

APTDecoder

New Software for NOAA APT Processing

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Some months ago, **Patrik Tast** of Västervik in Finland released *APTDecoder*, a software package that allows you to capture NOAA APT audio, convert it into weather images, then subsequently process these to add colour, remove noise, create a weblog and much more. Although still under continuous development, *APTDecoder* already offers a host of features which make it a powerful rival to established favourites in its field, like *WXsat*, *WXtoImg* and *Satsignal*.

Obtaining and Installing APTDecoder

APTDecoder is free software and is available both from the Software Library and by direct download from:

<http://www.ptast.com/apt/decoder/>

The single installation file will, by default, install *APTDecoder* in the folder 'C:\APTDecoder' although it does offer a 'browse' button that allows you to select your own preferred location. The first time you run *APTDecoder*, it is a good idea to open the **<Help → About>** menu and click where it says 'Create a desktop shortcut'.

Preparing APTDecoder for Imaging

APTDecoder offers a host of user options. Here are just a few that you are recommended to modify before starting to use the program.

- Click **<Settings → General settings>** and in the *General* tab check 'Enable auto recording and processing' so that satellite passes will be captured automatically.
- Open **<Settings → Ground station>** and type in your latitude, longitude, altitude and station name.
- Make sure you are on-line then open **<Satellite → Keplerian elements>** and click 'Download' to import the latest 2-line elements.
- Open **<Satellite → Active APT satellites>** and place a check mark against the names of those satellites from which you wish to create images. *Note:* If no satellite is checked, the program will not do anything!

Capturing your first image

Now just leave *APTDecoder* running. The legend at the top of the screen announces which satellite is approaching and continually updates its azimuth and elevation, as well as stating the maximum elevation and AOS (Acquisition Of Signal—the time when the satellite rises above your horizon). Signal capture then commences (figure 1), the image displaying in real-time as it builds up. Note the floating overlay which shows full details of the satellite pass; this overlay does not appear on the saved images. Once the pass is complete the satellite audio, the decoded image and an information file are all saved automatically

Setting Recording Volume

If you already have other software such as *WXsat* or *WXtoImg* working satisfactorily on your PC, the recording level should

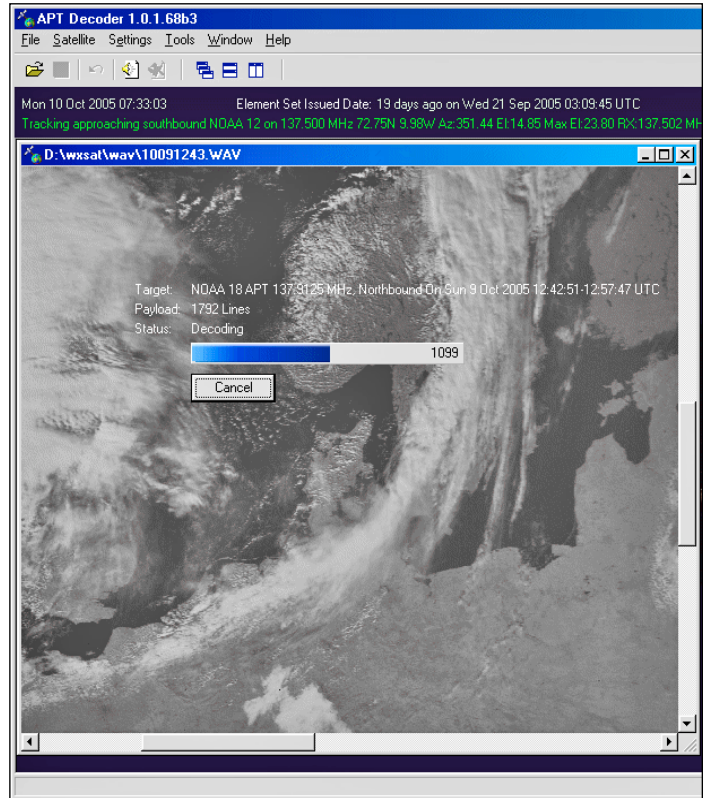


Figure 1 - The APTDecoder main screen

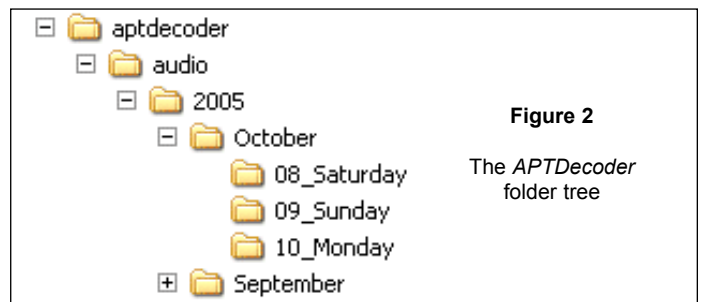


Figure 2
The APTDecoder folder tree

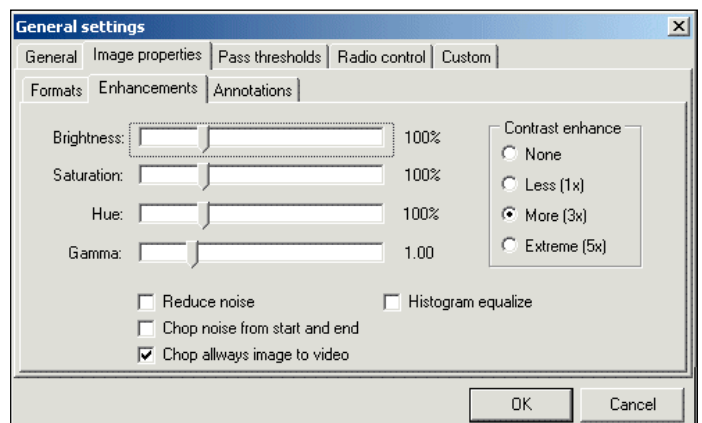


Figure 3 - The Image Enhancement Window

prove satisfactory for *APTDecoder* and your images should show a full range of tones. Otherwise, wait until a satellite image is forming and click **<Tools → Recording control>**. Check the 'Select' box for the input channel that you connected to your receiver ('line-in' or 'microphone' as appropriate) and adjust its volume slider until the decoding NOAA image shows a good range of tones without 'burning out' the cloud detail.

Filing System

APTDecoder creates a new data folder each year, containing a subfolder for each month and a further subfolder, as required, for each day of the month (figure 2). Every NOAA pass generates three files: a WAV file containing the satellite audio, a jpeg image in the standard NOAA format of two side-by-side images, and a text file which contains full details of the pass (satellite name, times of AOS and LOS, station details and the 2-line element set). All these are saved in the current 'day' folder, every file with a convenient generic stem filename based on the date and time:

```
yyymmdd_hhmmss_NOAA_nn
```

Optimising Image Reception

Even though you take the trouble to set the recording level carefully, you may well discover that your images still lack the brightness and contrast that you desire. *APTDecoder* has built-in tools for modifying its default image parameters under the **<Settings → General settings → Image properties → Enhancements>** menu (figure 3). Any changes made here will become the defaults for all future satellite images. You can actually change these parameters during image acquisition then store the changes by clicking 'OK'.

Pass Thresholds

Unless you have a particularly clear horizon you will probably find that the beginning and end of each pass is of poor quality and not worth decoding. The **<Settings → General settings → Pass thresholds>** tab allows you to select, by either elevation or pathloss (in dB), when during a NOAA pass imaging starts and ends.

Modifying Images

Once a basic twin-channel NOAA image has been captured it can be processed in a variety of ways. The two channels, *Video-A* (daytime visible channel-2) and *Video-B* (infrared channel-4) may be displayed individually or further improved using the tools in the **<Enhance>** menu. False colour can be applied in several ways, both as a colour-composite image and as colour enhanced IR. The full range of image possibilities available in the **<Images>** menu is:

- Normal - the basic twin-channel NOAA transmission
- Video A - visible channel-2 by day, channel-3 IR overnight
- Video B - channel-2 infrared
- * False colour (A,B)
- * False colour temperature enhanced (ch 2+4)
- * False-colour low temperature enhanced (ch 2+4)
- IR brightness temperatures (ch 4)
- * IR low temperature enhanced (ch 4)

An additional useful option in the **<Images>** menu is called **<Spacecraft → Passinfo>** which displays a screen showing the contents of the logfile produced at the time of acquisition (see figure 4).

The **<Enhance>** menu provides tools to normalise and equalise the image, as well as to adjust contrast and modify the gamma setting (figure 5). The **<Effect>** menu offers additional tools, some more useful than others. The 'Magnifier' opens a small

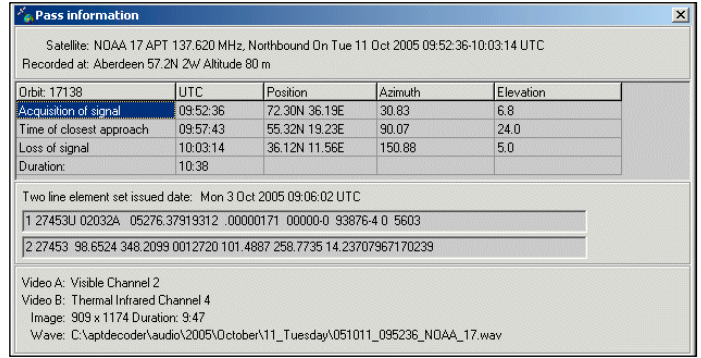


Figure 4 - The satellite pass information window

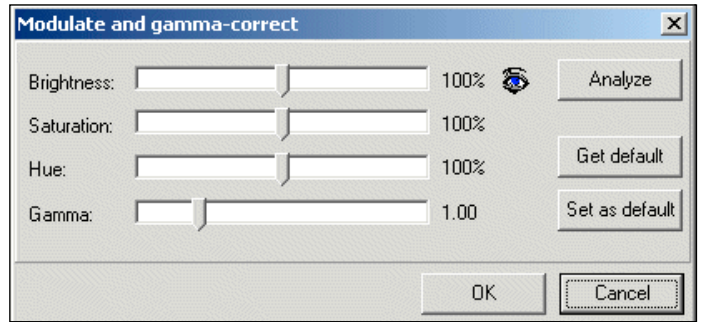


Figure 5 - Gamma correction in the **<Enhance>** menu

scalable window showing the region beneath the cursor at up to 500% enlargement; the 'Reduce noise', 'Median filter', 'Despeckle' and 'Sharpen' options all work well; others such as 'Enhance', 'Emboss' and 'Find edges' are of dubious usefulness in this field.

Selecting a Colour Palette

Four of the image modes listed above (asterisked) can each be assigned its own individual colour palette through the **<Settings → Color lookup tables>** menu (figure 6). Click the yellow folder icon adjacent to the mode for which the palette is to be changed, select a new one from the pick-list that is displayed, then click 'OK'. If you wish to see the immediate effect of a new palette, load an image of the appropriate mode, select a new palette and click the appropriate 'eye' icon. This way you can check various palettes before making a final decision as to which you wish to be the default for that mode. *APTDecoder* also features an editor where you can create palettes of your own (**<Tools → Color Lookup Table Editor>**).

Imaging from Archived WAV Files

APTDecoder can be used to create images from archived WAV files. Because these will often be stored on a CD or DVD, writing the images to the same folder as the WAV file is no

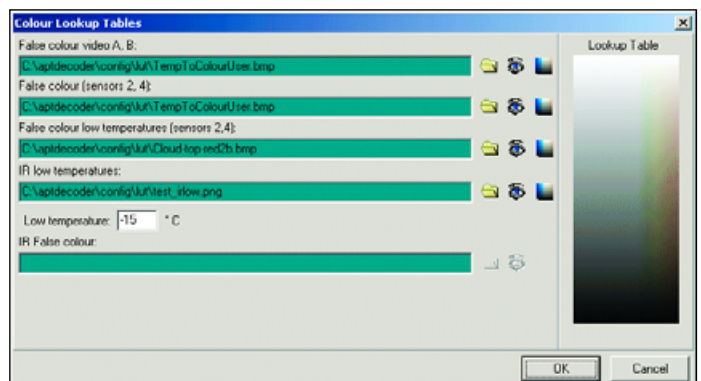


Figure 6 - The colour palette selection window

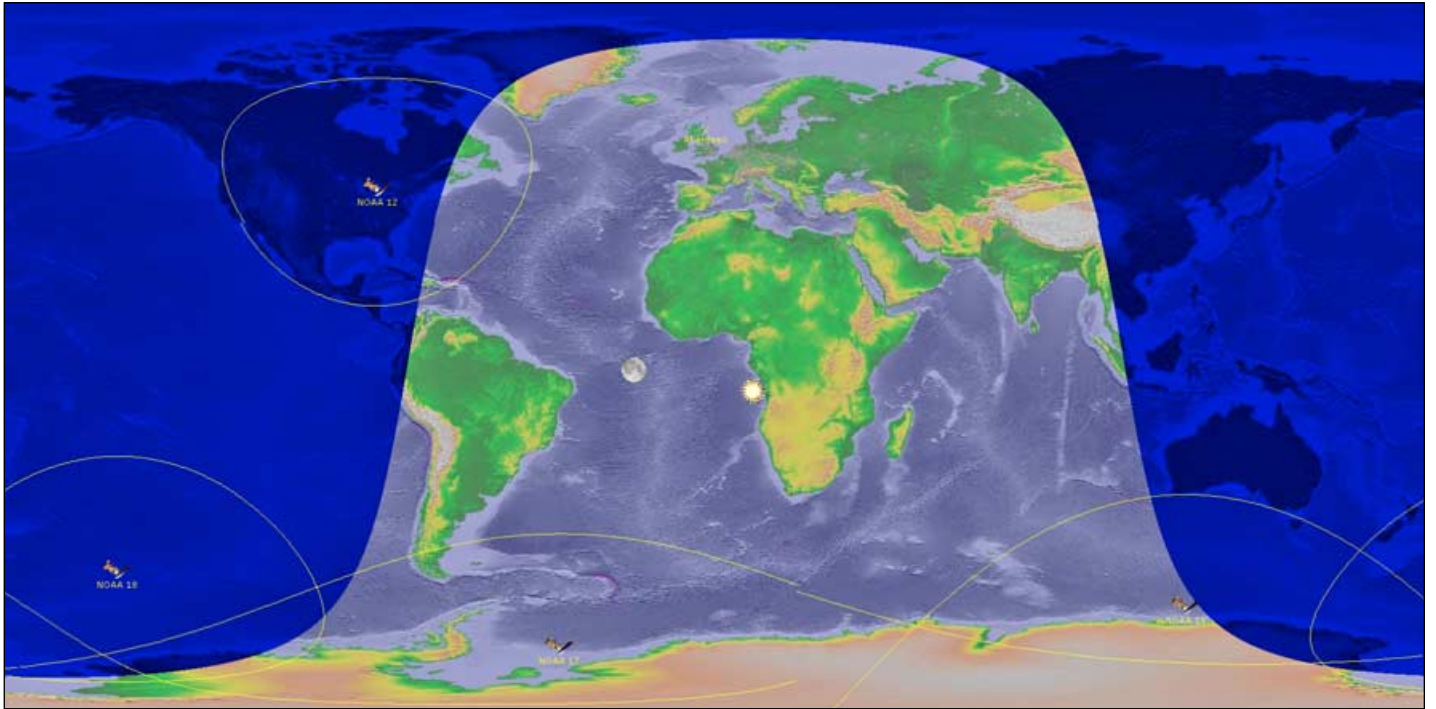


Figure 7 - APTDecoder's Flat Earth Monitor (satellite tracking screen)



Figure 8 - NOAA 17 at 11:37 UT on July 7, 2005, processed in APTDecoder using a customised palette

longer possible—but there is an ingenious solution. *APTDecoder* creates a new folder called 'raw' inside its 'audio' folder, and deposits the images there. The format in which the images are stored (JPG, BMP, GIF etc.) can be selected from **<General settings → Image properties>** by using the 'RAW Image format' drop-down menu. This setting also determines the format of images saved during direct reception from the satellites.

Flat Earth Monitor

A satellite tracker called the *Flat Earth Monitor* is an integral feature of *APTDecoder*. It operates continuously in the background but can be displayed from the **<Tools>** menu (figure 7). The satellites you display, and whether you choose to draw footprints and display the positions of the sun and moon, are all controlled under the **<Settings>** menu.

Daily Log

APTDecoder can prepare a web page containing any, or all, of the images that you process during the day. This is a very elegant HTML page (index.html), stored in the 'APTdecoder\html\daily' folder, which displays a thumbnail copy of each image along with a neat table listing full details of each satellite pass. Clicking on any thumbnail reveals the full-size image. To generate the Log just check 'Create an html log' on the *General* tab. If you wish, the program will also upload the Daily Log to your FTP server—an ideal way to keep your web page of satellite images up to date.

At the start of each day, *APTDecoder* erases the previous day's Log and starts a new one so you don't have to continually delete old images.

Radio Control

APTDecoder supports radio tuning control for the RX2, R2FX, and EMGO weather satellite receivers.

RSS Reader

Another valuable feature of *APTDecoder* is its in-built RSS Feed reader (see Peter Green's article on page 11). Not only does this connect with updates on the *APTDecoder* Forum, you can also program in RSS feed addresses for NASA, NOAA, GEO_Subscribers and so on.

Other Features

In a program as feature-laden as *APTDecoder*, it is impossible to cover everything in a single article. Other useful attributes are a Pass List table, Footprint Overlap predictor, Orbit Data table (expanded display of the 2-line

element data), Satellite swath display plus a feature to check and update your computer clock via the Internet.

The APTDecoder Internet Forum

The *APTDecoder* software is under constant development and one of its strengths is the availability of a dedicated forum where users can ask questions, make bug reports, offer suggestions, and generally benefit from each others' experiences. The forum can be accessed directly through the **<Help → Community>** menu, or by pointing your Internet browser to:

<http://www.ptast.com/apt/decoder/>

and clicking the *Community* button at the top of the page.

Questions and bug reports are generally dealt with promptly. Unfortunately, *APTDecoder* does not yet possess a *Help File*. No doubt this will appear in time, but meanwhile, why not join the Internet Forum and share your experiences with other members. You should find that this Forum goes a long way towards meeting all your program 'help' requirements.

Conclusions

Although still very much a work in progress, *APTDecoder* is already an impressive program for capturing APT weather satellite transmissions. The software is really easy to use: just enable auto-recording and sit back and await results. High-quality images are created at the time of acquisition and the program also saves the WAV file so that processing in other software can be undertaken later if desired.

Julian Moss has been an enthusiastic user of APTDecoder since it was launched, and his appraisal of the software can be read in the gray side-panel at right.

It is worth noting that *APTDecoder* is a multi-threaded application and manages the CPU demands of its own modules, and any other high-priority software running at the same time, in an intelligent manner. For example, if *Flat Earth Monitor* is open when a satellite pass becomes due it slows down as the recording thread takes priority. When the recorder is inactive, more time is devoted to *Flat Earth Monitor*. This can result in several seconds delay when closing down modules such as Flat Earth monitor and the Radio Control tuner-programmer; the module may appear to 'hang' for several seconds before vanishing from the screen.

Julian Moss has been involved in trialling and testing *APTDecoder* since it first appeared, and many of the CLUTs (colour palette files) distributed with the program were created by him. Here is Julian's appraisal of *APTDecoder*.

"I am extremely pleased with this software. I am now using it exclusively, instead of the full version of WXtolmg which I not so long ago paid for. I find that *APTDecoder* produces much finer and more natural looking images than WXtolmg, though as with SatSignal it is not tolerant of poor quality telemetry and cannot produce an image from a pass recorded using a narrow band receiver (at least, not in my experience.) *APTDecoder* cannot (yet) add overlays to an image, but this is currently being developed and I am very excited about what I have seen so far.

"I find that *APTDecoder* produces images that are as good as those produced by SatSignal. But it has the major advantage over SatSignal that it is a fully integrated package that automates the whole process, from recording the satellite pass to uploading decoded images to a web server.

"I suppose I should add that *APTDecoder* has the advantage of being free, but as someone in the software business I have no problem with the idea of paying for software.

I have customised my own colour look-up tables for false colouring my images. I started this some time ago when *APTDecoder* did not provide much control over the appearance of images. I find that by increasing the contrast of the look-up bitmaps in a paint package, I can produce brighter images that are more to my liking. However, if you do this, then it is no longer possible to edit the bitmaps using *APTDecoder*'s built-in CLUT editor, and any other changes must be made manually.

"I have found Patrik Task to be extremely responsive to suggestions. Several of the features in the program, such as the ability to run minimised in the system tray, and to produce an XML RSS feed of new images, were suggestions I made. I really hope that, as a result of this article, more APT enthusiasts from around the world will begin using Patrik's program, so that I can add their RSS feeds to my feed reader and start seeing weather images from other places as soon as they are created."