AMF BBSS Launch Operations at China-Shouxian 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 China Site in Shouxian, China.

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 an accurate climate record. Giving yourself plenty of time means, if you need to prepare a second sonde, you will still be able to release the balloon on time.

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.
- The 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 this is a problem.

III.   Requirements:

- DigiCORA III
- RS92 radiosonde package, SGPD (w/ 9.5V battery)
- GC25 Ground Check Set (GCS)
- GPS omni-directional antenna
- Meteorological balloon (350 grams)
- Cable ties or string to tie off balloon
- Cutters
- Helium or "balloon gas" for lifting gas
- Balloon Launcher Cart

- Safety glasses

- Balloon filing valve and hose

- Timer or stopwatch

- BBSS PC with BBSS and PCMF software

- For changing regulator position: open-end wrench (1 1/8 inch) or crescent wrench (12 inch)

IV. Procedure:

A. Schedule

Balloons are launched four times a day:

1) 05:30 UTC (13:30 CST)

2) 11:30 UTC (19:30 CST)

3) 17:30 UTC (01:30 CST, next day)

4) 23:30 UTC (07:30 CST, next day)

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, near the metal gas nozzle.

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. Check the helium cylinder pressure on the gauge (closest to the cylinder with a 0-to-28,000 kPa gauge). If the pressure is less than 4,000 kPa, monitor the gauge closely; it may not have enough gas to fill one balloon.

8. Open the cylinder valve and then the red valve. The flow gauge should read 100 kPa.

    a) Start the timer.

    b) Fill the balloon for approximately **[   ] minutes and [   ] seconds** – This should result in an ascent rate between 3 and 5 m/s.

9. <u>If the helium gas stops flowing before the filling time is reached or the flow gauge reading drops below 100 kPa</u>:

    a) Stop the timer and close the red valve and then the cylinder valve.

    b) Move the regulator gauge assembly to the next full cylinder – See *Compressed Gas Cylinder Handling, PRO(OPS)-031* for details.

10. When alarm sounds, turn off the red valve and the cylinder valve.

11. Go to the Shouxian Meteorological Bureau building.

C. Prepare BBSS Computer

12. 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."

13. Double-click on the "Digicora III" icon to launch the software.

14. Check the year, month, and time at the lower right of the computer screen for correctness (if incorrect, note in comments in the general comment section of the SDL).

D. Ground Check Set (GCS)

15. Open the radiosonde package and carefully remove the RS92 and unwinder. **Note: The sensor boom is extremely fragile.**

16. 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.
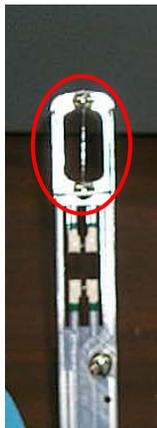
Figure 1: RS92 sensor boom (temperature sensor in red circle)

If using a water-activated battery:

a) Remove battery packet and carefully open foil packet.

b) Remove battery from foil packet and position connector.

c) Put battery back in foil packet and fill with water until battery is completely covered.

d) Start timer for 5 minutes

e) When alarm sounds, pour out water, wipe off any excess water on battery case, and place battery on sponge.

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

1. Chamber door
2. LED display
3. Control buttons
4. Chamber door latch
5. Radiosonde positioning tray
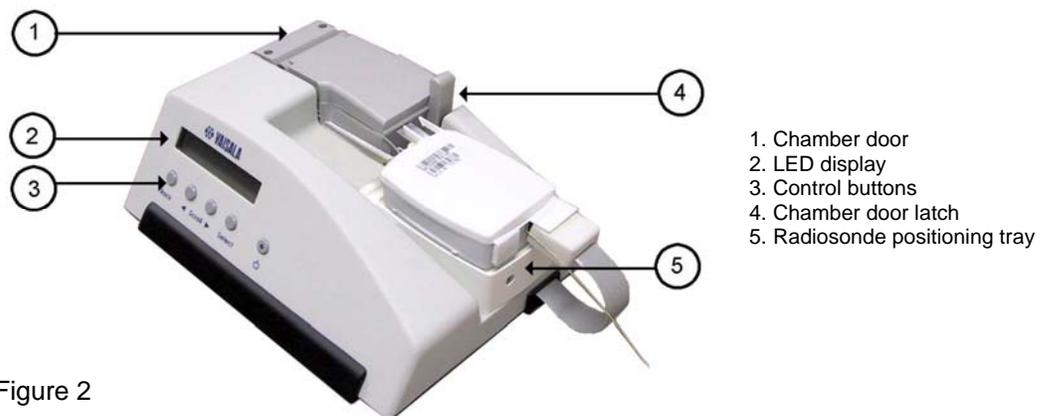
Figure 2

18. <u>Carefully</u> place the RS92 with the <u>"Radiosonde" label up</u> as shown in Figure 2, making sure it fits in the indentation on the positioning tray. Close the chamber door immediately.

19. 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.

20. Turn on the GC25 by pushing the power button (far right on the front panel with a light). The display will briefly read the following: "Identifying…," "RECOND. U-SENSOR," and "YES."

21. Push the "Select" button. A 3-minute timer will start. Wait until the timer is finished.

22. The display should read, "FREQUENCY 402.76 MHZ" (or something close to 403) – remember this value. When prompted to change

frequency, press the "Select" button for "NO" (unless this is a second launch and the frequency needs to be changed).

23. Press the "Select" button for "NO" when prompted to "TUNER DISABLED SET TIME?"

24. Push the "Select" button in response to the prompt "GRND CHK MODE PRESS SELECT."

E. DigiCORA III Program

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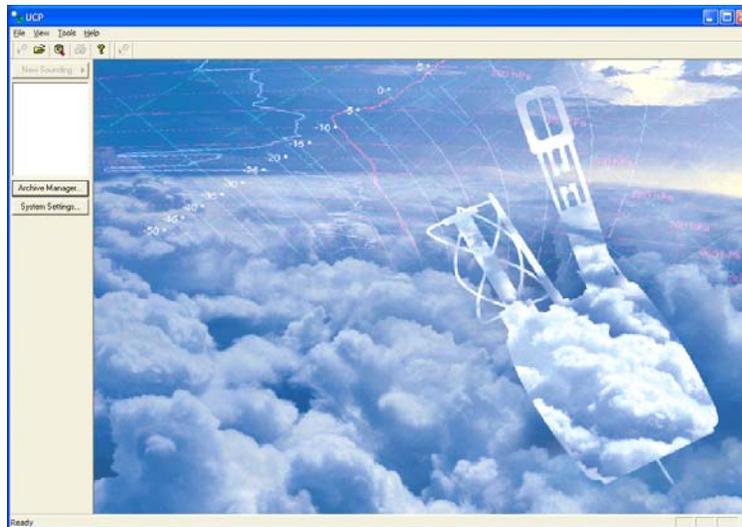
Figure 3: DigiCORA III initial screen

26. If the screen (Figure 3) is not displayed, double-click on the DigiCORA icon on the desktop.

27. 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.)
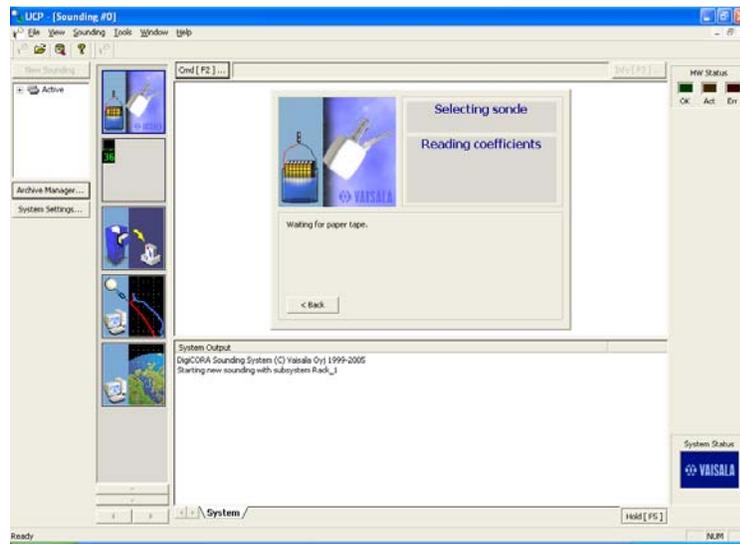
Figure 4

28. The RS92 radiosonde will be transmitting at the frequency you selected. Click on the spectrum window, check frequency, and then click on "Find" so that the DigiCORA can receive the signal (Figure 5).
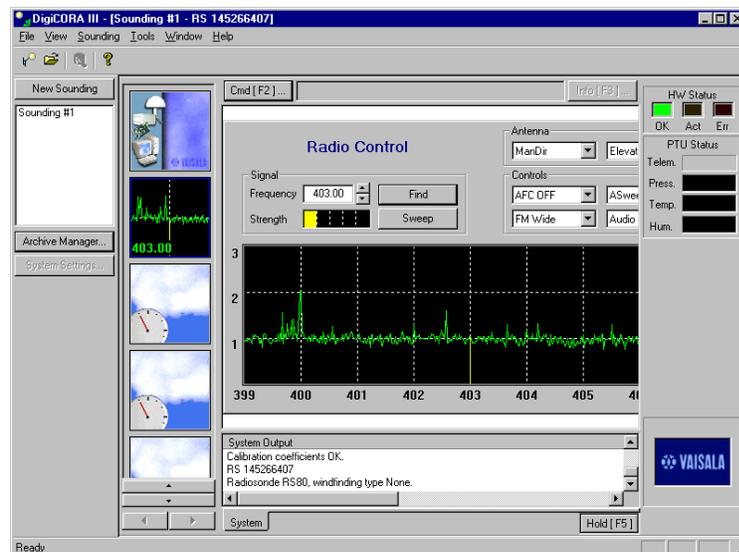
Figure 5

29. Once the system has found the radiosonde, click on the top left icon (see Figure 6) to get back to the control screen. You should see a screen as shown in Figure 7.
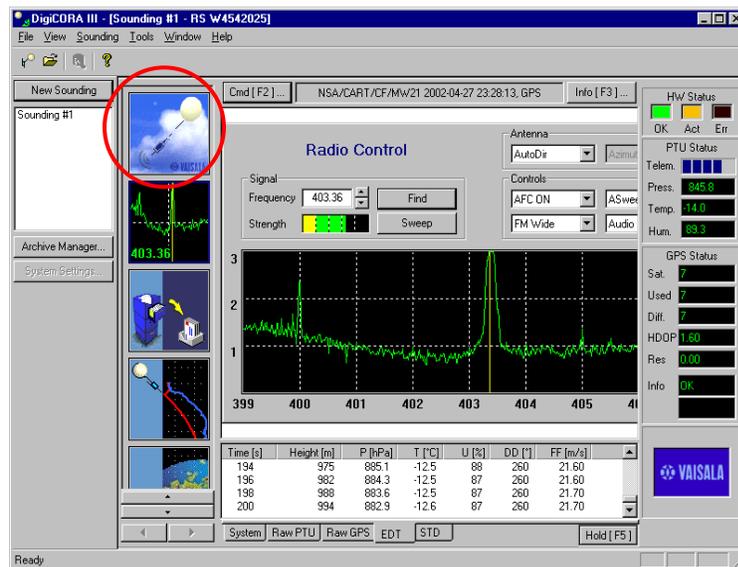
Figure 6
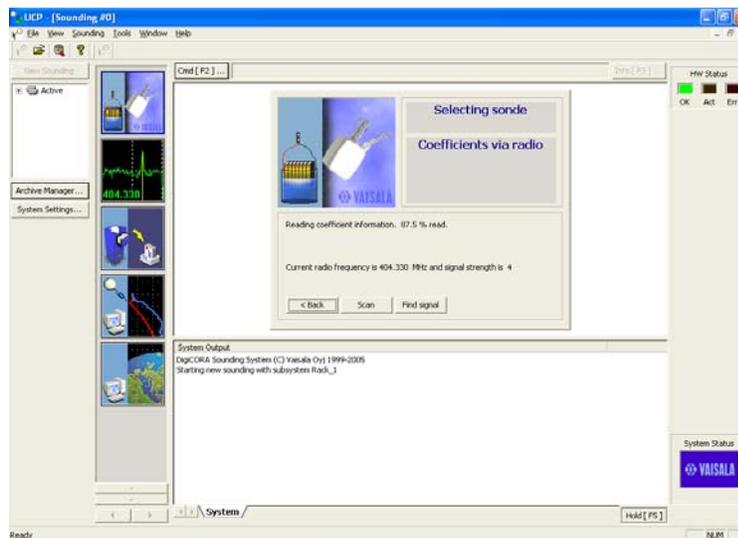
Figure 7

30. When the coefficients have been read 100%, click on "Next," and you will see the following screen (Figure 8a). Verify the serial number and radiosonde type. Click on "Next."
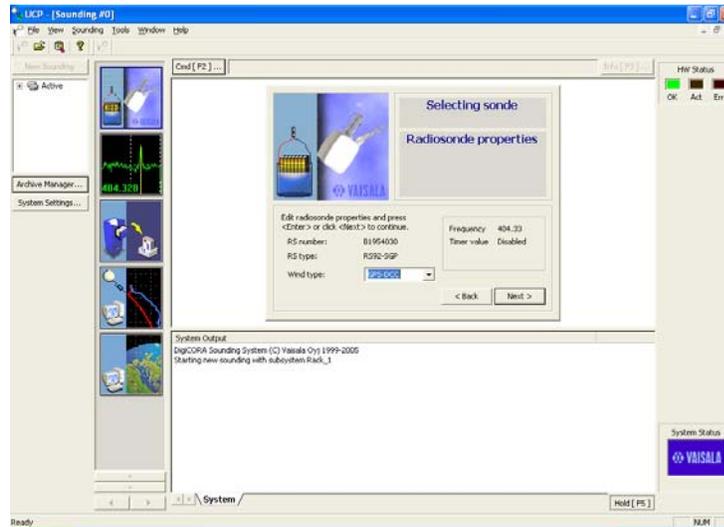
Figure 8a

31. Enter the sounding number in the blank box (see Figure 8b) and on the Pre-Flight Sonde Check Form 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.
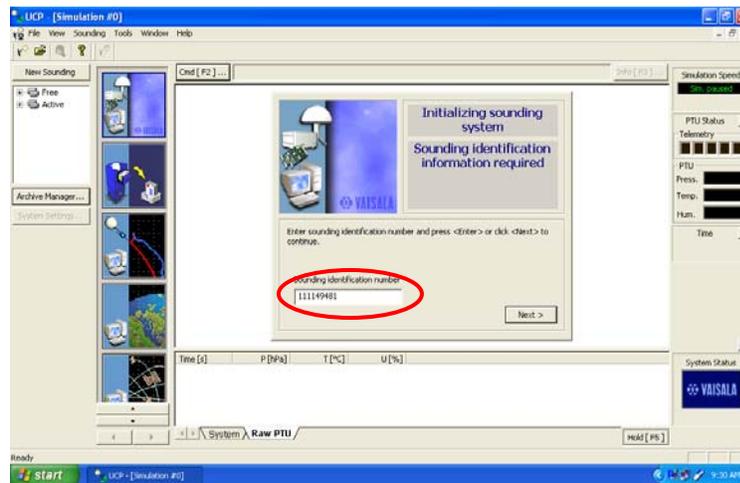
Figure 8b

32. Click on "Next." The system will go through initialization process.

33. When the following screen (Figure 9) appears, click on "Perform GC."
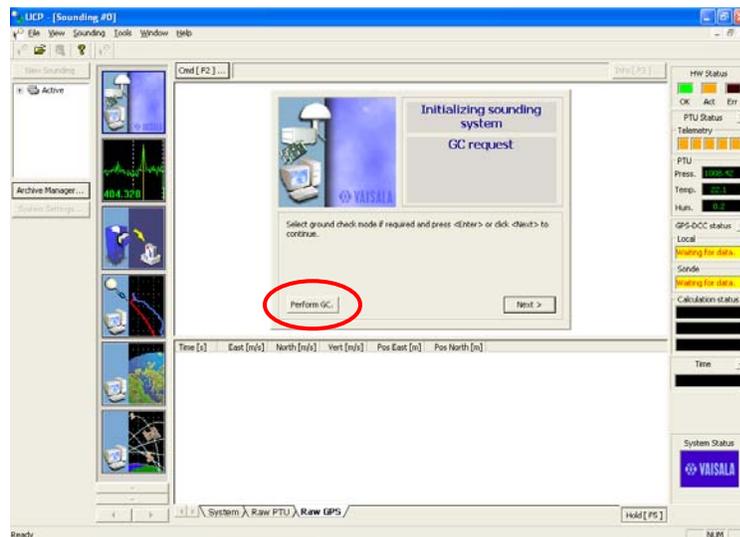
Figure 9

34. Wait until you see the next screen (Figure 10). 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 <u>on the GC25 unit LED display window</u> (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."
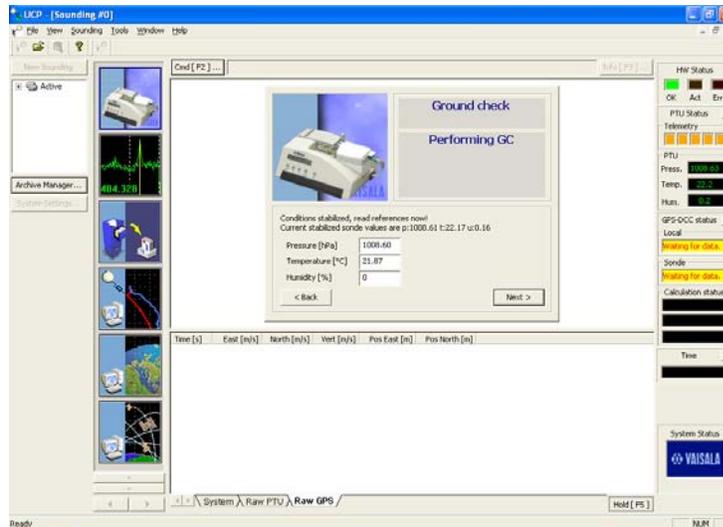
Figure 10

35. If everything looks OK, click on "Next" (see Figure 11).

Figure 11

36. When the screen says "Ready for sonde release," open the chamber door on the GC25 Ground Check Set, and <u>carefully</u> remove the radiosonde. **Be sure to close the chamber door immediately and securely.**

37. Remove the GC25 cable from the RS92 radiosonde, attach the battery connector to the radiosonde, and snap the plastic tub containing the battery onto the radiosonde. **Note: You may have to squeeze the 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 12).

Figure 12

40. Go to the SMET computer and check the surface wind speed. If the surface wind speed is <u>less than 3 m/s</u>, manually aspirate the radiosonde prior to launch, as described in step 48.

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 <u>carefully</u> 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 <u>keep the sonde in a shade</u> 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 SMET computer was <u>more than 3 m/s</u>, proceed to the next step. If the wind speed was <u>less than 3 m/s</u>, 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 13):
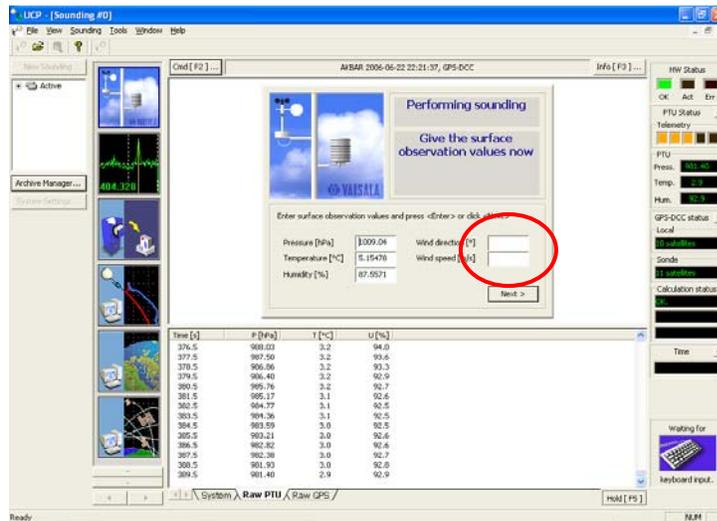
Figure 13

51. Enter wind direction and speed obtained from the SMET computer. Click on "Next." You should see the following screen (Figure 14):

Figure 14

I. After the Balloon Release

You should watch the sounding for 10 minutes after launch. If anything is going to go wrong, it will likely happen soon after the balloon is released. Here 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 show slashes and there is no check telemetry, then we have a problem and should launch another radiosonde if it is within 30 minutes of the original launch time. See <u>Launching Second Balloon, PRO(BBSS)-024</u>.**

- 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 is ready for the next launch.

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.