

USNO Almanac Products



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What is an Almanac?



- A publication containing astronomical data arranged according to date, usually for a given year.
- Provides observable characteristics of bodies
 - Position, brightness, phenomena, etc.
- Based on fundamental reference data
 - Star catalogs
 - Solar system ephemerides
 - Adopted constants

What is an Almanac? (con't.)



- Traditionally, a paper publication
- Today, almanac data is available from USNO via...
 - Paper publications*
 - Executable software
 - Source code software
 - Web-based services
- Data, precision, and format tailored for specific applications

* co-published with H.M. Nautical Almanac Office, United Kingdom

Applications



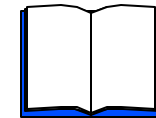
- Celestial navigation
- “High precision”
 - Telescope / sensor pointing
 - Scientific research
- Special purposes
 - Ground illumination
 - Mission planning & scheduling
 - NVG use
- General use
 - Litigation, accident reconstruction, photography, architecture, etc.

Almanac Products for Celestial Navigation



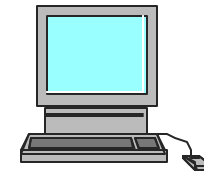
- *The Nautical Almanac*

- For marine navigation
- Required by Navy policy and U.S. law



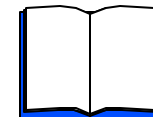
- STELLA

- For marine navigation
- Includes full sight planning and reduction tools
- U.S. DoD only

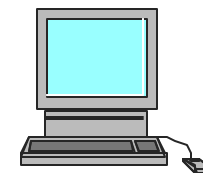


- *The Air Almanac (U.S. version)*

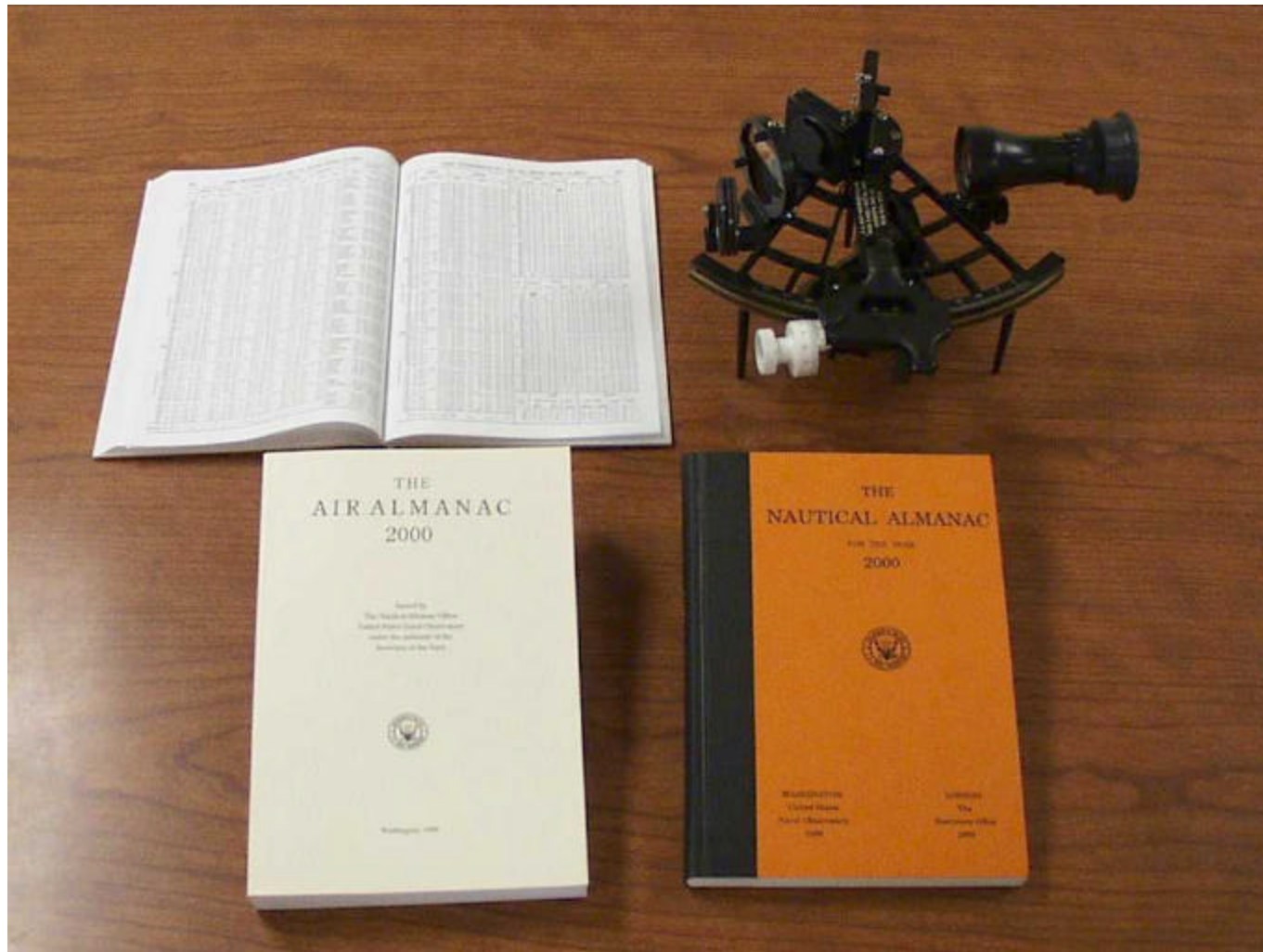
- For air navigation



- Web services



The Air & Nautical Almanacs



STELLA Overview



- PC-based application
 - Version 2.0 (1970-2010)
- Response to formal U.S. Navy requirement
- Provides standard means for performing cel nav computations
 - Almanac
 - Position update
 - Rise/set/transit/twilight (fixed site and moving platform)
 - Gyro/compass error (planning and computation)
 - Sight planning (table and graphic)
 - Sight reduction (with sight recorder)
 - Log

STELLA User Interface



STELLA WorkSheet1.sdf (modified)

File Edit Task View Window Help

WorkSheet1.sdf (modified)

SIGHT PLANNING - STARS

Lat: N 41 19.0
Long: W039 41.7
Ht: 0 ft.

24 Oct 2000

UTC	Hc	Zn	Dubhe	Denebola	REGULUS	SIRIUS	RIGEL	ALDEBARAN	Mirfak
0801	53	01	039	29	14	096	45	23	120
0805	53	29	038	29	59	097	46	02	121
0821	55	20	038	32	58	100	48	33	125

SUN, MOON, PLANETS

24 Oct 2000

UTC	LHA	Hc	Zn	Aries	Sun	Moon	Venus	Mars	Jupiter	Saturn
0801	114			24	22	104		24	10	107
0805	115			25	04	105		24	53	108

Current Log

INITIAL FIX

Date	UTC	Latitude	Longitude	Course	Speed
24 Oct 2000	00:00:00	N40 00.0	W040 00.0	010.0	10.0

SIGHT RECORDER

Body	UTC	hs	IC	Temp	Press	Ht	UT1-UTC	Quality
DENEBO	00:00:00	15 00.0	+0.0	+10	1010	0	+0.0	Average

CurrentTrack

For Help, press F1

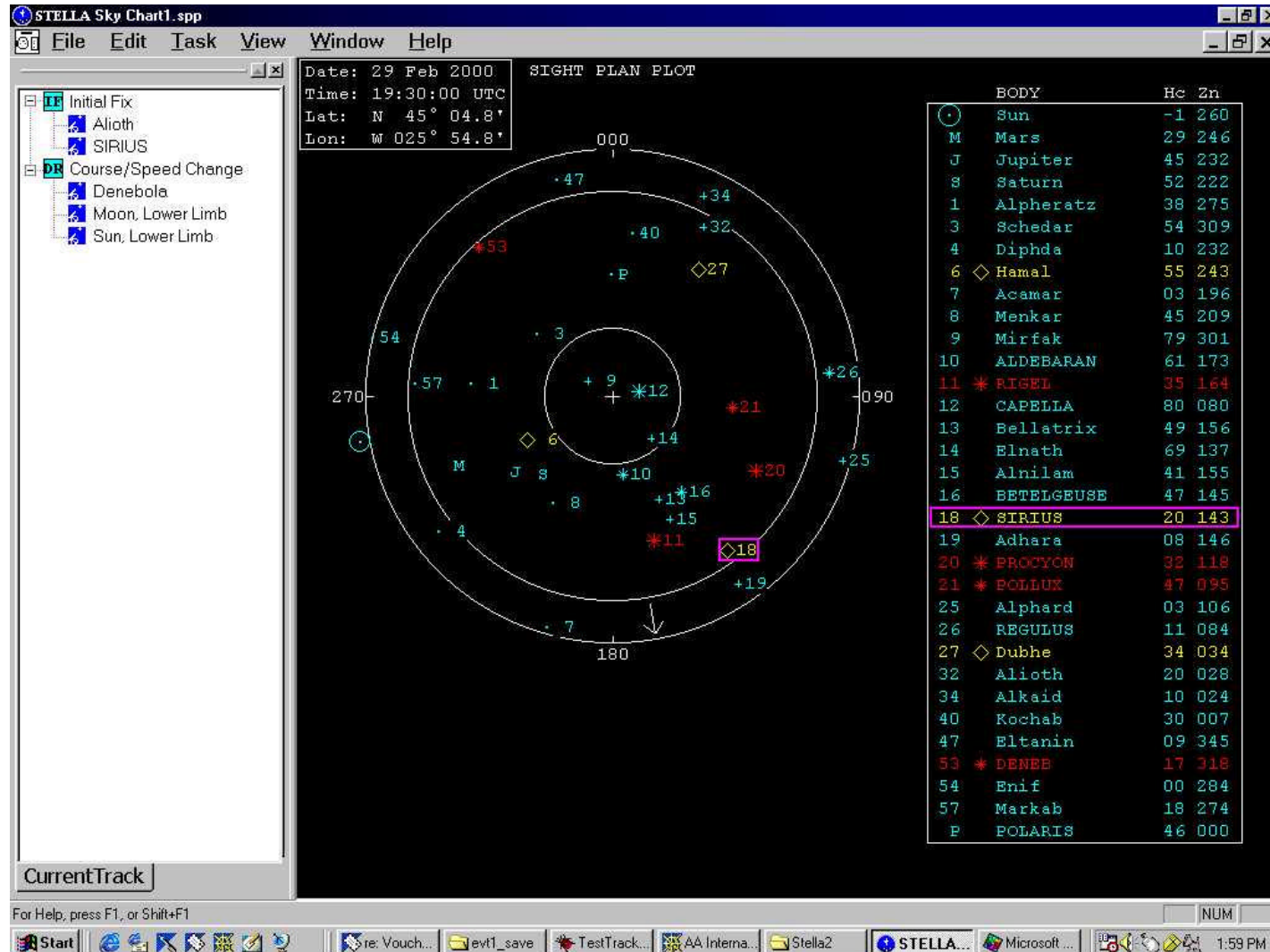
NUM

Worksheet

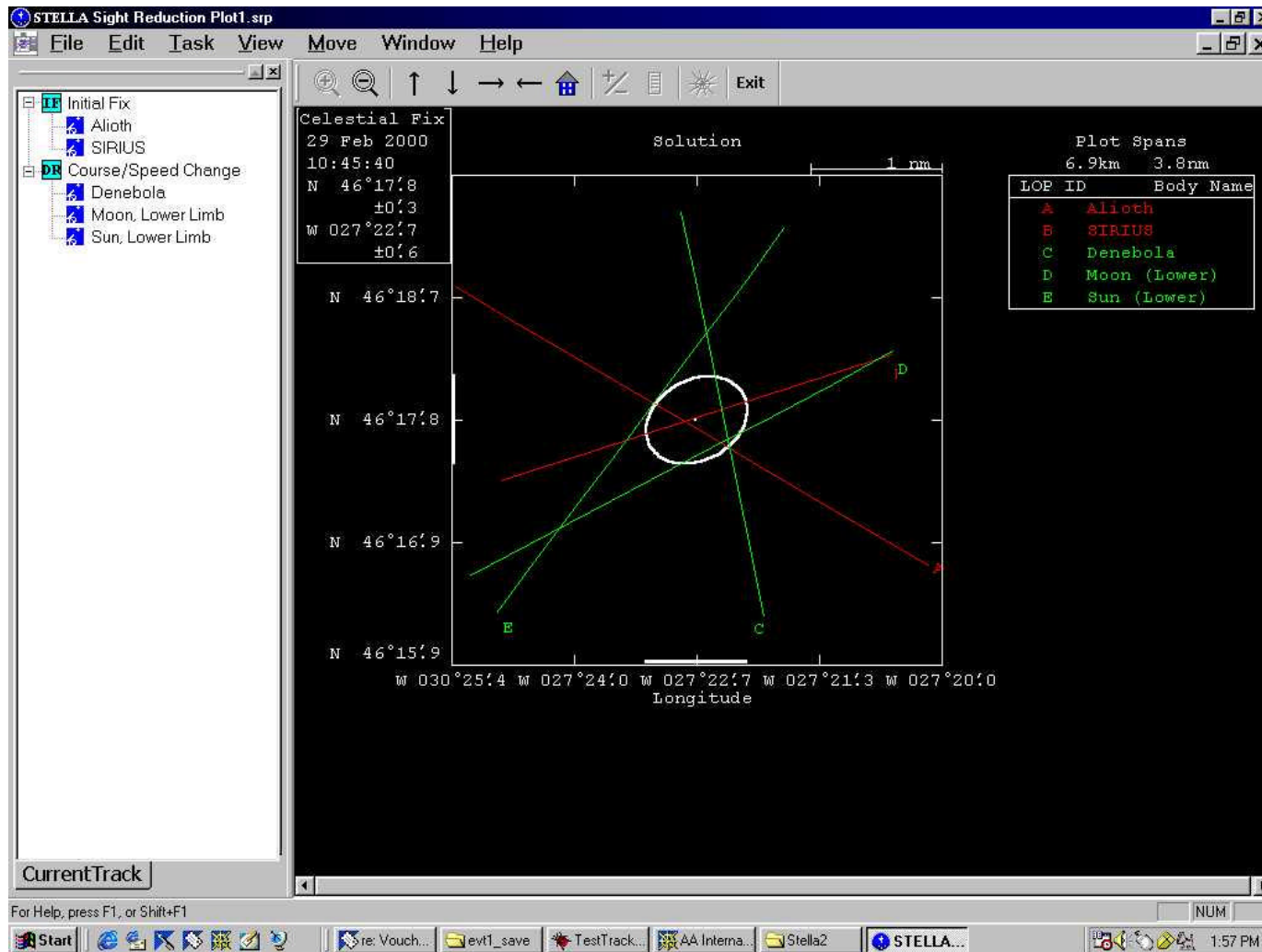
Log

Current Track

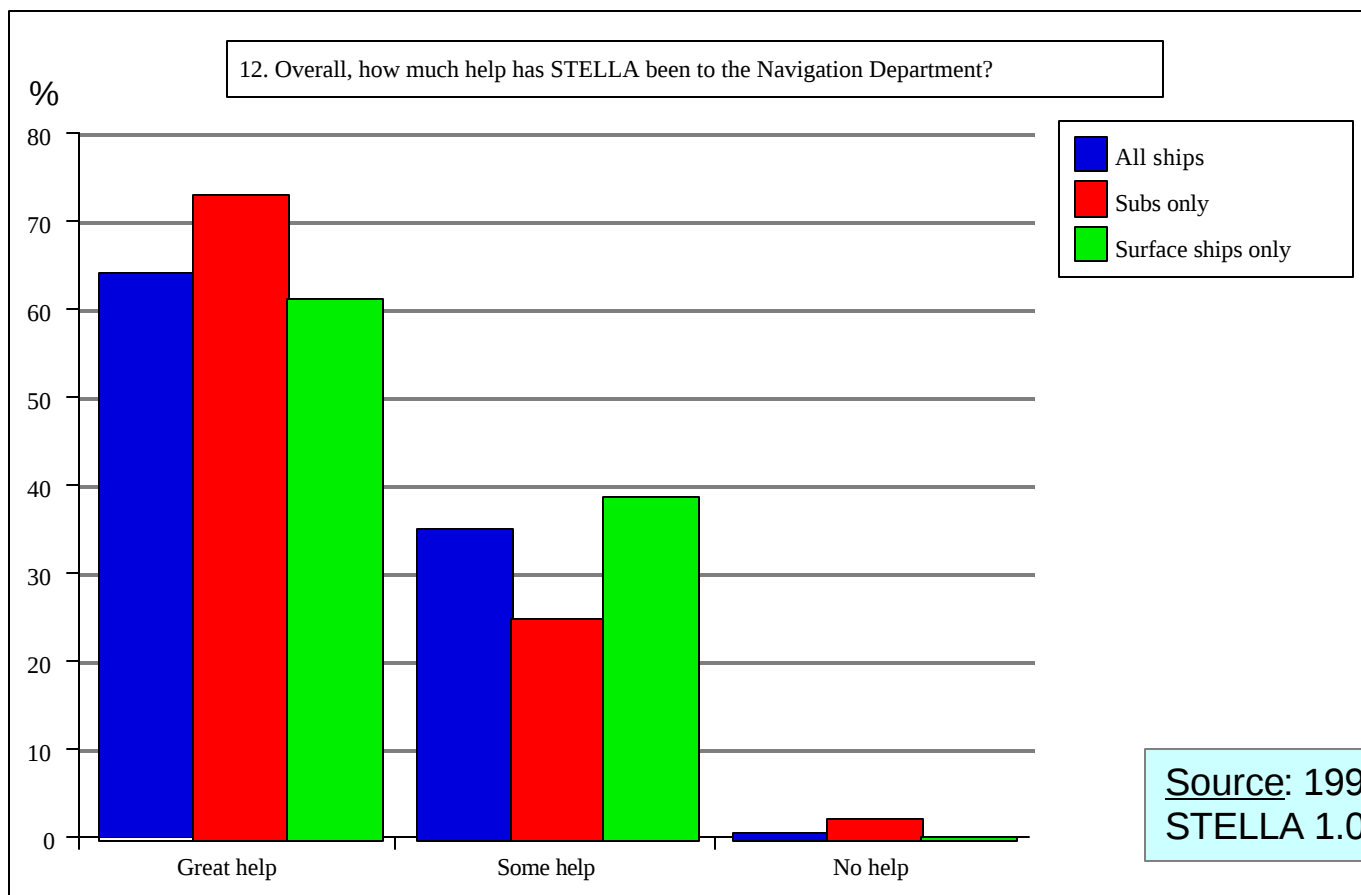
STELLA (Sight Planning)



STELLA (Sight Reduction)



Impact of STELLA

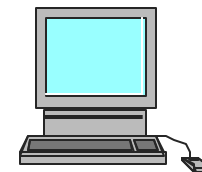
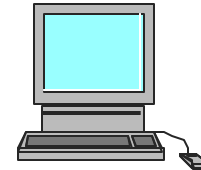
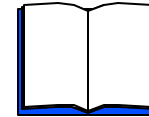


Source: 1997 Survey of STELLA 1.0 Users

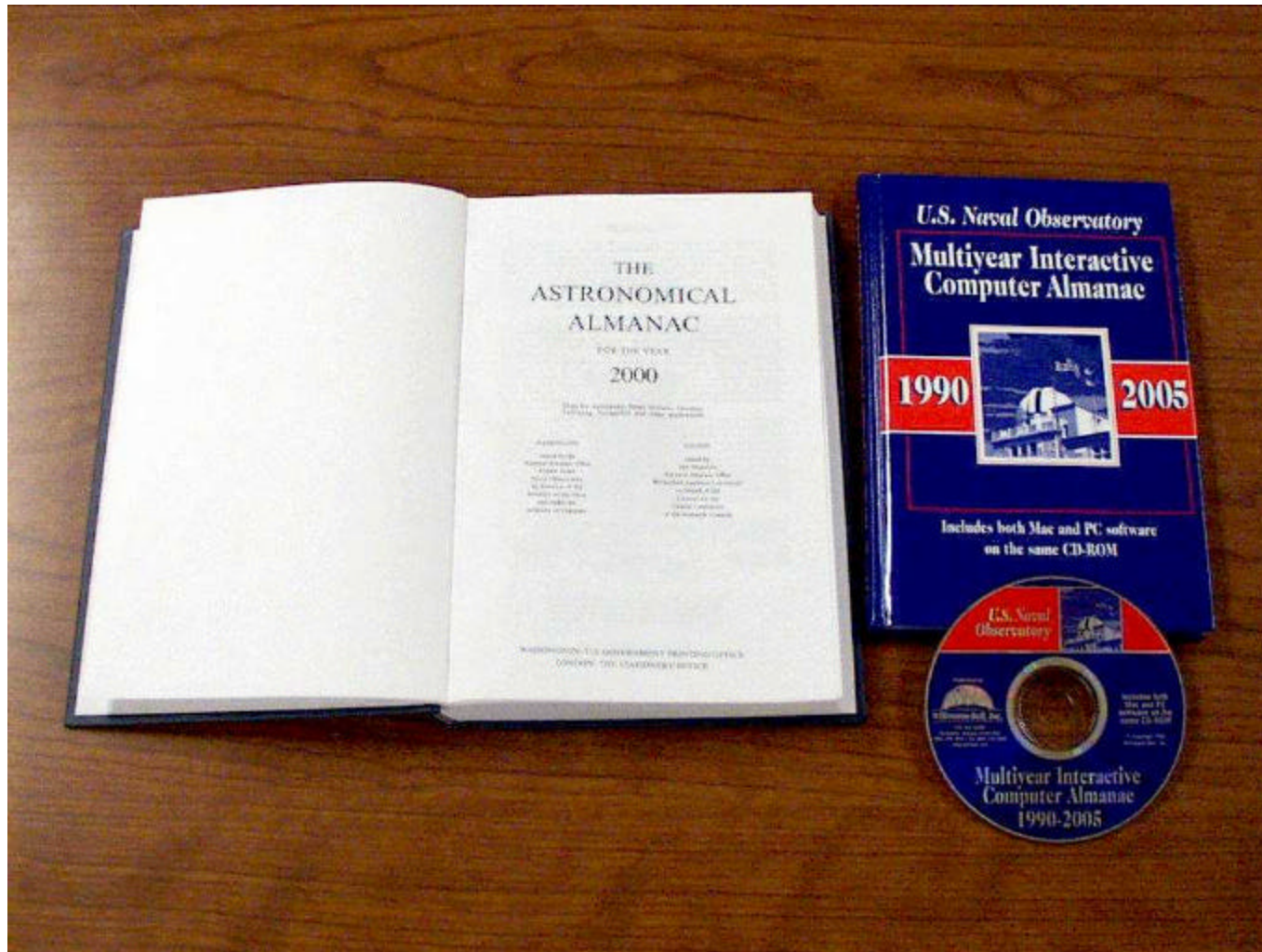
Almanac Products for High-Precision Applications



- *The Astronomical Almanac*
- MICA
 - Computer-based counterpart of *Astron. Alm.*
 - PC and Macintosh editions
- NOVAS
 - Source code (Fortran and C)
 - Common astrometric quantities & transformations
- Web services
 - WebMICA



The Astronomical Almanac & MICA



MICA Overview



- USNO's second-generation computer almanac
- Complements the *Astronomical Almanac*
 - Geocentric *and* topocentric data
 - TT *and* UT
 - Long interval: 1990-2005 (Version 1.5)
- Provides
 - Nine positions types
 - Sidereal time, nutation & obliquity, calendar
 - Rise/set/transit/twilight
 - Physical ephemerides
 - Configuration

MICA (DOS User Interface)



► Calculate ◀ Preferences Save Output Exit to DOS

Moon

Location: W 77°04'00", N38°55'20"
(Longitude referred to Greenwich meridian)
Sea level; level horizon

Time Zone: 5h 00m west of Greenwich

Date (Zone)	Rise	Az.	Transit	Alt.	Set	Az.
	d h m °		d h m °		d h m °	
1996 Jul 25 (Thu)	25 14:39	111	25 19:55	34S	26 01:09	248
1996 Jul 26 (Fri)	26 15:42	113	26 20:53	32S	27 02:02	246
1996 Jul 27 (Sat)	27 16:44	114	27 21:53	32S	28 03:03	246
1996 Jul 28 (Sun)	28 17:43	113	28 22:55	33S	29 04:10	248
1996 Jul 29 (Mon)	29 18:36	110	29 23:56	36S	30 05:22	252

NOVAS



-
- Source code library
 - C & Fortran
 - Common astrometric quantities and transformations
 - Precession, nutation, sidereal time, etc.
 - PNSW transformation
 - Apparent, topocentric, astrometric places
 - Rigorous and precise
 - Consistent with IAU resolutions
 - Current version: 2.0
 - ICRS-compatible

Almanac Products for Special Purposes



- **Solar Lunar Almanac Core (SLAC)**

- Specialized almanac “engine”
- C source code
- Sun/Moon phenomena + illumination
- U.S. DoD-only



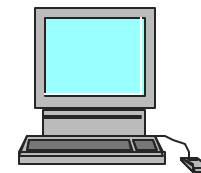
- **Custom solutions**

- Mainly for U.S. DoD
- Software
- Data



- **Web services**

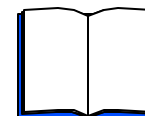
- Example: illumination data based on SLAC



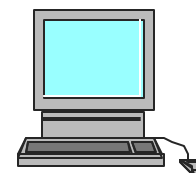
Products for General Use



- *Astronomical Phenomena*
 - Preprint of selected data from the *Astron. Alm.*

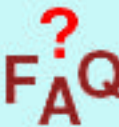


- **Web Site**
 - Wide variety of information
 - Product information
 - Interactive data services
 - Answers to FAQ
 - 7000-10000 user sessions per day
 - DoD-only services



AA Web Site



 <u>Data Services</u> Sun and Moon rise and set times, Moon phases, eclipses, seasons, positions of solar system objects, and other data	 <u>Frequently Asked Questions</u> background information on common astronomical phenomena, calendars and time, and related topics
 <u>Publications</u> astronomical and navigational almanacs, special publications, research reports	 <u>Software Products</u> computer almanac for PCs and Macs, and more
 <u>Research</u> current research projects in the department	 <u>About AA</u> information about the department, its history, and staff
 <u>News</u> announcements, product availability, new releases, errata, employment	 Find it! ● <u>Search</u> ● <u>Index</u> ● <u>Site Map</u>

<http://aa.usno.navy.mil/AA/>

Plans



- Major revision of the *Astronomical Almanac*
 - Content and format
 - Incorporate ICRS and new ephemeris (DE405)
 - Web component
 - In progress
- Determine future of *Air Almanac*
 - Assess true requirements
- STELLA
 - Version 2.0 done
 - Continue to maintain and improve

Plans (con't.)



- **MICA**
 - Version 2.0 in development
 - Improved user interface
 - More calculations
 - Longer interval (~200 years)
- **SLAC**
 - Version 2.0 in development
 - Phenomena at heights above sea level
 - Better refraction model
- **Web site**
 - Ongoing improvements

Summary



USNO...

- Provides a wide range of almanac products and astronomical data services
 - Printed almanacs
 - Computer-based almanacs
 - Source-code software and data
 - World Wide Web sitethat are benchmark standards used worldwide.
- Will continue to update and improve these products
 - To satisfy user requirements
 - To incorporate the best fundamental reference data