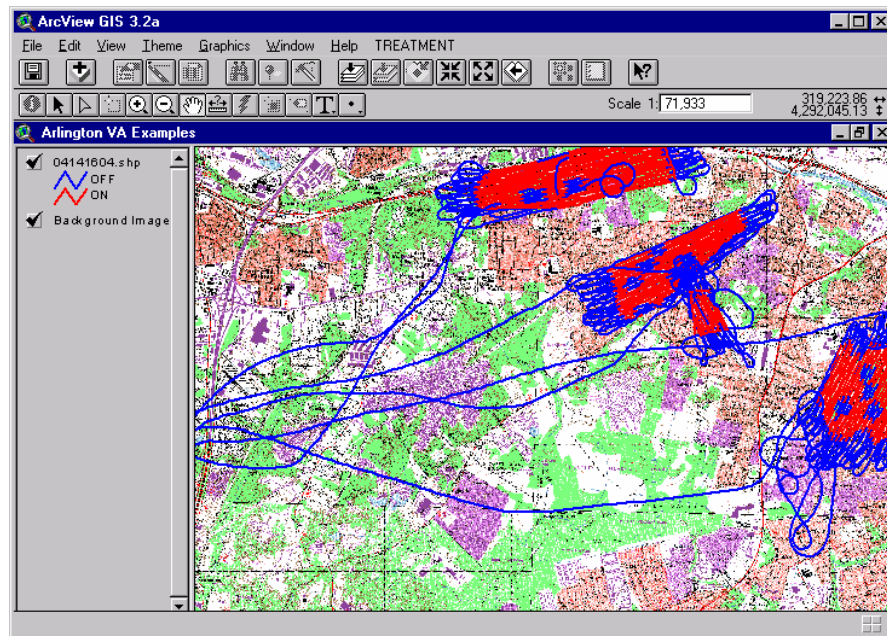


Spray Advisor ArcView Extension

Developed for USDA Forest Service
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April 2004 Update
Technical Manual



Spray Advisor ArcView Extension
Version 1.0
Manual Last Modified: April 5, 2004

This document explains the use of the USDA Forest Service Spray Advisor ArcView 3.x extension. This extension is used for import/export of spray block information to and from airborne navigation systems.

Known issues with the extension are listed. Please send any comments, questions or suggestions to the author at the address below. Thanks!

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Section 1. Introduction

1.1 Background

This manual describes the USDA Forest Service Spray Advisor ArcView 3.x Extension. This extension was developed as an adaptation of portions of the Gypsy Moth Expert System (GYPSES) for use with Environmental Systems Research Institute's (ESRI's) ArcView 3.x GIS software platform. GYPSES was originally developed as a decision support system for natural resource managers concerned with the spread and control of the gypsy moth, but has since been adapted for use in general pest management.

1.2 Required Files for Use of the Extension

The USFS Spray Advisor ArcView extension is provided as a file or on floppy disk with this manual. The extension is stored as a self-extracting ZIP file, listed below. The ZIP file uncompresses into the required files listed.

sa_usfs.exe - self-extracting ZIP archive of required files

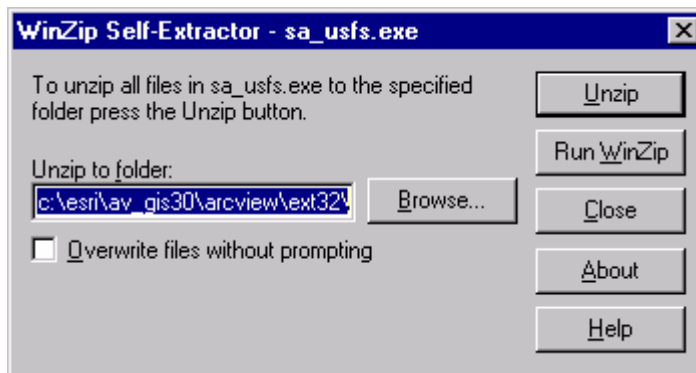
Required files:

Sa_usfs.avx - The actual ArcView extension file
/spadvbin/Sa_userprj.prj - an object database of the user's default projection
/spadvbin/Sa_prj.prj - an object database of all available projections
/spadvbin/Agnavparms.dat - set of AG-NAV parameters set by user
/spadvbin/agnavimport.exe - exe file to import AG-NAV files
/spadvbin/satlocimport.exe - exe file to import Satloc files

1.3 Installation of the Extension

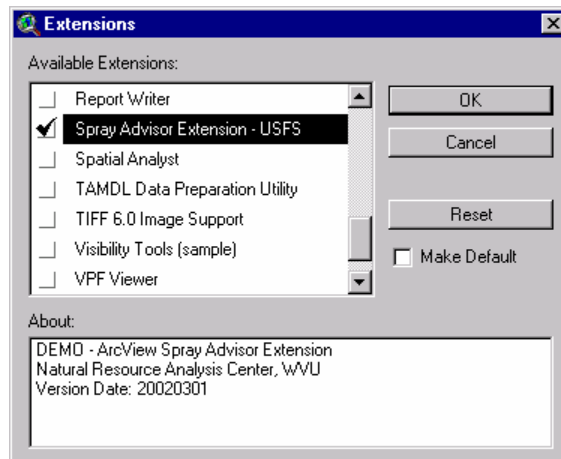
1. Double-click on the sa_usfs.exe file name in Windows Explorer to start the self-extraction of required files listed above.
2. The following Self-Extractor window will appear. Files will be automatically unzipped to the folder listed in the "Unzip to folder" box. This assumes that ArcView is installed in the C:/esri/av_gis30/arcview/ folder on your computer. If this is not the case, hit the "Browse" button on this window and navigate to the ext32 folder under your ArcView software installation (for example, you may have ArcView loaded on your D:/ drive instead).

3. When you have verified the “Unzip to folder” location, press the Unzip button to extract all required files to the proper locations.



1.4 Loading the Extension within ArcView

- ❑ Start ArcView 3.x.
- ❑ To load the extension, go to the ‘File’ menu and select “Extensions”.
- ❑ When the Extensions dialog box (window) appears, you will see a list of available extensions on your current ArcView installation.
- ❑ Place a checkmark next to the extension called “USFS Spray Advisor Extension”. If you don’t check this box, the extension won’t load (a common mistake).
- ❑ Press OK to load the extension.
- ❑ Once the extension has loaded, you should see a menu called “TREATMENT” *only* when you have a view as the active window on your screen.



NOTE: As the extension loads, you will be asked to specify a default coordinate system and projection information for your data. You can go back and modify this later at any time by selecting “Change Projection Defaults” from the treatment menu.

The extension currently supports data conversion between UTM (NAD 1983, units meters), State Plane (NAD 1983, units meters), and geographic (WGS 1984, units

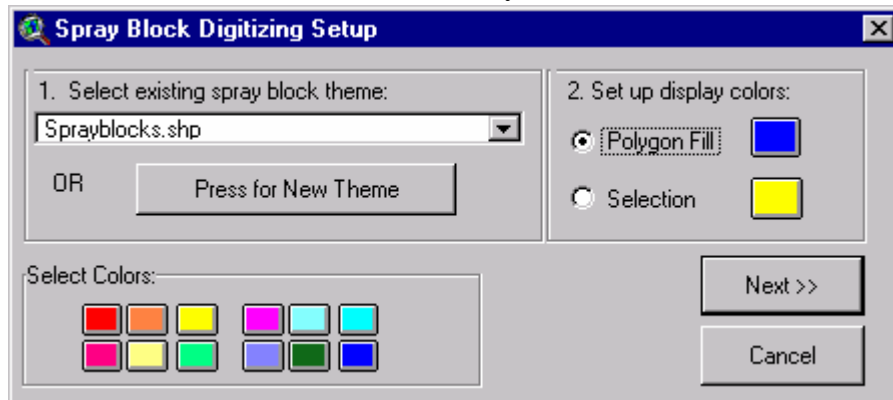
decimal degrees). Note that conversion to/from the NAD 1927 (North American Datum of 1927) is now supported for exporting spray blocks and for importing spray lines.

Datum conversion requires ArcView version 3.2 or higher.

See Section 5.2 of this manual for more information.

Section 2. Digitizing Spray Blocks

- ❑ Open a new or existing view in ArcView. (You should see the TREATMENT menu if a view is open).
- ❑ Add some background data to your view (preferably data that are already in your desired map projection, like a background image etc.) See notes at end.
- ❑ Go to the Treatment menu and select “Digitize Spray Blocks”.
- ❑ The Spray Block Digitizing Setup dialog will appear (see below).
 - Specify whether you would like to edit an existing theme (map layer) already in your view (you are given a list of polygon based themes in the view)
 - *Or* press the New Theme button if you would like to create a new spray block shapefile dataset (you will be given a chance to specify the file name and location for this new file)
 - Specify colors used for polygon fill and selection.
 - Press Next>> to continue when you’re done.














- ❑ The Digitizing Tools dialog will appear. The icons in the center box are all ‘Tools’ that control the action of the mouse on the screen. Use the tools to add, delete, reshape polygons etc. If you pause your mouse over the tool, a yellow box should appear describe the use of the tool. The tool must be ‘selected’ (click once on the tool icon to select a tool) before you can apply the tool in the view window. The currently selected tool will be listed on the dialog.



2.1 Using the Digitizing Tools

Click on any tool to select. The currently selected tool's icon will appear depressed on the dialog. To apply the tool, click on the desired location in the view window. For example, to Identify a polygon, click on the Identify tool to select, then move your cursor to the view window and click on the polygon you wish to identify.

Tool	Name	Function
	Add Polygon	Add a new spray block polygon to the theme. Click on polygon vertices in the view window. Double-click to end digitizing. The polygon will be automatically formed into a closed shape. You will be prompted to enter a block ID and a label value.
	Delete Polygon	Single-click on polygons you wish to delete. You will be asked to verify deletions.
	Clip Polygon	This tool erases or clips interior portions of polygons. Click in view window to create a new polygon shape that will be used to cut or clip existing polygon shapes. You can clip off a corner, or you can make interior "donut holes" within existing polygons.
	Split Polygon	This tool splits polygons into two or more pieces along a line that you digitize. Digitize the split line by clicking on the view window. Double-click to finish digitizing. New polygons will have the same attributes (including block ID) as the original, therefore, you may wish to also use the Edit Table tool to edit attribute values accordingly.
	Edit Polygon	Click on polygon you wish to edit. Polygon vertices will be indicated. Click and drag any vertices to new locations. You can also click on a polygon border at any point to add a new vertex.
	Pan	Pans display. To apply, click in the view window, keep holding down the mouse button and drag the view display in the desired direction. Release the mouse button.
	Zoom In	Zooms in display to single point clicked OR to rectangle indicated by mouse click and drag operation.
	Zoom Out	Zooms out display from single point clicked OR to rectangle indicated by mouse click and drag operation.
	Identify	Click on any spray block in the view window. All attribute information will be shown.
	Label	Click on any spray block to label polygon with current label field value. If no value is found for label, you will be prompted to add a value (you can press Cancel to leave label field blank).
	Edit Table	Click on any spray block to edit attribute values for Block ID and current block label. Block ID number is stored in the Block ID field. Block label is stored in the current label field (usually "Label" but may change according to user settings). Current attribute values (if any) are shown as defaults.

- Press the Undo button to reverse the last change made.

- ❑ Press Undo All to undo all changes made since last save operation.
- ❑ Press Remove Labels to delete all label graphics associated with your polygon edit theme.
- ❑ Press Save to save all changes (editing does not stop – you may wish to save as you go along). At this point, area (in sq meters, acres, and hectares) will be calculated for each polygon.
- ❑ Press Done to save all edits and stop editing. Final calculations of area (in sq meters, acres, and hectares) will be made for each polygon.

2.2 Digitizing Spray Block Exclusions

Exclusions should be digitized as holes within existing polygons. Use the Erase tool to add exclusions. If you add additional polygon shapes within existing polygons to indicate exclusions, these areas will be “fixed” for you when you export the spray blocks.

Section 3. Exporting Spray Blocks

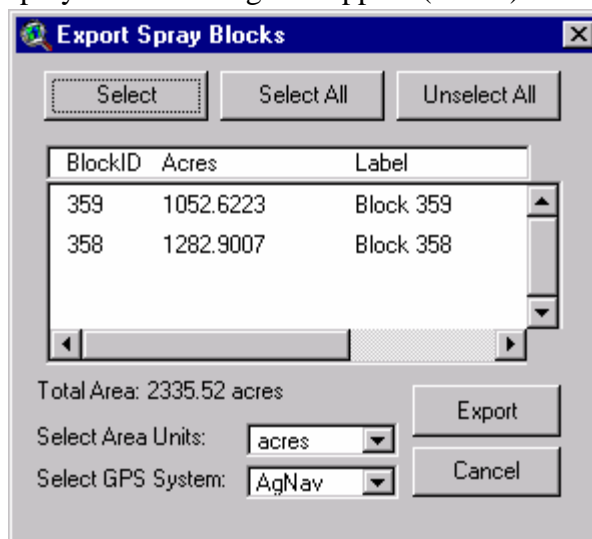
Once you are done digitizing spray blocks (or once you have added an existing spray block theme to your view) you can export the blocks to AG-NAV, Satloc, or Trimble format.

3.1 All Formats

- ❑ Begin export by going to the Treatment menu and selecting Export Spray Blocks.
- ❑ Select the theme (layer) you wish to export. Only polygon layers are listed.
- ❑ Any selected records in your theme are cleared, and if the theme is open for editing, you will be prompted to stop editing and save any changes.
- ❑ You may be prompted to provide a two required fields: numeric spray block identification field and/or a spray block label field. If these fields have already been specified, you will not see these prompts.

Notes on required fields:

- BlockID field is required to keep track of a unique numeric identifier for each block to be exported. If the BlockID field does not already exist in your table, it will be created for you. The BlockID values will be copied from an existing field (if you specify) or they will be filled in sequentially starting with 1.
 - A label field is required to keep track of block labels. If your spray block theme already has a label field specified (check under Theme> Properties if you are not sure) then this label field is used. If there is no label field initially specified, the extension will ask you to select a label field from all string-based fields in the spray block theme's table. If no string fields are present, a new field called "Label" will be added to the table automatically.
- ❑ Next, the Export Spray Blocks dialog will appear (below).



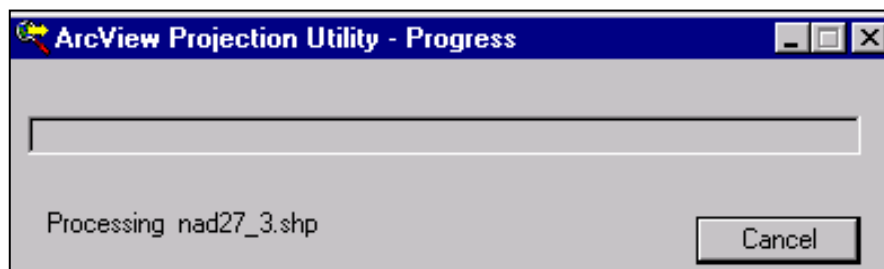
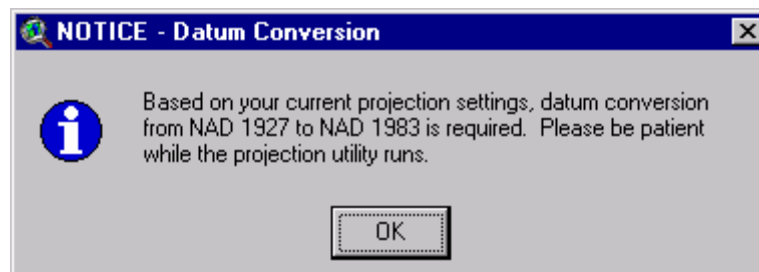
- ❑ In the Export Spray Blocks dialog window, press the ‘Select’ button to be able to click on a single polygon for export. Block ID and label for each selected block are listed on the Export Spray Blocks dialog.
- ❑ If you wish to select all polygons at once, click ‘Select All’. Error messages will appear if you have blocks with blockID = 0, or if blocks have duplicate block ID values.
- ❑ Click “Unselect All” to clear all selected blocks.
- ❑ If you click again on a block that is already selected, the block will be unselected.
- ❑ You can specify the Area Units (acres or ha) as you go along to display a running total of spray block area.
- ❑ You will be prompted to enter new block information if block ID number is blank or is duplicated.
- ❑ Specify software format (AG-NAV, Satloc, or Trimble, defaults to AG-NAV).
- ❑ When you are done selecting blocks, click the ‘Export’ button to begin exporting the currently selected polygons.

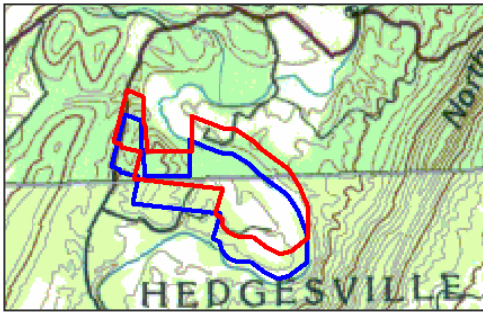
3.2 Notes on Exporting NAD 1927 Spray Blocks

The GPS software formats supported by this extension generally work with data points stored in geographic decimal degree coordinates in the North American Datum of 1983.

The extension now supports exporting spray blocks from projected coordinate systems using the North American Datum of 1927, including UTM NAD 1927 and State Plane NAD 1927.

If your default projection uses NAD 1927 and requires conversion, you should see the following notices. This indicates that ArcView will perform the datum conversion from NAD 1927 to NAD 1983 before exporting your data. Your original shapefile data will remain in NAD 1927 and will be unchanged. The conversion process will take a few extra seconds – please be patient.



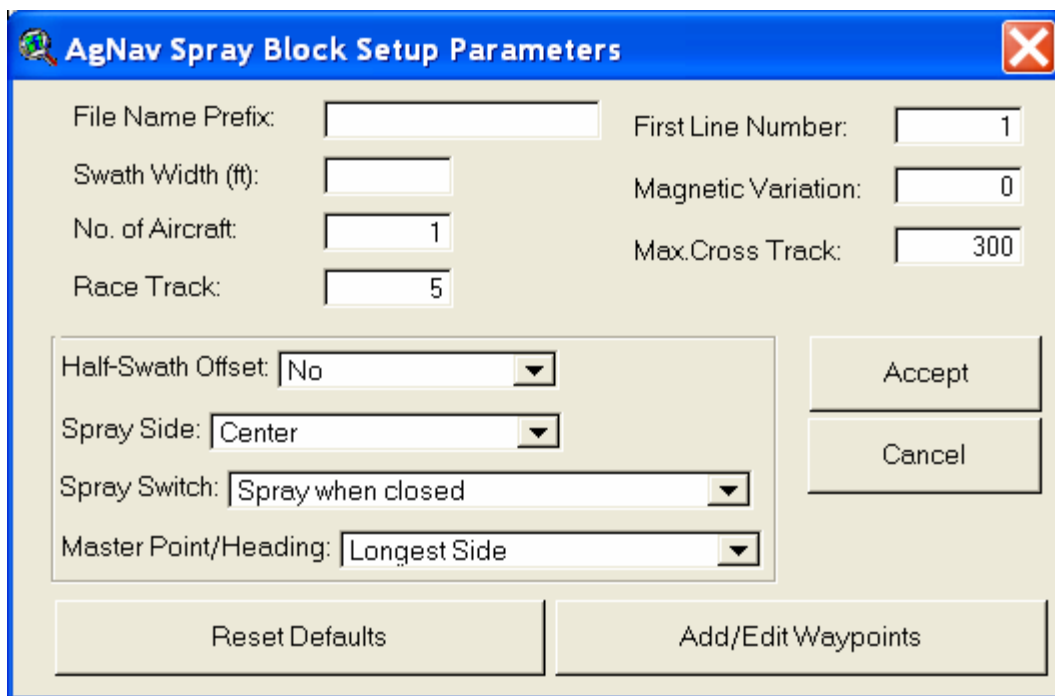


An example of the need to know your datum. Blue outlines indicate a spray block in NAD 1927, and red indicates the same block in NAD 1983.

See Section 5.2 for more information.

3.3 Exporting to AG-NAV

- ❑ AG-NAV is limited to a maximum of 10 exclusion polygons per spray block. You will be informed if this situation occurs.
- ❑ AG-NAV is limited to a maximum of 10 vertices per exclusion area. You will be informed if this situation occurs.
- ❑ After specifying blocks for export, the AG-NAV Spray Block Setup Parameters dialog will appear (see following). This dialog has been recently modified in May 2003. Parameters that are initially blank and must be set by the user include file name prefix and swath width in feet. By design, there are no default values for these two parameters.

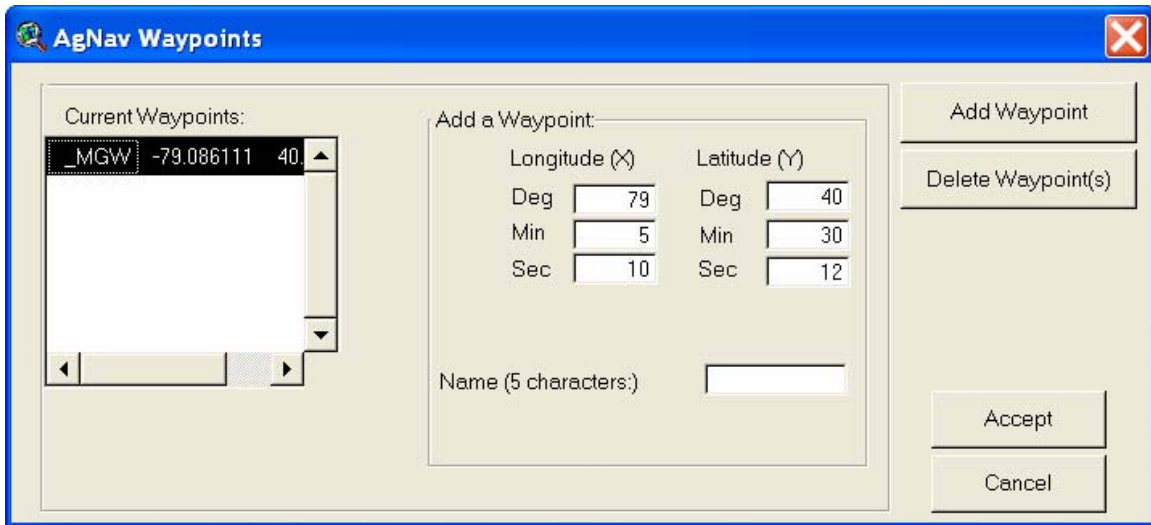


Description of AG-NAV Setup Parameters and Important Note:

For many of these AG-NAV parameters, it is recommended that you consult your pilot and/or the AG-NAV documentation if you intend to change default values.

Parameter	Choices/Acceptable Values	Description
File Name Prefix	Limited to a maximum of 5 characters (may be less if block)	Prefix for NO1 file names. File names are automatically generated from prefix plus block number.
Swath Width (Ft)	20 to 1000	Swath width of aircraft in feet
No. of Aircraft	1 to 10	Number of aircraft
Race Track	-99 to 99	Consult AG-NAV documentation
First Line Number	Usually 1	Consult AG-NAV documentation
Magnetic Variation	-50 to +50	Magnetic variation in degrees, negative values are East, positive values are West.
Max. Cross Track	1 to 999	Determines sensitivity of track bar on AG-NAV steering display, has to do with sensitivity to cross track error. See AG-NAV documentation.
Half-Swath Offset	No Yes	Sets offset of first grid line.
Spray Side	Left Right Center	
Spray Switch	Spray when closed Spray when opened Spray inside area	Automatic control of spray booms. Consult with pilot or have pilot set in AG-NAV software.
Master Point/Heading	Longest side Set for each block	Determines master point/heading for flight. If set to longest side, ArcView will determine the longest side of the spray block. If set to "Set for each block", you will be prompted to specify the flight direction interactively.

- ❑ Once AG-NAV parameters are set, you may or may not have to set the master point/heading for each block. (A dialog will appear if you need to do this).
- ❑ To set master point, click ONCE at beginning of master line, drag your mouse in the required direction, and click ONCE again to end the line. The heading for the line you drew will be displayed on the dialog. If you don't like the heading, press 'Try Again'.
- ❑ Make sure you specify a location for output files.
- ❑ If you wish to add waypoints such as locations of airports or other point locations to your AG-NAV dataset, press the "Add/Edit Waypoints" button on the dialog.

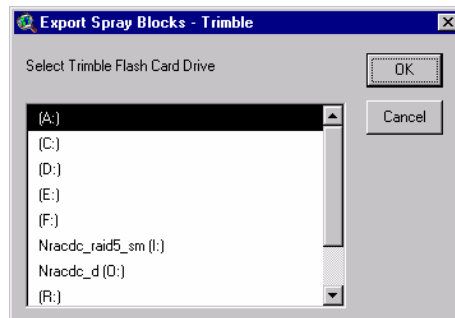


3.4 Exporting to Satloc

- ❑ You will be asked to provide a numeric Satloc job extension number to be used for the output file name.

3.5 Exporting to Trimble

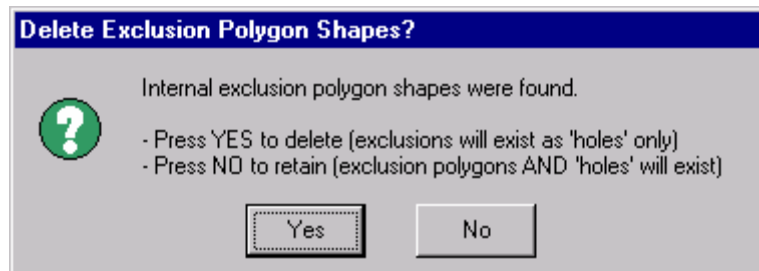
Trimble uses a Flash Card system on which to store data used in aerial navigation. When exporting to Trimble, you must first use the dialog shown below to specify the disk drive location of the Flash Card on your computer.



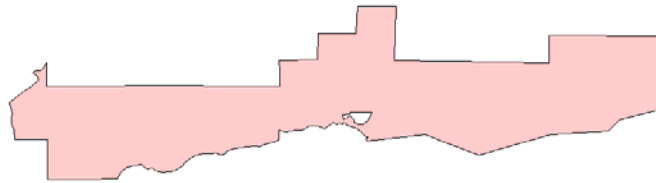
- ❑ Each selected spray block will be exported to its own individual set of Trimble shapefiles.
- ❑ If the file structure on the Flash Card is not as expected, you may be prompted to specify an output location for the exported shapefiles. Otherwise, the exported shapefiles are saved in the “AgGPS170 GIS FIELDS” folder on the Flash Card.
- ❑ Exported shapefiles are named according to the block ID number. Each exclusion within a spray block is also exported to an individual shapefile.

3.6 Notes on Exclusions

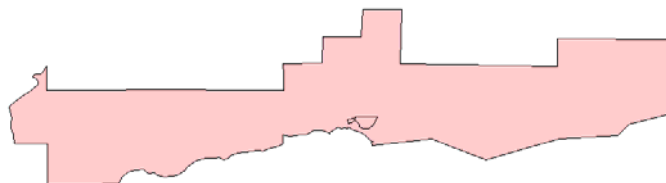
- If *exclusions* are encountered in your selected blocks, exclusions will automatically be “subtracted” from the outer polygon (leaving a donut hole). This is a requirement for many of the navigation software systems.
- The following dialog may appear. This dialog provides two choices on how ArcView will handle your exclusion polygons (see following example).



Example 1. User answered “YES”. Exclusion has been deleted and subtracted.



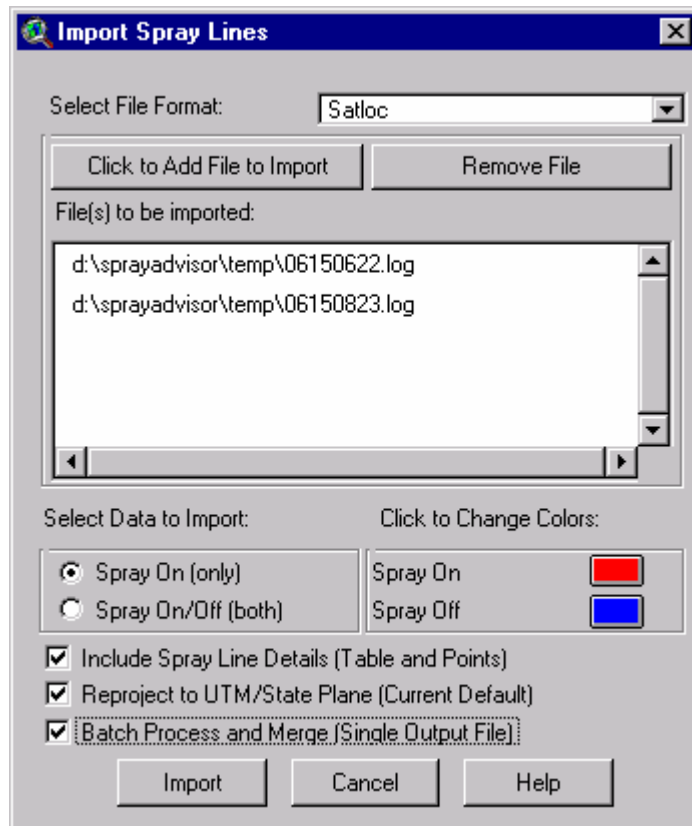
Example 2. User answered “NO”. Exclusion has been subtracted from original polygon, but still exists as independent polygon shape.



Section 4. Importing Spray Lines

The Extension will allow the user to import spray line files from AG-NAV, Satloc, or Trimble format. Both Satloc and AG-NAV formats are in binary file format. These files are read into ArcView using C code routines to read the binary files and translate them into a format that can be transformed into shapefiles by ArcView. Trimble files are already in ArcView shapefile format, but require some initial data processing including reprojection etc.

- ❑ Begin import by going to the Treatment menu and selecting Import Spray Lines. A dialog will appear.
- ❑ In the dialog, click the “Click to Add File” button to add files to be imported. More than one file may be imported at once. AG-NAV file names begin with “N”, Satloc files have the extension “.log”, and Trimble file name should be an ESRI shapefile ending in _Track2d.shp.
- ❑ Also in the dialog, specify if you want to include spray on (only) or both spray on/off lines, specify spray on/off display colors, etc.
- ❑ When you are ready to import, press the Import button. Your spray lines will be imported according to your specifications and the resulting shapefile dataset will be added to your view.
- ❑ If you check the “Include Spray Line Details” checkbox, you will be able to view point by point spray line information, including airspeed, cross track error, actual application rate, and application error rate. Spray line details will be provided as a new point shapefile and as a table. You will be prompted to provide desired application rate (in gallons per acre or liters per hectare) and desired airspeed (in miles per hour or kilometers per hour).
- ❑ If you check the “Batch Process and Merge” option (for AG-NAV/Satloc only) you will be able to merge all selected files into a single output shapefile, with minimal input required from the user as the import is running. See below for details.
- ❑ Actual application rate is calculated as $(\text{Desired application rate} / \text{Desired airspeed}) / \text{Actual airspeed}$ from GPS. Actual rate units correspond to the units previously selected by the user.
- ❑ Percent application error rate is calculated as $((\text{Desired application speed} / \text{actual application speed}) * 100) - 100$. Rates less than zero are “light” spray, rates greater than zero are “heavy” spray values.



4.1 Notes on Import and Batch Import

Batch import is only available for AG-NAV and Satloc.

Output shapefile filenames during regular (*non-batch*) import will default to the filename prefix of the original AG-NAV or Satloc file. The default file location is the same folder as your AG-NAV or Satloc files. For example, the Satloc file 04161234.log will import to 04161234.shp. If you select the “Include Spray Line Details” option, the spray line detail points will be saved in a dBase file. The default filename for this dBase file is the name of the Satloc file plus “_points”. For example, 04161234_points.dbf. If the default filename is already in use, you will be prompted to provide a different filename.

Batch import means that multiple input files from either Satloc or AG-NAV will be merged into a single output shapefile of flightlines. If you have the “Include Spray Line Details” option checked on, all spray line details will be saved as a single dBase file. You will be required to specify the single output shapefile’s filename, which will default to “Import.shp” in your ArcView project’s current working directory (usually c:/temp). If you have the “Include Spray Line Details” option checked on, the spray line detail points will be saved in a dBase file with the shapefile name plus “_points” on the end. If this filename is already in use, ArcView will create a file named “pointsX.dbf” (where X is a unique integer) in your ArcView project’s current working directory.

4.2 Notes on Potential Import Errors from AG-NAV and Satloc

It is possible that some of the AG-NAV or Satloc files that you are importing will have errors. Potential sources of errors include:

Incorrect format of the AG-NAV or Satloc file. No data will be imported.

No spray line data at all within the file. No data will be imported. Batch file imports will continue, skipping files with this error.

Spray line data present, but no spray 'on' data within the file. Spray lines will be imported for spray "off" lines only. NO spray line detail calculations will be made. Batch file imports will continue, skipping files with this error.

Below is an example of a portion of the import summary for a batch import of 4 data files. Two data files were successfully imported, one file was not imported due to a possible error (blank file), and one file was not included in calculations since it lacked spray "on" data.

```
-----  
Summary of Results for import_results_points.dbf  
-----
```

```
Total number of sample points: 7540  
NOTE: All sample points are spray on only.
```

```
...
```

```
-----  
FILES IMPORTED IN THIS BATCH PROCESS (With Spray Data Points):  
-----
```

```
d:\sprayadvisor\examples\06250721.log  
d:\sprayadvisor\examples\06291010.log
```

```
-----  
FILES WITH NO SPRAY ON DATA (Not Included in Calculations):  
-----
```

```
d:\sprayadvisor\examples\06291401.log
```

```
Note: These flight lines ARE mapped, but no spray data points are analyzed.
```

```
-----  
FILES WITH POSSIBLE ERRORS (Not Imported):  
-----
```

```
d:\sprayadvisor\examples\06250718.log
```

```
Errors may include no spray 'on' data or error reading AG-NAV/Satloc output files.
```

4.3 Notes on Import from Trimble

You can import data either directly from the Flash Card, or you may use Windows Explorer to copy the data files from the Flash Card to your computer. In either case, ArcView will NOT over-write the original files. However, it may be faster to copy the files from the Flash Card to your computer. It is recommended that the output shapefiles are not saved on the Flash Card (to conserve disk space).

To import Trimble files, click the “Click to Add File to Import” button, then locate any XXX_Track2d.shp file on your computer or on the Flash Card. XXX refers to the Trimble Field name (usually your spray block number).

Track2d shapefiles are typically found on the flash card in the folder under /AgGPS 170 Data/ for the Field (spray block) and Event (spray event). You may have to “drill down” several directories to locate this file. For example: /AgGPS 170 Data/block number/spray/spray_Track2d.shp.

Next, you will be prompted to enter a file prefix (this defaults to your Trimble “field”) and output shapefile name for all Trimble output files. The default file location for output files will be your ArcView project’s current working directory.

Depending on the options you have selected in the Import Spray Lines dialog, ArcView will import either one or two shapefiles. These shapefiles will be placed in a location of your choice. The shapefile filenames are automatically generated from your file prefix (suggestion – use the block number), the event name (usually ‘spray’ – this comes from the track2d filename) and the type of shapefile (point or line).

Shapefiles created include:

Prefix_Event_lines.shp	- spray lines
Prefix_Event_points.shp	- points along spray lines with details (optional)

Section 5. Additional Extension Capabilities

5.1 Background Image Setup

This option will allow the user to display one or more background images as a seamless dataset. Background images must currently be stored in the same projection as the user's other ArcView datasets – the extension cannot perform image registration.

To Use:

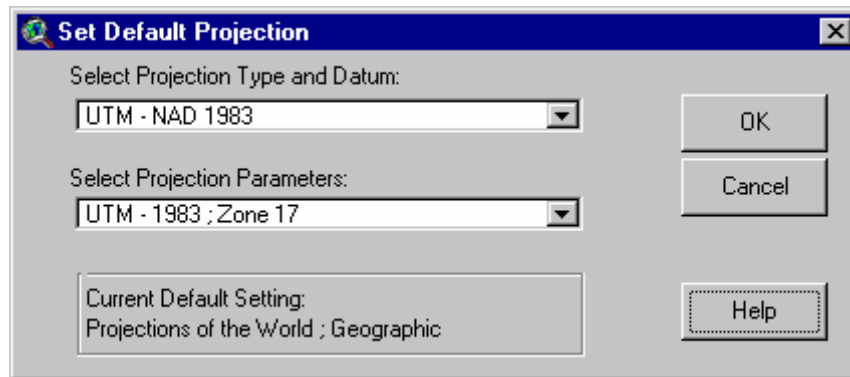
- ❑ Begin by going to the Treatment menu and selecting Background Image setup.
- ❑ A File dialog will appear. Use the dialog to locate one more image files (multiple file types are supported, but all images must be in the same format and must be in the same folder). Use the shift key to select more than one file.
- ❑ Once files are selected, ArcView creates an Image Catalog file (dbf table) that allows the seamless display of the imagery. You will be prompted to specify a location for this dbf file.
- ❑ The image catalog is added to the view as a new theme. You may wish to move the background imagery to the “bottom” of the view's table of contents so that the image is drawn beneath other map layers.

5.2 Specifying a New Default Projection for your Data

ArcView 3.x does not include the ability to determine map projections of shapefiles without user input. Therefore, the Spray Advisor extension relies on user settings to determine the default projection for all datasets used. User default projection information is accessed when you are exporting or importing spray blocks.

To set the default projection that ArcView will apply to your datasets, use the “Change Projection Defaults” menu choice found in the TREATMENT menu when a view document is open in ArcView.

This dialog appears after selecting “Change Projection Defaults” and is used to set user defaults for map projection. **You should select the projection of the data with which you are currently working.** You may change this information at any time. The Current Default Setting box shows the currently saved parameters, which are set after you press the “OK” button.



Use of the dialog:

1. Select general projection type and datum (choices are Geographic, State Plane, or UTM)
2. Select specific projection details

Notes:

- The Geographic projection only has one format (WGS 1984).
- Export from NAD27 is now supported. This means that spray blocks projected onto the North American Datum of 1927 (NAD27) in UTM or State Plane coordinates may be exported correctly into GPS formats.
- The extension also supports import of spray lines into NAD27 at this time.
- Map units (units of measurement) for all state plane and UTM projections are assumed to be meters. Development for state plane projections with measurements in feet is ongoing.

5.3 Saving your Work

Any **shapefiles** (*.shp) that you create by digitizing will be permanently saved on your computer until you specifically erase them. A shapefile consists of three (or more) files, including yourshapefile.shp, yourshapefile.shx, and yourshapefile.dbf. A shapefile is a data source that can be used over and over again in any ArcView project.

You do NOT have to save an ArcView project file (APR) to be able to re-use a shapefile that you digitize.

An ArcView **project** (*.apr) essentially saves your current ArcView workspace for future use. All colors, labels, open windows, and ArcView documents (any views, tables, charts, scripts, or layouts that you have opened) will be saved in your project file. Project files are linked to data sources (e.g. shapefiles, images) displayed within views by saving

the complete pathname to the data source. So, if you move a shapefile that is used by your project from your C drive to your D drive, ArcView will not be able to 'find' this shapefile the next time you try to open this project.

If you save a project while the Spray Advisor extension is loaded, the extension should automatically be loaded the next time that you open your project.

Section 6. Known Issues

1. Installation – Eventually I would like to have an InstallShield file that puts all necessary files in the correct location. I will also probably change the file location of required files (right now, all are put into ArcView's EXT32 folder) and possibly allow the user to modify these with an initialization (ini) file.
2. Projections – The extension does support conversion of NAD27 data in the export process. **Note that state plane reprojections have not been thoroughly tested and are not supported for map units of feet** (coming soon).
3. Adding additional data – right now this is NOT automated. Most ArcView users should be able to load the background data by themselves that they need to be able to digitize spray blocks (i.e. Digital Raster Graphics).
4. Action of Digitizing Tools dialog with regards to splitting polygons – user needs to attribute newly split polygons with new block ID numbers (should not duplicate existing numbers). The user must use the Edit Attributes tool on the Digitizing Tools dialog to perform this function. Currently, a warning message is displayed on the tools dialog if duplicate block IDs occur, but duplicates are still allowed.
5. The Import executables (Agnavimport.exe and satlocimport.exe) may have issues with previous versions of the Microsoft Windows operating system (Windows 98 etc). They were developed and tested for Windows NT and XP only.
6. Batch import of multiple Satloc and AG-NAV files has been completed and tested.
7. Area of all digitized polygons is calculated when the Done button is pressed on the Digitizing Tools dialog. The dialog code assumes that the underlying map units of the digitized polygon shapefile are meters.

Section 7. Contact Information

7.1 Software Updates

Periodic updates will be made to the ArcView extension. To be sure that you have the most up-to-date version, check with the NRAC Spray Advisor web page, at the following URL:

<http://www.nrac.wvu.edu/sprayadvisor/>

An email mailing list will also send news of updates to all subscribers.

7.2 Contact Information

If you wish to be added to the update email list, or if you have any questions, comments, or suggestions, please feel free to contact me:

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7.3 Additional Information

For more information on the use of AG-NAV, Satloc, and Trimble GPS navigation, please refer to the current versions of each system's user manual.

AG-NAV Inc. 2003. AG-NAV2 Operations Manual. AG-NAV Inc. Newmarket, Ontario, Canada. Web: www.agnav.com

Satloc, LLC, 2003. AirStar M3 User Guide. Satloc Precision GPS Applications, Scottsdale, AZ. Web: www.satloc.com

Trimble, 2002. AgGPS 170 Field Computer. Trimble Navigation Limited, Sunnyvale, CA. Web: www.trimble.com