UAHuntsville NOAA/ESRL Ozonesonde Station Operator's Manual

Cover Photo: Ozonesonde launch by Al Powell, NOAA and Stephanie Long, UAH.

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How the ECC Ozonesonde Works

How the ECC Ozonesonde Works

This section of the manual is designed to help you understand how the ozonesonde measures ozone in the atmosphere. It is a brief overview of how the chemical reactions that take place enable us to "count" ozone. The following is an excerpt from [Komhyr et al, 1995b]. If you would like to read a more in-depth explanation, the complete paper is referenced at the end of the excerpt.

Firstly, the Electrochemical concentration cell (ECC) ozonesonde is launched by us every Saturday and reaches altitudes between 30 and 35 km. During the ascent the sonde measures the amount of ozone in the air, with help from various chemical reactions; these measurements are taken to supplement data obtained with the stratospheric lidar and ROCOZ A instruments which measure ozone above 20 km.

The ECC sonde is an instrument which contains an ECC ozone sensor, a battery-powered Teflon gas-sampling pump, and an electrochemical coupler that connects the ozone sensor to a meteorological radiosonde for data telemetry. During the ascent there are several data points that are transmitted to the ground-based receiver; these include the air pressure and temperature, relative humidity, ozone, sonde air pump speed, and the pump temperature.

The dimensions of this device are 7.6 x 7.9 x 13.3 cm and it weighs 390 g. During flight this instrument is enclosed in a weatherproof, polystyrene flight box. The total weight of the package, not including the Vaisala Radiosonde is approximately 700 g.

The ECC ozone sensor is made of two bright-platinum electrodes immersed in potassium iodide (KI) solutions of different concentrations, contained in separate cathode and anode chambers. The chambers are linked with an ion bridge that in addition to providing an ion pathway retards mixing of the cathode and anode electrolytes and thereby preserves their concentrations. The electrolytes also contain potassium bromide (KBr) and a buffer, whose concentrations in each half-cell are the same.

When ozone in air enters the sensor, I_2 *is formed in the cathode half-cell according to the relation*

$$2KI + O_3 + H_2O \rightarrow 2KOH + I_2 + O_2$$

The cell converts the iodine to iodide in accordance with the overall cell reaction

$$3I^-(a_2) + I_2(a_4) \rightarrow I_3^-(a_1) + 2I^-(a_3)$$

Where a_1, a_2 *are the activities, respectively of the tri-iodide and iodide within the anode half-cell; and* a_3 *and* a_4 *are the activities respectively of the iodide and iodine within the cathode half-cell.*

The 1% KI sensing solution used frequently by NOAA in the cathode cell of the ECC ozone sensors gives us the following reaction. For an iodine/iodide redox electrode

[Vetter, 1967] with low iodide concentration, the ECC sensor reaction is predominantly reducing

$$I_2(a_4) + 2e \rightarrow 2I^-(a_3)$$

Thus, each ozone molecule entering the sensor and reacting with the KI in aqueous solution to release one molecule of iodine causes two electrons to flow in the cell's external circuit when the iodine molecule is reconverted to iodide by the cell. The cell therefore, essentially counts ozone molecules entering it per unit time.

Reference

Komhyr, W. D., R. A. Barnes, G. B. Brothers, J. A. Lathrop, D. P. Opperman (1995), Electrochemical concentration cell ozonesondes performance evaluation during STOIC 1989, *J. Geophys. Res.*, 100 (D5), 9231-9244.

3-7 Days Prior to Flight Conditioning

3-7 Days Prior to Flight Conditioning

If conditioning while the balloon is out, don't forget about the data! **Make sure the data is coming in correctly!** Adjust the antenna if necessary to receive a better signal; for guidelines look in Appendix A.

Start the Initial Conditioning for the new sonde.

1. Take out a new checkout sheet from the bottom drawer, as well as a new sonde from the top shelf.
2. Remove the ozonesonde from the white Styrofoam box; keep the tape (by sticking it on the cabinet door) and the plastic bag.
3. Take off the cover and take out the sensor leads and connect them to the power box- blue to blue, white to white.
4. Connect the power and the ozonesonde tubing.
5. Place the feeder tube in the **NO/LO** ozone port.
6. Turn on the main power, the Vaisala, and the air. Let run for **5 minutes**.
7. **Record the pump current** on checkout sheet. **(acceptable range 50-120 mA).**
8. Disconnect the feeder tube and the cathode sensor tube from the pump. Use the vacuum/pressure gauge to measure the pressure (cathode side) and vacuum (feeder tube). Record these on the report form.
    a. **Acceptable ranges** - pressure **> 8psi**
        i. **NOTE:** Even though we still measure the vacuum, it is no longer regarded as critical to the sonde's performance.
9. Reconnect all the tubing.
10. Turn **on** the UV Mercury lamp, pull the shield all the way out, fasten it with a piece of tape, and **turn off the air**.
11. Place the feeder tube into the **High ozone** port and place the high ozone scrubber on the cathode exhaust tube. (Placing the scrubber on the exhaust port **is optional,** but inhaling high ozone might give you a headache if inhaled for long periods of time).
12. Run the High ozone for **30 minutes.**
13. Move the feeder tube to the **No/Lo** port, turn **off** the Mercury lamp and push the shield back in.
14. Turn **on the air pump** and let run for **5 minutes.**
15. Turn **off** the power, the Vaisala, and the air.
16. Remove cathode cell cap, place on Kimwipe.
17. **Add 3.00cc** of cathode solution to the cathode cell using the cathode syringe, replace the cap, and be sure to get the tube over the Teflon sensor (the white thing sticking up) in the bottom of the cell.
18. **Always** add the cathode solution **before** adding the anode solution.
19. Wait **2 minutes** for the solution to permeate the ion bridge.
20. Remove anode cap, and place on a Kimwipe.

21. **Add 1.5cc** of the anode (yellow) solution to the anode cell using the anode syringe.
22. Replace the cap; put the syringe on a Kimwipe, and set the solutions aside.
23. Turn on the main power, the Vaisala, and the air.
24. Run on **No/Lo ozone** for **20 minutes**.
25. Record the cell current; it must be **below 0.8.**
26. Shut off the power, Vaisala, and air, and disconnect the ozonesonde from the test unit and filter.
27. Remove the cathode cell cap and add **2.5cc** of cathode solution to the cathode cell using the cathode syringe. Replace the cap, again making sure to get the tubing over the Teflon sensor.
28. Short the ECC sensor leads (blue and white cables) with a shorting plug (small black plug saved from the previous sonde).
29. Take the feeder tube and place it sideways in the space between the motor, so that it makes a "C" shape; this will reduce bending of the tube, and ensure it will not slip out of the ports as easily as it would if you stored it in a "U" shape.

Figure 1 - The feeder tube is slid into the space between the motor, making a "C" shape

30. Replace the cover; make sure the cables are not pinched in the cover.
31. Place ozonesonde back into the plastic bag, and put it carefully into the Styrofoam box.
32. Take the masking tape you saved, and tape the box shut as before.
33. Take a sticky note from the drawer and write TODAY's date on it, stick it on the front of the checkout sheet.
34. Now, take an extra piece of tape (it can be piece of saved masking tape) and **tape the checkout sheet** to the front of the box.
35. Place the box in the cabinet, to the right of the older sonde, with the checkout sheet visible.

36. Take the squirt bottle of distilled water and squirt a small amount into the Styrofoam cup.
37. Use this to flush out the syringes (2 times per syringe). Use the plastic container for the waste.
38. Fill the syringes with distilled water, but don't flush. Keep them filled.
39. Wrap in the Kimwipe, store in plastic cover, and put in drawer.
40. Pour the waste down the sink, and rinse the sink out with tap water.
41. Lock all the cabinets before you leave.

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Day of Flight Preparations

Day of Flight Preparations

1. Record summary of activity in the station log book.
2. Remove tape and checkout sheet from Styrofoam box, remove ozonesonde and set aside.
3. Connect feeder tube to pump intake.
4. Inspect the cathode cell for KI salts or white film. If necessary, rinse with distilled water and wipe with a Kimwipe.

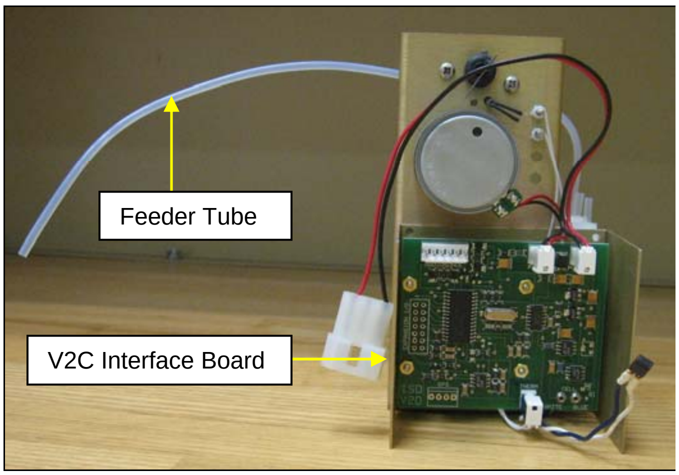

Figure 2 - Ozonesonde layout showing interface board and feeder tube

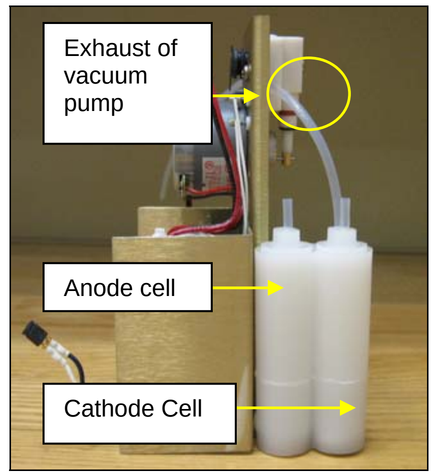

Figure 3 - Ozonesonde layout showing vacuum pump, cathode cell, and anode cell

5. Cathode
   a. Disconnect cathode tube from exhaust side of vacuum pump.
   b. Remove cathode cap from the cell.
   c. Place cap on Kimwipe.
   d. **Add** cathode solution until cathode cell is full (~**3.0cc**). Replace cap on cell (to protect the cell from contamination).

      Note: Once solution, either cathode or anode, is in the appropriate syringe, and you decide to not use it for any reason, **do NOT** put it back in the bottle, discard it.
6. Anode
   a. Remove anode cap and place on Kimwipe.
   b. Remove all anode solution with anode syringe. Discard in separate container.
   c. Put cap back on cell.
7. Cathode
   a. Remove cathode cap and place on Kimwipe.
   b. Remove all cathode solution with cathode syringe. Discard in separate container.

c. **Add 3.0cc** of cathode solution using cathode syringe.
d. Replace cathode cell cap making sure exhaust tube **covers the small Teflon rod** inside the cell. Use pliers to ensure the cap is tight. Reconnect the exhaust cathode tube.

8. Anode
   a. Remove cell cap and **add 1.5cc** of anode solution using anode syringe.
   b. Replace anode cell cap. Use pliers to ensure the cap is tight.
      1. If you are not preparing another sonde after the launch, then flush and store the syringes as described in steps 36 – 40 under "3-7 Days Prior to Flight Conditioning" on page 11.
9. Set the syringes aside on a Kimwipe.
10. Remove metal cover to expose Ozonesonde interface board.
11. Remove ECC cell shorting plug (little black plug at the end of the blue and white wires, set it aside and save for later!) and connect sensor leads to ozone test unit, connect **blue to blue and white to white**.
12. Connect the power leads.
13. Place ozonesonde on towel to keep unit from shifting during preparation.
14. Place feeder tube into **No/Lo** ozone port.
15. Turn on the surge-protector.
16. Turn **on** ozone test unit power, vaisala, and air pump switches.
17. Run pump **5 minutes** to stabilize the background.
18. **Record the cell current** number on the Ozonesonde checkout list as Background Current one (BG1).
    a. **Reject** sonde if: Background (BG1) is greater than 0.10 microamps, or negative (-0.02 microamps).

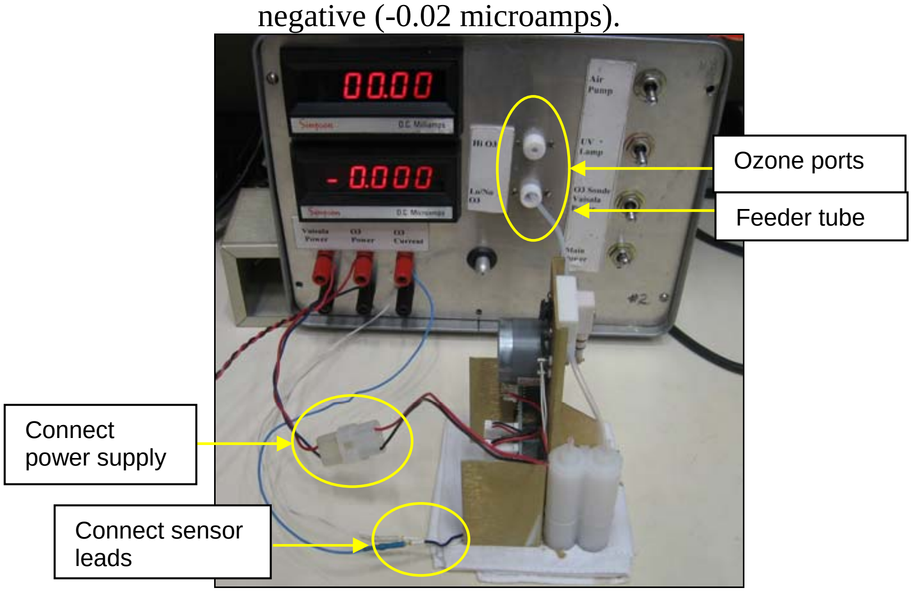

Figure 4 - Locations of important elements of the ozonesonde and test unit

19. Once this is complete, begin the ozone process.
    a. **Turn on** the Mercury lamp keeping the feeder tube in the **No/Lo** ozone port (keep power, Vaisala, and Air on).
    b. Pull out lamp shield (silver rod) out as far as it can go.
    c. Wait for cell current to start increasing.
        1. When you start reaching 3.8 microamps start pushing the shield back in so you don't overshoot your goal, it will go quickly!
    d. Once 5.0 microamps is reached, adjust silver rod to maintain this number for **10 minutes**. This is done by moving the rod in and out in small increments to expose or cover the Mercury lamp inside.
        1. In time critical situations (multiple launches), you can maintain it for **5 minutes** which is **the absolute minimum!**
    e. Keep it between **5.000 and 5.070** as a maximum, when you adjust the rod. Keep it until you see the numbers begin to decline, then **immediately** pull the rod back out all the way, otherwise the numbers will go down too far.
20. *****Very important step*****
    a. Once the 10 minutes are completed, check the ozone response time.
    b. Push in Mercury lamp cover (silver rod) all the way and turn off the Mercury lamp. Watch the cell current display.
        1. The cell current will drop quickly if you don't pay attention, so **you must be ready!**
    c. Use the stopwatch to time the drop from **4.0xx to 1.5xx** microamps.
    d. Record this ozone response time on the ozonesonde checkout list.
    e. The response time should be under **1 minute.**
21. **T100 test**
    a. Leave the entire ozonesonde set up attached to the test unit leaving on the power, vaisala, and air pump switches.
    b. Connect soap bubble Manometer to the **exhaust port on the cathode** cell.
    c. Remove red cap from manometer top.
    d. Let setup warm up for **4 minutes.**
    e. Allow some bubbles to move from the bottom of the tube to the top by squeezing the bulb, this conditions the tube. Continue to squeeze the bulb until the bubbles reach the top of the tube.
        1. Remember to wipe off bubbles at the top, so they don't fall into the tube and interfere with the bubble you want to time.
    f. Once the manometer is ready, collect a single, flat bubble and record the time it takes for the bubble to go from 0 to 100 on the ozonesonde checkout list.
    g. Repeat this process five times to calculate the average T100 time for this ozonesonde.
22. Remove the Manometer from the ozonesonde and the sonde from the test unit. Attach the regular (not the high ozone scrubber) filter to the **feeder tube** to keep sonde conditioned, and set aside.

23. Attach the dry sonde from the drawer by connecting the Manometer tube to the exhaust cell of the cathode, as well as the sensor leads and power supply.
24. Warm up the unit on **No/Lo** ozone for **5 minutes**. This requires you to turn on the main power, Vaisala, and air.

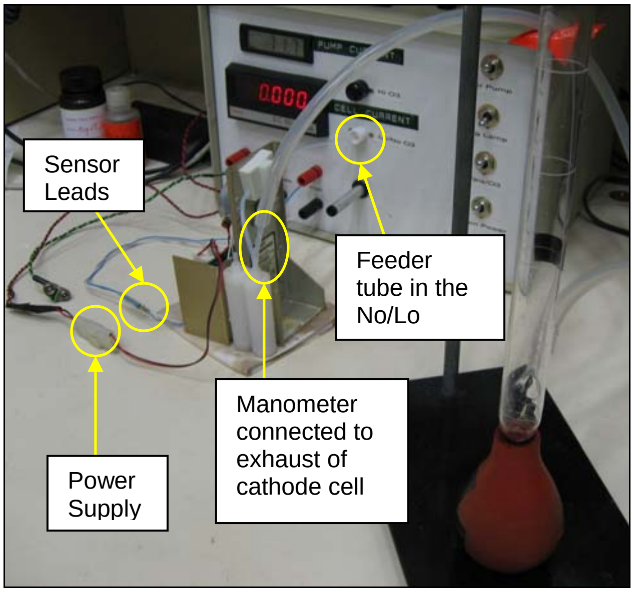

Figure 5 - Setup for T100 and dry test

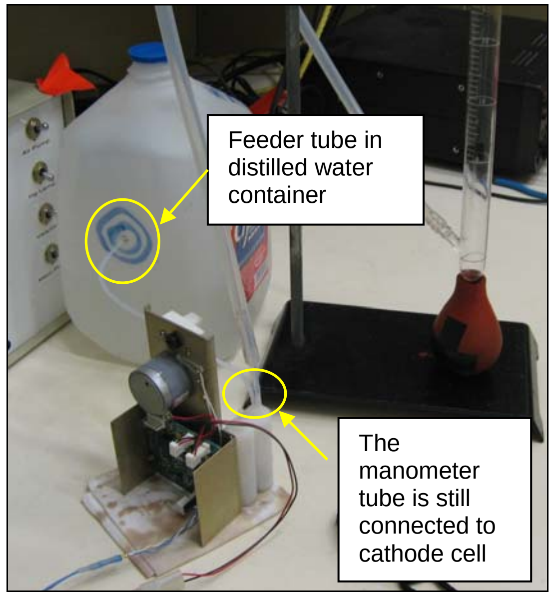

Figure 6 - Setup for wet test

25. Dry and Wet Test
    a. Do the bubble test using the dry sonde.
    b. Time one bubble as before.
    c. **Record times** on the ozonesonde checkout list.
    d. Repeat 3 times, and calculate the average time.
    e. Take the distilled water jug out of the cabinet.
    f. Connect the feeder tube to the distilled water jug, as shown in Figure 6.
    g. Allow the sonde to warm up for about **4 minutes.**
    h. Do the bubble test using the humid sonde.
    i. **Record times** on the ozonesonde checkout list.
    j. Repeat three times and calculate the average time.
    k. Calculate the correction factor (equation at the bottom of the checkout list (**[(wet/dry) -1] x100**)) and record it, room temperature, and relative humidity on the ozonesonde checkout list.
    l. Disconnect everything, and put the dry sonde and water jug back into the cabinet.
26. Balloon Set Up
    a. Place the plastic tarp onto the floor.

b. Sweep the tarp with the **ozone broom** to ensure nothing will damage the balloon. (Using a different broom may cause you to get metal scrapings on the tarp which could harm the balloon).
c. Lay out the balloon, taking caution not to touch the balloon (touching the thick neck is ok, just not the thin balloon material). To move the balloon, use the bag that it is shipped in, turn it inside out and use as a glove.

27. Balloon Fill at the Helium (He) Tank
    a. Attach the regulator to the helium tank.
        1. Tighten with a wrench.
    b. Make sure the shut-off valve on the regulator is set to **closed (perpendicular)**, and open the valve on the tank.
        1. You will see the right pressure dial jump from zero to however much pressure/gas is left in the tank.
        2. Make sure the left dial, release pressure, is on or below 30psi. You don't want to go any higher than that; it might cause the balloon to slip off the nozzle.

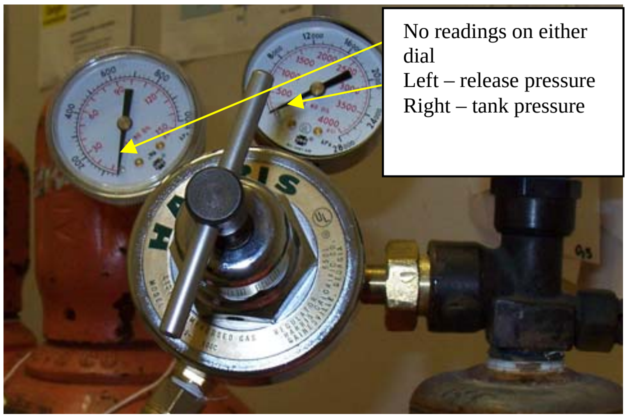

Figure 7- The regulator attached to the helium tank showing no readings on either dial

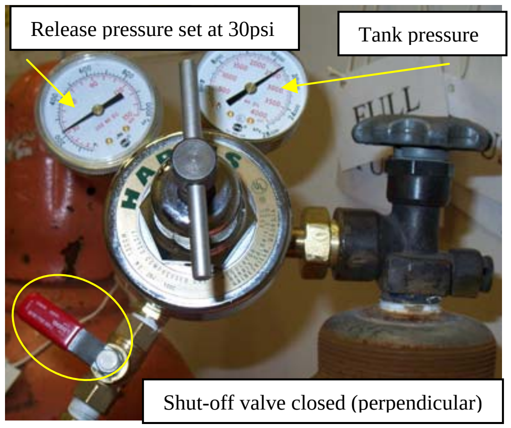

Figure 8- The regulator showing readings on the pressure dial and release pressure dial

    c. Attach the balloon to the plastic end of the hose (the one not attached to the tank), again, taking care not to touch the balloon.
    d. **Open** the shut-off valve on the regulator (**parallel**) and let the helium flow into the balloon.
        1. You might have to adjust the release pressure
        2. If the regulator makes a loud squeaking noise, close the shut-off valve (perpendicular), make sure the tank valve is open all the way, and adjust the release pressure. Then try again.
    e. When the balloon begins to lift the **weight** off the ground **completely**, turn off the He and add a weight on to the cord, to keep the balloon from floating away.
    f. Close the shut-off valve on the regulator.
    g. Close the valve on the tank.

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h. Open the shut-off valve on the regulator to let any gas trapped in the hose escape and close it again.

28. Balloon Tie Up
   a. Cut 3 pieces of cord, one super long ~8-10 ft., one long (arm to opposite arm) and one short (arm's length).
   b. Double up the long cord and leave the loop hanging as you tie successive square knots up the neck, switching back to front, until the cord runs out.

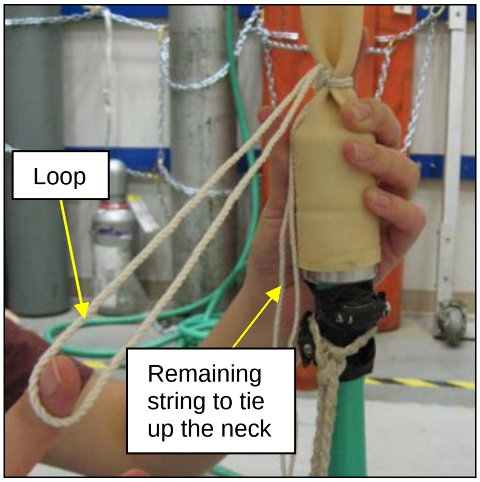

Figure 9 - Start tying neck of the balloon, be sure to leave a loop

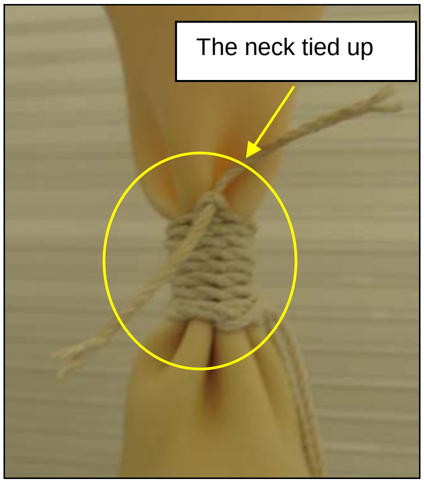

Figure 10 - The neck of the balloon after completing step 26 b

   c. ***Attach the clip to the loop***so the weights will still hold down the balloon when the neck is removed from the hose.
   d. Fold balloon neck over the tie off and use the short cord to complete the seal using the same tie down method.

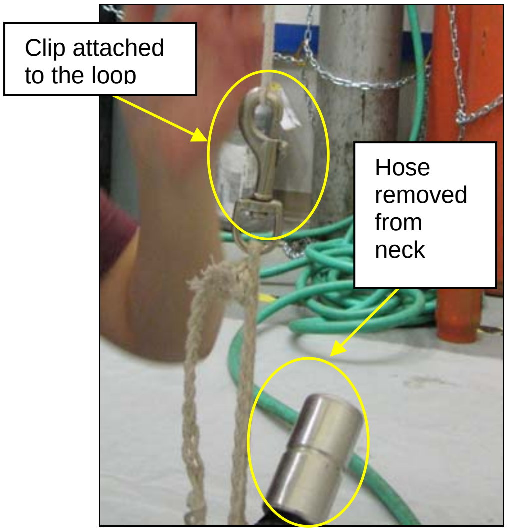

Figure 11 – Attach clip to the loop and remove balloon from the hose

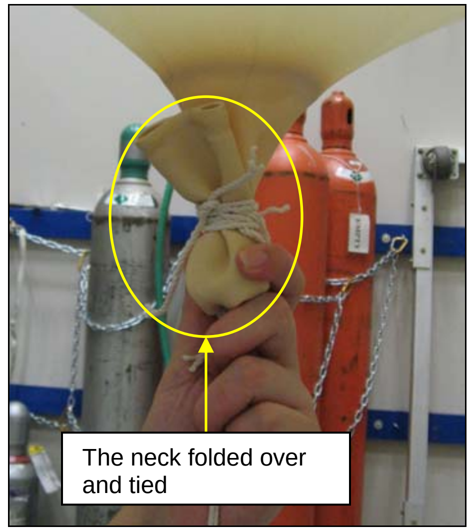

Figure 12 - The neck completely tied

e. Take the parachute and **remove** the warning tag; then unfold it and drag it around the room to get some air into it. Then, use your arm to separate all of the folds.

Figure 13 - Fluff out parachute by swiftly pulling it behind you

f. Loop the super long cord through the 4 loops at the top of the parachute.
g. Attach the super long cord to the loop and secure with two slip knots.

Figure 14 - Pull cord through four loops at the top of the parachute

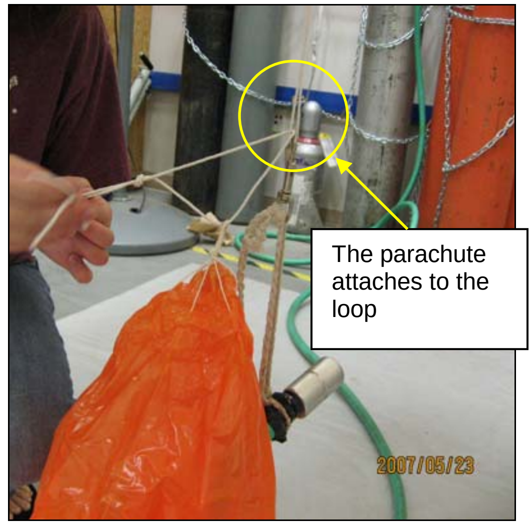

Figure 15 - Attach cord to the loop that the clip is attached to

h. Make sure the parachute lines aren't tangled or knotted. To ensure this, untie the knot at the bottom of the parachute. Straighten all the lines, and then retie the knot.

i. Then at the bottom of the parachute, separate the remaining strings into half, (4 strings to each half) and loop one half through the hole at the top of the reel.

j. Attach the reel using multiple knots.

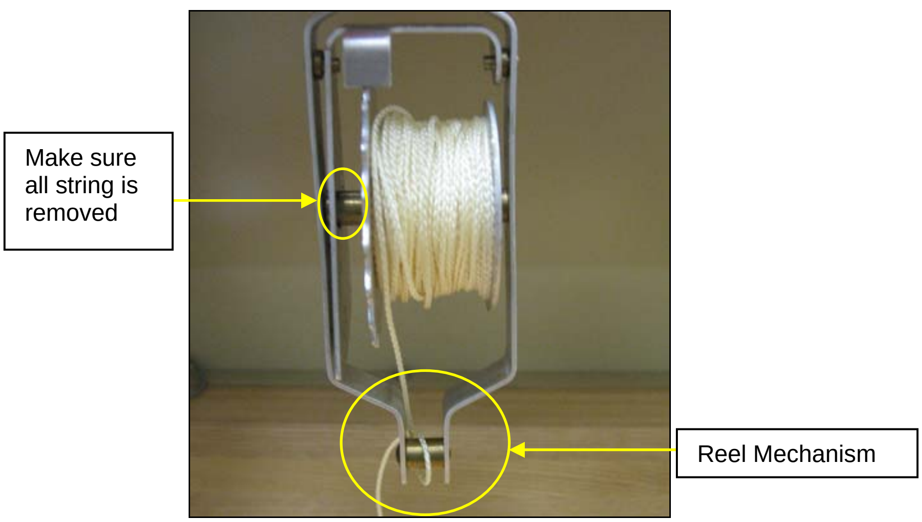

Figure 16 - Loop string around reel mechanism

k. Pull out the string of the reel for a few clicks, and then loop the string through the brass bar **once**. This will prevent the reel from clicking off too much string and letting the package drag on the ground during take off.
l. The balloon is ready to go. Time to finish the sonde testing.

29. Select a Vaisala radiosonde from the cabinet and check for the calibration file in the STRATO directory.
    a. Make a folder and name it HUXXX where "XXX" is the flight number.
        1. Make sure to use all caps for "HU"!
    b. Open the folder Strato and hit CTRL+F, select files and folders and type in the **last 7** digits of the Vaisala serial number.
    c. Copy and save these two files in the newly created folder.
30. **Record serial number** on the report form.

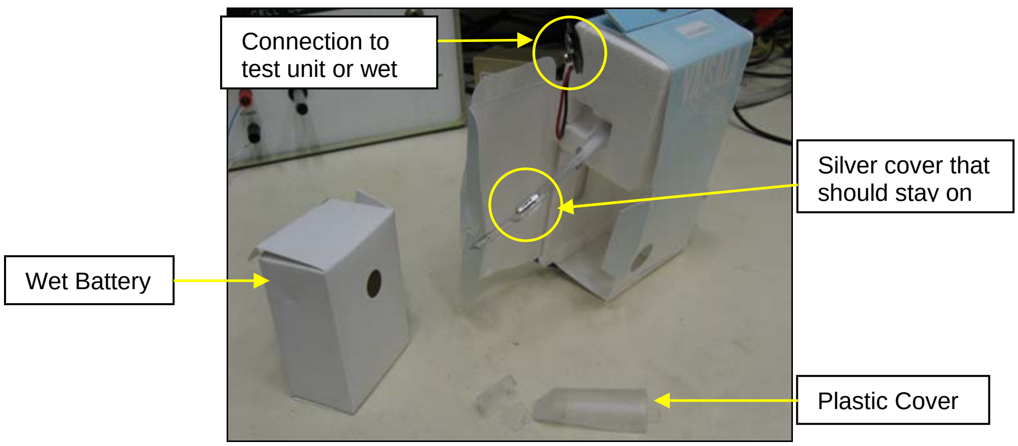

Figure 17 - Layout of important Vaisala elements

31. Remove wet battery from radiosonde and set aside.
32. Connect radiosonde to test unit, turn on main power and Vaisala.
33. Turn on radio receiver to verify signal lock.
    a. Unplug white cable from back of receiver.
    b. Frequency should be around **WFM 402.5**; make sure AFC is turned on as well.
    c. Make sure the signal is coming from the Vaisala by separating the connection from the Vaisala to the test unit. If the signal goes away then it is the Vaisala; otherwise, it is a signal from a different device in the area, such as a TV station.
        1. Try to avoid WFM 402.3, 407.6, 421.25, and 403.26 due to the interference of other devices on these frequencies.
    d. Turn off the main power and Vaisala, and reconnect the white cable with the back of the receiver.
34. Return your attention to the Styrofoam box.
35. Remove 9V battery from the front, bottom side of the box.
36. Poke vent holes into the sides of the box with a screw driver.

    a. Winter time –One vent hole on two sides
    b. Summer time –Two vent holes on two sides
        1. Monitor pump temperature during flight to determine if vent holes are adequate.

37. Remove double-sided tape from the side of the box and attach to the radiosonde.
    a. Attach it so that the end with the space for the battery and the sensor tongue **is away from** the box, and attach the side with the white cord to the double-sided tape.
38. Secure with two pieces of tape, one on each side, attaching it firmly to the box.

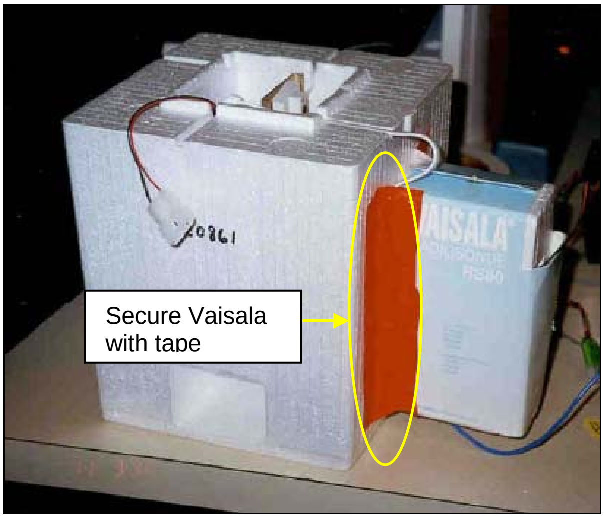

Figure 18 - Vaisala attached to ozonesonde box

Figure 19 - Battery attached to ozonesonde with cables underneath the cathode tube

39. **Attach 9V** battery to the ozonesonde with the cable closest to the inside of the sonde, so you can feed the cable underneath the cathode feeder tube.
40. **Connect the ozonesonde to the radiosonde**, the white multicolored cable. Be sure to **connect the sensor leads** as well. **Replace the cover**, making sure not to pinch any wires.
41. Place ozonesonde into the box making sure the proper items are in the correct channels. (Intake hose in the deepest channel. Radiosonde connection in the widest. Battery cables in the remainder.)

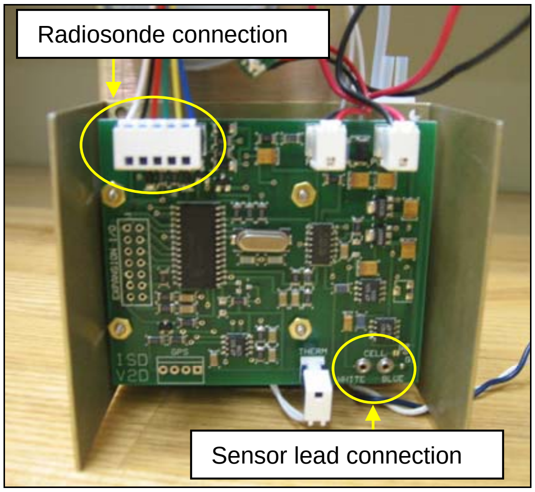

Figure 20 - Interface board showing radiosonde and sensor lead connection locations

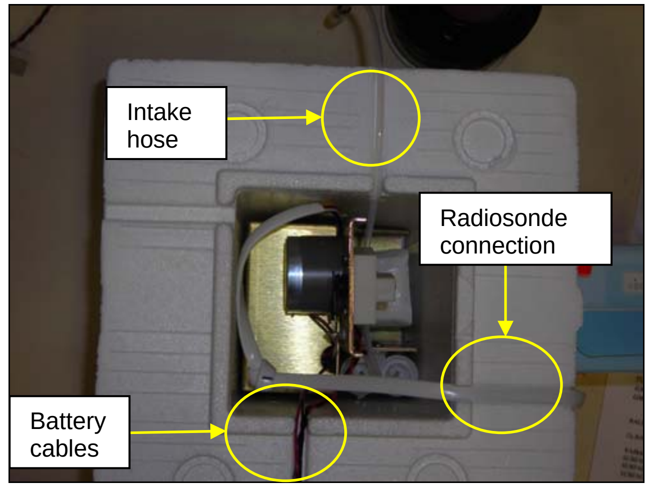

Figure 21 - Top view of ozonesonde box showing channel locations

42. Take a Reward Notice and a Business reply card out of the bottom drawer, where the checklists are located, and take a plastic slip out of the middle drawer. Enter the flight date as well as the flight number and the pump number onto the sheet. See Appendix A on page 65.
43. Fold so it fits neatly into the envelope (business reply card is inside the reward notice). The date as well as the "this is not dangerous" notice **must be visible**!
44. Tape onto the lid.
45. Place lid onto the box. Line up the bumps on the box for optimal balance and sealing. Tape all sides of the box (**keep ring exposed**) closed, taking care **not to tip** the box. This could spill the cathode/anode solutions.
46. Make sure the feeder tube is still connected.
47. Start STRATO program on the PC.
    a. See Appendix A for detailed instructions on page 66.
48. Take the wet battery and open it. Take out the battery and turn it over, so the cables are sticking up from the sides and the plastic is on the bottom. Place the battery back into the cover it came in; make sure the cables are sticking out of the package.
49. Add water to the wet battery package. Make sure that the water level is well above the battery inside the package. (DO NOT let this sit for longer than **10 minutes**. This is a sulfur battery and if it sits too long, the fumes could begin to escape causing all kinds of issues.)
    a. In a time critical situation, there is a **3 minute** conditioning minimum.

Figure 22 - Wet battery with cables out of bag

Figure 23 - Wet battery bag with water filled above the battery

50. Let it sit leaned against the inside of the sink while it is warming up.
51. When the **10 minutes** are over, pour out the water and fold the top of the battery down, still having the cables sticking out.
52. Place the wet battery into the radiosonde, and connect the wires.
53. Close the radiosonde, and remove the plastic cover from the sensor. Tape closed.
    a. Be careful not to touch the sensor, now that it is exposed it can easily be damaged.

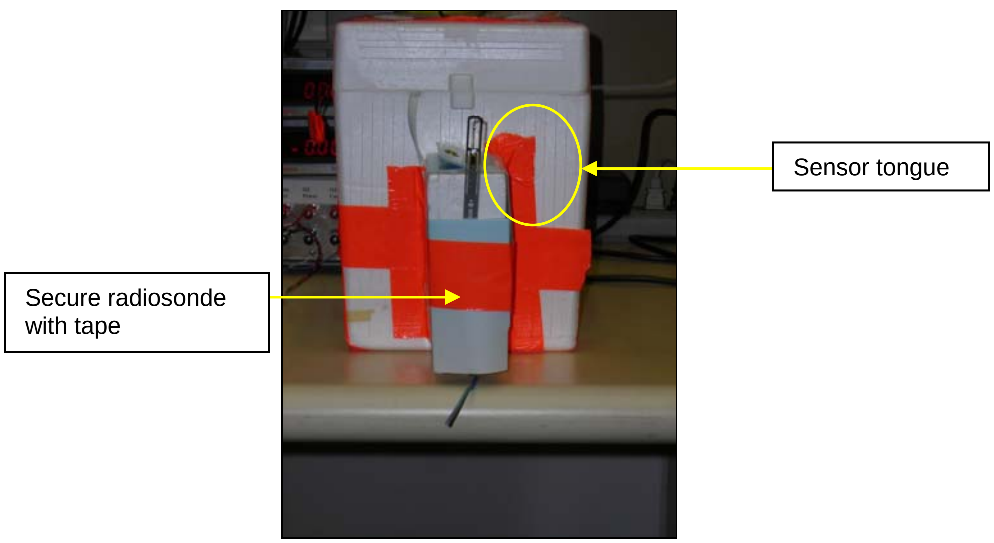

Figure 24 - Radiosonde secured to ozonesonde box after wet battery activation

54. Connect the ozonesonde battery cables, and secure with tape.

Figure 25 - Connect battery cables

Figure 26 -Once connected wrap cables with tape

55. Turn receiver on and make sure you locate the signal; it might be as much as ±1 from the starting frequency.
56. Start the backup tape. (Be sure to switch to side B or a new tape as needed during flight.)
57. Remove the ozone filter from the feeder tube and take the package to the balloon setup.
58. Set the package on a chair, make sure it is sitting securely in the chair and then **straighten the antenna**.
59. Lay the reel on top of the package, and tie the package to the reel. Make sure the strings are not caught in the sensor or the feeder tube.

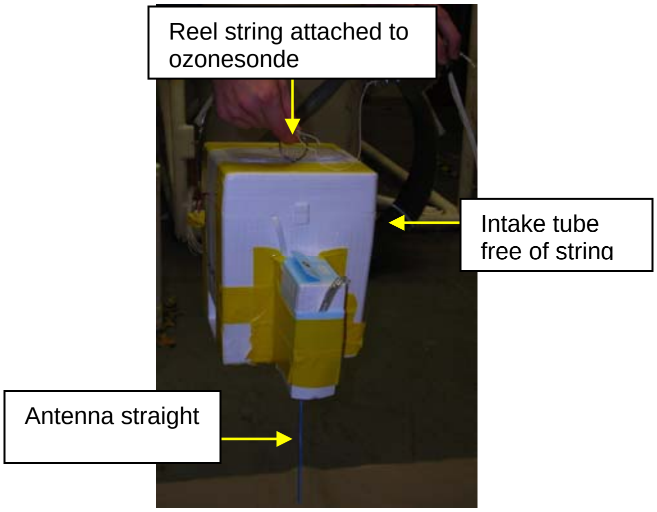

Figure 27 - Ozonesonde box ready for launch

60. **Press F9 and enter ozone background (BG1) again**.
61. While you're in STRATO, check data reception and validity. See FAQ-Faulty Readings section for troubleshooting.
    a. Is data being received?
    b. Any 9999 values?
    c. Check sonde reported surface ozone mixing ratio. Should be on the order of 2 x 10^{-2} (winter) to 1 x 10^{-1} (summer) ppmv. Comparable to local EPA ozone monitor sample value.
    d. Are battery and current plots steady?
        1. To toggle between graphs, press the F4 key.
    e. Pump Temperature above 25°C?
62. Put on the gloves for launching.
63. Remove balloon from the hose by holding the **balloon neck and parachute in your RIGHT hand** and the **reel and package in your LEFT hand.**

Figure 28 - Walking the balloon down the ramp, holding the balloon away from the wall

Figure 29 - Walking the balloon up the hill to the parking lot

64. Walk the balloon outside. **Hold it over the railing** to make sure it **does not touch the wall.**
65. Walk up the hill to the open parking lot. Allow **~1min** of sampling time for the radiosonde to collect surface data.
66. Make sure none of the parachute strings get tangled in the feeder tube or sensor.
67. Release balloon by allowing the parachute and line to slide through your right hand. **Do not release the reel until you are ready to deploy.**

Figure 30 - Slowly release the balloon with your right hand

68. Release the reel allowing it to click off for a few seconds.
69. Release the package.

Figure 31 - Release the balloon and parachute first; make sure the strings are not tangled

Figure 32 - Release the ozonesonde

70. Return to HiBay and **save the EPA data** from the MET Bookmarks, in the same folder as the calibration files (HUXXX folder). You have **30 minutes after launch** to do this.

Collecting the Data

Collecting the Data

Once the Balloon bursts:

1. To collect the Data in STRATO:
    - **a. F1** stops STRATO
    Do you want to stop the program?
        - **i.** (Y) **ENTER**
    Insert floppy for backup; hit any key to continue or Esc to abort.
        - **ii. Esc**
        - **iii. Record the burst pressure and altitude**
    Verify information hit any key to continue
        - **iv. ENTER**
    Verify information hit any key to continue
        - **v. ENTER**
    Hit any key to clear screen.
        - **vi. ENTER**

2. Open Strato folder.
    - a. Ctrl + F
    - b. Select files and folders
    - c. Enter flight number HUXXX
    - d. Copy all of the files into the HUXXX folder you created earlier.
    - e. Turn **off the power on the receiver**, and then **turn off the surge protector**.

3. Sign-in to the Virtual Private Network
    - a. Double-click on the VPN Client icon.
    - b. Enter your username and password.
    - c. You should be signed onto the network now, and able to access network files located on uahdata.

4. Move your HUXXX folder, currently located on the desktop, to uahdata/atmchem folder "Hsv ozonesonde stn flights"

5. Right-click on the VPN icon on the taskbar, and choose "Disconnect".
6. Then right-click again and choose "Exit VPN Client"
7. Then shut down the laptop, disconnect all the cables from it and put it in the upper cabinet by the balloons.
8. Now, access your desktop or laptop.
    - a. Access the "Hsv ozonesonde stn flights" folder from your desktop.
    - b. Create a DATA and a MET folder within the HUXXX folder.
        - i. Remember to use all caps!!

c. Transfer all the files from the network into the created DATA folder.
d. Save all MET files from bookmarked pages into the MET folder.
    i. Save either as a picture or as a webpage complete.
        1. Each webpage needs to be saved the same way the database requires. Please see page 67 for details.
    ii. Zip all the files together and rename into HUXXX-MET
        1. ALL CAPS!

9. Start IDL, open O3_sonde_5_2010.pro
    a. From menu select Run, then Compile O3_sonde_5_2010
        i. Select Sonde File to Read: Find the file HUXXXFLT.dat in your DATA folder and open it.
        ii. IDL creates three graphs from this data and saves them in the same folder.
        iii. Close the graph windows and IDL, and go back to the DATA folder.
        iv. **Copy** the three graphs and **paste one copy** in the main HUXXX folder.
        v. **Rename** the three graphs in the **DATA folder** to read HUXXXFLTDAT1.png
        vi. Leave the three graph files **out**, and zip the rest of your DATA folder together, name it HUXXX-DATA.
            1. **ALL CAPS!**
10. Emails
    a. You need to email all of today's information to the interested parties.
        i. See Email List below.
    b. The information should include the following:
        i. The **one zipped file** (DATA).
        ii. The **three graphs from the DATA folder**.
            1. Use the renamed files! Otherwise the email scanner will not send it out!
        iii. Mention any problems that happened during flight or during prep.
        iv. Mention if you are running low on supplies or helium.
        v. Name the email HUXXX

6. Log books
    a. Remember to **leave a comment** in the log book before you leave.

Email list:

Dr. Newchurch	mike@nsstc.uah.edu
Bill Brown	WB8ELK@aol.com
Shi Kuang	kuang@nsstc.uah.edu
Bryan Johnson	bryan.johnson@noaa.gov
Arastoo Biazar	Arastoo.biazar@nsstc.uah.edu
Maudood Khan	Maudood.n.khan@nasa.gov
Dustin Phillips	dustin.phillips@nsstc.uah.edu
Patrick Buckley	buckley@nsstc.uah.edu
Stephanie Long	long@nsstc.uah.edu
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Wes Cantrell	Wes.Cantrell@nsstc.uah.edu

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Frequently Asked Questions (FAQs)

DOF Conditioning Problems

1. *The Cell Current won't reach 5.0*
    - **a.** To get it to increase faster, try turning the air off for about 5-10 seconds and then turn it back on; this will increase the amount of ozone in the test unit.
    - **b.** You can also try increasing the sensitivity in the sonde to the ozone. This is done in the 3-7 Days preparation section when the sonde is run on High ozone for 30 minutes. Try running it for ~45 minutes and note if it makes any difference when that sonde is used.
    - **c.** It could be due to bad solution or a bad Mercury lamp.
        - **i.** To check the Mercury lamp:
            1. Turn on the Mercury Lamp on the outside of the box. Look through the tiny hole in the shield. If you can see the bright blue light of the Mercury lamp, then it is most likely ok. If you are unsure you can get a closer look inside the box.
            2. Disconnect the test unit from the outlet, and unscrew the top cover, and take it off.
            3. Look where the shield leads and that should be your Mercury lamp container.
            4. Loosen the screw on the back rod holding the lamp in place; make sure you can pull it out to look at it.
            5. Clean the lamp if necessary with a Kimwipe, and replace it. Make sure not to screw it in too tight.
        - **ii.** If the Mercury lamp is still working, then it is most likely bad solution.

2. *The response time is over 1 minute*
    - **a.** This could be due to the ozone filter or the micro ammeter inside the test unit needs to be replaced. If your facility has an external ammeter try using that for now.
    - **b.** Another option is to leave the test unit on (everything except the UV lamp) overnight or for several hours. This flushes the air filter and has the unit completely warmed up. To test this, use the T100 flow test connected directly to the sample port. This should give you a flow rate of about 6-7 seconds. Once that is completed, try changing solutions and go through the checkout procedure again to see if it works better now.

3. *The flow rate correction factor is below 1% or above 3%*
    - **a.** Make sure you run the setup for about 5 minutes on the filtered air to warm up, as well as letting bubbles condition the burette for about 5 minutes.
    - **b.** The highest correction factor is 4% at the South Pole with very dry air, and the lowest is at Fiji with 0.7%. Our correction factor is normally between 1-2%.

4. *High Background (greater than about 0.10 microamps or 0.8 in 3-7Day Prep)*
    - **a.** Change both cathode and anode solutions as outlined in the day of preparation procedure. Short the cell leads. Run on filtered air for several minutes. Then, store for about 1 hour or up to 8 hours. If the background is still high, then try the ozonesonde on another filter (test unit or individual ozone filter).
    - **b.** Make sure all the pins are properly connected or shorted on the TMAX board. The first pin has the cell leads connected (blue to top). The next two are open. The fourth pin is shorted. The fifth has the thermistor. The last five are all shorted.
    - **c.** The sonde pump may have a leak; try the cell on a new pump.

5. *Negative Background*
    - **a.** Check to make sure the leads, the blue and white cables to the ozone test unit, are not reversed.
    - **b.** This is a potentially serious problem leading to low ozone measurements in the stratosphere. Other signs that indicate a bad sonde are: the anode has turned clear instead of being slight to dark yellow, or there is a lot of white crust around the bottom of the cell indicating a leak of KI solution. Try changing solutions and letting the sonde sit for several days with the cell leads shorted. If negative background, clear anode, or lots of white crust at the bottom of the cell still shows up, then send the sonde back to NOAA in Boulder, CO. Attach a note to the sonde describing the problems.

6. *Put the wrong solution in the wrong cell/syringe*
    - **a.** For the wrong cell: Take the **syringe of which ever solution you put in the cell** and **extract it.** Discard the solution in the waste container. Next, take **the appropriate syringe for the cell and fill it with distilled water** and flush the cell out. Repeat until clear.
    - **b.** For the wrong syringe: Discard the solution and flush the syringe with distilled water until it is clear of contamination.
    - **c.** If you still feel there is some contamination, you can use the replacement syringes until you feel that the regular syringes are acceptable for use again.

7. *The Stopwatch jammed / I missed the timing during the Response Time testing*
   a. When this happens, you need to get the test unit back up to 5.0 microamps, maintain it for another 10 minutes and then do it again. Make sure the stopwatch is ready to go when you are.

Signal and Interference

8. *Can't get a signal when connecting the Vaisala to the radiosonde*
    - **a.** Sometimes there is a slight but considerable difference from the test unit to the wet battery voltage, and this affects the frequency at which the signal is broadcast. Adjust the receiver until you find the signal, and make sure the AFC is turned on during the flight.
    - **b.** If you still cannot find the signal, check the graphs of the battery voltage/current on the STRATO program, and if necessary, replace the battery. To toggle between graphs, press F4.
    - **c.** Use an Ohm meter to test the continuity of the antenna leads.

9. *The Vaisala transmission frequency shifts to a lower frequency or sounds unusual*
    - **a.** This usually happens when a bad cell or negative background cell from a Science Pump 6A sonde is plugged into the TMAX board. Try unplugging the cell leads from the board, if the signal returns to normal when the cell is unplugged then you have a bad cell. See section 3 above.
    - **b.** Try a different Vaisala Radiosonde or try the Vaisala on another Tmax board.

10. *Losing signal throughout the flight*
    - **a.** This can happen when the balloon is passing through clouds or turbulent weather. You can try adjusting the receiver as well as the antenna to get a better signal.
    - **b.** Another possibility would be that the battery is losing power. You can check it by finding its graph in STRATO, to do this hit F4.
    - **c.** Sometimes the wire will break INSIDE the insulation (usually near a connector or where the wire was crimped or abraded). You may receive signal for up to 2 km even with a broken wire. If you lose signal below 2 km, check the signal leads for continuity.

11. *A lot of interference at the 403.6 MHz*
    - **a.** You may have to tune the Vaisala up or down from 403.6 MHz to 402 or 404 to get away from other possible signals. There is a small screw inside one of the flaps on the side of the Vaisala. Use a long, narrow screwdriver to tune up (turn counterclockwise) or tune down (turn clockwise). About ½ to ¾ turn is about 1 MHz.

Balloon Set-up and Helium

12. *The balloon has a leak*
    - **a.** When the balloon has a leak, you can either let it leak slowly, or you can pop the balloon. If you decide to pop it, be sure to take it outside, so the powder inside the balloon doesn't go everywhere and the helium doesn't vent inside the building. Then, simply replace it with a new balloon.

13. *Touched the balloon*
    - **a.** There is not much you can do, but try to avoid it in the future. Touching the balloon may cause an early burst due to the oils on your hands making the already thin material even thinner.

14. *The parachute won't deploy*
    - **a.** To ensure the parachute deploys on your next flight, make sure to "fluff" it. Open it up and drag it around the room to get air into it, or use your arm to open up the folds.
    - **b.** Also, make sure the lines are not tangled or knotted. Untie the bottom knot, straighten the lines, and then retie it.
    - **c.** Make sure you are giving the parachute enough room from the balloon, so it doesn't get entangled in the burst remains when it is time to deploy. Give ~ 8-10 feet between the balloon and the parachute.

15. *The reel let off too much string*
    - **a.** To prevent this happening, loop the string around the brass bar of the mechanism **once**.
        - **i.** Unravel all of the string that's on the little side bar.
        - **ii.** Roll it back up onto the main wheel. Keep a good length of the string pulled out.
        - **iii.** Loop the string around one of the metal bars at the bottom once.
        - **iv.** Pull more string through, it should be a noticeable slow down.
        - **v.** To prevent jamming, **don't** loop it more than once.

16. *How do the Helium tanks need to be secured?*
    - **a.** The tanks need to each be secured individually, which means that each tank should have two chains (one on the top and one on the bottom) fitted snuggly around it and secured with clips to the hooks in the wall.
    - **b.** Also, the protective lid should always be in place and secured while the tank is not in use. This protects the valve from damage.
    - **c.** If a full tank falls and breaks off the valve, it will have enough propulsion to go through a concrete wall and the operator. Be careful with the bottles!

Faulty Readings

(mainly from DOF Step 61)

17. *Faulty temperature pressure reading*
    - **a.** In dry environments, static electricity can easily zap a Vaisala Radiosonde. Be sure to ground yourself before touching the Radiosonde, and try not to touch the tongue. If you see bad Vaisala data coming in, then it may be zapped, and you will have to replace the Vaisala.
    - **b.** Make sure you entered the correct Vaisala number. Each Vaisala has its own set of calibration values. If you can't find any stickers on the bag or outside of the Vaisala Radiosonde paper enclosure, and you want to be absolutely sure the correct number has been used, you can check the number on the label inside the white Styrofoam Vaisala box. You will have to slide the box out from its paper enclosure.

18. *No ozone data is coming in or showing all 99999's on the computer screen*
    - **a.** Check that the blue/white sensor leads are plugged into the first set of pins (blue to the top).
    - **b.** If the measured ozone drops below the background entered then the ozone summary lines will show 9999's instead of negative numbers. Hit F9 to enter the new lower background level and record it on the checkout sheet.

19. *No data coming in on computer screen*
    - **a.** Loose or poor connections are the most common problem. Check all connections on Vaisala and sonde.
    - **b.** Make sure the Receiver is adjusted properly and tuned into the strongest signal.
    - **c.** Be sure the squelch on the receiver is turned down but not far enough to mute sound.
    - **d.** Restart telemetry program.

20. *Pump temperature seems incorrect and ozone concentration data is too low*
    - **a.** The pump temperature thermistors may not be plugged into the board.
    - **b.** The pump temperature in winter time should be at least 25°C. This gives it enough time to cool down as it ascends. If the temperature falls below 5°C the data becomes noisy. Warm the sonde carefully by holding it near our heater.

21. *Battery Voltage is below 14V*
    - ***a.*** *Replace the 9V battery pack. Use an exacto-knife and carefully remove the double-sided tape from the pump. Cut a new piece of tape and use a new battery.*

Computer and STRATO Errors

22. *I need to restart STRATO*
    - **a.** Restarting would be done in situations when you are getting faulty readings or no readings at all. Hit **F1** to stop STRATO and exit the program. Then, re-open the program and re-enter all of your information.
    - **b.** If this occurs during the flight, data will be lost while you are re-entering information. However, since you are using the same flight number, it will append to the end of the data, so you won't have to worry about two different files.
    - **c.** Keep in mind that if restarting STRATO does not correct the irregular readings, a lot of them can be edited out of the final graphs. So just let the program run if restarting it won't fix it, that way you at least have some data.

23. *Missing the pre.dat file*
    - **a.** This file contains all the surface data (the data before you let go of the balloon, red lines), and it should be created automatically.
    - **b.** To check that the file is being written after you've run STRATO (sometime after you have entered the flight number) hit **F12** to go to the settings. Make sure that the option "Analyze pre-launch data" is set to yes.
    - **c.** If the files have not been written you can rerun the flight to create the file.
        - **i.** Once you open STRATO make sure to change from "S" to "F" for file. This will make sure that STRATO looks for the de1 and raw files.
        - **ii.** Also ensure that the "Analyze pre-launch data" option is set to yes as described in the step b above.

24. *Wrong latitude/longitude readings in STRATO*
    - **a.** The correct values should be hard coded into STRATO for each individual station, but to correct configuration factors like latitude and longitude, you have to change them in the .ini file. Either change them in the file and save them manually, or delete the .ini file and let it correct itself when STRATO is run the next time.
        - **i.** The correct latitude and longitude should be hard coded into the program, and by deleting the .ini file STRATO will replace the whole file with the correct values on the next run.

25. The computer froze, and I need to restart it

a. To check if the computer really froze first try pressing Ctrl + Alt + Delete, like you do when logging on. If that doesn't work try pressing the windows button  to see if the menu comes up.

If that does not fix the problem then:

a. Restart the computer. First press the Reset button on the processor unit. This will allow the computer to do a warm reboot.

b. Once that has successfully brought you back to the log-in page, log on and then directly go to the start menu and shut down the computer. **Decline** any offerings of searching for new drivers.

c. Once the computer has been shut down for at least 10 seconds (the fan and the hard drive should have stopped spinning, and the computer should not be making any noise), you can power it on again.

d. Let it boot up normally, and log on. Again, **decline** any offers to search for new drivers.

e. Go to the My Computer icon on the Desktop and right click.

f. Select Properties. Find the tab that says Tools. Under the "Scan Disk", select "Check Now" and make sure it is **only** checking the C: Drive.

g. Once this is finished under the same tab select Defrag. Make sure that it is **only** checking the C: Drive.

h. The defrag process may take a while, so start your prep work during this time. Once, it is completed, shut down one more time, restart, and continue like normal.

26. Where do I put STRATO on a new computer?

a. When switching computers all you need to make sure is to put the strato.exe into a folder named "strato".

b. Copy all the Vaisala files into a folder named "vais" that is located in the strato folder. When you run STRATO it first looks for the Vaisala calibration files in the floppy drive and then moves to the strato or strato/vais folder.

27. STRATO can't find the pump.dat file, what do I do?

a. *The pump.dat file holds lots of old pump data which is now incorporated into STRATO via an average. The file is no longer needed.*

Miscellaneous Information

28. How do I recover data from the tape?

- **a.** To do this run STRATO normally and select 's' for serial port. To feed the data to the modem, move the receiver-to-modem cable to the headphone or output jack on the tape recorder. Then start the tape at the beginning and STRATO should see the signal. When tape runs out, flip to side B and continue until end of recorded data is reached.

29. How to condition a used sonde

- **a.** Connect normally and run High ozone for about **5 minutes**, then switch to filtered air for another **5 minutes**. Add solutions to the cells and run on No/Lo ozone for **20 minutes** and record the background in the initial prep on the checkout sheet. Treat them like new sondes except you **do NOT** have to run them on High ozone for **30 minutes.**
- **b.** Remember the longer the solution sits in the cells, the better the refurbished sonde seems to run. Add the solution ASAP, and let the sonde sit shorted until it gets used.
- **c.** Note that the X at the pump number signifies that it is a used sonde.

30. Need to replace old solutions with new solutions

- **a.** When one solution runs out, pour any remaining liquid from the old cathode solution back into the bottle, and put both old cathode and anode solutions into the bottom drawer. Next, rinse out the small cathode container with DISTILLED water and replenish with new solution. Make sure to write the new correct date on the small bottle of cathode; it must match the date on the big bottle.
- **b.** Also, make sure there are always back up solutions available, if not, order more from Boulder, CO.

31. How do I make new Anode solution?

- **a.** When the anode solution is getting low, just add approximately 100g of crystals to 50ml of **cathode** solution, to the anode solution bottle.
  - **i.** Remember to use **matching** cathode and anode solutions. They need to both be from the same batch!!
- **b.** Allow the solution to sit for about 3 days to become fully saturated; there should be some KI crystals visible at the bottom of the bottle. If there are no signs of KI crystals, add more crystals and allow the mixture to sit another day or two.
- **c.** You don't need to dump out the old anode when you make more solution.

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32. The Dry-sonde broke, what can I replace it with?

- **a.** Take the broken sonde and put it on the left side of the bottom cabinet next to the Vaisalas, and put a note on it. Make sure the station manager knows. Then, take a new sonde, one that has not been conditioned at all, and use it.

33. How do I do a no-reel launch?

- **a.** No-reel launches should be done either to conserve reels on **very calm days** (less than 5mph winds), or when none are available.
- **b.** Use about 100-200g **less** weight, to compensate for no reel. That way you keep the rise rate between 3-6 m/s.
- **c.** As usual us the normal string to tie off the balloon and parachute. Use the thin string off the cone for the pay-out line. You will need 50-70 feet of string.
- **d.** Attach one end of the string to the bottom of the parachute with several slip-knots; roll the rest of the string, leaving a bit out to attach the sonde to, on to the spool. This will keep the very long string from getting tangled.
- **e.** Tie a snap-hook on to the exposed end of the string. Attach the snap-hook to the exposed ozonesonde ring.
- **f.** As usual, walk the all the components up to the parking lot.
  - **i.** First time doing a no-reel launch you might want someone else there to hold the sonde package while you let the balloon up.
- **g.** Use a gloved hand to let the long string up, and hold on tight for a smooth release. Take your time. It should be a very calm day when you do this, so you have plenty of time.

34. When do we need to retire old Vaisala files?

- **a.** It is a good idea to clean up the old Vaisala files about once a year. Make a folder named "Old Vais" and move the files there. This keeps things neat as well as prevents duplicate cal file numbers being in the folder. This can occasionally happen due to the DOS configuration which requires the first 2 numbers to be left off.

Ordering Supplies

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Ordering Supplies

Ozone Supplies

Ozone supplies such as sondes, Vaisalas, reels, parachutes, etc. should be ordered when we have ~**10** **un-prepped** sondes left. There should always be an equal amount of parachutes, reels, sondes, etc. left since we use one of each per flight. If there is an uneven amount of supplies, make sure to order however many extra of the supply to even it out again. Remember to order more string, duct tape, and solutions when necessary; they are also part of our supplies.

To order supplies: Email Patrick Cullis and let him know what we need, and how much we approximately have left, or when we need the supplies. When the order arrives, don't forget to leave out the floppy disk for the person in charge of updating the calibration files.

People to Contact

NSSTC: **Wes Cantrell**
Wes.Cantrell@nsstc.uah.edu
961-7840

Boulder, CO: **Patrick Cullis**
Patrick.Cullis@noaa.gov

Ordering Helium

Helium Orders

We should always have **at least one full tank** of helium **in addition to the one in use**, just in case something goes wrong, and you need to fill two balloons. Make sure the **correct labels** (full, in use, empty) are always around the necks of the cylinders. Let the person in charge of ordering helium from NSSTC know how much is left during the email you send out after the launch.

To order Helium: Get the Helium log book from Whitney Guerin Jewett. Fill out one of the forms as shown in Appendix A. **Don't forget to sign and date it as well as tell them when you need it delivered**! Take the form to the copy room and put it upside down and face down on the fax machine. Enter the fax number (256-882–1684) when prompted; **remember to add the 9 to dial out**. The machine will then return the form to you, as well as a receipt. Go to the copy machine and **make a copy of the form.** Now, return the **original form to Whitney's Helium log book**. Also, give her the **copy of the form to give to Cindy Henderson. Keep the receipt,** and file it in the Helium folder. The Helium will be delivered by NexAir. After the order arrives, make sure the tanks are secured correctly. Also make sure there was an invoice left with the bottles, we need this to process payment to NexAir. Give the invoice to Whitney, if there wasn't one with the bottles call Johnny Findley and they can fax one to us. If there are any **special requests,** call or email NexAir to make sure they see the note on the fax and understand what you need them to do.

NSSTC: **Wes Cantrell**
Wes.Cantrell@nsstc.uah.edu
256-961-7840

NexAir: **Johnny Findley**
johnny.findley@nexair.com
256-859 -7521

Helium Prices

As of August 3rd, 2010

1 Large/Normal Helium Cylinder:	$72.20
Shipping and Handling:	$8.00
Environmental Compliance:	$6.00
Rental Fee:	$6.00 /month/cylinder
Company used: NexAir	

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Data Management and Station Upkeep

How to enter new Vaisala files into the System

When receiving new Vaisalas, you need to enter them into the system, so they will be available for the next flight.

1. When unpacking the shipment, watch for a floppy disk wrapped either in bubble paper, or a plastic sleeve cover.
2. Take the floppy to your desktop UPSTAIRS!
3. Insert it into your computer and copy all the files.
4. Access UAHDATA/atmchem network.
    a. Go to ozonesonde.
    b. Find the Vaisala folder
        i. Paste all the files into this folder. (This is only temporary).
5. Go downstairs to HiBay.
6. Log on to the computer.
7. Open windows explorer and find the files titled: Strato.
8. Open up the Vaisala file on the network.
9. Transfer all the files from the Vaisala folder (on the network) to the Strato folder.
10. Double check that all the files are there, and then delete the files from the Vaisala folder leaving it empty.
11. Log off the computer.
12. Keep the floppy in the designated area.

Updating the Master Database and Backing-up Files

1. Master Database Update
   a. Copy the folder HUXXX
      i. Should contain DATA and MET folders as well as the two graphs.
         1. Inside the DATA and MET folders, there should be the respective zipped files (HUXXX-DATA HUXXX-MET)
   b. Open the **UAHDATA/atmchem** network and find the folder titled: "**ozonesonde**".
      i. Then, go to the **Database_rebuild** folder.
         1. Paste your flight folder in this folder.
   c. Open the Ozonsonde Master Database (UAH). It is found in the Database_rebuild folder.
      i. Enter the flight number, date, any comments from Dr. Newchurch and location in the appropriate spaces.
      ii. Ensure that the links are working for DATA and MET.
         1. If not check to make sure the path is correct.
   d. On a regular basis go downstairs and get all the old checkout sheets.
   e. Scan them using the Xerox machine and have them emailed to you.
      i. Do each sheet separately.
   f. Add the appropriate checkout sheet to the appropriate flight.
      i. It goes inside the HUXXX folder.
   g. Be sure to rename the checkout sheet to match the flight number (HUXXX).
   h. Do the same for Vortex storage.
      i. Follow the same procedure, but the files are kept on the vortex server.
      ii. Link: \\vortex/htdocs/atmchem/ozonesonde/Database_rebuild

2. File Backup
   a. When everything is in the folder (checkout sheet etc.) Take approximately 10 files (10 HUXXX folders) and burn them to a CD.
   b. Make 3 copies of the CD, one goes to Wes Cantrell, one to Highbay, and one to Dr. Newchurch.
      i. Put the CDs in CD cases.
   c. Periodically back up all the files onto your computer.

Return Shipments to NOAA

Shipments to Patrick Cullis should be made when there are a number of things that need to go back, like multiple sondes, and solutions.

Then, there are several things you must remember:

1. The solutions should be double bagged. Old balloon bags and rubber bands work well for bagging the solutions.
2. Sondes should be in the Styrofoam boxes, and the boxes should be taped closed with either masking tape or duct tape.
    a. If the sonde is bad, write a brief note explaining the problems with it and stick it on the defective sonde.
    b. Make sure the tubes and cells are empty (solution free).
3. Once you have everything assembled you need to find a box large enough to hold everything.
    a. Don't forget to add bubble wrap and cushioning wherever there are free spaces between the boxes, solutions etc.
4. Write (handwritten) a brief note to Patrick explaining what you have sent back and any problems with the returned materials.
5. Print out 2 copies of the UPS shipping information.
    a. Place one inside the box next to the note for Patrick.
6. Close the box and tape it shut with lots of shipping tape
7. Call Central Receiving (256-824-6315) and let them know there will be a pick-up at the NSSTC front desk
8. Email Cindy Henderson and let her know there will be a UPS charge coming in soon.
9. Take the second UPS shipping information sheet and tape it to the outside of the box.
10. On that sheet of paper, stick a post-it note (a large and noticeable one) reading "For UAH Central Receiving to mail via UPS".
11. Take the package down to the front desk and leave it on the counter.
12. Once the tracking number and charges have been emailed to you, immediately send it along to Cindy Henderson.

UPS Shipping Information

RECEIVER:

Patrick Cullis
NOAA/ESRL
325 Broadway, R/GMD1
Boulder, CO 80305-3328
(303) 497-6842

SENDER:

Wes Cantrell
320 Sparkman Drive, NSSTC
Atmospheric Science Department
University of Alabama in Huntsville
Huntsville, AL 35899
(256) 961-7840
wes.cantrell@nsstc.uah.edu

Shipment Priority: Ground

Budget Account Number: 740001

Please email the UPS tracking number and the final mailing costs.
Thanks!

Visitors to the UAH Ozonesonde Station

This section of the manual is designed to acquaint you with some of the people that use our station on a regular basis. Our station is one of only four in the U.S., and we help various organizations and researchers with their experiments that require balloon and helium assistance. When any of these parties contact you to inquire about a launch, make sure to address such issues as who pays for the Helium, when, and where they want to launch. Also, make sure there is enough space in HighBay, etc.

Bill Brown
Email: wb8elk@aol.com
Website: http://www.wb8elk.com/

Bill Brown started the modern, active era of ham radio ballooning in the USA with a score of successful flights in 1987. He and other amateur radio operators routinely launch, track, chase and frequently recover high altitude balloons fitted with ham radio transmitters.

In November 2004, Bill was named "Father of Amateur Radio High Altitude Ballooning" by the ARRL for his early achievements and continuing energetic support to others.

Each week Bill predicts the UAH ozonesonde path and when the end point is in North Alabama, he (and others join him) chases the descending payload attempting recovery. Occasionally, specialized radio packages are included in the sonde train to validate changes in the balloon path or testing mobile signal reception equipment. Please be as accommodating as possible to any of Mr. Brown's requests.

"Ballooning is an interesting niche in ham radio requiring skills in a variety of areas including building and launching airworthy radio payloads, tracking a balloon via APRS (Automatic Position reporting System), weather data interpretation, etc., and finding a downed balloon using radio direction finding (RDF) techniques." - *Surfin': Up, Up and Away*, Stan Horzepa (WA1LOU), American Radio Relay League, weekly feature article , Nov 26, 2004, http://www.arrl.org/news/features/2004/11/26/1/.

UAH Electrical and Computer Engineering Department

John Piccirillo

Email: jpicciri@eng.uah.edu

Charles Corsetti

Email: corsetti@eng.uah.edu

The ozonesonde team provided flight support for the ECE senior design project both semesters. The students design and build an electronic payload that is launched by high-altitude balloon, chased and eventually recovered. Ozonesonde personnel ensure a successful launch and tie-off the sonde train. Bill Brown helps the event by calculating the required gas volume for the final payload. We provide the Helium order forms and make sure everything is delivered correctly. We provide safety instructions on pressurized gas use and weather balloon inflation. Because the balloon is easily damaged, we fill the balloon and tie it off securely. We also coach and advise the ECE students as they exit the preparation area and during launch. We give instructions on how to release the packages successfully. Engineering faculty John Piccirillo and Charles Corsetti were class instructors.

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UAH Space Hardware Club

Georgia Richardson

Email: Georgia.richardson@uah.edu

The ozonesonde team provides flight support for the Space Hardware Club both semesters. The students design and build an electronic payload that is launched by high-altitude balloon, chased and eventually recovered. Ozonesonde personnel ensure a successful launch and tie-off the sonde train. Again, Bill Brown helps the event by calculating the required gas volume for the final payload. We provide safety instructions on pressurized gas use and weather balloon inflation.

Because the balloon is easily damaged, we coach and advise the students as they exit the preparation area and during launch. Dr. Georgia Richardson is the advisor for this group of students.

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Appendix A

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Sample Helium Order Form

RAPCD Gas Request Form

This form requests pressurized gas for the Huntsville RAPCD Ozonesonde Station from the NexAir provider. In order for payment to be processed an invoice will need to be either included upon delivery of the tanks, or mailed or faxed to:

Whitney Guerin
Research Coordinator
UAH/NSSTC
320 Sparkman Drive
Huntsville, AL 35809
Ph: 961-7946
Fax: 961-7755

Type of Gas	Quantity	Size and Purity	Department	Custodian	Delivery Location	PO Number
Helium	1	Large / Normal	ATS	Newchurch	NSSTC 1210	019125

Additional Information:

Please deliver tanks by Friday (5/2) and pick up empty tanks. Thank you!!

Requestor: ____ Stephanie Long __ Date: __4/28/2008 _____

RAPCD Contact:
Stephanie Long – Ozone Station Manager – Ph: 961-7840 – long@nsstc.uah.edu

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Antenna Pointing Instructions

To get the best possible signal the antenna needs to be pointing in the direction the balloon will travel in. This changes from season to season with the winds. The most reliable way we have found to do this to run a program that Bill Brown wrote; Web Based Balloon Flight Track Prediction.

1. Go to http://nearspaceventures.com/w3Baltrak/readyget.pl
2. The parameters should be:
    a. The launch date: i.e. 2009-9-27
    b. The launch time in UTC: i.e. 18:00:00
    c. Latitude: i.e. 34.72
    d. Longitude: i.e. -86.64
    e. Elevation: i.e. 540
    f. Ascent Rate: i.e. 984
    g. Descent Rate: i.e. 1300
    h. Burst Altitude: i.e. 104000
    i. WX Station: i.e. HSV

***examples given pertain to the Huntsville Station ***

3. Select the "GFS Model (0-180 hours, 6hrly)"
4. Click Submit
5. Now, select the time and date closest to your launch date and time.
    a. For Huntsville, select the date which equals the launch date and has 18 UTC as launch time
6. Now enter the access code in the box and click "Get Profile"
7. The easiest way to view the data is to click on "Plot Track on Google Maps"
8. This will open a new window in which you can view the balloon's flight track. Ascent is in blue, descent in red. You can clearly see which direction the balloon will fly in and adjust the rotator of the antenna box accordingly. There might still be some minor interference due to weather and numerous other reasons, but having the antenna pointed in the right direction will keep the signal at its maximum strength.

Sample Checkout Sheet

NOTE: Highlighted portions correspond to values entered into STRATO program. See page 60.

U.S. DEPT. OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
CLIMATE MONITORING AND DIAGNOSTICS LABORATORY
DIGITAL OZONESONDE CHECKLIST

FLT # HU 455
Huntsville

INITIAL PREPARATION 3-7 DAYS BEFORE FLIGHT.

DATE (LOCAL): 6/23/07
INITIALS: SL
PUMP NUMBER 226748

PUMP CURRENT: 75.9
PUMP PRESSURE: 210
PUMP VACUUM: 23

30 MINUTES HI O_3 ✓ (√)
5 MINUTE NO O_3 ✓ (√)

ADD 3.0 CC CATHODE SOLUTION: ✓ (√)
WAIT 2 MINUTES: ✓ (√)
ADD 1.5 CC ANODE SOLUTION: ✓ (√)
RUN 20 MINUTES ON NO O_3 ✓ (√)

Short the cell leads: ✓ (√)
Add about 2.5 CC more Cathode Solution (2Z) ✓ (√)
Place Instrument inside plastic bag: ✓ (√)
Store inside Styrofoam flight box: ✓ (√)

Record the current after the 20 MINUTES ON NO O_3: = 0.353 µamps

FLIGHT PREPARATION IN LAB.

DATE (LOCAL): 7/7/07
INITIALS: SL
Cathode solution date written on bottle: Aug 14, 06
CHANGE CATHODE SOLUTION (3cc): ✓ (√)
CHANGE ANODE SOLUTION (1.5cc): ✓ (Yes/No)
RUN ON NO O_3 FOR 5 MINUTES: ✓ (√)
RECORD THE NO O_3 BACKGRND#1: **BG1**= 0.018 µamps
RUN ON 5 microamps of O_3 for 10 Minutes: ✓ (√)

T100 FLOWRATE TIMES:
FLOWRATE #1: 28.99 sec
FLOWRATE #2: 29.07
FLOWRATE #3: 28.92
FLOWRATE #4: 29.03
FLOWRATE #5 28.97
AVERAGE T100: 28.99

DRY T100
#1: 28.44
#2: 28.52
#3: 28.61
DRY AVG: 28.52

WET T100
#1: 28.83
#2: 28.69
#3: 28.83
WET AVG: 28.78

RESONSE TIME
SWITCH TO NO O_3 AIR.
RECORD: THE TIME TO DROP FROM 4 TO 1.5 µamps: 28.65 sec.
RECORD: ROOM TEMP (C) 23 ROOM REL. HUMID. (%) 46
RECORD: 5 - T100 FLOWRATE TIMES:

***T100 Flowrate correction.** 0.92%

DAY OF FLIGHT @ THE LAUNCH SITE.

FLIGHT NUMBER: HU 455
GMT DATE : 7/7/07
GMT LAUNCH TIME : 17:59
LOCAL DATE: 7/7/07
LOCAL TIME: 12:59

BALLOON TYPE 1200 **Gram :** Kaymont ✓ Scientific Sales____ (√ one)

O_3 BACKGROUND (µamps from F9 key): 0.018

VAISALA NUMBER (9 digit): 916505114
SURFACE PRESSURE: ____
SURFACE TEMP. (C): ____
SURFACE HUMIDITY : ____

SKY CONDITIONS: Cloudy

~ BURST PRESSURE (mb) : 6.823
burst at : 34.04km

REMARKS: ____

weighoff = ____ grams

*T100 flow corr (%) = [(WET/DRY)-1.0] X 100

Sample Reward Notice

NOTE: Only fill out highlighted portions. Make sure that "This package is not dangerous" and date are visible once it is put into the protective sleeve.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Oceanic and Atmospheric Research
Earth System Research Laboratory
325 Broadway – David Skaggs Research Center
Boulder, Colorado 80305-3337

***** REWARD OFFERED ***** **R/GMD1**

THIS PACKAGE IS NOT DANGEROUS

Dear Finder: Date: ____________

You have found a balloon-borne instrument package launched from Huntsville, Alabama which was used to measure ozone in the atmosphere to altitudes of 100,000 feet above the surface of the earth. With your help, this instrument may be repaired and used again. Please use the enclosed Business Reply Card to mail the equipment that you found back to NOAA. Firmly affix the Business Reply Card to a box containing the equipment. Include this sheet with the completed information below. ******Please note that the post office will not deliver liquor boxes**.

No other postage is required.

In approximately 8-12 weeks, you will receive a $30 reward check issued from the U.S. Dept. of Revenue.

Thanks for your help with our ozone measurement program!

Sincerely,

Bryan J. Johnson
NOAA/ESRL/ Global Monitoring Division

Please print clearly and enclose this sheet with the instrument for REWARD payment

YOUR NAME ____

ADDRESS ____
No. and Street City State Zip

DATE FOUND: ____________________

APPROXIMATELY WHERE FOUND: ____________________________

RETURN TO: U. S. DEPARTMENT OF COMMERCE
NOAA/ESRL
ATTN: Bryan J. Johnson
325 Broadway, R/GMD1
Boulder, Colorado 80305

NOAA office use:
DATE: ____________
PUMP # ____________
FLIGHT#: ____________
Confirm initials: ______
HU oz $30

Enclosure: Business Reply Card

Starting the STRATO Program

1. Click on STRATO.exe icon
2. The prompts will appear as follows…

Read data from serial port or file (s/f): choose "s" for serial port

Time GMT = 15:32:21 This is based upon PC time. If time is incorrect adjust clock on the PC making sure that AM/PM is still consistent.

1. Input Flight Name = ##### Use HUXXX based upon the current flight name.

Enter Surface Pressure: 999999999 }

Enter Surface Temperature: 99999 } **DO NOT ENTER THIS DATA**

Enter Surface Humidity: 99999 }

Enter Instrument Type 1: 1 is selected for ozonesonde

2. Ozonesonde Number: 2zXXXX Number is on the Styrofoam box

3. Ozone Flow Rate: Enter **average T100 flow rate** time from ozonesonde checkout list

*****The default value is 28.00 if this happens to be <u>your</u> value, enter 28.01 to make sure you don't get the incorrect default value*****

4. Lab Temperature:

5. Lab Humidity: These values are obtained prior to T100 testing.

6. Measured Flow Rate Correction: This number is calculated on the ozonesonde checkout list.

7. Response Time from 4 to 1.5 uA: ~18-35 sec range

8. Prep Background #1: ~0.00-0.05 range (**NOTE: This must be re-entered just prior to launch by pressing F9**.)

9. Serial Number of Vaisala Sonde: Enter 9 digit serial number on the Vaisala Radiosonde.

Values Correct? (Y/N) (Y) and hit enter

Data will begin to collect once batteries are connected to the sondes.

Saving Meteorological Webpages

In order to assure that the ozonesonde database links work correctly, the meteorological files saved on the day of flight must be saved in a consistent manner. The following table represents how each file needs to be saved:

Meteorological File	Save as:
EPA at launch	Webpage complete
MIPS Skew T at launch	Webpage complete
NSSTC Berm Current Conditions	Webpage complete
NSSTC Current Conditions	Webpage complete
NSSTC Tabular Data	Webpage complete
Birmingham Radiosonde	GIF
Nashville Radiosonde	GIF
700 mb Conus Plot	GIF
24 hour Conus precip	GIF
Huntsville Current Conditions	GIF
200 mb Conus Plot	GIF
500 mb Conus Plot	GIF
700 mb Conus Plot (different from above)	GIF
925 mb Conus Plot	GIF
Surface Max Temperature	GIF
Satellite Surface Map Plot	GIF
SE IR GOES Image	GIF
SE Radar Summary	GIF
Conus Surface Map	GIF
Conus Temperature Conus Plot	GIF
Conus Water Vapor Satellite Image	GIF
PWV - UAH/NSSTC Huntsville, AL	JPEG
Redstone SODAR Plot	Webpage complete
MIPS Ceilometer Plot	Webpage complete
MIPS SODAR Plot	Webpage complete
MIPS 915 MHz Wind Profiler Plots	Webpage complete
MIPS Radiometer Plots 3 km	Webpage complete
MIPS Radiometer Plots 10 km	Webpage complete
MIPS Skew T (after burst)	Webpage complete

Times

NOTE: Greenwich Mean Time (GMT) is often incorrectly used to refer to Coordinated Universal Time (UTC). GMT experiences Daylight Saving and Standard Times while UTC does not. For the purpose of this document, the GMT abbreviation is used in place of UTC (aka Zulu or Z). See discussion below for additional information.

Standard Time: Usually the time difference between CST and GMT is -6 hours, which means that when it is 1 pm here, it is 7 pm in England (13:00, 19:00). The computer time should read 19:00 around launch and the STRATO program should have -6 as the time zone.

****You can change this simply while entering all the other information before a flight; it will be the second prompt you get after opening the program. ****

Daylight Saving Time: The computer time should read 18:00 around launch, and the STRATO program should have -5 as the time zone. This will give you accurate GMT as well as local time.

About Time: ***Daylight Saving Time*** (DST) begins each year at 2:00 AM on the second Sunday in March (as of 2007) in most of the United States and its territories. Clocks must be moved ahead one hour when DST goes into effect. ***Standard Time*** begins each year at 2:00 AM on the first Sunday of November. Move clocks back one hour at the resumption of Standard Time.

GMT vs. UTC:
Greenwich Mean Time (GMT) is a term originally referring to mean solar time at the Royal Observatory, Greenwich in London. It is now often used to refer to Coordinated Universal Time (UTC) when this is viewed as a time zone, although strictly UTC is an atomic time scale which only approximates GMT in the old sense.

Originally, the local time at the Royal Observatory, Greenwich, England was chosen as standard, leading to the widespread use of Greenwich Mean Time (GMT) in order to set local clocks. This location was chosen because by 1884 two-thirds of all charts and maps already used it as their Prime Meridian. In 1929, the term Universal Time (UT) was introduced to refer to GMT with the day starting at midnight. Until the 1950s, broadcast time signals were based on UT, and hence on the rotation of the Earth. In 1955, the caesium atomic clock was invented. This provided a form of timekeeping that was both more stable and more convenient than astronomical observations. In 1961, UTC was officially initiated.

Balloon Manufacturer vs. Burst Altitude

Interesting research done by Bill Brown on differences in manufacturing processes for balloons and the affect on burst altitude:

"It's been my experience that getting above 31.5 km with a 1200 gram balloon is difficult. I've found that different batches and different manufacturers make a difference.

For example: the 2004 batch of Scientific Sales balloons were consistent high altitude performers which nearly always made it to 35 km or more with payloads about the same weight as your ozonesondes. Also, I've noticed that some of the more recent Kaymont balloons seem to burst at lower altitudes than I've seen in years past.
…By the way, Kaymont imports Japanese balloons from a company called Totex. Scientific Sales usually imports balloons from a rival Japanese company called the "Weather Balloon Manufacturing Company". They are both synthetic latex. American based Kaysam was made using natural latex and seemed to go higher than the synthetic balloons primarily due to a higher resistance to UV degradation. Unfortunately Kaysam went out of business in 2004.
Other factors involve the amount of time spent with intense UV radiation that degrades the latex, so there may be a seasonal influence as well. If the balloon is handled without gloves it can make a difference as the oils on our fingertips can cause weak spots in the latex.
Recent flight averages put your burst altitude at approximately 31.5 km, which actually is what I'd expect with a 1200 gram balloon with the nozzle lift you typically use.
One possible solution is to use a larger balloon; I recommend a 1500 gram balloon that would probably get you close to having a consistent 35 km peak altitude."

Appendix B

Rules for Using the NSSTC HighBay Area

National Space Science & Technology Center
320 Sparkman Drive
Huntsville, Alabama 35805
(256) 961-7700

Rules for Users of the NSSTC High Bay Area

Usage

1. The High Bay (Room 1210) is an active laboratory and work area, and is not to be used as a storage area or warehouse.
2. If equipment is to be stored in the High Bay for periods greater than one week, written permission from the Deputy Manager, Space Science Department, or his designated alternate must be obtained. Requests for long-term storage (> 1 year) are not likely to be approved.
3. If material is to be stored for short periods of time, it must not interfere with ongoing operations, and must not be placed in work areas delineated by safety tape on the floor.
4. Unfortunately, the loading dock area is a windy location. Any individual who opens the High Bay door is responsible for sweeping/vacuuming up any leaves or trash that blows in, or in getting the janitors to perform this service.
5. When material is placed on the dock for disposal, it must be clearly marked as trash. The janitors will only dispose of material so marked. Everyone is expected to take responsibility for making sure that his or her trash is properly marked.

Deliveries

6. If or when deliveries are made to the loading dock they should be brought into the building through door 1203b, not through the High Bay. They should only be brought in through the High Bay door (1210a) if the High Bay, or the Materials Laboratory is their destination, or they are too large to pass through door 1203b.
7. When deliveries are made to the loading dock, the deliverer must attempt to reach the recipient using the phone mounted to the external wall. If this fails, or the recipient is not known they should contact the NSSTC receptionist (5-7000) who will contact the UAH Facilities Manager or his alternate.
8. Employees in the area of the loading dock should not be too helpful in opening doors until the above attempts have failed to locate the responsible person. In this eventuality, the NSSTC receptionist may ask someone in the area to help. If they do open the High Bay doors they must take responsibility for ensuring that the delivered material does not violate #3 above.
9. If you are expecting deliveries that will require the use of the loading dock, you are responsible for informing the NSSTC receptionist in advance.

Approved:

Original Signed by Robin Henderson — 06/06/2003
Chief Operating Officer — Date

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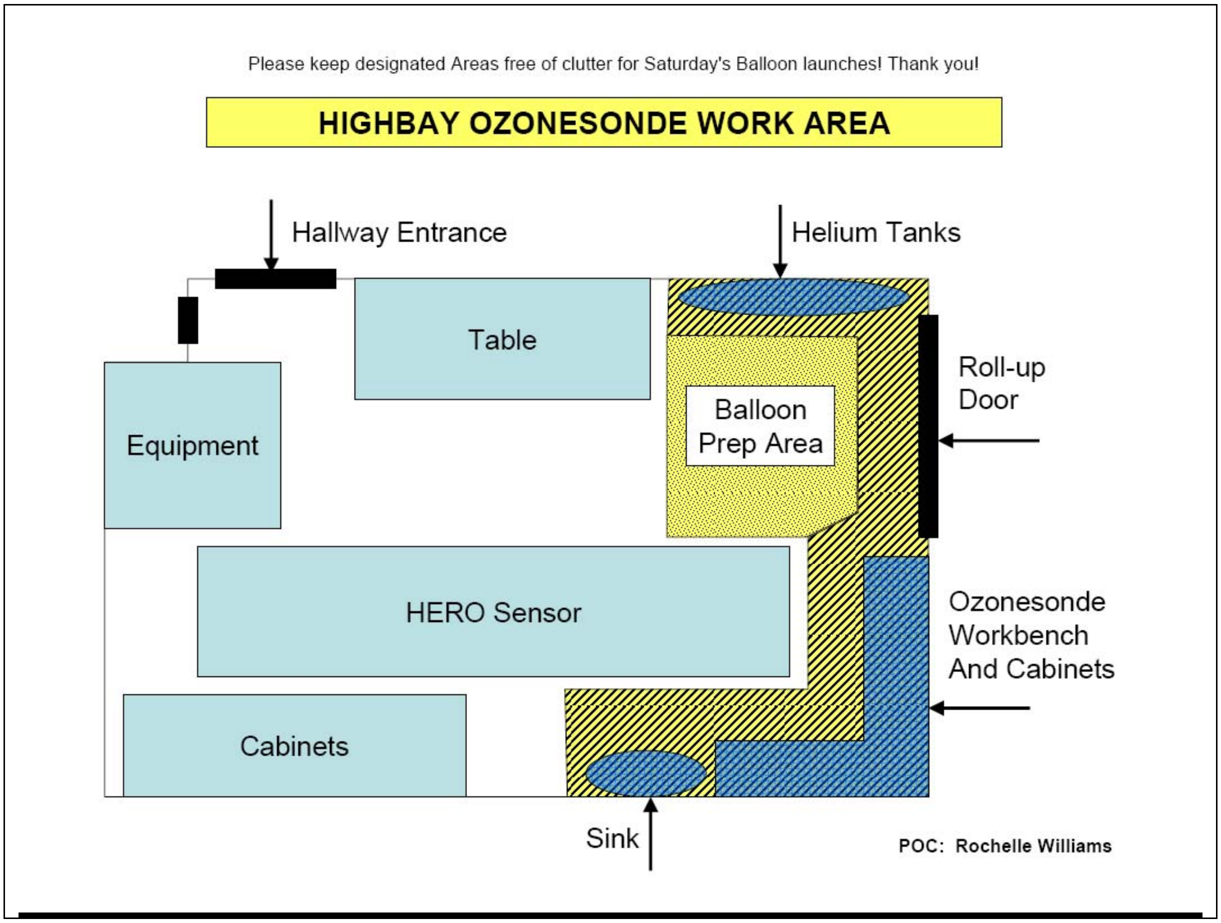
The University of Alabama in Huntsville

HighBay Workstation Schematic



NSSTC Workstation Detail Inventory

NSSTC Ozonesonde Workstation Detail

A Extra weights, Pressure gauge

B Tank Labels: Full, In use, Empty

C Extra High Ozone Scrubbers

D Checkout sheets, Reward Notices, Business Reply, Manuals

E Pliers, Scissors, Box cutter, Flashlight, manometer bulb, extra intake tubes, batteries (AA), Syringe, Sealant, Stopwatch, Pen, Post-its, Volt meter, screwdrivers

F Reels, Parachutes, Solutions, Scrubbers, Pressure/Vacuum Gauge, dry Sonde, Wrench, Tape, String, Plastic envelope cover, soap, extra wet and 9V batteries, Clorox Wipes, Gloves

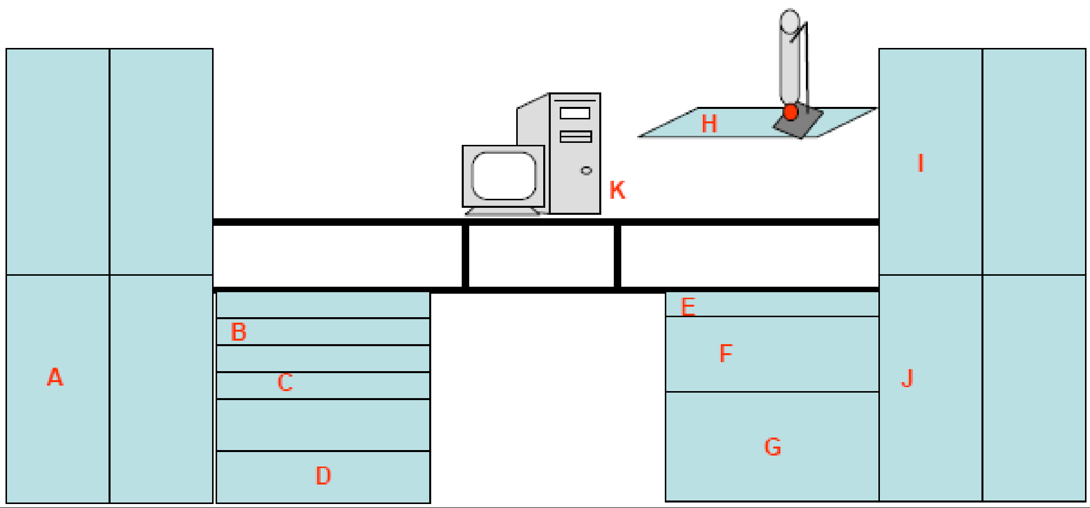
G Double-sided Tape, empty solution bottles, screwdriver kit

H T100 Flowrate Test Manometer

I Balloons, Un-/Prepped Sondes, Water for Humid T100 Test, Distilled Water, Collapsible Ozone broom

J Vaisalas, Tarp, hose

K FAQ, Operator's Guide



UPS Shipping Tips

Central Receiving can arrange shipment for all official University packages and priority letters through United Parcel Service (UPS). Domestic and international shipment options are available. Departmental pick-up service is available. Call Central Receiving at 824-6315 and give your location, number of packages, and shipment priority (Ground, Next Day, 2nd Day Air, etc.). For all priority shipments (Next Day and 2nd Day Air), call us before 1:00 p.m. to allow time for pick-up and processing before the scheduled 3:00 p.m. UPS pick-up time.

International shipments have special requirements and conditions which vary depending on the destination country. Contact Central Receiving and Shipping for additional requirements for international shipments.

Convenient tracking updates for all outgoing UPS shipments are also available. Carrier pick-up and delivery notifications can be sent via campus email to you at no additional cost. This optional service will provide delivery confirmation of your package. Simply provide your email address when preparing your sender's information. When sending a package through UPS, include the following information so shipments may be properly processed:

- **University budget account number for shipping costs**
- Receiver's company name
- Receiver's contact/department name
- RMA number (if product return)
- Receiver's phone number
- Receiver's address (no PO box, must be a street address) with **ZIP** code
- Sender's name/department name
- Sender's phone number
- Sender's University email address and contact name for pick-up and delivery notification (optional)

This information, except for the email address, will appear on the shipping label and will help the recipient properly identify the shipment. The information also ensures that shipping charges are properly assigned to each department. The budget account number is necessary to ensure proper recording of charges.

UPS Ground rates are much less expensive than air express charges (e.g., Next Day, 2nd Day, FedEx, DHL). In addition, UPS currently provides overnight Ground service from Huntsville to Montgomery, Alabama. With this service, a 2-pound package can ship to Montgomery for approximately $6 to $8, versus $15 to $17 for air express service. Services through other carriers, freight forwarders, and trucking companies can also be arranged when required.

Emergency Contact Information

If you have a problem during prep or during flight and you cannot find the answer in the FAQ Manual, contact any of the people listed below for assistance. Make sure to record your problems in the log book at the end of the flight.

Wes Cantrell	256-797-4870
Patrick Buckley	256-289-1129
Brian Huang	256-479-6152
Shi Kuang	256-417-2952
Dr. Newchurch	256-520-1882

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