Satellite Times®

Software Review: *Micro Orbiter 3.0*

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[Note: This product is no longer available. - TS]

One of the most common questions I get when talking to satellite tracking enthusiasts—both amateur and professional—is "what's the best satellite tracking software currently available?" Of course, there is no %best" package, because the features that make a particular software package great for one person won't satisfy another. That being said, some packages are better suited for certain tasks and without a review of the contenders, it's hard to know which ones those are.

That being said, I'd like to start of with a review of ***Micro Orbiter 3.0***. Of all the packages I've had a chance to look at, it is one of the few that will still run on a PC under ***MS-DOS*** and provides stunning graphics while doing so. It will also run in full-screen mode under newer operating systems such as ***Windows 95***, but running in a standalone window requires some extensive configuration (instructions for which are not included in the documentation). Let's take a closer look at how ***Micro Orbiter 3.0*** stacks up.

Installation and Documentation

Micro Orbiter 3.0 Release 4.2, written by Peter D. Armstrong of Precision Software Solutions, comes on three 3.5-inch diskettes together with an 82-page users guide, a command summary/quick start and reference summary card, and a postage-paid registration card—it even comes with a pen to use for filling out the registration card! Precision Software Solutions has made every effort to make installation a snap. The installation instructions are very simple and the process itself is very straightforward. Overall, it took me less than five minutes to install the software and get the program up and running. And, the entire installation (including the optional US-only airport data) takes up just over 4 megabytes of disk space. The documentation is thorough, well organized, and easy to read.

Features

If you are serious about your satellite tracking, your first concern when evaluating a satellite tracking package is to determine what kind of orbital model is used. Since most of us rely on the NORAD two-line element sets as our data source, it is important that a satellite tracking program include the SGP4 and SDP4 orbital models. ***Micro Orbiter 3.0*** incorporates not only SGP4 and SDP4 but also includes the older SGP and the newer (but never implemented) SGP8 and SDP8.

Micro Orbiter 3.0 will allow for tracking of up to 20 satellites from a database of 65,535 satellites—more than enough, since NORAD only tracks about 7,500 today. Options for how to display these satellites abound, with no less than ten different projection modes:

- Mercator (see figure 1)
- Orthographic (see figure 2)
- Armadillo
- Alber's Equal-Area
- Littrow
- Gnomonic
- Aitoff
- Lagrange
- Oblique Aspect
- Star Chart (see figure 3)

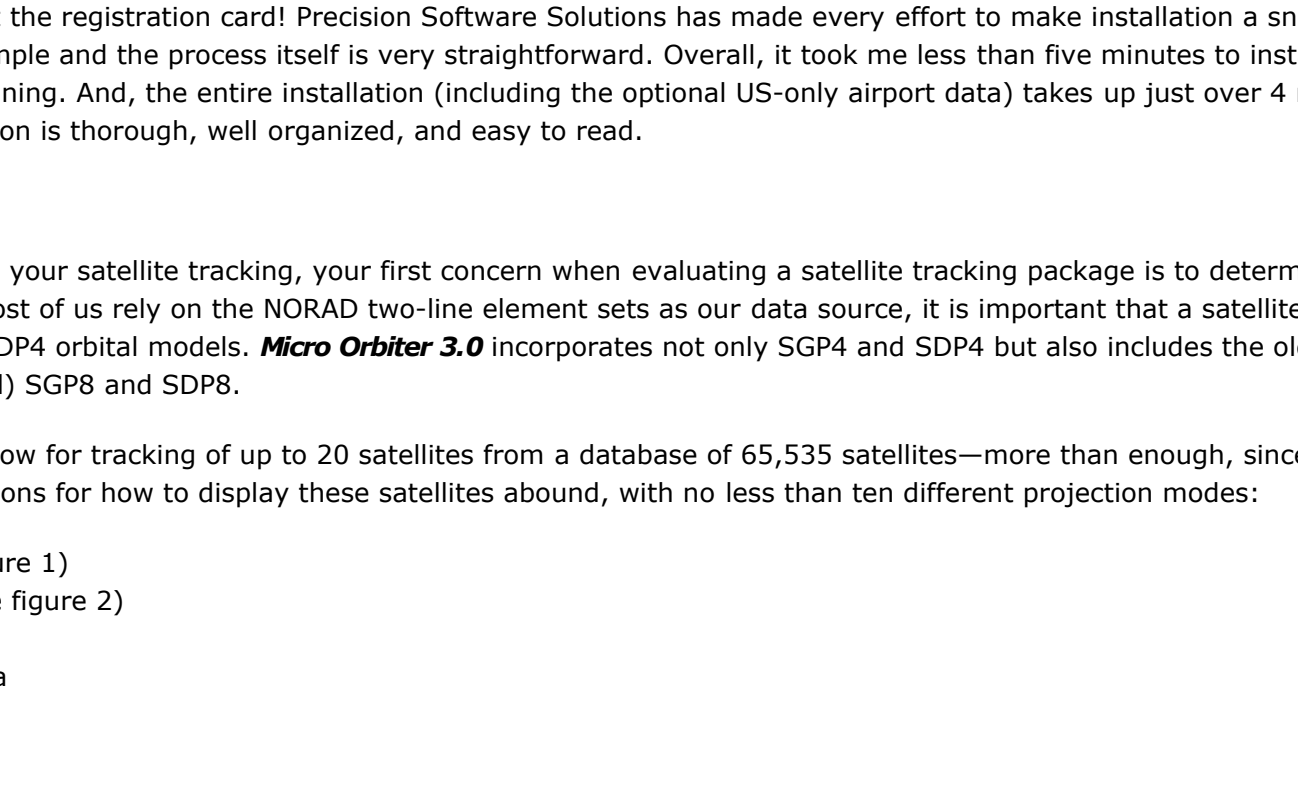

Figure 1. Mercator projection of NOAA weather satellites.

If anything, the wealth of projections is almost overwhelming. It quickly becomes apparent that projections were added to the program incrementally, since the hot-key combinations, mapping features, and modes of operation vary among the many projections. But even here, ***Micro Orbiter 3.0*** provides a solution by providing a pull-down menu which provides a much cleaner presentation of the options available—I only wish it had mouse support to make this type of access easier.

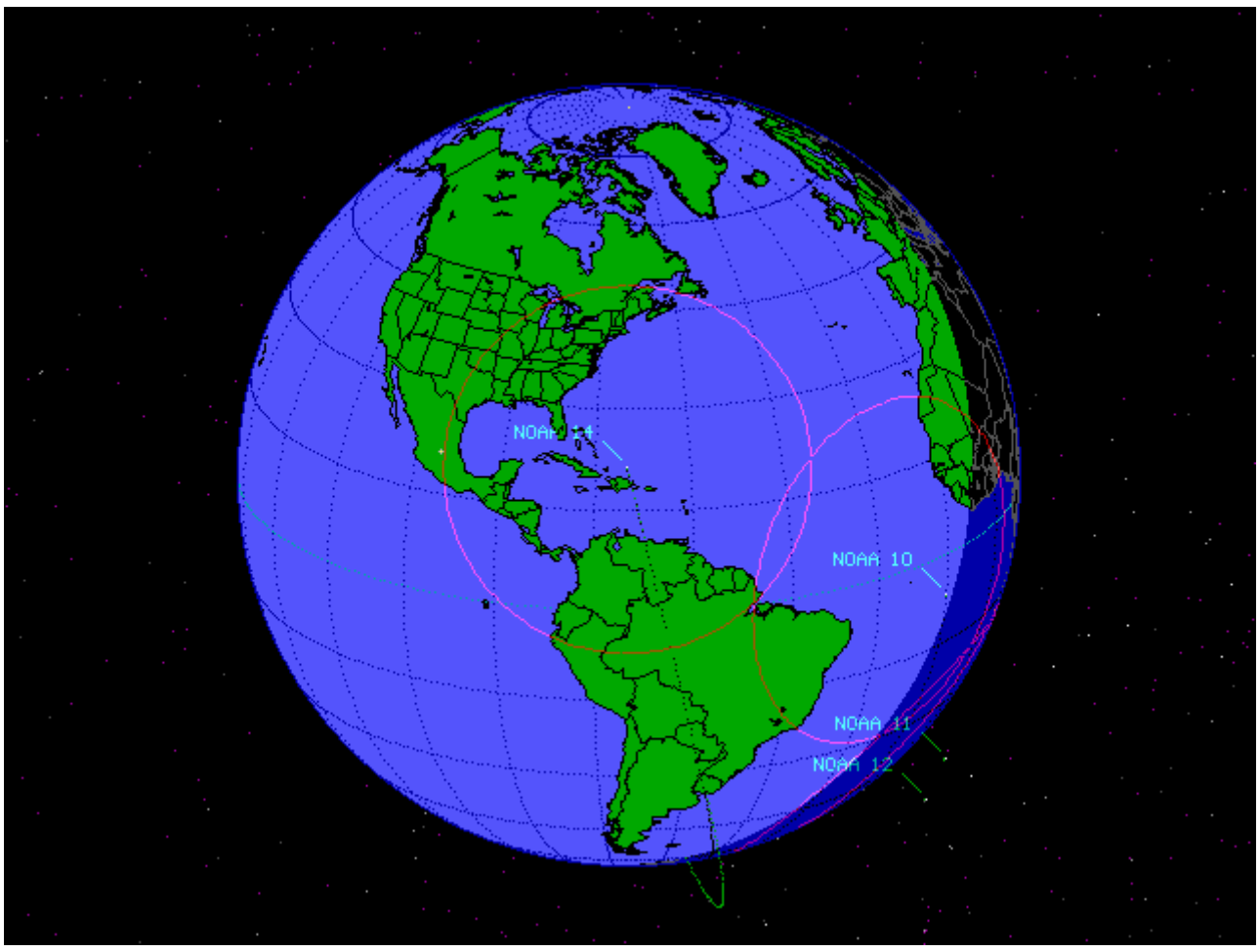

Figure 2. Orthographic projection of NOAA weather satellites.

The program has a clean, professional-looking interface and the graphics are both fast and superb, especially for ***MS-DOS***. Most displays include: time (elapsed or local), range, range rate, doppler, latitude and longitude, and azimuth and elevation. These data can also be output to a text file for more precise analysis. And, context-sensitive help is available throughout the program—that is, when you hit F1, you get help tailored to the part of the program you are currently working with. The only problem I had with the interface was using the hot key combinations. Not all of the hot key sequences make sense (most likely the result of features being added over time) and the command summary card has the hot keys listed in alphabetical order rather than functionally grouped. The context-sensitive help is a great aid here and the pull-down menus do group things functionally.

Almost everything in ***Micro Orbiter 3.0*** is configurable to accommodate varied user tastes. Don't like the map colors? Change them. Want to show constellation names on your star chart? Go right ahead. The options for displays are well thought out, right down to allowing night-vision colors for the star chart (see figure 3).

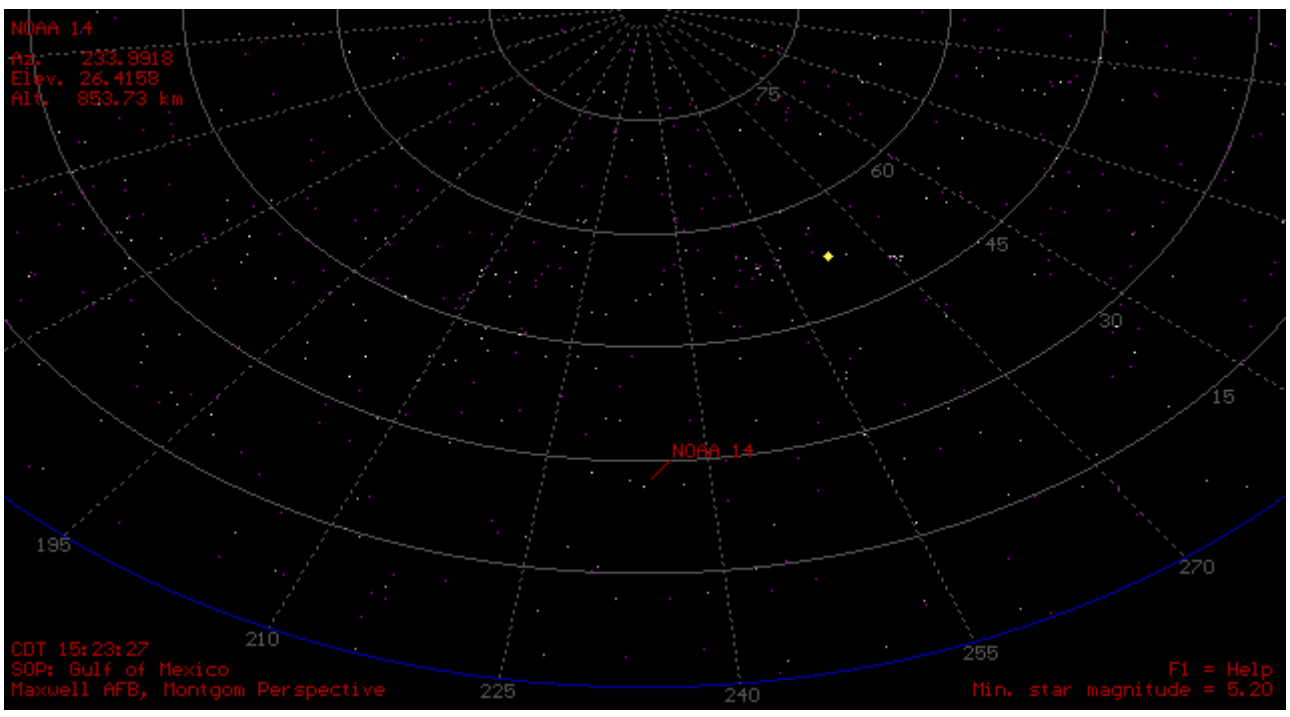

Figure 3. Sky projection of *NOAA 14* satellite.

Micro Orbiter 3.0 is best suited to real-time tracking. While, it does have features to do some rudimentary time control, such as advancing manually or automatically (in most modes) or jumping to a particular time, this control lacks flexibility. For example, there is no way to look at a satellite's position prior to the epoch of the element set being used—the program assumes such a projection would be invalid and provides no option to override it. These limitations can make analysis difficult.

In real-time tracking mode, however, ***Micro Orbiter 3.0*** excels. There are features to calculate upcoming passes—visible or otherwise—and event timers which count down to inform you of when an upcoming event (rise, set, peak elevation) will occur. In fact, the user can set ***hundreds*** of event timers. The user can even generate pass schedules for large numbers of satellites at once, although this output goes to a text file. Displays show the position of the sun and moon and will indicate when a satellite is illuminated, above the observer's horizon, and visible. For star backgrounds, ***Micro Orbiter 3.0*** uses the ***Yale Bright Star Catalog*** of over 9,000 stars (down to magnitude 8.2).

Last, but not least, is the ability to input orbital data. The layout here is not as clear as other parts of the program, but the context-sensitive help will guide you through. It is quite easy to update, append, merge, or replace elements in the master database using text files containing NORAD two-line element sets found on the Celestial WWW site and many other sources. The only apparent limitations are in the delete function which will

only work with a single satellite at a time—making it difficult to clear out the file and start over, and the search function—which requires a case-sensitive exact match.

Selecting 20 satellites out of 65,535 to begin tracking might seem like a daunting task, but ***Micro Orbiter 3.0*** does provide a mechanism to track groups of satellites with a little pre-configuration. By defining a list of satellites in a text file and then creating an ***MS-DOS*** batch file to make this file the default tracking file, it is easy to start up tracking your favorite weather, amateur radio, or visible satellites.

Benchmarking

The bread and butter of any satellite tracking program lies in the accuracy of its predictions. All the fancy graphics in the world won't amount to much if the results can't be relied upon. In an earlier column on benchmarking ("Real-World Benchmarking," ***Satellite Times***, Volume 3, Number 2), we demonstrated that the basic routines used in my ***TrakStar*** program were able to predict satellite positions within about one-tenth of a degree—***TrakStar*** has also been validated against test cases for SGP4 and SDP4 provided by US Space Command.

As such, we can use the output from ***TrakStar*** and compare it to that of ***Micro Orbiter 3.0*** to give us an idea of how well the latter performs. I used NORAD Element Set 201 for ***Mir*** and generated ephemerides (tables of predictions) of ECI position and velocity and latitude, longitude, and altitude for the period 1200-1230 UTC on 1997 April 17; and azimuth, elevation, and range for the period 0157-0207 UTC on 1997 April 18 for a limited test case. The results are shown in table 1.

Table 1. Maximum differences between *TrakStar* and *Micro Orbiter 3.0*.

X position m	***Y position m***	***Z position m***	***X velocity m/s***	***Y velocity m/s***	***Z velocity m/s***
0.000	0.000	0.000	0.000	0.000	0.000
Latitude deg		***Longitude deg***		***Altitude km***	
0.1810		0.0001		3.299	
Azimuth deg		***Elevation deg***		***Range km***	
0.0000		0.3481 ***(at ~1.5° elevation)***		0.000	

There was no difference at all in the SGP4 position and velocity predicted by ***Micro Orbiter 3.0***, indicating a good implementation of the NORAD model. There was some small difference in the latitude and altitude (but not the longitude) of ***Mir***, most likely due to a difference in the model of the earth's shape used by the two programs—***TrakStar*** uses WGS 72; ***Micro Orbiter 3.0*** uses WGS 84. Finally, there was no difference in azimuth or range between the two programs, but there was a difference in elevation, which was inversely proportional to the elevation. This result is probably due to the fact that ***TrakStar*** models atmospheric refraction at standard temperature and pressure and ***Micro Orbiter 3.0*** does not. Overall, a very good performance by ***Micro Orbiter 3.0.***

It should be noted that by differences, I do not mean to imply that ***Micro Orbiter 3.0*** is in error—only that it uses different modeling assumptions than ***TrakStar***. These differences are well within the error tolerance of the SGP4 orbital model (5 kilometers with 90 percent confidence) and should not be treated as significant.

Summary

Micro Orbiter 3.0 is a superb choice for real-time satellite tracking—especially if you are still using ***MS-DOS***. Installation is a snap, taking less than five minutes to get it up and running. Orbital predictions are quick and accurate, based upon the NORAD orbital models, and an easy mechanism for importing two-line element sets is provided. The interface is professional and graphics are excellent, rivaling even some Windows-based packages. It features a wealth of map projections and options for configuring them which, although cumbersome to access via hot keys, are easy to access via pull-down menus. And, at a price of $49.95 (plus $4 shipping and handling), it is a hard deal to beat.

If you have any questions or comments regarding this column, please feel free to contact me at TS.Kelso@celestrak.com. Until next time, keep looking up!

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