# Day(s) before

* Go over the checklist in the excel spreadsheet (should be kept in the same directory as this document), make sure everything is accounted for.
* Charge the laptop and the power banks (the 2 spare rechargeable batteries).
* Assure there are enough charged AA batteries to power the ADCP.
* Double, triple check the overpass times of the SWOT satellite using the [online web map](https://arcg.is/1myyGW0).
* View satellite images to estimate the best locations for a discharge measurement (TJ uses Caltopo).
  + Ideal locations will have:
    - No braids
    - No curves
    - Consistent and stable hydrology
    - Easy eddy access on both sides
    - Limited vegetation on both sides
    - A good location for a base station (see figure 2)
  + Always look for multiple locations so there are backups in case one does not work out.
* If possible, run the section without any science equipment with an experienced local to find and mark hazards and ideal discharge measurement locations.

# Pre-measurement

* Check the checklist in the excel file so nothing gets left behind.
* Arrive at the put-in early and assemble the raft as seen in figure 1.
* Be sure to adhere to all SOPs for a drift.
  + This document does not list everything in the SOP document so be sure to read it!
  + Make sure to mark down all the movement codes with a time zone code.
  + Make sure to mark the interferences with a time zone code.
* Assure the GNSS antenna is not attached in a way that it will be lowered, raised or moved during the measurement.

# Set up the Septentrio receiver for data collection

* Plug the power cable into the receiver into the power bank and connect to the laptop via the com cable.
* Click the bookmark in the Microsoft Edge tab called ‘Web-PolaRx’
* Navigate to Logging->Disk Contents
  + Make sure that the disk contents are COMPLETELY empty
    - If there is an active logging session it will automatically populate with data even if you click delete, this is fine.
  + Double check that the logging session is active under:
    - Logging->Log Session. Use the MSU\_test session.
* If everything is plugged in correctly you should see satellites under the GNSS tab.
* If everything is good, unplug the com cable and close the case and strap it down. This will not be disturbed until the entire trip is over!
* Make sure the raft sits undisturbed for 30 minutes prior to measurement as per the SOP.
  + Make sure to pay attention to the SOPs for the movement codes.

# During measurement (on river)

* MEASURE THE HEIGHT OF THE GNSS ANTENNA!
* Measure the antenna base and add the value listed on the antenna to get to the phase center.
  + Make sure to note which measurement you are reporting (antenna base or phase center).
  + Do not disturb the antenna during the measurement.
* While taking a centerline, try to stay as centered on the river as possible while remaining safe.
  + Meandering side to side will artificially lengthen the river segment, but…
  + BE SAFE!

# Boat based discharge measurement

* Once you arrive to the location where a discharge is to be measured:
  + Mark to movement codes and time with a time zone for the GNSS SOPs.
  + Assemble the raft/base as seen in figures 1 and 2, if applicable.
    - Do not disturb the GNSS antenna. It will remain running the whole time
* Turn everything on and attempt to connect the laptop to the ADCP
  + The river surveyor has a link to the manual for troubleshooting, but here are some common problems:
    - If the GPS light on the rover PCM does not flash any color, the cable between the PCM and ADCP is not fully connected.
      * Be VERY careful with this cable. Assure that the prongs are in the right place, but it does take some force to get it all in.
    - If the Radio and GPS lights are both on, on the rover PCM, you should be able to connect it to the laptop.
      * If the ADCP does not show up at all in the Riversurveyor software, reinstall the driver, following the instructions as seen on the laptop desktop yellow sticky note (virtual).
    - If you see the ADCP in the Riversurveyor software, but it is still not connecting, or you get any weird error:
      * Restart EVERYTHING
        + Restart the laptop
        + Take out all batteries from the PCM
        + Unplug the cable on both ends from the ADCP and PCM
        + Start over
    - When in doubt try restarting EVERYTHING
* Once you are connected and everything is operational, perform the pre-measurement steps
  + Fill out the boxes in the software (station ID, temp, run the system test, etc.)
  + Perform the compass calibration:
    - Once you click start, spin the boat, rotating in one direction for 1 min, while rocking the raft. Then after a minute is up spin the other direction for a full minute.
    - Then click done.
  + After all steps above are completed and you have a good compass calibration you are ready for a bed test:
    - To effectively run a loop method in a raft please read below carefully:
      * Make sure the raft can sit with one tube parallel to the shore up against the shore, so it is stable and still.
      * Drop the ADCP into the water, if it is not deep enough while having a stable raft, find a new location.
      * Mark the tip of the tube with a rock or stick. Be very precise
      * Click start in the loop method pop up window.
      * Row the raft SLOWLY across the river, bump the shore, and row SLOWLY back across over the course of about
      * The boat speed should be the lesser of a.) the boat speed that requires no less than 3-minutes to complete the loop or b.) the boat speed that is less than 1.5 times the mean water speed.
      * Return to the EXACT same location as the starting place and click finish.
      * Carefully read the output as it might recommend a repeat due to poor data, or it will say that the test failed (meaning it was good data but there is a moving bed)
      * If after 2 or 3 attempts, you cannot get good data for this test make a note of that and we will use a GGA reference for discharge calculations.
  + Next, MEASURE THE DEPTH OF THE ADCP.
    - Load the raft as it will be during the measurement paying attention to where weight is distributed.
    - From the flat part of the bottom of the sensor measure to the water surface.
* After the above is completed, you are ready for a measurement.
  + Fire up the system. You should see the ADCP start to take measurements if it hasn’t already; it is not yet collecting data.
  + Get the raft to the start edge.
    - While it is not moving, click on the samples tab at the bottom of the software.
    - There should be at minimum value of 2 in the ‘cells’ column before you click begin start edge. The raft should also not be moving at all.
    - Fill in the value for distance to shore and left/right bank while looking downstream.
    - If this is impossible due to fast moving water or hazards, get the raft as close to the shore as possible and proceed to start moving. Make a note of this.
    - Once there are 10 rows of a valid begin edge click start moving and give the signal to begin moving
  + It is important to maintain a consistent heading and speed as you move across the river.
  + Once across the river, get the raft to a place where it can remain completely stationary and repeat the start edge procedure for the end edge.
  + Repeat this such that there are 2-6 transects for a total measurement time of at least 12 minutes.
* Now you will perform a quick in field data quality check:
  + Export the files into a .mat file and move **ALL FILES** out of the default created folder (documents/sontek/data/*todays date*).
    - If you do not remove these files, it can corrupt future measurements.
  + In a new file following the structure of previous measurements, paste the SystemTest, CompassCal, and all .mat files.
  + Open the QREV software and **select only the transect files** (all the .mat files except the one that starts with ‘loop’)
  + It is important to check that the transects are all similar in discharge within reason. Use your best judgement based on conditions.
  + If there is one or more that is negative, that just means that the right/left edge is backwards, and you can change that in the ‘Edges’ tab.
  + For each tab there is a ‘data’ tab and a ‘messages’ tab. Read through them to see what the cause of the red/yellow errors are.
  + Remember it is nearly impossible to get a perfect measurement, so do your best and use your best judgement!
* If anything is glaringly wrong you can take 2 or more transects (skip straight to the start edge, no need to redo the compass calibration or loop if you do not move down stream).
  + You can pick and choose the best 4-6 transects if one or more are very poor.
* Remember to enjoy the scenery as you adhere to the GNSS SOPs as you float out!

# Post-measurement

* Make sure the raft sits undisturbed for 30 minutes after the measurement.
* Use this time to de-rig the rest of the raft, but make sure to be careful to not move the raft or the GNSS antenna.
* After the 30 minutes complete de-rig is allowed.
* Download the data off the GNSS receiver (I usually do this back at the comfort of a house as it takes a while)
  + Power up the GNSS receiver and connect the com cable
  + Navigate to Logging -> Disc Contents and click the green download button. This should take a while.
* Back up all the Sontek files (the .mat transects, .map loop, SystemTest, CompassCal, and pre-lim Qrev).
* Back up the GNSS data (.sbf file).
* These files go in teams under ADCP\_data.
  + Explore previous examples to see the file structure. Note there will be no base station data.

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Figure 1: This is the rover or boat based set up for the ADCP. The PCM controls the ADCP which is the device that measures the river. The PCM for the boat has 3 ports on it along with 2 places for battery cartridges. The Septentrio receiver requires a power bank with a 3-prong outlet and it’s specialized power cable. Be sure that the T split takes the 1 cable coming out the Spetentrio antenna and splits it to the receiver and the PCM (see below).

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Figure 2: Base station set up for the ADCP data. This set up is to be used during a discharge measurement only!