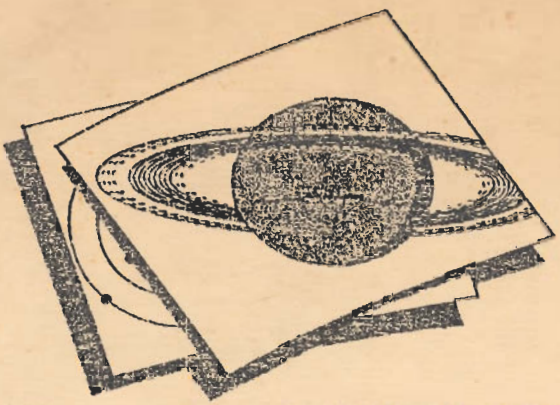


>PLANET ENGINE 1.0

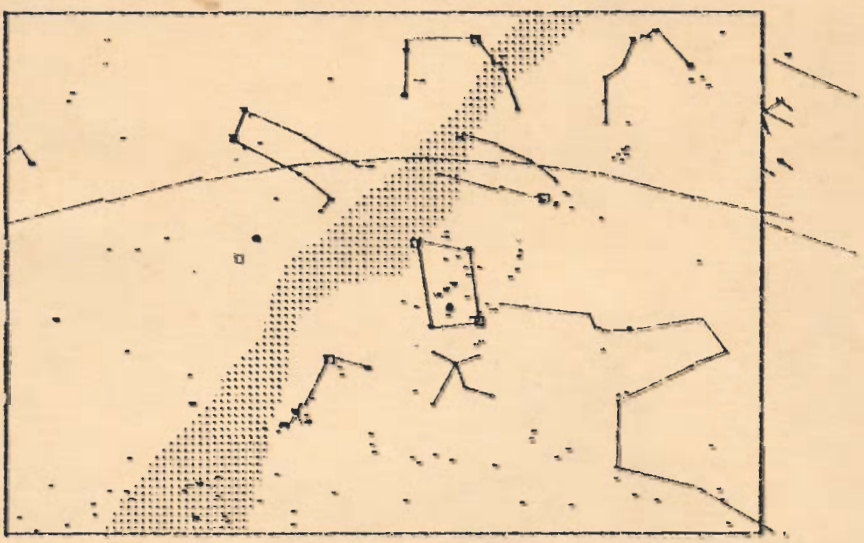
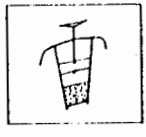


Table of Contents



G R A V I T Y S T U D I O
Box 791
Belton, Texas 76513-791

GENERAL DESCRIPTION

Planet Engine is a program that takes your time and location to chart a colored sky full of planets, stars, and the Moon and Sun. Upon startup, the planets are mapped from current computer time and boldly drawn on the field of equatorial stars beyond. From here you can request orbits, precise data, planet drawings; or skip around to any past or future time or location The Moon and all planets are shadowed to their proper phase; the Earth is shadowed for its appearance from the Moon.

Like a cosmic clock, there is no need for it to produce data files since the display for any time and circumstance is quick and convenient enough. Planet Engine sometimes produces its own graphics and sometimes refers to an atlas of 58 star, annotation, and planet drawings. Planet Engine thrives in the OS-9 Level 2 Windowing environment, where multi-tasking enhances its operation -actually inviting the user to shape the window or run multiple Planet Engines side-by-side for comparison of displays.

SYSTEM REQUIREMENTS

This version of Planet Engine 1.0 requires the Tandy Color Computer 3 and the OS-9 Operating System Level 2 with 128k minimum memory. However, the extreme limitations of 128k allow only the execution of the 'planetn' version.

No language module is required (such as 'runb') since the program is 100% machine code compiled from the "C" programming language.

Planet Engine is ideally run with 512k memory from the Multi-Vue window with a mouse and a color monitor. Fast disk drives or RAM disk space make the complex graphics snappy and exciting.

So if you have 512k and Multi-Vue, run the 'planet' version.
All others must use 'planetn'.

START/STOP THE PROGRAM

Install Program From Original Disk:

Experienced users:

1) Copy the desired executable file(s) from CMDS to your commands directory (usually /dd/CMDS).

2) Copy the Multi-Vue icon in CMDS/ICONS to your icon directory (usually /dd/CMDS/ICONS).

3) Make a directory (with any name) for the read-only drawing files and copy everything in PLATES5 to this new directory. If you are using Multi-Vue the AIF file will be waiting in your new directory.

4) Verify the integrity of the new files with the 'dir e' output.

Beginners:

Installation means creating a working copy of the original disk in some form that is convenient to your use of this program and your computer. When your working copy is ultimately damaged or worn-out, you can make another working disk from the original disk -which should be safely stored somewhere. As a beginner, you can simply make a duplicate of the original

disk and constrain your use of the program to one disk. But, as you learn more, you will probably copy these files to some more convenient arrangement.

1) Get a formatted disk and backup the original disk.

2) If you successfully duplicated the disk, proceed to the "Start" instructions below that apply to your memory size.

For more information, refer to Operating System Manual
Making Copies of Diskettes: Getting Started p. 3-3
Accessing Commands: Getting Started p. 5-4
Error Messages: Getting Started p. 2-4
Error Codes: Appendix C
Creating Directories, Copying Files: Getting Started p. 6-1, 6-3
'dsave' Command: System Command Descriptions p. 6-39
If you have Multi-Vue, more information on 'format' and 'backup' is found in the Multi-Vue Manual, Chapter 1/Getting Started p. 1-2 and Chapter 8/The Files, Disk, and View Menus p. 8-4

Start 'planet' with Multi-Vue and 512k:

1) Verify that Multi-Vue will look for the executable file, 'planet', in the directory displayed at "Set Execute" in the "Disk" Menu. Otherwise you may pre-load 'planet' from its directory with the 'load' command.

2) Verify that the computer's system time is current.

3) From Multi-Vue, re-read the disk (or device) containing your new directory by clicking on the disk icons on the far left side.

4) Move into your new directory by clicking through the folder icons; and find the Planet Icon.

5) Double-click on the Planet Icon and size the window as you like; Planet Engine will generate the current sky and await your menu selection.

6) Exit program by clicking on the Close Window Icon on the upper left.

For more information, refer to the Multi-Vue Manual:
Executing Files, Changing Folders: Chapter 2/Gshell p. 2-12
Sizing Windows: Chapter 2/Gshell p. 2-17
Setting Time: Chapter 5/The Clock p. 5-1
AIF Files: Chapter 9/Programmer's Notes p. 9-22
Framed Window Regions: Chapter 9/Programmer's Notes p. 9-2

Start 'planetn' on 128k Memory:

1) Verify that the system will look for the 'planetn' and the other executable files (planetn2' and 'planetn3') in the execution directory. Because of memory limits, you may not pre-load 'planetn'.

2) 'unlink' any modules that you may have loaded and open 56k RAM space as shown by the 'mfree' command.

3) Verify that the computer's system time is current.

4) Create a 40 X 24, four-color graphic screen and shell.

```
OS9: wcreate /w1 -s=6 0 0 40 24 1 0 0
OS9: chd /dd/SYS        *or wherever your SYS directory is*
OS9: merge stdfonts stdpats_4 )/w1
OS9: display 1b 3a c8 01 )/w1
OS9: display 1b 25 1 1 26 16 )/w1
OS9: shell i=/w1&
```

5) Press (clear) to move into graphic screen. Verify that a "dir x" shows the 'planetN-planetN3 programs -also "chd" if necessary to the read-only drawings directory (PLATES5).

6) At the graphic screen shell prompt, type...
OS9: planetn
This command will load and run 'planetn' and subsequently load and run (called chaining) 'planetn2' and 'planetn3'.
7) When the display is done, type '100' at the "Display Planet ?" prompt to exit, and the shell prompt will reappear for another run or any shell command.
8) Before the screen can be discarded, kill the shell with...
OS9: ex
Then discard the screen memory from the /TERM window with...
OS9: display 1b 24)/w1

For more information, refer to Operating System Manual:
OS-9 Windowing System: Opening a Device Window p. 1-2
Using Windows: Getting Started/Customizing Your System p. 7-9

Abnormal Exit:

For whatever reason any program should refuse to stop, don't get mad, get a shell and type:
OS9: procs
The ouput will be similar to this text below...

Id	PId	Number	Pty	Age	Sts	Signl	Siz	Ptr	Primary Module
2	1	0	128	129	$81	228	3	$02F0	DEAD
4	0	0	128	191	$80	0	29	$57E2	gshell
6	0	0	128	129	$80	0	31	$51E2	Shell
7	5	0	128	129	$80	0	31	$44E2	planet
8	4	0	128	130	$80	0	26	$41E2	Shell
9	8	0	128	129	$80	0	91	$1BF3	Procs

-and find the offending name and number from the list and type:
OS9: kill 7 *in the case of 'planet'*
If this fails, remove (or park) your disks and reboot the computer.
If this fails, turn off the computer and restart everything.
If this fails, unplug the equipment.
If this fails, beat the computer into a plough, and accept your destiny as a tiller of the earth.

SAMPLE SESSION: 'planet'

1) Double-click on Planet Icon and create a full-size window. Watch Planet Engine display the current planets over the horizon.
2) When you hear the "beep" and see the arrow cursor appear, you are free to click on the "Settings" Menu at the top of the window; the menu will "pull-down" into several items. Click once on the "Orbits" Item and look at the Solar System as it looks today.
3) Click the mouse or hit the "BREAK" key to return to the main screen.
4) Now, select the "Planets" Menu; and click on the "Moon" Item for a color diagram of the Moon and its current shadow. Click the Moon away when you are ready.
5) Now, return to the "Settings" Menu and click on "Display"; check this tablet for what display groups are currently on. Hit the 'S' key once or twice until you see the blue Star Icon appear in the upper left.

Hit any key to close this window.

6) Now that you have turned the stars on, simply click on the "Sky" Item again in "Settings" Menu. If you started the program within the directory with the read-only drawings, then the stars, constellations, and Milky Way will appear from left to right with the planets and Moon and Sun in the foreground.

7) You can turn your Planet Engine clock to another time with the "Time" Item under "Settings". When the tablet appears, hit the 'T' key and enter "7:30 p" for Seven-thirty PM Local Standard Time. For your convenience, just hit the 'R' key to run the "Sky" display; it is not necessary to click on "Sky" again.

8) By clicking on the scroll button in the lower left, the sky will backward scroll east by one hour.

9) Exit by clicking on the Close Window Icon in the upper left; verify your decision by hitting the 'Y' key.

SAMPLE SESSION: 'planetn'

---

1) For a default execution type...

OS9: planetn

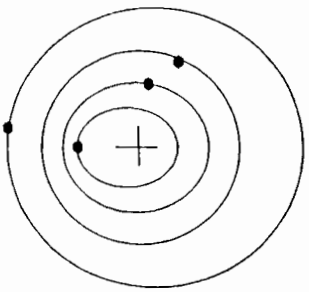
2) Watch Planet Engine display the current planets over the horizon. When the "Display Planet ?" prompt appears, type '100' to exit back to the shell.

3) This time, type 'planetn h'; although the same calculations occur the Solar System orbits are displayed as it looks today.

4) Now, instead of exiting, type '11' for a color diagram of the Moon and its current shadow. At the "Display Planet ?" prompt type '6' for the 6th planet, Saturn; Saturn will be shaded and tilted to its approximate appearance from the Earth. Type '100' to exit.

5) Now, if you are not already there, change your directory to the read-only drawings directory, and type 'planetn o=spam'. The stars, constellations, and Moon and Sun in the foreground. Type '100' to Exit.

6) You can turn your Planet Engine clock to another time by typing 'planetn p'. When the tablet appears, hit the 'T' key and enter "7:30 p" for Seven-thirty PM Local Standard Time. Simply hit the 'R' key to proceed with the Sky display. Type '100' to exit.



PLANET ENGINE CONCEPT

Planets and the Equatorial Stars:

All planetary bodies in our solar system revolve in roughly the same plane, called the Ecliptic Plane. The Earth spins at a 23.5 degree inclination to this plane -not very far- making the most interesting view a wide band around the Earth's equator. It is this equatorial band that the Planet Engine displays (from the sky inclined 50 degrees north of our equator to the sky declined 50 degrees south of our equator). This area includes all the zodiac, most familiar constellations, and all possible positions of the planets. When the Annotation group is on, the Ecliptic plane appears as curved, blue line across the "Sky" display; you will notice that the planets stay near this line. In an equatorial format, unfortunately, the popular North Star and Big Dipper must be excluded; these are always found in the sky regions around the poles, called circumpolar regions. But with this sacrifice, Planet Engine is able to quickly display a huge area with little distortion all at one view. It is the horizon that must bear the heavy distortion -especially in locations close to the equator.

Horizon and Zenith:

The crosshairs labeled "Znth" mark the local zenith (the point directly overhead); the large complete or partial curve labeled "S Horz" (or "N Horz" for the Southern Hemisphere) describe the approximate horizon. The region between the zenith and horizon are visible; the remaining sky region across the horizon line is occluded by the Earth's surface. Since the apparent motion of the sky is always westward (or to the right), you can see what objects are about to rise on the left side and what objects have just set on the right.

As you might expect, the display favors views from the North Hemisphere (we apologize to Australia). For the north, the display is like a very wide-angle view looking South; or like the view of the sky from a flat meadow where you are lying down with your feet south and your head north. For the South Hemisphere, it is like the view from the same position, but your head is hanging off the end of a chaise lounge so that you are looking north and the ground appears to be above you.

Time and Date:

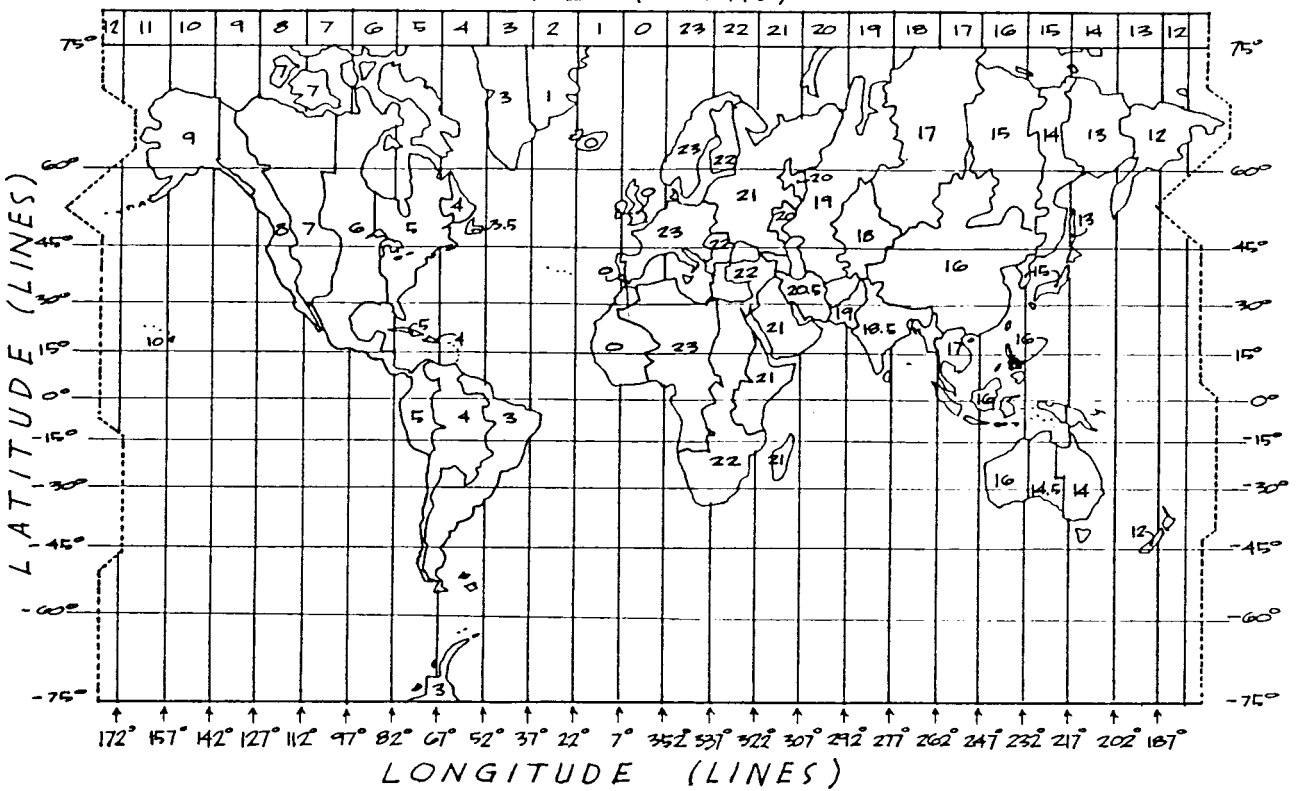
For the position of the planets, Planet Engine considers only the date, not the time. So expect no change in planet position by less than a day's change. The visible stars move rapidly over the horizon, however; every few minutes the zenith marker will change (not automatically, you must manually request an update). Although the left and right edges of the display change only at even hours, the zenith marker is always accurately placed in the sky.

Planet Renditions:

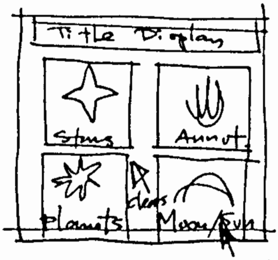
The planets in the "Sky" display are exaggerated for clarity; the stars are all constrained to the blue color. When the "True" switch is on in the "Display" group icon tablet, the display is more pictorial than when this switch is off. When it is off, the planets and Moon and Sun are hugely exaggerated making the sky into a diagram -most useful for the user confused by the random spangle of stars and the wandering specks of planets.

It is very important to understand exactly what is displayed from the "Planets" Menu. The planet drawing is not accurate beyond its shadow phase and tilt; the details visible are merely characteristic of their appearance. One exception is the Moon, which conveniently shows one face always toward

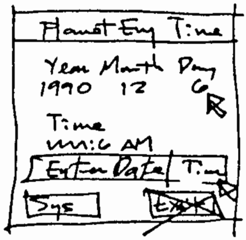
PLANET ENGINE LOCATION DATA



PlanetEngine 1.1 Upgrade



toggle on/off

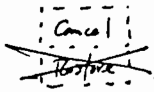


left button decs
rt button incs

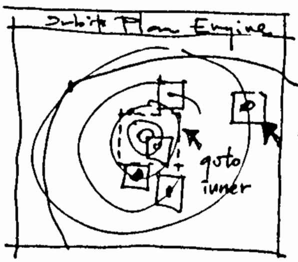
enter string

downward compatibility?
with keys

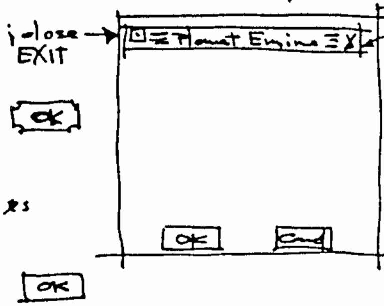
SPAMC,E



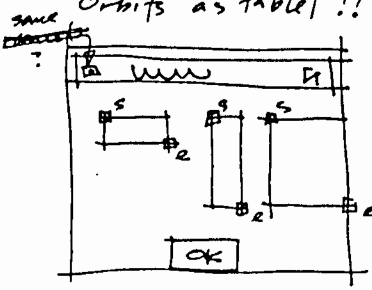
No, this is implicit upon re... to tak...



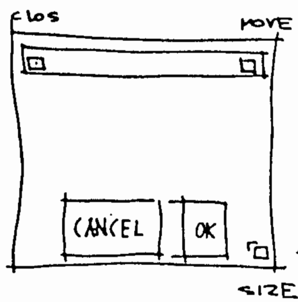
fork to fezdwy() w/ cool phases & moons

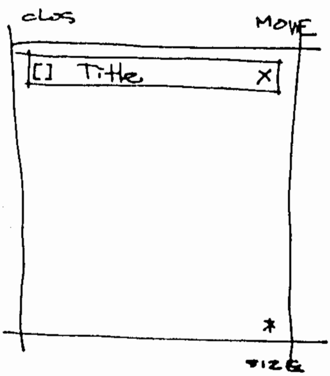


Orbits as tablet!!



~~check~~ ... >'s'
~~start corners first~~
~~verify with pos < 'e'~~





or Bold characters mean ba...

[Bttn]

27 July

add prompt fo ...

~~why 'R' to Quit?~~

~~add err msgs in mapfar, maphel~~

perce... plat... pgw... pa...

REVISION HISTORY & BUGS

Planet Engine 1.0 Released 29 April 1990

1) Manual errors bottom of Page 2 for 128k startup: here is the correct text...

```
OS9: wcreate /w1 -s=6 0 0 40 24 1 0 0
OS9: chd /d0/SYS                    #or wherever your SYS dir is...
OS9: merge stdfonts stdpats_4 >/w1
OS9: display 1b 3a c8 01 >/w1
OS9: display 1b 25 1  1  26 16 >/w1  #planetn tries to increase
                                     #window size by 1
OS9: shell i=/w1&
```

2) Time and Location Tablet hangup on keyboard entry flubs: Suspicious "scanf()" C function or read() interface with STDIN prevents entry of any more tablet data after certain user mistakes. No solution for now except to exit the entire program and restart it; then, enter your data with care.

Planet Engine 1.0 / 2nd Manual Released 1 June 1990

3) Manual corrected on Page 2

4) New Application Ideas on page 12

5) Note: Realize that any eclipses that occur on "Sky" are not reliable to the time or date. The current calculations are not that precise.

Planet Engine 1.1 / 2nd Manual Released 27 July 1990

6) 2nd Manual is appended with one sheet, upgrade notice/coupons mailed to all previous customers.

7) Planet Engine 1.1 Revision:

a) -ABANDONS SUPPORT OF 128k MEMORY VERSION: 'planet' is too large and ambitious for such small memory.
So, ignore any instructions to 'planetn' or 128k programs.
'planet' requires Multi-Vue, Coco 3, 512k memory.

b) -MOUSE SUPPORT TO TABLETS AND KEYBOARD MENU ADDED:
"Time Tablet" and "Location Tablet" support labeled "buttons". Some buttons accept single clicks to increment the above number. Left mouse click adds; right mouse click subtracts.
No checking is done on these changes; they are meant to conveniently adjust your time or location relatively.
To provide downward compatibility with version 1.0, the keystrokes described in the manual are still supported. One exception is the "Display Groups" Tablet: the 'R' key is alone accepted and the four icons are directly clicked on with the mouse to toggle them on and off.
Tablets recognize two normal EXIT conditions: click on the "Close Window" Icon or "ENTER" key.
Tablets recognize two more normal EXIT with RUN conditions: click on "Sky" button or 'R' key
Tablets also recognize two CANCEL conditions: click off the

tablet or click on "Cancel" button. This action discards your changes and attempts to restore the data current upon tablet entry.

Again, "Display Groups" Tablet is exceptional in that all EXITs affect the system and no CANCELs are possible.

Tablets may be accessed also by upper or lower case 'T','L','D' keystrokes.

'R' key will RUN the "Sky" display under current settings.

'Q' or "BREAK" key will prompt for EXIT.

If you cannot decode the military time display; click on the "Location Tablet" title bar and the "Time: hh:mm AM/PM" will update.

c) SKY DISPLAY ADDITIONS: Horizon is calculated only at start-up, change in Latitude, and implicit change at "Default" button. Otherwise, a fast horizon redisplay is performed. "E" and "W" markers attempt to intersect horizon at east and west points. At the repeated urges of customers, time and date is titled above display. Congratulations on convincing me!

d) MOON CALCULATIONS UPDATED BY HOURS: Moon is no longer assumed to be at noon position, but moved according to calculations from hours.

e) PLANET AND MOON DATA UPDATED TO EPOCH 1980.0 POSITIONS: not a big change, but anything to enhance accuracy...

Also, calculations were optimized for speed and elimination of redundant code.

f) EXCISION OF 'mapfaz' AND 'maphel' MODULES: Planet Engine 1.1 now requires these two executable programs to display all items in "Planets" Menu, and "Orbits" or "Inner" items, respectively.

So, if pre-load them if you will want to refer to them often and save all the time for the disk to find them:

```
OS9: load mapfaz maphel
```

No error message is given if the system cannot find the modules; it just leaves a blank screen and the "Click to Exit" message. So make sure 'mapfaz' and 'maphel' are in current execution directory.

If you are interested, you can run these modules directly:

```
mapfaz [ planet#(0-11), phase(+/-12.0), sattilt(+/-1.57),
nepttilt(+/-1.57), label(lor0) ] = 5 params

maphel [ format('I'or'O'), [heliolong.(planet#(0-9)(0.0-6.28))],
[orbdist(planet#(0-9)(0.0-6.28))], rt.asc.[MOON(0.0-24.0)],
rt.asc.[SUN(0.0-24.0)], label(lor0), orbits(lor0) ] = 23 params
```

g) OPPOSITION AND QUADRATURE LINES ADDED TO ORBIT DISPLAYS:

One customer effectively argued that Earth's relation to outer planets is invisible without its opposition line, so "Opp", "Conj", "EQ", and "WQ" indicate lines of Opposition, Conjunction, East Quadrature, and West Quadrature, respectively. Any superior, or outer, planet approaches opposition when it highest at midnight.

h) MOON POSITION DIAGRAMMED ON "Inner" ORBIT DISPLAY:

"Yee-haw!" The Moon is located in an exaggerated orbit around the Earth on the "Inner" orbit display.

8) Fast mouse click bug: this will hang up any more entry until the standard output buffer is flushed. Hit the "BREAK" key (good luck!) The "BREAK" key is somewhat out of control; its effect is unpredic- table (f

restart the program. If you mistype at data entry, simply backspace or re-enter the prompt twice and it will allow another go.

10) Similarly, a hypothetical error can affect system window data; causing it to hang up displays, sometimes hitting any key will continue display. If you suspect this, be sure to exit the program AND kill the window and start with a fresh window.

11) Do not exit overlay windows with "BREAK" key -if you have this habit.

12) Some customers complained that time or date is not checked for legality: but our time system is quite removed from the reality astronomical time. The program allows the user to input what time and date we earthlings think it is; this is converted to raw gregorian days from the epoch date 1980.0 and some remainder of hours. The program simply allows you to relatively adjust the day and time forward and backward; it is not miscalculating when the display shows "7 -11 1990" (for the -11th of July). This relative adjustment is available on the main screen scroll buttons or "Time Tablet". If you adjust time or date to far, the program leaves you confused to the earth calendar date; admittedly an inconvenience.

13) Make sure that "Merge" is in memory; normally it is packed into the 'shell' command. You can load merge or shell to get it there. Check for "Merge" with the 'mdir' command (also in 'shell')...

```
OS9: mdir
```

Planet Engine uses "Merge" to display all drawing files in "PLATES5" directory.

14) Some customers get STACK OVERFLOW error message with Error 207 -Out of Process Memory: I have seen this twice. Since, the program has no recursive functions or deeply nested calls, no cause is obvious. In a mythical gesture, I compiled one module with extra memory hoping to cool the engines. -'til I know better, good luck to us!

15) Yes, future plans are to redirect output to drawing files that can be displayed apart from Planet Engine. Hopefully, you could paint or draw on them and then print or plot under some graphics program! Feel free to do this with 'mapfaz' or 'maphel' now, but 'planet' makes intensive use of CWArez system codes on output -no telling what will happen now, but try it anyway! I'm too busy writing "Pico".

```
OS9: chd /dd/PLATES5
OS9: mapfaz 2 3 0.2 0.2 I )niceplanet.dwg
OS9: display c; merge niceplanet.dwg
```

Or, "click-click" on the icon, if you have my 'mvdwg' display thing.

us on Earth. The planet diameters are relatively scaled to each other only in four groups:

Small, rocky planets	Mercury, Venus, Earth, Mars
Gas Giants	Jupiter, Saturn, Uranus, Neptune
Sun	
Pluto and the Moon	

Saturn and Neptune show their tilts. Relatively featureless Mercury, Venus, Mars, Uranus and Pluto do not. The Earth hides its continents and tilt behind its beautiful clouds and gets its shadow phase as if viewed from the Moon. Planet Engine shows no change in the angular diameter of the planets.

PLANET ENGINE FEATURES

'planet' AIF or Icon Execution:

Default AIF File (named AIF.pln)

```
planet                          *Program Name
o=pam l97.4  z6  k30.0          *Parameters: location=Temple, Texas, USA
ICONS/icon.planet2              *Icon Name
0                               *Default Memory Request
7                               *7=80 columns, 6=40 columns
30                              *Minimum Width
16                              *Minimum Height
0                               *Background Color (ignored)
1                               *Foreground Color (ignored)
```

Feel free to edit this AIF file to your needs or preference. You should definitely replace the 'L', 'z', and k' parameters with your longitude, zone, and latitude respectively. Study the 'o' parameter below and include the display groups you would prefer upon startup. Study the other parameters below and include them on the parameter line if they are valuable to you.

Command Line Execution and Parameters (or Argument):

From a shell type:
OS9: planet ?
This will display the Usage Sheet and available parameters...

```
P L A N E T  *  E N G I N E

Issue 1.0                    R
                            +
(C) 1990 Paul H. Light     * I
                      +     *
Try parameters:.             D
'planet (L z) k o=spam w t'
U         o o  L u tlno a rA
          n n  a t anno i u
R         g e  t p rton t eN
                 *
Example:     30x16 Min Wdw U
'planet L97.4 z6 k30 o=pm t'
S T A R S  +  P L A N E T S
```

It is not necessary to execute 'planet' from the Planet Icon; from any four-color graphic screen (larger than 30 X 16), you can type...

OS9: planet
for a default execution of the Planet Engine. Or try the available parameters below.
Here are some examples for the command line (or in an AIF File):

The stars only over Honolulu, Hawaii...
OS9: planet o=s L157.5 z10 k21.5

The true appearance Moon and Sun at Los Angeles, California (PST)
OS9: planet o=ma L119.3 z8 k33.1 t

The planets and stars diagrammed over Austin, Texas (CST)
OS9: planet o=sp L97.4 z6 k30.3

The planets and stars labeled at Philadelphia, Pennsylvania (EST)
OS9: planet o=spa L76.6 z5 k39.3

Stars and constellations at Alexandria, Egypt
OS9: planet o=sa L330 z22 k30.1

The planets, Moon, and Sun labeled at Canberra, Australia
OS9: planet o=pam L211.2 z14 k-35.8

Available Parameters:

(L)ongitude	Earth Longitude (0 to 360 degrees), Floating Pt
(Z)one	Standard Time Zone (0 to 23 hours), Integer
Both 'L' and 'z' are required, do not present just one of them.	
(K) Latitude	Earth Latitude (90 to -90 degrees), Floating Pt
(O)utput	Display Group Output:
	(S)tars, (P)lanets, (A)nnotation, (M)oon/Sun
	If no 'o' is offered, the default is: o=pam
	Examples 'o:pa', 'o=m', 'o=spam', 'o=ap'
(W)ait	No automatic calculation or display upon startup
(T)rue	Display planets close to their true appearance in the sky.

If you enjoy a realistic, pictorial display of the heavens, include this parameter: 'o=spm t'
If you have little interest in the stars, omit the 'o' altogether and get a quicker display with the internal default of 'o=pam'.

In general, arguments can be...
-preceded by dashes,
-upper or lower case,
-in any order,
-followed by an '=' or ':' character if the parameter requires data

Whatever your interest or expertise with your computer; use the parameters that you can now understand -forgetting about the others -until such a time that you wish to further customize its operation. In this way, you will not outgrow the limits of the program too quickly.

Tandy Desk Accessories: Hourglass Icon

In the spirit of a standard interface, the 'X' (Hourglass) Icon will open the Tandy Desk Accessories available under Multi-Vue. It could possibly be convenient (certainly, impressive) to start a shell on Planet Engine and

execute a new Planet Engine !
For more information, refer to the Multi-Vue Manual/Chapter 2 Gshell p. 2-18 and Chapters 3-7

"Settings" Menu:

"Time" *Time Tablet always shows current time variables. Hit the keys in the parentheses to make selections. Hit any other key to exit. Changing the Planet Engine Time has no effect on the computer's system time.*
(T)ime: Enter hour:minute a/p
If you think in military time always enter an 'a' after the time: e.g. '16:45 a'
Changing only the time avoids re-calculation for planets.

For a more accurate sky, remember to always provide the program with Standard Time, not Daylight Time. You could avoid this problem by keeping your computer in Standard Time, but this could be inconvenient for other time uses.

(D)ate: Enter year month day
E.g. July 16, 1976 would be 1976 7 16
Changing date always produces a re-calculation.
(S)ystem Time: Get date and time from computer.
This is an easy way to quickly return from the past or future, or update the display if the program has slept for an hour or so. You must manually update the display for continuous use.
(R)un: Run the Planet Engine for a new display.
Re-calculation will be done only if necessary.
This is equivalent to clicking the "Sky" Item.

"Locale" *Location Tablet always shows the current location variables. Hit the keys to make selections and exit as described in Time Tablet.*
(C)hange: Enter longitude zone latitude
Changing location produces a re-calculation.
If your latitude exceeds 50 degrees north or 50 degrees south (-50), the zenith is off-screen.
Longitude and zone are both required to calculate your true local sidereal time (star time).
(D)efault: The program assumes the location parameters that were presented upon startup is your permanent Earth location. It is very easy to jump back "home" this way after resetting the location variables elsewhere.
(R)un: same as "Run" in Time Tablet.

"Display" *Display Group Icon Tablet shows current groups of objects to be displayed at the next "Sky" update. Hit the keys to make selections and exit as described in Time Tablet.*
The four groups are identical to the 'o' parameter options...
(S)tars: blue star / upper left
(P)lanets: white star / lower left
(A)nnotation: red hand / upper right
-adds constellations if Stars are on
-adds planet names if Planets are on

(M)oon/Sun: white crescent / lower right
(T)rue: refer to 't' parameter above
(C)lear: Turn off all groups

"Orbits" Display Solar System Orbits in overlay window The outer planets will be labeled if annotation group is on. The inner planets are minutely displayed near the center since the orbit sizes are relatively scaled to each other. Pluto's eccentric orbit is permitted to leave the window to enlarge the other orbits.

"Inner" For a closer look at our local neighborhood, the inner planets (Mercury, Venus, Earth, and Mars) are also displayed to relative scale and labeled in an overlay window. In both orbit displays, the shape of the window affects the orbit appearance. Keep in mind that the orbits are really close to circular.

"Sky" Display sky with current display groups according to time and location variables. Certain variable changes force a re-calculation of planet appearances, otherwise a mere redisplay is performed. If the stars are on, Planet Engine looks for the "hour[HR]" and "cnst[HR]" read-only files in the current directory. Unlike the orbit displays, "Sky" does not allow radical distortion of the stars regardless of the size and shape of its window. In fact, a long horizontal window will display all 24 hours of stars; conversely, a tall, thin window shows only a few hours near the meridian (line from zenith to South).

"Report" Display table of planets in celestial co-ordinates; -useful for setting telescopes with equatorial mounts Heliocentric Longitude of the planets is also shown; this is the revolution angle for each planet around the Sun.

"Planets" Menu:

Simply click on the planet you wish to see; read notes on planet rendition above. Saturn, Neptune, and the Moon do not require any reference to read-only drawing files.

Scroll Buttons:

Horizontal Left Arrow: Subtract one hour and redisplay "Sky". All scroll buttons are useful for hand-positioning the stars or planets to some desired position. Then check the Time Tablet for the resultant time.
Horizontal Right Arrow: Add one hour and redisplay "Sky".
Vertical Up Arrow: Add one day; redisplay "Sky", re-calc.
Vertical Down Arrow: Subtract one day; redisplay "Sky", re-calc.

'planetn' Command Line Execution and Parameters (or Argument):

From a shell type:
OS9: planetn ?
This will display the Usage Sheet and available parameters.
Most of the parameters are identical to the 'planet' version described above with these exceptions:
No (W)ait parameter available.
(P)rompt Prompt for time input: Similar to Time Tablet as decribed in 'planet' version

APPLICATION IDEAS

Are the stars out tonight? What does the sky look like right now?
Just "click-click" on the Planet Icon and find out immediately. This is the best application of Planet Engine: your own colorful planetarium ready anytime you get curious about the heavens for your time and location!

Check the sky as it appears this evening or later when you will go out:
Run Planet Engine and check for moon phase and location; the bright glare of the Moon often hides something you may want to see. If you are learning the constellations or planet appearances, you can compare your display to the actual sky.

Compare planet positions between two dates:
Run two Planet Engines side-by-side and check sky and orbit displays.

Learn the seasonal appearances of the evening constellations:
Display the stars only and change the months during one year. Get a good astronomy book with the constellations names; compare them to your display to where you recognize the constellations by their common names. (Although, it occurs to me, you could make up your own names.) As they become more familiar, turn off the annotation group and see if you can still recognize them on the display and in the sky.

Study the reason for late sunrises in winter; early sunrises in summer:
Display only the Moon/Sun group and scroll the sun onto the left horizon line near the solstice dates. Then check the resultant time in "Time."

And by the way, do not forget that as long as the Sun is over the horizon, you cannot normally see anything else except the Moon. But, it is good to be aware of what planets are flying high over your head in the daytime; living in the 21st century means being much more space-oriented. Displaying the Moon/Sun only simulates the appearance of the daytime sky.

Catch the most elusive planet, Mercury, as it hugs near the Sun:
Display the planets with labels in the sky and in the orbit diagram. Mercury is named for its speed: 88 days to go around the Sun. Watch for it to quickly swing to its widest point away from the Sun and check the time when it will be above the horizon.

Get Venus at a shadow phase you have never seen in your telescope:
Display the planets and change the date forward -checking its position in orbit and its shadow in the "Planets" Menu. Record the date and time for your future observation (and put it in Multi-Vue's Clock alarm!)

See our own galaxy, the Milky Way, at its best:
Display everything and find a summer night where there is no Moon out

and the Milky Way stretches across the zenith and go see it away from city lights (try "1990 7 14", "11:0 p"). Also, when searching for a certain date or time, turn the stars off unless they are absolutely necessary -this will speed up your search. Then switch them on again when you need to see them.

Keep abreast of coming planet alignments:
The close passing of two bright planets together is never to be missed. Display the planets (with the "True" switch on) about one or two weeks ahead and look for near-misses; then, adjust the day forward or backward for their closest appearance. Write down the date and a good time to see it. Check the near passing of Mars and Saturn on "1990 2 28", "7:0 a"; also check Venus and Jupiter on "1988 3 6", "7:0 p".

Look at the favorable position of the outer planets for Voyager 1:
Simply look at the "Orbits" display during its 1981 launch year. Move the years forward to 1986 and watch the alignment of Saturn, Uranus, and Neptune.

Check out the coming Mars opposition in 1993:
Display the planets with annotation; enter "1993 1 1", "12:0 a". Look at Mars riding high near the zenith on the "Sky" display and look how near it is to Earth on the "Inner" orbits display.

What is in the sky right now over another point on Earth?:
Click on the "Locale" menu item and (C)hange only the Longitude and Latitude -keeping your Time Zone that you are in now. Refer to the World Map for other longitudes and latitudes. For example, you are in zone 6 at "10:22 a" and you wish to see the sky in Western Australia: hit the (C)hange key and enter "240 6 -30"

R E V I S I O N H I S T O R Y & B U G S

Planet Engine 1.0 Released 29 April 1990

1) Manual errors bottom of Page 2 for 128k startup: here is the correct text...

```
OS9: wcreate /w1 -s=6 0 0 40 24 1 0 0
OS9: chd /d0/SYS                        *or wherever your SYS dir is...
OS9: merge stdfonts stdpats_4 )/w1
OS9: display 1b 3a c8 01 )/w1
OS9: display 1b 25 1  1  28 18 )/w1     *planetn tries to increase
                                        *window size by 1
OS9: shell t=/w1&
```

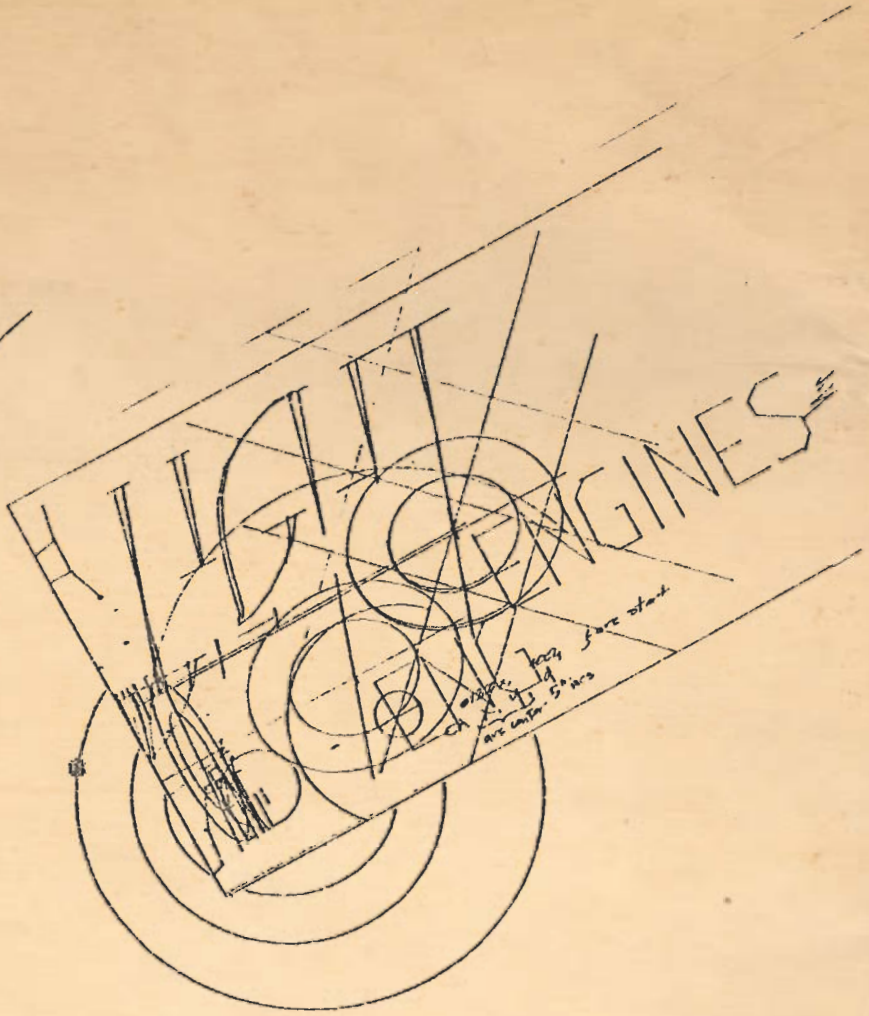
2) Time and Location Tablet hangup on keyboard entry flubs: Suspicious "scanf()" C function or read() interface with STDIN prevents entry of any more tablet data after certain user mistakes. No solution for now except to exit the entire program and restart it; then, enter your data with care.

Planet Engine 1.0 / 2nd Manual Released 1 June 1990

3) Manual corrected on Page 2

4) New Application Ideas on page 12

5) Note: Realize that any eclipses that occur on "Sky" are not reliable to the time or date. The current calculations are not that precise.



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