

# Racket Validation Plug-in

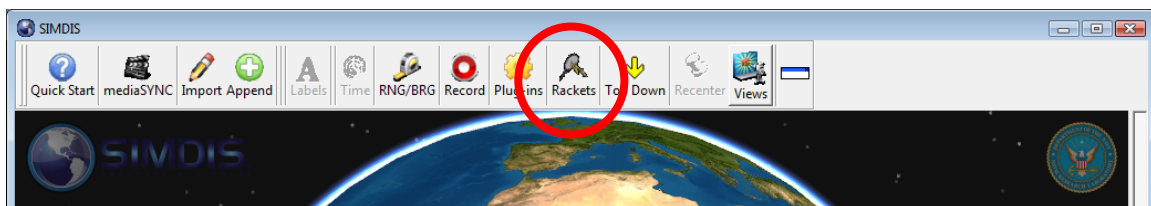
April 29, 2009

## Introduction

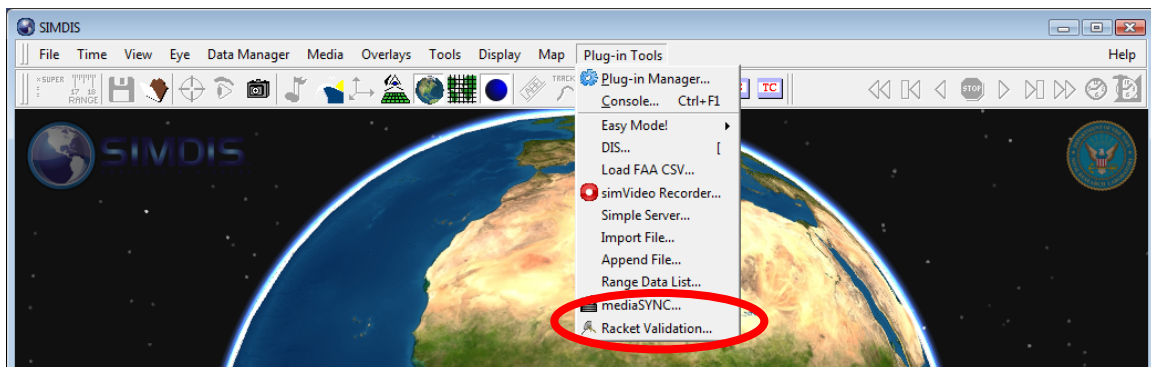
The Racket Validation Plug-in allows an operator to visualize a Racket Report and verify the results of an Electronic Warfare (EW) exercise. The plug-in works with a SCORE TSPI CSV or SIMDIS ASI or FCT file which contain the ground truth positions of the reporting units. The plug-in requires at least 3 different types of files: Racket File, Debrief File and Band File. All times must be specified in UTC and call signs within the Racket and Debrief files must match those found in the ground truth data. The user may specify multiple files of each type. In order for an accurate assessment to be performed, the times in the files should be within the time range of the ground truth data.

The data in the Racket Table can be saved in a Session file for later use. The Session file is a CSV file that contains the data found in the Racket Table plus the files specified by the user that created the Racket Table. The user can save the state of software to a Session file. At a later time the user can restore the state of the software by loading the Session file. The Session file is also useful as a final data product.

Once SIMDIS has been started, the Racket Validation plug-in can be accessed via the “Racket” tool bar button in Easy Mode, as illustrated below.



In Advanced Mode, the Racket Validation plug-in can be accessed via the “Racket Validation...” button in the Plug-in Tools Menu, as seen below.



## Main Dialog

The Main Dialog is divided into 3 parts with 5 sections. The top part is the menu bar section with contains only a File Menu. The middle part contains the 3 sections of Input Parameters, Metrics and Messages. The bottom part contains the Racket Table

Unit	Time	Assessed Emitter	Assessed Bearing	Racket Points	Emitter	OPFOR Call Sign	Calculated Bearing	Emitter Points	Valid Emitter	Valid Bearing	Valid	Comments
------	------	------------------	------------------	---------------	---------	-----------------	--------------------	----------------	---------------	---------------	-------	----------

## File Menu

The File Menu contains the entries of “Open Session...”, “Save Session...”, “New Session...”, “Open File...”, “Mapping...”, “Bookmarks...”, “Preference...”, “Help...”, “About...” and “Close”.

**Open Session** – Allows the user to load a previously saved session. Selecting the Open Session will display the standard File Open Dialog.

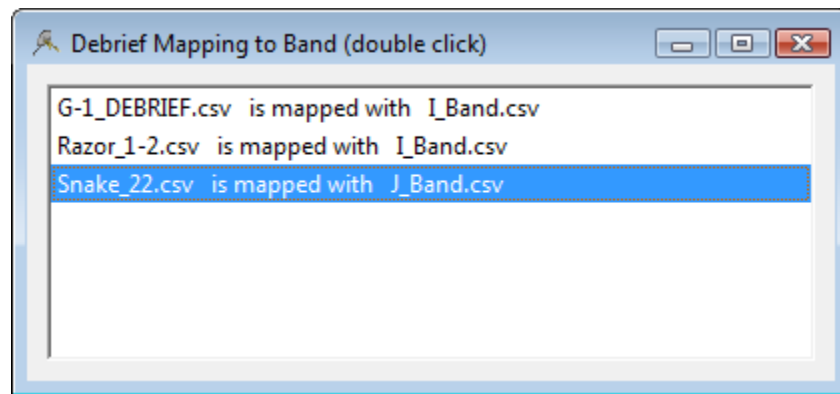
**Save Session** – Allows the user to save the results of the Racket Table to a comma separated value file (.csv) for later use or printing. The user should not hand edit the session file as it is automatically generated by the Racket Validation plug-in. Selecting the Save Session will display the standard File Save Dialog.

**New Session** – Clears out the Racket table and all loaded files.

**Open File** – Allows the user to specify the files necessary for the Racket Report. Selecting the Open will display the standard multi-File Open dialog. The plug-in supports 3 types of files, the Racket File, the Debrief File and the Band File. The plug-in needs at least one of each type of file. To ease the burden on the operator the software auto-detects the file type using the first line of text in the file. After reading in the files,

the plug-in will display the Debrief Mapping to Band Dialog to allow the user to review the automatic association, if any. The user can add or change associations as necessary. When the user closes the dialog, the plug-in will calculate the validations and display the results in the Racket Table. **NOTE:** A *SCORE TSPI CSV* or *SIMDIS ASI* or *FCT* file which contain the ground truth positions of the reporting units is required to be loaded first prior to loading the individual Racket and OPFOR .csv files.

Mappings – Allows the user to change which Band File is associated with a Debrief File via the Debrief Mapping to Band Dialog. If the band is specified in the Debrief File the plug-in will automatically associate a band file to the Debrief File. If the Debrief File does not specify the band or if the user wishes to override the automatic selection, the user may select a new Band file for a Debrief File. The user selects a new Band file for a Debrief File by double clicking on the Debrief entry in the dialog. Double clicking will display a standard File Open Dialog. When finished making the new associations, the user closes the Debrief Mapping to Band dialog by clicking the X in the upper right corner.

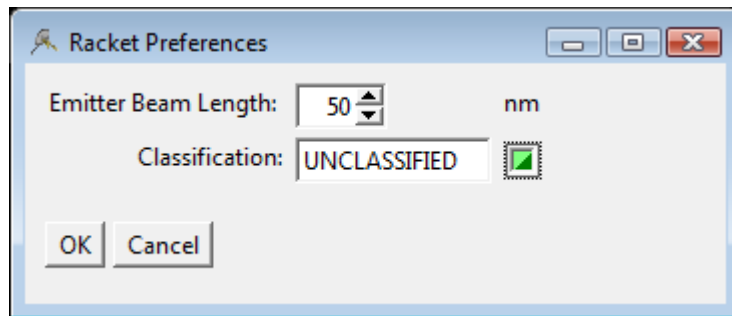


Bookmark Dialog – Allows the user to change the scenario's time via the Bookmark Dialog. The dialog is populated with the Racket's assessed times and the Emitter's on time. Single clicking on an entry will update the scenario time to the time specified in the Time column. The user may sort by any column by selecting the column header. First click sorts ascending and the second click sorts descending. When finished setting the scenario time, the user closes the Bookmark dialog by click the X in the upper right corner.

The screenshot shows a dialog box titled "Racket Bookmarks". It contains a table with the following data:

Type	Call Sign	Emitter	Time
Emitter	LR-3	ABC-9	294 2008 08:58:00
Emitter	LR-3	ABC-10	294 2008 09:00:00
Emitter	LR-3	ABC-11	294 2008 09:02:00
Emitter	GLF-1	ABC-34	294 2008 09:12:00
Emitter	LR-3	ABC-9	294 2008 09:15:00

Preferences – Allows the user to change options via the Preferences Dialog. The dialog currently has the Emitter Beam Length in nautical miles and Classification with color specification. Change the Emitter Beam Length by either typing a new value or clicking on the up and down arrows. Change the Classification by typing new text. Change the Classification Color by double clicking on the Color Well. When finished close the Preference Dialog by clicking the X in the upper right corner or by clicking the OK button. Changes can be discarded by pressing the Cancel button.



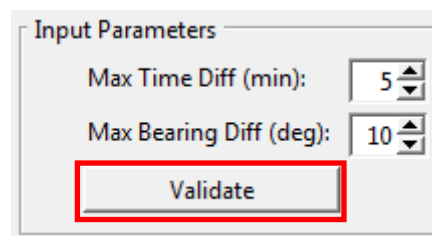
Help – Displays this document.

About – Displays version information about the Racket Validation Tool Dialog.

Close – Allows the user to close the Racket Validation Tool Dialog.

## Input Parameters

The Input Parameters section allows the user to control the tolerances for the automatic validation calculation. The user may specify the maximum time difference and the maximum bearing angle difference. When the user changes either value the Validate Button is enabled. Pressing the button, see screen shot below, will update all the entries in the Racket table writing over any previous user supplied information.



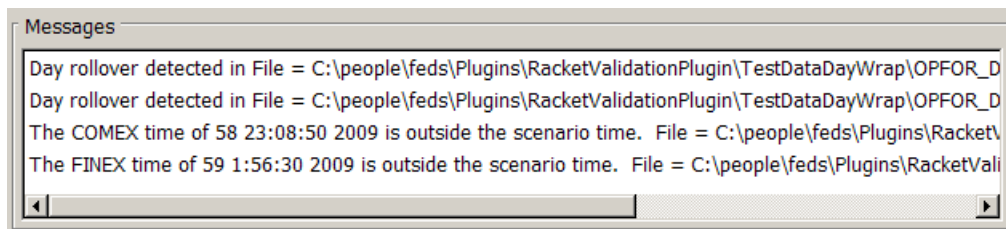
## Metrics

The Metrics section provides a summary of the Racket entries. The Metrics summary will automatically update when the user presses the Validate button in the Input Parameter section or if the user overrides a field in the Racket Table.

Rockets:	Number of rockets specified in the racket report(s)
With Track Data	Number of rockets with SIMDIS data
With Emitter Data	Number of rockets specifying an emitter with SIMDIS data
With Both	Number of rockets with both track and emitter data
Overall Valid	Percentage of rockets that have both the reported emitter name and bearing correct
Valid Emitter	Percentage of rockets that have the emitter name correct
Valid Bearing	Percentage of rockets that have the bearing correct

## Messages

The Message section is an area for the plug-in to display error messages. See the screen shot below for an example of the Message area with error messages. Since the software is designed to allow the user to specify multiple files at once it is better to display possible error messages in a list instead of requiring the user to acknowledge every error via a pop up dialog. The user should review all messages in the section with particular attention to messages about time errors. Since the times specified in the files are not complete the software must create a composite time from several input sources while still accounting for missions that cross a day boundary. Most error messages provide the complete file name and line number causing the problem. The user may clear the messages from the list via right mouse clicking and selecting “Clear Messages”.



## Racket Table

The Racket Table displays the Racket Entries with the calculated Emitter and validation fields. The columns are:

Unit	The call sign of the assessor
Time	The assessed time
Assessed Emitter	The assessed emitter name
Assessed Bearing	The assessed absolute bearing in degrees, 0 to 360
Racket Points	True if the call sign exists as a platform in SIMDIS
Emitter	Calculated emitter name. The user may override this field by either right mouse clicking and selecting a new Emitter/OPFOR pair or by double clicking and typing in a new name.
OPFOR Call Sign	OPFOR call sign with the emitter. The user may override this field by either right mouse clicking and selecting a new Emitter/OPFOR pair or by double clicking and typing in a new name.
Calculated Bearing	Calculated absolute bearing in degrees, 0 to 360, to the calculated emitter
Emitter Points	True if emitter data exists in SIMDIS
Valid Emitter	True if the assessed emitter name matches calculated emitter. The user may override this field by double clicking the field.
Valid Bearing	True if the assessed bearing matches within the difference of the calculated bearing. The user may override this field by double clicking the field.
Valid	True if both Valid Emitter and Valid Bearing are true. The user may override this field by double clicking the field.
Comments	The initial value of the field is the comment from the Racket file. The user may add additional comments that will be saved with the session.

Single clicking on a Racket entry will update the scenario time to the time specified in the Time column. Double clicking on an entry will update the scenario time to the time specified in the Time column plus update the view to include both the Racket and the Emitter. The user may sort by any column by selecting the column header. The first click sorts ascending and the second click sorts descending. A right mouse click on a Racket entry in the Unit column has the following options:

Reset to Original Entry	Overwrites any user input with original values
Start of Assessed Time	Changes scenario time to the Assessed Time minus the Time Difference. The time maybe truncated by available data.
At Assessed Time	Changes scenario time to the Assessed Time
At Calculated Bearing Time	Changes scenario time to the time associate with the Calculated Bearing Time. The Calculated Bearing Time can be anywhere with the time Assessed Time plus or minus the Time Difference as modified by available data.
End of Assessed Time	Changes scenario time to the Assessed Time plus the Time Difference. The time maybe truncated by available data.
Details	Displays the file names and line numbers for the Racket, Debrief and Band file information that generated the Racket Entry.

A right mouse click in the Emitter and OPFOR columns allows the user to change the calculated Emitter and OPFOR pair.

## Algorithm

The plug-in uses an algorithm to calculate which Emitter/OPFOR pair to associate with a Racket Entry. The Input Parameters are used to control the tolerance of the algorithm. First the Assessed Time plus and minus the Time Difference is compared against the On Time and Off Time of an emitter. If it is possible the emitter was on during the time window of opportunity then the algorithm continues, otherwise the emitter is dropped and the algorithm goes to the next emitter. The algorithm verifies that scenario data is available for the time window and shortens the time window if necessary to match the available data. The algorithm calculates the bearings at a one second interval during the time window. The algorithm selects the calculated bearing closes to the Assessed Bearing. If the Calculate Bearing is within the Bearing Difference and the Emitter Name matches the Assessed Emitter the algorithm stops and declares a perfect match and exits.

If it is not a perfect match the algorithm determines if the delta between the Calculate Bearing and the Assessed Bearing is smaller than the current delta. If the delta is smaller than any previous delta, the algorithm marks the Emitter/OPFOR pair as the current best match. The algorithm continues until all active emitters are compared against the Racket Assessed values. If no perfect match is found, the best match is returned. If no best match is found (i.e., no emitters were on during the assessed time plus or minus the time difference) the algorithm returns N/A for both the Emitter and OPFOR and returns a value of -999 for the calculated bearing.

## Use Case

The user is expected to use the software as follows:

1. Start SIMDIS
2. Load the appropriate SCORE TSPI CSV or SIMDIS ASI file
3. Start the Racket Validation Plug-in
4. Select **File** then Select **Open File...**
5. Select all the associated Racket Files, Debrief Files and Band Files
6. The software responds by displaying the Debrief Mapping to Band Dialog
7. Review the association between the Debrief Files and the Band Files. The user will make any necessary changes by double clicking on the Debrief entry.
8. If necessary, the user adjusts the Bearing Difference and/or Time Difference values and presses the Validate button.
9. The software will respond by updating the Racket Table and the Metrics.
10. The user may adjust the scenario time via the SIMDIS time controls, or by single clicking on a Racket Table entry, or by single clicking on a Bookmark entry.
11. The user may adjust the view via the SIMDIS controls or by double clicking on a Racket Entry.
12. The user can override calculated values by either a right mouse click or a double click on a field in the Racket Entry.
13. The user can repeat step 7 through step 12 as necessary.
14. Once the user considers the report complete, the user can save the report as a Session file by selecting **File** and then the **Save Session...** option.
15. Saved Sessions can be reloaded by selecting the **File** and then **Open Session...** option. The session can then be modified, saved and reloaded as needed. Loading data via a session does not require step 2 or steps 4 through 7.



## Appendix: File Formats

All 3 file formats are comma separated value format, i.e., Excel CSV files. All times are expected to be referenced to UTC (Zulu). All required information must appear in the correct column.

### Racket Format

The Racket Format is used to specify the name, time and bearing of an assessed emitter. The first line must contain the word "Racket". The file header must contain the COMEX and FINEX in DDD HH:MM:SS YYYY format in UTC (Zulu). The file Header must contain the Unit Call Sign which must correspond to a call sign found in the SIMDIS ground truth data (SCORE TSPI CSV or SIMDIS ASI). After the header the file contains the Racket Entries. The entries include The Assessed time in DDD HH:MM:SS format in Zulu. Followed by the Racket Number, the Emitter name, the Emitter Frequency, the Emitter Pulse Repetition Frequency (PRF), the Emitter Scan and the Assessed Bearing. The bearing is true, in degrees, from 0 to 360. Blank entries are supported.

#### NOTES:

*Typically these files are distributed as binary Excel (.xls) files. In order for the Racket Validation plug-in to process the files, they must be saved to the ASCII .csv file format.*

*The LATR pod assignment file is a valuable source in determining the correct call sign associations between the Racket file and the ground truth data.*

Example File:

```
# Racket Report File:  ,,,,,,
#  ,,,,,,
# # indicates a comment specifier ,,,,,,
# and will be ignored by the parser,Time Format:  DDD HH:MM:SS,,,,,,
#  ,,,,,,
# Version: 1,,,,,,
# Event: Zoolander,,,,,,
# COMEX (Zulu): 58 23:08:50 2009,FINEX (Zulu): 59 1:56:30 2009,,,,,,
# Unit Callsign: 7307,,,,,,
# Assessment Time (Zulu),Racket #,Emitter Name,Freq,PRF,Scan,Bearing
(T),Comments
,,,,,,
58 23:51:00,C01,ABC-123,9245,357,A 2.5,160,This is a comment
```

## Debrief Format

The first line of the Debrief file must contain the work DEBRIEF. The header must contain the DATE in the format of DD-MMM-YYYY. The file Header must contain the OPFOR unit call sign which must correspond to a call sign found in the SIMDIS ground truth data (SCORE TSPI CSV or SIMDIS ASI). Each entry includes the SIGNAL CODE, TIME ON and TIME OFF. The times must be in the format of HHMM referenced to UTC (Zulu). If the code entry includes a letter it must precede the number and must be separated from the number by a “-“. The numerical value of the code is used as an index into the Emitter Band file. Blank entries are supported.

### NOTES:

*Typically these files are distributed as binary Excel (.xls) files. In order for the Racket Validation plug-in to process the files, they must be saved to the ASCII .csv file format.*

*The LATR pod assignment file is a valuable source in determining the correct call sign associations between the Racket file and the ground truth data.*

*The OPFOR ATOs are a valuable source in determining the OPFOR pod load outs when assigning the band file mappings to the debrief file.*

### Example File 1:

```
EW DEBRIEF FORM,,
DATE,20-Oct-2008,
CALLSIGN,Barney,
'',
SIGNAL (I/J CODE),TIME ON,TIME OFF
34,951,956
35,956,1000
```

### Example File 2:

```
EW DEBRIEF FORM,,
DATE,20-Oct-2008,
CALLSIGN,Fred,
'',
SIGNAL (I/J CODE),TIME ON,TIME OFF
I-34,912,930,58Y
I-9,934,940,78Y
I-10,940,942,58Y
```

## Band Format

The first line must contain the word Band. If a letter precedes Band, it must precede by one space. If the first character of a line is a number the line is treated as an entry. The entry includes an Index followed by and Emitter Name with PRI, PW, RF and Scan. The index found in this file will be used to correlate the emitter to the code used in the Debrief file.

### NOTES:

*Typically these files are distributed as binary Excel (.xls) files and contain both the I and J band emitters. In order for the Racket Validation plug-in to process the files, they must be saved into individual ASCII .csv files.*

*The OPFOR ATOs are a valuable source in determining the OPFOR pod load outs when assigning the band file mappings to the debrief file.*

Example File:

```
,AST-6 V30 I Band,,,,,  
,, ,PRI,PW,RF,SCAN  
,, ,usec,usec,MHz,  
23,ABC-123,,1,2,3,Y  
24,RADAR-1,,1,2,3,Y  
50,Jammer,,1,2,3,Y
```