

<b>ARCS PROCEDURE:</b>	<b>AMF BBSS LAUNCH OPERATIONS</b> <b>(AZORES SITE)</b>	<b>PRO(BBSS)-022.010EN</b> <b>August 2009</b> <b>Page 1 of 18</b>
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## **AMF BBSS Launch Operations at Azores Site**

### **I. Purpose:**

This procedure describes the work process performed by the on-site Observers to launch the Balloon-Borne Sounding System (BBSS) using Vaisala DigiCORA III at the ARM Mobile Facility Azores Site on Graciosa Island in the Azores, Portugal.

It is important to be ready to launch on time. Balloons need to be launched at 23:30 UTC, 05:30 UTC, 11:30 UTC, and 17:30 UTC. Weather observers around the world release their balloons at the same time so that “snap shots” of the atmosphere at 00:00, 06:00, 12:00, and 18:00 UTC are taken. This is best for forecasting purposes and for keeping an accurate climate record. Give yourself plenty of time so that you will still be able to release the balloon on time if you need to prepare a second radiosonde.

### **II. Cautions and Hazards:**

- Take care during balloon filling and handle gas cylinders as per procedures.
- Launch only under safe meteorological conditions – wind speeds below 15 m/s and not during electrical storms.
- Radiosondes are very fragile – handle them with extreme care.
- The desiccant in the GC25 Ground Check Set must be changed periodically. It should be changed weekly or whenever the radiosonde RH reading while in the GC25 exceeds 1%, whichever comes sooner. The GC25 will prompt if there is a problem with desiccant.

### **III. Requirements:**

- DigiCORA III Sounding System
- PC with BBSS software
- RS92 radiosonde package, SGPD (w/ 9.5V battery)
- GC25 Ground Check Set (GCS)
- GPS omni-directional antenna
- UHF antenna
- Meteorological balloon (350 g)
- Cable ties or string to tie off balloon
- Cutters

- Helium for lifting gas
- Balloon Launcher Cart
- Safety glasses
- Balloon filling valve and hose
- Timer or stopwatch
- Open-end wrench (1 1/8 inch) or crescent wrench (12 inch) for changing regulator position.

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#### IV. Procedure:

##### A. Schedule

Balloons are launched four times a day:

- 1) 05:30 UTC (04:30 AZOT)
- 2) 11:30 UTC (10:30 AZOT)
- 3) 17:30 UTC (16:30 AZOT)
- 4) 23:30 UTC (22:30 AZOT)

**Note: Launch preparations should take about 30 minutes. Adjust your time as you gain experience and confidence with the system.**

##### B. Inflate Balloon

1. Put on safety glasses and get timer.
2. Go to the balloon/radiosonde storage area and get a balloon.
3. Take the balloon to the Balloon Launcher Cart.
4. Extend the balloon and drape it into the canvas bag in the Balloon Launcher Cart so that the balloon neck extends through the hole at the bottom of the bag.
5. Stretch the balloon neck over the nozzle.
6. Put the canvas flap over the top of the Balloon Launcher Cart and secure it to the top set of brackets.
7. Verify that both valves (cylinder and hose nozzle) are closed.
8. Open the **cylinder valve** and check the helium gas pressure on the gauge closest to the cylinder (assume a full cylinder to have approximately 2,200 psi or 15,000 kPa). If the pressure is lower than 500 psi (3,400 kPa), monitor the gauge closely; it may not have enough gas to fill one balloon.
9. Slowly open the **hose nozzle valve** until the regulator gauge reads about 15 psi (100 kPa).
  - a) Start the timer.
  - b) Fill the balloon for approximately [ ] minutes and [ ] seconds monitoring the regulator gauge for 15 psi (100 kPa). This should result in an ascent rate between 3 and 5 m/s.

**Note: Vary the fill time as needed to achieve the desired ascent rate.**

10. If the regulator gauge reading drops under 15 psi (100 kPa) before the filling time is reached, follow the steps below. Otherwise, skip to step 11.

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- a) Stop the timer and close both valves (**hose nozzle** and then **cylinder**). Mark the cylinder with a big fat “X” to identify it as empty.
  - b) Remove the regulator hose from the empty cylinder and attach it to a full cylinder – See Compressed Gas Cylinder Handling Procedure for details.
  - c) Open the full cylinder valve and check the helium gas pressure on the gauge closest to the cylinder (assume a full cylinder to have approximately 2,200 psi or 15,000 kPa).
  - d) Now slowly open the hose nozzle valve until the gauge reads 15 psi (100 kPa).
  - e) Re-start the timer.
  - f) Open the hose nozzle valve and fill the balloon for the remaining time left on the timer, monitoring the regulator gauge for 100 kPa.
11. When timer alarm beeps, close both valves in the following order: **hose nozzle valve** and then **cylinder valve**.
  12. Go to BBSS Room in A3 Van.

### C. Prepare BBSS Computer

13. Go to the BBSS computer. If the computer is ready, skip to the next step. If the computer is not ready, follow the steps below to log on to the computer as “operator”:
  - a) Press **Ctrl + Alt + Delete**.
  - b) Click on “OK” in the warning banner text box (if needed).
  - c) Do the following (if necessary):
    - (i) Enter “operator” in the user name box.
    - (ii) Enter “operator” in the password box.
    - (iii) Click “OK.”
14. Double-click on the “DigiCORA” icon to launch the software.
15. Check the **year**, **month**, and **time** at the lower right of the computer screen for correctness (if incorrect, notify the on-site technician).

### D. Ground Check Set (GCS)

16. Open the radiosonde package and carefully remove the RS92 and unwinder. **Note: The sensor boom is extremely fragile.**
17. Inspect the temperature sensor visually for any damage (see Figure 1). If the temperature sensor is damaged in any way, do not use the radiosonde.

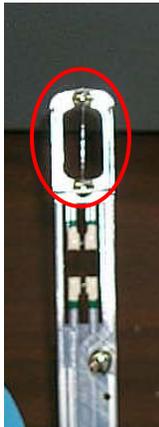


Figure 1: RS92 sensor boom (temperature sensor in red circle)

18. Open the GC25 Ground Check Set chamber door by releasing the latch (see Figure 2).

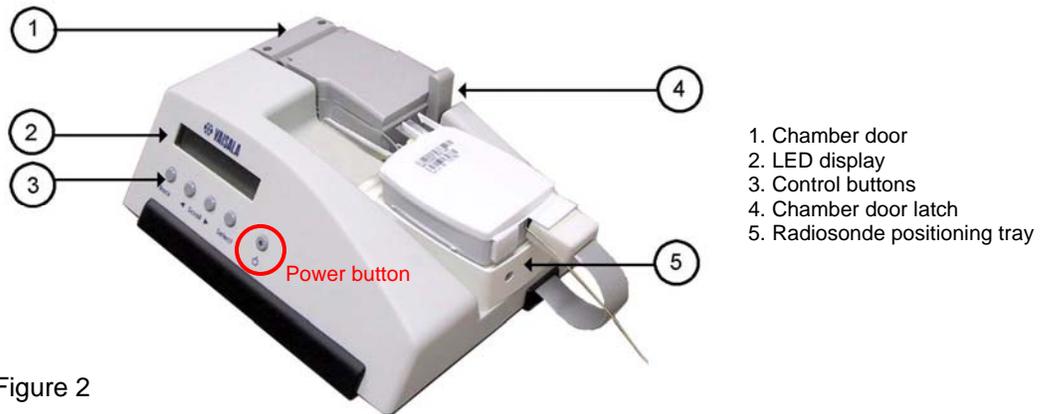


Figure 2

19. Carefully place the RS92 with the “Radiosonde” label up as shown in Figure 2, making sure it fits in the indentation on the positioning tray. Close the chamber door immediately.
20. Insert the GC25 connector into the corresponding receptacle on the RS92, making sure the connector is oriented so that the word “UP” is showing on top.
21. Turn on the GC25 by pushing the power button (far right on the front panel with a light, see Figure 2). The display will briefly read the following: “Identifying...,” “RECOND. U-SENSOR,” and “YES.”

**Important: Do NOT press any buttons on the GC25 for the remainder of this procedure.**

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### E. DigiCORA III Program

22. Go to the BBSS computer to start the DigiCORA III program. If it is already open, the screen should look like the following (Figure 3).

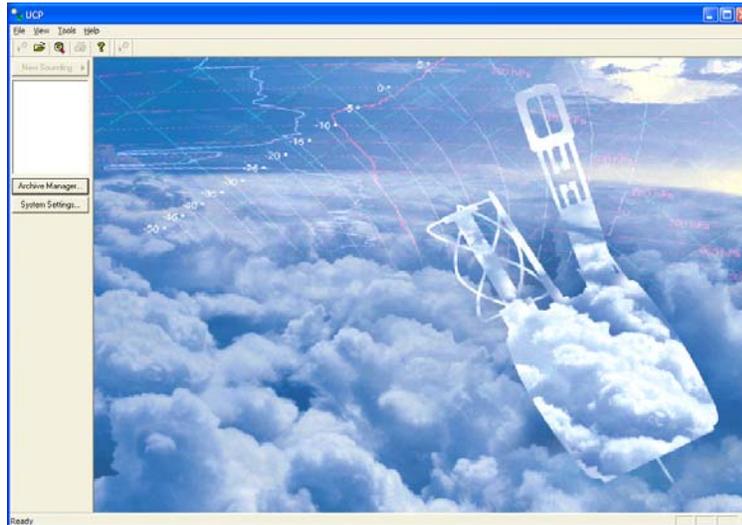


Figure 3: DigiCORA III initial screen

23. If the screen (Figure 3) is not displayed, double-click on the DigiCORA icon on the desktop.
24. Click on "New Sounding" in the upper left portion of the DigiCORA III window to allow the system go through its start-up checks. It will take a few minutes to reach 100 %. See Figure 4 for the screen shot. (If "New Sounding" is not available, open the "Active" file and close the last sounding file.)

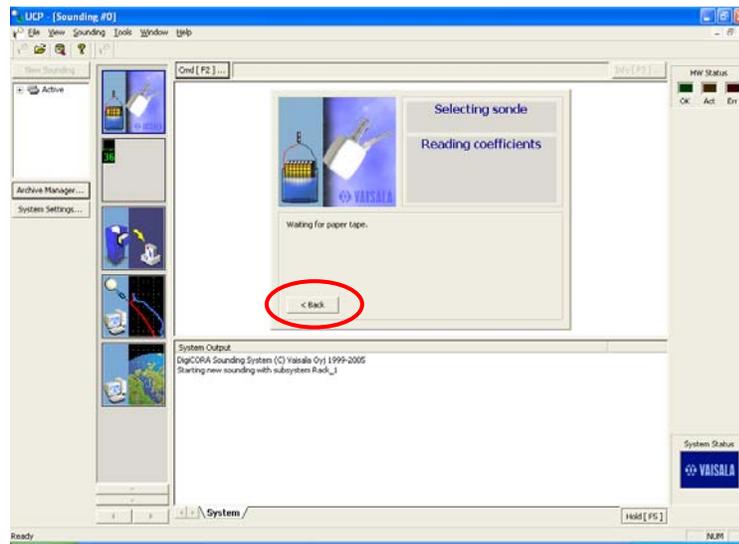


Figure 4

25. If "Cable" selection option is not on screen, press "Back" (see Figure 4) to select media, otherwise go to next step.
26. On "Select coefficient source" screen, select "Cable." (Note: If radiosonde is automatically recognized, you will not need to select anything.) It may take several seconds to reach 100% of reading coefficients.
27. When the program finishes reading the coefficients, press "Next."
28. On the "Radiosonde properties" screen, verify the serial number and sonde type, and then press "Next" (see Figure 5).

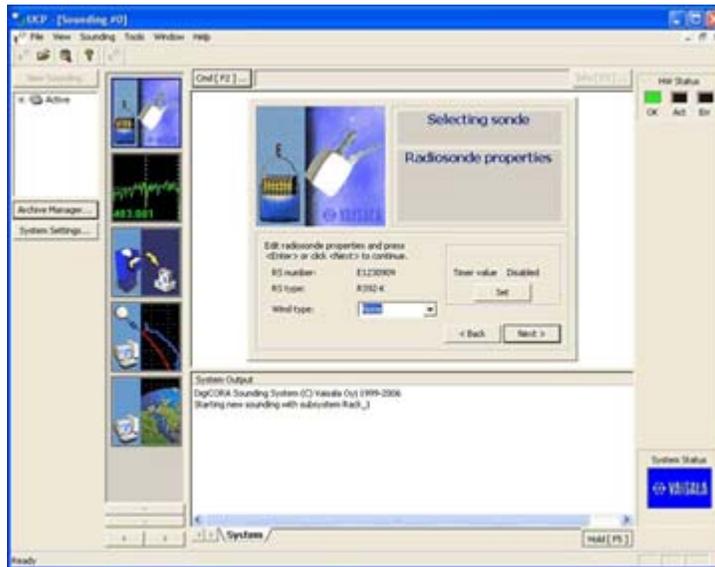


Figure 5

29. On the next screen (Figure 6), enter the sounding number using using the following format: **90MMDDYYn**.

- **MM** = UTC month
- **DD** = UTC day
- **YY** = UTC year
- **n** = Launch number for that UTC day:
  - ⇒ **n = 1** for the local morning launch at 05:30 UTC.
  - ⇒ **n = 2** for the midday launch at 11:30 UTC.
  - ⇒ **n = 3** for the evening launch at 17:30 UTC.
  - ⇒ **n = 4** for the nighttime launch at 23:30 UTC.

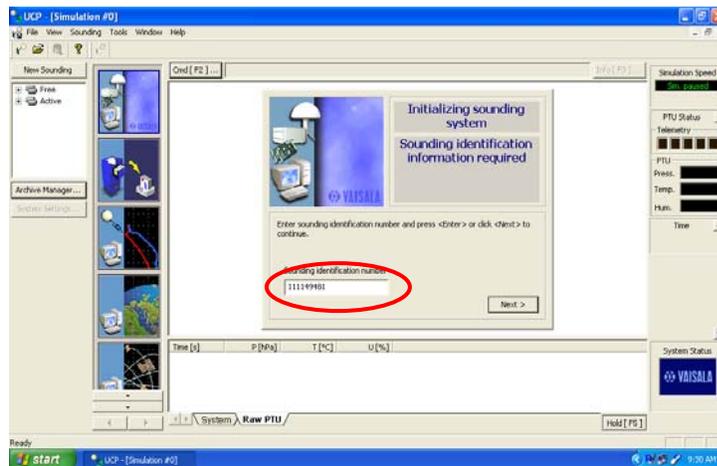


Figure 6

30. Once sonde is connected, press “Recond.” to start reconditioning (see Figure 7). Wait 3 minutes until reconditioning finishes.

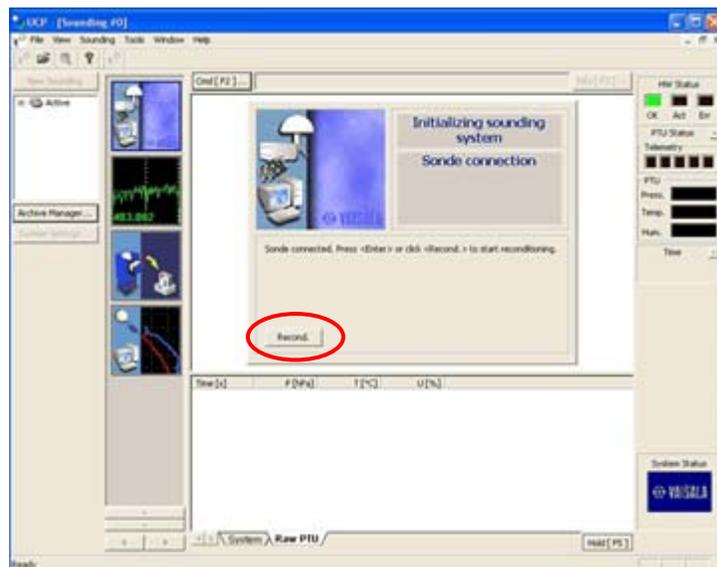


Figure 7

31. The system will go through initialization process. Click on “Perform GC” when the following screen (Figure 8) appears.

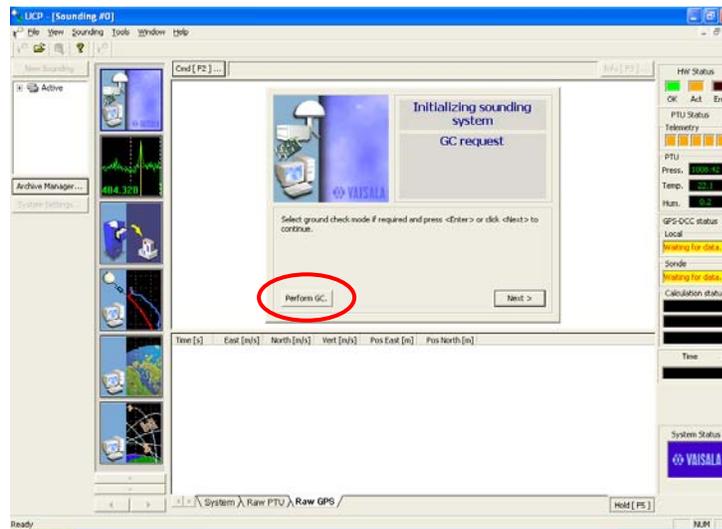


Figure 8

32. The DigiCORA system should find the radio signal from the RS92. To ensure this, click on the spectrum window (see Figure 9) and then click on "Find" (see Figure 10) so that the DigiCORA III can receive the signal.

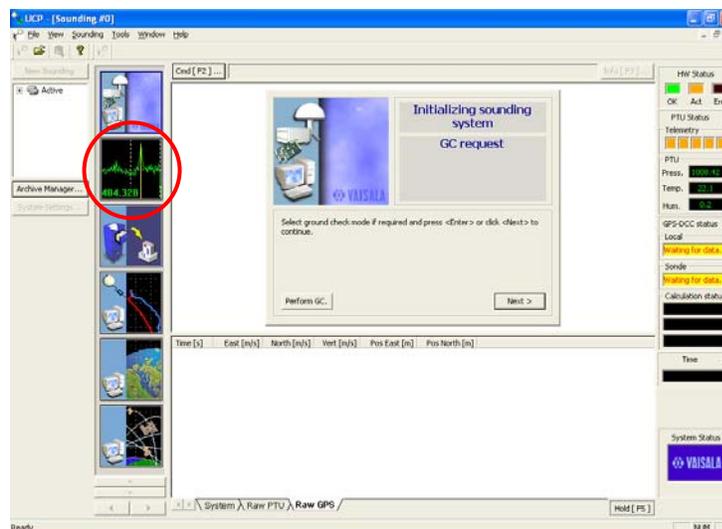


Figure 9

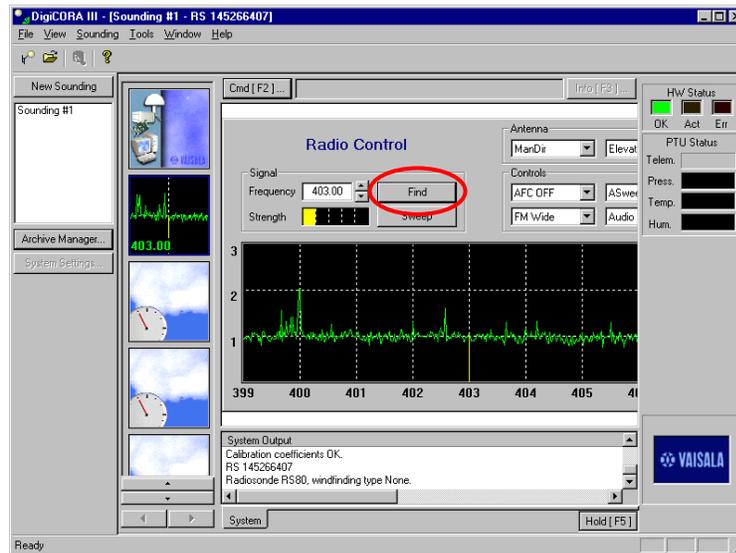


Figure 10

33. Once the system has found the radiosonde, click on the top left icon (see Figure 11) to get back to the control screen.

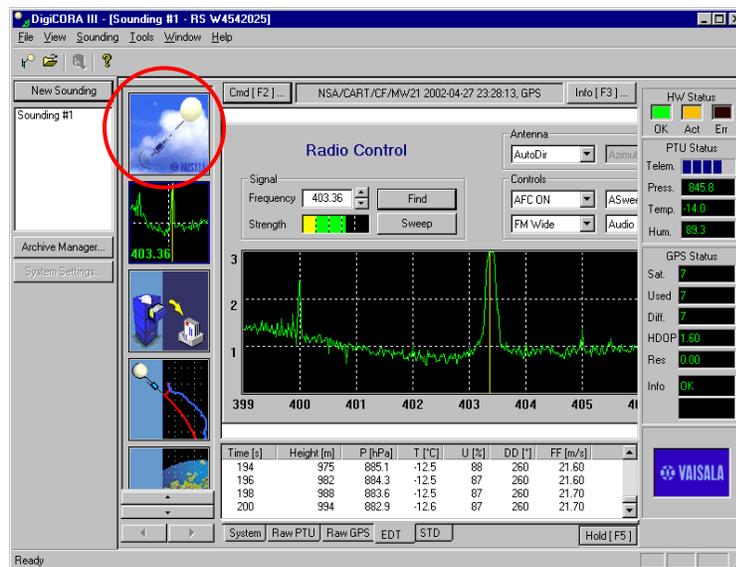


Figure 11

34. Wait until you see the next screen (Figure 12). The spaces for **Pressure**, **Temperature**, and **Humidity** will be blank in the middle window. Do the following:

- a) Read the pressure value from the “Current stabilized sonde values are” note (located above the blank boxes) you see in the “Ground check” window. Enter this value in the pressure entry box.
- b) Enter the temperature shown on the GC25 unit LED display window (see Figure 2) in the blank temperature box in the “Ground check” window.
- c) Type “0” in the blank humidity box.
- d) Click on “Next.”

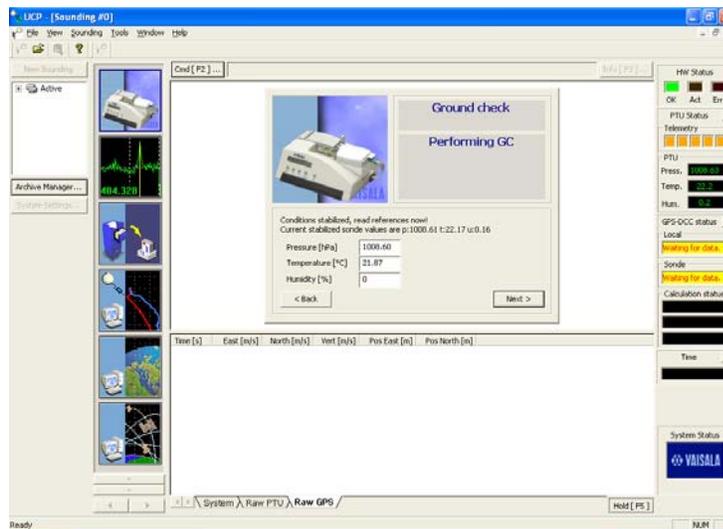


Figure 12

35. On the next screen (Figure 13), if everything looks OK, click on “Next.” If you need to change any values, click on “Back” and try again.



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**sides of the tub a little so that it will fit.** Once the battery tub is snapped on the radiosonde, it is secure.

38. Turn off the GC25. **Make sure the chamber door is closed securely.**
39. Carefully position the sensor boom so that it snaps into and is captured by the two plastic pieces at the top of the radiosonde. When the sensor boom is in the correct position, it should be at approximately 30-degree angle to the radiosonde (see Figure 15).



Figure 15

40. Go to the Loggernet display on the BBSS computer and check the surface wind speed. If the surface wind speed is less than 3 m/s, manually aspirate the radiosonde prior to launch, as described in step 48.

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## F. Attach RS-92 to Balloon and Position for Launch

41. Take cable ties, cutters, and the radiosonde from the balloon/radiosonde storage area to the Balloon Launcher Cart, and carefully set the radiosonde on the small platform.
42. Remove the rubber string stopper from the radiosonde unwinder and drop the unwinder down inside the canvas bag. Bring the unwinder out through the hole on the bottom.
43. Tie off the balloon at the neck with a cable tie, and then remove the balloon neck from the nozzle.
44. Attach the unwinder clip to the balloon neck, below the first tie. And then, double the rest of the neck back over the unwinder clip and secure it with the other cable tie.
45. Cut the loose ends off of the cable ties.
46. Make sure to keep the sonde in a shade so that the radiosonde is out of direct sunlight.

## G. Launch Balloon

47. Carefully move the Balloon Launcher Cart to a position that is free from possible obstruction.
48. When the time is right, release the balloon following the next steps:
  - a) Carefully remove the canvas strap over the balloon.
  - b) Remove the radiosonde from the platform.
  - c) Hold the radiosonde with one hand, and then carefully free the balloon from the launcher by reaching into the bag and hold onto the balloon neck and unwinder.
  - d) If the wind speed reading on the Loggernet display was more than 3 m/s, proceed to step e. If the wind speed was less than 3 m/s, manually aspirate the radiosonde as described below:
    - (i) Hold the balloon and the radiosonde at arm's length.
    - (ii) Allow the radiosonde to dangle from the string about 30 cm.
    - (iii) Slowly swing the radiosonde back and forth like a pendulum about 20 times. **Do not let the radiosonde touch anything.**
    - (iv) Hold the radiosonde in one hand, keeping the balloon neck in the other.
  - e) Hold the balloon over your head, and let it go. **Make sure to let the balloon pull the radiosonde out of your hand.**
49. Go back to the BBSS computer for the last few steps.

## H. Enter Wind Direction and Speed

50. When you get back to the computer, you should see the following screen (Figure 16):

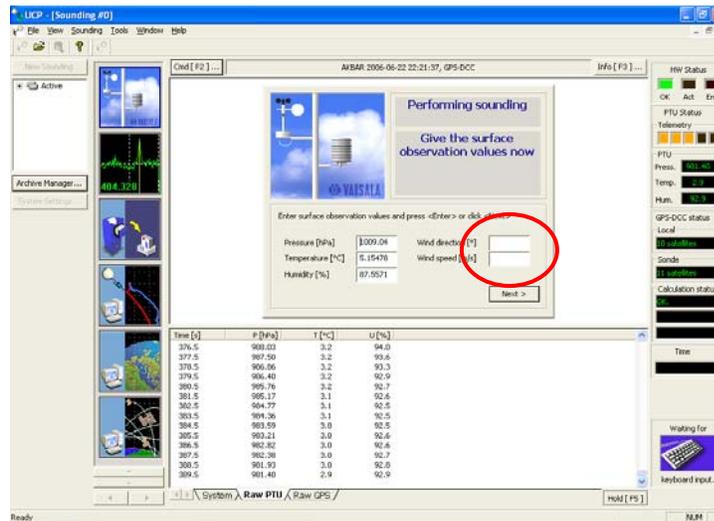


Figure 16

51. Enter wind direction and speed obtained from the Loggernet display on the BBSS computer. Click on "Next." You should see the following screen (Figure 17):

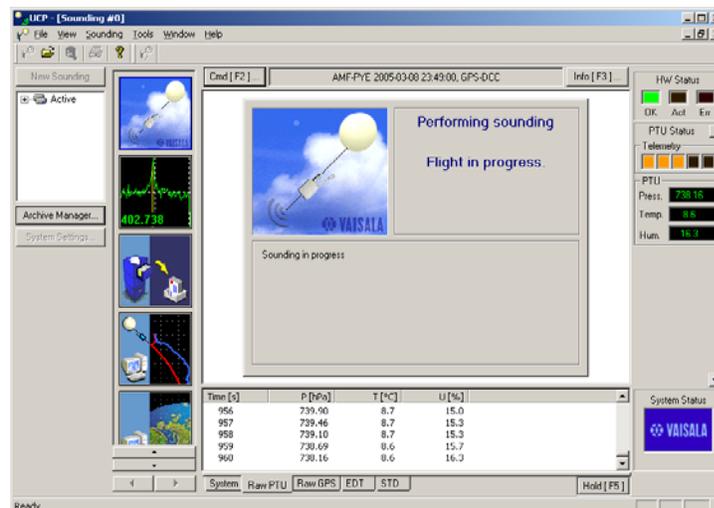


Figure 17

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## I. After the Balloon Release

You should watch the sounding closely for 15 minutes after launch. If anything is going to go wrong, it will likely happen soon after the balloon is released. The following are a few things to look for in order to identify problems.

- There should be reasonable looking numbers in the “RawPTU display”:
  - ⇒ The pressure (P) numbers should be getting smaller.
  - ⇒ The temperature (T) numbers should be changing smoothly without any large jumps.
  - ⇒ The humidity (U) values should be between 0 and 100.
  - ⇒ **If you see slashes (///) in any of the data fields on the “RawPTU” display, it means either that the sensor has failed or that the system has lost the signal. Loss of signal should trigger the “Check Telemetry” alarm. If the data window shows slashes and/or there is no telemetry for longer than a few minutes, then we have a problem and should launch another radiosonde only if it is within **60 minutes** of the original launch time. See Launching Second Balloon, PRO(BBSS)-024.**
- Loss of signal may occur during a sounding for a variety of reasons. Usually the system will recover automatically.
- The launch should end automatically about 2 hours after launch. The system will return to the “New Sounding” screen and be ready for the next launch.

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**V. References:**

1. Ground Check Set GC25 User's Guide, MAN(BBSS)-034.
2. Compressed Gas Cylinder Handling at AMF, PRO(OPS)-031.
3. Launching Second Balloon, PRO(BBSS)-024.

**VI. Attachments:**

None.