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Data Base on Physical Observations of Near-Earth Asteroids and Establishment of a Network to Coordinate Observations of Newly Discovered Near-Earth Asteroids

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This programs consists of two tasks: (1) development of a data base of physical observations of near-Earth asteroids and establishment of a network to coordinate observations of newly discovered Earth-approaching asteroids and (2) a simulation of the surfaces of low-activity comets. Significant progress was made on Task 1, and Task 2 was completed during the period covered by this progress report.

Task 1: Astromical Data Bank on Local Space Resources

(D. R. Davis and C. R. Chapman)

In the past six months, work continued on the development of the data base of near-Earth asteroids. Specific items accomplished in this period were:

- Completion of the initial data base as an ASCII file containing data from: (i) Russian ephemeris on orbit elements, (ii) McFadden review paper for the forthcoming *Asteroids II* book on physical observations of near-Earth asteriods, and (iii) IRAS data files. A printout of the ASCII file is given in Appendix G.
- Installation and familiarization with dBase IV at PSI. The ASCII data base described above was tranferred into a dBase IV file for evaluation of the dBase software for scientific use. A major defect in dBase is the inability to produce plots in any convenient fashion. Generally, one has to create an ASCII file containing the data to be plotted, exit dBase, and go to a separate plotting program in order to generate graphical output.
- We started work to extend the data base to include reference to the scientific literature for all entries. This subtask will be completed by the end of the current contract period (February 1, 1990).
- All entries in the data base were verified against original sources.

The second part of the Astronomical Data Bank task is to establish and operate a coordination/communication network to inform astronomical observers worldwide of newly discovered asteroids and to encourage them to make physical observations of such bodies. In the past six months, we sent a participation request form to 87 individual astronomers and 24 observatories (Appendix H). The individuals and observatories were selected based on their having done asteroid work previously. To date, we have received 20 positive responses from individuals (23%) and 8 responses from observatories (30%), with 1 refusal of participation from an observatory. Only 3 individual responses and 1 observatory response came from outside the United States. Further effort will be made to expand the global availability of participating observers.

Following the relocation of PSI to our new quarters at 2421 East 6th Street in early October, we prepared a master schedule of observers that we can consult immediately upon receiving word of newly discovered asteroids. We have re-established the electronic IAU circular service and will notify teams searching for near-Earth asteroids (Shoemakers, Helin, Spacewatch, etc.) in the next few weeks requesting that they alert us as soon as new objects are found. The network is anticipated to be operational by the end of the year. A telephone-answering machine will be installed so that messages can be left regarding discoveries and observations outside of normal business hours.

Task 2: Modeling of the Surface Properties of Cometary Nuclei

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This task was aimed at characterizing the surface and subsurface properties of cometary nuclei, particularly to characterize regoliths and reveal indications of surface ice and water of hydration. Such studies are vital in order to plan how to utilize asteroidal resources. An analysis of the surface characteristics of the nuclei of periodic Comets Arend-Rigaux and Tempel 2 has been completed. We have used extensive visible and infrared observations of the nuclei of these two Earth-approaching comets to constrain a nonspherical thermal model developed by Dr. R. H. Brown (1985, *Icarus*, Vol. 64, p. 53). Our results indicate that the albedo and emissivity (at 10 μm) of the nuclear surface of both comets is constant within the uncertainties. We interpret such constancy as due to a uniform mantle of dust that covers the surface of each nucleus. It appears that the source of volatiles is buried sufficiently deep that it does not significantly affect the surface temperature. We estimated how deep inside the nucleus the ice must be to be consistent with our results.

Meanwhile, we are preparing to publish our results. A paper by A'Hearn et al. describing our preliminary analysis of nuclear properties of Comet Tempel 2 has been accepted for publication in the *Astrophysical Journal* (Appendix I).