

# REMSAT

## REMSpC Spray Analysis Tool Version 1.2

### Program Instructions



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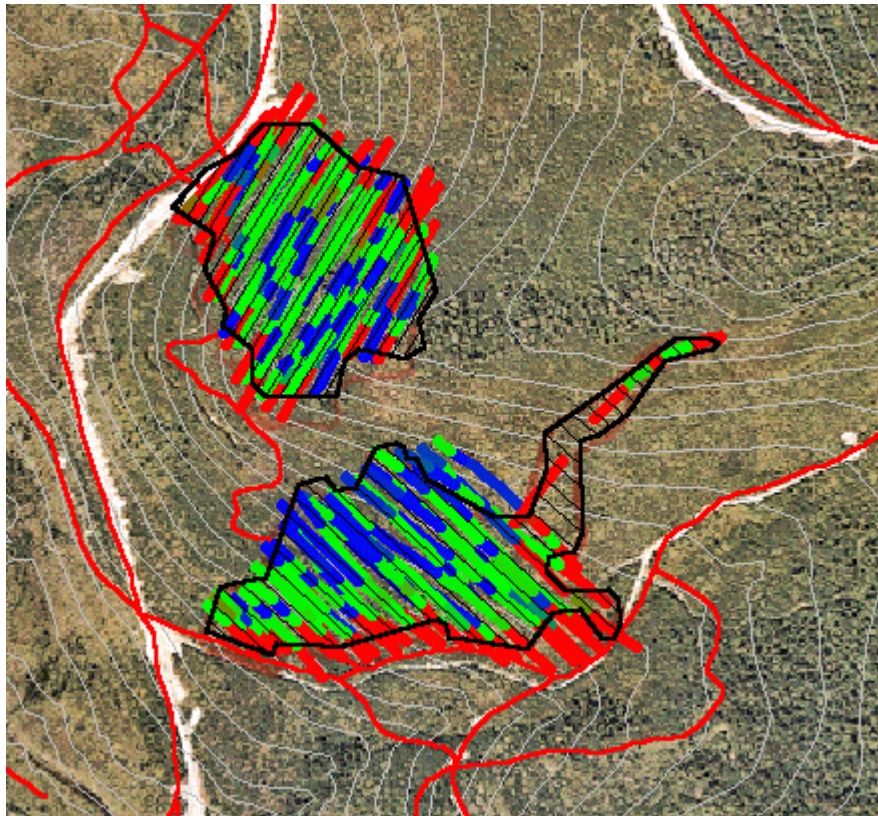
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## Overview:

The REMSpC Spray Analysis Tool (REMSAT) program has been designed to work with ESRI GIS data, aerial and satellite imagery and AG-NAV spray files. The aim of the program is to manipulate and plot these data in an easy-to-use and convenient format that can be used both in the field and in follow-up analyses. Though still in its mid-development stage, the program is currently useful as:

- a geo-referencing tool for aerial or satellite photos
- a digitizing tool for AG-NAV blocks, guidance lines and exclusion zones
- a method of displaying AG-NAV spray data in relation to ground/topographical features
- a statistical analysis and report package for operational spray programs

Future revisions include real-time data reception from spray aircraft and the integration of meteorological data with real-time optimization of aircraft guidance .



Typical view of GIS and AG-NAV data plotted using REMSAT. Spray rate is colour-coded along spray lines.

## Getting Started:

### Installation:

1. If the installation splash screen doesn't automatically appear when you insert the REMSAT CD, run *REMSAT\_Install.exe*, located in the CD's root directory. A splash screen will appear, allowing the installation of REMSAT or viewing of these instructions. Click on **Install REMSAT**.
2. Any open programs should be closed prior to installation. Acceptance of the Terms of the Licensing Agreement and Disclaimer is required to continue installation. Choose a directory for the REMSAT installation. *C:\Program Files\REMSAT* is the default location. Click on the REMSpC logo to continue. Finally, ownership information is required to track registration information, i.e. to produce a registration key. Click **OK** to finish the installation.
3. If another program is already associated with *.rjm* file types (ie. when you double-click a *.rjm* file, Windows opens it in that program), the installation process will inform you. REMSAT uses the *.rjm* extension for its session files but will not associate itself with these files if another program already has.
4. The REMSAT demo files will be automatically copied to *C:\REMSAT Demo Files* during installation. These files are the only files REMSAT will open while in demo mode.

Please Note: The two demo 'session' files will try to open files from '*C:\REMSAT Demo Files\*'. If you move the demo files to a folder other than this, you will still be able to open them individually, however the sessions will not load properly. It is suggested that you leave the demo files in the folder indicated above.


5. REMSAT was designed using a resolution of 1152×864. Although every attempt has been made to accommodate 800×600 (since most notebooks currently operate at 800×600), there may be some minor alignment problems that have been overlooked. Please document any problems using REMSAT and forward to [REMSAT@REMSpC.com](mailto:REMSAT@REMSpC.com).

## Program Controls:




### **File:**

<i>Load Session*</i>	Allows a session (*.rjm) file to be opened. Sessions retain loaded files and various settings from a previous REMSAT run.
<i>Save Session</i>	Allows a session to be saved for later retrieval.
<i>Load Graphic*</i>	Opens an image file (.BMP, .TIF, .GIF, .JPG) for display.
<i>Load GIS Layer</i>	Opens an ESRI shape file (*.shp) or Arc Interchange file (*.e00) for display.
<i>Load AG-NAV:</i>	
<i>Block Boundary*</i>	Opens an AG-NAV boundary file (*.noi) and adds it to the files list.
<i>Guidance File</i>	Opens an AG-NAV guidance file (*.xyz).
<i>Exclusion Zones</i>	Opens an AG-NAV exclusion zone file (*.xcl).
<i>Spray Data*</i>	Opens an AG-NAV spray session file.
<i>Close All Files</i>	Closes all open files and clears the graph area.
<i>Exit</i>	Exits REMSAT.


### **View:**

<i>Cluttered Mode</i>	The default view when starting REMSAT. Displays a square graph area and information along the right-hand side of the screen. Used when working with data and files.	
<i>Map Mode</i>	Expands the graph area to fill the screen. Used for greater detail of graphical data.	
<i>Preferences</i>	Opens a small form to customize the REMSAT environment.	
<i>About</i>	Displays information about the program.	
<i>Refresh</i>	Performs a full redraw of all data in REMSAT's main window.	

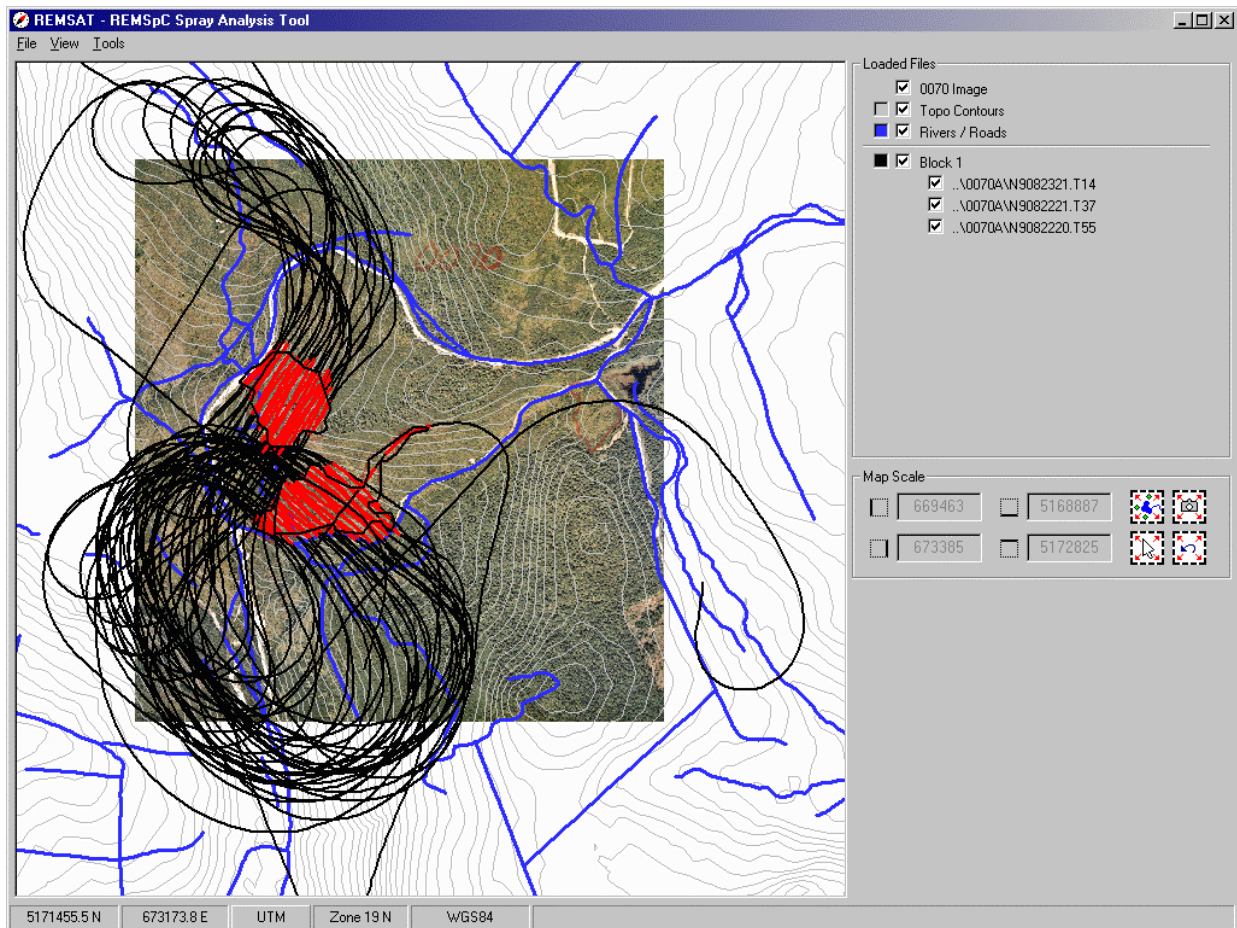
### **Tools:**

<i>Spray Statistics</i>	Opens a graphics page to display statistics for selected AG-NAV flight files.	
<i>Geo-referencing</i>	Opens a form allowing geo-referencing of an image using selected GIS data or manual input of coordinate locations (if no GIS files are selected).	
<i>Digitize AG-NAV</i>		
<i>Block Boundary*</i>	Used to create an AG-NAV block boundary.	
<i>Guidance Lines*</i>	Used to create aircraft guidance lines within a loaded block boundary.	
<i>Exclusion Zone*</i>	Used to create an AG-NAV exclusion zone.	
<i>Ruler</i>	Turns on a ruler function for measuring distances. Holding the Shift key while dragging forces the line to measure vertical or horizontal distances.	
<i>REMSAT WebUpdate</i>	Disabled for now, it will allow you to automatically update future REMSAT versions to the newest version via the Internet.	

\* These commands are unavailable or are restricted to certain files while in demo mode.

 For more information, please see the relevant section later in the instructions.

## Main REMSAT Window:



### Main Window

Displays georeferenced aerial photos and GIS and AG-NAV files. Double-clicking in the window allows the background colour to be changed. Cursor position is displayed in UTM or Lat/Long coordinates on the status bar at the bottom.

### Loaded Files Frame

Loaded files are displayed along with checkboxes that allow data plotting in the graphics window to be turned on and off. Long filenames are abbreviated but can be seen if the mouse pointer is briefly held over the name in the list. The following commands can be performed directly from the list:

- **Right-clicking** any file in the list pops up a context-sensitive menu of actions.
- **Dragging** an image or GIS file over another changes the order in which the files are graphed (*top to bottom*).
- **Double-clicking** on the coloured box next to a checkbox allows the file's graphing colour to be changed.
- **Double-clicking** an AG-NAV boundary (\*.noi) file in the list opens the guidance file for that spray block (if one exists).
- **<Ctrl>-right-clicking** a file in the list removes that file from REMSAT.



These commands can be performed from the pop-up (right-click) menu, however you may find it faster to do them this way.

### Map Scale Frame

Displays coordinates of the four sides of the graph window. Clicking the buttons will perform various zoom functions. Zoom boundaries can also be input manually in the text boxes.

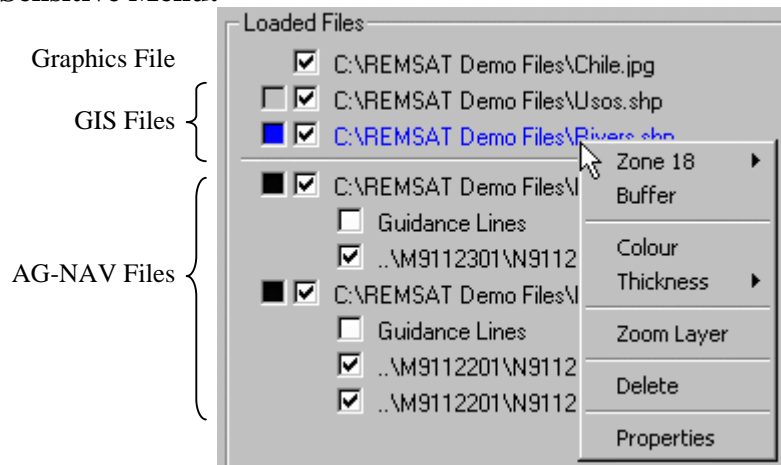


### StatusBar

Seen along the bottom of the screen, the two left panels indicate the position of the mouse pointer. The next panel indicates the current coordinate system (UTM or Lat/Long). To switch between the two, click on this button. The next panel indicates which zone you are in (go to **View** → **Preferences** to change this, or press <Ctrl>-P). Beside the zone is the projection datum. Finally, the right-most panel indicates the status of loading or graphing various files.



## Context-Sensitive Menu:



Right-clicking on a filename in the main REMSAT window will pop up a context-sensitive menu like the one pictured above. The menu will have different options depending on what type of file you right-click. An example of each is shown below, along with descriptions of what functions they perform:

### Graphics File popup menu:

Geo-reference	Allows the selected image to be georeferenced.
Delete	Removes the selected image from REMSAT.
Properties	Displays the selected image's properties.

### GIS File popup menu:

Zone 18	Reprojects the selected GIS file to another UTM zone.
Buffer	Draws a buffer zone around the selected GIS file.
Colour	Changes the selected GIS file's graph colour.
Thickness	Changes the selected GIS file's graph thickness.
Zoom Layer	Zooms the main window to the extent of the selected GIS file.
Delete	Removes the selected GIS file from REMSAT.
Properties	Displays the selected GIS file's properties. Also allows access to colour-coding of SHP file features based on attributes in a .dbf file. (See further down)

Zone 19	17	When GIS files are loaded (in UTM coordinates), REMSAT assumes they are in the <u>current zone</u> (displayed on Status Bar). If this is not the case, the file can be reprojected up to 2 zones away, using the current zone's central meridian. This option is only available while in UTM coordinates. Coordinate system conversions (UTM→Lat./Long→UTM) also use the current zone for the projection calculations.
Buffer	18	
Colour	20	
Thickness	21	
Delete		

### AG-NAV boundary file popup menu:

<b>Load Guidance File</b>	Loads the guidance file for the selected boundary.
Load Exclusion Zones	Loads exclusion zones for the selected boundary.
Load Spray Data	Loads flight files for the selected boundary.
Digitize Guidance Lines	Digitizes guidance lines inside the selected boundary.
Digitize Exclusion Zone	Allows digitization of an exclusion zone for the selected boundary.
Colour	Changes the selected AGNAV boundary's graph colour.
Thickness ▶	Changes the selected AGNAV boundary's graph thickness.
Zoom Boundary	Zooms the main window to the extent of the selected boundary.
Delete	Removes the selected AGNAV boundary and associated files from REMSAT.
Properties	Displays the selected AGNAV file's properties.

### Properties Windows:

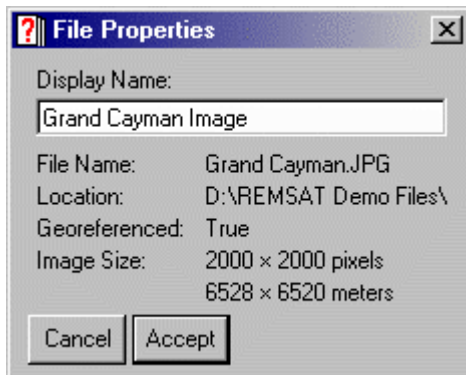
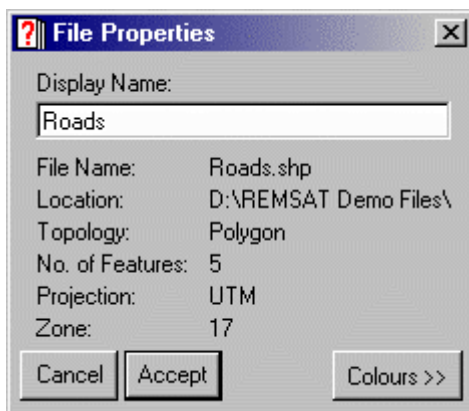
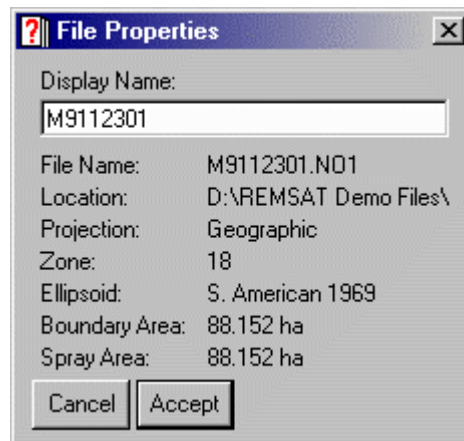


Image Properties

The 'Display Name' property is what will be shown in the Loaded Files frame of the main window. When a file is loaded, the default display name is its filename.



GIS file properties



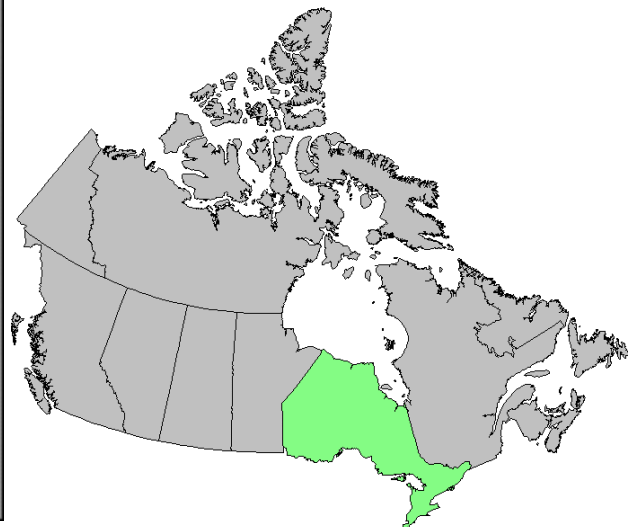
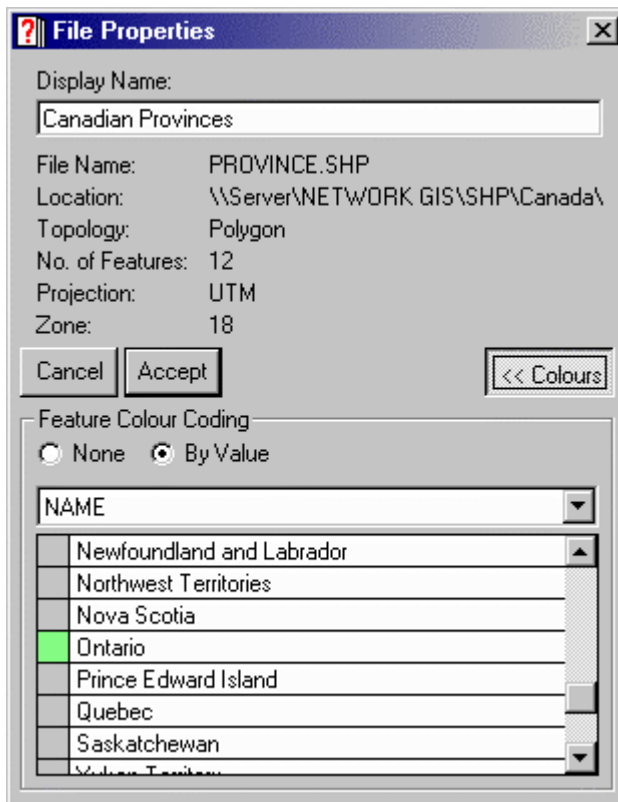
AG-NAV boundary properties



## Colour-Coding GIS features:

REMSAT allows you to colour-code features in a *.shp* file, provided an associated *.dbf* file exists. To colour code features, simply click the **Colours** button to display the bottom half of the window shown below. (Note: If there is no *.dbf* file for a particular *.shp* file, the **Colours** button will be disabled.)

Click the **By Value** option to display the drop-down box and table seen below. The drop-down box lists all the fields present in the *.dbf* file, and the table lists each unique value associated with a particular field. The coloured boxes will all initially be the same colour – the colour displayed for that file in the files list. By double-clicking the coloured box next to the desired value, a different colour can be selected for all features in that *.shp* file having that value.



### *Colours Button*

Visible only when *.shp* file properties are displayed. Disabled if no *.dbf* file exists for the selected *.shp* file. Click to display the **Feature Colour Coding** frame.

### *Feature Colour Coding*

Select **None** to display all features of the selected *.shp* file using the same colour. Select **By Value** to colour GIS features based on individual attributes.

### *Fields Drop-Down Box*

Lists all the fields present in the *.dbf* file. Changing this automatically updates the values in the **Features Table**.

### *Features Table*

Lists each unique value found in the selected field (sorted alphabetically or numerically, depending on the data). Double-clicking the coloured box next to a value lets you set the display colour for each GIS feature with that particular attribute.

## Map Scale Frame:



The Map Scale frame allows you to zoom in and out in the main REMSAT window. The various buttons will become active when the appropriate files have been loaded into REMSAT. The functions of the four buttons are as follows:



Zoom Selected GIS Layers

This button will zoom in or out to the boundaries of any GIS files that are checked (ie. turned **on**) in the files list. This includes SHP files and AG-NAV boundaries. If only one file is checked, it will zoom to the boundaries of only that file. (To zoom to one particular file without unchecking all the others, one could instead right-click the particular file in the files list and select **Zoom Layer** or **Zoom Boundary**.)



Zoom Selected Images

Similar to the Zoom Selected GIS Layers button, however this button zooms to selected image files.



Custom Zoom

When this button is clicked, a box can be drawn around features and when the button is “unclicked”, REMSAT will zoom to that box. Hitting <Enter> is the same as “unclicking” the button. When this button has been clicked down, manual entry of the zoom boundaries can be performed by entering the desired coordinates into the text boxes.



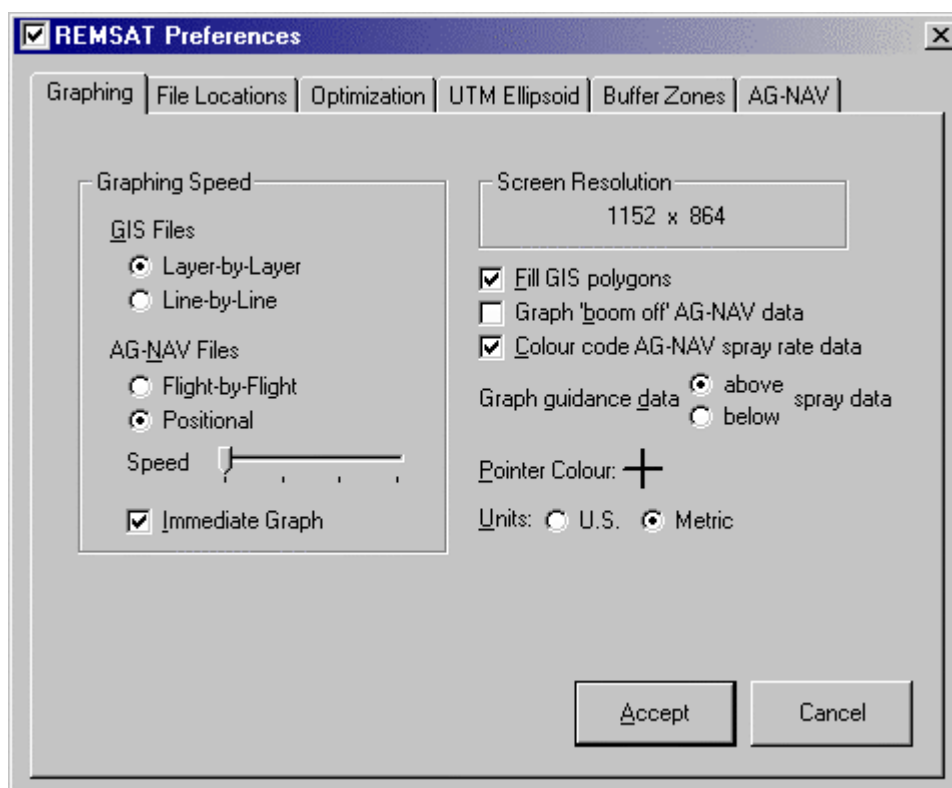
Previous Zoom

Clicking this button will revert to the previous zoom and location. Repeatedly clicking it alternates between the current zoom and the previous zoom.

## View → Preferences:

### GRAPHING TAB:

Note: You can use the mouse to navigate around the preferences, or you can <Tab> through the various options. You can also hold <Alt> while pressing an underlined letter to go directly to that option. <Esc> will always cancel and <Enter> will always accept. This may be more convenient when using notebook computers without a mouse attached.



#### *Graphing Speed*

Selecting the **Layer-by-Layer** / **Flight-by-Flight** options makes REMSAT draw files to memory then to the screen when finished. The **Line-by-Line** / **Positional** options are slower but show the GIS layers and AG-NAV flight data on-screen as they are being drawn.

#### *Immediate Graph*

Redraws various layers as soon as they are checked, unchecked or somehow changed (ie. colour, buffer, etc.) in the Loaded Files frame. If not selected, a Graph button will appear which must be clicked to redraw files.

#### *Fill GIS polygons*

If a GIS file has polygonal features and this option is checked, the polygons will be filled using the colour associated with that file. However, this may obscure parts of any layers that are beneath (satellite imagery, for example). Unchecking this option will draw polygon borders only, using the associated colour.

#### *Graph 'boom off' AG-NAV Data*

If selected, REMSAT draws black lines for aircraft position where the spray boom is off (as seen in the image on page 4).

#### *Colour code AG-NAV flow rate data*

If selected, REMSAT displays the 'boom-on' data as a ratio of the boom's spray rate to the desired spray rate (red = spray rate too high, blue = spray rate too low).

#### *Graph guidance data above/below...*

Determines whether spray data is drawn otop of guidance data (thus obscuring parts of the guidance lines and exclusion zones), or vice versa.

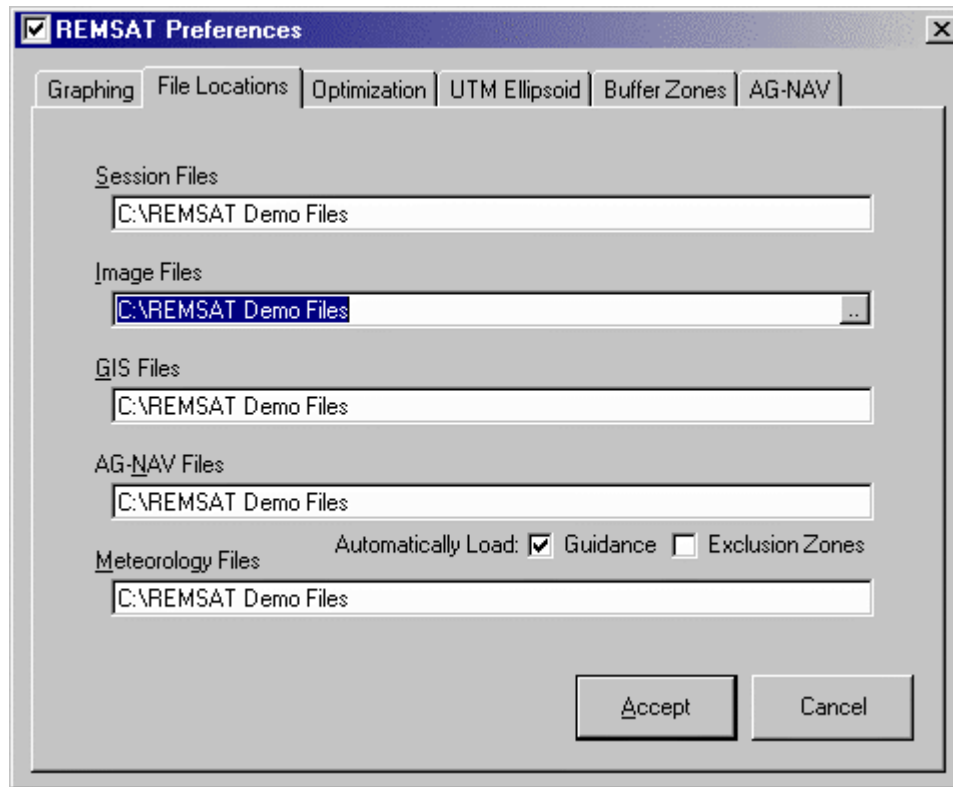
#### *Pointer Colour*

Some aerial photos or GIS colours may make it difficult to see the mouse pointer. Clicking the cross-hair changes the pointer colour.

#### *Units*

Numbers are displayed with the appropriate units (ie. meters/feet, hectares/acres, etc.).

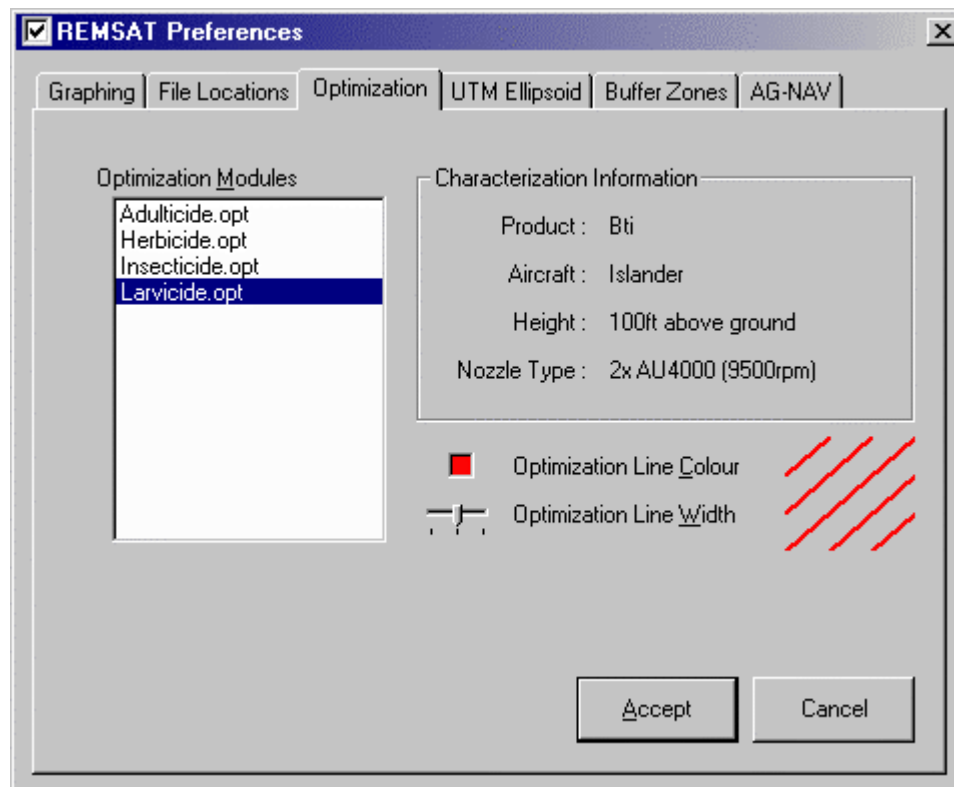
## FILE LOCATIONS TAB:



*File Locations* Default directories can be assigned for each file type used in REMSAT. If left blank, C:\ is chosen automatically. Clicking on ... opens a browser window to find a particular folder.

*Automatically Load:* These options determine whether REMSAT opens an AG-NAV boundary's associated guidance and / or exclusion files when the boundary is loaded.

## OPTIMIZATION TAB:

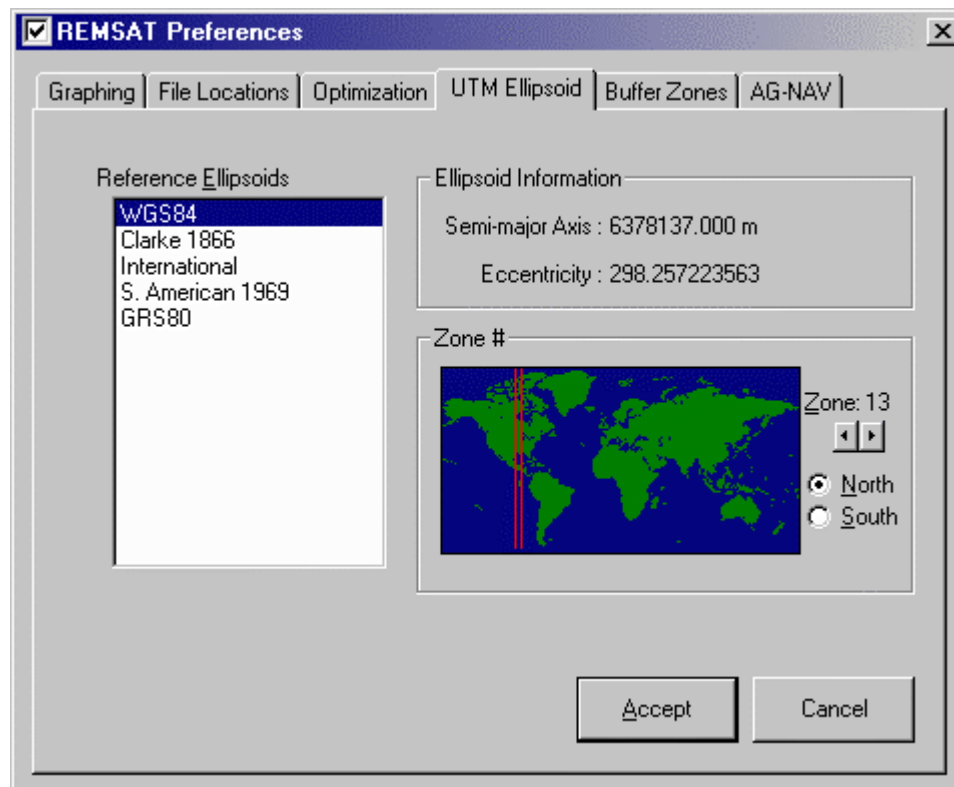


Spray movement away from an aircraft depends on application parameters and meteorology. Aircraft type coupled with drop size distribution (defined by nozzle type/product) define initial spray-cloud characteristics. Release height and meteorology affect spray fate. Characterizing operational conditions allows alternate spray strategies to be assessed.

Real-time optimization is a new technique that automatically shifts aircraft guidance lines based on real-time meteorological conditions in order to maximize in-block deposit. However, this functionality has yet to be implemented operationally. Contact REMSpC for further details.

<i>Optimization <u>M</u>odules</i>	Lists characterization data files to be used to display optimization options (placed in the Optimization folder, which is in the REMSAT program folder).
<i>Characterization <u>I</u>nf.</i>	Displays information about the aircraft, product, etc. that has been used to derive the characterization data base.
<i>Optimization Line <u>C</u>olour</i>	The colour REMSAT uses to draw the optimized guidance lines in the main window. Double-click the box to change the colour.
<i>Optimization Line <u>W</u>idth</i>	The width that REMSAT uses to draw the optimized guidance lines. Drag the slider or <Tab> to the slider and use the left or right keys to adjust.

## UTM ELLIPSOID TAB:



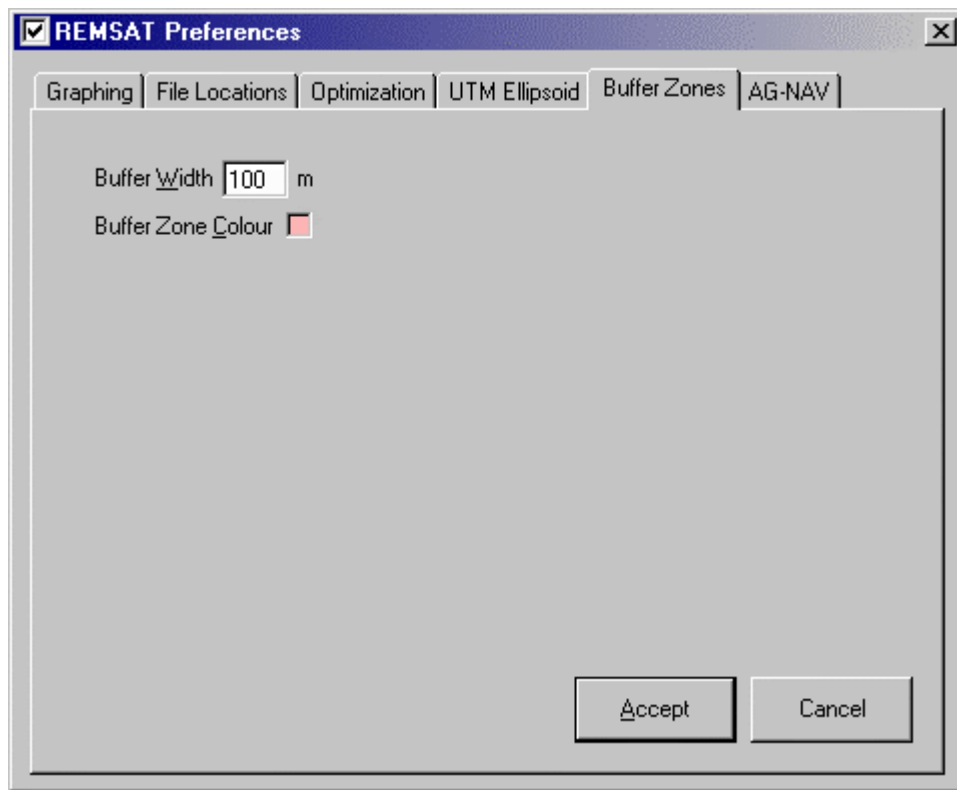
*Reference Ellipsoids* Displays ellipsoids contained in the Ellipsoid.dat file (REMSAT program folder).

*Ellipsoid Information* Displays information on the selected ellipsoid.

*Zone #* Specifies the current zone (displayed on Status Bar) and hemisphere, used when importing or working with GIS files (i.e. coordinate conversions and geo-referencing). Click on the map or the buttons to adjust the zone.

Note: you should use the value displayed beside the map for final zone selection, not the locations of the red lines on the map. These are intended only as a simple visual reference.

## BUFFER ZONES TAB:

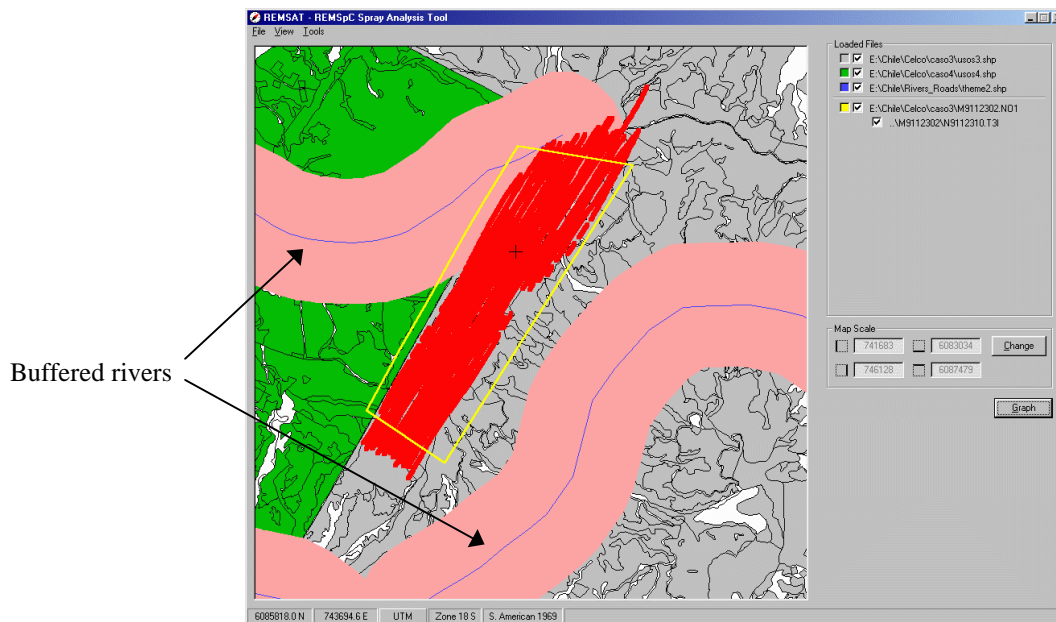


### *Buffer Width*

This is the width REMSAT will use when drawing buffer zones around buffered GIS files (see the **Context-Sensitive Menu** section earlier in this manual for details on how to activate buffer zones).

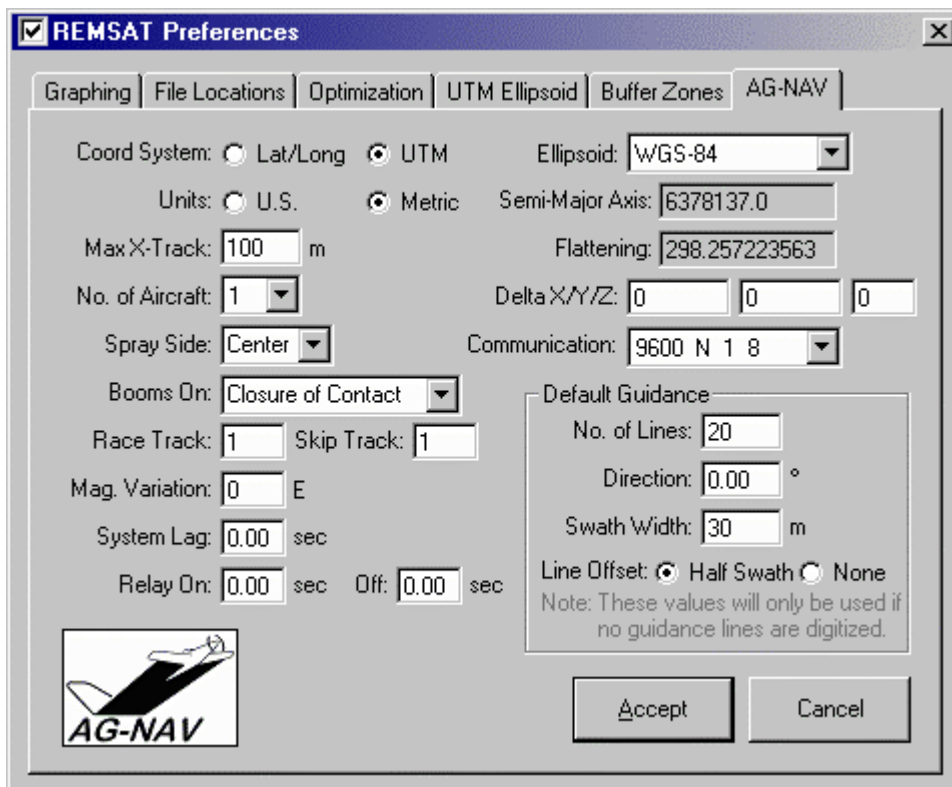
### *Buffer Zone Colour*

The colour REMSAT uses to draw the buffer zones in the main window. Double-click the box to change the colour.





## AG-NAV TAB:



The image shows the 'REMSAT Preferences' dialog box with the 'AG-NAV' tab selected. The dialog has a title bar with a checkmark and the text 'REMSAT Preferences'. Below the title bar are several tabs: 'Graphing', 'File Locations', 'Optimization', 'UTM Ellipsoid', 'Buffer Zones', and 'AG-NAV'. The 'AG-NAV' tab is active, showing various settings for AG-NAV spray blocks. The settings include: 'Coord System' with radio buttons for 'Lat/Long' and 'UTM' (selected); 'Units' with radio buttons for 'U.S.' and 'Metric' (selected); 'Ellipsoid' set to 'WGS-84'; 'Semi-Major Axis' set to '6378137.0'; 'Flattening' set to '298.257223563'; 'Max X-Track' set to '100' m; 'No. of Aircraft' set to '1'; 'Delta X/Y/Z' set to '0', '0', '0'; 'Spray Side' set to 'Center'; 'Communication' set to '9600 N 1 8'; 'Booms On' set to 'Closure of Contact'; 'Race Track' set to '1'; 'Skip Track' set to '1'; 'Mag. Variation' set to '0' E; 'System Lag' set to '0.00' sec; 'Relay On' set to '0.00' sec; 'Off' set to '0.00' sec; 'Default Guidance' section with 'No. of Lines' set to '20', 'Direction' set to '0.00' °, 'Swath Width' set to '30' m, and 'Line Offset' set to 'Half Swath' (selected over 'None'); and a note: 'Note: These values will only be used if no guidance lines are digitized.' At the bottom left is the 'AG-NAV' logo, and at the bottom right are 'Accept' and 'Cancel' buttons.

☒ REMSAT Preferences

Graphing | File Locations | Optimization | UTM Ellipsoid | Buffer Zones | AG-NAV

Coord System: ☐ Lat/Long ☒ UTM Ellipsoid: WGS-84

Units: ☐ U.S. ☒ Metric Semi-Major Axis: 6378137.0

Max X-Track: 100 m Flattening: 298.257223563

No. of Aircraft: 1 Delta X/Y/Z: 0 0 0

Spray Side: Center Communication: 9600 N 1 8

Booms On: Closure of Contact

Race Track: 1 Skip Track: 1

Mag. Variation: 0 E

System Lag: 0.00 sec

Relay On: 0.00 sec Off: 0.00 sec

Default Guidance

No. of Lines: 20

Direction: 0.00 °

Swath Width: 30 m

Line Offset: ☒ Half Swath ☐ None

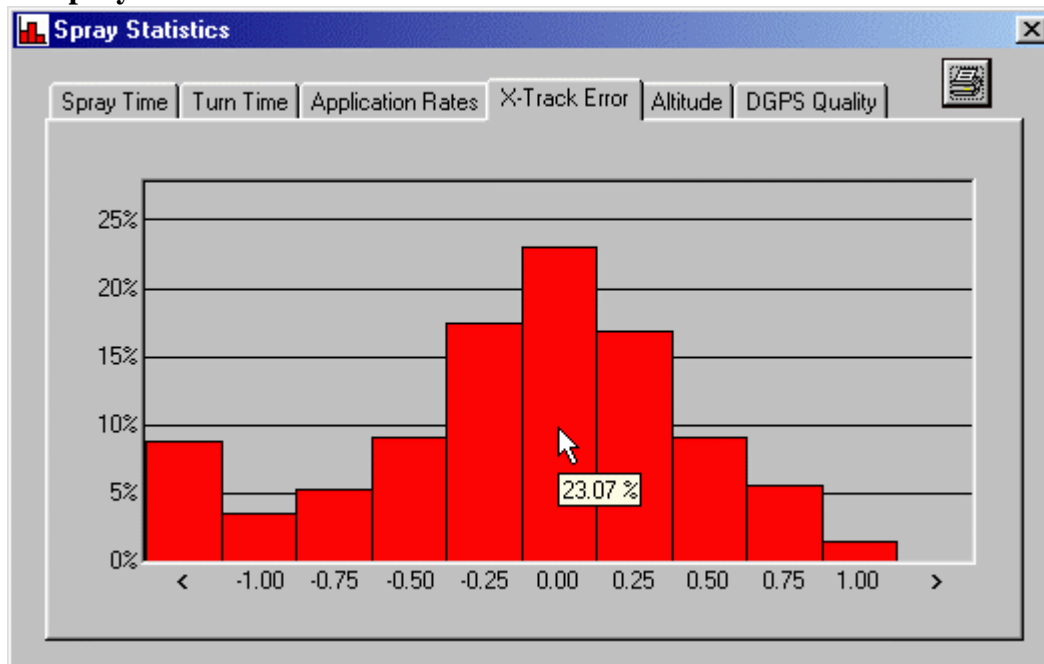
Note: These values will only be used if no guidance lines are digitized.

AG-NAV

Accept Cancel

This tab sets the default values for creation of AG-NAV spray blocks (see page 17). See AG-NAV documentation for a description of what each value represents.

## Tools → Spray Statistics:



*Histogram Window*      Holding the mouse over a histogram bar pops up a box displaying that bar's value.

*Print Button*              Prints a spray operation report (see below). The report is relevant to AG-NAV files marked for display in the Main REMSAT Window.

Before printing a report, REMSAT opens a window allowing you to specify certain information relevant to the spray:

**Application Information**

Company Info | Client Info | Application | Report Layout

Name: REMSpC Spraying, Inc.

Address: 12 Welsh Dr.  
Ayr  
Ontario, Canada  
N0B 1E0

Phone: (519) 632-5006

Fax: (519) 632-5007

Email: Bob.Mickle@REMSpC.com

Accept

Company / Client Info

**Application Information**

Company Info | Client Info | Application | Report Layout

Aircraft: Islander

Registration: C-UWES

Product: Chlorphedromone

Product Rate: 0.5066      ☐ oz/ac  
☐ gal/ac

Spray Rate: 0.5011      ☒ L/ha

Accept

Application Info

**Application Information**

Company Info | Client Info | Application | Report Layout

Title: Waterloo County Mosquito Adulticide

☒ Print GIS / Flight Image  
☒ Colour    ☐ Greyscale

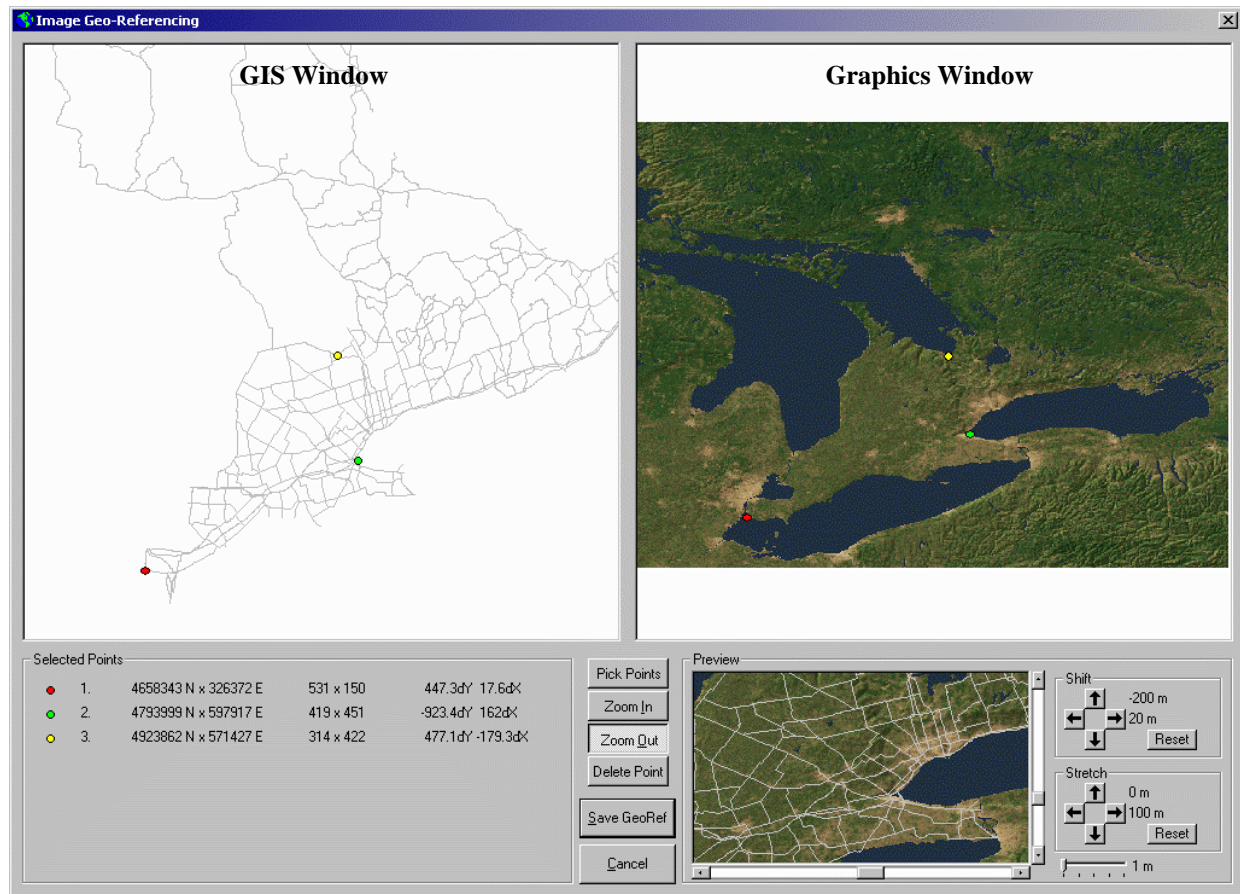
Footnote: REMSpC Spraying, Inc. -- June 2001

Accept

Report Layout

## Tools → Geo-referencing:

Note: Geo-referencing is currently only available while in the UTM coordinate system.



### *GIS Window*

Click to add a reference point (UTM) to the list.

### *Graphics Window*

Click equivalent reference point on the picture. Pixel position is added to list.

### *Selected Points Frame*

Shows the symbol, UTM coordinates and pixel coordinates of selected points, plus the error between each point and the best fit origin (using a least squares fit method). <Ctrl>-right-clicking a point in the list or selecting Delete Point then clicking in the list will remove the desired point. A maximum of 8 points can be used to geo-reference an image.

### *Selection Buttons*

Zooming in on or out of a particular area involves simply clicking a zoom button then pointing and clicking on the desired location. The zoom factor is 2x for both zoom in and zoom out. With **Zoom Out** selected, <Ctrl>-clicking on any spot within a window will zoom out to fit the entire object.

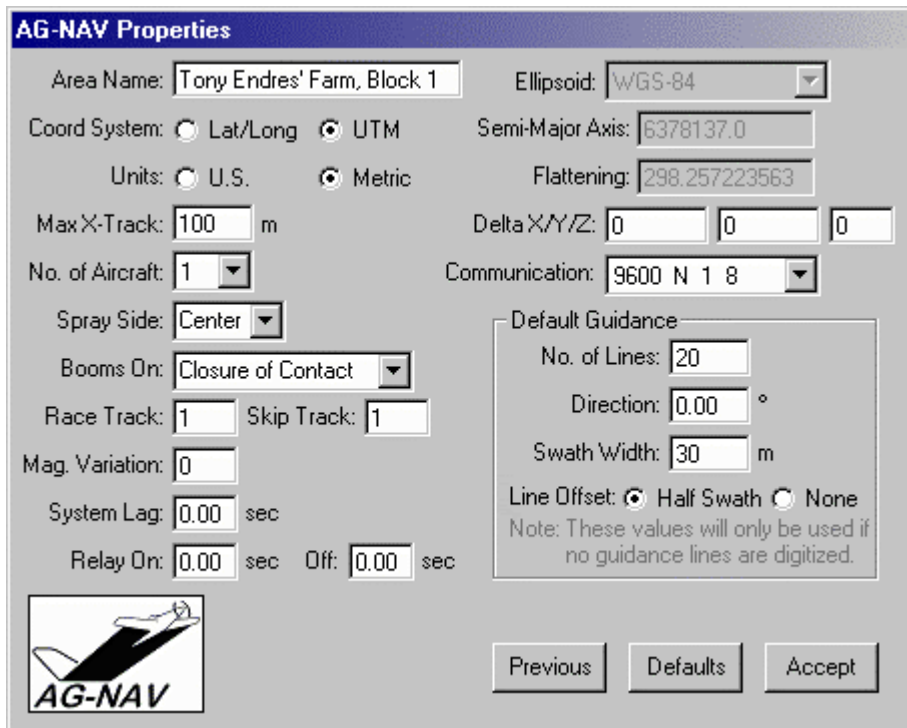
### *Preview Window*

Displayed when sufficient points are selected to geo-reference the image. The preview displays the image at its true size (i.e. each pixel in the image occupies one pixel on the screen) with the selected GIS files drawn overtop according to REMSAT's geo-ref calculations. In addition, the image can be stretched or shifted underneath the GIS data to make a better fit. Move the slider bar until correct units are displayed (1m, 10m, 100m, 1km, 10km). Values can be reset to zero at any time to return to REMSAT's calculated geo-referencing. (Note: although the GIS data appears to be moving in the preview, it is the image that is being shifted and stretched underneath.)

## Tools → Digitize AG-NAV:

### AG-NAV Block Boundaries:

To digitize an AG-NAV boundary, another GIS, AG-NAV or geo-referenced image must be loaded. Click **Tools → Digitize AG-NAV → Block Boundary**. Trace out the block boundary using the left mouse button (click at each corner). If a mistake is made and one or more sides are to be removed, hold the <Ctrl> key while clicking anywhere in the GIS window. To close the final side of the boundary, right-click anywhere on the screen. To cancel block digitization at any time, simply press <Esc>. The file can then be saved at the prompt. A form will appear asking for various parameters:



The image shows the 'AG-NAV Properties' dialog box. It contains various input fields and buttons for configuring the digitization process. The 'Area Name' is 'Tony Endres' Farm, Block 1'. The 'Ellipsoid' is 'WGS-84'. The 'Coord System' has 'Lat/Long' selected. The 'Units' have 'Metric' selected. The 'Max X-Track' is '100 m'. The 'No. of Aircraft' is '1'. The 'Spray Side' is 'Center'. The 'Booms On' is 'Closure of Contact'. The 'Race Track' is '1' and 'Skip Track' is '1'. The 'Mag. Variation' is '0'. The 'System Lag' is '0.00 sec'. The 'Relay On' is '0.00 sec' and 'Off' is '0.00 sec'. The 'Semi-Major Axis' is '6378137.0'. The 'Flattening' is '298.257223563'. The 'Delta X/Y/Z' is '0 0 0'. The 'Communication' is '9600 N 1 8'. The 'Default Guidance' section has 'No. of Lines' as '20', 'Direction' as '0.00 °', and 'Swath Width' as '30 m'. The 'Line Offset' has 'Half Swath' selected. A note states: 'Note: These values will only be used if no guidance lines are digitized.' At the bottom, there is an 'AG-NAV' logo and three buttons: 'Previous', 'Defaults', and 'Accept'.

Area Name:	Tony Endres' Farm, Block 1	Ellipsoid:	WGS-84
Coord System:	<input type="radio"/> Lat/Long <input checked="" type="radio"/> UTM	Semi-Major Axis:	6378137.0
Units:	<input type="radio"/> U.S. <input checked="" type="radio"/> Metric	Flattening:	298.257223563
Max X-Track:	100 m	Delta X/Y/Z:	0 0 0
No. of Aircraft:	1	Communication:	9600 N 1 8
Spray Side:	Center	Default Guidance	
Booms On:	Closure of Contact	No. of Lines:	20
Race Track:	1	Direction:	0.00 °
Skip Track:	1	Swath Width:	30 m
Mag. Variation:	0	Line Offset:	<input checked="" type="radio"/> Half Swath <input type="radio"/> None
System Lag:	0.00 sec	Note: These values will only be used if no guidance lines are digitized.	
Relay On:	0.00 sec	Off:	0.00 sec
AG-NAV			
Previous Defaults Accept			

Clicking the **Previous** button will load the settings used when the last block was digitized. Clicking the **Defaults** button has a similar effect, except that these are values that can be specified in the Preferences (AG-NAV tab).

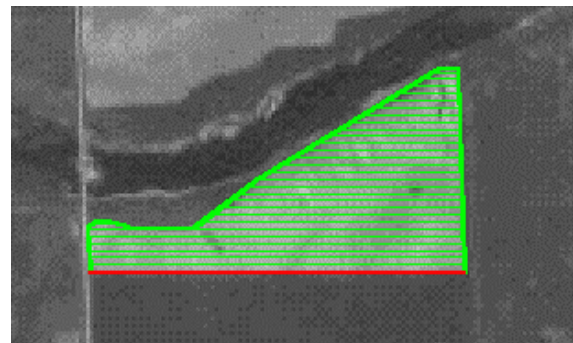
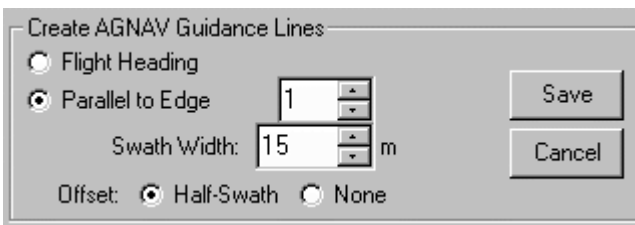
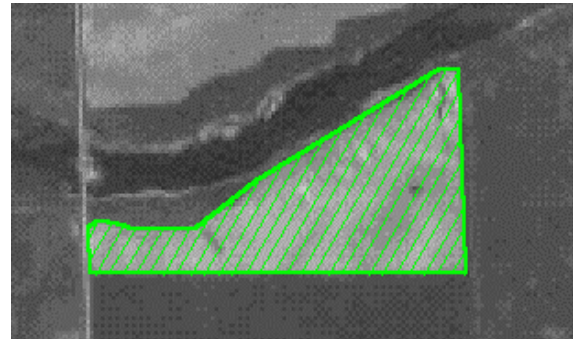
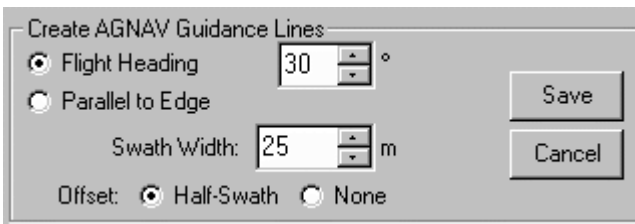
After saving, the files list will be updated with the new block boundary.

### AG-NAV Guidance Lines:

To digitize guidance lines, one or more block boundaries must be loaded. Click **Tools → Digitize AG-NAV → Guidance Lines**, or right-click the desired block name in the files list and choose **Digitize Guidance Lines**. If guidance for this file already exists (whether already loaded into REMSAT or not), you are asked whether you want to overwrite it. The following frame will then appear in the main REMSAT window, presenting alignment and swath width options. To edit the options, you can:

- type in the desired number (then press <Enter> to update the lines)
- press the <Page-Up> or <Page-Down> keys (increments by  $\pm 10$ )
- press the Up or Down keys (increments by  $\pm 1$ )
- click the up and down arrows next to the box (increments by  $\pm 1$ )

The **Half-Swath Offset** option positions the first guidance line half of a swath width inside the block. (Swath width was defined when the block was created.)



Hit <Esc> at any time (or click Cancel) to cancel digitization of guidance lines.

Clicking the **Save** button will save the guidance file to disk and add it to the loaded files list.

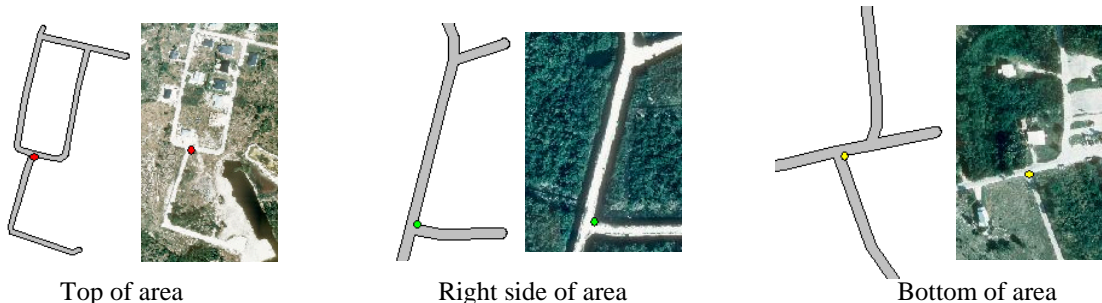
# Appendix A

## Getting to know REMSAT:

Below is a list of operations that can be followed to demonstrate many of the main features of REMSAT. Although one can freely explore the program, the following sessions highlight the main features of REMSAT. Please note that many of REMSAT's functions have been limited or disabled in the Demo Mode. For example, session files cannot be saved (although the two demo sessions can be loaded). As well, only the GIS files that are included with the demo can be loaded.

### A) Grand Cayman Islands: building a spray program

1. Before running the program, find the geo-reference file *Grand Cayman.ref* in the *REMSAT Demo Files* folder and either rename it (i.e. *New.ref*, etc.) or move it to the Windows Recycling Bin. This will force you to try the geo-referencing feature of the program. (To later skip the geo-referencing step, rename the file back to *Grand Cayman.ref* or restore it from the Recycling Bin.)
2. The area of interest for this spray lies in UTM zone 17 (north), using the WGS84 reference ellipsoid. Verify along the bottom of the main REMSAT window that this is the zone and ellipsoid you are currently using. If not, these can be changed in the preferences on the **UTM Ellipsoid** tab.
3. Click on **File → Load GIS Layer**. Two sample shape files are included in the *REMSAT Demo Files* folder for this area and will be called *Roads.shp* and *Buildings.shp*. For now, just load the Roads file. When loaded, it will be assigned a random colour for display.
4. Click on **File → Load Graphic**. Load in the *Grand Cayman.jpg* image file (same folder as the Shape files). If you followed step 1 above, the filename will appear red in the list, indicating that it is not geo-referenced.
5. You may wish to change the colour of the roads in the display. Either double-click the coloured box in the files list, or right-click the roads file and select Colour from the popup menu. Red is a good colour for the roads. If the polygons are not being filled and you would prefer that they were (or vice versa), you can change this in the preferences on the Graphing tab (**Fill GIS polygons**).
6. Right-click the image name in the Loaded Files list and select **Geo-reference**. The geo-referencing screen will appear with the roads drawn in the left window and the image in the right window. If you skipped step 1 above, you will see three points that have already been selected.
7. Select a point in the roads file and find its corresponding point in the image (you will likely need to zoom in to attain any kind of accuracy). Select the point in each window, then zoom out and select another point. Generally, the more spread out the points are, the more satisfactory the geo-referencing will be (however, if you have any geometrical distortions in your image, things may not line up very well). Some good locations to match might be:



8. Once at least two points have been selected, the Preview frame will appear with a preview of how the GIS data is lining up with the image. If satisfactory results can't be obtained by matching points, the image can be shifted or stretched underneath the GIS data. Experiment with these

- buttons to see whether they can improve the alignment (the shifting / stretching can always be reset with the corresponding **Reset** button).
9. Once satisfied with the alignment, clicking the **Save GeoRef** button will save the reference information and return you to the main REMSAT window. To show the image, check its name in the files list.
  10. Now that the image has been georeferenced to the roads file, load the other demo shape file for this area (*Buildings.shp*). Either choose **File → Load GIS Layer**, or press <Ctrl-S>. (Shortcut keys are a much easier way to accomplish many tasks in REMSAT, as with many other Windows programs.)
  11. Now would be a good time to familiarize yourself with how to zoom in and out in the REMSAT window. To zoom to a particular shape file, right-click its name in the files list and click **Zoom Layer**. To zoom out to both shape files, click the **Zoom Selected GIS Layers** button, or to zoom to the image, Click the **Zoom Selected Imagery** button (although all three files have roughly the same boundaries).
  12. To digitize a complete AG-NAV block, first zoom into a suitable area (perhaps the forested area in the upper right corner with the small ponds). Click **Tools → Digitize AG-NAV → Block Boundary**. Trace out a polygon with a series of left mouse clicks. If you make a mistake and want to back up one or more lines, hold the <Ctrl> key and click anywhere in the image. When finished, right-click anywhere in REMSAT's main window and the polygon will snap closed. You will then be prompted as to whether you would like to save the boundary or discard it. If you click **Yes**, you will be prompted to enter a filename. After doing so, the boundary will show in the loaded files list and in the main window. You may want to choose another colour for the boundary so that it shows up better over the image.
  13. Digitizing exclusion zones uses exactly the same process. Go to **Tools → Digitize AG-NAV → Exclusion Zone** and trace out a polygon overtop of the large pond. If desired, you can repeat this step for the smaller ponds in the top right corner.
  14. To digitize guidance lines, click **Tools → Digitize AG-NAV → Guidance Lines**. A small frame will appear, allowing you to specify a direction (in degrees or parallel to a side), and the swath width (in meters). Clicking save will add the guidance file to the files list.
  15. To further experiment with this session at a later date, load the Grand Cayman session by clicking **File → Load Session**. Keep in mind that any AG-NAV blocks, guidance lines and exclusion zones you may have created will be lost (REMSAT won't save these in Demo Mode).



B) Chile: a post-spray analysis

1. If any files are open from the last session, click **File → Close All**. This will close any open files and return REMSAT to its original state.
2. Either open the Chile session, or perform the following:
  - switch to UTM zone 18 (south), with the S. American 1969 ellipsoid (in Preferences).
  - load the Usos and Rivers shape files.
  - load the two AG-NAV blocks (M9112201.no1 and M9112301.no1).
  - right-click each block name and load their guidance files (this can be performed automatically in the future by choosing to **Automatically Load** the guidance lines in the Preferences [File Locations tab]).
  - load the logged spray files for each block by either clicking **File → Load AG-NAV → Spray Data** or by right-clicking the appropriate block filename and selecting **Load Spray Data**.
  - change the order the shape files are graphed so that the rivers are drawn above the surface features (REMSAT graphs *from the top down*).
  - change the colours and thicknesses of the shape files and blocks, as appropriate.
3. The first thing you're likely to notice after loading the flight data is that it is colour-coded. The colour has been coded to the application rate, such that green represents a proper application rate, red is too high and blue is too low. You can turn this off and just graph the spray locations all in one colour by unchecking **Colour code AG-NAV spray rate data** in the Preferences (Graphing tab).
4. To perform a statistical analysis of the spray data, check only the AG-NAV spray files in the list that you want to analyze, then click **Tools → Spray Statistics**. This opens up a form in which you can view and/or print the Spray Time, Turn Time, Application Rates, Cross-Track Error and DGPS quality histograms. Holding the mouse pointer over a histogram bar will display the value of that bar.
5. To 'watch' the different spray operations, make sure **Graph 'boom off' AG-NAV data** is checked in the Preferences, and that the **Graphing Speed** for AG-NAV files is set to **Positional** (both of these options are on the Graphing tab). At the present time, the **Speed** slider for graphing AG-NAV data simply slows down or speeds up the graphing of the flight data, however it will eventually control the "real" speed (ie. the flight track onscreen moves at the same rate as the airplane did in real life, or 2× the real speed, 4×, etc.). I would suggest the highest setting for now (ie. slide it to the right), as the lowest setting is quite slow.

## Appendix B

### Waterloo County Mosquito Adulticide

#### Company:

Name: REMSpC Spray Consultants  
Address: 12 Welsh Dr.  
Ayr  
Ontario, Canada  
N0B 1E0  
Phone: (519) 632-5006  
Fax: (519) 632-5007  
Email: Bob.Mickle@REMSpC.com

#### Client:

Name: Tony Endres  
Address: 23 Columbia St.  
Waterloo  
Ontario, Canada  
N2G 4E9  
Phone: (519) 555-5706  
Fax: (519) 555-7468  
Email: tony.endres@home.net

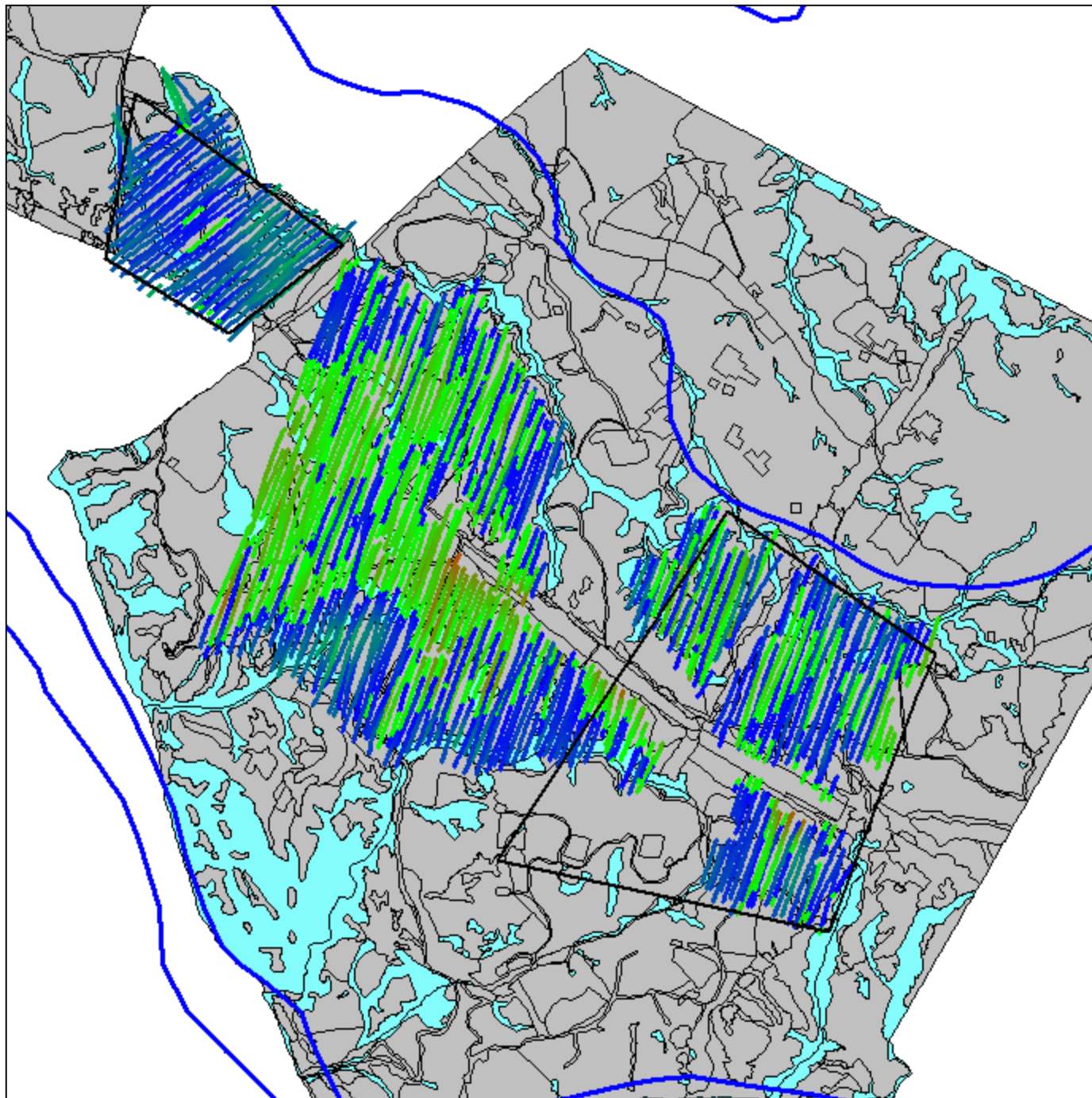
#### Application:

Aircraft:  
Registration:  
Product:  
Product Rate:  
Spray Rate:

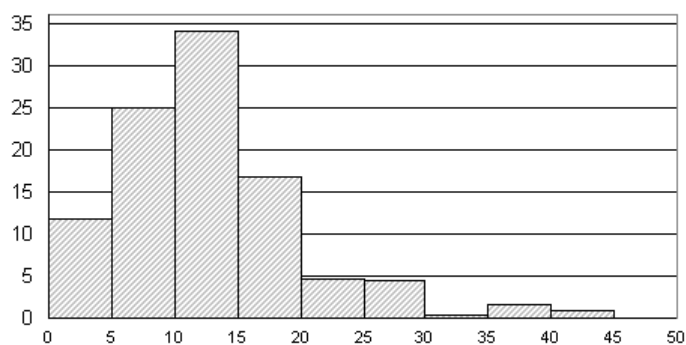
#### Flights:

	Block	Inside (ha)	Outside (ha)
M9112301.NO1	88.15		
N9112309.T4A		81.17	16.17
M9112201.NO1	311.35		
N9112212.T01		0.00	224.74
N9112209.T43		161.71	153.91

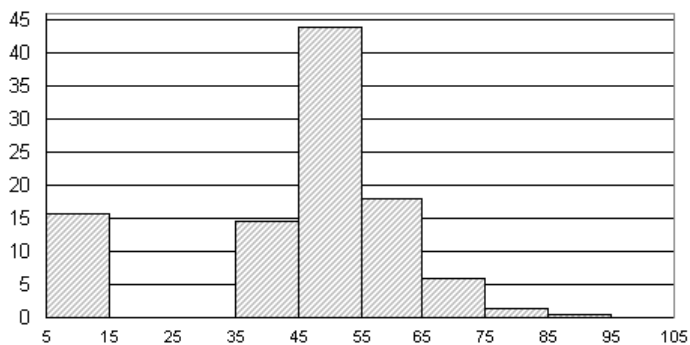
**Application:**



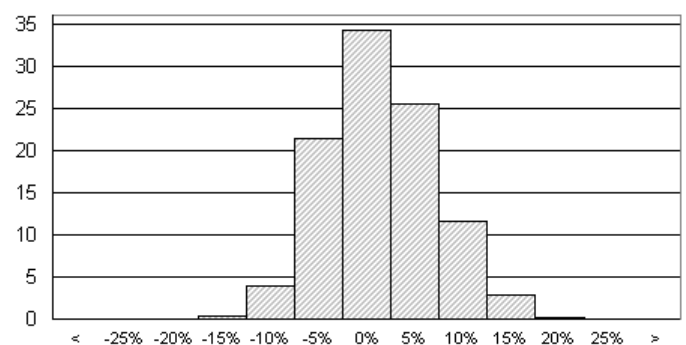
### Spray Time (% vs Sec)



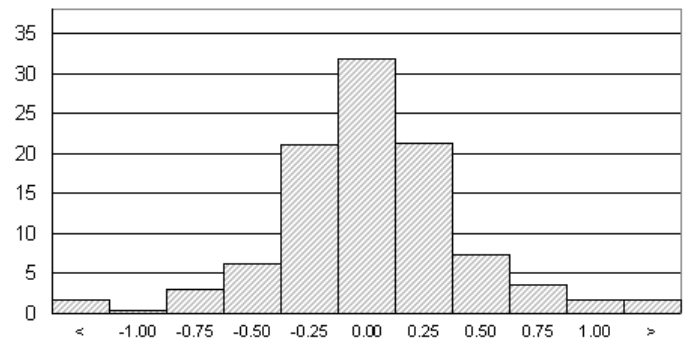
### Turn Time (% vs Sec)



### Application Rate (% vs %)



### X-Track Error (% vs Swath Width)



### Altitude (% vs m.a.s.l.)

