

# A Short Guide to Celestial Navigation

Copyright © 1997-2004 Henning Umland



[Introduction & Tutorial](#)



[Freeware](#)



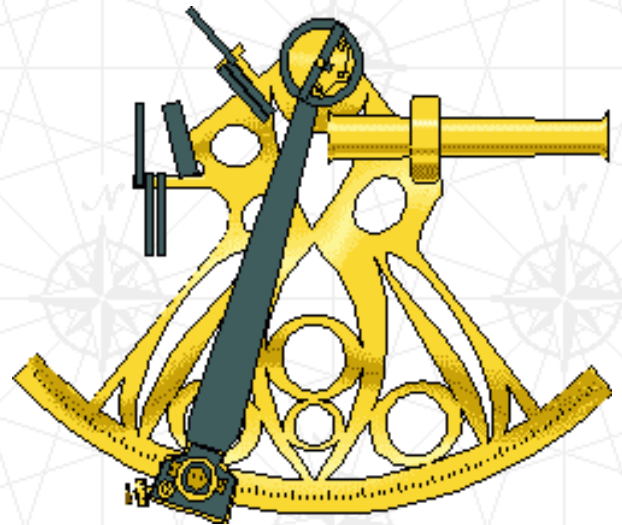
[Cool Links](#)



[Contact](#)



[Author's Note & Personal Stuff](#)



Visitors since May 20, 1997:

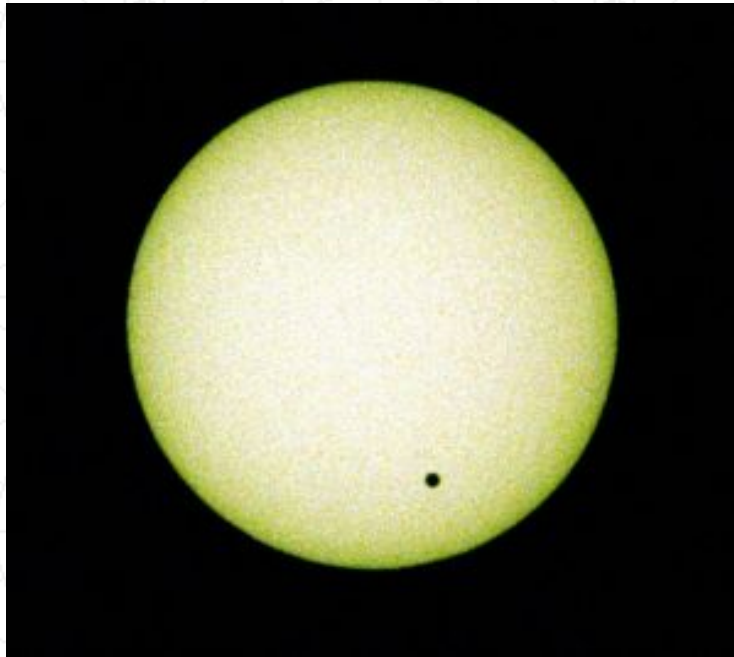
90925

Last update: July 15, 2004

# Introduction



**Celestial navigation is the art and science of finding one's geographic position by means of astronomical observations, particularly by measuring altitudes of celestial objects – sun, moon, planets, or stars.**



**Venus Transit 2004-06-08**

*Photo Copyright © 2004 H. Umland*

**This website provides a compact manual I wrote for mariners, surveyors, globetrotters, outdoorsmen, students, and other people interested in navigation, earth sciences, and astronomy:**

## ***A Short Guide to Celestial Navigation***



This electronic book is intended for readers familiar with the fundamentals of geography, algebra, and geometry. In particular, the principles of geographic coordinates and trigonometric functions should be known. Everything else is explained in the text.

The complete manual is available as a single, compressed file (astro.zip, approx. 1.2 mb, updated June 22, 2004). To download it, click [here](#). Each chapter of the manual is a separate pdf file (Adobe Reader™ required). A preview is given below. Please observe the *legal notice* at the end of the manual.

## Index

[Title Page](#)

[Preface](#)

[Chapter 1](#)     **The Basics of Celestial Navigation**

[Chapter 2](#)     **Altitude Measurement**

[Chapter 3](#)     **Geographic Position and Time**

[Chapter 4](#)     **Finding One's Position (Sight Reduction)**

[Chapter 5](#)     **Finding the Position of a Traveling Vessel**

[Chapter 6](#)     **Methods for Latitude and Longitude Measurement**

[Chapter 7](#)     **Finding Time and Longitude by Lunar Distances**

[Chapter 8](#)     **Rise, Set, Twilight**

[Chapter 9](#)     **Geodetic Aspects of Celestial Navigation**

[Chapter 10](#)   **Spherical Trigonometry**

<a href="#"><u>Chapter 11</u></a>	<b>The Navigational Triangle</b>
<a href="#"><u>Chapter 12</u></a>	<b>Other Navigational Formulas</b>
<a href="#"><u>Chapter 13</u></a>	<b>Mercator Charts and Plotting Sheets</b>
<a href="#"><u>Chapter 14</u></a>	<b>Magnetic Declination</b>
<a href="#"><u>Chapter 15</u></a>	<b>Ephemerides of the Sun</b>
<a href="#"><u>Chapter 16</u></a>	<b>Navigational Errors</b>
<a href="#"><u>Appendix</u></a>	
<a href="#"><u>Legal Notice</u></a>	

Occasionally, I add new information to the manual. Therefore, it may be a good idea to check this site for updates from time to time.



[Home](#)

# Freeware



## **Interactive Computer Ephemeris 0.51 (ICE) by U.S. Naval Observatory**

This powerful DOS program calculates Greenwich hour angle and declination for Sun, Moon, planets, and the navigational stars with a precision equal to that given in the *Nautical Almanac*. ICE is very similar to the former *Floppy Almanac* but covers a time span of almost 250 (!) years. Rising, setting, and twilight times are also provided. It further performs sight reduction (including altitude corrections) for any assumed position. Beside its navigational functions, ICE provides highly accurate ephemeral data for astronomers. Results can be stored in an output file. ICE, predecessor of MICA (Multiyear Interactive Computer Almanac), is in the public domain now and no longer controlled or supported by *USNO*. This program is a must!

**[Download ice.zip \(1 mb\)](#)**

## **The Navigator's Almanac 2.0 by J. K. Simmonds**

Another compact and user-friendly computer almanac. Creates and prints daily pages (interpolation tables required).

**[Download almanac.zip \(63 kb\)](#)**

# JavaScripts

JavaScript is a nice language for programming scientific calculators. It is fairly easy to learn and



has a complete set of mathematical functions. The following utilities are interactive HTML documents containing JavaScript code. They have a user-friendly graphic interface (like Windows programs) and require much less space on the hard drive than stand-alone software. To run these programs, you need a web browser. One of the advantages of JavaScript is that browsers are available for most operating systems. Therefore, JavaScript programs are more or less platform-independent. The programs have been tested with Microsoft Internet Explorer 6 and Mozilla Firefox 0.9. Other browsers have to be checked individually.

### **Long Term Almanac for Sun, Moon, and Polaris 1.08** *by H. Umland*

A perpetual almanac for Sun, Moon, and Polaris. Calculates GHA, SHA, and Dec,  $GHA_{Aries}$ , and miscellaneous astronomical data. Requires current value for Delta T. To test the program click [here](#).

[Download longterm.zip \(14 kb\)](#)

### **Long Term Almanac for Sun, Moon, Brighter Planets and Polaris 1.12** *by H. Umland*

A perpetual almanac for Sun, Moon, Venus, Mars, Jupiter, Saturn, and Polaris. Calculates GHA, RA, Dec, and miscellaneous astronomical data. Requires current value for Delta T. This is an extended version of the above program. Since the uncompressed file is rather large (1.1 mb), starting the program from the hard drive is recommended.

[Download planets.zip \(340 kb\)](#)

### **Long Term Almanac for Moon, Stars, and Lunar Distances 1.11** *by H. Umland*

A perpetual almanac for the Moon and 58 bright stars including Polaris. Calculates GHA, SHA, and Dec for the Moon and a chosen star and the lunar distance of the star. In addition,  $GHA_{Aries}$  as well as HP, SD, and the phase of the moon are displayed. Requires current value for Delta T. To test the program click [here](#).

[Download staralm.zip \(13 kb\)](#)

## **Sight Reduction for the Sun 1.36** by *H. Umland*

A user-friendly sight reduction program for observations of the Sun. Includes 40-year almanac and altitude corrections. To test the program click [here](#).

[Download sunsight.zip \(8 kb\)](#)

## **Sight Reduction for the Moon 1.03** by *H. Umland*

A user-friendly sight reduction program for observations of the Moon. Includes 10-year almanac and altitude corrections. To test the program click [here](#).

[Download moonsght.zip \(8 kb\)](#)

## **Sight Reduction Calculator 1.49** by *H. Umland*

A compact sight reduction program. Includes altitude corrections. Requires GHA and declination from the *Nautical Almanac* or ICE. To test the program click [here](#).

[Download sightred.zip \(4 kb\)](#)

## **Fix Calculator 1.07** by *H. Umland*

A program calculating the point where two lines of position intersect. Replaces a graphic plot. To test the program click [here](#).

[Download fixcalc.zip \(3 kb\)](#)

## **RA to GHA Converter 1.02** by *H. Umland*

A utility calculating the GHA of a celestial body from right ascension and Greenwich siderial time as provided by MICA (Multiyear Interactive Computer Almanac). To test the program click [here](#).

[Download ragha.zip \(2 kb\)](#)

## **Sight Reduction Tables** *by H. Umland*

An extended version of Ageton's Tables in PDF format (90 pages). Includes instructions for use and a workform template.

### **[Download tables.zip \(650 kb\)](#)**

A compact version of these tables (15 pages only) is also available.

### **[Download compact.zip \(334 kb\)](#)**

Attention! If you downloaded an older version of the file compact.zip (dated before Jan 17, 2002), update it now. The old version contains a systematic error in one column of each page.

## **Other Stuff**



## **Molecular Weight Calculator 1.06** *by H. Umland*

A JavaScript program for chemists and lab technicians. Calculates the molecular weight of a chemical substance. To test the program click [here](#).

### **[Download molwt.zip \(3 kb\)](#)**

#### Disclaimer:

I provide the software on this page to you "as is" without any express or implied warranties of any kind including, but not limited to, any implied warranties of fitness for a particular purpose. I make no representations or warranties of any kind



with respect to any support services I may render to you. I do not warrant that the software will meet your requirements or that the operation of the software will be uninterrupted or error-free or that the software contains no defects or errors. You assume full responsibility for the selection, possession, performance, and proper installation and use of the software and for verifying the results obtained therefrom. You, the user, are solely responsible for determining the appropriateness of this software for your use and accept full responsibility for all risks associated with its use.



Home

# Links to Related Web Sites



The author does not verify the correctness of the sites linked to. No effort is made to ensure that they are error-free. The following links are offered without any express or implied warranty.

- [Interactive Computer Ephemeris \(ICE\) by U.S. Naval Observatory](#)
- [Multiyear Interactive Computer Almanac \(MICA\) by U.S. Naval Observatory](#)
- [Web Version of MICA](#)
- [Celestial Navigation Data for Assumed Position and Time](#)
- [Ephemerides Server of the Bureau des Longitudes](#)
- [Data Online](#)
- [The Lunar Distance Page](#)
- [Stormy Weather Software](#)
- [Navigator for Windows](#)
- [Alcyone Software](#)
- [The Constants and Equations Pages](#)
- [Cadastral Survey](#)
- [Home Planet](#)
- [Analemma](#)

- [Sundials on the Internet](#)
- [The U.S. Naval Observatory](#)
- [The Institute of Navigation](#)
- [Sailing Issues](#)
- [H. M. Nautical Almanac Office](#)
- [National Maritime Museum](#)
- [The Navigation Foundation](#)
- [The Navigation-L Mailing List](#)
- [Mary Taylor's Celestial Navigation Pages](#)
- [Heavenly Mathematics: Highlights of Cultural Astronomy](#)
- [Paul Schlyter's Homepage](#)
- [SEDS](#)
- [Global Positioning System Overview](#)
- [DGPS Beacon Locations](#)
- [National Imagery and Mapping Agency](#)
- [IERS Rapid Service / Prediction Center](#)
- [Earth Orientation Data \(UT1-UTC\)](#)
- [Geomagnetism Home Page](#)
- [Canadian Geomagnetic Reference Field](#)

- [The Munich Astro Archive](#)
- [Eric Weisstein's World of Mathematics](#)
- [Celestaire Navigation Instruments](#)
- [Clausen Instrument Company, Inc.](#)
- [Willmann-Bell, Inc. \(astronomy books\)](#)
- [Cassens & Plath](#)
- [Weems & Plath](#)
- [Freiberger Präzisionsmechanik](#)
- [GraphPap \(a program for printing graduated paper, e. g., plotting sheets\)](#)

## Other Useful Web Sites



- [SciCentral](#)
- [PSIgate](#)
- [Google Search](#)
- [AlltheWeb](#)
- [Fast FTP Search](#)
- [Freeware Shareware World Center](#)

- [The International PGP Home Page](#)



[Home](#)



# Contact



**E-mail:** [astro@celnav.de](mailto:astro@celnav.de)

**Fax (Germany):** +49 721 151296535

**Fax (USA):** +1 734 448 1646

**Please contact me only if you want to report errors or if you have really urgent questions. People ask me all kinds of questions about navigation and astronomy or want me to solve specific navigational problems for them. I really appreciate the interest in my web site, but I cannot keep up with the increasing number of inquiries and simply don't have enough time to provide individual support. Besides, I do not consider myself an authority in navigation. This is just a hobby...**



**Home**

# Author's Note



**Why should anybody still learn celestial navigation in the era of electronics and GPS? The answer is simple: because it is a noble art, and because it is fun. No doubt, GPS technology is highly sophisticated, but using a GPS navigator is about as exciting as using a pocket calculator. Celestial navigation, however, is an intellectual challenge. Finding one's position by astronomical observations requires knowlegde, judgement, and skillfulness. In other words, you have to use your brains. Everyone who ever reduced a sight knows the thrill I am talking about. The way is the goal.**

**I'm an industrial chemist, not a professional navigator or mariner. My interest in navigation is a result of my travel activities. In the late eighties, I decided to spend a vacation in the western part of the USA. I was immediatly overwhelmed by the vast open spaces and the grandeur of this country. This became something like an addiction, and I returned almost every year eversince. On a sunny afternoon in October 1991, during a vacation in Utah, I spontaneously tried to find a shortcut from Interstate 70 to Cathedral Valley, a remote part of Capitol Reef National Park. After driving dozens of miles on various dirt roads and jeep trails, I finally got lost and found myself in the middle of a barren and isolated desert. I was ill-prepared. I was not familiar with the terrain, the fuel was alarmingly low, and my supplies consisted mainly of a candy bar and a can of Coke. I hadn't seen any other car for hours, sunset was drawing near, and I began to realize that I had done a rather foolish thing. If I hadn't purchased my first GPS receiver a few days before the trip, I would have been in trouble. With the GPS, I managed to locate my position on the map - far away from my estimated position - and find the shortest way to the next paved road, Highway 24. A park ranger shook his head when I told him the story later. This incident did not diminish my affection for the desert, but it taught me to be more cautious in the future.**



Author posing in front of a river ford near Capitol Reef National Park, Utah

**Back home in Germany, I was eager to learn everything about orientation and survival in the desert. One of the books I read included a chapter on celestial navigation. The subject fascinated me so much that it finally became a hobby.**

**Celestial navigation is based upon spherical astronomy and spherical trigonometry. Both sciences can be practiced at the desk or in the backyard, even without expensive instruments. One can, for example, find one's (approximate) position by the length of shadows, design sundials, measure the local magnetic declination, compute ephemerides, make calendaric calculations, etc. In summary, this is a nice playground for people who don't want to waste their life watching TV.**

**[Click here to learn more about my desert trips.](#)**

**[Here is another hobby of mine.](#)**



# Home



# Navigate!



While originally intended for police boat operators, this mini-course is designed to provide all Small Boat Professionals with the basics of navigation. Divided into modules, this free, online tutorial allows the student to chip away at the subject at a comfortable and steady pace. Each module builds on the ones before it and learning is reinforced with numerous illustrations, examples, and exercises.

To begin, click onto the first module. When completed, return to the course home page. If you experience any problems with the course or the material, give me a shout and I'll be glad to help you. Good luck.

**Stuck in another site's frame?  
break free**

**[Italiano](#) | [Español](#) | [Français](#) | [Deutscher](#)**





## HELLO ALL STATIONS:

USCG approved and ready to save your life! Read our review of the new auto-inflatable PFDs.

# Contents

- [First Things First](#)
- [History of Navigation](#)
- [the Magnetic Compass](#)
- [Latitude & Longitude](#)
- [Charts](#)
- [Plotting](#)
- [Time, Speed, and Distance](#)
- [Dead Reckoning & Fixes](#)
- [Set & Drift](#)
- [Piloting \(to be posted\)](#)
- [Electronic Aids to Navigation](#)
- [Practice Problems](#)
- [Celestial Navigation](#)
- [Celestial Work sheets \(to be posted\)](#)
- [Underwater Navigation](#)

[Product Reviews](#)

[The Best in \(Free\) Online Boating Courses](#)

## SAR Photo Gallery



[Gallery I](#) | [Gallery II](#) | [Gallery III](#)

# On-line tools

[U.S.C.G. Local Notice to Mariners](#)

[USCG NAVCEN](#)

[US Naval Observatory](#)

[Marine Weather Forecast](#)

[Celestial Navigation Calculator](#)

[National Imagery & Mapping Agency](#)

[NIMA Online Publications](#)

[National Ocean Service Online products](#)

[Celestaire Navigation Instruments](#)

[Additional Links & Resources](#)



[HOME](#) | [LINKS](#) | [MAIL](#)

---

*Disclaimer: All information is provided as an aid in training. Remember that the prudent mariner never depends on any single method of navigating and instead uses multiple solutions as a cross check for errors. It is up to you to decide on the accuracy and relevance of any method used in this tutorial and any use of this material is at your own risk. Navigate! is neither supported, nor endorsed by any government agency. If you would like to comment on any aspect of this site, please write to: [agligani@worldnet.att.net](mailto:agligani@worldnet.att.net)*

Copyright © 1999-2000 Navigate! Background courtesy of Rich Galiano

Updated 07/26/00



Visitors Since January 2000



[Member of The International Maritime Ring](#)

Webring controls



[\[Previous\]](#) [\[Next\]](#) [\[Random\]](#) [\[List Sites\]](#) [\[Join\]](#)

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Titlepage.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.





# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Preface.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter1.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter2.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter3.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter4.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter5.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter6.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter7.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter8.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter9.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter10.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter11.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter12.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter13.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter14.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter15.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Chapter16.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.



# Embedded Secure Document

The file <http://home.t-online.de/home/h.umland/Appendix.pdf> is a secure document that has been embedded in this document. Double click the pushpin to view.

## U.S. Naval Observatory's

# ICE

## Interactive Computer Ephemeris

---

The 4 files below constitute version 0.51 of the U.S. Naval Observatory's "Interactive Computer Ephemeris", which replaces the yearly programs called the [Floppy Almanac](#). Operationally, ICE is identical to the FA series, except that there are a number of data files, each covering part of the range of dates.

[ice1.zip](#) Main program, data for 1979-2001  
[ice2.zip](#) Aux. catalogs, data for 2110-2049  
[ice3.zip](#) Data for 1801-1902  
[ice4.zip](#) Data for 1902-1979

Only the first is needed for the years indicated. Other disks contain only the additional data files, and require the first disk. Disk 2 has the catalog files (Messier catalog, etc) that were part of the FAnn series; the files are identical to the older versions, so if you have built a special catalog, it can be used directly with ICE.

The program covers nearly all that is given in the yearly "Astronomical Almanac" published by USNO. Positions of planets; rotational and illumination data; sun/moon/planet rise, transit, and set times. It does not include the satellite (moon) data for other planets; the latter IS included in the book. The output is a simple numerical tabulation, no graphics. Accuracy is equivalent to the book, that is, world-class accuracy. Output may be directed to a file for later use.

A more recent program called [MICA](#) (Multi-year Interactive Computer Almanac) is intended to replace ICE. MICA also runs on the Macintosh. However, MICA is good for only 1990 - 2000, whereas ICE covers 1801 to 2049. And, unlike ICE, MICA is not free.

[ICE is no longer supported by USNO.](#)

---

[Bill Arnett](#); last updated: 2000 Jan 20

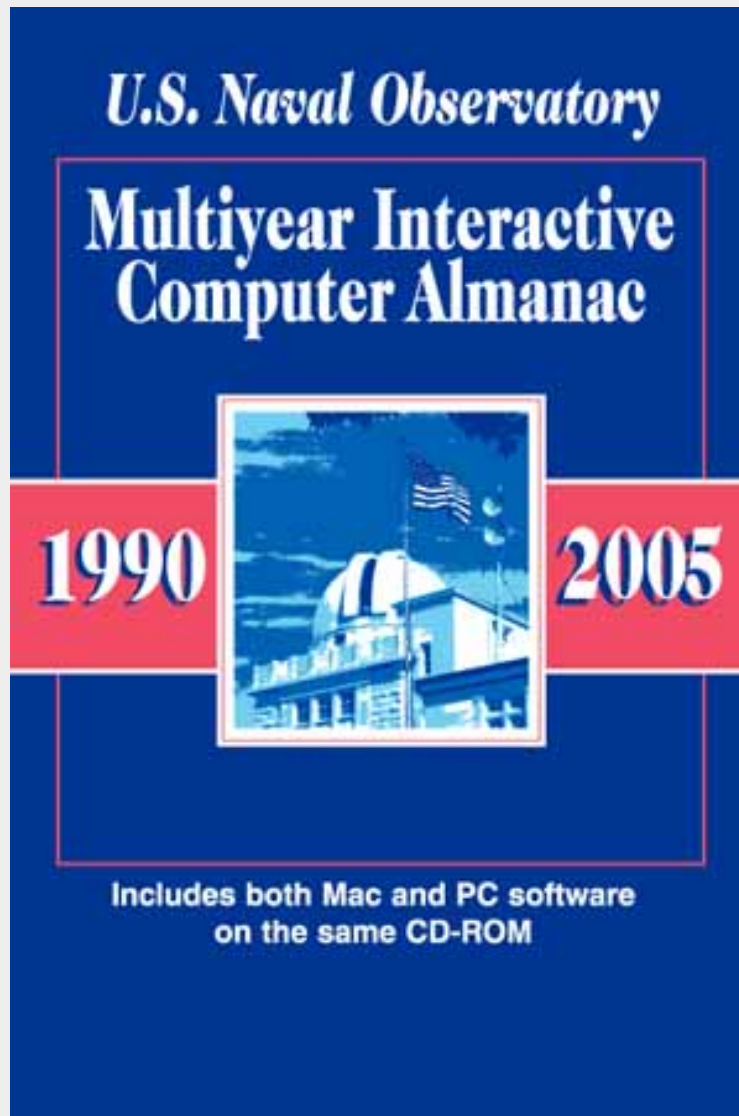
U.S. Naval Observatory

Astronomical Applications Department



# Multyear Interactive Computer Almanac

New! MICA  
Version 1.5



Software for  
PCs and Macs

*Now Available*

# MICA: an easy-to-use astronomical almanac program from the U.S. Naval Observatory

- [About MICA](#)
- [What's New in Version 1.5](#)
- [Test Drive MICA Now!](#)
- [System Requirements](#)
- [Ordering Information](#)

---

## About MICA

The Multiyear Interactive Computer Almanac, MICA, is a software system that provides high-precision astronomical data in tabular form for a wide variety of celestial objects. MICA calculates, in real-time, much of the information tabulated in the benchmark annual publication, *The Astronomical Almanac* (see [Annual Astronomical and Navigational Almanacs](#) in **Publications**). However, MICA goes beyond traditional almanacs by enabling the user to calculate data for user-specified locations at user-specified times within a sixteen-year interval (1990-2005). Designed primarily for professional applications, MICA is intended for intermediate-to-advanced users. The MICA manual provides a chapter on astronomical background, but basic knowledge of astronomical terminology and positional astronomy is assumed.

MICA provides essential data for use in:

Astronomy and  
astrophysics

Space science

Geodesy and  
surveying

Geophysics

Meteorology

Environmental  
science

Operations  
planning

Accident  
reconstruction and  
litigation

Illumination  
engineering

Specifically, MICA provides the following information:

- nine types of positions of celestial objects, including geocentric and topocentric apparent places, astrometric places, and topocentric horizon coordinates
- time and Earth orientation data, including sidereal time, nutation components, and obliquity of the ecliptic
- times of rise, set, and transit of celestial objects, and times of civil, nautical, and astronomical twilight
- data on the apparent size, illumination, and orientation of the Sun, Moon, and major planets for telescopic observations
- a summary of the instantaneous configuration of the Sun, Moon, and major planets at user-specified times

The data provided by MICA match the high precision and benchmark accuracy of *The Astronomical Almanac*. MICA features a sixteen-year solar system ephemeris (the Jet Propulsion Laboratory's DE200/LE200), an internal catalog of the 21 brightest stars and Polaris, and five additional catalogs of astronomical objects. Furthermore, MICA has the ability to access specialized catalogs created by a competent user. MICA tables can be generated in either of two different time scales, with either civil or Julian dates. Rise, set, transit, and twilight times can be tabulated for any time zone. The MICA software is accompanied by a comprehensive, hardcover manual.

Reviews of MICA version 1.0 have appeared in:

- *Sky & Telescope*, August 1993, pp. 54-55.
- *Sky & Telescope*, August 1995, pp. 58-61.

[ [Top](#) | [About MICA](#) | [What's New](#) | [Test Drive](#) | [Requirements](#) | [Ordering](#) ]

---

## What's New in Version 1.5

MICA 1.5 retains the same interface as, and similar system requirements to, the previous version (1.0). Version 1.5 differs from Version 1.0 in the following ways:

- the solar system ephemerides have been extended through 2005
- the external catalog of bright stars has been updated using improved data from



- the preliminary Yale Bright Star Catalog, 5th edition
- the lunar and planetary constants have been updated
- the DOS edition features several new batch control parameters
- both DOS and Macintosh editions are now provided on a single, hybrid CD-ROM
- the user's guides have been unified into a single, hardcover book
- a number of minor bug fixes and improvements

[ [Top](#) | [About MICA](#) | [What's New](#) | [Test Drive](#) | [Requirements](#) | [Ordering](#) ]

---

## Test Drive MICA Now!

A web version of MICA is available that allows you to get an idea of some of MICA's capabilities. However, the web version is not a full MICA implementation and differs from the PC and Mac editions in several important ways:

- the date range is limited: it begins on 1 January of last year and ends 30 days after today's date
- only selected MICA capabilities are available
- the menus and forms for entering data are web-specific and not as user-friendly as those in the PC and Mac editions

However, the output data is the same as that from the PC and Mac editions. If you'd like to give the web version of MICA a try, click [here](#).

[ [Top](#) | [About MICA](#) | [What's New](#) | [Test Drive](#) | [Requirements](#) | [Ordering](#) ]

---

## System Requirements

MICA is provided in editions for PCs (Intel processors) and Apple Macintosh systems. In both cases the system requirements for MICA are quite modest. The PC (DOS) edition features an easy-to-use menu-driven interface. The Macintosh edition offers a full-featured Macintosh graphical user interface.

The **DOS edition** requires a PC with an Intel processor running DOS version 2.0 or higher and at least 512K of RAM. Instructions are provided for running MICA under Windows 3.x or Windows 95. A hard drive with 3 megabytes of free space is also required. A processor with a clock speed of at least 8 MHz and a math coprocessor

are highly recommended.

The **Macintosh edition** requires a Macintosh Plus or higher running System 6.0.2 or higher. It is compatible with System 7 and MacOS 8, requiring at least 1 megabyte of memory in addition to the system requirements. A hard drive with at least 3 megabytes of free space is also required. Power Macintosh systems, or Macintosh systems with 68020 or higher processors and math coprocessors, are highly recommended.

For a sample screen from the DOS edition of MICA, click [here](#). For a sample screen from the Macintosh edition, click [here](#). See also [Test Drive](#).

[ [Top](#) | [About MICA](#) | [What's New](#) | [Test Drive](#) | [Requirements](#) | [Ordering](#) ]

---

## Ordering Information

MICA was published for the U.S. Naval Observatory by Willmann-Bell, Inc. Both DOS and Macintosh editions of the software are distributed on a single CD-ROM, with a hardcover user's guide, for \$24.95. Please direct all orders or general requests for product information to:

**Willmann-Bell, Inc.**  
P.O. Box 35025  
Richmond, VA 23235

(800) 825-7827 (orders only)  
(804) 320-7016 (orders and information)  
(804) 272-5920 (Fax)

<http://www.willbell.com>



Further information is given on [Willmann-Bell's MICA page](#).

[ [Top](#) | [About MICA](#) | [What's New](#) | [Test Drive](#) | [Requirements](#) | [Ordering](#) ]

[\[Publications](#) | [Data Services](#) | [Software](#) | [FAQ](#) | [Research](#) | [About AA\]](#)

[\[News](#) | [Site Map](#) | [Index](#) | [Home\]](#)

---

[Need help?](#)

Last modified undefined NaN, NaN at NaN:NaN

U.S. Naval Observatory

Astronomical Applications Department



# Web Version of MICA

This page enables you to obtain many kinds of astronomical data, including celestial coordinates, sidereal time, lunar and planetary configurations and aspects, and rise/set times. Specify the type of calculation you want below, click on the "Continue..." button, and fill in the form that will appear. The computations are performed by [MICA](#), the Multiyear Interactive Computer Almanac. The basis of the calculations is the same as for the [Astronomical Almanac](#).

A knowledge of general astronomy terms and concepts, as well as astronomical coordinate systems and time, is assumed. The input forms as well as the output data may seem "unfriendly" and possibly opaque to those without such a background. This service has been designed for technical users who require high-precision astronomy data. [Universal Time](#) is used throughout, except for rise/set/transit times, where a time zone may be specified.

This web version of MICA is not a full MICA implementation, but provides some of the most commonly-used functions for a limited range of dates. The dates for which data will be provided run from 1 January of the previous year through 30 days beyond the current date.

Select type of calculation:

...to form where date, object, etc., can be specified.

---

[[Publications](#) | [Data Services](#) | [Software](#) | [FAQ](#) | [Research](#) | [About AA](#)]  
[[News](#) | [Site Map](#) | [Index](#) | [Home](#)]

---

[Need help?](#)

Last modified undefined NaN, NaN at NaN:NaN

U.S. Naval Observatory

Astronomical Applications Department



# Celestial Navigation Data for Assumed Position and Time

This page allows you to obtain all the astronomical information necessary to plot navigational lines of position from observations of the altitudes of celestial bodies. Simply fill in the form below and click on the "Get data" button at the end of the form.

A table of data will be provided giving both almanac data and altitude corrections for each celestial body that is above the horizon at the place and time that you specify. Sea-level observations are assumed. The almanac data consist of Greenwich hour angle (GHA), declination (Dec), computed altitude ( $H_c$ ), and computed azimuth ( $Z_n$ ). The altitude corrections consist of atmospheric refraction (Refr), semidiameter (SD), parallax in altitude (PA), and the sum  $\text{Refr} + \text{SD} + \text{PA}$ . The SD and PA values are, of course, non-zero only for solar system objects.

The assumed position that you enter below can be your best estimate of your actual location (e.g., your DR position); there is no need to round the coordinate values, since all data is computed specifically for the exact position you provide without any table lookup.

Data can be produced for any date and time from year 1700 through year 2035.

Be sure to check [Notes on the Data](#), located after the form.

---

## Date and time of observation:

Use UT (Universal Time). Specifically, the program assumes UT1.



Year:            Month:            Day:  
 Hour:           Minute:           Second:           UT

## Assumed position:

Enter best-estimate sea level coordinates.

Latitude:        north        south        °        '  
 Longitude:       east        west        °        '

---

## Notes on the Data:

Data are shown for the navigational stars and planets only if their computed geocentric altitude,  $H_c$ , is equal to or greater than +1 degree at the place and time specified. Almanac data for the Sun is shown if its  $H_c$  is greater than -12 degrees, the limit for nautical twilight (this is intended as an aid in judging the brightness of the sky). Almanac data for the Moon is shown if its  $H_c$  is greater than -3 degrees; when data for the Moon is shown, a note on its phase appears at the end of the table.

Data are shown for objects above the horizon without regard to whether observations of them are practical. For example, data for stars are shown for either day or night, and data for objects that may be too close to the Sun for observation are also shown.

The GHA of Aries is always shown at the end of the list of objects.

The data are color-coded as follows: Data for solar system objects are shown in red and always appear first in the table. Data for the stars that are listed in *Sight Reduction Tables for Air Navigation (Selected Stars)* ([Pub. No. 249](#), [AP3270](#), Vol. 1) are shown in blue providing that their  $H_c$  values are between 15 and 65 degrees; otherwise they are shown in black. Data for the other navigational stars are also shown in black. Data for Polaris and the GHA of Aries are shown in green.

The altitude corrections are intended for use during sight reduction. For a given object, to obtain the observed altitude ( $H_o$ ), the sum of the altitude corrections (in the rightmost column) is added to the apparent altitude ( $h_a$ ), which is itself obtained from the sextant altitude ( $h_s$ ) by removing instrumental and dip (height of eye) corrections. That is,  $H_o = h_a + \text{Sum}$ . Then  $H_o$  can be compared to  $H_c$  to obtain the altitude intercept in the usual way. The altitude correction values strictly apply only in the case where the observations were in fact made from the assumed position, and, for solar system objects, the lower limb of the object was observed. Generally, however, these corrections are weak functions of altitude and can therefore be applied, with some small error, to sights made close to the assumed position. The first of the listed corrections, refraction, applies to sea level observations made under standard atmospheric conditions. The SD correction for the Moon includes augmentation.

The tabulated data can also be used for observation planning, where a prediction of the the apparent altitude ( $h_a$ ) may be formed by subtracting the sum of the altitude corrections (in the rightmost column) from the computed altitude:  $h_a$  (predicted) =  $H_c - \text{Sum}$ . In many cases, the sum of the altitude corrections is negative, so that  $h_a$  (predicted) will be greater than  $H_c$ .

If you are having trouble seeing the date fields on this page, try the [version without JavaScript](#).

Back to [input form](#)

---

[\[Publications](#) | [Data Services](#) | [Software](#) | [FAQ](#) | [Research](#) | [About AA](#)  
[\[News](#) | [Site Map](#) | [Index](#) | [Home\]](#)

---

[Need help?](#)

Last modified undefined NaN, NaN at NaN:NaN



This server allows the real time calculation of the position of the solar system bodies using the official ephemerides worked out at the IMCCE following the recommendation of the IAU (International Astronomical Union). These ephemerides, defined by the BDL, are also available

# Ephemerides server of the Institut de mécanique céleste et de calcul des éphémérides

---

## Ephemerides :

- [General ephemerides of Solar System bodies \(in french\)](#)
- [General ephemerides of the natural planetary satellites](#)
- [Ephemerides for physical observations](#)

## Celestial Events :

- [Rising, transit and setting of the Sun, the Moon, the planets and the asteroids \(in french\)](#)
- [Solar transit of Mercury et Venus between -2999 and 3000\(in french\)](#)
- **new**
- [Lunar eclipses between 1997 and 2010 \(in french\)](#)
- [Solar eclipses between 1998 and 2005 \(in french\)](#) **new**
- [Asteroidal stellar occultations](#) **new** (In preparation, restricted access)
- [Predictions of the phenomena of the natural satellites and of the Jovian mutual events](#)
- [Next leonids activity](#) **new**

## Astronomical Data :

- [Cometary notes of the IMCCE](#) (last update: 2004, April 26)
- [A list of suspected or known binary asteroids](#)
- [Astronomical glossary](#)

## Tools :

- [The StarField Map server](#)
- [Aspect of the planets Jupiter and Saturn](#) (Astronomy On Line)
- [Links useful for the astrometric observer](#)

**through the  
Minitel network  
: 36 16 BDL.**

- [Conversion between calendar date and julian day](#) (TCL/TK plug-in)
- [Conversion between calendar date and julian day](#) (javascript)

**Attention:** This ephemerides server has been made thanks to the **Ministère de l'Éducation Nationale, to the CNRS and to the CNES. Any professional use of the data provided by this server are submitted to [the authorization of IMCCE](#).**

---

URL : [http://www.imcce.fr/ephemeride\\_eng.html](http://www.imcce.fr/ephemeride_eng.html)

[Back to the Home Page](#)

[Contact us](#)



# Data Services

## Sunrise, Sunset, Moonrise, Moonset, and Twilight

- [Complete Sun and Moon Data for One Day](#)
- [Table of Sunrise/Sunset, Moonrise/Moonset, or Twilight Times for an Entire Year](#)

## Phases of the Moon

- [Dates of Primary Phases of the Moon](#)
- [Fraction of the Moon Illuminated](#)
- [What the Moon Looks Like Today](#)

## Eclipses and Transits

- [Recent and Upcoming Eclipses of the Sun and Moon](#)
- [Lunar Eclipse Computer](#)  
computes circumstances for selected lunar eclipses at any given location
- [Recent and Upcoming Transits of Mercury and Venus](#)
- [Transit of Venus Computer](#)  
computes circumstances for the June 8, 2004 transit of Venus at any given location

## Positions of the Sun and Moon

- [Altitude and Azimuth of the Sun or Moon During One Day](#)
- [Position of the Sun at Noon for Washington, D.C.](#)
- [Day and Night Across the Earth](#)  
creates synthetic views of the Earth's surface (in grayscale or color) for any date and time

## Data for Solar System Bodies and Bright Stars

- [Web Version of MICA - Multi-Year Interactive Computer Almanac](#)  
includes positions, rise/set/transit, physical ephemerides - plus sidereal time & Julian dates
- [Orbital Elements of Asteroids](#)  
provides an online interface to a database of orbital elements and other properties of known solar system small bodies (NEOs, main-belt asteroids, Centaurs, trans-Neptunian objects, but not comets)
- [Apparent Disk of Solar System Object](#)  
creates a synthetic image of the telescopic appearance of the Moon or other solar system object for specified date and time

## Dates

- [Earth's Seasons - Equinoxes, Solstices, Perihelion, and Aphelion 1992-2020](#)
- [Spring Phenomena, 25 BCE to 38 CE](#)
- [Julian Date Conversion](#)

## Celestial Navigation

- [Celestial Navigation Data](#)  
provides computed altitudes and azimuths and other data for an assumed position and time
- [Navigational Star Chart](#)

## Miscellaneous

- [International Celestial Reference System \(ICRS\) - Important Links](#)
- [Occultations of Stars by Asteroids](#) (International Occultation Timing Association)
- [Eclipses/Occultations of the Galilean Satellites 2002 - 2003](#)

## DoD Information

- [DoD Information](#) (restricted access)

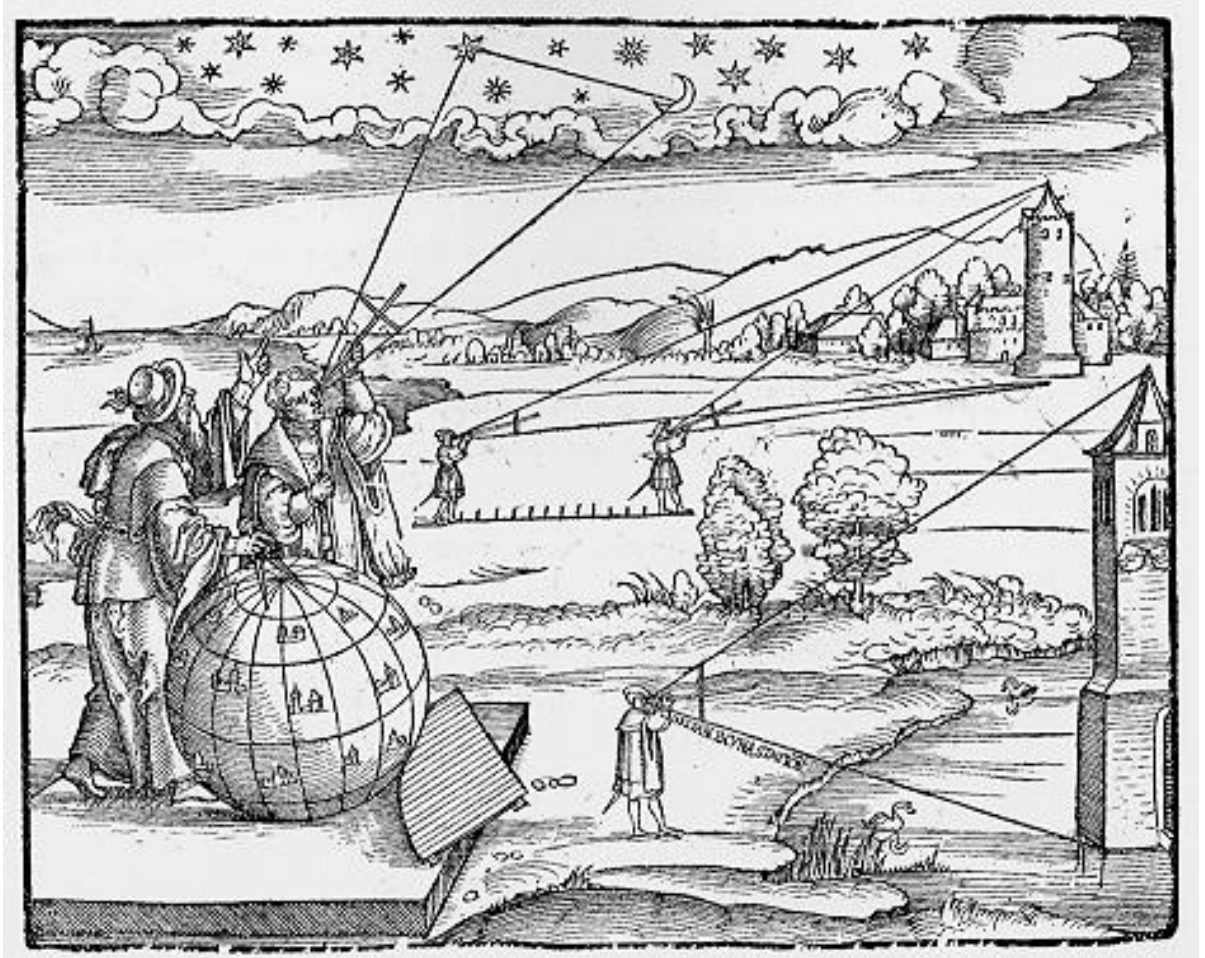


[Need help?](#)

Last modified undefined NaN, NaN at NaN:NaN

# THE LUNAR DISTANCE PAGE

**A resource for those interested in the history, theory and practice of determining time by measuring the angle between the moon and the sun, stars or planets.**



[Introduction](#)

[Basics](#)

[Links, etc.](#)

[Nav-L](#)

[Site Map](#)

[Home](#)

What is the lunar distance and why is it so interesting? For a quick introduction, [click here](#).

For basic theory and instruction on how to observe the lunar distance at home, [click here](#).

For links to a variety of lunar distance topics and resources, [click here](#).

The Navigation-L discussion list is an excellent source of in depth information about the lunar distance. For links to selected topics and materials referenced on the Nav-L, [click here](#).

**This website is intended to make it easier for amateur navigators, astronomers and nautical historians to get involved with the lunar distance method in theory and practice. I hope to add links and information over time. Please pass along any comments, corrections or suggestions.**

**Arthur N. Pearson  
Belmont, Massachusetts, USA  
[arthurpearson@hotmail.com](mailto:arthurpearson@hotmail.com)**

**visitors since May 30, 2003**

# Stormy Weather SoftWare

Box 125, Picton, Ontario, K0K 2T0, Canada



**S**pecializing in software consultancy and programming since 1989. We have made our reputation serving your needs in marine and security applications, communications programming, web technology, video conferencing and graphic art.

## Software

- Tides
- Almanac
- Morse Code
- Screen Savers
- Downloads
- Web design

## Marine

- Album
- General interest
- History

## Technology

- Amateur Radio
- VCI Software

## Art Gallery

The County

## Archives and Collections

Marine Museums

[Contact](#) | [Index](#) | [Search](#)



### [Tide Tables - Worldwide](#)

More than eight hundred ports, graphs and tables, valid forever! [Aussi en français](#)



### [Morse Code Training](#)

This is all you need to become an expert!



### [Maritime navigation, almanac](#)

Permanent nautical and astronomical almanac, instant sight reductions for the mariner. [Aussi en français](#)

Stormy Weather [Privacy Policy](#)

From conservative solutions to maritime and navigation data treatment, to complex applications in data bases and communications - via web pages, graphics and networking, local and wide area, security and e-commerce, we provide definitive, custom and off-the-shelf consultancy, applications and programming.

**Visit our [SECURE on-line store....](#)**



[The Weather!](#)  
[Lake Ontario marine](#)



by [Google](#) Search this Site, or the Web.

| [Maritime page](#) | [Owl in the Sun](#) | [Amateur Radio](#) | [Software](#) | [Purchase](#) | [Text only](#) | [Full Search](#) | [Links](#) | [Contact us](#) |  
| [Stormy Weather](#) | [Maritime documentation](#) | [Canadian Society of Marine Artists](#) | [Archives & Collections](#) |

July 19, 2004.

**Tides for 300 ports . . . worldwide . . . valid forever!**

Copyright © 1994-2004 Stormy Weather SoftWare Ltd



**Web services**

- [Star Finder](#)
- [Almanac](#)
- [Interactive Sextant](#)

**Software**

**Purchase**

**User manual**

**News**

**Download trial**

**Screen shots**

**Feedback**

**Chart Library and links**

**Learn**

**Celestial Navigation**

**Using Navigator**

**Stars & planets**

**Navigator methods**

**Build your sextant**

**The CD-Sextant**

**Navigator Store**



exclusive Navigator designs



**Cartoon**

**> Navigator News**

- Navigator "in the box" released **New!** [more >>](#)
- Yet another sextant: the CD-Sextant** [more >>](#)
- The Navigator Store is on the air [more >>](#)
- Real and virtual sextants [more >>](#)
- Moon calculations improved. Navigator 4.1 released [more >>](#)

**> Sextant Corner**

**The CD-Sextant**  
*build your own sextant easy cheap and fun*

**Build your own Octant**

- [The interactive Sextant - Flash movie](#)

**> Download**

- [Download Navigator for Windows](#)  
Celestial and chart navigation software . Free trial.
- [Chart library](#)  
Vector charts for the registered edition. [Links](#) for raster chart images in the Internet.
- [Navigator for DOS](#)  
For old DOS machines and HP LX 95/100 palmtops. Free. Service release 1.3 available.

**star finder**

*your guide to the navigation sky*

- sky map in any position and time
- stars, constellations and planets with complete positional data.
- specify position or choose one of 300 listed cities
- requires a Java enabled browser
- printer friendly results
- free web service

**> Learn**

**Theory**

- [Celestial navigation fundamentals](#)

[English](#) › [Français](#) › [Português](#)

- [Identification of stars and planets](#)

- [keeping the time...](#)
- [object distances and Lunar calculation.](#)
- [Navigator calculation methods](#)

**Practice**

- [How to find your position using Navigator](#)
  - Navigator 4 User Manual
  - How to find your position using celestial navigation.
  - How to scan, import and use existing paper charts.
  - Tips for improving results.

- [Navigator screen shots](#)

[Texto em português](#)

**> Navigator software purchase**

**buy online**  
*register and get the full Navigator*

- **Vector and raster charts** with routes and tracks.
- NMEA compatible **GPS interface**. Save your track in real time
- Build your own vector charts with ChartMaker.
- Import and use GIF and JPG images as raster charts.
- **Star Finder**, for easy star identification.
- **Meridian Passage** and artificial horizon support.
- **Leg calculator** (Great circle and rhumb lines).
- Print **Nautical Almanac** pages.
- Secure online registration.
- Register, download and install in minutes.
- One year e-mail support and software upgrades.

**The Online Nautical Almanac**



**Perpetual online Nautical Almanac**  
*free web service*





# alcyone software

## software

### Planet's Visibility

- ▶ description
- ▶ download
- ▶ documentation

### Planet's Orbits

- ▶ description
- ▶ samples
- ▶ data files
- ▶ download
- ▶ FAQ
- ▶ register

### C88

- ▶ data files
- ▶ download
- ▶ documentation
- ▶ register

## star data

- ▶ main page
- ▶ Bright Star Catalogue
- ▶ search in BSC
- ▶ the brightest stars
- ▶ variable stars
- ▶ double/multiple stars

## contact / leave your message

- email
- imprint

## Planet's Orbits

*an accurate digital orrery*

## Planet's Visibility

*Tells, when a planet, the moon or the sun is visible.*

**Version (2.0) of Planet's Visibility available.**

**Planet's Visibility** presents a 3-color graph that shows when a planet, the moon or the sun is visible during any year from 3000 BC to AD 6000 at any location on the earth. The vertical axis marks the months of the year, the horizontal axis marks the hours of the day. The three colors create a contour map effect and show whether the body is under the horizon (black) and invisible, above the horizon with the sun (light color) and invisible, above the horizon without the sun (shaded color) and so possibly visible. The times of sunrise and sunset can be shown on all the diagrams. By moving the mouse over the diagram, the date and time along with the object's altitude, azimuth, and magnitude, or the phase of the moon, are displayed. In addition, **Planet's Visibility** computes the dates of visibility phenomena, first and last visibility, acronychal rising and cosmical setting, with much supplementary information. These phenomena are very useful for historical purposes. Since the computation of these phenomena is complex and uncertain, alternate methods are provided and parameters can be altered by the user to find what appear to be the best results. There are also diagrams of solar and lunar eclipses, of the rotation, inclination, illumination, and apparent size of the bodies, and of Jupiter's satellites. The settings for the computations may be saved, the graphics may be saved, pasted into documents, and printed, and the tables for visibility phenomena may be accumulated, edited, printed, and saved as .rtf files to be pasted into documents and printed.

Documentation is available.

**Planet's Visibility** is freeware and runs under Windows 98, ME, 2000 and XP.

some screenshot samples

click to enlarge the image



download Planet's Visibility (~5.6 MByte)

- from this site

**for more informations see here:**

- [Planet's Visibility website](#)
- [Planet's Visibility documentation](#)



## C88 - an informational tool for amateur astronomers

*"...a little program that does a big job."  
(Sky & Telescope April 2002)*

### Version 1.2 of C88 available.

**C88** provides detailed information about the celestial objects visible with naked eye, and may be used to aid in viewing of deep sky objects through the eyepiece of a modest amateur telescope. Complex information about the planets, sun and moon completes the functionality of the program. It is based on the extensive data of the Bright Star Catalogue (9110 entries) and of the Saguaro Astronomy Club Deep Sky Database (10700 entries). These catalogues provide basic data (i.e. positions, magnitudes, sizes, spectral data, catalogue references) as well as specific data, like double/multiple star informations, variability data or - in the case of deep sky objects - object classifications and descriptions. The data can be printed out in several types of lists and orders.

some screenshot samples  
click to enlarge the image

**download C88 (~12 MByte)**  
- from this site  
- from SIMTEL archive

The "Solar System Section" of C88 gives informations about the physical, observational and optical parameters of the planets as well as it's orbital, rotational and illuminational data, data about it's satellites and much more. Of course special data of our sun and moon are available too (i.e. an online-updatable sun spot number archive, solar/lunar eclipse informations printable high accurate ephemeris and others.)

One of the most noteworthy functions of C88 is the constellation chart module. The charts are printable and fully user configurable. Stars or deep sky objects can be searched or marked in the charts.

C88 is shareware. That means you may use it for free for a 30-day trial period (with some restrictions). You can [download C88 here](#) or [from the SIMTEL archive](#) (~12MByte). [Registering](#) a copy of C88 costs **only \$24.95**.

#### for more informations see here:

- C88 informations: [star data](#)
- C88 informations: [deep sky objects](#)
- C88 informations: [planets, sun, moon](#)
- C88 charts: [some examples](#)
- [program descripton](#)
- [some screenshot samples](#)
- [Whats new in version 1.2 ?](#)

### New Version (1.7) of Planet's Orbits available.

**Planet's Orbits** is an accurate digital orrery with a wealth of functionality. The program uses the DE404 ephemeris (accurate for dates between 2000 B.C. and 6000 AD) for the calculation of planetary (except Pluto) and lunar positions. The calculation of the positions of the satellites (new in version 1.6) of Jupiter, Saturn, and Uranus is done by the various analytic theories given in the Explanatory Supplement to the Astronomical Almanac (1992).

The positions of the other objects (asteroids, comets) are calculated by it's osculating orbital elements. Therefore the positions of these objects are accurate only for a small period of time.

The version 1.7. shows the positions and trajectories of spacecrafts, using the ephemeris data from [NASA's HORIZON online ephemeris generator](#) (see a [list of the available data files](#)).

The most noteworthy functions are date specification (past, future), 2D/3D orbital animation and custom zoom, orbits of 10000+ asteroids and comets from different databases, simple database handling and updates, printing, statistic, and information windows.

This site shows some of screenshots of the program, which illustrate the capabilities of Planet's Orbits.

Planet's Orbits is shareware and runs under Windows 98, ME, 2000 and XP.

some screenshot samples  
[click to enlarge the image](#)

**download Planet's Orbits (~16 MByte)**  
- from this site  
- from SIMTEL

**for more informations see here:**

- [Planet's Orbits website](#)
- [Planet's Orbits samples](#)

**Sponsored by  
the  
Institute of  
Physics**

[New on TCAEP](#)

[Download](#)

[Bookshop](#)

[Talk TCAEP](#)

[About TCAEP](#)

[Source](#)

[Copyright](#)

 [Printer Version](#)

## Welcome to TCAEP.co.uk

### Science

- [Constants](#) - Over **600** alphabetically listed entries
- [Equations](#) - **UPDATED** - Some **450** entries
- [Periodic Table](#) - Complete periodic table with info on each element
- [Conversions](#) - **UPDATED** - Interactive conversion of over **500** units
- [Java Structurer](#) - **UPDATED** - Create your own interactive chemical compounds to find their systematic names
- [SI Units](#) - Details on all the standard SI Units of measurement

### Maths

- [Topics](#) - Explanations of the more common aspects of maths. Over **400** links
- [Numbers](#) - Addition & Multiplication tables, log tables, metric prefixes and more
- [Algebra](#) - **UPDATED** - All the common algebraic identities, including complex numbers
- [Trigonometry](#) - **UPDATED** - Identities
- [Calculus](#) - Integral and differential functions
- [Symbols](#) - Greek alphabet, electronic symbols and mathematical symbols

### Astronomy

- [Planets](#) - **UPDATED** - Details on all the currently known planets and their satellites
- [Constellations](#) - **UPDATED** - Table of constellations with info on **3164** stars
- [Sunrise & Sunset Times](#) - Times for 231 locations around the world
- [Moon Phases](#) - Tables of moon phases for the next 20 years

**I am pleased to announce that TCAEP.co.uk has found a sponsor.** The [Institute of Physics](#) has agreed to house the site and will ensure it is made available on their servers to all users on a more reliable basis. The Institute of Physics is an international learned society and professional body for the advancement and dissemination of physics, pure and applied, and promotion of physics education. The Intitute is a registered charity, no. 293851 and has over 30,000 members world-wide.

As a result of this, the contact e-mail address for *TCAEP.co.uk* has changed to [tcaep@iop.org](mailto:tcaep@iop.org).

Welcome to **The Constants and Equations Pages**, an **award-winning** project providing one of the internet's most comprehensive sources for information on constants and equations, as well as much, much more. There are currently over **10,800** pages of information on this site.

*TCAEP.co.uk* is now in it's fourth year and is now more extensive than ever. Since its conception, *TCAEP.co.uk* has received over 20 million hits, with the number increasing every month!

[ [HOME](#) ] [ [SCIENCE](#) ] [ [MATHS](#) ] [ [ASTRONOMY](#) ]

[Download](#) | [Shop](#) | [Contact](#) | [About](#)

Page compiled: Mon Oct 22 18:59:58 GMT+01:00 2001



# Cadastral Survey\*

([www.cadastral.com](http://www.cadastral.com))

This site is privately supported reference providing information of interest to the land surveyor (also known as the **Cadastral Surveyor**) involved in the preservation and retracement of the *Public Land Survey System* (PLSS) in the United States. The term Cadastral, in the U.S., is most often associated with the Federal Land Surveying Authority. The PLSS is also known as the "rectangular system", and was a key factor in the orderly expansion west in the early history of the country.

We have had:  visits

New Features - New Look! Coming soon a new **Cadastral**

**Stay tuned...**

[\\*Cadastral is What?](#)

[Cadastral is Where?](#)

[The Manual of Surveying Instructions - 1973 info etc.](#) *updated 11/19/2001*

[2004 Solar and Polaris Surveyors Ephemerii](#) *updated 12/31/2003*

[Papers and miscellany...](#) *updated 8/11*

[EXCITE Search](#)





## Cadastral Survey\*

Cadastral Survey is an operational program within the Bureau of Land Management, Department of the Interior whose mission and focus includes:

- Performing legal boundary surveys for the Federal Government. This includes consultation and boundary determination expertise for USFS, Park Service, Corps of Engineers, BIA, Fish and Wildlife Service, Bureau of Reclamation, etc
- Steward of PLSS records for all active Public Land States, descendant from original General Land Office, or the GLO, the creators of the Public Land Survey System.
- A 215 year history of getting the job done and practical innovation.
- Currently maintains offices in [Alaska](#), [Arizona](#), [California](#), [Colorado](#), [GCDB Denver](#), [Eastern States](#), [Idaho](#), [Montana](#), [Nevada](#), [New Mexico](#), [Oregon](#), [Utah](#) , [Washington D.C.](#) and [Wyoming](#).
- Produces and maintains the primary land tenure records: the survey field notes and plats.
- Is a leader in developing spatial data as a basis for National Land Information System. This includes a large data collection efforts which is underway, known as the GCDB or Geographic Coordinate Data Base Project. This is the largest project in the world for development of records based geographic spatial framework.

So fine, but what is Cadastral really? The term comes from Latin base term Cadastre referring to a registry of lands. So actually Cadastral Surveying is surveying having to do with determining and defining land ownership and boundaries. Seems like a pretty boring thing perhaps? Well a lot of people think surveys are relatively unimportant until they find they have located many hundreds of thousands of

dollars of improvements, buildings, etc. on someone else's land. Suddenly the value of knowing where your land is comes into perspective.

The practice of finding boundaries is neither a purely legal process, nor a purely scientific process. It is something in between with a twist. The boundary surveyor in *finding* an old survey must be cognizant of the legal description of the land and any conflicts which may affect it. This involves not only knowledge but skills in research and investigation. Then the surveyor must be part archeologist to find physical evidence of previous surveys and occupation on the ground. Throughout the process the surveyor must understand the concepts of good measurements to find and describe what is found, and be able to interpret it's relationship to the record. In the end those that do it well find it can be rewarding and fun, sort of as mathematical detective work, with archeology, dendrology, geology and paralegal aspects thrown in. So we sometimes use the old saying "Land Surveying" is both an *art* and a science.

---

This site is was created in May of 1996. Email any problems or comments to [jwahl@qubicle.com](mailto:jwahl@qubicle.com).



---

This document modified: 12/31/2003

[jwahl@qubicle.com](mailto:jwahl@qubicle.com)



## Release 3.1 for Windows 95/98 and NT 4.0

August 19th, 2002

**NEW!** High resolution (8192x4096), natural colour, cloudless Earth image [upgrade now available](#).

Release 3.1 of Home Planet, a comprehensive astronomy / space / satellite-tracking package for Microsoft Windows 95/98/Me and Windows NT 4.0/2000/XP and above, is now available; see [details at the end](#) on how to download and install the software. Release 3.1 of Home Planet is a native 32-bit Windows application which cannot be used on Windows 3.1; if you have such a system, download Home Planet [Release 2](#), which remains available.

The basic functionality of Home Planet remains the same; the changes between Release 2 and 3.1 are those required to conform to the 32-bit Windows application programming interface, to exploit new features in 32-bit Windows (primarily the time zone configuration), and to adjust for changes in the user interface (notably, the replacement of minimised application icons with the taskbar). Home Planet now looks and behaves like a 32-bit Windows application, and some aspects of the program will run faster due to more efficient addressing of large blocks of data such as the star maps and planetary position



coefficient tables.

Release 3.1 is a minor update to 1997's Release 3 which fixes a couple of cosmetic year 2000 problems, incorporates a work-around for a problem in Windows 98 displaying large images on true-colour (24 or more bits per pixel) displays, and updates the help file to compensate for a Microsoft torpedo in Windows 98 which refused to display it on some systems claiming it was in an "unknown language".

Home Planet is in the public domain; it is free software. It is *not* shareware--you don't have to register it or pay anybody, and the version you download is fully functional as soon as you install it. You are free to give copies to your friends, post it on other systems, and otherwise use and distribute it in any way without permission, restriction, attribution, or compensation of any kind.

## Overview

I like to think of Home Planet as putting a somewhat different spin on the Earth and sky. It allows you to view:

- [An earth map](#), showing day and night regions, location of the Moon and current phase, and position of a selected earth satellite. Earth maps can be customised and extended by editing a DLL which provides maps to Home Planet.
- A panel showing detailed [position and phase data](#) for the Sun and Moon.
- Panel showing [positions of planets](#) and a selected asteroid or comet, both geocentric and from the observer's location.
- A [sky map](#), based on either the Yale Bright Star Catalogue or the 256,000 star SAO catalogue, including rendering of spectral types, planets, earth satellites, asteroids and comets. Celestial coordinates are included, and an extensive and user-extensible deep-sky database includes all Messier objects and many of the NGC objects. Precession and proper motion are accounted for in the display.
- Databases of the orbital elements of 5632 asteroids and principal periodic comets are included, allowing selection of any for tracking. These databases can be user-extended using standard orbital elements. MS-DOS utility programs are included which convert asteroid and comet orbital elements in the form published in [Minor Planet Electronic Circulars](#) (MPECs) to the CSV format used by Home Planet. Subscribers to the MPECs can thus easily add newly reported asteroids and comets to the database. Source code for these programs is included.
- A [telescope window](#) which can be aimed by clicking in the sky map or telescope itself, by

entering coordinates, or by selecting an object in the Object Catalogue (see below). Limiting magnitude, labeling, coordinate display, etc. can be defined by user. Right click on an object to display its entry in the Object Catalogue. Stellar magnitudes can be plotted for stars in a given magnitude range in the telescope window. This makes it easy to create comparison star charts for variable star observing.

- A [horizon window](#) which shows the view toward the horizon at any given azimuth. The horizon can be adorned, if you wish, with fractal forged terrain and randomly generated scenery, including houses, livestock, and trees. The scenery is generated by a user-extensible DLL which allows customisation.
- [Object Catalogue](#) allows archiving images, sounds, and tabular data about celestial objects. Both new objects and new categories can be added. Bidirectionally linked to the Telescope window.
- Chart catalogues, selectable from within the Object Catalogue, can be plotted in all sky view windows (Sky, Telescope, and Horizon). Objects are specified by right ascension and declination, and can use any of the star, deep-sky, satellite, or user-extensible scenery icons, plus text (in various colours) with user-defined justification. Commands allow plotting straight lines and lines which curve along parallels of latitude. Chart catalogues are included which display chart boundaries and numbers of Sky Atlas 2000.0, and radio sources from the Third Cambridge Survey (3C) cross-identified with the 4C survey.
- [Orrery](#) allows viewing the solar system, including a selected asteroid or comet, from any vantage point in space, in a variety of projections.
- [Satellite tracking panel](#). Select an Earth satellite from a database of two-line elements, and see its current position and altitude. Satellite will be shown as an [icon](#) on Earth map, Sky, Telescope, and Horizon windows.
- [View Earth From](#) panel allows you to view a texture-mapped image of the Earth as seen from the Sun, Moon, a selected Earth satellite, above the observing location, or the antisolar point. For a real thrill, fly Molniya through perigee!
- [Satellite database selection](#) allows maintenance of multiple lists of satellites, for example TV broadcast, ham radio, low orbit, etc.
- DDE server permits export of real-time Sun, Earth, and Moon information to any DDE client. A sample Excel worksheet is included.
- Computerised telescope pointing is supported via DDE. When the Telescope window is pointed at a given location in the sky, its coordinates are exported via DDE (in both Right Ascension and

Declination and Altitude and Azimuth), permitting a concurrently running telescope drive program to direct a physical telescope to the given location. The sample Excel spreadsheet displays the telescope pointing coordinates.

- Catalogue look-up allows you to right click in any of the sky windows (Sky, Telescope, or Horizon) and locate the closest object in the Object Catalogue. With no keyboard modifier, this searches all eligible catalogues. With SHIFT, CONTROL, or SHIFT+CONTROL, you can direct the search to a specific catalogue. Catalogues are provided which give the chart/plate number for the given location in the following atlases:

SHIFT	Sky Atlas 2000.0
CONTROL	Uranometria 2000.0
SHIFT+CONTROL	Palomar Observatory Sky Survey

- [Observing site selection](#) lets you choose a site from a database of more than 1300 cities and towns, or by clicking on the world map.
- Animation lets you put the heavens into higher gear, with selectable speed, time direction, and time step. Demonstrate seasonal changes, Moon phases, satellite orbits, precession, proper motion, etc.
- [Time and date](#) can be set to any moment from 4713 B.C. into the distant future. Examples of historical research are included.
- Planetary position calculations use the high-precision VSOP87 theory, and lunar position is calculated with the revised ELP-2000/82 lunar theory. Calculation of dynamical time, obliquity of the ecliptic, nutation, precession, and aberration all use high precision algorithms.
- [Cuckoo clock](#). Hey, I live in Switzerland! You can turn it off.
- A comprehensive WinHelp file is included, describing not only the program but the astronomical concepts that underlie it and how to learn more about astronomy.
- Complete program development log included in WinHelp format, accessible from main Help file.
- An [optional screen saver](#) that shows the illuminated Earth and position and phase of the Moon is included.

Home Planet was built entirely from source code using Microsoft Visual C++ version 5.0 bought directly from Microsoft.



# Downloading Home Planet

Home Planet Release 3.1 is supplied in two editions. The "Lite" edition is intended for users who wish to evaluate the program and for casual users. It includes all of the functionality described above and has no accuracy or feature limitations, but in order to reduce download time and to be able to fit on a single 1.4 megabyte diskette, contains smaller databases (for example, only the brightest 7000 stars instead of 256,000, and a 720×360 pixel map of the Earth rather than one with twice that resolution. The Lite edition does not include the collection of images of astronomical objects present in the full version. The Lite edition is less than 1.5 megabytes in size.

The "Full" version of Home Planet includes everything in the Lite edition, plus the larger databases, images, and sound files, which increase the size of the download to more than 7 megabytes--more than many people are comfortable downloading on dial-up connections. If you've downloaded the Lite edition and later wish to upgrade to the Full package, there is a Home Planet upgrade kit available which contains only the components of the Full package omitted from the Lite edition.

Since these files are large, please download from the closest mirror site. My site in Switzerland is extremely heavily loaded, especially in the hours surrounding midnight Universal Time, so even if you're based in Europe, you may get better response from the North America mirror.

## Download Home Planet "Lite" Edition (1411 Kb)

- [From this site](#)
- [From North America](#)
- [From Switzerland](#)

## Download Home Planet "Full" Edition (7221 Kb)

- [From this site](#)
- [From North America](#)
- [From Switzerland](#)

## Download Home Planet Upgrade (Lite => Full) (6342 Kb)

- [From this site](#)
- [From North America](#)
- [From Switzerland](#)

## [Download High-Resolution Cloudless Earth Image Upgrade](#)

# Installing Home Planet

At the risk of being repetitious, I'll give separate instructions for installing both Lite and Full editions, as well as the Upgrade Pack.

## Installing Home Planet Lite

You will have downloaded a "zip" compressed archive named **hp3lite.zip**. Create a directory for Home Planet (for example **C:\HPLANET**) and extract the files from the archive into it with [PKUNZIP](#) or a compatible extractor program. Be sure to specify the option which preserves directory structure in the archive. If you're using PKUNZIP from the MS-DOS prompt, you might install Home Planet with the commands:

```
MKDIR C:\HPLANET
CD C:\HPLANET
PKUNZIP -D HP3LITE.ZIP
```

Once Home Planet is installed, you can launch the application simply by typing **HPLANET** from the MS-DOS prompt while in its directory, or by using the Run item on the Start menu and entering **C:\HPLANET\HPLANET** as the program name. Obviously, if you used a different drive or directory name instead of "C:\HPLANET", you would enter that name. For convenience, create a shortcut icon that points to Home Planet, and you'll be able to launch Home Planet simply by double clicking it.

## Installing Home Planet Full

You will have downloaded a "zip" compressed archive named **hp3full.zip**. Create a directory for Home Planet (for example **C:\HPLANET**) and extract the files from the archive into it with [PKUNZIP](#) or a compatible extractor program. Be sure to specify the option which preserves directory structure in the archive. If you're using PKUNZIP from the MS-DOS prompt, you might install Home Planet with the commands:

```
MKDIR C:\HPLANET
CD C:\HPLANET
PKUNZIP -D HP3FULL.ZIP
```

Once Home Planet is installed, you can launch the application simply by typing **HPLANET** from the MS-DOS prompt while in its directory, or by using the Run item on the Start menu and entering **C:\HPLANET\HPLANET** as the program name. Obviously, if you used a different drive or directory

name instead of "C:\HPLANET", you would enter that name. For convenience, create a shortcut icon that points to Home Planet, and you'll be able to launch Home Planet simply by double clicking it.

## Installing Home Planet Upgrade

If you have already installed Home Planet Lite and wish to add the larger databases and images of the Full edition, you can download the Upgrade pack, which is supplied as a "zip" compressed archive named **hp3upg.zip**. Navigate to the directory in which you previously installed Home Planet Lite (for example **C:\HPLANET**) and extract the files from the **hp3upg.zip** archive into it with [PKUNZIP](#) or a compatible extractor program. If asked whether you want to overwrite existing files in the directory, answer "Yes" to all such queries (the upgrade pack replaces several DLLs and text databases furnished with the Lite edition with larger and more comprehensive replacements from the Full package). Be sure to specify the option which preserves directory structure in the archive. If you're using PKUNZIP from the MS-DOS prompt, you might install the upgrade pack with the commands:

```
CD C:\HPLANET
PKUNZIP -DO HP3UPG.ZIP
```

(The "O" option on PKUNZIP instructs it to replace existing files from the Lite edition with their counterparts from the Full release without asking whether it's OK to overwrite the old files.) Once the upgrade is installed, launch Home Planet as you did before. You will see new objects and images in the Object Catalogue, additional selections on the Display/Map Image menu item in the Map window and the Display/Star catalogue item in the Sky window.

## The Home Planet Screen Saver

A screen saver which displays the the [Earth map](#) with day and night regions and the current position and phase of the Moon like Home Planet's main Map window is available. It used to be included with Home Planet, but has been broken out into a separate package to reduce download time for Home Planet users who have no interest in the screen saver. To obtain the screen saver, first download it.

### Download Home Planet Screen Saver (266 Kb)

- [From this site](#)
- [From North America](#)
- [From Switzerland](#)

When the download is complete, you will have a "zip" compressed archive named **hp3ssave.zip**. Use PKUNZIP or a compatible utility to extract the file **HPSSAVE.SCR** into the directory on your system where screen savers are kept. On current releases of Windows 95 and 98 this is

**C:\WINDOWS\SYSTEM** and on Windows NT **C:\WINNT\SYSTEM32**. If you've installed your operating system on a different drive and/or directory, use the location where the system's **\*.SCR** files are found.

Once the screen saver is extracted into the system directory, use the "Display" item in the Control Panel to select the screen saver. Under brain-dead Windows 95, it will be called "Hpssave", while Windows NT 4.0 will display its correct name, "Home Planet".

---

[by John Walker](#)





ANALEMMA

# Sundials on the Internet



"Sundials on the Internet" is the leading world internet site for information about all aspects of sundials, including:

- **projects** you can do
- **books** you can get
- national **societies** to
- **pictures** you can see
- **sundials** you can **commission** or **buy**
- **sundial trails** all over the world
- including the most recent ones on the sundials of the [Camino de Santiago](#) in northern Spain, and the sundials of the [city of Oxford, England](#)



Our **traffic statistics** show **counter** visitors to our home page since 19 May 2000.- Please bookmark us - and come again!  
See our new **Solar Noon Calculator** giving the exact time of local solar noon for you

**spot  
on  
sundials**  
with the unique "line of light"

<h2>Practical information</h2>	<a href="#">Introduction</a> <a href="#">Set up a dial</a> <a href="#">Finding your latitude and longitude</a> <a href="#">Mottoes</a> <a href="#">Frequent questions</a> <a href="#">5 projects to do</a>	<a href="#">Mass dials</a> <a href="#">Bevezetés a Napórákhoz (HU)</a> <a href="#">Come preparare una meridiana (I)</a> <a href="#">Faire un cadran solaire (F)</a>	<a href="#">Types of sundials</a> <a href="#">Types de cadrans solaires(F)</a> <a href="#">Tipos de relógios solares(P)</a> <a href="#">Types Zonnewijzers (NL)</a>
<h2>Other languages</h2>	 <a href="#">Czech</a> <input type="checkbox"/> <a href="#">deutsch</a> <input type="checkbox"/> <a href="#">français</a> <input type="checkbox"/> <a href="#">magyar</a> <input type="checkbox"/> <a href="#">italiano</a> <input type="checkbox"/> <a href="#">nederlands</a> <input type="checkbox"/> <a href="#">portugues</a> <input type="checkbox"/> <a href="#">español</a> <input type="checkbox"/> <a href="#">Index of foreign language pages</a> <input type="checkbox"/> <a href="#">Can youhelp translate some more pages?</a>		
<h2>Sundial pictures</h2>	<a href="#">New sundials</a> <input type="checkbox"/> <a href="#">Links to pictures of sundials</a>		
<h2>Sundials to buy</h2>	<a href="#">The Sunfair</a> gives detailed information about most of the leading world sundial makes, including <input type="checkbox"/> <a href="#">OutdoorDecor.com</a> <input type="checkbox"/> <a href="#">Spot-On Sundials</a> <input type="checkbox"/> <a href="#">Connoisseur Sundials</a> <input type="checkbox"/>		
<h2>Commission a special sundial?</h2>	<a href="#">Harriet James</a> <input type="checkbox"/> <a href="#">David Harber Sundials</a>		

<h2>Technical information</h2>	<a href="#">Equation of Time</a> <a href="#">Computer programs</a> <a href="#">Declination of a wall</a> <a href="#">Nature of time</a>	<a href="#">Az időkiegyenlítés (HU)</a> <a href="#">L'equazione del tempo (I)</a> <a href="#">La Ecuación del Tiempo (SP)</a>	<a href="#">A fal tájolásának meghatározása (HU)</a> <a href="#">De Tijdsvereffening(NL)</a> <a href="#">Tijdsystemen(NL)</a>
<h2>NEW full-text search</h2>	Search complete site!	Find:	
<h2>Information sources</h2>	<a href="#">Sundial books</a> <input type="checkbox"/> <a href="#">Bücher(DE)</a> <input type="checkbox"/> <a href="#">Boeken(NL)</a> <input type="checkbox"/> <a href="#">BSS Bulletin</a> <input type="checkbox"/> <a href="#">Book Reviews</a> <input type="checkbox"/> <a href="#">NASS Publications</a> <input type="checkbox"/> <a href="#">Tijdschriften (NL)</a> <input type="checkbox"/> <a href="#">Sundial mailing list</a>		
<h2>Sundial makers</h2>	<a href="#">The Sundial Fair</a> <input type="checkbox"/> <a href="#">List of makers worldwide</a> <input type="checkbox"/> <a href="#">Include your details?</a> <input type="checkbox"/> <a href="#">Arthur Wilbur Co</a> <input type="checkbox"/> <a href="#">Connoisseur Sundials</a> <input type="checkbox"/> <a href="#">Harriet James</a>		
 <p>Sponsored by the British Sundial Society</p>	<a href="#">BSS Home Page</a> <input type="checkbox"/> <a href="#">What we do</a> <input type="checkbox"/> <a href="#">Join us!</a> <input type="checkbox"/> <a href="#">BSS Bulletin</a> <input type="checkbox"/> <a href="#">"Make A Sundial"</a> <input type="checkbox"/> <a href="#">Advertising</a> <input type="checkbox"/> <a href="#">BSS Conference 2003</a>		
<h2>Other societies</h2>	<a href="#">Full world list</a> <input type="checkbox"/> <a href="#">Netherlands</a> <input type="checkbox"/> <a href="#">Austria</a> <input type="checkbox"/> <a href="#">Österreich (A)</a> <input type="checkbox"/> <a href="#">N. America</a>		
<h2>Sundial trails: in S. England</h2>	<a href="#">The City of London sundial trail</a> <input type="checkbox"/> <a href="#">The London Thames trail</a> <input type="checkbox"/> <a href="#">Chipping Camden</a> <input type="checkbox"/> <a href="#">Cotswolds trail</a> <input type="checkbox"/> <a href="#">Cambridgeshire</a> <input type="checkbox"/> <a href="#">Hampshire seaports</a> <input type="checkbox"/> <a href="#">Horniman (London)</a> <input type="checkbox"/> <a href="#">East Sussex</a> <input type="checkbox"/> <a href="#">Test Valley (Hampshire)</a> <input type="checkbox"/>		
<h2>rest of UK</h2>	<a href="#">Derbyshire</a> <input type="checkbox"/> <a href="#">County Down, N. Ireland</a> <input type="checkbox"/> <a href="#">Leicester Time Trail</a> <input type="checkbox"/> <a href="#">Oxfordshire</a> <input type="checkbox"/> <a href="#">S. Norfolk</a> <input type="checkbox"/> <a href="#">Suffolk</a> <input type="checkbox"/> <a href="#">Winchester</a> <input type="checkbox"/> <a href="#">Isle of Guernsey</a>		
<h2>France:</h2>	<a href="#">Central Paris</a> , <a href="#">Brianconnais</a> <a href="#">Finistère</a> , <a href="#">Pays de Buech</a> , <a href="#">Queyras (F)</a> <a href="#">Queyras</a> <input type="checkbox"/>		
<h2>rest of Europe &amp; Middle East</h2>	<b>Austria</b> : <a href="#">Österreich (A)</a> , <a href="#">Austria</a> <input type="checkbox"/> <b>Belgium</b> : <a href="#">Rupelmonde</a> , <a href="#">Flanders</a> <b>Germany</b> : <a href="#">Gorlitz</a> <input type="checkbox"/> <b>Israel</b> : <a href="#">Israel sundial trail</a> , <b>Italy</b> : <a href="#">Milan/Bergamo</a> , <a href="#">Milano/Bergamo(I)</a> <input type="checkbox"/> <b>Malta</b> <input type="checkbox"/> <b>Netherlands</b> <input type="checkbox"/> <b>Poland</b> <input type="checkbox"/> <b>Spain</b> : <a href="#">Barcelona</a> <input type="checkbox"/> <a href="#">The Camino de Santiago</a> <input type="checkbox"/> <b>NEW</b> <input type="checkbox"/> <a href="#">Complete world list</a> <input type="checkbox"/>		
<h2>the Americas</h2>	<a href="#">Seattle</a> <input type="checkbox"/> <a href="#">Toronto</a> <input type="checkbox"/> <a href="#">Kentucky</a> <input type="checkbox"/> <a href="#">Ottawa</a> <input type="checkbox"/> <a href="#">Ecuador</a> <a href="#">Ecuador (SP)</a> <input type="checkbox"/> <b>NEW</b> <input type="checkbox"/>		
<h2>in Australia</h2>	<a href="#">Sydney</a> <input type="checkbox"/> <a href="#">Tasmania</a>		
<h2>Let's hear from you</h2>	<a href="#">Comments</a> <input type="checkbox"/> <a href="#">Feedback page</a> <input type="checkbox"/> <a href="#">Personals page</a> <input type="checkbox"/>		

"Clocks"  
magazine  
articles by N.  
Ta'Bois.

[Adjusting for Longitude](#)

[The Analemma](#)

[Calculating hour lines](#)

[Disc dials](#)

[Equinoctial dials](#)

[Gnomon or style](#)

[Greenwich meridian](#)

[Hours and hours](#)

[Latitude & sundials](#)

[Meantime dials](#)

[Minor adjustments](#)

[The Noon Mark](#)

[Pillar dials](#)

[Ring dials](#)

[Significant dials](#)

["Sun time & clock time"](#)

Links

[Other interesting sundial sites](#)  [Wemaster's choice - a miscellany of links to other sites which we have found useful or interesting or both](#)  [directory](#) [How to set up a reciprocal link](#)

This site is listed in the [BBC Education Web Guide](#) which brings you the newest and best websites for learning.

**Please bookmark Sundials on the Internet so we can see you again!**

<http://www.sundials.co.uk/index.html>

This home page was completely redesigned in March 2000. If you would like to see our previous home pages, they are kept posted for your interest (though without links) at [home99.htm](#), [home98.htm](#) and [home97.htm](#). We have come quite a long way since then!

Flags courtesy of [ITA's Flags of All Countries](#).

**This site is one of the community websites maintained by [Internetworks Ltd](#) who are interested in developing similar successful website for other communities. Please visit our websites on the [Camino de Santiago](#), the [Inca Trail](#) in Peru, the [High Atlas](#), and a list of our [other websites](#). We would be happy to build a website for you too!**

Entire contents Copyright © Internetworks Ltd 1997/2001 last revised NaN undefined NaN

**Comments/ suggestions/ problems, please get in touch by [E-mail](#)**



# U.S. Naval Observatory

Monday

September 6,  
2004

## Features

- > [Home](#)
- > [About USNO](#)
- > [FAQ](#)
- > [Products](#)
- > [Public Affairs](#)
- > [Science](#)
- > [Search](#)
- > [Site Map](#)
- > [News](#)

## Special Events

- > [Transit of Venus](#)

## Highlights

- > [FAME](#)
- > [Future Clocks](#)
- > [NPOI](#)
- > [PMM](#)

## Popular Links

- > [Almanacs](#)
- > [Contact the USNO](#)
- > [Navy Jobs](#)
- > [The Sky This Week](#)
- > [Star Catalogs](#)
- > [Sun Rise/Set](#)
- > [Tour Info](#)
- > [Travel Directions](#)
- > [What time is it?](#)

## Departments

- ([Synopsis](#))
- > [Astrometry](#)
- > [Astro Applications](#)
- > [Earth Orientation](#)
- > [Flagstaff Station](#)
- > [Library](#)
- > [Time Service](#)

- [Home](#)
- [About USNO](#)
- [FAQ](#)
- [Products](#)
- [Public Affairs](#)
- [Science](#)
- [Search](#)
- [Site Map](#)
- [News](#)

The **U.S. Naval Observatory** is one of the oldest scientific agencies in the country. Established in 1830 as the Depot of Charts and Instruments, its primary mission was to care for the U.S. Navy's chronometers, charts and other navigational equipment. Today, the U.S. Naval Observatory is the preeminent authority in the areas of [Precise Time](#) and [Astrometry](#), and distributes [Earth Orientation](#) parameters and other [Astronomical Data](#) required for accurate navigation and fundamental astronomy.



The **U.S. Naval Observatory** in Washington, D.C. conducts a free 90 minute [tour](#) of its facilities on alternating Monday evenings from 8:30 pm until 10:00 pm, except on Federal holidays. **Please read the new [tour policy and admission procedure](#).**

Please read this [Privacy and Security Notice](#) and this [Disclaimer for External Links](#). For Freedom of Information Act / Privacy Act questions, contact our [FOIA Program Office](#). Our [DoD Resource Locator](#) registration number is 46042.

Send comments on this page to [webmaster@usno.navy.mil](mailto:webmaster@usno.navy.mil)

This is an Official U.S. Navy Web Site

[Need Help?](#)





# THE INSTITUTE OF NAVIGATION

MEETINGS | PUBLICATIONS | MEMBERSHIP | SEARCH | MEMBERS ONLY LOGIN

## HOME

### ABOUT THE ION

Bylaws  
Contact The ION

### MEMBERSHIP

Individual  
Corporate

### MEMBERS ONLY

### MEETINGS

#### AM 2004

Meeting Program  
Technical Papers Online

#### GNSS 2004

Meeting Program  
Registration  
Hotel Reservations  
Exhibitor Information

#### NTM 2005

Call for Abstracts  
Submit Abstract

### ION COUNCIL

Minutes  
Policies/Procedures

### SECTIONS

### SATELLITE DIVISION

### ION OUTREACH

Scholarships  
Section Activities  
Government Fellowship  
Program

### NEWSLETTER

### LINKS

### ONLINE PUBLICATION PURCHASES

### AWARDS

Annual Awards  
Kepler Award  
Parkinson Award  
Fellow Award

### CALENDAR

### SEARCH

Proceedings  
Journals  
Sitemap



## Members Only Highlights

ION NTM 2004 Proceedings Are Here!  
[Search and Download papers online](#)



### ION GNSS 2004

September 21-24, 2004 - Long Beach, California

[Technical Program](#), [Registration/Hotel Reservations](#), [Exhibitor Information](#)



Now Accepting 2004 Kepler Award Nominations  
Nomination Deadline: August 20, 2004

[Details and Nomination Form](#)



### 2005 National Technical Meeting

January 24-26, 2005 - San Diego, California

[Call for Abstracts and Abstract Submission Form](#)



Classroom Lesson Plans on Navigation

[10 lesson ideas for Grades 6-8](#)



### ION Newsletter

Latest Issue: [Summer 2004, Vol. 14 No. 2](#)



---

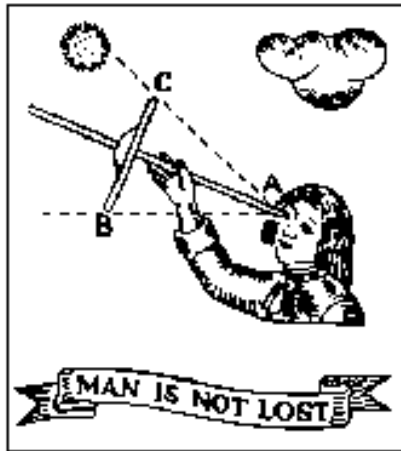
© Copyright 1995-2004, Institute of Navigation, Inc.  
© ION is a registered trademark of The Institute of Navigation, Inc.  
[Privacy - Legal Terms](#)  
[webmaster@ion.org](mailto:webmaster@ion.org)

**ION GNSS 2004**

Reserve your hotel room today!  
Rooms still available at  
[Long Beach Westin](#)



# Welcome to Her Majesty's Nautical Almanac Office



*H.M.  
Nautical  
Almanac  
Office*



**CCLRC**  
Rutherford Appleton Laboratory

HMNAO is part of the Space Data Division of the Space Science and Technology Department at the Rutherford Appleton Laboratory.



HMNAO operates on commercial principles under the auspices of the Council for the Central Laboratory of the Research Councils.

HMNAO is responsible for producing the annual volumes of *The Astronomical Almanac*, *The Nautical Almanac*, *Astronomical Phenomena*, *The Star Almanac* and *The UK Air Almanac* in the United Kingdom. Several of these publications are produced in collaboration with our colleagues at the [US Naval Observatory](#).

HMNAO also produces astronomical data suitable for a wide range of users, including professional and amateur astronomers, mariners, aviators, surveyors, the armed forces, lawyers, religious groups, architects, schools, diary and calendar publishers, photographers and film crews. This information can be accessed via the web by using [Websurf](#). This facility is in a beta test phase and the data produced by this service are **for personal use only**. Those without web access should contact the [Astronomy Information Service](#) of the Royal Observatory, Greenwich. All commercial users should contact HMNAO directly.

The Stationery Office publishes the majority of our books in the United Kingdom. Further information on the Stationery Office and online ordering can be found [here](#).

These web pages describe the history of HMNAO, its work and its publications and services.

## [Transits of Venus](#)

Observationally-orientated material on the transits of Venus in the period 1000 AD to 2700 AD are provided including information on the transit of Venus on 2004 June 8.

## [Rapid Sight Reduction Tables for Navigation \(AP3270/NP303\)](#)

More information on the successor to *Sight Reduction Tables for Air Navigation* published on 8th October 2002.

## [The Nautical Almanac 2003 \(NP314-03\).](#)

Please follow this link for information on a production problem with the bookmark for *The Nautical Almanac 2003*.

### [HMNAO publications from Willmann-Bell, Inc.](#)

Information on US editions of some of our publications available from Willmann-Bell, Inc.

### [NavPac and Compact Data 2001-2005](#)

Information on the successor to *Compact Data for Navigation and Astronomy 1996-2000* is available.

### [Planetary and Lunar Coordinates 2001-2020](#)

Information on the new edition of this continuing series is available.

### [Astronomical Phenomena](#)

Some people have reported difficulties in finding copies of this publication. Further information is available concerning the availability of editions for the years 2001, 2002, 2003 and 2004.

### [Relocation of HMNAO](#)

When the Particle Physics and Astronomy Research Council closed the Royal Greenwich Observatory on 31st October 1998, HM Nautical Almanac Office was transferred to the Council for the Central Laboratory of the Research Councils at Rutherford Appleton Laboratory.

Full details of the [new address](#) of the NAO are now available.

### [Publications](#)

Information on the almanacs, software and other publications of HMNAO: what they contain, how much they cost, and how to order copies.

### [Astronomical Information Sheets and Technical Notes](#)

Information on both general astronomical data and documents on specific techniques used by the HMNAO: what they contain and how to get them.

### [Data Services](#)

HMNAO provides specialised data to many types of client. These pages describe some of our more popular services and how they are provided.

### [On-line Data](#)

Daylight/moonlight diagrams and tables of astronomical data for major observatories around the world, and calendarial data sheets for this year and past years.

### [News](#)

**Information about new products, publication dates of forthcoming almanacs and other news related to HMNAO and its work.**

### [History](#)

The history of the Nautical Almanac Office and its role in the story of navigation at sea.

## People

Who works in HMNAO, and how to contact them.

---

[\[TRANSITS OF VENUS\]](#) [\[NAUTICAL ALMANAC 2002\]](#) [\[HMNAO PUBLICATIONS FROM WILLMANN BELL\]](#) [\[NAVPAC AND COMPACT DATA 2001-2005\]](#) [\[PLANETARY AND LUNAR COORDINATES 2001-2020\]](#) [\[RAPID SIGHT REDUCTION TABLES FOR NAVIGATION\]](#) [\[ASTRONOMICAL PHENOMENA\]](#) [\[RELOCATION OF HMNAO\]](#) [\[PUBLICATIONS\]](#) [\[ASTRONOMICAL INFORMATION SHEETS AND TECHNICAL NOTES\]](#) [\[DATA SERVICES\]](#) [\[ON-LINE DATA\]](#) [\[NEWS\]](#) [\[HISTORY\]](#) [\[PEOPLE\]](#)

---

HM Nautical Almanac Office, Rutherford Appleton Laboratory

E-mail: [hmnao@nao.rl.ac.uk](mailto:hmnao@nao.rl.ac.uk)

Last revision was made on 2004 May 06

---

**Copyright © 1997-2002 HM Nautical Almanac Office. All Rights Reserved.**

Permission must be granted to reproduce this material. HM Nautical Almanac Office, the Rutherford Appleton Laboratory and the Council for the Central Laboratory of the Research Councils do not accept any responsibility for loss or damage arising from the use of information contained in any of the following pages.



# Stormy Weather SoftWare

Systems Consultant - Artwork - Software Design and Realization

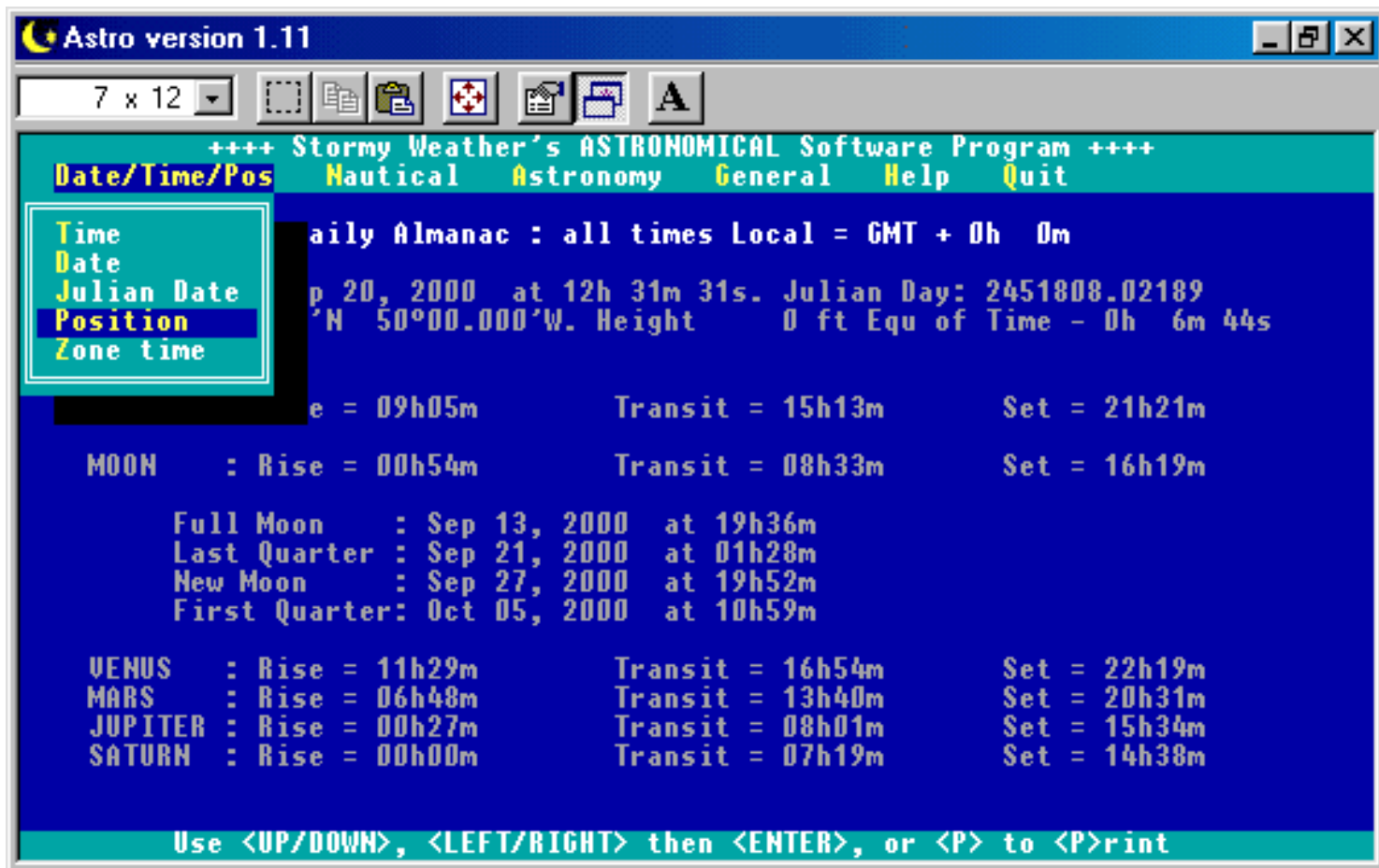
## Nautical Almanac and Astronomical Almanac

### "Astro" version 1.12

| [Download "Astro"](#) | [Version française](#) | [License](#) | [Register/Purchase](#) | [Back Home](#) |

This Almanac software is designed for general use as well as specific utilization by maritime navigators and by astronomers. Version 1.12 was released 1 July 2001, and corrected an error in the predictions of Delta T up to 2012.

Registered users with 6 digit Personal Code Numbers do not need to re-register



This is the latest release of our astronomy software. Use it for Marine celestial navigation, for general astronomical data, or just for your sunrise and moon rise or what planets are visible. Valid permanently, can be used for historical research.

## Multiple features include:

- "Astro" Version 1.11 was released 19 September 2000, including:
  - Cosmetic changes to ensure smooth running in a 'window' (later versions of Microsoft (tm) Windows.)
  - Correction of error produced if a star was selected immediately after a position change (one time only).
- "Astro" Version 1.10 released 15 January 2000, corrected an error in rise, transit and set times of stars if sun or moon had been run previously; added "Auto-Almanac" to allow or prevent the "General Daily Almanac Page" to load on startup; minor internal corrections
- "Astro" Version 1.09 released 1 February, 1999, bilingual English/[français](#), colour/black and white, metric/imperial, minor corrections, compatibility NT4, OS2, additional European DOS, Almanac print out, internal corrections.

- For navigators, the software ensures instant sight reductions for any object above the horizon, using full refraction, semi diameter and parallax calculations.
  - Based J2000, this software incorporates the very latest in mathematical formulae and algorithms. Recent theory has been studied in depth and incorporated in the program. Much of the data has been published by the Bureau des Longitudes in Paris and Department of Astronomy, Yale University in the USA.
  - Accuracy has been assessed against the latest editions of the Astronomical Almanac and has rarely been found to exceed one tenth of a second. This probably is well in excess of the accuracy of Nautical Almanacs which are mostly based J1950.
  - More than 3200 stars are included, (the "Harvard Bright Star List, 5th revised edition" of seventh magnitude and better), under their scientific names (generally Bayer and/or Flamsteed), while for the Mariner the sixty "navigational" stars are listed under their common names.
  - The program is valid "forever" and can therefore be used for historical purposes. It converts automatically Julian and Gregorian dates.
  - The four major (navigational, inner) planets are included. To prevent increasing unduly the size of the program, the outer planets have not been incorporated in this release, but are available from us.
- 

## Download the software

We have regrouped all our [downloads here](#).

**Please note that our server gets extremely busy particularly in the evenings. If you experience difficulties downloading, please [send us E-mail](#) and we will attach the ZIP file to our reply.**

| [Top of this page](#) | [Register Now!](#) | [Purchase Online](#) | [Version française](#) | [Tech Note A11-97](#) | [Homepage](#) |

For tech support, information, or feedback, send email to [astroinfo@stormy.ca](mailto:astroinfo@stormy.ca).

Visitor # 

**Stormy Weather SoftWare Ltd, Box 125, Picton, Ontario, Canada K0K 2T0**

E-mail: [astroinfo@stormy.ca](mailto:astroinfo@stormy.ca) · Web site: <http://www.stormy.ca>

Telephone: +1 613 476 1177 · Fax: +1 613 476 7598