

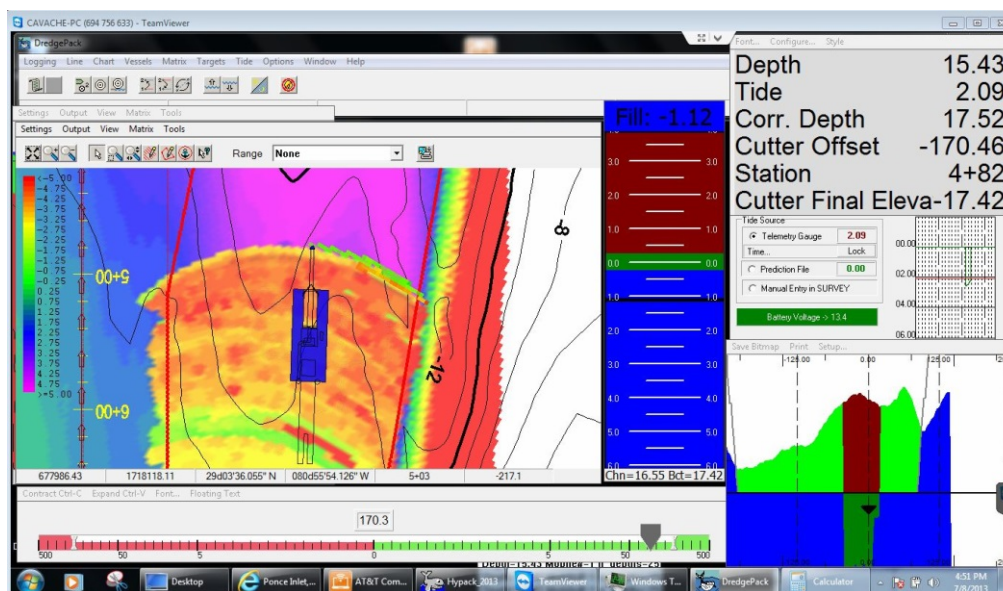


## Basic Guide to Cutter Suction Dredges

By Christian Shaw

This guide will facilitate the basic setup for a cutter suction dredge in DREDGEPACK®. There are extra considerations when using custom drivers, devices and setups. Please inquire in our support department if you have these special conditions.

**FIGURE 1. DREDGEPACK® Display**



Select PREPARATION-HARDWARE.

In HARDWARE, everything is broken down into mobiles. We track each part of the dredge like a separate vessel. The pontoon, ladder and spud are all treated like different boats. This allows you to track stationing and offsets for each mobile. It also allows for the computation for the cutter head X,Y and Z.

The 3 basic Mobiles function and order are as follows:

- **Boat Mobile**
  - [GPS.dll](#): Position, Heading, and Tide
  - [AIS.dll](#): Generates output messages. With class B transceiver see local vessels that transmit position.
- **Cutter Tool Mobile**
  - [Inclinometer.dll](#): Position, Depth, Heading
  - [HD25a.dll \(Optional\)](#): If it is a swinging ladder dredge then heading will differ from the pontoon.
  - [SwingInd.dll](#): Gives information about swing speed of cutter and angle of swing in degrees.

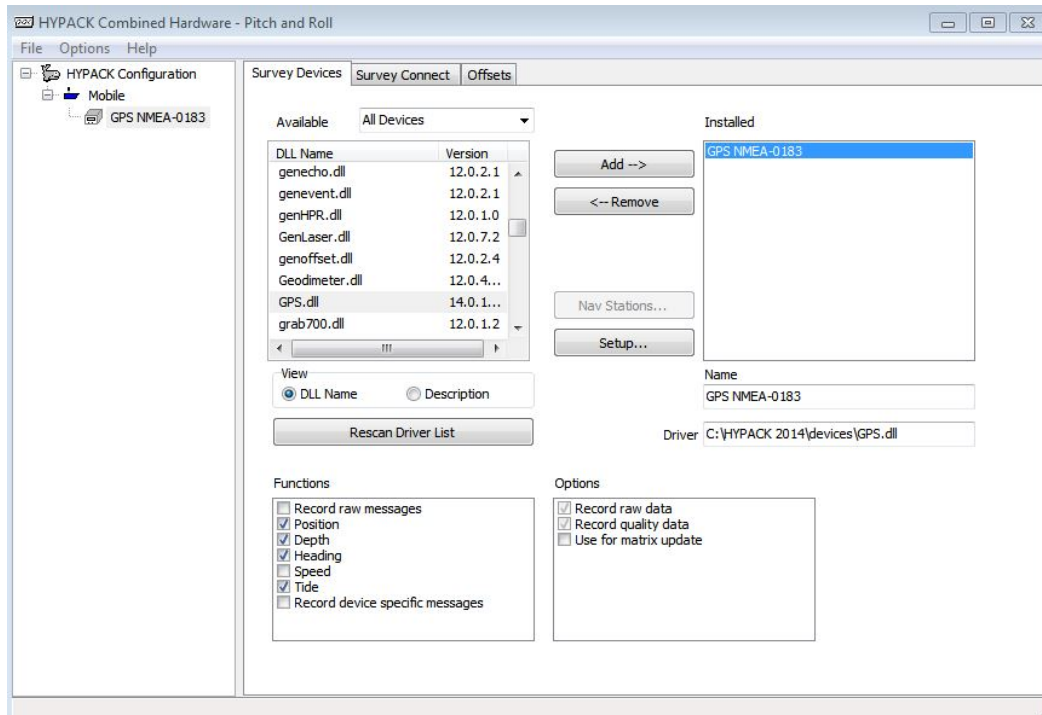
- [Cutfill.dll](#): Shows graphical information about cut/fill relative to a channel template.
- **Spud Mobile**
  - [Genoffset.dll](#): Generates a spud position based on offset from Trunnion X,Y.

The following sections explain each device driver in HARDWARE and the source of input for each.

## GPS.DLL

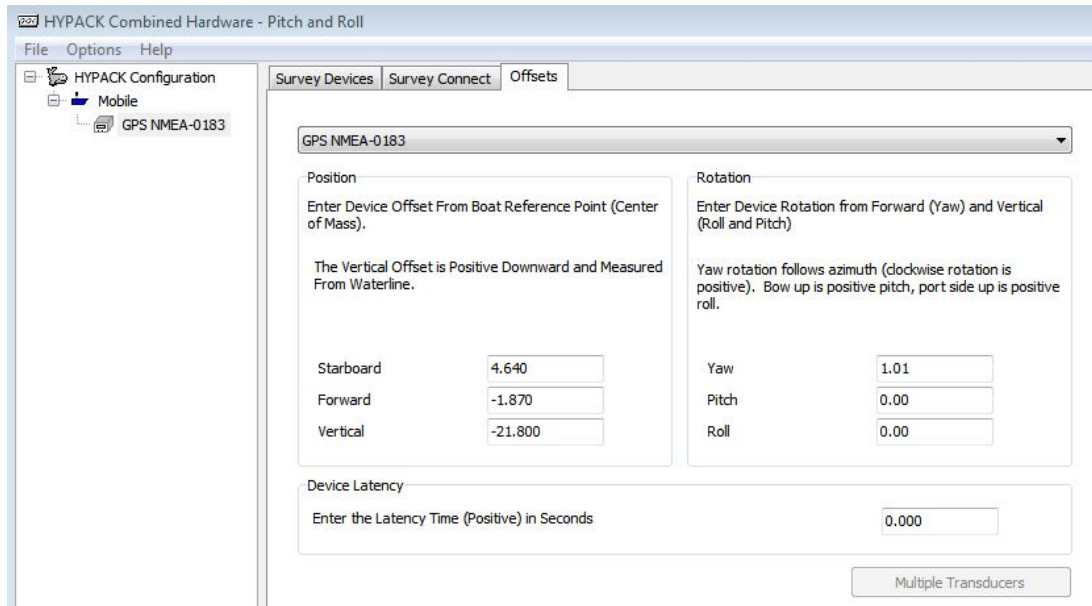
- **Position:**
  - Offset from Trunnion Pin for Starboard and Forward Offsets.
  - Vertical Offset measured to water surface or, if you have draft sensor to the keel.
- **Heading:** Derived from dual GPS system or gyro.
- **Tide:** Is this an RTK GPS? This computes RTK water surface elevations.

**FIGURE 2.** GPS Driver Setup



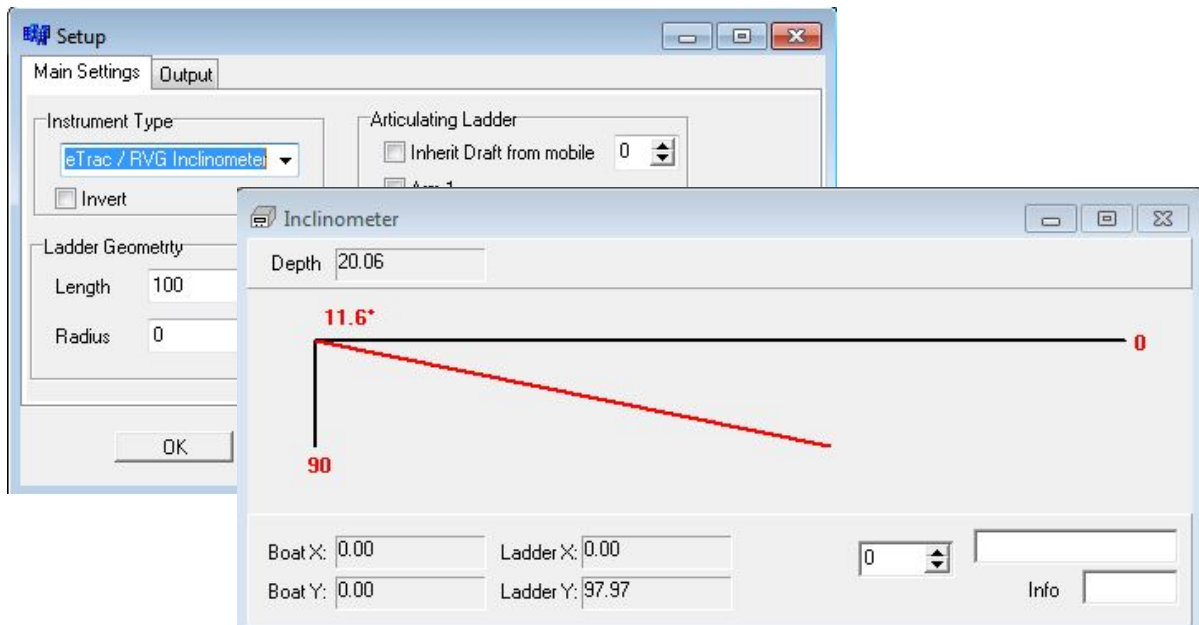
**Offsets:** If there is any deviation from dual GPS antenna mounts versus the centerline of machine, enter a Yaw Rotation offset.

**FIGURE 3.** GPS Device Setup



## INCLINOMETER.DLL

**FIGURE 4.** Inclinator Driver Setup

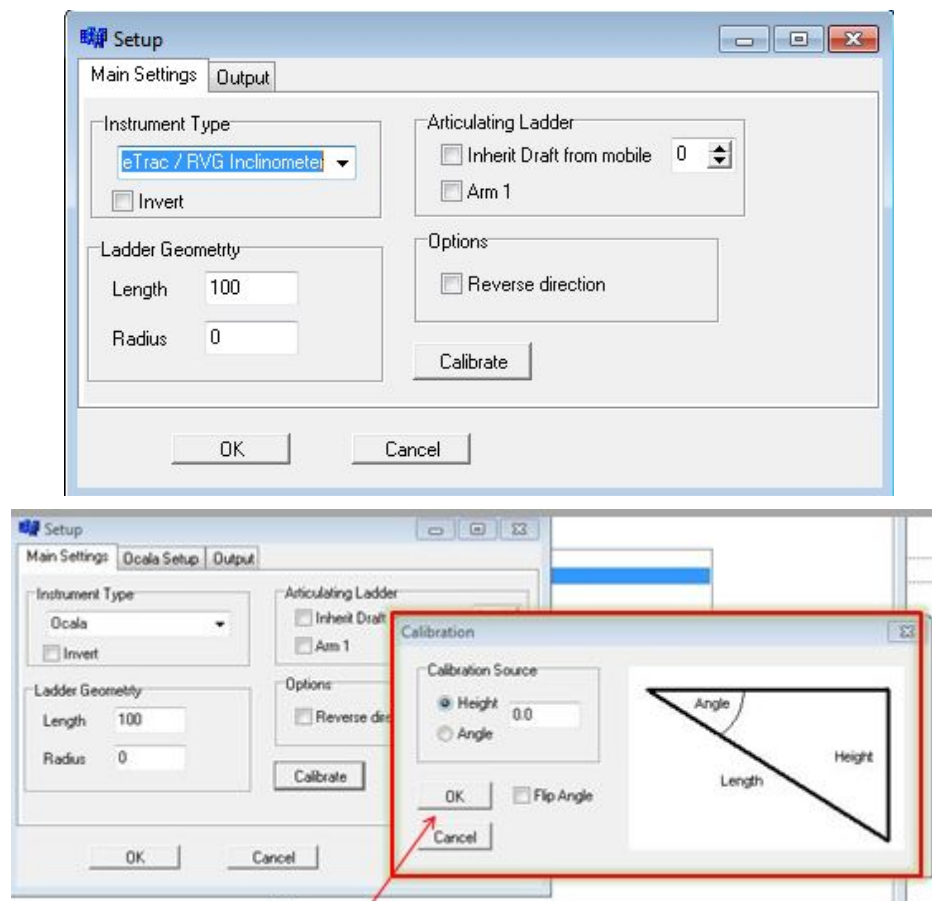


- **Instrument Type:** Type of hardware installed.

- **Invert:** If angle is reversed. Up is down and down is up etc...
- **Ladder Geometry:**
  - **Length:** Distance from the trunnion to cutter tool. This is a straight line measurement from the center of pin to end of the cutter head.
  - **Radius:** Distance from the center of cutter tool to teeth.

**NOTE:** Do not use if you calibrate with the teeth at the water surface.

**FIGURE 5.** *Inclinometer Driver Setup*

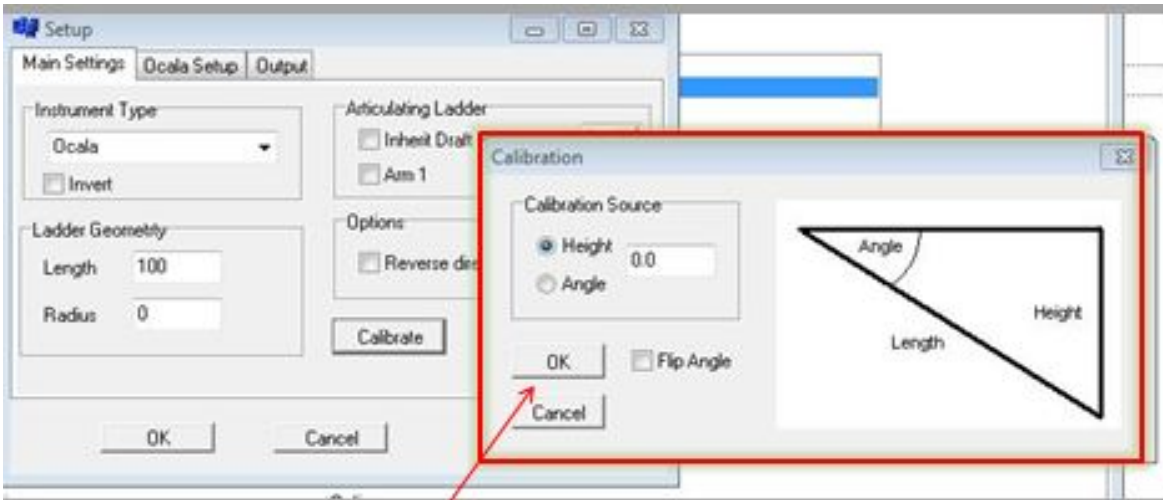


## **CALIBRATION OF CUTTER TOOL**

Click the Calibrate Button.

- Enter **Height** of the Tool above or below the water.
- **Angle** Calibration is only used if you have independent angle verification.

FIGURE 6. Calibration Measurements



**Tip:** The best way to verify is to take a take measure out to your boat and tie off to the cutter head. Lower the head to a known depth and match up with what DREDGEPACK® shows in the data display.

The formula for depth check:

$$(\text{Sin of the angle}) * (\text{Ladder Length})$$

## SWINGING LADDER DREDGE (OPTIONAL)

FIGURE 7. Angle Sensor

- Measures swing angle of the ladder (Heading).
- Pontoon heading and arm heading are different.
- Calibration is done in HARDWARE.
- Set ladder straight and enter an angle of 0 in the driver setup.
- Heading is the only function of this device. Disable heading from other devices under the cutter mobile.
- Serial and USB adapters are available.

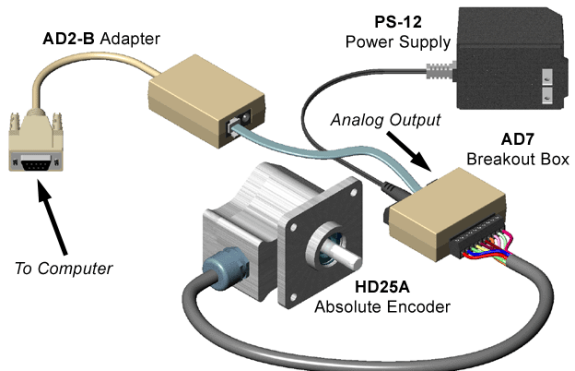
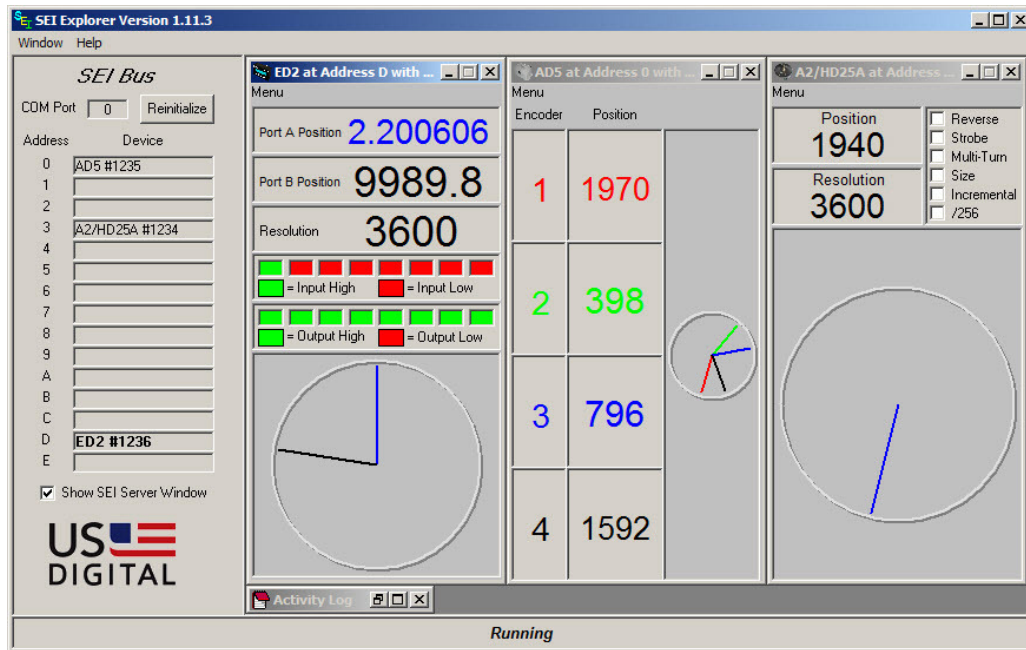


FIGURE 8. SEI Explorer Display

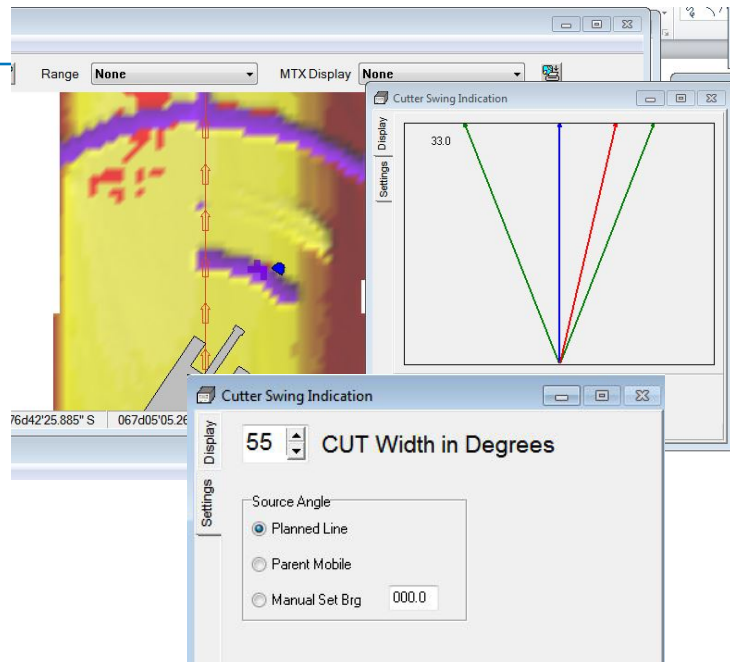


## SWINGIND.DLL

Measures angle of the cutter tool relative to the planned survey line (\*.LNW) or parent mobile (another vessel).

FIGURE 9. Swing Indication Display

- **Bearing:** set manually.
- **Cut width:** A set of predefined angled lines to keep the operator within the confines of the digging plan.
- **Speed:**
  - Expressed in feet per second or feet per minute.
  - Gives the operator a sense of how fast the cutter is moving through the material.
  - Typically, good dredge managers have calculated a optimal swing speed given the type of material, the amount of material to be dredged to grade, and number of passes.



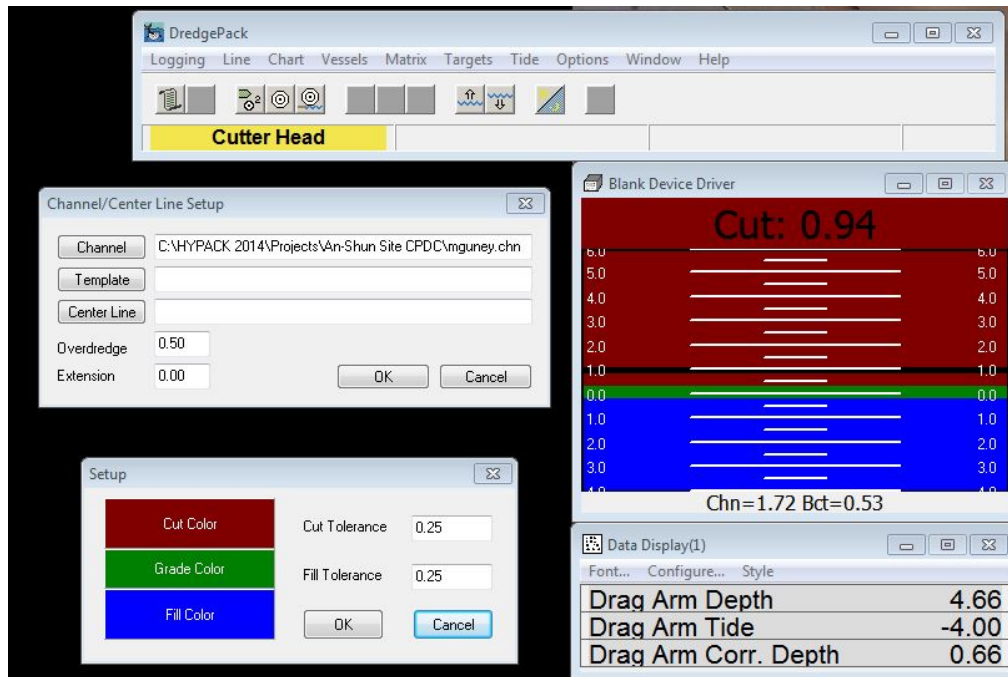
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## CUTFILL.DLL

The CutFill driver tells the operator how much material is above or below the template in the matrix cell at the cutter tool position.

**FIGURE 10.** CutFill Device Window (bottom right) and Configuration in DREDGEPACK® (bottom left)



- Load the template for the cutfill.dll to reference. Select CHART-CHANNEL and load either a matrix (\*.MTX) or a channel file (\*.CHN) representing your channel design.
- In DREDGEPACK®, right-click in the driver GUI to configure options to configure tolerances for the operator and display colors.

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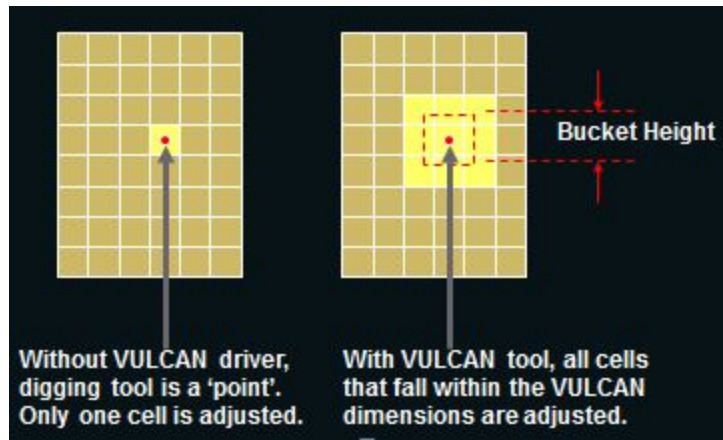
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## VULCAN.DLL

This driver is used to span multiple matrix cells, e.g. if you have a 1x1 matrix resolution and a cutter tool that is 3X3, with this driver you will effectively change 9 matrix cells at a time as the cutter moves through the surface.

Set the size of the bucket (Bucket Height and Width) in the driver setup.

FIGURE 11. Filling a Matrix with the Vulcan Driver



## GENOFFSET.DLL

The GenOffset driver can be used to track the position of just about anything on your dredge.

- Offsets are placed *in the setup form* for this driver.
- Left-right indicators, and station and range for this position can be derived for the Data Display.
- Best way to avoid a pipeline!

FIGURE 12. Genoffset Configuration

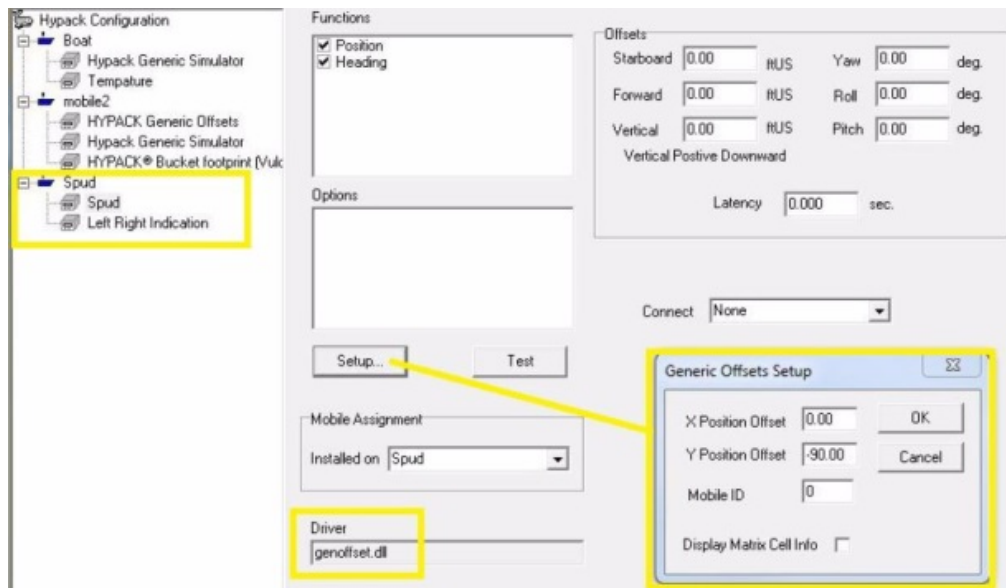
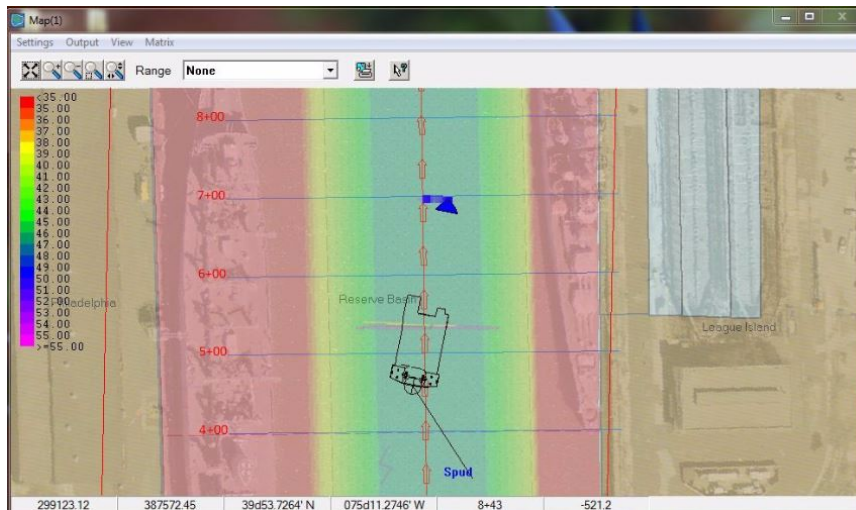
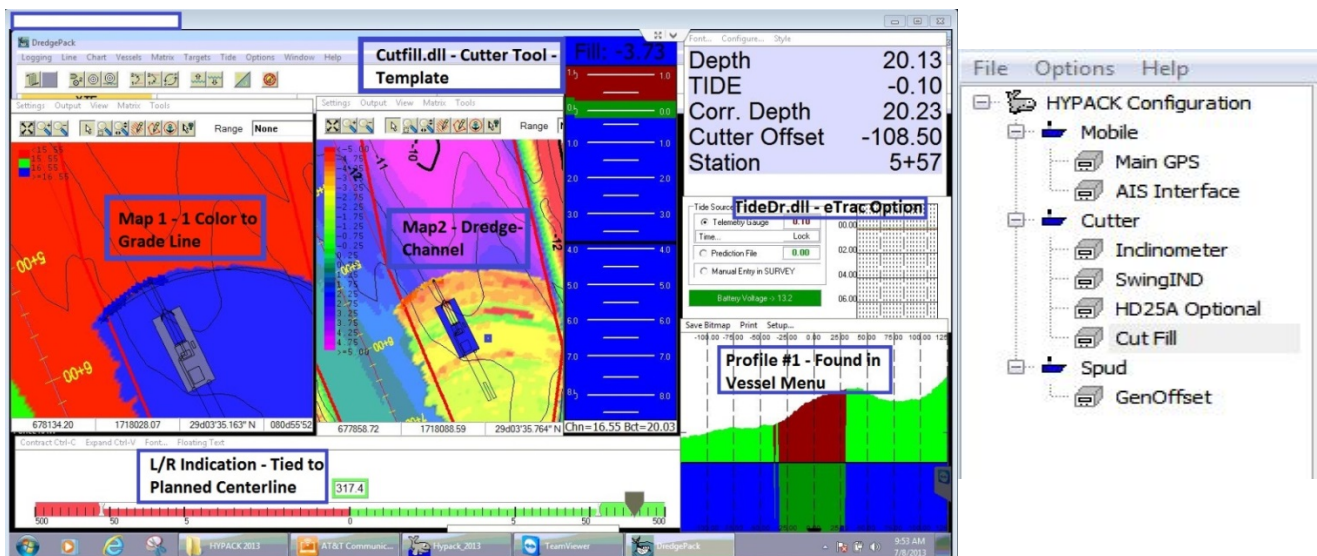


FIGURE 13. Spud Position in the DREDGEPAK® Map Window



## CUTTER DREDGE HARDWARE SAMPLE

FIGURE 14. Cutter Dredge Configuration and Display



### Files in DREDGEPAK®:

- **Digging Templates:**
  - Loaded under CHART-CHANNEL-CHANNEL.
  - Can be \*.MTX or \*.CHN. These template files can be made in TIN MODEL or in ADVANCED CHANNEL DESIGN.
- **Centerline offsets:**
  - For the Left-Right Indicator, load in the Shell before entering DREDGEPAK®.

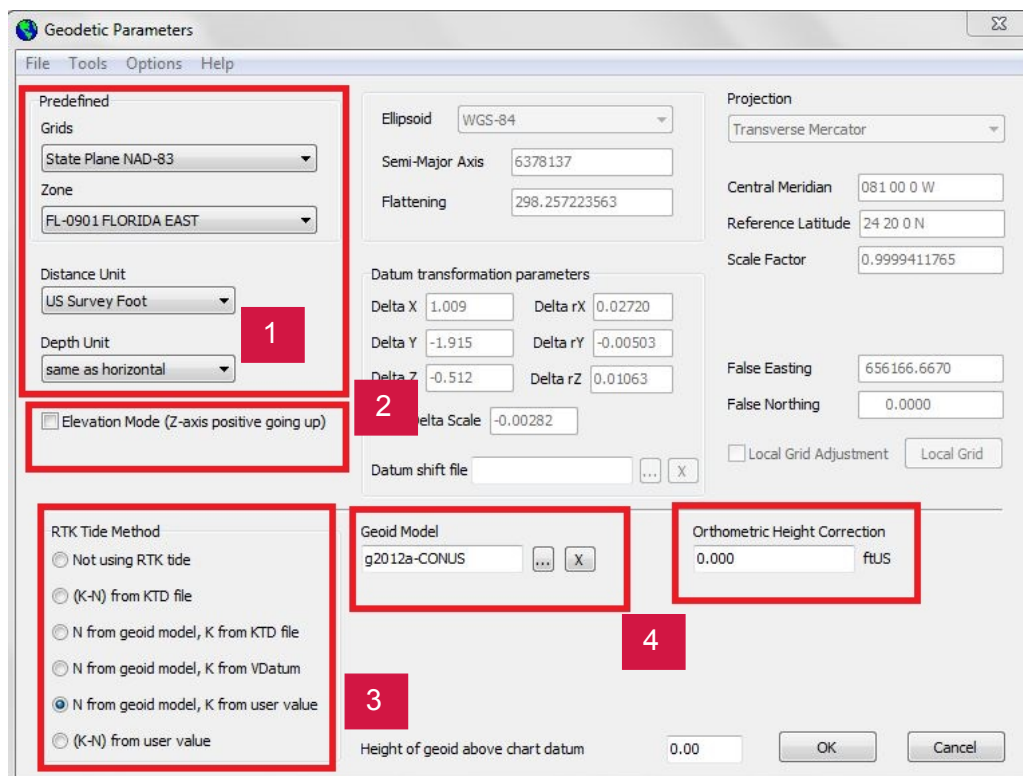
- For the Data Display, Station and Offset load under CHART-CHANNEL-CENTERLINE.
- **Digging Matrix:**
  - Load in HYPACK® Shell before entering DREDGEPACK®.
    - Right-click on matrix in Map and set to Dredge Depth or Dredge Minus option.
    - Ensure color palette is to match the depths that will be dug.
    - Color.HCF is the color file in your project.
  - In the main HYPACK® tool bar, select MATRIX-OPTIONS.
    - In Elevation Mode change Record to Minimum.
    - If in Depth Mode change to Record to Minimum.
- **Opening a Cross Section Profile:**
  - In the Vessel dialog in DREDGEPACK®, choose the mobile and click Profile Window.

## ADDENDUM: SETTING UP HYPACK® GEODESY

HYPACK® geodesy is necessary for computing the XYZ positions of the mobiles that you have setup in HARDWARE. As positions from the GPS are passed to HYPACK®, we change the Latitude and Longitude to your grid XY positions. It also allows you to define how RTK will be handled in DREDGEPACK®.

Select PREPARATION-GEODETIC PARAMETERS.

**FIGURE 15.** Configuring your Project Geodesy



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1. **Predefined:** This is your Grid such as state plane coordinate system or countries grid system.
  2. **Elevation Mode** flips the signage for final elevation. Depths below 0, in Elevation mode, are Negative.

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**NOTE:**Tide always holds same convention.

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3. **RTK Tide Method:** The geoid model for the US is currently 2012a/b. This, with no Orthometric Height correction delivers NAVD88 positions to HYPACK®.
4. **Geoid Model/Orthometric Height Correction** is simply and offset. As an example, this can convert to datum's. For instance from NAVD to MLLW. For a small area would put in the separation value. It can also be used for small scale adjustments to the RTK tides displayed in HYPACK®.

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**NOTE:**It is preferable to adjust this value to get the tides dialed in as opposed to adjusting the GPS.dll vertical offset.

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There is more you can do with DREDGEPACK® for cutter suction, however it cannot be covered in one document. The intent of this document is to layout the basic drivers and window setup so that you can start your project and track your dredging progress: viewing depths, updating a matrix, and tracking your center line and template.