UOSAT-2 WHOLE ORBIT DATA DECODING PROGRAMS

IMPORTANT !! BEFORE USE MAKE A BACK-UP COPY OF THE PROGRAM DISK.

The disk contains the following programs -

UOSAT	Display and stogage program
U2WOD	ASCII Decoding Program
U2PW	Packet Decoding Program
SCALE	Utility for scaling data
JOIN	Utility for joining files
SBASE	Program for changing Keplers

and the following data files -

3.D134	ASCII WOD 14-may-93	Channels 0 10 20 30 Arrays
3.D137	ASCII WOD 17-may-93	Channels 1 2 3 61 Magnetometers
3.D134P	PACKET WOD 14-May-93	Channels 0 10 20 30 Arrays
3.D147P	PACKET WOD 27-May-93	Channels 1 2 3 61 Magnetometers
SAT	Kepler file for SBASE	
S147	Screen dump from 3.D147P	

COMPUTER REQUIREMENTS.

BBC B, 32K
Monochrome display
BASIC 2
OS 1.2
DFS ... Acorn or Watford 1.43

These are simple programs for decoding and displaying OSCAR-11 Whole Orbit Data. They are not intended to be the ultimate in display programs, but for the experimenter. Being coded in BASIC and using floppy disks they are VERY slow. You are encouraged to modify the programs to include more or less analogue channels, and add other surveys or experiments to the menus.

Data from the satellite is recorded on an audio cassette and then played back into the computer cassette port. The program UOSAT creates a disk file of the data. This is then processed by U2WOD or U2PW. The data from a single pass is usually insufficient to produce a complete graph, and it is often necessary to combine the data from two or more passes. The program JOIN allows two or more files to be combined into a single file.

Some form of text editor is recommended for changing the program code. I recommend TOOLKIT PLUS which can be obtained from BEEBUG Ltd., of 117 Hatfield Road, St. Albans, AL1 4JS. This is a program development ROM, which includes a screen editor, and many other useful features which enable you to move lines around, delete lines, and merge files etc.

The programs do not have any facilities for producing a printout from the screen. Various sideways ROMs are available for doing this.

The ASCII version is a very large program mainly due to the inclusion of PLAN10 and SBASE routines for calculation of satellite position and solar illumination. This part of the program is from line 5000 to the end. If

you need more memory there is quite a lot of unused code and comments which can be deleted from this section. If you do not require the satellite tracking part, this section can be deleted. The packet version U2PW does not include the satellite tracking, although it could be included if required.

DECODING ASCII WHOLE ORBIT DATA

LOADING AND OPERATING INSTRUCTIONS

CHAIN "U2WOD"

You will be asked for your file name. For the demonstration select one of the ASCII data files say the magnetometer channels 3.d137. To display the WOD select the appropiate test from the menu ie. test 4. The plot will slowly build up. The the vertical lines indicate the rotations round the earth. Similarly you can use menu option 1 with 3.D134 to show the solar array currents.

Usually the WOD transmitted in a single pass doesn't completly scan the survey time, and two or more passes from the same day have to be combined. Use the program JOIN for this. Both demonstration files were made up from two passes.

An interesting demonstration is menu option 6 which can be used with 3.D134. This plots the sum of all the solar array currents, and the predicted solar illumination of the satellite. Enter the day number of the WOD ie 134, and starting time of WOD 0,0. Press return to get the default data base SAT. Select appropiate Keplerian set, ie enter 1 for 93D124. The program will be very slow as it is now calculating the satellite position and solar illumination for ever data point. Time to make a cup of tea! Note how the solar current falls to zero when the illumination changes from light (L) to dark (D).

DECODING PACKET WHOLE ORBIT DATA

LOADING AND OPERATING INSTRUCTIONS

CHAIN "U2PW"

The operation is similar to the ASCII WOD program, although the menu includes some additional features for dealing with the packets. These are

1. Review File. Scans file for packets. Indicates their type and location in file.
2. Change File Pointer. Allows you to start in middle of file.
3. Change File Name.
4. Display WOD. Displays WOD line number, and channel data. You have to enter the number of channels in survey.
5. WOD to File. Similar to above, but also puts the tabulated data in a file.

For the demonstration use data file 3.D134P with menu option 6 (Arrays). Note that the resolution is higher than for the ASCII program, but plotting is slower. This data was collected from a single pass, and covers about one revolution around the earth. The data from four passes was combined to produce the other demonstration file 3.D147P. This is a very large file which takes a long time to plot, and still contains gaps in the data. There is no guarantee that recording every available pass during a given day will give a complete survey. I have noticed that adjacent passes often tend to cover the same part of the survey! If 3.D147P takes too long for you to plot, I have prepared a screen dump for you to load! Just type MODE4 <ret> then *LOAD S147 <ret>.

PROGRAM NOTES

The programs have been outlined in OSCAR News (ASCII WOD June 1993, Packet WOD awaiting publication). The STATUS channels ie 61+ are NOT decoded. Identical names have been used for procedures and data, in the ASCII and Packet programs so that the same code can be used for the TEST procedures in both cases. You have to set the value of channels% to the number of channels in the survey, usually 2 or 4. The Packet processing has to be initialised by PROCinit_wod. The procedure PROCdata puts the next set of data into array data%(), and sets up line_no%. The data is then plotted against line_no%.

A major task with any plotting program is the scaling,and calibration of the axes. No attempt has been made to do this automatically, although a simple routine has been incorporated for labelling and calibrating the axes manually. To get the data to fit into a given part of the screen it has to be multiplied by a constant m, and then offset by another constant c.

```
y = m*data + c      where y is the vertical axis coordinate
m = (y_top - y_bottom)/(max_data - min_data)
c = y_top - m*max_data.
```

The Y axis input range is 0 to 1080. The bottom of the screen 0 to 150 is reserved for messages. The remainder is divided into four fields for plotting the the four different channels. There is a small gap between fields -

FIELD No.	1	2	3	4
Y RANGE	150 - 350	370 - 570	590 - 790	810 - 1010

The small stand alone program SCALE can be used to calculate m and c. It has the facility to specify the four fixed fields in the Y axis. Many of the telemetry channels such as temperatures have a negative calibration (eg. T= (480 - N)/5). To plot this correctly max_data has to be the lower value, and min_data the upper value.

The plots are identified on the left side of the screen using PROCid(id$,field_no), id$ is text of up to six characters, and field_no specifies the range as above. The text is placed in the middle of the field.

There is a similar procedure PROCy_cal(id$,y), where the text is centered at the actual Y co-ordinate.

The X axis input range is 0 to 1279. 0 to 199 is reserved for channel identification and calibration leaving 1080 units for the graph. The line number has to be divided by max_line_no/1080 to make the x values fit the screen. Thus x = line_no% /max_line_no * 1080 + 199
(for a four channel survey the maximum line number is 4096)

The procedure x_cal(x_scale) draws vertical lines for each revolution of the earth. The variable x_scale = max_line_no/1080.

To use the satellite position or solar illumination features, the procedure PROCset_keps is used to initialise the routines. The PROCsat_pos will calculate the position from line_no%. Three variables are calculated sun%, lon, and lat. Sun% is 1 when the satellite is in sunshine, and 0 when in eclipse; lon and lat are the co-ordinates of the sub-satellite point in degrees.

UPDATING THE KEPLERIAN ELEMENTS

The program SBASE must be used for adding or changing the Keplerian elements in file SAT. Chain "SBASE", and press return for the default file SAT. Use menu option 1 to edit or create new Keplers. It will show the value of each item, type in a new value or press return to retain the existing value. Option 5 will display the complete element set.

The information above is probably all you need for this application, although SBASE has many other features and applications. Full documentation and an applications disk is available. An SAE will get you details. SBASE was outlined in OSCAR News 99, February 93, page 13.

UOSAT DISPLAY AND STORAGE PROGRAM.

This program evolved from Trevor Stockhill's program, published by AMSAT and UOS. It includes data storage on disk, and printer control. The display can be toggled between TEXT and HEXADECIMAL, which is useful for looking at UOSAT packet data.

UOSAT displays, prints, and stores satellite data from a cassette or via a decoder. Better results are obtained if a decoder is used. However in practice due to the characteristics of FM, the signal quality changes very rapidly from good to poor and therefore the decoder has little opportunity to show its enhanced performance with marginal signals. The Jim Miller decoder is recommended (details from AMSAT-UK).

LOADING AND OPERATING INSTRUCTIONS.

CHAIN "UOSAT"

The program lets you choose a cassette input, otherwise it uses the serial port. The menu displayed has the following options -

1. Display only
2. Display and store bulletin, TM or WOD
3. Display and store DCE data.

I usually record UOSAT signals on tape, and then replay into directly into the computer cassette port. The tape can be started, stopped, or rewound, to allow you to read the screen. When the tape is running the following keys are active -

H	Toggle display between TEXT and HEX
B	Start printing
C	Stop printing
Q	Quit

In the storage modes the following additional keys are active -

S	Start storage
D	Stop storage (ie. display only)

NOTE! These keys only work when characters are going into the input port, ie the tape is running.

DISPLAY AND STORE (menu option 2)

This option allows you to store UOSAT text data on the disk. Unwanted control characters have been removed from the ASCII data which may then be edited by WORDWISE. It is suitable for telemetry, WOD, or the bulletin, but not for DCE messages, or packet data frames.

The default file name is UDUMP. The program lets you use other names if required. I usually find it best to use UDUMP, and then rename it using *RENAME. The code I use is n.UmDxxxB/T/W/K, where n is the year, m is UOSAT number, xxx is day number, B = bulletin, T = telemetry, W = WOD, K = Keplers. Eg. 8.U1D305W means UOSAT1,year 1988, day 305, WOD

DISPLAY AND STORE (menu option 3)

This option allows you to store the raw data from UOSAT. The stored data contains control characters which prevent it being edited by WORDWISE, but which are needed for the packet data frames. The default file name is RAW.

NOTES ON STORAGE.

a) Storage does not start until you press the S key.

b) Make sure that the disk has sufficient room to allow the data to be stored. Compact the disk if any files have been deleted. Do not overwrite a file, unless it was the last one written, as only the last file can be extended. You can check the order of files on the disk by using *COMPACT.

c) Do not use the ESCAPE key to exit from the program. Always use Q. If you do use the ESCAPE key, you must then close the file by CLOSE£ 0, press shift-break, and then reload the program.

GENERAL INFORMATION

These progams are given to the Public Domain for the benefit of all Radio Amateurs, and users of amateur satellites. The disk does however contain routines from PLAN10 by James Miller G3RUH. Permission has been granted by the author to use these routines for amateur purposes, provided his copyright is respected.

I plan to support these programs for as long as possible, but cannot guarantee to do so indefinitely. An SAE at any time will get you details of any updates.

If you have any comments or queries please write (enclosing SAE if you need a reply) to -

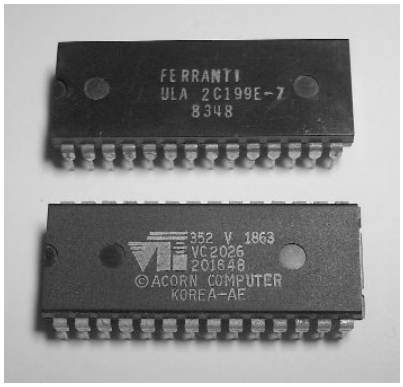
Clive Wallis G3CWV

"Wychwood"
Snailswell Lane,
Ickleford,
Hitchin,
Herts.
SG5 3TP.

If you require further details of Amateur Radio Satellite please send a large SAE to - AMSAT-UK, LONDON E12 5EQ.

28-May-1993

Additional software for VLSI SERPROC owners



The BBC Micro is fitted with one of two types of serial processor: the Serial ULA by Ferranti (top) and the later SERPROC chip by VLSI (bottom). This can be found in socket IC 7, next to the cassette socket.

The SERPROC was revised to accept either normal or inverted modulation, allowing computers with this chip to read telemetry from both UoSAT-1 and UoSAT-2 through the cassette port. However a small amount of software, including the original *UOSAT* program on this disk, is incompatible with the SERPROC's updated control register.

Therefore a new version of the *UOSAT* program, named ***VLSI***, is included on this disk. Operating instructions for *VLSI* are the same as for *UOSAT*, except that while characters are being decoded, the user can press **V** to switch between 'V.1' and 'Acorn' modulation used respectively by UoSAT-1 and UoSAT-2. The program starts by using UoSAT-2 modulation.

The **V** key is not needed in conjunction with the programs on this disk, but UoSAT-1 telemetry can be saved for interpreting with the programs on Disk 1. The *VLSI* program also runs on computers with the Ferranti ULA, but the **V** key will have no effect while receiving.

Greg Cook
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