BOP Procedures SRH1

See Appendix A before Editing!

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General Best Practices

- Start by **reading the flight notes**. This will inform you of any unusual aspects of the data collection such as words of encouragement, PST re-namings, restarted instruments, or anything that may have affected data collection.
- Avoid overloading the QNAP by being mindful of the I/O and bandwidth requirements of your task. Use **sudo iotop** to determine which process are I/O limited and which are CPU-limited. Use the suggested order (for maximizing usage of the QNAP) shown in the BOP Workflow document.
- **Do not delete** any original data unless it has been **archived**.
- Archiving tapes (copies and full tapes) should be physically separated as much as practical, even if not complete.
- Always unmount media before removing them.
- Make any qualitative notes about what you find in this process go in: $ICE/note/xped/$QPROJ/notebook/BOPnotes
- After each operation, review the output log file for problems. To search a log file for errors, use a text editor, or the programs *grep* or *less*. Search for keywords such as **ERROR**, **WARN, FAIL**.
- See **Useful Linux Tips** on page 25 for useful command line tips.

- **Write your initials** on the media envelopes and the BOP checklist when you complete a process such as downloading or deleting.
- Never place **anything** on top of equipment such as laptops, hard drives, and router, especially drinks. Keep cables routed safely so they can't be pulled out.

Formatting Conventions

In this document, you will see example command lines to run, as below:

```
# Copy fstab to some location
$ cp [optional_args]  /etc/fstab {target}
```

In the above example, $ denotes the command prompt, and everything after this point should be typed. Arguments in {braces} are required arguments, that should be replaced with a suitable literal value. Arguments in [square brackets] are optional arguments, that should be either omitted, or replaced with a suitable literal value, and literal arguments should be typed verbatim.

The braces and square brackets themselves should not be typed. If we wanted to use the above command example to copy fstab to tmp, with prompting, then we would add -i as an optional argument, and /tmp as the target, which is required:

```
# Copy fstab to to tmp with prompting
$ cp -i  /etc/fstab /tmp
```

When not representing an argument, items in braces represent parts of filenames or paths that must be adjusted by the user (i.e. F##, J###). F## is the flight number (i.e. F02, F12) and J### is the Julian day (i.e. J055, J132).

Startup and Shutdown

Most parts of BOP are not exceptionally picky about the order in which they are started up and shut down, except for the following.

- Power must be available to each device before it is turned on.
- After starting up a laptop, Network Attached Storage (NAS/QNAP) must be manually mounted on each laptop, or you won't be able to see most of the data. (see Mount QNAP NAS on page 27)
- Before powering off a NAS/QNAP, manually unmount it from all laptops, or else the laptops will become frozen. (see Unmount QNAP NAS on page 27).

That being said, observe the following startup and shutdown sequence.

Startup Checklist

1. Confirm completion of **Hardware Setup Checklist** (below).
2. Power on network router, ethernet switches (if applicable), QNAP, laptops, and tape drive.
3. Mount QNAP NAS on each laptop.

Shutdown Checklist

1. Unmount QNAP NAS on each laptop (if this fails, shut down the laptop).
2. Shut down QNAP NAS, power off LTO tape drives, and shut down laptops.
3. Power off router and ethernet switches.

Hardware Setup Checklist

- General Notes:
  - Before plugging in any device into AC mains, confirm expected AC mains voltage from wall, and whether the device is compatible with this AC mains voltage! If you have doubts, consult an engineer.
  - Think first about cable routing before placing devices and cables.
  - Try to keep power and data cables behind user control interfaces.
  - Keep strain off cables, and don't use cables for mechanical structure.
  - Use cable cuffs and velcro ties if helpful.
  - Do not defeat circuit protection mechanisms.
- Connect Linksys Router power and network cables. (consult connection diagram if available)
  - [GNG] In general, I would recommend connecting the router's WAN port to the external network and using port forwarding to reach laptops. This is more trouble to configure than using wifi and ethernet together, but tends to lead to more reliable behavior.
- Connect QNAP NAS power and network cables. (consult connection diagram if available)
- Connect Ethernet network switch power and network. (if applicable)
- Connect laptop power and network.
- Connect LTO6 Tape drive power and USB.
- Survey the general area for possible future cable strain relief problems, loose connections, bumped power switches, or spilled beverages.

- Set system times and time zones to UTC on Laptops and QNAP NASes (Control Panel → General Settings → Time). Set NTP servers:
  North America: us.pool.ntp.org
  Casey Station: casey-time.aad.gov.au
  Local Raspberry Pi: *See GNG*.
- Configure the default printer in Linux system settings.

Download

- Avoid downloading large data in parallel (such as radar and camera)
- When manually copying, preserve the time stamps of files (i.e. **cp -p**)
- Mark the media envelope after downloaded with your initials.
- When there are multiple GPS units of the same type, verify the instrument ID
- After download, be sure to move files to a new folder on the media named by the flight number (i.e. {F##}/{data}) EXCEPT where noted not to (i.e. Ashtech media)

The following sections are organized by **Physical Media Type**, then by the **Instrument** that uses this media, and subdivided into download instructions for each type.

Media: ELSA USB Hard Drive/SSD

These hard drives are labeled JKB2 or GCX0, depending on which aircraft is used, and contains ELSA (serial) and radar data.

Instrument: JKB2 (ELSA and Radar)[1]

Use the following command to download data from the USB drive mounted at /media/{USB}, for flight {F##}:

```
$ cd $ICE/code/xped/$QPROJ/download
$ ./dljkb2 -f {F##} -i /media/{USB}
```

Underlying Download Procedure

This script essentially does the following, but with a few additional safety checks:

For ELSA, make folder in hierarchy and copy files from media:

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/ELSA/{F##}
$ cp -p /media/{USB}/{J###}/serial* $ICE/orig/xped/$QPROJ/acqn/ELSA/{F##}
```

MARFA/HiCARS2

If your radar system is MARFA , make folder in hierarchy corresponding to your radar system and copy:

1 ELSA (Environment for Linked Systems Acquisition) contains many instruments, including Riegl Laser altimeter (LASrz1), Fluxgate magnetometer, OAT, truetime, realtime GPS

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/MARFA/{F##}
$ rsync -avn -p /media/qc/{USB}/{J###}/radar*
$ICE/orig/xped/$QPROJ/acqn/MARFA/{F##}
```

Then run the rsync command again without the -n flag.

```
$ rsync -av -p /media/qc/{USB}/{J###}/radar*
$ICE/orig/xped/$QPROJ/acqn/MARFA/{F##}
```

If your radar system is HiCARS2, examine the disk contents using rsync:

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/HiCARS2/{F##}
$ rsync -avn -p /media/{USB}/{J###}/radar*
$ICE/orig/xped/$QPROJ/acqn/HiCARS2/{F##}
```

Then run the rsync command again without the -n flag.

```
$ rsync -av -p /media/{USB}/{J###}/radar*
$ICE/orig/xped/$QPROJ/acqn/HiCARS2/{F##}
```

Media: CAM CompactFlash Card

Instrument: CAM (Canon Camera)

Example:

```
$ICE/code/xped/$QPROJ/download/ ./dlcam -n -flight {F01} -i {/media/qc/CAM01}
```

Check the output to see if it seems like an appropriate quantity of images, then remove the -n flag to execute the command.

Manual Download Instructions:

#TODO: script this to simply get the path to the canon folders. download_cam -flight {F##} -i

Make folder in hierarchy:

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/CAM/{F##}
```

Copy complete camera directories, including the containing folder below DCIM, so that images are sorted chronologically by name. Source_folder={100CANON, 101CANON, etc.}:

```
$ cp -rp {SOURCEFOLDER} $ICE/orig/xped/$QPROJ/acqn/CAM/{F##}
```

Media: The Internet

Instrument: MAG external Antarctica and Canada [CHA,ICP]

Download files from http://www.intermagnet.org/data-donnee/download-eng.php. using these settings:

- **Sample Rate**: second is preferred, minute is ok.
- **Data type**: best available of all types
- **Start/End Date**: (as required)

Select the region and location for your theater of operations and download relevant data:

Project	Region	Latitude	Location(s)
ICP	Antarctica	S High Latitude	CAS
CHA	Antarctica	S High Latitude	VOS
SRH	North America	N High Latitude	RES,THL,IQA
GOG	North America	N High Latitude	THL

Instrument: MAG external, Qaanaaq Region

Note: You can also visualize the last 24h data at Qaanaaq:
http://flux.phys.uit.no/cgi-bin/plotgeodata.cgi?Last24&site=thl6d&

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/EXTERNAL/JDAY/MAG_IAGA
```

Move unzipped .scc files to this folder.

#TODO: make download script where you specify the file's current location, and it takes care of copying it to the given path.

All Regions – Saving Data

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/EXTERNAL/JDAY/MAG_IAGA
```

• Move downloaded file to this folder.

#TODO: make download script to copy file from USB stick directory and print the beginning and end lines and number of lines.

Media: USB

Note: multiple instruments may be included on one USB media. Data should be arranged by flight number, then instrument, as follows in the root directory:

```
F01/JVD
F01/CMG
F01/JKB32
```

```
F01/JKB22
F01/note
```

If it isn't arranged this way, move files until it is.

Instrument: GT-2A (CMG[2])

Instrument: JVD

Instrument: PFX [CHA]

On a Windows machine, use RINEX.exe to convert from G file to Rinex 2.10

$ICE/code/xped/CHA3/breakout/PFX/RINEX_Converter (has the binary to copy, if you need it)

Resulting files should be copied to:$ICE/orig/xped/CHA3/acqn/PFX/{F##}/{ZGN11,ZGN21}

NOTE: the converted files need to be named zgn1{jday}0.{m,n,o} and zgn2{jday}0.{m,n,o} for the 2 receivers! The 0 maybe incremented to 1,2, if there happen to be multiple files (untested/unverified)

NOTE: If there is a different name, rename EACH of the {m,n,o} files doing the following for EACH {m,n,o} file:

```
mv {oldname_receiver1}.{m,n,o} zgn1{jday}0.{m,n,o}
```

m = meteorology files

n = navigation (ephemeris) files

o = observation files

Instrument: TG3 (JKB32, JKB22)

#TODO: update instructions for using TG3 as a network-connected device (FTP)

#TODO: make a script that can just figure this out?

Note: Verify the instrument number

Make folders in hierarchy for each TG3 receiver

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/TG3/{F##}/JKB32
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/TG3/{F##}/JKB22
```

Select the relevant files from the source folder (e.g. /media/TG3_USB32/TOPCONFS/YXSV9EPZ/*D*)

Copy files from media:

2 CMG = Canadian Micro Gravity

```
$ cp -p $ICE/orig/xped/$QPROJ/acqn/TG3/{F##}/{JKB##}
```

NOTE: the file name indicates the instrument id and date (i.e. 321122 = MKB32 Nov 22).

Instrument: TRM[3]

Trimble NetR5 (Skiway, CSY11, CSY21)

Make folder in hierarchy:

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/TRM/{F##}
```

Rename files to be ###11.T01 and ###21.T01, where numbers follow the base naming convention (### = base station identifier: ZWD = Williams, CSY = Casey, WSD = WAIS), leaving file extensions as is. Where a GPS monument is not available, the naming should correspond to the IATA airport code (### = IATA airport code: YRB = Resolute).

Check CSY11/CSY21 labels on media slip.

Copy files from media:

```
$cp -p {/path/to/media} $ICE/orig/xped/$QPROJ/acqn/TRM/{F##}
```

Note: The Trimble NetR9 or NetR5 receiver data can also be accessed by logging into the receiver using a web browser (see ip address on device).

CAS TRM (Geoscience Australia Casey Station, CAS11)

```
$ $ICE/code/xped/$QPROJ/download/EXTERNAL/TRM_CAS1/download_cas1.sh {yyyy}
{J###}
```

Note: download_cas1.sh sends files to $ICE/orig/xped/$QPROJ/acqn/TRM/J###.

Media: SD Card

#TODO: make a script download_SPAN that does this

Instrument: SPAN (NVT)

Make folder in hierarchy:

```
$ mkdir -p $ICE/orig/xped/$QPROJ/acqn/NVT/{F##}
```

Copy files from media:

```
$ cp -p /media/qc/{SPAN}/{J###}/*.LOG  $ICE/orig/xped/$QPROJ/acqn/NVT/{F##}
```

3 CAS11 = Geoscience Australia Casey Station monument; CSY11/CSY21 = ICECAP Casey Skiway monument

PST Renaming

NOTE: The need for renaming should be noted in flight log. Also inspect the ELSA PSTs used in ELSA for problems, by running check_raw_psts.sh

```
$ cd $ICE/code/xped/$QPROJ/all
$ ./check_raw_psts.sh {F##}
```

The output will be a sequential list of PSTs used in the ELSA (and radar) data.

If required, begin editing a modify_pst.rc file using your preferred editor, such as nano, vi, or emacs.

```
$ nano -w $ICE/orig/xped/$QPROJ/acqn/{SNM}/{F##}/modify_pst.rc
```

Where SNM is one of {HF, HiCARS2, ELSA}. Typically you need to put the same file in both ELSA and HiCARS2.

This file should have one or more lines of the form:

```
PRJold1/SETold1/TRNold1 PRJnew1/SETnew1/TRNnew1
```

This line replaces all occurrences of PRJold1/SETold1/TRNold1 with PRJnew1/SETnew1/TRNnew1.

After you've created this file, then run breakout scripts adding the following options:

- Add -modpst to grad
- Add -modpst to glnk

An example file can be found at $ICE/code/xped/CHA3/breakout/ELSA/src/ex_modpst.rc.

Note: If you find that there are wrong PSTs, you also need to remove any directories that were created. For each wrong transect,

```
cd $ICE/targ/xped/$QPROJ/quality/pcor/P/S

rm -rf {Wrong_Transect}
```

Breakout

Scripts in $ICE/code/xped/$QPROJ/all breakout data AND generate files for printing

To save a log file, run the breakout script using ./glog. (i.e. $ ./glog ./grad -flags …)

Note: There are warnings that will be displayed (along with other verbose statements). To check if the script worked check the contents of targ and the corresponding print folders.

ELSA

Change directories and run ELSA breakout:

```
$ cd $ICE/code/xped/$QPROJ/all
$ ./glog ./glnk -flight {F##} [-overwrite] [-modpst] [-platform PLAT]
```

Optional arguments:

- -platform is the name of the airframe used in the survey (JKB is a likely option). This needs to be defined either in the ./glnk call or as an environmental variable $QPLAT

Check that all expected PSTs are there:

```
$ ls $ICE/targ/xped/$QPROJ/breakout/ELSA/{F##}/*/*
```

Note: breakout will not complete, because the track generation script circularly requires information from ELSA to be broken out. Re-run after MARFA breakout is complete.

#TODO: Fix script circularity

VHF Radar (MARFA)

```
$ cd $ICE/code/xped/$QPROJ/all

$ ./glog ./grad -mode MARFA [-p] [-f] [-modpst] {F##}
```

Optional arguments:

- -p (print) will make the pdfs used in print section below.
- -f forces overwrite of breakout

MAG External

```
$ cd $ICE/code/xped/$QPROJ/breakout/MAG_IAGA

./run_breakout {F##} {J###}
```

GPS

Note: Run this after running ELSA and MAG.

#TODO: or else what?

Run Full Workflow

```
$ cd $ICE/code/xped/$QPROJ/all

$ ./glog ./ggps [-ignoremissing] {F##} {J###} {yyyy}
```

NOTE: Use -ignoremissing flag if missing data.

Run Breakout Steps Individually

If there are problems with the script above, GPS can be manually broken out separately, as follows:

#TODO: make -proj optional for bo_pos_nvt/tg3

```
$ cd $ICE/code/xped/$QPROJ/breakout/{GPSsnm}

$ ./bo_pos_{nvt, tg3} -proj ICP9 {F##}

$ ./bo_pos_trm --project $XPED --{J###} ${J###} --year $year --flight $flight

$ ./bo_pos_jvd -y $year --project $XPED $flight
```

Run QC Steps Individually

If re-running TEQC[4] to integrate other sensors into the QC sheets:

```
$ cd $ICE/code/xped/$QPROJ/quality/xlob/teqc
$ ./doteqc {F##}

$ cd $ICE/code/xped/$QPROJ/quality/flight
$ ./run_qc.sh {F##}

$ cd $ICE/code/xped/$QPROJ/print
$ ./ggps -proj ICP9 -year {yyyy} {F##} ~/Desktop/{F##}_gps_printing
```

CAM

```
$ cd $ICE/code/xped/$QPROJ/breakout/CAM
$ ./bo_cam -flight {F##}
```

After CAM breakout, make a movie using the image files.

```
$ cd $ICE/code/xped/$QPROJ/quality/xlob/CAM
$ ./makemovie -flight {F##}
```

Proflex GPS PFX [CHA]

On a Windows machine, use RINEX.exe to convert from G file to Rinex 2.10

You can find the binaries in:
$ICE/code/xped/CHA3/breakout/PFX/RINEX_Converter (has the binary to copy, if you need it)

#TODO: make a script that rsyncs this and the data.

Resulting files should be copied to:$ICE/orig/xped/CHA3/acqn/PFX/{F##}/{ZGN11,ZGN21}

4 TEQC - UNAVCO software for GPS quality control

NOTE: the converted files need to be named zgn1{jday}0.{m,n,o} and zgn2{jday}0.{m,n,o} for the 2 receivers! The 0 maybe incremented to 1,2, if there happen to be multiple files (untested/unverified)

#TODO: implement this warning check in the script

NOTE: If there is a different name, rename EACH of the {m,n,o} files doing the following for EACH {m,n,o} file:

```
mv {oldname_receiver1}.{m,n,o} zgn1{jday}0.{m,n,o}
```

m = meteorology files

n = navigation (ephemeris) files

o = observation files

MAG_ZGN EREV-1 Base Magnetometer [CHA]

Copy the files to a BOP USB stick

```
cd $ICE/orig/xped/CHA3/acqn/MAG_ZGN/{F##}
cp -p B* /media/qc/{USB_BOP##}/{J###}
```

On a Windows machine, use ProtonMag_Utility.exe located at:

```
$ICE/code/xped/CHA3/breakout/MAG_ZGN/ErevASCIIConversion
```

to convert the original files.txt into 1 file (i.e. B*_to_*.Erv_dataview_ASCII.txt)

#TODO: make a script to help copy these things, with export (copy to USB), and import (copy to Linux) commands.

Copy the resulting file to back to the hierarchy $ICE/orig/xped/CHA3/acqn/MAG_ZGN/{F##}/

```
cd $ICE/orig/xped/CHA3/acqn/MAG_ZGN/{F##}

cp -p
/media/qc/{not_an_instrument_USB}/{Folder_with_Converted_File}/{Converted_file}.
Erv_dataview_ASCII.txt .
```

GT-2A Gravity Data Processing

Gravity processing is described in a separate procedure. The gravity processing operator will generate a folder with *.fun and *.g3 files and copy this to a BOP USB stick.

Copy these files to the correct location in the hierarchy:

```
$ mkdir -p $ICE/orig/xped/{XPED}/quality/cmg1/{F##}
$ cd $ICE/orig/xped/{XPED}/quality/cmg1/{F##}
```

```
$ cp -p /media/qc/{USB_BOP##}/{F##}/CMG/* .
```

IF the folders are copied, make sure you copy the *.g3 and *.FUN files to the {F##} directory, with the Flight used as the filename[5]

For example:

```
cd $ICE/orig/xped/CHA3/quality/cmg1/{F##}
cp {Folders_with_g3_FUN_files}/*.g3 {F##}.g3
cp {Folders_with_g3_FUN_files}/*.FUN {F##}.FUN
```

GT-2A (CMG) Engineering Parameters

```
$ cd $ICE/code/xped/$QPROJ/quality/cmg/monitoring
```

(This script is also run from gqc). Under $ICE/code/xped/$QPROJ/quality/cmg/ pdfs representing the last 7 weeks of R and T files will be plotted. These are files tracking the gravimeter on the ground. Print the one with Week0 in the name, this will represent the last 7 days.

Note from Wayne Hewison:

> "An obvious one to keep an eye on, is kdr.
>
> Wzc indicates vertical sensor noise. px and qy are angular velocity measurements around the x and y axis (resp), as measured by the DTG. Ordinarily (when the system is stabilised to the north), px is noisier, as it is affected by Fiber Optic Gyro noise. Wxave and Wyave will provide a measure of platform stability. Data will also be affected by movement of the system on the ground (wind buffeting the aircraft, or people climbing in and out, plus any bumps, knocks, etc). This will show up mainly in Wz channels."

Print

VHF

When grad.sh was run in breakout with the -p flag, it generated MARFA QC sheets in the folder below.

If flights are short, no compiled MARFA_printing will be generated. Check individual files in $ICE/targ/xped/SRH1/quality/xtra/plots/pik1/*/*/*

Print the MARFA QC sheets:

```
$ lpr -o fit-to-page -o media=letter -o page-top=54
$ICE/targ/xped/$QPROJ/print/{F##}_MARFA_printing/{F##}_MARFA.pdf
```

5 GNG: This needs review and work

Place the MARFA QC sheets in the RADAR binder.

Manual VHF printing:

If grad.sh worked, radargrams have been saved in targ/../../quality/xtra/plots/pik1.RADnh4. Otherwise, manually generate the VHF QC pages as follows:

```
$ cd $ICE/code/xped/$QPROJ/quality/xlob/RAD
$ ./run_rp {F##} pik1.RADnh3
$ ./plot_radar.sh {F##}
$ cd $ICE/code/xped/$QPROJ/print/RAD
$ ./print.sh {season} {platform} {F##} MARFA pik1
```

AQN(ELSA)

Print ELSA QC sheets:

```
$ lpr -o fit-to-page -o media=letter -o page-bottom=54
$ICE/targ/xped/$QPROJ/print/{F##}_pcor_printing/*
```

Place the ELSA QC sheets in the PCOR binder.

GPS

Print the GPS QC sheets:

```
$ lpr -o fit-to-page -o media=letter -o page-left=54
$ICE/targ/xped/$QPROJ/print/{F##}_GPS_for_printing/*
```

Place the GPS QC sheets in the PCOR binder.

Quality Control (GQC)

Generate flightQC, flight_review_sheet, geologyQC and iceQC pdfs:

```
$ $ICE/code/xped/SRH1/all

$ ./gqc {F##}
```

When gqc.sh was run, it generated four GQC pdfs.

• Copy files into note:

```
$ cd $ICE/targ/xped/$QPROJ/quality/flight/plots/{F##}
$ cp * $ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}
```

• Print the GQC pdf files:

```
$ cd $ICE/targ/xped/$QPROJ/quality/flight/plots/{F##}
$ lpr -o fit-to-page -o media=letter *
```

• Place GQC printouts in the FLIGHT NOTES binder.

Clean Media

• Once downloaded, move the files in a media subdirectory called {F##} for clarity.

• We keep a minimum of data from the two last flights on media.

Before deleting:

(1) Check qc sheets to be sure the media was qc-ed and makes sense.

(2) Create log files of each tape on **DIFFERENT TAPE DRIVE** than they were written (e.g., use icecap9):

```
# (will return status including number of files written to tape,
# normally want last file).
$ $ICE/code/xped/$QPROJ/archive/LTO_num_files

# tag (eg LTO_check 5 oelpo – will create log in
#  $ICE/note/xped/$QPROJ/archive/logs/readback)
$ $ICE/code/xped/$QPROJ/archive/LTO_check file
```

The LTO_check command should complete without any errors

(3) For each piece of media, run one of: (the GPS renames files, so requires diff script)

```
$ ./media/ICE/code/xped/$QPROJ/media/check_media.sh {F##} {tag} {/path/to/media}

$ ./media/code/xped/$QPROJ/media/check_trm.sh {F##} {tag} {CSY11,CSY21}
{/path/to/media}

$ ./media/ICE/code/xped/$QPROJ/media/check_tg3.sh {F##} {tag} {/path/to/media}
```

These scripts may break quite easily as they look at the file number for the readback logs, and not a flight number. Since there are extra ground tests this will probably screw up.

(4) if the files were found in the logfile, remove them from media.

Evaluating Quality Control (QC)

Definitions

- Device QC: Instrument operation quality control
- Experiment QC: Science objective quality control

On the flight based QC sheet, highlight quality of each sub-section of transects using the following color code:

- **Blue** = all is well
- **Yellow** = experiment level issue with the data (i.e., not a GAN issue, but an EDS or FOP issue)
- **Orange** = device level issue with the data (GAN relavent)
- **Pink** = missing data or sections where the instrument could not be expected to perform normally

Note any error messages, synchronization problems, or times missing in each dataset.

Positioning

Each receiver has at least 7 satellites, with few I's (indicates loss of lock). See print-out or tecq ++sym or teqc -help for symbol list explanation. Ideally we want obs/cycle slip (o/slps) to be >1000. On the Flight QC page. The black histograms in the GPS streams represent cycle slips and dips in the red lines represent loss of lock.

CENTER OF GRAVITY (POS/CG):
Blue: At least one POS reciever for full section of transect
Yellow: Cycle slips correlated with strong mag event, or aircraft maneuvers
Orange: No antennas recorded or loss of L1, L2 and/or C1/P1

BASE (POS/BASE):
Blue: At least one base receiver for full section of transect
Yellow: Cycle slips correlated with strong mag event
Orange: No antennas recorded, or loss of L1, L2 and/or C1/P1

Gravity

ACCELERATIONS (GRV/ACC): qc of GT2A and flight dynamics (all flight based)
Blue: Accelerations are largely less than ±1000 Gal

Yellow: Accelerations are larger than ±1000 Gal in times of aircraft maneuvers
Orange: No acceleration signal or high constant accelerations

FREE AIR GRAVITY ANOMALY (GRV/GRV): qc of GT2A, flight dynamics and gps combinations (all flight based)
Blue: Gravity anomaly follows topography on radar; different runs are similar; gravity anomaly compares well with previous data; signal is ± 100 mGal
Yellow: Signal is decorrelated with topography and between runs, in times of aircraft maneuvers
Orange: No gravity anomaly signal or high signals greater than ±100 mGal"

Magnetics

GEOMAGNETIC FIELD (MAG/GEO): qc of intermagnetic base magnetics and geomagnetic activity
Blue: Rate of change is less than 3nT/min
Yellow: Rate of change is greater than 3nT/min
Orange: No functioning base mag was recorded

SCALAR MAGNETIC FIELD (MAG/FIELD): qc of MAG-823A cesium magnetometer
Blue: Flight based magnetic anomaly is less than ± 1000 nT; correlation with geology; transect based magnetic field strength is between 55,000 and 65,000 nT
Yellow: Flight based magnetic anomaly is greater than ± 1000 nT, transect based magnetic field strength has aircraft noise (ripples, steps)
Orange: transect based magnetic field strength is below 55,000 nT; abrupt tears present; signal voltages are low in breakout data

VECTOR MAGNETIC FIELD (MAG/FLUX): qc of Watson FGM-103 fluxgate magnetometer
Blue: Flight based magnetic anomaly is less than ± 1000 nT; correlation with geology; transect based magnetic field strength is between 55,000 and 65,000 nT
Yellow: Flight based magnetic anomaly is greater than ± 1000 nT, transect based magnetic field strength has aircraft noise (ripples, steps)
Orange: transect based magnetic field strength for each vector is decorrelated with IMU; abrupt tears present; signal voltages are low in breakout data

Acquisition

ELSA TIME SYNCHRONIZATION (ACQN/TCG): qc of PXI-6683 gps card and TrueTime Timer Counter GPS
Blue: No seq-skipped (dropped) packets in GPSnc1 or GPSkc1 sample stats, regular timing on either system
Yellow: dropped packets correlated with times of magnetic events
Orange: dropped packets or irregular timing on both systems

ELSA DATA ACQUSITION (ACQN/REC): qc of PXI data acquisition
Blue: No dropped packets in sample stats, regular timing on either system for all streams, no tears in radar data
Orange: dropped packets, irregular timing or tears

Altimetry

SPAN attitude (ALT/SPAN): qc of NOVATEL SPAN/iMAR FSAS IMU and flight dynamics
Blue: Pitch is realistic (± a few degrees), roll is realistic (centered on zero) and responsible at turns (<10˚)
Yellow: roll exceeds 10˚, and biased from zero
Orange: roll and pitch decorrelated from flight plan, rapid changes, does not correlate with IMU

IMU attitude (ALT/IMU): qc of Systron Donner MMQ-G and flight dynamics
Blue: Pitch is realistic (± a few degrees), roll is realistic (centered on zero) and limited to ± 1˚ along transects for RSR
Yellow: roll exceeds 1˚, and biased from zero
Orange: roll and pitch decorrelated from flight plan, rapid changes, does not correlate with SPAN

GPS ORIENTATION (ALT/dPOS): qc of Javad Delta/Topcon NetG3A POS (flight based only)
Blue: At least a combination of 1 tail + 2 wings at any time across full section of transect
Yellow: Cycle clips correlated with strong mag event, or aircraft maneuvers
Orange: No more than two antennas recorded

DOWNWARD LOOKING CAMERA (ALT/CAM): qc of Canon camera (mplayer $ICE/targ/xped/$QPROJ/quality/xlob/CAM/{F##}/CAM_F{##}.mp4)
Blue: Movie in focus, window is clean, record is complete
Yellow: Movie out of focus, window is dirty, record is incomplete; excessive compression artifacts in original images
Orange: Shutter failure, evidence of optical damage, no GPS timestamp

LASER RANGE (ALT/LAS): qc of Riegl LD90 laser
Blue: surface detected and correlates with VHF radar and PCL ranges
Yellow: surface dropouts due to height or cloud (see checklists and CAM)
Orange: loss of surface signal

PHOTON COUNTING LIDAR (ALT/PCL): qc of PCL lidar (flight based only)
Blue: surface detected in at least one channel and correlates with VHF radar and LAS ranges
Yellow: surface dropouts due to height or cloud (see checklists and CAM)

Orange: loss of surface signal in both channels; decorrelation with VHF and LAS (indicates scanner failure)

AXBT, AXCTD

AXBT raw data (AXBT/RAW): qc of raw AXBT audio data and flight notes
Blue: Data is acquired and has high signal to noise, logs document times correctly
Yellow: Data is noisy, data is missing, logs are incomplete, buoy hit ice
Orange: All data is missing for a drop, buoy failed to transmit on water impact

AXBT converted data (AXBT/EDF): qc of processed AXBT audio data and flight notes (plots in $WAIS/targ/xped/$QPROJ/quality/axbt)
Blue: Data shows smooth in-water trend, temperatures are between -4 C and +2 C bottom impact is detectable
Yellow: Data is noisy, no bottom detectable
Orange: Data is missing

RADAR

It is recommended that VHF QC is done from xevas

```
$ cd $ICE/code/xped/$QPROJ/analysis/xlob/HiCARS2/picking
$ ./pst_list.sh {find desired PST}
$ ./xevas_any.sh PSTNAME
```

QC HF by comparing HF and VHF on gqc sheet:
SURFACE (Low gain, channel 1):
1. Surface traceable without interruption across entire section
2. One or more locations where the surface is present but poorly defined or indistinct
3. One or more location where the surface is not present in the radargram
Note: Traces should not saturate at the surface

LAYERS (Low/High gain):
1. Layers visible to a depth of ~8 µs above the bed over >80% of the section
2. Layers visible to a depth of ~8 µs above the bed over 40-80% of the section
3. Layers visible to a depth of ~8 µs above the bed over <40% of the section

BEDROCK (High gain, channel 2):
1. Bed is clear and traceable across full section of transect
2. Bed is faint or partially obscured by noise at one or more points along the section
3. Bed is not present or completely obscured by noise at one or more points along the section

MEDIA

On the flight based QC sheet, record the media ID of each physical piece of media that has been used for this flight.

Flight Notes

Review the flight notes to check any PST renaming, FOP passes to BOP, and events that could explain data irregularities.

Scans

FOP Flight Notes

Scan the flight plan and flight notes into a color pdf/jpg format, at least 200 dpi, confirm that each page is legible and completely visible, and save them to:

$ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}/{F##}_FlightNotes_SRH1.pdf

Store flight notes hard copy in the FLIGHT NOTES binder.

```
$ hp-scan -m color --adf --size=letter -f
$ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}/{F##}_FlightNotes_{PROJ}.pdf
```

BOP Notes

Scan all BOP-generated notes into a color pdf/jpg format, at least 200 dpi, confirm that each page is legible and completely visible, and copy them to:

$ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}

Store QC hard copy in the FLIGHT NOTES binder.

These notes include, but may not be limited to:

- Flight QC evaluation pages

```
$ hp-scan -m color --adf --size=letter -f
$ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}/{F##}_FlightQC_{PROJ}.pdf
```

- BOP operational checklists

```
$ hp-scan -m color --adf --size=letter -f
$ICE/note/xped/$QPROJ/acqn/Flight_Logs/{F##}/{F##}_BOPChecklist_{PROJ}.pdf
```

- AXBT QC pages

Flight Plan

Copy flight plan documents from $ICE/targ/xped/$QPROJ/plan/{Flight Name} to $ICE/note/acqn/Flight_Plans/{F##}

```
$ cp -p $ICE/targ/xped/$QPROJ/plan/{Flight Name}/*
$ICE/note/acqn/Flight_Plans/{F##}
```

Copy flight plan .src file from $ICE/syst/xped/plan/flights/$QPROJ/{Flight Name}.src to note/acqn/Flight_Plans/{F##}

```
$ cp -p $ICE/syst/xped/plan/flights/$QPROJ/{Flight Name}.src
$ICE/note/acqn/Flight_Plans/{F##}
```

HP Multifunction Scanner (ICP)

The M1212nf MFP printer/scanner can be used from Linux using the HP Linux Imaging and Printing (hplip) package. Use Google to find the latest version of this package from HP/sourceforge.

To scan, use the hp-scan command line program. Run hp-scan -h for help.

Example:

To scan in color, using the automatic document feeder to scan a letter-sized page, to a file named ~/Desktop/scans/Flight_Logs/F01.pdf, run:

```
hp-scan -m color --adf --size=letter -f ~/Desktop/scans/Flight_Logs/F01.pdf
```

Archive

The LTO-6 tape drive plugs directly into a USB3 port, and usually mounts to /dev/nst0 under Ubuntu Connect LTO6 Tape Drive USB Cable into laptop ICECAP9.

After archiving a flight to a tape, WRITE the estimated amount of required space onto the BOP worksheet

For all archiving scripts, it is recommended that you first go to the archive code directory:

```
$ cd $ICE/code/xped/$QPROJ/archive
```

To add tags to tape, run:

```
$ICE/code/xped/$QPROJ/archive/add_tag.py {orig|targ} copynum
```

ORIG

ORIGINAL DATA make two copies:

Insert "SRH1 orig copy #1" into the tape drive.

```
$ ./find_data.py --flight {F##} --tag orig [-v]
$ ./arc_syst.py {F##} orig 1
$ ./eject_tape
```

Insert "SRH1 orig copy #2" into the tape drive.

```
$ ./arc_syst.py {F##} orig 2
$ ./eject_tape
```

TARG

BREAKOUT DATA (targ x1):

Insert "SRH1 targ copy #1" into the tape drive.

```
$ ./find_data.py --flight {F##} --tag targ [-v]
$ ./arc_syst.py {F##} targ 1

$ ./eject_tape
```

Sunday

A weekly archive of the hierarchy's critical working parts: code/note/syst, saved offline to protect against accidental deletion.

Go to the secondary QNAP (e.g., /media/ICE03, and run the archiving script:

```
$ cd /media/ICE03/sunday
$ ./run_sunday
```

Find the output .bz2.* files in /media/ICE03/sunday_data, and copy them to an external hard drive, then unplug the hard drive and put it in a safe place separate from the QNAPs. Delete older backups if required.

Extra

Useful Linux Tips

Mounting media:

Some media automount in the GUI. Get the path (address) to the media by clicking Places (upper left). If the media doesn't mount:

```
# (check name of the connected media, should be /dev/{sd})
$ sudo fdisk -l

# (create the directory where the media will be mounted)
$ sudo mkdir -p /media/{name}

# Mount the media
$ sudo mount /dev/{sd} / media/{name}

# (check if the media is mounted)
$ df -h
```

Unmount USB media

Use df to search for the name of the mounted media:

```
$ df -h
```

Unmount the media you wish to unmount:

```
$ sudo umount /media/{USB} OR $ sudo umount /dev/{sd}
```

Check if media has successfully unmounted:

```
$ df -h
```

Check file systems for errors on a media

```
$ sudo fsck /dev/{sd}     (see if there are errors)

$ sudo fsck -r /dev/{sd}  (repair errors)

$ sudo fsck /dev/{sd}     (see if errors have been fixed; run with -r option
again if not)
```

Copy a disk image from a media to another

```
#(create an image from sd1 or other media)
$ dd if=/dev/sd1 of=~/Desktop/media.img

#(copy the image to sd2 or other media)
$ dd if=~/Desktop/media.img of=/dev/sd2
```

Check size of folder or disk:

```
$ du -ch | grep total
```

Adjust size of terminal window (without mouse):

Alt+F8 (use arrows to resize, press enter to fix)

Git

Example: Change the remote URL of the Field Code repository to an HTTPS URL:

```
git remote set-url origin https://github.com/UTIG/FieldCode_JKB.git
```

If git is using an incorrect username for commit messages, you can set your username and email address for commit messages:

```
git config [--global] user.name "My Full Name"
git config [--global] user.email "myemail@utexas.edu"
```

If you omit the –global option, it will set the information for only the current repository. There is a helper script for these commands in the~/qchome/gituser. See this script for more information.

Configuring BOP Hardware

Linksys Router

Basic Information

IP Address: 192.168.1.1
username:
password:
Setup → DHCP reservations to see what devices are currently connected and how

QNAP Network Attached Storage (NAS)

Mount QNAP NAS

If you have defined a mountpoint on a laptop in the file /etc/fstab for /media/ICE04, then you may mount the NAS using:

```
$ sudo mount /media/ICE04
```

If you know the IP address, then you can also manually mount it using a command of the form:

```
$ sudo mount 192.168.1.104:/ICE   /media/ICE04
```

Be sure to run source ~/.bashrc, or restart your terminal window, to ensure that your terminal has loaded all network-based startup configuration scripts.

Unmount QNAP NAS

```
$ sudo umount /media/ICE04
```

To reprioritize RAID checking

(The QNAP may slow down drastically when its checking the RAID)
ssh into the QNAP
use top to find the PID of the process hogging resources
renice <pid> 20

To administer via the webpage:

Find the IP address, and open a web browser to port 8080, such as 192.168.1.103:8080

LTO Tape Drive

Tape Drive Status lights

- amber status light: cleaning request
- orange error and amber status light blinking fast: cleaning error or media failure
- error blinking fast: hardware error
- error light stuck on: manual intervention requested

Re-running Archive

delete Index and Log files in $ICE/note/xped/$QPROJ/archive/{ovhfr, telpo, etc}"

Useful Tape Archive Commands

Tagging new tapes:

```
$ cd $ICE/code/xped/$QPROJ/archive

$ ./add_tag {tape_type} {1 or 2 or 3}
```

Checking flights recorded on a tape:

```
$ as-list
```

Downloading data from a tape:

```
$ as-read {F##}.tar | tar -xv
```

Checking tape was recorded properly (do this on different LTO tape drive than the one that wrote it):

```
$ as-read {F##}.tar | tar tv > ~/tape_check/{F##}.tag
```

• Ejecting a tape:

```
$ as-eject
```

Port Aggregation (ICP)

Port aggregation is the process of logically combining two or more network ports on a device, to improve total transfer speed. It is sometimes also called **link bonding**. Usually you will want to aggregate ports on both the sender (e.g., laptop) and receiver (e.g., QNAP) for best effect. For our purposes in ICP9, it's only required to set up one laptop with port aggregation, because we only have one high speed data transfer (radar data) at a time.

In the qchome git repository[6], there is a script qchome/bin/port_aggregation.sh, with internal documentation on how to use it.

In ICP9, we configured ports 3 and 4 of the QNAP to use a balance-rr bonding method, and directly connected these ports to ethernet ports on a USB 3.0 dual network interface device. The QNAP was set up with IP configuration 169.254.0.107/255.255.0.0, and the Linux laptop 169.254.0.101/255.255.0.0. The fstab entry for the QNAP at /media/ICE07 was reconfigured to match this IP address.

Run ifconfig to get the network interface name.

Software Guides

XEVAS

Opening xevas

```
cd $WAIS/code/xped/$QPROJ/analysis/xlob/HiCARS2/picking

./pst_list.sh {find desired PST}

./xevas_any.sh PSTNAME
```

Initial setup

- Select File, Select data, type MagLoResInco1 (ENTER) for Low gain/ surface picking OR MagLoResInco2 (ENTER) for High gain/ bed picking
- Select pick, type srf_fld (ENTER) for Low gain/ surface picking OR bed_fld (ENTER) for High gain/ bed picking
- Select display, Select density, type 1000 (ENTER)
- Select draw. You should see the radargram on the screen

Picking the bed: I recommend you change the numbers at the top left and right to be 90000 and 190000, respectively. To do this, click on the box with the number in it, type in the desired value and

6 At ssh://melt.ig.utexas.edu//disk/kea/WAIS/code/repo/git/qchome.git

press enter. You can play around with these values: it will adjust the grayscale brightness. Sometimes this takes some maneuvering to get the right balance. Press draw to see these changes (draw should be orange, indicating that there's something new to print on the screen)

Maneuvering in the gui

- To change the viewing window you can right click and drag to choice, selecting the now orange draw again
- You can also left click and drag along the bars below and to the left of the radar gram to select how much is displayed. Again, you have to hit draw for this to print on your screen
- Another option for moving the image is to select the arrow buttons on either side of the afore-mentioned bars. This will move the screen just about the same distance that is shown on the bar, with some overlap. This allows for smoother transitions to keep picking. Once again, you have to hit the orange draw for this new section to show up

Picking!!!

- On the display tab, pik1 should be deep orange. This means it is selected. Click along the top of the surface or bed (a little bit above what you want)
- Click pik2 until it is deep orange/ selected. Click along the bottom of the surface or bed (a little bit below what you want).
- If you made a mistake (pik1 points being below the desired line, for instance) and wish to delete one or more of your points, you can hold down the center mouse button and drag across the points to be removed. They should be whited out, indicating that they have been removed
- If there is an area that you just can't make out (this mostly happens on the bed) select points for pik1 below pik2, this will indicate to the algorithm to ignore this section

Completing and saving picks

- When you have picked the entire radargram, select file, and select auto. This should bring up the image of your picks! Huzzah. If the pick is incredibly noisy in places (more leniency is given for field picks) you may have to go back and re-pick that section. Once you have done so, simply select file, auto (again), and the new pick will show up
- Once you are satisfied with your pick, hit write
- **DO NOT CLICK READ, OR PRINT**. (Unless you know what you are doing)
- Hit quit to exit once your pick has been written"

PYEVA

Pyeva is a python-based radar data viewing utility, an alternative to XEVAS. Provide it with a pik1 data file and a transect name at the command line. Example:

```
$ICE/syst/linux/src/pyeva/pyeva.py -filename
$ICE/targ/xped/ICP8/quality/xlob/pik1/ICP8/JKB2p/J364d/MagLoResInco2
ICP8/JKB2p/J364d
```

ELSA Streams

Path: $ICE/targ/xped/$QPROJ/breakout/ELSA/P/S/T/<stream>

Current Streams (ICP9)

- AVNnt2: Outside Air Temperature (OAT)
- AQNnr1 → internal status packets
- AVNcp1: Systron Donner MMQ-G IMU Data
- AVNcp2: Systron Donner MMQ-G IMU Status
- GPSkc1: Truetime – time synchronization
- LASrz1: Riegl Laser Altimeter
- MAGgm2: Geometrics G823A mag, scalar magnetometer
- MAGim1: Watson Flux-gate magnetometer
- RADnh3: VHF Radar

Old streams:

- AVNnt1: OAT
- AVNiz1: radar altimeter (from SJB itself)
- CCMei1: Elphel camera images
- GPSap3: Ashtech GG-24
- PRSpz2: barometric pressure
- RADnh4: HF Radar

Stream naming convention:

AAAbbn:

- AAA = instrument;

- bb = first letter: abbrev for manufacture; second letter: abbrev for what it is measuring;
- n = version

Emergency Procedures

Some events, such as fire, loss of power, or liquid spills are potentially hazardous to the equipment. Here are some recommendations for responding to these events.

Fire

1. Disconnect power from the affected device.
2. Use a fire blanket or B-type (electrical fire) fire extinguisher on the device.

Loss of Power

When AC mains power is lost, UPS battery power takes over. Data corruption may occur, if a data archive tape is being written, or data is being written to the QNAP NAS. Expected run time with a UPS varies according to the UPS model number, battery health, and output load. Consult your local BOP architect for estimates of run time.

1. Nonessential devices should (already) be disconnected from the **battery-backed** UPS outputs.
2. Interrupt any tape archiving processes at the command prompt.
3. Unmount (umount command) QNAP NAS from each laptop.
4. Power off QNAP NAS from the front panel.
5. Wait for any noises to subside on the tape drive, then power it off.
6. Once power is restored:
    1. If QNAP shutdown was not performed or interrupted, scrub and check disks for errors.
    2. If LTO tape archive was interrupted, assume that the archive is incomplete, and re-archive the file.

Liquid Spill

1. Remove any more moisture-sensitive items in the spill path.
2. Dry the item, then evaluate function.

Appendix A

When editing this document, note that most formatting is taken care of by styles. Normally you **should not** need to use the manual formatting commands such as bold, font size changes, etc.

Here's a couple of styles that are used most often:

Heading 2 for section headings

Heading 3 for sub-points

```
"Command Line Example" is used when you need to type some commands,

possibly multiple commands.
```