

IRIS/PASSCAL INSTRUMENT CENTER
FLEXIBLE ARRAY (FA) DATA PROCESSING –
Passive Source

Version 2011-083

Questions/comments: data_group@passcal.nmt.edu

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FLEXIBLE ARRAY (FA) DATA PROCESSING
Version 2011-083


1. Introduction

The purpose of this document is to provide a short overview of the interaction between principal investigators for FA experiments and PASSCAL Instrument Center staff in terms of data processing and archiving.

Notice that:

General scripts and command-line usage are bold and highlighted yellow.

Standard output is italicized; URL addresses are blue followed by the computer symbol: 

Email addresses are dark blue followed by an envelope:  Important notes are brown.

Menu options for PASSCAL and/or REFTEK software are highlighted turquoise.

Antelope tools are highlighted fuchsia

2. Data Delivery Policy

NSF Program Solicitation 06-562 states that:

"The intent is that all data from the EarthScope Facility will be openly available in near-real-time to maximize participation from the scientific community and to provide on-going educational outreach to students and the public."

The solicitation also states that: "Principal investigators are required to adhere to the EAR Data Policy available on the NSF website."

The EAR data policy can be found at:

http://www.nsf.gov/geo/ear/EAR_data_policy_204.pdf

and it states:

" For those programs in which selected principle investigators have initial periods of exclusive data use, data should be made openly available as soon as possible, but no later than two (2) years after the data were collected. This period may be extended under exceptional circumstances, but only by agreement between the Principal Investigator and the National Science Foundation. For continuing observations or for long-term (multi-year) projects, data are to be made public annually."

If investigators requesting use of Flexible Array instruments wish to take advantage of the proprietary period of exclusive data use, they should state this explicitly in their proposals.

For more information, contact the NSF EarthScope Program Officer(s). A more recent revision (April 20, 2008) states more detail information and although preliminary.

As specified above under Earthscope Specific Policy, data are to be archived and made publicly available as soon as possible. In the instance where NSF has granted a period of exclusivity, data are still required to be archived at the DMC without artificial delays though the PI will control access to them. The DMC will only allow access to the waveforms to the PI and others designated by the PI. Access will be by password that will be provided by the DMC to the PI. The PI can share the password with anyone he/she wishes. The PI will be notified when anyone registers for access to a proprietary dataset. Information about the experiment such as station locations and characteristics will be made publicly available during the experiment; only waveform data will be limited in distribution during the proprietary period. All passive experiments with five or more stations will designate at least one station as and “open station”. The data from the “open station/s” will be made available to the public immediately upon being archived.

3. Responsibilities for Principal Investigator and PASSCAL for Data Processing/Archiving

PASSCAL – Instrument Center is responsible for archiving data from any USArray Flexible Array experiment to the DMC, although responsibilities for the complete process are shared with the principal investigator(s) (PI) and archiver(s). Below are the main responsibilities for each part for data archiving:

- ❖ PASSCAL Responsibilities
 1. Archive raw data with DMC
 2. Provide an Antelope database to the PI where appropriate.

- ❖ PI Responsibilities
 1. Provide raw data to PIC after each service run.
 2. Acquire, reduce and QC metadata.
 3. Provide meta-data in machine readable, tab-delimited format to PIC

- ❖ Shared Responsibilities
 1. Construct, verify, and archive SEED with DMC

4. Data format - SEED

The Standard for the Exchange of Earthquake Data (SEED) is an international standard format for the exchange of digital seismological data. SEED was designed for use by the earthquake research community, primarily for the exchange between institutions of unprocessed earth motion data. It is a format for digital data measured at one point in space and at equal intervals of time.

What needs to be archive When Passive Source?

a. RAW data in ZIP format in an organized directory structure

IF YOU HAVE REFTEK DATALOGGERS (RT130):

1. Create a directory in /data or /your_data directories to hold the offloaded data. It is important that a NEW directory be created for each service run. The directory should be named, for example, /data/CAFE01DISK02. This would indicate that this is from the CAFE experiment, service run 01, and disk 2.
2. Run **neo**, setting the 'Destination and Format' to the directory created above, and the format to 'Zip'.
3. Once all of the flash cards have been off-loaded, disconnect the CF card reader.
4. Connect the mobile disk first, and then turn on the power using the small switch on the back of the drive enclosure (if it has one).
5. Mounting the drive:
 - On Linux machines - the drive should auto-mount at /media/XXXXGB_EXT (where XXXXGB- size of the drive; EXT – referring to External Hard drive. If the disk does not mount, double click on 'Computer' then right click on 'XXXXGB External Hard Drive' and select mount.
 - On MACS – the drive will mount under: /Volumes/XXXXGB_MAC

Copy the entire directory that you created above using one of the following examples:

```
<my_cpu> cp -r /data/CAFE01DISK02 /media/ XXXXGB_EXT
```

OR

```
<my_cpu> tar -cf - .* | (cd /media/ XXXXGB_EXT; tar -xf -) # (This option may be faster)
```

Now that the data is ready, you can proceed to send a copy to IRIS/PASSCAL or use it for your own further processing.

1. Directory structure: **/data/Experiment_name_service#Disk#**

where :

- Experiment_name - Name of your FA experiment (Labarge, wallowa, snep, etc)
- service# - Data recovery service number (e.g. service1,service2, etc)
- Disk# - If data for the current service used more than one disk, please label disk number sequentially.

- IF YOU HAVE QUANTERRA DATALOGGERS (Q330S):

When downloading the data from a Q330's (currently dedicated to FA Experiments) you need to proceed as follows:

1. Connecting to the Baler

In the Mac network configuration make sure the location is set to EzBaler. The computer IP address should be 192.168.0.5 and the subnet should be 255.0.0.0.

- Connect one, two, three, or four Balers to the download box via QNET cables and connect the download box to the laptop via Ethernet-type cable with an RJ45 connector, and power the download box with 12 Volt DC (range 12-14).
- Select the ezb icon from the toolbar.
- Select the Enumerate button on the bottom of the EzBaler screen.
- Select Start Enum on the bottom of the Enumeration page.
- Press the ATTN buttons on each of the Balers one at a time, waiting a few seconds between each one, so that they don't all come up at once.
- Wait patiently (or impatiently) while the Balers boot up. Eventually you should see all of the Balers listed on the Enumeration screen. If one or more of the Balers fails to appear on the enumeration screen then try the following in this order.
 1. Select Done, then Select Enumerate, then select Start Enum, then reboot the problem Baler(s).
 2. Close the EzBaler program and start over.
 3. Close the EzBaler program, reboot the computer and start over.
- Once all of the Balers have been enumerated select done.

1. Downloading the Full Data set for each baler/station

To download the full data set, return to the EZBaler, ezb, program and select the Balers to be downloaded from the list on the left.

- In the Action menu select Retrieve All to a File.
- Select the fulldata directory for the current service run.
- In the message box verify that all the selected Balers are downloading.
- After the download is complete verify that the sizes of the downloaded files are about the same as the Datasize shown in EzBaler
- Open an Xterm terminal window and run sdrsplit on each of the data files using the -n option (no data files created), and the -i option (output an index). Redirect the output of sdrsplit to an index file for that station.
- Open the index file in a text editor and verify that all the channels are present and that they have expected time span.

Now that the data is ready, you can proceed to send a copy to IRIS/PASSCAL or use it for your own further processing.

2. Directory structure: `/data/Experiment_name_service#Disk#/`

where :

- Experiment_name - Name of your FA experiment (Labarge, wallowa, snep, etc)
- service# - Data recovery service number (e.g. service1,service2, etc)
- Disk# - If data for the current service used more than one disk, please label disk number sequentially.

3. ZIP files: file names follow usually the name convention:

2009307.XX-BHM1.00.ZIP where:

2009307 – day when file was generated (year - juliandate)

XX – default network code assigned when Q330's not programmed with it on the field

BHM1 – station name (if programmed in the field)

00 – location code (programmed in the field, loc code are usually not required, instead you can leave blank field)

b. Metadata

It is the PI's responsibility to provide meta-data in machine readable, tab-delimited format to PIC (PI will provide meta-data –e.g. batch file with correct location, instrumentation serial number, sample rate, etc). The PASSCAL data group will work with PI and/or archiver to generate or fix the batch file. PASSCAL staff will work closely with PIs to acquire necessary and accurate metadata in order to have a complete description of the network (realtime and standalone stations).

Information you as PI will need for the Metadata:

- Network code: Two (2) alphabetical characters assigned by DMC at start of deployment.
- Station name: Up to five (5) alphanumeric characters; no special characters allowed
- Location: Latitude, longitude and elevation
- Station Long Name: A long, descriptive name for the station
- Start Time for configuration: Make sure the start time is exactly the same or earlier than the first trace sample for each station
- Datalogger code: the type of datalogger you used for the station
- Datalogger Serial Number
- Sensor Type: Type of sensor for each station.
- Sensor Serial Number
- Sensor Orientation - (see description from the Antelope man page for db)
- Sample rate(s)

- Channel Description: MSEED channel names are defined by the sample rate and sensor type
- Instrument (i.e. sensor) type, and channel orientation.
- Close Time: When the experiment ends or this configuration changes

How does this information for the metadata will be sent to PASSCAL?

For data processing PASSCAL and Flexible Array experiments we at PASSCAL use antelope (www.brrt.com) software to generate metadata and data in the SEED format required for archiving.

During the duration of the experiment the metadata will be presented as a batch_file, which simply is an ascii file with defined fields needed to construct the dataless or metadata by building a relational CSS3.0 database.

NOTE: In the example below the fields in green are inputs that you need to provide. Noticed we don't include location codes. If you prefer to use location codes you should have something like:

An example of a batch file

```
#comment: This is an example of a batch file.
net PI Pier database at PASSCAL

sta NP00 -77.72237 162.27354 0.042 Socorro, NM
time 02/06/2004 02:50:53
datalogger rt130 0984
sensor cmg3t 0 0001
axis Z 0 180 - 1 1
axis N 0 90 - 2 1
axis E 90 90 - 3 1
samplerate 200sps
channel Z HHZ
channel N HHN
channel E HHE
samplerate 1sps
channel Z LHZ
channel N LHN
channel E LHE
add

sta NP02 -77.72591 162.26907 0.079 Socorro, NM
time 02/29/2004 02:57:57
datalogger rt130 0988
sensor cmg3t 0 0015
axis Z 0 180 - 1 1
axis N 0 90 - 2 1
axis E 90 90 - 3 1
samplerate 200sps
channel Z HHZ
channel N HHN
channel E HHE
samplerate 1sps
channel Z LHZ
channel N LHN
channel E LHE
add

close NP00 12/31/2007 23:59:59
close NP01 12/31/2007 23:59:59
```

We discourage the use of locations codes and suggest they be explicitly defined only when necessary to avoid ambiguity (such as when operating a dense network (stations within 1 km) or when recording multiple streams at sample rates sharing a common band code (first letter) within the channel code.

Your batch file is the history of all the changes, additions, removals, etc. done to your network, so it MUST include all the time frames from the very first sample rate on any channel to the day the station is closed.

We suggest a slightly earlier time for start time (second line after station in the batch file) to assure all the traces are included on the metadata. This will prevent from further errors and problems during archiving.

Please read this manual carefully and refer to the appendixes for detail information on several steps in this guide.

Where:

- 1) Network code <net>: Two (2) alphabetical characters assigned by DMC at start of deployment

Example: XN, YD, PI

Make sure you have a network code, if you don't please let us know

- 2) Station name <sta>: Up to five (5) alphanumeric characters; no special characters allowed

Example: STA01, NP00, Y2CC

- 3) Location: Latitude, longitude and elevation – in kilometers

Example: -77.72237 162.27354 0.042

- 4) Staname - long descriptive name for the station

Example: M-mountain Socorro

- 5) Time Start configuration - Make sure the time described as starting time is exactly the time for the first trace sample for each station or at least give a time frame prior (before) this time to make sure the first sample of the waveforms is covered with this time frame

Example: time 07/26/2004/ 21:00:00

- 6) Datalogger code – this line refers to the type of datalogger you use for the station

Example of datalogger line in batch file:

datalogger rt130 0984

Note: For the specific name of different types of digitizers, sensors, etc, go to `/antelope/4.8/data/responses` & `~/antelope/current_version/data/instruments/dataloggers` or `~/antelope/current_version/data/instruments/sensors`, there you will find the different response files (and the way it is named) to be added in the batch.

If the response file is not in the default directory please let us know and we will work with you building the required files.

Example of sensors and dataloggers files: rt130, Passcal_q330_linear, cmg3t, cmg40t, cmg40t_1s, l22, cmg3esp, sts2

- 7) serialnumber [dlsta] – serial number for the datalogger

Example datalogger Passcal_q330_linear 0984 (from the example above)

8) Sensor – please select the type of sensor for each station.

The description used for digitizer and sensor will take the associated response file and description from the directories mentioned above.

Example of this line in the batch file:

In the batch file: sensor cmg3t 0 0001
What it means: sensor code edepth serialnumber [loc]

The code must be chosen from the filenames of the sensor parameter files in dbbuild's database. **dbbuild** uses the corresponding parameter file to fill in other values and configure itself for the chosen sensor. The emplacement depth and serial number are also specified on this line, along with an optional location code.

This loc code is merged with the SEED code to create the CSS 3.0 channel code. This is necessary in various situations, as for example when there is a borehole instrument and a surface instrument.

code edepth serialnumber [loc] : Amend the edepth, serialnumber, and/or loc code for the sensor code. (Note that this syntax does not provide for modifying a case where multiple sensors of the same name are connected to a datalogger.

Antelope has a setup of responses for most common sensors and digitizers, however some sensors have specific features (sensitivity, poles and zeros, etc) so make sure the description you select truly describes the instruments on your station. Streckeisen sensors response is very uniform but for Guralp sensors there may be some exceptions. Please find the associated response file for each sensor and datalogger on

Example:

/opt/antelope/current_version/data/responses/cmg3t

Standard cmg3t – 120 seconds - Sensitivity 1500 V/m/sec

Other cmg3t descriptions:

/opt/antelope/current_version/data/responses/cmg3t_30sec

/opt/antelope/current_version/data/responses/cmg3t_360sec

/opt/antelope/current_version/data/responses/cm3t_60sec

/opt/antelope/current_version/data/responses/cm40t :
Standard 30 sec cm40t; Sensitivity 800 V/m/sec

Other cm40t descriptions:

/opt/antelope/current_version/data/responses/cm40t_1 :
Guralp 40T-1 1 Hz sensor; sensitivity 2000 V/m/sec

/opt/antelope/current_version/data/responses/cm40t_1_hi
Guralp 40T-1 1 Hz sensor; sensitivity 4000 V/m/sec

If you are not sure about the description of your GURALP sensor you can request the response file from guralp (caldoc@guralp.com), which is from where we get the response files to get them in the proper antelope format.

9) Sensor serial number

Example: sensor cm3t 0
0001

10) Sensor Orientation - description from the man page for dbbuild_batch :

axis label hang vang [sens [lead [pgain [pstage]]]]

axis2 label hang vang [sens [dlgain [pgain [pstage [lead]]]]]

11) Sample rate – taken from the digitizer, this will determine the channel name according to SEED format. You can have more than one sample rate description for the same station. Please refer to the man page for dbbuild_batch if you would like more detail.

Example: samplerate 1sps

12) Channel description: MSEED channel names are defined by the sample rate, instrument (i.e. sensor) type, and channel orientation. Table 2 shows the suggested channel name conventions depending on the instrumentation and sample rates on your experiment.

In the batch file defined by a line like:

Example in the batch file: channel Z EPZ

What each field means: channel axis-label chan loc [dlchan]

Where :

channel: part of the template to defined the channel

Z : Axis

HHZ : Label (based on SEED convention)

Loc : absent in this example, PASSCAL does not require location codes unless more than one sensor in the same station or by PI preference

- 13) add - Add the current configuration to the database
- 14) Close times – when the experiment ends or there is a need for changing the configuration in one or more of the station on your network you can use the following statements to define specific configurations during a time frame:

close sta time : Turn off the station with code sta as of the specified time.

close sensor sensor time : Turn off a particular sensor at the selected station

close datalogger datalogger time : Turn off the datalogger at the selected station

Example: close NP00 12/31/2007 23:59:59

NOTE: If you have any questions about this, you can find more information on the man pages for dbbuild_batch (man dbbuild_batch) or you can contact data_group@passcal.nmt.edu for further assistance.

5. Forms to Complete:

Fill out the following forms and contact data group at PASSCAL

- Contact data_group@passcal.nmt.edu to start your data submission process. You will need to create an account and follow your experiment.
- Principal Investigator web page (new) – creat account <http://www.passcal.nmt.edu/pihomepage>
 - Mobilization and Network code request form, preferred done through [PI Home Page](#):
- Demobilization form, done through [PI Home Page](#): to be completed by the end of the experiment)

6. Data Handling & Processing

a. Handling - Principal Investigator(s): Below there is a brief description of the recommended steps to take into account when starting the data archiving process:

- 1) After downloading the data and using neo to generate the ZIP files to send to PASSCAL.
- 2) Back up raw data.
- 3) Make a copy of the raw data to send to PASSCAL
- 4) Contact data group to initiate communication (data_group@passcal.nmt.edu)
- 5) Fill out forms listed on numeral 6.
- 6) Acquire, reduce and QC metadata and e-mail the data group if any questions.
- 7) Send to PASSCAL on disk or as established raw data and metadata.
- 8) The data group will make accessible the State of Health files (SOH) and/or LOG files for your evaluation after each service
- 9) PI will evaluate log files and do QC on waveforms and give the OK to PIC for further processing and archiving.
- 10) Modify metadata as needed.
- 11) PI provides name of the open station (if more than 5 stations) following PASSCAL Data Delivery Policy.
- 12) For further services, please provide all the changes made in the configuration of stations (sample rates, changes on instrumentation, new station, removing site, addition/removal of data streams, closing times, etc)

❖ **IMPORTANT:**

If your experiment has a REAL TIME and a STANDALONE component, we suggest to please provide the information associated to both sets of stations ahead of time to make proper changes in dataless for easy archiving flow with the DMC.

b. Data Processing – Data Group at PASSCAL

Below there is a brief description of the steps one of the staff from the data group will follow after receiving all the raw data and metadata.

1. Downloading of data from Disk to Processing Server
2. Evaluation batch file provided by PI
 - Data Reduction and Timing Quality controlData conversion from raw to mseed
 - Quick Evaluation log Files and generation of summary of comments
 - Generation of tar file from Log files to send to PI/archiver(s)

- Modify headers using fixhdr
- 3. Populating the Antelope Database
 - Edit/verify batch file
 - Build the Antelope Database
 - Create your database
 - View your database
 - Create mseed day volumes and add them to your database
 - Assign calibration values from calibration table to the wfdisc table
 - Verify the Integrity of Your Database
 - Create the dataless SEED volume
 - Verify the dataless
- 4. Send data to in-house QC system for final quality control
- 5. Submit data to the DMC
- 6. Confirm data archived at DMC
- 7. Send summary of archived data to PI/archiver for corroboration

Expected processing & archiving duration at PASSCAL

The duration of complete processing varies depending on:

- Load of experiments in the data group (PASSCAL & FA), although priority is given to FA experiments
- Size of serviced data
- Incomplete batch file
- Trouble data
- Communication with PI(s) about metadata

Data flow to the DMC and availability

Data submitted to the DMC for archiving is a semi-automatic process that will require checks on data vs dataless for archiving. Once all data is archived, in-house we run a confirmation script that will verify that data sent from PIC is exactly the same archived at the DMC.

IN-house we generate a summary from the confirmed DMC-sync by running ds_sum (please use -h for details)

This summary is sent to the PI/archiver for verification.

If data archived is restricted or falls into grace period the archived data remains restricted to the public but available to PI's and allowed users by main PI.

7. Sending Flexible Array data to PASSCAL

Before shipping your data, please take a moment to:

- Confirm a network code has been assigned? ([apply here through the PASSCAL PI web home](#))
- Verify the meta-data are accurate and complete - please double check
- Include a description of the data/meta-data organization
- verify an open station is identified
- Physically label the media with:
 - The experiment name
 - Network code
 - Your contact information
 - Notes regarding issues with the data, if applicable

We have many incoming shipments; items with inadequate labels can easily get lost in the shuffle. Always label your disk. Before sending your data, kindly [drop us a note](#) with the experiment name and network code, IRIS DMC Assembled Data Set ID Number or PIC Code in the subject line.

Shipping Address

IRIS PASSCAL Instrument Center
Attention: Data Group –
Experiment name:
100 East Rd.
New Mexico Tech
Socorro, NM 87801

For U.S. POSTAL SERVICE SHIPMENTS, please use our campus address:

New Mexico Tech - IRIS/PASSCAL
Attn: Data Group
Experiment name: Flexible Array - Name of your experiment
801 Leroy Place Socorro, NM 87801

Additional Suggestions

1. Download and create a local back up copy of the raw data: make sure to have at least 2 copies of your raw data. Keep always those copies in case they are needed in the future.
2. Send: ONE copy of your raw data to IRIS/PASSCAL with special attention to Data Group, if possible please e-mail data group and provide shipment-tracking number.

3. If you are demobilizing your experiment, please fill out a demobilization form at: <http://www.iris.edu/stations/demob.htm>
4. If you decide to extend the length of your experiment and have received an approval for this extension regarding instrumentation, please make sure to request an extension of your network code for the additional year(s).

8. General

Open station: As part of the PASSCAL DATA DELIVERY POLICY (November 18, 2004), “all passive experiments with five or more stations will designate at least one station as and “open station”. The data from the “open station/s” will be made available to the public immediately upon being archived.” Please provide the name of your open station to data_group@passcal.nmt.edu

Working together

Once you have sent the batch file and your data to, we will keep in touch with you about the status of the processing, data, metadata submission or other related issues.

Feel free to contact us anytime to data_group@passcal.nmt.edu.

Thanks for all your efforts during this experiment.

Appendix 1 - Backing up your data – some guidelines

We encourage USArray- FlexArray users to follow the suggested procedures below to backup the raw images, and simultaneously generate zip files of the raw images where you can extract the mseed, ref, or log files for quality control and further processing.

Instructions on this step vary depending on the platform you are working on. Please find found on Appendix 1 at the end of this document a suggested guide about how to back up your data when working from one of the PASSCAL field machines (LINUX, MAC OS) or a Solaris machine.

The software programs you will use for taring the file is called **neo** which is part of the PASSCAL software release.

Neo : is a method of extracting the data from the flash cards

If you cannot find the programs listed above or have any trouble please let us know by writing to software@passcal.nmt.edu ✉

- o Working on  LINUX

Backing up to an external disk drive

Data will be collected from the stations on 2GB or 4GB compact flash cards and offloaded to the field laptop using neo in zip format.

- a. Create a directory in /data or /your_data directories to hold the offloaded data. **It is important that a directory be created for each service run.** The directory should be named, for example, /data/CAFE01DISK02. This would indicate that this is from the CAFE experiment, service run 01, and disk 2.
- b. Run **neo**, setting the 'Destination and Format' to the directory created above, and the format to 'Zip'.

NOTE: If you wish to generate log files, select MODE -> Generate log files. This will cause the offload to run slower. It is faster to run **neo** for this purpose once the zipping is done.

- c. Once all of the flash cards have been off-loaded, disconnect the CF card reader.
- d. Connect the mobile disk first, and then turn on the power using the small switch on the back of the drive enclosure (if it has one).

- e. On Linux machines, the drive should auto-mount at /media/MOBILE01 or /media/MOBILE02. If the disk does not mount, double click on 'Computer' then right click on 'XXXGB External Hard Drive' and select mount.
- f. Copy the entire directory that you created above using one of the following examples:

```
<my_cpu> cp -r /data/CAFE01DISK02 /media/MOBILE02
```

OR

```
<my_cpu> tar -cf - ./ * | (cd /media/MOBILE02; tar -xf -)
```

(This option may be faster)

Now that the data is ready for backup, you can proceed to extract it from the .zip file for further processing.

Backing up to DVD

Data from RT130 dataloggers will be collected from the stations on compact flash cards, off-loaded to a directory using the **neo** program in zip format, organized using the program **chunky**, and written to DVD using the program k3b.

Run **neo**, setting the 'Destination:' to "/data" , "/your_data", or whatever you prefer, and the format to 'Zip'. This will cause the off-load to run slower. It is faster to run **neo** once the Zipping is done.

- a. After all of the compact flash cards have been off-loaded, create a directory at the same level as the above directory ("/data"). This will hold the links created by 'chunky' to the zipped data files.
- b. Change into the directory you just made and run the 'chunky' command.

For example:

```
<my_cpu> chunky -s CAFE01 -d /data/CAFE01
```

Where: /data/CAFE01 is the first directory created above and 01 indicates service run 1.

- c. Launch the k3b program, **Applications -> Sound & Video -> k3b** and burn the directories created above, one per DVD.

- d. Be sure to set [follow links](#), and [Rock Ridge](#) and [Joliet](#) format.
- e. Be sure to label each DVD with the name of the directory that was burned to DVD. As an example CAFE01DISK00, would indicate the first DVD burned from the first service run.

Now that the data is ready for backup, you can proceed to extract your data from the zip file for further processing.

- o Working on  MAC OS

Backing up to an external disk drive or DVD

On MAC OS X machines, the drive or DVD should auto-mount. Steps a-d are the same as for LINUX description defined previously. On MAC there are multiple options to make secure backup of your data (SuperDuper!, DiskUtility, SilverKeeper, etc). Procedures to back up securely your data may vary depending on which tool you are using, thus, if you have questions about it, please let us know which tool you are trying to use and we will try to guide you through the steps although most of these tools have simple manual pages to do so.

- o Working on  Solaris

The easiest way to back up your files into an external drive is by tarring it up however, that's still easier under Solaris 10 than 8 or 9 because they just don't have good USB support.

Please find below some instructions on how to create a new set of backup by using tar commands

To create a Tar file, use tar command as follows:

```
<my_cpu> tar cvf /dev/rmt/X file1 file2 dir1 dir2 file2 ...
```

Where

- * c – Create a new files on tape/archive
- * v – verbose i.e. show list of files while backing up
- * f – tape device name or file

For example, to backup /export/home/vivek/sprj directory to tape device /dev/rmt/0, enter in the command line:

```
<my_cpu> tar cvf /dev/rmt/0 /export/home/vivek/sprj/
```

Remember c option should only use to create new set of backup.

If you wish to append or back up more files to same tape using tar, tar provides the “r” option for appending files to tape.

For example to backup /data2/tpj/alpha1 files to same tape i.e. appending files to a first tape device:

```
<my_cpu> tar rvf /dev/rmt/0 /data2/tpj/alpha1/*
```

Note that you could redirect the output of the table of contents listing into a file, or pipe it into a printing command or a screen-pager program like less. That way you could make it easier to read through, or save it permanently.

```
<my_cpu> tar -tvf /dev/rmt/0 > ~/tape.list
```

Look in man tar for even better examples

Backing up to DVD from sun is a bit verbose. You have to run a command to make an ISO image of the files, and then burn that to the DVD if you have the correct DVD software installed. Under Solaris 10 is easier than in previous versions but it's certainly not trivial from the command line, and the GUI for it is a bit hard to follow.

Appendix 2 – SEED Channel name convention guide

Instrument	Sample Rates (Hz)					
	≥ 80	10 \geq to < 80	>1 to < 10	1	0.1	0.01
STS-2	HH?	BH?	MH?	LH?	VH?	UH?
CMG-3T	HH?	BH?	MH?	LH?	VH?	UH?
CMG-ESP	HH?	BH?	MH?	LH?	VH?	UH?
TR-240	HH?	BH?	MH?	LH?	VH?	UH?
TR-120	HH?	BH?	MH?	LH?	VH?	UH?
TR-40	HH?	BH?	MH?	LH?	VH?	UH?
CMG-40T 30s	HH?	BH?	MH?	LH?	VH?	UH?
CMG-40T 1s	EH?	SH?	MH?	LH?	VH?	UH?
S-13	EH?	SH?	MH?	LH?	VH?	UH?
HS-10	EH?	SH?	MH?	LH?	VH?	UH?
L-4C	EL?	SL?	ML?	LL?	VL?	UL?
L-22	EL?	SL?	ML?	LL?	VL?	UL?
L-28	EL?	SL?	ML?	LL?	VL?	UL?
L-28LB (4.5 Hz geophone)	EL?	SL?	ML?	LL?	VL?	UL?
L-40A (40 Hz geophone)	EP?	SP?	MP?	LP?	VP?	UP?
FBA ES-T	HN?	BN?	MN?	LN?	VH?	UN?

Table 2. Recommended SEED channel names for many of the sensors available from PASSCAL.