Final Report for NASA Grant NAG2-855
Total Project Period July 1, 1993 to March 31, 2000 entitled:
Archiving of Planetary Ring Data

Principal Investigator and Grantee Institution

James L. Elliot
Massachusetts Institute of Technology
Rm. 54-422
Cambridge, MA 02139

Attention:

NASA Washington Office, Accessioning Department
FINAL REPORT FOR NASA GRANT NAG2-855
MIT PARTICIPATION IN THE PDS RING NODE
(project end date: 2000-03-31)

J. L. Elliot, PI
August 8, 2001

GOAL OF THE PROJECT

Stellar occultation data provide our only Earth-based means of probing planetary rings at kilometer spatial resolution. The occultation data archive at MIT contains original data and analysis products of stellar occultations by the ring systems of the planets Jupiter, Saturn, Uranus, and Neptune observed by members of the group (and other groups) from 1977 to the present. During this time period, several media have been used to record and store the original and processed data:

(i) chart records,
(ii) printed output,
(iii) audio reel tape,
(iv) audio cassette tape,
(v) 7-track, 1/2-inch computer tape,
(vi) 9-track, 1/2-inch computer tape at 800, 1600, and 6250 bpi,
(vii) NOVA disk platters (2.5 and 5.0 Mbyte),
(viii) write once optical disks,
(ix) punched cards, and
(x) read-write optical disks.

With the rapid change of computer technology over this time period, some of these media have become not only obsolete, but nearly extinct. In particular, it has become nearly impossible to find any facilities that can still read 800 bpi tapes, which contain the only copies of several important data sets for the ring system of Uranus. In particular, we have an extensive ring data collection that includes data sets for the following Uranian ring occultations: U0, U11, U12, U13, U14, U25, U17 and U36.

COMPLETED WORK

During this project we (i) searched our data tapes and found most of the Uranian data sets that we recorded during the 1970's and 80's, (ii) developed software needed to convert these files to FITS format, (iii) worked with the PDS node to develop a set of key words for our FITS headers, (v) supplied a Hubble Space Telescope for an occultation by Saturn's ring the following Uranus occultation data sets to the Planetary Data System:
<table>
<thead>
<tr>
<th>Star</th>
<th>Occultation Date</th>
<th>Observatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>U0</td>
<td>1977-03-10</td>
<td>Kuiper Airborne Observatory</td>
</tr>
<tr>
<td>U11</td>
<td>1980-03-20</td>
<td>Cerro Tololo Inter-American Observatory</td>
</tr>
<tr>
<td>U12</td>
<td>1980-08-15</td>
<td>Cerro Tololo Inter-American Observatory</td>
</tr>
<tr>
<td>U12</td>
<td>1980-08-15</td>
<td>European Southern Observatory</td>
</tr>
<tr>
<td>U13</td>
<td>1981-04-26</td>
<td>Anglo-Australian Observatory</td>
</tr>
<tr>
<td>U14</td>
<td>1982-04-21</td>
<td>Cerro Tololo Inter-American Observatory</td>
</tr>
<tr>
<td>U15</td>
<td>1982-05-01</td>
<td>Mount Stromlo Observatory</td>
</tr>
<tr>
<td>U17</td>
<td>1983-03-25</td>
<td>South African Astronomical Observatory</td>
</tr>
<tr>
<td>U23</td>
<td>1985-05-04</td>
<td>Cerro Tololo Inter-American Observatory</td>
</tr>
<tr>
<td>U23</td>
<td>1985-05-04</td>
<td>McDonald Observatory</td>
</tr>
<tr>
<td>U23</td>
<td>1985-05-04</td>
<td>Teide Observatory</td>
</tr>
<tr>
<td>U25</td>
<td>1985-05-24</td>
<td>McDonald Observatory</td>
</tr>
</tbody>
</table>

These constitute the most important Uranus occultation data taken up through 1985, which have been used in the major ring-orbit analyses performed by Prof. Richard G. French of Wellesley College. All of the data sets were translated from old formats, some of which were unidentified when we started. Unfortunately, we were unable to find the original full data from the U13 and U15 events, but were able to provide extracts of the data encompassing the ring occultations. All of the data submitted are in FITS format, with a consistent set of header keywords. These keywords define the date and time of observation, the instrument, telescope, observatory and observers, approximate coordinates of the occulted star, integration time in the data series, published references to the observations and subsequent analyses of the data, and other comments that may be useful in interpreting the data. With the exception of U36, a huge data set that has not yet been completely analyzed and published, Dr. Bosh of Lowell Observatory and Prof. French should have most of the remaining Uranian-ring occultation data sets. We plan to eventually supply the U36 data set to the Rings Node, after this data set has been completely organized and published.

**BIBLIOGRAPHY FOR ANALYSES OF THE SUBMITTED DATA SETS**


