# Smart Aligner – Advanced Tool Course

Topics Covered

Note: This training course assumes that the Introductory Course has been completed and the user is familiar with the basic operation of the Smart Aligner System.

1. Battery Level and Charging: Slides 3 - 6
2. Advanced Tool Deployment: Slides 7 - 14
3. Information Screens: Slides 15 - 23
4. Menu System: Slides 24 - 26
5. Storing Surveys: Slides 27 - 33
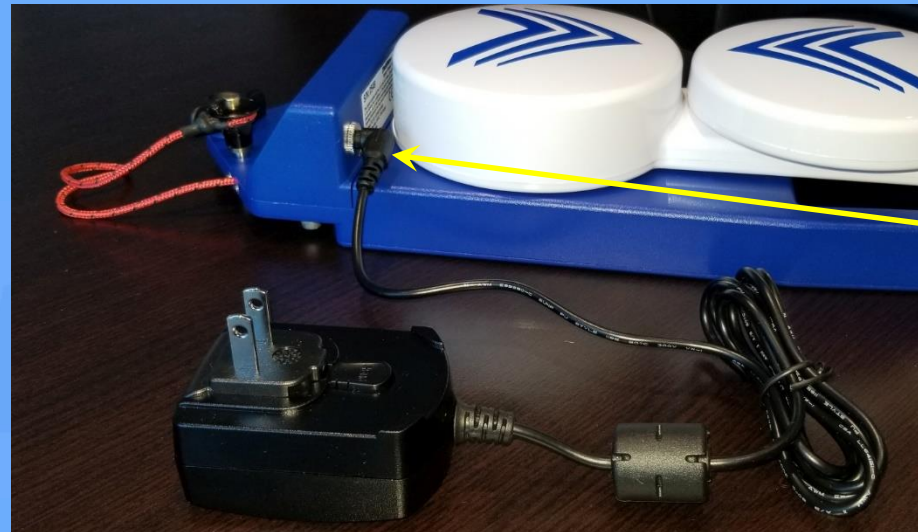
Battery Level and Charging

1. The battery level is displayed by a series of bars, each of which signifies 2 hours of remaining operation time. Maximum time is over 11 hours.
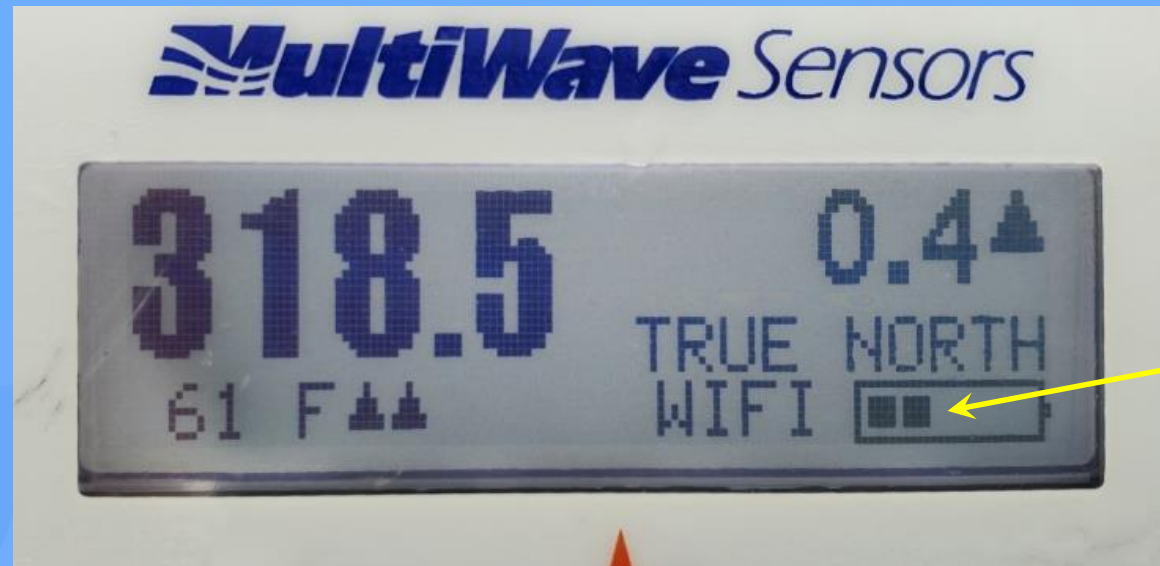
Battery Bars (>10 hours)
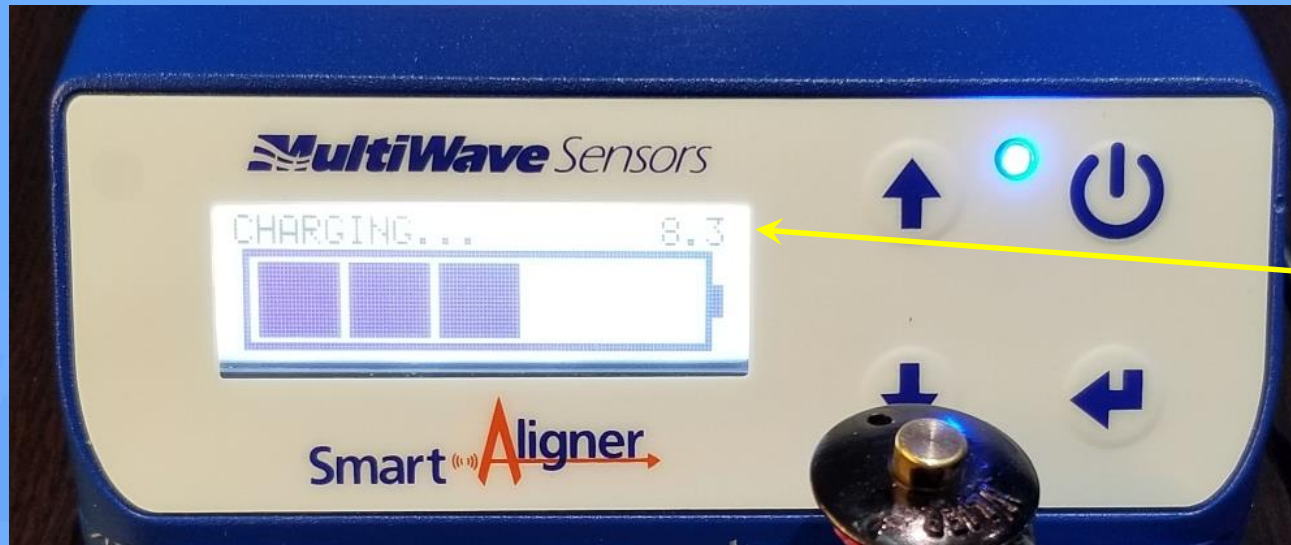
Battery Level and Charging

2. The Tool can be charged with the supplied Wall Charger or Vehicle Charger. Do not use any other charger than supplied chargers.

3. Plug the Jack of either Charger into the Charging Port as shown:

Jack in Tool's Charge Port

Battery Level and Charging

4. When external power is applied, the LCD Backlight will turn on and display the charging status. The battery voltage is displayed in the top right corner of the screen.

Battery Voltage

Battery Level and Charging

5. The Tool can take up to 5 hours to fully charge. When the Tool is fully charged, the display will display "CHARGED" or "BATTERY CHARGED" and the backlight will turn off.

Advanced Tool Deployment

1. Once the Tool has been attached to the Bracket, there are three possible arm configurations:

Chevrons

Chevrons Forward
(Introductory Course)

Chevrons Left
(Left "T")

Chevrons Right
(Right "T")

Advanced Tool Deployment

2. Unless there are space restrictions, it is highly recommended to use either the Left or Right "T" configuration to mitigate multipath interference.

Advanced Tool Deployment

What is Multipath Interference?

3. When the satellite signal comes to the GPS antenna (yellow arrows), it can come directly to the GPS antenna or reflect off of a surface and then go into the GPS antenna (red arrow). This creates two paths, thus two distances and this affects the compass' accuracy.
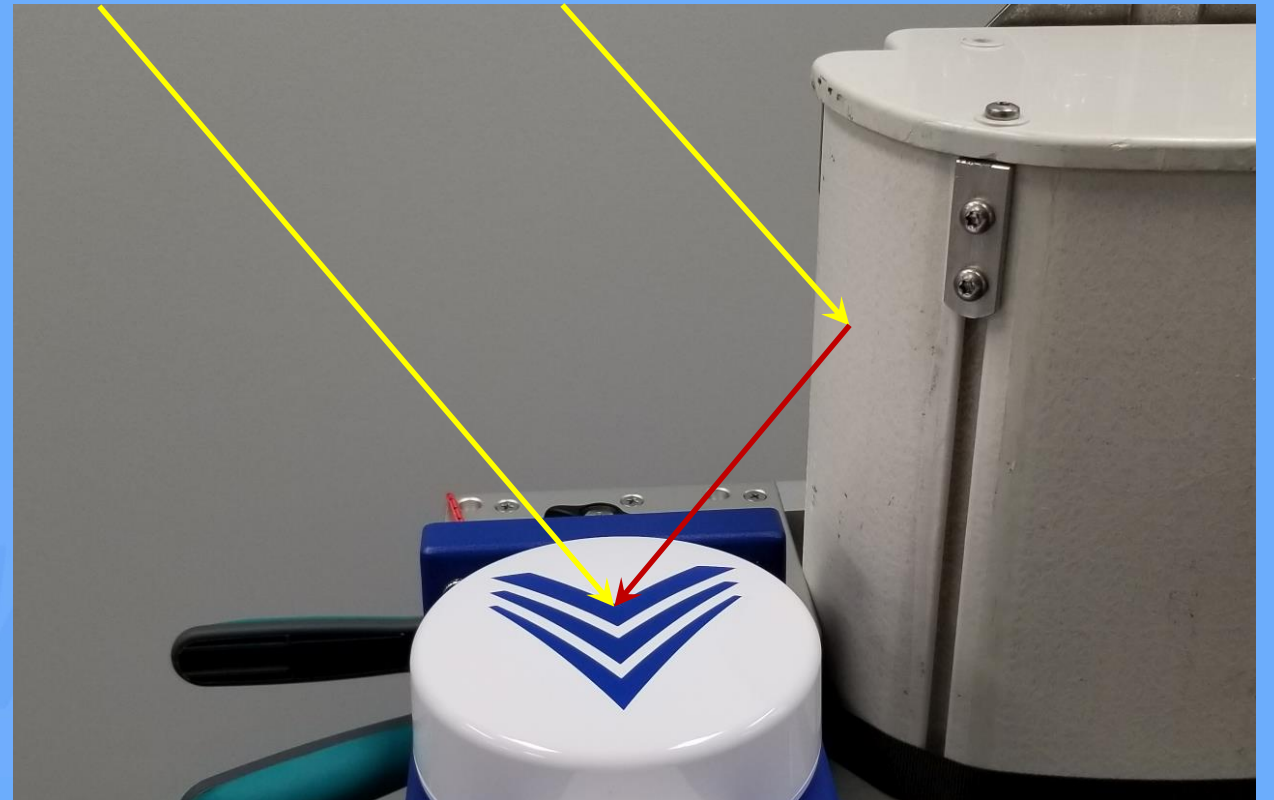
Advanced Tool Deployment

How does the "T" Configuration help mitigate multipath?

4. The reflected satellite signal cannot go into the GPS antennas because it is too far away from the reflected surface.
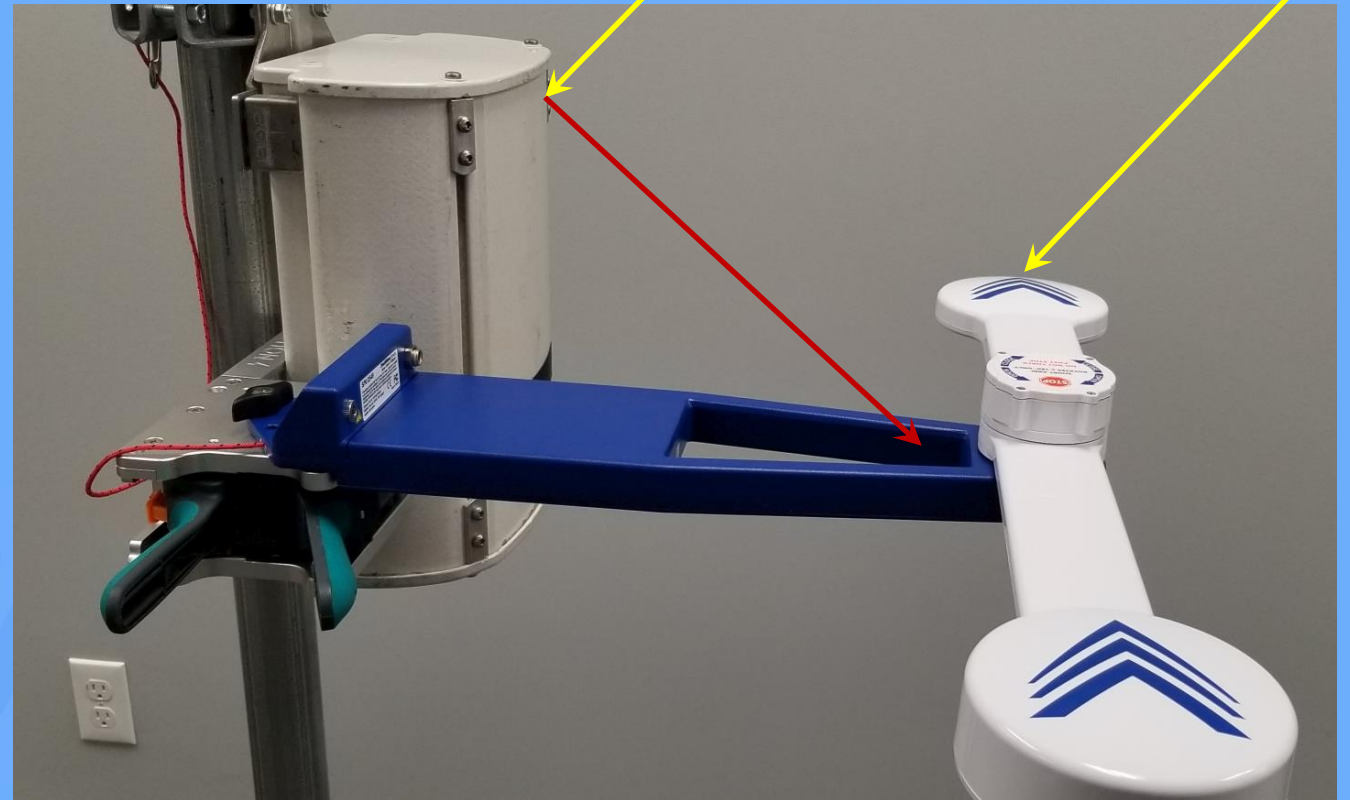
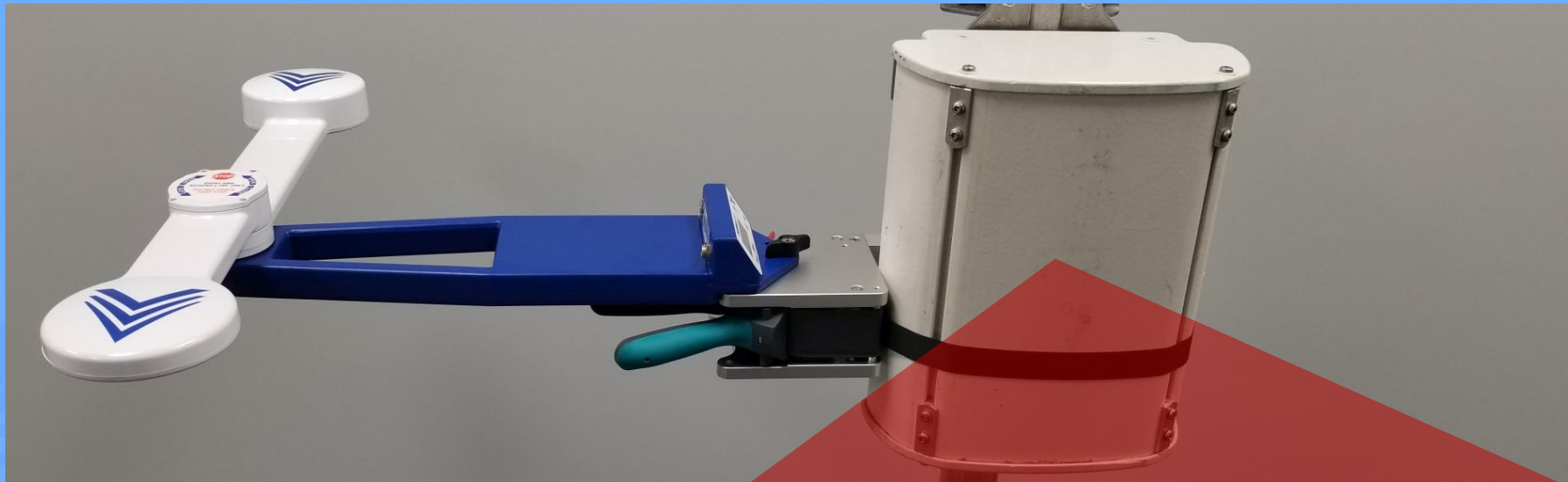# Advanced Tool Deployment

Working with a Live Antenna?

5. Even though the antenna will not broadcast at the same frequency as the GPS band, out-of-band RF (red) can get into the ground plane and cause problems with determining the GPS compass solution. Wi-Fi communication can also be affected since the Wi-Fi antenna is in the Short Arm.

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Advanced Tool Deployment

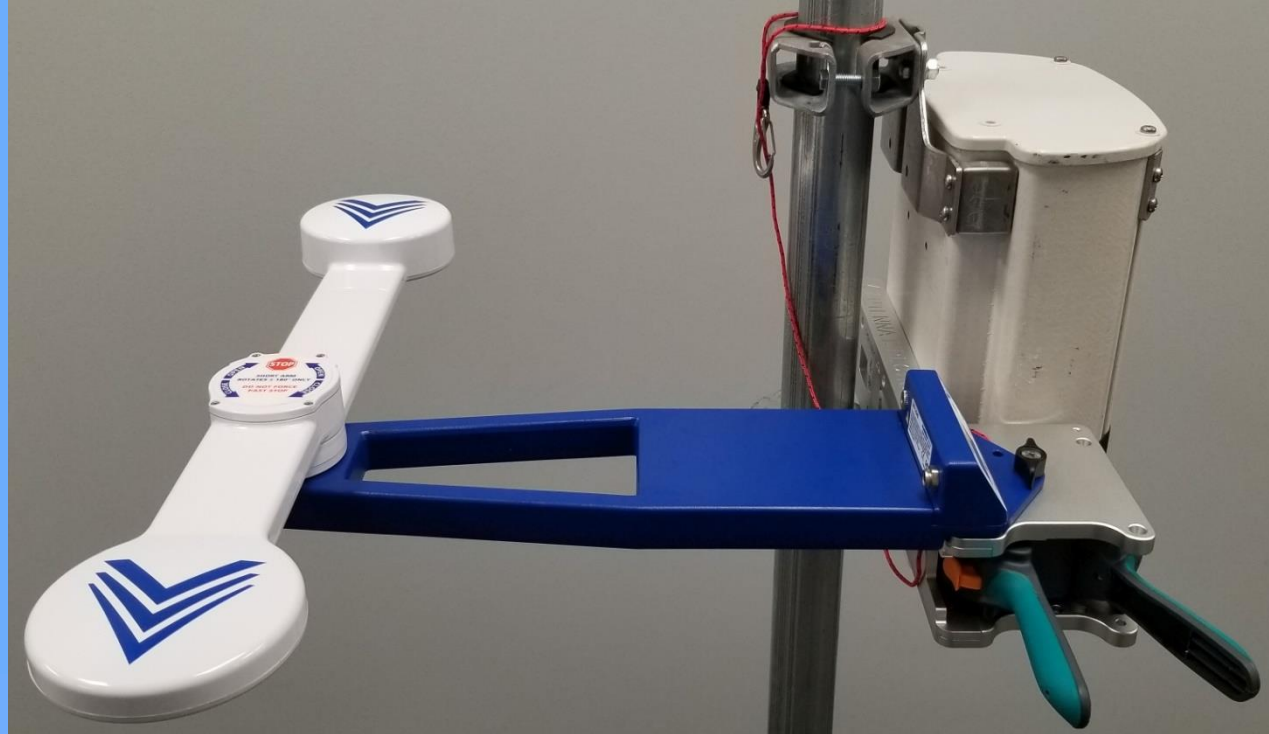What can be done to avoid RF?

6. The Tool can be mounted 90° off to the side to remove the GPS antennas and Wi-Fi antenna from the RF path (red).

# Advanced Tool Deployment

Where else can the Tool be mounted?

7. The Tool can also be mounted 180° (backwards) in the bracket if obstacles need to be avoided.

Advanced Tool Deployment

8. The Arms can be mounted in 3 different configurations. The Tool can be mounted in three different orientations and the bracket can be on the left or the right side of the antenna. Therefore, there are 18 possible mounting configurations. **The Tool senses the Arm/Tool positions and automatically applies offsets so that the Tool only produces the Azimuth, Tilt and Roll of the antenna, regardless of its configuration.**
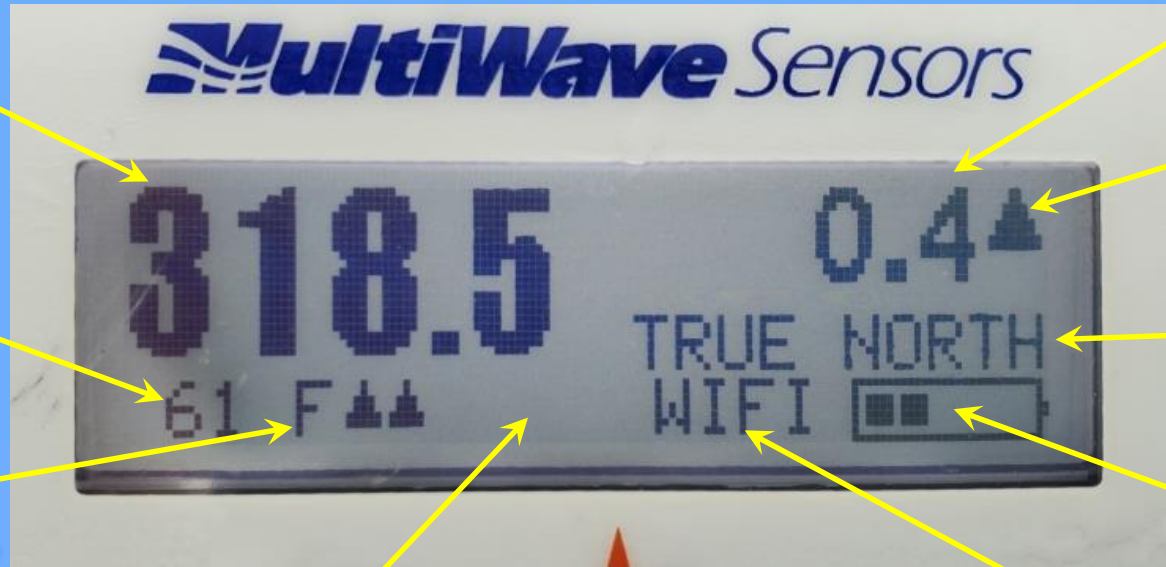
Smart Aligner Advanced Tool Course
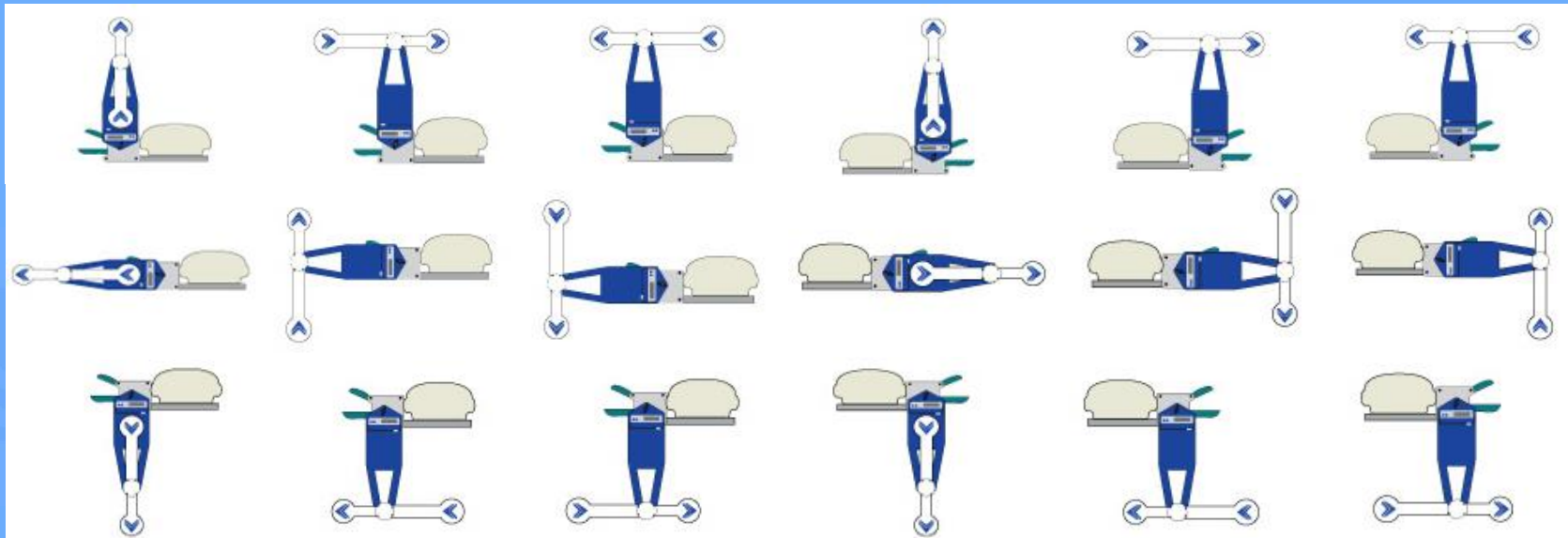
Main Information Screen

1. In the Introductory Course, the Main Measurement Screen was described as below. The GPS Integrity, Tool/Arm Positions and WIFI/BT will be explained on the next slides.

Azimuth (degrees)

Tilt (degrees)

Down Arrow (up tilt)

GPS Integrity (percent)

MultiWave Sensors

318.5   0.4▲

TRUE NORTH

WIFI

61 F▲▲

Azimuth Reference (True)

Tool and Arm Positions

Battery Life (2 Hours/bar)

If GYRO appears here, see Troubleshooting Course

WIFI or BT (may not appear)

Main Information Screen

2. The GPS Integrity is a confidence factor in percent. It is a blend of satellite quality and how the compass solution is reacting in real-time. The GPS Integrity should improve the longer the Tool is running. Typically 2-3 minutes should be enough time to maximize the azimuth solution. If the GPS Integrity is below 40%, then there is probably an external factor such as satellite access blockage, multipath or RF interference. Please see the previous section to optimize the Tool Deployment for these conditions. If the GPS Integrity is above 80%, then the azimuth accuracy should be within 0.2°. The typical accuracy specification for the Smart Aligner is 0.5° for all environments.

Main Information Screen

3. The Tool position is described with a letter. The letter can be an F (Tool is in the forward position), L (Tool is to the Left of the antenna), R (Tool is to the Right of the antenna) or B (Tool is Backwards). The first arrow is describing the direction of the Chevron on the Short (upper) Arm and the second arrow is representing the Chevron direction on the Long (lower) Arm. Example of F ▲▲ means Tool is forward and both arms are forward.

<u>Short (Upper) Arm Positions:</u>
- ▬ Stored (backward)
- ◄ Left
- ► Right
- ▲ Forward

<u>Long (Lower) Arm Positions:</u>
- ◄ Left
- ► Right
- ▲ Forward

Main Information Screen

4. If WIFI or BT appears on the screen, it has a serial number > 3001 or it has been upgraded with a new Carrier Board at MultiWave Sensors. If this is the case, the Tool will communicate with the phone via Wi-Fi or BT depending on how it is set in the menu. The default is Wi-Fi. If the wireless information is not displayed, then the Tool only communicates with Wi-Fi and the app should not be set to BT. In general, Wi-Fi will provide better range capability and BT will be better in difficult RF environments. For information on changing the wireless mode, please see Slide 26 of this course. The new Carrier Board has the restriction of connecting to only one phone at a time, regardless of the wireless mode.
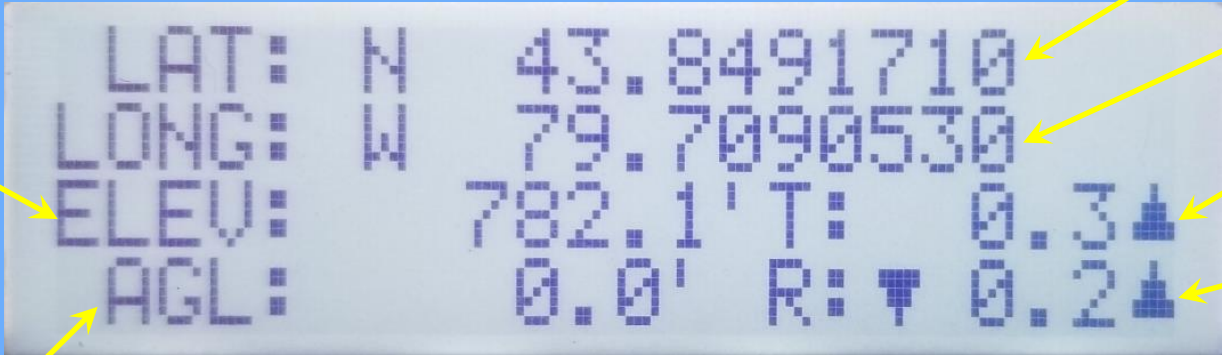
Addition Information Screens

5. From the Main Information Screen, additional information screens can be viewed by using the Up and Down Arrow keys on the Front Panel.

Power LED

Power

Display Window

Up Arrow

Enter

Down Arrow

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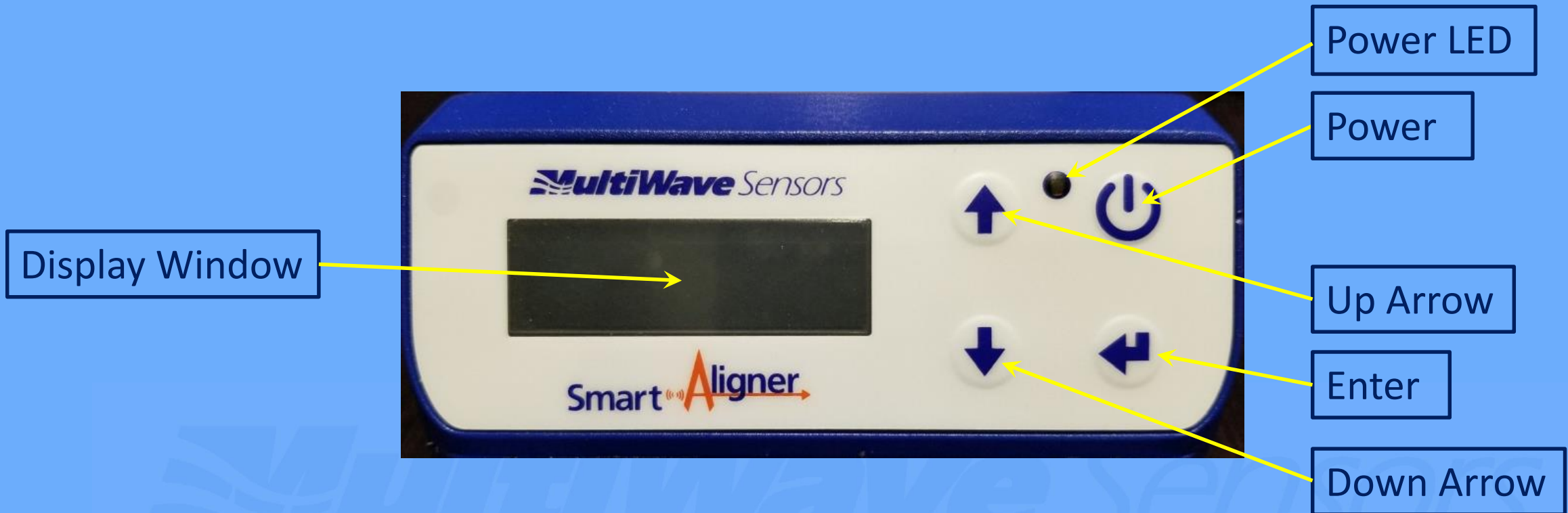
Position Information Screen

6. Pressing the Down Arrow will display the Position Screen. If this is the only additional measurement screen accessed, it will revert back to the Main Measurement screen in 10 seconds.

Latitude

Longitude

Elevation

Tilt/direction

Roll/direction

```
LAT:  N    43.8491710
LONG: W    79.7090530
ELEV:      782.1'T:    0.3
AGL:         0.0'  R:  ▼ 0.2
```

AGL - Above Ground Level
(See AGL Measurements Course)

Tool Information Screen

7. Pressing the Down Arrow again will display the Tool Screen.

Carrier Board with FW version

Tool Serial #

Time

Date

```
SAS-11 2.9.60 sn   2549
2015.12.14  12:47:01AM
TZ: -5.00 TTS:4
WIFI CH: 9A:0 R3
```

Time Zone Difference

Wi-Fi Channel Information

Time To Solution (seconds)

Azimuth Solution Information Screen

8. Pressing the Down Arrow again will display the Azimuth Solution Screen.

Internal Diagnostic Parameter

Time To Solution (seconds)

GPS Integrity (%)

Horizontal Dilution of Precision

Solution Quality (2 is best)

```
CSEP:505 TTS:4   GI: 53
HDOP: 1.3  #:  7   Q:2
GPS:  14 >50:  0
GLN:   9 >50:  3
```

Satellites used in solution

GPS satellites in view

Satellites with excellent signal

GLONASSS satellites in view

Navigating Information Screens

9. Pressing the Down Arrow again will scroll back to the Main Measurement Screen. All information screens can be accessed using the Up Arrow as well, but they will be reverse order:

Main Measurement Screen
Position Screen
Tool Screen
Azimuth Solution Screen
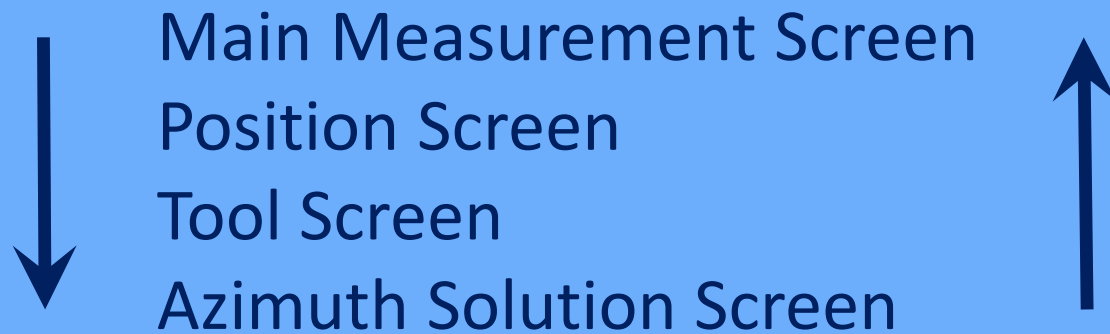
User Menu

1. The User Menu is accessed at any time by pressing the Enter Button.
2. To change a parameter, use the Up or Down Button to move the cursor to the desired parameter.
3. Press the Enter Button to change to parameter.
4. Using the Up or Down Button, scroll to Exit and press Enter (saves new setting).

Cursor

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User Menu

5. LOCATION FORMAT: D.D (degrees, decimal degrees)(default)
   D M.M (degrees, minutes, decimal minutes)
   D M S.S (degrees, minutes, seconds, decimal seconds)

6. TIME FORMAT: AM/PM (default)
   24 HR

7. UNITS: FEET (default)
   METERS

8. SOUNDS: EVENTS (default)
   BUTTONS+EVENTS
   OFF

User Menu

9.   BACKLIGHT: ON (default)
                             AUTO (may not appear)
                             OFF

10. WIRELESS: WIFI (default)   Note: Whatever wireless mode is selected, the app setting must match
                             BT

11. WIFI CHANNEL: AUTO (default)
                             MANUAL SELECT (scroll)

12. DATA PORT: LASER (default)
                             DATA (USB Data Cable and logging)

13. TIME ZONE ADJUST: See Storing Surveys (next Section)
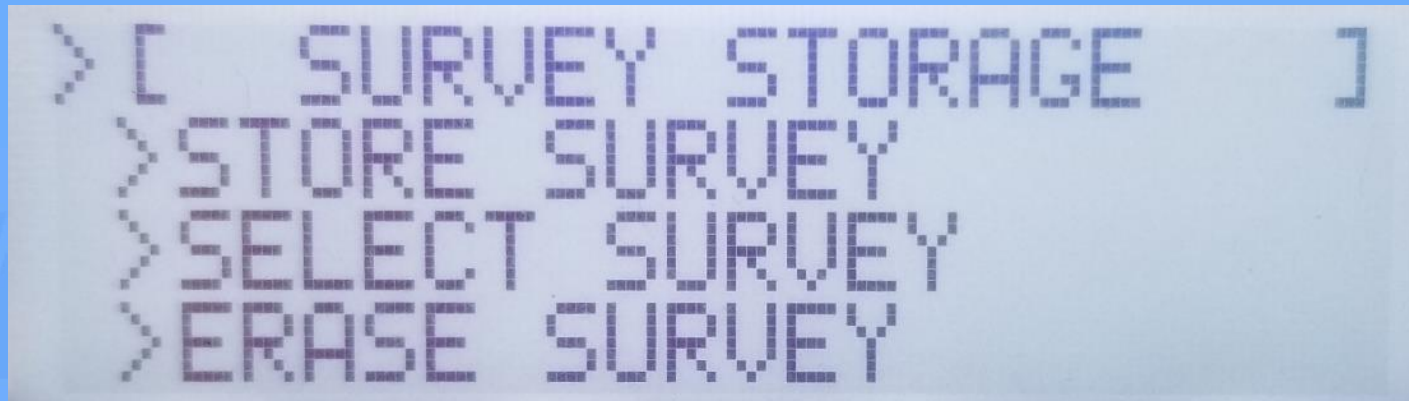14. SURVEY MENU: See Storing Surveys (next Section)

Storing Surveys on Tool

1. When using the smart phone/app to perform a survey, it uses the phone's clock to set the time. When storing a survey file on the Tool, the Tool must record the time of day with the survey. Since the Tool only knows the UTC time (GPS time), the UTC time zone offset needs to be set.
2. Go to the User Menu. Scroll down to TIMEZONE ADJUST and press Enter.
3. Use the Up or Down Buttons to change the offset to your location. If you are outside with the arms deployed, the display will show what the corrected time is given the offset that was entered.

Smart Aligner Advanced Tool Course

Storing Surveys on Tool

4. Now that the Tool knows what the correct local time is, survey files can be properly stored on the Tool. This can be performed in the event that the Tool is not communicating with the smart phone/app or the user does not want to take the smart phone to the RAD center.

5. To save a survey, go to the User Menu and scroll down to the Survey Menu and press Enter. The following Survey Storage Menu will appear:

Storing Surveys on Tool

6. Before selecting Store Survey, make sure that the antenna is aligned properly. Selecting STORE SURVEY is like pressing VERIFY in the app. It will be recording the measurement data.
7. Select STORE SURVEY. The following screen will appear while Verifying:

Storing Surveys on Tool

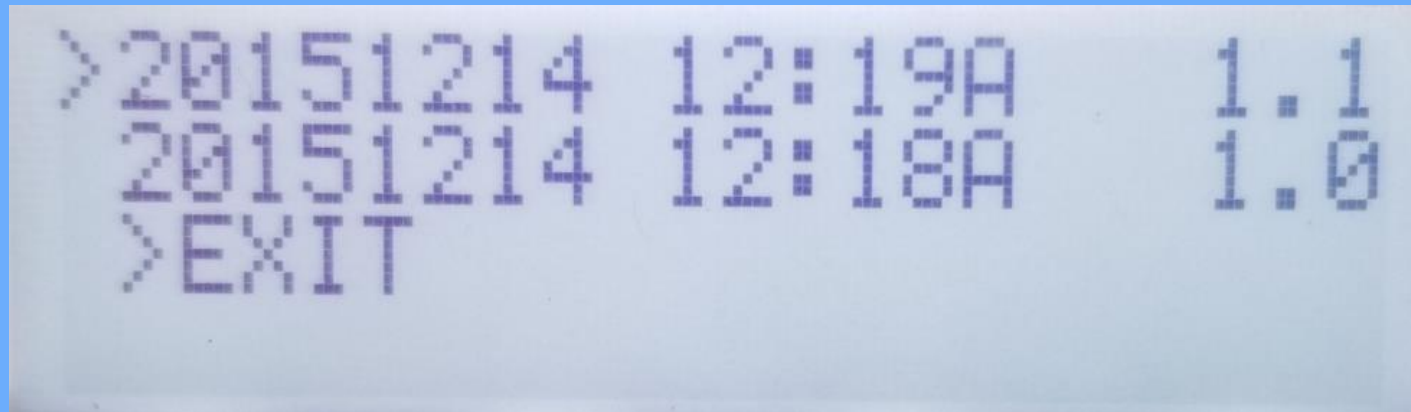8. After about 10 seconds, the following survey summary screen will appear:

9. The file is now saved. Press Enter to return to the Main Measurement Screen.

Storing Surveys on Tool

10. To see or download the survey file, go to User Menu, Survey Menu and Select Survey. The list of all stored surveys will appear as follows:
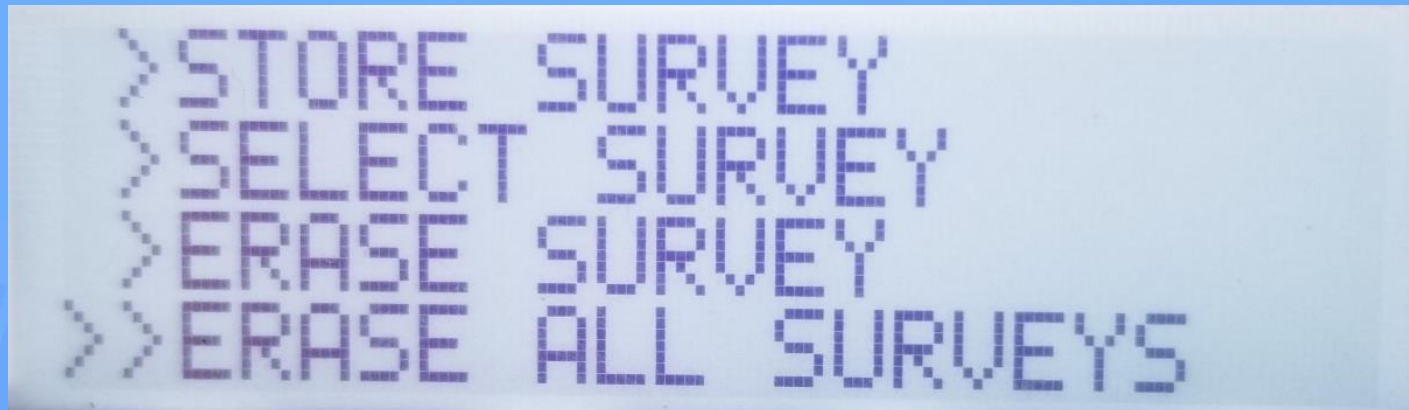

11. The files are named by date, time and the verified azimuth. If you are surveying more than one antenna at the same azimuth, record which antenna you aligned first so that you know what antenna file you are downloading.

Storing Surveys on Tool

12. Before selecting a file for download, the Smart Aligner app must be connected to the Tool and the antenna parameters (targets, etc.) need to created as per a normal survey.
13. When the app is at the point of VERIFY, select the survey file on the Tool and press Enter. When you see the survey file summary screen, it is broadcasting to the app.
14. After the app has collected all of the survey file data (about 10 seconds), it will ask if you want to Accept the data or Re-align. Choose Accept.
15. Hint: If you have the phone at the RAD center and you can`t get communication, create the antenna profile in the app and take photos. Then, when you download the data from the Tool, the survey file will be complete with photos.

Storing Surveys on Tool

16. The Tool is capable of storing up to 32 surveys. It is recommended to download the surveys as soon as possible. Once the survey files have been downloaded and are not needed on the Tool, go to User Menu, Survey Menu and ERASE the individual surveys or select ERASE All SURVEYS as per the following menu:

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Course End

Recommended Next Course

1. Advanced App Course