# RVMap Software for RV2

RVMap Overview

The RVMap application provides a simple visual interface to define regions and targets for video tracking. RVMap is installed with TDT drivers, version 72 or greater. See "Setting-Up Your Hardware" on page 9-5, for information on setting up the RV2 video processor, VGAC camera, and RZ recording system.

The overall process for using the RVMap is as follows:

1. Get a snapshot of the experiment space from the camera connected to the RV2.

2. Describe targets that will be tracked in the experiment space and regions of interest.

3. Upload the configuration to the RV2 file system.

The Workspace

RVMap provides a workspace where users can display a camera snapshot and define regions and targets.

Menus and Toolbars

Window

Status Bar
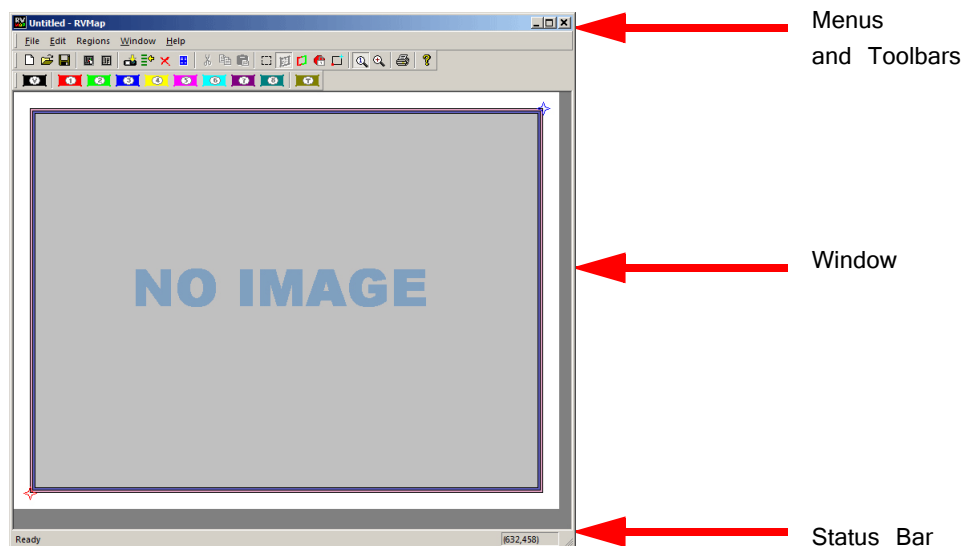
Window

The main workspace window displays an image from a camera or loaded file. Click-and-drag tools are used to define regions and targets on a map overlaying the image.

Menus and Toolbars

A comprehensive set of menus and toolbars provides access to commands and tools. Frequently-used commands are available via toolbar buttons. Move the mouse pointer over a toolbar button to display the button name. A tool tip for the button is also displayed in the Status Bar. See "Menu and Toolbar Reference" on page 9-34, for a complete list of commands and tools. Context sensitive menus are available by right-clicking the workspace.

Status Bar

A status bar along the bottom of the window displays status messages, tool tips. The right side of the status bar displays the coordinates of the pointer.

Creating a Configuration

Before a recording session can be started, an RVMap configuration file (*.rvm) must be created, saved, and uploaded to the RV2. Configurations are created by drawing regions and targets to create a map overlaying a reference image. The *.rvm files contain region descriptions, reference points, target descriptions and camera settings.

Loading an Image

RVMap can load a snapshot image from a connected RV2 and camera or from a previously saved image file.

Loading Existing Image Files

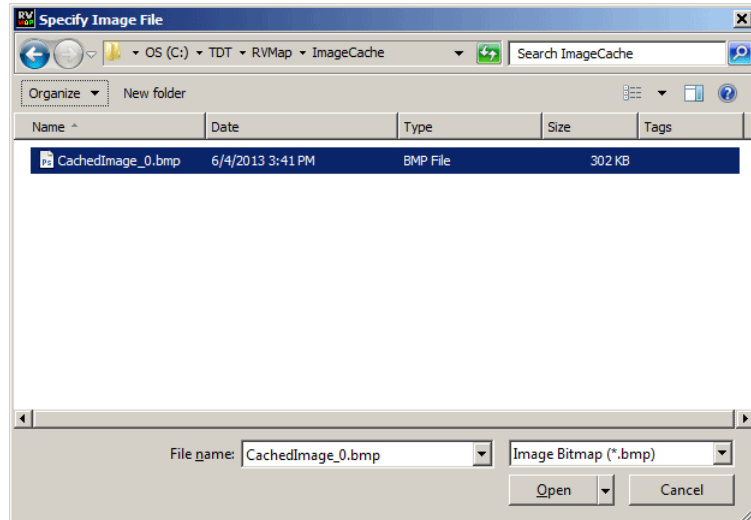**To load an existing image:**

1. Click the **File** menu and click **Load Image**.

    or

    Click the **Load Image** button on the Standard Toolbar.

2. The Specify Image File dialog box is launched.

    Browse to the desired folder.

3. Select the image file and click **Open**.

Loading Images from the RV2

RVMap can auto−detect the RV2 and then retrieve a snapshot from a connected camera. Before loading an image from an RV2, ensure the RV2 is on and connected to the PC or network and then connect and position the camera over the experiment space, preferably with the targets visible. Try to make the conditions as close as possible to the recording conditions as this will aid in creating accurate target and region definitions.

To load an image from the RV2:

1. Click the **File** menu and click **Load Image from RV2**.

2. If a default RV2 has not previously been defined, the **Load Image From** dialog is opened.
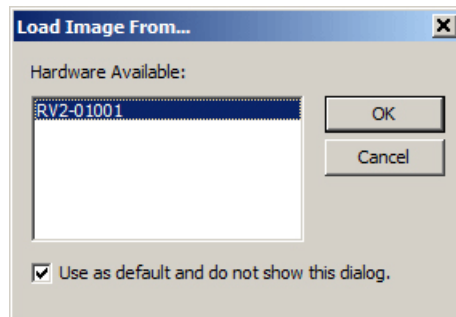
In this dialog box, any available RV2s connected to the system or available across a network will be displayed.

In the *Hardware Available* list, select the desired RV2.

Note: Every time RVMap needs information from an RV2, it pings the network for available RV2s and lists them. To make the selected RV2 the default hardware and bypass this step in the future, select the **Use as default and do not show this dialog** check box.

3. Click **OK**. A snapshot from the RV2 is retrieved and displayed.

Defining Regions

RVMap allows users to define up to eight active regions and one void region. Active regions are numbered one to eight and the corresponding region number will be included in the returned data when a target is found in that region. A void region can be used to eliminate areas of the image which are outside the experiment space. The tracking algorithm will not look for targets in void regions.

Regions are defined by drawing a region shape over the image in the main window. The shape must be a polygon and may have any number of vertices.

Note: The X,Y coordinates of the pointer are displayed in the right end of the status bar for more specific information about placement of the region vertices.
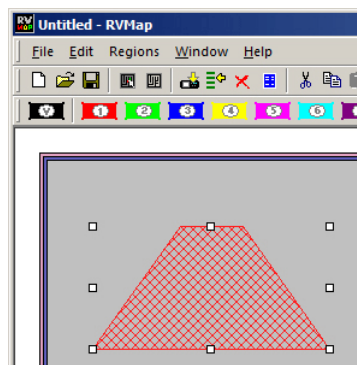
To place a region:

1. Click a region button on the region toolbar.
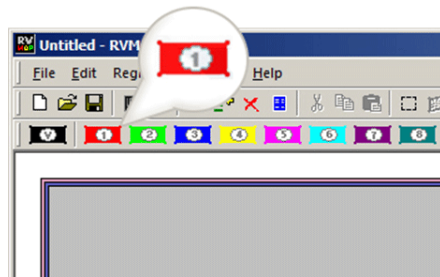
2. Click the image area in one corner of the desired region to begin drawing a polygon. Click each corner of the region in turn to create a vertex point.
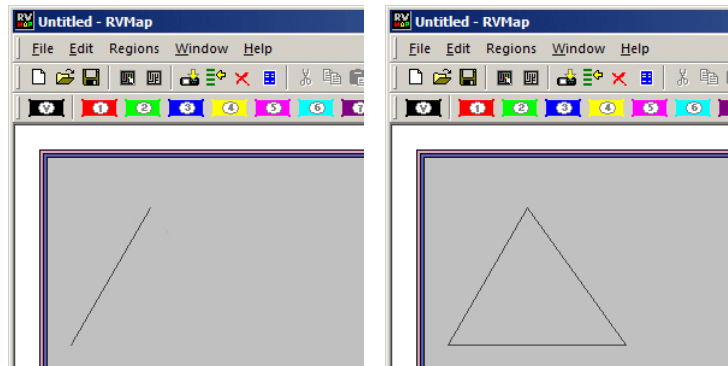
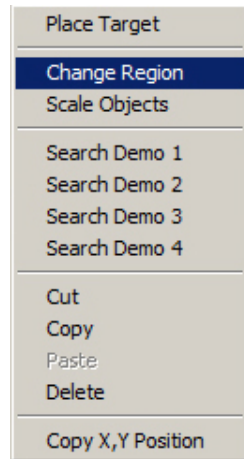3. Double-click the last vertex to complete the region shape.

Modifying a Region
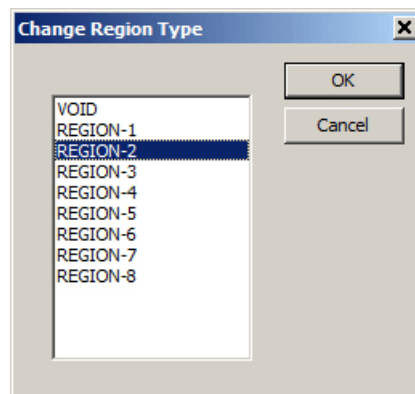
To move a region:

- Click and drag the region to the desired location.

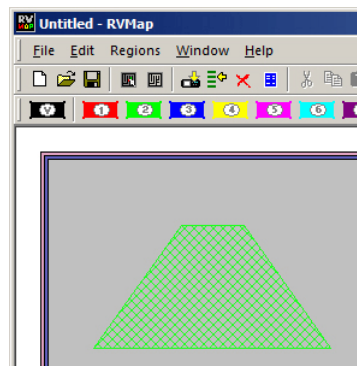**To change the region number:**

1. Regions are numbered and identified on screen using colors. Right‑click the region to be changed.

2. Click **Change Region** on the shortcut menu.

3. In the *Change Region Type* dialog box, select the desired region label in the list and click **OK**.

The region has been changed and should be displayed in the color corresponding to the new region number.

Note: Selected regions can also be changed using the *Regions* menu.

To edit the vertices:

1. Hold down CTRL and double-click a region. The regions outline will be wider and the vertices will be selectable.

2. You can now move, add, or remove a vertex.

   • To move a vertex, click and drag the vertex.

   • To add a vertex, hold CTRL and click on the region's boundary to place a new vertex in that location.

   • To remove a vertex, hold CTRL and click the vertex you want to remove.

Defining Targets

Targets are added to the configuration to identify fixed, relative, or reference targets for tracking.

Fixed targets are an easily identified red, blue, or green area on the target subject, such as an LED on a headstage or color marker.

Relative targets are points expected to always be located in a predictable area relative to a previously defined target, such as a second LED on a headstage. This limits the search area, which reduces processing demands and increases accuracy. The location of the relative target can be used to infer information, such as the orientation of the subject and can be used to more accurately place reference targets.

Reference targets are identified based on the location of previously defined target(s). This is a point that maintains a fixed distance and angular separation from other trackable targets but does not have a trackable marker. An example of this is the nose of a mouse wearing a red/green LED headstage.

During recording, the tracking algorithm searches all areas of the image not defined as a void region and identifies the location of the targets. Data for each target (region, O, x, y) and reference (region, heading, x, y) are saved in a text file (tracking.txt) during each recording session. For each target or reference, the user defines whether or not information is sent back to the RZ for real-time analysis and/or storage. Information from up to eight targets and/or references can be returned to the RZ. The Return option in the Target Specifications determines if the target or reference target will be returned to the RZ.
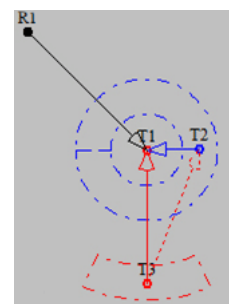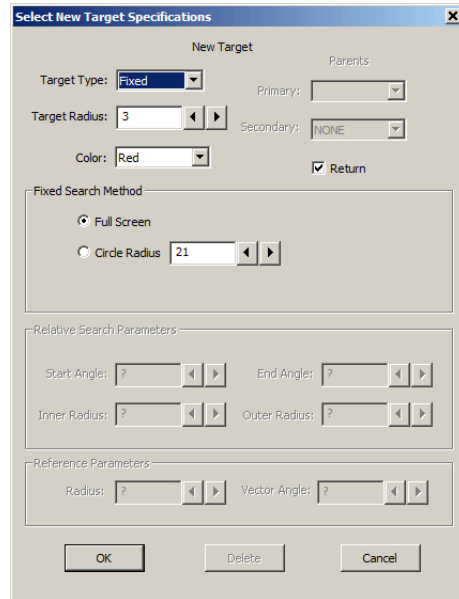
Fixed Targets

At least one fixed target must be placed before any other types of targets.

To place a fixed target:

1. Click the **Target** button on the **Region** toolbar.

2. Click in the image window to place the target.

   The *Select New Target Specifications* dialog opens.

3. Ensure the **Target Type** is set to **Fixed.**

4. In the **Target Radius** box, type a new value to define the target radius (in pixels) or adjust the value using the adjacent arrow buttons.

5. In the **Color** drop-down list, select the desired color or IR/BW for infrared or white light tracking.

6. Select or clear the **Return** checkbox to determine if data from this target will be sent back to the RZ for real-time analysis and/or storage.

7. Under *Fixed Search Method* select the radio button for the desired method.

   Full Screen: Search for a target of the defined color and radius in any location in the image window (except Void regions).

   Circle Radius: Search for the target in a particular circle in the image window. If this option is selected, enter the radius in the Circle Radius value box or use the arrows to adjust the value.

8. Click **OK.**

Fixed Target with Full Screen Search   Fixed Target with Circle Radius Search
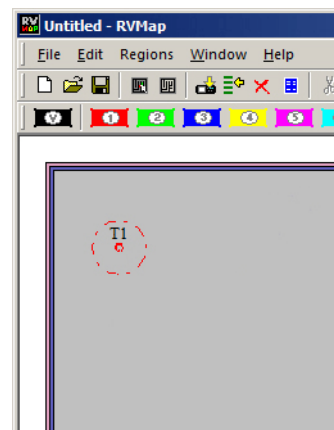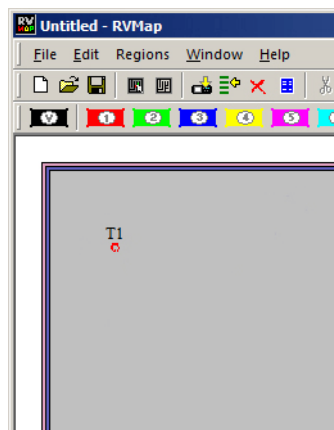
Relative Targets

Once a Fixed target has been placed, a Relative target can be placed. An arc segment around the Fixed target determines a search area for the Relative target.

To place a relative target:

1. Click the **Target** button on the **Region** toolbar.

2. Click the target in the image window.

   The *Select New Target Specifications* dialog opens.

3. In the **Target Type** dropdown list, select **Relative.**

4. In the **Target Radius** box, type a new value to define the target radius or adjust the value using the adjacent arrow buttons.

5. In the **Color** drop-down list, select the desired color or IR/BW for infrared or white light tracking.

6. Under *Parents*, select the desired target from the **Primary** and **Secondary** (if there are more than two targets already) drop down lists.

7. Select or clear the **Return** checkbox to determine if data from this target will be returned to the RZ for real-time analysis and/or storage.
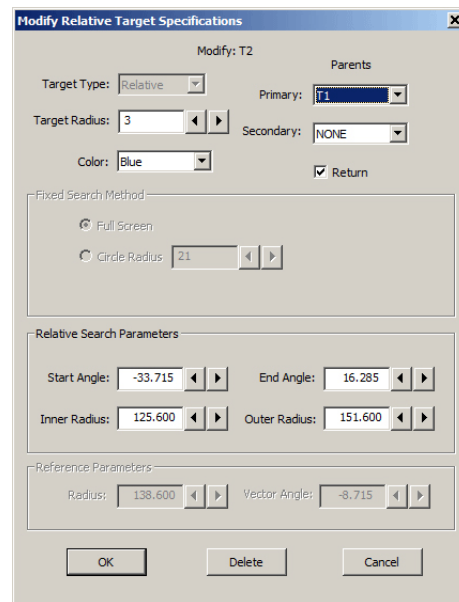
8. Click **OK.**
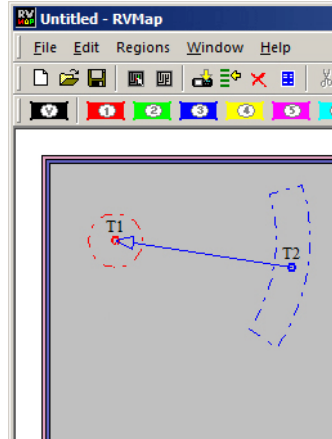
The *Relative Search Parameters* can be modified after the Relative target has been added.

To modify the parameters:

1. Double-click the target.

   The *Modify Relative Target Specifications* dialog box opens.

2. Type values or use the arrow buttons to adjust the values of the search area Start Angle, End Angle, Inner Radius, and Outer Radius. This defines the shape of the arc to look in. Enter -180 and 180 for the Start Angle and End Angle, respectively, to search in a complete circle.

3. To apply the changes, click **OK.**

Reference Targets

Reference targets can be created after one or more *Parent* targets have been place. References can be placed with one or two *Parents*.

When only a *Primary Parent* target is defined, the distance and angle (relative to 0, i.e. the horizontal axis) from *Reference* target to the *Primary* target is preserved.

When two *Parent* targets are defined, the distance from the reference to the *Primary* target is preserved, and the angle from the *Secondary Parent* to the *Primary Parent* to the *Reference* target is also preserved.

Example: When a two LED headstage, red and green, is used with a mouse, a reference point may be placed on the nose. There is no LED there, but the distance from primary target to the nose is constant, and so is the angle between the green LED, the red LED and the nose. In this way the nose can be tracked without having to place an LED directly on the nose.

**To place a reference target:**

1. Click the **Target** button on the **Region** toolbar.

2. Click the target in the image window.

   The *Select New Target Specifications* dialog opens.

3. In the **Target Type** dropdown list, select **Reference**.

4. Under *Parents*, select the desired target from the **Primary** and **Secondary** (if applicable) drop down lists.

5. Select or clear the **Return** checkbox to determine if data from this target will be returned to the RZ for real-time analysis and/or storage.

6. Click **OK.**
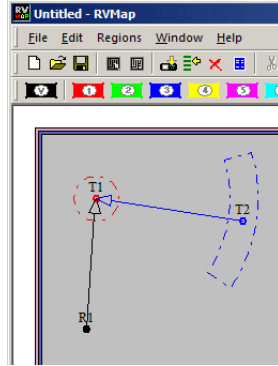
Saving Configurations

The configuration is saved to an RVMap file (∗.rvm).

To save the map file:

1. Click the **File** menu and click **Save As.**

2. Browse to the desired location, type a name in the **File name** box, and click **Save.**

To upload to an RV2:

1. Click the **File** menu and click **Send Config to RV2.**

   or

   Click the 🗀 button on the toolbar.

2. If prompted, select the hardware.

3. In the Create/Replace Config dialog box, enter a name in the New Config Name box and click **Send.**

4. Verify that the new config is listed as the Current Config on the Live tab of the RV2 interface.

   You are now ready to begin your OpenEx recording.

Scale/Offset Objects

The entire map can be scaled or offset using the Scale/Offset Object tools. These tools simplify adjustments to the map that may be required if the distance or placement of the camera has changed since the map was configured.

To open the Scale/Offset Objects dialog:

- Click the **File** menu and click **Scale/Offset Objects.**
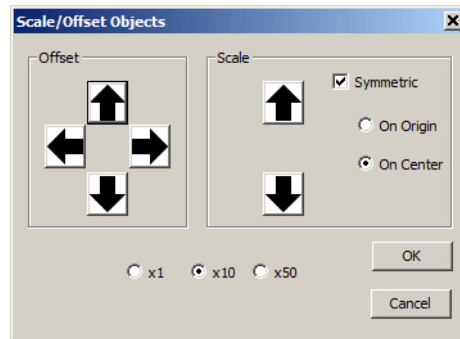
Offset	Click arrows to offset（move）the map in the indicated direction.
Scale	Choose among the options then click the arrows to adjust the size of the map.
Factor	Choose x1, x10, or x50 to determine the factor of adjustments applied when using the scale or offset arrows.
OK	When adjustments are complete, click to close the dialog and apply the changes.
Cancel	Click to discard changes.

Workplace Settings

The workplace settings, including range/units of the display, camera settings, and tracking details can be accessed in the Settings dialog bog.

The Settings dialog can be opened using the [icon] Settings button on the toolbar or from the File menu.
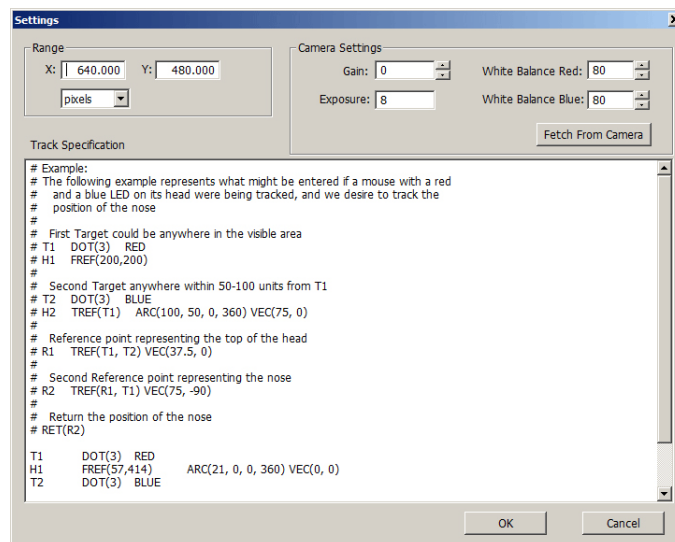
Reference Points and Range

The units/scaling of the workplace and all X, Y coordinate values returned by the tracking algorithm are determined by the following image window *Reference Points*:
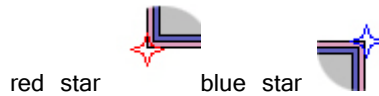
red star   blue star

By default, the red star and blue star Reference Points are positioned, respectively, in the bottom left and top right corners of the image. The red star defines the center point (0,0) and the blue star defines the position of the (X,Y) range value in the Settings dialog.
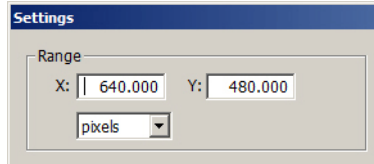
After the range values have been defined, click OK to apply them to the RVMap settings.

The *Reference Points* can be dragged to a new position, such as the location of a known object in a displayed image, to help define a real-world scale for the image. For example, a ruler might be placed in the camera frame and the Reference Point can be dragged to each end of the ruler so that the X,Y coordinates will be redefined based on the ruler visible in the image.

To select and move the *Reference Points* **simultaneously:**

- Hold down the CTRL key and click each of the *Reference Points*. They are now both selected and both will move in unison.

Camera Settings

The Camera Settings area of the Settings dialog box enables user to retrieve settings from the camera so that they can be stored with the configuration and applied each time that configuration is used. The RV2 does not maintain the camera settings after it is rebooted, so it is a good idea to store the current settings in the configuration file. The values you see initially are the default values.

To retrieve the camera settings to be applied each time the configuration is loaded:

- Click **Fetch From Camera.**

The Live tab on the RV2 interface provides an AutoOnce button that tells the camera to perform its own auto-adjustment of exposure, gain and white balance. The Lighter and Darker buttons on the Live tab are used to adjust the exposure time. There is no direct control of gain and white balance on the RV2 interface, so if you want to manipulate those values you will have to adjust them in the Settings dialog and upload the configuration to the RV2 to apply those camera settings. See "Saving Configurations" on page 9-31, for more information on uploading the configuration.
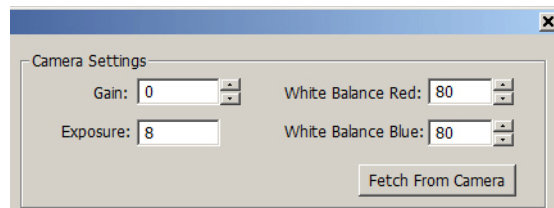
Track Specifications

The Track Specifications area of the Settings dialog box displays details of the current map configurations and can be used to edit and/or enter configurations in a text format.

An example is displayed in the commented text (the lines begin with '#') to provide some description of the structure. Targets can be refined here more precisely than in the GUI. This method is recommended for users who are very familiar with the system and scripting. In general, it is easiest to use the GUI to design the tracking algorithm and visit the Track Specifications textbox later if necessary.

Menu and Toolbar Reference

Menus

File Menu

New	Open a new RV Map file.
Open	Launch the Load RV Map File dialog box.
Close	Close the application.
Save	Save changes to the current RV Map File or launches the Save RV Map file.
Save As	Launch the Save RV Map file.
Load Image	Launch the Specify Image File and enable the user to load a saved snapshot image.
Load Image from RV2	Load a snapshot image from a connected camera. If a default hardware device has not been previously defined, the Load Image From dialog box is launched to prompt hardware selection.
Send Config to RV2	Send the current configuration to the RV2. If a default hardware device has not been previously defined, the Send Config To dialog box is launched to prompt hardware selection.
Use Configs	Retrieve a list of available configuration on the RV2 and allow the user to select a configuration. If a default hardware device has not been previously defined, the Use Config On dialog box is launched to prompt hardware selection.
Purge Configs	Delete the previously saved configurations on the RV2. If a default hardware device has not been previously defined, a dialog box is launched to prompt hardware selection.

Settings	Launch the Settings Window and allow the user to define range, camera, and track specifications.
Exit Manual Mode	If RV2 is manual mode and is NOT recording, a command to exit manual mode is sent. The RV2 will display the message: Remote RvMap User Exited Manual Control.
Page Setup	Enable the user to define specifications for printing the image.
Print	Print the currently displayed image.
Print Preview	Preview how the currently displayed image would be printed.
Recent File	List recently used RV Map files.
Exit	Close the application.

Edit Menu

Undo	Undo the most recent action.
Redo	Redo the most recent action.
Cut	Cut the selection and put on the clipboard.
Copy	Copy the selection and put on the clipboard.
Paste	Insert clipboard contents.
Delete	Delete selection.
Show/Hide Regions	Toggle the region image overlay on or off.
Edit Vertices	Enable click-and-drag editing for a selected region. Drag Vertices to change the shape of the image, or CTRL+click to add/remove vertices along the region boundary.
Scale Objects	Launch the Scale/Offset Objects dialog box.
Change Region	Launch the Change Region Type dialog box and enable the user to change the region label for a selected region.
Lock References	Lock the Reference Points at their current positions.
Reset References	Reset Reference Points to their default positions.
Use Default RV2	Make the currently connected RV2 the default hardware throughout the software.

Regions Menu

Void	Enable multi-click region drawing tool to define a void region.
Region-1	Enable multi-click region drawing tool to define Region-1.
Region-2	Enable multi-click region drawing tool to define Region-2.
Region-3	Enable multi-click region drawing tool to define Region-3.
Region-4	Enable multi-click region drawing tool to define Region-4.
Region-5	Enable multi-click region drawing tool to define Region-5.
Region-6	Enable multi-click region drawing tool to define Region-6.
Region-7	Enable multi-click region drawing tool to define Region-7.
Region-8	Enable multi-click region drawing tool to define Region-8.

Targets   Enable click drawing tool to place a new target.

Window Menu

New Window   Not currently used.

Cascade   Not currently used.

Tile   Not currently used.

Arrange Icons   Not currently used.

Zoom 50%   Display the image in the main window at 50%.

Zoom 100%   Display the image in the main window at 100% (scale 1:1).

Zoom 200%   Display the image in the main window at 200%.

Help Menu

About RVmap   Display program information including version and copyright.

Toolbars

Standard Toolbar

New   Create a new document.

Open   Open an existing document.

Save   Save the active document.

Load Image   Load bitmap image from disk.

Load Image From RV2 Load snapshot from RV2.

Send To Hardware   Send the active configuration to RV2 and set it as the current configuration.

Use Configs   Tell RV2 which rvm file to use.

Purge Configs   Purge unused rvm files from RV2.

Change Settings   Change settings, such as range, camera settings, and tracking details.

Cut   Cut the selection and put on the clipboard.

Copy   Copy the selection and put on the clipboard.

Paste   Insert clipboard contents.

Icon	Command	Description
⬚	Show/Hide Regions	Toggle the region image overlay on or off.
▣	Edit Vertices	Enable click-and-drag editing for a selected region. Drag Vertices to change the shape of the image. CTRL+click to add/remove vertices along region boundary.
▱	Change Regions	Launch the Change Region Type dialog box and enable the user to change the region label for a selected region.
🔒	Lock Reference Points	Lock the Reference Points at their current positions.
⬓	Reset Reference Points	Reset Reference Points to their default positions.
🔍	Zoom 100%	Zoom to 100% (scale 1:1).
🔍	Zoom 200%	Zoom to 200%
🖨	Print	Print the active document.
❓	About	Display program information including version and copyright.

Region Toolbar

Icon	Command	Description
V	Draw Void Region	Select pen to draw void region.
1	Draw Region 1	Select pen to draw region 1.
2	Draw Region 2	Select pen to draw region 2.
3	Draw Region 3	Select pen to draw region 3.
4	Draw Region 4	Select pen to draw region 4.
5	Draw Region 5	Select pen to draw region 5.
6	Draw Region 6	Select pen to draw region 6.
7	Draw Region 7	Select pen to draw region 7.
8	Draw Region 8	Select pen to draw region 8.
T	Draw Targets	Select pen to place a new target.