VIKTRAK+ DISTRIBUTED BY
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VIKTRAK+ is a satellite tracking program for the VIC20 with three or more kilobytes of additional memory (see note 1),

MAIN FEATURES

1. This program is easy to use, fast, and colourful.
2. Handles both elliptical and circular satellites.
3. Provides satellite location with a blinking cursor on a World Map.
   Provides bearing and elevation to satellite if it is within range.
4. Output to a printer is provided for hardcopy of data.
5. A software routine is built in to operate an automatic antenna aiming system.

STARTING OUT

"LOAD" the program into the computer using normal tape loading procedure. The program starts at 5 on the tape counter and takes about two minutes. A second copy of the program is at 50 on the counter.

After the tape is loaded you need to put in your home latitude (HT) and home Longitude (HN). Type in LIST 150 and press RETURN. Use normal VIC editing techniques to enter your latitude and longitude. At this time it would be wise to get a clean cassette and make an operating copy of this program. To do so enter RUN and press RETURN. A MENU will appear. Press "D" (SAVE PGM) and start recording on your clean cassette. Take the original cassette of VIKTRAK+ and put it in a safe place as a permanent backup copy. If you hate to read instructions, now is the time to put this aside and play with the program. Just follow screen instructions. If you should drop out of the program just enter RUN and press RETURN to get back to the MENU.

HOW TO USE THE PROGRAM

The MENU gives you four choices. The main section, "Tracking," is entered by pressing "A". Next will follow three requests. First enter the date you desire, using the example, incorrect format cannot be processed so a "?" will appear meaning try again. Next you will be asked which satellite you want. A list of satellites available is provided on the screen. The program will only accept these as choices, otherwise a "?" will appear. Lastly the UTC time will be asked for. Times from 0000 to 2359 UTC will be accepted, otherwise the "?" will appear again. When these three requests are fulfilled a World Map will be drawn on the screen with a blinking cursor showing satellite location, name of satellite, date, time, satellite longitude and latitude will also be shown, as well as bearing and elevation IF the satellite is within range. Orbit PHASE is included for elliptical satellites. The program is designed to run in real time, updating itself each six minutes for elliptical satellites and two minutes for circular ones. Manual updating can be accomplished by pressing RETURN as often as you desire. Several choices are available at this time if so desired and are noted at the top of the screen. Here is how they work.

A=AOS will cause the program to leave real time and calculate the next Acquisition of Signal time. It may take a while, so relax. The length of time depends on which satellite is being tracked and how long it is to AOS.

N=NEW SAT allows you to switch satellites at will. You will be asked for what UTC time you desire for this new satellite.
M=MENU returns you to the start of the program. You should do this whenever you want to change dates.
T=TIME lets you change UTC time at will. The new data will appear in about two seconds.
P=PRINTER allows the screen data to be output to a printer. In this mode real time is bypassed and your printer will give new update information every five seconds or so. To exit this mode press "P" again right after a line is printed, it will revert to normal tracking mode.

One thing about the program should be noted. You can proceed into a new day and the date will change but if a new UTC time is requested the resulting data will be for the original date selected. Remember, return to the MENU whenever a new date is desired unless you leave the program in the automatic update mode.

Back to the menu choices:
Pressing "B" allows you to easily change satellite data. You will be asked for which satellite you want data. After entering this the program lines containing that satellite data will be listed on the screen. This data can be changed by the normal screen editing of the VIC20. Return to the MENY by entering RUN and pressing RETURN. Don't forget to move the cursor out of the listing area before entering RUN as you may modify the program lines accidentally.
Pressing "C" brings up a screen page of frequency information for satellites available in the program.
Selecting "D" allows a quick and easy way to RESAVE the program after any data has been changed. Please don't use this to make extra copies of this program for your friends. The program is copyrighted and besides the price is very reasonable. Telling them where to send for the program would be a honest help for your friends.

SATELLITE DATA UPDATES
This program uses a somewhat non-standard set of data to computer satellite location but this information is readily available from several sources such as WIAW bulletins, NASA, AMSAT nets, and AMATEUR SATELLITE REPORT published by AMSAT.

The first three numbers needed pertain to reference orbit information. A reference orbit is the first orbit of whatever reference day you choose.
DR is Day of Reference and is the day of the year. DR can be calculated by using the tracking program. When asked for the date you desire, enter the date of your reference data. Example: 04APR84. When the program ask for satellite name press RUN/STOP and RESTORE together. You will exit the program (and change screen colour). Now enter PRINT DY, and press RETURN. The number that appears is DR (Day Reference).
MR is Minutes of Reference. It is the time of apogee (for elliptical satellites) or equator crossing (for circular satellites) and is entered in minutes and tenths of minutes, example: 2 hrs 10 mins and 30 secs would be 130.5 minutes.
LR is Longitude Reference and is always west longitude. If a reference is given as east longitude just subtract it from 360. Example: 15 degrees east longitude would be 360-15, or 345 degrees west longitude.
Remember: DR is Day of Year, MR is in minutes, and LR is always in longitude west.

Elliptical satellites use first apogee for Reference Day, circular satellites use first EQX crossing of Reference Day.

There are six other pieces of data still needed - these are the Keplerian or orbital elements. They are:

PE - Nodal Period
LI - Longitude Increment West
W - Argument of Perigee (zero for circular satellites)
I - Inclination
SE - Semimajor Axis
EC - Eccentricity

This information is available from AMATEUR SATELLITE REPORT, AMSAT nets (Tuesday, 8:00pm local, 3850 kHz) or NASA. Of these only one needs to be updated except rarely. Once a month or so for elliptical satellites update W (Argument of Perigee). At the same time put in new reference orbit data for those satellites you're using. This should be often enough.

TO ADD NEW SATELLITES

As more satellites are put up you will want to add them to this program. A standard layout is used to store data. LIST 650-658 to see the layout for circular satellites, or LIST 800-894 for elliptical satellites. Use these as a pattern.

```
650 ON-(N$<>"RS5") GOTO 660:IF M$="B"THEN LIST 652-656
652 W=0:I=82.96:SE=8034:EC=0
654 PE=119.554:LI=30.02
656 DR=346:MR=16.4:LR=236.4
658 RETURN

800 ON-(N$<>"O10") GOTO 620:IF M$="B" THEN LIST802-806
802 I=26.35:SE=26106:EC=.597
804 PE=699.45:LI=175.42
806 DR=334:MR=582:LR=225:W=65
808 GOTO 890
890 MR=MR-PE/2:LR=LR+(360-LI)/2:IF MR<0 THEN MR=MR+PE:LR=LR+LI
892 IF LR>=360 THEN LR=LR-360
894 RETURN
```

Note lines 980-984 are needed to convert apogee data to the perigee data used by the program for elliptical satellites. These lines are not needed for circular satellites as perigee is set on the equator when W is zero. Don't forget to add your new satellites name to line 610.

AUTOROTOR is a software routine designed to work into a plug-in board to interface with appropriate rotators for automatic antenna aiming. These boards should be available soon.

Any comments and/or suggestions would be appreciated. See you on the birds.

Note: 1. This program comes set up for 8K or more of extra memory. It can be used with 3K memory by making these changes:
Line 43, change 4404 to 7988
Line 44, change 33792 to 30720

```
43 U%=4404-INT((U+50)/10)*22:S%=S%+U%
44 POKE S%,96:POKE S%+33792,1:FOR L=1 TO 9:GET A$:ON-(A$<>"") GOTO 54:NEXT
```

FURTHER INFORMATION [NOV 2024]
https://www.spaceacademy.net.au/watch/track/orbspec.htm

The position of an orbital space object can thus be specified by six parameters:

1. a - the semimajor axis specifies the size of the orbit
2. e - the eccentricity specifies the shape of the orbit
3. i - the inclination specifies one orientation of the orbit
4. ω - the argument of perigee specifies a 2nd orientation of the orbit
5. Ω - the argument of the ascending node specifies the 3rd oreientation
6. t_p - the time of perigee passage is used to calculate the object location in the orbit

These parameters are sometimes referred to as the Keplerian elements of the orbit.

However, they are not the only way to specify the position of an object.

The US Strategic Command, which operates the US space tracking network issues space object orbital information in a form they call TLE (Two Line Elements) because the specified parameters are printed over two lines.

The actual six parameters used are a modification of the six elements we have used previously.

- n - the mean motion of the satellite in revolutions per day (this gives a)
- e - the orbital eccentricity (identical)
- i - the orbital inclination (identical)
- RAAN - the Right Ascension of the Ascending Node (this gives Ω)
- ω - the argument of perigee (identical)
- M - the mean anomaly at the time specified in the TLE and substitutes for the t_p parameter
- D/T - date and time of the TLE

There is also a decay value included - which refers to orbital change due to atmospheric perturbation of the elements.

To calculate the satellite mean anomaly you subtract the the TLE time from the satellite prediction time and multiply the result by the mean motion n.