SNOdar/SWEdar (SDS-X3) Mobile Installation Guide

Parts List

1. 1 – SDS-X3
2. 1 – Outrigger Antenna w/ drill template
3. 2 – 10 ft. LMR240 Antenna cables
4. 1 – SDS-X3 data cable
5. 1 – SDS-X3 power cable
6. 1 – Roll, cold shrink black tape
7. 1 – Lightbar w/ attached ball mount
8. 1 – Lightbar power cable
9. 1 – Ball Mount
10. 1 – Mounting Clip

1.

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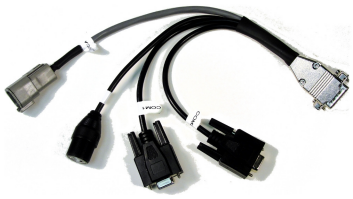

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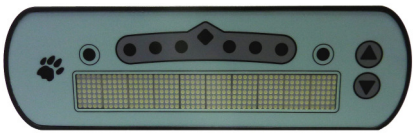

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Overview

The FlatEarth SNOdar/SWEdar, SDS-X3 system is designed for ease of operation and installation. The full installation should take less than 2 hours per vehicle once you are familiar with the steps involved. Some general considerations for the installation are:

a) The Lightbar should be located within the operator's field of view, to usefully observe snow-depth messages, without obscuring the view of the blade or other vital components.
b) A specific mounting location for the Outrigger Antenna-X3 is outlined below, but may have to be customized depending on the model and year of the vehicle. However, always mount the Outrigger Antenna along the center line of the vehicle and parallel to the ground.
c) The SDS-X3 should be mounted under the vehicle's passenger seat or in the center console to ensure the provided Antenna Cables properly span the distance between the Outrigger Antenna and the SDS. The exact position my need to be customized depending on the model and year of the vehicle.

Power requirements for the FlatEarth SNOdar/SWEdar, SDS-X3 system are 9-36 VDC. Connection to a power source for the X3 components is provided by wiring power leads with the red/positive wire connected to ignition sense power and the black/brown/negative wire properly grounded. This ensures that the system will only be on when the ignition key is on and will not drain the vehicle battery. Also, ensure all components use the same ignition sense power source so everything powers up simultaneously.

Installation Steps

Lightbar

1. Locate Ball Mount (#9) for Lightbar (#7) on dash cover toward the front of the operator's view in the vehicle cab. Be sure to locate the Ball Mount where mounting holes can be drilled through the dash cover without interfering with underlying electronic components and wiring in the vehicle. Drill three holes using a 3/16 inch drill bit and secure the ball mount with the three 10-24 mounting bolt and nut pairs.

Figure 1: Lightbar ball mount in central viewing location

2. Attach Mounting Clip (#10) to Ball Mount and Lightbar. Position Lightbar toward operator and secure by tightening mounting clip, see figures 2 and 3. Route the Lightbar power cable (#8), pigtail side, to the desired power supply location in the cab. Attach the blue cap end of the Lightbar power cable to the Lightbar. If desired, wrap the exposed Lightbar power cable wires in plastic

sheathing for maximum protection against wear. To change Lightbar brightness see the Appendix.

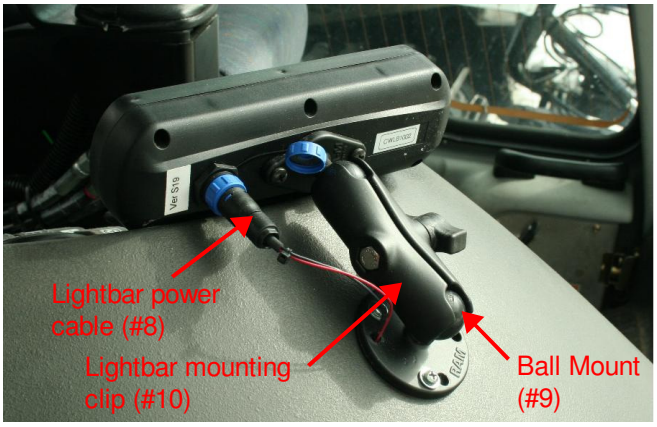

Figure 2: Lightbar on center dash in vehicle cab

Figure 3: Lightbar in driver's field of view

SNOdar/SWEdar, SDS-X3

3. Next, locate a sufficiently sized space, similar to the dashed area in the figure 4 photo, in the cargo hold underneath the vehicle's passenger seat for mounting the SDS (#1). Use the mounting flange holes as a template to drill 4 pilot holes. *Note: For ISAAC configuration skip step 4 below.

Figure 4: Cargo hold under passenger seat

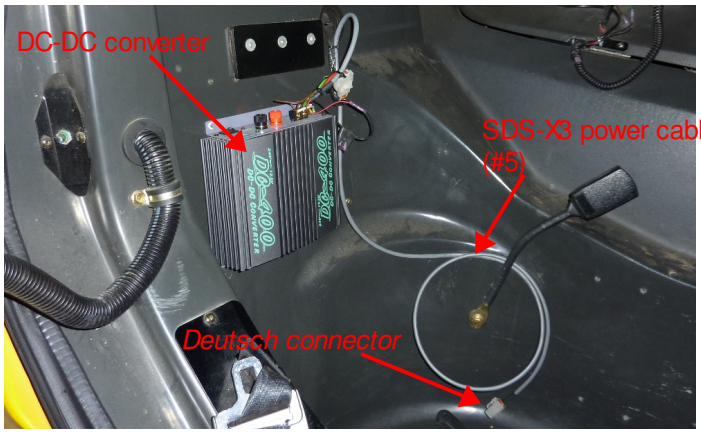

Figure 5: DC-DC converter under backrest

4. Route the SDS-X3 power cable (#5), pigtail side first, to the desired power supply location in the cab, e.g. DC-DC converter beneath the backrest of the passenger seat. Connect the power leads appropriately (red/positive & brown/negative) with a 1 Amp in-line fuse.

5. Connect the SDS-X3 data cable (#4) to the SDS, and tighten the captive screws on either side of the connector (2, #4-40 slot-head). Mount the SDS with 4 screws of your choice, depending on the material to which you are mounting, using the previously drilled pilot holes. Finally, connect the power cable to the data cable via the *Deutsch connector* interface. For Standalone Configuration details see the Appendix.

   ***Note:** If CAN interface communication is desired for ISAAC configuration; instead, connect the existing ISAAC CAN/PWR cable to the *Deutsch connector* on the SDS data cable.

Figure 6: SDS-X3 mounted in cargo space under passenger seat

6. Drill an elongated hole through the snowcat body and insulating foam, near the SDS-X3 as seen in figure 6 above, slightly larger than two SMA connectors side by side (small gold connectors, see figure 8 below). Be careful to drill above any horizontal metal tubing, supporting the cab. This hole will provide a pathway for the Antenna Cables (#3) to enter the cab and attach to the SDS. The other end of the cables will be dropped through the frame via the cab pivot joint down to the Outrigger Antenna-X3 (#2) mounting position.

Figure 7: Right Angle (RA) Type-N connector

Figure 8: SMA male connector

7. While the cab is elevated, route the Antenna Cables – SMA end first – into the cab from the cavity, under the cab and above the gas tank. Keep the cables secured behind the cab frame, and leave them hanging free as the cable slack will have to be drawn up and coiled in the cargo hold beneath the passenger seat. See example in figures 9 and 10. Route the larger Type-N side of the Antenna Cables around the cab pivot joint and down to the main forward-facing cross-member of the frame, near to where the Outrigger Antenna will be mounted. For routing, follow an established routing path of the factory installed wiring harness/plastic sheathing. Leave the connectors hanging free over the beam with 12-18 inches of slack.

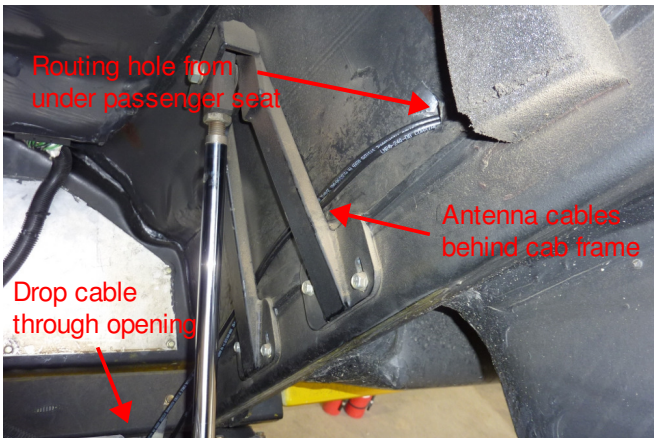

Figure 9: Antenna cable routed beneath cab frame under elevated cab

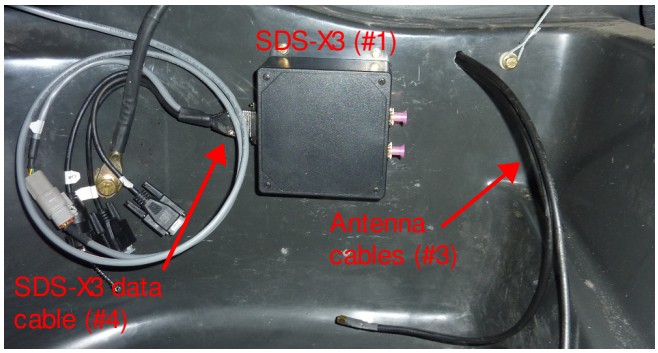

Figure 10: Antenna cable routed into cargo hold from underneath cab

Outrigger Antenna-X3

8. Locate the main cross-member of the frame underneath the snowcat vehicle for Outrigger Antenna mounting. Find the horizontal center of the beam, as the antenna will be mounted along the center-line of the vehicle. The top of the Outrigger Antenna will be mounted just below the top of the beam. This ensures the proper sensor height and ease of cable installation.

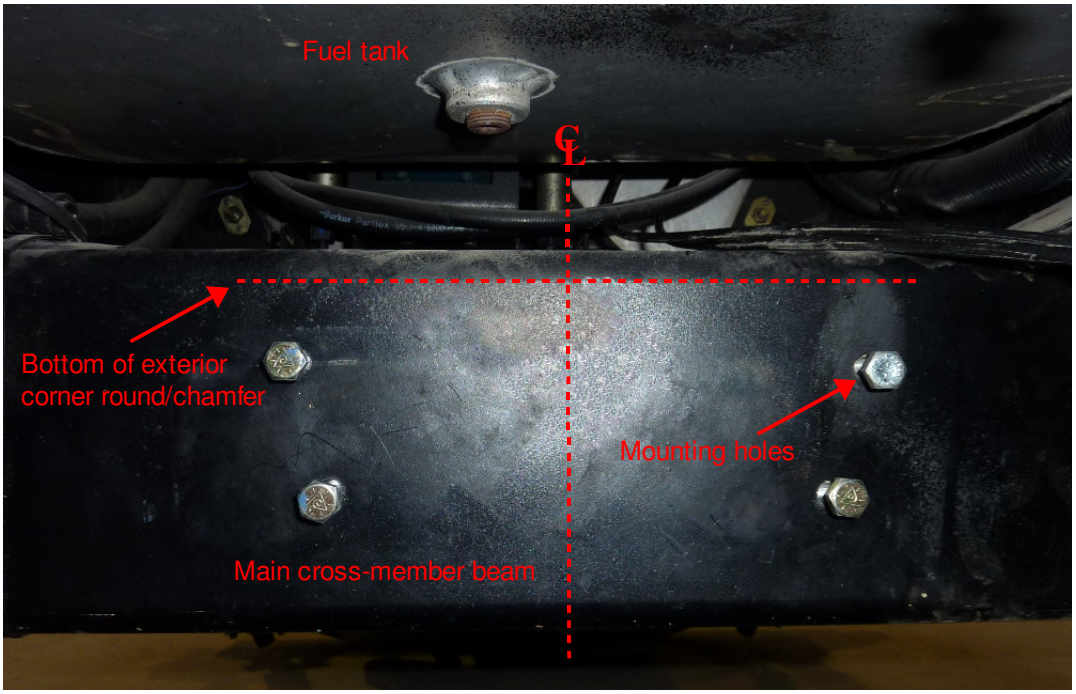

Figure 11: Main, forward frame cross-member underneath snowcat

9. Position and clamp the supplied drill template according to your measurements: horizontally centered and vertically, position the top of the template flush with the bottom of the exterior corner round of the beam. Make sure the template is kept precisely parallel with the beam so the Outrigger Antenna is mounted parallel with the ground. Punch all four holes according to the template. The hole pattern is shown to the right. Use a Q size drill bit (0.332 in.) and a 3/8-24 tap to thread the drill holes. Clean the holes with a thread chaser if needed.

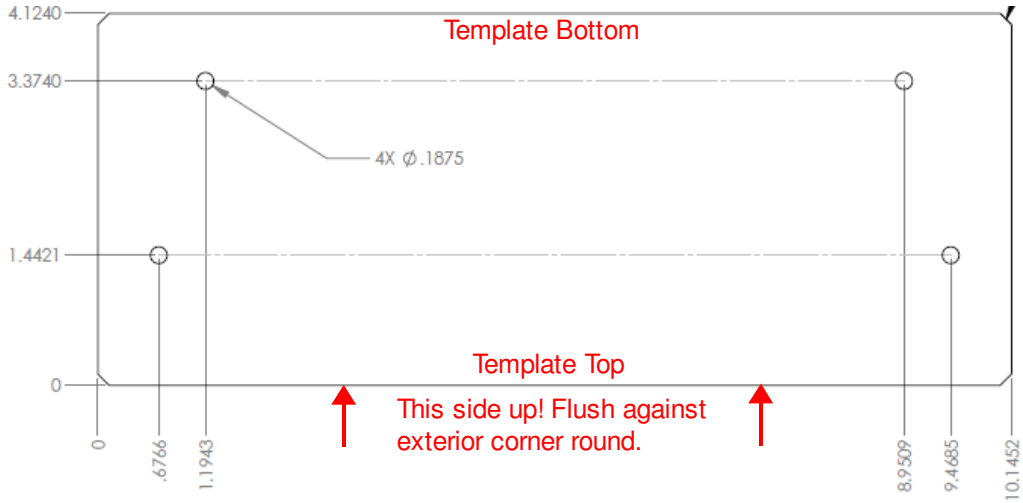

Figure 12: Antenna Outrigger-X3 drill template

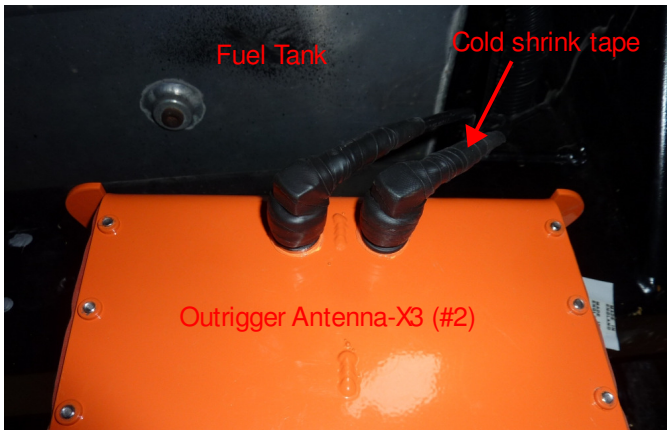

Figure 13: Outrigger Antenna with N-type connectors attached and wrapped with cold shrink tape (not yet mounted)

10. Attach the Type-N connectors on the antenna cables to the outrigger antenna and tighten to 15 in-lbs of torque, angling the connectors slightly for easier routing. Wrap each connector with the supplied Cold Shrink Black Tape (#6), a.k.a. vulcanizing tape, to sufficiently cover the connector junction, as seen in figure 13. This acts as a moisture and temperature barrier at this interconnect.

11. Mount the Outrigger Antenna with four 3/8-24, 1-1/4 inch long Grade-8 bolts, four flat washers, and four lock washers. Apply a liberal amount of blue Loctite on each bolt before assembly to ensure the bolts stay securely threaded in place over the life of the antenna and torque to a

comfortable force. Do not over tighten or threads may strip! To properly measure and update the Outrigger Antenna-X3 sensor height see the Appendix.

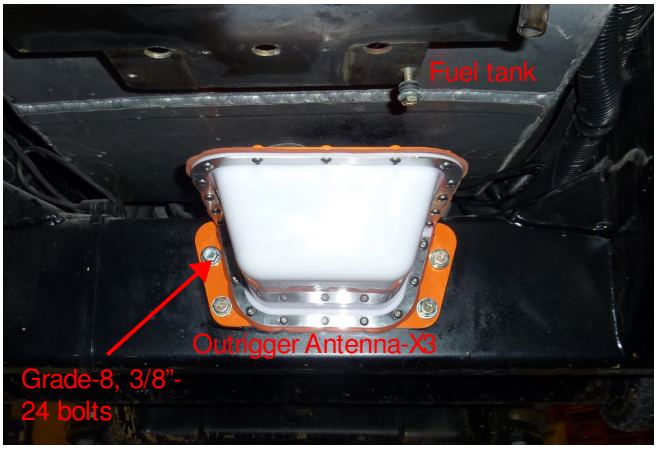

Figure 14: Outrigger Antenna mounted parallel to ground

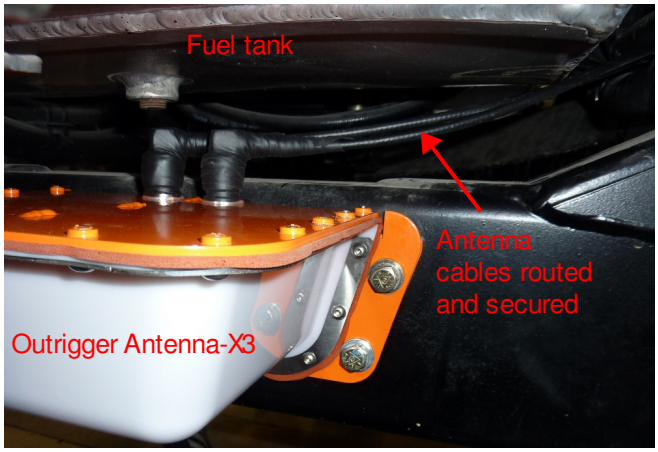

Figure 15: Cables slightly angled and routed/secured along frame

12. Zip-tie the cables together near their connection to the Outrigger Antenna, and/or to any secure area on the frame where the cables appear loose or in danger of catching on a foreign object.

13. Also, zip-tie the antenna cables to the factory tubing every 12 to 18 inches to secure the cables from movement. Keep cables elevated and taut; protected by the factory tubing. Start at the Outrigger Antenna and work your way backward to the SDS in the cab, pulling the cable slack into the cargo hold, or other chosen mounting space. If possible, route the antenna cables similar to the path shown in the figures below (photos are specific to a Prinoth BR350).

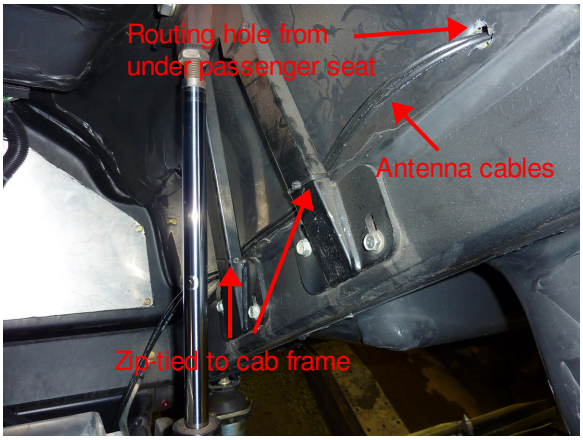

Figure 16: Zip-tie to frame under elevated cab

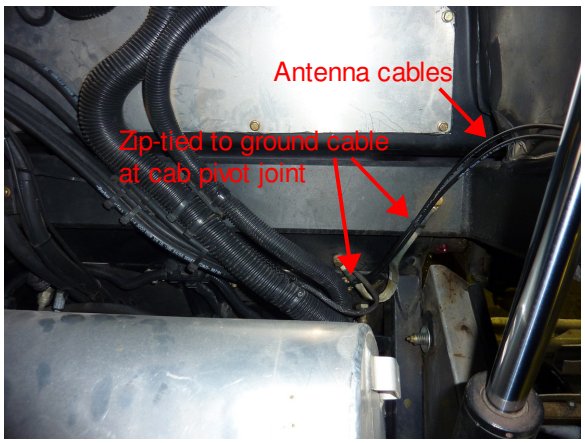

Figure 17: Zip-tie to ground strap under elevated cab

14. Finally, pull all remaining Antenna Cable slack into the cargo hold with the SDS and coil – no smaller than a 3 inch bend radius – and zip-tie together. Connect the Antenna Cables to the gold, SMA female connectors on the SDS and tighten to 5 in-lbs of torque. Supply power (9-36VDC) and notice the blinking red and blue LEDs, adjacent to the SNOdar/SWEdar, SDS-X3 data connector. After a few seconds the red LED will hold "ON" while the blue LED will blink at a 1/sec rate.

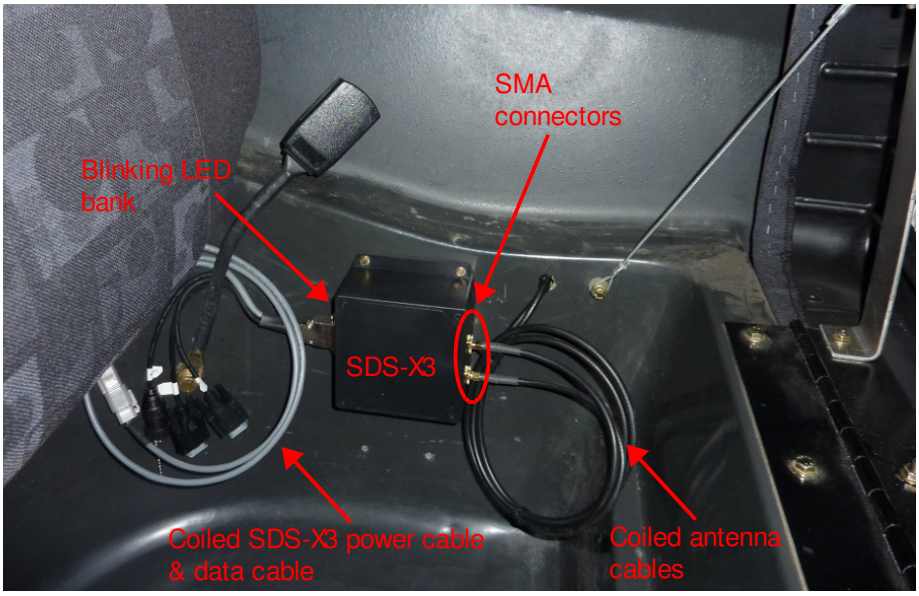

Figure 18: SDS-X3 connected with coiled antenna cable below passenger seat

Flat Earth SNOdar/SWEdar (SDS-X3) installation is now complete!

Appendix

GPS Installation for Standalone Configuration

If standalone configuration is required, a GPS unit must be connected to the SDS to relay speed and position data. The data stream must be reported in NMEA (National Marine Electronics Association) format using $GPVTG and $GPGGA strings. Speed is mandatory while position data is optional. *Note: The SDS does not use GPS position data to track the snowcat vehicle.

Install the GPS receiver per manufacturers instructions. The GPS receiver must draw power from the same ignition sense power as the X3 system to ensure they are powered simultaneously.

Configure the GPS receiver with the following RS-232 communication attributes:

Baud rate	19200
Data bits	8
Parity	None
Stop bits	1

Securely route the GPS data cable (most likely a male DSUB-9 type RS-232 cable) to the mounting position of the SDS.

Attach the male DSUB-9 GPS cable to the female DSUB-9 connector on the SDS-X3 data cable, labeled COM1, as shown in figure 19. Secure the connection with the thumb screws on either side of the connector. If connector genders are mismatched, a *gender changer* can be used between connectors for proper hookup.

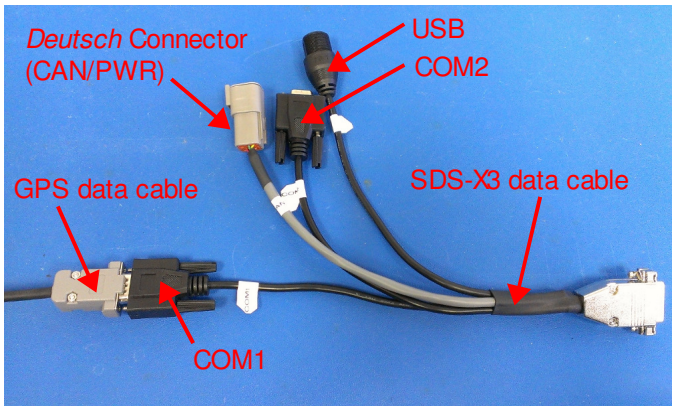

Figure 19: SDS-X3 data cable connected to GPS data cable via COM1

GPS receiver will now automatically relay data to the SDS.

How to Measure and Update Antenna Sensor Height

Depending on the vehicle model and the actual placement of the Outrigger Antenna-X3, the antenna "Sensor Ht" attribute may have to be adjusted using the *SDS-X3 Field Update Tool*. This software tool is provided by FlatEarth to communicate with the SDS-X3 via USB and is referenced in the *sdsX3_firmware_update_guide_rev1_0.pdf*.

To accurately measure the antenna sensor height use a standard or metric tape measure to record the distance from the bottom of the Antenna Outrigger-X3 radome, *point A* (white, glossy covering), to the bottom of the vehicle track rubber, *point B*. This is precisely where the grousers are bolted to the rubber. See figure 20-21 as a measurement guide.

***Example:** Using the standard mounting position on a BR350, the sensor height should be approximately 32 cm.

***Note:** For best results measure the distance to the nearest centimeter or half an inch.

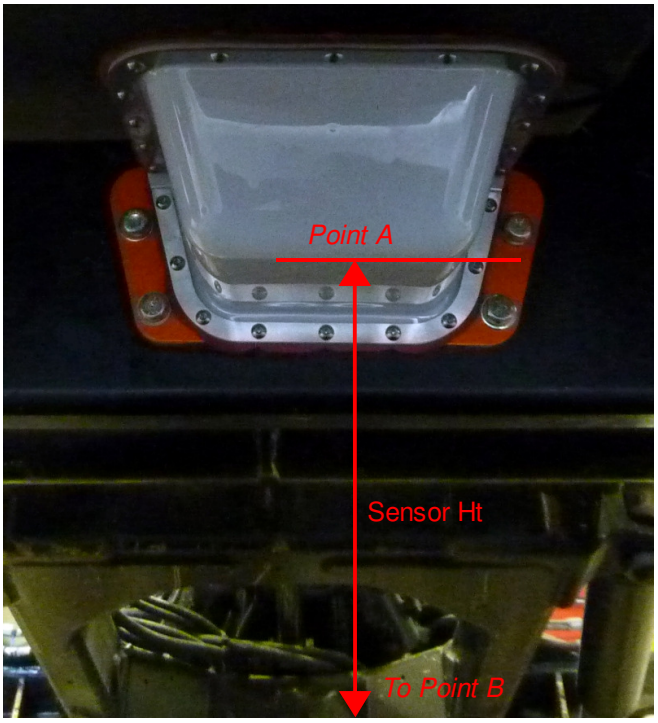

Figure 20: Antenna Outrigger-X3, point A

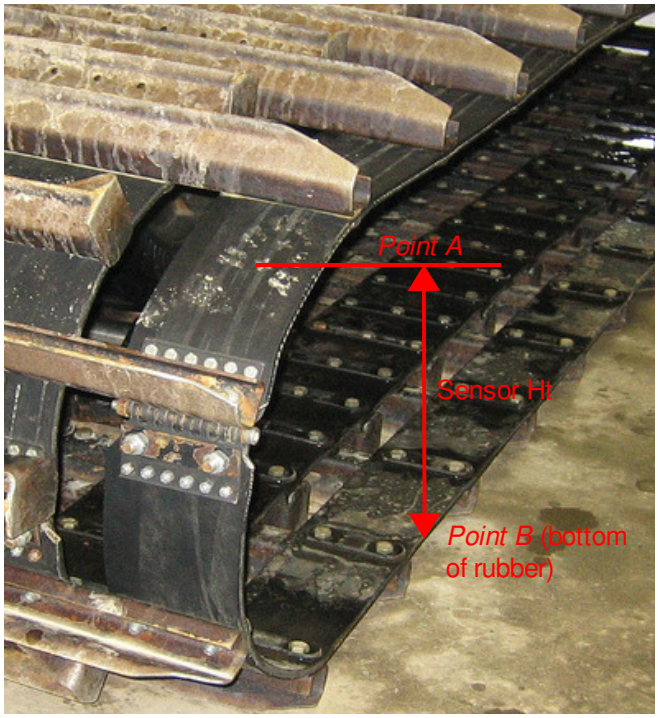

Figure 21: Grouser/Rubber Interface, point B

Once the antenna sensor height is successfully measured and recorded, use the *SDS-X3 Field Update Tool* to set the "Sensor Ht" attribute for the given snowcat vehicle. Follow the instructions in the *sdsX3_firmware_update_guide_rev1_0.pdf*. As a reference the software interface is shown in figure 22.

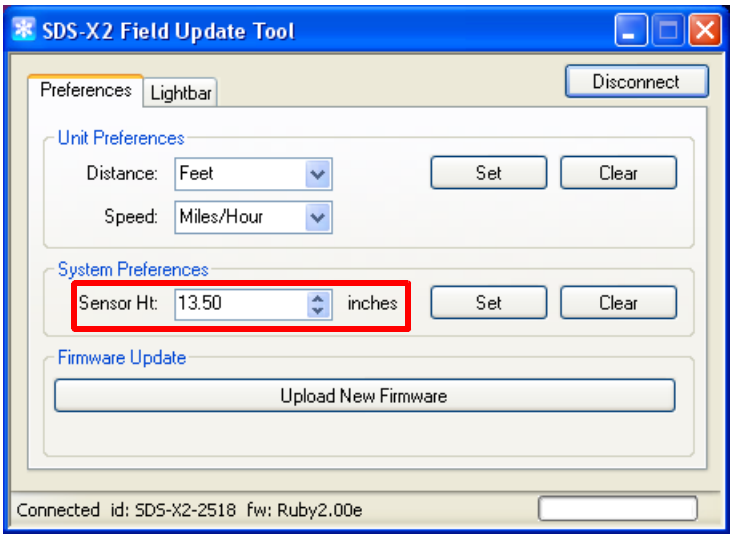

Figure 22: Updating Sensor Height via SDS-X3 Field Update Tool

How to Adjust Lightbar Brightness

The Lightbar is preset to a dim level to accommodate the typical dark environment in a snowcat. However, it may be necessary to adjust brightness levels because of daytime operation or operator's preference.

To increase/decrease brightness, toggle the arrow keys, by applying constant pressure, up/down to desired brightness levels once the Lightbar has powered up and “Prinoth” is displayed. See figure 23. This setting must be adjusted on every power-up as the operating environment may change from shift to shift.

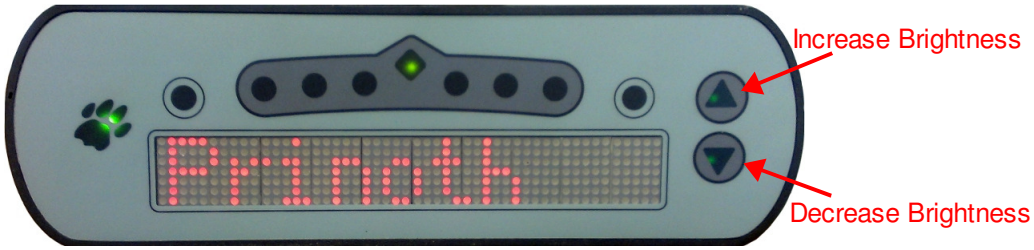

Figure 23: Lightbar brightness adjustment

Operating Restrictions

Operation of this device is limited to purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial ski areas, commercial mining, government agencies, or construction. Parties operating this equipment must be eligible for licensing under the provisions of ***Code of Federal Regulations:*** CFR 47 Part 15 Subpart F. Operation by any other party is a violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties.

This Ground Penetrating Radar Device shall be operated only when in contact with or within 1 m of the ground, or anticipated snow pack surface.

IMPORTANT NOTE:

The SNOdar/SWEdar systems are considered UWB imaging devices and are subject to FCC Coordination requirements under the CFR Tile 47 Chapter I, Sub chapter A, Part 15, Subpart F , Section 15.525. As such it is the responsibility of the users of theses systems to submit the following information to the FCC prior to use of these systems.

The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area(s) of operation, and the FCC ID number and other nomenclature of the UWB device. If the imaging device is intended to be used for mobile applications, the geographical area(s) of operation may be the state(s) or county(ies) in which the equipment will be operated. The operator of an imaging system used for fixed operation shall supply a specific geographical location or the address at which the equipment will be operated.

This material shall be submitted to Frequency Coordination Branch, OET, Federal Communications Commission, 445 12th Street, SW, Washington, D.C. 20554, Attn: UWB Coordination.

The operator shall comply with any constraints on equipment usage resulting from this coordination.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.
(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This radio transmitter, FCC ID: 2AEJO-PGC2661184, and IC: 20216-PGC2661184, has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device

Mfg.: Flat Earth, Inc.

Type: Bowtie Planar Outrigger Antenna

Gain: 0.5-6 dBi

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.