Base to Rover GNSS Surveying

<u>Overview:</u> Use a Base and Rover survey when the cellular data signal is not strong enough for a reliable connection.

- Establish the location of the base control point using either:
  - o   an IaRTN via a cellular connection, or
  - o   an OPUS data collection and processing, and post survey adjustment.
- Use the Base w/ radio to send a signal to the Rover.

<u>Equipment:</u> Trimble TSC3, 2 Receivers w/ radios, Trimble Access v2015.22

Setting up Survey Job

<u>Start a New Job using the Data Collector for the Rover</u>
(This can be done prior to setting up the survey equipment.)
1. Turn the TSC3 controller on by <u>pressing</u> the green power button.
2. <u>Press</u> the **Trimble** button 🧭 or <u>Click</u> *Start... Trimble Access*.
3. <u>Click</u> *General Survey*
4. <u>Click </u>on *Jobs... New Job*
5. <u>Input</u> the new *Job name*,
6. Set Template as ***nrcs-gps***
7. <u>Click</u> *Linked Files* if you want to select coordinate files that have existing points to be referenced into this project.
8. <u>Tab</u> down to the 2nd screen and type in the *operator name* & any other *notes*
9. <u>Click</u> Accept.

Option A - GPS Control Point Surveying using IaRTN
For use when IaRTN coverage will reach the base location

<u>Set up the Rover GPS to determine the position of the control point using IaRTN.</u>
10. Turn on R8/ R10 that will be used as the Rover. (External radio antenna is not needed at this point.) Turn the TSC3 controller on by <u>pressing</u> the green power button.

11. <u>Enable</u> the internal or external cellular connection:

For systems using a Mifi device	For systems using the internal connection
a. Turn on Mifi Data cellular device.	
b. <u>Click</u> the **Trimble Access** button 🧭 .	i. <u>Click</u> the **Trimble Access** button 🧭 .
c. <u>Click</u> *Internet Setup*	ii. <u>Click</u> *Internet Setup*
d. The display should show "Internet Connection (WiFi) Established"	iii. <u>Select</u> Connect using: *Phone/Modem*
• If not refer to the notes for **TSC3 Wireless Hookup to Jetpack**.	iv. <u>Click</u> Connect
	v. Wait for display to change to "Internet Connection (Internal Modem) Established"
e. <u>Press</u> ESC.	vi. <u>Press</u> ESC.

12. <u>Click</u> *General Survey*

13. Controller will connect to GPS unit via Bluetooth. Watch for satellites beneath the battery level on the right side of screen. If having problems connecting to the rover GPS, see **Setting GPS Bluetooth Connections**.

Capture Observed Control Point
14. Click *Measure... Iowa RTN... Measure Points*.
15. If asked select the **RTCM3_IMAX** Identifier. Click Enter
16. The Controller will initialize the GPS survey. Watch for **RTN:Fixed** to appear and for the Vertical precision to get down to around 0.10 ft.

17. Take a Control Point using the Rover:
    Input the *Point Name* for the TBM 1 (e.g. 501),
    Code = tbm 1
18. *Method* = **Observed control point**
19. *Antenna Height* = 2m
20. *Measured to* = **Bottom of antenna mount**
21. Set up bipod on benchmark and Click Measure
22. Once the 3 minutes of data collection has occurred click Store.
Repeat for additional control points.

> *Point Names for Survey Shots*
>   Instrument Points use 1, 2, 3 …
>   Benchmarks use 501, 502, 503 …
>   Turning Points use 201, 202, 203 …
>
>   Topog shots – start at 1000
>   Continuous Topo – start at 3000

Recheck Control Points
23. Before ending the survey, **return to the control points** and take a 2nd shot on those points. Compare the coordinates to the earlier results.

Quit out of Survey
24. Click *Measure... End GNSS Survey*
25. Click No to Power Down Receiver.
26. Remove the Rover GPS from the Control Point
27. Press ESC. Click Yes to Shut Down General Survey.

Turn off the mifi device and put it away.
If using internal connection
    a) Click *Internet Setup*
    b) Click Hang Up
    c) Press ESC.

Set Base Receiver on Control Point
28. Set the Base GPS on the control point securely using the bipod
29. Attach the radio antennas to the Base GPS receiver and to the Rover GPS receiver. Power on both receivers
30. Setup the Rover GPS with the Data Collector Attached
31. Click *General Survey....Measure... Base-Rover... Start base receiver*. If GPS units don't connect correctly see **Setting GPS Bluetooth Connections**.
32. *Antenna Height* = 2m or adjust as needed.
33. *Measured to* = **Bottom of antenna mount**

34. Under Point Name: <u>Press</u> the right arrow
35. <u>Select</u> List
36. <u>Select</u> the Observed Control Point you had previously captured
37. <u>Click</u> Start
38. Base Started…Click Ok

Continue with **Base-Rover Topo Survey**

<u>Option B - GPS Control Point Surveying using OPUS</u>
<u>For use</u> when no IaRTN data coverage is available.

<u>Collect GPS Survey for base location</u>
39. Set the Base GPS on the control point securely using the bipod.
40. Attach the radio antennas to the Base GPS receiver and to the Rover GPS receiver.
41. Power on both receivers. Turn the TSC3 controller on
42. <u>Press</u> the **Trimble** button
43. <u>Click</u> *General Survey* and verify that you have the correct Job open.
44. <u>Click</u> on *Measure… Base-Rover… Start base receiver.* If GPS units don't connect correctly see **Setting GPS Bluetooth Connections**.
45. *Broadcast format =* **CMR+**
46. **Right Arrow** for the *Point Name* to **Key In**
47. <u>Press</u> the Here button to populate the coordinates.
48. <u>Input</u> a *Point Name* and *Code*
49. <u>Click</u> Store
50. *Input antenna height =* **2.0m**
51. *Measured to: =* **Bottom of antenna mount**
52. <u>Click</u> Start
53. *Base Started*, <u>Click</u> Ok
54. To verify that the data is being collected, <u>click</u> *Instrument… Base Mode…GNSS Functions… Import files…* You'll see a padlocked file if it is working correctly. <u>Press</u> ESC.
55. You will need to have the Base collect data for a **minimum** of 20 minutes for OPUS-RS (Rapid Static). Or 2 hours for OPUS (Static).

Continue with **Base-Rover Topo Survey**

<u>Base – Rover Topo Survey</u>

<u>Conduct Topo Survey</u>
56. Setup the Rover GPS with the Data Collector Attached
57. <u>Click</u> *Measure… Base-Rover… Measure Points*.
58. *When Reliability reaches 100%* <u>Click</u> Accept
59. Take normal topo shots:
    <u>Input</u> the *Point Name* for the shot (e.g. 1000), *Code =* g

60. *Method =* **Topo Point**
61. *Antenna Height =* 2m or adjust as needed.
62. *Measured to =* **Bottom of antenna mount**
63. Click Measure
64. Once the 5 seconds of data collection has occurred click Store.
65. Press ESC when done collecting points.
When setting additional control points set the *Method* = **Observed Control Point**

Conduct Continuous Topo Survey
66. Click *Measure…Base-Rover….Continuous Topo.*
67. *Method =* **Fixed Distance**
68. *Antenna Height =* adjust as needed.
69. *Measured to =* **Bottom of antenna mount**
70. *Distance =* **50** or as desired
71. Offset = **None**
72. Input the *Point Name* for the topo shots (e.g. 3000), *Code =* g
73. Click Start.
74. To stop continuous topo click End.
75. Press ESC when done collecting points.

Job & Point Information (Optional but helpful)
76. To review point coordinates, click *Jobs... Point Manager.* Press ESC when done.
77. To review GPS quality of points, click *Jobs... QC Graph.* click *Display... Vertical Precision.* and press ESC when done.
78. To review Map of job, click *Jobs... Map.* Press ESC when done.
79. To review job details in the order of work done, click *Jobs... Review Job.* Antenna Height errors can be corrected or Notes can be added here. Press ESC when done.
80. To review or change linked files, units, or coordinate system, click *Jobs... Properties of Job.* Press ESC when done.

Note: Using the Trimble Globe Key allows the user to keep multiple items open and allows switching among tasks.
Note: Check out the Favorites button at the right side of the screen.

Recheck Control Points
81. Before ending the survey, **return to the control points** and take a 2nd shot on those points. Compare the coordinates to the earlier results.

End Rover Survey
82. When survey is completed, click *Measure... End GNSS Survey*
83. *Power Down Receiver?* Click Yes.

End Base Survey (when using OPUS be sure to not stop too soon)
84. Click *Measure... End GNSS Base Survey*
85. *Power Down Receiver?* Click No.

Trimble Survey How to

Transferring receiver files for OPUS (Required for Option A; Optional for Option B)
86. <u>Click</u> on *Instrument… GNSS Functions… Base Mode…Import files …*
87. <u>Find</u> to the receiver files that you want to transfer and <u>click</u> to the left of the Name to <u>checkmark</u> the file. [Files are named with the first 4 digits based on the last 4 digits of the receiver serial number, the next 3 digits are the calendar day of the year (e.g. Feb 20 = day 051, and the last digit is the order of receiver files collected that day (starting with 0 as the 1st file). E.g. 80110720 would be from the 8011 receiver, on day 072 of the year, and the first log file of the day.]
88. <u>Click</u> Import. <u>Click</u> Start.
89. Once files are successfully transferred <u>Click</u> Ok. <u>Click</u> ESC <u>Click</u> ESC

You will be able to download the .T02 files from TSC3 to your computer using Windows Mobile Device Manager and Explorer. This will be used to get an OPUS adjusted base point.

Quit out of Survey
90. <u>Click</u> ESC. <u>Click</u> Yes to Shut Down General Survey.
91. <u>Press</u> ESC or <u>Click</u> X to Close Trimble Access. <u>Click</u> OK to confirm Access shutdown.
92. Power off base receiver.

Setting GPS Bluetooth Connections

Settings for GPS Base-Rover mode via Bluetooth
   a) <u>Click</u> on *Instrument… GNSS Functions… Bluetooth…*
   b) <u>Set</u> *Connect to GNSS Base* = Serial Number of the Trimble R8/R10 being used as the Base
   c) <u>Set</u> *Connect to GNSS Rover* = Serial Number of the Trimble R8/R10 being used as the Rover
   d) <u>Click</u> Accept. <u>Press</u> ESC

Check to see that Bluetooth is turned on
   a) <u>Click</u> on *Instrument… GNSS Functions… Bluetooth...*
   b) <u>Click</u> *Config*
   c) <u>Select</u> *Mode*
   d) <u>Checkmark</u> *Turn on Bluetooth*
   e) <u>Click</u> Ok <u>Press</u> ESC

Creating a new Bluetooth connection to a receiver
   a) Click on *Instrument... GNSS Functions... Bluetooth...*
   b) Click *Config*
   c) Select *Devices*
   d) Click *Add new device...*
   e) In the *Select a Bluetooth Device* list click on the Receiver that you need to create the connection to.
   f) Click Next Click Next
   g) *Your device has been added* Click Done
   h) Click Ok Press ESC