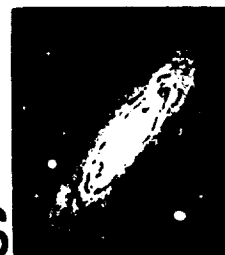1153

IN-89-TM

32992

NSSDC
WDC-A-R&S

National Space Science Data Center/
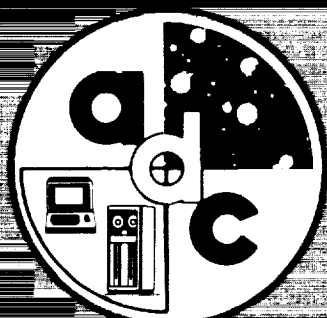World Data Center A For Rockets and Satellites

90-05

LICK SATURN-VOYAGER REFERENCE

STAR CATALOGUE

(Klemola, Taraji, and Ocampo 1979)

Documentation for the Machine-Readable Version

February 1990

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Documentation for the Machine-Readable Version

Wayne H. Warren Jr.

February 1990

Abstract

The machine-readable version of the catalog, as it is currently being distributed from the Astronomical Data Center, is described. The catalog contains accurate equatorial coordinates for 4551 stars in a band of sky against which cameras of the Voyager spacecraft were pointed for observations in the region of Saturn during the flyby. All of the reference stars are in the range $12^h 40^m$ to $14^h 12^m$ in right ascension (1950) and $+02°$ to $-09°$ in declination. Mean errors of the positions are about $0.''25$.

Table of Contents

List of Tables

1.0   Introduction

1.1   Description

The *Lick Saturn-Voyager Reference Star Catalogue* (Klemola, Taraji, and Ocampo 1979) was prepared for purposes of determining up-to-date, reasonably accurate, equatorial coordinates for reference stars in a band of sky against which cameras of the Voyager spacecraft were aligned for observations in the region of Saturn during the flyby. The requirements were a surface density of about three reference stars per observation frame of 24 arcmin^2 of the cameras — somewhat greater that the SAO (Smithsonian Astrophsyical Observatory Staff 1966) and the AGK3 (Dieckvoss *et al.* 1975) densities — and a positional accuracy $\cong 0\overset{''}{.}5$. Visual magnitudes were also required. The completed catalog contains 4551 stars in the right ascension range $12^h \, 40^m$ to $14^h \, 12^m$, declination zones $+02°$ to $-09°$. Mean errors of the positions, as derived from least squares solutions against the *Perth 70 Catalogue* (Høg and von der Heide 1976), are about $0\overset{''}{.}25$; however, individual residuals for some bright and excessively faint stars are as high as $0\overset{''}{.}5$ to $1\overset{''}{.}0$. The accidental error of one measurement, as deduced from a tabular histogram given in the original catalog publication (referenced below), is about $0\overset{''}{.}09$. Apparent photographic and visual magnitudes were derived from iris photometer measurements, m_v being approximated from a derived color-index relation using *UBV* stars selected from the USNO photoelectric catalog (Blanco *et al.* 1968) and extended with Perth 70 stars. The resulting magnitudes appear to have mean errors of at least $0\overset{m}{.}2$ - $0\overset{m}{.}3$ for the brighter stars ($m_v < 10^m$) and uncertainties can be as much as $0\overset{m}{.}5$ for the fainter stars. The magnitudes are considered to be only approximate, especially on the faint end, because of a lack of photoelectric standards there.

This document describes the machine-readable version of the *Lick Saturn-Voyager Reference Star Catalogue* as it is currently being distributed from the Astronomical Data Center (ADC). It is intended to enable users to read and process the computerized catalog without problems and guesswork. For additional information concerning the observations and reductions, the original publication (available from A. R. Klemola) should be consulted. **A copy of this document should be transmitted to any recipient of the machine-readable catalog.**

1.2   Source Reference

Klemola, A. R. (Lick Obs.), Taraji, H., and Ocampo, A. (Jet Propulsion Lab.) 1979, *Lick Saturn-Voyager Reference Star Catalogue*, Lick Observatory, University of California, Santa Cruz.

2.0 Structure

2.1 File Summary

The machine version of the *Lick Saturn-Voyager Reference Star Catalogue* consists of a single file. Table 1 gives the machine-independent file attributes. All logical records are of fixed length, and, if the catalog is received on magnetic tape, it will contain blocks of fixed length (as noted below), except that the last block may be short.

Lick Saturn-Voyager Reference Star Catalogue (Klemola, Taraji, and Ocampo 1979)				
File	Contents	Record Format	Logical Record Length	Total Number of Logical Records
1	Catalog	FB	56	4551

Table 1.   Summary Description of Catalog Files: FB = Fixed length blocks (last may be short)

The information contained in the above table is sufficient for a user to describe the indigenous characteristics of the machine-readable version of the *Lick Saturn-Voyager Reference Star Catalogue* to a computer. Information easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, density, number of tracks, and character coding (ASCII, EBCDIC) for tapes is not included, but should always accompany secondary copies if any are supplied to other users or installations.

2.2 Catalog (File 1 of 1)

Table 2 gives a byte-by-byte description of the contents of the data file. A suggested Fortran format specification for reading each data field is included and can be modified depending upon individual programming and processing requirements (Fortran 77 character string-type formats are used); however, caution is advised when substituting format specifications, since certain fields contain character data and others are blank when data are absent. Particular care is necessary with the proper-motion data, where missing data will be read as zeros, but where valid zero values may exist. (Under certain circumstances, this might also be true for magnitude data, but there are no bright stars in this catalog.) For such fields, primary numerical format specifications are given to indicate decimal point locations, while alternate A-type formats are specified in parentheses. Default (null) values are always blanks in data fields for which primary suggested formats are given as A. Where no default values are given for numerical fields, there are always valid data present.

Byte(s)	Units	Suggested Format	Default Value	Data
1-4	---	I4	---	Running star number
5-8	---	I4	---	Plate number
9-10	hours	I2	---	Right ascension, α
11-12	min	I2	---	α
13-18	sec	F6.3	---	α
19	---	A1	---	Sign of declination zone
20-21	°	I2	---	Declination, δ
22-23	'	I2	---	δ
24-28	"	F5.2	---	δ
29-33	mag	F5.2 (A5)	blank	Photographic magnitude
34-38	mag	F5.2	---	Visual magnitude
39-46	---	A8 (I8)	---	Alternate identification
47-51	"	F5.1 (A5)	blank	Proper motion in α
52-56	"	F5.1 (A5)	blank	Proper motion in δ

Table 2. Catalog Record Format

Running star number A running star number denoting the order in which stars were selected for measurement on each plate.

Plate number Four-digit plate number.

Equatorial coordinates Equinox 1950, epoch 1978.92.

Photographic magnitude Apparent photographic magnitude, m_{pg}, as determined from iris photometry.

Visual magnitude Apparent visual magnitude, m_v, approximated from m_{pg} and a derived color-index relation using UBV stars selected from the USNO photoelectric catalog of Blanco *et al.* (1968) and extended with Perth 70 stars.

Alternate identification AGK3 or SAO identification number. For AGK3 numbers, bytes 39-41 contain the zone and bytes 42-46 the number. SAO numbers are contained in bytes 41-46.

Proper motions The centennial proper motions (μ_α, μ_δ). These data are taken from the AGK3 or SAO catalogs. The proper motions in right ascension are given as the great circle measures ($\mu_\alpha \cos \delta$).

3.0 History

3.1 Remarks and Modifications

A magnetic tape containing the catalog, in binary format, was received from Dr. A. R. Klemola in November 1981. The data were converted to character-coded form and written to a direct access storage device for editing. The following modifications were made to the data in order to effect a more uniform format and to standardize the data representation:

1. Plus signs were added to all positive declination zones.

2. Missing data were converted from zeros to blanks. Since there are valid zero proper-motion data in the catalog, the source reference had to be scanned visually to locate all these values so that they could be converted back to zeros again. In the original machine-readable file, there was no way to tell between zero proper motions and missing values.

3. All AGK3 numbers were converted to the representation $\pm$ XX XXXX (SAO numbers were not modified).

4. The catalog was sorted by increasing right ascension (the stars were originally in some kind of plate or measurements order).

A copy of the catalog, originally archived and documented at the ADC in 1982, was sent to W. M. Owen, Jr. of the NASA Jet Propulsion Laboratory, in January 1990. Mr. Owen, having collaborated with Dr. Klemola in the preparation of the Lick Reference catalogs for the Uranus and Neptune encounters, reviewed the catalog and made the following modifications to the file:

1. AGK3 designations and proper motions were added for 17 stars not previously identified as AGK3 stars.

2. SAO numbers and proper motions were added for eight stars not previously identified as SAO stars.

3. Four stars appeared in the catalog twice. Their positions and magnitudes were averaged and the duplicate entries deleted.

4. Stars 575/8718 and 219/8718 were incorrectly identified as SAO stars; their identification and proper-motion fields were blanked out.

5. Three AGK3 and six SAO designations were erroneous and were corrected. (The proper motions were found to be correct for these entries, however.)

4.0 Acknowledgments and References

4.1 Acknowledgments

Appreciation is expressed to A. R. Klemola for providing the magnetic tape of the catalog and for reviewing the modifications made to the data. Dr. Klemola also kindly reviewed a draft copy of this document before its completion and printing.

The work of W. M. (Bill) Owen, Jr., in correcting and updating the earlier version of the catalog, is gratefully acknowledged, as are his comments on the statistical accuracy of the positions and the revised documentation.

4.2 References

Blanco, V. M., Demers, S., Douglass, G. G., and FitzGerald, M. P. 1968, *Publ. U. S. Naval Obs.*, 2nd Ser., **21**.

Dieckvoss, W., Kox, H., Günther, A., and Brosterhus, E. 1975, *AGK3. Star catalogue of positions and proper motions north of -2°5 declination, derived from plates taken at Bergedorf and Bonn in the years 1928-1932 and 1956-1963*, Hamburger Sternwarte, Hamburg-Bergedorf.

Høg, E. and von der Heide, J. 1976, *Perth 70, A Catalogue of Positions of 24900 Stars, Abh. der Hamburger Sternwarte*, Band IX.

Klemola, A. R. (Lick Obs.), Taraji, H., and Ocampo, A. (Jet Propulsion Lab.) 1979, *Lick Saturn-Voyager Reference Star Catalogue*, Lick Observatory, University of California, Santa Cruz.

Smithsonian Astrophysical Observatory Staff 1966, *Star Catalog. Positions and Proper Motions of 258,997 Stars for the Epoch and Equinox of 1950.0*, Publ. of the Smithsonian Institution of Washington, DC No. 4652 (Washington: Smithsonian Institution).

5.0 Sample Listing

The sample listing given on the following pages shows logical records exactly as they are recorded in the machine-readable version of the catalog. Groups of records from the beginning and end of the file are illustrated. The beginning of each record and the bytes within the record are indicated by the column heading index across the top of each page (digits read vertically).

L I S T I N G   O F   R E C O R D S   F R O M   D A T A   F I L E

Data File Name: Saturn-Voyager Ref Stars
Records   1 to   20
Data File   54
Record Length   56 bytes
Input VOLSER   ADC001

```
          1111111111222222222233333333334444444444555555555566666666667777777777888888888899999
 123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123
```

```
Record   1   54387111124019.165- 11720.65       11.04
Record   2   62187111124019.708- 01535.94       11.28
Record   3   54887111124019.844- 1 216.25       11.27
Record   4    5987111124021.292- 44120.1510.56 9.61  138926-14.5 -1.0
Record   5   54687111124022.150- 15839.4510.00 8.84-01 1688-18.4  3.9
Record   6   62087111124022.870- 02932.72       10.31
Record   7   31187111124025.009- 34628.10 8.41 7.78 138928-22.9-19.0
Record   8   54587111124026.283- 14254.6110.10 9.22-01 1689  1.6 -5.5
Record   9   31087111124028.213- 34133.0211.2010.68
Record  10   62287111124032.200- 01552.7110.23 9.33-00 1760 -1.2 -0.2
Record  11   57871111124033.109- 45411.4311.5110.93
Record  12   31287111124033.711- 3 059.6211.8411.37
Record  13   69887111124034.462+ 032 6.4711.2010.25
Record  14   69787111124036.307+ 01617.67        9.68+00 1598 -2.5 -2.5
Record  15   54487111124038.126- 13640.9111.2910.20
Record  16   31887111124038.606- 24125.43 9.94 9.00-02  755  4.8-10.4
Record  17   69687111124040.599+ 0 732.4512.6411.58
Record  18   54287111124041.845- 12220.4911.4310.70
Record  19    5687111124042.197- 44850.3411.0210.13
Record  20   69587111124043.154+ 0 4 9.1011.25 9.99+00 1599 -2.8 -2.4
```

10

L I S T I N G   O F   R E C O R D S   F R O M   D A T A   F I L E

Data File Name: Saturn-Voyager Ref Stars

Records   4532 to   4551

Data File   54

Record Length 56 bytes

Input VOLSER   ADC001

```
COLUMN
HEADING          111111111122222222223333333333444444444455555555556666666666777777777788888888889999
INDEX   1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123
```

```
Record 4532  6758719141156.065+ 21431.9210.7310.29+02 1736 -0.2 -4.1
Record 4533  7508719141158.579+ 22828.5010.37 9.80+02 1737 -4.9 -5.1
Record 4534  3708719141412 1.548- 04749.8611.7111.49
Record 4535  6748719141412 3.581+ 15149.03 9.70 9.18+01 1620  2.9 -5.9
Record 4536  4987191412 6.005+ 24344.49 9.46 8.95+02 1738 -4.6 -1.5
Record 4537   987191412 6.318+ 2 147.23 9.47 8.66+02 1739 -2.4 -1.7
Record 4538  7518719141412 7.140+ 23447.1610.8210.31
Record 4539  7087191412 9.766- 31224.5311.2711.38
Record 4540  2998719141211.666- 13234.1711.9011.40
Record 4541  3018719141216.723- 1 132.3310.7910.52
Record 4542  5298719141216.772+ 02911.6410.01 9.51+00 1729 -5.8 -2.1
Record 4543  6987191412 20.002- 32336.51 9.46 8.57 139813-15.4 -3.6
Record 4544  1438719141222.854- 22627.7110.8111.10
Record 4545  1087191412 24.097- 2 414.0510.29 9.66-02  855 -0.5 -3.1
Record 4546  4478719141226.598- 01230.2011.2111.12
Record 4547  5087191412 26.756+ 2 744.18 9.47 9.03+02 1740 -0.2 -0.6
Record 4548  6028719141228.465+ 12547.4910.8210.51
Record 4549  5328719141230.613+ 05836.1710.8110.51
Record 4550  6018719141231.029+ 11137.9210.30 9.57+01 1621 -8.5 -5.4
Record 4551  3008719141231.802- 11118.05 9.84 9.27-01 1821 -4.4 -2.9
```

11