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#SK **Overview**

GraphDark is a tool which allows you to work out when an astronomical object will be visible from your location and when moonlight, twilight or low haze will affect its visibility.

Clicking on a timetable can provide a simple sky map for that instant, a list of coordinates or a world map showing night and day. The sky map shows all the naked eye stars plus Milky Way and Zodiacal light if desired.

The visibility of a single object, such as a comet, can be shown over a period of months or years. Alternatively a number of objects on a single night can be displayed.

Additional displays available include a lunar calendar, covering months or years, and a world map showing night and day at any given time. Other options allow for printing timetables, importing object elements, setting display preferences etc.

The timetables can be useful for planning a series of observing sessions for deep sky objects or meteors so that moonlight can be avoided, working out when a comet will be visible from your location at a reasonable altitude, when a variable star will be visible, or when a series of objects is available for observation.

Alternatively the sky display can be used just to see what is up at any given time and place.

#SK Using GraphDark

GraphDark provides an easy way of summarising the visibility of astronomical objects over a period of days or months. Except for the sun, moon, planets and lunar calendar it is assumed that you have coordinates or orbital elements for the object concerned. Once the required data has been entered or selected the appropriate timetable can be generated for any site in the world.

The rising and setting times are displayed in a commonly used but very compact format called a graphic timetable. To generate a timetable you will need to tell the program :

WHERE you will observe from

WHAT you are interested in

WHEN you want to see it

These can be chosen from the input bar along the top of the timetable, or by clicking on the Selection button to get a form containing all the necessary inputs (as per version 1). Once the full selection has been made, click on Draw [Graphic Timetable] and the program will calculate the necessary ephemerides and display the results.

Clicking on a portion of the timetable will provide one of several possible views. These include a zenith centred sky map, a simple graphic horizon view, a tabular coordinate display showing details of objects visible at the date and time clicked, or a world map view showing day and night at that time.

For some types of display colour coded altitude masks can be used to clarify an object's visibility.

Timetables can be centred on midday or midnight and the day lines can be vertical or horizontal. Options for varying the appearance of the display, colours used, preferred site etc. are available by clicking on Edit, Preferences.

Details of objects can be added or amended by selecting the appropriate type from the Edit menu. Import and Export options are available for some types of objects in the database.

Printing the timetables can be done on most Windows compatible printers, although a colour printer is best for distinguishing the planets.

Help is available at any time by pressing **F1**, or selecting it from the menu bar. Samples are available from the menu bar to help with understanding how to use the timetables.

#SK**WHAT**

The program can provide timetables for several types of object.

Moving refers to Solar system objects such as asteroids and comets.

Fixed is mainly for objects outside the Solar system.

List provides a single night display for any combination of fixed objects, moving objects or planets.

Planet displays a single planet in the same way as other moving objects.

Moon will provide a timetable with just moonrise and moonset times.

Sun shows just sunrise, sunset and twilight.

All planets deals with the the moon and planets out to Neptune.

Lunar calendar provides a graphical display of the moon's phases plus a list of phase dates

World map provides a display of night and day on a simple world map.

Meteor stream displays the period of visibility of a meteor stream.

Moving and fixed objects will need some information to be supplied before a timetable can be run. If insufficient information is provided the program will ask for it. List uses existing objects but the contents of the list need to be added to the list first.

All Planets, Lunar Calendar, Moon, Planet, Sun and World map do not require extra information but there are options to select which colours are used on the display or printout, for All planets there is also a choice of symbols.

Clicking within the timetable area will pop up a view giving additional information, this could be one of, Zenith view, Horizon view, Coordinates or World view (Does not apply to Lunar calendar and World map)

#SK **Moving objects**

If the object you are interested in is a comet or minor planet then select the Moving type from the input bar followed by the specific object.

Alternatively use the Selection button to open the old style input form, select Moving object type, Moving object details and choose from the list.

Information shown on the timetable includes object rise and set, sunrise and sunset, beginning and end of twilight plus options to show dusk and dawn, transit times and an altitude mask.

Object colours - On

The appropriate background colours are displayed with coloured object lines drawn over them. The times when the moon is up are shown by a broad line in the selected moon colour. The times when the object is up are shown by a thinner line in the object colour. An optional altitude mask or haze may be drawn over the object line.

Dusk, Moon, Mask and Grids display can be toggled on or off as required.

Object colours - Off

Effectively a black and white display where the line thickness is used to represent the object visibility. Sunrise and sunset, beginning and end of twilight, dusk and dawn are shown by black tick marks across the lines representing each night. Object details are only shown for the hours of darkness.

If the object is down, or in bright twilight or daylight

the line is blank

If the object is up :

in deep twilight a thin line is shown, (if Dusk is on)

in haze the line is dashed

and there is no moon the line is thick

and the moon is also up the line is

thin near full moon

thick near new moon

Dusk, Haze and Grids display can be toggled on or off as required.

Whether object colours are used, the choice of object colours, whether objects are shown by day or night and other details shown can be set on the [Timetable objects](#) tab of the preferences.

The background sky colours can be changed by using Preferences, [Timetable colours](#).

Editing moving objects

To amend or create new moving objects bring up the Moving objects form either by clicking on Edit, Moving objects or by Selection, Moving object type, Moving object details.

Selecting from the existing list of objects gives the elements displayed in the style they were originally entered (comet or minor planet). These can be amended as necessary, clicking on OK will save the changes.

To enter a new object first click on **New object** , enter its name and select the element type, click OK to return to the elements window and enter the orbital [elements](#) in the appropriate boxes.

An **Import object** option is also provided, this allows elements to be imported directly from a flat text file with a user defined layout, or from a .gdd file exported from another copy of GraphDark.

Delete object will remove details of the currently selected object, there is no undo facility !

Moving object elements can be exported from the application using the Edit, Export.gdd option.

#SK Planet

This type of display shows the timetable for a single planet in the same style as other Moving objects. There are no elements to enter as the information needed is already in the program.

Altitude masks can be used, something which is not possible with the All planets display.

KS#Importing elements or positions

This allows elements or positions of individual objects to be imported into the program from another source, provided it is a simple text file or has been created by GraphDark as an export file (.gdd). Selection of individual records from the import file is possible so it is not necessary to import the whole file every time. Be aware that the imported objects will overwrite any objects of the same name - it is assumed that imported data is more up to date.

GraphDark data (.gdd) files can be used to transfer **Fixed, Moving, List, and Site** data between GraphDark users.

For Fixed and Moving objects text files from other sources may also be used but an import format must be provided to allow GraphDark to interpret the file in a sensible way. Unless you regularly use the same sources this facility may be of limited value.

To reach the Import form click on Edit, Import data. If already editing fixed or moving objects then click on Import Object to bring up the same form.

File

Enter the full filename, find the file using Browse or select from the recently used files.

Format

If the file is a GraphDark file, with a .gdd extension, then there is no need for an import format and the format section will be greyed out.

For any other type of file a format for the record layout needs to be specified as there is no standard for the order in which orbital elements or RA and Dec are quoted. The source file itself could be laid out in a number of different ways. The format can be saved for future use.

Select an existing format from the drop down list or use **New** to create one . Use **Edit** to change the details of the selected format or **Delete** to remove the selected format completely.

Import

Clicking on **Open file** will display the header information in the file, if possible, and will also try to display the name fields in the available records list. If the names displayed are not as expected then maybe the wrong format has been used or it needs amending.

If the file has been saved in unix format then check the box **Convert from unix** before opening the file. This adds the necessary carriage return characters so that individual lines are recognised by Windows.

Selection

To import a complete file just click on Select all. If only a single record is needed then select it from the Available records list, click on Add and the object will appear in the Selected records list. Alternatively select a number of records (Shift + click) from the list and click Add.

When the list is complete click on **Import Selection** to process the chosen object(s), warnings will be given if the converted values are not sensible. The values will be stored in the main elements or positions files for future reference. Import as many records as needed from the import file and press Close to finish.

Notes

A default import file and format can be set using the preferences Database tab.

Where Fixed or Moving data is not already in a flat text file then it may be possible to use an export function from a database to get it into a suitable form first. Where data needs reformatting use a wordprocessor or spreadsheet to manipulate the data then export it as an ascii text file.

A useful source of comet and minor planets elements in a variety of formats is the Minor Planet Centre <http://cfa-www.harvard.edu/iau/Ephemerides/index.html>

#SK **Exporting data**

This allows GraphDark users to exchange data in a simple way. Several types of data can be exported to a **.gdd** file which can be copied to another user or even used as a backup. Only one data type can be included in each export file but when reimported GraphDark will automatically direct the records to the appropriate database files.

To export a set of data go to Edit, **Export gdd**.

Export file

Type in, or browse for, an export folder then enter a meaningful export filename, including the **.gdd** extension.

Enter suitable details in the **header line**, for example contents of the file, data source, author and date etc. This will be displayed when the user imports the file and is a useful check on the contents.

Choose a data source within GraphDark, one of **Moving, Fixed, List** or **Site**

Selection

Choose objects from the **Available records** list and Add them until all the desired objects are in the **Selected records** list.

Click on **Export selection** to create the file, a warning is given if the file already exists.

Notes

In the case of an object List the actual object data is included in the export file as well the list of names to ensure that the list is complete. In this case the export file may contain data of different types but this will be handled automatically.

#SK **Editing import formats**

Records can be read from comma separated variable (CSV), tab, blank, colon or semicolon separated or fixed field length text files. Each record must be on a separate line. The order of the elements or positions in the file can be specified along with the date or position image to be used.

When creating or amending formats it is a good idea to open the the import file with a simple text editor, for example Notepad, to make it easier to check the layout. The options offered can only deal with the more common situations, it is also very easy to make mistakes in a format so it is worth checking a few imported records to ensure that all is well (or not !).

A format consists of a **file layout**, **field definitions** and a **record layout**. The file layout and field definition will affect the fields available for selection so altering them may force any existing record layout to be cleared.

File layout

Enter the number of **header lines**, that is lines to be skipped before the data starts.

Select a field separator character: **blank, tab, comma, colon, semicolon** or **none**.

Note that where blanks are used in object names then blank should not be used as a separator.

Where **none** is selected the fields are identified by their positions so the start bytes will need to be specified.

Field definitions

These determine which fields will be offered in the record layout and how they are interpreted. The type of record is chosen when a new format is created.

Fixed objects

Up to three fields may be needed for the Right Ascension and Declination.

If a single combined field then an image is needed as described in [field detail](#) .

If two or three fields are specified then the fields are assumed to be numeric.

Moving objects

Select **comet** style or **minor planet** style to define which elements are expected.

The perihelion date or epoch may be specified as a single combined field, an image of the type described in [field detail](#) is needed.

Alternatively the date may consist of three fields which are then assumed to be numeric.

Record layout

For each field position in the import file record select the matching field name from the drop down list or SKIP if the field is to be ignored. Up to 20 input fields can be handled, additional fields are ignored.

When the separator is **none**, for fixed length fields , then the start byte of each field must also be specified. In addition a fictional END field is needed to ensure that the last required field can be read correctly. The start byte for the end field will be one greater than the end byte of the last required field. It need not be the end of the line but it should not be more than one byte past the end of the line.

The object must have either a name or a designation, if both are used they will be combined when the object is imported.

Equinox and magnitude fields are optional. More information on individual fields is given in [field detail](#)

.

Click **OK** to save the format and return to the import window, **Cancel** to abandon changes.

#SK **Field detail**

To cope with a variety of data types a number of options are available, these should deal with the more common situations.

Fixed objects

Fields using an image

For single field Right Ascension use **h m s 0** to define the hours, minutes, seconds or decimal parts. For single field Declination use **d m s 0** to define the degrees, minutes, seconds or decimal parts. A - sign is also needed immediately before the **d**.

For example to convert a declination of -23 44.2 use an image of -dd mm.0

The image must match the positions of the characters in the data field. Only the specified positions are searched so an extra character in the data, for example H for hours, will be ignored if there is a blank in its place in the image. Leading 0s to match the image should be present in the imported data otherwise problems can occur. For declination the leading sign (+ or -) should also be in the data.

Fields without an image

Multiple RA or Dec fields are assumed to be numeric with the appropriate sign included. Equinox is assumed to be in the form 1950 or 1950.0 If no equinox is specified then J2000 is assumed. The apparent magnitude is optional.

Moving objects

With the exception of dates all fields are assumed to be numeric so no image is needed. Perihelion distance or semi-major axis are expected in astronomical units. Angles must be in decimal degrees. Fractions of a day are expected in decimal day form, the most common format for orbital elements. Absolute magnitude and magnitude constant are optional.

Calendar date input

For single field **calendar** dates use the following characters to create a date image.

y for years

m for months

d for days

0 for decimals of the day

use the date separator found in the data file, for example / or -

For example a date image of

yyyy-mm-dd.0000 would be required to convert 1998-Feb-28.0982

yyyymmdd.0000 would convert 19980228.0982

Note that 2 digit years will probably give incorrect results and the date separator should not be a blank if the record separator is a blank. If the image is not an exact match then the date won't convert properly.

Julian date input

For single field **Julian** dates the full 7 digit date should be given, the number of decimal places can vary.

The digits must be represented by 0s, for example a date image of

0000000.0000 would be needed to convert 2450872.5982 correctly

(If 6 day digits are given the constant is assumed to be 2000000, for 5 digits a constant of 2400000 is assumed.)

MPC format dates

This is a special 5 character encoded date used by the Minor Planet Centre for the epoch in its minor planet elements format. If MPC is entered as the single field date format then the alphanumeric characters in the Epoch field will be translated to a date by the import routine. An example is K027P which converts to 2002 July 25.

#SK **Orbital elements**

These are needed by the program to calculate an ephemeris (daily positions) for a solar system object. Different sources can quote elements in a different order so it is worth checking carefully when entering values. There are variations depending on which style of element is required.

Elements may be entered manually or imported from a text file.

Comet style

Perihelion date should be entered either as a Julian day number or in UT calendar date (with decimal days) depending on which date preference is selected.

Perihelion distance (q) in astronomical units.

Absolute magnitude (H1) optional

Magnitude constant (K1) optional

Minor planet style

Epoch should be entered either as a Julian day number or in UT calendar date (with decimal days) depending on which date preference is selected.

Semi-major axis (a) in astronomical units.

Mean anomaly (M) in decimal degrees (range 0 to 360)

Absolute magnitude (H) optional

Magnitude constant (G) optional

Common to comet and minor planet styles

Eccentricity (e) (0 for circular orbits, 1 for a parabolic orbit, maximum 1.1)

The following angular elements should be in decimal degrees.

Argument of perihelion (omega) (range 0 to 180)

Longitude of ascending node (OMEGA) (range 0 to 360)

Inclination (i) (range -90 to + 90)

#SK **Fixed objects**

These are objects whose coordinates don't change significantly from year to year.

Choose the Fixed type from the input bar and then select a specific object from the next box. If using the Selection form click on Fixed object type, Fixed object details and choose from the list.

Object display

Information shown on the timetable includes object rise and set, sunrise and sunset, beginning and end of twilight, dusk and dawn, transits and an optional altitude or haze mask.

The style of display is exactly the same as for Moving objects.

Editing fixed objects

Load the object edit form either from Edit, Fixed objects or via the Selection button. To amend an object select it from the list and change the details as necessary.

Use **New object** to create new records, enter the object name before returning to the fixed object positions to complete the details.

An **Import object** option is provided, this allows positions to be imported directly from a flat text file in a user defined layout.

Delete object will completely remove the record, there is no undo facility !

Object details

Apart from a name the sky coordinates of the object are needed.

Right Ascension is given in hours, minutes and seconds.

Declination in degrees, minutes and seconds.

Coordinates accurate to a tenth of a degree will be quite sufficient for most purposes, the seconds are optional.

If no **Equinox** is given then 2000 is assumed.

The apparent **Magnitude** is optional and is only used on the coordinate display.

Fixed object positions can be exported from the application using the Edit, Export gdd option.

#SK **Moon Only**

This timetable shows just Moon rise, set and transit over the usual background of sun rise and set. No further details need to be entered for this.

Object colours - On

The times when the moon is above the horizon are shown by a line in the selected moon colour. The moon lines can be shown by day or night, transit times and altitude masks are optional. The transit time, if switched on, is shown as a white tick across the line at the time the moon crosses the meridian.

Dusk, Mask and Grids display can be toggled on or off as required.

Object colours - Off

The thickness of the night lines provides some indication of phase and how dark the sky will be.

Sunrise and sunset, beginning and end of twilight, dusk and dawn are shown by black tick marks across the lines representing each night.

In daylight

the line is blank

Between dusk and end of twilight

a thin line is shown, (if Dusk is on)

Between end of evening twilight and start of morning twilight

if the moon is down the line is thick

If the moon up the line is;

thin near full moon

thick near new moon

dashed in haze

Dusk, Haze and Grids display can be toggled on or off as required.

Use Preferences and the Timetable objects tab to change these colour settings.

#SK **All Planets**

This will display rising, transit and setting times for planets out to Neptune.

Details shown on the timetable include sunrise and sunset, beginning and end of twilight, dusk and dawn are shown by black tick marks across the lines representing each night.

Clicking one of the planet buttons along the top of the timetable will toggle the display for that planet on and off. Each planet is colour coded according to the lines displayed along the top of the timetable, below the planet buttons. Alternatively the selected symbols may be shown depending on the preferences chosen.

Rise time is represented by a tick mark or symbol across the night line and a 'tail' for a short period after rising. **Setting time** is represented by a tick mark or symbol across the night line and a 'tail' for a short period before setting. **Transits**, if switched on, are shown by a tick mark across the night line.

The period when the moon is up is represented by broad shaded lines, this can also be toggled on or off. .

Dusk and **Grids** can be toggled on or off as necessary.

Preferences, [All planets](#) will allow the default planet selection, colours or symbols to be changed.

#SK **Object list**

This type of display is for a single night only but allows a number of objects to be shown together. The objects can be fixed, moving, planets or meteor stream. This can be of use in planning a series of observations for a variable star programme or a Messier marathon for example.

Switch to this type of display by selecting the **List** object type, then select a specific list from the next box in the input bar. The date entry will switch to a single date - the default is today's date.

Each object is displayed on a separate horizontal line on the timetable with time of night running from left to right. As with the other types timetables can be centred on midnight or midday. The name of each object is along the right edge with the local dates and times along the top. The sunset, end of twilight, beginning of twilight and sunrise are shown as single vertical lines. See the Sample screen for examples.

The general style of display is similar to Moving objects with day lines horizontal.

Object colours on

The time an object is above the horizon is shown as a coloured bar, transits and altitude masks are optional. The time the moon is above the horizon is shown in the background as a broader bar in the current moon colour.

Object colours off

The time the object is above the horizon is represented by a black line whose thickness depends on the phase of the moon.

Controls

A number of buttons along the top of the timetable allow sorting of the list in different ways:

List order	will present the list in the same order as it appears in the list editor.
by Name	sorts the list into alphabetical order, (numerals come before letters)
by Rise	sorts in order of increasing rise times.
by Transit	sorts in order of meridian transit.
by Set	sorts in order of increasing setting times
by RA	sorts in order of increasing Right Ascension (for the night displayed)
by Dec	sorts in order of increasing Declination (for the night displayed)

The starting time for the sort is the left side of the timetable. If the object is only shown during the hours of darkness then it may not always be obvious how the object fits in the sequence, particularly if the object is not up during the night.

Dusk, Moon, Mask and Grid can all be toggled on or off as necessary.

Use Preferences and the Timetable objects tab to change the display settings. The default sort order can be set from Preferences, Startup.

Editing object lists

Open the list editor from Edit, Lists or by Selection, List object type, Object list.

Select an existing list name from the combo box or create one by clicking on **New list**.

The contents of the current object list are displayed on the left side while the current source list is displayed on the right. Change sources by clicking on the appropriate option button at the top of the

source list. To add an object to the list simply select it in the source list box on the right, then click on the **Add** button to complete the transfer. To delete an object from the object list simply select it from the left list box and click **Remove**.

The changes will only take effect when the **Save list** button is clicked. **Cancel** will abandon any changes and return to the main form. **OK** will take the selected list back to the main form, the latest changes will be saved if this has not already been done.

To delete the currently selected list click on **Delete list**. Only the list of objects is deleted - not the moving or fixed records themselves. There is no undo facility.

Object lists, including any associated elements or positions, can be exported from the application using the Edit, Export gdd option.

#SK Lunar calendar

This will display lunar phases on a daily basis with enough space at each end to ensure that the chosen dates are adequately covered. The phase is displayed for local midnight each night. The moon is shown with north or south up (not the lunar poles) so the cusps may be quite obviously off vertical because of the tilts of the earth's axis and moon's orbit.

Select Lunar calendar from the object types and select a range of dates before clicking on Draw.

Use the buttons along the top of the calendar to change between **week**, **fortnight** or **month** per row display. The month or dates of the start and end of line are given down the left side, days in the month or days of week are shown along the top and bottom.

Clicking on **Dates** will show a list of dates and times of the main phases in a separate form. These are given to the nearest tenth of an hour in **UT**, **Local** or **Summer** time. These times can be printed out.

Moving the cursor over a phase symbol will give further information in the status line. This will include the **date** selected, the **percentage sunlit**, the **age** in days since last new moon and a **phase description**.

The phase description is based on the percentage sunlit with an arbitrary tolerance of 5% around each of the main phases. For example first quarter lasts from 45% to 55% sunlit, this takes place in only a day or so whereas at full moon the change from 95% to 100% and back to 95% could take several days.

The **phase orientation** is usually **north up** for northern hemisphere sites and **south up** in the southern hemisphere. This and other settings such as colours can be changed using [Lunar calendar preferences](#).

#SK **Sun Only**

This is the minimum timetable display showing sunrise, sunset, transit and twilight times. Sky background colours can be used to emphasise the difference between day and night. The display can be centred on midnight or midday, use Edit Preferences, Timetable display, Times, Day mode to set this.

The display can be enhanced by using altitude masks to show how the sun's altitude varies during the day and throughout the year. An example is the Rainbow mask which indicates when the sun is at a suitable altitude for natural rainbows to be visible, assuming of course the rain is in the right place !

If transits are switched on then a black tick mark is shown across the day line at the time the Sun crosses the meridian, which effectively shows the Equation of Time. Use Edit, Preferences, Timetable objects, Sun, Transits to set this.

#SK **World map**

Shows night and day at any given time on a simple projection of the world, areas in twilight and total darkness are distinguished by different shadow densities. The map is centred in longitude on the currently selected site.

This option is selected from the 'What' drop down box on the input bar, it also needs a site, date and time. The default is the current date and time.

After entering a date and the desired time remember to check the box for Summer time, if this needs to be taken into account.

When the cursor is moved over the map the current latitude and longitude, lighting conditions, solar altitude and lunar altitude (if selected) are displayed in the status bar. When the cursor is off the map then the conditions for the currently selected site are displayed.

Now Once a map has been drawn clicking on this button will calculate the current universal time from the system settings and update the display once per minute. Clicking on it again will stop the updates. When this mode is active 'Now' is printed at the end of the form caption.

Dusk toggles the intermediate twilight display.

Moon toggles the display of areas where the moon is above the horizon.

Day mode emphasises areas in daylight, boundaries of areas in darkness may not be very clear.

Night mode emphasises areas in darkness with 'false' colours.

Map only turns off the night and day display.

Political toggles the display of political boundaries.

Markers shows the equator, arctic circle, sub-solar point etc.

Grids shows a ten degree latitude and longitude grid.

Colours used and default settings can be changed using [World map preferences](#).

When a graphic timetable is clicked the world map display for that instant is also available as a [World view](#). This can be set as the default pop-up view or selected from any of the other views.

Note: there is no printout for the world map.

#K\$ Meteor stream

The period of visibility of a meteor stream can be displayed on the timetable, showing when the radiant is above the horizon and when moonlight will interfere. The lines are just a little brighter than the sky background at the stream limits and increasing to the full object colour around maximum. For periods outside the specified stream limits nothing is shown. Clicking on the timetable will show the meteor radiant on a sky diagram or give details of the expected hourly rate in the coordinate view.

To edit the details for a meteor stream use Edit, Meteor streams. Select or add a new stream as necessary.

Maximum

Solar longitude is the ecliptic longitude of the Sun at the time the Earth crosses the densest part of a meteor stream. This gives the time of maximum activity.

Zenithal Hourly Rate (ZHR) is the number of meteors per hour that might be seen under a perfectly dark sky with no moon and with the radiant overhead. The observed rate is generally much lower than this, particularly away from the time of maximum.

Right Ascension and **Declination** is the position of the radiant in the sky at the time of maximum.

Daily motion offsets allow for the changing apparent position of the radiant either side of maximum. Not very accurate when used too far from the date of maximum.

Stream limits are the number of days either side of maximum when meteors from a particular stream can be identified. Rates may be very low by then.

Stream rate factors

Used in the calculation of observed hourly rates in the coordinate display. Data in this section will not always be available, in which case all the fields can be left at zero and GraphDark will make a reasonable estimate instead.

The variation in rate for certain showers is better described by two curves. The main curve dominates at maximum and is superimposed on a general background curve.

Main slope is a value which describes the changing rate of the peak activity.

Background ZHR is the zenithal hourly rate of the background component at maximum, if known.

Slope before and **Slope after** are values applied to the background ZHR, if known.

Data on about 50 streams can be obtained from the Dutch Meteor Society web site, <http://www.xs4all.nl/~dmsweb/datalist/datalist.html>

Note: If object colours are not switched on the timetable is limited to displaying when the radiant is above the horizon between stream limits and when moonlight will interfere.

K#\$ **Altitude masks**

These can be used to show how the altitude of an object varies over hours or days and gives a better idea of its visibility than just the standard rise and set display. The mask can be toggled on or off as needed.

To select a new mask from the **input bar** click on the small button marked **M** and choose a mask from the list. Alternatively from the main menu choose Edit, **Altitude masks** or, if using the Selection form, click the Masks button.

Different masks can be defined for a variety purposes each with its own colours and altitudes, any mask can be used with any **Fixed, Moving, Meteor stream, List, Planet, Sun** or **Moon** timetable.

For example, a general mask at 10 degree intervals is useful for most objects. A mask which shows when the object altitude is below 42 degrees can be used with a Sun timetable to show when natural rainbows are likely to be visible, but there isn't much point using this mask with other objects, except perhaps the moon. Some ice halo phenomena are only visible when the sun is in a narrow range of altitudes so this can be represented with a mask highlighting specific altitude ranges.

Haze is a special mask with just one level from the horizon to a specified altitude. The haze level can be changed either by editing the Haze mask as below or by setting a value in either Selection, Site details or the Startup preferences.

Masks aren't available for All planets display. When object colours are not being used then haze is used instead and is indicated by a broken line.

Editing masks

Select a mask from the list and double click on a level to change its colour, or enter a different value in the level box. Levels can only be changed in the left column and the levels values must increase going up the page. To switch on a level check the box in the middle column, leaving levels switched off allows for gaps in the mask if desired. The right column allows different colours to be used on the printout.

To create a mask click on New mask, enter the mask name, set the level values, select suitable colours for each level, turn the levels on and save the mask.

Because Haze is a special mask it can't be deleted and only the level and its colour can be changed.

Full object width means the mask will completely cover the object line, for the altitude levels which exist.

K\$#WHERE

The observing site can be chosen from the list in the first box of the input bar, or by using the Selection form and Site details. Only a few sample sites are given so you would usually need to enter details of your own preferred locations.

The site name currently in use is displayed at the top of the application.

Editing sites

Sites can be added or amended using the site form which can be reached from Edit, **Site details** or via Selection, Site details

To create a site click on **Add New Site**, enter the new **site name** in the window provided, then its **West longitude** in degrees, **latitude** in degrees and the local time difference from Greenwich or **UT**. For most practical purposes the position can be to the nearest degree, but of course any calculated positions will be in error by a similar amount.

Delete Site will permanently remove the currently selected site from the list, there is no undo facility.

There is an option **Custom horizon** to enter a profile of your local horizon which can take into account obstructions such as nearby trees or buildings. This will be used by the zenith display, coordinate or horizon shown when the timetable is clicked.

Note

If the Selection form is used to choose a site then the **haze** level used by the program can be changed here, this level applies to all sites and objects. Alternative ways to change the haze are by amending the level on the Haze altitude mask or in the Where section of Startup preferences.

#SK**WHEN**

The program will need start and end dates for a timetable, or a display date if a list of objects, or World map is used. When the **input bar** and calendar dates are used they can be selected from the **dropdown calendar**.

For a timetable enter the local date for the first and last evenings you wish to cover in the **Start** and **Finish** dates, **display date** for a List or **display date/time** for the World map. Calendar date style is the default but this can be changed to Julian date style using the General preferences.

A timetable would normally start today and be 100 days long but this can be changed by setting a **start date offset** and **number of days** in the When section of Startup preferences.

For calendar dates the date format will be the one set up in your Windows control panel. If two digit years are entered they will be assumed to be less than fifty years from the current date.

Julian day numbers are the full 7 digit astronomical dates (not the day number in a given year). For example 2000 January 1st at 12:00 UT will be 2451545.0.

Timetables can be from 30 to 5000 days long, however only 60 to 600 days can fit on an 800 x 600 screen at a time, depending on the day width chosen.

Dates more than 7 centuries from the present will not be accepted

#SK **Graphic timetables**

These are a convenient way of showing rising and setting times for objects over a period of months or years. Days of the year are plotted along one axis while time of night is plotted along the other, times of interest can then be easily read off the graph and long term trends become obvious. An alternative type of display is a list of different objects on a single night. Timetables can be in **night mode**, centred on midnight, or **day mode** which is centred on midday.

GraphDark provides the opportunity to display or print timetables for any object from anywhere in the world at a time of your choosing. There are additional options with displayed timetables, giving more information than could be held in a printed timetable. These are reached by clicking inside the timetable area.

The way the timetable is displayed depends on the type of object being dealt with. For examples of the different types click on Help, Samples or read the descriptions for Moving, Fixed, Planet, Meteor stream, Moon, Sun, All planets or List .

The current site name, and the object details, or list name and sort order, are displayed in the caption at the top.

Selection of the observing site, object type, object name and dates is usually by means of boxes in the **input bar**. This can be along the top, bottom or sides of the timetable. The input bar can also be hidden in which case the **Selection** button is used to get to the entry form. To change the position of the input bar use General preferences .

Dates and times are displayed around the edge of the timetable. For multi-day timetables the dates shown are the local calendar dates or Julian day numbers of the corresponding edge of the timetable. For a single night list the local evening and morning dates are shown at the top along with local times. The local times shown are based on the value entered for 'Hours from UT' for the site, if summer time is on then 1 hour is added to the local standard time.

The timetables can be shown with or without gaps between the days. Regular observing days, for example weekends, can be marked by a small block of colour at the edge of the timetable.

If the **cursor** is inside the graph area the **status bar** along the bottom of the timetable shows the local date and time at the cursor position, (for a list the name of the current object is also shown). This is easier to read than estimating from grids and can also help position the cursor for selecting the time of the zenith view horizon display . If the cursor is outside the graph area the status bar reverts to: haze level (if active), sun altitude at nightfall and sun altitude at dusk (if active).

Along the side, or bottom, of the timetable is a **scroll bar** to allow you to move along the file to show portions which may not have been able to fit on the screen. The size of the scroll bar slider is proportional to the size of the visible graph and the total number of days calculated.

Buttons along the top of the timetable will vary depending on the display but the general ones are:

Selection	allows object selection in a separate form, (the input bar can be hidden).
Now	shows the sky view for the current time and site.
Dusk	toggle to show civil (or nautical) twilight
Moon	toggle on or off
Mask	toggle on or off to show the altitude mask or haze
Grid	toggle on or off to help with reading off times and dates

For All planets an extra set of buttons is provided so that the display of individual planets can be toggled on or off. There is also a legend bar to show the planet colours or symbols in use.

For the List display the extra buttons allow the list to be sorted in different ways.

There are a number of different settings for timetables which can be accessed by using [Edit, Preferences](#)

Note: The Now button will only work if the date range of the timetable extends either side of the current date and time, this is normally the case when GraphDark is first started. On returning to the timetable the current section is displayed. It is not available for Lists or the Lunar calendar.

#SK **Coordinate display**

When the timetable is clicked a display window is opened to show details of the objects currently being used. The date and time clicked is marked on the timetable with a coloured cross.

The display can be a list of **coordinates**, a zenith centred sky view, a simple horizon based graph or a World map. You can switch from coordinates to the others by clicking on [Zenith](#), [Horizon](#) ,. or [World view](#) To choose which is displayed first use the [timetable display](#) preferences.

The local date and time where the timetable was clicked is shown along with the corresponding Universal time, Sidereal time, Julian date and solar longitude. The phase of the moon, if it is above the horizon, is also shown.

The coordinate display shows both equatorial and horizontal coordinates but to keep the size down only one type is visible at a time, simply use the scroll bar to get to the other type. The coordinate type first shown can be changed with [Timetable display](#) preferences.

The horizontal coordinates of each object are given as altitude and azimuth in degrees.

Azimuth is measured in degrees along the horizon starting with 0 at the north point and going eastwards, this is the most common usage.

Altitude is measured from 0 degrees at the (theoretical) horizon to 90 degrees directly overhead, altitudes are corrected for refraction.

A status is also given for the visibility of the object. If below the horizon this could be **Set** or **Never rises**. If above the theoretical horizon it will be **Visible**, unless it is still below a user defined horizon in which case it is **Obscured** or below the haze level when it is **In haze**. In the case of the Sun and Moon **Rising** and **Setting** are also shown when they aren't fully above the horizon.

The equatorial coordinates are precessed to J2000.

Right Ascension is in hours and minutes while **Declination** is in decimal degrees. These values could be used to plot an approximate position on a small scale star atlas.

If magnitudes were supplied with orbital elements then the current calculated **magnitude** will be displayed. For fixed objects the stored apparent magnitude is displayed.

Note that comets can vary significantly from predicted magnitudes and the formulae are usually only valid for part of a return.

In the case of meteor streams an estimate of the observed hourly rate **OHR** is displayed instead of a magnitude. This is based on the maximum rate and the half maximum days in the meteor stream details, plus the radiant altitude. It does not take moonlight into account so rates will be lower still when the moon is up. If the time clicked is outside the limits of the stream then the visibility is given as **No stream**.

#SK Horizon view

When the timetable is clicked a display window is opened to show details of the objects currently being used. The date and time clicked is marked on the timetable with a coloured cross.

The display can be a zenith centred sky view, a list of coordinates or a simple **horizon** based graph. You can switch from the horizon display to the others by clicking on [Zenith](#), [Coordinates](#) or [World view](#). To choose which view is displayed first use the [Timetable display](#) preferences, Click on graph section. The appearance of the graph and the features shown when it is first displayed can be set using [Sky display](#) preferences.

The graph is only intended as a rough guide showing the horizontal coordinates and is very distorted at high altitudes, the Zenith view gives a better general view of the sky. Because of the distortion there is no attempt to show the Milky Way or Zodiacal light, although stars are shown. The view covers the whole sky and there is no zoom, although the form can be resized.

The site name, local date and time, plus name of the object are shown in the caption at the top. If an object is below the horizon then the name is enclosed in brackets to indicate that it doesn't appear in the view.

A user defined local horizon for each site can be edited and saved using this form, for subsequent display in this view or the Zenith view.

Various grids and markers can be shown, the markers are colour coded and the current selection is named in the top left corner of the display. Selected objects, bright stars and planets are labelled, these labels can be turned on or off as necessary.

The control buttons along the bottom vary the appearance:

Labels on/off will show or hide all the object names.

Haze will toggle the background haze layer.

Grids on/off will toggle the current marker and grid selection.

Stars on/off will toggle the display of background stars

Options allows the selection for grids and stars to be changed temporarily.

World opens a world map view for the date and time the graph was clicked.

Coordinates will open the Coordinate display (if it isn't already open)

Zenith will open the Zenith display (if it isn't already open)

Orientation allows the graph to be shifted left or right, the value shown is the azimuth at the left edge of the display

Click on an individual object symbol, or bright star, in the graph area to show its name.

A user defined horizon for a site can be drawn on the graph and saved for later use. This can be done when details for a site are first entered or when the graph is displayed. This is really only of use if you have a permanent site and can measure a rough horizon profile.

In the Horizon group:

Hide/Show will toggle any user defined horizon on or off.

Edit will activate the graph area so the horizon can be changed, just click on the graph and drag out the outline required. To correct a portion of the line simply drag along the new outline.

Save will store the result permanently against the current site.

Delete will remove it permanently from the current site.

The colours of the horizon, haze, sky background, markers and grids can be changed from [Sky display](#)

preferences, Colours section. Use the Grids and Markers section to decide what is shown when the horizon is first displayed. At display time the selection can be temporarily changed by clicking on the Options button.

The Celestial Equator, Ecliptic and Galactic equator can be shown on the Horizon display, however the full grids for these are not activated because of the large distortion.

Names of minor constellations may be shortened when the display is small.

The maximise button is not active so drag the form to resize it. Use the Startup preferences to always open the view at maximum size.

The horizon view cannot be printed out at the moment.

#KS **Zenith view**

When the timetable is clicked a display window is opened to show details of the objects currently being used. The date and time clicked is marked on the timetable with a coloured cross.

The display can be a list of coordinates, a simple horizon based graph, a World map or a **zenith** centred sky display. You can switch from the zenith display to the others by clicking on [Coordinates](#) , [Horizon view](#) .or [World view](#) . To choose which view is displayed first use the [Timetable display](#) preferences, Click on graph section. The appearance of the graph and the features shown when it is first displayed can be set using [Sky display](#) preferences.

The view covers the whole sky with the option to zoom in up to 2x, the form can also be resized. Stars to magnitude 6.5 can be shown along with the Milky Way, Zodiacal light and constellation names. Star names to magnitude 2.5 can be shown, clicking on a bright star will show its name .Stars are slightly tinted according to their spectral type.

The site name, local date and time, plus name of the object are shown in the caption at the top. If an object is below the horizon then the name is enclosed in brackets to indicate that it doesn't appear in the view.

A user defined local horizon for each site can be shown, however the shape of this horizon can only be changed from the Horizon view. Also shown are various grids and markers, the markers are colour coded and the current selection is named in the bottom left corner of the display. Selected objects, bright stars and planets are labelled, these labels can be turned on or off as necessary. The colour codes used for active labels plus the Milky Way and Zodiacal light are shown in the bottom right corners of the display

The control buttons down the side vary the appearance of the display:

Orientation allows the graph to be rotated, the value shown is the azimuth at the top edge of the display. Alternatively click on the arrows to move the sky round in 10 degree steps.

Zoom allows the scale to be increased up to 2x showing the sky from horizon to zenith in a particular direction. Enter a value or click on the '+' or '-' buttons

Arrows click these to move the sky in the direction indicated, greyed out when not available. Click the diamond in the centre to move the zenith to the centre of the display.

Options offers a form which allows standard settings to be temporarily changed.

Stars on/off toggles the display of stars

Background on/off toggles the display of Milky Way and Zodiacal light

Grids on/off will toggle the current marker and grid selection.

Labels on/off will show or hide all the object names.

Haze will toggle the background haze layer.

Hide/Show horizon will toggle any user defined horizon on or off.

Coordinates will open the Coordinate display (if it isn't already open)

Horizon view will open the horizon display (if it isn't already open)

World map will open the world map view (if it isn't already open)

Click on an individual object symbol, or bright star, in the sky area to show its name.

Double click on an area of sky to move it to the centre of the display, provided the horizon does not move too far from the edge of the frame.

The settings which can be changed by clicking on the **Options** button include the selection of grids, Milky Way and Zodiacal light display options, star magnitude limits plus star and constellation name options. The temporary changes are lost when the sky map is closed. To keep the changes between sessions use the Sky preferences.

The colours of the horizon, haze, sky background, markers and grids can be changed from Sky display preferences, Colours section. Use the Grids and Markers section to decide what is shown when the horizon is first displayed.

The star magnitude limits, Milky Way brightness, Zodiacal light brightness, star name limit and other settings used when the sky is first displayed can be changed with Sky background preferences.

Full grids can be shown in the zenith view, usually every third grid is labelled and shown in a different style, line styles can be changed using the preferences.

Names of minor constellations may be shortened when the display is shrunk down.

Use the Startup preferences to always open the view at maximum size.

The zenith sky view cannot be printed out at the moment.

#World view

This shows a world map for the date and time clicked on the timetable. Although very similar to the main world map display there are extra options linked to the timetable such as object visibility and links to other views.

Dusk toggles the intermediate twilight display.

Moon toggles the display of areas where the moon is above the horizon.

Object shows the area of visibility of the object used for the timetable.

Coordinates will open the Coordinate display (if it isn't already open)

Horizon will open the Horizon view (if it isn't already open)

Zenith will open the Zenith view (if it isn't already open)

Day mode emphasises areas in daylight, boundaries of areas in darkness may not be very clear.

Night mode emphasises areas in darkness with 'false' colours

Map only turns off the night and day display.

Political toggles the display of political boundaries.

Markers shows the equator, arctic circle, sub-solar point etc.

Grids shows a ten degree latitude and longitude grid.

(There is no Now option because this view is limited to the time clicked on a timetable.)

Colours and settings for this view can be changed with [World map preferences](#)

When this view is maximised the map will be centred on the current site but there are no scroll bars, so the whole map may not be visible. Clicking maximise again will restore the standard size with the whole map visible. Use the [Startup](#) preferences to always open the view at maximum size.

The world view cannot be printed out at the moment.

#SK Preferences

A number of settings which affect the appearance of the timetable can be altered and, if desired, saved for next time. All preferences can be reached from the main menu bar and Edit, Preferences.

Changed preferences will be applied to the current session on clicking OK to exit the preferences form. To save them permanently click on the Save button first. Clicking on Defaults will restore the program's built in values.

The settings are grouped on different tabs according to their type.

General preferences affect the whole program.

Startup controls what is shown when the program is first run.

Database deals with entry style and import/export defaults.

Timetable display controls layout, display modes, summer time, day width and click actions.

Timetable objects controls features such as daytime display, transits and colours used.

Timetable colours is used for sky and general background colours.

Timetable lines affect special marked days, grids and moon symbols.

Sky display covers the preferred markers and colours to be used

Sky background covers Milky Way, Zodiacal light and star visibility

All planets allows colours, symbols and visibility to be changed.

Lunar calendar covers colours, display period and orientation.

World map allows colours and the default display to be chosen.

#SK **General preferences**

Input bar

This contains the selection controls for timetables and can be shown along any edge of the timetable by choosing the appropriate setting.

Position

The position of the input bar will have some effect on the available display area, for example Top and Bottom allow for the maximum number of days on a screen when vertical day lines are used

The input bar can be hidden by choosing None, in which case objects must be chosen via the old style selection form.

Selection

The old style (version 1) input form is no longer needed in most cases but can still be used if preferred. Check this box to show the selection button at the top of the graph, always available if there is no input bar.

Printing

This determines whether the print layout defaults to a specific page orientation, or whether GraphDark picks up the current printer orientation.

The final setting can be changed as needed when using the Print layout form.

Date input

Gives the option of entering dates in **Calendar** date or **Julian day** format.

Calendar date formats are based on the current Windows settings.

Julian day numbers are the full 7 digit astronomical dates (not the day number in a given year).

#SK **Startup preferences**

These settings are used to determine what objects are displayed when the program is started.

What defaults

Object type is used as the default when the program is first run, provided a matching object exists in the program or database.

List order sets the sort order to be used by an object list when it is first displayed.

Mask sets the default mask to be used.

Setting the **Moving name**, **Fixed name**, **List Name**, **Planet name** or **Meteor stream** allows that particular object or list to be shown first, if the matching type is chosen for startup.

Where defaults

Sets the 'home' site name and a default haze level.

When defaults

Date offset gives the number of days from today for the start of the timetable. 0 means the timetable starts from today and -7 starts a week ago.

Number of days sets the finish date relative to the start date when a multi-day timetable type is first selected.

Start maximised

Main graph - if checked will maximise the main timetable when the program is started, clicking the maximise button restores the standard size. Only takes effect the next time the program is run.

Zenith view - fills the screen when the zenith display is opened, clicking the maximise button restores the standard size.

Horizon view - opens this at full screen width, the height is adjusted accordingly. The maximise button has no effect so drag the corner to resize.

World view - opens the map view at maximum size, clicking the maximize button restores the standard size.

#SK **Database preferences**

Moving edit defaults

This determines whether the new moving object defaults to comet or minor planet style elements.
Can always be changed at the time.

Import defaults

Allows for a default import file name and format name to be specified.

Export defaults

Sets the output folder and filename when the Export form is opened.

#SK Timetable display preferences

Layout

The timetable can have **Vertical** day lines or **Horizontal** day lines. Vertical day lines allow more days to be shown on one screen but the hour grids will be closer together. Note that the number of days displayed is also affected by the size of screen being used. Object lists are always displayed with Horizontal day lines.

Times

Full 24 hour frame affects the number of hours displayed. If this is not checked then only 20 hours are shown which allows a slightly larger scale for the hours, this can be useful if you are only interested in night time objects for instance. At polar latitudes the full 24 hour frame is needed.

If **Day mode** is checked then the timetable will be centred on local midday. Leaving this unchecked centres the timetable on midnight which is more suitable for night time objects.

Summer time on will add one hour to the standard local time for the hours displayed. Summer time off shows standard local time, as defined by the 'Hours from UT' set on the site details.

Twilight

Astronomical twilight ends when the Sun is 18 degrees below the horizon. This is the default and allows the display to distinguish deep twilight from total darkness. Some brighter objects can be seen in twilight particularly if they are away from the sun, and for most people with light-polluted skies an earlier nightfall setting may be more appropriate.

Nautical moves nightfall forward to when the Sun is 12 degrees below the horizon, Dusk is then the end of Civil twilight with the Sun at 6 degrees below the horizon.

An **Intermediate** setting with the Sun 15 degrees down at nightfall and 9 degrees down at Dusk is also available, for most skies this is more realistic than the rather strict Astronomical setting.

Day Width

Thin settings are good for long term trends but will give poor results when planet symbols are used. Using a higher screen resolution for your monitor will increase the number of days per screen.

A number of common settings are offered - **Very thin** and **Thin** are good for longer term trends, **Default** typically gives a 100 day timetable on an 800 by 600 screen while **Thick** reduces the number of days shown but may be easier to see.

It is also possible to directly set the day width from **1 pixel to 10 pixels**. At 1 pixel per day an 800 x 600 display will comfortably show more than a year on one screen but at the expense of some detail. (These settings do not apply to object lists which are a fixed width)

To make the division between each night clearer check the box **Gaps between days**. This will leave a small gap between each day if sky colours are on, only effective for day widths of 4 pixels or more.

Click on graph

The colour of the cross which marks the point clicked on the graph can be changed here.

Choose **Coordinate list**, **Horizon view**, **Zenith view** or **World map** as the default display when the mouse is clicked on the timetable. It will still be possible to switch another type when necessary.

Coordinate list

When coordinates are displayed only one set is visible at a time, the type first visible can be set here. To see the other type when the coordinate window is actually displayed simply scroll to the right.

#SK Timetable objects preferences

Show

This section controls what events are displayed for various object types and when they should be shown on the graph. These settings are only fully effective when object colours are used because a black and white display is limited to depicting night time visibility.

Any Fixed, Moving, single Planet, List or Meteor stream object can be shown **by night** or **by day** or both. Showing **rise and set** is optional, meridian **transits** are also optional, this allows a display of just the transit times or full display of rise, set and transit.

The Moon can be shown by day or night. Transits are optional but rise and set will always be shown as the moon display usually provides a background for other objects.

In the case of the Sun only the transits are optional.

Object colours

The colours used for objects and the **moon colour** can be changed here as necessary, printer colours can be set separately depending on the type of printout required. Double click on a colour box to select and change the colour.

If Object colours is checked then the maximum information is available in the display, by allowing coloured altitude masks to work for example. Turning them off gives a different style of display and may be useful for black and white only printers for example.

#SK **Timetable colours preferences**

Sky colours

These are a useful way of indicating the sky brightness during day and night and provide a background to the timetable.

To change colours double click on the appropriate box to get the standard dialog for selecting colours. Depending on the number of display colours actually in use by the computer the colours displayed may not always turn out as expected from the small boxes, so some experimentation may be needed for best results.

Clearing the Use colours check box will mean the timetable is drawn over the uniform background colour set in the section below. Used together with the object colours off this can give a 'black and white' display.

Screen and **printer** colours often don't match very well so it is possible to adjust these independently for best results. It can also help to reduce the amount of ink used by choosing paler colours for the printouts. With some printed colours banding may be noticeable on large areas of sky colour because of the dot pattern used.

To disable printing of sky colours on the printer clear the check box **Use colours** on the printer side. This may be needed when only a black and white printer is available and will avoid heavily shaded grey backgrounds when sky colours are used on the screen.

Standard colours will restore the system defaults. These colours may be needed to give the best results with the Milky Way and Zodiacal light background.

Background colours

Empty graph covers the actual timetable area and is used before the timetable is drawn and in any gaps between lines, for example when there are gaps between days or for haze ticks when object colours aren't being used.

Text frame is the area round the graph with dates times etc

Status bar is below the timetable and shows changing information such as the cursor position.

#SK **Timetable lines preferences**

Mark days

These are regular days of the week which may be suitable for observing, for example Friday and Saturday evenings.

When **Show marked days** is checked small blocks of colour are shown on the edge of the timetable. These are selected here by double clicking on the appropriate morning or evening boxes for each day.

The colour used can be changed and as usual can be different on screen and printer.

Moon phases

To activate the display of small symbols for new and full moon on the timetable check the box **Show on timetable edge**. This is only intended as a rough guide but it can be useful for spotting when new moon and weekends coincide for example. Much more detailed phase information is available in the [Lunar calendar](#)

Grid style

Use opaque grid checked shows black grids on the timetable. To use an **inverse grid** clear the check box, this could be a help if dark sky colours are used although the results may not always be pleasing.

To make it easier to distinguish grids a number of line styles are offered for day and hour grids, plus significant times such as midnight and 6PM or 6AM. To change a line style double click on a box and choose from the list provided.

Day Grid spacing

These can be at 10 day or 7 day intervals. When very narrow day widths are used this may be automatically increased to prevent overlapping text.

#SK **All planets preferences**

Display

The selection of planets displayed when the planet timetable is first shown can be changed here. Once drawn the planets can be toggled on or off as needed.

Colours

Two sets of **planet colours** are offered, printed colours do not always match screen colours so the print colours can be adjusted to suit a particular printer without affecting the display. Double click on a planet colour box to get a dialog for selecting new colours. Switch the colours on or off by checking the **Use colours** box.

Colours can be a little unpredictable if a small colour range is in use so the screen display and print colours are not always as expected, some experimentation is usually needed for best results.

Planet symbols can be used instead of tick marks at rise and set, this may be useful where no colour printer is available. Note that these are better seen when using a thick day width, symbols will be very poorly displayed using the thin day width. Double click the appropriate planet symbol to get a selection window, select the new symbol by clicking on it. Switch on the symbols by checking the **Use symbols** box.

Symbols can be displayed in the planet colour if desired, it is also possible to use colours on the screen and black symbols on the printer for example. If colours are not used then symbols are assumed.

Some experimentation will also be needed with symbols as the results are not always pleasing - turning off some planets can help if it is too crowded.

Show planets

This allows for planets to be shown **by day** or **by night**, or both.

Planet **Rise-set** and **Transits** are optional to allow display of rise, set and transit or just transit only for example.

#SK Lunar calendar preferences

Initial display type

This controls whether the calendar is first displayed with a **week**, **fortnight** or **month** per row. It can then be changed using the buttons along the top of the calendar.

Orientation

This determines whether the display is forced to be **North up** or **South up**.

If **by latitude** is checked then the upward direction matches the hemisphere of the current site, north up in the northern hemisphere for example.

Colours

The colours used for the **light side**, **dark side** and **sky background** can be changed here.

Different colours can be used on the screen and printer.

If **Use colours** is not checked then the display is dark grey for the dark side on whatever graph background colour is in use.

An **outline** may also be drawn round the moon to emphasise it, this is particularly useful when colours are not being used.

#K\$ Sky display preferences

Grids and Markers

This section determines which markers are shown when the horizon or zenith displays are opened. The selection can also be temporarily changed at display time

Equator - the projection of the Earth's equator on the sky is shown, along with the celestial poles and Right Ascension labels.

Ecliptic - the projection of the Earth's orbit plane on the sky is shown, along with the ecliptic poles and longitude labels.

Galactic equator - the projection of the plane of the Milky Way on the sky is shown, along with the galactic poles and longitude labels.

Equatorial grid, Ecliptic grid, Galactic grid - are only available on the zenith view. These extend the plane and pole display above to show latitude and longitude grids across the whole sky.

Altitude and Azimuth - shows altitude and azimuth (compass bearing) grids at 10 degree intervals.

Cardinal points - North, East, West and South points shown along the horizon.

Start with

grids on - affects all the grids and markers, with the exception of Cardinal points.

labels on - if most displays are very cluttered, large Lists for example, then it may be helpful to start with labels off and click on individual object to get its name.

background on - will show the Milky Way and Zodiacal light if either of these is set for display.

stars on – will show the stars if set for display.

horizon on – will show the user defined horizon, if it exists.

haze on – will show the user defined haze level.

Colours

Ground is the colour around the edge of the zenith view, below the horizon.

Horizon is the colour below a user defined horizon and above the true horizon.

Haze is between the horizon and a level set in the Haze mask.

AltAz grid, Equator, Ecliptic, Galactic grid and **Cardinal points** are all colour coded for clarity.

Star names, Planet names and **Constellations** for the text colour to be used.

Restore standard colours sets the colours to those used at the time of release.

Line styles

Although grids are labelled it makes things clearer if every third grid or so is shown in a different, bolder style. Select the appropriate line styles for the **Normal grid** and the **Bold grid**.

Orientation

Top azimuth is the compass bearing round the horizon which lies at the top of the Zenith view or the left edge of the Horizon view. This may be useful if you tend to orient yourself in a preferred direction, perhaps the direction your garden faces. For example if this is towards the north set the value to 180, North will then be in the middle of the Horizon view and at the bottom of the Zenith view.

Zoom starts at 1 for an all-sky view and can be increased to 2 which shows a section of sky from the horizon to overhead. It is only relevant to the zenith view.

#K\$ **World map preferences**

Start with

Check the items to be active when the world map is first selected or displayed

Summer time is the default used on the input bar.

Night mode, **Dusk**, **Markers**, **Grids** and **Political** all have buttons to toggle the display after the map is shown.

Map colours

To allow boundaries to show through the shadow colours are combined with the map colours. Because it is the combination that matters some experimentation is needed to get the best results.

Land will appear as shown.

Sea will appear as shown

Political will appear as shown

Object will be combined with land, sea and shadow colours.

Shadow colours

Day mode

Colours selected here will resemble those shown on the display but bear in mind that Night is added to Dusk which is added to Twilight etc.

Twilight covers the area between sunset and true darkness or dusk.

Dusk may not be turned on which affects how Night will appear.

Night covers the area where it is truly dark, after astronomical twilight has ended.

Night mode

To get the false colour effect the way colours are combined is the inverse of the day mode. This means that colours selected here will bear little resemblance to the final display and are very sensitive to the particular combinations chosen.

Twilight, **Dusk** and **Night** colours will interact in ways which are hard to predict.

If obtaining satisfactory colour combinations is a problem then the original colours can be recovered by clicking on **Restore standard colours**

#K\$Sky background preferences

The settings on this page are used when a sky view is first displayed. They can all be temporarily changed at display time by clicking on the **Options** button. Any changes made there will only last till the sky display is closed.

Milky Way

Show Milky way - check this box to switch on the Milky Way display.

Intensity from 1 to 50 increases the apparent brightness of the Milky Way relative to the background. The units are arbitrary.

Isophote lines, if checked this will show the Milky Way as dotted lines for two brightness levels (provided the Milky Way is switched on)

Zodiacal light

Show Zodiacal light - check this box to switch on the Zodiacal light display.

Intensity from 1 to 50 increases the apparent brightness of the Zodiacal light relative to the background. The units are arbitrary.

Isophote lines, if checked will show the Zodiacal light as dotted lines for multiple brightness levels (provided the Zodiacal light is switched on)

Note that if both the Milky Way and Zodiacal light are switched on, and neither are shown as isophote lines, then the Milky Way display will switch to a diagonal line fill for clarity.

Stars

Show stars needs to be checked for stars to be displayed.

Magnitude limit sets the faintest star shown (limit is 6.5) when a completely dark sky is displayed. The limit may be changed automatically by the program to reduce the number of stars shown in a twilit sky.

Star names

Show star names needs to be checked for star names to be displayed.

Magnitude limit sets the faintest star which has a name shown when star names are switched on. Currently only stars to magnitude 2.5 are listed but this covers most well known naked eye stars.

Constellation names

Show names needs to be checked for constellation names to be displayed.

#SK **Printing timetables or calendars**

This is done from the timetable menu bar using File, Print.

Printer Setup

Use this to get the standard Windows dialog for setting up your particular printer. Note that this acts directly on the printer so changing these settings may affect other users if a printer is shared.

Page layout

A simple **print preview** is provided to show the effect of changing the various settings. The unprintable area is greyed out while an outline of the timetable or calendar shows where it will be placed on the paper. Generally the program will try to print as large as possible depending on the orientation of the printer. For the printer in landscape mode the whole page is available while in portrait mode only the top half of the page is used.

Printer orientation determines which page orientation will be used at the time the graph is printed. It will not be affected by the current printer orientation and does not change the printer settings permanently. Using the printing section of general preferences this can be made to pick up the current printer orientation automatically.

If **Centre Timetable** is checked then the program will roughly centre the timetable in the appropriate area.

With some printers, particularly bubble jets, the thick black lines can be over-inked. If this occurs with black and white printouts, when sky colours are off, then use **Print Grey** to get less dense lines on the printout, screen display is not changed.

The size of the printed timetable can be varied with the **Printer scaling (Pixel factor)**. To avoid erratic spacing when lines are close together the print size can only be varied in steps. The maximum number of steps will depend on the relative number of printer pixels to screen pixels, orientation of the printer, margins set etc. Set the pixel factor to a preferred value within the specified range.

Timetable offset can be used to position the **Top** and **Left** of the timetable, not relevant if **Centre print** is checked. The values must be in millimetres, maximum available offsets are given but if these are used the space left for the timetable will be very small.

A **Printer offset** is also available because the printer origin is usually offset from the edge of the paper. This can result in prints being cut off because they extend into an unprintable area or not being centred properly. This effectively reduces the paper size and is indicated by the grey band along the right and bottom edges. These **Horizontal** and **Vertical** settings will be printer dependent so some experimentation may be needed.

The new settings will be activated for the current session when OK is clicked. They can be kept for future use by clicking on **Save**.

Print

This prints the part of the timetable currently being displayed. As far as possible the printout matches the display, although some adjustments may be made automatically to cope with small windows for example

Printed colours may not always match those used on the screen so some experimentation may be necessary for best results. Depending on the printer and the different patterns of dots used for each colour the sky background may have small gaps between the night lines. This can vary with the pixel

factor, the colour used or even the positioning on the paper. Provided light colours are used this should not be too intrusive.

Note that not every display in GraphDark can be printed, this includes the Zenith and Horizon sky displays plus the World map.

#SK **Samples**

Selecting **Help, Samples** from the main menu bar will display a sample timetable closest to the type of object currently in use. Not all possible combinations can be covered but there should be enough to show what the various lines mean.

Sample timetables for the different types of object, and the different display styles, can be viewed at this stage by selecting from the sample menu bar, this will not affect the main display

Only vertical day line samples are provided for fixed, moving, moon and planets but there should be no difficulty in relating these to a horizontal line format. Object lists are always in a horizontal line format.

There is no sample for the Lunar calendar or World map.

#\$K Limits, accuracy and sources

Actual rising and setting times will depend very much on local conditions so accuracy of a few minutes is considered sufficient. They will also depend on the accuracy with which site positions and object details are entered.

Timetables can be from 30 days to 5000 days long, though the amount displayed at one time will be limited by the day width and screen size.

Dates more than about 7 centuries from the present won't be accepted.

Total Lunar eclipses are not taken into account when indicating the interference from the moon.

Moving objects

When working with moving objects such as comets the elements must be the ones for the apparition you are interested in. For example, using the elements from the 1986 Halley return will give spurious results for 1910.

Moving objects with orbit eccentricity greater than 1 can be accommodated, but this can cause problems particularly when the object is far from perihelion or as the eccentricity increases. An upper limit of 1.1 for eccentricity has been set, but problems can be encountered before that. Such objects are extremely rare anyway.

Coordinate display

Altitudes and Azimuths are quoted to tenths of a degree but this is only meaningful if the site and object data provided are at least this accurate. Positive altitudes are corrected for refraction, negative altitudes are true altitudes since refraction is meaningless in this case.

Right Ascension and Declination values are precessed to J2000. These are only intended as a rough guide to an object position but they will generally be accurate to within a few tenths of a degree, provided the ephemeris information is good enough. If high precision is required then use a specialist ephemeris program.

Calculated magnitudes, particularly for comets, can be substantially in error so they should only be taken as a rough guide.

Estimates for the observed hourly rate (OHR) for meteors may be very wide of the mark because of variations in stream activity and local observing conditions.

World map

This is based on the Digital Chart of the World, two-point country files, from Penn State University Libraries <http://www.maproom.psu.edu/dcw/>. These were substantially reduced in size to suit the small scale being used. Political boundaries are circa 1992 and are shown merely as a familiar guide to the location of the day and night boundaries.

Meteor streams

The sample data provided is based on meteor streams with a maximum zenithal hourly rate of 10 or more, as listed in the BAA handbook.

The method and data for estimating observed hourly rates comes from Astronomy and Astrophysics 207 (1994) 'Meteor stream activity, annual streams' by P. Jenniskens.

Zodiacal light

Data for this was obtained from Astronomy and Astrophysics, 'The 1997 reference of diffuse night sky brightness', <http://aanda.u-strasbg.fr:2002/articles/astro/full/1998/01/ds1449/ds1449.html>

Isophotes for the zodiacal light were interpolated from the table of brightness values by Levasseur-Regourd and Dumont. The choice of brightness levels used is arbitrary.

Milky Way

Most modern small and medium scale sky maps use a two level simplification of Pannekoek's 1920s visual work. There are often minor variations in the detail, compare Sky Atlas 2000 first edition and Redshift in the Sagittarius region for example. Some small scale maps only use the shape of the brighter level. Unfortunately the two level scheme doesn't really convey the richness of some areas of the Milky Way.

The outline used in GraphDark is largely the traditional one. Some additional detail in bright and dark regions was added by comparison with the Sky Atlas 2000 Deluxe second edition, which shows more brightness levels than the first edition.

Stars

Positions and magnitudes are taken from the Yale Bright Star Catalogue, 5th revised edition, Hoffleit & Warren 1991. Downloaded from the SIMBAD Astronomical database <http://simbad.u-strasbg.fr/Simbad>

Deep sky objects and miscellaneous sky data

Compiled from a variety of sources including Sky Catalogue 2000, Sky Atlas 2000, AAVSO Star Atlas and Astronomical Objects for Southern Telescopes. Sample comet and minor planet elements come from the BAA Handbook and the Minor Planet Centre.

#K\$ **General notes and hints**

This section is a collection of miscellaneous items, ranging from examples of how to use particular features to explanations of astronomical terms.

[Zodiacal light](#)

[Transits and the Equation of Time](#)

[Altitude masks and Saturn's visibility](#)

[Importing comet elements](#)

#K\$Zodiacal light

Sometimes called the 'false dawn' this should be familiar to sky watchers who live in the tropics. Unfortunately most people living at higher latitudes, particularly in more populated areas, have probably never seen, or even heard of it.

There is a very diffuse glow all along the ecliptic caused by dust in the solar system, probably left over from comets and meteor streams. Because of the way dust scatters sunlight it appears brightest to us in the general direction of the sun but much of this is, of course, hidden by daylight and twilight. The main part of what remains visible shows up as the Zodiacal light, a broad cone of light in the western evening sky after twilight has ended - or in the morning sky before twilight begins.

There is also a very slight brightening directly opposite the sun called the Gegenschein, or counter glow. It is very broad and faint but can be seen with the naked eye under excellent conditions, when it is high enough in the sky and not in front of the Milky Way etc. Some dust is faintly visible all along the ecliptic with the faintest part being between the Gegenschein and the main Zodiacal light. This is called the Zodiacal band and requires exceptionally dark skies to be seen with the naked eye.

The best times for viewing Zodiacal light are at the end of evening twilight and just before morning twilight, at times of the year when the ecliptic makes the steepest angle with the horizon. Under good conditions, just before dawn at low latitudes, it shows up as an easily visible, diffuse cone of light which reaches high up the sky along the ecliptic. Near the horizon it is tens of degrees wide and comparable to the brightest parts of the Milky Way. The name false dawn is very appropriate, but the real approaching dawn soon merges with it and drowns it out.

Because it reaches tens of degrees along the ecliptic the top of the Zodiacal light cone can be seen for several hours after dusk and before dawn. The Gegenschein of course is highest in the sky around midnight, but its altitude and visibility will also depend on the latitude and time of year.

For those living at higher latitudes, for example in the United Kingdom, the Zodiacal light is not so obvious, but it was easily recorded in the days before light pollution and can still be seen from darker parts of the country. Part of the problem is knowing what to look for and when, and having sufficiently clear and dark conditions at the right time of year.

Example

Take a higher latitude site to start with, choose London and draw a timetable for a year with, say, All planets. Use Edit, Preferences, Sky background and switch on the Zodiacal light by checking the box Show zodiacal light. Also make sure Show Milky Way is checked and leave Isophote lines for both unchecked. Save the preferences if you want to keep them for next time the program is used.

Click on the timetable just after it gets dark in early March and get a zenith display. You should now see the Milky Way as an area of diagonal lines and another glow stretching from the western horizon up to the Milky Way. This is the main zodiacal light cone and is well placed at this time of year. You can confirm it runs along the ecliptic by going to Options and checking the Ecliptic box in the Grids and Markers section. Clicking on Show grids will now show the ecliptic, allowing you to trace the faint glow along this to the eastern horizon, where the Gegenschein shows up as a broadening in the glow. To make the Zodiacal light more prominent use the Intensity in the Options, Background section. In reality the brightness is already exaggerated – and you would have to be a long way from London itself to have any chance of seeing it.

Return to the timetable and for the same night click just before darkness ends. The Zodiacal light now is spread low along the eastern horizon and would be further obscured by any haze or distant light pollution. In midsummer it doesn't show at all and it's not till the predawn hours in mid September that it's well placed again, although in the evening it's pretty hopeless.

Moving to lower latitudes, choose Harare as a site and click in mid March just after dusk. The Zodiacal light is then no better placed than it was for London, but now click just before dawn on the same night. The ecliptic is now almost vertical and the Zodiacal light would be easily visible reaching right up into the Milky Way. A month earlier in mid February it is still well placed but would not be so obvious because it is mingling with the Milky Way.

Midnight in June would be a hopeless time to see the Gegenschein because it is then in front of the brightest part of the Milky Way. You might have a better chance around midnight in March or September for example.

#K\$ Transits and the Equation of Time

Transits are indicated by a narrow dash across the day line when an object is on the meridian. For the moon this a white dash, for the Sun it is black. For 'All planets' the planet colour is used but for other objects a different colour can be set to show up against the object colour.

The Equation of Time is a good example of how this can be used, since it is shown by the changing transit time of the Sun. The solar transit time varies by up to 16 minutes during the year because of the combined effects of the eccentricity of the Earth's orbit and the tilt of its axis. This is why accurate sundials need small corrections, the equation of time, to be applied at different times of year.

To show this effect, turn on Sun transits using Preferences, Timetable objects and check the 'Transits' box in the Sun column. Because solar transit occurs close to midday you will also need to make sure the display is suitable for this. Go to Preferences, Timetable display and check the 'Full 24 hour frame' and 'Day mode' boxes. While there, it is probably also a good idea to select 'Horizontal day lines'. This will make the changing transit times a little more obvious because the hours are now spread across the width of the screen.

Choose 'Sun' from the list of objects on the input bar. Set a date range of, say, a calendar year and draw the timetable. The changing transit time will be a thick wavy vertical line down the centre of the graph.

Toggling the grid on will make the deviations more obvious, as will using the maximise button to fill the whole screen. You could also set a very narrow day width to get a whole year on one screen, which makes the trend through the year much clearer.

#K\$ Altitude masks and Saturn's visibility

For most objects in GraphDark, apart from 'All planets', the time it is above the horizon is represented by a single coloured bar. Altitude masks overlay this bar with different colours to represent the altitude ranges - different masks can be created with varying altitude ranges and colours. Using masks can give a better idea of how well placed an object might be for observing. Just because an object is above the horizon for several hours doesn't mean it rises very high.

Taking Saturn as an example. Currently, in 2004, it is well placed for northern hemisphere observers - but in 10 years time things will be very different.

First choose a northern site, say London, then choose Planet, Saturn. To set an altitude mask click on the **M** button (between Planet and Saturn). From the form presented choose the mask 'Ten degrees'. Set an end date in mid 2014 and draw the graph. For the time when Saturn is above the horizon the graph should now be colour coded according to its altitude. To toggle the mask on or off simply click the 'Mask' button at the top edge of the timetable.

By comparing it to the colour coded bar along the top of the timetable you will see that currently Saturn rises to over 60 degrees. Now move the slider bar, at the bottom of the timetable, to the extreme right to see the situation in 10 years time. Saturn doesn't even rise above 30 degrees then.

For this example, you might want to set the narrowest possible day width to make the changes from year to year more obvious. Go to Edit, Preferences, Timetable display, and put 1 in the 'Pixels' box. Using 'Vertical day lines', also on the Timetable display tab, and maximising the timetable squeezes in more days on a single screen.

The masks need not represent all altitudes from 0 to 90 degrees. For example the 'Rainbow' mask has just two ranges for altitudes where the Sun is low enough to show the primary and secondary arcs above the horizon. The special 'Haze' mask only has a single colour from the horizon up to the selected altitude - equivalent to Haze in version 1.

The default mask can be changed in Preferences, Startup, What defaults.

#\$K Importing comet elements

Manually typing in comet elements can be error prone. Provided you have a source of elements in a consistent format, with one object per line, it is possible to use a format saved in GraphDark to extract specific elements from the source file.

To get to this option use Edit, Moving objects, Import object. You will then need to select the source file, select a matching format and click on Open file. Any header information, the lines before the data starts, will be shown to the right. If the 'Available records' section looks garbled it may be that the file was created in unix rather than DOS/Windows. In this case click on 'Convert from unix file' and open the file again. You should now get a list of the names of objects in the file. If not, then you may need to check the format again.

All you have to do now is select and add more lines from the 'Available records' section till you've got the ones you want. Click on Import selection to convert the records, any problems with converting numbers, dates etc. are reported at this point. You can import the whole file though its probably better to be selective about which records to import, saves deleting loads of unwanted ones later.

The Minor Planet Centre offers an excellent service with the latest comet and minor planet elements in downloadable files. <http://cfa-www.harvard.edu/iau/Ephemerides/SoftwareEls.html>

Go to the MPC section at the top of the list and choose the type of elements you want. The GraphDark format 'MPC Comets' is typically used with a file called Soft00Cmt.txt The format 'MPC Minor planet' is typically used with a file called Soft00Bright.txt

These two formats for converting MPC data are included in the new installations of GraphDark 2.03 onwards. Users upgrading from earlier versions have probably kept the original format file so these would not be added automatically. Details for creating these standard formats are given at the end of this section.

Creating Formats

If there isn't a suitable format then you will need to create a new one. Although there is some work in identifying the file layout and checking the results it can save quite a lot of time once you've got the format right.

To create a format the program needs to know how far down the file to start looking for the data, how the fields are separated, the type of elements to create and the format of the dates. The main part is the record layout. When the source file has fixed field positions the start position of each field needs to be worked out, when a separator is used it is just the sequence of fields that matters.

For each field in the source file select the element type from the drop down, where a source field is not required select SKIP. With fields at fixed column positions you can skip multiple fields, if a separator is used then each field needs to be skipped separately. The source file can have more fields than the elements needed but it shouldn't have less.

With fixed fields you will need to enter the start position for each field. You will also need to indicate the end of the record by selecting END and entering the record length, this isn't always clear from sample files but enter a reasonable figure here so that the last field isn't truncated.

Click OK to save the format and try it out on sample data.

Standard formats

MPC Comets

Header lines	0
Separator	none
Element type	Comet
Date format	3 fields

Start	Element
15	Perihelion year
20	Perihelion month
23	Perihelion day
31	Perihelion distance
42	Eccentricity
52	Argument of perihelion
62	Ascending node
72	Inclination
82	SKIP
92	Absolute magnitude
97	SKIP
103	Name
130	END

MPC Minor planet

Header lines	0
Separator	none
Element type	Minor planet
Date format	MPC

Start	Element
9	Absolute magnitude
15	Magnitude constant
21	Epoch
27	Mean anomaly
38	Argument of perihelion
49	Ascending node
61	Inclination
71	Eccentricity
81	SKIP
94	Semi-major axis
105	SKIP
175	Name
202	END

#SK **Troubleshooting**

GraphDark 2 requires at least Windows 95 and 5MB of disk space to run, most of the disk space is for standard system files which may already exist on your machine.

It is not compatible with Windows 3.1 which requires GraphDark Version 1.

Upgrades are released at irregular intervals, these can be downloaded from <http://www.dewbow.co.uk/graphdark/download.htm>

Installation

For convenience all the necessary files are supplied as a single self extracting zip file called GRAPHDIS2.EXE. If upgrading an existing version 2 then you can use the much smaller patch file GRAPHPAT2.EXE

Unzip the installation file by double clicking on it in Explorer, the setup files will be unzipped to the specified source directory, for example C:\WINDOWS\TEMP.

From the source directory run the setup program SETUP.EXE. This will extract and copy the appropriate files to the application directory, for example C:\Program Files\GraphDark, update system files if necessary, create a program icon and an entry in the Windows Add/Remove programs option.

(Users with Windows operating systems released earlier than 2001 may be prompted to reboot to allow revised Microsoft setup files to be used.)

GraphDark version 1 data files are compatible with version 2. If you already have version 1 of GraphDark installed run the full installation (not the patch) as above, you will then get the option to copy your existing data to the new version. If installing over an existing GraphDark 2 it is assumed that you wish to keep the existing data files, unless you specify otherwise. Standard system files are only updated if they don't exist or are an older version.

Files needed

GraphDark consists of one exe file and one help file, normally in the directory C:\Program Files\Graphdark

- GRAPHDARK.EXE
- GRAPHELP.HLP
- WINHELP.EXE (old version)

Data files generated and used by the application are also kept in the application directory.

- ELEMENTS.DAT
- FORMATS.DAT
- GRAPHD.DAT
- POSITION.DAT
- SITES.DAT
- HORIZON.DAT
- LIST.DAT
- ALTMASK.DAT
- WORLD.DAT
- METEOR.DAT
- SKY.DAT

If there is a problem with one of these then rename or delete the file, restarting the program will automatically create a new blank version so you can enter fresh data (this does not apply to world.dat or sky.dat). None of these files are intended to be user editable outside the application, sample data

files are provided with the application.

The following Windows system files are used by the program, these may already exist on the system but will be copied in if required.

MSSTDFMT.DLL
TABCTL32.OCX
MSFLXGRD.OCX
MSCOMCT2.OCX
COMDLG32.OCX

Any of these missing will cause a crash at some point with a "File not found " error, or worse !

The setup program SETUP.EXE requires various supporting files but these are automatically loaded and removed by the setup utility.

Uninstalling

Go to Settings, ControlPanel, Add/Remove programs and select GraphDark 2. This will remove all application files registered during installation. Shared system files are not removed nor are any files in the application directory which may have been created after installation.

#SK **Copyright and acknowledgements**

Copyright

Copyright for the program GraphDark remains with the author Richard Fleet. The associated system files are copyright of Microsoft. All trademarks are acknowledged.

The program GraphDark is freeware so you may copy it freely provided that it is not altered in any way, no financial gain is involved, and the application is distributed in full by including all associated program and data files.

If you find this program useful then I would encourage a small donation to an organisation which does useful work in assisting amateur astronomers or promoting astronomy to the general public.

Acknowledgements

Calculation methods have come from a number of sources. Astronomical Algorithms by Jean Meeus has been a useful source of formulae and algorithms, particularly for the lunar and planetary positions. Other useful sources were the BAA Handbook, Planetary and Lunar Coordinates 1984 - 2000 and Sky Catalogue 2000. The adaptation is often substantial so any errors are my fault !

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#SK**Disclaimer**

In an ideal world this wouldn't be necessary but...

The program GraphDark was originally written for the personal use of the author, Richard Fleet. It is released on the understanding that it is not a commercial product and that there is no obligation on the author to provide additional information or support for use of the software.

While every effort has been made to ensure accuracy it remains the user's responsibility to check the accuracy of any conclusions made as a result of using the software.

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