequent high-resolution observations of the nucleus of Comet Kohoutek in early January. Culp, Chastain, and Shanks continued

assembly of an equipment elevator (obtained with private funds) for the 24-inch reflector, which is devoted primarily to our planetary programs. Work on the planetary image rectification system was suspended during the report period, pending a reassessment of computer image rectification.

DISTRIBUTION OF PHOTOGRAPHS AND DATA

As of December 31, 1973, the photographic collection on file at the Planetary Research Center required 12 catalogue volumes and included ephemeris and photographic data for about 127,000 image sets. Of the total, about 87,000 are image sequences on film obtained since 1969 under the Planetary Patrol Program, about 10,000 are plates obtained between 1903 and 1968 at Lowell Observatory (including early Planetary Center work), and the remaining 30,000 are records of plates or films either copied from or on file at New Mexico State University, the IAU Planetary Data Center in Meudon, Lick Observatory, Table Mountain Observatory, and other sources. A continuing major task during this report period was the updating of catalogue volumes. However, since distribution of some of the catalogues to other institutions had taken place in June 1973 and was scheduled again for early 1974, no general mailing of catalogue volumes took place within this report period. Two specific catalogue requests were filled: a printout of 1972 Jupiter images, based on specific parameters, was furnished to Dr. Gerald E. Hunt of the Meteorological Office, Bracknell, United Kingdom; and Dr. Charles Boyer of the IAU Planetary Data Center, Meudon, was provided with listings of Data Center planetary images for cross-checking purposes.

We supplied, as usual, a number of Planetary Research Center photo products and maps, and other special items. New Mexico State University was loaned 206 original film sequences, composite positives, and copies of original plates of Venus, and 490 such records of Mars. Drs. Robert Murphy and William Sinton of the Institute for Astronomy, Honolulu, Hawaii, were provided with mutual occultation sequence photographs specially taken at the Mauna Kea Patrol station. Dr. Jay Bergstrahl of the Jet Propulsion Laboratory, Pasadena, received 72 single-image prints of Jupiter, prepared from 1972 Patrol sequences selected by him during a visit to the Planetary Research Center, and specially composited prints from 1973 Jupiter sequences were sent at the request of Dr. David J. Adams of the Department of Astronomy, University of Leicester, United Kingdom. Dr. Edward Bowell, while still at Meudon Observatory, France, was loaned 24 positives of 1972 Venus composites, which were copied and added to the IAU collection at Meudon; and six Venus composite prints were sent at the request of Dr. Bruce Hapke of the University of Pittsburgh.

Eighty-three copies each of the three Lambert azimuthal equal-area projection maps showing Martian albedo features and topography (published in the Lowell Observatory Map Series, scale 1:28,600,000), and 56 copies of the corresponding new Mercator version (ibid., scale 1:25,000,000) were distributed to interested scientists.

Photographic layouts showing atmospheric phenomena on Jupiter recorded on Patrol images were mailed to about 50 interested scientists. These were: (1) Changes on Jupiter since 1891, (2) Changes on Jupiter since 1970, (3) Various aspects of Jupiter, (4) 1971 SEB disturbance, (5) Jupiter's red spot and white ovals, (6) Three faces of Jupiter at the time of the 1973 Pioneer 10 flyby.

A total of 20 requests from publishers and scientific institutions were fulfilled, including the request from RAI-TV (Italy) of a portion of our 16-mm Jupiter time-lapse film.

GUEST INVESTIGATORS AND VISITORS

Scientific visitors to the Planetary Research Center during this report period included Dr. William McKinney of the Department of Geography at the University of Wisconsin in Stevens Point, Dr. Robert Pavlis of the College of the Virgin Islands in St. Thomas, Joseph Hing-Chai Liu of the Astronomy Section at the University of Hong Kong, Dr. Michael A'Hearn and Herbert Frey of the Astronomy Program at the University of Maryland, Claude Michaux and Dr. Philip Steffey of the Planetary Atmospheres Section at the Jet Propulsion Laboratory in Pasadena, Thomas Duxbury of the Tracking and Orbit Determination Section at the Jet Propulsion Laboratory in Pasadena, Dr. Alan Binder of the Planetary Science Institute in Tucson, astronomical writer Werner Sandner of West Germany, Professor J. D. McGee of the Physics Department at the Imperial College of Science and Technology in London, Dr. Jay Bergstrahl of the Planetary Atmospheres Section at the Jet Propulsion Laboratory in Pasadena, Dr. A. Dollfus of the Planetary Data Center at l'Observatoire de Paris in Meudon, Dr. Paul Byard and Gerald Newsom of the Astronomy Department at Ohio State University in Columbus, and Drs. David and Nancy Morrison of the Institute for Astronomy at the University of Hawaii in Honolulu.

Dr. McKinney continued his stay as a summer guest investigator at the Planetary Center, collaborating with Leonard Martin on the mapping of polar hoods from the Planetary Patrol collection from 1969. The visits of Dr. Pavlis, Mr. Duxbury, and Dr. Morrison were all concerned with our coordinated program for obtaining photoelectric light curves of the mutual occultations and eclipses of the Jovian satellites. Dr. Pavlis borrowed a photometer for use on a telescope in the Virgin Islands. Dr. A'Hearn and Mr. Frey made planetary observations with a Fourier spectrometer belonging to the University of Maryland. Drs. Byard

and Newsom obtained spectra of Comet Kohoutek with the 42-inch reflector, Mr. Michaux and Dr. Steffey obtained photographs of Mars around the time of opposition with the 20-inch apochromatic refractor and the 24-inch Lowell refractor. Professor McGee conferred with Baum on recent developments in photoelectronic imaging devices for astronomy. Dr. Dollfus spent several days conferring with us on programs of mutual interest at our two Planetary Centers, Meudon and Flagstaff.

FINANCIAL STATUS

Routine monthly expenditures have been running close to the budgeted level, and the margin in the account is adequate to cover any expenditures anticipated during the remaining six months of this fiscal year.

FOREIGN TRAVEL

Foreign travel during this report period totalled $4600. It included the installation and checkout of mutual satellite photometers at Cerro Tololo in Chile by White, and at Perth in Australia by Millis, both in the month of July. It also covered satellite photometry at Cerro Tololo by Thompson in August and September. The Planetary Center was represented by Hall at the August IAU general assembly in Australia and by Baum at the September IAU planetary symposium in Poland.

REPORTS AND PUBLICATIONS

The following is a list of papers that appeared in print or that were in press (accepted for publication) during the twelve months ending 31 December 1973. Papers which appeared or were submitted in the present reporting period are indicated by asterisks and daggers, respectively.

* Baum, W. A. (1973). The International Planetary Patrol Program: An assessment of the first three years. Planet. Space Sci. 21, 1511.

† Baum, W. A. (1974a). Synoptic planetary imaging with the LST high-resolution camera. To appear in the final report (1974) of the LST High Resolution Camera Instrument Definition Team.

† Baum, W. A. (1974b). Results of current Mars studies at the IAU Planetary Research Center. In Transactions of the IAU Symposium No. 65 (C. Iwaniszewska and A. Woszczyk, eds.), in press.

Baum, W. A., and Martin, L. J. (1973). Behavior of the Martian polar caps since 1905. Bull. Amer. Astron. Soc. 5, 296.

Boyce, P. B. (1973a). Remote sensing photometric studies of Mars in 1971. Icarus 18, 134.

Boyce, P. B. (1973b). Photometry of the 1971 Martian dust storm. Bull. Amer. Astron. Soc. 5, 298.

† Boyce, P. B. (1974). Mars 1971: Photometric behavior of the Martian dust. Icarus, in press.

Brinkmann, R. T., and Millis, R. L. (1973a). Jovian satellite-satellite eclipses and occultations in 1973-74. Bull. Amer. Astron. Soc. 5, 37.

Brinkmann, R. T., and Millis, R. L. (1973b). Mutual phenomena of Jupiter's satellites in 1973-74. Sky and Telescope 45, 93.

Caldwell, J. J. (1973). Ultraviolet observations of Mars made by the Orbiting Astronomical Observatory. Icarus 18, 489.

* Capen, C. F. (1973). The planet Mars in 1973. Sky and Telescope 46, 53.

Capen, C. F., and Martin, L. J. (1973). The Martian yellow cloud of July 1971. Bull. Amer. Astron. Soc. 5, 266.

Hall, J. S., and Riley, L. A. (1973). Polarization observations of Saturn made in ultraviolet and visual light since 1968. Bull. Amer. Astron. Soc. 5, 289.

Hall, J. S., and Riley, L. A. (1973b). Polarization measurements of Jupiter and its Red Spot. In IAU Colloquium No. 23, Planets, Stars, and Nebulae Studied With Photopolarimetry (T. Gehrels, ed).

* Inge, J. L. (1973a). Short-term Jovian rotation profiles, 1970-1972. Icarus 20, 1.

* Inge, J. L. (1973b). Martian albedo features and topography. Lambert azimuthal equal-area projection, 0°, 120°, 240° meridians (1:28,600,000). Lowell Obs. Map Series.

* Inge, J. L. (1973c). Martian albedo features and topography. Mercator map (1:25,000,000). Lowell Obs. Map Series. Also Mercury 2, No. 6, 10/11 (centerfold), in press.

Inge, J. L. (1973d). The red planet Mars. Color map supplement to National Geographic Magazine 143 (February).

* Inge, J. L., and Baum, W. A. (1973). A comparison of Martian albedo features with topography. Icarus 19, 323.

† Jones, S. E., and Cook, N. O. (1974). Producing color photographs of the planets from filtered black-and-white images. Sky and Telescope 47, 57.

† Martin, L. J. (1974). The major Martian yellow storm of 1971. Icarus, in press.

Martin, L. J., Baum, W. A., and Crump, P. C. (1973). The distribution of clouds on Mars in 1969 and 1971. Bull. Amer. Astron. Soc. 5, 298.

Millis, R. L. (1973). UBV photometry of Iapetus. Icarus 18, 247.

Thompson, D. T. (1973a). A new look at the Martian "violet haze" problem. II. "Blue clearing" in 1969. Icarus 18, 164.

* Thompson, D. T. (1973b). Time variation of Martian regional contrasts. Icarus 20, 42.

Thompson, D. T. (1973c). Interpretation of diurnal contrast changes on Mars. Bull. Amer. Astron. Soc. 5, 296.

Participants in scientific meetings and conferences during this report period (six months only) included the following:

Baum, W. A. "Results of current Mars studies at the IAU Planetary Research Center." IAU Symposium No. 65 (Copernicus Symposium IV), Extraordinary Assembly of the International Astronomical Union, Toruń, Poland, 5-8 September 1973. Also chaired one of the sessions.

Baum, W. A. "Earth-based observations of albedo changes." International Mars Colloquium, Pasadena, California, 28 November - 1 December 1973.

Bowell, E. L. G. Participated in an organized panel discussion on "Albedo markings and time variability." International Mars Colloquium, Pasadena, California, 28 November - 1 December 1973.

Bowell, E. L. G. Participated in an informal conference on "Laboratory photometry, polarimetry, and spectrophotometry." Cornell University, Ithaca, New York, 14 December 1973.

Hall, J. S. "Résumé of recent progress at the Planetary Research Center." Commission 16, General Assembly of the International Astronomical Union, Sydney, Australia, 21-30 August 1973.

ATTACHMENT

THE MAJOR MARTIAN YELLOW STORM OF 1971

Leonard J. Martin

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ABSTRACT

Extensive Earth-based photography produced by the International Planetary Patrol has been used to map the positions of brightened areas (clouds) during the 1971 storm on Mars. The mapping was done on an hourly basis from two days prior to the onset of the storm through its twenty-second day. Summaries of these maps are presented to illustrate the changes that take place during the course of a Martian day, as well as the changes from one day to the next. It is shown that the storm goes through a daily cycle of regeneration, although each day it advances farther than it did the day before. The possible influence of Martian topography on the progress of the storm is examined. Comparisons between red- and blue-filter photographs of the storm are presented cartographically and are discussed. Areas most affected by the storm during this period are summarized in Figure 8.

ATTACHMENT

A MARTIAN YELLOW CLOUD - JULY 1971*

Charles F. Capen

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ABSTRACT

A short-term yellow cloud was observed in the southern hemisphere of Mars from July 10 to 22, 1971. The initial cloud was first photographed on the morning limb at 7:45 a.m. local Martian sun time in the Serpentis-Hellespontus region (315°W; 27°S), 74 Earth days (72 Martian days) prior to the onset of the September major yellow storm. Historical observations from the Lowell Observatory archives indicate that pre-storm yellow clouds of limited extent are not uncommon.

Positional measurement and photographic differential photometry of the July yellow cloud were possible throughout its entire evolution because Mars was favorably situated and photographic coverage by the International Planetary Patrol was adequate. Maps showing the cloud's initial location, hourly and diurnal behavior, apparent motion, and areal coverage by haze are presented. The similarities between the July cloud and other southern hemisphere yellow clouds are summarized. Its relationships to classical albedo features and Mariner 9 topographic data are discussed. Photographic photometry indicates that the enhanced contrast between the yellow cloud and its surroundings is probably due more to the brightening of the cloud-covered areas than to any darkening of contiguous areas.

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*Submitted for publication in Icarus

ATTACHMENT

MARS 1971: PHOTOMETRIC BEHAVIOR OF THE MARTIAN DUST*

Peter B. Boyce**

Lowell Observatory†
Flagstaff, Arizona 86001

ABSTRACT

Intensity profiles of Mars were obtained during the 1971 opposition by means of photoelectric area scanning. These profiles were fitted by the Minnaert function. The Minnaert limb-darkening parameter, k, exhibits a smooth variation with wavelength but appears to be independent of phase angle. The k's determined at the time of the dust storm do not significantly differ from those determined at the time of opposition. For the time of the dust storm the single-scattering albedo is determined as a function of wavelength.

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*Submitted for publication in Icarus

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ATTACHMENT

SYNOPTIC PLANETARY IMAGING WITH THE LST HIGH-RESOLUTION CAMERA

W. A. Baum

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ABSTRACT

The value of synoptic imaging of the planets is illustrated. The advantage of the Large Space Telescope, as compared with ground-based telescopes and planetary orbiters and flybys, is discussed. Desirable LST camera parameters and observing strategies are considered from the standpoint of synoptic imaging.