

## SeaSonde Radial Suite Release 8 Starter Guide

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### About

Radial Suite Starter Guide gives an introductory description of all software that runs on the SeaSonde Remote Unit. This guide's purpose is to show the computer layout, SeaSonde configuration, active real-time applications, and useful utilities. Most applications have their own user guides for in depth detail. The Radial Operator Manual shows how the SeaSonde hardware is set up and configured.

For the SeaSonde Central Management / Data Combining Station, refer to the Install\_CombineSuite\_R8 documentation.

### Requirements



**Release 8 requires a SeaSonde USB Hardware Key containing a Radial Suite License for R8.** If you do not have the USB Key, you should contact CODAR support or sales to obtain one. The key needs to be plugged directly into a computer USB port (NOT the keyboard or other hub) in order for the Radial Suite to run. If you are upgrading from R7, then you'll need a key license update file (klu) for Release 8 from [support@codar.com](mailto:support@codar.com). **Do not install Release 8 if you do not yet have a Release 8 license as it will install but won't run.**

Refer to the SeaSonde Radial Suite Release 8 Installation Guide for minimum processor and software requirements and instructions to install Radial Suite R8.

### SeaSonde Processor as Delivered

With the purchase of a new SeaSonde Remote Unit you will receive the most current model Macintosh computer (Mac) that has been tested and approved for use with **SeaSonde Radial Suite** software.

Your computer will be delivered with the SeaSonde software installed. However, SeaSonde must be configured for the specific site location after the transmitter, receiver, and antenna have been installed. CODAR technical Support will

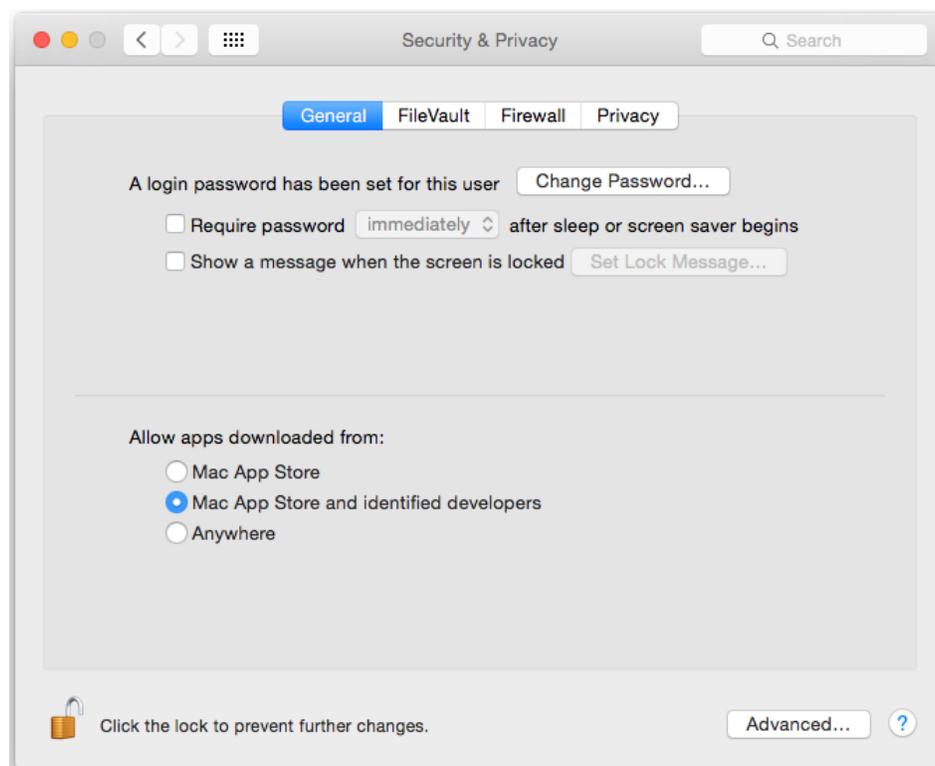
configure the Mac with a default login administrative username and password. You can change the username and password, however, in order for CODAR to provide full support, you will need to provide us with your administrative username and password. This will enable us to access your computer for troubleshooting and diagnostic purposes.

## What's New For Release 8

Release 8 is for Intel OS X only OS X 10.7.5 and later.

### Code Signed

Improved system security where all CODAR applications are code signed as required by Apple for macOS 10.12. This means that your Mac's **System Preferences** -> **Security** should be set to Allow apps to be downloaded from Mac App Store and identified developers.



### New Archivalist

Archivalist is now designed to fill up any hard disk to a set limit. When run for the first time, Archivalist will disable the destination file limits of any existing task plist(s) and use its own volume and archive reserve limits. Archivalist's volume and reserve limits can be modified.

## **New Waves Processing**

New wave tools use measured antenna patterns and can be configured for improved limits in enclosed bays.

## **New Filtered Wave Results**

New wave outlier filtering and averaging across range cells means that the primary form of wave output is range-less; wave data from all ranges have been processed to reduce the noise inherent in HF Radar wave measurements. A new processing tool can be used offline to quickly reprocess the un-averaged wave output to optimize outlier filter settings. In addition, filtered, ranged wave output files will be available in a sub-folder so that range-specific output can be still examined.

## **New SeaDisplay 8**

SeaDisplay 8 draws maps using vector graphics and Portable Document Format (PDF) output. SeaDisplay 8 contains many new features like bathymetry, radial coverage plots, map creation, map editing, site editing, and much more.

SeaDisplay 8 will read and upgrade SeaDisplay 7 site maps while leaving them compatible with SeaDisplay 7; however, site maps created or edited in SeaDisplay 8 Site will not display in previous versions.

SeaDisplay 8 now creates site maps; SeaDisplaySetup is no longer used. This means the site map's viewport and content can be modified within SeaDisplay without having to open SeaDisplaySetup and make a new map.

## **New CallSign**

SeaSondeController can be used to configure a periodic callsign broadcast in Morse code. **New firmware must be installed**; contact CODAR Support about setting this up.

**CallSign is not supported for Low Power with Class E amplifier at this time.**

## **New Viewers**

SpectraPlotterMap, DiagDisplay, and WaveDisplay have all been rewritten and for ease of use, greatly enhanced graphics, and PDF output.

## **RadialWebServer**

Many improvements for cleaner refresh. Uses PDF plots if using Safari browser. Improved Waves layout.

## **New KML Tools**

LLUVtoKML, PattToKML, and TRAKtoKML have been rewritten and enable easy generation of Keyhole Markup Language (KML) files for use in GoogleEarth.

## Compressed LLUV and Wave file support

CODAR's LLUV file format consists of columns of latitude, longitude, u velocity, and v velocity in that order.

All LLUV tools and viewers will support a gzip compressed form of the LLUV file. From the command line 'gzip' any LLUV file and add 'z' to its extension and SeaDisplay 8 will read that file.

## New SpectraAverager and Cross Spectra version 6

SpectraAverager replaces CPro, and new standard default timing for CSS output is installed. If you were using non-standard timing, be sure to change spectra timing in SeaSondeRadialSetup.

Cross Spectra version 6 files contain more metadata and embedded first order limits. These are no longer attached to the resource fork, where they were vulnerable to being stripped by non-native Apple file systems.

Warning: Reprocessing previous spectra will update them to version 6 and make them incompatible with Radial Suite versions prior to Release 8.

## Installation



**Release 8 requires a SeaSonde USB Hardware Key containing a Radial Suite R8 License.** If you do not have a SeaSonde Key, you should contact CODAR support or sales to obtain one. The key needs to be plugged directly into a computer USB port (NOT the keyboard or other hub) in order for the Radial Suite to run. If you are upgrading from R7, then you'll need a klu for Release 8 from support@codar.com.

See SeaSonde Radial Suite Release 8 Installation Guide for full step by step details on installing the Radial Suite. The bathymetry installer is a separate 1.2GB download from CODAR Support.

**Install\_GebcoDB** installs the GEBCO bathymetry database for SeaDisplay8

## GPS Timing for Multi-Static and Elliptical Operation

GPS equipped receivers using the same transmit frequency will also need a timing adjustment parameter entered into [SeaSondeController](#). This timing offset value prevents multiple sites with the same frequency from interfering with one another and is a function of the frequency, site distances, and processed range cells. Currently, only CODAR staff can perform the calculations necessary to determine the correct GPS timing adjustment values. These values will be determined by CODAR's support staff at the time of installation.

## SeaSonde Software Folder Structure

Except for system extensions, all the SeaSonde applications, configuration files, and data products are located in the SeaSonde folder inside the "Codar" folder on the boot volume (hard disk). The SeaSonde applications and data files can be found by opening the boot volume then navigating to /Codar/SeaSonde/. The folder structure is hierarchical, grouping like applications and data under subfolders.

### SeaSonde subfolders:

Apps	All applications are found here organized into further subfolders labeled according to usage. See next section for details.
Archives	Archived data products are stored here. Backup this folder periodically as this will contain all of the latest data you have collected and stored in "archive" folders labeled according to the settings in the <a href="#">Archivalist</a> application. <b>Note that CODAR is not responsible for archiving your data; when these archives reach certain thresholds, older data will be deleted.</b> It is the user's responsibility to assure that the Archivalist settings are configured properly in order to archive and save data that the user deems important.
Configs	All major configuration files are located here and are separated into sub-folders depending on their suite or specific task. Most Radial Suite settings are stored in sub-folder named RadialConfigs.
Data	Data products are all stored here and separated into sub-folders according to type.
Docs	All SeaSonde documentation is available here. The majority of the documents are in PDF.
Logs	Sentinel, site, and other logs are stored here.
Users	This folder is for storage of custom user software and documents.

## Apps folder:

Bin	Command line tools.
Installations	All system installers that SeaSonde needs are stored here. These items are installed into the system folder and must be reinstalled if the OS or SeaSonde software is overwritten.
RadialTools	This contains the real-time processing applications and tools for producing radials and waves output.
Scripts	Utility helper scripts are stored here. These are primarily used for routine maintenance tasks.
Tools	Utility applications are kept here. These tools are for setup, diagnostics and maintenance.
Viewers	All applications used for viewing data are kept here. Radial site viewing tools are used primarily for diagnostic purposes.

## Applications

This section briefly describes each application and its purpose. A number of these applications have their own detailed user guides (see /Codar/SeaSonde/ Docs/ folder).

### Installations Folder



SeaSondeKey shows the current licenses and is used with a klu file to update the licenses. **If you're upgrading from Release 7, you'll need to drop a klu file onto the window or app icon in order to upgrade the key to Release 8.**

The following have already been run by the Radial Suite installer, but are also here just in case they need to re-installed or a specific patch is needed.



Install\_SeaSondeService installs SeaSondeService and BillsScripting which is used for licensing and setting the computer time to the Receiver's GPS unit.



**Install\_ReceiverDrivers** installs the USB kernel extension `SeaSondeAwgiii.kext` into `"/Library/Extensions/"`. This kext is required by `SeaSondeController` and `SeaSondeAcquisition` in order to access the USB SeaSonde Receiver. The kernel extension is only loaded by the system when a powered SeaSonde Receiver is plugged into one of the computer's USB ports.



**Install\_RadialWebServer** installs the RadialWebServer on port 8240 with default user and password.



**Install\_CoastlineDB** installs the world coastline databases for SeaDisplay 8

## RadialTools Folder

The RadialTools folder contains all the real-time software tools for data collection and radial processing. Most of these applications run continuously during normal operation.



**SeaSondeRadialSetup** application installs the default configuration files and edits the required basic operating parameters. This application needs to be run at least once before running Sentinel and can be run again at any time to modify or just view the processing parameters. You will find this icon in the Dock, click to edit or view the SeaSonde Remote Unit configuration.



**SeaSondeRadialSiteCheck** application is run once each time the system starts up through Sentinel in order to check whether Radial Site configuration files have been installed and configured. If not, then it tells

Sentinel not to run any other SeaSonde applications and launches [SeaSondeRadialSetup](#).



Sentinel starts all the real-time applications, keeps an event log, restarts real-time applications when needed, and restarts the computer periodically.



SeaSondeController controls the SeaSonde receiver and provides [SeaSondeAcquisition](#), [SeaSondeRadialSetup](#), and other applications with the current settings.



SeaSondeAcquisition is the primary application for sea echo data collection and basic processing into time series, range series, and raw (un-averaged) cross spectra. [SeaSondeAcquisition](#) has many diagnostic graph windows for showing the real-time data and basic processing.



SpectraAverager reads the un-averaged cross spectra files from [SeaSondeAcquisition](#) and produces averaged cross spectra after removing interference. These cross spectra are saved as 'CSS' files for the [AnalyzeSpectra](#) script to process.



RunSpectraAnalysis is a Terminal saved session that opens a new Terminal window and starts up the [AnalyzeSpectra](#) script. Selecting the window and typing `<command><period>` will stop processing. You can double click its icon in the dock to relaunch [AnalyzeSpectra](#).



AnalyzeSpectra is the shell script, which continuously looks for new 'CSS' cross spectra and processes them into radial and/or waves.



The tools that **AnalyzeSpectra** runs are:

CheckForSpectra	CheckRadialSiteConfigs	GetParameter
RadialArchiver	RadialDiagnostic	RadialFiller
RadialMerger	RadialSlider	SpectraArchiver
SpectraToRadial	SpectraToWaveModel	WaveModelArchiver
WaveModelForFive	WaveModelFilter	



Archivalist application automatically archives data files into weekly and monthly archive folders in order to keep the hard drive from filling up. **Archivalist** is user-configurable, very flexible, and has numerous archiving options. It can be configured for periodic archiving or from an AppleEvent "open file" (This is how the archiving steps in the processing tools communicate with **Archivalist**). It is up to the owner to archived data off site.



LostTheDate is run by Sentinel when it detects that the computer time is not valid. This Applescript applet will try to correct the time with the SeaSondeController GPS or will wait until the time is correct by OS X's built in time server. The time server requires an Internet connection or other device capable of supplying the computer with the correct time.



GpsTimeSync Applescript applet is run by **Sentinel** prior to doing a scheduled restart of the computer. It communicates with **SeaSondeController** to check if the computer time needs to be adjusted using GPS time.



SeaSondeStartupExtras arranges all the real-time windows when the system starts up.

## Scripts folder



SSCleanOutProcessing Applescript applet, which moves all temporary processing files to the trash. When reprocessing cross spectra, it is desirable to start from a known start up state. The processing folder contains files that hold information about past processing such as amplitude factors, spectra averages, and radial merging.



SSMoveCSSforReprocessing Applescript applet moves all CSS spectra from the SpectraProcessed folder to the SpectraToProcess folder. This is a simple way to reprocess all recent spectra. If you change phases, for example, or any other configuration file, you will need to reprocess so that radials will be regenerated with the new settings.



SeaSondeReports.pl is a command line tool used to capture all of the system log files pertinent to SeaSonde operation. It zips and date stamps the diagnostic log files and writes them to the SeaSonde/Logs/ folder. The RadialWebServer uses this to create and download report files.



SeaSondeReportsHigh captures all the system log files pertinent to SeaSonde operation. It zips and date stamps the diagnostic log and configuration files. In addition, this script adds the latest CSS or total vectors (depending on the suite) to the file written to the SeaSonde/Logs/ folder.



**SeaSondeReportsMedium** captures all the system log files pertinent to SeaSonde operation. It zips and date stamps the diagnostic log and configuration files and writes the zipped files to the SeaSonde/Logs/ folder. By capturing configuration files, it documents the settings whenever the site's hardware or software has been changed.

### Tools folder:



**CrossLoopPatterner** processes loop measurement files into antenna pattern correction files.



**CtfRadialer** converts older radial and total vector files into the newer LLUV format. Just drag and drop the files you want to convert onto its icon or window.



**GPSTracker** converts GPS track files into a bearing track file. **SeaSondeAcquisition** uses the bearing track file and a transponder time series file to produce an antenna loop measurement file.



**LLUVRepair** converts older LLUV files into the latest format. It will automatically correct any deficiencies with older variations.



**RadialAdjuster** adjusts groups of radial files. It can change their times, site name, and bearing. This utility is used when a SeaSonde Site is found to have been running with incorrect time or bearing settings. After changing the preferences, drag and drop the radials to be adjusted onto its icon or window.



**SpectraScrambler** corrects or unscrambles cross spectra that have been generated with crossed antenna cables. Any possible combination can be unscrambled, but you must know beforehand how the cables were switched.



**SpectraShortener** reduces the size of cross spectra to help with archiving and/or sending files across the Internet. Standard cross spectra files, for example, are 628 KB and will not compress significantly when using **Zip** or other utilities. **SpectraShortener** is a lossy compression scheme, which typically reduces the data to .01 dB resolution. This provides over 2.5 to 1 compression without significantly changing the radial results.



**SpectraSlicer** cuts partial ranges out of one or more cross spectra to reduce file size; portions of interest can be extracted and emailed to CODAR support.



**SeaSondeAwgiiiLoader** is used when the receiver firmware needs to be upgraded. Please, do NOT attempt to update the receiver firmware without first consulting with CODAR support staff.

## Tools/Extras folder:



GreatCircle calculates the distance between two or three latitude, longitude locations using a version of Vincenty's Great Circle calculation. This calculation is used to generate the LLUV radial files.



MagneticDeclination is helpful when setting up a new SeaSonde installation. The magnetic compass bearing of the receive antenna's directional arrow (stenciled in black on the bottom of the receive antenna dome) is entered into this application. It calculates local deviation based on the geographic coordinates and will supply the true north bearing to enter into the header of the RadialConfigs file (Header.txt).



LLUVtoKML converts any LLUV radial, total vector, elliptical or grid file to kml format for viewing in GoogleEarth®. Just drag and drop the LLUV file on the application icon or window. There's a preference dialog, which will allow you to scale the vectors and color them.



PATTtoKML converts any antenna pattern file to kml format for viewing in GoogleEarth®. Just drag and drop the pattern file on the application icon or window. There's a preference dialog, which will allow you to scale the loops and color them.



TRAKtoKML converts a GPSTracker track file to kml format for viewing in GoogleEarth®. Just drag and drop the track file on the application icon or window. There's a preference dialog, which will allow you to scale the target symbol and select its color. The kml contains time so that you can do a movie replay of the track.

## Viewers folder:



DiagDisplay is a viewer application that graphs radial diagnostic files and determines antenna phase corrections. You can see if and when significant changing in antenna setup or transmitter problems have occurred.



SeaDisplay is a viewer application that plots radials into a site map file, SiteMap\_XXXX.smap, where XXXX denotes the four character site name. Previously, site maps were created using SeaDisplaySetup. Now they are created and modified in SeaDisplay. SeaDisplay contains tools for viewing and assessing radials.



SpectraPlotterMap generates 3D cross spectra maps across all range cells in a radial site where the vertical axis represents range, the horizontal axis represents frequency or Doppler, and the color bar indicates intensity. This application can also be used to modify how the first order Bragg region is determined during spectra to radial processing. See the document [HowTo\\_FirstOrderRegion](#) for more information.



WaveDisplay is a viewer application that graphs wave model files.

## Built-in OS X and Third Party Applications



**Terminal** is an Apple® application for Unix shell windows. **RunSpectraAnalysis**, for example, runs in the shell window. Users familiar with Unix can open new windows and run their own shell scripts or commands.



**TextEdit** is an Apple® text editing application. TextEdit is useful for making changes to the configuration files.



**Preview** is an Apple® viewer that applies to generic pictures and documents in many formats such as JPG, PICT, PNG, or PDF.



**Console** is an Apple® application that views the OS X diagnostic text files. It is great for viewing the system.log and console.log



**Activity Monitor** is an Apple® application that shows all the currently loaded processes. When using the Process Viewer you should be able to see all real-time SeaSonde applications running in addition to numerous processes required by the operating system.



**ScriptEditor** is used to create or edit AppleScripts. AppleScripts are an easy way to control applications and perform common tasks. Apple scripting can invoke shell commands, and shell commands can invoke Applescripts.



**DiskUtility** is an Apple® application used to check and erase hard drives and mount or create disk image files, which are suitable for file transfer over the Internet. When a disk image file is opened, it is mounted as a new disk volume in Mac's Finder. A disk image file is created by running DiskUtility and then dropping the folder or files onto the DiskUtility window.

# Data Products

This section provides an overview of the various types of output files produced by SeaSonde.

## File Nomenclature and Structure

CODAR file names typically contain a common root, XXXX\_YY\_MM\_DD\_HHMMSS, where XXXX is the site name; YY\_MM\_DD is the year, month, and day; and HHMMSS is hour, minute, and seconds that mark the start or the center time stamp of the file, depending on the file type. CODAR files usually have a three or four letter prefix that identifies the file type.

CODAR Table Format (CTF) implements a consistent use of column-wise tables of latitude, longitude, u velocity, and v velocity in that order. This suite of data is referred to as LLUV. This file format is easily imported to into MATLAB or spreadsheet applications. A description of this format can be found in the document File\_LonLatUV\_RDL\_TOT\_ELP and File\_CodarTableFormat.

Resource Index File Format (RIFF) is a format for time series and range series data. A description can be found in the document File\_TimeSeries and File\_RangeSeries

## Cross Spectra

Cross Spectra files contain a range and doppler matrix of signal levels and phases received from the cross loop antennas. Each cross spectra file covers a specific period of time centered on a time stamp. The coverage time that [SeaSondeAcquisition](#) uses equals the number of Doppler cells divided by the receiver waveform sweep rate. A typical SeaSonde configuration will use 512 Doppler bins and a 2 Hz sweep rate which results in 256 seconds of data per cross spectra (NOTE: Long Range SeaSondes use 1024 Doppler cells and a 1Hz sweep rate).

The output coverage time of a cross spectra produced by SpectraAverager depends upon its settings. A typical configuration will have 15 minute averaging with an output every 10 minutes creating a 2.5 minute overlap between the previous and following cross spectra. All cross spectra are in a binary file format. Details about their contents are described in the document File\_CrossSpectra.



CSQ\_XXXX\_YY\_MM\_DD\_HHMMSS.cs

CSQ files, or cross spectra files, are written by [SeaSondeAcquisition](#) to /Codar/SeaSonde/Data/Spectra/SpectraSeries/. [SpectraAverager](#) reads the files in sequence and then moves them to /Codar/SeaSonde/Data/Spectra/SpectraSeriesProcessed/. The filename time stamp marks the start time of the file.



CSS\_XXXX\_YY\_MM\_DD\_HHMM.cs

CSS files are produced by [SpectraAverager](#) and written to the folder /Codar/SeaSonde/Data/Spectra/SpectraToProcess/ from which they are passed to [AnalyzeSpectra](#) for processing. These files will have one of the following extensions ".cs", ".cs4," or ".cs5". It is recommended that CSS files are archived in case radials need to be reprocessed. The filename time stamp marks the center time of the file.



CSA\_XXXX\_YY\_MM\_DD\_HHMM.cs

CSA, or average cross spectra files are produced by the [SpectraSlider](#) tool and written to the folder /Codar/SeaSonde/Data/Spectra/SpectraToProcess/ from which they are passed to [AnalyzeSpectra](#) for processing. They are an average of the corresponding CSS files and are used to process second order energy into wave height estimates for the defined interval. They can be used to create radials where the original CSS files are lost, but this is not recommended. The filename time stamp marks the center time of the file.



CSR\_XXXX\_YYYY\_MM\_DD\_HHMMSS.csr

CSR, or reduced cross spectra files are produced by [SpectraShortener](#), by [SpectraArchiver](#) if so configured, and by the RadialWebServer when a spectra file download is requested by the user via web browser. Reduced cross spectra files have a different format than the three previous cross spectra files. They can be processed directly through [AnalyzeSpectra](#) for radial processing similar to CSS files. The filename time stamp marks the center time of the file.

## Radials

Radial files contain a list of radial current velocities for each detectable bearing and range ring progressing outwards from the SeaSonde receive antenna. Each radial file covers a specific amount of time (typically 1 hour) centered on a time stamp. These files are the primary output product of the SeaSonde Remote Unit. These files are transferred to the SeaSonde Combine Site for combining with radials from other SeaSonde Remote Units in order to generate 2D total vector files, or combined files. The radials can be recreated if needed by reprocessing the CSS files for the same time span. Most users will archive their CSS files for this reason.



RDLi\_XXXX\_YYYY\_MM\_DD\_HHMM.ruv

Radial file names contain an 'i' or 'm' following the prefix 'RDL' to indicate an ideal or measured antenna pattern, respectively. Radial files follow LLUV file format in addition to the attributes noted in the LLUV format above. The filename time stamp marks the center time of the file.

## Waves



WVLM\_XXXX\_YYYY\_MM\_DD\_HHMM.wl4,

The wave model list file contains a column-wise list of wave history information created from wave model tools on a monthly basis using CTF. See documentation [File\\_Waves](#) and [File\\_CodarTableFormat](#). The filename time stamp marks the start time of the file.

## Time Series



LvI\_XXXX\_YYYY\_MM\_DD\_HHMMSS.ts

LVL or time series files are an output option of [SeaSondeAcquisition](#). Time series are the raw unprocessed data collected immediately after the conversion of analog voltages to digitized values by the SeaSonde receiver module. Each file is a collection of continuous samples over each Doppler cell or frequency sweep of the receiver. They are stored in a binary RIFF. The filename time stamp

marks the center time of the file.

Each sample is the measured voltage of I & Q at a point in time, where I & Q are voltage measurements of two signal channels in quadrature representing real and imaginary parts, respectively. A standard SeaSonde will generate 48 KB per second or 4 GB per day. Time series files are not normally recorded except for transponder runs, where range series will also work. Time series and range series files can be imported via [SeaSondeAcquisition](#) to regenerate cross spectra or perform diagnostic processing.

## Range Series



Rng\_XXXX\_YYYY\_MM\_DD\_HHMM.rs

Range files are optionally saved from [SeaSondeAcquisition](#). Range files are the second step in [SeaSondeAcquisition](#) processing before generating cross spectra. Each file is a collection of signal energy versus range over a continuous time period. They are stored in a binary RIFF (resource index file format). See [File\\_RangeSeries](#). A standard SeaSonde would generate 384kBytes every 2.5minutes. Time Series and Range Series can be imported back into [SeaSondeAcquisition](#) to regenerate cross spectra or perform diagnostic processing. The filename time stamp marks the center time of the file.

## Diagnostics

There are currently three types of diagnostic files produced in the Data/Diagnostics/ folder.

The .rdt and .xdt are produced during processing spectra into radials. The .hdt file is created by SeaSondeController.



STAT\_XXXX\_YYYY\_MM\_DD.rdt

Radial diagnostic files are weekly summary files of diagnostic information collected as cross spectra are processed into radials. A daily temporary file is stored in the processing folder and appended to the radial diagnostic file. These files contain measured sea amplitude and phase, measured signals, number of radial vectors, and more. The filename time stamp marks the center time of the file.



STAT\_XXXX\_YYYY\_MM\_DD.hdt

Hardware diagnostic files contain such information as various temperature sensors, GPS status, power supply status, transmitter power, and more. Hardware diagnostics are created and updated by SeaSondeController. The filename time stamp marks the center time of the file.



STAT\_XXXX\_YYYY\_MM\_DD.xdt

Cross spectra diagnostic files contain diagnostics of each CSS processed. While some of the parameters here the same as those in radial diagnostic files, data in here files is an average of all processed range cells. Radial diagnostic files use a single range cell with the largest signal to noise. The filename time stamp marks the center time of the file.

# Real-Time Processing and Data Flow

Real-time processing refers to the normal radial site operation and the continuous collection and processing of data from the receiver into radial and/or wave files.

## Operating System Start up

When the computer powers up, it performs an internal hardware check and then searches for an available operating system to load. A progress bar is shown as the system starts loading, normally the startup process takes only a minute or two. Once the System has loaded, Finder, the Mac's file manager, will load.

## Sentinel Startup

The SeaSonde program **Sentinel** is launched by the system as a user "Login Items."

If **Sentinel** detects that the System time is not valid, it will bypass the startup sequence and run **LostTheDate**. **LostTheDate** tells **SeaSondeController** to turn off the transmitter and wait until it can either correct the time using a GPS signal (on SeaSonde receivers equipped with GPS) or by using a network time server (via an Internet connection) or until someone visits the site and sets the clock. Once the system has maintained a valid time for ten minutes, **LostTheDate** will tell **Sentinel** to resume the startup sequence.

**Sentinel** launches each required SeaSonde application in a specified order. First, **SeaSondeRadialSiteCheck** will check the radial configuration files. If it detects invalid settings or one or more missing files, it will launch **SeaSondeRadialSetup** application and tell **Sentinel** to stop the start up sequence.

**SeaSondeController** is started next. In normal operation, **SeaSondeController** needs to query the receiver at least once every ten minutes otherwise the receiver will think the computer is "hung".

**SeaSondeAcquisition** is launched next. It communicates with **SeaSondeController** to retrieve the current settings and enable the receiver to continuously collect and process time series data into CSQ cross spectra.

**SpectraAverager** retrieves the new cross spectra from **SeaSondeAcquisition** for averaging and ship interference removal.

**RunSpectraAnalysis** will launch, open the Terminal application, and initiate the **AnalyzeSpectra** script tools to process each averaged cross spectra (CSS) into radial and/or wave files.

**Archivalist** manages the data products. By default, Archivalist is configured with optimal settings to prevent the hard disk from filling and overloading the system. It also backs up the data into archive folders. The /Codar/SeaSonde/Data folders contain the most recent data and the /Codar/SeaSonde/Archives/ folders store the archived data.

## Restarting the Computer

Restarting the computer is the simplest way for the new SeaSonde user to relaunch all of the processing software and re-initiate the data processing sequence. To restart the computer you have several options:

- Under **Sentinel's** Control menu, select "Restart Computer." **Sentinel** will attempt to quit the current applications and perform a 'sudo reboot'.
- Under the Apple menu, select "Restart" and click OK to dismiss the Terminal application if **AnalyzeSpectra** is running. If any application fails to quit then the Restart command will abort.
- In the RadialTools folder, you can create a folder or file named "Sentinel Restart", "Sentinel\_Restart", or "SentinelRestart". **Sentinel** looks for one of these items every two minutes. If it sees one of these folders or files and can successfully delete it, then it will restart the computer the same as the previous method.
- Lastly, you can type 'sudo reboot' in a shell (Terminal window) or ssh into the machine. In order to do this you must enter your administrative administrative password. This method is more abrupt than others as it doesn't allow applications to quit before initiating.

## Reprocessing Cross Spectra

To reprocess cross spectra into radials and/or waves:

- Stop **AnalyzeSpectra** if running by selecting the Terminal window that is running the **AnalyzeSpectra** script (i.e. bring it to the front)
- Close the window and click OK when asked if you want to stop the Terminal window
- Run /Codar/SeaSonde/Apps/Scripts/**SSCleanOutProcessing** to clean out the temporary processing folder. Alternately, delete (move to the trash)

all of the items in the folder /Codar/SeaSonde/Data/Processing/.

- Move all of the CSS files that you want to reprocess to the /Codar/SeaSonde/Data/Spectra/SpectraToProcess/ folder. (For speed, you should keep CSS to 2000 files or less.)

Note: If you want to reprocess only the latest processed CSS files, you can use the script /Codar/SeaSonde/Apps/Scripts/[SSMoveCSSforReprocessing](#). It will move the CSSs that are in /Codar/SeaSonde/Data/Spectra/SpectraProcessed to the /Codar/SeaSonde/Data/Spectra/SpectraToProcess/ folder. You will find the older CSS files in the archived files folder /Codar/SeaSonde/Archives/Spectra/.

- Lastly, double click [RunSpectraAnalysis](#) in /Codar/SeaSonde/Apps/RadialTools/. This will induce the Terminal window to run all of the radial processing tools.

## Troubleshooting

When you have any issue with the site or change the system configuration you should run **SeaSondeReportsMedium**. This will create a zipped report file which contains crucial information about the SeaSonde and computer. Send the file to [support@codar.com](mailto:support@codar.com) which will help to diagnose problems with the SeaSonde.

You can also collect screen shots of all error message windows. Screen shots can be made by pressing command+shift+4 (⌘+⇧+4) keys simultaneously. When the cross-hair cursor appears, hold down the mouse button and drag the cursor to define a rectangular picture area. When you release the mouse button, a camera shutter will sound, and a PDF file will appear on your desktop. The files are named "Screen Shot YYYY-MM-DD at HH.MM.SS.png". The picture files should be attached with the SeaSondeReports result and sent to [support@codar.com](mailto:support@codar.com).

The most common problems encountered by SeaSonde users generally fall into one of these categories:

- Antenna and antenna cabling problems
- Transmitter problems
- Receiver problems
- Computer problems
- Software configuration problems
- Software problems

If the computer does not seem to be operating properly or you are getting no data at all, the most basic diagnosis begins by answering the following:

- Does the computer power up?
- Can the computer find a system to boot from?
- Does the boot sequence run to completion?
- Are the clock and time zone correct?
- Does the computer launch the Sentinel application?
- Is the hard disk full?

The first indication that your SeaSonde is not working properly or is configured improperly can generally be found by examining the quality of the radials. Note the following:

- What are the symptoms observed?
- Are radial files being generated?
- Are there few vectors or none at all?
- Do the vectors extend out to the expected range?
- Are a large percentage of the vectors over land?
- Are there extraordinarily large vectors?
- Do neighboring vectors contradict each other?
- Do the total vectors generated from these radials make sense?

Once you have identified a problem area, there are generally two approaches to diagnosing the problem(s). The first is the top down approach; you know that something is wrong and you backtrack to the source of the problem. The second is bottom up; the system is monitored by scrutinizing each step in the processing sequence until the source of the problem is found.

The difficulty in making a diagnosis is that for each possible problem there are several potential causes. The SeaSonde uses sophisticated hardware and software to produce radial files, and an understanding of the complex processing flow is required to determine a problem's root. The previous section provided an overview of the individual applications and how they fit together. Start stepping through the software and processing sequences. Using the bottom up approach, your troubleshooting path would begin with:

Checking [SeaSondeController](#).....

- Does it see and talk to the receiver?
- Are the receiver settings correct?
- Is the receiver temperature below 38°C?
- Are the power supply voltages okay (available only on newer receivers)?
- Is the GPS functioning correctly (if the receiver has a GPS installed)?
- Are the forward and reflected power readings okay?
- If "Transmit Watch" features are enabled, are any of them tripped (causing

the transmitted signal to be turned off)?

Next, examine [SeaSondeAcquisition...](#)

- Does it see and acquire data from the receiver?
- Are the spectra maps free of obvious interference and does each antenna channel have well pronounced Bragg peaks?
- Are the cross spectra being saved without the reporting of errors?

## Support

Comprehensive technical support plans for SeaSonde systems are available for purchase. SeaSonde owners should report any problem to their local authorized CODAR representative. In the United States, SeaSonde owners should send email to [support@codar.com](mailto:support@codar.com) along with a thorough description of the problem.

Relevant manuals along with answers to frequently asked questions (FAQs) can be found at [support.seasonde.com](http://support.seasonde.com).

Apple computers and their software can be found at [www.apple.com](http://www.apple.com)

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