

**NAME**

**WXtoImg** – program for decoding weather satellite signals.

**SYNOPSIS**

**xwxtoimg**

```
wxtoimg [-N|-S] [-a|-b] [-e enh]
          [-f hz] [-t sat] [-8|-16] [-prIKnc]
          [-H cont] [-y comp] [-m map[x,y]]
          [-k text] [-C 'tag: desc']
          [-g gamma] [-s sharp]
          [-D sigma] [-P plte] [-Q qual]
          [-M frame] [-U fps] [-J codec]
          [-A] [-w width] [-B sec] [-L sec]
          [-X fact] [-R [0|1]] [-i fmt]
          [-loFqvdZVEGh] [-T A|W|E]
          infile [outfile]
```

**DESCRIPTION**

*WXtoImg* converts an audio file recording of a weather satellite audio signal to the image it represents. *WXtoImg* also provides a large number of image processing functions and contrast enhancements for weather satellite images.

*WXtoImg* supports both APT transmissions from polar orbiting satellites and WEFAX transmissions from geostationary satellites. *WXtoImg* has a built in set of image processing facilities, but can output raw images for further processing. Output is in JPEG, PNG, BMP, PBM (PGM/PPM/PNM), or AVI format.

*WXtoImg* can read AU, WAVE, and raw linear PCM audio files.

*WXtoImg* attempts to produce reasonable images from receivers which have too narrow an IF bandwidth (e.g. scanners) although there are limitations on what can be done.

*WXtoImg* uses the telemetry data on NOAA APT images to very accurately calibrate the image, correct for non-linearities in signal strength, and make adjustments for gain changes across the pass. The telemetry data is also used to calibrate the instruments to provide for very accurate temperature readings.

On GOES satellites, the grayscale is used to correct for non-linearities in signal strength and normalise the image. Accurate temperature calibration on IR images is also performed.

On other satellites, the grayscale and black and white bars are used to adjust the gain.

*WXtoImg* uses a PLL technique to correct for doppler shift and ensure straight images on NOAA satellites even in the presence of very high noise levels or poor signal quality. A burst cycle PLL is used on Meteor and Resurs satellites to correct for doppler shift and to help ensure the images are straight.

**OPTIONS**

The *xwxtoimg* command brings up *WXtoImg*'s graphical user interface. Help on using *xwxtoimg* via the graphical user interface is available under the help menu. This section describes using the *wxtoimg* command line interface.

The *infile* must be present and must be the name of an audio file. The *outfile* is optional. If it is omitted then the image will be written to stdout, otherwise the image will be written to *outfile*. *outfile* may contain embedded % sequences which will be replaced with information about the satellite image. The % sequences are described in OUTPUT FILENAME SUBSTITUTION below.

Multiple options may be given on the command line.

**-N** Northbound (ascending) pass. Satellite is moving from the south to the north. In this case the image is rotated 180 degrees. For combined NOAA APT images, the image is subsequently shifted 1/2 it's width so that the channel A and B images remain on their original sides of the combined image.

- S** Southbound (descending) pass. Satellite is moving from the north to the south.
- a** Channel A image only
- b** Channel B image only
- e *enh*** Enhancement option. Only one -e option should be specified. Enhancements available are:
  - ZA** NOAA general purpose meteorological IR enhancement option. Increases contrast by saturating the very low and very high temperature regions where there is typically very little information. This enhancement option is temperature normalised.
  - MB** NOAA cold cloud top enhancement option. Useful for showing where the strongest rainfall is occurring in thunderstorms. This enhancement option is temperature normalised.
  - MD** The NOAA MD enhancement is a modification of the popular, general use MB enhancement scheme. It is intended for warm season use, and provides improved enhancement within the gray "step wedges" that depict "warm top" convection. An additional improvement is better delineation of warm low clouds (30C to 7C). The middle cloud range is somewhat broader than the MB, and enhancement of details is minimised. Otherwise, it is the same as the MB enhancement. This enhancement option is temperature normalised.
  - BD** NOAA hurricane enhancement option. Highlights certain temperatures in the eye and eye wall of the storm system which are known to be related to the intensity of the hurricane. This enhancement option is temperature normalised.
  - CC** NOAA CC enhancement curve. This enhancement option is temperature normalised.
  - EC** NOAA EC enhancement curve. This enhancement option is temperature normalised.
  - HE** The NOAA HE enhancement is used principally by weather offices in the western United States. It provides good enhancement of a wide variety of cloud types, but is somewhat complex, and may be difficult to use at first. It enhances low and middle level clouds common along the Pacific Coast of North America in two separate gray shade ranges. The freezing level is easily determined, an advantage for aviation users concerned with icing. Step wedge regions display very cold infrared cloud top temperatures associated with thunderstorms and frontal systems in 5 degree increments down to -60 C. Two additional "repeat gray" segments define cloud top temperatures colder than -60C. This enhancement option is temperature normalised.
  - HF** The NOAA HF enhancement is the most current of the "H" series of enhancements, and is used principally by weather offices in the western United States. It provides good enhancement of low and middle level clouds common along the Pacific Coast of North America. Step wedge regions display very cold infrared cloud top temperatures associated with thunderstorms and frontal systems in 5 degree increments down to -60 C. Two additional "repeat gray" segments define cloud top temperatures colder than -60C. This enhancement option is temperature normalised.
  - JF** The NOAA JF enhancement is a hybrid enhancement scheme used to highlight both sea surface temperatures, and cold cloud tops associated with thunderstorms and other weather systems. It is somewhat simpler to interpret than the later JJ enhancement. The coldest portion of the enhancement (less than -33C) is nearly identical to the general-use MB enhancement. Maximum enhancement is provided at the warm end (25 to 10C) to depict sea surface temperatures and warm low clouds in tropical and sub-tropical areas. This enhancement option is temperature normalised.

- JJ* The NOAA JJ enhancement is used to highlight both sea surface temperatures, and cold cloud tops associated with thunderstorms and other weather systems. Maximum enhancement is provided at the warm end (23 to 0C) to depict sea surface temperatures and low clouds. The presence of a freezing level break point is important for aviation users interested in icing conditions. Multiple, steep, ramp enhancement ranges provide considerable detail within cold cloud tops such as thunderstorms, but it is difficult to determine the actual temperatures with any accuracy. This enhancement option is temperature normalised.
- LC* The NOAA LC curve is used on images from the 3.9 micron shortwave infrared channel (CH2) of GOES. It provides maximum enhancement in the temperature range where fog and low clouds typically occur (36C to -9C). Another enhanced thermal range is from -10C to -29C, the region of precipitation generation in mid-latitude weather systems. Since CH2 is sensitive to "hot spots," a steep, reverse ramp is found at the warm end (68C to 50C) to show any observable fires as white. There is no enhancement at the very cold end (-30 to -67C), due to the instrument noise normally present at these temperatures. This enhancement option is temperature normalised.
- TA* NOAA TA enhancement curve. This enhancement option is temperature normalised.
- WV* The modified NOAA WV curve is used for the 6.7 micron water vapor channel (CH3) on GOES. The only temperature range that is enhanced is between -5C and -90C. Temperatures colder than -90C are shown as white, and temperatures warmer than -5C are displayed as black. This enhancement option is temperature normalised. (See also *WV-old*).
- WV-old* The original NOAA WV curve is used for the 6.7 micron water vapor channel (CH3) on GOES. The only temperature range that is enhanced is between -10C and -60C. This is the most important range because it shows middle and upper tropospheric moisture patterns that relate to significant features such as: jet streams, upper troughs, dry slots, and deformation zones. Temperatures colder than -60C are shown as white, and temperatures warmer than -10C are displayed as black. The latter condition is very rare, and occurs mainly in the subtropics. This enhancement option is temperature normalised. (See also *WV*).
- NO* NOAA colour IR contrast enhancement option. Greatly increases contrast in the darker land/sea regions and colours the cold cloud tops. Allows fine detail in land and sea to be seen and provides a very readable indication of cloud top temperatures. This enhancement option is temperature normalised.
- MCIR* Colours the NOAA sensor 4 IR image using a map to colour the sea blue and land green. High clouds appear white, lower clouds gray or land/sea coloured, clouds generally appear lighter, but distinguishing between land/sea and low cloud may be difficult. Darker colours indicate warmer regions.
- MSA[:SeaToLand[:LandToCloud[:ColdRegion]]]*  
 Multispectral analysis. Uses a NOAA channel 2-4 image and determines which regions are most likely to be cloud, land, or sea based on an analysis of the two images. Produces a vivid false-coloured image as a result. This enhancement takes up to three options separated from the enhancement name by colons. The first option is the sea to land adjustment. The default value is 50 with the valid range being 0 to 100. This should be decreased if land appears blue, and increased if water appears green. The second option is the land to cloud adjustment. The default value is 50 with the valid range being 0 to 100. This should be decreased if cloud appears green and increased if land appears gray or white. The final option should be 0 to indicate warm or summertime analysis or 1 to indicate there

are large cold regions. Note that perfect colouring is difficult to obtain, especially with low illumination angles. This enhancement does not use a palette nor is it temperature normalised.

*MSA-precip[:SeaToLand[:LandToCloud[:ColdRegion]]]*

Same as MSA multispectral analysis, but high cold cloud tops are coloured the same as the NO enhancement to give an approximate indication of the probability and intensity of precipitation.

*MSA-anaglyph[:SeaToLand[:LandToCloud[:ColdRegion]]]*

Same as MSA multispectral analysis, but creates a 3-D anaglyph image (must be viewed with red/blue glasses). Operational only if the software has been upgraded.

*HVC*

Creates a false colour image from NOAA APT images based on temperature using the HVC colour model. Uses the temperature derived from the sensor 4 image to select the hue and the brightness from the histogram equalised other image to select the value and chroma. The HVC colour model attempts to ensure that different colours at the same value will appear to the eye to be the same brightness and the spacing between colours representing each degree will appear to the eye to be similar. Bright areas are completely unsaturated in this model. The palette used can be changed using the -P option.

*HVCT*

Similar to HVC (below), but with blue water and with colours more indicative of land temperatures. The palette used can be changed using the -P option.

*sea*

Creates a false colour image from NOAA APT images based on sea surface temperature. Uses the sea surface temperature derived from just the sensor 4 image to colour the image. Land appears black and cold high cloud will also appear black. The sea surface temperature may be incorrect due to the presence of low cloud, or of thin or small clouds in the pixel evaluated, or from noise in the signal. The palette used can be changed using the -P option.

*therm*

Produces a false colour image from NOAA APT images based on temperature. Provides a good way of visualising cloud temperatures. The palette used can be changed using the -P option.

*veg*

Requires the rarely available NOAA APT sensor 1 and 2 images (seen during the test phase after satellite launch). A vegetative index is built up and this is used so that land will be coloured green, water dark blue, and clouds white. No palette is used for this enhancement and the output is not temperature normalised.

*anaglyph[:plane]*

Creates a false 3-D anaglyph (must be viewed with red/blue glasses) of the visible image (or the far-IR image if no visible image is available) by estimating cloud height. The optional plane value can be an integer between 0 (in) and 16 (out) to specify the location of the ground plane. Operational only if the software has been upgraded.

*canaglyph[:plane]*

Creates a false colour 3-D anaglyph (must be viewed with red/blue glasses) of the visible image (or the far-IR image if no visible image is available) by estimating cloud height. The optional plane value can be an integer between 0 (in) and 16 (out) to specify the location of the ground plane. Operational only if the software has been upgraded.

*class*

Unsupervised classification of NOAA APT images using an iterative optimisation clustering algorithm. Uses an initial 27 cluster centres spaced equally along the two-dimensional diagonal. The classification is used to tint the histogram equalised channel A image.

- histeq* Histogram equalisation is performed.
- contrast* Contrast enhancement is performed as per **-H** setting. Using this enhancement with **-H** set to *histeq* will produce the same results as using the *histeq* enhancement.
- invert* Creates a grayscale negative, setting black to white and white to black.
- bw* Creates a black and white image, setting darker pixels to black and lighter pixels to white.
- f** *hz* Adjust sample rate. This can be used to correct for sound card sampling rates that vary too much (+/- 0.05%) for the PLL code to work correctly, and to ensure images are as straight as possible where PLL is not available. Try varying the sample rate from the normal by 5 samples per second at a time (so if you have 11025 samples per second audio files try, 11020, 11030, 11015, 11035, 11010, 11040, etc) until the image is reasonably vertical, then adjust by 1 or 2 samples per second until the PLL locks and the image becomes exactly vertical. Determination of the sound cards sample rate normally needs to be done only once. The sample rate can then be placed in the configuration file (see CONFIGURATION FILES).
- t** *sat* Force processing to one of: Resurs(r), Meteor3(m), Meteor2(2), SICH(s), Okean(o), NOAA(n), NOAA-12, NOAA-14, NOAA-15, NOAA-16, NOAA-17, Meteosat(e), GOES(g), or other(x). The entire name may be specified or just the single letter abbreviation shown in parenthesis (if available). Not case sensitive. The default is to autodetect the satellite type, but this may fail or work incorrectly due to the presence of noise or poor signal quality, in which case this option should be used. Specific NOAA satellites only need to be specified for sea temperature enhancements.
- 8** Write 8 bit grayscale / 24 bit RGB colour (default)
- 16** Write 16 bit grayscale. Only PNG and PBM (PGM) formats can support 16 bit grayscale.
- p** Pristine output (best representation of original digital data). Typically used to output images for further processing by other software (and can be used with **-16** option). Pristine images are unenhanced, but unlike raw images have been normalised to produce images which represent, as best as the software is able to, the original digital data. No attempt is made to temperature normalise IR images. Disables gamma, sharpening, rotation, and other enhancements.
- r** Raw output (disables normalisation, gamma, sharpening, enhancements). Normally used with the **-16** option to create an image that can be reprocessed with different enhancements to produce a set of images. This is much faster than, and produces identical results to, re-processing the audio file. Also useful for archival storage of the images rather than storing the audio file as it can be considerably smaller.
- I** Interpolate and oversample (50% larger images). Creates larger images by increasing the sampling rate in the horizontal and interpolation in the vertical. In the case of NOAA images the Channel B image is also shifted down to compensate for the satellite movement and the sampling method. This provides better registration between the images and thus improves image quality in multispectral transformations.
- K** The HVC and HVCT enhancements normally require one of the channels to be a visible light sensor. By setting this option, the enhancement will make use of the far-IR sensor when no visible sensor is available.
- n** Noise filter. Uses a 5x5 median edge-preserving noise filter. Causes significant blurring of the image.
- c** Crop telemetry lines from the sides of the image. See also **-A** which disables the automatic cropping of the top and bottom of the image.
- H** *cont* Allows selection of the contrast enhancement used within the contrast, HVC, HVCT, MSA, and veg enhancements. Operational only if the software has been upgraded. The value of *cont* may be either *histeq* for histogram equalisation, *const* for a constant linear enhancement which

varies according to the satellite sensor, *var* for variable linear enhancement which is different for every image, or *none* to disable any contrast enhancement. If images are going to be later compared or combined then either *const* or *none* should be used as all images are treated in exactly the same way with these options.

**-y comp** Illumination compensation (*none, low, med, high, full*, default=*none*) corrects for the uneven lighting of the earth's surface by the sun; *full* compensation corrects each image so that the earth's surface appears to be lit from directly overhead; *high, med* and *low* compensation apply some compensation, but do not fully correct; *none* performs no compensation. Note that with low sun angles compensation can dramatically increase the effects of noise in the signal.

**-m map[*x,y*]**

Overlays the PNG map file onto image. Normally the map will be placed in the correct location, however the map may be adjusted right or left (-) and down or up (-) by specifying *x* and *y* offsets (positive or negative) in pixels. For example: `-m 11071916map.png,1,-12` to move the map right 1 pixel and up 12 pixels relative to the image.

**-k "[xpos=*pos*,][ypos=*pos*,][fontsize=*pt*,][color=*col*]text"**

Overlays the image with text. Operational only if the software has been upgraded. Multiple **-k** options may be used as each option overlays a single line of text. The text may contain percent sequences that will be expanded as described in *OUTPUT FILENAME SUBSTITUTION* below. A default setting showing the satellite name, time, direction, elevation, azimuth direction, and frequency may be set simply by following **-k** with a dot (i.e. *-k.*). The *x* and *y* position may be specified using *xpos* and *ypos*. The value of *pos* may be *c* for centre, or a positive number for the number of pixels from the left or top edge, or a negative number for the number of pixels from the right or bottom edge. The default *xpos* is centered, and *ypos* 30 pixels from the top. Subsequent **-k** options will move the text down to the next line if no position info is given. The font size (in points) may be specified (the default is 20), once set it will hold for all subsequent **-k** options until changed. The colour may be set using a colour name or to specify an arbitrary colour, use `0xRRGGBB` where *RR* is the hex value for red (00-FF), *GG* is the hex value for green (00-FF) and *BB* is the hex value for blue (00-FF). For example, green would be `0x00FF00`, and white would be `0xFFFFFFFF`. The list of valid colour names is: black, white, gray, light-gray, dark-gray, red, pink dark-red, light-red, green, light-green, dark-green, black-green, blue, light-blue, dark-blue, black-blue, yellow, light-yellow, dark-yellow, magenta, light-magenta, dark-magenta, cyan, light-cyan, dark-cyan, orange, dark-orange, purple, lavender, violet, navy, turquoise, aquamarine, chartreuse, gold, beige, tan, brown, and maroon. Once set the colour will hold for all subsequent **-k** options until changed.

**-C cmnt** Add tagged comment to image. Comments should be in the form "tag: description". The following tags are a part of the PNG specification and should be used regardless of the image output format. Note that the BMP format does not support image comments. Tags are limited to 80 characters and may not contain new lines or colon characters. The description may be up to 4k and may contain new lines and colon characters.

Title:	Short (one line) title or caption for image.
Author:	Name of image's creator.
Description:	Description of image (possibly long).
Copyright:	Copyright notice.
Creation Time:	Time of original image creation preferably in RFC 1123 format (e.g. "12 Jan 2001 16:23:18 GMT").
Software:	Software used to create the image (this will be set to "WXtoImg version X.XX").
Disclaimer:	Legal disclaimer.
Warning:	Warning of nature of content.

Source:	Device used to create the image.
Comment:	Miscellaneous comment; conversion from other image format.

In addition, the following are recommended tags for use with satellite imagery:

Satellite:	Full name of Satellite (e.g. NOAA 17, Resurs O1-N4).
Satellite Type:	Type of Satellite (e.g. NOAA, Resurs, Meteor3). Set automatically by WXtoImg.
Pass Start:	For (polar) orbiting satellites, the time of the start of the pass preferably in RFC 1123 format (e.g. "23 Jun 2001 18:23:18 GMT").
Pass Duration:	For (polar) orbiting satellites, the length of the pass in minutes and seconds (MM:SS).
Ground Station:	Ground station's location. A description (e.g. city, country) of the ground station.
Latitude:	Latitude of the ground station (in decimal degrees).
Longitude:	Longitude of the ground station (in decimal degrees).
Altitude:	Altitude of the ground station above mean sea level (in meters).
Frequency:	Frequency of the satellite data downlink in MHz. (e.g. 137.50).
Elevation:	Maximum elevation of satellite during pass (integer or decimal value between 0.0 and 90.0) for polar orbiting satellites, or elevation of geostationary satellites.
Azimuth:	Azimuth at maximum elevation (integer or decimal value between 0.0 and 360.0) for polar orbiting satellites, or azimuth for geostationary satellites.
Direction:	For polar orbiting satellites, the direction of travel, either northbound or southbound.
Channel A:	For NOAA polar orbiting satellites, the sensor used for channel A (left side image). This is automatically set by WXtoImg.
Channel B:	For NOAA polar orbiting satellites, the sensor used for channel B (right side image). This is automatically set by WXtoImg.
Enhancement:	Any enhancement (e.g. ZA, HVC) done on the image. This is automatically set by WXtoImg.
<b>-g gamma</b>	The default gamma correction to apply. Typically between 1.00 and 2.50. A value of 1.00 disables gamma correction. For PC displays a gamma of about 1.40 seems to be optimal for viewing, for Macintosh systems 1.15, for SGI systems 1.10, for NeXT systems 1.00, and for Sun and other systems 1.40 is recommended.
<b>-s sharp</b>	Set sharpening factor (default 0.6, max 1.0, none 0.0).
<b>-D sigma</b>	Sets the despeckling threshold. To disable despeckling use 0.0. The threshold is the number of standard deviations the pixel in question can vary from the mean of the other pixels in a 5x5 area surrounding it before it is considered noise and is replaced by the mean value. Increasing sigma decreases the number of pixels which will be replaced, decreasing sigma increases the number of pixels which will be replaced. The default is none (0.0).
<b>-P plte</b>	Set the palette to be used by the enhancement. Palettes are two dimensional 24 bit colour images, the X direction (width) is used to look up the column corresponding to the temperature from the IR image. the Y direction (height) is used to look up the row corresponding to brightness of the VIS image. The output pixel value is chosen from the intersection of the row and column. PNG, PPM, and 24 bit (RGB) BMP files are supported. The width should be 100 (covering the temperature range -60 to 39 C in 1 C increments), 320 (covering the temperature

range -110 to 49.5 C in 0.5 C increments), or 250 (covering the temperature range -10 to 39.8 in 0.2 C increments -- used for sea surface temperatures). Note that the normal height of the palette will be 256 corresponding to the 8 bit pixel value of the other image. However heights between 1 and 32768 are supported and the indexing of the palette is scaled accordingly. A height of 1 is useful when the other image should not affect the output (e.g. sea). For all enhancements that use palettes except *sea*, the NOAA sensor 4 image is used as the IR image, and the other sensor (generally 2, 3, or 3B) is histogram equalised and used as the VIS image. For *sea*, the sensor 3 or 3B image is used as the IR image, and the other sensor (generally 4) is histogram equalised and used as the VIS image.

- Q *qual*** JPEG or AVI image quality. By default both are set to *qual*, however *qual* may be prefixed by an **A**, or a **J** to set the AVI and JPEG quality only. Default for JPEG is 65, default for AVI is 20. The valid range is 0 to 100. See IMAGE OUTPUT FORMATS for discussion. The defaults can be changed independently in the config files (see CONFIGURATION FILES).
- M *frame*** The maximum number of frames in the animation. If, after adding the new image, the number of frames in the animation exceeds *frame* then frames will be dropped from the beginning so that the total number of frames is equal to *frame*.
- U *fps*** The rate at which to display the animation in frames/second. Normally values between 0.2 (1 frame every 5 seconds) and 8.0 (8 frames per second) are useful.
- J *codec*** The compression method to use for AVI animations. See **AVI Codec** in CONFIGURATION FILES for more information.
- A** All (do not cut top and bottom low signal sections). See also -c which enables cropping on the sides of the image.
- w *width*** Alter output image width. Normally the image output width is set by using the default for the satellite (e.g. for NOAA APT the width is 2080), but this can be altered by using this option.
- B *sec*** Start processing *sec* seconds into the file. Can be used to clip sections of the input audio or image file.
- L *sec*** Process only *sec* seconds of the file. Can be used to clip sections of the input audio of image file.
- X *fact*** Reduce output image by *fact* factor. Factor should be between 0.0 and 1.0. By default both AVI and image scales are set to *fact*, however *fact* may be prefixed by an **A**, or a **I** to set the AVI or (still) image scale factor only. The default is 1.0 for still images, 0.5 for AVI but this may be changed in the configuration file (see CONFIGURATION FILES).
- R [0|1]** Disable or enable attempts to resync image. If enabled *WXtoImg* attempts to correct for stair-stepped/split images caused by missing time in the input audio file, however with low S/N ratios or from recordings made by too narrow IF bandwidth receivers (scanners), this may cause false corrections to be made resulting in very broken images. In this case attempts to resync should be disabled. Normally resync is disabled by default but it may have been enabled in the configuration file (see CONFIGURATION FILES). **-R** alone or **-R0** (-R followed by zero) disables resync, **-R1** (-R followed by one) enables resync.
- i *fmt*** Force the output image format to one of JPEG, PNG, BMP, PBM (PGM/PPM/PNM), or AVI. Normally, *WXtoImg* uses the filename extension (one of .png, .bmp, .pbm, .pgm, .ppm, .pnm, .jpg, .jpeg, or .avi in lower or upper case) to determine the output file type. If the output file is not specified (stdout is used), or the output extension does not indicate the type of the format desired, then the -i option can be used to set the file type. The default type in these circumstances can also be set in the configuration files (see Image Format in the CONFIGURATION FILES section).
- l** Disable PLL. Disables the phase locked loop code used to ensure the image is not bent due to doppler-shift nor slanted due to slight variations in sampling rate. This option is sometimes useful with recordings from scanners to disable the burst PLL on Meteor and Resurs satellites which can cause problems when decoding very poor quality signals.

- o** Overwrite output file if it exists. Normally *WXtoImg* will exit with an error if the output file already exists. Using the **-o** option will force *WXtoImg* to truncate and overwrite the file if it exists.
- F** Identify the satellite associated with the audio file and exit. For image files just display any comments. The format of the audio and image file can also be displayed if combined with the **-v** (verbose) option.
- q** Quiet (no messages except errors).
- v** Verbose (more information).
- d** Debug (lots of stuff). Generally of no use except when reporting problems.
- Z** Write configuration file. This option causes any configuration files to be read, any options following the **-Z** to be processed and the resulting configuration written back to the users local configuration file.
- V** Print program version and exit.
- E** Write messages to stdout instead of stderr. Note that if an output filename is not specified and this option is used, then both the messages and the image will be written to stdout which is almost certainly not desirable.
- G** Under \*NIX, start *WXtoImg* with a graphical user interface (this is the same as using *xwx-toimg*). Any options that follow are interpreted as standard GUI application options and are **not** processed as documented in this section. For example, the following can be used to display *WXtoImg* on system *workstation-two*:  

```
wxtoimg -G -display workstation-two:0.0
```
- h** Show this advanced options usage.
- T A|W|E** check for APT (A) signals, WEFAX (W) signals, or either (E) (default Either). Can be used to limit checking of signals to only APT or WEFAX satellites, this is useful to ensure better automatic detection of the satellite when the audio file is known to be an APT or WEFAX signal.

## OUTPUT FILENAME SUBSTITUTION

The following % sequences may appear in *outfile*. All replacements will be converted to lowercase. For example an *outfile* of:

```
%s-%T
```

Could produce output filenames like:

```
meteor3-01061123.jpg
noaa-12-01062348.bmp
noaa-01062352.png
met7-01022603.png
```

Templates may expand to create directories, for example:

```
%Y/%m/%d/%s-%n
%Y\%m\%d\%s-%n
```

under Linux/\*NIX and Windows/DOS respectively.

- %@** causes any time or date % sequences (either before or after the %@) to use local time rather than UTC time.
- %s** is replaced with the satellite name in lowercase (up to 8 characters, e.g. **met7**, **noaa-14**, **meteor3**).
- %N** is replaced with the satellite name in mixed case and with spaces (e.g. **MET7**, **NOAA 17**, **Meteor 3-5**).
- %g** is replaced with the satellite type in lowercase (e.g. **met**, **noaa**, **meteor3**).

<b>%D</b>	is replaced with the satellite direction, either <b>northbound</b> or <b>southbound</b> .
<b>%p</b>	is replaced with a single character abbreviation for the satellite direction, either <b>N</b> for northbound or <b>S</b> for southbound southbound.
<b>%E</b>	is replaced with the maximum elevation for the pass in degrees ( <b>0-90</b> ).
<b>%^</b>	is replaced with the azimuth at maximum elevation for the pass in degrees ( <b>0-360</b> ).
<b>%z</b>	is replaced with a single letter, either <b>E</b> or <b>W</b> to specify the azimuth is more easterly or more westerly at maximum elevation.
<b>%:</b>	is replaced with either <b>east</b> or <b>west</b> to specify the azimuth is more easterly or more westerly at maximum elevation.
<b>%f</b>	is replaced with the original audio input filename but without any folder or directory name nor with any extension (e.g. if the input filename is /tmp/03042215.wav then %f is replaced with 03042215).
<b>%F</b>	is replaced with the format (either <b>apt</b> or <b>wefax</b> ).
<b>%C</b>	is replaced with the WEFAX spectral band or NOAA APT channel a-channel b. Up to 3 characters, e.g. WEFAX: <b>vis, ir, nir</b> ; NOAA APT: <b>2-4, 3-4</b> . If unknown will be replaced with nothing.
<b>%e</b>	is replaced by the name of the enhancement (e.g. <b>za, hvc</b> ) or <b>raw</b> for raw, <b>pris</b> for pristine, <b>norm</b> for normal (no enhancement). With the histeq and norm enhancements, if only the A or B channel is selected then the name of the enhancement is appended with a or b (e.g. histeqb, contrasta, norma).
<b>%l</b>	is replaced by the sector. Up to 4 character sector information from WEFAX digital headers. If not available (or APT), will be substituted with nothing.
<b>%n</b>	is replaced by a sequence number. The sequence number starts at 1, but if the resulting filename is the name of an existing file, then the sequence number is increased until there is no existing file with the same name.
<b>%8,9,10,11%</b>	is replaced by the 9th, 10th, 11th and 12th characters from the WEFAX digital header (they appear off by one because numbering starts at 0). The valid range of the numbers is 0 - 49 which corresponds to the 50 characters in the digital header. The numbers start at 0, are separated by commas, and a % ends the sequence. If the character selected is a space (or is otherwise not available) then nothing will be substituted (i.e. the resulting filename will not contain space characters).
<b>%r</b>	is replaced by the satellite radio frequency in MHz (e.g. 137.50).
<b>%k</b>	is replaced by the date in YYMMDD format. For WEFAX this is the date embedded in the digital header from the image. For APT the current UTC date is used. (Equivalent to <b>%y%m%d</b> ).
<b>%K</b>	is the same as <b>%k</b> but in DDMMYY format (equivalent to <b>%d%m%y</b> ).
<b>%L</b>	is the same as <b>%k</b> but in MMDDYY format (equivalent to <b>%m%d%y</b> ).
<b>%d</b>	is replaced by the 2 digit day of the month ( <b>01-31</b> ).
<b>%m</b>	is replaced by the 2 digit month ( <b>01-12</b> ).
<b>%y</b>	is replaced by the year without the century (e.g. <b>01</b> ).
<b>%Y</b>	is replaced by the year with the century (e.g. <b>2001</b> ).
<b>%T</b>	is replaced by the date and time in MMDDHHMM format. For WEFAX this is the date and time embedded in the digital header from the image. For APT the current UTC time is used. (Equivalent to <b>%m%d%H%M</b> ).

<b>%t</b>	is replaced by the time in HHMM format. For WEFAX this is the time embedded in the digital header from the image. For APT the current UTC time is used. (Equivalent to <b>%H%M</b> ).
<b>%H</b>	is replaced by the 2 digit hour (24-hour clock) ( <b>00-23</b> ).
<b>%=</b>	on MTSAT or GMS images is replaced by the 2 digit hour (24-hour UTC) given in the digital header. For other satellites, this will be the same as %H.
<b>%I</b>	is replaced by the 2 digit hour (12-hour clock) ( <b>0-12</b> ).
<b>%P</b>	is replaced by the AM/PM designation.
<b>%M</b>	is replaced by the 2 digit minute ( <b>00-59</b> ).
<b>%Z</b>	is replaced by the timezone name or abbreviation.
<b>%%</b>	is replaced by %.

### AUDIO INPUT FORMATS

Audio input files may be in either AU (.au), WAVE (.wav), or raw (8-bit unsigned or 16-bit signed LSB) format. The files must be encoded in linear PCM format at 11025 samples per second.

Either 8, 16, or 32 bits per sample is acceptable, but 8 bits per sample recordings *do not* contain enough information to produce good quality images. 16 bits per sample is highly recommended.

Audio files should be mono. If a stereo (or multi channel) audio file is used the program will ignore all but one channel. It is strongly recommended that only mono audio files are used.

If audio files are in some other format, the *SoX* program (not supplied, but widely available) can be used to convert the audio files to an acceptable format.

### IMAGE INPUT FORMATS

*WXtoImg* can read images in *PNG*, *PBM* (PGM) or *NOA* formats. These images should be 16 bit raw grayscale images, produced using the *-16* and *-r* options. *NOA* files are a format created by some weather satellite receiving systems. These raw images can be used to create a set of enhanced images for display. The advantage to using the raw images is that reading in the raw image is much faster than re-processing the audio file. Images in *JPEG*, *BMP*, *AVI* or other formats cannot be read by *WXtoImg*.

### IMAGE OUTPUT FORMATS

Images may be produced in *JPEG*, *PNG*, *BMP*, *PBM* (PGM/PPM/PNM), or *AVI* format.

*JPEG* files are a lossy compressed format. The quality (*-Q* option) can be varied to control the amount of detail preserved and the amount of compression. Quality can vary from 0 to 100. The useful range is probably 30 to 95 where a quality of 30 produces a well compressed image (although lacking in some detail and with some artifacts), whereas a quality of 95 produces a very good image, but with little compression. *JPEG* cannot support 16 bit grayscale images. *JPEG* images can contain comments.

*PNG* files are a compressed lossless image format. Due to having good compression and being lossless they are the preferred format. *PNG* supports 16 bit grayscale images, comments, and records gamma.

*BMP* files are an image format widely used on PC based systems. The *BMP* files produced by *WXtoImg* are not compressed. *BMP* files cannot support 16 bit grayscale images, nor can they contain comments.

*PBM* files are an uncompressed image format but well suited to further processing and display on \*NIX systems. *PBM* (bitmap) files are also called *PPM* (colour), *PGM* (grayscale), and *PNM* (any). They support 16 bit grayscale images and comments.

*AVI* files are animated sequences of images. *AVI* files support different types of compression, *RGB* which is uncompressed, *JPEG* which uses *JPEG* compression, and *MJPG* (or Motion *JPEG*) which uses a special abbreviated form of *JPEG* compression. The type of compression used in the *AVI* file is controlled with the configuration file parameter *AVI Codec*. For *JPEG* and *MJPG* the image quality (*-Q* option, or configuration file parameter *AVI Quality*) will control the quality of the *AVI* animation. *AVI* files use a lower default quality to achieve better compression. Because of the motion, lower image quality is needed. When you select an *AVI* file for output, if the file exists, the new image will be added to the end of the sequence. If the *AVI* file does not already exist then a new *AVI* file will be created with only the new image. If the *AVI*

file already contains the maximum number or greater of frames (images) in the sequence then the first frame (or frames) will be removed so that the total number of frames will be the maximum after the new image is added.

## VOLUME CONTROL

When recording signals it is important that the volume is not set too high or too low. If the volume is set too high, clipping will occur and detail will be lost in the white areas of the image. If the volume is set too low, some detail will be lost throughout the image.

The volume should be adjusted so that the gain which is displayed when the signal is processed is between about 2.0 and 32.0. Higher numeric values of gain (e.g. 76.3) indicate that the volume should be increased, lower numeric values of gain (e.g. 1.7) indicate that the volume should be decreased.

If using 8-bit audio files, the volume should be slowly increased until the gain is between about 1.1 and 1.5. Unfortunately, each satellite will require a different optimal volume setting. Results will never be as good as images created from 16-bit recordings, especially where any of the image enhancements are used.

If the volume is set very high, WXtoImg may issue a warning message.

## CONFIGURATION FILES

When *WXtoImg* starts it first looks in `/usr/local/etc/wxtoimg.cfg` (or `\WXTOIMG.CFG` under Windows/DOS), then in `$HOME/.wxtoimgrc` (or in `WXTOIMG.CFG` in the current directory under Windows/DOS) for configuration information. These files, if present, can be used to set some default options. The command line can override any values the `$HOME/.wxtoimgrc` (`\WXTOIMG.CFG`) file, which in turn can override any value in `/usr/local/etc/wxtoimg.cfg` (`\WXTOIMG.CFG`). This allows a set of system wide defaults to be placed in `/usr/local/etc/wxtoimg.cfg`. Users can override these defaults in their own `$HOME/.wxtoimgrc` files. And, finally, users can override their own defaults using command line options.

The format of these configuration files is as follows:

A line beginning with a the pound or hash symbol (#) is a configuration file comment and will be ignored.

Other lines consist of keyword: value pairs. A single colon (:) separates the keyword from the value. The value can contain colons. The value can be extended onto the next line by ensuring that the last character of the line is a backslash (\). Keywords are not case sensitive, values are not case sensitive, but case will be preserved.

The following keywords are recognised by *WXtoImg* (other *WXtoImg* programs may recognise other keywords in the configuration file):

- |               |  |
|---------------|--|
| Signal Type:  | Satellite signal type. Value should be <i>APT</i> , <i>WEFAX</i> , or <i>either</i> . (See also -T option).  |
| Image Format: | The default image format. Value should be <i>JPEG</i> , <i>PNG</i> , <i>BMP</i> , <i>PBM</i> , or <i>AVI</i> . (See also -i option).   |
| Direction:    | The default direction for polar orbiting satellites. Value should be <i>northbound</i> or <i>southbound</i> . (See also -N and -S options).  |
| Messages:     | Selects the output messaging level. Value should be <i>normal</i> (default), <i>verbose</i> (more messages), <i>quiet</i> (no messages except warnings and errors), or <i>debug</i> (a huge number of meaningless messages). (See also -v, -q, and -d options).  |
| Resync:       | The default resync mode. This option should only be enabled on systems where large sections of the images are shifted due to the presence of gaps in the recording. Value should be <i>enabled</i> or <i>disabled</i> . (See also -R option).  |
| JPEG Quality: | The default JPEG quality. Should be an integer between 0 and 100. (See also -Q option and IMAGE OUTPUT FORMATS for discussion).  |
| AVI Codec:    | The compression method to use for AVI animations. Currently three types are supported: <i>MJPG</i> , <i>JPEG</i> , and <i>RGB</i> . MJPG (Motion JPEG) provides for excellent compression, JPEG provides somewhat less compression (and may be less standardised), RGB does no compression at all. Under BeOS JPEG is recommended (as there are no available MJPG decoders), under all other operating systems MJPG is the recommended |

- choice (MJPEG decoders for Windows are available in the DirectX package). (See also -J option).
- AVI Quality:** The default AVI quality. Should be an integer between 0 and 100. This option has no effect if the AVI Codec is *RGB*. (See also -Q option and IMAGE OUTPUT FORMATS for discussion).
- AVI Scale:** The default AVI scale. AVI frames are normally scaled to 50% (0.50) of their normal size, but this may be altered here or on the command line (see -X option).
- Max Frames:** The maximum number of frames an animation can contain. (See -M option for discussion).
- Frame Rate:** The number of frames per second an animation should be displayed. (See -U option for discussion).
- Sharpen:** The default sharpening factor. Should be between 0.00 and 1.00. A value of 0.00 disables sharpening. (See also -s option).
- Gamma:** The default gamma correction to apply. (See -g option for description).
- Despeckle:** The default despeckling value for both APT and WEFAX images. Use 0.0 to disable despeckling. (See -D option for details).
- Sample Rate:** The default sample rate. Used both when trying to determine which satellite the signal came from and when no specific sample rate for a satellite is given. Even if sample rates are provided for each satellite, this should be set (to the average) so that WXToImg can reliably determine which satellite a signal came from. (See also XXX Sample Rate below or -f option for discussion).
- XXX Sample Rate:**  
The default sample rate for satellite *XXX*. Allows the sample rate to be configured differently for each satellite. If no specific match is found then Sample Rate is used if it is defined. *XXX* must be Resurs, Meteor3, Meteor2, SICH, Okean, NOAA, Meteosat, GOES, or other.
- Comment:** An image comment in the "tag: description" format described under the -C option above. Typically, Ground Station and Copyright comments are placed in the config file as they typically do not vary from one image to the next. (See also -C option).

## EXAMPLES

To create a standard 8 bit side-by-side NOAA image for viewing (PNG output):

```
wxtoimg noaa12.wav noaa12.png
```

And the same only for a northbound (ascending) pass (JPEG output):

```
wxtoimg -N noaa12.wav noaa12.jpg
```

To create a single false colour NOAA image for viewing (BMP output):

```
wxtoimg -e hvc noaa14.wav noaa14.bmp
```

Similar as above but with text overlay describing the pass:

```
wxtoimg -e hvc -k. noaa14.wav noaa14.bmp
```

To create a set of the full image, channel A, channel B, and a false coloured JPEG images from a NOAA satellite:

```
# first create a raw image for further processing:
```

```
wxtoimg -l6r noaa.wav noaa-raw.png
```

```
# next create the separate full, A, B, and false
```

```
# coloured images (for a northbound/ascending) pass:
```

```
wxtoimg -N noaa-raw.png noaa-full.jpg
```

```
wxtoimg -Na -e histeq noaa-raw.png noaa-a.jpg
```

```
wxtoimg -Nb -e histeq noaa-raw.png noaa-b.jpg
```

```
wxtoimg -N -e HVC noaa-raw.png noaa-hvc.jpg
```

To build up an animated (AVI) movie from a series of GOES recordings:

```
wxtoimg goes9-06.wav goes9.avi
wxtoimg goes9-09.wav goes9.avi
wxtoimg goes9-12.wav goes9.avi
wxtoimg goes9-15.wav goes9.avi
wxtoimg goes9-18.wav goes9.avi
```

To create a pristine 16 bit side-by-side NOAA image for external processing:

```
wxtoimg -16p noaa14.au noaa14.pgm
```

On an \*NIX system to create an enhanced image and view it immediately using xv on a 24 bit colour display:

```
wxtoimg -e hvc noaa-raw.ppm | xv -2xlimit -
```

or on an 8 bit colour display:

```
wxtoimg -e hvc noaa-raw.ppm | xv -8 -perfect -2xlimit -
```

Automated audio recording under Windows, Linux and other \*NIX systems can be performed using the *wxrec(1)* command supplied with WXtoImg (no arguments are required, files will be written to the current directory with filenames made up of the date and time):

```
wxrec
```

Audio recording under other \*NIX can sometimes be achieved using the *rec(1)* command:

```
rec -c 1 -f s -v 1.0 -s w -r 11025 noaa12.wav
```

## EQUIPMENT REQUIRED

In order to make use of this program for APT transmissions you will need a receiver capable of receiving FM signals in the 137-138MHz band (look for satellites at 137.30, 137.40, 137.50, 137.62, 137.80, and 137.85 MHz). A purpose designed weather satellite receiver is the best option as the sensitivity and IF bandwidth (about 50kHz) will be correct.

Scanners and general purpose communications receivers can be used, however these often have a very narrow IF bandwidth (close to 15kHz) with the result that whites (above about 128 on a scale of 0-255) invariably will be noisy and clipped. The narrow bandwidth will also cause a lot of noise except when the satellite is straight overhead as the doppler-shift combined with the narrow IF bandwidth will result in a very poor signal. However, the upgraded versions of WXtoImg adjust the frequency to compensate for doppler shift on supported receivers with an RS-232 connection. Some communications receivers have a 30kHz (acceptable if the frequency is adjusted using an upgraded version of WXtoImg) or 50kHz IF filter option, and there are modifications for a few scanners to increase the IF bandwidth. A pre-amp can help with the poor sensitivity, but these modifications may not result in the same image quality as a purpose designed weather satellite receiver.

The upgraded versions of WXtoImg also contain special code to much more accurately build colour enhancements when using narrow bandwidth receivers. The upgrade will be of considerable benefit to those getting reasonable images when using *-e contrast -H var -b* options.

A special antenna will be needed regardless of which receiver you have available. You can build an antenna and there are several designs for the highly recommended QFH antenna available on the Internet. Turnstile and crossed dipole antennas are other options.

You will, of course, need an audio cable between the "speaker out" of your receiver and the "line in" on your sound card.

You'll also need some means of recording an audio file in AU or WAVE format (or recording in some other format and converting). On Windows, Linux and other \*NIX systems, the *wxrec(1)* program is supplied for automatic recording. And the *wxbatch(1)* command automates the record/decode process. The *SoX* program (widely available on the Internet) converts audio files and can record on Sun and Linux systems.

Finally, it may help to know when the polar orbiting weather satellites are passing overhead, so you might want to obtain a tracking program. However, *wxrec* (when run from *wxbatch* or when used with the *-T*

option) will let you know the next satellite pass is expected.

For WEFAX transmissions from geostationary satellites, the most common method is to use a small parabolic dish antenna, coupled with an active feed and down converter to convert the 1600 MHz band signal to the 137 MHz band. Then the same receiver can be used for these satellites. See references for more information.

## REFERENCES AND MORE INFORMATION

Paul Hayes has information on building a QFH antenna at:

[http://homepage.ntlworld.com/phqfh1/qfh\\_diy\\_guide.htm](http://homepage.ntlworld.com/phqfh1/qfh_diy_guide.htm)

Also check out the information and FAQ on the WXtoImg home page at:

<http://www.wxtoimg.com/>

## TERMS AND CONDITIONS

The *WXtoImg* programs (which include *wxtoimg*, *xwxtoimg*, *wxrec*, *wxmap*, *wxproj*, and *wxbatch*) and documentation are not warranted to be free of bugs. You should backup your system before installing this software. Because of the nature of the analog signals and complex processing performed do not expect results of this program to be correct in any or every instance.

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Central North Publishing Limited

P.O. Box 99597

Newmarket

Auckland

New Zealand

Email: <http://www.wxtoimg.com/email.html>

<http://www.wxtoimg.com/reg/>

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## SEE ALSO

**wxrec(1)**, **wxbatch(1)**, **wxmap(1)** , **wxproj(1)**

## CREDITS

Special thanks to Andreas Rehberg, Gerd Berg (DK1RR), John Boudreau, Adrian Chamberlain, Ari Ervaskivi, Andy Eskelson, Jakub Gorzynski (SQ2WB), Les Hamilton, Paul Hayes, Paul Holder, Nakato Mikiya, Pauli Nunez (EA3BLQ), Andre Phillips, Steven Ross, Jeremy Royle, Hartmut Schaksmeier and many others who beta tested the numerous early versions of this software.

NOAA provided a wealth of information on their web-site and in their publications, developed most of the enhancement curves used in *WXtoImg*, and provided outstanding support.

## **NOTICES**

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The ZA, MB, MD, BD, CC, EC, HE, HF, JF, JJ, LC, TA, WV, WV-old and NO enhancement curves were provided by the National Oceanic & Atmospheric Administration (NOAA).

JPEG support, in part, provided by the Independent JPEG Group.

Text overlay support based on the work of the FreeType Team.

**NAME**

**wxrec** – program for squelch and satellite pass based automated recording suitable for recording weather satellite signals.

**SYNOPSIS**

```
wxrec [-8|-16] [-C|-W|-w|-N] [-D dir]
        [-l lev] [-t sec] [-f hz]
        [-s dev] [-S src] [-R name]
        [-P defP] [-B baud] [-y name]
        [-p defP] [-b baud] [-T sat [...]]
        [-G dir] [-H tle] [-k sec]
        [-L lat/lon/alt]
        [-n city, country]
        [-M elev] [-A elev] [-Q [0|1]]
        [-YZoxqVh]
```

**DESCRIPTION**

*wxrec* is used to record audio from receivers with or without squelch control.

When using squelch only (the default), each time a signal breaks the squelch, and the audio rises above a reasonable level, a new audio file is recorded. Audio files are recorded until the signal has dropped out for 60 seconds (this can be altered using the **-t** option). *wxrec* then waits for audio to rise again.

When using pass based recording, recording is only attempted when a specified satellite is overhead (**-T** option). If squelch is enabled (the default, but see **-Q** option), then while the satellite is overhead and a signal has broken the squelch, a file is recorded. If squelch is disabled, then a recording is made during the entire time the satellite is overhead (signal or no signal).

The name of the audio file is mmddHHMM.wav, where mm and dd are the month and day of the month, and where HH and MM are the hour and minute in UTC time.

**OPTIONS**

Multiple options may be given on the command line.

- 8** Record 8 bit audio files.
- 16** Record 16 bit audio files (default).
- C** Record as long as 2400Hz carrier is detected (instead of recording while sound level increases).
- W** Start/stop recording on WEFAX start/stop signals. Use to record geostationary satellites (i.e. GOES or Meteosat).
- w** Start/stop recording on GMS WEFAX start/stop signals. Use to record WEFAX from Japan's GMS geostationary satellites.
- N** Record unconditionally.
- D *dir*** Directory to create files in (default ".").
- l *lev*** Sound trigger level (0 - 100, default 25). Decreasing the level makes *wxrec* more sensitive, increasing the level makes *wxrec* less sensitive.
- t *sec*** Finish recording delay in seconds (default 60).
- f *hz*** Sample rate (default 11025).
- k *sec*** Maximum recording time in seconds. The **-k** option should not be used with the **-T**, **-W**, **-m**, and **-w** options as these options imply a maximum recording time.
- s *dev*** Soundcard device. Default on Linux is `"/dev/dsp"` (additional soundcards will be named `"/dev/dsp1"`, `"/dev/dsp2"`, etc.). On DOS and Windows the device is the soundcard number, the default is 0 (additional soundcards will be numbered 1, 2, etc.).

- S dev** Input source (default "LINE"). Other possible inputs would be "MIC", "LINE1", "LINE2", or "LINE3" depending on the soundcard.
- R name** Receiver control mode. The default is "none". The *-T* option must be used to select which satellites will be recorded for receiver control to be enabled. Can be set to "RX2-RS232" to enable RX2 control via an RS-232 cable, "Kenwood" to control of many Kenwood receivers (at 4800 baud default), "AR3000", "AR3000A+", "AR5000", or "AOR" to control AOR receivers (at 4800 baud default), "BC245XLT", "BC895XLT" or "BC780XLT" to enable control of these Uniden Bearcat scanners, "IC-R7000", "IC-R7100", "IC-R8500", "IC-R9000", or "IC-R10" to control these ICOM receivers on address 08, 34, 4A, 2A and 52 respectively, "FT-817" or "FT-847" to enable control of the Yaesu FT-817 or FT-847 receivers (default 4800 baud), "PCR1000" to enable control of the ICOM IC-PCR1000 (**ensure you have set the PCR1000's internal jumper for line out as discussed in the PCR1000 manual before using this option or alternatively use the PCR100 setting (which assumes speaker-level output)**), "PCR-1500" to enable control of the ICOM IC-PCR1500 (or PCR2500) receiver (note that the speaker will be turned off -- you will need to change the soundcard setting to pickup input from the PCR USB Audio device), "SAN-200" to enable control of the SAN 200 receiver, "WRX-137" to enable control of the Wraase WRX-137 receiver, "R2FX" to enable control of the R2FX receiver, "R2F" or "R3F" to enable control of the R2F or R3F receivers, or to "wxctl" to invoke a user supplied program (wxctl, wxctl.com, wxctl.exe, or wxctl.bat) for control (passed the satellite name as argument 1, the frequency in MHz as argument 2, and the control port as argument 3; satellite name will be an empty string and frequency will be 0.00 when no channel is selected -- generally the control program should enter scan mode but this is optional). See also *-P* option.
- P dev** Receiver control port, used for program control of the receiver's channel. The default under Linux is "/dev/ttyS0" under Windows "COM1:". See also *-R* option.
- B baud** Receiver control baud rate. The default is to use the receiver's default baud rate. For devices which do not have a configurable baud rate, this option has no effect.
- y name** Rotor control mode. The default is "none". The *-T* option must be used to select which satellites will be recorded for rotor control to be enabled. Can be set to "GA-232A" to enable rotor control via the Yaesu GA-232A controller. See also *-p* option and *-b* options.
- p dev** Rotor control port used for control of an attached rotor controller. The default under Linux is "/dev/ttyS1" under Windows "COM2:". See also *-y* option.
- B baud** Rotor control baud rate. The default is to use the rotor controller's default baud rate. For controllers which do not have a configurable baud rate, this option has no effect.
- T sat** Record this satellite (multiple *-T* options may be used). Satellite may either be by name (e.g. "Meteor 3-5") or by the NORAD catalog number (e.g. 21655). The catalog number is preferred as different element sources may have different names for each satellite. If no satellites are chosen then only squelch or carrier control is used to start/stop recording. Note that using *-T* is the most efficient means of recording, since the program does not need to continuously monitor for a signal, instead it just waits until the satellite is over the horizon before monitoring for a signal.
- G dir** The directory where TLE files are to be found. On Windows and Macintosh systems the default is the directory where the program is located. On \*NIX systems, the directory \$HOME/.wxtoimg is searched first, then the directory /usr/local/lib/wx/tle is checked. See also *-H*. This option is only useful if *-T* is also used.
- H tle** The filename containing the two line elements (TLEs). Multiple *-H* options may be used to specify a list of filenames containing TLEs. The default is to look for "weather.txt" and "resource.txt". See also *-G*. This option is only useful if *-T* is also used.
- L l/l/a** Set ground station location using "latitude / longitude / altitude". Latitude and longitude are given in degrees and fractions of degrees, with north and east values given as positive numbers,

and south and west values given as negative numbers. The altitude is given in meters above mean sea level. For example: `-L"-36.85/174.81/30"`. See also `-n`. This option is only useful if `-T` is also used.

- `-n "city, country"` Set ground station location using city and country name. Most cities with over 100,000 people are recognised. For example: `-n"London, United Kingdom"` or `-n"Seattle, United States"`. See also `-L`. This option is only useful if `-T` is also used.
- `-M elev` Minimum maximum elevation (default 20.0). Passes where the maximum elevation is below *elev* will be ignored. Contrast with the `-A` option. This option is only useful if `-T` is also used.
- `-A elev` Record only while satellite is above this elevation in degrees (default 1.0). Can be used to record only the portion of the pass where the satellite is high enough to obtain a good quality signal. Contrast with the `-M` option. This option is only useful if `-T` is also used.
- `-Q [0|1]` Disable/enable squelch. Using `-Q` or `-Q0` disables waiting for the volume to rise above a certain level. Using `-Q1` (the default) causes the program to wait for the volume to reach a higher level before starting/stopping recording. The squelch cannot be disabled unless the `-T` option is used (otherwise the recording would never stop). If `-T` is specified and `-Q0` is used, then the entire satellite pass will be recorded (whether or not there is any signal).
- `-Y` Manual record. Immediately starts recording.
- `-Z` Test record. Immediately tests recording without writing an output file.
- `-o` Overwrite output file if it exists. Normally *wxrec* will exit with an error if the output file already exists (for some reason). Using the `-o` option will force *wxrec* to truncate and overwrite a file if it exists.
- `-x` Record only one file and exit. *wxrec* behaves as usual, waiting for a signal to arrive and then stop, but after it has completed one recording, *wxrec* terminates.
- `-q` Quiet (no messages except errors).
- `-V` Print program version and exit.
- `-h` Display usage.

## CONFIGURATION FILES

When *wxrec* starts it first looks in `/usr/local/etc/wxtoimg.cfg` (or `\WXTOIMG.CFG` under Windows/DOS), then in `$HOME/.wxtoimgrc` (or in `WXTOIMG.CFG` in the current directory under Windows/DOS) for configuration information. These files, if present, can be used to set some default options. The command line can override any values the `$HOME/.wxtoimgrc` (`\WXTOIMG.CFG`) file, which in turn can override any value in `/usr/local/etc/wxtoimg.cfg` (`\WXTOIMG.CFG`). This allows a set of system wide defaults to be placed in `/usr/local/etc/wxtoimg.cfg`. Users can override these defaults in their own `$HOME/.wxtoimgrc` files. And, finally, users can override their own defaults using command line options.

The format of these configuration files is as follows:

A line beginning with a the pound or hash symbol (`#`) is a configuration file comment and will be ignored.

Other lines consist of keyword: value pairs. A single colon (`:`) separates the keyword from the value. The value can contain colons. The value can be extended onto the next line by ensuring that the last character of the line is a backslash (`\`). Keywords are not case sensitive, values are not case sensitive, but case will be preserved.

The following keywords are recognised by *wxrec* (other *WXtoImg* programs may recognise other keywords):

**Ground Station:** The city, country where the ground station is located. (See also `-n` option and alternative Latitude, Longitude, and Altitude keywords.)

**Latitude:** The latitude where the ground station is located. In degrees and fractions of degrees with north given as a positive number, and south as a negative number. Longitude

should also be specified if Latitude is given. (See also -L option and alternative Ground Station keyword.)

Longitude: The longitude where the ground station is located. In degrees and fractions of degrees with east given as a positive number, and west as a negative number. Latitude should also be specified if Longitude is given. (See also -L option and alternative Ground Station keyword.)

Altitude: The altitude (above mean sea level) where the ground station is located. Altitude should be given in meters. (See also -L option and alternative Ground Station keyword.)

## EXAMPLES

To record audio files in the current directory  
wxrec

Record the audio files in /tmp  
wxrec -D /tmp

Record the audio files only for NOAA 12, NOAA 15, and Meteor 3-5 satellites where the maximum elevation is 20 degrees or above in /home/wxrecord:  
wxrec -D /home/wxrecord -M 20 -T 'NOAA 12' -T 'NOAA 15' -T 'Meteor 3-5'

## KNOWN BUGS

Cannot write .au files.

## TERMS AND CONDITIONS

The *WXtoImg* programs (which include wxtoimg, xwxtoimg, wxrec, wxmap, wxproj, and wxbatch) and documentation are not warranted to be free of bugs. You should backup your system before installing this software. Because of the nature of the analog signals and complex processing performed do not expect results of this program to be correct in any or every instance.

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Central North Publishing Limited  
P.O. Box 99597  
Newmarket  
Auckland  
New Zealand  
Email: <http://www.wxtoimg.com/email.html>  
<http://www.wxtoimg.com/reg/>

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**SEE ALSO**

**wxtoimg(1), wxbatch(1), wxmap(1), wxproj(1)**

**NOTICES**

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**NAME**

**wxbatch** – program for automating the recording of weather satellite signals and the generation of images. Note that wxbatch has been greatly surpassed by the built in automation in the graphical user interface version of wxtoimg (xwxtoimg).

**SYNOPSIS**

```
wxbatch [-e enh] [-C|-W] [-D dir]
          [-i ext] [-8|-16] [-l lev]
          [-c] [-r] [-m] [-k text] [-H cont]
          [-t sec] [-f hz] [-E min]
          [-R name] [-P defP] [-s device]
          [-L lat/lon/alt] [-n city, country ]
          [-T sat [...]] [-M elev]
          [-A elev] [-Q {0|1}]
          [-X prog] [-IFoVh]
```

**DESCRIPTION**

*wxbatch* is used to automate the recording and generation of image files. It runs continuously, recording audio files of satellites and creating images.

Image processing is done in the background, so that wxbatch can be recording another satellite while decoding the previous recording.

**OPTIONS**

Multiple options may be given on the command line.

- e "*enh*" A list of enhanced images to produce from NOAA satellites (for other satellites only the normal image will be produced). The default is "**norm histeq hvc msa no**" which produces the normal side by side image, histogram equalised channel A and B images, and HVC, MSA multispectral analysis and NO false colour enhanced images.
- C Record as long as 2400Hz carrier is detected (instead of recording while sound level increases).
- W Start/stop recording on WEFAX start/stop signals. Use to record geostationary satellites (i.e. GOES, Meteosat, or GMS).
- D *dir* Directory to write audio recordings and images. The default is ".".
- i *ext* Image file output extension. The default is **jpg**. Other values would include **png**, **bmp**, and **pnm**.
- 8 Record 8 bit audio files.
- 16 Record 16 bit audio files (default).
- l *lev* Sound trigger level (0 - 100, default 25). Decreasing the level makes wxrec more sensitive, increasing the level makes wxrec less sensitive.
- c Crop telemetry lines out of images.
- r Produce raw PNG images only. This is useful to allow viewing and manipulating of the images later (through the WXtoImg GUI for instance).
- m Generate and use overlay map. Latitude, Longitude, and Altitude must be given using the -L or -n options or by setting them in the configuration file (see CONFIGURATION FILES below).
- k *text* Overlay text onto image. Use -k. for default text overlay text. See -k in wxtoimg(1) for other options.
- H *cont* Allows selection of the contrast enhancement used within the HVC, HVCT, MSA, and veg enhancements. Operational only if the software has been upgraded. The value of *cont* may be either *histeq* for histogram equalisation, *const* for a constant linear enhancement which varies according to the satellite sensor, *var* for variable linear enhancement which is different for

every image, or *none* to disable any contrast enhancement. If images are going to be later compared or combined then either *const* or *none* should be used as all images are treated in exactly the same way with these options.

- t** *sec* Finish recording delay in seconds (default 60).
- f** *hz* Sample rate (default 11025).
- s** *dev* Soundcard device (default "/dev/dsp").
- R** *name* Receiver control mode. The default is "none". Can be set to "RX2-RS232" to enable RX2 control via an RS-232 cable, or to "wxctl" to invoke a user supplied program (wxctl) for control (passed the satellite name as argument 1, the frequency in MHz as argument 2, and the control port as argument 3; satellite name will be an empty string and frequency will be 0.00 when no channel is selected -- generally the control program should enter scan mode but this is optional).
- P** *dev* Receiver control port, used for program control of the receiver's channel. The default under Linux is "/dev/ttyS0" under Windows "COM1:". See also -R option.
- E** *min* Eliminate (delete and do not process) recordings less than *min* minutes in length. Can be used to prevent saving recordings and images from low elevation passes.
- L** *l/l/a* Set ground station location using "latitude / longitude / altitude". Latitude and longitude are given in degrees and fractions of degrees, with north and east values given as positive numbers, and south and west values given as negative numbers. The altitude is given in meters above mean sea level. For example: -L"-36.85/174.81/30". See also **-n**. This option is only used if **-T** and/or **-m** are also used.
- n** "*city, country*" Set ground station location using city and country name. Most cities with over 100,000 people are recognised. For example: -n"London, United Kingdom" or -n"Seattle, United States". See also **-L**. This option is only used if **-T** and/or **-m** are also used.
- T** *sat* Record this satellite (multiple -T options may be used). If no satellites are chosen then only squelch control is used to start/stop recording. Latitude, Longitude, and Altitude must be given using the -L or -n options or by setting them in the configuration file (see CONFIGURATION FILES below).
- M** *elev* Minimum maximum elevation (default 20.0). Passes where the maximum elevation is below *elev* will be ignored. This option is only useful if **-T** is also used.
- A** *elev* Record only while satellite is above this elevation in degrees (default 1.0). Can be used to record only the portion of the pass where the satellite is high enough to obtain a good quality signal. Contrast with the -M option. This option is only useful if **-T** is also used.
- Q** **{0|1}** Disable/enable squelch. Using -Q0 disables waiting for the volume to rise above a certain level. Using -Q1 (the default) causes the program to wait for the volume to reach a higher level before starting/stopping recording. The squelch cannot be disabled unless the -T option is used (otherwise the recording would never stop). If -T is specified and -Q0 is used, then the entire satellite pass will be recorded (whether or not there is any signal).
- X** *prog* Execute *prog* on completion of image processing. The single argument passed to prog is the pathname of the audio file processed.
- I** Interpolate and oversample (50% larger images). Creates larger images by increasing the sampling rate in the horizontal and interpolation in the vertical.
- F** Flip Meteor series 3 images (rotate 180 degrees).
- o** Overwrite any output files if they exist (for some reason).
- V** Print program version and exit.

**-h** Display usage.

## CONFIGURATION FILES

When *wxbatch* is run it will execute *wxrec* and possibly *wxmap*. These programs first look in */usr/local/etc/wxtoimg.cfg* (or *\WXTOIMG.CFG* under Windows/DOS), then in *\$HOME/.wxtoimgrc* (or in *WXTOIMG.CFG* in the current directory under Windows/DOS) for configuration information. These files, if present, can be used to set some default options. The command line can override any values the *\$HOME/.wxtoimgrc* (*.\WXTOIMG.CFG*) file, which in turn can override any value in */usr/local/etc/wxtoimg.cfg* (*\WXTOIMG.CFG*). This allows a set of system wide defaults to be placed in */usr/local/etc/wxtoimg.cfg*. Users can override these defaults in their own *\$HOME/.wxtoimgrc* files. And, finally, users can override their own defaults using command line options.

The format of these configuration files is as follows:

A line beginning with a the pound or hash symbol (#) is a configuration file comment and will be ignored.

Other lines consist of keyword: value pairs. A single colon (:) separates the keyword from the value. The value can contain colons. The value can be extended onto the next line by ensuring that the last character of the line is a backslash (\). Keywords are not case sensitive, values are not case sensitive, but case will be preserved.

The following keywords can be used to set the location. Other keywords may be used by the *wxrec*, *wxmap*, and *wxtoimg* programs called by *wxbatch*:

Latitude: The latitude where the ground station is located. In degrees and fractions of degrees with north given as a positive number, and south as a negative number.

Longitude: The longitude where the ground station is located. In degrees and fractions of degrees with east given as a positive number, and west as a negative number.

Altitude: The altitude (above mean sea level) where the ground station is located. Altitude should be given in meters.

## EXAMPLES

To record, process, overlay maps, and to leave recordings and images in */home/wximages* (for an earth station located in Aberdeen, United Kingdom):

```
wxbatch -m -D /home/wximages -n"Aberdeen, United Kingdom"
```

As above, but record only passes above 25 degrees which are 5 minutes or longer and only from NOAA 12, NOAA 15, or Meteor 3-5 satellites (for an earth station located in Los Angeles, USA):

```
wxbatch -m -D /home/wximages -n"Los Angeles, United States" \  
-M 25 -E 5 -T 'NOAA 12' -T 'NOAA 15' -T 'METEOR 3-5'
```

As above, but record only when the satellite is above 9.5 degrees:

```
wxbatch -m -D /home/wximages -n"Los Angeles, United States" \  
-A 9.5 -M 25 -E 5 -T 'NOAA 12' -T 'NOAA 15' -T 'METEOR 3-5'
```

## KNOWN BUGS

Has no provisions for removing older recordings and images.

*wxbatch* is only available only on Linux and other \*NIX systems.

## TERMS AND CONDITIONS

The *WXtoImg* programs (which include *wxtoimg*, *xwxtoimg*, *wxrec*, *wxmap*, *wxproj*, and *wxbatch*) and documentation are not warranted to be free of bugs. You should backup your system before installing this software. Because of the nature of the analog signals and complex processing performed do not expect results of this program to be correct in any or every instance.

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Central North Publishing Limited

P.O. Box 99597

Newmarket

Auckland

New Zealand

Email: <http://www.wxtoimg.com/email.html>

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#### **SEE ALSO**

**wxtoimg(1), wxrec(1), wxmap(1), wxproj(1)**

#### **NOTICES**

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**NAME**

**wxmap** – program for generation of maps to match a weather satellite image of the earth.

**SYNOPSIS**

```
wxmap [-T sat [...]]
        [-G dir] [-H tle]
        [-L lat/lon/alt]
        [-n city, country ] [-a]
        [-M elev] [-O secs] [-p pop]
        [-b [0|1]] [-g deg] [-l [0|1]]
        [-t [0|1]] [-A [0|1]] [-K [0|1]] [-R [0|1]]
        [-C [0|1]] [-S [0|1]] [-f [0|1]] [-F [0|1]]
        [-c t:clr]
        [-oqdVh] time [output.png]
```

**DESCRIPTION**

*wxmap* is used to generate maps which match a weather satellite's image of the earth. There are many options to control the features that appear on the maps and the colour. The maps are generally used to provide an overlay on a weather satellite image.

The output image format is in either PPM or PNG. If no output filename is given (i.e. stdout) or the output filename has a PPM/PBM extension (e.g. output.ppm), then the output format will PPM. Otherwise the file format will be PNG. The PNG format is lossless compressed and is almost always preferred.

**OPTIONS**

Multiple options may be given on the command line.

- T *sat*** Check this satellite (multiple -T options may be used). Satellite may either be by name (e.g. "Meteor 3-5") or by the NORAD catalog number (e.g. 21655). The catalog number is preferred as different element sources may have different names for each satellite.
- G *dir*** The directory where TLE files are to be found. On Windows and Macintosh systems the default is the directory where the program is located. On \*NIX systems, the directory \$HOME/.wxtoimg is searched first, then the directory /usr/local/lib/wx/tle is checked. See also -H.
- H *tle*** The filename containing the two line elements (TLEs). Multiple -H options may be used to specify a list of filenames containing TLEs. The default is to look for "weather.txt" and "resource.txt". And to search for historical records for a single satellite in "noaa-12.txt", "noaa-12h.txt", "noaa-14.txt", "noaa-14h.txt", "noaa-15.txt", "noaa-15h.txt", "met3-05.txt", "met3-05h.txt", "met2-21.txt", and "met2-21h.txt". See also -G.
- L *l/l/a*** Set ground station location using "latitude / longitude / altitude". Latitude and longitude are given in degrees and fractions of degrees, with north and east values given as positive numbers, and south and west values given as negative numbers. The altitude is given in meters above mean sea level. For example: -L"-36.85/174.81/30". See also -n.
- n "*city, country*"** Set ground station location using city and country name. Most cities with over 100,000 people are recognised. For example: -n"London, United Kingdom" or -n"Seattle, United States". See also -L.
- a** Look for a pass anytime during or after the given time. By default *wxmap* only looks for satellites which are overhead at the given time.
- M *elev*** Minimum maximum elevation (default 20.0). Passes where the maximum elevation is below *elev* will be ignored.
- O *secs*** Minimum duration (in seconds or M:SS) after the given time in which the satellite is still above the horizon. By giving both the start time and duration of a recorded signal, some low elevation passes may be excluded from choice. This option is silently ignored if the -a option is

used.

- p** *pop* Minimum population of cities (default 500000, none 0). Sets the minimum population a city must have before it is displayed. The database of cities does not contain cities with populations less than 100000. If set to zero, no cities will be displayed.
- b** [**0**|**1**] Disable/enable drawing image borders (enabled by default). If disabled, then the scan and minute marker borders are not drawn on the image.
- g** *grid* Draw lines of latitude/longitude every grid degrees (default 10.0, none 0.0).
- l** [**0**|**1**] Disable/enable location (enabled by default). If enabled, then a cross is placed over the ground station location.
- t** [**0**|**1**] Disable/enable thick lines (-t enables, disabled by default). If enabled, then thick lines will be drawn.
- A** [**0**|**1**] Disable/enable antialiasing. If enabled, then lines will be antialiased to reduce the staircase effect. Enabled by default.
- K** [**0**|**1**] Disable/enable lakes (disabled by default). If enabled, then lakes and islands in lakes are drawn.
- R** [**0**|**1**] Disable/enable rivers (disabled by default). If enabled, major rivers are drawn.
- C** [**0**|**1**] Disable/enable country borders (enabled by default). If enabled country borders are drawn.
- S** [**0**|**1**] Disable/enable state borders (enabled by default). If enabled state borders are drawn (Americas only).
- f** [**0**|**1**] Disable/enable filling land areas (enabled by default). If enabled land areas will be filled with the land fill colour.
- F** [**0**|**1**] Disable/enable filling sea/lake areas (enabled by default). If enabled seas and lakes will be filled with the sea fill colour.
- c l:clr** Set colour for cross at ground station location (default yellow or 0xffff00). See section on COLOURS (below) for information on colour names. See also -l option.
- c p:clr** Set colour for cities (default orange or 0xffa500). See section on COLOURS (below) for information on colour names. See also -p option.
- c g:clr** Set colour for grid (default red or 0xff0000). See section on COLOURS (below) for information on colour names. See also -g option.
- c L:clr** Set colour for land (default light-green or 0x90ee90). See section on COLOURS (below) for information on colour names.
- c K:clr** Set colour for lakes (default light-green or 0x90ee90). See section on COLOURS (below) for information on colour names. See also -K option.
- c R:clr** Set colour for rivers (default light-green or 0x90ee90). See section on COLOURS (below) for information on colour names. See also -R option.
- c C:clr** Set colour for country borders (default yellow or 0xffff00). See section on COLOURS (below) for information on colour names. See also -C option.
- c S:clr** Set colour for state borders (default yellow or 0xffff00). See section on COLOURS (below) for information on colour names. See also -S option.
- c f:clr** Set colour for land fill (default black-green or 0x000100). See section on COLOURS (below) for information on colour names. See also -f option.
- c F:clr** Set colour for sea/lake fill (default black-blue or 0x000001). See section on COLOURS (below) for information on colour names. See also -F option.
- o** Overwrite output file if it exists. Normally *wxmap* will exit with an error if the output file already exists. Using the -o option will force *wxmap* to truncate and overwrite a file if it exists.

- q** Quiet (no messages except errors).
- d** Debug (print extra information).
- V** Print program version and exit.
- h** Display usage.

## KNOWN SATELLITES

wxmap can generate maps only for the NOAA APT and Meteor 3-5 weather satellites.

## TIME

Time may be specified as an RFC822 date (in UTC). For example: "26 Oct 2001 23:22 UTC". Seconds may also be added, the month may be numeric (1-12), and/or the timezone dropped. For example: "26 10 2001 23:22:17".

Alternatively the date may be specified as the number of seconds since the operating system epoch. For example: 946689627.

Or the time may be specified as the number of seconds before or after the current time. To specify the current time use +0. Examples: -3600, +14400.

*wxmap* looks only for satellites which are overhead at the given time, unless the *-a* option is used which causes *wxmap* to look forward from the given time to find the next pass meeting other criteria (satellite type or elevation). If the time given is during a pass then *wxmap* backtracks to the beginning of the pass.

## COLOURS

Colours may be specified by name or by RGB values (in hex).

The list of valid colour names is: black, white, gray, light-gray, dark-gray, red, pink dark-red, light-red, green, light-green, dark-green, black-green, blue, light-blue, dark-blue, black-blue, yellow, light-yellow, dark-yellow, magenta, light-magenta, dark-magenta, cyan, light-cyan, dark-cyan, orange, dark-orange, purple, lavender, violet, navy, turquoise, aquamarine, chartreuse, gold, beige, tan, brown, and maroon.

To specify an arbitrary colour, use 0xRRGGBB where RR is the hex value for red (00-FF), GG is the hex value for green (00-FF) and BB is the hex value for blue (00-FF). For example, green would be 0x00FF00, and white would be 0xFFFFFFFF.

## CONFIGURATION FILES

When *wxmap* starts it first looks in /usr/local/etc/wxtoimg.cfg (or \WXTOIMG.CFG under Windows/DOS), then in \$HOME/.wxtoimgrc (or in WXTOIMG.CFG in the current directory under Windows/DOS) for configuration information. These files, if present, can be used to set some default options. The command line can override any values the \$HOME/.wxtoimgrc (.WXTOIMG.CFG) file, which in turn can override any value in /usr/local/etc/wxtoimg.cfg (\WXTOIMG.CFG). This allows a set of system wide defaults to be placed in /usr/local/etc/wxtoimg.cfg. Users can override these defaults in their own \$HOME/.wxtoimgrc files. And, finally, users can override their own defaults using command line options.

The format of these configuration files is as follows:

A line beginning with a the pound or hash symbol (#) is a configuration file comment and will be ignored.

Other lines consist of keyword: value pairs. A single colon (:) separates the keyword from the value. The value can contain colons. The value can be extended onto the next line by ensuring that the last character of the line is a backslash (\). Keywords are not case sensitive, values are not case sensitive, but case will be preserved.

The following keywords are recognised by *wxmap* (other WXtoImg programs may recognise other keywords):

**Ground Station:** The city, country where the ground station is located. (See also *-n* option and alternative Latitude, Longitude, and Altitude keywords.)

**Latitude:** The latitude where the ground station is located. In degrees and fractions of degrees with north given as a positive number, and south as a negative number. Longitude should also be specified if Latitude is given. (See also *-L* option and alternative Ground

Station keyword.)

Longitude: The longitude where the ground station is located. In degrees and fractions of degrees with east given as a positive number, and west as a negative number. Latitude should also be specified if Longitude is given. (See also -L option and alternative Ground Station keyword.)

Altitude: The altitude (above mean sea level) where the ground station is located. Altitude should be given in meters. (See also -L option and alternative Ground Station keyword.)

## EXAMPLES

To generate a map corresponding to the next NOAA 15 pass with a maximum elevation above 23 degrees.  
 wxmap -a -M 23 -T "NOAA 15" +0 noaa15map.png

To generate a map for the NOAA satellite (specific satellite unknown) pass occurring at 18:36:12 UTC on 23 June 2001:

wxmap -T "NOAA 12" -T "NOAA 14" -T "NOAA 15" "23 Jun 2001 18:36:12" noaa12map.png

## KNOWN BUGS

Geometry near the poles on images that near, cross, or show the poles is considerably distorted.

There is no option to fill land/sea regions with a colour.

## TERMS AND CONDITIONS

The *WXtoImg* programs (which include *wxtoimg*, *xwxtoimg*, *wxrec*, *wxmap*, *wxproj*, and *wxbatch*) and documentation are not warranted to be free of bugs. You should backup your system before installing this software. Because of the nature of the analog signals and complex processing performed do not expect results of this program to be correct in any or every instance.

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**SEE ALSO**

**wxtoimg(1), wxbatch(1), wxrec(1), wxproj(1)**

**NOTICES**

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1TH WXPROJ 1 "version 2.10.10" – program for performing geometric transformation of weather satellite images produced by WXtoImg.

is used to perform geometric transformations of weather satellite images. It converts the space oblique projection of polar orbiting weather satellites to a number of standard map projections. The input image format can be JPEG, PNG, PGM, PPM, or BMP. Images must have been produced by the WXtoImg program. The output image format can be JPEG, PNG, PPM, or BMP. If no output filename is given (i.e. stdout) or the output filename has a PPM/PBM extension (e.g. output.ppm), then the output format will PPM. Otherwise the file format will be JPEG for .jpg or .jpeg extensions, or BMP for Multiple options may be given on the command line. **-pproj** Set projection to one of: mercator (Mercator), cylindrical (Equidistant Cylindrical), cyl-area (Equal Area Cylindrical), eckert4 (Eckert IV), eckert6 (Eckert VI), mollweide (Mollweide), miller (Miller), lambert (Lambert Equal-Area Azimuthal), stereographic (Stereographic), azimuth (Azimuthal Equidistant), orthographic (Orthographic) **-N** Northern hemisphere centric projection. Applicable to polar stereographic projections. The default is to choose the hemisphere based on the location of the image. **-S** Southern hemisphere centric projection. Applicable to polar stereographic projections. The default is to choose the hemisphere based on the location of the image. **-lat** The reference latitude. Can be used to alter the stereographic projection from polar stereographic (90.0, -90.0) to oblique stereographic (45.0, -45.0) to equatorial stereographic (0.0). Defaults to the nearest pole. **-mlong** The reference longitude. Defaults to nearest 10 degree longitude to the centre of the image. If producing non-cylindrical projections (e.g. polar stereographic) for combining, then all images should be produced using the same reference longitude to avoid having to rotate the resulting images before combining. Longitude should be 0 to 180 for east, -0 to -180 for west. **-scale** Set output scale factor, default is usually 1.0, but with some projections may be more or less to create a reasonably sized output image. Typical values would be 0.5 (half size) to 2.0 (double size). If the scale is greater than 50 then the scale is assumed to be the required output width and the scale is automatically determined. This option has no effect if the freeware edition is being used. **-b N,S,W,E** Set boundaries for output image as latitude of north and south boundaries, and longitude of west and east boundaries. Longitude should use positive and negative numbers between 0 and 180 with negative numbers indicating west. This option has no effect if the freeware edition is being used. **-Qual** Set JPEG output quality (0-100, default 65). **-k "[xpos=pos],[ypos=pos],[fontsize=pt],[color=col]text"** Overlays the image with text. Multiple -k options may be used as each option overlays a single line of text. The text may contain percent sequences that will be expanded as described in *OUTPUT FILENAME SUBSTITUTION* below. A default setting showing the satellite name, time, direction, elevation, azimuth direction, and frequency may be set simply by following -k with a dot (i.e. *-k.*). The x and y position may be specified using xpos and ypos. The value of *pos* may be *c* for centre, or a positive number for the number of pixels from the left or top edge, or a negative number for the number of pixels from the right or bottom edge. The default xpos is centered, and ypos 30 pixels from the top. Subsequent -k options will move the text down to the next line if no position info is given. The font size (in points) may be specified (the default is 20), once set it will hold for all subsequent -k options until changed. The colour may be set using a colour name or to specify an arbitrary colour, use 0xRRGGBB where RR is the hex value for red (00-FF), GG is the hex value for green (00-FF) and BB is the hex value for blue (00-FF). For example, green would be 0x00FF00, and white would be 0xFFFFFFFF. The list of valid colour names is: black, white, gray, light-gray, dark-gray, red, pink dark-red, light-red, green, light-green, dark-green, black-green, blue, light-blue, dark-blue, black-blue, yellow, light-yellow, dark-yellow, magenta, light-magenta, dark-magenta, cyan, light-cyan, dark-cyan, orange, dark-orange, purple, lavender, violet, navy, turquoise, aquamarine, chartreuse, gold, beige, tan, brown, and maroon. Once set the colour will hold for all subsequent -k options until changed. This option has no effect if the freeware edition is being used. **-Apct** Issue a warning message if less than *pct* percent of the output image is filled (default 0%). **-rmethod** Set the resampling method to *nearest* (nearest neighbor), *bilinear* (bilinear interpolation), or *bicubic* (bicubic interpolation). The default is *bicubic*. The resampling method can only be changed on the professional edition. **-o** Overwrite output file if it exists. Normally *wxproj* will exit with an error if the output file already exists. Using the -o option will force *wxproj* to truncate and overwrite a file if it exists. **-q** Quiet (no messages except errors). **-v** Verbose (show informational messages during processing). **-d** Debug (print extra information). **-V** Print program version and exit. **-h** Display usage. *wxproj* can generate projections only for the NOAA APT and Meteor 3-5 weather satellites. To generate a mercator projection of a WXtoImg produced image:

```
wxproj -p mercator 08082223-hvct.jpg 08082223-hvct-merc.jpg
```

To generate a sequence of polar stereographic projections to be later combined using an image publishing program:

```
wxproj -p stereographic -m 170 08082102-hvct.jpg 08082102-hvct-ps.jpg
```

```
wxproj -p stereographic -m 170 08082223-hvct.jpg 08082223-hvct-ps.jpg
```

```
wxproj -p stereographic -m 170 08082358-hvct.jpg 08082358-hvct-ps.jpg
```

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