FINAL REPORT

Period: April 1, 1997 to March 31, 1998
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Extension 3: April 1, 2000 to March 31, 2001

NASA Grant NAS5-96097:   Analysis and Quality Assurance of the SKYMAP 4.0
                          Guidance and Tracking Star Catalog

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    Raytheon ITSS Project: 3091
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NOTE: During the year that passed between the awarding of this grant
        and its activation, the 4.0 version of the SKYMAP catalog was
        completed and plans were conceived for version 4.1, whose name
        was changed to SKY2000. Thus, the reports for this award will
        not correspond to the original proposal title.

SUMMARY

The objective of this project was to prepare an updated and improved
version of the NASA spacecraft acquisition and attitude determination
star catalog, now called SKY2000. The highest priority goals were to
completely replace the astrometric (positions and proper motions) data
with the high accuracy results from the Hipparcos and Tycho experiments
aboard the European Space Agency's HIPPARCOS satellite, and to update
and extend the photometric (magnitudes and colors) data. A secondary
priority was to correct individual errors in the existing catalog,
which were mostly associated with double and multiple stars, and to
examine the catalog for additional errors that could be detected in a
staightforward way; i.e., without extensive data analysis and complex
software screening programs.

The replacement and upgrading of the astrometric and photometric data
has been completed during this grant period, as supplemented by the
two extensions. While several thousand individual errors in catalog
data have been detected and corrected, many errors still linger. The
remaining errors are not systematic and are spread throughout the
catalog. They are not expected to detract significantly from the
general usefulness of the catalog for its intended purposes.

Two versions of the SKY2000 catalog were actually prepared during
the grant period because the first version (called Version 2) still
had a considerable number of shortcomings that were deemed serious
enough that the next version (Version 3) was planned and begun as
soon as Version 2 was completed.

The current version of the SKY2000 catalog, SKY2000, Version 3, can
be accessed from the GSFC Flight Dynamics web page:

http://cheli.gsfc.nasa.gov/dist/attitude/skymap.html

Supporting information and reference materials (published papers, format and data descriptions, etc.) can also be found at the website.

WORK PERFORMED

1. The SKYMAP SKY2000 Version 2 Master Catalog

Version 2 of the SKY2000 Master Catalog was completed in September of 1998 and represented a substantial improvement over Version 1. A high proportion of the astrometric data in Version 2 came from ESA's Hipparcos mission, by way of the Hipparcos Output, Hipparcos Component, and Tycho Catalogues. Astrometric data are also present from USNO's ACT Catalog and the European Tycho Reference Catalogue, both of which refine the proper motions in the original Tycho catalog by an order of magnitude. While some objects still retain ACRS and PPM data, the proportion is very small and there are no stars left in the catalog that do not have astrometric quality positions. A large number of photoelectric data on the Johnson system (V, B) has been added from the Tycho Catalogue, such that there are now very few stars in SKY2000 that lack photoelectric data. More than 4000 stars observed by the Ball CT-601 star trackers on the RXTE spacecraft had their observed CCD ST magnitudes incorporated into Version 2. IAU designations based on J2000.0 positions were also added to the catalog, while all previous identifiers (SKY2000, HD, SAO, DM, HR, WDS, PPM, AG, bright- and variable-star designations) were retained. The IAU-approved identifiers allow new objects to be inserted without disrupting the natural order of the principal catalog identifier.

2. The SKYMAP SKY2000 Version 3 Master Catalog

Version 3 of the SKY2000 Master Catalog was completed in May of 2000 and represents an incremental but substantial improvement over Version 2. A global replacement of photovisual (ptv) and photographic (ptg) magnitudes and of Henry Draper spectral types was performed using as sources the SAO, PPM, and HD catalogs.

Several hundred entries previously lacking them now have CCD ST magnitudes from the star tracker onboard the SWAS spacecraft (transformed to the photometric system defined by the RXTE CCD ST data in SKY2000 Version 2). Several thousand missing HD catalog identifiers (mostly for HD Extension stars) were added, and several hundred missing variable-star identifiers were added. 61 stars bright enough for inclusion in SKY2000 were added, bringing the total number of entries in the SKY2000 Version 3 Master Catalog to 299,160.

The SKY2000 Master Catalog, Version 3, is available for download in two different formats:

(a) A version compressed using GZIP (~32 MB) for Unix/Linux

(b) A version compressed using WinZip (~ 31 MB) for Windows

A detailed format description for the SKY2000 Version 3 Master Catalog can also be found at the GSFC Flight Dynamics website, the URL of which is given in the Summary of this report.

REPORT DOCUMENTATION PAGE

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13. ABSTRACT *(Maximum 200 words)*

An updated and improved NASA spacecraft attitude determination catalog, now called SKY2000, Version 3, has been prepared and quality assured. The highest priority goals were to replace the astrometric (positions and motions) and photometric (brightnesses and colors) data with the most recent and accurate data available. Quality assurance has been performed in a fairly straightforward manner, i.e., without extensive data checking and analysis, and many errors and inconsistencies were corrected. Additional work should eventually be done on the variability and multiple-star data in the catalog, while certain other data can be significantly improved. The current version of the catalog can be found at the GSFC Flight Dynamics website: http://cheli.gsfc.nasa.gov/dist/attitude/skymap.html

Supporting information and reference materials (published papers, format and data descriptions, etc.) can also be found at the website.

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