

Customer Instructions for a Successful Deployment of North Star's Globalstar Collars



We at North Star are pleased to provide you with our technology. We test each collar extensively during the production process, including one last test before we ship. Nonetheless, we strongly urge you to re-test each collar upon receipt to ensure nothing unforeseen has occurred during shipping. You will notice a magnet on the aluminum enclosure of your collar. This magnet turns the collar ON and OFF. When the magnet is snugly in place on the collar enclosure, the collar will remain OFF. Remove the magnet to turn the collar ON (see below for more details), but do so outside only. These collars will not work indoors.

The accuracy of our GPS units is within 2.5 m 66% of the time and within 5 m more than 95% of the time. Globalstar offers truly real time data, from the field to the www. There is no delay and no latency in data delivery. The Globalstar constellation includes 52 satellites, so there are always 2-4 satellites in view from any location on the ground at any time. [Argos has 5 operational satellites.]

Our Globalstar collars can be configured to transmit every GPS location that they acquire in real time (typical), or they can be configured to log GPS locations more frequently than they transmit; in which case they store the rest for later retrieval (like a "GPS logging" collar, which are so popular these days). For example, our collars can be configured to acquire a GPS location 8 times per day and to transmit out only 1 GPS location per day, or per week (which saves on airtime costs). We can program them any way that a user might want. This way, you will get all the benefits of a traditional logging collar with the added advantage of being able to have the collar transmit a new GPS location on a schedule via satellite. Thus, you will know where your collar is and that it is working properly on a pre-determined transmit schedule.

Through the use of the data delivery portal, we can offer several alarms that are new to the wildlife tracking industry. These include a "not moving" alarm (i.e., the collar has not moved outside a given radius in x days); a "no messages sent" alarm (i.e., the collar has sent no messages in x days); and a GeoFence alarm. The GeoFencing capability allows users to define a boundary of "acceptable" ranging for their animals. If the target animals move outside the GeoFence boundary, an alarm message is sent to a pre-defined recipient list. Unlike other GeoFencing methods that require laborious programming, North Star's system allows users to simply draw a polygon directly on a map in Google Earth to define their GeoFencing area. Multiple areas can be defined, saved, and applied to various collars in the field. The data delivery portal identifies GeoFencing violations and sends e-mails, text messages, or other alarms to user PCs and wireless devices.

UNDERSTANDING YOUR COLLAR, TESTING AND GENERAL OPERATION

There can be as many as 3 different components on your collar – all of which are completely independent and have their own batteries and controllers: these are (1) the GPS/Globalstar collar; (2) a VHF transmitter, and (3) a drop-off mechanism.

1. If you ordered a drop-off mechanism with your collar, we will have programmed it with a calendar date for drop-off (there will be a white sticker on the side of the drop-off unit indicating the drop-off date), and we ship them “armed” and ready to deploy. You can (and SHOULD) confirm this by looking for the blinking red LED under the cover (look carefully for a long time, as it only blinks every 10 seconds). [Note: the “cover” of the drop-off mechanism is the uppermost, flat piece that has 4 screws holding it down on the top of the drop-off unit.] If the LED is blinking any color OTHER than red, please call Blake Henke (410-961-6692 cell) to remedy; or just place a strong magnet over the cover and wave it back and forth closely, and that should arm the unit. You want it blinking **red** before you deploy; red indicates ARMED status. If it is blinking green, the drop-off unit is disarmed and will never fire, so please never deploy a collar with a drop-off unit blinking green.



2. If you ordered a VHF transmitter with your collar, you will see it attached to your collar with its own magnet attached and with a display area noting the EXACT frequency that it is outputting. Please make a note of this frequency for later reference. To turn ON the VHF unit, you will need to remove the magnet and listen for the VHF signal on your corresponding VHF receiver. The VHF transmitter unit should turn ON fairly quickly after you remove the magnet; but if it does not, you will need to resolve a sticky magnetic switch. To do so, you will need to heat the VHF unit in your hand or with a blow dryer and/or slap it smartly against something hard with the magnet removed. Please note: you may want to test the VHF unit second, after first testing the Globalstar portion of the collar. If you are using a small receiver provided by North Star to test your collar in the field, you DEFINITELY want to test the Globalstar portion of the collar first and the VHF transmitter second. See below for more clarification.



3. The most important part of your collar is the GPS/Globalstar portion, and this part is – unfortunately – not as easy to test as the others. It does not blink a colored LED nor does it emit a signal that you can hear. What you need to do to test the GPS/Globalstar component of your collar is to remove the magnet **OUTSIDE in an open place away from any buildings, and leave the collar there for about 30 minutes with the antennas pointed upward toward the sky.** If you can, you might want to hang the collar from a wood fence post or the branch of a tree, again with the antennas pointed upwards. Make sure you test the collar in the ROUND shape rather than laying it flat on the ground as the wires inside the collar can flex and bend when moving from the flat to the round shape, and you want to test your collar in the round since it will be on the animal that way. Please be sure that there are no buildings nearby nor heavy canopy (tree) cover. Also, be sure there is nothing metal in the vicinity, like a metal fence.

After you have removed the magnet and left the collar OUTSIDE for 30 minutes, log into your account via www.sensorlink.biz and access your data. Your collar should have a new location from today on the www site. If it does, then the collar is ON and working properly. If you will be deploying the collar soon, the best thing to do is to leave the collar outside and ON and deploy it as soon as you can. In other words, let it run outside until you can deploy. If you MUST



turn it OFF again prior to deployment, bear in mind that the ONLY way to test this collar to be SURE it is ON is to turn it ON (by removing the magnet) outside and to check the www site 30 minutes later. [NOTE: an alternate procedure is described below, but the alternate method should ONLY be used in extreme cases.] If your collar does not report when you remove the magnet, chances are you have a sticky magnetic switch. To remedy this situation, you need to re-apply the magnet to the collar where the "magnet" sticker is located and hold it there for about 10-15 seconds. Then remove the magnet quickly and leave the collar outside for 30 minutes with the antennas pointed upward, and check the www site to see if the collar has reported. If so, you are fine to deploy. If not, please repeat the procedure up to 5 more times. If this does not resolve the matter, please contact North Star.

If you plan to deploy your collar in a remote area and have no way of accessing the www to verify that your collar is, in fact, turned ON when you deploy it, first try to pre-arrange a colleague that you can call to verify for you. You may be able to phone your colleague via cell phone or satellite phone 30 minutes after you have removed the magnet from your collar, and in this manner verify that the collar has turned ON and is ready to deploy.

If the above procedures are not possible, there is a final (though extreme) alternative. North Star can provide a small and quite simple receiver that will pick up the transmissions from our collars to the Globalstar satellites. To use this device, pull out the antenna and hold it over the TRANSMIT antenna on the top of the collar. [NOTE: there are 2 antennas on the top of the collar; one that receives the GPS signals – and this one is typically black or dark gray in color and encased in a plastic shell underneath the roxolite antenna cover; and the other is the transmit antenna – this one is usually smaller in appearance and has no plastic cover underneath the rexolite antenna cover.] Turn the sensitivity of the receiver up to the maximum setting, and remove the magnet. [NOTE: this is a broad spectrum receiver, and it will pick up virtually anything that transmits a signal – so be sure that all VHF units are OFF, cell phones are OFF, and anything that transmits a signal is OFF when you try to use this device.] Take special note of the time when you remove the magnet on the collar, and within 2 minutes of removing the magnet, you should feel the unit vibrate and also see all of the lights light up on the front face of the unit. When it does this, you now KNOW that the collar is ON and that it just received a new GPS location and transmitted it to the Globalstar satellites. You can now safely deploy your collar. At this point, go ahead and test the VHF portion of your collar and make any other necessary preparations to deploy.



Let me say this in no uncertain terms for all to understand: under NO CIRCUMSTANCES should you deploy a collar on an animal without FIRST making sure it is turned ON and operating properly. This requires advanced testing of all components of the collar; and this ALSO requires that you VERIFY that the collar (all parts of the collar) is ON and OPERATING when you deploy the collar. This is your responsibility as a field user of this technology. North Star is not responsible for collars that are deployed on animals that either were not tested prior to use OR were not verified to be ON when deployed. Believe me, we have had more than enough instances of collars being fitted to animals and the animals turned loose with nothing more than neck ornaments around their necks. If the collar does not turn ON, do not deploy it, PERIOD.

ACCESSING THE SENSORLINK SYSTEM

Your account has been set-up in our Sensorlink system. You will use this online site to track your unit as it moves.

Please go to: www.sensorlink.biz.
You should see this page:



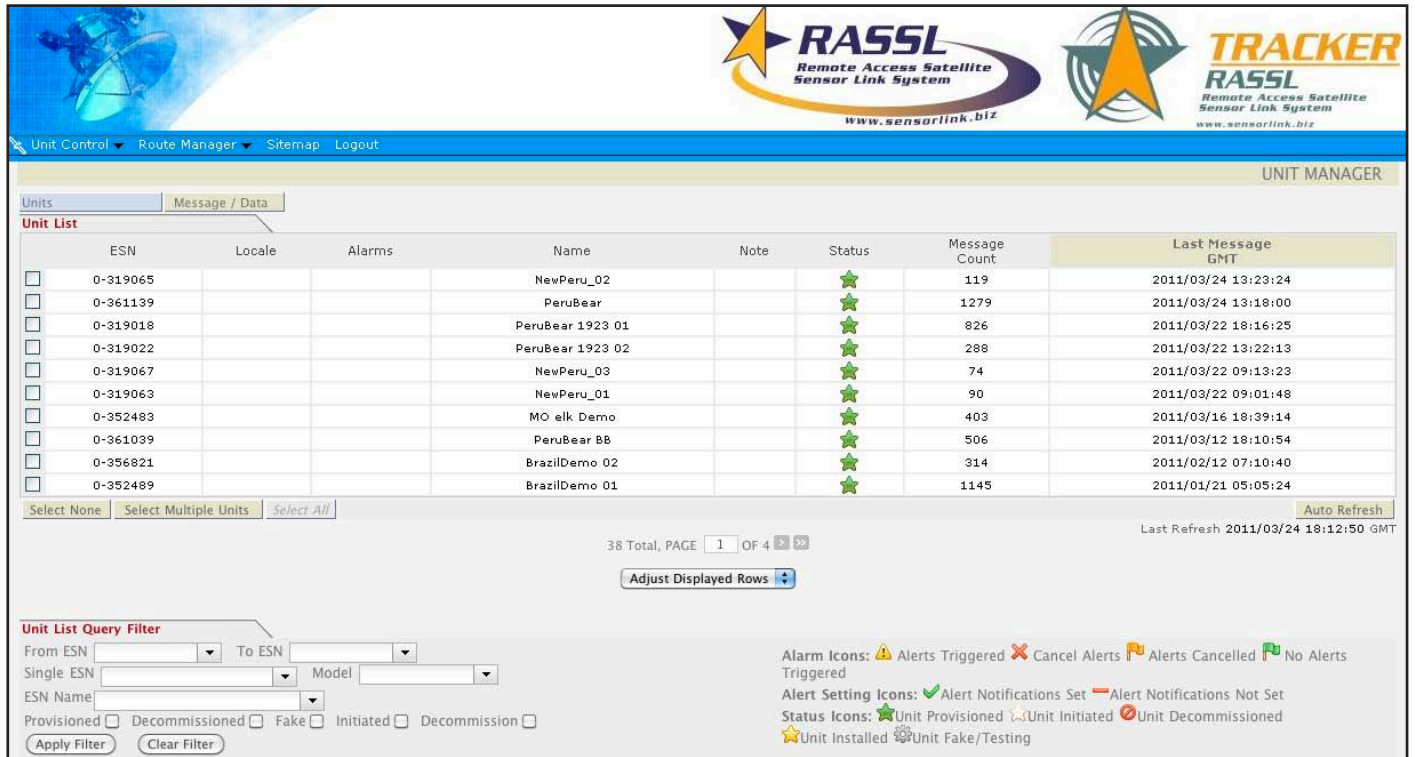
Providing Sensor and Tracking Data
from the Field to the WWW in Real Time via Satellite

Username: Password:

TRACKER
RASSL
Remote Access Satellite
Sensor Link System
www.sensorlink.biz

[Login](#) · [FAQ](#) · [Privacy Policy](#) · [Warranty Information](#) · [Contact](#)

Enter your Username & Password and select Login
Next you will see a page similar to this:



RASSL Remote Access Satellite Sensor Link System
www.sensorlink.biz

TRACKER RASSL
Remote Access Satellite Sensor Link System
www.sensorlink.biz

Unit Control ▾ Route Manager ▾ Sitemap Logout

UNIT MANAGER

Units Message / Data

Unit List

	ESN	Locale	Alarms	Name	Note	Status	Message Count	Last Message GMT
<input type="checkbox"/>	0-319065			NewPeru_02		★	119	2011/03/24 13:23:24
<input type="checkbox"/>	0-361139			PeruBear		★	1279	2011/03/24 13:18:00
<input type="checkbox"/>	0-319018			PeruBear 1923 01		★	826	2011/03/22 18:16:25
<input type="checkbox"/>	0-319022			PeruBear 1923 02		★	288	2011/03/22 13:22:13
<input type="checkbox"/>	0-319067			NewPeru_03		★	74	2011/03/22 09:13:23
<input type="checkbox"/>	0-319063			NewPeru_01		★	90	2011/03/22 09:01:48
<input type="checkbox"/>	0-352483			MO elk Demo		★	403	2011/03/16 18:39:14
<input type="checkbox"/>	0-361039			PeruBear 88		★	506	2011/03/12 18:10:54
<input type="checkbox"/>	0-356821			BrazilDemo 02		★	314	2011/02/12 07:10:40
<input type="checkbox"/>	0-352489			BrazilDemo 01		★	1145	2011/01/21 05:05:24

Select None Select Multiple Units Select All

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Adjust Displayed Rows

Unit List Query Filter

From ESN To ESN

Single ESN Model

ESN Name

Provisioned ☐ Decommissioned ☐ Fake ☐ Initiated ☐ Decommission ☐

Apply Filter Clear Filter

Alarm Icons: ⚠ Alerts Triggered ✖ Cancel Alerts 🛑 Alerts Cancelled 🟢 No Alerts Triggered

Alert Setting Icons: ✔ Alert Notifications Set ✖ Alert Notifications Not Set

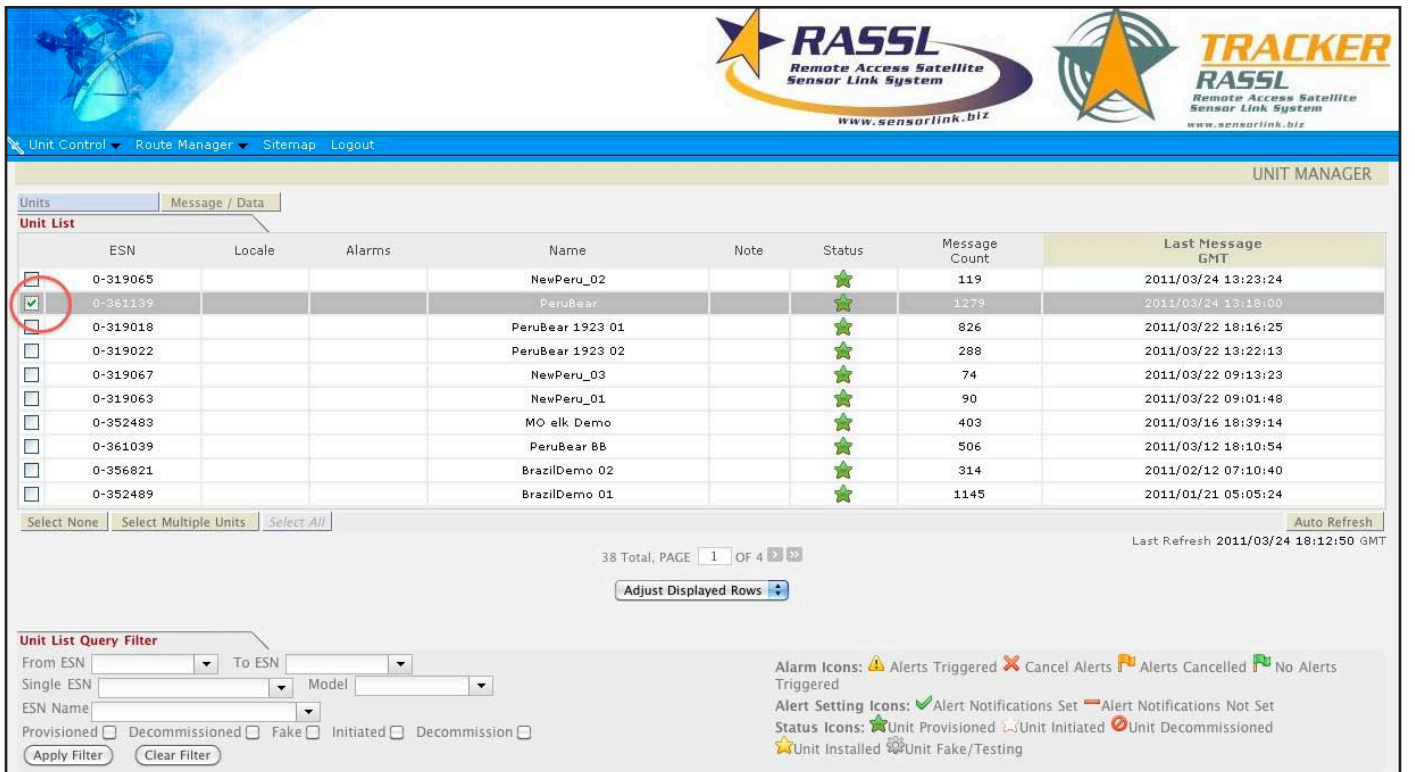
Status Icons: ★ Unit Provisioned ⚡ Unit Initiated 🛑 Unit Decommissioned

★ Unit Installed 🛑 Unit Fake/Testing

Auto Refresh

Last Refresh 2011/03/24 18:12:50 GMT

Click the check box next to your unit number and a check will appear.



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Unit Control ▾ Route Manager ▾ Sitemap Logout

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<input type="checkbox"/>	0-319065			NewPeru_02		★	119	2011/03/24 13:23:24
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<input type="checkbox"/>	0-319022			PeruBear 1923 02		★	288	2011/03/22 13:22:13
<input type="checkbox"/>	0-319067			NewPeru_03		★	74	2011/03/22 09:13:23
<input type="checkbox"/>	0-319063			NewPeru_01		★	90	2011/03/22 09:01:48
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<input type="checkbox"/>	0-352489			BrazilDemo 01		★	1145	2011/01/21 05:05:24

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Single ESN Model

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Apply Filter Clear Filter

Alarm Icons: ⚠ Alerts Triggered ✖ Cancel Alerts 🛑 Alerts Cancelled 🟢 No Alerts Triggered

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Status Icons: ★ Unit Provisioned ⚡ Unit Initiated 🛑 Unit Decommissioned

★ Unit Installed 🛑 Unit Fake/Testing

Auto Refresh

Last Refresh 2011/03/24 18:12:50 GMT

Click the Message/Data button at the top left side.

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Unit Control ▾ Route Manager ▾ Sitemap Logout

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38 Total, PAGE 1 OF 4

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From ESN To ESN

Single ESN Model

ESN Name

Provisioned ☐ Decommissioned ☐ Fake ☐ Initiated ☐ Decommission ☐

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Alarm Icons: ⚠ Alerts Triggered ✖ Cancel Alerts 🚫 Alerts Cancelled 🟢 No Alerts Triggered

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Status Icons: ★ Unit Provisioned 🚧 Unit Initiated 🛑 Unit Decommissioned ⭐ Unit Installed 🧪 Unit Fake/Testing

Auto Refresh

Last Refresh 2011/03/24 18:12:50 GMT

This will take you to the MAP page where, you can see the movement of your unit.

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Unit Control ▾ Route Manager ▾ Sitemap Logout

UNIT MANAGER

Selected (0-361139) Messages / Data

Download Message Data

Auto Refresh

Unit List

	ESN	Locale	Alarms	Name	Note	Status	Message Count	Last Message GMT
<input checked="" type="checkbox"/>	0-361139			PeruBear		★	1279	2011/03/24 13:18:00

Map Satellite Hybrid

Map data ©2011 Google - Terms of Use

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	M-ID	ESN	Unit Name	GPS Fix Time (GMT) Y/M/D H:M:S	Longitude	Latitude	Moving	Message GMT
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/24 13:02:02	-79.511769	-6.506063	Y	2011/03/24 13:18:00
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/22 22:01:09	-79.488831	-6.501417	Y	2011/03/22 22:01:31
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/22 13:00:55	-79.515846	-6.504368	Y	2011/03/22 13:17:58
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/20 22:02:17	-79.490504	-6.505955	Y	2011/03/20 22:09:50
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/20 18:00:57	-79.502263	-6.501117	Y	2011/03/20 18:01:19
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/19 13:01:52	-79.488208	-6.490592	Y	2011/03/19 13:20:39
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/19 09:01:03	-79.481235	-6.505612	Y	2011/03/19 09:01:25
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/18 13:01:24	-79.495955	-6.534215	Y	2011/03/18 13:14:02
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/17 22:02:19	-79.497972	-6.525600	Y	2011/03/17 22:24:07
<input type="checkbox"/>	0	0-361139	PeruBear	2011/03/17 13:00:59	-79.496470	-6.526855	Y	2011/03/17 13:15:32

The BLUE PIN indicates a GPS fix. If you wish to review a specific fix, select the check box next to that line in the table, and the BLUE PIN will change to RED.

Unit List	ESN	Locale	Alarms	Name	Note	Status	Message Count	Last Message GMT
	0-361139			PeruBear		★	1279	2011/03/24 13:18:00

M-ID	ESN	Unit Name	GPS Fix Time (GMT) Y/M/D H:M:S	Longitude	Latitude	Moving	Message GMT
<input checked="" type="checkbox"/>	0-361139	PeruBear	2011/03/24 13:18:02	-79.511769	-6.506063	Y	2011/03/24 13:18:00
<input type="checkbox"/>	0-361139	PeruBear	2011/03/22 22:01:09	-79.488831	-6.501417	Y	2011/03/22 22:01:31
<input type="checkbox"/>	0-361139	PeruBear	2011/03/22 13:00:55	-79.515846	-6.504368	Y	2011/03/22 13:17:58

You can use the map controls on the left of the screen to zoom in or out. You can also grab the map with the "hand" and pan the image in any direction.

There is also a pull-down menu at the bottom of the page:

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- ✓ Adjust Displayed Rows
- 10 / page
- 20 / page
- 30 / page
- 50 / page

Display 50 rows per page

This will allow you to show up to 50 messages on one map screen.

To download the data that appears in the Sensorlink.biz system, click the Download Message Data button. [Note: Only uploaded points will be available. Data stored on the collar won't be available until you return the collar to us for extraction.]

The screenshot shows the RASSL Tracker web interface. At the top, there are logos for RASSL and TRACKER. Below the navigation bar, the 'UNIT MANAGER' section is visible. A dropdown menu is open, showing 'Selected (0-361139)' and 'Messages / Data'. The 'Download Message Data' button is circled in red. Below this, a table lists units with columns: ESN, Locale, Alarms, Name, Note, Status, Message Count, and Last Message GMT. The first unit listed is 'PeruBear' with ESN '0-361139' and a message count of '1279'. A map of South America is displayed below the table, showing the location of PeruBear. The map includes a scale bar and a 'Map' button.

Select the date range for your data download.

The screenshot shows the RASSL Tracker web interface with the date range selection dialog open. The 'From Time' field is set to '2011-03-24' and the 'To' field is set to '2011-03-24'. The 'Format' dropdown is set to 'Decoded'. A calendar for March 2011 is displayed, showing the date range from 27 to 31. The 'Go' button is visible. Below the calendar, there is a section for 'To download messages older than' with a date range from 2010 to 2012. The bottom of the page features logos for VeriSign and a 'VeriSign Secured' badge.

Confirm your format is set to "DECODED".

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Unit Control Route Manager Sitemap Logout

Selected (0-361139) Messages / Data

Unit List

ESN	Locale	Alarms	Name	Note	Status	Message Count	Last
0-361139			PeruBear		★	1279	2011/0

From Time 2011-03-24 To 2011-03-24 Form: ☒ Decoded ☐ Raw Go

Select a time span to download messages.

To download messages older than three months you must have the "View Archive Messages" button pressed on the "Messages/Data" page

North Star Science and Technology, LLC

Your file will look similar to this. It will be a comma/space delimited text file.

32stxmsg-20120417.txt									
ESN	SeqNo	ESN	Unit Name	GPS Fix Time (GMT)	Longitude	Latitude	Moving	Message GMT	Message Time GMT
0-361139	0	361139	PeruBear	2012/04/17 13:00:58	-79.569039	-6.455562	N	2012/04/17 13:01:20	2012/04/17 13:01:20
0-361139	0	361139	PeruBear	2012/04/16 13:00:56	-79.569039	-6.455551	N	2012/04/16 13:21:37	2012/04/16 13:21:37
0-361139	0	361139	PeruBear	2012/04/15 22:02:21	-79.568954	-6.455669	N	2012/04/15 22:02:43	2012/04/15 22:02:43
0-361139	0	361139	PeruBear	2012/04/15 18:00:56	-79.569061	-6.455487	N	2012/04/15 18:01:18	2012/04/15 18:01:18
0-361139	0	361139	PeruBear	2012/04/14 13:00:55	-79.569104	-6.455498	N	2012/04/14 13:16:32	2012/04/14 13:16:32
0-361139	0	361139	PeruBear	2012/04/11 13:00:55	-79.568975	-6.455626	N	2012/04/11 13:07:28	2012/04/11 13:07:28
0-361139	0	361139	PeruBear	2012/04/10 18:00:56	-79.569082	-6.455519	N	2012/04/10 18:01:18	2012/04/10 18:01:18
0-361139	0	361139	PeruBear	2012/04/09 22:00:55	-79.569082	-6.455594	N	2012/04/09 22:08:20	2012/04/09 22:08:20
0-361139	0	361139	PeruBear	2012/04/08 22:00:55	-79.569061	-6.455508	N	2012/04/08 22:23:07	2012/04/08 22:23:07
0-361139	0	361139	PeruBear	2012/04/07 22:01:08	-79.569082	-6.455573	N	2012/04/07 22:17:52	2012/04/07 22:17:52
0-361139	0	361139	PeruBear	2012/04/07 13:00:57	-79.569125	-6.455605	N	2012/04/07 13:09:07	2012/04/07 13:09:07
0-361139	0	361139	PeruBear	2012/04/06 22:01:08	-79.569125	-6.455616	N	2012/04/06 22:07:18	2012/04/06 22:07:18
0-361139	0	361139	PeruBear	2012/04/06 13:00:55	-79.569104	-6.455530	N	2012/04/06 13:21:34	2012/04/06 13:21:34
0-361139	0	361139	PeruBear	2012/04/05 13:00:55	-79.569104	-6.455605	N	2012/04/05 13:21:36	2012/04/05 13:21:36
0-361139	0	361139	PeruBear	2012/04/04 22:00:55	-79.569190	-6.455669	N	2012/04/04 22:01:17	2012/04/04 22:01:17
0-361139	0	361139	PeruBear	2012/04/02 18:00:57	-79.569125	-6.455530	N	2012/04/02 18:01:19	2012/04/02 18:01:19
0-361139	0	361139	PeruBear	2012/04/01 18:02:08	-79.569125	-6.455519	N	2012/04/01 18:15:17	2012/04/01 18:15:17
0-361139	0	361139	PeruBear	2012/03/31 22:01:32	-79.569082	-6.455476	N	2012/03/31 22:14:04	2012/03/31 22:14:04
0-361139	0	361139	PeruBear	2012/03/31 09:02:05	-79.569147	-6.455508	N	2012/03/31 09:10:04	2012/03/31 09:10:04
0-361139	0	361139	PeruBear	2012/03/30 18:01:34	-79.569125	-6.455616	N	2012/03/30 18:12:51	2012/03/30 18:12:51
0-361139	0	361139	PeruBear	2012/03/30 13:01:08	-79.569061	-6.455626	N	2012/03/30 13:01:30	2012/03/30 13:01:30
0-361139	0	361139	PeruBear	2012/03/29 13:02:21	-79.569168	-6.455551	N	2012/03/29 13:09:54	2012/03/29 13:09:54
0-361139	0	361139	PeruBear	2012/03/28 18:02:22	-79.565113	-6.460905	Y	2012/03/28 18:22:41	2012/03/28 18:22:41
0-361139	0	361139	PeruBear	2012/03/27 22:01:57	-79.569039	-6.455551	N	2012/03/27 22:08:30	2012/03/27 22:08:30
0-361139	0	361139	PeruBear	2012/03/22 22:00:54	-79.569082	-6.455498	N	2012/03/22 22:09:59	2012/03/22 22:09:59
0-361139	0	361139	PeruBear	2012/03/14 13:01:08	-79.588416	-6.450530	Y	2012/03/14 13:16:06	2012/03/14 13:16:06
0-361139	0	361139	PeruBear	2012/03/11 22:01:34	-79.524043	-6.442612	Y	2012/03/11 22:23:36	2012/03/11 22:23:36
0-361139	0	361139	PeruBear	2012/03/08 22:01:01	-79.512970	-6.509357	Y	2012/03/08 22:23:31	2012/03/08 22:23:31
0-361139	0	361139	PeruBear	2012/03/08 13:01:19	-79.517326	-6.517328	Y	2012/03/08 13:06:49	2012/03/08 13:06:49



Comparing Logged vs. Transmitted GPS Data

1. Introduction

The main components of the tracking collar are (1) a microcontroller, (2) a GPS receiver, (3) Flash memory, and (4) a GlobalStar satellite transmitter (or modem).

Position data (latitude and longitude) are sampled at a pre-programmed rate and transmitted to a GlobalStar satellite via the satellite transmitter. All transmitted data is stored into on-board Flash memory.

It has been noted that there are differences between the transmitted and logged positions for the same sample. The following explains this difference.

2. System Description

The data out of the GPS receiver is in NMEA ASCII format.

Latitude is in the format ddmm.mmmmm, where dd is degrees and mm.mmmmm is minutes and fractional minutes to five decimal places. Longitude is in the format dddmm.mmmmm, where ddd is degrees and mm.mmmmm is minutes and fractional minutes to five decimal places. For example, latitude and longitude at our facility is 3910.57610, N and 07715.15087, W.

The first step in the processing is an ASCII-to-Floating Point conversion, and then a conversion from degrees-minutes-fractional minutes to degrees-fractional degrees. That is, the minutes and fractional minutes are divided by 60 (60 minutes per degree) and added back to the decimal degrees. This floating point number is stored into flash memory and is the logged sample.

The next step is to convert the floating point number (degrees-fractional degrees) into a format compatible with the GlobalStar transmitter message structure.

GlobalStar represents latitude and longitude as a 24-bit signed binary number; that is one sign bit and 23 data bits.

A 23-bit number can be in the range 0 to $2^{23} - 1$, or 0 to 8388607 decimal. The number 8388607 represents 90 degrees latitude and 180 degrees longitude. The scale factors are computed as follows:

For latitude, 8388607 counts represent 90 degrees, so the scale factor is 93206.7 counts per degree. For longitude, 8388607 counts represent 180 degrees, so the scale factor is 46603.4 counts per degree. The latitude and longitude are converted to counts by multiplying degrees by the scale factor (counts per degree). The resulting floating point numbers are converted to signed-binary. These two 3-byte signed binary numbers (eight bits per byte) are packed into the transmitted message.

Note that as part of the conversion from floating point to binary, the original floating point number is rounded. For example, assume the NMEA latitude is 3910.57962, N. The floating point representation in degrees-fractional degrees is 39.1763267; the result of the multiplication by the scale factor (93206.7) is 3651496.13, and the signed binary number is decimal equivalent 3651496.

At the GlobalStar site, the signed binary number is converted back to latitude/longitude by dividing by the scale factor. The problem is that the original number has been rounded and the part of the number to the right of the decimal point is lost.

The number to the right of the decimal point can be in the range .0000 to .9999. This represents an error of 0 to .0000107 (.9999/93206.7) degrees in latitude and 0 to .0000215 (.9999/46603.4) degrees in longitude.

The difference in latitude is +.0000001 to -.0000078; the range of the difference between transmitted and logged latitude is .0000088, which is close to the expected .0000107.

The difference in longitude is +.000012 to -.000008; the magnitude of the difference is .00002, which is close to the expected .0000215.

The data agrees with the firmware computations. Two things to note:

(1) We would expect the rounding error to be symmetrical; that is latitude $\pm .0000054$ and longitude $\pm .0000107$. This was not the case; the lack of symmetry is probably due to slight errors in the other conversion routines.

(2) The difference in location is very small. The worst case difference in longitude is .00002 degrees. At the equator one degree of longitude is 60 nautical miles, or about 364,320 feet; .0000215 degrees is equivalent to seven feet.

In summary, we looked at the code and found why there is a difference between the locations being logged and transmitted. We ran the program on the emulator and put in a break point just in front of the code where the data is logged and transmitted. We manually changed the latitude and longitude to the logged values then looked at what was transmitted.

We were able to duplicate the transmitted and logged numbers almost exactly.



Airtime Billing Policy for North Star Science and Technology, LLC

Just so there is no confusion about how the airtime invoices are being calculated, here is what North Star is doing.

For each calendar quarter, North Star prints out a usage report from the www site that provides the exact number of messages received through the system for each ESN (i.e., collar serial number). Based on that number, North Star can determine exactly how much airtime was used per collar and per account holder. The exact number of messages per account holder is then added up for each month in the quarter, and airtime is billed based not on how your collars were programmed but on how much data you actually received through the system. So you **ONLY PAY FOR THE DATA THAT YOU RECEIVE**. The monthly rates are shown below. If your collar was programmed to collect, for example, 8 locations per day, but in practice it actually only successfully transmitted 6 per day, you are only charged for the 6 locations per day that you actually received.

Partial months are prorated. Also, in cases where you actually received some number of locations other than what is posted below (e.g., 7 transmissions per day), you will be charged a monthly amount between the posted fees for 6 and 8 transmissions per day.

If a collar is provisioned on the system and it is not transmitting, you are only charged \$5 per month per collar to keep it provisioned on the system. If you do not want to pay the \$5 per month for a non-transmitting collar, you can ask North Star to decommission it. Once it is decommissioned, there will not be any further charges for that collar, ever. However, if you ever want to use that collar again, you will be charged a \$75 activation fee to re-provision it on the system.

Collars that remain provisioned on the system and do not transmit for 12 sequential months will be decommissioned summarily. This is because we have over 1,000 collars provisioned on the system, and we get charged to keep them there. If the collars are not being used, we need to limit our liability for the costs that they generate to us. And it is not our responsibility to track down each researcher to determine why the collars are not being used. After 12 months of inactivity, they will be decommissioned. If, at a later time, the client decides to use the decommissioned collars, a \$75 re-activation fee will be charged.

The account holder is responsible for all testing time, both at our shop and while the collar is in your possession. However, we do try to limit the amount of testing time that is actually charged to the account holder.

If a client would like, you can ask North Star to provide its notes and calculations that were used to determine your invoice amount.

Monthly Rates

24 transmissions per day	\$120 per month
12 transmissions per day	\$80 per month
8 transmissions per day	\$63 per month
6 transmissions per day	\$48 per month
4 transmissions per day	\$41 per month
3 transmissions per day	\$36 per month
2 transmissions per day	\$33 per month
1 transmission per day	\$30 per month
< 1 transmission per day	Custom pricing (ask)



North Star Policy for Shipping Items Back to us for Repair or Refurbishment

North Star routinely accepts wildlife collars and bird PTTs for repair and/or refurbishment, and refurbishment can often be done for a very reasonable amount of money, much less than the cost of a new unit. However, please follow the policies and procedures outlined below when preparing to send items back to North Star. And please notify North Star in advance so we can know to look out for specific items. This way, we can alert you if an item does not arrive.

1. Whether you are shipping internationally or domestically, **PLEASE do not declare the items for any value higher than \$100 total**. Use a reliable shipper – like FEDEX or UPS or even the Post Office (**Please do NOT use DHL**) – and declare the items for a low value. This will save North Star from having to pay import duties and taxes, which we would then have to pass along to you, the customer. And this will save you from having to pay exorbitant insurance fees. Used equipment is not worth a high declared value, so don't do it. Declare the cargo for no more than \$100 total.
2. Mark the airbill to allow delivery without signature. I know all of the FEDEX and UPS drivers, and we have a very SAFE place for them to leave packages for me if I am not around. Your package will be delivered safe and sound – and dry – without my signature.
3. I cannot say this emphatically enough: PLEASE PLEASE clean every item that you send back as thoroughly as possible. We have received bird PTTs that were retrieved off dead birds, and they sure smelled the part. Also, we have received collars back with feces, blood, mud, hair, and all sorts of unmentionable odors. Please DO NOT ship equipment to us in this condition as it creates a health concern for our workers and can potentially contaminate equipment for other customers. Clean each item thoroughly with soap and water, and please disinfect each item – especially the collars that may have had blood and/or feces on them. If you do not know what to use to disinfect a collar or PTT, let me know and I will send you some solvent to use.
4. Please do not make North Star responsible for paying any transportation, duties, taxes, etc. If you want to ship something back to us, feel free, but North Star is not responsible for any of the costs.
5. Select your shipping method as listed below

UPS or FEDEX please use:

Blake Henke
North Star Science and Technology, LLC
3325 Lenzi Lane
King George, VA 22485
410-961-6692

Via the Postal Service please use:

Blake Henke
North Star Science and Technology, LLC
P.O. Box 438
King George, VA 22485

I check both mail boxes every day, so I will get anything that you send.

6. Please include a note in the box with the items returned that explains what you want done and when you need to get the items back. Please be as detailed as possible. Send me an e-mail also with the same information.

7. Feel free to remind me often about your equipment and when you need to get it back. I do not mind the e-mails or phone calls, and it helps keep me on my toes.

SPECIAL NOTES FOR RETURNING WILDLIFE TRACKING COLLARS

If you send a collar(s) back to the lab to have the data dumped, we need to know the following from you:

1. What will happen to the collar once the data is dumped? For safety reasons, we will need to remove and dispose of the battery. This will cost our client \$7 per collar. After that, we need to know if we are to store the collar(s) with us after removal of battery, return to client with no battery, or return to client with new battery in operational condition). NOTE: If you intend to replace the batteries at some point but are not yet ready to get the collars back, we will hold them until you are ready for field work to resume; this way, fresh batteries are not wasted sitting in a collar for months without being used.

2. If we keep the collar and store it, a \$2 per month fee will be assessed per collar stored.