Real Time Interactive Mapping System (RIMS)
Barebones User's Guide v1.0
Oct. 30, 2006

Copyright (C) 2006, Eric Cowgill
RIMS program, Copyright (C) 2006, Tony Bernardin

If you publish results obtained using RIMS, please cite the G-cubed paper by Bernardin, T., E. Cowgill, R. Gold, B. Hamann, O. Kreylos, and A. Schmitt, 2006, Interactive mapping on 3-D terrain models: Geochemistry, Geophysics, Geosystems, 7, Q10013, doi:10.1029/2006GC001335

You are strongly encouraged to read the following directions before doing any extensive mapping with RIMS.

See the Readme file distributed with RIMS for important information.

RIMS is a proof-of-concept, prototype research application developed during ongoing research at the University of California, Davis. It is not a commercial package and users should expect to encounter problems during its use. Despite its developmental status, we've found it to be quite useful and hope you will too.

RIMS is distributed as is and with no support. Please do NOT contact the authors directly with support requests or problem reports. If you have trouble running RIMS, find bugs, or have suggestions and/or requests for future development, please submit that information through the KeckCAVES site (www.keckcaves.org), as that will allow us to track that important information.

RIMS is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version. RIMS is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

* RIMS currently only runs in Windows (see Readme.txt for requirements). Mac/Linux versions are under development. Two modes of RIMS are available:
    - DEMOv###: Double-click on the executable to automatically load preprocessed DEM and texture data provided with the demo.
    - RELEASEv###: command-line launch that requires you to load your own DEM and texture (image) data, after they have been preprocessed using the Quadbuild.exe utility.

* This user manual is in two parts. "RIMS controls" describes the basic operation of the program. "Quick Reference" provides the same information in summary form.

RIMS Controls:

0. Launching

a. Demo version

*Download and unpack the compressed demo. Navigate into the demo folder and double-click on the executable.

*To expand the display to full screen: double click on the frame at the top of the RIMS display window. This allows you to still see the program windows at the bottom of the screen. To completely fill the screen, press the "esc" key, right click on the view and select "fullscreen" from the menu. Press "esc" again to reactivate RIMS.

b. Release version

* Download and unpack the compressed release.

* Prepare a matched set of DEM and texture (image) data that satisfy the criteria specified in the Quadbuild Manual, and then run the Quadbuild utility to preprocess the data and generate the RIMS input files. Note that the texture is not strictly needed to run.

* Place the *.qdb and *.qdh files generated by the Quadbuild utility into the folder containing the release version of the RIMS executable. Open a command window and change directories into this folder.

*type RIMS "DEM_filename" if only using a DEM or RIMS "DEM_filename" "Texture_filename" (leave off extensions) if also using a texture. RIMS display should open with image and interaction cursor (red wedge) visible in plan view. If not, see Troubleshooting Manual.

*To expand the display to full screen: double click on the frame at the top of the terrain display window. This allows you to still see the program windows on the taskbar at the bottom of the screen. To completely fill the screen, press the "esc" key, right click on the view and select "fullscreen" from the menu. Press "esc" again to reactivate RIMS.

1. Navigation & Display

* The interaction cursor is a red wedge that can be moved across the terrain using the mouse. The blue line denotes the current center of the view.

* To use the navigation keys, press ***and hold down*** the one of the following keys and then move the mouse:

a = zooms in/out on the red wedge. Forward-back motion of mouse moves scene away or towards you, i.e.,

forward mouse motion zooms out

backward mouse motion zooms in

e = rotates about vertical and horizontal axes.
forward-back motion of mouse tilts scene around horizontal axis
left-right motion rotates scene about vertical axis

f = moves scene so that red wedge is in center of view. Use this to pan around the scene.

*Alternatively, you can move the image around the blue camera position without jumping to the cursor by pressing ***and holding down*** one of the following keys and then moving the mouse:

z = zooms in/out on the blue camera line. Forward-back motion of mouse moves scene away or towards you, i.e.,
forward mouse motion zooms out
backward mouse motion zooms in

d = rotates about vertical and horizontal axes centered on the blue camera line.
forward-back motion of mouse tilts scene around horizontal axis
left-right motion rotates scene about vertical axis

c = moves scene so the blue camera line is in the center of the view.
right motion moves mouse to right over terrain
left motion moves mouse to left over terrain.

*Display adjustments

j = adjust z-scaling. Press & hold j key while pulling mouse down to dynamically increases vertical exaggeration. Exaggeration level is indicated by "Vexa" value at the top of screen.

- = Resets scene to 1:1 vertical exaggeration and normal x & y scale

k = distort scene by stretching x & y scales independently (not clear why you'd want to stretch your data like this). Press "-" to reset the view.

p = turns on/off edge highlighting. Not generally useful.

2 = turns on/off extraction of a surface "skeleton" from mapped lines. Not generally useful.

*Selecting mapped lines:
Position red wedge over point/line to be selected, then press "space" or center button on a 3-button mouse to select the line.

*Deselecting mapped lines:
Move red wedge away from point/line and press "space" or middle button on 3-button mouse. Line should deactivate. If not, cursor is too close to the line.

2. Mapping

* To attribute, save, and export/import mapping you must switch back and forth between the terrain display and the command prompt. Mapping thus works best if the terrain display is not in fullscreen mode, but is fully expanded with the program windows visible on the taskbar. This allows you to easily switch between the display and command windows by using the mouse to click on the appropriate window in the taskbar.

* Alternatively, a dual-monitor system allows you to have the RIMS display on one monitor and the command line window (or better yet a GIS project) on the other.

* If you have only one monitor and you want to map in fullscreen mode, you can toggle between the terrain display and command window screens by holding down the Alt key and then tapping the Tab key to toggle through the applications you have open until the one you want is selected. Releasing the Alt key will then pop the selected window to the front.

a. Drawing & Editing Polylines

*To map, left-click (LC) with mouse and draw the line. To end the line, right-click (RC). You can't start mapping if another line is selected (i.e., nodes are displayed).

*To edit mapping, move red wedge over line and press spacebar to select it (nodes will turn on). Now move wedge over the node you want to edit so that it switches from orange to red. Node can be added to a line segment when the line switches to orange.

-to insert node: RC and drag in middle of segment
-to delete node: RC only (no drag!) on top of node to kill
-to continue line: select endnode, RC and drag. Repeat for more nodes.
-to delete line: select and then hit delete button (DANGER: no undo!).

*NOTE: all of the "navigation & display" keys are still active, so you can change views while mapping.

*NOTE: There is no "undo" function yet.

*NOTE: To attribute lines for classification and decoration in GIS, see Section 2d below. If lines are to be decorated with asymmetric symbols (e.g., ticks along only one side of the line), it is particularly important to read the note on the direction in which lines should be mapped.

b. Export mapping

*Start by drawing a few lines. With the RIMS window still active, press the "o" key. Nothing obvious will happen, but the program is now waiting for you to input a filename.

*Switch to the command window by

- selecting it on the taskbar with the mouse, or
- selecting it on another monitor with the mouse, or
- holding down the Alt key and tapping the Tab key to toggle through the applications until you get to the command window and then releasing the Alt key

*The prompt in the command window should now read: "Export file name (without the extension)". Enter a name for the vector output and press enter to save the file in *.e00 format in the current project directory. To specify an alternative directory add the appropriate path as a prefix to the file name.

*Switch back to the RIMS window by
- selecting it on the taskbar with the mouse, or
- selecting it on another monitor with the mouse, or
- holding down the Alt key and tapping the Tab key to toggle through the applications until you get to the command window and then releasing the Alt key. You'll need to press the "Esc" key to reactivate the interactive cursor and continue mapping.

*NOTE: It is strongly recommended that you "version" your mapping by saving frequently and using a different file name at each save.

*NOTE: To avoid problems importing e00 to Arc, do not digitize more than 400 nodes in a single line.

*NOTE: see Section 2f for information on attributing mapping for subsequent classification and decoration in ArcGIS 9.

c. Import mapping

* If the mapping was done in a RIMS project with the same projection & datum, press the i key. Nothing obvious will happen, but the program is now waiting for you to input a filename.

*Switch to the command window as described in the "export mapping" section above. Prompt should now read "Import file name (without the extension)". Enter the name of the e00 file to import, press return, and switch back to terrain window as described in the "export mapping" section above.

*If the mapping was done in another program, then you'll need to convert it first:
-make a copy to be edited
-reproject it to the same projection and datum as the DEM and texture (if needed)
-delete all possible attribute fields
-add a field with the following characteristics:
    name: L_CLASSSTR
    Type: String
    Length: 10
-export the file to *.e00 format, saving it in the RIMS project folder
-launch RIMS and import the e00 file as described above.

d. Attributing Lines:

*You can assign 4-digit numerical codes to each mapped line before you draw it to attribute your mapping. This is useful if you want to classify your mapping, export the file to a GIS application, and then decorate the mapped lines using symbols in a styles file. See Section 2f for more information. The "Map Conventions.pdf" file in the ARC folder at the RIMS download site found at www.keckcaves.org provides a list of 4-digit attribute codes that can be used to classify lines while mapping in RIMS and then decorate those lines in ArcGIS 9 using the standard map symbols provided in the

GPSec.style file created by Eric Cowgill. You can also use the attributing function to create your own set of map conventions and custom styles file.

*To start attributing, launch RIMS and then press the g key. It is important to do this before you start mapping. Nothing obvious will happen, but the program is now waiting for you to input a filename.

*Switch to the command window as described in the "export mapping" section above. The prompt should ask you to "Input new line type id-number". Enter a 4-digit number to classify the line you are about to map, press return and switch back to the terrain display window as described in the "export mapping" section above.

*Map line. All subsequent lines will have the same attribute code until the g key is pressed again and the code is changed.

*NOTE: it is critical to pay attention to the direction in which you are mapping the line if it is to be decorated with an "asymmetric" symbol such as that for a scarp, which only has ticks on one side of the line, or a monocline, which has a short arrow on the steeply dipping limb and a long arrow on the gently dipping limb. RIMS, the L-CLASSSTR field, and the GPSec.style file are all set up presuming that such symbols "point" toward the left-hand side of the line when it is mapped. For example, an east-west trending, active, well-located monocline with **north**-dipping limbs and the steep limb on the north side should be mapped as #1811 (Mono1) and drawn from **west** to **east** so the arrows point **north** (i.e., towards the left side of the line in the direction of digitization). In contrast, an east-west trending, active, well-located monocline with **south**-dipping limbs and the steep limb still on the north side should be mapped as #5811 (Mono2) and drawn from **east** to **west** so the arrows point **south** (i.e., still towards the left side of the line in the direction of digitization).

*NOTE: there is currently no easy way to swap the mapping direction for a line in RIMS. If the line was mapped in the wrong direction you could manually edit the e00 file to correct the error, but it's usually simpler to just delete the line and remap it correctly.

*NOTE: if you need to edit the classification number for a line you can either delete and remap the line or save the e00 file, quit RIMS, and then open the e00 file in a text editor and manually change the L-CLASSSTR value in the list at the end of the file.

e. Load Mapping into ArcGIS 9

* make a backup copy of the e00 mapping file.

* Launch ArcCatalog, Select View > Toolbars and make sure ArcView8x tools are on.

* In the "conversion tools" menu select "import to interchange", specify input and output file names and directories. Note that you can run the import tool in batch mode to ingest more than one e00 file at a time. Also note that we have found this conversion method to be much more stable than the one available in ArcToolbox.

* If the RIMS and ArcMap projects have the same projection and datum, the imported file can be loaded without a projection. Otherwise projection/datum will need to be assigned.

*NOTE: Neither the ArcCatalog nor ArcToolbox e00 conversion tools in ArcGIS v9.1 can import an e00 file with line segments that have more than 400 nodes. If there is a line with more than 400 nodes, ArcToolbox will hang and the process must be killed manually, whereas ArcCatalog just fails to import.

f. Decorate Lines in ArcGIS 9 Using Symbols in Styles File

*This information is provided for users who wish to import their mapping into ArcGIS 9 and then decorate the mapped lines using the set of standard symbols developed by Eric Cowgill. It is presumed that you have attributed your mapping within RIMS using the 4-digit L-CLASSSTR values shown in the "Map Conventions.pdf" file available in the ARC folder in the RIMS download site at www.keckcaves.org. It is also presumed that lines to be decorated with "asymmetric" symbols have been mapped in the correct direction as explained in the note in Section 2d, above.

*Go to the RIMS download area at www.keckcaves.org and download the Arc style file "GPSec.style" available from the ARC folder. Note where you save it.

*Launch ArcMap and import the mapping done in RIMS, as described in Section 2e.

*Load the GPSec.style custom style file into the ArcMap project
-in ArcMap select Tools > styles > style manager.
-StyleManager window opens.
-In StyleManager window select Styles pull down and select new stylefile "GPSec.style"
-Folder will appear in leftmost tree
-Check the style file: expand the GPSec.style folder in tree and open the Line Symbols folder. The new line styles should appear in column to right.
-Close Style Manager.

*Apply styles to project
- In ArcMap table of contents, right click on coverage to be decorated and select properties
- Click on Symbology tab
- Click on Categories in tree on left
- Select "match to symbols in a style"
- Select L-CLASSSTR in Value Field in pull-down menu
- Select "GPSec.style" in "match to symbols in style"
- Press "Match Symbols" button and then "Apply" and "OK"

*If symbols are too big/small, try setting a reference scale:

- in ArcMap go to View > Data Frame Properties and select the “General Tab”
- set reference scale t0 1:750,000

*Now apply the reference scale to the RIMS mapping imported into ArcMap:

- right click on the coverage imported from RIMS in table of contents
- select properties
- select Display tab and tick “scale symbols when a reference scale is set”

3. Virtual Geologic Compass (VGC):

Virtual compasses are just like mapped lines: they can be created, selected, modified, deselected, etc.

*Press “9” to switch into VGC mode.

*Click left mouse button to drop a measurement point (horizontal VGC plane will flash).

*Position red wedge over measurement point and press the space bar to select the point. Plane stays on and orientation of the VGC plane (“azi” and “dip” values) are displayed at top of screen. The values are corrected for vertical exaggeration, as needed.

*Press and hold the left mouse button to grab and move the VGC point/plane with the mouse. Release the button to drop the point.

*Press and hold the right mouse button to change the azimuth (left/right mouse movement), and dip (forward/back mouse motion) of the VGC plane.

*NOTE: the dip value is measured from horizontal and ranges from 0° to 90°. The azi value reports the direction your thumb would point if your right hand were placed on the dipping plane such that your index finger points down-dip. Azi values range from 0° to 360°. When RIMS is first launched and the data are in plan view, the 0° direction points orthogonally at the left side of the display (i.e., “west”), 90° points orthogonally towards the top of the display (i.e., “north”), 180° points orthogonally towards the right side of the display (i.e., “east), and 270° points orthogonally towards the bottom of the display (i.e., “south”). If your data are rotated such that sides of the image are not parallel to lines of longitude, then you will need to apply a correction to the reported azi values to account for this rotation. The azi values are always reported with respect to the sides of the tile, and thus do not change if the tile is rotated as described in Section 1 above.

*NOTE: we’re currently working on a plane-from-points extraction feature that will allow users to drop a series of points on a surface and then calculate the strike, dip, and error for the best-fit plane through that set of points.

*When a VGC plane is selected, you can chose to keep the plane displayed when the VGC point is deselected by pressing the '[' key. Now move the interaction cursor away

from the plane and press the space bar to deselect it. Plane lightens but remains displayed. To reset this behavior and hide the plane when the VGC point is deselected, reselect the plane and press the ']' key. The [and] keys toggle the display behavior for individual VGC points.

*To kill a VGC point/plane, select and then press the “delete” key.

*Press “0” to switch back to line mapping.

4. Surface Projection from Mapped Lines

*WARNING: this utility is “proof-of-concept”. Work on the admittedly clunky user interface is ongoing!

*Start by mapping a line, or set of lines, through which you wish to project a surface.

*Press “2” key to turn on/off the projection of one plane per mapped line. When turned on, each line that is selected/activate will have plane generated out of it.

*Press “3” to turn on/off surface projection through multiple lines. In this mode, every line selected will be added to a list of features through which a curved surface will be projected. IMPORTANT: the lines must all have been mapped in the same direction (e.g. if the first line was mapped from west to east, the others must also be mapped from W-E. Mapping an E-W line in this case will generate a twisted curve.

*Press “4” to turn on/off adding selected lines to surface extraction: if turned off (on is the default) you can select previous line maps that are part of the current surface extraction without adding them into surface extraction. Changes on control points there will affect the surface.

*To modify the projected surfaces:

keys ',' and '.' move between different pairs of tangent lines
keys 'v' and 'b' increase/decrease the length of the green tangent line
keys 'n' and 'm' increase/decrease the length of the red tangent line

Quick Reference:

1. Navigation:

f = pan/jump around red wedge
e = rotate/ tilt around red wedge
a = zoom in/out around red wedge
z = zooms in/out on the blue camera line.
d = rotate/tilt about the blue camera line.
c = pan scene around blue camera line
j = adjust z-scaling. Scale level is indicated by "Vexa" at top of screen.
- = reset to 1:1 vertical exaggeration and normal x & y scale
Spacebar = select point/line under red wedge
k = distort scene by stretching x & y scales independently. Not useful
p = turns on/off edge highlighting. Not useful.
2 = turns on/off extraction of a surface "skeleton" from lines. Not useful.

2a. Mapping:

*press "g" (can enter 4-digit value to attribute the line you are about to map).
*LC with mouse to drop node. RC to end line.
*spacebar to select line & activate nodes
*insert node: RC and drag in middle of segment
*delete node: RC only (no drag!) on top of node to kill
*add nodes: select end node, RC and drag. repeat
*delete whole line: select line and press delete

2b-c. Import/Export:

o = export *.e00 file (do not type extension)
i = import *.e00 (do not type extension)

3. VGC

9 = switch into VGC mode
0 = switch out of VGC mode.
LC mouse = drop/move VGC point/plane.
RC mouse = adjust strike & dip
[= toggle on continuous display of individual VGC planes when deselected
] = toggle off continuous display of VGC planes

4. Surfaces

2 = turn on/off extrapolation of one surface per line
3 = turn on/off one surface through multiple lines.

4 = turn on/off addition of selected lines to surface extraction (on is the default)
, or . = move between different pairs of tangent lines
v or b = increase/decrease the length of the green tangent line
n or m = increase/decrease the length of the red tangent line