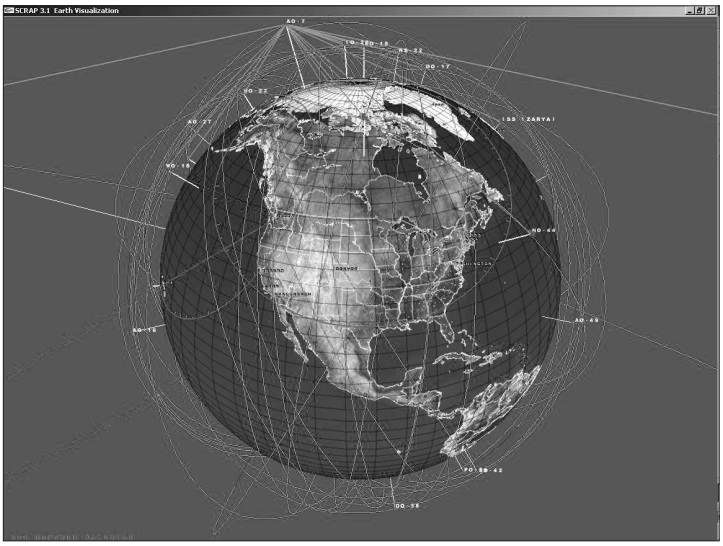
New release for 2006!

Satellite Contact Report Analysis & Prediction (SCRAP) Version 3

William H. Bytheway, K7TTY, k7tty@arrl.net

What is SCRAP?

Satellite Contact Report Analysis & Prediction (SCRAP) is a tracking, report, analysis, prediction and 3-D real time display program. SCRAP tracks and predicts passes of satellites based on the geographical location of the ground station, the current date and time and Keplerian orbital data for the satellites of interest to the ground station. SCRAP was released by AMSAT over two years ago as a joint agreement with the author.



Since its original release, the project has added several new features to include radio frequency interference (RFI) and satellite conjunction analysis. A conjunction is useful if you wish to use one satellite to communicate with another satellite as a relay.

SCRAP is similar to Analytic Graphics STK, Aerospace SOAP, Predict and InstantTrack software. This software was developed using Microsoft Visual C++, OpenGL and a modified version of Glut DLL.

Scrap is based on NORAD's Spacetrack SGP propagation algorithms and John Magliacane's PREDICT. As such, SCRAP was developed under the GNU General Public License (GPL) and the source code is also available from AMSAT on the distribution CD-ROM (http://www.amsat-na.com/category.php?c=Software).

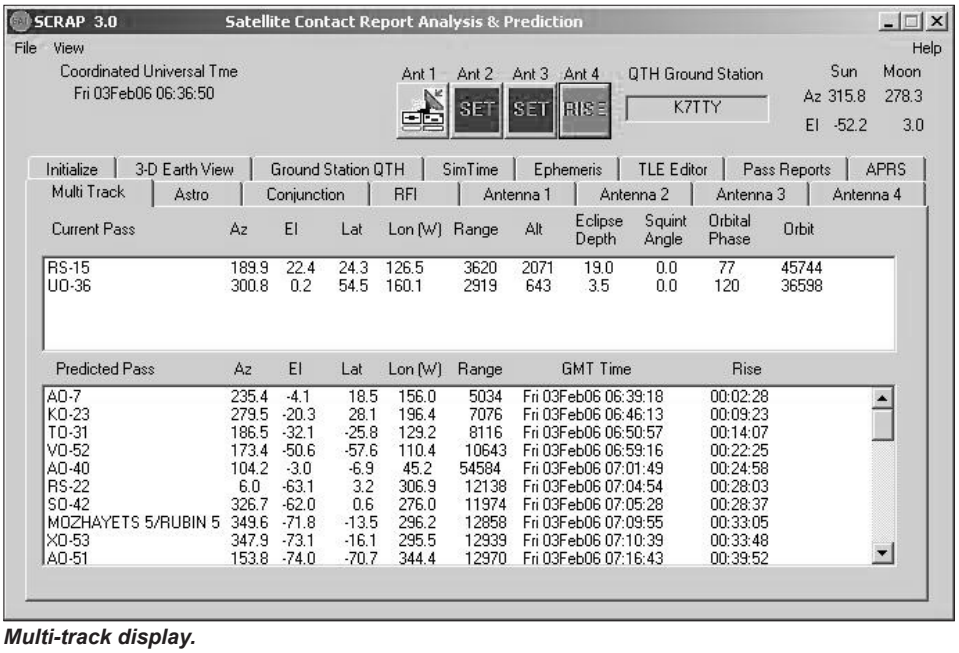
Supported Computer Platforms

SCRAP is not for the underpowered computer. To propagate ephemeris for each of the satellites it displays and reports on, the program performs millions of floating-point calculations every second. Therefore, the minimum recommended platform is Windows 98 or better running on a Pentium Processor with a clock speed of 500 MHz or greater, 256 Mbytes RAM and a graphics accelerator card with OpenGL support. Of course it helps to have at least 1024x768 resolution.

For example, test results on a Windows 98 500 MHz Pentium show that it takes about 5 seconds to calculate 200 satellite positions and display the results. If your processor does not meet the minimum recommended horsepower it is suggested you should keep the maximum number of satellites to a minimum. This can be done at run time via a command-line entry.

Display and Control

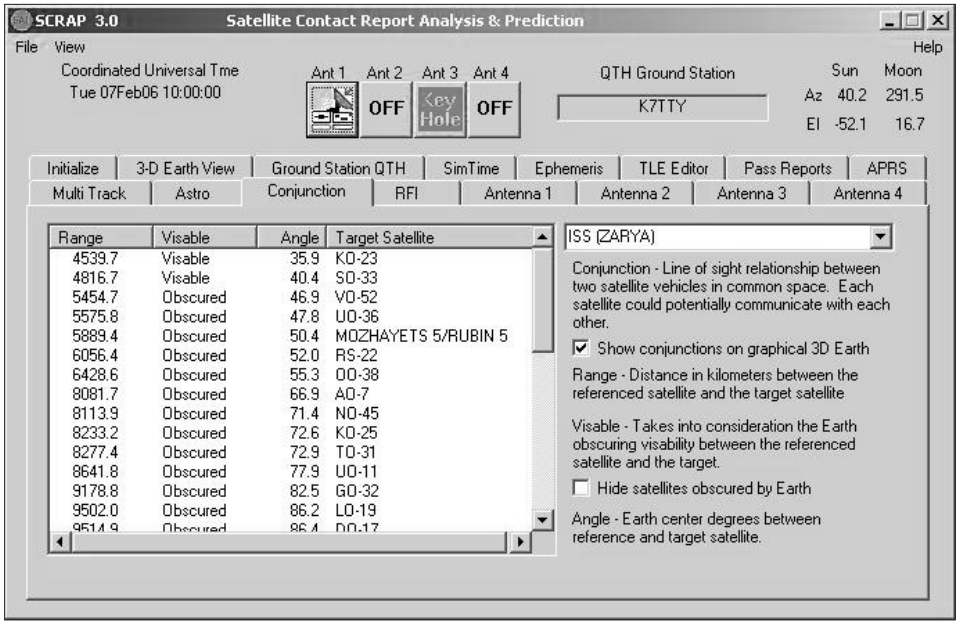
The display is organized into tabbed panels as shown in the picture below, thus allowing the user to control SCRAP's features. This screen shot shows the Multi-Track display option.

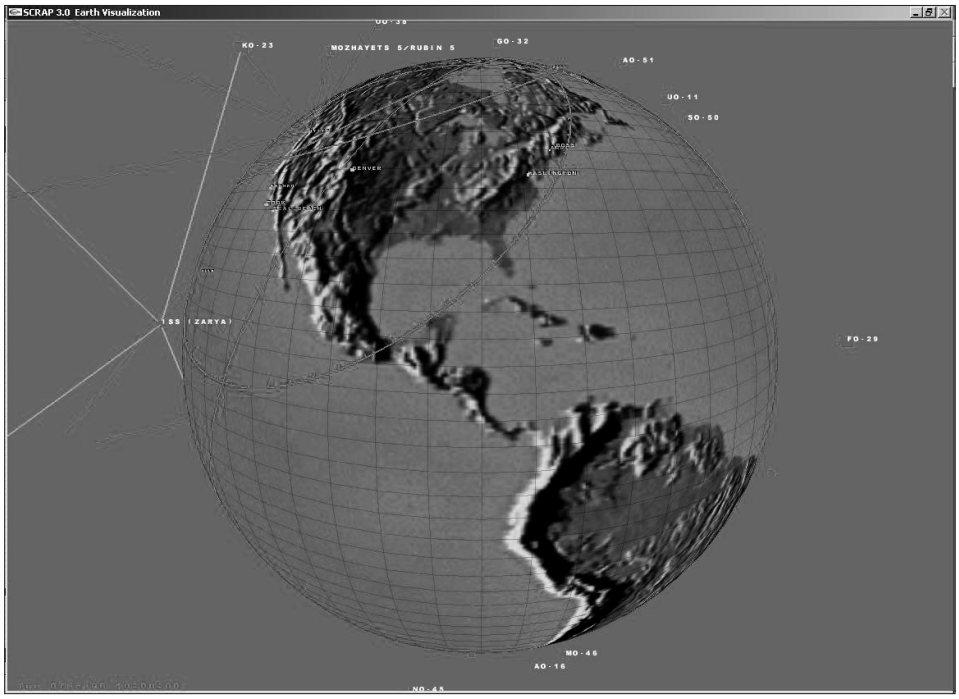


Multi-track display.

The display is organized into panels as shown in the picture at the top of the next page, thus allowing the user to control SCRAP's features. In summary these functions are listed in the table below:

Initialize	Allows the user to load in the various TLE files and to download new TLE files from the Internet.
Earth View	Selection of viewpoint to include country, satellite, QTH, etc. and to select the Earth Orthographic projection overlay map and display options.
Target QTH	Select the QTH to be used for pass predictions and reports.
Simulation Time	Define a simulation and step time other than current UST time. Useful for stepping forward or backward in time for testing.
Ephemeris	Set the SGP propagation model and view the position and velocity of satellites.
TLE Editor and Viewer	View and edit the decoded TLE parameter in classic Orbital Elements.
Pass Report Generator	Produce predicted orbit pass reports, visible passes and solar illuminations.
APRS Plotting from Internet	Download APRS stations via Internet. Locations can be used for prediction and display.
Multi Track	Display current and upcoming passes in real time.
Antenna	Az/El rotor control for up to four antennas.
Conjunctions	Calculate conjunctions between satellites.
RFI	Calculate radio frequency interference for satellites in contact.
Astro-Dynamics	Calculate position of the planets and look angles from your home QTH.





Tabular (above top) and graphical (directly above) conjunction displays.

Conjunction (Satellite-to-Satellite)

Conjunction between satellites occurs when two satellites can be seen by each other. SCRAP allows the user to select a single satellite of interest and calculate conjunctions taking into consideration the obscura of the Earth. A check box is provided to graph a connecting line on the 3-D Earth window.

Conjunctions can also be viewed on the 3-D Earth view by checking the "Show Conjunctions" check box. In this example, my station K7TTY, cannot see ISS, but KO-23 is visible from ISS and K7TTY. The range between ISS and the relays is about 4540 km. K7TTY can see KO-23 with an 88 degree elevation pass at a range of 1318 km. Contact may be possible using Mode JD 9600 bps FSK.

Radio Frequency Interference (RFI)

Interference is possible if two satellites as viewed from the ground station have a low delta angle between them. Depending on the antenna and path losses, it could be possible that two satellites could be communicated with at the same time. A display is provided that shows the angle in degrees between the referenced satellite and target satellite. If any two satellites are using the same uplink or downlink frequency, then RFI is possible.

Control of Up to 4 Antennas

This antenna feature allows the user to control an azimuth-elevation rotor for a real-time antenna pointing. Elevation angle control is suppressed until the angle rises above zero. The QTH is selected from the "Ground Station QTH" panel and once you start control you cannot change the QTH until you stop the action (just a little protective control). The precision function allows you to update the rotor with data that has less than one-degree accuracy. Data is sent to the rotor once per second.

The icon will change from set (no contact), to rise, to the antenna symbol, to fade and finally loss of signal. The icon is also displayed in the upper section.

The Maximum Azimuth, Elevation Delta, and Azimuth Delta can be set from the initialization file and the numbers are set at runtime. See the panel on the next page.

New Feature: Separate Display Windows

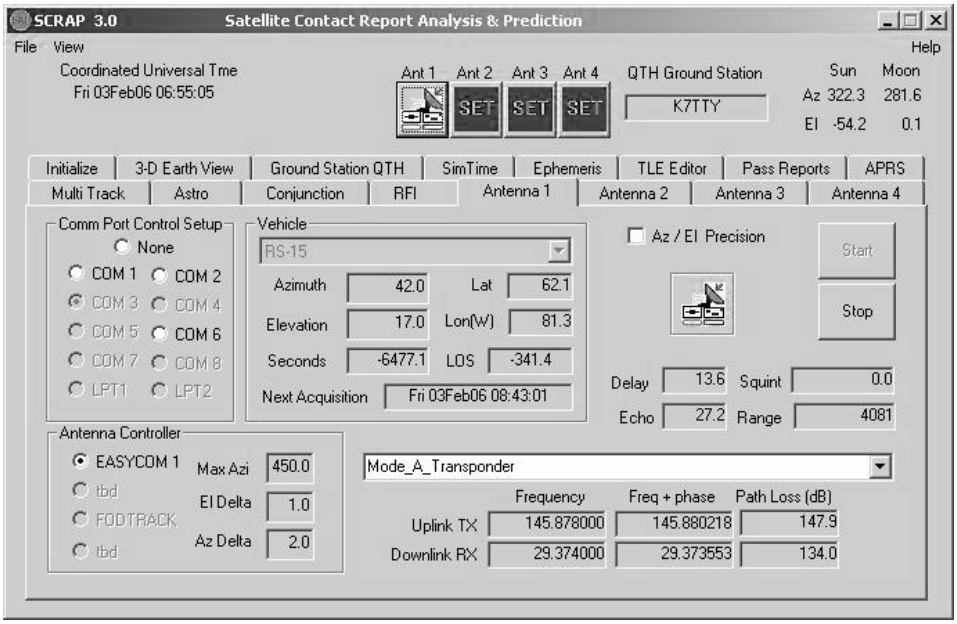
In the past, you were only able to view one tabbed window at a time, similar to many other satellite tracking programs. A new feature has been added that allows you to separate the selected windows from the main display. In the second picture on page 28 you can find the following windows:

- Astro-Dynamics – Look angles to the nine planets
- TLE Editor – View and edit each of the two line orbital elements
- Multi-Track Viewer – View current and upcoming satellite passes
- Satellite Conjunction – Distances between two satellites
- Radio Frequency Interference – Possibility of RFI during any contact

Obtaining the Software

SCRAP is distributed by AMSAT-NA. See the SCRAP ad on page 17 of this issue for more information. Contact the AMSAT office to order. The price is $50 for members and $60 for non-members.

continued on the next page ...



Antenna control display (above).

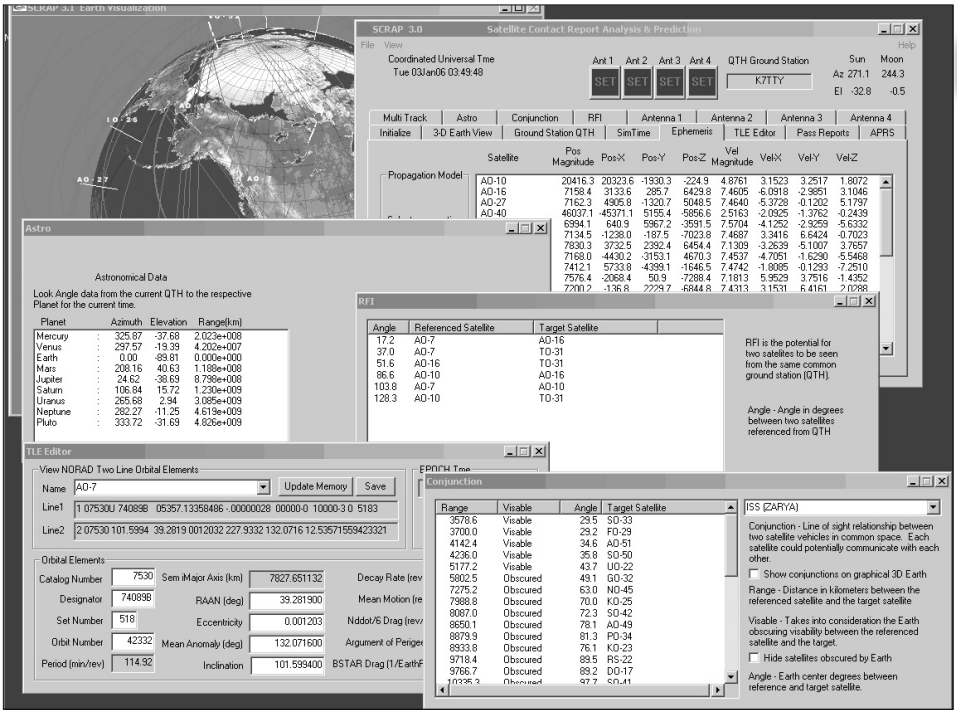
Additional Web site Information and Support

Since its original release, the author, from his home Web site at the following URL, has provided SCRAP support as well as free updates and fixes to the product: http://207-207-72-42.ip.theriver.com/

For more information about RTTY please visit the following site: http://www.rtty.com/

For information on how to obtain the software on CD-ROM visit: http://www.amsat.org or call the AMSAT office.

Editor's Note: SCRAP has very colorful display panels that easily show satellite orbits and a wide variety of other information. Grayscale graphics as printed in the Journal don't show the full extent of SCRAP's capability. Why not try a copy of SCRAP and see just how great it is. You'll support AMSAT too!



A new SCRAP feature - multiple window views.

About the Author

William Bytheway, K7TTY, has been licensed since 1969 and has 30 years of experience providing software and systems engineering development support to the aerospace and defense industry.

Programming language capability include C/C++, HTML, JAVA and PASCAL with some experience in BASIC and FORTRAN. Included are dialog-based WIN32 applications using MS Visual C++ 6.0, Borland PASCAL 7.0 and C++ 4.52 IDE. Bill has performed extensive work with RS-232 and TCP/IP protocols on DEC-VMS, UNIX and DOS/WIN32 systems.

Aside from developing SCRAP, K7TTY also has an interest in antique radio Teletype machines and software development to support integrating computers and mechanical teletypes.

SuitSat from NASA

ISS012-E-15666 (24 Jan. 2006) --- An old Russian Orlan spacesuit is photographed in the Unity node of the International Space Station, which was released by hand from the space station during a spacewalk Feb. 3, 2006. Outfitted with a special radio transmitter and other gear, the spacesuit comprises a Russian experiment called SuitSat. It will fly free from the station as a satellite in orbit for several weeks of scientific research and radio tracking, including communications by Amateur Radio operators. Eventually, it will enter the atmosphere and be destroyed.

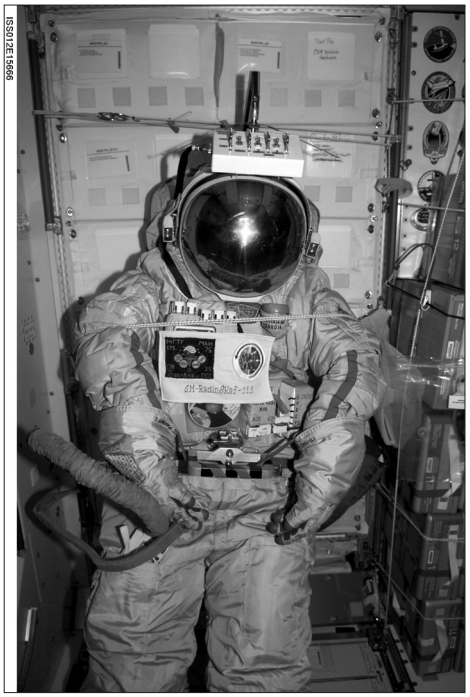


photo courtesy of NASA