EHB 9-720-S2

RADIOSONDE REPLACEMENT SYSTEM (RRS) WORKSTATION USER GUIDE
for
RWS Software Version 1.2.0.0

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Office of Climate, Water, and Weather Services/Observing Services Division

Table of Contents

1. Introduction 7
1.1 Purpose 7
1.2 Organization 7
1.3 RRS Software Adjustments for Sippican Instruments 7
2. System Description 9
2.1 Introduction 9
2.2 System Overview 9
2.3 System Hardware 9
2.3.1 Telemetry Receiving System (TRS) 10
2.3.2 Signal Processing System (SPS) 11
2.3.3 Radiosonde Replacement System Workstation 11
2.3.4 RRS Workstation Software (RWS) 12
2.3.4.1 Operator Commands 12
2.3.4.2 Compact Disk Drive 12
2.3.5 Different Compact Disks 12
2.3.5.1 RWS CD 12
2.3.5.2 Training CD 13
2.3.5.3 Data CD 14
2.3.6 RRS Training DVD 14
2.3.7 Printer 15
2.3.8 External Hard Drive 15
2.3.9 RSOIS Sensors 15
2.3.10 Precision Digital Barometer (PDB) 16
2.3.11 GPS Base Station Antenna 16
2.3.12 GPS Repeater 16
2.3.13 GPS Radiosonde 16
3. Simulated Flight - Overview of Operations 17
3.1 Introduction 17
3.2 Simulated - Prerelease Data Tutorial 17
3.2.1 Pre-flight Sequence 17
3.2.2 In-Flight Procedures 29
3.2.3 Flight Termination 43
4. RRS Observation – Preflight / Release Sequence 45
4.1 Introduction 45
4.2 Turning on Power to the TRS 45
4.3 Preparing Balloon and Flight Train during TRS warm-up 47
4.4 Preparing the Radiosonde 48
4.5 Completing the Preflight Information 48
4.6 Baselining the Radiosonde 56
4.7 Launching the Balloon 59
5. Checking and Editing Data 63
5.1 Introduction 63
5.2 Data Editing 63
5.2.1 Post-Release Surface Observation 63
5.2.2 Sounding Release Detection 64
5.2.3 Deleting and Restoring Marked Data 66
5.3 Checking Sounding Data Quality 69
5.3.1 Pressure Data 69
5.3.1.1 Typical Features in Pressure Data Profiles 70
5.3.2 Temperature Data 71
5.3.2.1 Typical Features In Temperature Data Profiles 72

Table of Contents

5.3.3 RH data 73
5.3.4 Wind Data 74
5.3.4.1 Typical Features in Wind Data profiles 76
5.3.5 Missing Data 76
5.3.5.1 Missing And Rejected Received PTU Data 76
5.3.5.2 Missing Processed Data 77
5.3.5.3 Missing Data Appearing In Plots 78
5.3.5.4 Missing Data and the WMO Levels Table 78
6. RRS Observation – Check and Status Messages 79
6.1 Introduction 79
6.2 Check Messages 79
6.3 Status Messages 80
6.3.1 Status Messages Explanations 81
7. RRS Observation – Plot Selection & Management 85
7.1 Introduction 85
7.2 Plot Selection 85
7.3 Plot Zoom 91
7.4 Plot Options 91
8. RRS Observation - Transmitting Messages 95
8.1 Introduction 95
8.2 General Procedures 95
8.3 Coded Messages 95
8.3.1 Manually Coded No Data Messages 96
8.3.2 Using the Code Option 97
8.3.3 The RADAT Message 100
8.3.3.1 Automatically Coded Groups of the RADAT message 101
8.4 Coded Message Breakdown 102
9. RRS Observation - Flight Termination 111
9.1 Introduction 111
9.2 Automatic Flight Termination 111
9.2.1 Balloon Burst 113
9.2.2 Leaking or Floating Balloon 113
9.2.3 Excessive Missing Data 114
9.2.4 Radiosonde Failure 114
9.2.5 RWS unknown failure – Recovery 114
9.3 Manual Termination 114
9.4 Early Termination Prior to 400 hPa and Second Release 118
9.5 Predetermined Termination 119
9.6 Manually Selectable Termination Reasons 120
9.7 Hardware or Software Failures 121
10. Transferring Archive Files 123
10.1 Introduction 123
10.2 Zipping and Sending Archiving Flight Data 123
10.3 Locate, Name and Zip the Archive Files 125
10.4 Send Zipped File to NCDC 129
11. In-flight Data Problems 133
11.1 Introduction 133
11.2 Balloon Release Made Too Early Or Late. 133
11.3 Pressure Data Anomalies And Problems 134
11.3.1 Wavy Pressure Profile 135
11.3.3 Soundings Inside Severe Turbulence 139
11.3.4 Very High Termination Altitude (Leaking Pressure Cell) 142
11.4 Temperature Data Problems 148

11.4.1 Superadiabatic Lapse Rate 148
11.4.1.1 Strong Superadiabatic Lapse Rate Off Surface 148
11.4.1.2 Evaporative Cooling On The Temperature Sensor (“Wet bulb Effect”) 150
11.4.1.3 Superadiabatic Lapse Rates Above 8 km. 151
11.4.1.4 Sounding Inside A Thunderstorm 152
11.5 Relative Humidity Data Problems 153
11.5.1 Rapid Change In RH Off Surface 154
11.5.2 Layers Of Constant 1% RH Values 155
11.5.3 Noisy Or Erratic RH Data 156
11.5.4 High RH In The Stratosphere 157
11.6 Wind Data 158
11.6.1 Missing Winds 159
11.7 Data Spikes 159
11.8 Radiosonde or Sensor Failure 161
12. Rework – Reprocessing Flights 163
12.1 Introduction 163
12.2 Rework Functions 163
12.3 Starting Rework 163
12.4 Rework as a Flight Recovery Tool 165
12.5 Exiting Rework 165
13. Station Data 169
13.2 Station Data Display 169
13.2.1 National Weather Service Headquarters Maintained Data 170
13.2.2 Data Entered and Maintained by Station 170
13.3 Viewing Station Data 171
13.3.1 Entering Individual Data Blocks 173
14. RWS Software Utilities 179
14.1 Introduction 179
14.2 Flight Management Utilities 179
14.2.1 NCDC Archive Utility 180
14.2.2 Flight Export Utility 180
14.2.3 Flight Summary Utility 181
14.2.3.1 Flight Summary Options 181
14.2.3.2 Individual Flight Summary Display 182
14.3 Application Utilities 182
14.4 Administrative Utilities 184
15. Checking the System Status 185
15.1 Introduction 185
15.2 Getting Started 185
15.3 Printer Test 189
15.4 SPS Status Window 190
15.5 Gathering Specific Data for Fault Isolation 190
A. Appendix A - Abbreviations and Acronyms 191
B. Appendix B. Clouds/WX Codes 195
B.1 Introduction 195
B.2 Getting Started 195
C. Appendix C - RRS Offline Maintenance 219
C.1 Introduction 219
C.2 Offline Maintenance Menu 219
C.2.1 Intermet Maintenance Option 220
C.2.2 Sippican Maintenance Option 220
C.2.3 RSOIS Maintenance Option 221
C.2.4 PDB Maintenance Option 222

Table of Contents

C.2.5 TRS Maintenance Option 222
C.2.5.1 MCU Tests 223
C.2.5.2 Receiver Tests 223
C.2.5.3 Scanner Tests 224
C.2.5.4 LCDU Tests 224
C.2.5.5 RCDU Tests 225
C.2.6 UPS Maintenance Option 226
D. APPENDIX D- Troubleshooting 227
D.1 Introduction 227
D.2 Pre-flight Troubleshooting 227
D.2.1 Failure to Complete Warmup and/or Initialization 227
D.2.2 No Antenna Control – Corrective Actions 228
D.2.3 SPS Failing to Initialize at Baseline 229
D.2.4 No GPS at Baseline – Corrective Actions 231
D.2.5 GPS at Baseline but GPS Status window shows 0 Matches – Corrective Actions 231
D.3 In-flight Troubleshooting 232
D.3.1 Signal loss - Corrective Actions 232
D.3.2 Missing Data – Corrective Actions 233
D.3.3 Antenna Not Tracking Properly GPS Loss - Corrective Actions 234
D.3.4 RWS fails to detect release – Corrective action 235
D.3.5 MCU Overload with Rapidly Changing Angles – Corrective Actions 236
D.4 Doing a Screen Capture 238
D.5 Post-Flight Troubleshooting 240

RECORD OF CHANGES

Change Number	Effective Date	Initials	Date Entered	Remarks
Rev A	10/09/08	JP		Original issue
Rev B	10/28/08	JP		Incorporated various comments from OPS22

When you enter a change to this handbook make a notation on this page. . Pen and ink changes within this handbook can be indicated by a vertical line (.) in the outside margin adjacent to your marked subject matter or data. This redline or highlighting method is illustrated to the right of this paragraph

Record of Changes

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1. Introduction

1.1 Purpose

This training guide is designed to teach how to take upper air observations with the Radiosonde Replacement System (RRS) workstation using Sippican radiosondes. In reading this guide, a basic knowledge of taking an observation with the RRS Telemetry Receiving System is assumed. This knowledge may be gained by reading the sections of NWS-10-1401 relating to the Telemetry Receiving System, from the RRS Training Video, and hands-on training. Previous experience with a Windows based personal computer is also assumed.

1.2 Organization

This training guide has 15 chapters and four appendices. Chapter 2 provides a brief description of the RRS system and the RRS workstation. Chapter 3 uses actual flight data to allow the operator to become familiar with user features by running a simulated flight. Chapter 4 walks the user through both the Preflight and Release sequences. Chapter 5 describes the process of checking and editing data during a flight. Chapter 6 describes the possible check and status messages that a user will encounter during a typical flight. Chapter 7 discusses the selection and management of plots. Chapters 8 deals with the coding and transmitting of messages. Chapter 9 and 10 describe the process of terminating a flight and how to archive the files during post processing. Chapter 11 describes in detail some of the most common in-flight data problems. Chapter 12 describes how to rework a flight. Chapter 13 discusses station data and the responsibility of maintaining it. Chapter 14 describes the various utilities available to users. Finally, chapter 15 deals with checking the system status.

Appendix A provides a list of abbreviations and acronyms used with RRS and the upper-air program. Appendix B provides codes for the Clouds/Weather entry in the prerelease data. Appendix C provides brief instructions on using the RRS Offline Maintenance software for providing maintenance personnel with more detailed information of equipment problems. Appendix D provides helpful hints in troubleshooting problems during Pre-flight, In-flight and Post-flight activities.

Operators are encouraged to read the manual in its entirety since each chapter has valuable information meant to ensure quality soundings. This guide is also meant to be used for reference after training is completed with special attention paid to chapters 5, 11 and appendix D

1.3 RRS Software Adjustments for Sippican Instruments

While, the RRS software (RWS) is designed to allow a variety of radiosondes, it is currently configured for just the Sippican MKIIA radiosonde. Future versions of RRS software will be configured for other radiosonde types.

Chapter 1 - Introduction

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2. System Description

2.1 Introduction

This chapter provides an introduction to the RRS system. While completely understanding the system hardware isn't necessary to use the operational RRS, understanding the basic functions for the hardware will provide valuable insight into the flight process, and for troubleshooting problems that may occur.

2.2 System Overview

The RRS tracking and receiving equipment tracks and receives the radiosonde signals. The signals are received from the Telemetry Receiving System (TRS) and Global Positioning System (GPS) and transmitted via the Signal Processing System (SPS) through a fiber optic cable to the workstation. The Signal Processing System (SPS), which is within the TRS, converts these signals to a digital (numeric) form that can be used by the RRS Workstation (RWS) software. The RWS has a user interface that allows you to display and edit upper air data during the flight. When the coded messages are ready for transmission, they are sent from the RRS workstation to AWIPS via LAN, or a modem. The modem converts the data into a form that can be transmitted over telephone lines.

2.3 System Hardware

The RRS system hardware consists of the following items:

- Telemetry Receiving System (TRS)
- Signal Processing System (SPS)
- RRS Workstation (RWS) (CPU/Monitor/Keyboard)
- Printer
- External Hard Drive (Backup)
- RSOIS
- Precision Digital Barometer (PDB)
- Cables to RRS Tracking Equipment
- GPS Base Antenna
- Multiplexer (DCE)
- GPS Repeater
- Control Display Unit (CDU)
- GPS Radiosonde
- Cables to the RSOIS and PDB

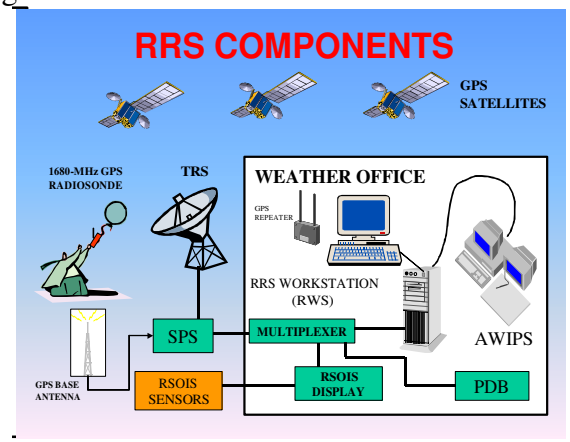

Exhibit 2-1 RRS Components

2.3.1 Telemetry Receiving System (TRS)

The TRS consists of three units (Exhibit 2-2): The antenna unit, the workstation unit, and launch area unit. The TRS workstation unit consists of the Digital Communication Equipment (DCE) and the workstation intercom.

The antenna is a 2 meter parabolic dish consisting of two halves for ease of transportation and assembly. Within the antenna unit, there are three major groups. They are the Radio Frequency (RF) group, Yoke group, and the Rack group.

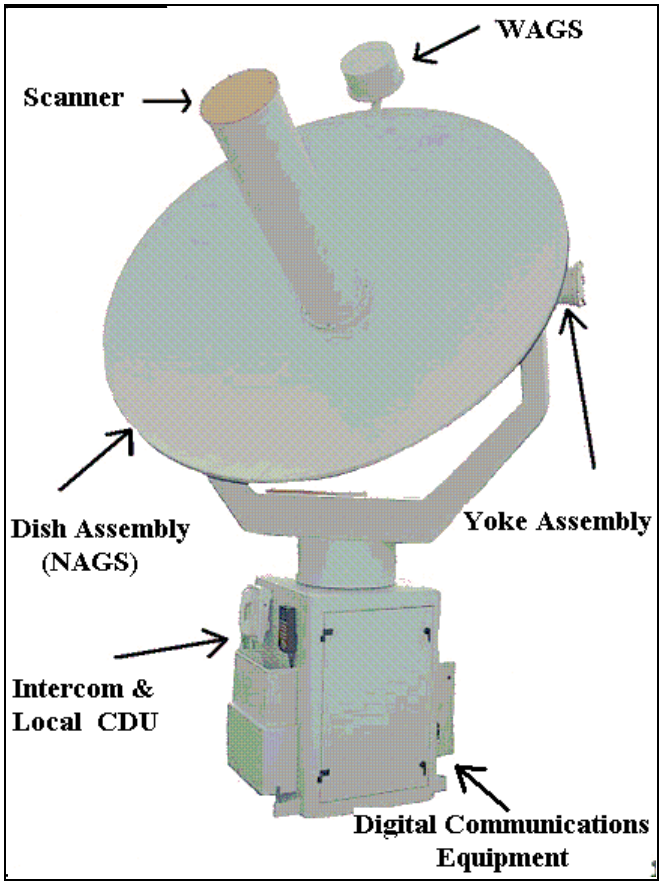

Exhibit 2-2 Telemetry Receiving System (TRS)

The RF group consists of the following six RF sensitive elements plus associated cables:

- Dish - Narrow Angle Gathering Sensor (NAGS) - 15 degree beam width
- Receiver assembly
- Scanner low noise amplifier (LNA) assembly
- Helix assembly
- Wide angle gathering sensor (WAGS) - 100 degree beam width
- Counter-weights
- Associated cables

The Yoke group consists of six major assemblies plus associated cables. These assemblies and cables are the physical motion elements:

- Yoke
- Elevation motor drive assembly
- Motor Control Unit
- Associated cables
- Cross-member
- Azimuth motor drive assembly
- Slipring assembly

The Rack group consists of thirteen major assemblies plus associated cables. The assemblies and cables are the remaining elements within the antenna unit:

- 19 inch Rack
- Interconnection box
- Two heater assemblies
- Signal Processing System (SPS)
- Uninterruptible power supply (UPS)
- Local Control Display Unit (CDU)
- Antenna Digital Communication Equipment (DCE)
- Bulkhead
- System communication assembly (SCA)
- Air conditioner (AC)
- Power supply assembly (PSA)
- Local area intercom
- Associated cables

2.3.2 Signal Processing System (SPS)

The TRS is designed to receive telemetry from any radiosonde that meets the RRS specifications. The TRS delivers the radiosonde telemetry signal as 10.7 MHz IF to the SPS located in the 19 inch Rack below the antenna. The SPS includes a power supply, GPS receiver, 10.7 MHz IF front end, and a processor.

The SPS provides baseband conversion of the modulation on the Intermediate Frequency (IF) input. This baseband data is provided to the processor within the SPS. The GPS receiver provides the reference position and velocity data to the processor within the SPS. The processor within the SPS provides the corrections to the radiosonde data and provides it to the workstation.

2.3.3 Radiosonde Replacement System Workstation

The RRS workstation, at a minimum has a 3.2 GHz Pentium 4 processor and motherboard. The memory is at least 1024 megabytes (Mb) RDRAM with a 160 gigabyte (Gb) hard drive. It has a rewritable CD-RW along with a 3.5 inch floppy diskette drive. The workstation uses Windows XP as an operating system. The workstation has a 19 inch monitor, a telecommunications modem, 104 PS2 keyboard, a mouse, and an external 160 gigabyte (Gb) hard drive for backup of all flight data. These specific characteristics will change with time, but will not be less than described above.

The RRS software is stored on the hard disk, along with the data, archive, and station data files. The Offline Maintenance software is also included to help identify equipment problems.

2.3.4 RRS Workstation Software

The system is very interactive and allows a high degree of control over the data products that are generated and transmitted.

RWS allows the user to enter preflight information, baseline the radiosonde, control the TRS and display and interact with flight data. Flight data is stored automatically, and flights may be reworked in RWS. In the event of a power failure, the flight data can be reworked allowing the data (to the point where the power was lost) to be transmitted. The flight data can also be Archived and transmitted to the National Climatic Data Center (NCDC).

2.3.4.1 Operator Commands

Commands to the RWS are entered through the mouse or the keyboard. The mouse is the primary means of entering commands. The keys function with the RRS software similar to their operation with any other typical Windows based program. The RRS software is not case sensitive.

2.3.4.2 Compact Disk Drive

The CD drive reads and writes data to a CD. This disk drive is also referred to as the D: drive. The disk drive is located at the top slot of the tower. A CD is inserted into the CD drive by pressing the button to the right and below the opening or slot. Each CD can hold 650 Mb of data. The light on the lower left part of the disk drive turns on when the CD drive is either reading or writing data.

2.3.5 Different Compact Disks

There are two CDs for the systems, the RWS 1.2.0.0 CD (Exhibit 2-3) and the RRS Training CD (Exhibit 2-4). The RWS CD is used to install the RWS software and RRS Offline Utility software. The RRS Training CD contains operational flight data. CDs can be used for semi-monthly backups of the flight files. The following sections describe the software, training and data CDs.

2.3.5.1 RWS CD

The RRS CD (Exhibit 2-3) comes with the RRS pre-deployment kit, which typically arrives 90 – 120 days prior to deployment. Once RWS is installed, observers can begin using the software for training.

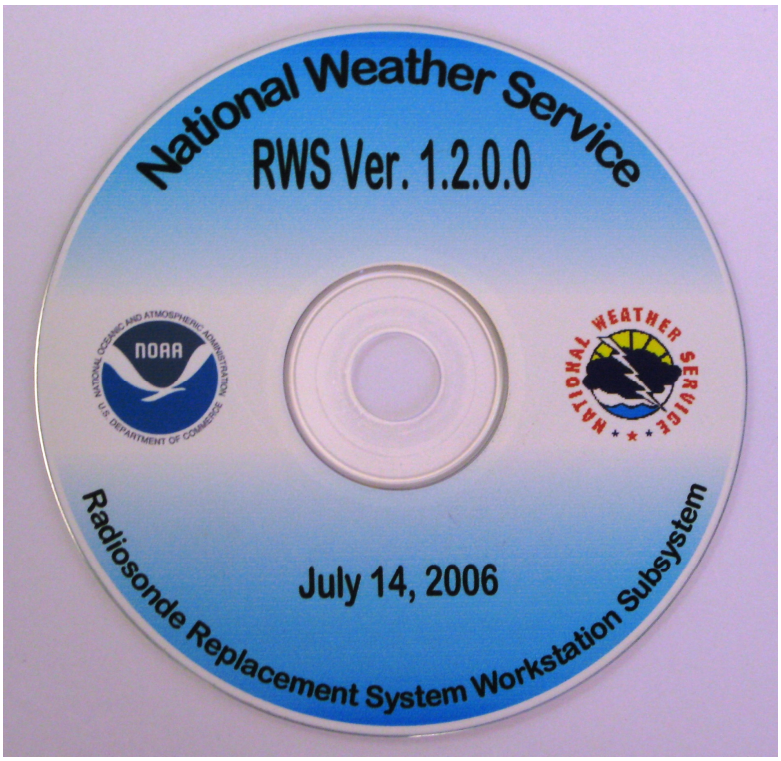

Exhibit 2-3 RRS Software CD

2.3.5.2 Training CD

A substantial part of the RRS training will involve displaying and marking data from previously recorded flights using the Simulated and Rework Flight Options (Chapters 3 and 12). The Training CD contains training exercises and flight data files (files with a **.mdb** extension) that can Reworked after they are imported into RWS. The Training CD will also be used to demonstrate normal flight operations and possible options within the Tools option in Chapter 3. The Training CD should be loaded on the RRS workstation and used in conjunction with the RRS User Guide to become familiar with the various operator features before doing Live Flights. (Exhibit 2-4)

Exhibit 2-4 RRS Training CD

2.3.5.3 Data CD

A data CD can be created at anytime to provide a secondary backup of existing flights. WSH policy is to keep the RRS Archive data on station for at least three months. After this time, a data CD can be created to backup the Archive flight files and RWS flight files. A label for the data CD made by the site should clearly state on the disk or on an attached sheet of paper, the files contained on the disk.

NOTE: Anytime a flight has unusual meteorological or other events which may include tracking problems, software issues, or possible problems with the radiosonde or sensors use the capture utility to upload data to the RRS team for analysis.

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	CD Type	Data on CD	Input Data	Output Data
1	Training	Training Data	1-second flight data	
2	Data	Flight Data	1-second flight data	Used to Archive, Rework or Analysis Flight Performance

2.3.6 RRS Training DVD

A key part of learning about the RRS System is operator training. Operator training consists of using the RRS User Guide and NWS Manual 10-1401, along with exercising the RRS software on the workstation utilizing the Training CD. Besides the Training CD there is a RRS Training DVD that provides a detailed overview of entire RRS Tracking System, RWS software, and key components. It also details normal operator actions and shows corrective measures that should be taken to ensure a successful flight. This DVD should be viewed by all new observers and used for refresher training to ensure proper procedures are followed.

The RRS Training DVD is broken up into sections and may be viewed a chapter at a time on any computer workstation having a DVD drive. (Exhibit 2-5)

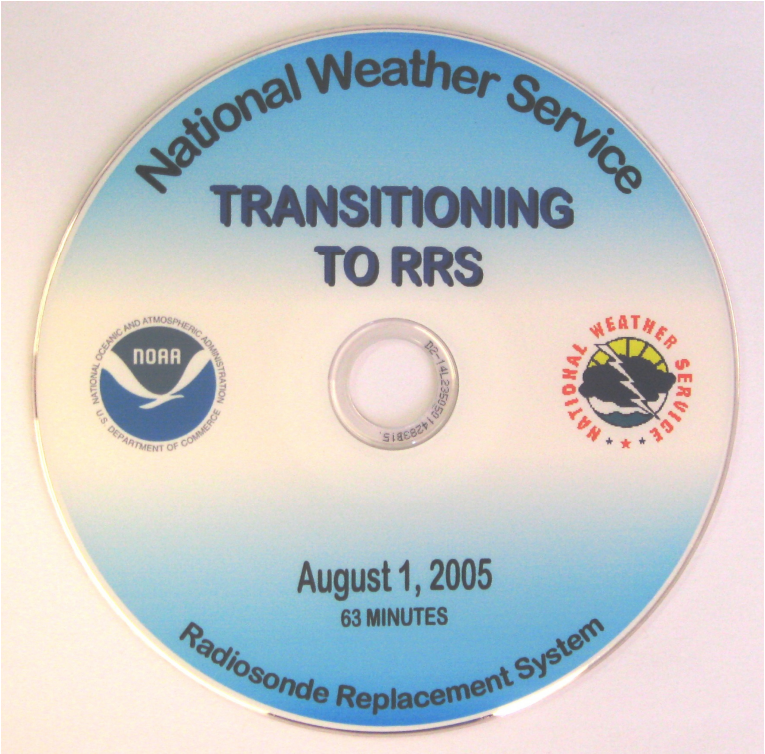


Exhibit 2-5 RRS DVD

2.3.7 Printer

The RWS comes standard with a color printer to be used to print screenshots, flight data etc as needed.

2.3.8 External Hard Drive

Once a flight has been terminated, the data is backed up to the external hard drive in case of a hard drive failure of the RRS computer. In case of such a failure previous flights will be available from the external hard drive once the workstation has been replaced.

2.3.9 RSOIS Sensors

The surface observing sensors are located within 200 meters of the release point unless a waiver has been issued by WSH. The RSOIS reports:

- Temperature
- Dewpoint/RH
- Wind Speed/Direction/Gusts

If RSOIS is not available or inoperative, a site may use the ASOS sensors or manually take the observations using a combination of handheld and fixed equipment if authorized.

2.3.10 Precision Digital Barometer (PDB)

The station pressure is measured by the Precision Digital Barometer (PDB). It is located at the baseline point and used to check the accuracy of the radiosonde pressure sensor. The radiosonde pressure sensor must be within ± 5 hPa of the PDB reading or the instrument must be rejected.

2.3.11 GPS Base Station Antenna

The GPS base station antenna is located inside the radome above the TRS. The GPS base station provides Global Positioning System data from up to 24 satellites, 8 additional satellites used for backup, all in geo-synchronized orbit. The GPS antenna must receive data from at least four satellites to compute positional data including height.

Location is determined by positional change in the radiosonde's location in relationship to the satellites. This information is transmitted via the radiosonde's GPS antenna back to the GPS ground station. Accuracy of wind data improves as much as five times that of wind calculations using RDF equipment.

2.3.12 GPS Repeater

A GPS repeater is installed at all stations. The GPS repeater is located inside the office and surveyed for an established location at the baseline location to ensure GPS lock-on is acquired during the baseline check.

NOTE: GPS repeater location and baseline location are established and should not be moved without prior WSH approval. Each site will have a primary and backup location surveyed.

2.3.13 GPS Radiosonde

GPS radiosondes transmit a signal that provides pressure, temperature, and relative humidity readings. Positional data is calculated by a change in radiosonde GPS position relative to the GPS Base Station location. Data is transmitted from the radiosonde at 1-second intervals back to the ground tracking system.

3. Simulated Flight - Overview of Operations

3.1 Introduction

This chapter provides instructions on using the Simulated Flight function of RRS. The Simulated Flight mode is used in training to provide as close to Live Flight operations and commands as possible. Some of the activities in Simulated Flight mode, not available in Rework are:

1. Pre-release sequence and the radiosonde baseline screen.
2. Flight data progressively be received and processed as in a live flight.
3. Automatic coding of the WMO Coded Messages.
4. Flight termination sequence.
5. Additional release(s) sequence.

The Simulated Flight mode contains nearly all of the capabilities for displaying and editing data that are available in the Live Flight mode. Learning to use the Simulated Flight mode will allow you to become familiar with many RRS features before you take an actual observation.

Before you begin training in the Simulated Flight mode, you should have a basic knowledge of using a Windows based computer and should have read Chapter 2 of this user guide.

3.2 Simulated - Prerelease Data Tutorial

Before the radiosonde is released, information about the flight must be supplied to RRS. In this chapter you will see an example of these prerelease data for a sample flight and get some experience in manipulating the data. The prerelease data are displayed on five separate screens. Each of the screens are dealt with in a separate section.

3.2.1 Pre-flight Sequence

1. Turn on the RRS workstation.

2. Log on using your individual Username and Password. Double click the RWS desktop icon.

3. The RWS Window will appear with the Security Warning message. Read the message, and click on the OK button. (Exhibit 3-1)

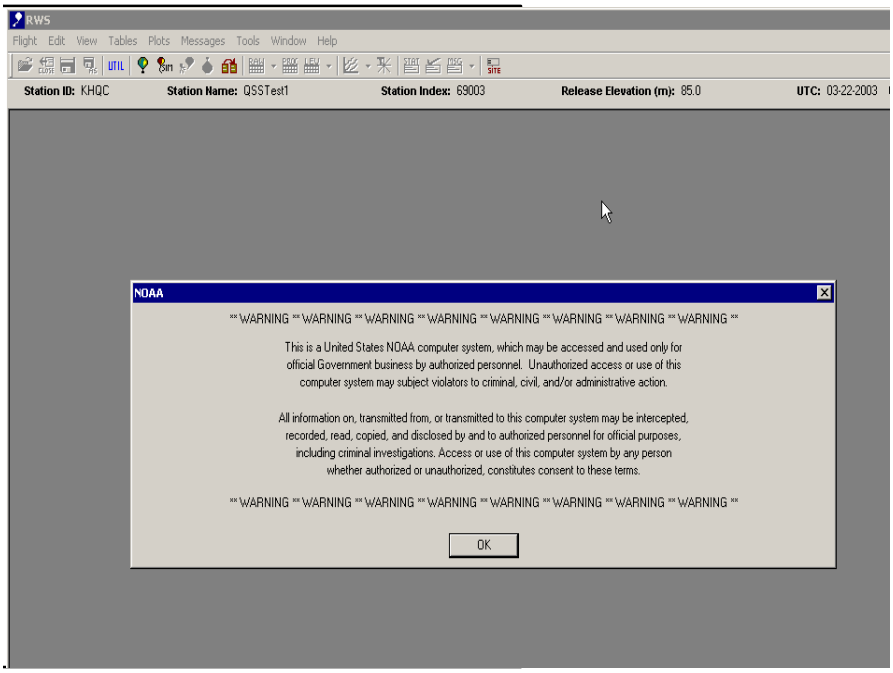


Exhibit 3-1 RWS Window with Security Warning Message

4. Flight Options Window appears. (Exhibit 3-2) Select "Run a simulated flight".

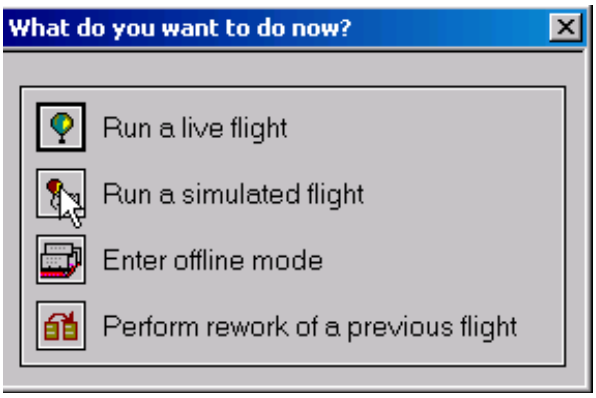


Exhibit 3-2 Flight Options Window

NOTE: In a live flight, a prompt to power on the UPS will first appear. Click Yes to power on the UPS

5. The GPS Status window, Administrative Display window, Antenna Orientation/TRS Display window, Hardware Status window, and Status Message Display window appear. (Exhibit 3-3) The GPS status window indicates no matches throughout the entire simulated flight. In a live flight a minimum of 4 matches are required to process position and calculate height data. If a match were present, numbers would appear in place of the gray boxes in a single column. (Exhibit 3-4)

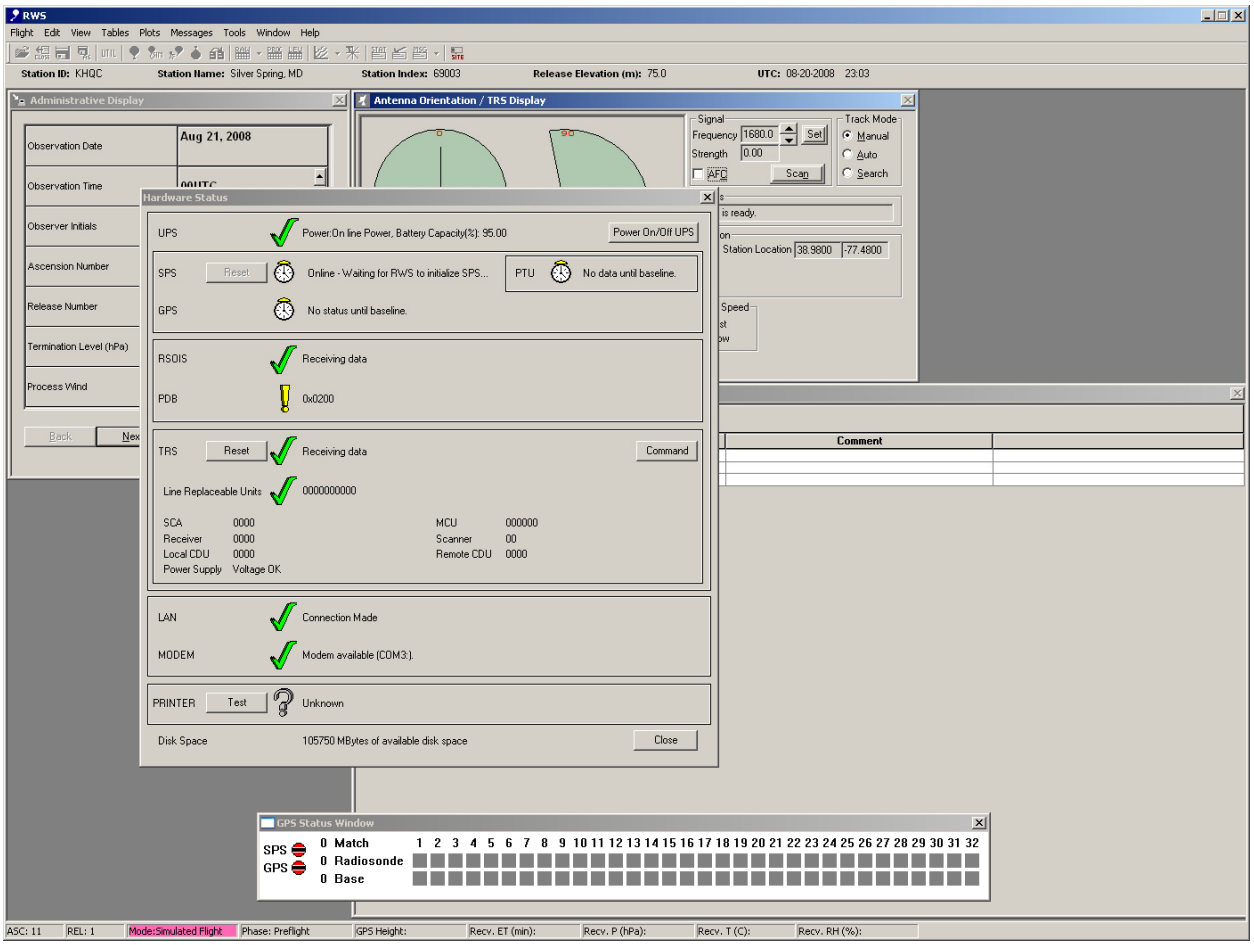


Exhibit 3-3 Simulated Preflight Display

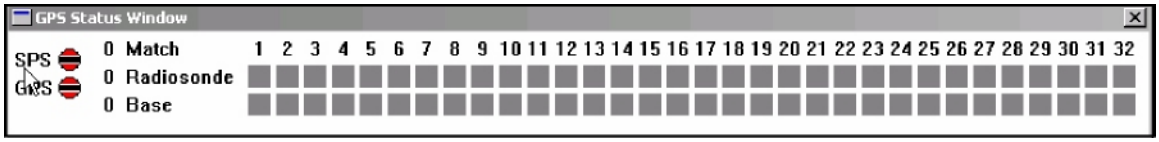


Exhibit 3-4 GPS Status Window

NOTE: Numbers indicate the signal to noise ratio. Numbers typically should be between the upper 30's and lower 50's.

6. In the Hardware Status window, (Exhibit 3-5) the various components except for the SPS and GPS should have a green check mark when operating properly. The SPS and GPS status can not be determined until a radiosonde has been prepared and connected to the battery, the baseline process has begun and the SPS has initialized. Chapter 15 titled "Checking the System Status" provides detailed information on the various hardware components checked and recommended actions.

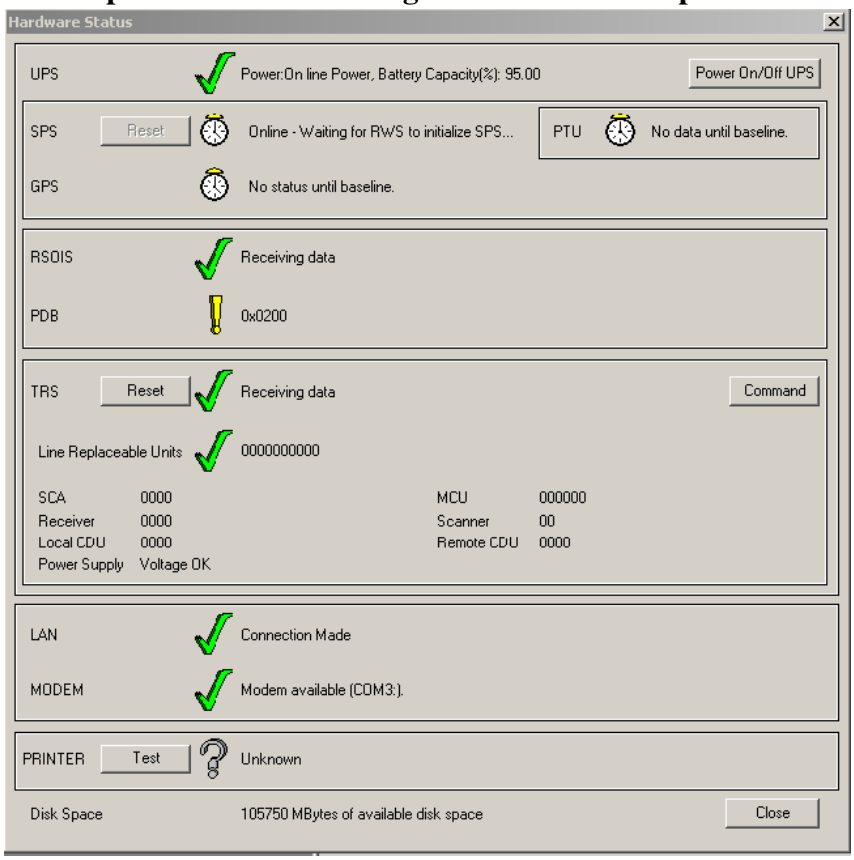


Exhibit 3-5 Hardware Status windows

7. Once powered on, the UPS Status window will appear alerting you that the UPS has now been turned on. Click OK (Exhibit 3-6).

Exhibit 3-6 UPS Status window

NOTE: During a Live Flight, this message will appear anytime the UPS status changes.

8. The Administrative Display, the Antenna Orientation/TRS Display and the Status Messages Display all are displayed with the GPS Status Window below them. (Exhibit 3-7)

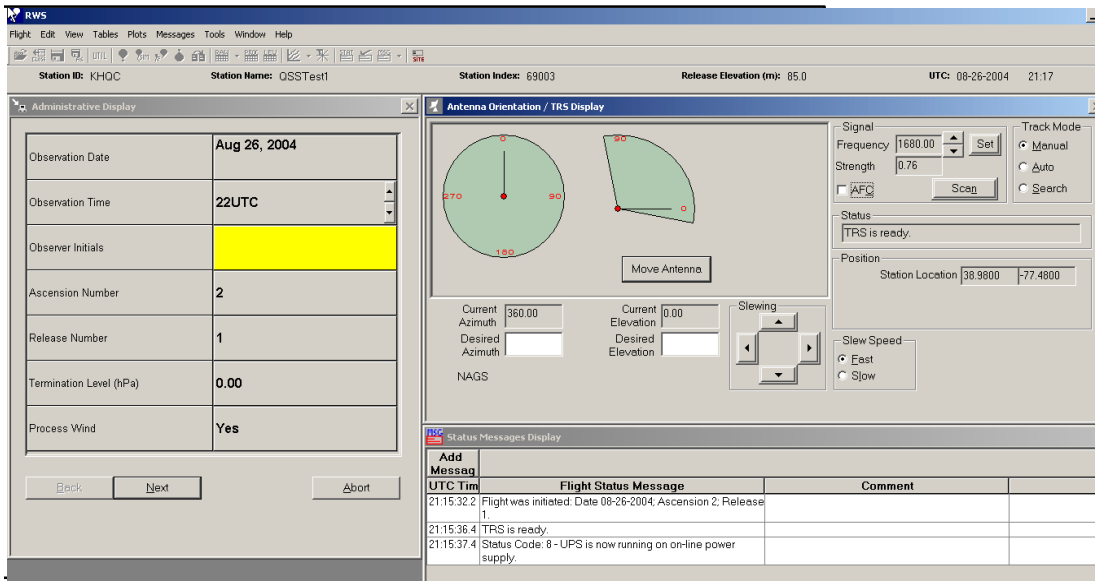


Exhibit 3-7 Administrative/Antenna & TRS/Status Message Displays

9. Fill in your initials in the Administrative Display and then click the "Next" button. (Exhibit 3-8)

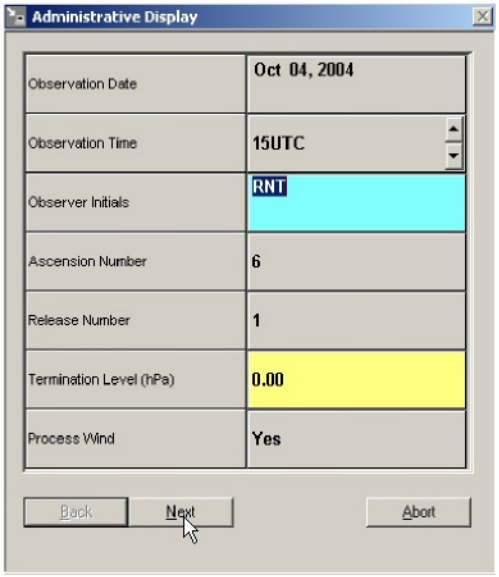


Exhibit 3-8 Administrative Display

10. The Equipment Display appears, fill in the blocks. (Exhibit 3-9) All blocks except the Calibration File Location must be completed. This information is transmitted from the radiosonde at baseline. *The radiosonde serial number is on the label at the bottom of the instrument*. Some balloon information may be obtained off each balloon box label. The amount of gas is the nozzle lift used. The cells for Train Regulator, Lighting Unit, and Parachute are all Yes or No responses. The operator may toggle to get the desired answer. Click the **Next** button when done.

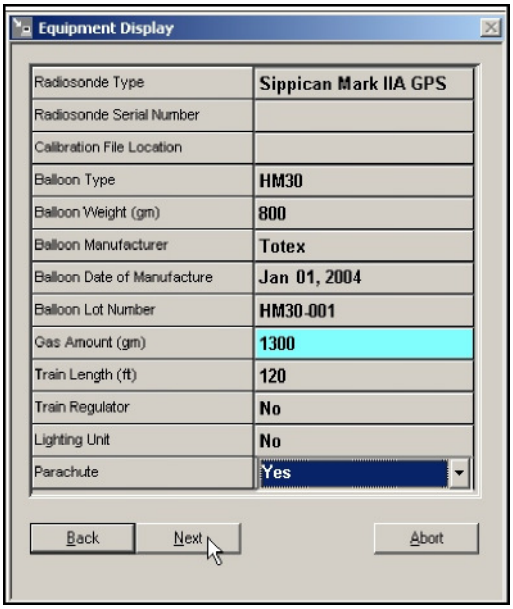


Exhibit 3-9 Equipment Display

11. The Surface Observation Display appears (Exhibits 3-10) The simulated flight has surface observation data, click the **Refresh** button to populate (Exhibit 3-11). Clicking **Refresh** will populate all columns, except the Cloud/WX block. Fill in the Cloud/WX block using codes provided in Appendix B. Correct cloud data is imperative. It directly influences the temperature radiation correction applied which impacts the RADAT and all Coded Messages.

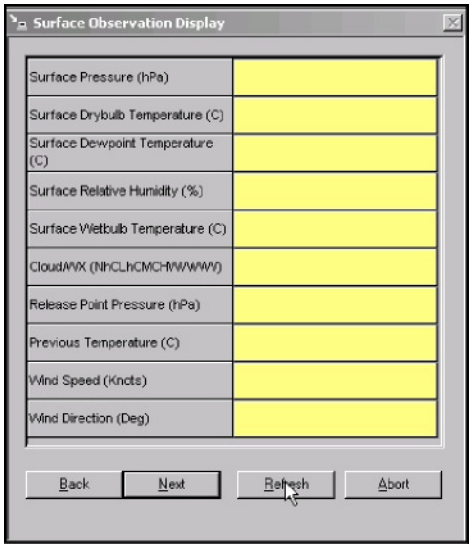


Exhibit 3-10 Surface Observation Display

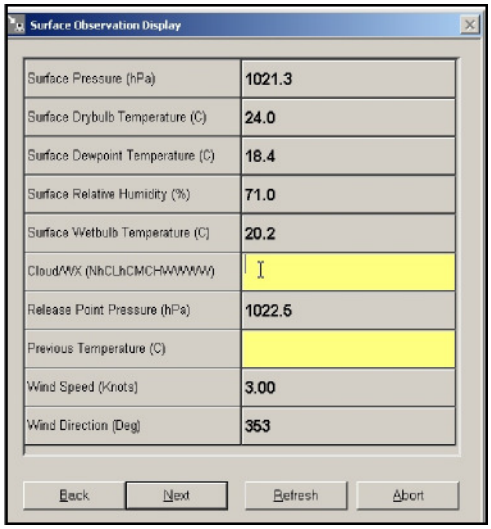


Exhibit 3-11 Surface Display After Refresh with Cloud/WX Entered

NOTE: The Previous Temperature is only required when the surface pressure is less than 1000 hPa (e.g. 998 hPa) (Exhibit 3-11)

12. In the Antenna Orientation/TRS Display, position the antenna to the azimuth and elevation for radiosonde baseline. This is accomplished by entering the Desired Azimuth and Desired Elevation in the blocks and then clicking the **Move Antenna** button, or by using the "Slewing" arrows.

NOTE: Azimuth indicates the direction the TRS antenna is pointing. (This is 180 degrees out from the old ART system.)

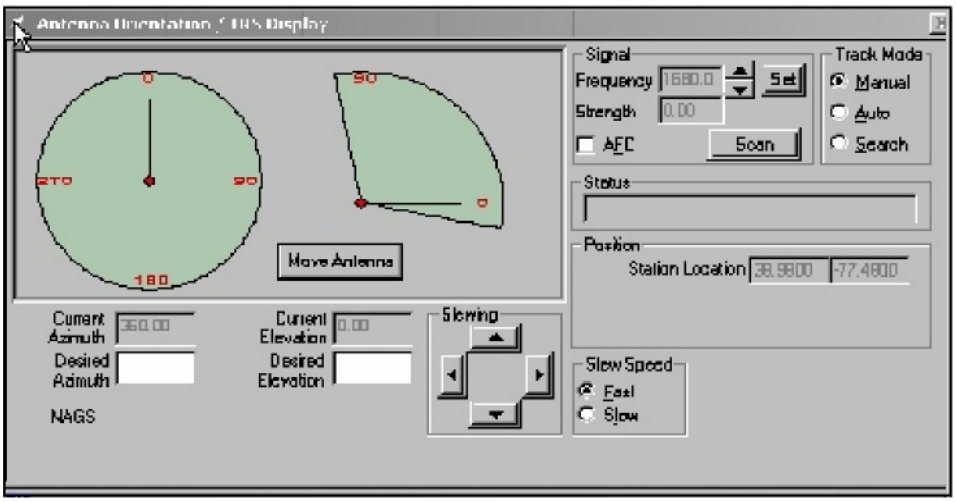


Exhibit 3-12 TRS Display

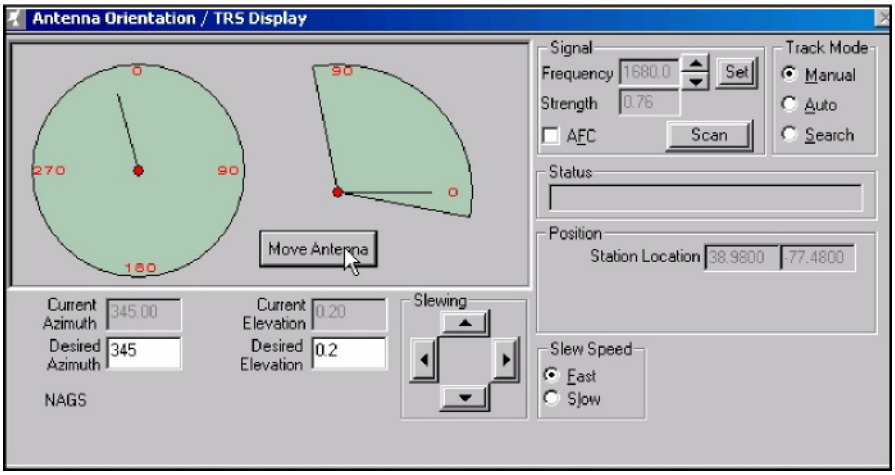


Exhibit 3-13 TRS pointed for baseline

13. The next step is to set the TRS frequency. There are 4 possible frequencies to choose from. They are 1676, 1678, 1680 and 1682 MHz. The TRS default frequency is 1680 MHz.

14. To change the frequency in the Antenna Orientation/TRS Display, click the **Set** button (which opens up the Set Frequency Box) and type the desired frequency, then click the **OK** button. (Exhibit 3-14) Once the frequency is set, ensure the AFC box is checked (Exhibit 3-

15).

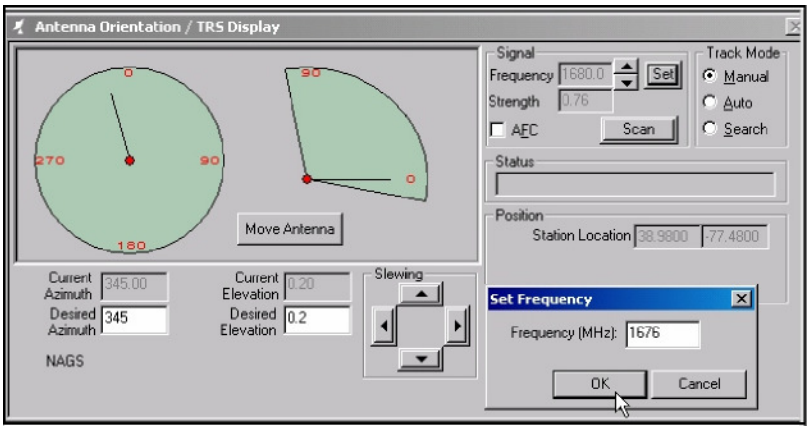


Exhibit 3-14 Setting Frequency

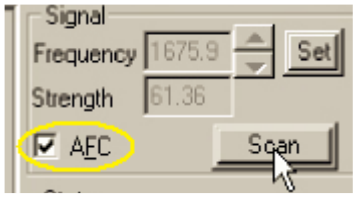


Exhibit 3-15 AFC Box Checked

NOTE: Do not use the "Scan" button if doing a second or third release. The receiver may lock-on to the previous radiosonde causing the invalid calibration data to be used at baseline.

15. During an actual flight, the radiosonde would now be prepared in accordance with the vendor instructions (NWSM 10-1401, Appendix N).

IMPORTANT: Special attention should be paid to the wait times required during the prep of the radiosonde

16. Once the antenna has been positioned and the radiosonde signal acquired, click the **Next** button on the Surface Observation Display. (Exhibit 3-16)

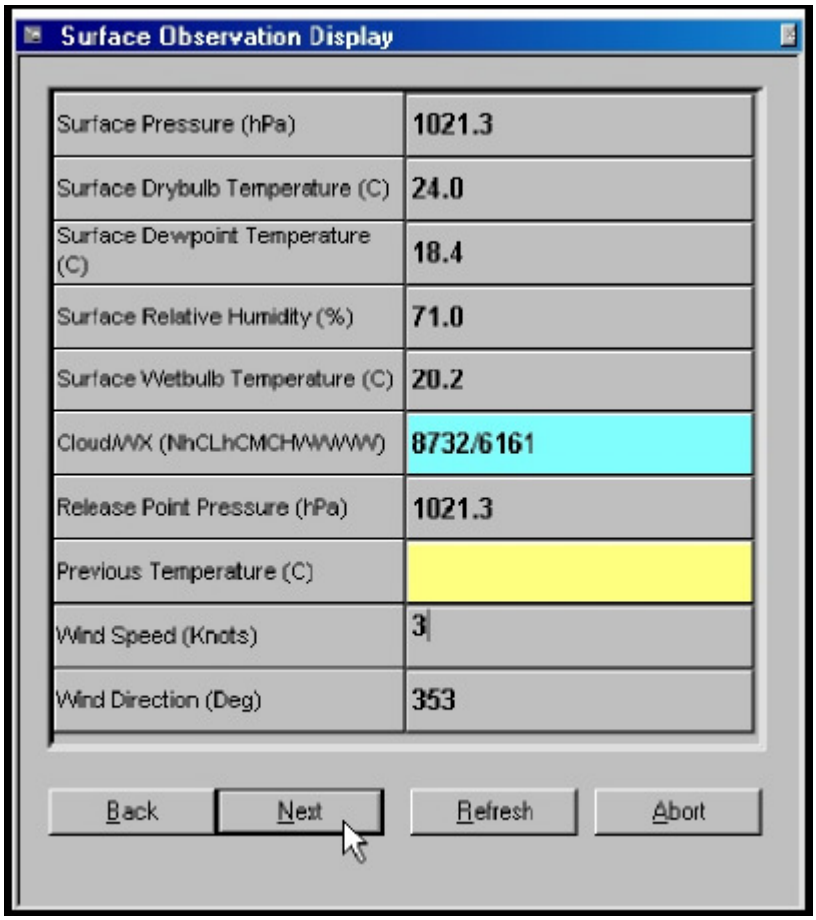


Exhibit 3-16 Surface Observation Display

NOTE: The Release Point Pressure adjusts for the elevation difference between the baseline and release points. This can be verified in the Station Data Display and validated with the Pressure Correction Table found in Chapter 13 Table 13-1.

17. The Baseline Display and the Waiting for SPS to Initialize windows appear (Exhibit 3-17). The Waiting for SPS to Initialize window will close once the SPS initializes.

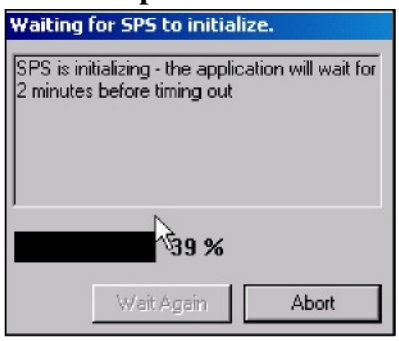


Exhibit 3-17 SPS Initialization

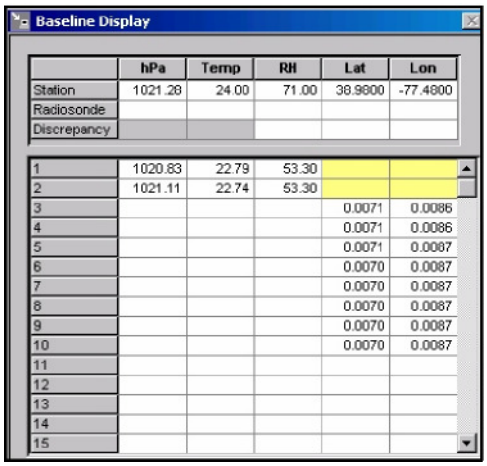


Exhibit 3-18 Start of Baseline

18. The Baseline Display will begin to be populated with data (Exhibit 3-18).

19. The GPS Status Window indicates the SPS and GPS status and the number of satellites seen by the SPS and radiosonde (Exhibit 3-19). The circles next to the SPS and GPS indicate the status of PTU data and GPS/Wind data respectively. A red circle (or minus) indicates no data, while a green circle (or plus) indicates data is being received. When a match is present, numbers appear in both cells of a single column.

    During a Simulated flight, no GPS matches are shown in the GPS Status window. Typically expect to see at least 6 matches in this window during a live flight.

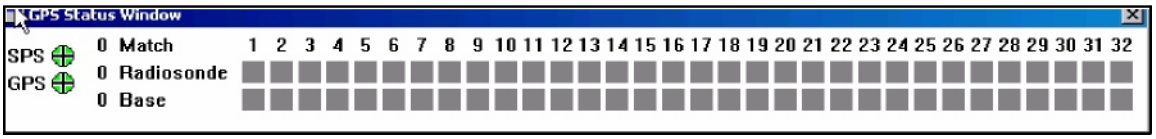


Exhibit 3-19 GPS Status Window

20. Once the PTU and GPS data have stabilized, wait 5 minutes before clicking the **Calculate** button (Exhibit 3-20). Waiting until the data has stabilized will increase the accuracy of the pressure discrepancy used for as a pressure correction. It also provides enough time for the radiosonde to acquire GPS lock. The Pressure Discrepancy must be less than ±5 hPa and the Temp and RH values should be reasonably close to the office conditions (Exhibit 3-21) Remember, there may be a significant temperature and humidity difference between the surface sensors readings and the values inside the office where the instrument is located. If readings look reasonable, click the **Accept** button (Exhibit 3-21).

NOTE: Numbers in the GPS status window indicate the signal to noise ratio. Numbers typically should be between the lower 30's and lower 50's.

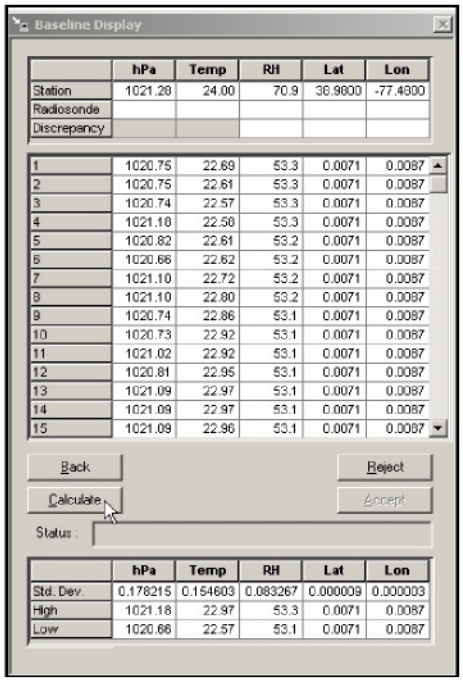


Exhibit 3-20 Baseline Ready to Calculate

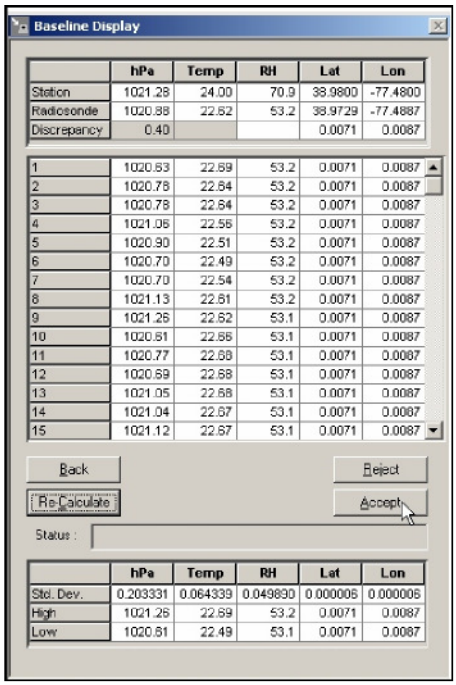


Exhibit 3-21 Baseline Calculated

21. Once the baseline has been accepted, a window will appear asking if you would like to continue. Click the **Yes** button (Exhibit 3-22).

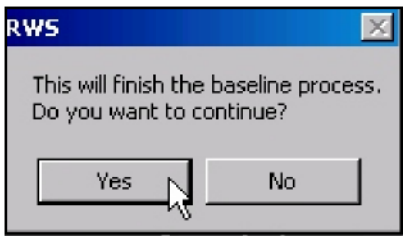


Exhibit 3-22

22. Shortly thereafter the Waiting for Balloon Release Display appears (Exhibit 3-25).

23. After Baseline is concluded, the observer should monitor the "Status Bar" at the bottom of the screen (Exhibit 3-23) to ensure the radiosonde sensors are working properly prior to leaving the office to go to the inflation building.

Exhibit 3-23 Status Bar with Current Radiosonde PTU Values

NOTE: During a live flight, the TRS Antenna would be positioned to face the direction the balloon is expected to travel. The motors should be left in "Manual" tracking mode until the instrument is released.

24. In an actual flight, RWS automatically detects release. In the simulated flight, start the flight by clicking on the Icon with the Yellow Balloon (Exhibit 3-25). The Waiting for Balloon Release Display will indicate that the release was detected.

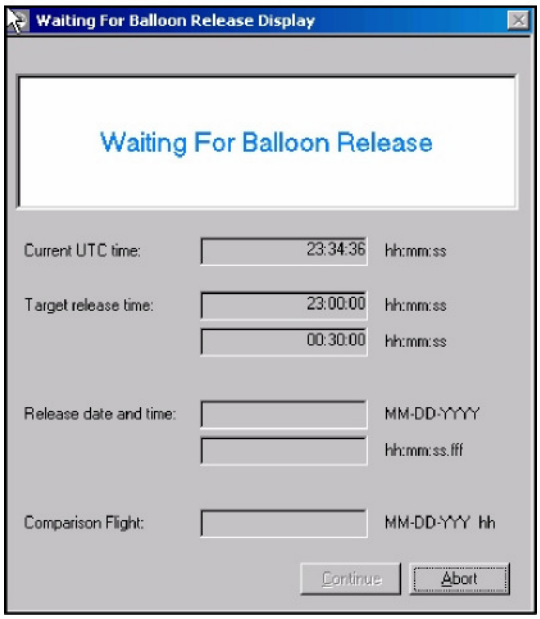


Exhibit 3-24 Waiting for Balloon Release

Exhibit 3-25 Simulate Release

25. Once the balloon release is detected, click the **Continue** button to move forward into the flight (Exhibit 3-26).

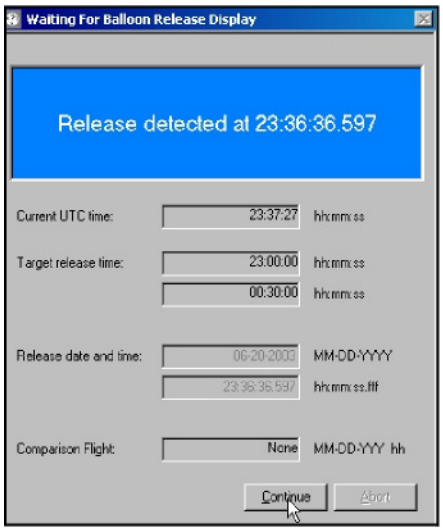


Exhibit 3-26 Release Detected

3.2.2 In-Flight Procedures

Once the radiosonde has been launched the in-flight can be divided into several main areas:

- Post release Surface Observation
- TRS Tracking
- Flight Release Detection
- Data transition from surface into flight
- Checking/Marking flight data
- Transmitting coded messages

It is important to remember there are four basic operator tasks to ensure data quality. They should normally be performed in order to ensure changes are saved.

1. Validate Surface Observation
2. Verify Release Point was selected correctly
3. Mark Data if needed.
4. Validate Termination Time and Reason.

1. The Surface Observation Display will appear after clicking the **Continue** button in the Waiting for Balloon Release Display (Exhibit 3-27). The Surface Observation Display contains the preflight surface observation and the release surface observation (RSOIS/PDB data captured at the time of release). RWS uses the release surface observation data as the first data point of the sounding. The operator may edit any block of the release surface observation except the Release Pressure. It is a derived field. Clicking **OK** will place the changes in the release surface observation into the data shown at release or at 0.0 minutes of the flight.

NOTE: Recheck the Cloud Data for accuracy. The temperature radiation correction is derived from the Cloud Data. It significantly impacts the RADAT and Coded Messages.

Surface Observation Display

	Preflight	Release
Surface Pressure (hPa)	1021.3	1021.3
Surface Drybulb Temperature (C)	24.0	24.0
Surface Dewpoint Temperature (C)	18.2	18.2
Surface Relative Humidity (%)	70.0	70.0
Surface Wetbulb Temperature (C)	20.1	20.1
Cloud/WX (NhCLhCMCHWWWW)	009000101	009000101
Release Point Pressure (hPa)	1022.5	1022.5
Previous Temperature (C)		
Wind Speed (Knots)	0.0	0.00
Wind Direction (Deg)	360	360

Back OK Refresh

Exhibit 3-27 Surface Observation

2. At the same time the Surface Observation Display appears, the Status Message Display will indicate a "Balloon release detected" message on the last line. (Exhibit 3-28)

Status Messages Display

Add Messag

UTC Tim	Flight Status Message	Comment
21:15:32.2	Flight was initiated: Date 08-26-2004; Ascension 2; Release 1.	
21:15:36.4	TRS is ready.	
21:15:37.4	Status Code: 8 - UPS is now running on on-line power supply.	
21:25:00.4	SPS has been initialized successfully.	
21:34:47.5	Radiosonde has been baselined successfully.	
21:38:03.8	No appropriate flight found for comparison.	
21:38:03.8	Balloon release detected at 21:38:03.737 UTC.	

Exhibit 3-28 Balloon Release Detected

3. After release, it takes about 90 seconds for the Processed Tabular Display to become available. During this time, a limited amount of tables are available. Once the Processed Tabular Display appears all the tables and plots are available. There are a few windows which are preferable to open after release to ensure the flight is proceeding and to make any necessary adjustments. These include:

- TRS Display
- Received PTU Tabular Display
- Processed Tabular Display
- SPS/GPS Status

NOTE: Displays and plots may be called up and viewed simultaneously by selecting Tile under the Window pull-down menu (Exhibit 3-29).

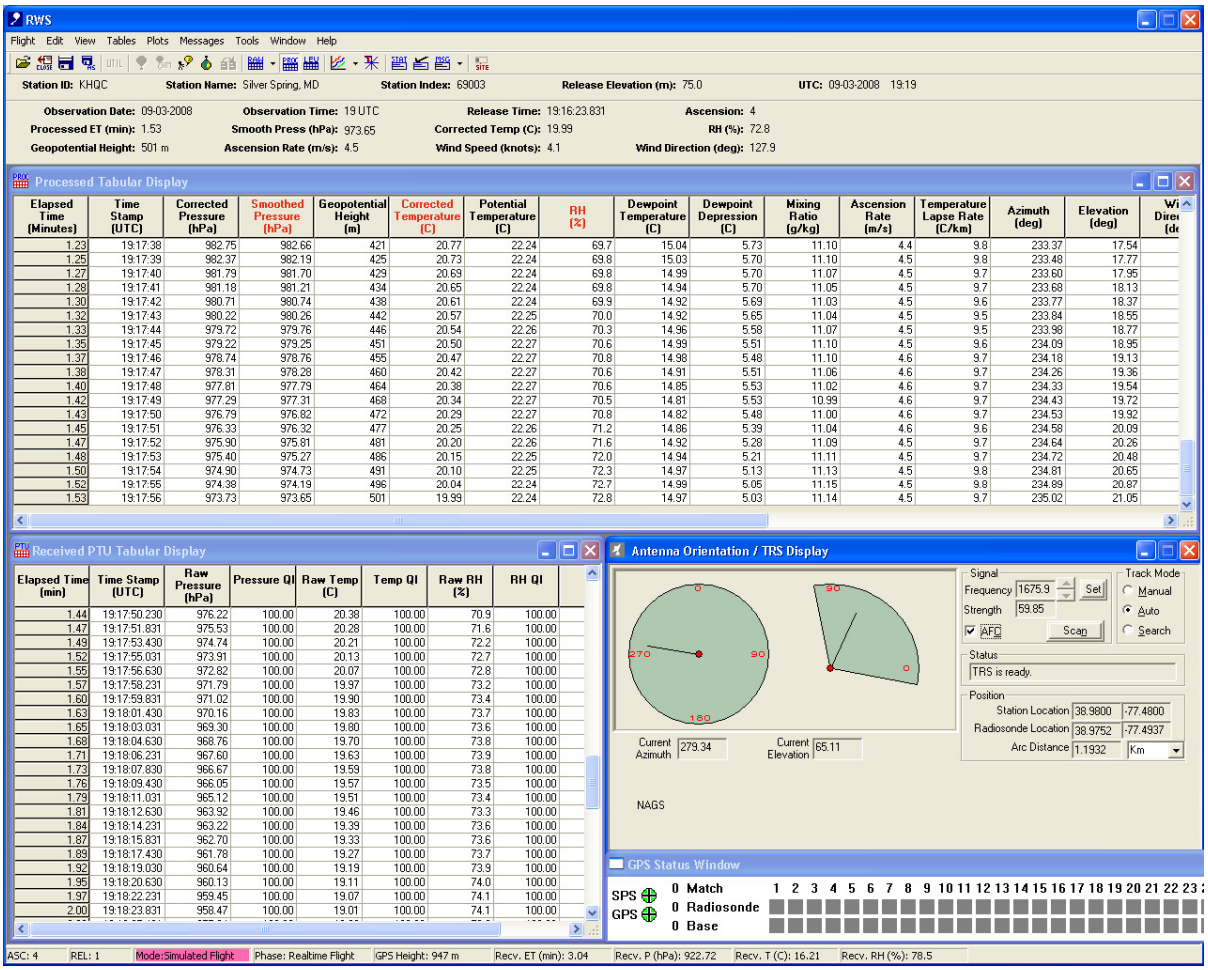


Exhibit 3-29 Initial Displays and Plots to View after Release

4. The TRS Display is the most essential display to first view (Exhibit 3-30). This display allows the operator to verify that the TRS is tracking and if necessary take corrective action. Appendix E of NWSM 10-1401 provides guidance in TRS tracking.

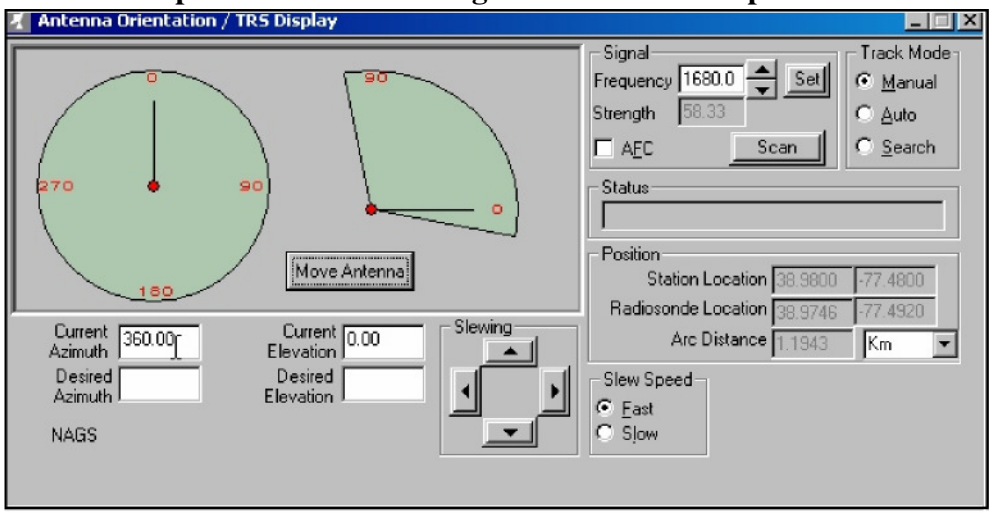


Exhibit 3-30 Antenna Orientation/TRS Display

5. Even though the software detects release it is critical that the observer verify that RWS selected the correct release point. Validating the release point is correct is typically the second task that the operator should be performed after release. Use the Received PTU Tabular Display (raw data) and Processed Tabular Display to determine if RWS detected release correctly (Exhibits 3-31 and 3-32). In the Received PTU Tabular Display, the release detection is indicated by a red line above elapsed time 0.00. The pressure data above the red line should be relatively constant (preflight) and the pressure data below the red line should show decreasing pressure (flight) In the Processed Tabular Display, the first data point (0.00) is the surface observation and the second data point (0.02) is the data from the radiosonde.

Received PTU Tabular Display

Elapsed Time (min)	Time Stamp (UTC)	Raw Pressure (hPa)	Pressure QI	Raw Temp (C)	Temp QI	Raw RH (%)	RH QI
-0.21	19:16:11.330	1021.10	100.00	22.80	100.00	53.2	100.00
-0.18	19:16:12.930	1020.74	100.00	22.86	100.00	53.1	100.00
-0.16	19:16:14.531	1020.73	100.00	22.92	100.00	53.1	100.00
-0.13	19:16:16.130	1021.02	100.00	22.92	100.00	53.1	100.00
-0.10	19:16:17.731	1020.81	100.00	22.95	100.00	53.1	100.00
-0.07	19:16:19.331	1021.09	100.00	22.97	100.00	53.1	100.00
-0.05	19:16:20.930	1021.09	100.00	22.97	100.00	53.1	100.00
-0.02	19:16:22.531	1021.09	100.00	22.96	100.00	53.1	100.00
0.00	19:16:23.831	1020.69	100.00	23.77	100.00	53.6	100.00
0.03	19:16:25.430	1020.10	100.00	23.67	100.00	53.1	100.00
0.05	19:16:27.031	1018.69	100.00	23.86	100.00	52.1	100.00
0.08	19:16:28.630	1017.55	100.00	23.86	100.00	51.6	100.00
0.11	19:16:30.230	1016.70	100.00	23.78	100.00	52.1	100.00
0.13	19:16:31.831	1015.88	100.00	23.74	100.00	52.6	100.00
0.16	19:16:33.430	1015.07	100.00	23.57	100.00	54.6	100.00
0.19	19:16:35.031	1013.40	100.00	23.54	100.00	54.9	100.00
0.21	19:16:36.630	1012.62	100.00	23.47	100.00	56.7	100.00

Exhibit 3-31 Raw PTU Tabular Data at Release

Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	Potential Temperature (C)	RH (%)
0.00	19:16:24	1022.48	1022.48	75	24.00	22.12	70.0
0.02	19:16:25	1021.37	1021.28	85	23.89	22.11	66.2
0.03	19:16:26	1020.13	1020.42	93	23.86	22.15	62.3
0.05	19:16:27	1019.25	1019.64	99	23.83	22.18	58.5
0.07	19:16:28	1018.50	1018.92	105	23.79	22.21	54.7
0.08	19:16:29	1017.82	1018.24	111	23.76	22.23	51.7
0.10	19:16:30	1017.29	1017.47	118	23.72	22.26	52.0
0.12	19:16:31	1016.77	1016.74	124	23.68	22.28	52.3
0.13	19:16:32	1016.26	1016.08	130	23.64	22.29	52.6

Exhibit 3-32 Processed Tables at Release

6. The SPS/GPS Status Window is another display that should be viewed to ensure wind computation is being performed (Exhibit 3-33). In order for GPS winds to be calculated there must be 4 or more satellites matches between the SPS (Base) and the Radiosonde. During a simulated flight, this window shows no matches. In a live flight, typically 4 – 10 matches can be expected.

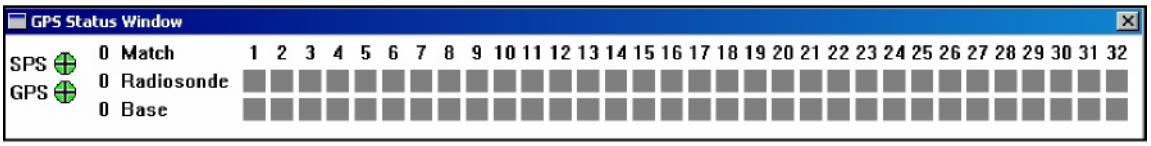


Exhibit 3-33 Simulated GPS Status Window

NOTE: Green + SPS Icon- Indicates PTU Data being received
Green + GPS Icon- Indicates Wind Data being received

7. The Temperature-RH Plot also provides a means to ensure the Temperature and RH trend lines look reasonable. (Exhibit 3-34) Any abrupt deviation in the trend lines should be verified for accuracy. If the data is bad, the operator must go in and mark the data in question in the Processed Data Set (PDS). See Chapters 5 and 11 for more information.

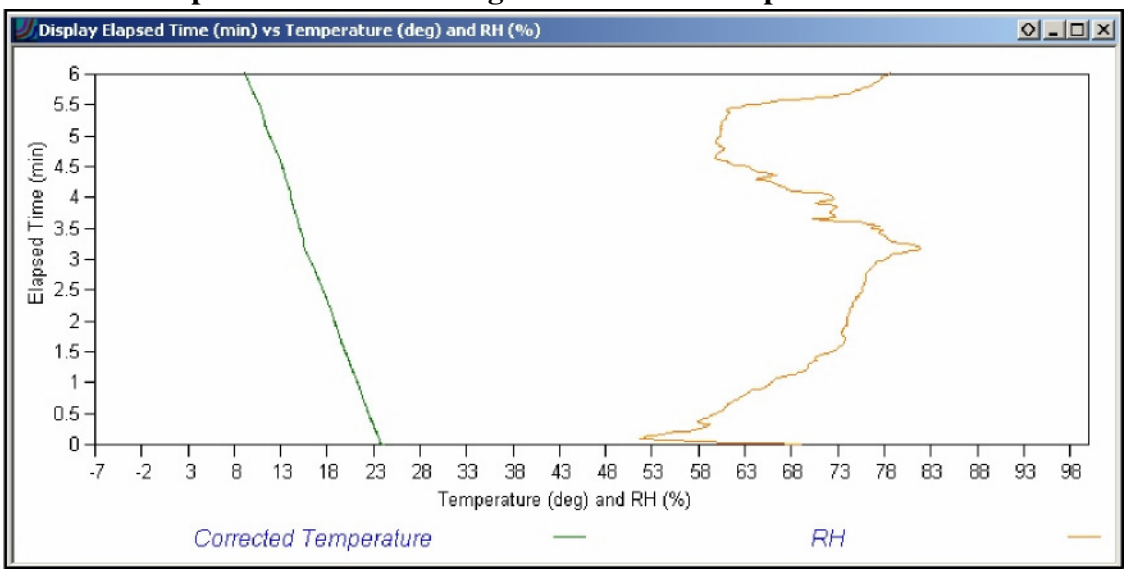


Exhibit 3-34 Temperature/RH Plot

8. If there is questionable data or possibly bad data a closer look is desired. Zoom in on the area by clicking and holding the left mouse button, while dragging over the area of interest. (Exhibit 3-35)

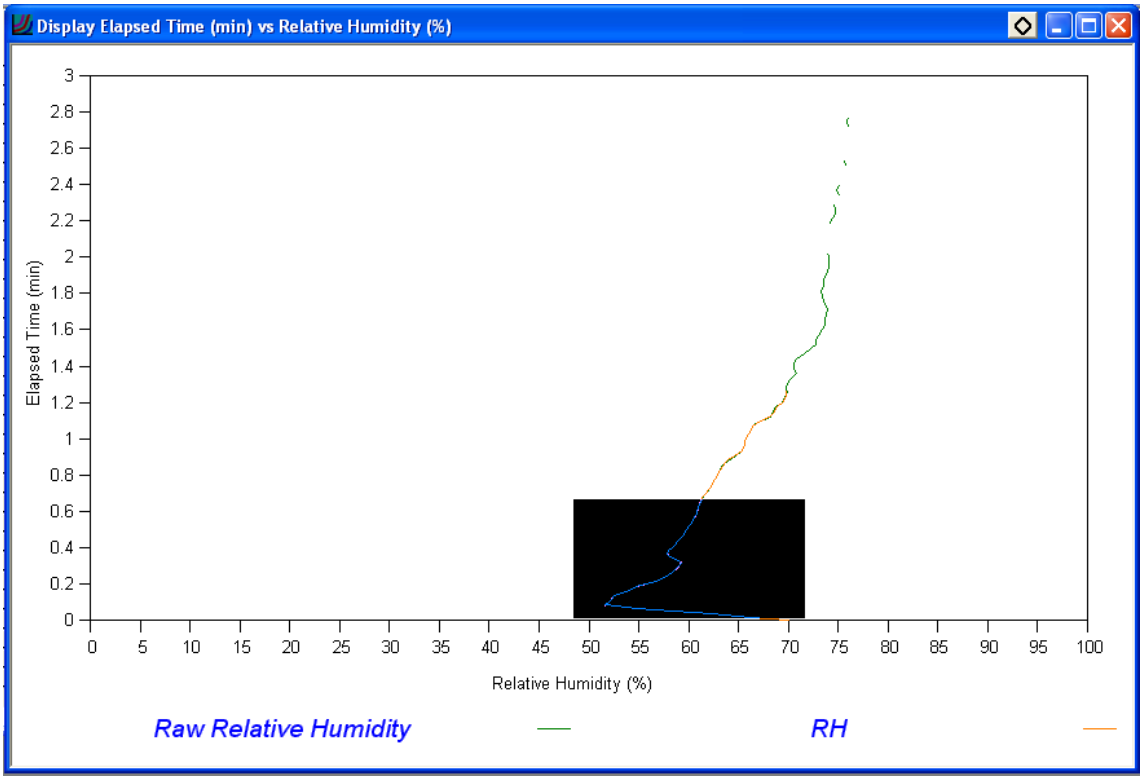
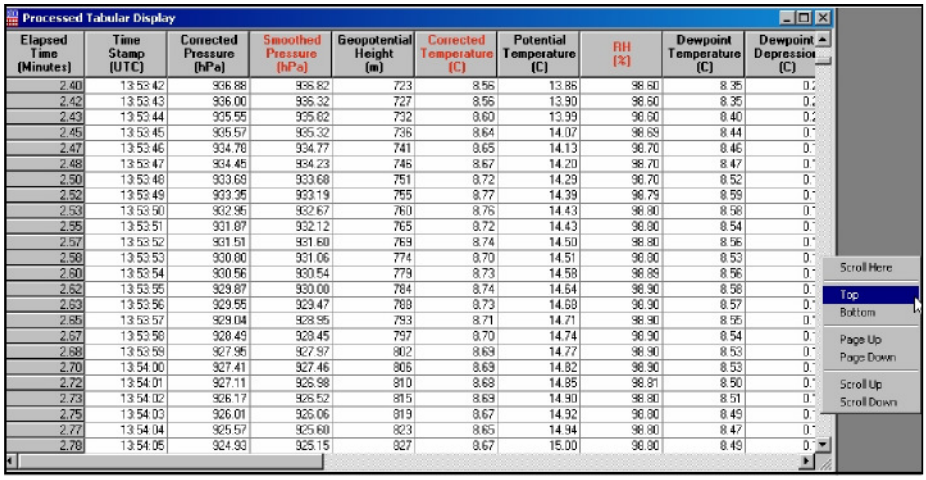


Exhibit 3-35 Expanded Temp/RH Plot Near Surface

9. Looking at the tabular data is the next step after viewing a plot and finding data that may need attention. The Processed Tabular Display is available under the Tables pull-down menu. Go to the top of the RWS Main Window and select Tables and click on **Processed**. Once the Processed Data Display appears, move the cursor to the right scroll bar and right click to select a scroll option. (Exhibit 3-36)



Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	Potential Temperature (C)	RH (%)	Dewpoint Temperature (C)	Dewpoint Depression (C)
2.40	13:53:42	936.88	936.82	723	8.56	13.86	98.60	8.35	0.2
2.42	13:53:43	936.00	936.32	727	8.56	13.90	98.60	8.35	0.2
2.43	13:53:44	935.55	935.62	732	8.60	13.99	98.60	8.40	0.2
2.45	13:53:45	935.57	935.32	736	8.64	14.07	98.69	8.44	0.1
2.47	13:53:46	934.78	934.77	741	8.65	14.13	98.70	8.46	0.1
2.48	13:53:47	934.45	934.23	746	8.67	14.20	98.70	8.47	0.1
2.50	13:53:48	933.69	933.68	751	8.72	14.29	98.70	8.52	0.1
2.52	13:53:49	933.35	933.19	755	8.77	14.39	98.79	8.59	0.1
2.53	13:53:50	932.95	932.67	760	8.76	14.43	98.80	8.58	0.1
2.55	13:53:51	931.87	932.12	765	8.72	14.43	98.80	8.54	0.1
2.57	13:53:52	931.51	931.68	769	8.74	14.50	98.80	8.56	0.1
2.58	13:53:53	930.80	931.06	774	8.70	14.51	98.80	8.53	0.1
2.60	13:53:54	930.56	930.54	779	8.73	14.58	98.89	8.56	0.1
2.62	13:53:55	929.87	930.00	784	8.74	14.64	98.90	8.58	0.1
2.63	13:53:56	929.55	929.47	789	8.73	14.68	98.90	8.57	0.1
2.65	13:53:57	929.04	928.95	793	8.71	14.71	98.90	8.55	0.1
2.67	13:53:58	928.49	928.45	797	8.70	14.74	98.90	8.54	0.1
2.68	13:53:59	927.95	927.97	802	8.69	14.77	98.90	8.53	0.1
2.70	13:54:00	927.41	927.46	806	8.69	14.82	98.90	8.53	0.1
2.72	13:54:01	927.11	926.98	810	8.69	14.85	98.81	8.50	0.1
2.73	13:54:02	926.17	926.52	815	8.69	14.90	98.80	8.51	0.1
2.75	13:54:03	926.01	926.06	819	8.67	14.92	98.80	8.49	0.1
2.77	13:54:04	925.57	925.60	823	8.65	14.94	98.80	8.47	0.1
2.78	13:54:05	924.93	925.15	827	8.67	15.00	98.90	8.49	0.1

Exhibit 3-36 Processed Tabular Display with Scroll Options

10. The Processed Data Display may be configured to show only certain parameters and also have the data points spaced at a greater time interval than 1 per second. Move the cursor inside the Processed Tabular Display and right click and select **Configuration**. Using Configuration to eliminate certain parameters not required can make quality control and data editing an easier task. (Exhibit 3-37 and Exhibit 3-38)

NOTE: Data cannot be "Marked" in data intervals greater than 1 second.

Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height	Corrected Temperature	Potential Temperature	RH (%)	Dewpoint Temperature	Dewpoint Depression
2.93	21:41:00	926.71	926.53	914	16.35	22.73	77.0	12.32	4.03
2.95	21:41:01	926.05	925.93	920	16.30	22.73	77.1	12.29	4.01
2.97	21:41:02	925.41	925.33	925	16.24	22.73	77.4	12.28	3.96
2.98	21:41:03	924.82	924.71	931	16.19	22.73	77.8	12.31	3.88
3.00	21:41:04	924.15	924.09	937	16.14	22.74	78.1	12.33	3.81
3.02	21:41:05	923.49	923.48	942	16.08	22.73	78.4	12.33	3.75
3.03	21:41:06	922.95	922.87	948	16.02	22.73	78.5	12.28	3.74
3.05	21:41:07	922.20	922.27	954	15.96	22.72	78.6	12.24	3.72
3.07	21:41:08	921.32	921.68	959	15.90	22.72	78.7	12.21	3.69
3.08	21:41:09	920.85	921.06	965	15.84	22.71	79.2	12.24	3.60
3.10	21:41:10	920.40	920.44	970	15.78	22.71	79.7	12.28	3.50
3.12	21:41:11	919.96	919.80	976	15.73	22.71	80.2	12.33	3.41
3.13	21:41:12	919.47	919.15	982	15.68	22.72	80.9	12.41	3.27
3.15	21:41:13	918.90	918.51	988	15.63	22.73	81.6	12.50	3.13
3.17	21:41:14	918.04	917.88	994	15.60			12.53	3.07
3.18	21:41:15	917.25	917.24	1000	15.57			12.49	3.08
3.20	21:41:16	916.50	916.60	1006	15.55			12.40	3.14
3.22	21:41:17	915.83	915.95	1012	15.53			12.37	3.16
3.23	21:41:18	915.13	915.28	1018	15.51			12.28	3.22
3.25	21:41:19	914.37	914.62	1024	15.49			12.13	3.36
3.27	21:41:20	913.85	913.96	1030	15.47	22.99	79.7	11.98	3.49
3.28	21:41:21	913.36	913.31	1037	15.46	23.04	79.0	11.85	3.62

Legend
Hide/Show Preflight Data
Configuration
Save Data in a File
Print Tabular Data
Apply User Edits

Exhibit 3-37 Configuring Processed Tabular Display

- **Elapsed Time**
- Time Stamp
- Corrected Pressure
- **Smoothed Pressure (Editable)**
- **Geopotential Height**
- **Corrected Temperature (Editable)**
- Potential Temperature
- **RH (Editable)**
- Dewpoint Temperature
- Dewpoint Depression
- Mixing Ratio
- **Ascension Rate**
- Temperature Lapse Rate
- **Corrected Azimuth**
- **Corrected Elevation**
- Wind Direction
- Wind Speed
- Wind U Component (Editable)
- Wind V Component (Editable)
- Radiosonde Latitude (Editable)
- Radiosonde Longitude (Editable)
- **Geometric Height**
- Arc Distance

Exhibit 3-38 Processed Tabular Display columns

NOTE: The items from Exhibit 3-38 that are in bold are considered essential to taking timely corrective action during a flight.

11. Marking data requires a left click on the appropriate columns in which changes are desired. If data is bad or questionable, click on the appropriate column and drag over the desired interval of time to mark the data. Finally, right click inside the window and click on **Apply User Edits.** (See Exhibit 3-39) After the edits are completed, if a need to adjust or unmark some of the data, click on the appropriate area or areas, the color should change blue back to white. Then click on Apply User Edits. Data marked for less than a minute will be interpolated. See Chapters 5 and 11 for more information.

NOTE: Marking data should be done after verifying the Surface Observation and Release Point. This is the 3rd operator task typically performed. All data marking will be lost if the Surface Observation or Release Point is changed after marking data.

Processed Table Columns

Potential Temperature (C)	RH (%)	Dewpoint Temperature (C)	Dewpoint Depression (C)
22.12	70.0	18.19	5.81
22.06	66.2	17.15	6.69
22.11	62.3	16.19	7.63
22.14	58.5	15.17	8.61
22.16	54.7	14.09	9.66
22.18	51.7	13.19	10.52
22.21	52.0	13.24	10.44
22.23	52.3	13.29	10.34
22.24	52.6	13.34	10.25
22.25	53.3	13.51	10.03
22.25	54.0	13.67	9.82
22.25	54.8	13.82	9.61
22.25			9.33
22.25			9.04
22.25			8.84
22.25			8.71
22.26			8.63
22.26			8.51
22.26			8.43
22.27	53.2	14.68	8.38
22.27	58.7	14.50	8.51
22.27	58.1	14.30	8.67
22.26	57.9	14.20	8.72
22.26	58.0	14.18	8.69
22.25	58.3	14.22	8.60

Legend
Hide/Show Preflight Data
Configuration
Save Data in a File
Print Tabular Data
Apply User Edits

Exhibit 3-39 Example of Marking Data

12. Go to the top of the RWS Screen display and select Plots. Under the Plots select the Temperature Plot. Exhibit 3-40 reflects the changes to the Processed Data Set when marking Temperature and RH data from 8.0 to 11.0 minutes.

NOTE: When more than 1 minute is marked, the plotted and tabular data will be missing. However, missing data will not be reflected in the coded messages until the missing data is > 20 hPa of PTU or > 1500 meters of winds data.

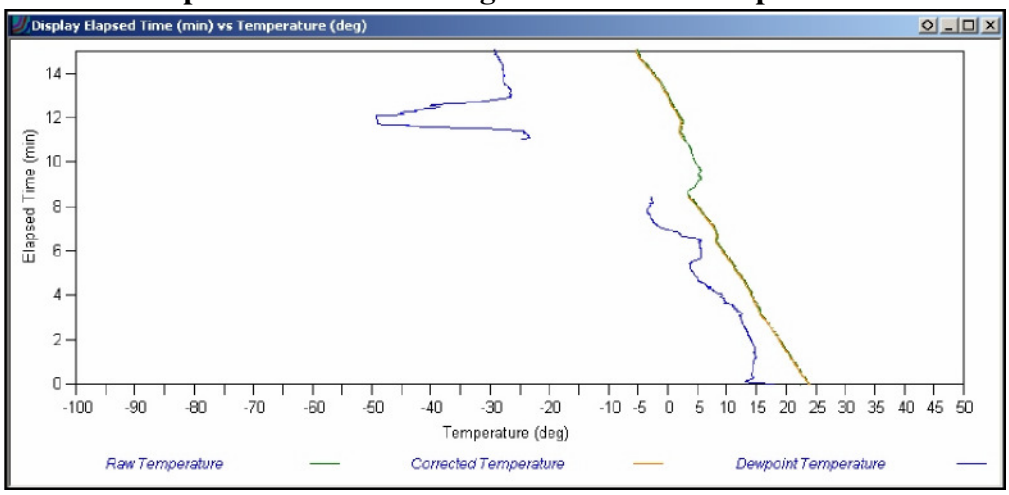


Exhibit 3-40 Temperature plot with Deleted Data

13. You may wish to mark all the editable data. This can be accomplished by clicking and dragging on the Elapsed Time Column of the Processed Tabular Data Display. (See Exhibit 3-41)

.

Processed Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	RH (%)
2.83	929.59	886		
2.85	929.06	891		
2.87	928.53	896		
2.88	928.00	901		
2.90	927.48	905		
2.92	926.95	910		
2.93	926.42	915		
2.95	925.90	920		
2.97	925.37	925		
2.98	924.84	930		
3.00	924.32	934		
3.02	923.79	939	16.06	78.4

Exhibit 3-41 Marking All Data

14. Exhibit 3-42 is the subsequent Temperature and RH Plot with the missing data from minute 1 to 3 minutes that was marked missing from Exhibit 3-41.

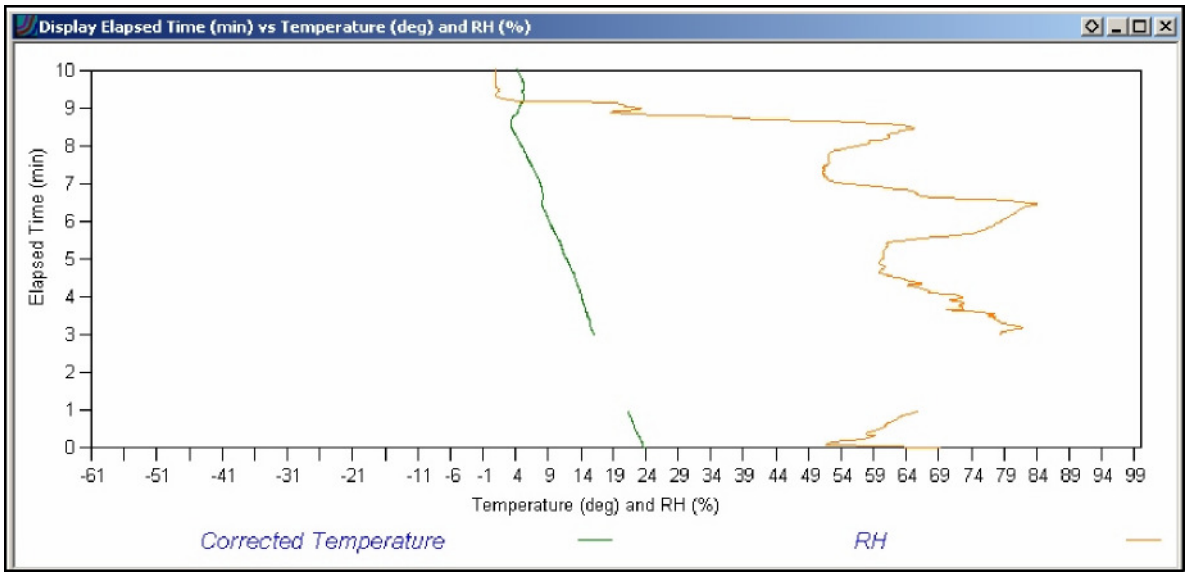


Exhibit 3-42 Temperature and RH Deleted from Minute 1 to Minute 3

15. Besides using the plot displays, the Check and Status Messages may provide assistance in finding areas of the flight that have questionable or bad data. The Check Messages are designed to alert the operator of unusual or abnormal flight occurrences (Exhibit 3-43). The Check and Status Messages however do not catch all flight problems and the operator must use these alerts in conjunction with the plots and other tools to monitor the flight. See Chapter 11 for more information

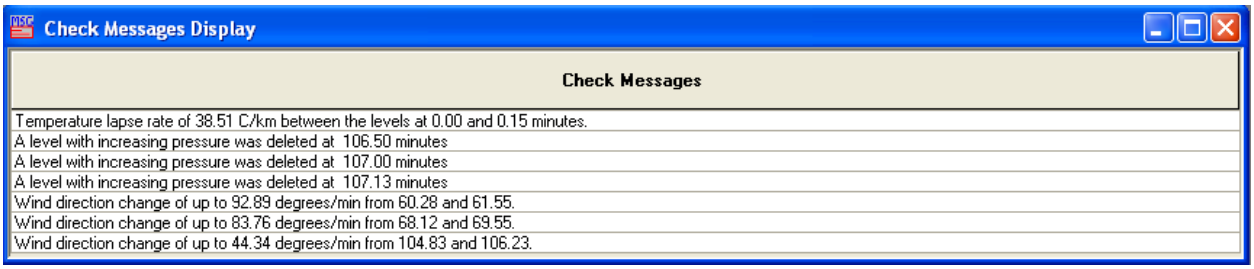


Exhibit 3-43 Check Messages

16. Status Messages provide information on flight events (Exhibit 3-44). There are some Status Messages such as Balloon Descending and Re-ascending messages that alert the observer that a closer look at the data is required to determine if some data must be edited or deleted.

Status Messages Display

Add Messag	
UTC Tim	Flight Status Message
21:15:32.2	Flight was initiated: Date 08-26-2004; Ascension 2; Release 1.
21:15:36.4	TRS is ready.
21:15:37.4	Status Code: 8 - UPS is now running on on-line power supply.
21:25:00.4	SPS has been initialized successfully.
21:34:47.5	Radiosonde has been baselined successfully.
21:38:03.8	No appropriate flight found for comparison.
21:38:03.8	Balloon release detected at 21:38:03.737 UTC.
21:44:34.2	Successful release.
22:03:07.5	Coded Messages were generated.
22:03:08.1	The RADAT message has been generated.
22:14:55.4	Coded Messages were generated.

Exhibit 3-44 Status Messages

17. The Coded Messages and RADAT are automatically coded at 400 hPa for RADAT, 70 hPa for TTAA, TTBB, and PPBB Messages and at Flight Termination for TTCC, TTDD, and PPDD. The observer can also initiate the **Code** command at anytime during the flight by selecting **Code** under the **Messages** pull-down menu.

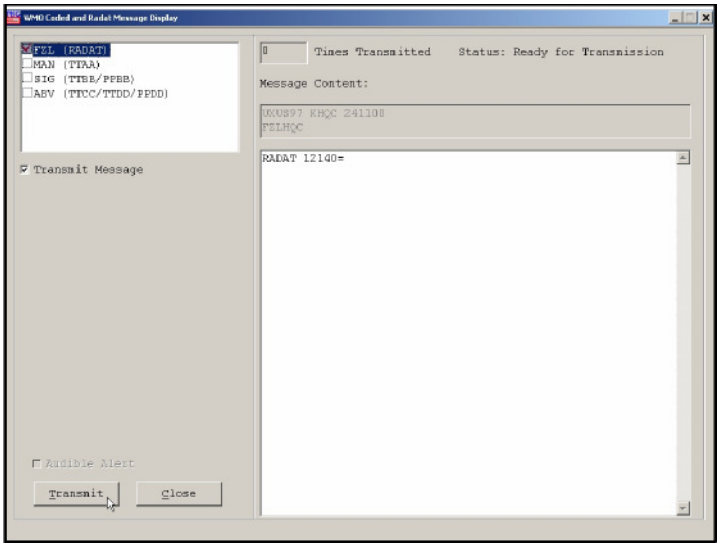


Exhibit 3-45 RADAT Message

18. The MAN (TTAA), SIG (TTBB and PPBB), and the ABV (TTCC, TTDD, and PPDD) can be coded (Exhibit 3-45). WMO message transmission is not allowed during simulated flight. Exhibit 3-46 shows examples of partial MAN and SIG messages. Chapter 8 provides more detailed information on groups within the coded messages.

```
69003 TTAA  74014 69003 99022 24056 00000 00269 22458 12503
92941 16439 12007 85656 12458 10004 70255 05699 01014 50592
11577 05523 40759 24778 06029 88999 77999 31313 08708 80031
51515 10159 10164 00007 10194 11005 01008=

69003 TTBB  74010 69003 00022 24056 11018 23861 22974 20050
33919 15831 44918 15831 55861 13058 66860 13058 77838 11457
88831 11057 99823 10244 11799 08428 22796 08225 33791 08456
44778 08059 55776 07859 66753 05659 77733 03656 88722 04471
99715 05071 11712 05489 22711 05695 33709 05699 44700 05499
55674 04099 66659 02676 77654 02276 88643 02499 99640 02499
11622 00890 22611 00276 33609 00076 44569 04774 55563 04974
66540 06777 31313 08708 80031 41414 00900 51515 10159=

PPBB  74010 69003 90012 00000 12502 10506 90346 12007 11507
08505 90789 00507 34511 36012 91123 01014 35517 35512 91468
04520 04021 03022 919// 06024 92012 04523 04530 06528 925//
06530=
```

Exhibit 3-46 Partial MAN and SIG Coded Messages

19. The Trajectory Plot is a plot of the radiosonde position in relation to the TRS using the radiosonde GPS data (Exhibit 3-47). It can be useful in aligning the TRS azimuth with the radiosonde position. This plot is less accurate when the radiosonde is < 5 km from the TRS. Since this plot is created from GPS data it will be blank when the GPS data are missing.

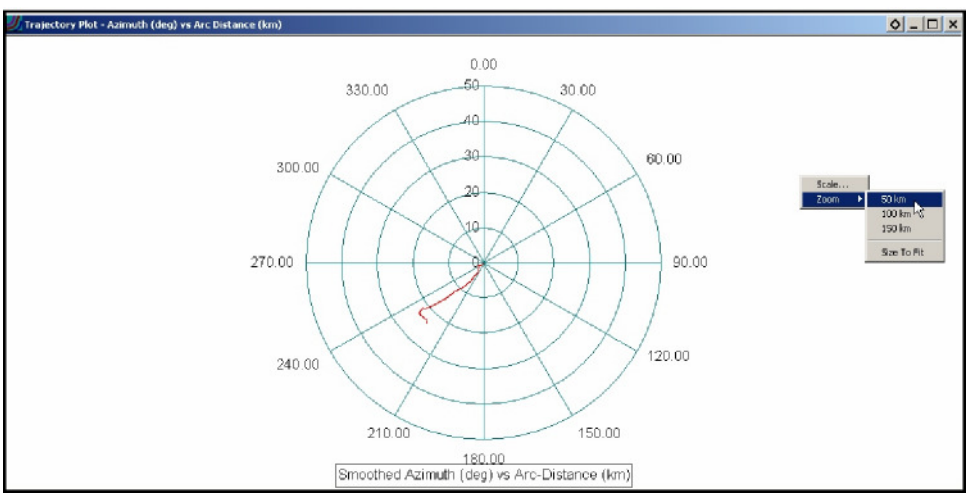


Exhibit 3-47 Trajectory Plot with Zoom Option

20. Another valuable tool for gathering flight information during and after the flight is concluded is the Flight Summary. To open the Flight Summary click on the **View** pull-down menu and select **Flight Summary** (Exhibit 3-48).

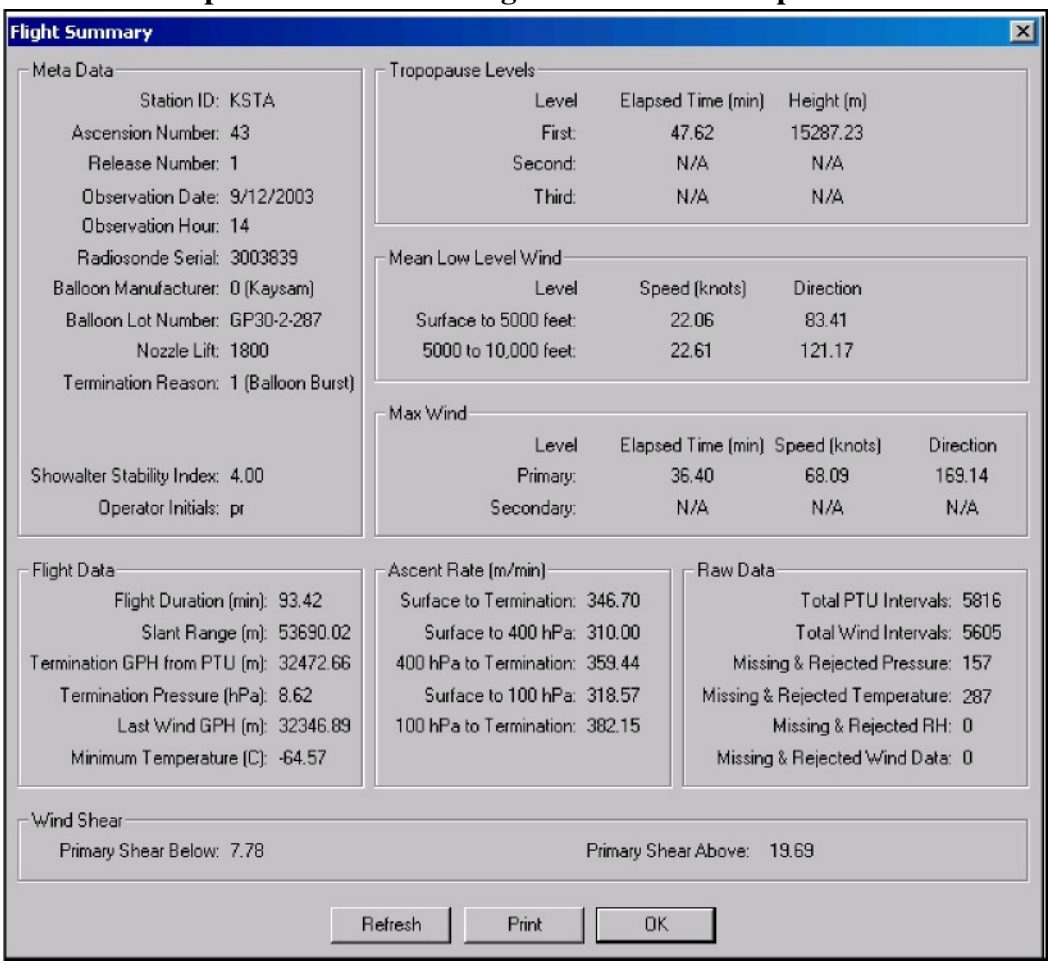


Exhibit 3-48 Flight Summary Displays

21. For convenience, RWS allows operators to save the arrangement of the currently open windows, known as a workspace. Several workspaces can be saved for use during various portions of the flight. Experiment with the windows and their options, as well as the Tile and Cascade functions to create useful workspace. To save the workspace, click **Save Workspace** from the **Flight** pull-down menu (Exhibit 3-49).

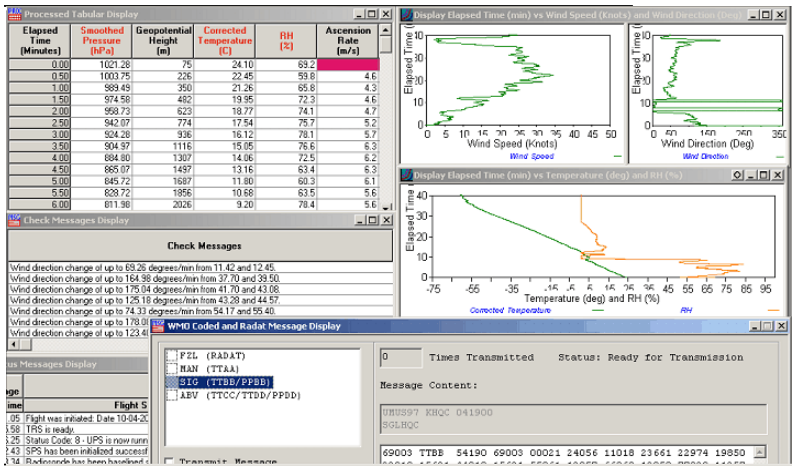


Exhibit 3-49 Tiled Displays and Plots Selected by Observer

3.2.3 Flight Termination

RWS will automatically detect termination and assign a reason for termination. The operator may also manually terminate the flight prior to the automatic termination. Once the flight is terminated, the operator should review and change, if necessary, the point of termination and the termination reason. To change the termination time or reason, select **Termination Time** or **Termination Reason** from the **Tools** pull-down menu. Validating the Termination Time and Reason is the final major operator task that should normally be performed.

NOTE: The observer may not change the termination time later than the time determined by the software.

Chapter 3 – Simulated Flight – Overview of Operations

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4.RRS Observation – Preflight / Release Sequence

4.1 Introduction

This chapter describes the prerelease sequence of a RRS upper air observation. (Chapter 3 provides an introduction to entering this data using the Simulated Flight option.)

The prerelease sequence consists of six steps:

a. Turning on Power to the TRS
b. Preparing Balloon and Flight Train during TRS warm-up
c. Preparing the Radiosonde
d. Completing the Preflight
e. Baselining the Radiosonde
f. Launching the Balloon

The following sections deal with these steps.

4.2 Turning on Power to the TRS

1. Turn on the RRS workstation and log in using your assigned Username and Password.

2. The RWS Window will appear with the Security Warning message. Read the message and click on the OK button.

3. Flight Options Window appears. Select "**Run a live flight"**.

4. To power on the TRS, the observer should click **Yes** button in the prompt to power on the UPS. The UPS provides uninterrupted power to the TRS & SPS.

5. Once the UPS has been powered on, multiple pop-up UPS Status messages will appear along with corresponding Status Messages (Exhibit 4-1). The Hardware Status display will indicate a green check mark for the UPS after it is powered on.

   The normal UPS message sequence is:
   1. UPS had been turned off.
   2. UPS is now running on battery. (Indicates the UPS battery is powering the TRS)
   3. UPS is now running on on-line power supply. (Indicates the on-line power supply is powering the TRS)

Status Messages Display

Add Messag

UTC Tim	Flight Status Message	Comment
12:38:10.	Flight was initiated: Date 02-03-2005; Ascension 7; Release 1.	
12:38:15.	TRS is ready.	
12:38:15.	Status Code: 8 - UPS is now running on on-line power supply.	

Exhibit 4-1 UPS Status Messages

6. After the UPS is powered on, the TRS may perform both Motor Warm-Up Operations and an Initialization or simply just an Initialization, depending on the outside ambient temperature. The TRS Display, Status Messages and Hardware Status will indicate which process the TRS is performing (Exhibit 4-2, 4-3, 4-4). The Hardware Status and TRS Display will indicate either:

    - TRS reset warm-up in progress (Usually preformed in ambient temperatures below 50°F)
    - TRS reset initialization in progress. (Always preformed before a flight)
    - TRS is Ready. (When the initialization has completed)

Hardware Status

UPS — Power:On line Power, Battery Capacity(%): 95.00 — Power On/Off UPS

SPS — Reset — Online - Waiting for RWS to initialize SPS...

PTU — No data until baseline.

GPS — No status until baseline.

RSOIS — Receiving data

PDB — 0x0200

TRS — Reset — Receiving data — Command

Line Replaceable Units — 0000000000

SCA	000000	MCU	00000000
Receiver	000000	Scanner	0000
Local CDU	000000	Remote CDU	000000
Power Supply	Voltage OK		

LAN — Connection Made

MODEM — Modem unavailable.

PRINTER — Test — Unknown

Disk Space — 13251 MBytes of available disk space — Close

Exhibit 4-2 Hardware Status Window

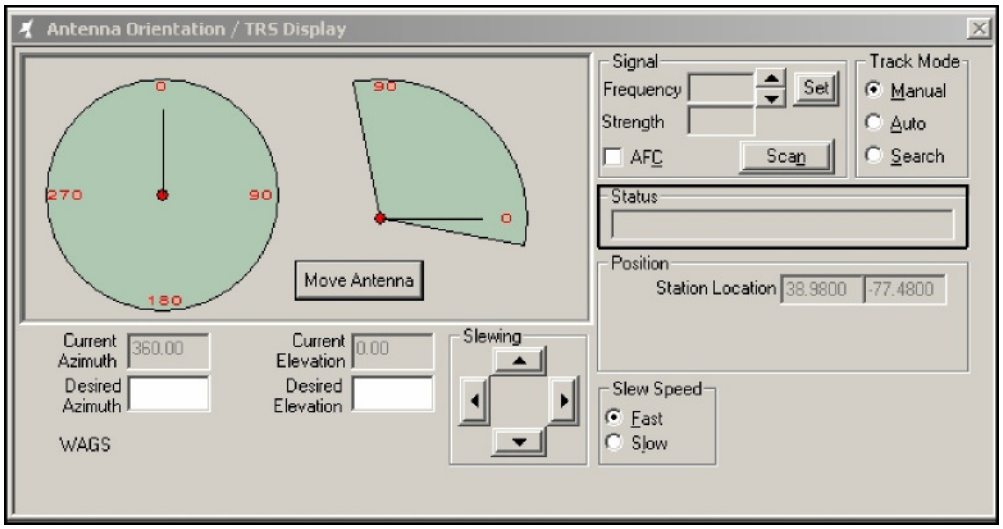


Exhibit 4-3 Status Bar within the Antenna Orientation/TRS Display

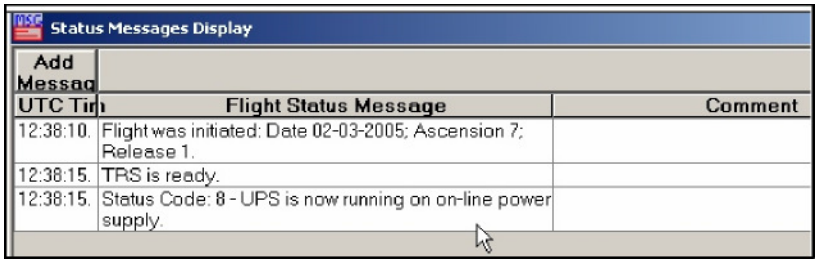


Exhibit 4-4 TRS Status Messages

7. In addition to the TRS Display messages, the Status Messages will indicate, "TRS is ready". Once the TRS completes warm-up/initialization, the Hardware Status display will indicate a green check mark for the TRS.

NOTE: The motor warm-up operations and the initialization can take longer than 20 minutes to complete. This is a convenient time for the observer to prepare the balloon and flight train.

4.3 Preparing Balloon and Flight Train during TRS warm-up

Prepare balloon and flight train in accordance with NWS Manual 10-1401 Appendix D: Pre-Observation Preparations

NOTE: Be sure to allow for enough time for equipment warm-up prior to beginning the Pre-release sequence. In cold temperatures, this may require more than 20 minutes. The warm-up begins after the UPS is turned on. The TRS equipment should be turned on at least 30 minutes before baseline.

4.4 Preparing the Radiosonde

Prepare radiosonde and battery in accordance with NWS-10-1401 Appendix N: Radiosonde Preparation and Battery Water Disposal

4.5 Completing the Preflight Information

Preflight information includes information about the time, flight equipment, radiosonde, and surface weather

1. Once the Status Messages indicate that the TRS is ready, (Exhibit 4-5) move the antenna to the baseline position using the TRS Display in both the azimuth and elevation before filling in the Administrative Data Display (Exhibit 4-6). This verifies the TRS did successfully complete initialization.

NOTE: If the TRS will not move in either the Azimuth and/or Elevation, reset the TRS in the Hardware Status Window. Then reattempt moving the TRS after it completes initialization.

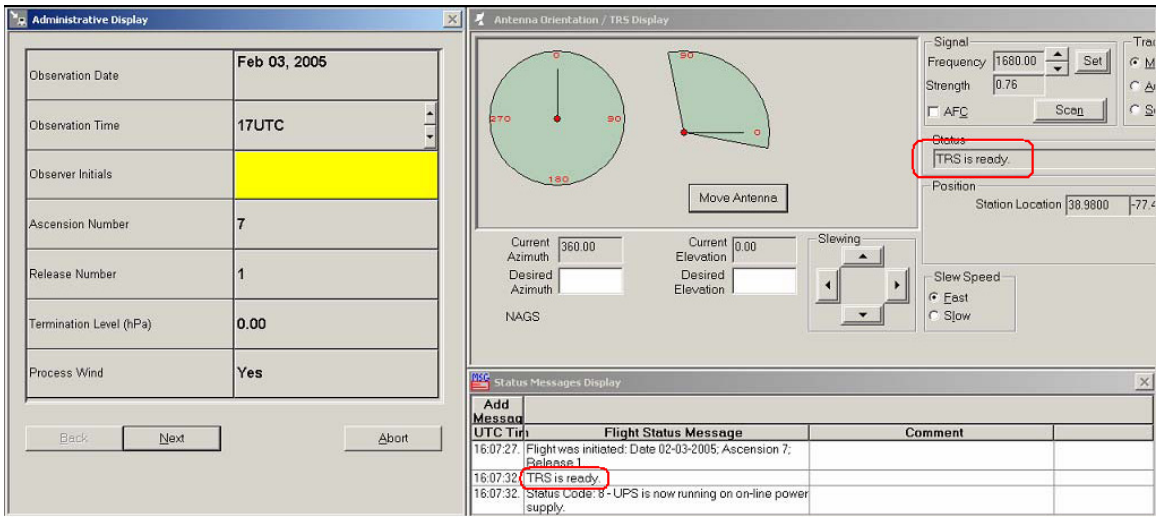


Exhibit 4-5 Status Message indicating the TRS initialization is successful

NOTE: The TRS does not require a preflight antenna alignment. The equipment should start with the antenna pointing North and at 0 degrees elevation. If it does not, review Appendix D and advise maintenance staff.

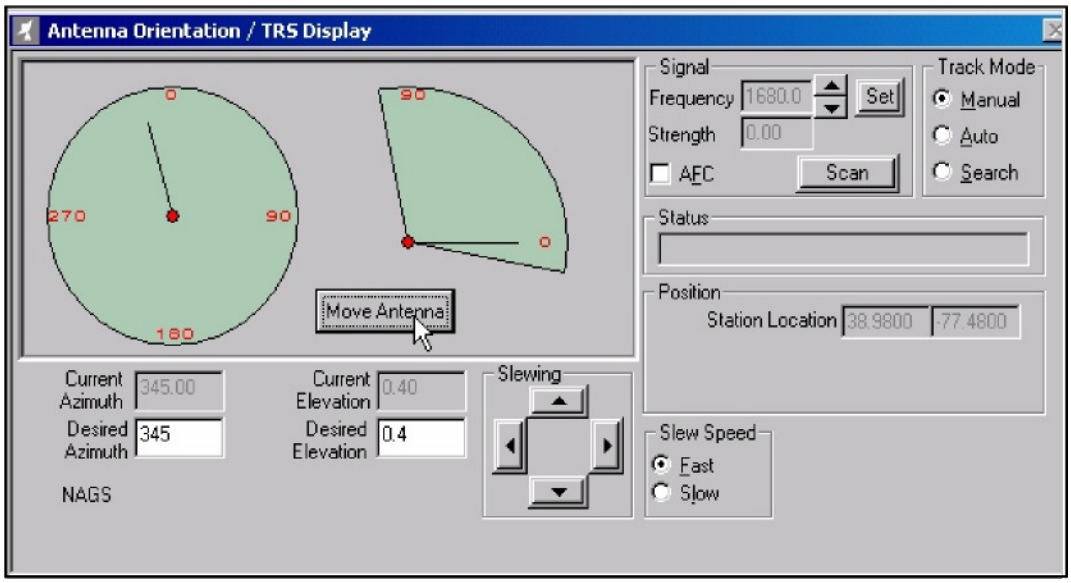


Exhibit 4-6 Move Antenna Prior to Baseline

NOTE: The Desired Azimuth and Desired Elevation fields are grayed out until the TRS has initialized or the antenna is in the auto mode. See the field on the TRS display for status messages which indicate what step in the startup process the antenna is at.

2. The Administrative Data Display's blocks for Date and Time are set automatically from the workstation date and time set. This time is updated automatically by Windows. The clock must be set to Universal Time Coordinated (UTC). (Exhibit 4-7)

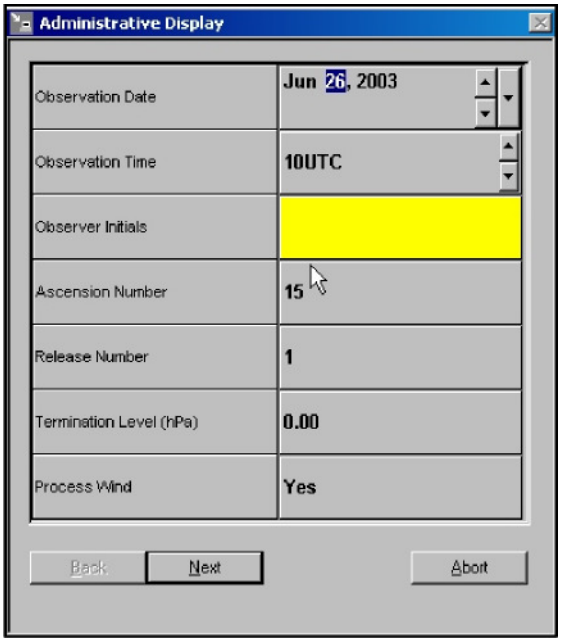


Exhibit 4-7 Date/Time Entries

3. If necessary, click on the up or down arrows in the Date and Time blocks to alter the entries provided by the software. The Date block allows the operator to select a date from a calendar. An error message will appear, if the entries are not within an hour of the time the software indicates. (Exhibit 4-8)

Exhibit 4-8 Date/Time Alert

4. When entering your initials, the software requires a minimum of 2 and up to a maximum of 4 letters. It will not allow numbers or any other deviations.

5. The Ascension Number is automatically entered by the software and cannot be altered. The release number is triggered by the software and will update if a flight terminates early and the observer elects to do another release. The software will allow a maximum of 3 releases with the same ascension number.

6. The Termination Level allows the observer to preselect a manual termination pressure (non-synoptic flights only). This cell allows only entries between 0.00 hPa to 400 hPa. Entering a termination pressure prior to reaching 400 hPa will not be accepted. Any entries outside this range will generate an error message alerting the observer

7. The Process Wind block default is "Yes". After clicking the **Next** button the Equipment Display appears. (Exhibit 4-9)

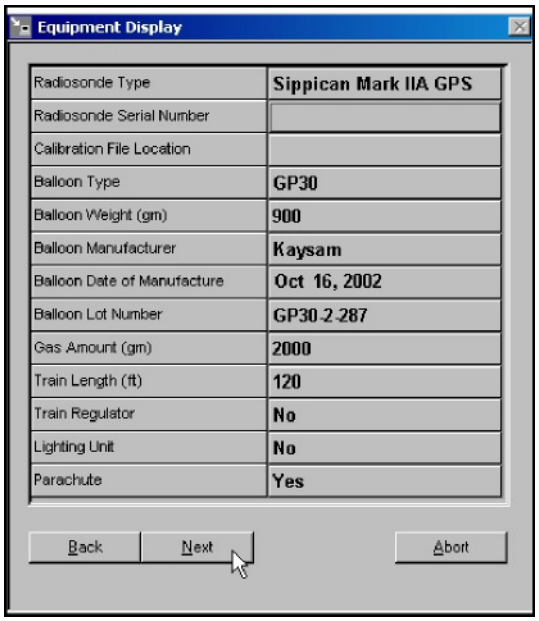


Exhibit 4-9 Equipment Display

8. The Equipment Display provides detailed information of the radiosonde, balloon, amount of gas, and the flight train. All this information is useful when analyzing the flight data.

9. The Radiosonde Type block is defined in the Station Data file entry and is not editable in preflight.

10. The Radiosonde Serial Number block should be filled with the appropriate number on a label at the bottom of the radiosonde.

11. The Calibration File Location block does not need to be filled. The instrument transmits the calibration data during baseline.

12. Select Balloon Type from the clickable drop-down. (Exhibit 4-10)

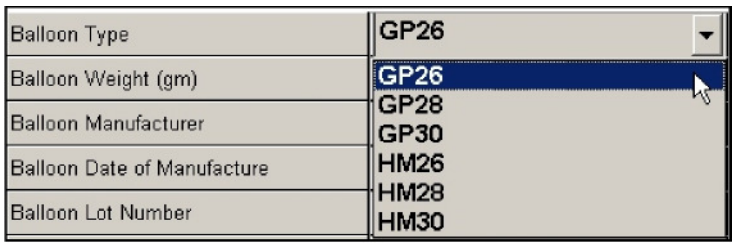


Exhibit 4-10 Balloon Type Dropdown

13. The Balloon Weight block requires an entry of 300 to 2500 grams. When the Balloon Type is entered, the appropriate weight is automatically entered. The entry may be edited. Any entries outside this range will generate an error message and are not accepted

14. The Balloon Manufacturer block allows the operator to choose from a drop-down list. (Exhibit 4-11)

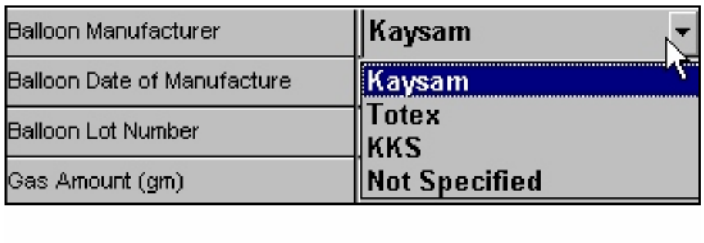


Exhibit 4-11 Balloon Manufacturer Options

NOTE: Select Totex for Kaymont Balloons

15. The Date of Manufacture block has an up/down arrow that may be used after placing the cursor over the Month, Date, or Year and then clicking the up or down arrow. (Exhibit 4-12)

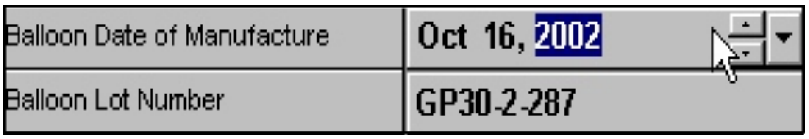


Exhibit 4-12 Date of Manufacture/Balloon Lot Number

16. The Date of Manufacture and the Lot Number block are related. The breakdown for the Balloon Lot Number is:

TTSS-Y-DDD

TT - Type of balloon only allowable entries are:

GP - General Purpose
HM - High Modulus

SS - Size of the balloon is what minimum burst altitude is expected from the balloon in kilometers (km). Acceptable entries are:

26 - 26 km balloon either GP or HM
28 - 28 km balloon either GP or HM
30 - 30 km balloon either GP or HM

Y - The last digit in the year of manufacture. Example: 2003 would be 3

DDD - The Julian date for the date of manufacture. (Beginning from the first of the year)

Example: The Julian date for April 8th for a non-leap year would be 98. January (31 days), February (28 days), March (31 days) and 8 days in April.

17. The Gas Amount block is the grams of "**Nozzle Lift**" placed in the balloon. Acceptable values are 300 to 5000; anything else will generate an error message.

Nozzle Lift: Is the total amount of gas placed in the balloon minus the gas required to lift the balloon by itself. Typically this value will be 1300 to 2000 depending on the weather conditions and type of radiosonde used.

18. Train Length block - Values entered must be between 70 and 120 feet.

19. Train Regulator, Lighting Unit, and Parachute are all entries that require either a Yes or No. If you click inside the block a down arrow will appear. Click the desired response

NOTE: All sites are required to use a parachute unless a special waiver has been granted by WSH. Sites granted waivers are extremely remote sites in the Alaskan and Pacific Regions

20. Click **Next** at the bottom of the Equipment Display

21. The Surface Observation Display appears. If it is initially blank, it may be populated by manually entering data or clicking the **Refresh** button to have the values from RSOIS and the PDB entered into the blocks. (Exhibits 4-13 and 4-14) RRS Sites without an RSOIS should enter the data from the local ASOS. For calm winds, enter the wind direction as "360" with a wind speed of "0".

NOTE: Surface Wetbulb is derived – there is no need to manually input this value

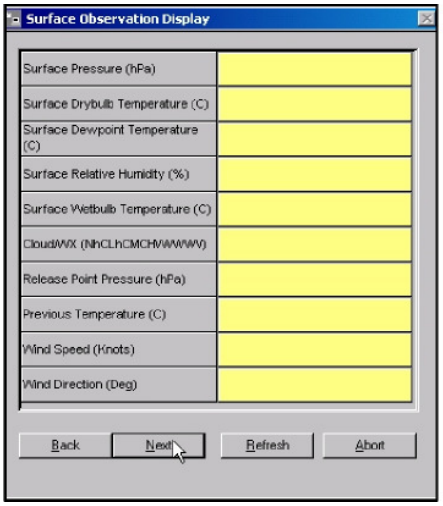


Exhibit 4-13 Blank SFC Observation Display

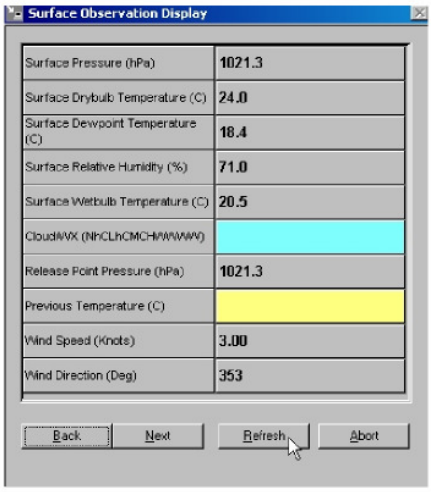


Exhibit 4-14 Refreshed SFC Observation Display

22. Entering the blocks manually provides the observer with feedback and error messages if the entries are outside the acceptable range.

Acceptable Ranges	
Surface Pressure :	750 to 1070 hPa
Surface Drybulb Temperature:	-55 to 45 C
Surface Dewpoint Temperature:	-135 to 35 C
Surface Relative Humidity:	5 to 100 %
Surface Wetbulb Temperature:	-55 to 45 C
Previous Temperature:	-100 to 50 C
Surface Wind Speed:	0 to 50 knots
Surface Wind Direction:	1 to 360 degrees

23. The Cloud/WX (NhCLhCMCHWWWW) Block - Requires 9 digits to be entered. The same present weather code may be entered twice if the weather is unchanging. The Cloud/WX Block accepts only numbers or / and must comply with the instructions in Appendix B.

IMPORTANT: It is essential that the cloud group be entered accurately. The software applies a temperature radiation correction algorithm based on the cloud group entered.

24. The Release Point Pressure Block - This value is automatically calculated from the Station Data height difference between the baseline point the release point height.

25. Previous Temperature Block is only required if the Surface Pressure is less than 1000 hPa. Enter the temperature 12 hours ago. Acceptable values are -100 to 50 C.

26. Wind Speed Block - Accepts values from 0 to 50 knots.

27. Wind Direction Block - Accepts values from 1 to 360 degrees. For calm winds, enter the wind direction as “360”.

NOTE: The Next button in the Surface Observation will proceed to Baseline. Before clicking the Next button in the Surface Observation be sure to wait **5 minutes** after the battery is connected, point the TRS toward the radiosonde and set the TRS frequency. **In addition, the surface observations should be updated to ensure accurate data is used in baselining the radiosonde.**

28. In the Antenna Orientation/TRS Display, move the antenna to the baseline Azimuth and Elevation position. (Exhibit 4-15)

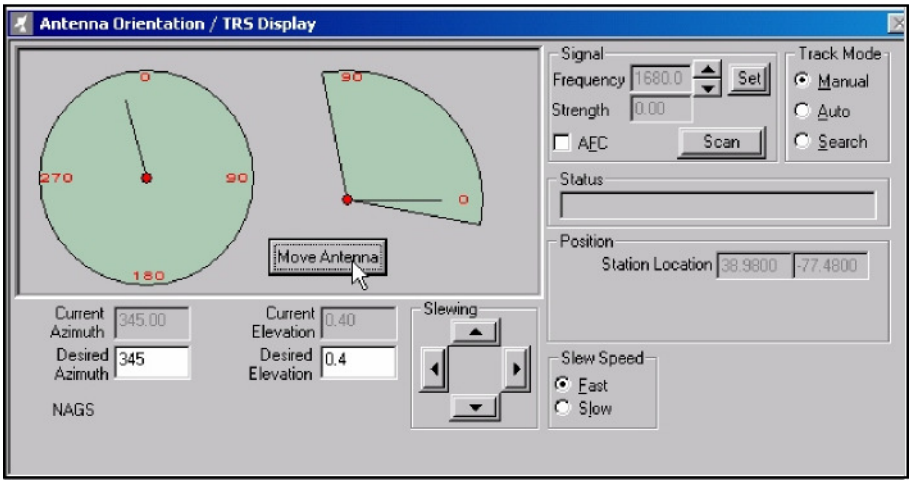


Exhibit 4-15 Move Antenna Prior to Baseline

29. Set the TRS frequency to the Radiosonde frequency. Then click on the **AFC** button. Signal strength should be over 50. (Exhibit 4-16)

NOTE: Do not use the "Scan" button if doing a second or third release. The receiver may lock-on to the previous radiosonde causing the invalid calibration data to be used at baseline.

NOTE: Manually setting the frequency prior to baseline is essential when doing a second or third release. This is done to ensure the calibration data from a previous radiosonde is not used during the baseline process. Remember, calibration data is transmitted from the instrument.

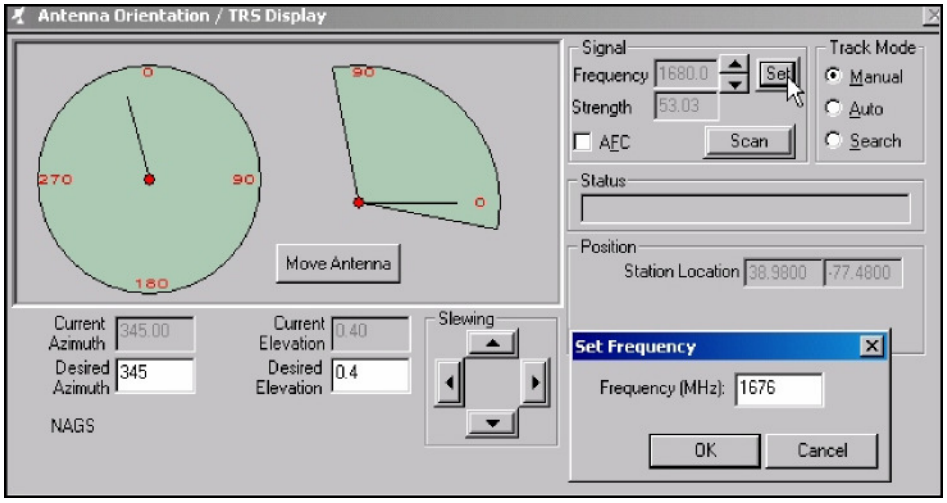


Exhibit 4-16 Manually Setting Frequency prior to Baseline

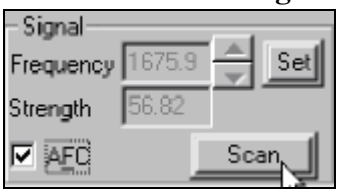


Exhibit 4-17 Manually Setting Frequency prior to Baseline

NOTE: Occasionally the radiosonde will be off one of the 4 allowable frequencies by .1 to .2 MHz. Be sure to check the "AFC" box to ensure the TRS is locked on the precise frequency for maximum signal.

30. After having soaked the battery for the **minimum 2 minutes** be sure to wait an **additional 2 minutes** before connecting the battery. This ensures that the battery has been activated. Connect the battery to the radiosonde for a **minimum of 5 minutes** before clicking the **Next** button on the bottom of the Surface Observation Display. Click the **Refresh** button to ensure Surface Observations are up to date and click **Next**. Baseline will begin.

NOTE: The baseline process should be delayed until just prior to release to ensure the pressure discrepancy applied is as accurate as possible to the actual conditions at release.

4.6 Baselining the Radiosonde

1. The SPS must initialize prior to beginning the baseline process. The SPS initialization usually takes about a minute. Once the SPS has initialized, the Baseline Display will begin to be populated with data (Exhibit 4-18). Pressure, Temperature and Humidity (PTU) data will usually come in before Latitude and Longitude (GPS). It may take up to 5 minutes before GPS data is displayed.

2. After receiving PTU data, wait 5 minutes. Waiting this time allows the radiosonde pressure sensor to stabilize and the radiosonde to acquire GPS. Once five minutes has passed, verify the PDB reading at the top of the baseline display is up to date. If necessary click the refresh button, or click in the Station PDB cell and enter the current reading of the PDB before clicking Calculate.

3. Once the data is stable and the radiosonde has baselined for at least 5 min, look at the PDB and update the Station Pressure block as shown in Exhibit 4-18 and click on the **Calculate** button (Exhibit 4-19).

NOTE: If the Baseline process can not be completed because the SPS does not initialize or you do not get GPS lock within 4 minutes, follow procedures in Appendix D (Section D.2.4).

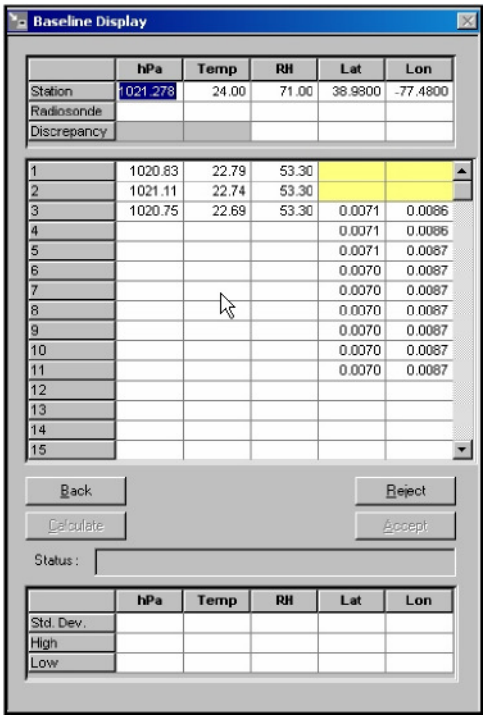


Exhibit 4-18 Baseline in Progress

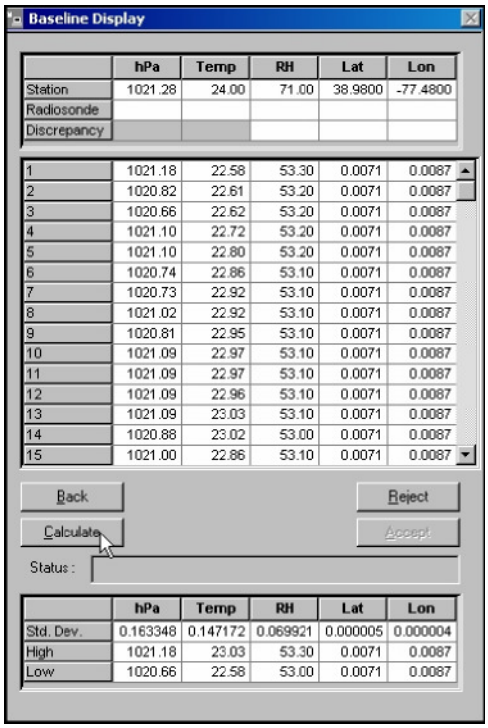
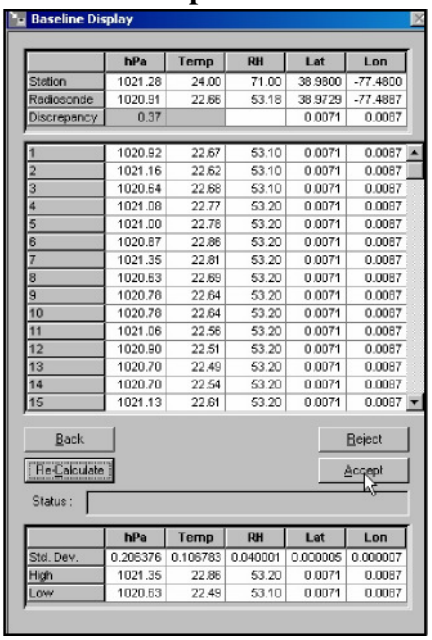


Exhibit 4-19 Baseline Ready to Run Calculate

4. After clicking the **Calculate** button, the Pressure Discrepancy and differences in the Latitude and Longitude are shown. For the Sippican MKIIA the pressure discrepancy must be within ± 5 hPa. The Temperature and RH values reflect the average conditions where the radiosonde is baselined. If the radiosonde is found to be outside of the 5 hPa tolerance reject the instrument.

5. Ensure the GPS winds are available. There should be a **minimum of 4 matches** between the Radiosonde and Base to compute heights

6. After clicking the **Accept** button (Exhibit 4-20), a window asking, "Do you wish to continue?" will appear (Exhibit 4-21).



	hPa	Temp	RH	Lat	Lon
Station	1021.28	24.00	71.00	38.9800	-77.4800
Radiosonde	1020.91	22.66	53.18	38.9729	-77.4887
Discrepancy	0.37			0.0071	0.0087

1	1020.92	22.67	53.10	0.0071	0.0087
2	1021.16	22.62	53.10	0.0071	0.0087
3	1020.64	22.68	53.10	0.0071	0.0087
4	1021.08	22.77	53.20	0.0071	0.0087
5	1021.00	22.78	53.20	0.0071	0.0087
6	1020.87	22.86	53.20	0.0071	0.0087
7	1021.35	22.81	53.20	0.0071	0.0087
8	1020.63	22.69	53.20	0.0071	0.0087
9	1020.78	22.64	53.20	0.0071	0.0087
10	1020.78	22.64	53.20	0.0071	0.0087
11	1021.06	22.56	53.20	0.0071	0.0087
12	1020.90	22.51	53.20	0.0071	0.0087
13	1020.70	22.49	53.20	0.0071	0.0087
14	1020.70	22.54	53.20	0.0071	0.0087
15	1021.13	22.61	53.20	0.0071	0.0087

	hPa	Temp	RH	Lat	Lon
Std. Dev.	0.206376	0.106783	0.040001	0.000005	0.000007
High	1021.35	22.86	53.20	0.0071	0.0087
Low	1020.63	22.49	53.10	0.0071	0.0087

Exhibit 4-20 Accept Baseline

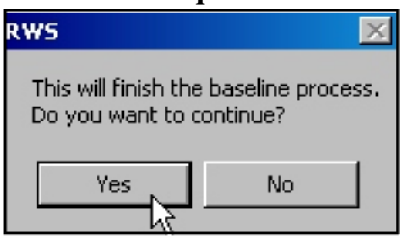


Exhibit 4-21 Continue Flight

7. Click the **Yes** button in the Accept Baseline window. The Waiting For Balloon Release Display will appear (Exhibit 4-22).

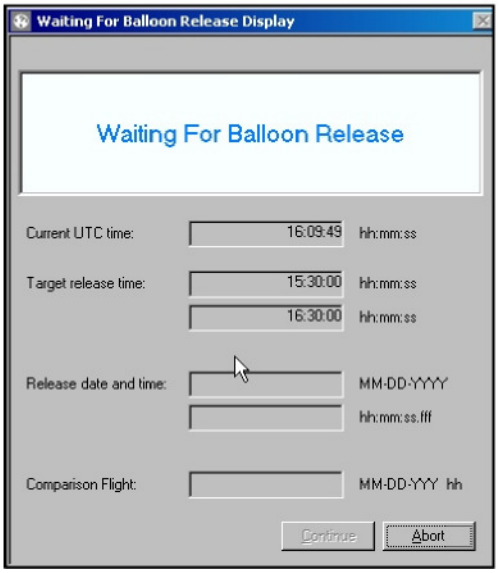


Exhibit 4-22 Waiting for Balloon Release

NOTE: Prior to leaving the office to go to the inflation building, check the "Status Bar" at the bottom of the screen to ensure the instrument is transmitting realistic pressure, temperature and relative humidity values (Exhibit 4-23). If the data is obviously bad based on conditions within the office, reject the radiosonde.

IMPORTANT: If an observer fails to click Yes in the "This will finish the baseline process, Do you want to continue?" He/She can still have a successful flight, but release will not be detected automatically. After returning from the shelter the observer will have to click on the the balloon release button, depicted as a figure holding a yellow balloon.

Exhibit 4-23 Status Bar with Current Radiosonde PTU Values

4.7 Launching the Balloon

1. Ensure all conditions are right for launch. Prior to leaving the office, use the WSR-88D wind profiles along with constant pressure charts and possibly wind profiler data to determine the wind direction and speed aloft. The antenna should be moved to point in the direction the radiosonde will travel after release. Using the Antenna Orientation/TRS Window point the antenna in the direction the wind is expected to take the balloon and leave the antenna in the Manual mode.

   At the release shelter, if possible keep the radiosonde in near full view of the sky. This will reduce the chance of missing GPS data near the surface. Using the CDU, verify the signal strength and antenna position. In addition, re-check the weather conditions prior to launch. When ready to release, coordinate the balloon release with the FAA if within 5 nautical miles of a controlled airfield.

IMPORTANT: Never release into a thunderstorm, wait until it passes or do not make a release. See Chapter 11 for more information.

.

2. Release the balloon. The software automatically detects launch by the decrease in pressure. If this function should fail the backup is click on the "Yellow Balloon" icon at the top of the RWS Main window to activate the launch (Exhibit 4-24). See Chapters 5 and 11 for more information

Exhibit 4-24 Manual or Simulated Balloon Release

NOTE: It is vital that the frequency and signal strength be checked prior to and immediately after release. This should be done using the CDU at the release site. It is also important to ensure the antenna is operational and tracking properly by using the CDU. For additional details read Appendix E (Section E2.2) and Chapter 3 of NWS Manual10-1401 and A.

3. After the launch, the Waiting for Balloon Release Display indicates Release detected (Exhibit 4-25). Click the **Continue** button.

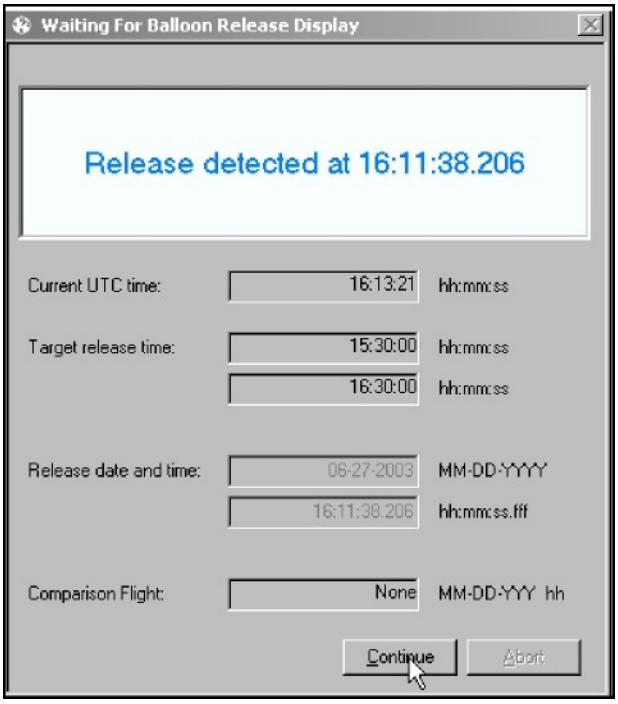
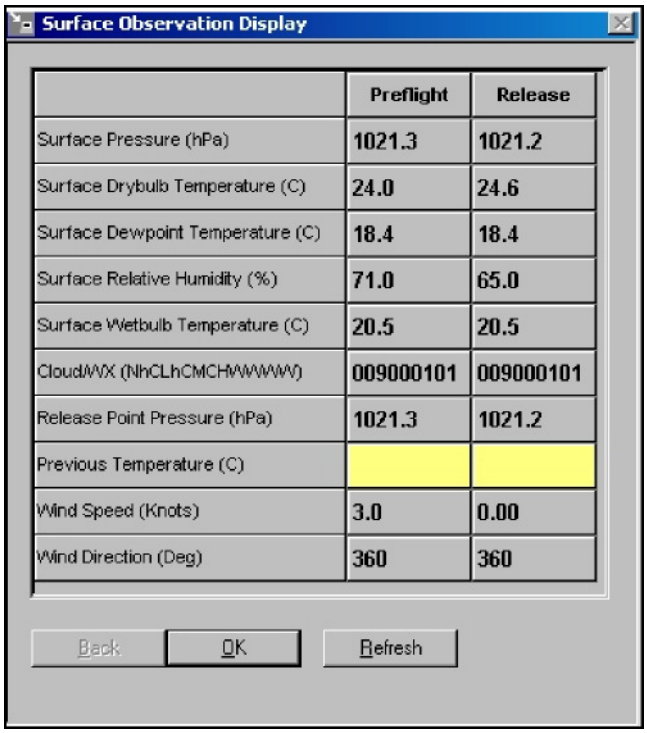


Exhibit 4-25 Balloon Release Detected

4. The Surface Observation Display will appear after clicking the **Continue** button in the Waiting for Balloon Release Display (Exhibit 4-26). The Surface Observation Display contains the preflight surface observation and the release surface observation (RSOIS/PDB data captured at the time of release). RWS uses the release surface observation data as the first data point of the sounding. The operator may edit any block of the release surface observation, or hit the Refresh button to undo any changes. Click **OK** to accept the Release Surface Observation. The Release Surface Observation will become the data at 0.0 minutes in the Processed Data Table. See Chapter 5 for more information on the Post-release Surface Observation.



Surface Observation Display

	Preflight	Release
Surface Pressure (hPa)	1021.3	1021.2
Surface Drybulb Temperature (C)	24.0	24.6
Surface Dewpoint Temperature (C)	18.4	18.4
Surface Relative Humidity (%)	71.0	65.0
Surface Wetbulb Temperature (C)	20.5	20.5
Cloud/WX (NhCLhCMCHWWWW)	009000101	009000101
Release Point Pressure (hPa)	1021.3	1021.2
Previous Temperature (C)		
Wind Speed (Knots)	3.0	0.00
Wind Direction (Deg)	360	360

Back OK Refresh

Exhibit 4-26 Surface Observation Display

NOTE: After closing the Surface Observation Display, if GPS is being received the operator may, at the Antenna Orientation/TRS Display, place the antenna in the Search mode. The antenna will automatically track to the last known GPS location.

CAUTION: If GPS is not being received, do not activate the Search mode. The antenna will be unable to find the signal because there is no GPS. This is why it is vital to know what the wind directions are above your location. Check the upper level charts and the wind profile from WSR-88D or wind profiler (if available) prior to launch. You may need to manually position the antenna if signal is lost due to a tracking problem.

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5. Checking and Editing Data

5.1 Introduction

This chapter describes the procedures for marking erroneous flight data and how to check sounding data during a typical RRS observation. **After reading this chapter, the observer should read Chapter 11 on handling significant, but less common, data problems.**

IMPORTANT: The RWS software doesn't delete all erroneous data and will not alert the observer to all questionable/erroneous data. The observer needs to periodically review the sounding data for erroneous data that needs to be deleted. If you do not edit the sounding data as required, erroneous data will appear in the coded messages and be transmitted to data users. Most observer quality control of the data should be done prior to data transmission.

5.2 Data Editing

Once the radiosonde has been launched, in-flight data editing can be divided into several main areas:

- Sounding Release Detection
- Post-release Surface Observation
- Deleting and restoring marked sounding data

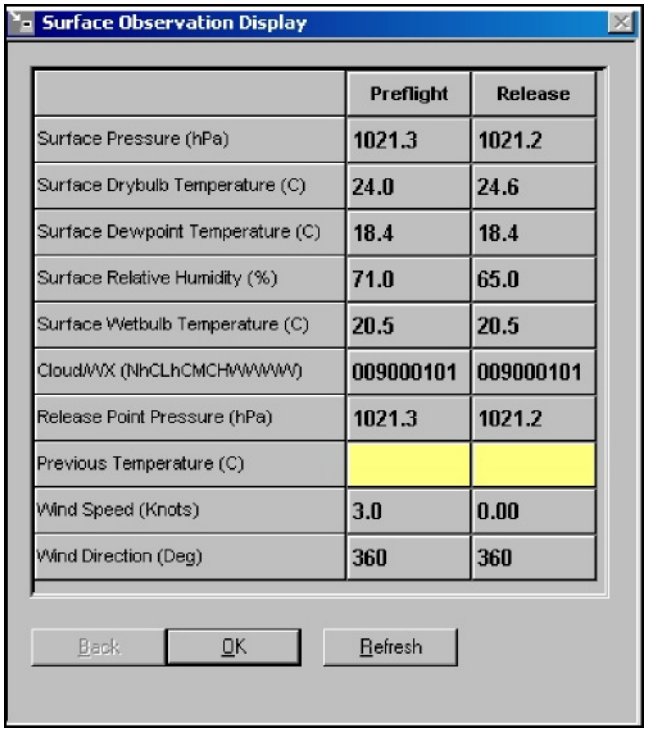
5.2.1 Post-Release Surface Observation

Follow these steps to check the Surface Observations:

1. After the Balloon Release Detected message appears, click **Continue** to move forward into the flight.

2. Re-validating the Surface Observations should normally be the first task performed after release. The Post-Release Surface Observation Display follows the release detection screen. This displays the preflight surface observation and the release surface observation captured from the RSOIS/PDB at the time of release. Review the surface data to verify it is correct and make any necessary changes to the Cloud/WX. Only the release surface observation may be edited. Clicking the **Refresh** button will undo any changes. Clicking the **OK** button will save the changes to the release surface observation. RWS uses the release surface observation data as the first data point of the sounding. Exhibit 5-1 is an example of the Post-Release Surface Observation Display.

NOTE: The Cloud/WX data at release time needs to be rechecked to ensure it is accurate. The temperature data radiation correction is derived from the cloud data and significantly impacts the RADAT and Coded Messages.



	Preflight	Release
Surface Pressure (hPa)	1021.3	1021.2
Surface Drybulb Temperature (C)	24.0	24.6
Surface Dewpoint Temperature (C)	18.4	18.4
Surface Relative Humidity (%)	71.0	65.0
Surface Wetbulb Temperature (C)	20.5	20.5
Cloud/WX (NhCLhCMCHWWWW)	009000101	009000101
Release Point Pressure (hPa)	1021.3	1021.2
Previous Temperature (C)		
Wind Speed (Knots)	3.0	0.00
Wind Direction (Deg)	360	360

Exhibit 5-1: Surface observation

NOTE: If the surface weather observation has any errors, it may be changed by the observer anytime during or after the flight and also in Rework. However, any flight data edits will be lost if the Surface Observation is changed. Thus it is important to verify the surface weather observation immediately after release.

5.2.2 Sounding Release Detection

Validating the release point time is correct should be performed after release. The RRS software automatically detects the time of release from the decrease in pressure. In some cases this time may be off. It is important that the observer verify that the release was accurately detected and if necessary adjust the release time. If the release is not detected correctly, the resulting sounding data may be erroneous.

To determine if the release time was selected correctly, use the Received PTU Tabular Display (raw data), Processed Tabular Display, and pressure data plot (Exhibit 5-2). In the Received PTU Tabular Display, the release detection is indicated by a red line at time 0.00. The pressure data above the red line should be relatively stable (preflight) and the pressure data below the line should show decreasing pressure (in-flight). In the Processed Tabular Display, the Geopotential Height should increase at approximately 3 to 6 meters per second.

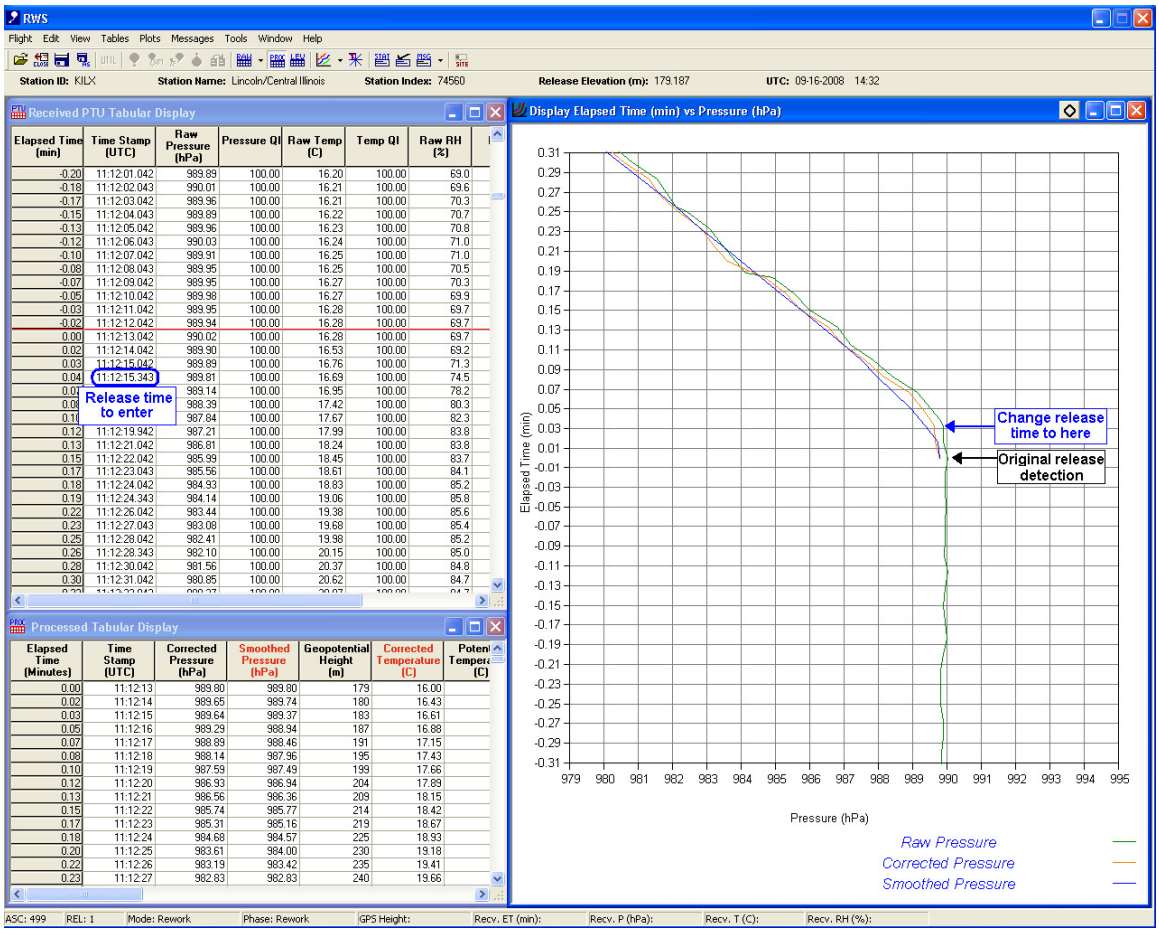


Exhibit 5-2: Verifying the accuracy of the Release Detection

Sometimes the release time will not be accurately detected (see Exhibit 5-2). To change the release time to the correct value, follow these steps:

1. Using the Received PTU Tabular Display and Pressure Plot, record the point at which release actually occurred.

2. Select **Release Time** from the Tools pull-down menu.

3. Enter the correct release time in the Release window. (The date may need to be modified if the release time crosses 00 UTC.)

4. Click **OK**. The surface observation screen will appear, populated with the surface weather data nearest the selected release time.

5. Review the surface observation and make any edits necessary and click **Accept**.

6. RWS will begin to reprocess the flight data using the changed release time.

7. Once the release time has been changed (see Exhibit 5-3), re-verify in the Received PTU Tabular Display that the release time was changed correctly. Additionally, the Processed Data Tabular Display can be checked to verify release was changed correctly. The Geopotential Height should have increasing heights from elapsed time 0.00 (surface) at about 3 to 6 meters a second.

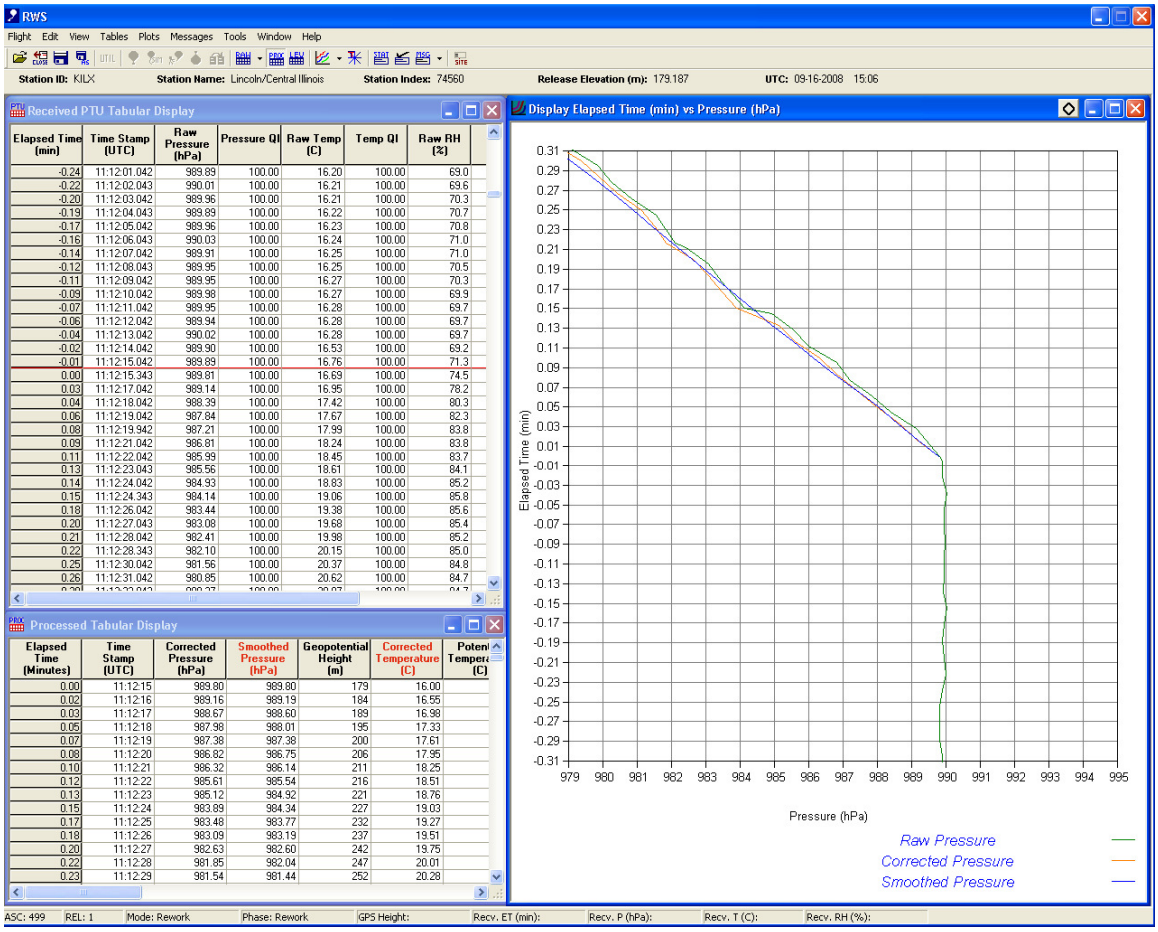


Exhibit 5-3: Release Time correctly changed

5.2.3 Deleting and Restoring Marked Data

Erroneous data can be marked and deleted by the observer in the Processed Tabular Display. The observer can only mark and delete the following data:

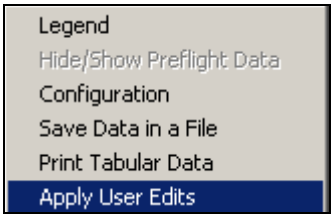
- Smoothed Pressure,
- Corrected Temperature
- Relative Humidity.
- Wind components u and v
- Radiosonde latitude and longitude

Marking and deleting data should be done after verifying the surface weather observation and release time. Otherwise all data marking will be lost if the surface observation or release time is changed after marking data.

To mark, delete, and restore data, follow these steps:

1. Click and hold the curser on the appropriate cell in the Processed Tabular Display and drag the curser to highlight other cells that were deemed erroneous.

2. To apply the marking, right click inside the window and click **Apply User Edits** from the menu (Exhibit 5-4). After the edits are applied, the marked data, if less than a minute, is colored blue and is filled with interpolated data. With the exception of the pressure data, if a minute or more of data is edited, the column will also be colored blue but no data will be seen. Columns of derived data such as potential temperature and mixing ratio will be empty and highlighted in red. Data missing for more than 1 minute will result in gaps in the plotted data. An example of marked and edited data is shown in Exhibit 5-5.



Processed Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	Potential Temperature (C)	RH (%)	Dewpoint Temperature (C)	Dewpo Depres (C)
0.00	989.80	179	16.00	16.85	96.0	15.36	
0.02	989.19	184	16.36	17.26	85.5	13.93	
0.03	988.60	189	16.72	17.67	78.8	13.03	
0.05	988.01	195	17.08	18.08	80.9	13.77	
0.07	987.38	200	17.44	18.49	82.8	14.48	
0.08	986.75	206	17.79	18.91	83.8	15.02	
0.10	986.14	211	18.15	19.32	83.8	15.37	
0.12	985.54	216	18.51	19.73	83.8	15.73	
0.13	984.92	221	18.76	20.03	84.4	16.09	
0.15	984.34	227	19.03	20.35	85.8	16.60	
0.17	983.77	232	19.27	20.64	85.7	16.82	
0.18	983.19	237	19.51	20.93	85.5	17.02	

Processed Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	Potential Temperature (C)	RH (%)	Dewpoint Temperature (C)	Dewpo Depres (C)
0.78	962.87	416			73.8		
0.80	962.32	420			73.9		
0.82	961.73	426			74.0		
0.83	961.14	431			74.0		
0.85	960.53	437			74.0		
0.87	959.91	442			74.0		
0.88	959.31	448			74.2		
0.90	958.73	453			74.8		
0.92	958.15	458			75.9		
0.93	957.59	463			76.5		
0.95	957.05	468			76.6		
0.97	956.48	473			76.5		

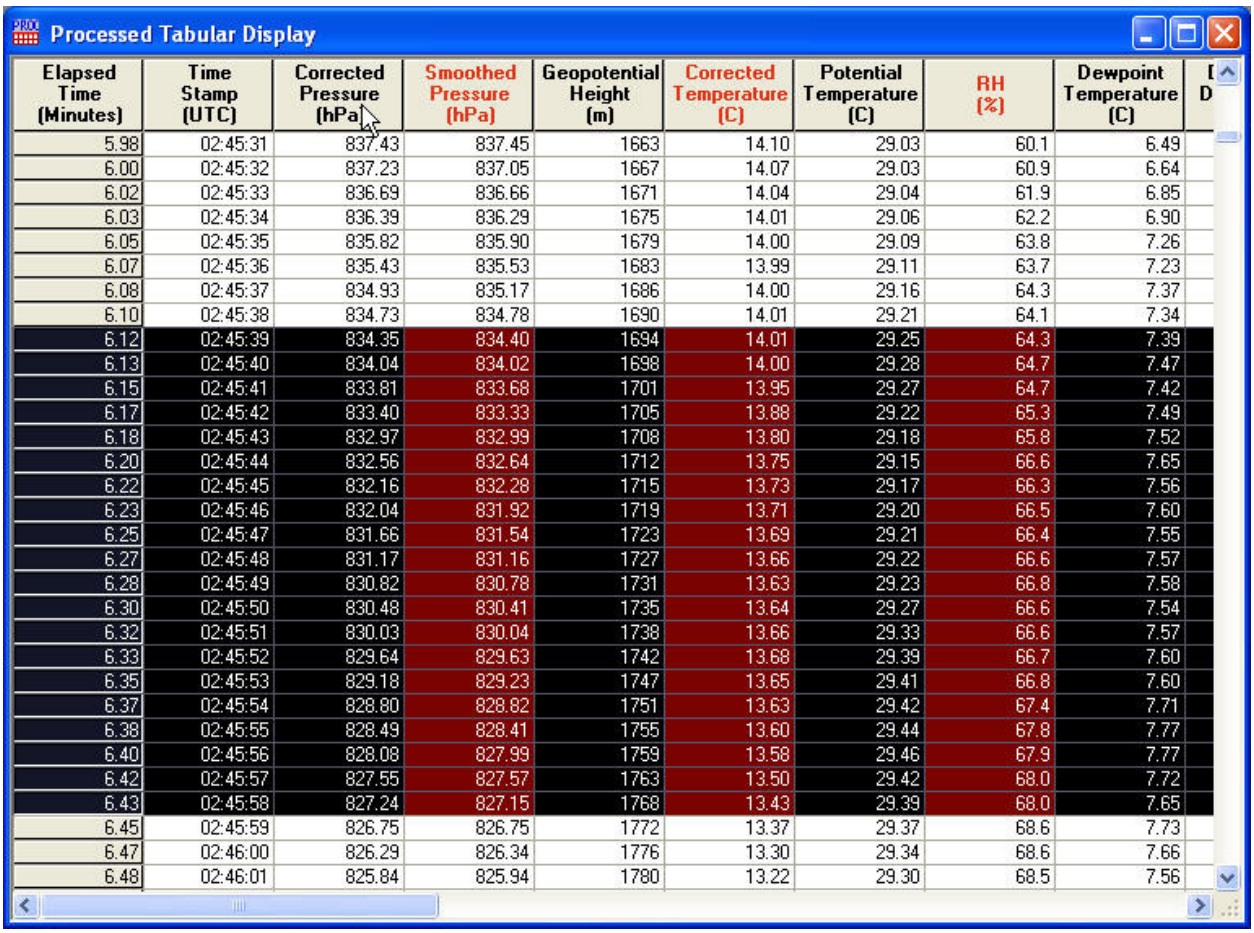
Exhibit 5-5: Less than a minute marked (top), and more than a minute of data marked (bottom).

NOTE: The first row of data in the Processed Tabular Display (surface data) cannot be marked.

3. To unmark and restore marked data, click and hold the curser on the appropriate marked cell and drag to highlight other marked cells. Next, right click inside the window and click **Apply User Edits** from the menu. After the edits are applied, the unmarked data is no longer colored blue or red and the original data is restored

NOTE: Data may not be marked if data intervals in the Processed Tabular Display are greater than 1 second.

4. Sometimes it may be necessary to mark **all** the sounding data (including winds) in the erroneous layer. This can be done by clicking and holding the curser on the Elapsed Time data column and dragging down the curser to highlight and mark all erroneous data cells (Exhibit 5-6). To mark data, follow steps 2 and 3.



Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	Potential Temperature (C)	RH (%)	Dewpoint Temperature (C)
5.98	02:45:31	837.43	837.45	1663	14.10	29.03	60.1	6.49
6.00	02:45:32	837.23	837.05	1667	14.07	29.03	60.9	6.64
6.02	02:45:33	836.69	836.66	1671	14.04	29.04	61.9	6.85
6.03	02:45:34	836.39	836.29	1675	14.01	29.06	62.2	6.90
6.05	02:45:35	835.82	835.90	1679	14.00	29.09	63.8	7.26
6.07	02:45:36	835.43	835.53	1683	13.99	29.11	63.7	7.23
6.08	02:45:37	834.93	835.17	1686	14.00	29.16	64.3	7.37
6.10	02:45:38	834.73	834.78	1690	14.01	29.21	64.1	7.34
6.12	02:45:39	834.35	834.40	1694	14.01	29.25	64.3	7.39
6.13	02:45:40	834.04	834.02	1698	14.00	29.28	64.7	7.47
6.15	02:45:41	833.81	833.68	1701	13.95	29.27	64.7	7.42
6.17	02:45:42	833.40	833.33	1705	13.88	29.22	65.3	7.49
6.18	02:45:43	832.97	832.99	1708	13.80	29.18	65.8	7.52
6.20	02:45:44	832.56	832.64	1712	13.75	29.15	66.6	7.65
6.22	02:45:45	832.16	832.28	1715	13.73	29.17	66.3	7.56
6.23	02:45:46	832.04	831.92	1719	13.71	29.20	66.5	7.60
6.25	02:45:47	831.66	831.54	1723	13.69	29.21	66.4	7.55
6.27	02:45:48	831.17	831.16	1727	13.66	29.22	66.6	7.57
6.28	02:45:49	830.82	830.78	1731	13.63	29.23	66.8	7.58
6.30	02:45:50	830.48	830.41	1735	13.64	29.27	66.6	7.54
6.32	02:45:51	830.03	830.04	1738	13.66	29.33	66.6	7.57
6.33	02:45:52	829.64	829.63	1742	13.68	29.39	66.7	7.60
6.35	02:45:53	829.18	829.23	1747	13.65	29.41	66.8	7.60
6.37	02:45:54	828.80	828.82	1751	13.63	29.42	67.4	7.71
6.38	02:45:55	828.49	828.41	1755	13.60	29.44	67.8	7.77
6.40	02:45:56	828.08	827.99	1759	13.58	29.46	67.9	7.77
6.42	02:45:57	827.55	827.57	1763	13.50	29.42	68.0	7.72
6.43	02:45:58	827.24	827.15	1768	13.43	29.39	68.0	7.65
6.45	02:45:59	826.75	826.75	1772	13.37	29.37	68.6	7.73
6.47	02:46:00	826.29	826.34	1776	13.30	29.34	68.6	7.66
6.48	02:46:01	825.84	825.94	1780	13.22	29.30	68.5	7.56

Exhibit 5-6: Marking all sounding data in a layer.

5.3 Checking Sounding Data Quality

It is very important to start reviewing the sounding data shortly after release and thereafter to ensure that the radiosonde is working correctly. While reviewing the tabular data is helpful, examining each data plot is a quick way to check sounding data quality.

IMPORTANT: Make sure to read Chapter 11 to understand significant data problems that can occur and how to handle them.

5.3.1 Pressure Data.

Follow these steps to check the pressure profile:

1. Review the pressure profile for the first ten minutes of the flight. It should be a smooth curve with a slightly concave shape. Exhibit 5-7 shows an example of this profile.

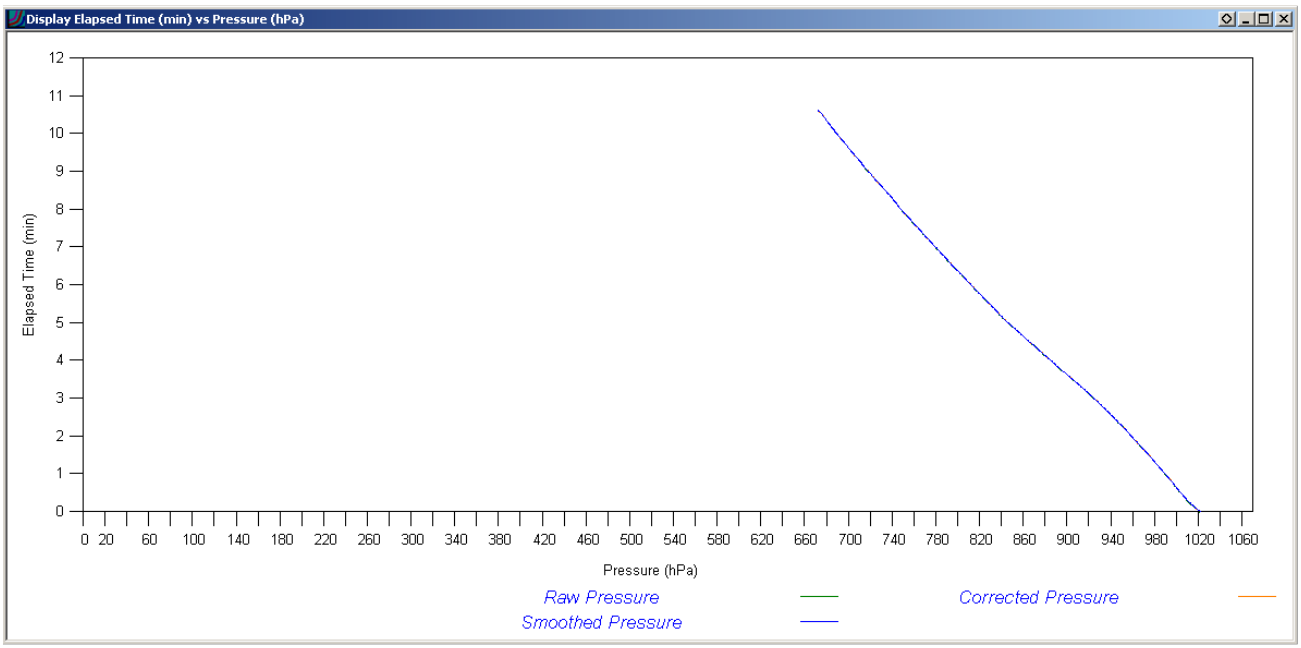


Exhibit 5-7: Pressure data plot for the first 10 minutes of the sounding

2. As the sounding proceeds to balloon burst, continue to monitor the pressure data. At balloon burst, the complete pressure profile will have taken on a smooth, logarithmic curve. Exhibit 5-8 shows a typical example.

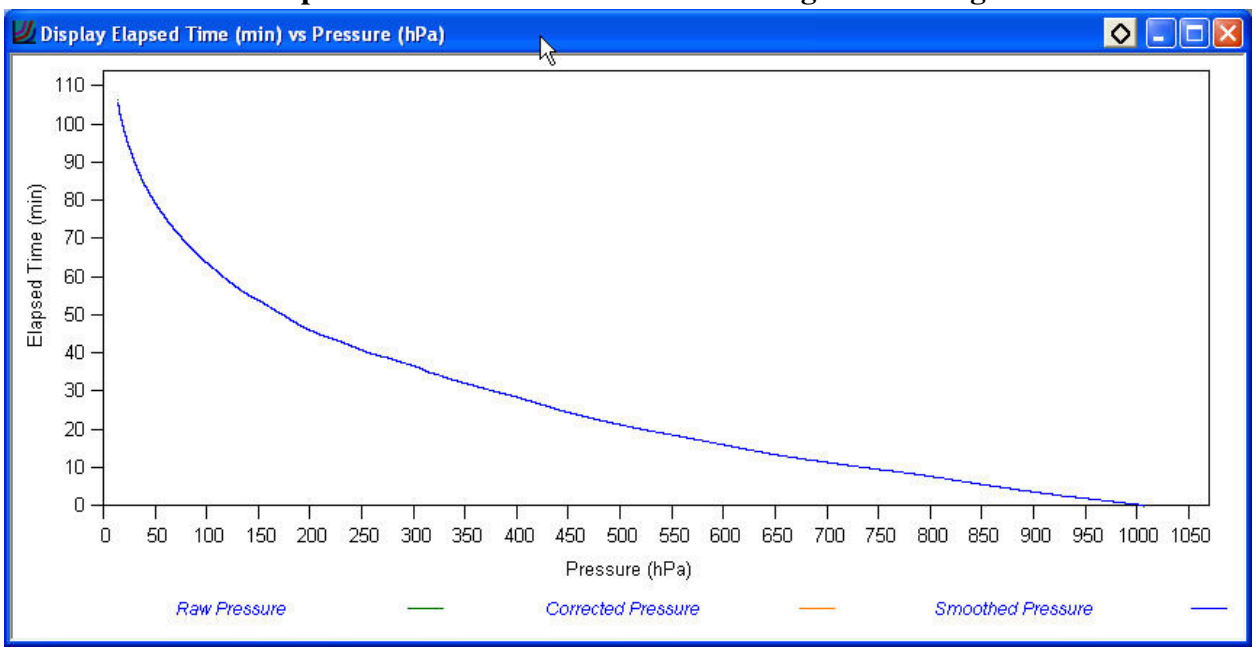


Exhibit 5-8: Pressure data plot for an entire sounding

3. In some situations, the profile may jump abruptly off surface, is very wavy, has data spikes, or other anomalies. Check Messages may appear for ascent rates and height changes from the previous sounding. Verify that the release time was selected correctly and refer to Chapter 11 for further information on unusual pressure profiles.

4. Examination of the pressure data plot will not likely show a leaking pressure cell and there may be no check messages to indicate a problem with the pressure data. Other data needs to be examined such as the Flight Summary and Processed Tabular Display to detect this problem. See Chapter 11 for more information.

5.3.1.1 Typical Features in Pressure Data Profiles

Balloon Burst**:** Balloon burst is automatically detected by the software when the ascent rate changes from ascending to rapidly descending. The pressure data plot will show the balloon burst level as the point where the smoothed pressure is no longer plotted and the raw pressure is rapidly increasing with time of height. Exhibit 5-9 shows a pressure data plot with the balloon burst occurring at 97.5 minutes and at a pressure of 6.5 hPa. Sometimes the sounding terminates for reasons other than balloon burst. See Chapter 9 for more information on flight termination.

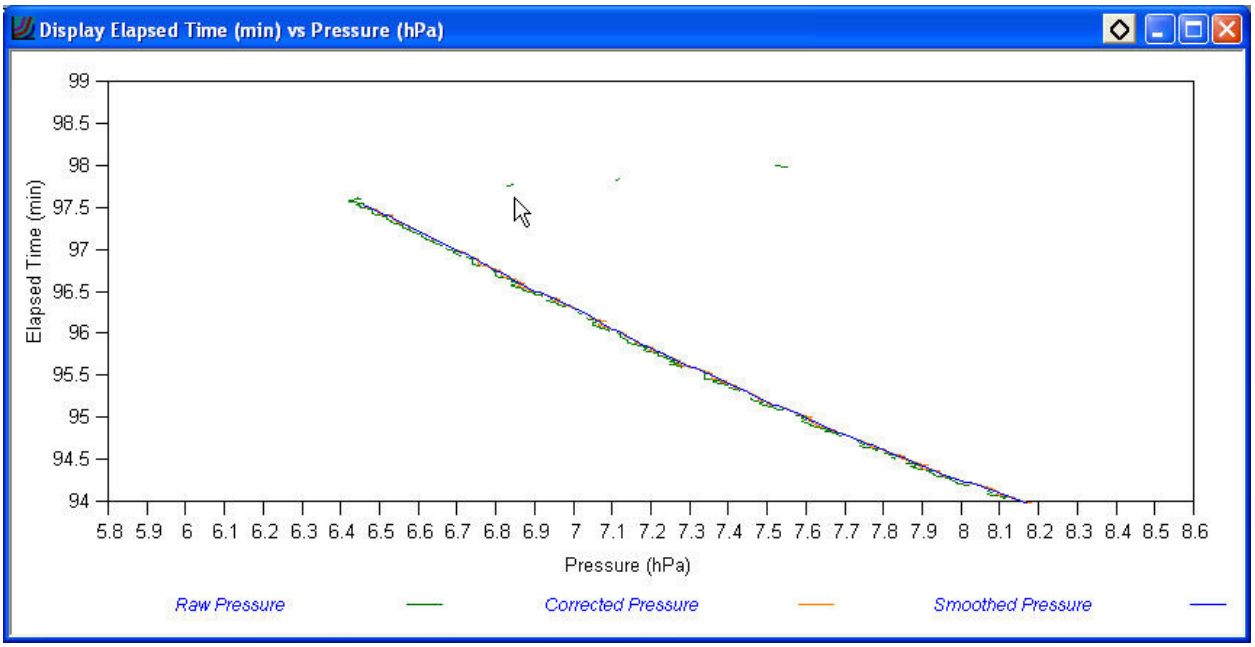


Exhibit 5-9: Typical balloon burst profile as shown in the pressure data plot

5.3.2 Temperature Data

Follow these steps to check the temperature data:

1. Review the temperature data plot for the first ten minutes of the flight. It may show inversions or decrease at a rate close to 9.8C/km. Exhibit 5-10 shows an example of a typical profile for a morning sounding.

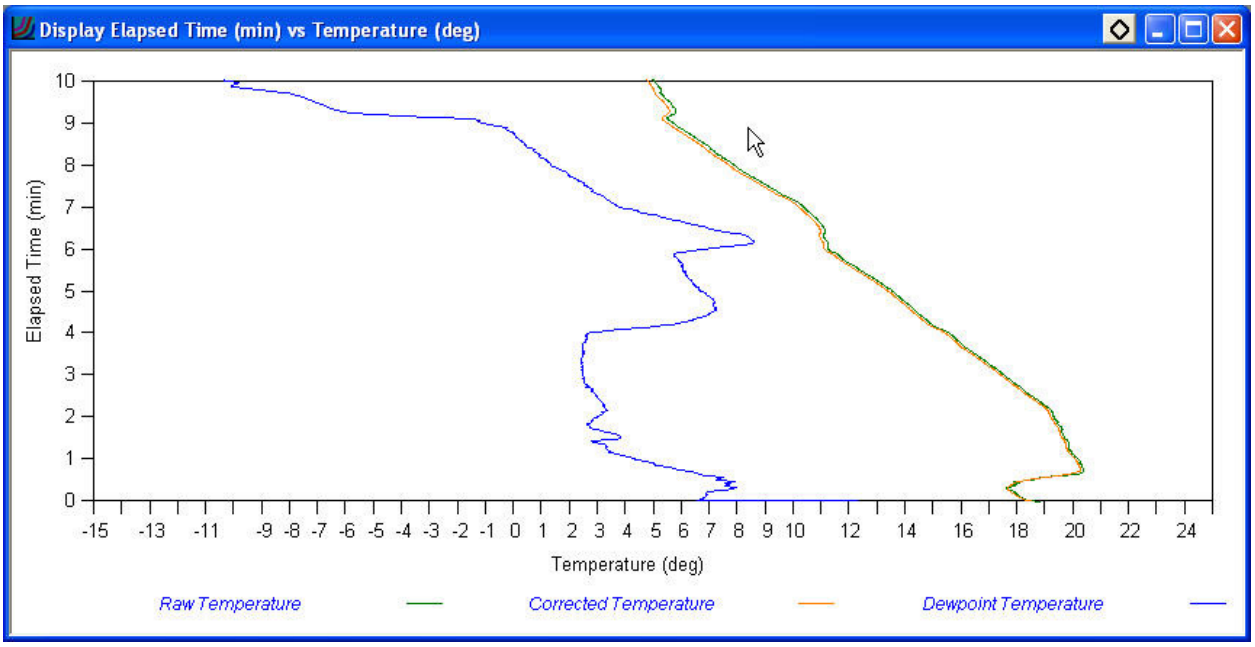


Exhibit 5-10: Typical temperature profile for the first 10 minutes of a sounding

2. As the sounding proceeds, continue to monitor the temperature data. Exhibit 5-11 shows a typical temperature profile from surface to balloon burst.

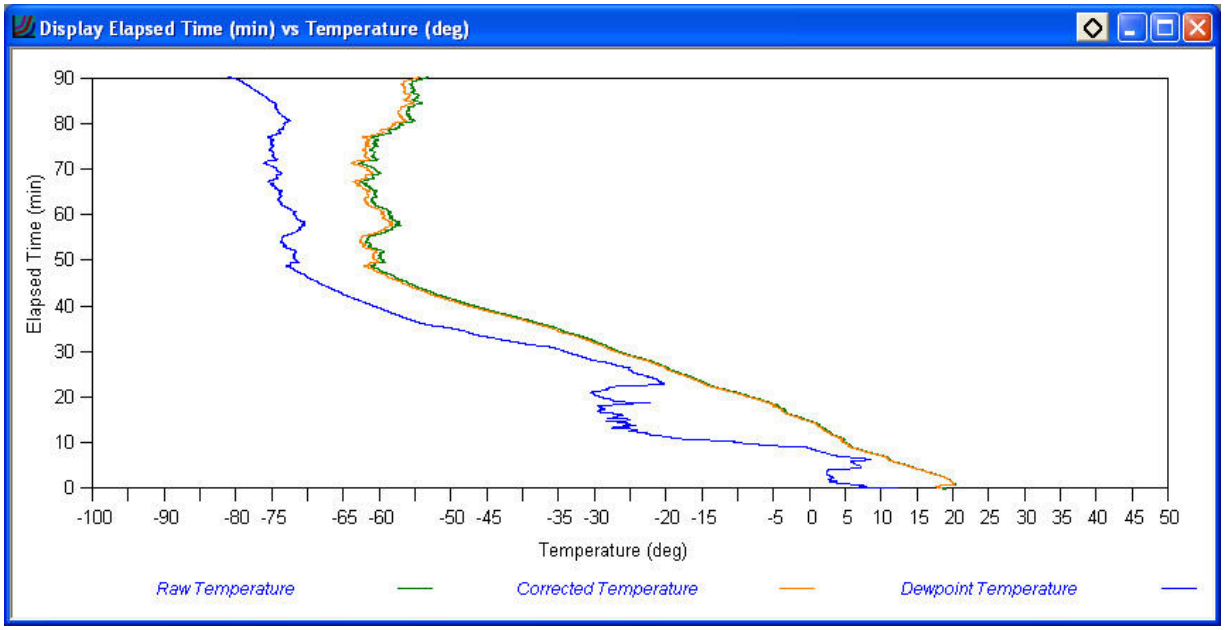


Exhibit 5-11: Typical temperature data profile for entire sounding

3. In some situations, the temperature lapse rate in portions of the sounding will be excessive and Check Messages for these lapse rates will appear. You need to take action on such messages and review Chapter 11 for more information.

5.3.2.1 Typical Features in Temperature Data Profiles

Inversions: These are layers where the temperature warms with height. It is not uncommon for to see layers aloft where the temperature warmed several degrees or more in only a few seconds. In most cases such inversions are real, but the temperatures in the Received PTU display may be marked as rejected (see Section 5.3.5 below)

Freezing levels: These are points where the temperature crosses the 0°C. Exhibit 5-11 shows the freezing level at 15 minutes. During the summer, there is typically just one crossing of the freezing level. In the winter months, it is not uncommon to see 3 or more crossings of the freezing level. RRS software automatically records the freezing level(s) in the WMO levels table and codes these data in the freezing level or RADAT message.

Tropopause: The tropopause is the level in the atmosphere where troposphere ends and the rate of temperature decrease with height slows or stops. The average height of the tropopause is about 10 km. The height will vary with latitude and time of year. The tropopause is a feature of almost all upper air soundings, although sometimes it is not clearly defined. There will also be cases where 2 or more tropopause levels are identified. Exhibit 5-11 shows the tropopause at about 49 minutes. The software automatically detects and records the tropopause.

Stratosphere: Above the tropopause is the stratosphere where temperature remains nearly constant or begins increasing with height. It is not uncommon to see the temperature warm to minus 40C or warmer as the radiosonde reaches 30 km and higher. You will also see more structure or oscillations in the temperature profile compared to that in the troposphere.

5.3.3 RH data

Follow these steps for checking the RH data:

1. Review the RH data plot for the first ten minutes of the flight. Exhibit 5-12 shows an example of a typical RH profile. The profile may show the RH falling or rising with height. If the radiosonde enters a cloud in the lower troposphere the RH will like likely exceed 90%.

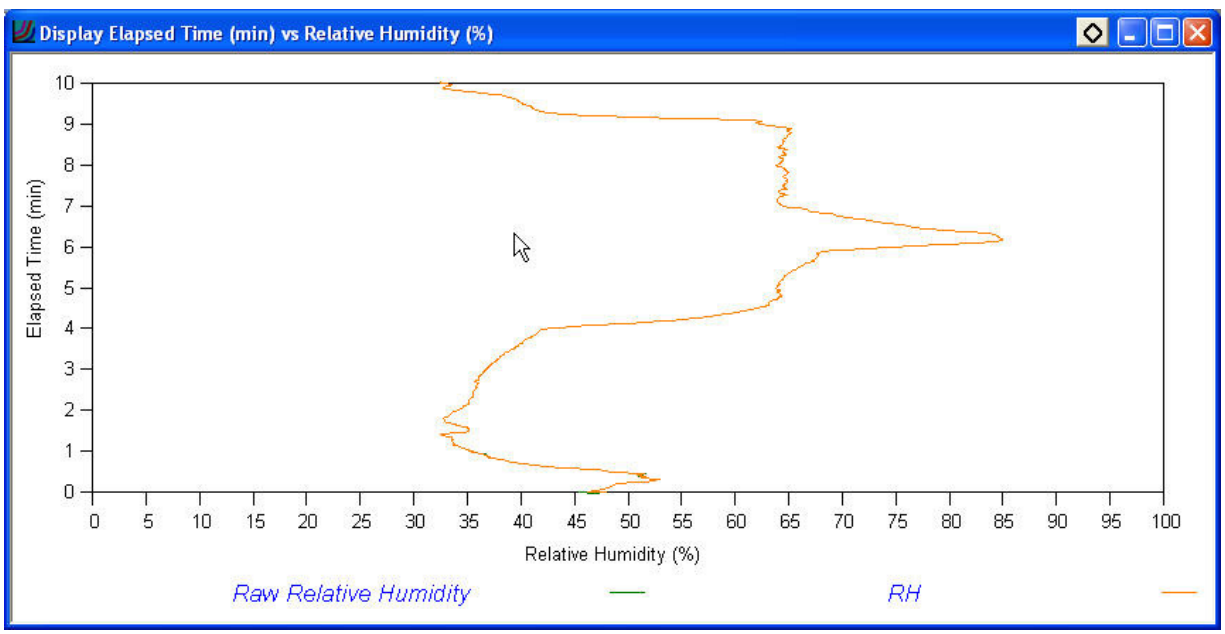


Exhibit 5-12: RH data plot for the first 10 minute of a sounding

2. As the sounding proceeds, continue to monitor the RH data. Exhibit 5-13 shows a typical RH profile from surface to balloon burst.

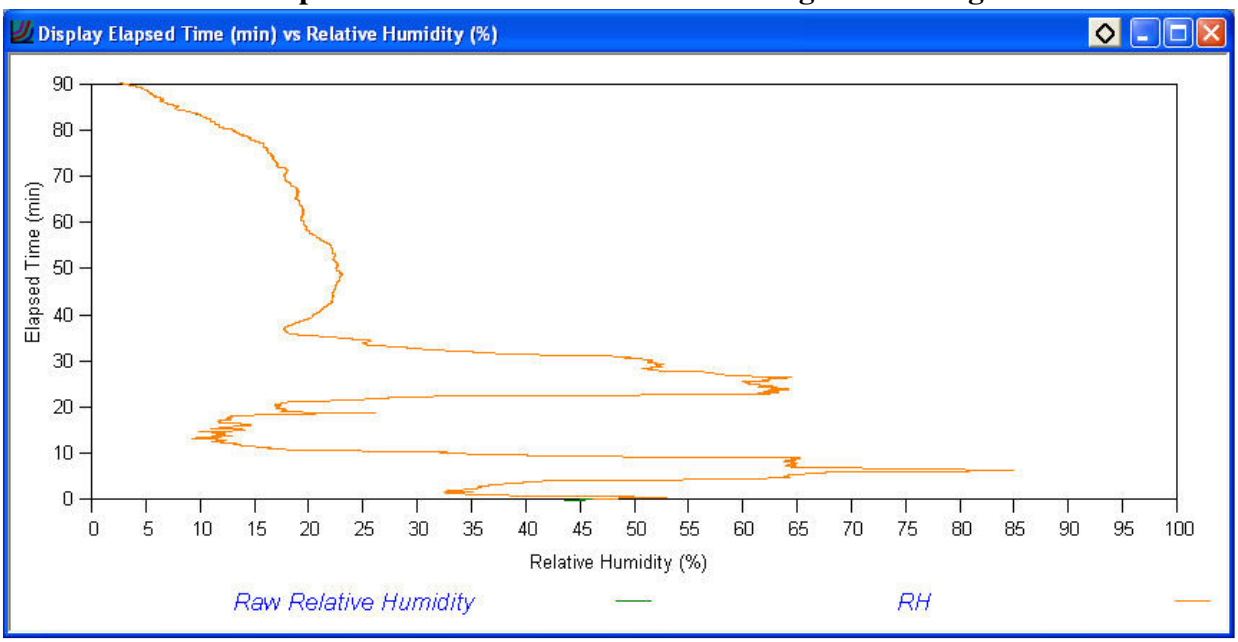


Exhibit 5-13: Example of a RH data profile from surface to flight termination

3. In some situations, the RH will fall by more than 5% just off surface, or is too moist in the stratosphere. You will need to take action on such data problems and review Chapter 11 for more information.

5.3.4 Wind Data

Follow these steps for checking the wind data:

1. For the most part the accuracy of the winds is rarely a problem. Review the wind data plot for the first ten minutes of the flight. Exhibit 5-14 shows an example of a typical wind profile near the surface.

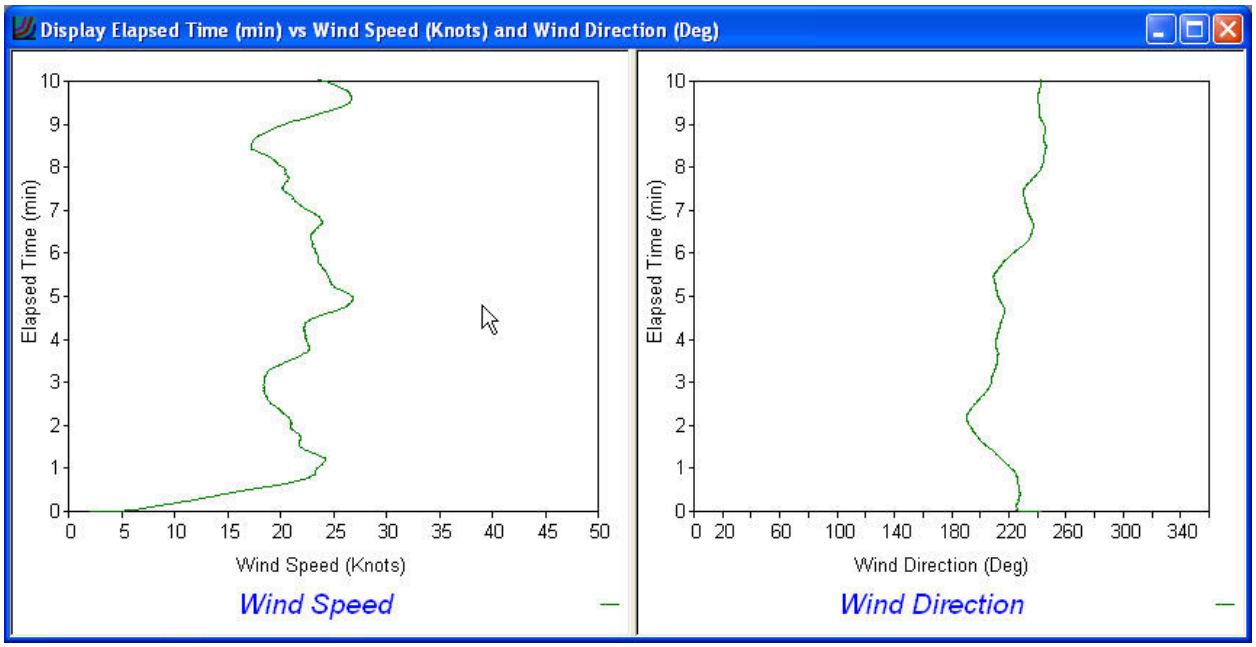


Exhibit 5-14: Typical wind data profile from surface to 10 minutes

2. As the sounding proceeds, continue to monitor the wind data. Exhibit 5-15 shows a typical wind profile during the winter months from surface to balloon burst.

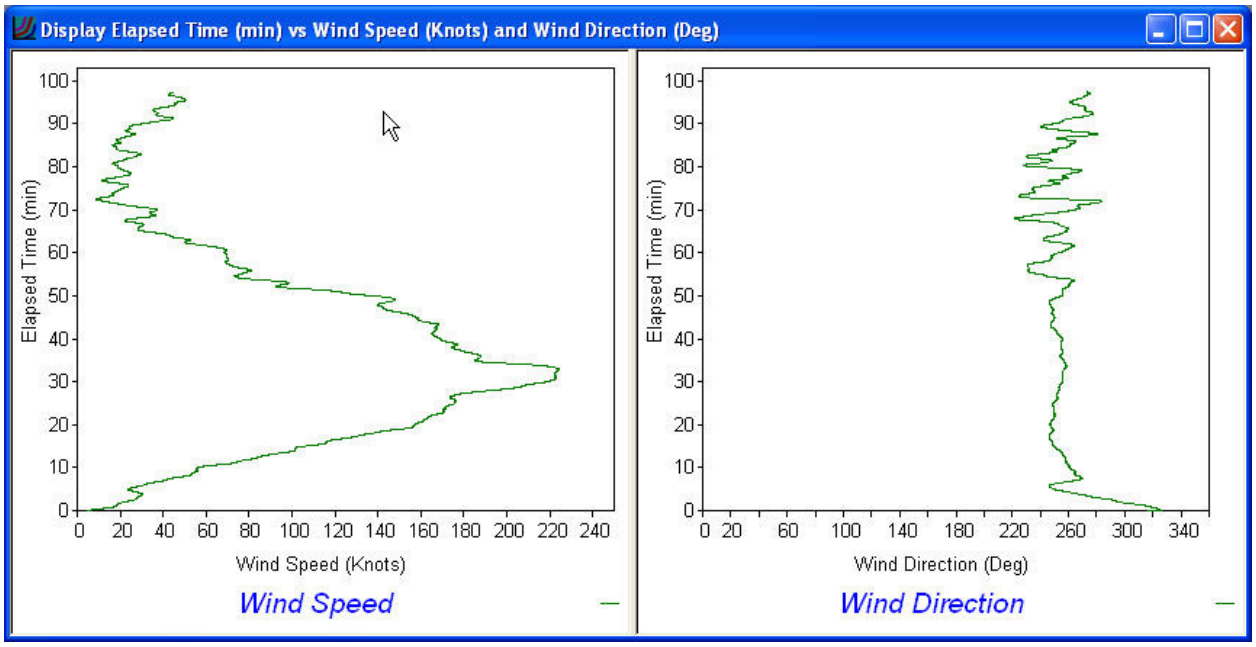


Exhibit 5-15: Example of a wind data profile from surface to balloon burst

NOTE: If the winds are missing for more than 5 minutes or look suspicious review Chapter 11 for more information

5.3.4.1 Typical Features in Wind Data profiles

Jet Stream Winds: Jet streams are narrow bands of high speed winds that meander around the Earth at altitudes ranging from 10 to 15 km. These high speed winds are generally 2 to 3 km thick and can be hundreds of km wide. Maximum wind speeds within jet streams can exceed 200 knots and are strongest during the winter and spring months. Exhibit 5-14 shows a jet stream with maximum winds near 225 knots. The RRS software records the highest winds and will generate a Check Message if winds exceed 180 knots.

Stratospheric winds: In the stratosphere winds speeds and direction and can vary significantly from what was measured in the troposphere. Exhibit 5-14 shows that from surface to about 30 minutes (tropopause) the wind direction remained nearly the same, while above 30 minutes the direction was more variable.

5.3.5 Missing Data

5.3.5.1 Missing and Rejected Received PTU Data

As you review the Received PTU data you may see segments of data that are missing and the cells are colored yellow. Exhibit 5-16 shows an example.

Received PTU Tabular Display

Elapsed Time (min)	Time Stamp (UTC)	Raw Pressure (hPa)	Pressure QI	Raw Temp (C)	Temp QI	Raw RH (%)	RH QI
80.45	19:06:35.430	36.38	100.00	-54.12	100.00	8.1	100.00
80.47	19:06:36.531	36.34	100.00	-54.19	100.00	8.1	100.00
80.48	19:06:37.531	36.32	100.00	-54.18	100.00	8.0	100.00
80.50	19:06:38.531	36.29	100.00	-54.20	100.00	8.0	100.00
80.55	19:06:41.531		0.00		0.00		0.00
80.60	19:06:44.531		0.00		0.00		0.00
80.65	19:06:47.530		0.00		0.00		0.00
80.68	19:06:49.531	36.02	100.00	-53.78	100.00	8.8	100.00
80.70	19:06:50.531	35.99	100.00	-53.78	100.00	8.8	100.00
80.72	19:06:51.530	35.93	100.00	-53.74	100.00	7.8	100.00
80.73	19:06:52.531	35.89	100.00	-53.55	100.00	7.6	100.00
80.78	19:06:55.531		0.00		0.00		0.00
80.83	19:06:58.530		0.00		0.00		0.00
80.88	19:07:01.531		0.00		0.00		0.00
80.93	19:07:04.430	35.57	100.00	-53.99	100.00	8.9	100.00
80.95	19:07:05.531	35.50	100.00	-53.96	100.00	8.9	100.00
81.00	19:07:08.531		0.00		0.00		0.00
81.05	19:07:11.531		0.00		0.00		0.00
81.10	19:07:14.530		0.00		0.00		0.00
81.15	19:07:17.530		0.00		0.00		0.00
81.20	19:07:20.531		0.00		0.00		0.00
81.25	19:07:23.531		0.00		0.00		0.00
81.30	19:07:26.531		0.00		0.00		0.00

Exhibit 5-16: Missing data in the Received PTU Tabular Display

Yellow cells in the Received PTU data indicate that no data was received by the radiosonde. The

PTU data from radiosonde may become missing during the flight for a variety of reasons. If the (pressure and/or temperature) data from the radiosonde becomes missing continuously for a minute, an audible alarm will sound and a pop-up message will appear. The flight will terminate if missing temperature data reaches 3 consecutive minutes and 10 consecutive minutes for missing pressure. If you hear an alarm or you see significant missing data, see Appendix D - Troubleshooting on how to handle this situation.

Data cells highlighted in red in the Received PTU indicate that the data were rejected by a software outlier removal algorithm. These data will not be used in the Processed Tabular data and can not be restored by the observer. Rejected data (and missing data) cells are often seen just prior to release and after balloon burst. Exhibit 5-17 shows typical Received PTU data at Balloon Burst. Rejected temperature data cells may also occur if the temperature cools or warms abruptly with time or height.

Received PTU Tabular Display

Elapsed Time (min)	Time Stamp (UTC)	Raw Pressure (hPa)	Pressure QI	Raw Temp (C)	Temp QI	Raw RH (%)	RH QI
100.34	19:16:59.653	7.24	100.00	-29.22	100.00	0.0	100.00
100.36	19:17:00.653	7.27	100.00	-29.16	100.00	0.0	100.00
100.38	19:17:01.653	7.28	100.00	-29.22	100.00	0.0	100.00
100.39	19:17:02.653	7.29	100.00	-29.34	100.00	0.0	100.00
100.40	19:17:03.053	7.34	100.00	-29.44	100.00	0.0	100.00
100.43	19:17:04.652	7.34	100.00	-29.54	100.00	0.0	100.00
100.44	19:17:05.653	7.37	100.00	-29.63	100.00	0.0	100.00
100.46	19:17:06.552	7.44	100.00	-29.59	100.00	0.0	100.00
100.47	19:17:07.552	7.54	100.00	-29.61	100.00	0.0	100.00
100.49	19:17:08.652	7.60	100.00	-29.86	100.00	0.0	100.00
100.51	19:17:09.653	7.63	100.00	-30.18	100.00	0.0	100.00
100.53	19:17:10.653	7.73	100.00	-30.36	100.00	0.0	100.00
100.54	19:17:11.552	7.77	100.00	-30.51	100.00	0.0	100.00
100.56	19:17:12.653	7.88	100.00	-30.46	100.00	0.0	100.00
100.58	19:17:13.653	7.95	100.00	-30.39	100.00	0.0	100.00
100.59	19:17:14.653	8.13	100.00	-30.31	100.00	0.0	100.00
100.61	19:17:15.653	8.18	100.00	-30.42	100.00	0.0	100.00
100.63	19:17:16.653	8.29	100.00	-30.54	100.00	0.0	100.00
100.64	19:17:17.653	8.35	100.00	-31.14	100.00	0.0	100.00
100.66	19:17:18.653	8.48	100.00	-31.90	100.00	0.0	100.00
100.68	19:17:19.653	8.61	100.00	-32.57	100.00	0.0	100.00
100.69	19:17:20.653	8.67	100.00	-33.24	100.00	0.0	100.00
100.71	19:17:21.653	8.76	100.00	-34.16	100.00	0.0	100.00

Exhibit 5-17: Rejected data in the Received PTU Tabular Display at balloon burst

5.3.5.2 Missing Processed Data

More than 1 minute of missing data in the Received PTU tabular display will result in a corresponding layer of missing data (and associated derived data) in the Processed Tabular data and it will be colored red. Pressure data cells will also be colored red but will show interpolated values.

NOTE: For all soundings, the ascension rate and temperature lapse rate data will be missing for a short time after release since insufficient data has been collected at release time for these parameters to be calculated.

5.3.5.3 Missing Data Appearing in Plots

If the temperature, RH or winds data are missing (or observer marked) for more than 1 minute the associated data plot will show gaps where the missing data occurred. Exhibit 5-18 shows an example of a data gap in the temperature and RH data plot.

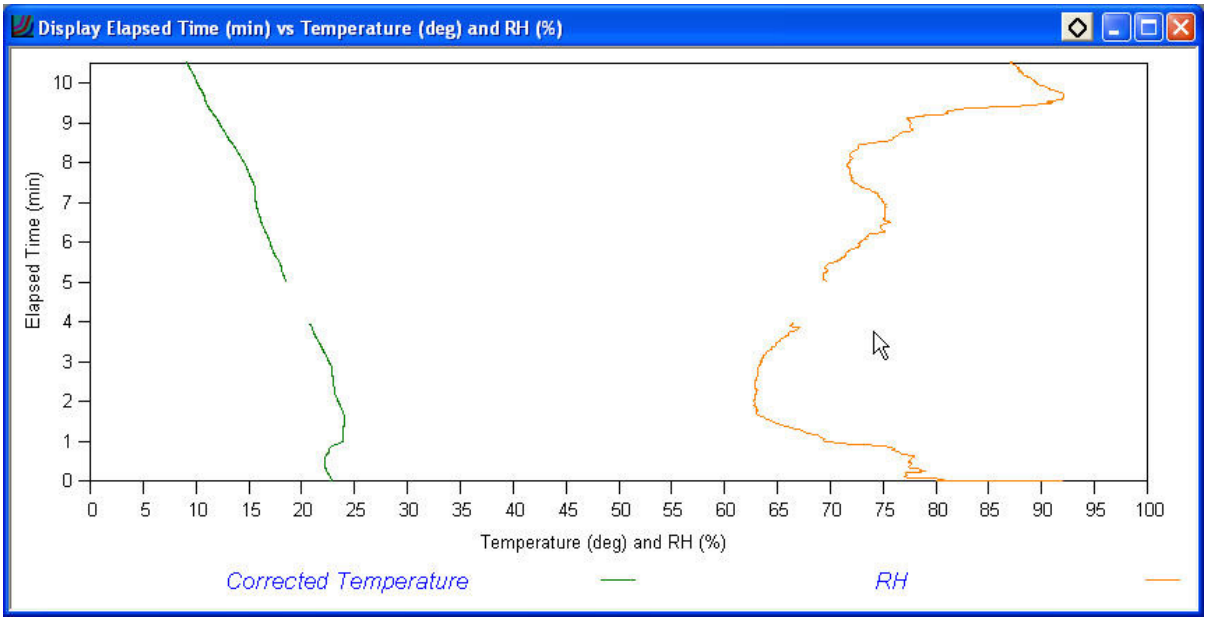


Exhibit 5-18: Missing data between 4 and 5 minutes in the temperature and RH data plot

5.3.5.4 Missing Data and the WMO Levels Table

WMO levels noting the beginning and ending of missing (or observer deleted) data will not be shown in the WMO Levels table (and coded messages) unless the missing (or deleted) temperature or RH data is at least 20 hPa thick. Levels noting the beginning and ending of missing wind data will only be shown in the WMO Levels table (and coded message) if the layer is at least 1,500 meters thick.

6.RRS Observation – Check and Status Messages

6.1 Introduction

The RWS software will automatically identify meteorological and flight/system conditions that may require the observer's attention. These conditions are logged in the Check and Status Messages. These messages can provide assistance in finding areas of the flight that have questionable or bad data, however they do not identify all flight problems. The operator must use these alerts in conjunction with the plots and other tools to determine data quality. Refer to Chapter 11 for more information on sounding data quality control.

6.2 Check Messages

The Check Messages are designed to alert the operator of unusual or abnormal meteorological conditions. The Check Messages are not continually updated, they are only generated when one of the following occur:

- The flight passes 400 or 70hPa
- The observer runs **Code, Update Levels** or **Apply User Edits** commands
- The flight is terminated.

Messages displayed may indicate problems with the data that require your attention. Typically, these messages point out data that are inconsistent with the rest of the sounding data or with data from the previous flight. Examine each message and corresponding data to determine if any intervention is required. Exhibit 6-1 shows Check Messages with some stratums that have large temperature lapse rates. The Table 6-1 is a list of all Check Messages.

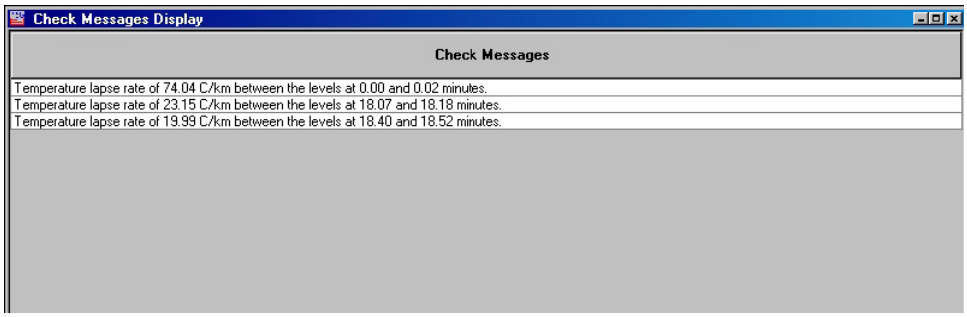


Exhibit 6-1 Temperature Lapse Rate Check Messages

Check Messages

No previous flight data available for comparison.
Data missing near possible Tropopause. Check Tropopause.
There was a height change of ***<height change (meters)>*** meters from previous flight at time ***<elapsed time (minutes)>.***
There was a temperature change of ***<temperature change (degrees Celsius)>*** degrees from previous flight at time ***<elapsed time (minutes)>.***
Missing mandatory pressure level at ***<pressure (hPa)>*** millibars
Multiple levels with same pressure at times ***<elapsed time (minutes)>*** and ***<elapsed time (minutes)>***
No tropopause found at 500 mb or above. Tropopause found at ***<pressure hPa)>*** will be used.
There is a temperature lapse rate of ***<value>*** degrees per kilometer between the levels at ***<elapsed time (minutes)>*** and ***<elapsed time (minutes)>*** minutes.
There is no level within 20mb of the surface.
Wind direction change of ***<angle (degrees)>*** degrees between minutes ***<elapsed time (minutes)>*** and ***<elapsed time (minutes)>.***
Wind speed change of ***<wind speed change (knots)>*** knots between minutes ***<elapsed time (minutes)>*** and ***<elapsed time (minutes)>.***
Wind speed exceeds 180 knots from minute ***<elapsed time (minutes)>*** to minute ***<elapsed time (minutes)>.***
Superadiabatic Lapse Rate of ***<value>*** Deg/Km detected from ***<elapsed time (minutes)>*** to ***<elapsed time (minutes)>*** minutes

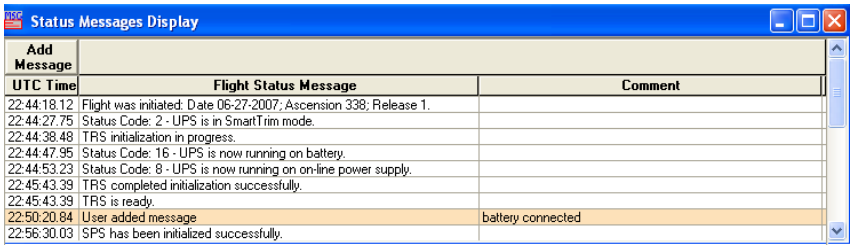
Table 6-1 List of Possible Check Messages

6.3 Status Messages

Status Messages provide information on (mostly non-meteorological) flight events. Unlike the Check Messages, the Status Message update automatically throughout the flight. Many of the Status Messages are routine, indicating that a part of the flight has been successful (i.e. Radiosonde has been baselined successfully). While other non-routine Status Messages alert the observer to take a closer look and determine if intervention is required.

The Status Message also allows the observer to add comments to any Status Message by clicking in the Comment column. Additionally, an observer can add another Status Message and add their own comment by clicking the **Add Message** button in the Status Messages. Adding a message is a good

method for the observer to document anything out of the ordinary or any actions they took. Exhibit 6-2 shows an example of a Status Message Display with an observer added message. Exhibit 6-3 is a list of Status Message descriptions.



Status Messages Display

Add Message

UTC Time	Flight Status Message	Comment
22:44:18.12	Flight was initiated: Date 06-27-2007; Ascension 338; Release 1.	
22:44:27.75	Status Code: 2 - UPS is in SmartTrim mode.	
22:44:38.48	TRS initialization in progress.	
22:44:47.95	Status Code: 16 - UPS is now running on battery.	
22:44:53.23	Status Code: 8 - UPS is now running on on-line power supply.	
22:45:43.39	TRS completed initialization successfully.	
22:45:43.39	TRS is ready.	
22:50:20.84	User added message	battery connected
22:56:30.03	SPS has been initialized successfully.	

Exhibit 6-2 User Added Message

6.3.1 Status Messages Explanations

Exhibit 6-3

Flight was initiated: Date <*mm-dd-yyyy*>; Ascension <*###*>; Release <*#*>. Date, Release and Ascension number for the flight.
Comparison flight is Ascension <#> Ascension number of flight used as a comparison.
No appropriate flight found for comparison. Previous synoptic flight more than 24 hours prior.
Comparison flight is more than 12 hours before current flight. A synoptic flight was not found within the past 24 hours to use as a comparison.
Observer has backed out of baseline and reentered preflight information entry. This message appears when the *Back* or *Reject* button is clicked in the baseline screen.
Status Code: 0 - UPS has been turned off. First message that appears after powering the UPS on. It indicates that the UPS was off.. Also indicates that the UPS has completed powering off.
Status Code: 8 - UPS is now running on on-line power supply. The UPS has completed powering on. Also indicates that the UPS is back on on-line power after a power failure.
Status Code: 16 - UPS is now running on battery. Second message that appears after powering the UPS on. It indicates that the UPS is running on battery.. Also indicates that the UPS is running on battery when the line power is not there (i.e. power failure).
TRS initialization in progress. The TRS has started its initialization. This occurs when the TRS is powered on or reset.
TRS busy with motor warm-up operation. The TRS must run motor warm-up prior to initialization. This usually occurs when ambient temperatures are below 50 degrees.
TRS completed initialization successfully. The TRS completed initialization without problem.

TRS completed initialization unsuccessfully. The TRS had a problem and is not initialized.
Reascending balloon detected --<time> minutes lost. RWS detected a descending /reascending balloon. Data during the descending /reascending was lost.
Event marker received from SPS Indicates a manual release button was clicked.
External Backup Device has been removed. Switching to alternate backup folder (C:\RWSBackup). The external hard drive has been disconnected or has failed. RWS will begin backing flights to C:\RWSBackup.
External Backup Device has been restored. RWS will backup files to external folder The external hard drive is working or has been connected. RWS will begin backing flights to the external hard drive.
Coded Messages were generated. RWS has selected levels data and coded the data into Coded Messages. Occurs automatically at 400 hPa, 70 hPa, and termination. Messages occurs when the observer runs the following commands Code, Apply User Edits, or Update Levels.
The RADAT message has been generated. The flight has reached 400 hPa and the Coded messages have been generated or the observer has manually run code prior to reaching 400 after a freezing level was reached allowing the RADAT to be generataed.
Part <*FZL , MAN, SIG, ABV*> **transmission SUCCESSFUL** The coded message was successfully transmitted. Doesn't indicate if the message was successfully received.
Part <*FZL , MAN, SIG, ABV*> **transmission UNSUCCESSFUL** The coded message was not successfully transmitted.
<*Termination Reason*> **detected at** <*time*> **minutes.** The termination reason and the elapsed time for termination.
Flight terminated: <*Termination Reason*> **.** The termination reason selected by RWS
Flight Levels termination is set to <*elapsed time*> **minutes** The elapsed time flight terminated as selected by RWS
Termination reason changed to <*reason*>. The observer changed the termination reason.
Successful observation. The flight terminated at a pressure higher in altitude than 400 hPa. The flight is officially successful.

Unsuccessful observation. The flight terminated at a pressure lower in altitude than 400 hPa. The flight is officially unsuccessful.
User added message. The observer clicked the **Add Message** button in the Status Messages.
TRS Error Reported: LRU: <*status bit***>, SCA: <***status bit***>, MCU: <***status bit***>, Receiver: <***status bit***>, Scanner: <***status bit***>, Power Supply: <***Status***>** Notify maintenance personnel if TRS error causes problems continuing the flight to normal termination.
TRS is ready. The TRS has completed initialization and is ready for use.
SPS has been initialized successfully. The SPS initialized and is sending radiosonde data.
Radiosonde has been baselined successfully. The radiosonde completed baseline with a pressure discrepancy within tolerance.
Successful release. The flight was released and 5 minutes of processed data has been received. This does **not** indicate the release is officially successful (aka. 400 hPa).
Unsuccessful release. The flight was terminated and data was not received
Balloon release detected at <*time***> UTC.** The time RWS detected release.
Balloon released <*EARLY / LATE***> outside of synoptic window. Observation re- categorized as a <***time***> UTC special observation.** The flight was originally identified as a synoptic flight, but was released outside a synoptic window and thus is a special observation.
Balloon released <*EARLY / LATE***> within a synoptic window. Observation re- categorized as a <***time***>UTC synoptic observation.** The flight was originally identified as a special flight, but was released inside a synoptic window and thus is a synoptic observation.
Release time changed to <*time***>.** New release time. This message appears after the observer changes the release time.
Surface Observation data was successfully modified. The observer modified the surface observation after release.
Flight Levels termination is set to <elapsed time> minutes. The observer changed the termination time.

Exhibit 6-3: Status Message descriptions

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7.RRS Observation – Plot Selection & Management

7.1 Introduction

RWS has the ability to display the flight data through a variety of plots. The plots are important aids for the operator to identify data that is missing, questionable or obviously erroneous. The plots provide a quick look at data trends and are helpful in picking out atmospheric anomalies. See Chapter 11 for identification of atmospheric anomalies.

7.2 Plot Selection

In order to make the best use of the plots, it is vital that each observer become thoroughly familiar with the plots and the plot options. To display the selection of plots click on the Plots pull-down menu (Exhibit 7-1).

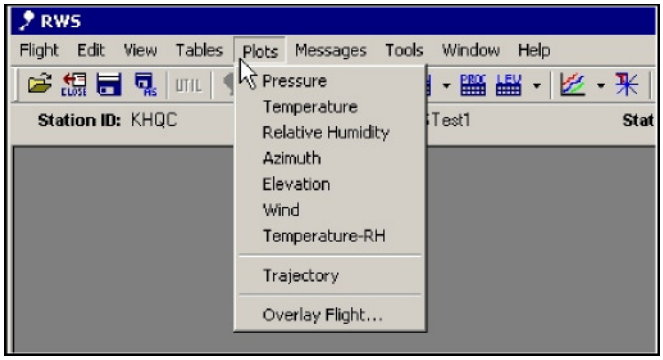

Exhibit 7-1 Plots Pull-down Menu

1. The Pressure plot displays Raw, Smoothed and Corrected Pressure versus Elapsed Time (Exhibit 7-2). This plot is useful for verifying release point selection and point of flight termination or other pressure anomalies that may require user interaction. Changing the Y Axis to Geometric Height can assist in identifying a descending and re-ascending balloon

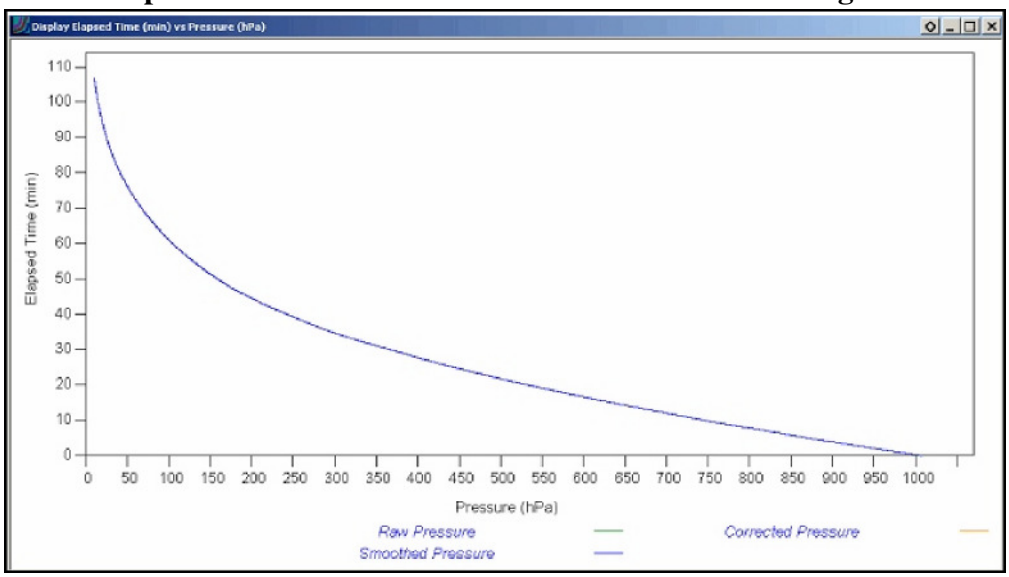

Exhibit 7-2 Pressure Plot

2. The Temperature plot displays Raw, Corrected and Dewpoint Temperature versus Elapsed Time (Exhibit 7-3). This plot is useful for identifying temperature anomalies that may require user interaction.

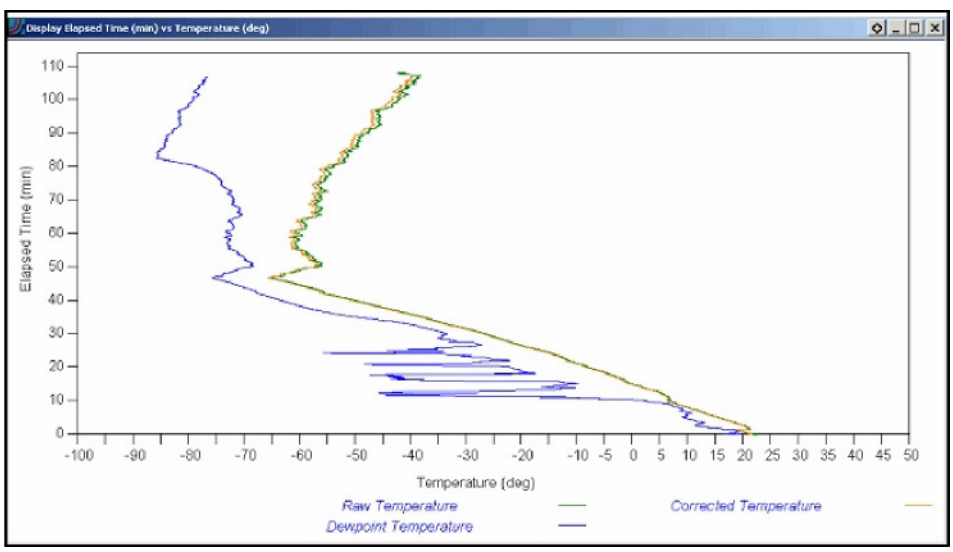

Exhibit 7-3 Temperature Plot

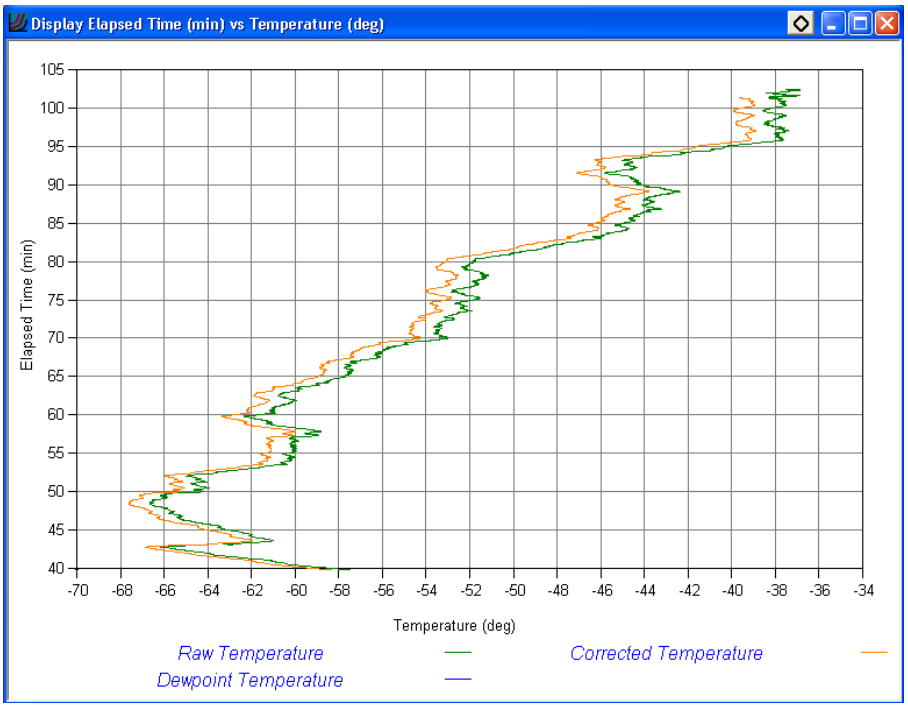

Exhibit 7-4 Differences between Raw and Corrected Temperature above 40 minutes

The differences between the Raw Temperature and Corrected Temperature in Exhibit 7-4 above 40 minutes. The difference is due to the temperature radiation correction being applied.

3. The Relative Humidity plot displays the Raw and Corrected Relative Humidity versus Elapsed Time (Exhibit 7-5). This plot is useful for identifying humidity anomalies that may require user interaction.

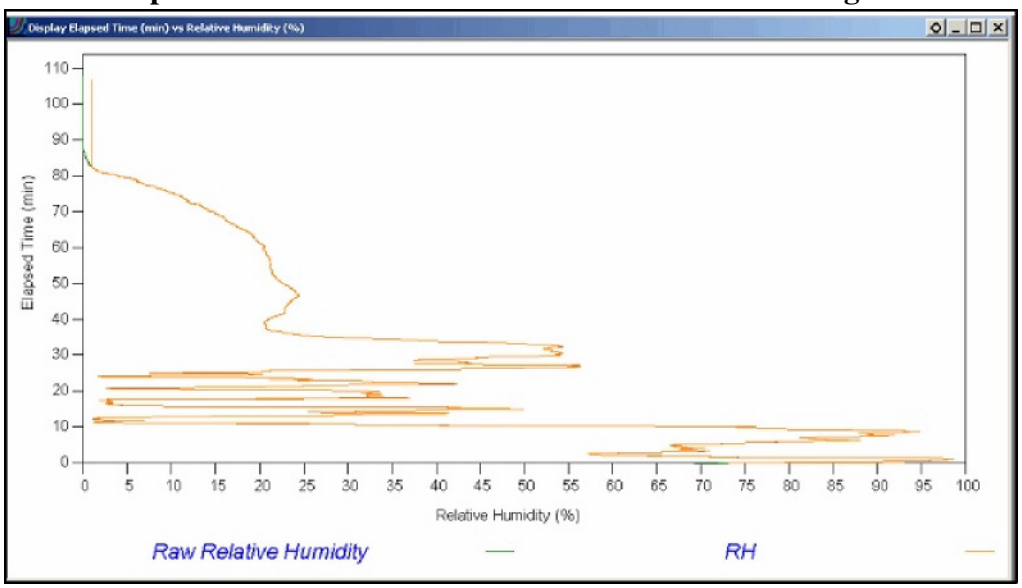

Exhibit 7-5 Relative Humidity Plot

4. The Azimuth plot displays the TRS Azimuth angle versus Elapsed Time (Exhibit 7-6). This plot shows the azimuth motion of the TRS and can assist electronics staff in troubleshooting tracking issues.

NOTE: Raw Azimuth and Elevation Plots are from the TRS position during the flight. This is not reflective of the Wind plot which is acquired from GPS data.

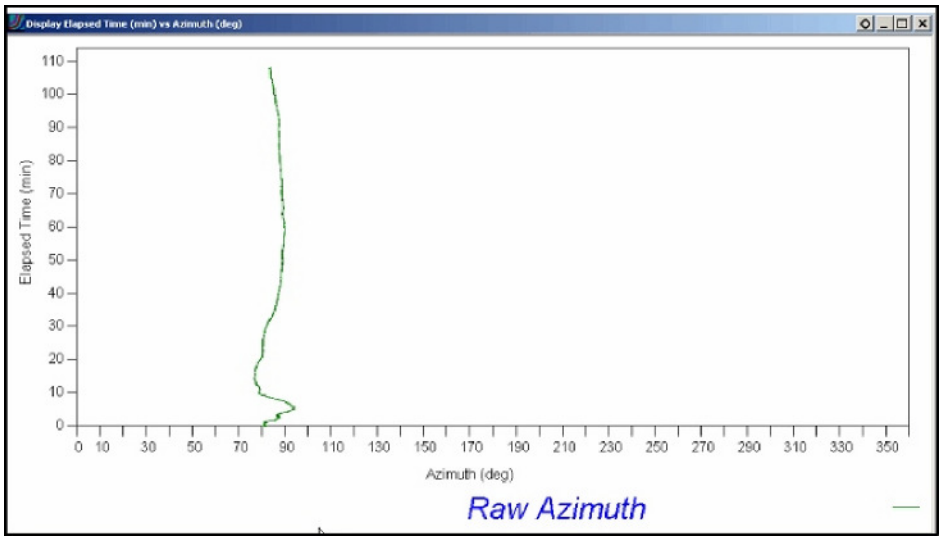

Exhibit 7-6 TRS Azimuth Plot

5. The Elevation plot displays the TRS Elevation angle versus Elapsed Time (Exhibit 7-7). This plot shows the Elevation motion of the TRS and can assist electronics staff in troubleshooting tracking issues.

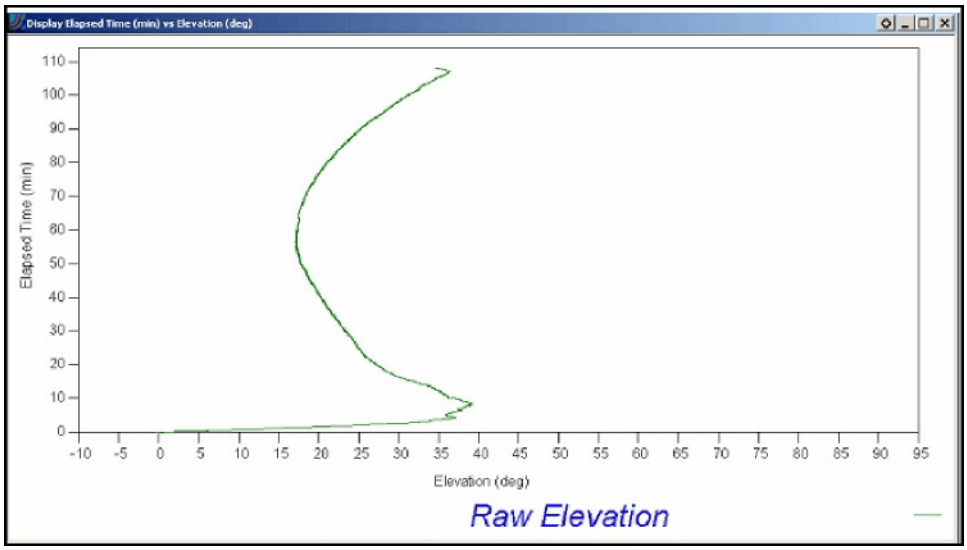

Exhibit 7-7 TRS Elevation Plot

6. The Wind plot displays the Wind Speed and Direction versus Elapsed Time (Exhibit 7-8). When GPS data are missing the plot will not update. Gaps in the GPS data for a minute or more will be displayed as breaks in the wind profiles. Nearly horizontal lines in the Wind direction plot indicate that the wind direction crossed the 0/359 degree direction.

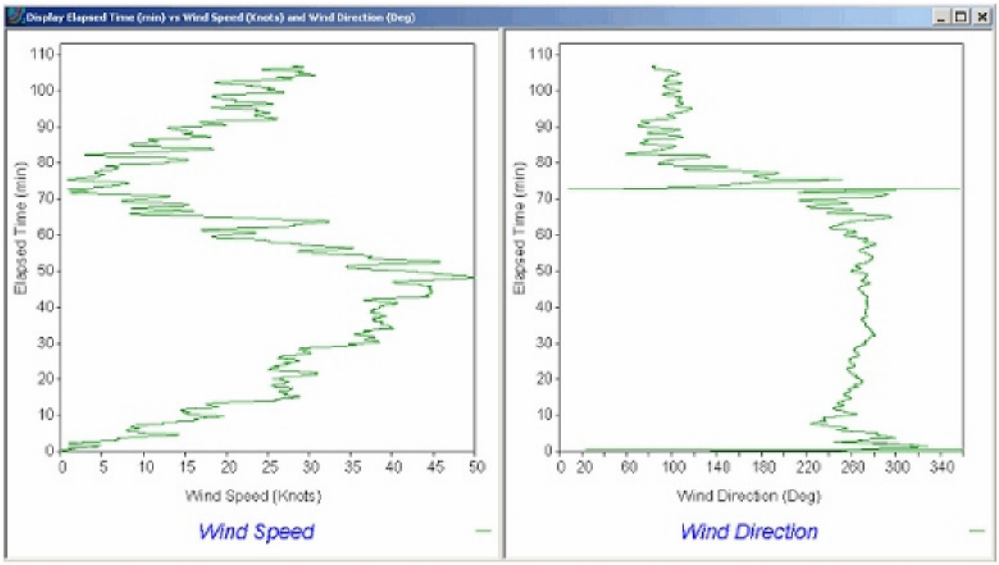

Exhibit 7-8 Wind Speed and Direction Plot

7. The Temperature-RH plot displays Corrected Temperature and Relative Humidity versus Elapsed Time (Exhibit 7-9). This plot can assist in identifying the wet-bulb effect/evaporative cooling and other anomalies that may require user interaction.

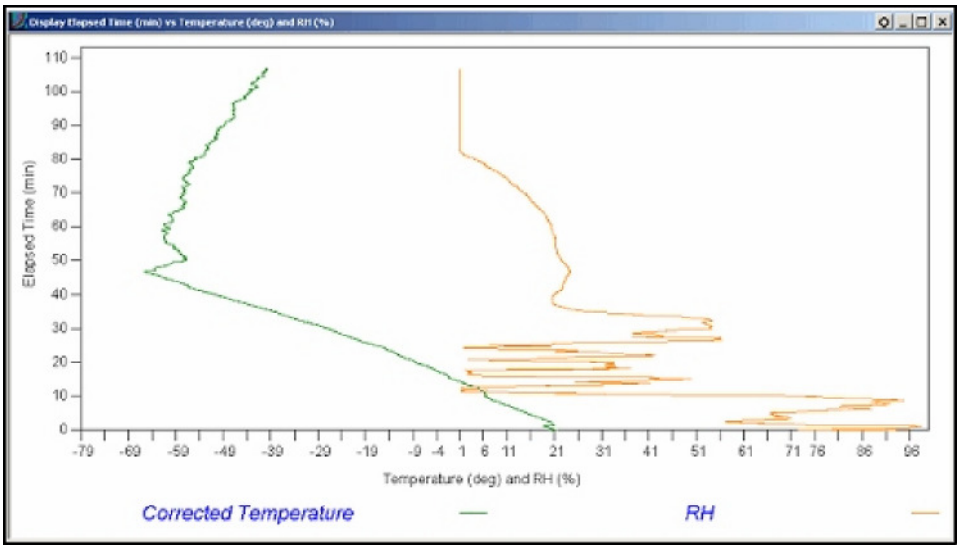

Exhibit 7-9 Temperature/RH Plot

8. The Trajectory plot displays GPS Calculated Azimuth versus Arc Distance (Exhibit 7-10). Since the center of the plot is the TRS/Release point, it is useful in verifying the TRS is pointed in the correct azimuth direction (Exhibit 7-11). When GPS data is missing the plot will not update. Once GPS data is received it will interpolate through the missing data.

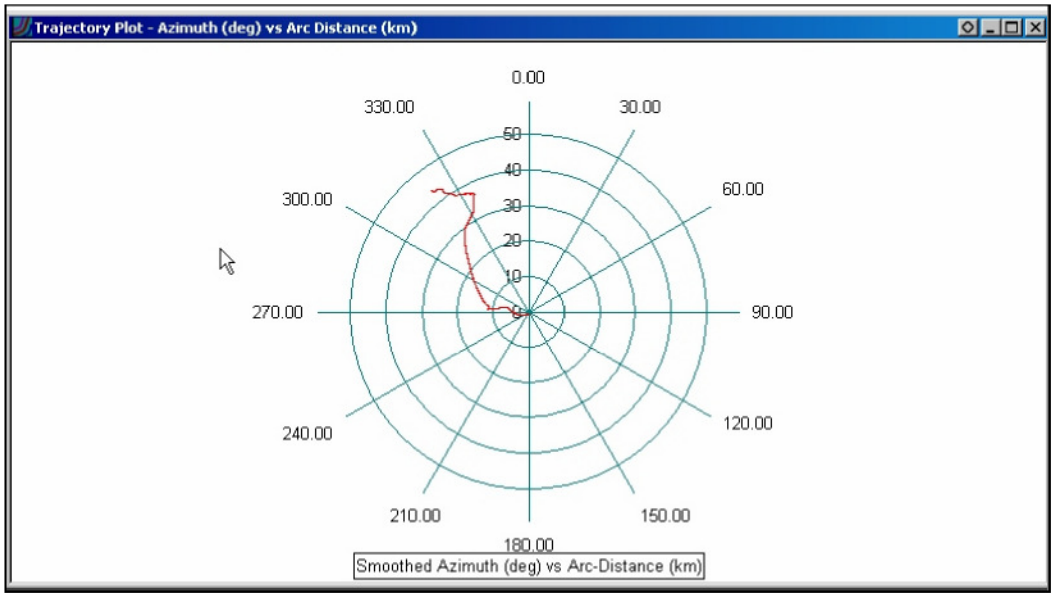

Exhibit 7-10 Trajectory Plot

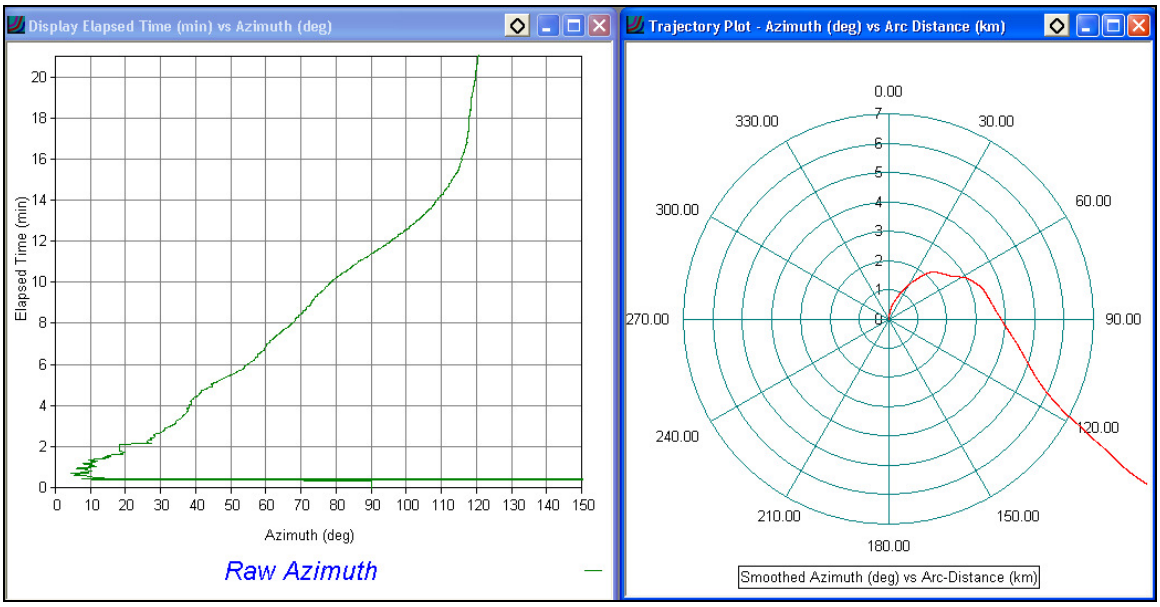

Exhibit 7-11 Elapsed Time vs. Azimuth and Azimuth vs. Arc Distance plots

7.3 Plot Zoom

To better see some of the details of the flight it may be necessary to modify the plot scale to better see them. The easiest method to zoom is to left click on the plot and hold the button down while dragging the mouse. More options scaling are available in the right click menu discussed in section 7.4.

7.4 Plot Options

Each plot has options to adjust and customize the display of data. To select the options, right click inside a plot window and the plot options menu will appear (Exhibit 7-12).

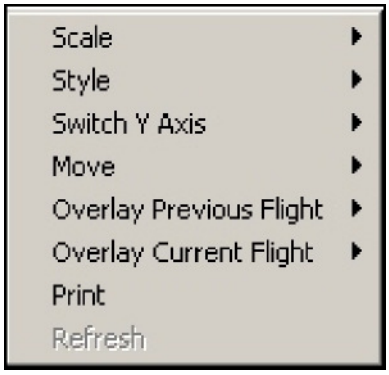

Exhibit 7-12 Plot Options

1. The Scale menu has several options for adjusting the Y-Axis of the plot (Exhibit 7-13).
   - **Zoom Out** returns to the scale when zooming in.
   - **Three Quarter** scales the Y-Axis to 90 minutes.
   - **Half** scales the Y-Axis to 60 minutes.
   - **Quarter** scales the Y-Axis to 30 minutes.
   - **Custom** allows the user to enter the desired minimum and maximum on the Y-Axis.
   - **Size to Fit** automatically adjusts the Y-Axis to fit the entire plot.

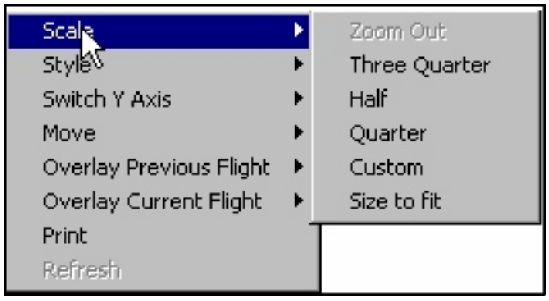

Exhibit 7-13 Scale Options

2. The Style menu has options for adjusting the plot style (Exhibit 7-14)
   a. **Line** adjusts the thickness of the line.
   b. **Symbol Size** adjusts the type of symbol.
   c. **Grid** turns the X and Y grid lines on/off.

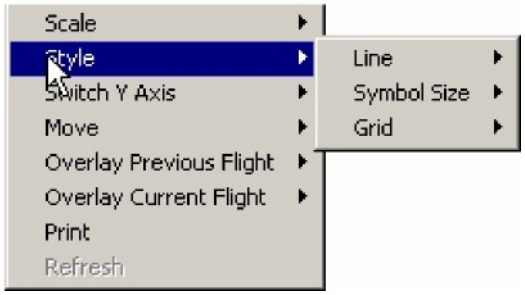

Exhibit 7-14 Style Options

3. The Switch Y Axis menu allows different parameters to used for the Y Axis (Exhibit 7-15).
   a. **Elapsed Time** sets the Y Axis to the time elapsed since release.
   b. **Geopotential Height** sets the Y Axis to the calculated Geopotential Height.
   c. **Geometric Height** set the Y Axis to the GPS measured height.

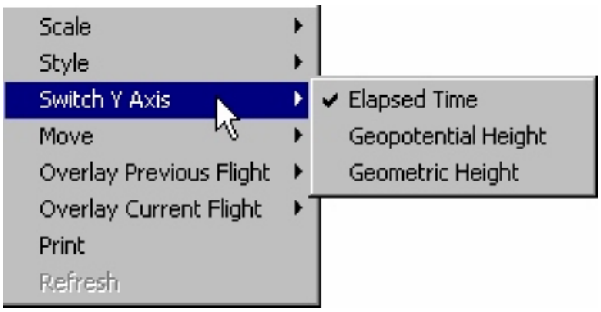

Exhibit 7-15 Switch Y Axis Options

4. When Zooming-in on the plot the Move menu adjusts the position of the zoom (Exhibit 7-16). This allows the zoomed window to be moved to follow the plot line without zooming-out and re-zooming-in.

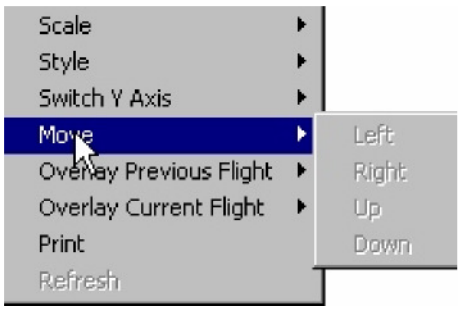

Exhibit 7-16 Move Options

5. The Overlay Previous Flight menu allows levels from a previous flight to be displayed on the plot (Exhibit 7-17).
    a. **No Levels** turns off the display of the previous flight's levels.
    b. **Level Marks** displays a point for each of the previous flight's levels.
    c. **Connect Levels** displays a line connecting each point of the previous flight's levels.

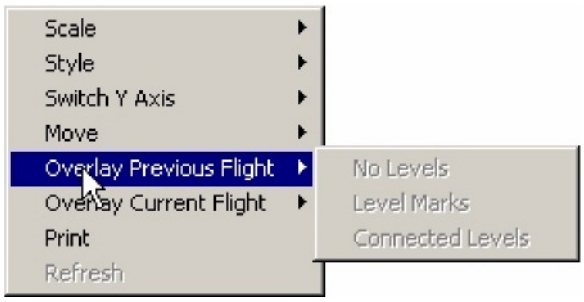

Exhibit 7-17 Overlay Previous Flight Options

6. The Overlay Current Flight menu allows levels from the current flight to be displayed on the plot (Exhibit 7-18).
    a. **No Levels** turns off the display of the levels.
    b. **Level Marks** displays a point for each of the levels.

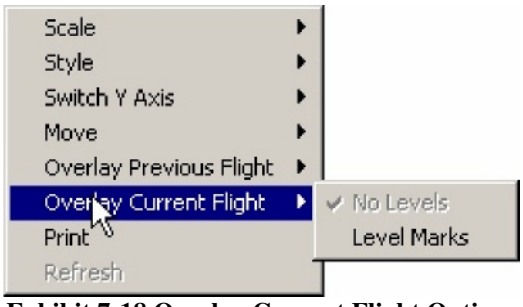

Exhibit 7-18 Overlay Current Flight Options

7. The Print option will bring up a display to select a printer and print (Exhibit 7-19).

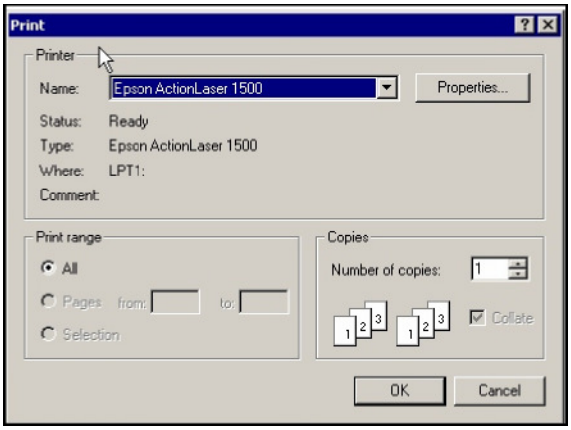

Exhibit 7-19 Print Window

8. The Trajectory Plot has fewer plot options then the other plots. To access the plot options right click anywhere in the Trajectory plot (Exhibit 7-20).
    - **Scale** allows a user defined Arc-Distance to be entered. This value must be a positive whole number.
    - **Zoom** has predefined Arc-Distance scales of 50 km, 100 km, 150 km and Size to Fit. **Size to Fit** adjusts the scale to best fit the entire Trajectory plot.

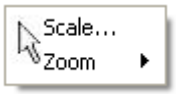

Exhibit 7-20 Trajectory Plot Options

8.RRS Observation - Transmitting Messages

8.1 Introduction

This chapter discusses the procedure for transmitting WMO Coded Messages to host computers. The following section describes general procedures for transmission.

8.2 General Procedures

RWS automatically generates WMO Coded Messages at specific levels during the flight. They may also be manually generated anytime during or after the flight. Once the WMO Coded Messages are generated, the observer should review the plots, Check Messages, and Tabular Data prior to transmitting. If changes are made to data the WMO Coded Messages will need to be re-coded. After data has been checked for quality and any re-coding has taken place, select the appropriate message/s and click the **Transmit** button.

8.3 Coded Messages

The WMO Coded messages include the RADAT, Mandatory Levels (MAN), Significant Levels (SGL), and Above 100 hPa Levels (ABV). RWS will **Code/**generate and display the WMO coded messages whenever the **Code** option is selected from the Messages pull-down menu. During a flight, RWS issues the **Code** command automatically when the flight reaches 400 hPa, 70 hPa, and at termination. When the WMO Coded Messages are generated, RWS also regenerates and displays the Check and Status messages. While not transmitted, the Check messages alert the observer to unusual or abnormal meteorological conditions.

IMPORTANT: While the WMO Coded Message window allows the edits to the coded message, the observer must not make edits unless there are obvious errors with the messages. Instead, the observer should review and edit the flight data by Marking data in the Processed Tabular Display and then re-Code the WMO Coded Messages. The RRS software has been designed to automatically include required 101 groups to cover most situations. Because of this, the program does not present a prompt asking for 101 groups. Any edits made to the WMO Coded Message will not be reflected in the Processed Tabular Display.

The transmission of WMO Coded Messages can take place anytime during a flight and up to 6 hours after flight termination in Rework. A message may be transmitted by clicking on the desired message in the upper left box. A “Red Check” indicates the message to be transmitted. Clicking the **Transmit** button will transmit the coded message. While not usually necessary, the entire Coded Message can be transmitted at anytime during the flight. In some instances, such as, multiple or late releases it may be necessary to transmit the entire Coded Message early in the flight to ensure

the data makes it into the weather prediction models. Exhibit 8-1 indicates which required portions of the Coded Messages must be transmitted when the flight reaches set levels.

Flight Level Reached	Coded Message to be Transmitted
400 hPa	RADAT
70 hPa	MAN and SGL
Termination	ABV

Exhibit 8-1 WMO Coded Message Transmission Requirements

The WMO Coded Messages are transmitted through one primary connection route with three backup connections. If the primary connection fails, RWS will automatically attempt to connect to each backup connection (in succession) three times. If all connections are unsuccessful it is recorded in the Status Messages. With remote upper air locations as the exception, the typical setup for the primary and backup connections is listed below.

- Primary connection for most sites is the LAN connection to local LDAD.
- First backup connection is a dial-in connection to the local LDAD.
- Second backup connection is a dial-in connection to the Regional Headquarters LDAD.
- Third backup connection is a dial-in connection to another Regional Headquarters LDAD.

NOTE: The RRS software does not compute fallout winds.

8.3.1 Manually Coded No Data Messages

If a flight fails at release and no data above surface is available or a flight will not be taken, the observer must select the Messages option, and click on the last option No Data. The No Data Message window will appear. Select from the drop-down menu the appropriate reason or reasons for no flight being taken. (Exhibit 8-1) The WMO Coded and RADAT Message window will open with TTAA Message in the bottom right window. The (TTAA), (TTBB), and (TTDD) messages must all be sent with the appropriate 101 groups when no flight has been taken or no data is available above the surface.

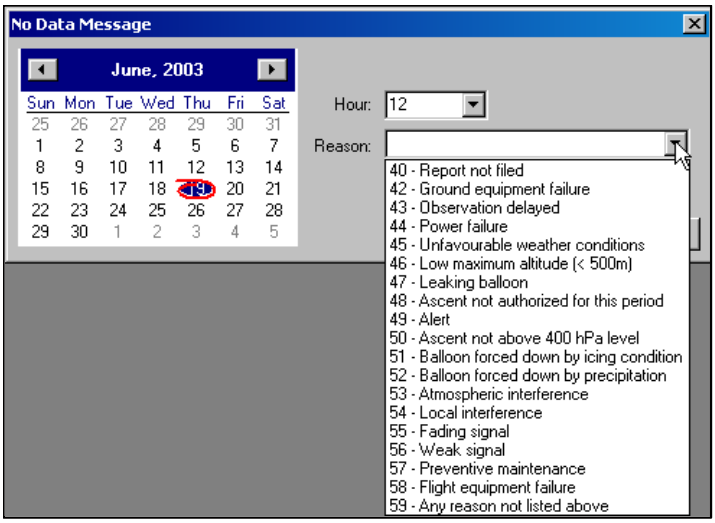

Exhibit 8-1 No Data Message with Options

AWIPS Message: USUS97 KQHC 270000
MANHQC
72403 TTAA 7700/ 72403 51515 10142=

NOTE: There are two different procedures that should be followed when a flight is missed.

1. When a flight is not possible for any reason, the observer must use the No Data option and add the proper 101 groups for the reason for no data.

2. When a flight is missed and another was possible, but not allowed - The observer must add a 10148 group after the 51515 message in the TTAA, TTBB and TTDD messages. The 10148 group signifies that an ascent was not authorized.

   The 10148 group should only be used when a second release is possible, but not allowed by NCEP or other approving authorities.

8.3.2 Using the Code Option

Unless the RRS software has automatically issued the **Code** command, click on the **Code** option to code a WMO message. From the WMO Message Display select the message you wish to view. If the MAN message is selected, the screen showing the TTAA coded message appears. (Exhibit 8-2)

NOTE: The group following the 10164 is the stability index and the two groups following the 10194 group are the mean level winds from surface to 5,000 feet and from 5,000 feet to 10,000 feet.

```
69003 TTAA  70001 69003 99021 24056 01002 00258 22458 12503
92930 16439 12007 85645 12458 10004 70244 05699 01014 50591
11577 05523 40758 24778 06029 30960 41387 05525 25081 51383
06525 20224 57782 17003 15404 59781 26501 10658 61581 30513
88179 60381 05024 77999 51515 10164 00007 10194 11005 01008=
```

Exhibit 8-2 Mandatory Levels to 100 hPa

Clicking on the SIG message will display the TTBB and PPBB messages. (Exhibit 8-3)

```
69003 TTBB  70000 69003 00021 24056 11018 23861 22974 20050
33918 15631 44860 13058 55859 13058 66838 11457 77831 11057
88823 10444 99799 08428 11797 08225 22791 08656 33777 08059
44776 07859 55753 05659 66734 03656 77733 03456 88728 03460
99722 04471 11715 05071 22712 05489 33711 05695 44709 05699
55701 05699 66674 04099 77659 02676 88653 02276 99643 02499
11640 02699 22634 02099 33605 00576 44598 01176 55567 04774
31313 58708 80003 41414 00900 51515 10159=

PPBB  70000 69003 90012 01002 12003 10006 90346 12007 11007
08005 90789 00507 35011 36012 91246 35517 05518 04021=
```

Exhibit 8-3 Significant Levels and Winds to 100 hPa

The group immediately after the 31313 group tells the user if a solar correction is used, the radiosonde type and the ground equipment used. The second group following the 31313 group always begins with an eight. This group provides actual time of release in UTC.

31313 $s_r r_a r_a s_a s_a$ 8GGgg - (Example : 31313 58708 80003)

s_r	Solar and infrared radiation correction
$r_a r_a$	Radiosonde/sounding system used
$s_a s_a$	Tracking technique/status of system used
8	Indicator for time
GGgg	Time of observation in hours and minutes UTC is the actual time of radiosonde release.

Examples of the 31313 code group

58708

5 = Data corrected for solar radiation. (0 = No solar correction)

87 = LM Sippican MKIIA GPS radiosonde

08 = GPS tracking system

80003

8 = Is a designator to indicate that the release time follows

0003 = Is the actual time of release in UTC in hours and minutes (00:03 UTC)

The group immediately after the 41414 is the cloud code group. Appendix B covers the coding and decoding of the cloud group and weather group that are entered during pre-flight.

41414 $N_hC_LhC_MC_H$ - (Example 41414 81571)

N_h Cloud amount in eights of the sky of low or middle clouds.
NOTE: Only the amount of the low clouds if present. If no low clouds are present, then the amount of middle clouds. Never include high clouds.

C_L Type of low cloud.

h Height of lowest cloud layer

C_M Type of middle cloud

C_H Type of high cloud

The group or groups immediately after the 51515 group tells the user additional information about the flight or reason for termination. 101 groups are groups strictly for U.S. stations. The 101 code breakdown is found in section 4 of this chapter.

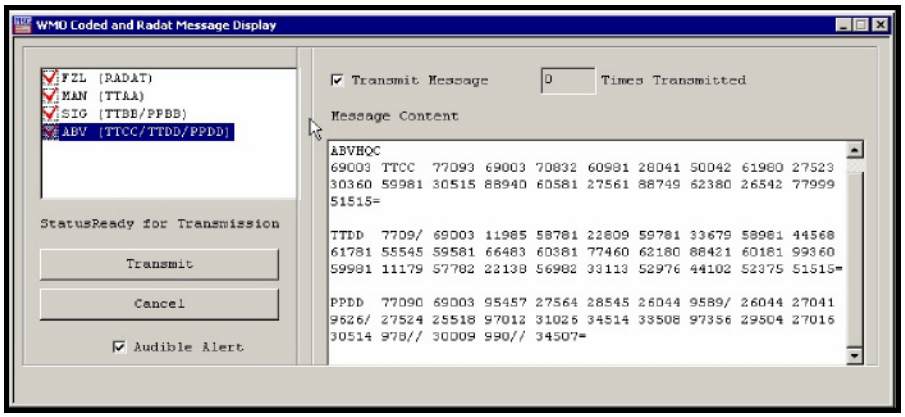

Exhibit 8-4 MAN and SIG Messages Above 100 hPa

Selecting the ABV message will display the TTCC, TTDD, and PPDD messages. (Exhibit 8-4)

8.3.3 The RADAT Message

The RADAT message indicates the height of the freezing level(s) in hundreds of feet based on pressure altitude along with the relative humidity at the various crossings. This data is important to meteorologists and aviation interests. The RADAT message is produced automatically at 400 hPa or may be manually generated by selecting **Code** under the Message pull-down menu during the flight. Verify the Check Messages, the Plotted Data and ascent rate in the PDS look reasonable prior to transmitting the RADAT message. After the RADAT message is coded, the software allows the operator to transmit it directly from the RRS workstation.

Coding the RADAT message may be done anytime during the flight by going to the top of the RWS screen display and clicking on the Messages option. The pull-down options are displayed, click on **Code**. (Exhibit 8-5.) Ensure the flight has gone above the freezing level and has no chance of crossing the freezing level again. Coding the RADAT message may be needed if a flight terminates prior to reaching 400 hPa and another release is not authorized or if the data is required due to operational demands prior to the balloon reaching 400 hPa.

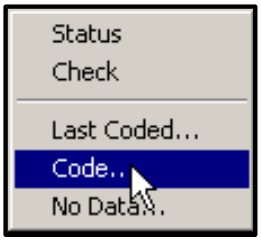

Exhibit 8-5 The Code Option Under the Messages Pull-down

The RRS software will automatically code the RADAT message and alarm after achieving 400 hPa. Close the Check and Status Message windows; the WMO Coded and Radat Message window is displayed. Select the FZL option in the WMO Coded Message List. (Exhibit 8-6) The RADAT message should display. (Exhibit 8-7)

IMPORTANT: Do **NOT** edit or change the data in the RADAT message. Pressure altitudes are used to generate heights and this data is not available to the observer. If the RADAT is erroneous you may code it as missing.

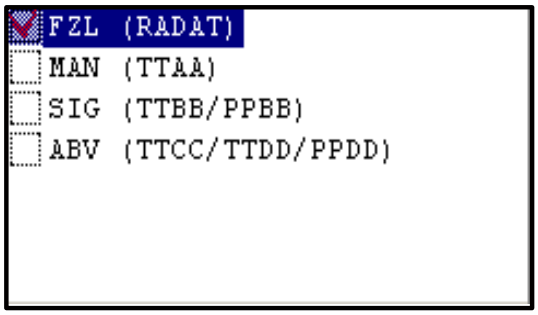

Exhibit 8-6 Message Options

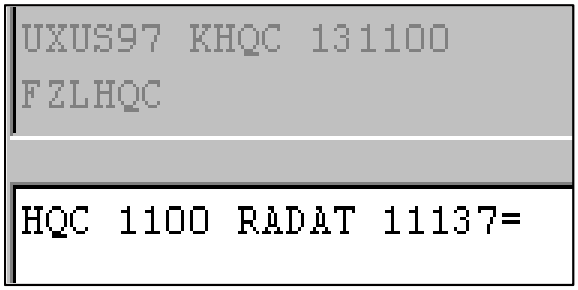

Exhibit 8-7 RADAT Message

8.3.3.1 Automatically Coded Groups of the RADAT message

The following is a breakdown of the RADAT message showing the elements the RRS software automatically codes.

CCC GGGG RADAT UU (D) (hphphp) (hphphp) (hphphp) (/n) RAICG HHMSL SNW

CCC 3 Letter Station ID

GGGG Observation time to the nearest hour (UTC)

RADAT A contraction to indicate that freezing level data follows.

UU Relative humidity to the nearest percent. The software will select the highest RH of any of the coded crossings of the 0° isotherm. Code 00 is used when the RH is 100 percent. RADAT "ZERO" is used when the entire sounding is below 0° C. RADAT "MISG" is used when the surface temperature is warmer than 0° C and the sounding is terminated before the 0° Celsius isotherm is reached. A // appears when RH is missing.

(D) A letter designator identifying the 0° C isotherm crossing to which the coded value of UU corresponds; L for lowest, M for middle, H for highest. When only one height value is coded, this figure is omitted.

(hphphp) Pressure altitude coded in hundreds of feet above MSL at which the sounding crosses the 0° C isotherm. A maximum of 3 levels are selected as follows:

A. The first crossing of the 0° C isotherm after release

B. The intermediate crossing of the 0° C isotherm. When there are two or more intermediate levels, the level with the highest RH is selected. If these levels have the same RH, the lowest level is selected.

C. The uppermost crossing of the 0° C isotherm.

D. After the levels are selected they are encoded in ascending order of height.

(/n) Indicator group to show the number of crossings of the 0° C isotherm other than those whose heights are coded. If all crossings are coded, the /n group is omitted.

Examples of Coded Freezing Level Data

	RH (%)	CROSSING ALTITUDE (FT)			CODED AS:
		Lowest	Middle	Upper	
Example 1:	63	3500			RADAT 63L035
Example 2:	89	2300	Missing	4200	RADAT 89H023///042

After the RADAT message is displayed, click on RADAT in the upper left box until a Red Check appears. After checking the RADAT message block, click on the **Transmit** button to send the message. Once the RADAT message is transmitted the display should update the Times Transmitted.

NOTE: If you attempt to transmit without checking the appropriate box a "No Message Selected" popup will appear (Exhibit 8-8).

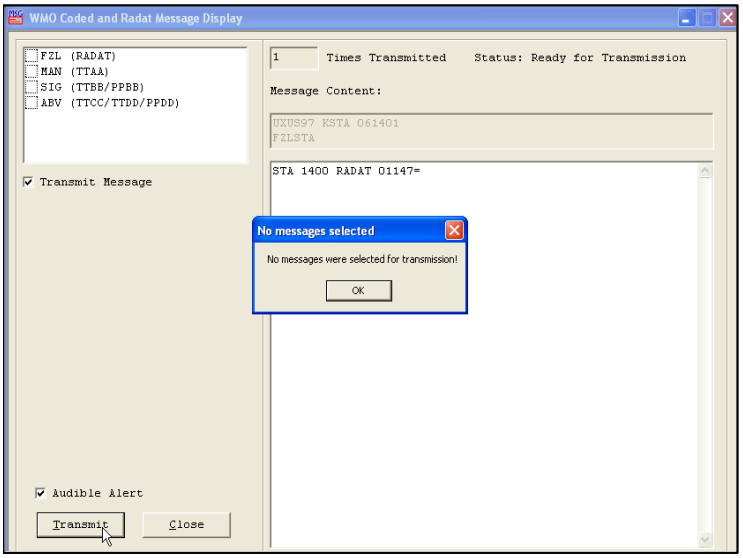

Exhibit 8-8 RADAT Message Not Selected

8.4 Coded Message Breakdown

The observer should understand how to properly code and decode upper-air messages. The messages for the sites in the continental United States, Alaska, the Bahamas, and the Caribbean are in WMO Region IV. The sites in the Pacific Region are in WMO Region V. The coding practices in Region IV and V differ slightly, the difference being the stability index and mean low level winds are not computed for sites in Region V.

CODED MESSAGE BREAKDOWN

91285 TTAA 56001 91285 99011 28060 01009 00107 24856 01007
92787 20456 33502 85514 18265 22504 70145 07413 27011 50586
04170 33025 40758 17367 32025 30966 32764 30537 25092 40762
30545 20241 52560 30541 15421 67158 30024 10657 79756 32024
88999 77999 51515 10164 00011 10194 32003 23507=

IIiii TTAA YYGGI_d IIiii 99PPP TTTDD ddfff 00hhh TTTDD ddfff
92hhh TTTDD ddfff 85hhh TTTDD ddfff 70hhh TTTDD ddfff 50hhh
TTTDD ddfff 40hhh TTTDD ddfff 30hhh TTTDD ddfff 25hhh TTTDD
ddfff 20hhh TTTDD ddfff 15hhh TTTDD ddfff 10hhh TTTDD ddfff
88PPP 77PPP 51515 10164 000I_sI_s 10194 ddfff ddfff=

IIiii - Block number and station number

TTAA - Indicator of mandatory levels up to 100 hPa.

YYGGI_d -

YY - Day of the month, (When winds are given in knots 50 will be added to YY)

GG - Actual time of observation, to the nearest whole hour UTC

I_d - Indicator used to specify the pressure relative to the last standard isobaric surface for which a wind is reported. Reported to the nearest hundreds of hectopascals. (Used in TTAA and TTCC)

PPhhh - Mandatory pressure levels

PP - Starts with 99 - indicating surface 00 -1000 hPa 92- 925 hPa 85 - 850 hPa on until 10 - 100 hPa.

hhh - Height in geopotential meters (gpm)

Sfc to 500 hPa - Reported in whole gpm (thousands not reported) 3204 gpm reported 204
500 hPa to Term - Reported in tens of gpm 6053 gpm reported 605

TTTDD - Temperature and Dewpoint Depression Values

TTT - Dry bulb Temperature in degrees Celsius. Last digit indicates if the temperature is negative or positive. Negative temperatures will have an odd number for the 3rd digit. Positive temperatures will have an even number for the last digit.

DD – Dewpoint Depression. This number is subtracted from the dry bulb temperature. Numbers of

less than 55, are degrees and tenths. (i.e) 49 is 4.9 degree dewpoint depression. Numbers of 56 or greater are dewpoint depressions in whole degrees. To obtain the proper dewpoint depression value subtract 50 from any value 56 or greater. (i.e) 72 would be a dewpoint depression of 22 degrees.

ddfff - Wind Direction and Speed

dd - True Wind Direction to the nearest 10 degrees. Wind directions of 500 degrees or greater indicate winds with speeds greater than 100 knots. When reading the direction in this case, one should subtract 500 from the direction and remember to add 100 to the wind speed value.

fff - Wind Speed in knots. Wind directions are actually rounded to the nearest 5 degrees. The unit digit of the wind direction is added to the hundreds digit of the wind speed. (i.e., 27520 is winds from 275 degrees at 20 knots.)

88hhh - TTTDD 88 - indicates tropopause

77hhh - ddfff 77 - indicates max wind group

51515 - Regional Code Groups Follow

10164 - Indicator that the stability index follows

10194 - Indicator that the mean low level wind groups follow

ddfff ddfff - First group mean winds sfc - 5000 feet
Second group mean winds 5000 - 10000 feet

= (End of message symbol) It is a telecommunications character and is not part of the code.

91285 TTBB 56000 91285 00011 28060 11008 26057 22000 24856
33905 19057 44850 18265 55795 13257 66768 12260 77764 12039
88700 07413 99679 05817 11675 06259 22670 06661 33652 06061
44644 05666 55627 03462 66606 02068 77567 01163 88548 01271
99478 05769 11339 28364 22281 34763 33137 71358 44100 79756
31313 01102 82307 41414 59571=

IIiii TTBB YYGGa_4 IIiii 00PPP TTTDD 11PPP TTTDD 22PPP TTTDD
33PPP TTTDD 44PPP TTTDD 55PPP TTTDD 66PPP TTTDD 77PPP TTTDD
88PPP TTTDD 99PPP TTTDD 11PPP TTTDD 22PPP TTTDD 33PPP TTTDD
44PPP TTTDD 55PPP TTTDD 66PPP TTTDD 77PPP TTTDD 88PPP TTTDD
99PPP TTTDD 11PPP TTTDD 22PPP TTTDD 33PPP TTTDD 44PPP TTTDD
31313 s_r $r_a r_a$ $s_a s_a$ 8GGgg 41414 $N_h C_L h C_M C_H$=

a_4 - Type of measuring equipment used. (Used only in TTBB and TTDD.)

0 - Pressure instrument associated with wind-measuring equipment
1 - Optical theodolite
2 - Radiotheodolite
3 - Radar
4 - Pressure instrument associated with wind-measuring equipment but pressure element failed during ascent
5 - VLF-Omega
6 - Loran-C
7 - Wind profiler
8 - Satellite navigation
9 - Reserved

NOTE: a_4 is not fully implemented into the RRS software - RRS codes “0" in TTBB & TTDD.

PPP - Pressure of Significant Levels Selected

SFC to 100 hPa - Levels selected to nearest whole hPa

Above 100 hPa - Levels selected to nearest 0.1 hPa

31313 - Data on Sea Surface Temp & Sounding System Used

s_r - Solar and infrared radiation correction.

0 - No correction
1 - Correction Made
4 - No Correction Made
5 - Correction Made

r_ar_a - Radiosonde Used

87 - Sippican GPS Mark II (USA)
51 - Sippican type B-2 time commutated (USA)
52 - Vaisala RS80-57 (Finland)

s_as_a -Tracking Technique/Status Used

00 - No windfinding
01 - Automatic with auxiliary optical direction finding
02 - Automatic with auxiliary radio direction finding
03 - Automatic with auxiliary ranging
05 - Automatic with multiple VLF-Omega frequencies

06 - Automatic cross chain Loran-C
07 - Automatic with auxiliary wind profiler
08 - Automatic satellite navigation

8 - Indicator
GG - Hour UTC of release
gg - Minute of release

41414 - Cloud Data $N_hC_LhC_MC_H$

N_h - Amount in eighths of all the C_L present or, if no C_L is present, the amount of all the C_M present.
C_L - Type of low cloud present
h - Height above surface of lowest cloud seen
C_M - Type of middle cloud present
C_H - Type of high cloud present

PPBB 56000 91285 90012 01009 01003 00502 90346 32002 26003
20502 90789 21005 23508 27013 91245 26512 27016 26514 9169/
31013 33026 9205/ 32523 32025 93013 31034 31538 29542 935//
30547 949// 30024 9504/ 30025 32037=

PPBB YYGGa_4 Iiiii 9$t_n$uuu ddfff ddfff ddfff 9tnuuu ddfff ddfff ddfff=

YYGGa_4 Iiiii ddfff - Previously described

9 - Indicator to show winds in units or 300 meters or 1,000 foot increments
t_n - Indicates tens digit of altitude - 0 = less than 10,000 feet 1 - 10,000 - 19,000 feet
u - Indicates the unit value of altitude of winds

91285 TTCC 56002 91285 70858 76757 05508 50059 63959 11005
30378 54160 06009 20638 51161 07512 88922 82356 33014 77999=

TTDD 5600/ 91285 11922 82356 22700 76757 33517 64359 44472
64959 55364 57560 66130 47162=

PPDD 56000 91285 9556/ 32522 33015 970// 13004 98047 08012
09512 07012 99015 08012 08011 05005=

Breakdown for $101A_{df}A_{df}$ - Miscellaneous Regional Data

Code Figure	Definition
40 - 59	Reason for no report or an incomplete report
40	Report not filed
41	Incomplete report; full report to follow
42	Ground equipment failure
43	Observation delayed
44	Power failure
45	Unfavorable weather conditions
46	Low maximum altitude (less than 1500 feet above ground)
47	Leaking balloon
48	Ascent not authorized for this period
49	Alert
50	Ascent did not extend above 400 hPa level
51	Balloon forced down by icing conditions
53	Atmospheric interference
54	Local interference
55	Fading signal*
56	Weak signal*
57	Preventive maintenance
58	Flight equipment failure (transmitter, balloon, attachments, etc.)
59	Any reason not listed above

* Fading signals differ from weak signals in that "fading signals" are first received satisfactorily, then become increasingly weaker, and finally become too weak for reception, while "weak signals" are weak from the beginning of the ascent.

60 - 64: Miscellaneous

62	Radiosonde report precedes
64	Stability index follows: $000I_sI_s$

65 - 69: Doubtful Data

65	Geopotential and temperature data are doubtful between following levels: $0P_nP_nP'_nP'_n$
66	Geopotential data are doubtful between the following levels: $0P_nP_nP'_nP'_n$
67	Temperature data are doubtful between the following levels: $0P_nP_nP'_nP'_n$
68	Dew point depression is missing between the following levels: $0P_nP_nP'_nP'_n$ (not used when T_nT_n is also missing)

70 - 74	Not allocated

Breakdown for $101A_{df}A_{df}$ - Miscellaneous Regional Data (Continued)

75 - 89	Corrected Data
78	Corrected tropopause data section follows
79	Corrected maximum wind section follows
80	Corrected report for the entire report (*first** and *second** transmissions) follows
81	Corrected report of the entire PART A and/or PART B precedes
82	Corrected report of the entire PART C and/or PART D precedes
83	Corrected data for *mandatory levels*** follow
84	Corrected data for *significant levels*** follow
85	Minor error(s) in this report; correction follows
86	*Significant level(s)* not included in original report follow: $//P_nP_nP_n T_nT_nT_{an}D_nD_n$ or $P_nP_nP_nT_nT_n$
87	Corrected data for *surface* follow
88	Corrected *additional data* groups follow: $101A_{df}A_{df}$ .... etc.
90 - 99	
90	Extrapolated geopotential data follow: $P_nP_nh_nh_nh_n$ $(d_nd_nd_nf_nf_n)$
94	Averaged wind for the surface to 5000 foot MSL layer and the 5000 to 10000 foot MSL layer follows: ddfff ddfff (can be used in the PART A message)

NOTE: Numbers not shown have no assigned meaning or do not pertain to NWS upper-air sites.

Unless both the stability index and the mean winds are missing, the Part A message always contains two special 101 groups as follows:

10164	Group that identifies stability index.
10194	Group that identifies the mean winds.

A 5-character group $000I_sI_s$ follows the 10164 which contains the encoded stability index. The I_sI_s value that appears in the coded message for the stability index is interpreted as follows:

Stability Index Table

Code Value	Meaning
00 to 40	Stability index is 0 to 40
51 to 90	Stability index is -1 to -40
91	RH < 20% at either base or 500 mb level or calculation failed.
92	RH is missing at the base level.

The 10194 group for mean winds from the surface to 5000 feet MSL and from 5000 to 10000 feet MSL are encoded in two code groups using the format $d_m d_m f_m f_m f_m$, where $d_m d_m$ is the mean direction and $f_m f_m f_m$ is the mean wind speed. If the mean wind is missing, it is reported as /////. If winds for both layers (i.e. Sfc. - 5K and 5K to 10K feet MSL) are missing, the 10194 is not sent.

Additional 101 groups as shown in the Table can be entered after the 51515 as long as the last two digits are in ascending order with the other groups. For example, if the report has been corrected, this section would appear as follows:

51515 10164 00092 10181 10194 ///// 26516=

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9.RRS Observation - Flight Termination

9.1 Introduction

RRS flights may terminate in one of four ways:

1. Automatic termination by the system.
2. Manual termination by the observer.
3. Predetermined termination at a certain pressure level.
4. Sudden unexpected failure such as hardware or power failure.

The following sections discuss each type of termination.

9.2 Automatic Flight Termination

RWS terminates a flight automatically when the radiosonde data indicates the observation has ended. Automatic termination can occur for a number of reasons, but the three most common are balloon burst, floating balloon, and excessive missing data. Even though RWS can automatically detect flight termination the flight data should be reviewed to verify the termination point and reason. If necessary the termination point/time and reason can be changed to accurately depict the flight.

When flight termination occurs, the UPS Status Window will appear indicating the software has terminated the flight. If an additional release is not necessary, click the **Yes** button to turn OFF the UPS and TRS (Exhibit 9-1). Otherwise, leave the UPS ON for the next release of the ascension.

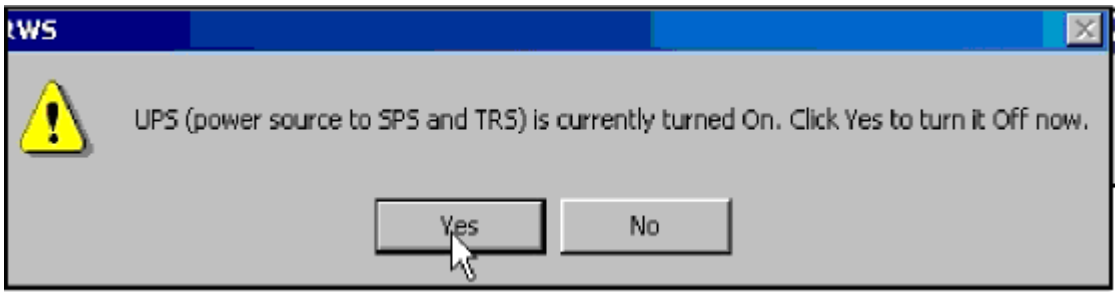

Exhibit 9-1 UPS Power Window

1. After clicking **Yes** in the UPS Power window, a Validation window appears (Exhibit 9-2) Click **Yes** to confirm the shutdown of the UPS.

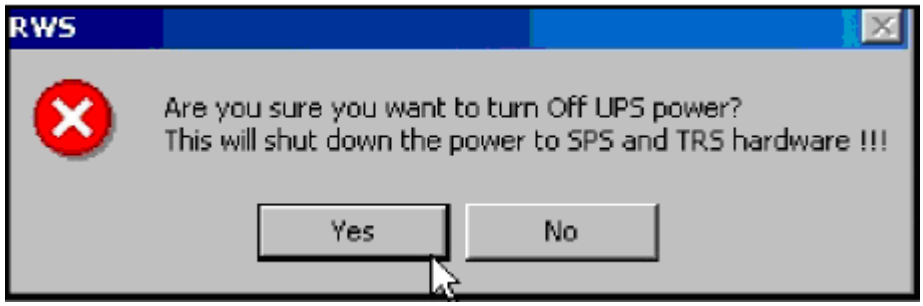

Exhibit 9-2 Validation Window

2. The window shown in Exhibit 9-3 appears, alerting the observer that the UPS status has been turned off. Click **OK**.

Exhibit 9-3 UPS Status Change Window

3. The window shown in Exhibit 9-4 will appear alerting the observer that this release will be marked as an active release. Click **OK.**

Exhibit 9-4 Mark As Active Flight

NOTE: An Active Release is the most successful release of an Ascension Number. When there are more than one release for an Ascension Number, RWS will prompt the observer to select the Active Release.

4. After the UPS prompt, the **Code** command is automatically executed and the Check, Status, and Coded Messages will appear. Do not transmit the Coded Messages, until the flight data and termination reason is reviewed for accuracy. (See Chapters 5 and 11)

9.2.1 Balloon Burst

The most common reason for flight termination is balloon burst. RWS will terminate a flight based on a decrease of radiosonde's geopotential height over a two minute interval. The burst detection process is delayed an additional three minutes to allow for potential floating balloon detection (Section 9.2.2).

The pressure profile is the best verification that the flight has terminated for balloon burst. Exhibit 9-5 illustrates a typical pressure profile that results when a balloon bursts. The Raw Pressure profile extends past the termination point and shows the part of the balloon's descent. The Corrected and Smoothed Pressure profiles end at the point of balloon burst. Exhibit 9-5 indicates balloon burst occurred just prior to 91 minutes.

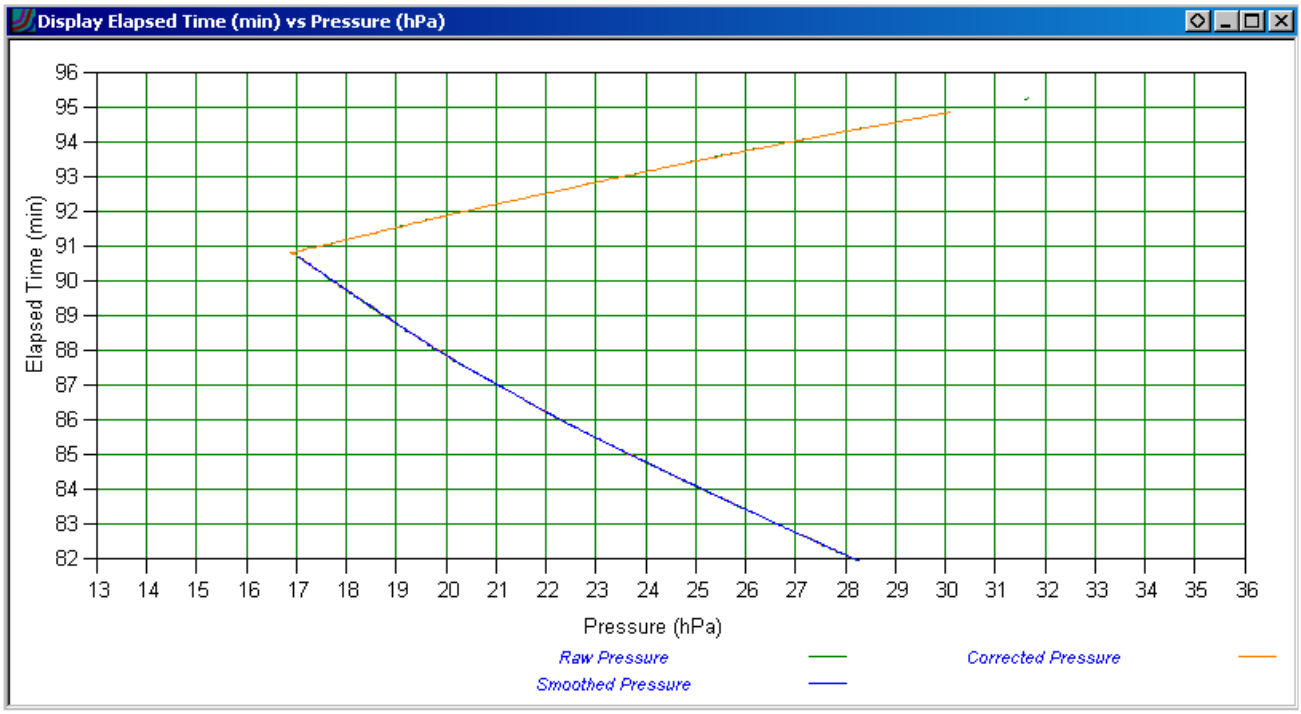

Exhibit 9-5 Termination for Balloon Burst

9.2.2 Leaking or Floating Balloon

Occasionally a flight terminates because the balloon stops rising and begins floating at a nearly constant altitude, or rises so slowly that there is no point in continuing the flight. A float can occur because of a leaking or icing balloon. RWS will terminate the float if the balloon fails to change height over time. If the Geopotential Height over 5 minutes does not increase at least 300 meters, and if the balloon does not rise at least 1 meter per second then the flight is terminated as a floating balloon. The termination point will be set to the starting point of the float.

9.2.3 Excessive Missing Data

Excessive Missing Data (EMD) can occur for a variety of reasons. The most common reasons are because of radiosonde battery failure or the loss of radiosonde signal.

RWS will terminate for EMD when the flight has three minutes of consecutive missing data or when the amount of cumulative missing data is reached (Table 9-1).

Flight Length	Cumulative Missing Data
Surface to 10 minutes	4 minutes
Surface to 25 minutes	6 minutes
Surface to 60 minutes	12 minutes
Entire flight	16 minutes

Table 9-1 Cumulative Missing Data Limits

RWS calculates the total amount of missing data in two ways, consecutive and cumulative (non-consecutive). EMD termination occurs when the flight has either three minutes of consecutive missing data or five minutes of cumulative missing data.

9.2.4 Radiosonde Failure

RWS will terminate the flight owing to radiosonde failure if it appears that the temperature sensor has failed. The temperature sensor is considered broken if:

1. Over any 5 minutes period the difference between highest and lowest temperature in that period is less than 0.2 degrees Celsius.
2. Over any 2 minute period the average raw temperature difference (temperature of a given point minus temperature of previous point) is greater than 0.5 degrees Celsius.

9.2.5 RWS unknown failure – Recovery

In the event the RWS software exits abruptly or the workstation abruptly turns off, the RWS software sets the termination reason to RWS unknown failure – Recovery. Once the flight is automatically reopened in Rework, If the flight ended under 400 hPa, the observer should review the flight data and determine if another release is necessary before sending the Coded Messages. See Section 9.7 for more information on flight recovery.

9.3 Manual Termination

In the event RWS has not terminated the flight, the observer can manually terminate the flight. Perform the following steps to manually terminate a flight.

1. Select **Terminate** from the Flight Pull-down menu. (Exhibit 9-6) The Validation window will appear. Click **Yes**. (Exhibit 9-7)

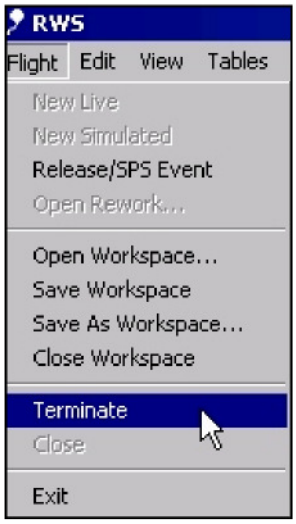

Exhibit 9-6 Manually Terminate

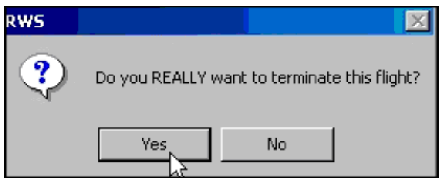

Exhibit 9-7 Validation window

2. After clicking **Yes** in the validation window, the UPS Status Window will appear indicating the flight has been terminated. If an additional release is not necessary, click the **Yes** button to turn OFF the UPS and TRS (Exhibit 9-8). Otherwise, leave the UPS ON for the next release of the ascension.

NOTE: Turning off the UPS enables the proper shutdown of the TRS and tracking equipment.

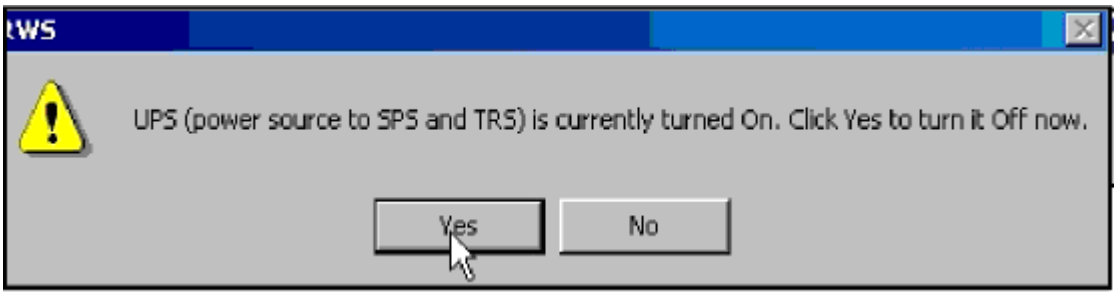

Exhibit 9-8 UPS Power Window

3. After clicking **Yes** in the UPS Power window, a validation window appears (Exhibit 9-9) Click **Yes** to confirm the observer wish to shutdown the UPS.

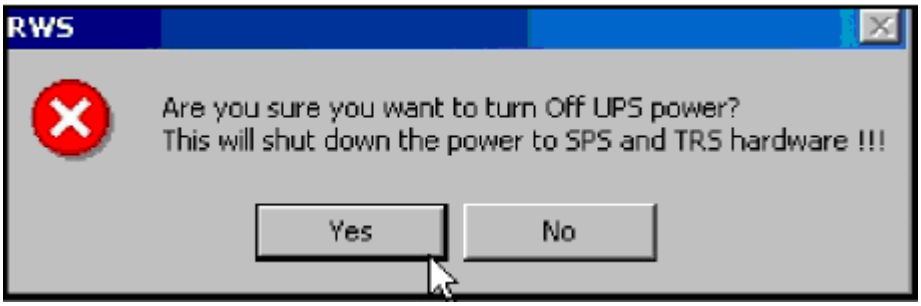

Exhibit 9-9 Validation Window

4. The window shown in Exhibit 9-10 appears, alerting you that the UPS status has been turned off. Click **OK**.

Exhibit 9-10 UPS Status Change Window

5. The window shown in Exhibit 9-11 will appear. Click **OK** to select this release as the active release.

Exhibit 9-11 Mark As Active Flight

6. After the UPS prompt, the Code command is automatically executed and the Check, Status, and Coded Messages will appear. Do not transmit the Coded Messages, until the flight data and termination reason is reviewed for accuracy. (See Chapters 5 and 11)

7. After transmitting the messages, open the Flight Summary display and copy or print the data required in WS Form B-29. If a problem or abnormal condition occurred save and print whatever messages or plots that may be of help. When finished reviewing and transmitting the flight data, close RWS from the Flight pull-down menu. (Exhibit 9-12)

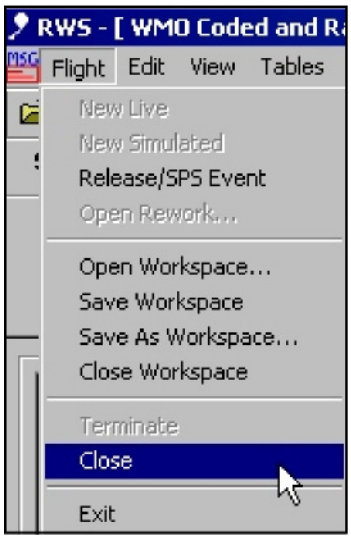

Exhibit 9-12 Close Flight

8. Click **Yes** in the Validation window (Exhibit 9-13).

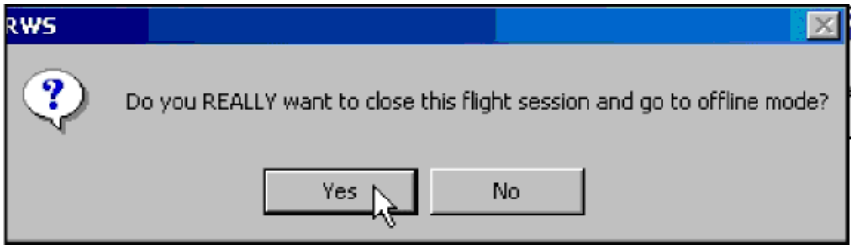

Exhibit 9-13 Validation Window

9. A final window appears stating that the flight was saved to the database and the flight should be archived. Click **OK**. (Exhibit 9-14)

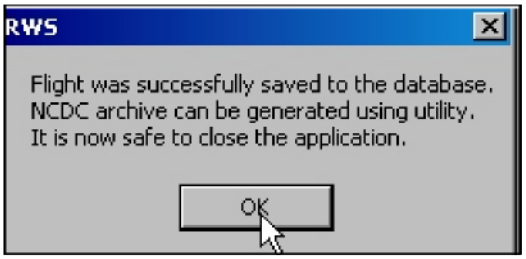

Exhibit 9-14 Close Application

NOTE: If the software crashes, the software will automatically go to Rework. In Rework, the flight may be transmitted up to 6 hours after flight termination, but RRS does not allow the flight to be continued after a crash or power failure.

9.4 Early Termination Prior to 400 hPa and Second Release

There will be occasions when the flight will either automatically terminate or have to be terminated by the observer prior to reaching 400 hPa. When this occurs, first determine if an additional release authorized. The following window will automatically be displayed (Exhibit 9-15).

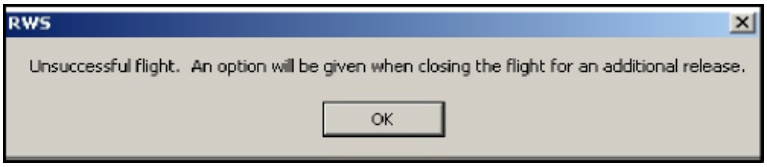

Exhibit 9-15 Unsuccessful Flight Popup

If an additional release is authorized, do the following steps:

1. Click **Close** under Flight pull-down menu.

2. A window will appear asking, "Would you like to run a new release of this ascension?" Click **Yes**. (Exhibit 9-16).

Exhibit 9-16 New Release Prompt

3. The pre-flight sequence of displays will begin again for the next release starting with the Hardware Display (Exhibit 9-17). Continue with the flight as described in Chapters 4-9.

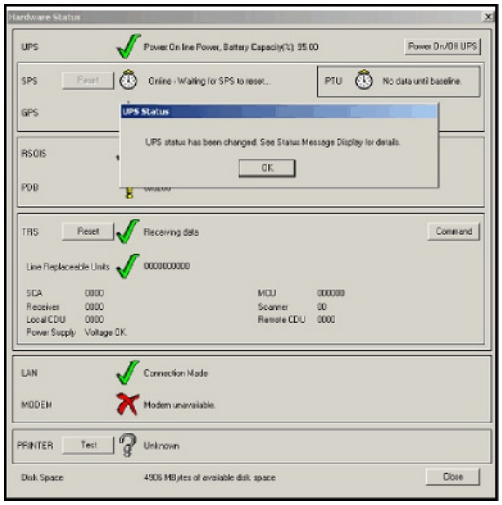

Exhibit 9-17 Hardware Display

NOTE: Make sure to use a different frequency on the new radiosonde. Additionally, set the TRS to Manual, realign it to the baseline azimuth and elevation and set it to the new radiosonde frequency.

4. After closing the Hardware Display and entering Administrative, Equipment and Surface Observation data click the **Next** button, a pop-up window appears reminding to change frequency (Exhibit 9-18).

Exhibit 9-18 Change Frequency Reminder Message

5. When closing the flight after completing additional releases a window will prompt the observer to select the active Release for the Ascension (Exhibit 9-19). This release is usually the most successful release with the best quality data and will be the release that is archived and sent to NCDC.

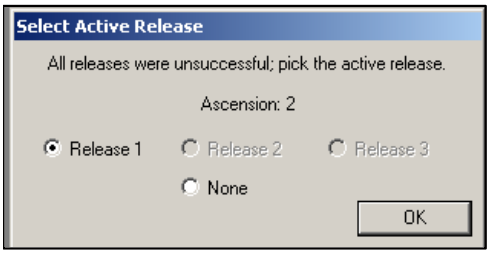

Exhibit 9-19 Select the Active Release

9.5 Predetermined Termination

Special (asynoptic) flights can be terminated (if authorized) when it reaches a predetermined pressure level. This pressure level is set in the Administrative Data screen (Exhibit 9-20). The minimum pressure level that can be entered is 400 hPa.

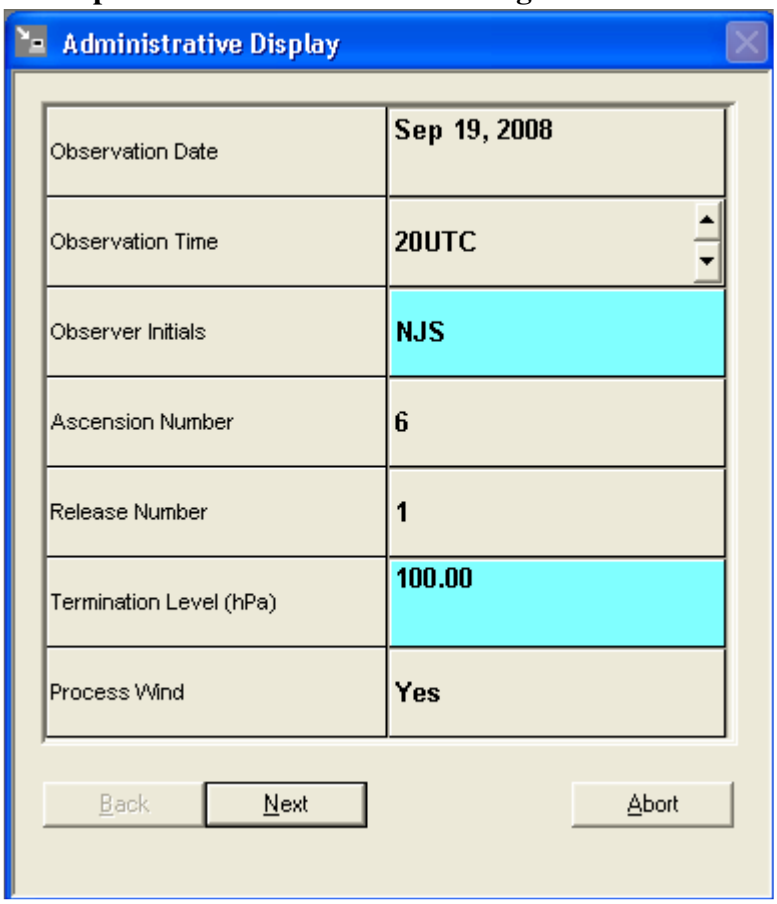

Exhibit 9-20 Predetermined Termination at 100hPa

9.6 Manually Selectable Termination Reasons

When reviewing flight data after flight termination, another termination reason may be more appropriately describe the flight termination.

- **Balloon forced down by icing**- RWS terminates the flight for Leaking or Floating Balloon. Flight data shows that the balloon began to float after crossing through a high humidity layer with temperatures below freezing.

- **Weak or fading signal** - RWS terminates the flight for EMD. Observer noted a fading TRS signal strength drop at the same time the raw data becomes missing.

- **Battery failure** – RWS terminates the flight for EMD. Observer noted a sudden TRS signal strength drop at the same time the raw data becomes missing.

- **SPS failure** – RWS terminates the flight for EMD. Either, the Observer noted strong TRS signal strength throughout the time raw data becomes missing, or RWS Hardware Status or pop-up message indicates no communication with the SPS (This assumes the MUX alarm light is not illuminated).

- **Signal Interference** – RWS terminates the flight for EMD. Observer noted a change in the TRS frequency greater than .5 MHz or heard via the CDU a signal not identifiable as the radiosonde.

- **Excessive missing temperature data** – RWS terminates the flight for EMD. Observer notes that only the temperature data was missing.

- **Excessive missing pressure data** – RWS terminates the flight for EMD. Observer notes that RWS rejected the pressure data.

- **RWS software failure** – RWS software froze or had an exception that caused it to close

- **TRS failure** – RWS terminates the flight for EMD. Observer or technician notes that the missing data is actually due to TRS component failure(s).

- **MUX failure** – RWS terminates the flight for EMD. Observer or technician notes that the MUX had an alarm at the time of missing data.

- **Unknown/Other** – The observer is unable to determine the cause for the termination.

9.7 Hardware or Software Failures

There may be occurrences where the hardware or software may fail in the middle of the flight. While these situations are expected to be rare the observer must understand what to do when these situations arise. Should RWS close suddenly due to a software or hardware failure, perform the following steps:

1. Start the RWS software. If the workstation lost power temporarily it may be necessary to turn the workstation back on.

2. Once RWS is started the software will alert the user that a flight did not terminate cleanly and RWS will open the flight in Rework.

3. Once in Rework, the observer should;
    a. Review the flight information to determine if the data is valid.
    b. Mark Data as necessary.
    c. Transmit the coded Messages.
    d. Determine if an additional release is necessary and authorized.

4. When exiting the Rework an option is provided to run a new release of this accession.

5. If a new release is necessary, see Section 9.4 for additional information.

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10. Transferring Archive Files

10.1 Introduction

After completion of each flight, the data needs to be archived on the RRS workstation, and sent to the National Climatic Data Center (NCDC) electronically using Internet Explorer from the RRS workstation. The primary method of transmitting the archive data to NCDC is through the use of File Transfer Protocol (FTP).

NOTE: Unless authorized by WSH, the archive should not be sent to NCDC on hard media, such as a CDROM.

10.2 Zipping and Sending Archiving Flight Data

1. On the RRS workstation, in the Offline Mode select the Tools Option and click on Utilities (Exhibit 10-1). When you select the Utilities option, the RWS software automatically defaults to the Archive Utility.

Exhibit 10-1 Utilities

2. In the NCDC Archive Utility (Exhibit 10-2), highlight the row of the flight to be archived (Exhibit 10-3.

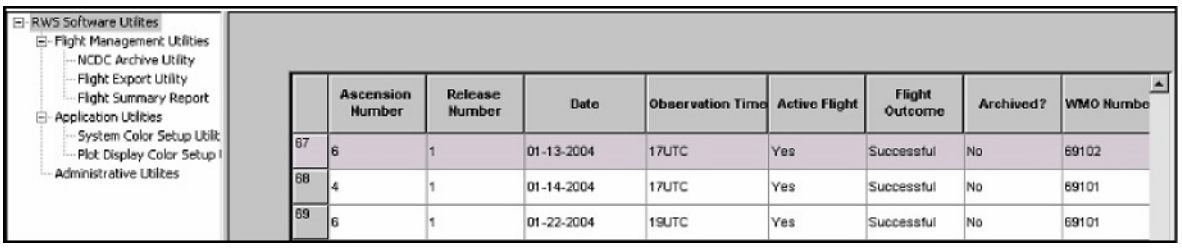
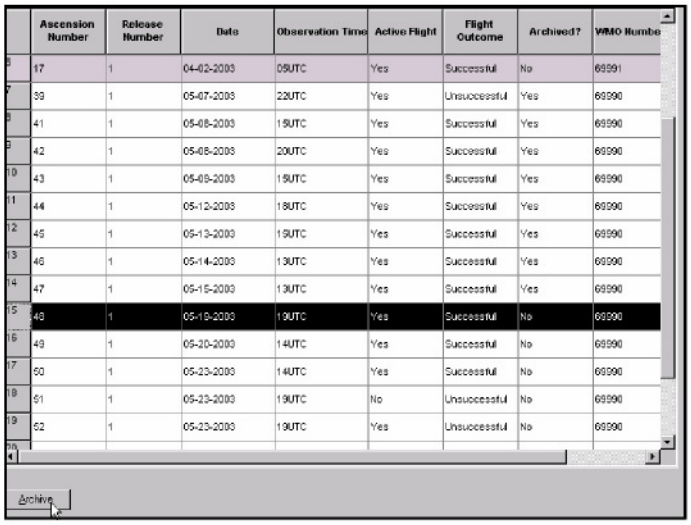


Exhibit 10-2 NCDC Archive Utility



	Ascension Number	Release Number	Date	Observation Time	Active Flight	Flight Outcome	Archived?	WMO Numbe
6	17	1	04-02-2003	05UTC	Yes	Successful	No	69991
7	39	1	05-07-2003	22UTC	Yes	Unsuccessful	Yes	69990
8	41	1	05-08-2003	15UTC	Yes	Successful	Yes	69990
9	42	1	05-08-2003	20UTC	Yes	Successful	Yes	69990
10	43	1	05-09-2003	15UTC	Yes	Successful	Yes	69990
11	44	1	05-12-2003	18UTC	Yes	Successful	Yes	69990
12	45	1	05-13-2003	15UTC	Yes	Successful	Yes	69990
13	46	1	05-14-2003	13UTC	Yes	Successful	Yes	69990
14	47	1	05-15-2003	13UTC	Yes	Successful	Yes	69990
15	48	1	05-19-2003	19UTC	Yes	Successful	No	69990
16	49	1	05-20-2003	14UTC	Yes	Successful	No	69990
17	50	1	05-23-2003	14UTC	Yes	Successful	No	69990
18	51	1	05-23-2003	19UTC	No	Unsuccessful	No	69990
19	52	1	05-23-2003	19UTC	Yes	Unsuccessful	No	69990

Archive

Exhibit 10-3 Select Ascension to Archive

3. Click the **Archive** button.

4. A window appears allowing the operator to designate a subdirectory to store the file. The default subdirectory is C:\RWS|RWS\NCDC. subdirectory. The operator may also insert a CD into the "D" drive and then select the "D" drive to copy the Archive data to by pressing "OK".

5. Verify the flight was archived by going back and viewing the Archive Table. The block in the "Archive?" column should have a "Yes" entered. (Exhibit 10-4)

	Ascension Number	Release Number	Date	Observation Time	Active Flight	Flight Outcome	Archived?	WMO Numbe
6	17	1	04-02-2003	05UTC	Yes	Successful	No	69991
7	39	1	05-07-2003	22UTC	Yes	Unsuccessful	Yes	69990
8	41	1	05-08-2003	15UTC	Yes	Successful	Yes	69990
9	42	1	05-08-2003	20UTC	Yes	Successful	Yes	69990
10	43	1	05-09-2003	15UTC	Yes	Successful	Yes	69990
11	44	1	05-12-2003	18UTC	Yes	Successful	Yes	69990
12	45	1	05-13-2003	15UTC	Yes	Successful	Yes	69990
13	46	1	05-14-2003	13UTC	Yes	Successful	Yes	69990
14	47	1	05-15-2003	13UTC	Yes	Successful	Yes	69990
15	48	1	05-19-2003	19UTC	Yes	Successful	Yes	69990

Exhibit 10-4 Verify Flight Archived

6. After archiving the flight, go back to the Flight option window select "Close" and then select "Exit". (Exhibit 10-5) This will shut the RWS software down.

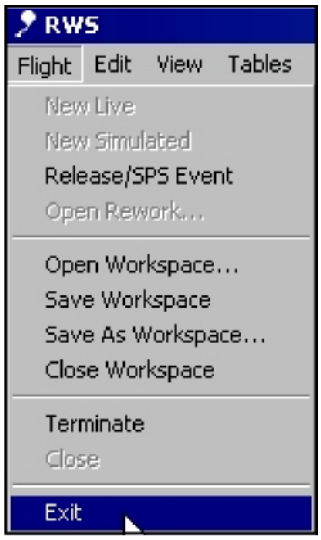


Exhibit 10-5 Exit Flight

NOTE: The zipped archive file is placed in the C:\RWS\RWS\NCDC subdirectory. The files in the zipped archive are the H, T, and B files followed by Ascent Number. (Example Ascent # 245 - files would be: H245, T245, and B245)

- "H" file (Archive header file)
- "T" file (Archive thermal file)
- "B" file (Archive BUFR file)

10.3 Locate, Name and Zip the Archive Files

Do the following steps to get the files Zipped and ready to transmit to NCDC:

1. On the desktop, double click on the "Archive" icon. (Exhibit 10-6) When the Archive window opens, locate the 3 files just archived. (Exhibit 10-7)

Exhibit 10-6 Archive Folder

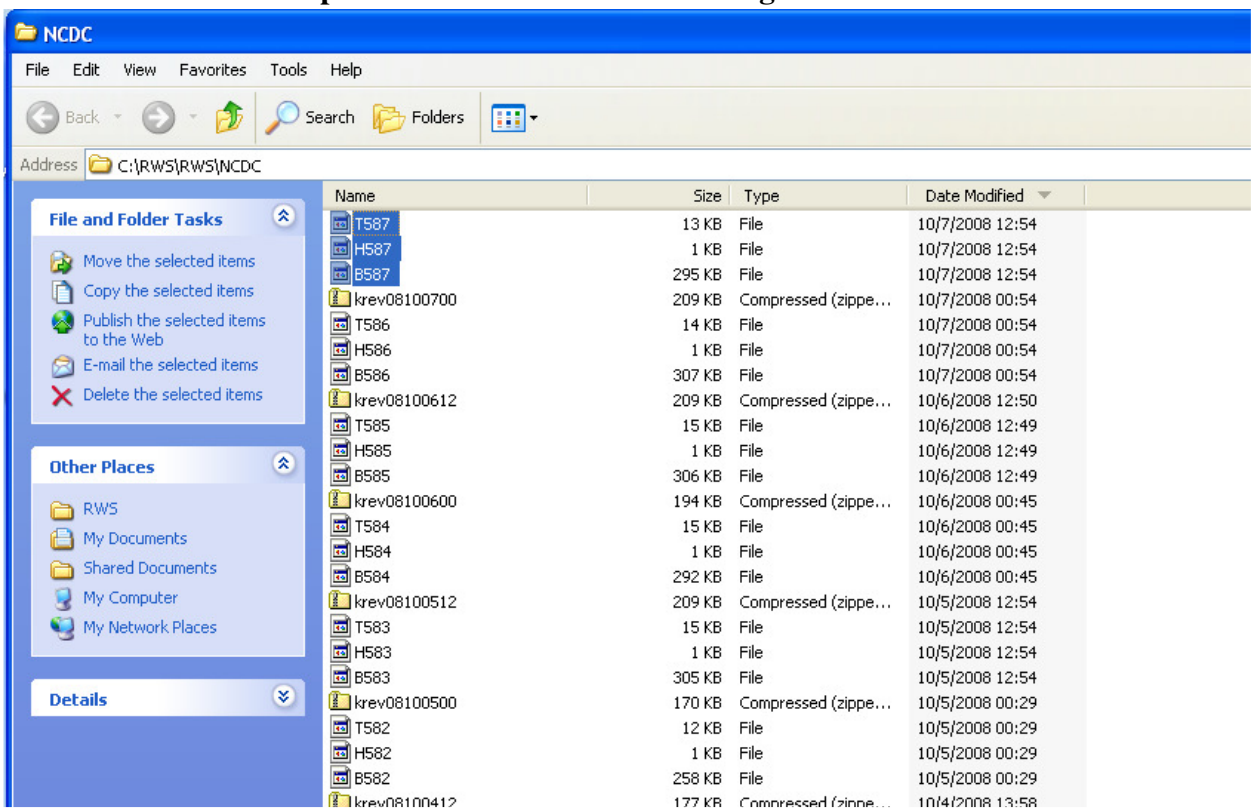


Exhibit 10-7 Select Files to Zip

2. Highlight the three files by holding the control key down and clicking each file. Then, right click and select "Send To" from the drop-down list and select "Compressed (zipped) Folder." (Exhibit 10-8 and Exhibit 10-9)

NOTE: If the files are not in order, sort by clicking on the date modified header in the top right corner of the window.

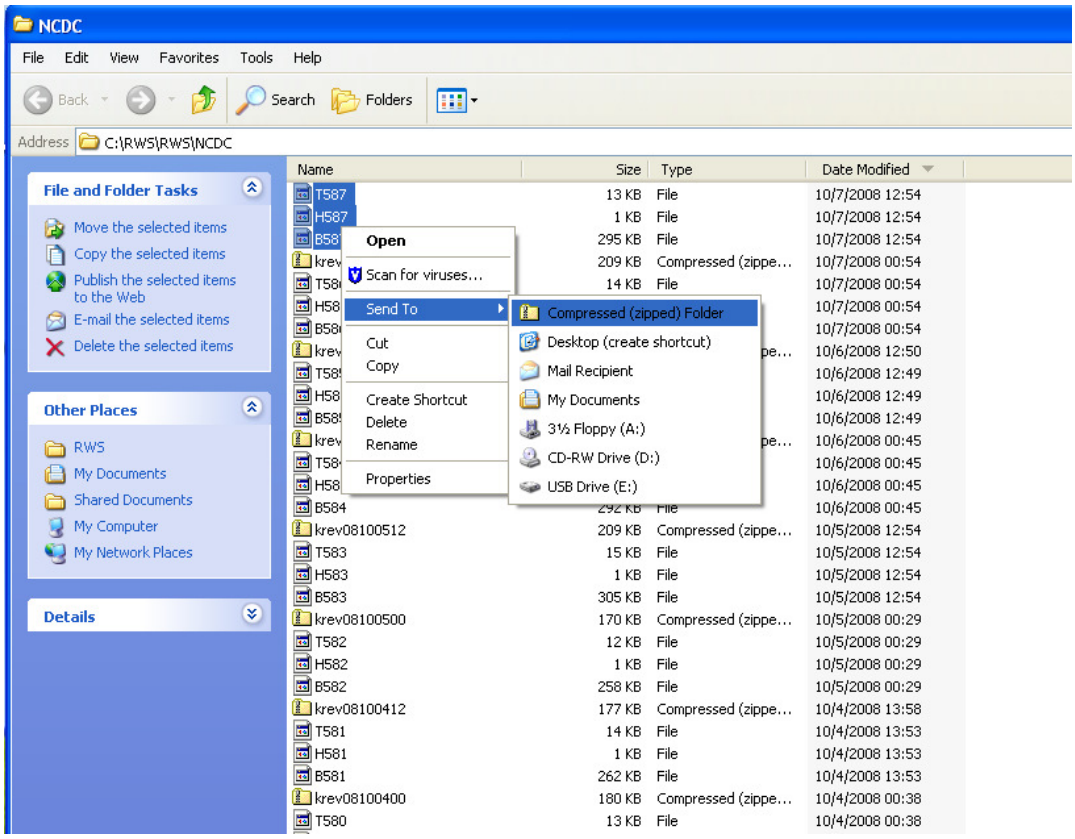


Exhibit 10-8 Selecting Files to be Zipped

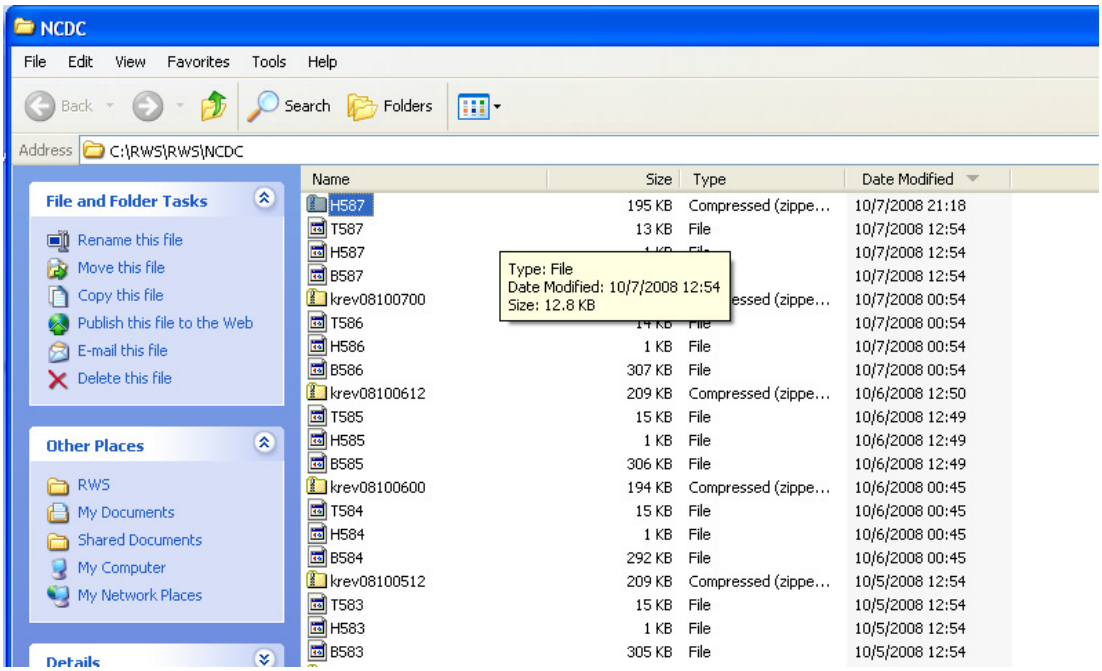


Exhibit 10-9 Zipped File Before Renaming

NOTE: After the files are zipped, the size of the newly created file should be smaller than the combined file size of the three files verifying the files were zipped. . (Exhibit 10-9) Verify the correct files were zipped, close the window.

3. After sending to the Zipped folder. Go into the window and right click on the newly named zipped folder and select "Rename". (Exhibit 10-9) Use the naming convention described after Exhibit 10-10.

Exhibit 10-10 Renaming Zip File

4. File naming conventions MUST be followed exactly or they will not be retrieved by NCDC. Name the file according to the rules below:

- **The files MUST be named as follows: xxxxyymmddhh**

- Breakdown:
  i. xxxx - The 4-letter Stn Id
  ii. yy - The last 2-digits of data year (00-99)
  iii. mm - The 2-digit month of the year (01-12)
  iv. dd - The 2-digit day of the month (01-3 1)
  v. hh - The 2-digit hour of the day in UTC (00-23)

- (all lower case letters - **CAPITAL LETTERS WILL NOT BE RECEIVED**)

Example: kiad05072019 or kiad05080218 (Exhibit 10-11)

NOTE: Do not add anything else - The ZIP Program will add: .zip - indicating this is a zip file. Never add ".exe" this will create problems at NCDC.

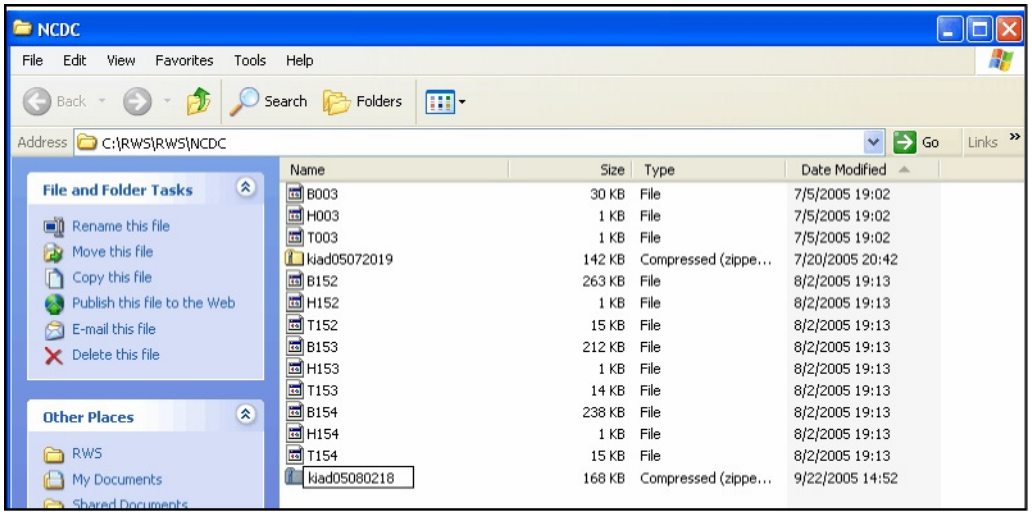


Exhibit 10-11 Zipped File Renamed with Station ID and Date/Time

10.4 Send Zipped File to NCDC

Do the following to send the zipped file to NCDC by FTP:

1. Double click on the "NCDC Upload" icon on the Desktop. Decrease the window size and move it so both the "Archive" and "NCDC Upload" windows are viewable on the desktop. window. (Exhibit 10-12)

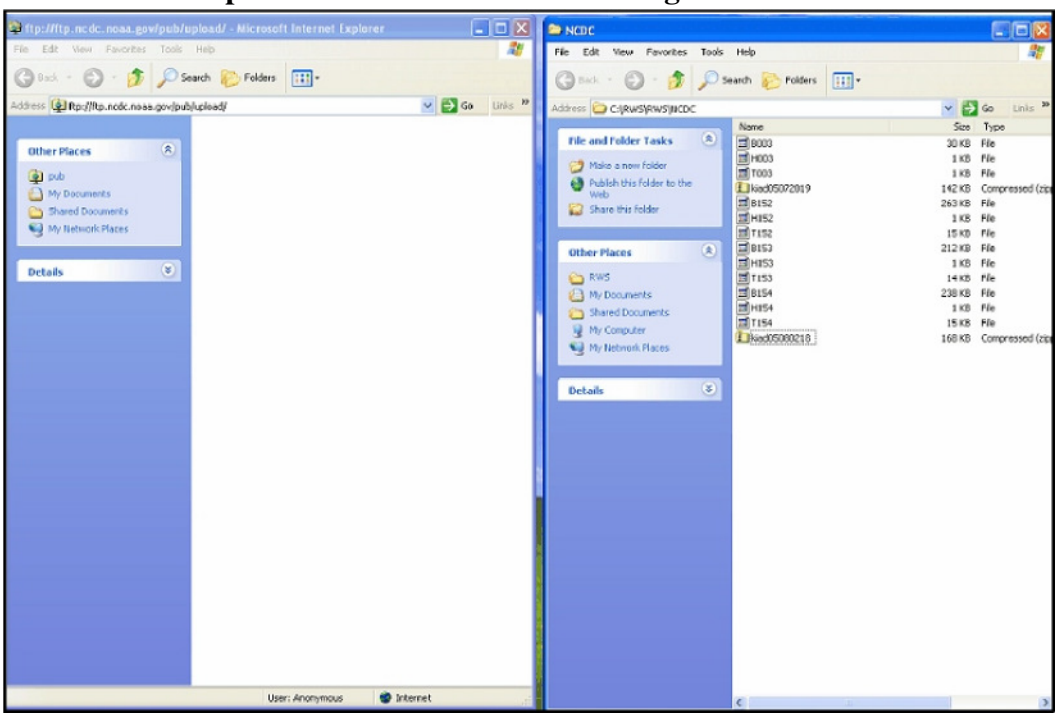


Exhibit 10-12 NCDC Upload and Archive folder

2. Click and drag the Zipped file in the C:\RWS\RWS\NCDC window over to the NCDC Upload window. The file will automatically be sent. (Exhibit 10-13)

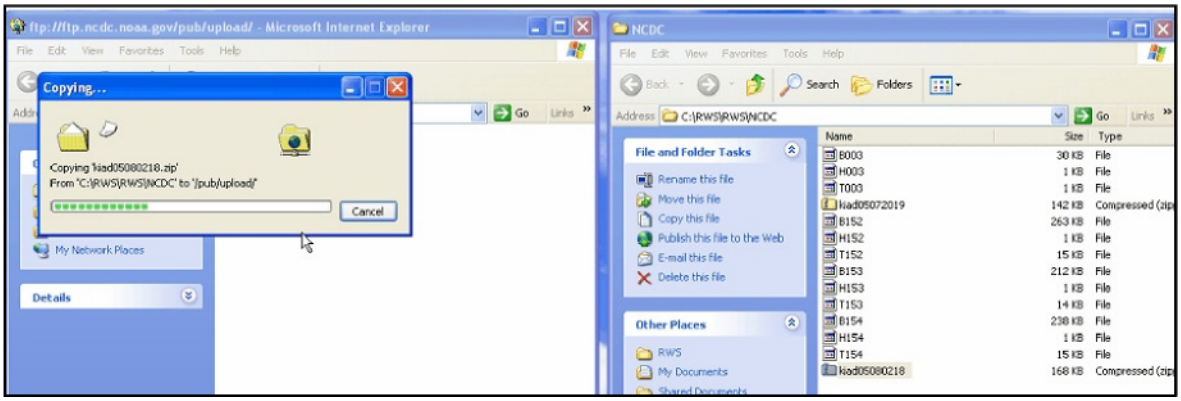


Exhibit 10-13 Zipped File Moved to NCDC/Upload Window with Automatic Transmission Occurring

3. The NCDC window will indicate that the file has been transmitted by a green line in the Copying window that pops up. Right click and select Refresh, the file will disappear. (Exhibit 10-14)

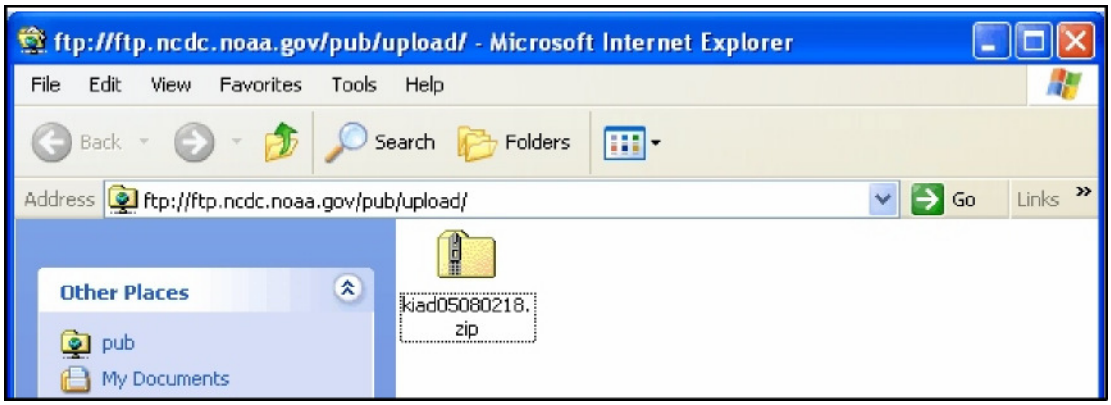


Exhibit 10-14 Zip File Transferred to NCDC by FTP

4. Verify the name and file size look reasonable, if so, the zipped file has been successfully sent. Close the window, the Archiving, Zipping and transmitting of the Zipped files by FTP to NCDC and all the normal post flight activities are completed.

NOTE: One way to verify the reception of archived data to the NCDC ftp site is to visit **www1.ncdc.noaa.gov/pub/data/ua/RRS/2008**. Once at the website find the log file representing the site by identifying the station ID and the year and month the data was transmitted. For example **klwx_0801_log.txt** would contain the upload history for LWX for January of 2008.

Chapter 10 – RRS Observation – Flight Termination

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11. In-flight Data Problems

11.1 Introduction

Accurate upper-air soundings are essential for weather forecasting. Yet there will be times where the sounding has data problems that require action by the observer as the software does not automatically edit all erroneous data. This chapter will cover the most common problems seen in radiosonde data. It is assumed that the reader can identify and understand typical sounding data features and how to mark and delete data (see Chapter 5).

If the observer has a sounding with data problems not covered in this chapter, an attempt must be made to verify that the data are accurate. If there are numerous data check messages for ascent rates, temperature lapse rates (superadiabats) and height/temperature changes, the temperature or pressure data are likely excessively bad and the sounding should be terminated at the point where the data problems began. If there are problems with RH or wind data, mark the data for either winds or RH from the point where it went bad to the end of the flight, but let the sounding proceed to flight termination (i.e. balloon burst).

Data quality control the sounding prior to dissemination to data users is essential. Never disseminate poor quality soundings with the assumption that NCEP or other data users will correct or edit the bad data on their end.

IMPORTANT: When editing pressure, temperature, RH or winds data, delete **all** the data in the erroneous layer. If more than 1 minute of data needs to be deleted, **do not** randomly keep a data point or two in the layer so that the RRS software backfills the layer with interpolated values. This does nothing more than generate an unrealistic sounding.

11.2 Balloon Release Made Too Early or Late

Observers should strive to launch the radiosonde during established release time windows. See NWS Manual 10-1401, Appendix E, for more information.

If an observer mistakenly releases a balloon even a second before 11:00 or 23:00 UTC, RRS will log the observation time as 11:00 or 23:00 UTC.

Under no circumstances will the observer modify the release time or observation time in the coded messages or elsewhere to make it a 12:00Z or 00:00Z observation. Let the software log the times correctly and disseminate the observation to NCEP and NCDC as is normally done. In NWS form B-29 log the flight in the Flight Summary section and note in the remarks that the release was made too early. Do not log the flight as missed or as a special sounding.

Equipment or weather (e.g., thunderstorms) may result in a balloon release being made late and if it is even a second beyond the release time window RRS will log the flight as a 13:00 UTC or 01:00

UTC observation. **Under no circumstances will the observer modify the release time or observation time in the coded messages or elsewhere to make it a 12:00Z or 00:00Z observation**. Let the software log the times correctly and disseminate the observation to NCEP and NCDC as is normally done. In NWS form B-29 log the flight in the Flight Summary section and note in the remarks that the release was made too late. Do not log the flight as missed or as a special sounding.

A similar situation may occur with special or non-synoptic soundings. Again, if the release is made outside the non-synoptic release time window, do not modify the release time or observation time.

11.3 Pressure Data Anomalies and Problems

If a pressure data plot is seen that does not show a smooth curve to flight termination one may conclude that the pressure sensor is faulty. However, this section will show that in most cases the questionable data are being caused by real atmospheric events rather than failure of the pressure sensor.

IMPORTANT: RRS will interpolate the pressure data no matter how thick a layer is deleted by the observer. **Never overly smooth the pressure data as this will likely create an erroneous sounding.** If the pressure data are erroneous and more than 10 consecutive minutes are to be deleted, then too much data are lost and the sounding needs to be terminated at the point where the pressure data went bad.

The geometric height or GPS height data in the Processed Tabular Display is an excellent tool for verifying the accuracy of the geopotential height (and pressure) data. Change the table configuration so that the two heights are side by side. When comparing the two heights, the difference in height from second to second will typically be within a meter or two of each other. See Exhibit 11-1 as an example. It shows the differences from second to second for the two heights at around 6 meters. The actual difference in the two heights for a particular level is usually within 25 meters (around 15 meters in Exhibit 11-1) early in the sounding, but can more than 200 meters different near flight termination. Thus the best way to use the geometric data is to review second to second changes. It should also be noted that the geometric height data are smoothed differently from the geopotential heights and there will likely be significant differences about a minute off surface and just before balloon burst, so don't make comparisons during these portions of the sounding.

Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height (m)	Geometric Height (m)
14.98	18:53:17	559.45	559.51	4763	4780
15.00	18:53:18	559.10	559.09	4769	4786
15.02	18:53:19	558.90	558.67	4774	4792
15.03	18:53:20	558.54	558.25	4780	4797
15.05	18:53:21	558.13	557.83	4786	4803
15.07	18:53:22	557.33	557.40	4792	4808
15.08	18:53:23	556.77	556.98	4797	4814
15.10	18:53:24	556.32	556.58	4803	4820
15.12	18:53:25	555.95	556.15	4809	4825
15.13	18:53:26	555.76	555.71	4815	4831
15.15	18:53:27	555.19	555.28	4820	4836
15.17	18:53:28	554.78	554.87	4826	4842
15.18	18:53:29	554.73	554.49	4831	4847
15.20	18:53:30	554.19	554.11	4836	4853
15.22	18:53:31	553.72	553.71	4842	4858
15.23	18:53:32	553.34	553.30	4847	4863
15.25	18:53:33	552.83	552.90	4853	4869
15.27	18:53:34	552.62	552.46	4859	4874
15.28	18:53:35	552.13	552.00	4865	4880
15.30	18:53:36	551.53	551.55	4871	4885
15.32	18:53:37	551.25	551.09	4878	4890

Exhibit 11-1: Processed Tabular Display showing the geopotential and geometric heights side by side for easy comparison

11.3.1 Wavy Pressure Profile

Sometimes if there is turbulence, atmospheric gravity waves, or balloon icing aloft, the pressure data plot will shows undulations or a "wavy" profile. With such a profile the balloon ascent rate speeds up and slows down or vice versa. A faulty pressure sensor may also cause this kind of problem, but is not common. With a wavy pressure profile, the Check Messages may appear for:

- Ascent rates exceeding 500 meters/minute
- Changes in heights and temperature from the previous sounding

Exhibit 11-2 shows a pressure data plot with a wavy profile between 10 and 20 minutes. If such a profile in seen, follow these steps:

1. Verify that the pressure data are accurate in the wavy pressure layer. One method is to use the geometric height data (derived from the radiosonde GPS receiver) found in the PDS tabular data. Note the difference in geometric heights from one second to the next and compare this with the corresponding geopotential heights. The change in heights or ascent rates from second to second should be within a meter or two of each other for both datasets. If they agree, then leave the pressure data as is. **Do not edit the pressure data.**

2. If they do not agree the pressure sensor is likely at fault and deletion of **all** the pressure data in the layer required. If the wavy profile persists for more than 10 consecutive minutes, the pressure sensor has likely failed and the flight needs to be terminated at the point where the sensor failure occurred.

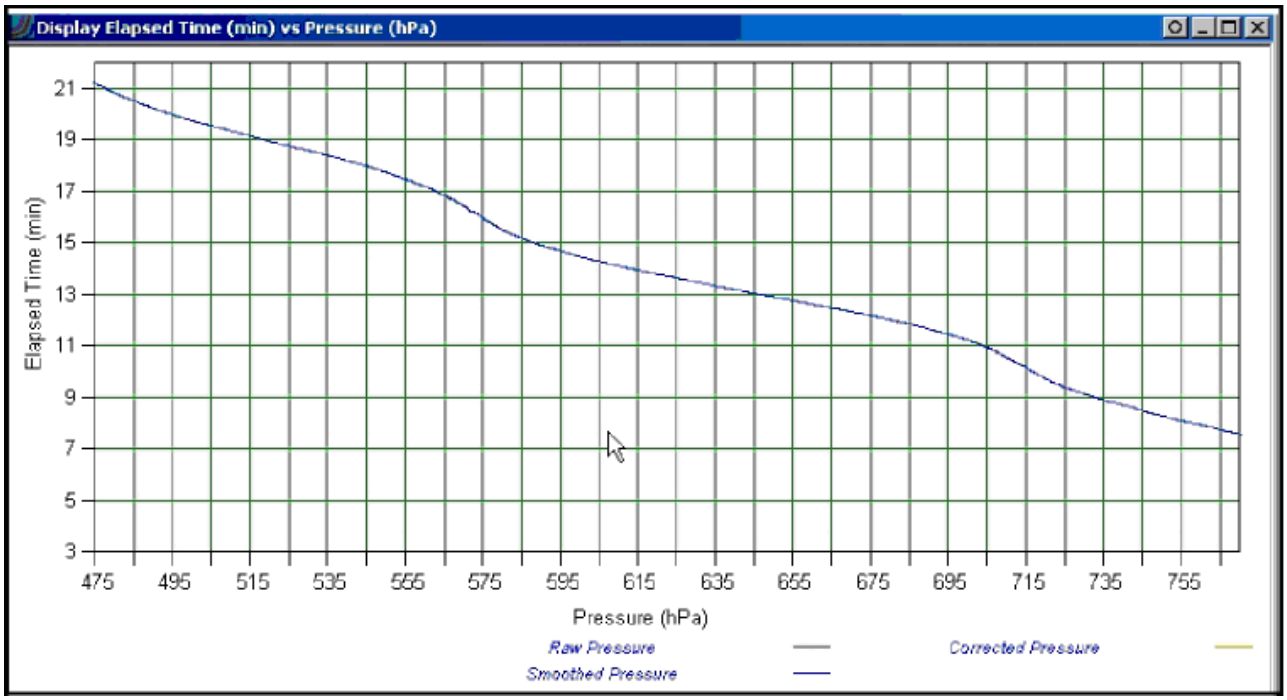


Exhibit 11-2: Pressure data profile showing fluctuations

11.3.2 Descending and Re-ascending Balloon

The descending/re-ascending balloon situation also causes a wavy pressure data profile but it is more severe in that the balloon actually descends for a period of time and then reascends. It typically occurs below 15 km and may be caused by extensive balloon icing, severe turbulence, or strong atmospheric gravity waves. It may also result from a faulty pressure sensor, but this is not common. RRS will not select levels during this event to avoid coding duplicate pressure levels.

Exhibit 11-3 shows descending/re-ascending layers between 40 and 55 minutes into the sounding. Exhibit 11-4 shows this layer in more detail and Exhibit 11-5 shows the geopotential heights during a portion of this layer.

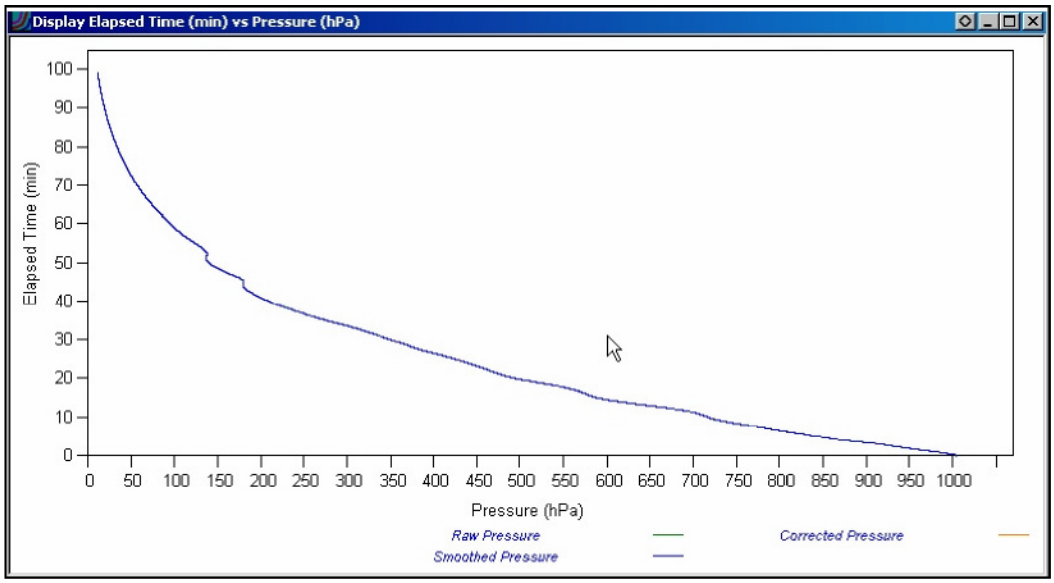


Exhibit 11-3: Pressure profile showing descending/reascending layers between 40 and 55 minutes

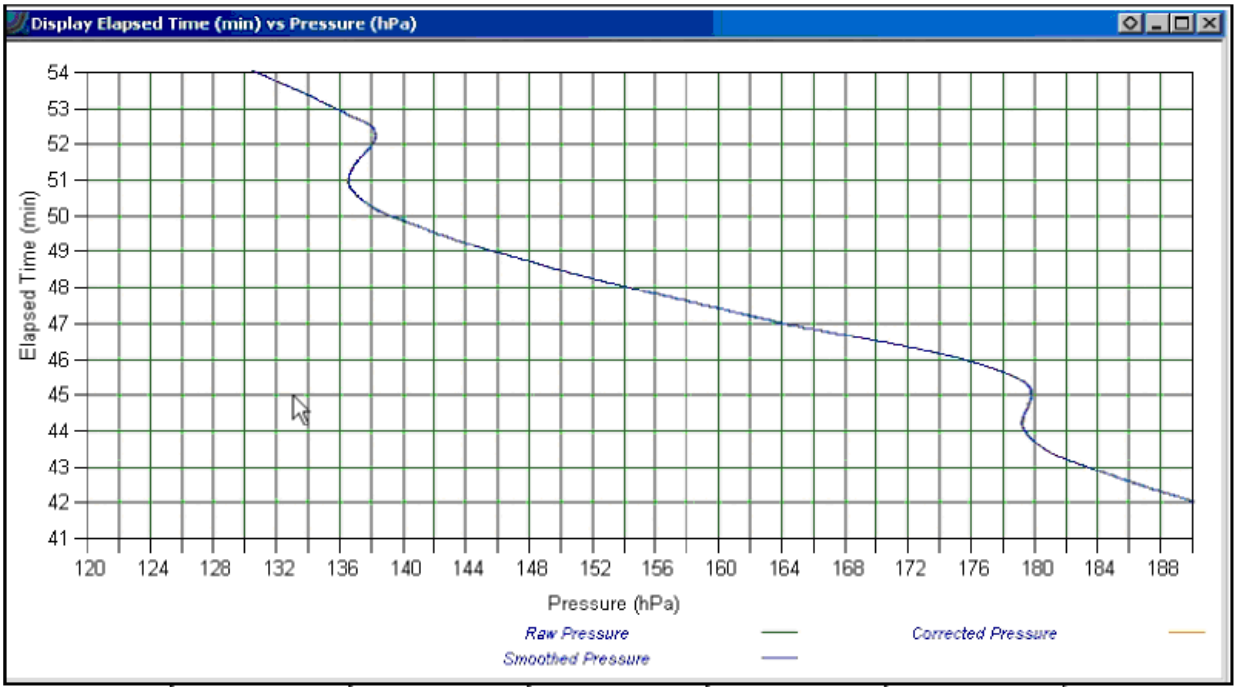


Exhibit 11-4: Same as Exhibit 11-3, but showing a closer view of the descending/reascending layers

Elapsed Time (Minutes)	Time Stamp (UTC)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	RH (%)	Ascension Rate (m/s)
42.00	19:03:17	190.33	12188	-64.04	27.9	4.1
42.50	19:03:47	186.66	12308	-62.75	27.7	3.8
43.00	19:04:17	183.35	12418	-62.73	27.6	3.4
43.50	19:04:47	180.64	12510	-61.01	27.5	2.2
44.00	19:05:17	179.42	12552	-58.53	27.2	0.7
44.50	19:05:47	179.40	12552	-56.12	27.0	-0.2
45.00	19:06:17	179.82	12538	-52.92	26.7	0.3
45.50	19:06:47	178.88	12572	-50.30	26.4	2.6
46.00	19:07:17	175.54	12695	-49.99	26.2	5.4
46.50	19:07:47	170.26	12894	-50.78	26.1	7.2
47.00	19:08:17	164.23	13128	-51.26	26.1	7.2
47.50	19:08:47	159.26	13328	-51.50	26.0	6.6
48.00	19:09:17	154.47	13526	-53.18	26.1	6.5
48.50	19:09:47	149.90	13718	-54.93	26.2	6.1
49.00	19:10:17	145.84	13893	-56.62	26.3	5.5
49.50	19:10:47	142.28	14049	-56.87	26.3	4.9
50.00	19:11:17	139.21	14187	-57.31	26.3	3.8
50.50	19:11:47	137.29	14275	-58.00	26.4	2.0

Exhibit 11-5: Processed data display indicating slowing ascent rate beginning at 42 minutes and ending around 46 minutes.

If there is a descending/reascending balloon detected by the software that persists for 30 or more seconds it will log the event in the Status Messages display. (Exhibit 11-6.)

Status Messages Display

Add Message

UTC Time	Flight Status Message
18:12:43.88	SPS has been initialized successfully.
18:14:49.96	Radiosonde has been baselined successfully.
18:21:16.62	No appropriate flight found for comparison.
18:21:16.62	Balloon release detected at 18:21:16.609 UTC.
18:43:24.59	Event marker received from SPS
18:49:24.21	Coded Messages were generated.
18:49:24.24	The RADAT message has been generated.
19:07:05.06	Descending balloon detected at 44.2 minutes.
19:08:17.03	Reascending balloon detected -- 0.5 minutes lost.
19:13:52.0[illegible]	Descending balloon detected at 51.0 minutes.
19:15:42.07	Reascending balloon detected -- 0.5 minutes lost.

Exhibit 11-6: Status Messages with descending and reascending messages

If such a pressure profile and Status Message are seen, the following Check Messages may also appear:

- Ascent rates
- Changes in heights and temperature from the previous sounding
- Super-adiabatic lapse rates
- Increasing pressure levels deleted

If the sounding indicates a descending/reascending balloon, follow these steps:

1. RRS software will not code any levels within the balloon descending/reascending event. Yet, the GPS geometric height changes from second to second need to be checked during this event to verify that the balloon did indeed descend and then reascend again.

2. If the GPS geometric heights show no descending of the balloon then there was likely a pressure sensor problem, especially if numerous data Check Messages appear for ascent rates, and height changes. The sounding needs to be terminated at the point where the pressure data went bad (i.e., increased).

3. **If the GPS geometric heights also show a descending/reascending balloon, then no editing of the pressure data are needed as the pressure sensor is accurately measuring the rise, fall and rise of the balloon. Do not edit the pressure data to smooth the profile.** However, there may also be superadibatic lapse rate check messages that will require editing of the temperature data

NOTE: If the GPS data are missing the GPS geometric heights will not be available to compare with the geopotential height data. If this occurs, assume that in most cases the pressure sensor is working correctly and that the pressure data does not require any action. Continue to monitor all the flight data and compare it the previous sounding from 12 hours ago. If the data do not compare well and there are numerous data check messages for ascent rates, superadiabats and/or height/temperature changes, terminate the sounding at the point where the data problems began.

11.3.3 Soundings Inside Severe Turbulence

Sometimes severe turbulence (e.g., strong atmospheric gravity waves, rotor cloud) can cause the balloon to descend or ascend very quickly or fly nearly horizontal for several kilometers. This anomaly is more common in winter and spring and at upper- stations located in mountainous regions. When the balloon finally starts rising again downwind from the release point, it can be very abrupt. Downdrafts can cause portions of the sounding to warm significantly when compared to the sounding taken 12 hours earlier.

Exhibit 11-7 shows the pressure profile of a sounding that passed through a severe atmospheric gravity wave or rotor cloud and Exhibit 11-8 shows a close up of the pressure profile inside this event. The balloon in this example flew nearly horizontal for more than 4 km and once the balloon

exited the wave, the ascent rate jumped to over 700 meters/minute. Exhibit 11-9 shows the check messages for this flight.

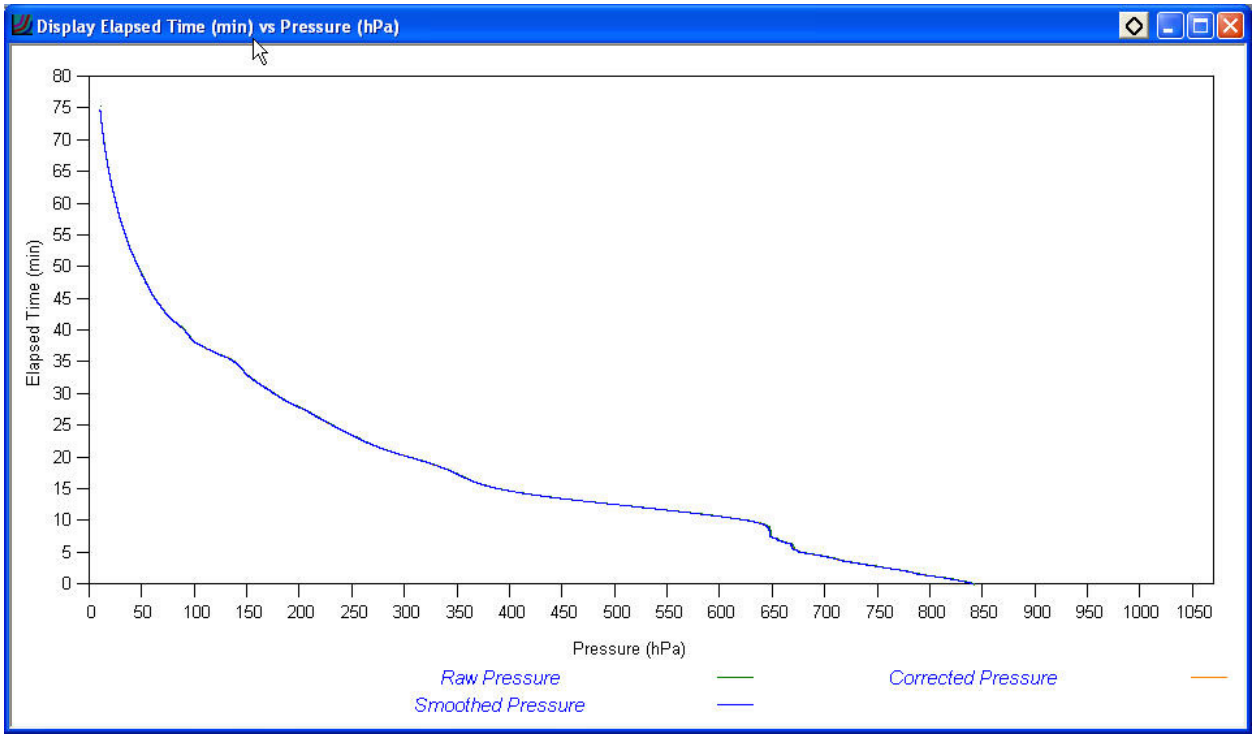


Exhibit 11-7: Pressure profile showing a balloon passing through a mountain wave between about 5 and 10 minutes

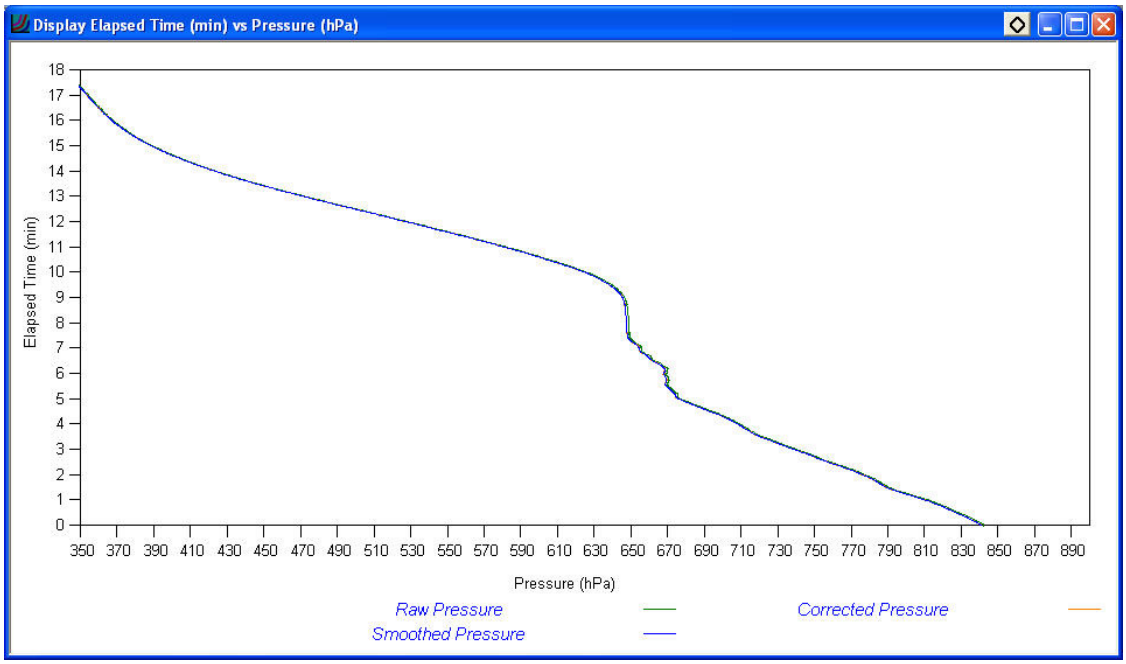


Exhibit 11-8: Same as Exhibit 11-7, but showing a close up of the pressure anomaly

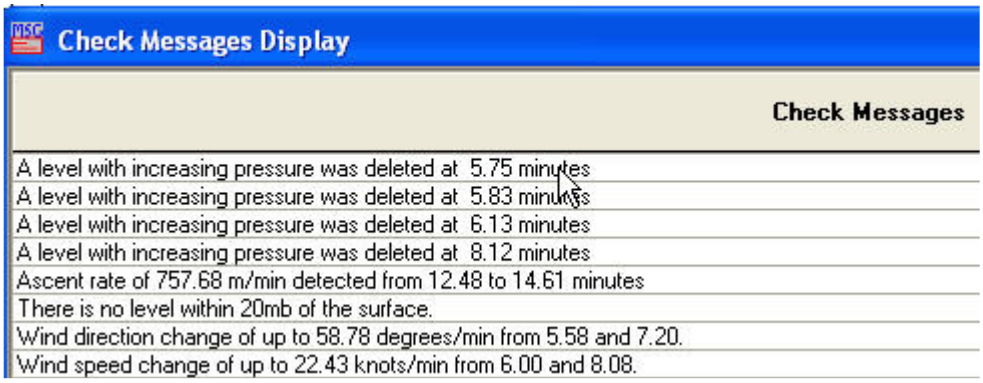


Exhibit 11-9: Check Messages when radiosonde enters the severe turbulence as shown in Exhibit 11-8

In such situations, Check Messages may also be seen for,

- Changes in heights and temperature from the previous sounding
- Super-adiabatic lapse rates

While flights into severe atmospheric turbulence are not common, they can create soundings that are not representative of the synoptic-scale environment and action needs to be taken. If the sounding has encountered severe turbulence or a wave and the pressure data profile is very erratic, follow these steps:

1. Compare the changes in GPS geometric height data each second to the corresponding geopotential heights. If the differences between the two heights are no more than one or two meters, then don't edit the pressure data. The pressure sensor is correctly measuring the ups and downs of the radiosonde as it passes through the turbulence. If the two heights are not close to one another, the pressure sensor has clearly failed. Terminate the sounding at the point where the pressure data first went bad.

2. If the wavy pressure profile is real, review the temperature plot and overlay the temperature plot from the sounding taken 12 hours ago. Notify the WFO lead forecaster and the NCEP SDM if any of the following are seen:

    - The temperature plot with an overlay of the previous sounding shows warming or cooling by more than 5C within or near the erratic pressure layer.
    - 4 or more check messages for height and temperature changes, deleted pressure levels, fast/slow ascension rates, and super-adiabatic lapse rates.

If it is decided that data will be deleted inside the turbulent layer, then **delete <u>all</u> the data in that layer (including winds). Do not arbitrarily save a few data points in the layer so that the RWS backfills the deleted layer with interpolated values.**

If it is decided to terminate the sounding early, do so at the point where the radiosonde entered the turbulence or wave.

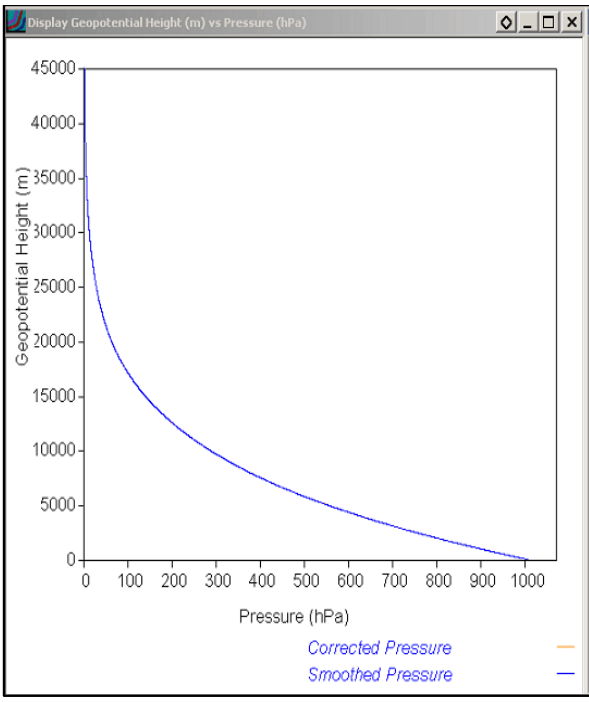
11.3.4 Very High Termination Altitude (Leaking Pressure Cell)

On rare occasions the pressure sensor cell will begin to leak or fail in some other way while the radiosonde is aloft. The problem typically becomes noticeable above 15 km. The result will likely be a very high, unrealistic termination altitude and pressure. The ascent rates in portions of the sounding will also likely exceed 500 meters/minute. Any sounding that ascends above 5 mb needs to be examined for this problem. If a leaking pressure cell has occurred, RRS may show Check Messages for,

- High ascent rates exceeding 500 meters/minute
- Height changes from the previous sounding

Exhibit 11-10 shows an extreme example of a leaking pressure cell as seen in the pressure data plot and PDS data. Note that the termination altitude is over 54,000 meters with a pressure of only 0.26 mb. The radiosonde also reached this altitude in just over 60 minutes providing an average ascent rate of more than 900 meters/minute. It is likely that the pressure cell failed shortly after the radiosonde was released.

Owing to design limitations, it is uncommon for typical NWS balloons, properly inflated, to rise above 5 mb and flights above 3.0 mb or about 40,000 meters are nearly impossible. Moreover, the balloons typically rise at less than 375 meters/minute on average from surface to flight termination and it takes around 90 minutes or more to reach an altitude of 30,000 meters.



Processed Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Geopotential Height	Corrected Temperature	Ascension Rate (m/s)	Wind Direction (deg)	Wind Speed (knots)	Geometric Height (m)
35.00	163.51	13983	-44.59	7.2	257.2	58.0	9843
36.00	153.68	14397	-46.18	6.8	259.4	60.3	10100
37.00	143.78	14837	-48.18	8.0	263.1	51.3	10372
38.00	133.90	15304	-50.27	7.0	265.1	48.0	10656
39.00	125.05	15748	-52.72	8.3	264.3	48.4	11006
40.00	115.51	16257	-55.33	8.1	275.1	52.3	11312
41.00	107.27	16727	-56.49	8.2	280.3	49.9	11580
42.00	99.04	17231	-58.30	8.6	273.0	43.6	11856
43.00	90.78	17777	-59.94	9.3	265.7	42.1	12144
44.00	82.67	18362	-59.61	10.7	258.6	47.0	12454
45.00	74.02	19049	-61.49	10.8	254.5	56.7	12789
46.00	67.16	19655	-59.49	10.8	254.5	60.1	13087
47.00	60.38	20317	-61.33	10.8	248.6	56.6	13388
48.00	54.31	20973	-61.69	10.9	251.9	66.9	13672
49.00	48.81	21636	-60.34	11.1	260.9	69.7	13954
50.00	43.77	22316	-60.25	12.0	264.9	64.0	14227
51.00	38.62	23102	-59.22	14.0	252.8	55.3	14513
52.00	33.56	23978	-60.02	15.5	257.0	59.5	14820
53.00	28.37	25026	-61.09	18.2	262.7	50.0	15144
54.00	23.85	26102	-61.07	18.8	269.6	33.6	15449
55.00	19.60	27317	-62.55	22.1	254.3	38.0	15752
56.00	15.50	28763	-62.82	26.5	262.7	51.5	16059
57.00	11.76	30471	-60.01	31.2	267.3	41.3	16354
58.00	8.33	32611	-61.52	43.2	271.8	37.5	16644
59.00	4.79	36054	-61.16	82.2	247.6	29.6	16956
60.00	1.36	43865	-60.56	294.7	243.7	32.1	17273
60.37	0.26	54314	-59.41	407.1	245.9	30.9	17385

Exhibit 11-10: Leaking pressure cell causing unrealistic height and pressure Values

Exhibit 11-11 shows a pressure data plot of a leaking pressure cell that is more typical. The pressure cell failed around 95 minutes into the flight.

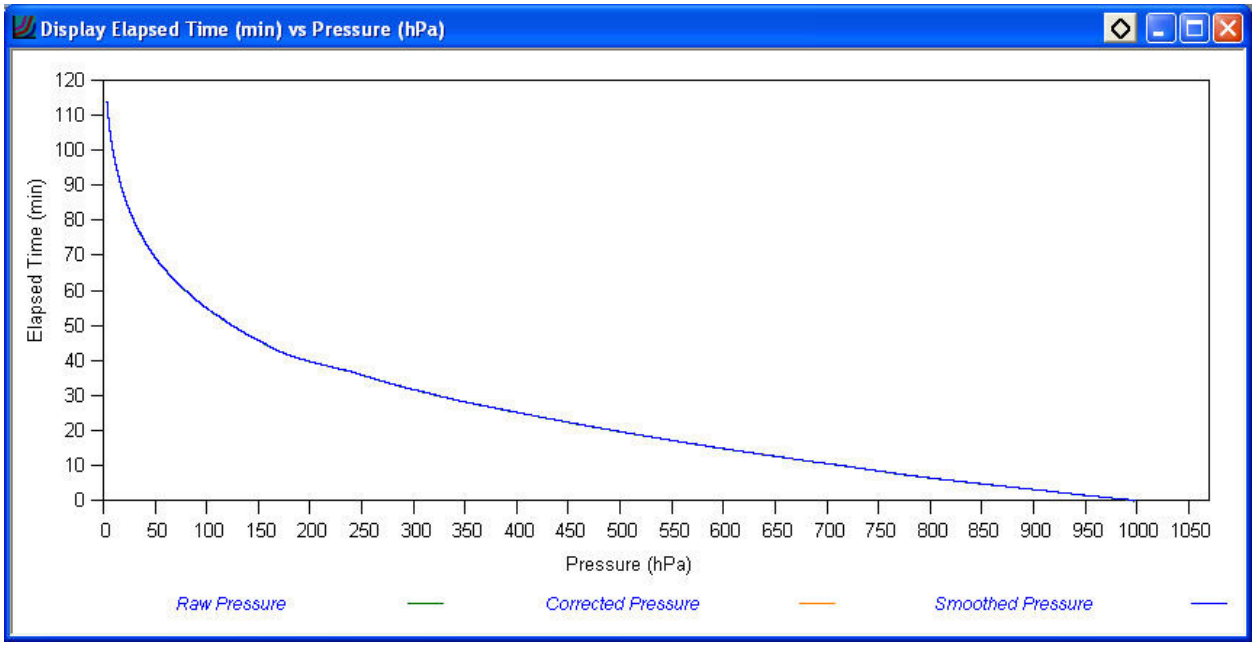


Exhibit 11-11: Typical pressure data plot of a leaking pressure cell

At first glance, the pressure data look reasonable. Yet, the Flight Summary showed the following information:

- An average ascent rate from surface to balloon burst of 368 meters/minute
- Balloon burst altitude at 38,000 meters
- Termination pressure at 3.4 mb.

There were also Check Messages for ascent rates exceeding 500 meters/minute at 110 minutes and a height change of 109 meters at 7.0 mb. Moreover, the difference in height between the GPS geometric height and geopotential height exceeded 1 km at 7.0 mb. At 5.0 mb it exceeded 1,650 meters (See Exhibit 11-12.) Near balloon burst the difference was over 2,500 meters. This information indicates a problem with the pressure sensor.

If the sounding terminates at or above 5.0mb (about 35,000 meters), follow these steps:

(1) Carefully review the Flight Summary data. Average ascent rates from surface to flight termination exceeding 360 meters/minute should be looked upon with suspicion.

(2) Compare the GPS Geometric height and Geopotential height at 7.0 mb. They should be well within 750 meters of each other. If the difference exceeds this value **and** there are Check Messages for fast ascent rates and height changes from the previous sounding, a pressure cell failure has likely

occurred. Terminate the sounding at the point where the height differences are no more than 500 meters. This should eliminate the Check Messages related to this problem.

If the GPS data (i.e., geometric heights) are missing, but several or more Check Messages for fast ascent rates and height changes for data above 15 km are seen, terminate the sounding at the level where the Check Messages first indicate questionable data.

Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Corrected Pressure (hPa)	Smoothed Pressure (hPa)	Geopotential Height (m)	Geometric Height (m)	Arc Distance (m)
108.88	12:52:00	5.04	5.05	35206	33532	121132.85
108.90	12:52:01	5.04	5.04	35214	33537	121142.02
108.92	12:52:02	5.04	5.04	35221	33542	121149.82
108.93	12:52:03	5.04	5.03	35227	33547	121159.56
108.95	12:52:04	5.03	5.03	35234	33553	121169.95
108.97	12:52:05	5.02	5.02	35240	33558	121177.75
108.98	12:52:06	5.01	5.02	35246	33563	121186.13
109.00	12:52:07	5.01	5.01	35253	33569	121195.14
109.02	12:52:08	5.02	5.01	35261	33574	121203.53
109.03	12:52:09	5.01	5.00	35269	33579	121211.90
109.05	12:52:10	5.00	5.00	35276	33584	121222.14
109.07	12:52:11	4.99	4.99	35284	33590	121232.45
109.08	12:52:12	4.99	4.99	35291	33595	121242.78
109.10	12:52:13	4.98	4.98	35300	33600	121253.03
109.12	12:52:14	4.98	4.97	35308	33605	121263.90
109.13	12:52:15	4.97	4.97	35316	33610	121272.95
109.15	12:52:16	4.96	4.96	35325	33616	121283.84
109.17	12:52:17	4.95	4.96	35333	33621	121292.77
109.18	12:52:18	4.95	4.95	35340	33626	121302.35
109.20	12:52:19	4.95	4.95	35348	33631	121311.91
109.22	12:52:20	4.94	4.94	35357	33637	121322.13
109.23	12:52:21	4.93	4.93	35364	33642	121332.95
109.25	12:52:22	4.93	4.93	35372	33647	121344.42

Exhibit 11-12: Process Tabular Display showing geopotential heights much higher than geometric heights

11.3.5 Pressure Increase after Balloon Release

Sometimes the pressure plot or PDS data shows that the smoothed pressure increased just after release and then decreased. As an example, see Exhibit 11-13. The "raw pressure" is decreasing with height, but the smoothed pressure increases just off surface and then decreases. This anomaly is likely caused by the station pressure changing from the time it was first entered into the workstation to when the radiosonde was baselined. An incorrect pressure correction is then applied to the corrected pressure data, which is used to generate the smoothed pressure data. The same problem can also cause the smoothed pressure off surface to rapidly decrease after release, but it will not be as noticeable in the data plot.

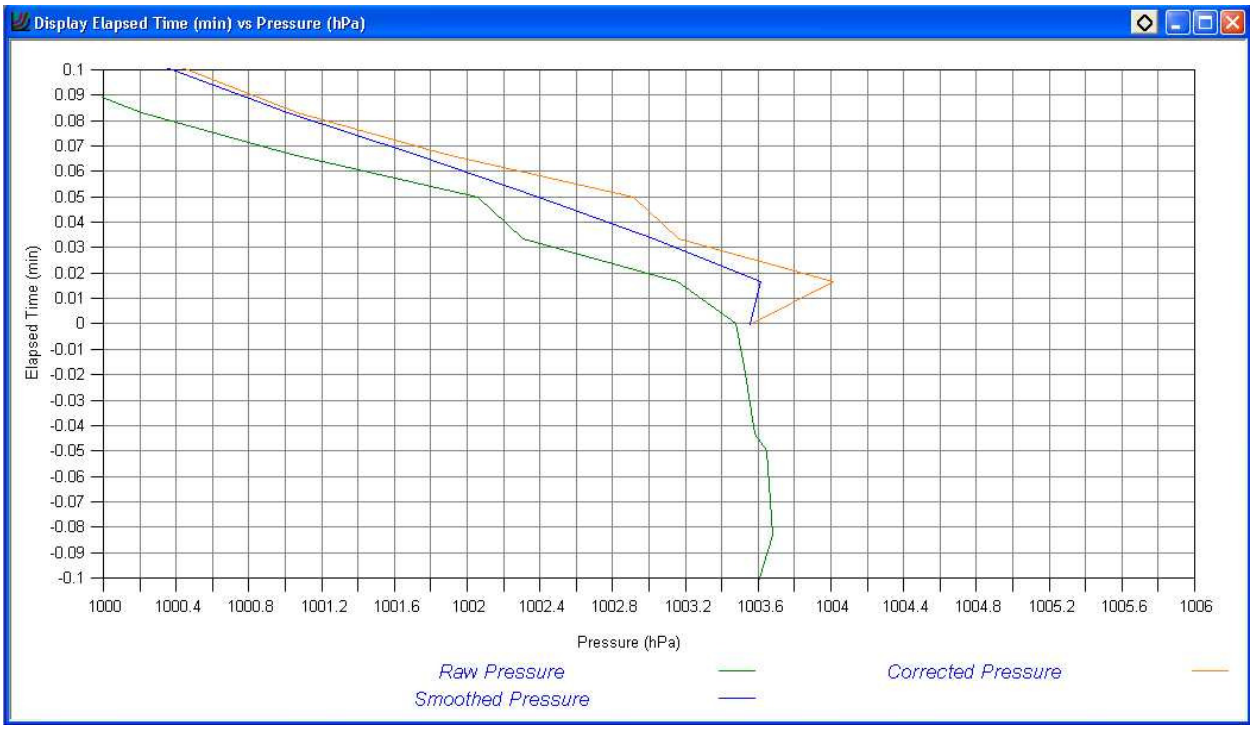


Exhibit 11-13: Corrected and smoothed pressure increase off surface

If a pressure increase off surface in seen in the plot and the difference between the surface pressure and the first pressure data point from the released radiosonde exceeds 0.5 mb, follow these steps:

1. If the release time was selected correctly, do not edit the pressure the data. Let the sounding proceed, but monitor the sounding data. If there are frequent check messages for height changes and the GPS height and geopotential height differences exceed 750 meters, terminate the sounding at the start of the flight.

2. If the pressure difference (increase or decrease) between the surface station pressure and the first point (3 to 6 meters above the surface) from the released radiosonde exceeds 5 mb, the pressure sensor clearly failed and the flight needs to be terminated at the start of the flight.

3. For future soundings, refresh the complete surface observation just prior to radiosonde baseline and then checked again at release time. This will ensure that the station pressure used for baseline is accurate.

11.3.6 Significant Error in Release Detection Time

The RRS software automatically recognizes balloon release by detecting a decrease in pressure. There are certain conditions that may cause the release detection to be significantly too early or late. These include:

- Missing data near release time
- High surface wind releases
- Rapid change in station pressure
- Erratic radiosonde motion at launch
- Change in radiosonde frequency
- Radiosonde or ground equipment failure

A rapid change in station pressure (approaching storm) may cause the software to detect an early or late release. This may also occur during transport to the inflation building if it is far from the radiosonde baseline location. A change in frequency of only .2 MHz may cause the signal to be lost and release may not be detected. Lastly, temporary radiosonde or equipment failure are possible points of failure.

The key to minimizing this problem is:

1. **Verify the frequency and sensor readings during baseline, after baseline, and prior to going to the inflation building.**

NOTE: The observer cannot validate the sensor performance at the inflation building, but he/she can check the frequency, signal strength, and the operation of the equipment.

2. **It is critical that the frequency and signal strength be verified at the release point prior to and immediately after release.**

Exhibit 11-14 shows a sounding where the release was not detected until 5 minutes after actual release. The surface pressure was 1005.7 hPa, but at .33 minutes into the sounding the received PTU shows a pressure of 843.9 hPa. The receiver shifted off frequency by only .4 MHz and lost signal. The operator in this example noticed the problem and locked back on frequency. Once the receiver locked back on frequency, the release was detected. The first .3 minutes after release detection had missing “Raw” PTU data and the software interpolated the “Processed” data from surface to the first good data point. Interpolation occurred because less than 1-minute of missing data was recognized.

Processed Tabular Display

Elapsed Time (Minutes)	Time Stamp (UTC)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	RH (%)
0.00	18:16:07	1005.71	190	-0.90	64.0
0.02	18:16:08	998.03	252	-1.10	61.7
0.03	18:16:09	989.50	320	-1.11	59.4
0.05	18:16:10	980.98	389	-1.12	57.2
0.07	18:16:11	972.50	458	-1.14	54.9
0.08	18:16:12	964.07	528	-1.15	52.6
0.10	18:16:13	955.80	596	-1.17	50.3
0.12	18:16:14	947.45	666	-1.18	48.0
0.13	18:16:15	939.18	736	-1.19	45.8
0.15	18:16:16	930.98	806	-1.21	43.5
0.17	18:16:17	922.85	876	-1.22	41.2
0.18	18:16:18	914.79	946	-1.23	38.9
0.20	18:16:19	906.81	1016	-1.25	36.6
0.22	18:16:20	898.89	1085	-1.26	34.4
0.23	18:16:21	891.04	1155	-1.27	32.1

Received PTU Tabular Display

Elapsed Time (min)	Time Stamp (UTC)	Raw Pressure (hPa)	Pressure QI	Raw Temp (C)
-0.00	18:16:06.714		0.00	
0.05	18:16:09.714		0.00	
0.10	18:16:12.714		0.00	
0.15	18:16:15.715		0.00	
0.20	18:16:18.714		0.00	
0.25	18:16:21.714		0.00	
0.30	18:16:24.714		0.00	
0.33	18:16:26.814	843.92	100.00	-1.14
0.35	18:16:27.714	843.63	100.00	-1.17
0.37	18:16:28.815	842.69	100.00	-1.21
0.38	18:16:29.814	842.52	100.00	-1.30
0.40	18:16:30.815	842.33	100.00	-1.31
0.42	18:16:31.815	841.65	100.00	-1.35
0.43	18:16:32.815	841.23	100.00	-1.34
0.45	18:16:33.814	840.65	100.00	-1.34

Exhibit 11-14: Processed and received data for a sounding with late release detection

In this example, the release was detected late, but no data was available because the receiver was off frequency at the true release time. In this example the flight should be terminated because more than 3 consecutive minutes of data were missing.

Exhibit 11-15 further illustrates the late release detection in the WMO Levels Table and the Pressure plot showing an abrupt change in pressure within the first .3 of a minute. Again, the shift in frequency prior to launch caused the radiosonde release to go undetected by the software.

WMO Levels Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Corrected Temperature (C)	RH (%)	Geopotential Height (m)	Reason
0.00	1005.71	-0.90	64.0	190	SFC
0.01	1000.00	-1.05	62.3	236	STD P
0.03	991.40	-1.11	59.9	305	REG W
0.10	954.21	-1.17	49.9	610	REG W
0.16	925.00	-1.22	41.8	857	STD P
0.18	918.40	-1.23	39.9	914	REG W
0.25	883.92	-1.29	30.0	1219	REG W
0.33	854.91	-1.36	18.4	1485	RH
0.36	850.00	-1.41	18.5	1531	STD P
0.47	841.82	-1.53	18.5	1608	TEMP
1.33	818.69	-2.56	26.7	1829	REG W
1.77	806.16	-3.37	27.7	1951	TEMP
2.25	791.66	-3.18	26.3	2094	TEMP
2.38	787.74	-3.59	27.2	2134	REG W
3.32	760.66	-5.32	31.8	2409	TEMP
3.41	757.82	-5.37	32.4	2438	REG W

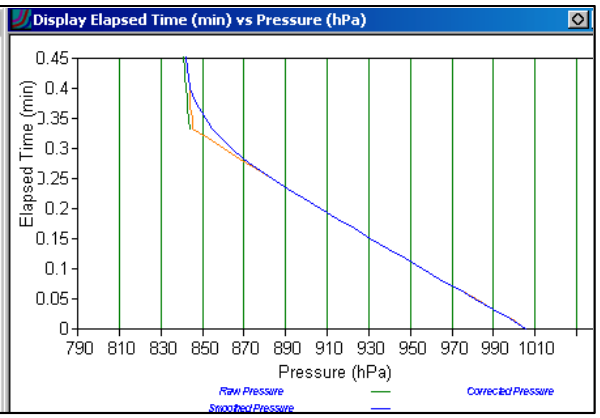


Exhibit 11-15: WMO Levels and pressure plot for sounding with late release detection

If balloon release was detected too early or late, follow these steps:

1. If a release is detected too early or too late review the "Received PTU" display to find the point where the pressure shows a continual decrease. It should be close to the station pressure recorded at baseline. This point is the correct release time. Record the time and then select "Tools" and then "Release Time" in the toolbar at the top of the screen. Enter the correct release time and select OK.

2. Sometimes, if a release is not detected automatically, the "waiting for balloon release" window will still be flashing. Select the yellow "manual release" icon on the toolbar at the top right of the screen display. The blinking blue screen will then show a release time. Select continue and verify the surface observation information, then select OK. Next, review the "Received PTU" display to find the point where the pressure shows a continual decrease. It should be close to the station pressure recorded at baseline. This point is the correct release time. Record the time and then select "Tools" and then "Release Time" in the toolbar at the top of the screen. Enter the correct release time and select OK.

11.4 Temperature Data Problems

Problems with the temperature data typically result from precipitation on the temperature sensor evaporating or freezing, radiosonde sensor defects, or incorrect radiosonde preparation by the observer.

11.4.1 Superadiabatic Lapse Rate

The dry adiabatic temperature lapse rate in the atmosphere is about 9.8C/km. Sometimes, the rate of cooling with altitude is higher than this value and the lapse rate is known as superadiabatic. RRS will generate temperature lapse rate Check Messages if the superadiabatic lapse rate is erroneous and exceeds the following values:

- Surface to 1 km: Lapse rate is 34C/km or more
- Above 1 km to sounding termination: Lapse rate is 15C/km or more

Superadiabatic lapse rates occur often just off surface and less so further aloft. **If RRS generates Check Messages for lapse rates, action needs to be taken to eliminate them.**

11.4.1.1 Strong Superadiabatic Lapse Rate Off Surface

Superadiabatic lapse rates occur frequently within 20 hPa of the surface. Many such lapse rates are legitimate meteorological events that result from solar heating of the ground. However, if the lapse rate exceeds 34°C per kilometer within 1 km of the surface, it is considered to be erroneous data and RRS will generate a check message. As an example, Exhibit 11-16 shows a temperature plot with the temperature cooling rapidly off surface. The resulting Check Message is also shown and shows an unrealistic lapse rate of nearly 105C/km.

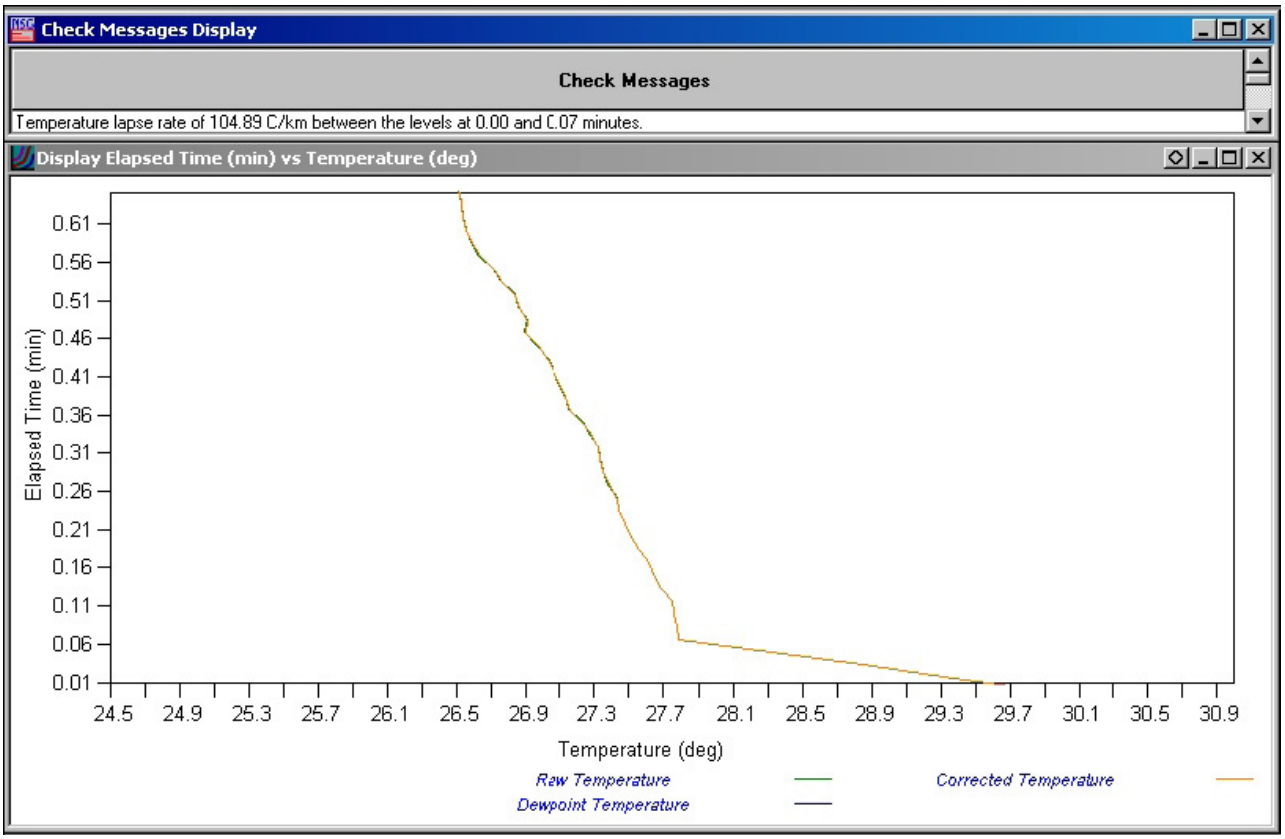


Exhibit 11-16: Superadiabatic lapse rate near surface and resulting Check Message

If RRS generates a superadiabatic lapse rate off surface exceeding 34C/km, follow these steps:

1. Verify that the surface temperature observation at the time of balloon release is correct. If it is not, change the observation. This may eliminate the Check Message.

IMPORTANT: Never adjust or apply an arbitrary correction to an accurate surface temperature value to eliminate the off-surface superadiabatic lapse rate.

2. If the surface temperature observation is correct, use the temperature plot to help identify the thickness of the erroneous layer. Delete up to 30 seconds of temperature data off surface. If this does not eliminate the Check Message, delete up to 1 minute of temperature data. Do not delete more than 1 minute of data to eliminate the superadiabatic lapse rate.

3. If the Check Message persists even after deleting up to 1 minute of temperature data, continue to monitor the sounding data and Check Messages as there may be a calibration problem with the radiosonde.

4. If the strong surface super is occurring at night or early morning hours or occurs frequently during daytime soundings notify the electronics technician of the problem. The surface weather observation equipment may be out of calibration or is poorly located and needs to be

checked. If the ET finds no fault with the surface weather equipment and the problem persists, then notify the Regional Office Upper air Program Manager as soon as possible.

11.4.1.2 Evaporative Cooling on the Temperature Sensor ("Wet bulb Effect")

The temperature sensor in the GPS radiosonde is very small and responds quickly to temperature changes. However, the small size of the sensor allows it to get easily wet when it is inside a cloud or exposed to precipitation. Once the sensor exits the cloud and is exposed to drier air, evaporative cooling or the "wet-bulb effect" occurs, causing an abrupt and unrealistic decrease in temperature with height. The wet-bulb effect typically occurs from near surface to about 8 km and may occur in one or more layers in the atmosphere, especially if the radiosonde enters a thick precipitating cloud.

Exhibit 11-17 shows a typical example of the wet-bulb effect. At about 3.5 minutes, into the sounding, the dewpoint decreases quickly (i.e., radiosonde is exiting the cloud) and the temperature cools off rapidly creating a layer of super-adiabatic lapse rates. Exhibit 11-18 shows the Check Messages for this sounding.

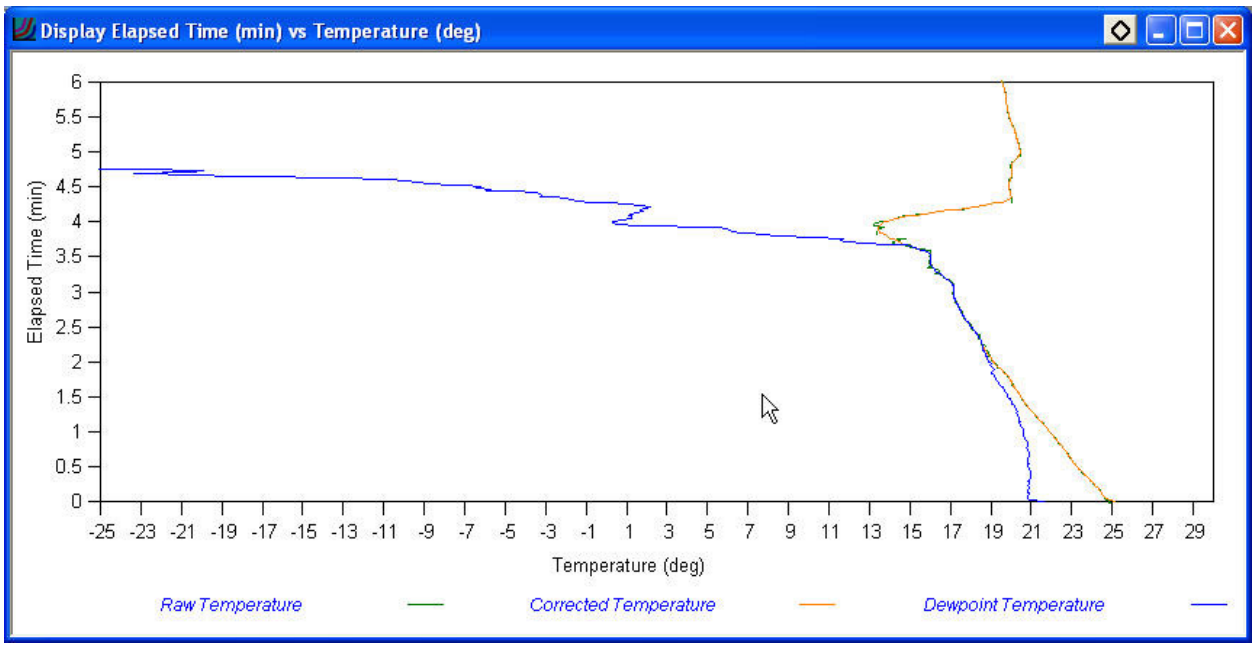


Exhibit 11-17: Temperature and dewpoint data plot showing the wet-bulb effect starting at about 3.5 minutes

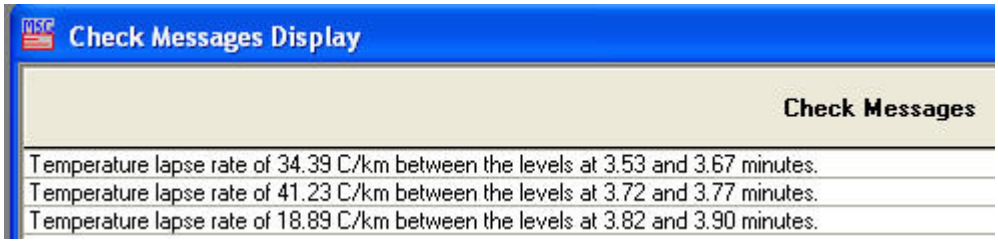


Exhibit 11-18: Check Messages as a result of the wet-bulb effect shown in Exhibit 11-17.

If the wet-bulb effect is observed in the sounding, follow these steps:

1. Examine the temperature data plot and lapse rate Check Messages to determine the thickness of the erroneous layer(s).

2. Using the Check Messages as a guide, go to the Processed Tabular Display and mark **all** the temperature data in the erroneous layer. If the first round of editing does not eliminate the super-adiabatic lapse rates in the Check Messages expand the layer deleted in small increments until the messages no longer appear. In the example shown in Exhibit 11-17 all the temperature data from 3.0 to 4.0 minutes was deleted.

3. Sometimes the wet-bulb effect is severe and may be caused by excessive wetting of the temperature sensor. Water may also freeze on the sensor making the problem worse. The temperature sensor in such a case may take several minutes or more to dry out and recover. If steps 1 and 2 do not eliminate the Check Message, continue deleting temperature data in small increments until the Check Message no longer appears. If the layer of deleted data is more than 3 consecutive minutes, terminate the sounding at the point where the wet-bulb effect began.

4. If there are more than 3 layers showing the wet-bulb effect, and more than one minute of data will have to be deleted to correct each layer, terminate the sounding at the point where the wet-bulb effect began.

11.4.1.3 Superadiabatic Lapse Rates Above 8 km.

Superadiabatic lapse rates exceeding 15C/km above about 8 km are very rare and not likely being caused by the wet-bulb effect. They may be a result of a radiosonde defect or the temperature sensor boom was not positioned correctly during radiosonde preparation.

If superadiabatic lapse rate Check Messages are seen above 8 km, follow these steps

1. Using the temperature data plot and Check Messages as a guide, delete **all** the erroneous temperature data. If the first round of editing does not eliminate the super-adiabatic lapse rates in the Check Messages expand the layer deleted in increments until the messages no longer appear. If the layer of deleted data is more than 3 consecutive minutes, terminate the sounding at the point where the superadiabatic lapse rates began.

2. If RRS generates four or more Check Messages for superadiabatic lapse rates above 8 km (see Exhibit 11-19), the temperature sensor has likely failed and the sounding needs to be terminated at the point where the bad lapse rates began.

3. In the future make sure the temperature sensor boom is positioned in accordance with the radiosonde preparation instructions.

Check Messages
Temperature lapse rate of 41.96 C/Km between the levels at 28.97 and 29.15 minutes.
Temperature lapse rate of 43.82 C/Km between the levels at 34.37 and 34.50 minutes.
Temperature lapse rate of 24.35 C/Km between the levels at 41.32 and 41.52 minutes.
Temperature lapse rate of 38.85 C/Km between the levels at 50.80 and 50.88 minutes.
Temperature lapse rate of 28.34 C/Km between the levels at 86.27 and 86.52 minutes.
Temperature lapse rate of 47.28 C/Km between the levels at 86.59 and 86.65 minutes.

Exhibit 11-19: Superadiabatic lapse rate Check Messages appearing for data above 8 km

11.4.1.4 Sounding Inside a Thunderstorm

RELEASING A RADIOSONDE WHILE A THUNDERSTORM IS OCCURRING IS STRICTLY FORBIDDEN! The observer risks being struck by lightning and the sounding data collected are mostly junk and do not represent the synoptic scale environment. NCEP will not use such soundings for their numerical weather prediction models. See NWS Upper air Manual 10-1401 for more information on radiosonde releases during thunderstorm activity.

Exhibit 11-20 shows a typical temperature and dewpoint temperature profile from a radiosonde that was released into a thunderstorm. Note the very erratic temperatures from near surface to about 18 minutes. Exhibit 11-21 shows numerous Check Messages for superadiabatic lapse rates.

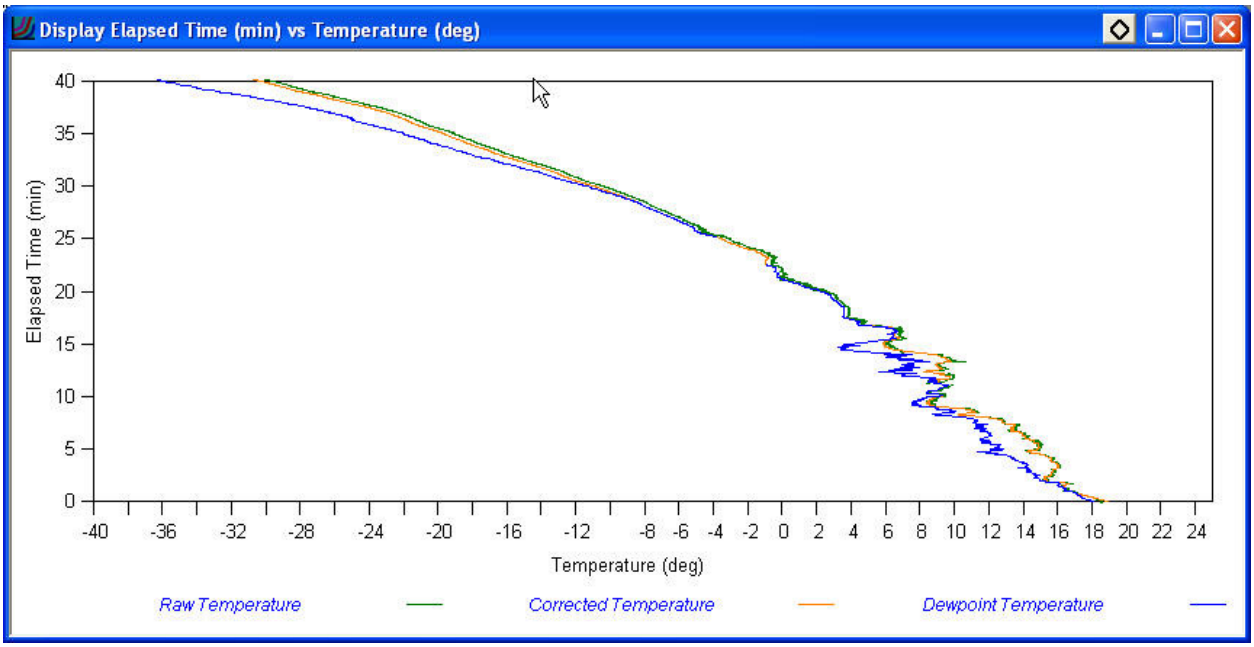
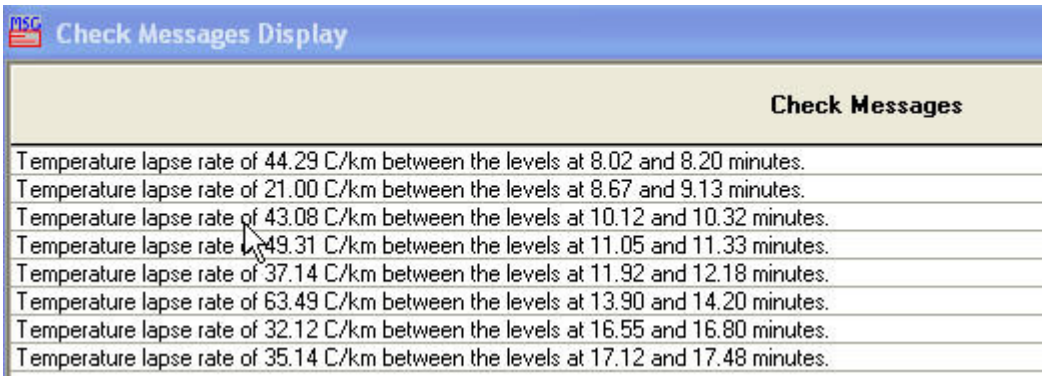


Exhibit 11-20: Typical temperature and dewpoint profile inside a thunderstorm



Check Messages Display

Check Messages
Temperature lapse rate of 44.29 C/km between the levels at 8.02 and 8.20 minutes.
Temperature lapse rate of 21.00 C/km between the levels at 8.67 and 9.13 minutes.
Temperature lapse rate of 43.08 C/km between the levels at 10.12 and 10.32 minutes.
Temperature lapse rate of 49.31 C/km between the levels at 11.05 and 11.33 minutes.
Temperature lapse rate of 37.14 C/km between the levels at 11.92 and 12.18 minutes.
Temperature lapse rate of 63.49 C/km between the levels at 13.90 and 14.20 minutes.
Temperature lapse rate of 32.12 C/km between the levels at 16.55 and 16.80 minutes.
Temperature lapse rate of 35.14 C/km between the levels at 17.12 and 17.48 minutes.

Exhibit 11-21: Check Messages from a sounding inside a thunderstorm

Other data problems encountered when a radiosonde enters a thunderstorm include very erratic wind directions and speeds, moist-biased RH data, and erratic ascent rates.

Sometimes there will be no thunderstorm at release time, but there is convective activity in the area some distance away from the release point. After release, the radiosonde will enter or go near a thunderstorm or a developing one. The temperature profile and check messages will be similar to those seen in Exhibits 11-20 and 11-21. If there is convective activity occurring in the area at release time, monitor the sounding data and Check Messages closely. If the radiosonde enters or goes near a thunderstorm, follows these steps:

1. Examine the temperature data plot and Check Messages.

2. If the temperature data looks very erratic and there are numerous Check Messages for superadiabatic lapse rates, terminate the sounding at the point where the temperature data first became erratic.

IMPORTANT: Never launch a radiosonde just before 11:00 or 23:00 UTC in an attempt to get a synoptic sounding off before a thunderstorm arrives.

11.5 Relative Humidity Data Problems

Of all the data provided by radiosondes, verifying the accuracy of the Relative Humidity data profile can be difficult since moisture in the atmosphere can vary significantly with height and over a short time. Many RH data problems are caused by limitations of the sensor technology and this section covers some of the more common problems.

NOTE: RRS does not provide Check Messages for RH data so monitor the RH profile carefully and edit the data if necessary.

11.5.1 Rapid Change in RH Off Surface

The RH sensor at times may indicate significantly lower or higher readings immediately off surface because the surface weather observation of RH does not agree with the first RH data reported from the radiosonde after release. Significant drying off surface is more common and is possibly caused by the RH sensor not being properly ventilated after release. Exhibit 11-21 shows and example where the Surface RH was 92% but the first RH data reported from the radiosonde was 76%.

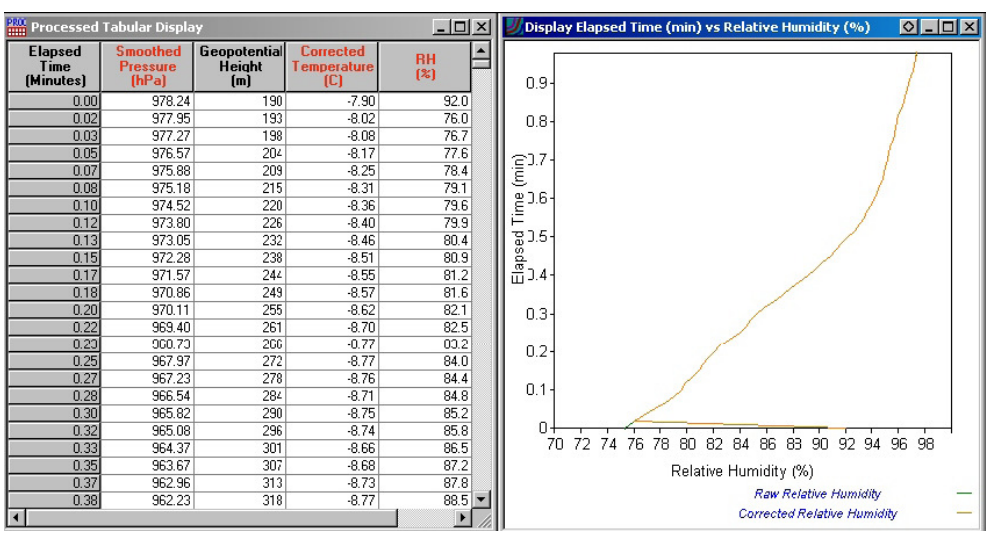
If the difference between the surface weather RH observation and the first RH data point aloft exceeds 5%, follow these steps:

1. Using the RH plot, determine the time it took for the RH sensor to recover (i.e, RH data increases) and provide RH measurements more in line with the surface weather observation. The example in Exhibit 11-22 shows that it took about 0.7 minutes for the sensor to recover.

2. Delete **all** the RH in the erroneous layer.

3. Correcting this RH anomaly should not require the deletion of more than 1 minute of data. If it appears that it took more than 1 minute for the sensor to recover, do not delete more than 1 minute of RH data. Let the sounding proceed, but continue to monitor the RH data for any further problems.

4. Significant discrepancies in RH off surface may also be caused by the surface weather equipment being out of calibration or poorly sited. The equipment should be checked by an electronics technician to make sure it is operating correctly. Routine maintenance of the equipment is essential.



Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Geopotential Height (m)	Corrected Temperature (C)	RH (%)
0.00	978.24	190	-7.90	92.0
0.02	977.95	193	-8.02	76.0
0.03	977.27	198	-8.08	76.7
0.05	976.57	204	-8.17	77.6
0.07	975.88	209	-8.25	78.4
0.08	975.18	215	-8.31	79.1
0.10	974.52	220	-8.36	79.6
0.12	973.80	226	-8.40	79.9
0.13	973.05	232	-8.46	80.4
0.15	972.28	238	-8.51	80.9
0.17	971.57	244	-8.55	81.2
0.18	970.86	249	-8.57	81.6
0.20	970.11	255	-8.62	82.1
0.22	969.40	261	-8.70	82.5
0.23	968.73	266	-8.77	83.2
0.25	967.97	272	-8.77	84.0
0.27	967.23	278	-8.76	84.4
0.28	966.54	284	-8.71	84.8
0.30	965.82	290	-8.75	85.2
0.32	965.08	296	-8.74	85.8
0.33	964.37	301	-8.66	86.5
0.35	963.67	307	-8.68	87.2
0.37	962.96	313	-8.73	87.8
0.38	962.23	318	-8.77	88.5

Exhibit 11-22: Processed Data and Relative Humidity Plot showing rapid drying off surface

11.5.2 Layers of Constant 1% RH Values

Sometimes if the RH sensor is exposed to high RH aloft followed by rapid drying (e.g., the radiosonde exits a cloud or inversion layer) the RH data will show prolonged periods of constant 1% RH values. Sometimes the sensor recovers while other times it does not. If prolonged periods of constant 1% RH data occur in the sounding, follow these steps:

1. If layer of constant 1% RH values persists for less than 15 minutes, and then recovers, leave the RH data as is. **Do not delete the data.** Exhibit 11-23 shows an example of such a RH profile.

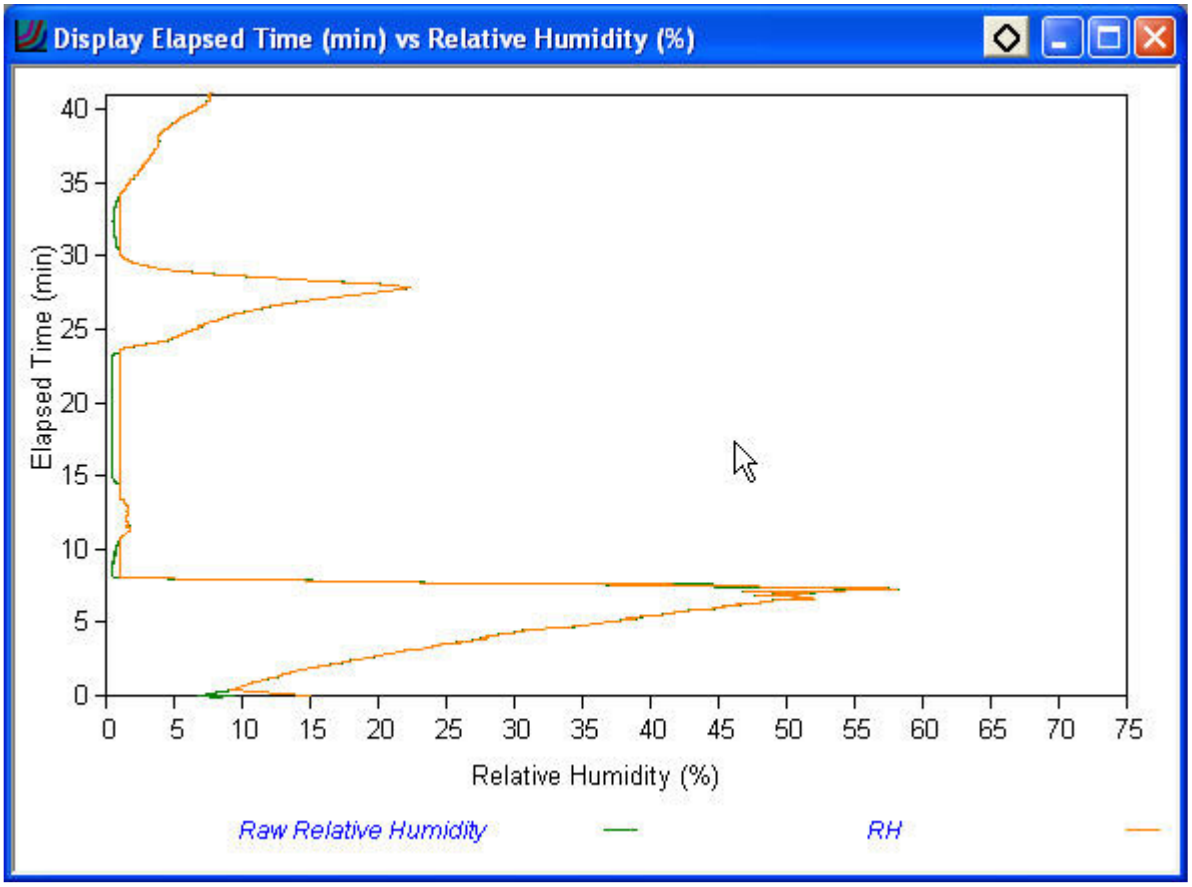


Exhibit 11-23: RH plot showing layers of 1% RH values lasting less than 15 minutes

2. If the constant 1% RH values persist for more than 15 minutes, the sensor has likely failed completely and **all** the RH data from the start of the 1% values to flight termination needs to be deleted. Exhibit 11-24 shows an example of such a RH data profile. The RH sensor failed at about 12 minutes into the sounding.

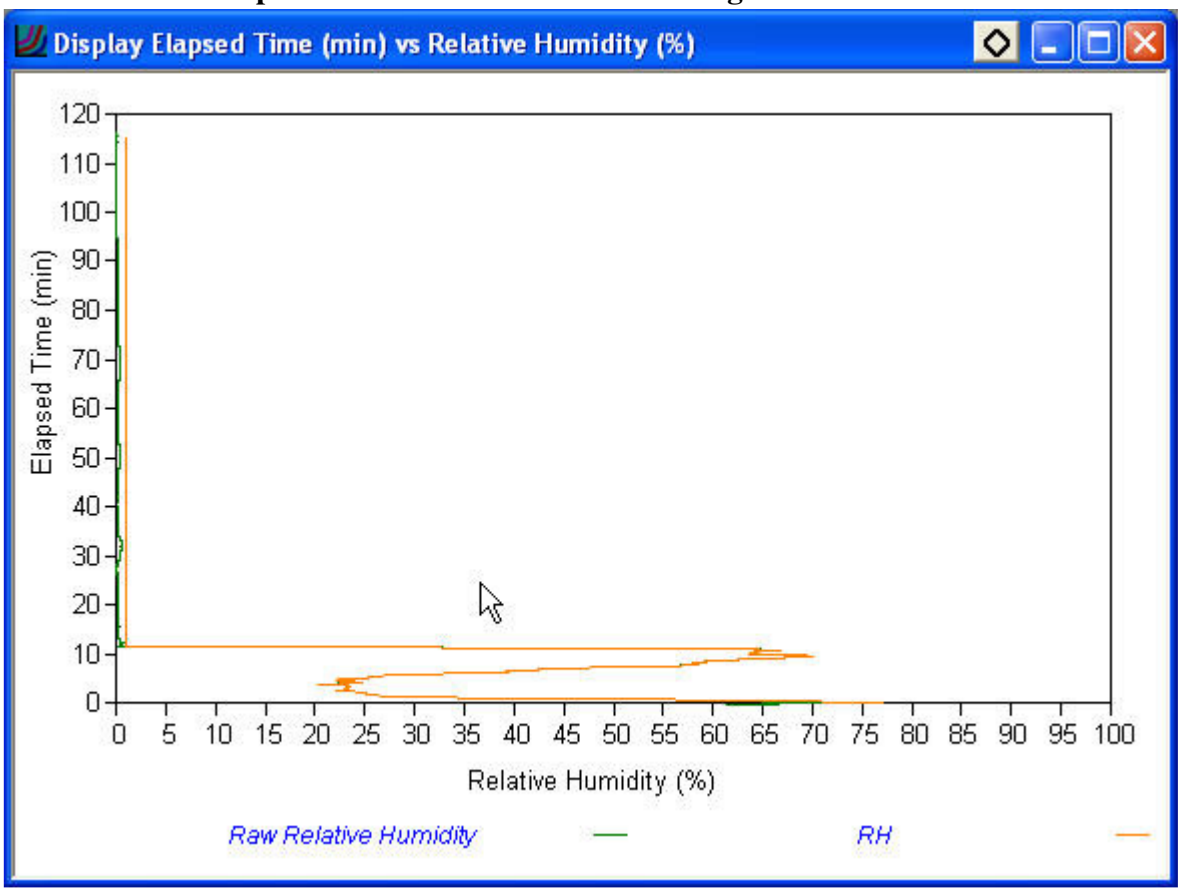


Exhibit 11-24: RH data showing senor failure at about 12 minutes

11.5.3 Noisy or Erratic RH Data

At times the RH data plot will show one or more layers of very erratic values. They tend to occur after the RH sensor is exposed to high RH during a portion of the sounding. They can persist for about 30 seconds or more. Exhibit 11-25 shows a RH data plot with erratic RH from about 28 to 33 minutes into the sounding. Such erratic RH values are not real and RRS does not delete such levels as it does with very erratic temperature or pressure values. The result can be a huge TTBB coded message with numerous, erroneous RH levels that are of no value to data users.

If the sounding shows very erratic RH data, follow these steps:

1. Use the RH data plot identify the area of erratic data. Use the Zoom feature to help define the start and end times of the erratic data. Delete **all** the RH data in the erratic layer.

2. The WMO Levels Tabular Display can also be used to help identify the erratic RH layer(s) by noting portions of the table where 10 or more RH levels were selected, but they are only 1 mb or less apart from one another. Exhibit 11-26 shows an example of the levels display with numerous RH levels selected.

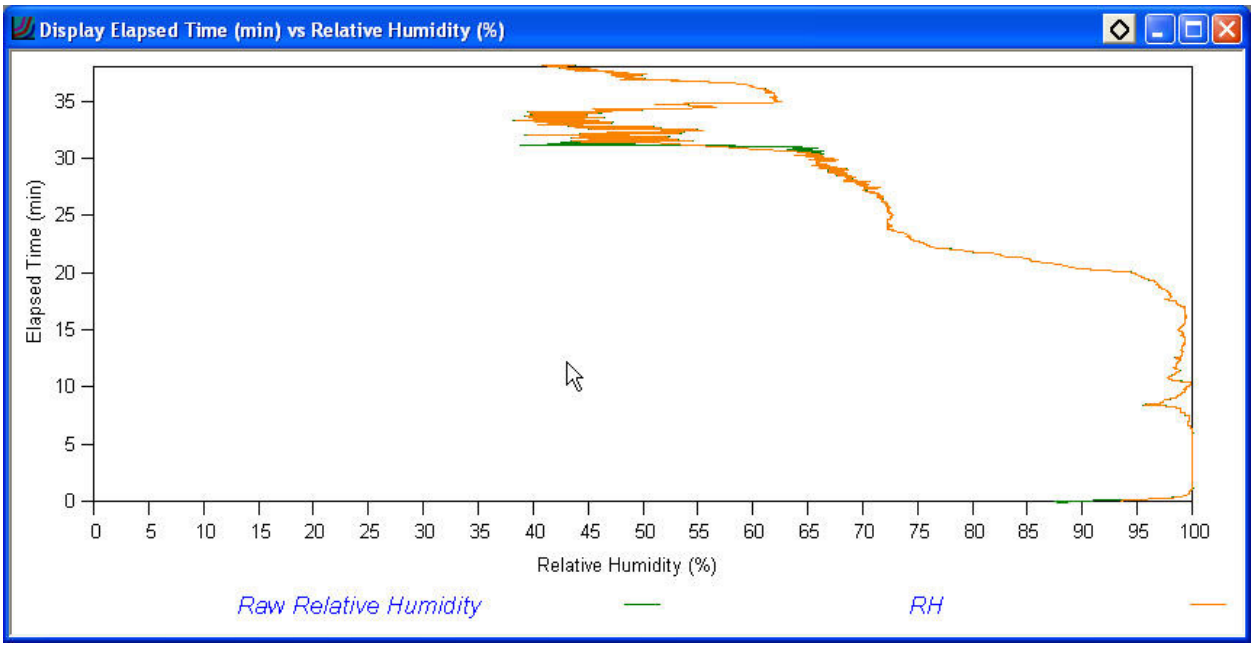


Exhibit 11-25: RH data plot with erratic RH data from about 28 to 33 minutes into the sounding.

WMO Levels Tabular Display

Elapsed Time (Minutes)	Smoothed Pressure (hPa)	Corrected Temperature (C)	RH (%)	Reason
42.18	320.67	-26.90	16.2	RH
42.22	320.36	-26.92	7.5	RH
42.32	319.48	-26.96	24.3	RH
42.37	319.07	-27.02	13.2	RH
42.42	318.69	-27.09	23.7	RH
42.47	318.31	-27.17	12.1	RH
42.53	317.79	-27.23	20.9	RH
42.65	316.83	-27.41	7.4	RH
42.68	316.55	-27.44	14.3	RH
42.83	315.23	-27.63	9.8	RH
42.88	314.75	-27.69	18.6	RH
42.95	314.12	-27.75	9.1	RH
43.07	313.09	-27.87	11.7	RH
43.17	312.31	-28.00	25.8	RH
43.28	311.41	-28.18	13.7	RH

Exhibit 11-26: WMO Levels Table showing numerous RH levels selected less than 1 hPa apart.

11.5.4 High RH in the Stratosphere

On occasion, the radiosonde will pass through a thick cloud or precipitation layer and the RH sensor absorbs excessive moisture or becomes ice covered. The radiosonde later enters drier air, but the RH sensor never dries out and RH values remain biased too high for the remainder of the sounding.

This will be readily apparent by examining the RH data plot above 300 mb, where RH in the atmosphere is typically well below 30%.

If the RH plot shows 30% or higher RH values persisting from above 300 mb to sounding termination, follow these steps.

1. After flight termination, delete **all** the RH data from 300 mb to the end of the sounding.

2. If the TTAA and TTBB coded messages were transmitted earlier without the RH data edits as noted in step 1, retransmit them with the RH data edits applied.

11.6 Wind Data

Unlike the wind data obtained from the old MicroART system, GPS winds from RRS are quite accurate and it is rare there will be problems. Wind speeds over 200 knots have been accurately measured from GPS radiosondes. Likewise, light and variable winds are also accurately measured. Yet, it is common to see Check Messages for wind speed and direction changes and Exhibit 11-27 shows a typical example.

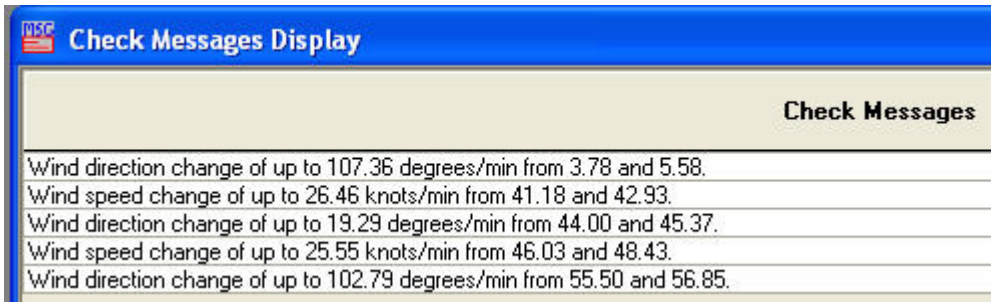


Exhibit 11-27: Typical wind speed and direction Check Messages

If there are Check Messages for wind speed and direction changes they can be mostly ignored and no action to edit the data needs to be taken. Don't delete wind data unless it is certain they are in error.

If the sounding shows wind data Check Messages numbering 12 or more you should verify the wind data accuracy, follow these steps:

1. Using the previous sounding, aircraft data, WSR-88D winds, and/or wind profilers verify the accuracy of the radiosonde winds. If the wind data look reasonably accurate, no further action needs to be taken.

2. If the observer is certain the winds are bad and has no doubts, then **all** the wind data in the erroneous layer need to be deleted.

11.6.1 Missing Winds

While the accuracy of the GPS winds are very good, there will be times when there is GPS loss and the wind data are missing for several minutes or more off surface or in thick layers elsewhere in the sounding. Sometimes all the winds are missing in the sounding.

If there are significant amounts (several minutes or more) of missing winds during the sounding notify the WFO lead forecaster and NCEP SDM. A second release may be required are the wind data are deemed essential. If there are frequent soundings with missing winds, notify the office electronics technician and the Regional Office Upper air Program Manager. There may be a ground equipment problem or a problem with the radiosonde shipment.

11.7 Data Spikes

Data spikes in the plots may be seen with any of the radiosonde data, but they will be more common with the RH data as the RRS software does not apply a data outlier removal algorithm to these data. When data spikes occur, the data plots will show one or more data points that are an extreme departure from the other plotted data. Exhibit 11-28 shows a data spike in the dewpoint temperature plot. The RH data plot would also this problem.

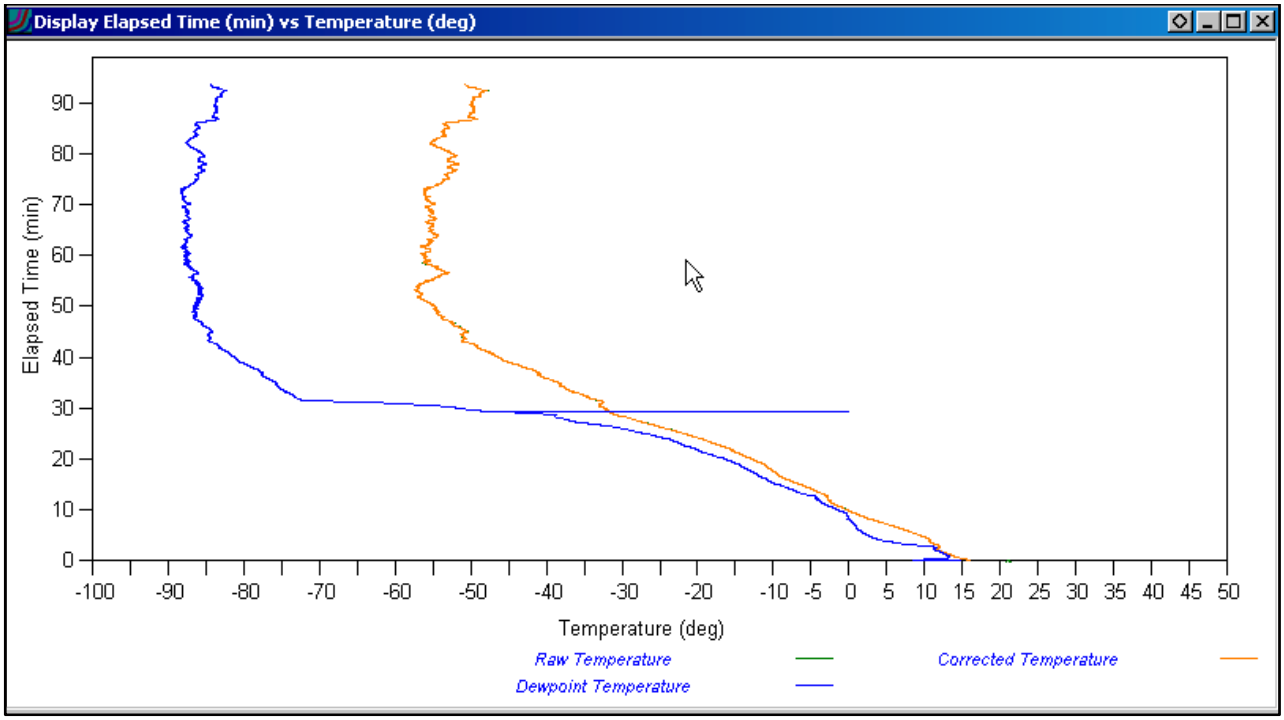


Exhibit 11-28: Data spike in the dewpoint temperature plot

Sometimes the outlier removal algorithm does not remove all the erroneous temperature data and a spike will appear in the temperature and RH data. Exhibit 11-29 shows a temperature and dewpoint spike at 8.7 minutes. The spike in temperature also caused a Check Message for a nearly 30C/km lapse rate to appear.

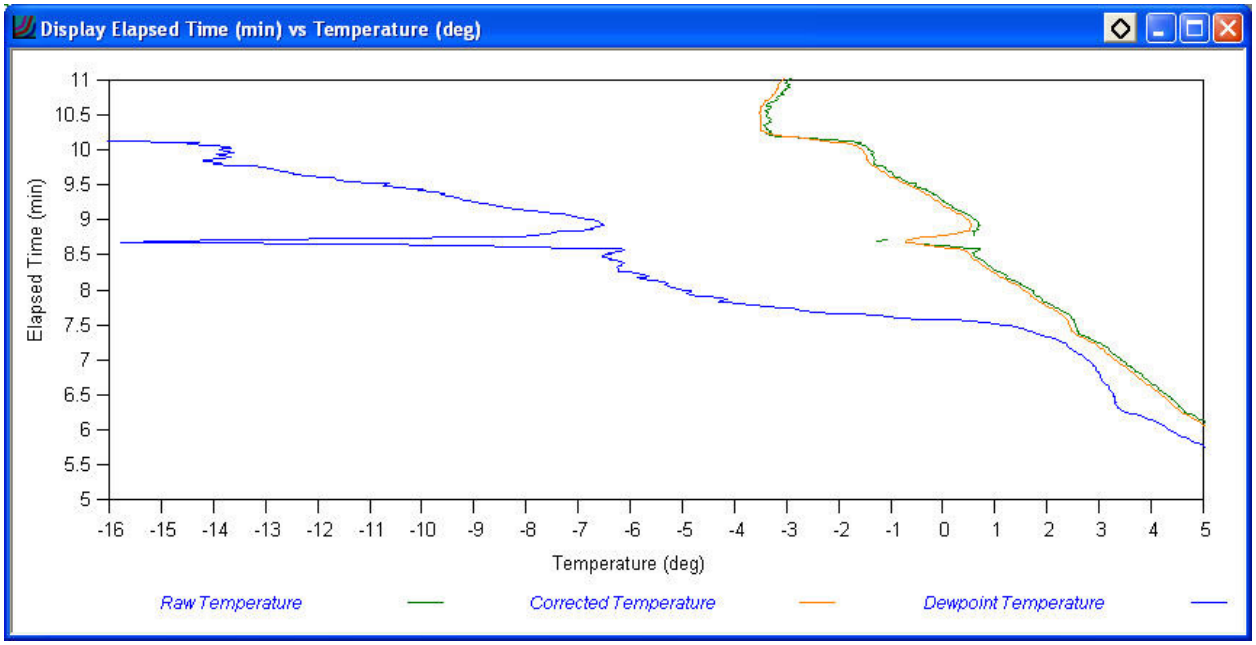


Exhibit 11-29: Temperature and dewpoint spike at 8.7 minutes

After identifying data spike in the plotted data, follow these steps.

1. Expand the data plot to help better find beginning and end points of the data spike. Exhibit 11-30 is a zoomed in view of the data spike shown in Exhibit 11-28 and indicates the spike occurring at about 29.3 minutes into the sounding.

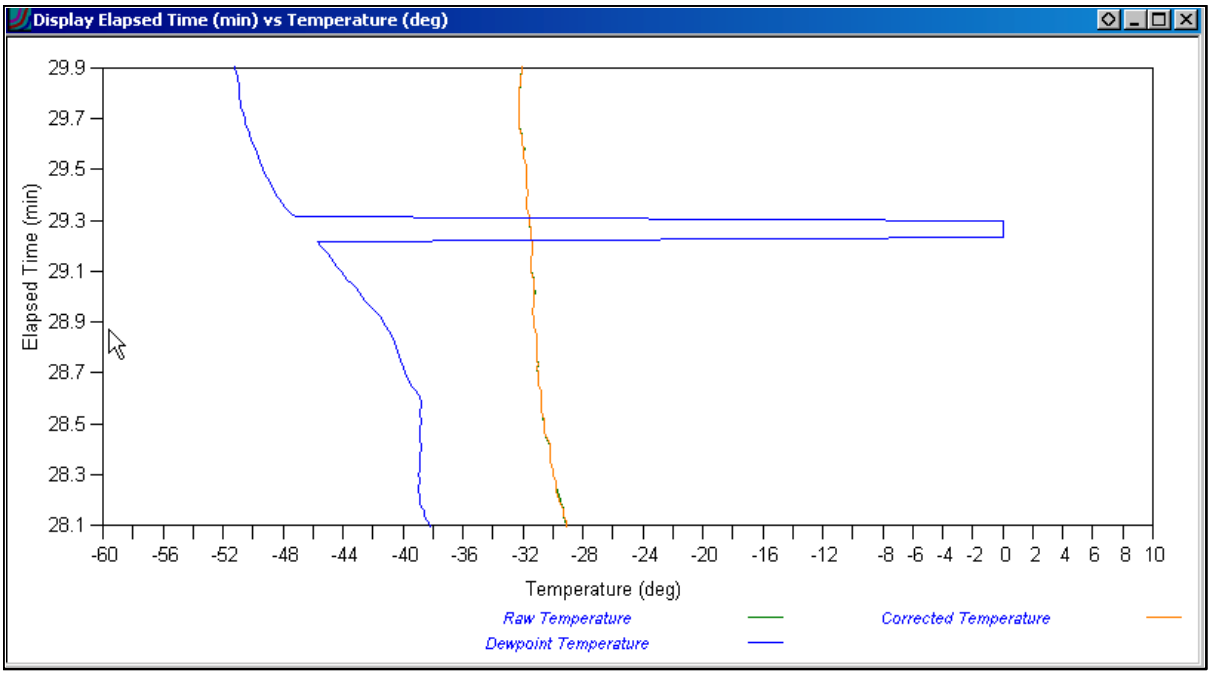


Exhibit 11-30: Zoomed in view of the dewpoint spike as seen in Exhibit 11-28

2. Go to the Processed Data Tabular Display, locate the data spike, and delete the data.

11.8 Radiosonde or Sensor Failure

NWS uses over 75,000 radiosondes across the 92 upper air station network each year. A small percentage of them will have serious defects or calibration problems. Sometimes these problems will not be detected by the observer or the software during radiosonde preparation and baseline. It's only when the radiosonde is aloft that data problems become apparent. When a radiosonde is not working correctly or is poorly calibrated at the factory one or more of the following may occur during the sounding:

- Abrupt rise or unrealistic drop in pressure exceeding 5 mb just off surface or aloft.
- Numerous check messages for super-adiabatic lapse rates, fast ascent rates, increasing pressure levels, and changes in heights and temperatures from the previous sounding.
- Erratic pressure, temperature, or RH data
- Frequent data drop-outs or spikes
- Freezing levels occurring at 6,000 meters or higher
- Early flight termination owing to battery or radiosonde failure
- All GPS winds are missing

In some cases the software will detect problems and correctly terminate the sounding early. Many times it does not. Exhibit 11-31 shows an example of a pressure sensor failure clearly occurring at 46.5 minutes. Check Messages were generated for the increasing pressure levels deleted by the software, but the flight was not automatically terminated until 48.6 minutes. Over two minutes of erroneous data remained and appeared in the coded messages.

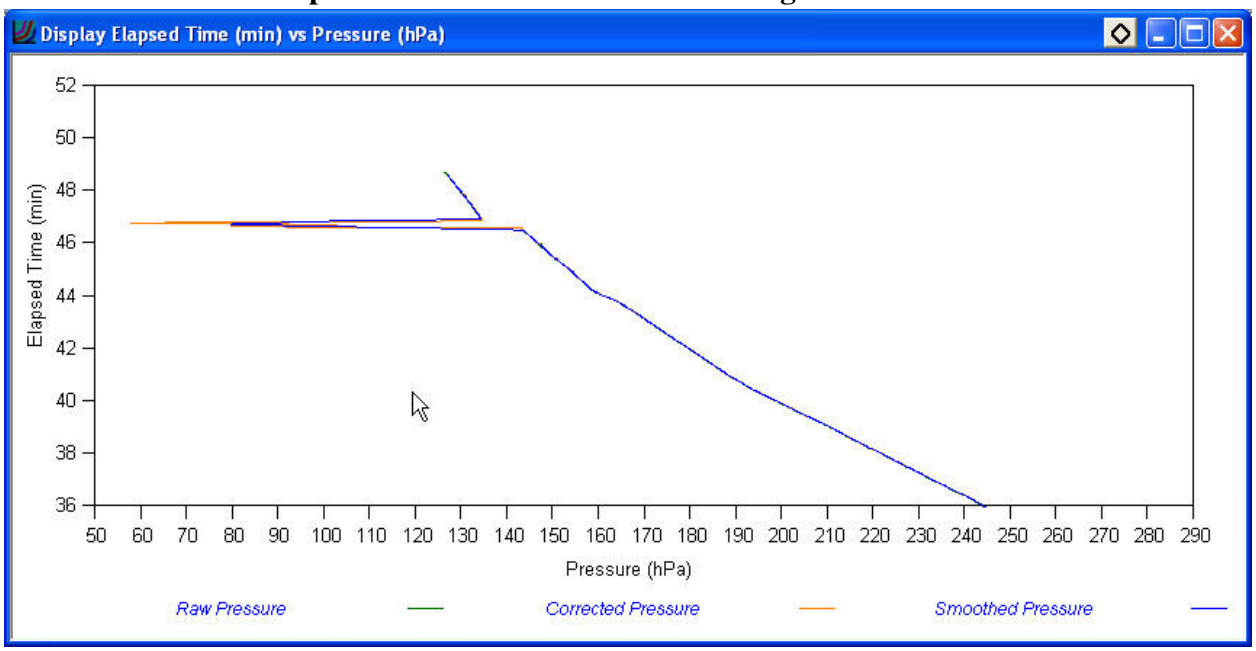


Exhibit 11-31: Pressure data plot showing sensor failure at 46.5 minutes

Thus, it is important to monitor all flight data and take action to edit the data and if necessary, terminate the sounding early. Never assume that the software will detect all bad data and terminate the sounding correctly. If problems with radiosonde data appear to be occurring often with a particular radiosonde shipment, promptly notify the Regional Office Upper air Program Manager.

12. Rework – Reprocessing Flights

12.1 Introduction

This chapter provides covers Rework mode and its use in reprocessing flights. Rework is used for several reasons. Some of the most common reasons are:

1. To correct data after a flight has been completed for re-transmition to NCEP and NCDC.
2. Quality control observations and assess operator performance.
3. Provide operator training.

NOTE: You have up to six hours from the observation termination time to rework a flight and re-transmit it to NCEP.

Rework mode allows the observer to open a previous flight and review and edit the flight data. Rework contains most of the capabilities available in the Live Flight mode. Observers should become familiar with Reworking flights, since it is a useful tool for reviewing flight data and the only means of transmitting data in the event of a software crash.

12.2 Rework Functions

Rework mode has the same functions available as the post-termination portion of a Live Flight, with the exception of anything to do with monitoring and controlling RRS hardware. The observer can review, Mark, Code and transmit flight data the same as in Live Flight mode.

The transmitting of the WMO Coded Messages is partially restricted in Rework. The WMO Coded Messages can only be transmitted within 6 hours of the observation termination time. Chapter 8 describes in detail the Coding and transmission of the WMO Coded Messages.

NOTE: For more information on reviewing or Marking flight review Chapters 5 through 7

12.3 Starting Rework

NOTE: The Baseline Display and Waiting for Balloon Release Display can not be viewed in Rework.

Follow these steps:

8. Select the **Perform rework of a previous flight** from the Main menu (Exhibit 12-1). Alternatively, select the **Open Rework** option from the *Flight* pull-down menu.

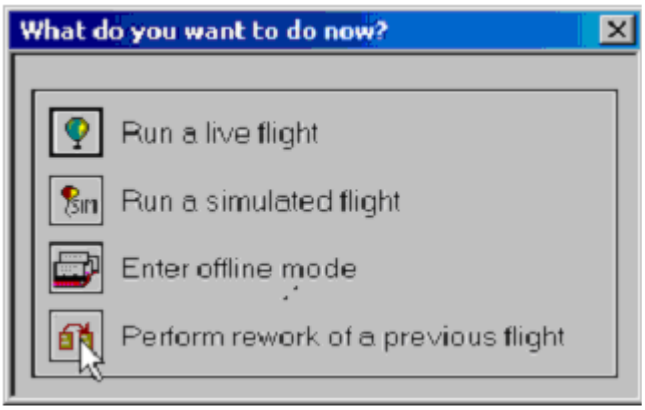


Exhibit 12-1 Flight Options

9. Select the flight to Rework from the *Previous Flight* window (Exhibit 12-2) and click **OK** button.

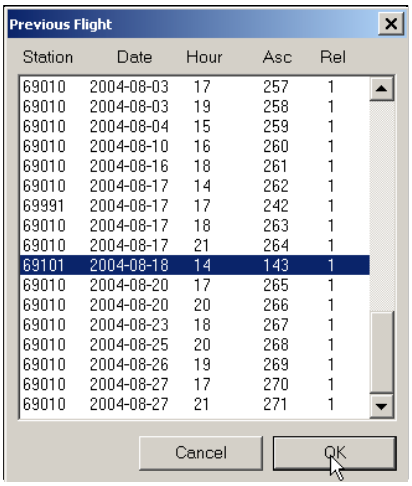


Exhibit 12-2 Previous Flight Window

NOTE: The flights are listed in chronological order including flights that were imported from other sites.

10. In the *Select Station Data* window, select the **Station Data of the station where the flight being reworked has taken place** option. Then click the **Continue** button (Exhibit 12-3).

Exhibit 12-3 Select Station Data

NOTE: The **Station Data of the current station data** option is not typically used.

11. The RWS opens in Rework mode, and the observer can now review the flight data (Exhibit 12-4).

Exhibit 12-4 Rework Mode

12.4 Rework as a Flight Recovery Tool

In the event of a software crash, RWS will automatically open the flight data in Rework once RWS software is restarted. This allows the observer to review, Mark, Code and transmit the flight data.

On very rare occasions, RWS will not automatically reopen the flight data in Rework. Check the Rework list of flights for the current ascension number (Exhibit 12-2). If the flight is not listed in the Rework list flights, it cannot be Reworked and an additional flight may be necessary.

12.5 Exiting Rework

1. To close Rework mode, select the **Close** option from the *Flight* pull-down menu.

2. If the flight was <u>not</u> recovered from a software crash.

    a. A pop-up window will then appear to confirm that the observer wants to close Rework (Exhibit 12-5). Click **Yes**.

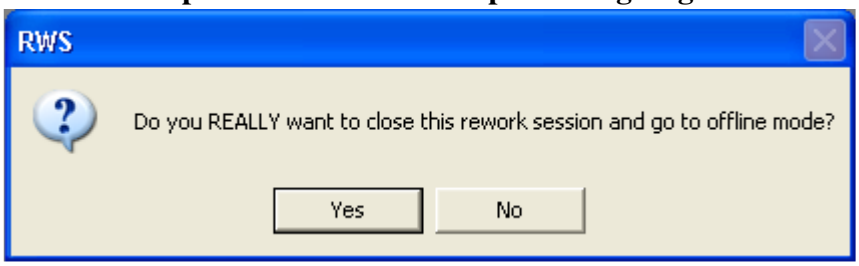


Exhibit 12-5 Confirmation to Close Rework

b. Another pop-up window will appear asking if the changes made to the flight data should be committed (saved) (Exhibit 12-6). Click **Yes** to save changes to the flight data or **No** to not to save changes to the flight data.

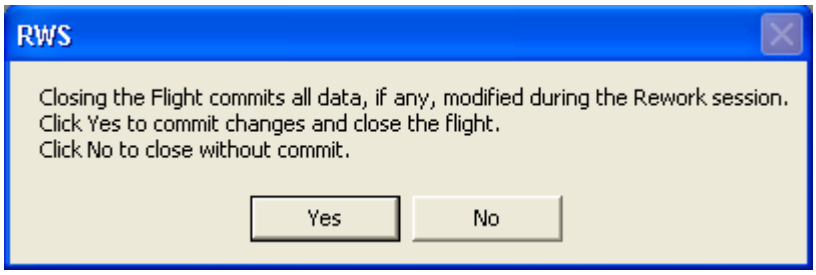


Exhibit 12-6 Commit/Save Changes to Flight

3. If the was recovered from a software crash.

a. A pop-up window will appear as a reminder that Rework mode does not have access to the Hardware (Exhibit 12-7).

Exhibit 12-7 Rework cannot access the Hardware

NOTE: To turn the UPS off, use the UPS Maintenance in the Offline Maintenance Suite (Exhibit 12-8 and 12-9) or use the Hardware Status in Live Flight Mode (Exhibit 12-10).

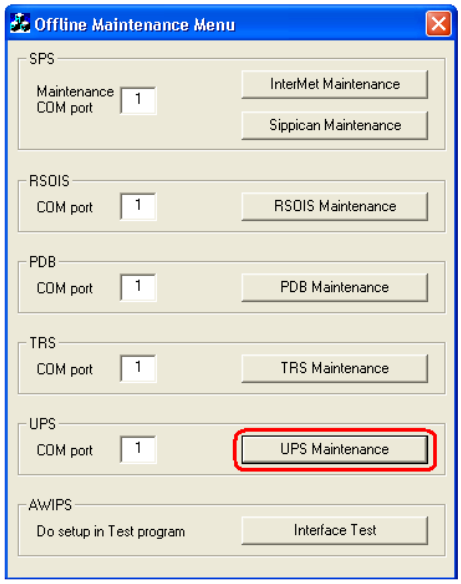


Exhibit 12-8 Offline Maintenance Suite

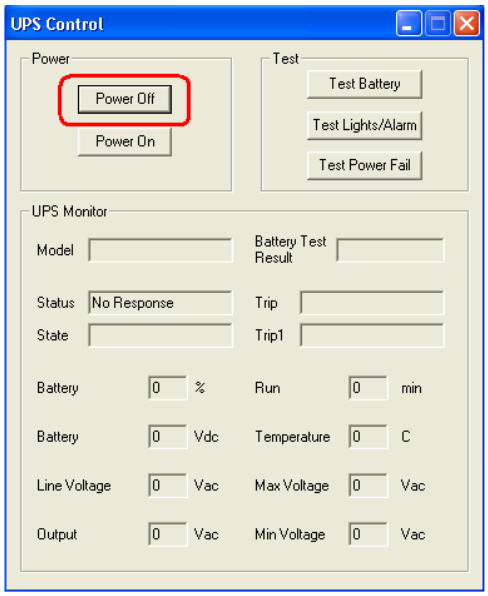


Exhibit 12-9 UPS Maintenance

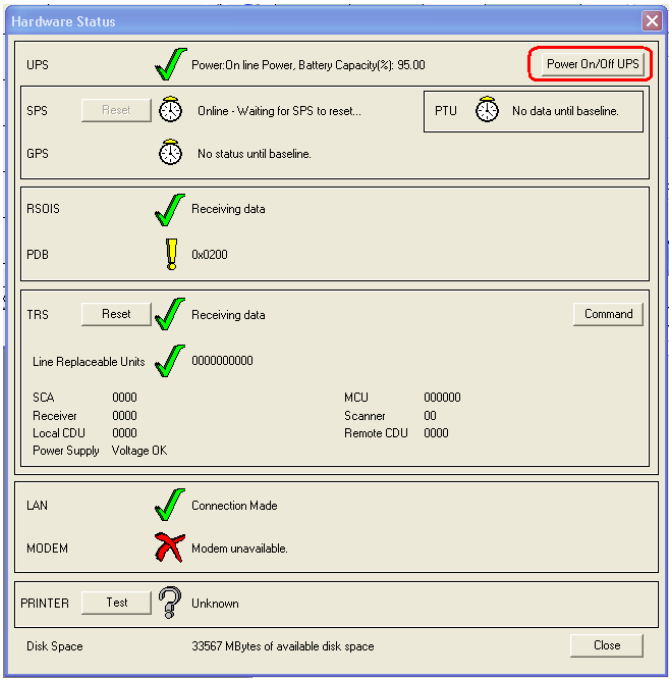


Exhibit 12-10 Hardware Status

b. Another pop-up window will appear asking if the changes made to the flight data should be committed (saved) (Exhibit 12-11). Click **Yes** <u>to save</u> changes to the flight data.

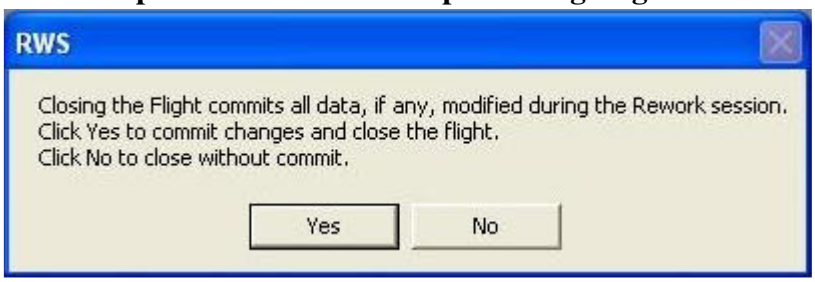


Exhibit 12-11 Commit/Save Changes to Flight

c. If the flight was marked unsuccessful, a pop-up message will appear asking if the observer wants to run another release of the same ascension (Exhibit 12-12). Section 9.4 describes the multiple releases. If another release is not necessary, click **No**.

Exhibit 12-12 New Release Prompt

d. Finally, the *Select an Active Release* pop-up window will appear. Select the appropriate release for the current ascension number. This is usually the flight that reached the highest altitude with good data. Then click **OK**.

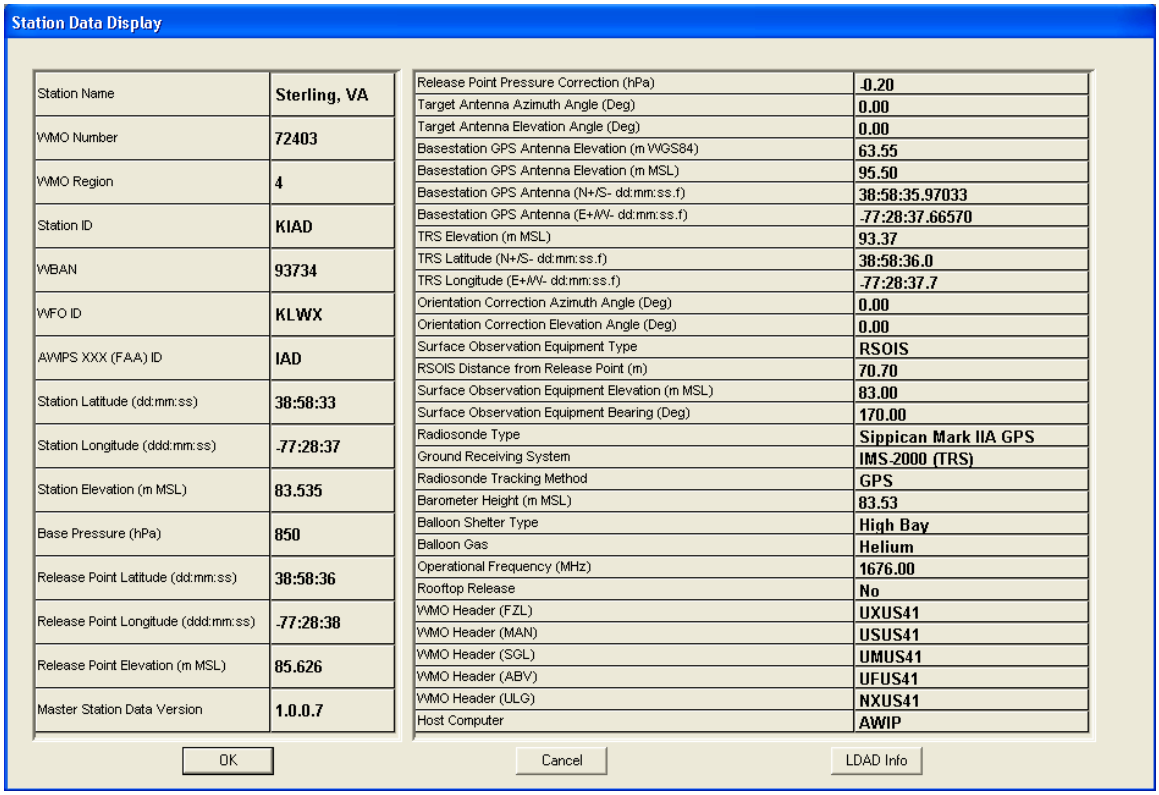
13. Station Data

13.1 Introduction

The station data must be entered as a part of the RWS software installation. These data can be entered directly from a WSH database by the Site Manager/Administrator. Once the data has been entered, updates are infrequent.

13.2 Station Data Display

The station resident data is used by the RRS software to ensure that data transmitted reflects the proper station data, radiosonde type, tracking method and equipment, along with communication header information. The station data consists of two sections. The left side of the display (known as the Master Station Data) is maintained by WSH. **No changes may be made by the site to this screen display unless authorized by WSH.** The right side of the screen display (known as the Local Station Data) may be entered by the site Manager/Administrator. (Exhibit 13-1)



Station Data Display

Station Name	Sterling, VA
WMO Number	72403
WMO Region	4
Station ID	KIAD
WBAN	93734
WFO ID	KLWX
AWIPS XXX (FAA) ID	IAD
Station Latitude (dd:mm:ss)	38:58:33
Station Longitude (ddd:mm:ss)	-77:28:37
Station Elevation (m MSL)	83.535
Base Pressure (hPa)	850
Release Point Latitude (dd:mm:ss)	38:58:36
Release Point Longitude (ddd:mm:ss)	-77:28:38
Release Point Elevation (m MSL)	85.626
Master Station Data Version	1.0.0.7

Release Point Pressure Correction (hPa)	-0.20
Target Antenna Azimuth Angle (Deg)	0.00
Target Antenna Elevation Angle (Deg)	0.00
Basestation GPS Antenna Elevation (m WGS84)	63.55
Basestation GPS Antenna Elevation (m MSL)	95.50
Basestation GPS Antenna (N+/S- dd:mm:ss.f)	38:58:35.97033
Basestation GPS Antenna (E+/W- dd:mm:ss.f)	-77:28:37.66570
TRS Elevation (m MSL)	93.37
TRS Latitude (N+/S- dd:mm:ss.f)	38:58:36.0
TRS Longitude (E+/W- dd:mm:ss.f)	-77:28:37.7
Orientation Correction Azimuth Angle (Deg)	0.00
Orientation Correction Elevation Angle (Deg)	0.00
Surface Observation Equipment Type	RSOIS
RSOIS Distance from Release Point (m)	70.70
Surface Observation Equipment Elevation (m MSL)	83.00
Surface Observation Equipment Bearing (Deg)	170.00
Radiosonde Type	Sippican Mark IIA GPS
Ground Receiving System	IMS-2000 (TRS)
Radiosonde Tracking Method	GPS
Barometer Height (m MSL)	83.53
Balloon Shelter Type	High Bay
Balloon Gas	Helium
Operational Frequency (MHz)	1676.00
Rooftop Release	No
WMO Header (FZL)	UXUS41
WMO Header (MAN)	USUS41
WMO Header (SGL)	UMUS41
WMO Header (ABV)	UFUS41
WMO Header (ULG)	NXUS41
Host Computer	AWIP

OK Cancel LDAD Info

Exhibit 13-1 Station Data Display

13.2.1 National Weather Service Headquarters Maintained Data

The Master Station Data contains basic information about the station that changes infrequently. This section is locked and should only be updated in coordination with WSH. The blocks include the Station Name, WMO Number, WMO Region, Station ID, WBAN, Latitude, Longitude, Elevation, etc. During installation, a site need only enter the proper WMO Number to populate the Master Station Data (Exhibit 13-2.).

Station Name	**Sterling, VA**
WMO Number	**72403**
WMO Region	**4**
Station ID	**KIAD**
WBAN	**93734**
WFO ID	**KLWX**
AWIPS XXX (FAA) ID	**IAD**
Station Latitude (dd:mm:ss)	**38:58:33**
Station Longitude (ddd:mm:ss)	**-77:28:37**
Station Elevation (m MSL)	**83.535**
Base Pressure (hPa)	**850**
Release Point Latitude (dd:mm:ss)	**38:58:36**
Release Point Longitude (ddd:mm:ss)	**-77:28:38**
Release Point Elevation (m MSL)	**85.626**
Master Station Data Version	**1.0.0.7**

Exhibit 13-2 WSH Maintained Data

NOTE: During RRS installation, a survey is done to ensure the Lat/Long and Elevation for the Release Point, Baseline Point and TRS are correct. Any corrections or updates made must be sent to the WSH to update the Master Station Database.

13.2.2 Data Entered and Maintained by Station

The Local Station Data can be entered and maintained by the Site Manager/Administrator (Exhibit 13-3). Accuracy of the information entered is essential and changes other than gas type, radiosonde type, and surface observation equipment must be coordinated with NWSH prior to implementation.

Release Point Pressure Correction (hPa)	-0.20
Target Antenna Azimuth Angle (Deg)	0.00
Target Antenna Elevation Angle (Deg)	0.00
Basestation GPS Antenna Elevation (m WGS84)	63.55
Basestation GPS Antenna Elevation (m MSL)	95.50
Basestation GPS Antenna (N+/S- dd:mm:ss.f)	38:58:35.97033
Basestation GPS Antenna (E+/W- dd:mm:ss.f)	-77:28:37.66570
TRS Elevation (m MSL)	93.37
TRS Latitude (N+/S- dd:mm:ss.f)	38:58:36.0
TRS Longitude (E+/W- dd:mm:ss.f)	-77:28:37.7
Orientation Correction Azimuth Angle (Deg)	0.00
Orientation Correction Elevation Angle (Deg)	0.00
Surface Observation Equipment Type	RSOIS
RSOIS Distance from Release Point (m)	70.70
Surface Observation Equipment Elevation (m MSL)	83.00
Surface Observation Equipment Bearing (Deg)	170.00
Radiosonde Type	Sippican Mark IIA GPS
Ground Receiving System	IMS-2000 (TRS)
Radiosonde Tracking Method	GPS
Barometer Height (m MSL)	83.53
Balloon Shelter Type	High Bay
Balloon Gas	Helium
Operational Frequency (MHz)	1676.00
Rooftop Release	No
WMO Header (FZL)	UXUS41
WMO Header (MAN)	USUS41
WMO Header (SGL)	UMUS41
WMO Header (ABV)	UFUS41
WMO Header (ULG)	NXUS41
Host Computer	AWIP

Exhibit 13-3 Station Maintained Data

13.3 Viewing Station Data

To enter the station data:

1. Start RWS.

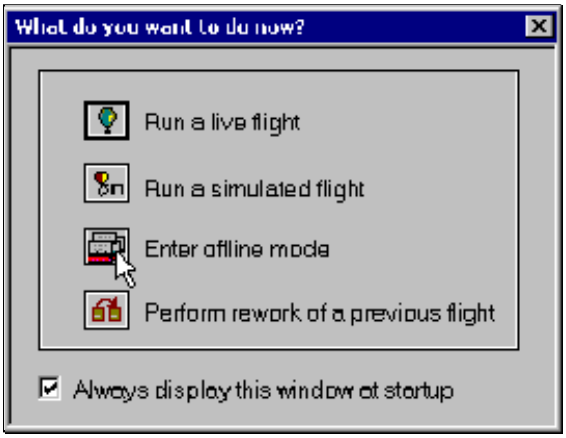


Exhibit 13-4 Options Window

2. In the main menu, select **Enter offline mode** (Exhibit 13-4).

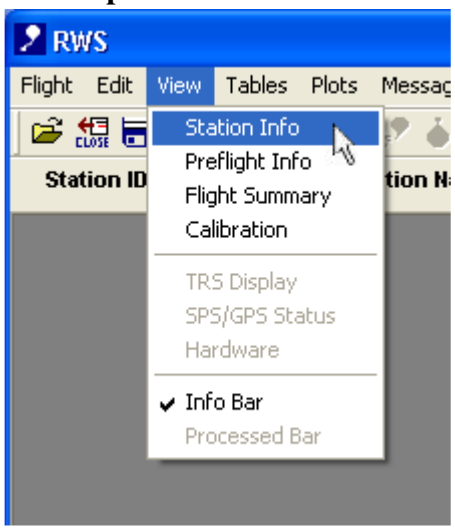
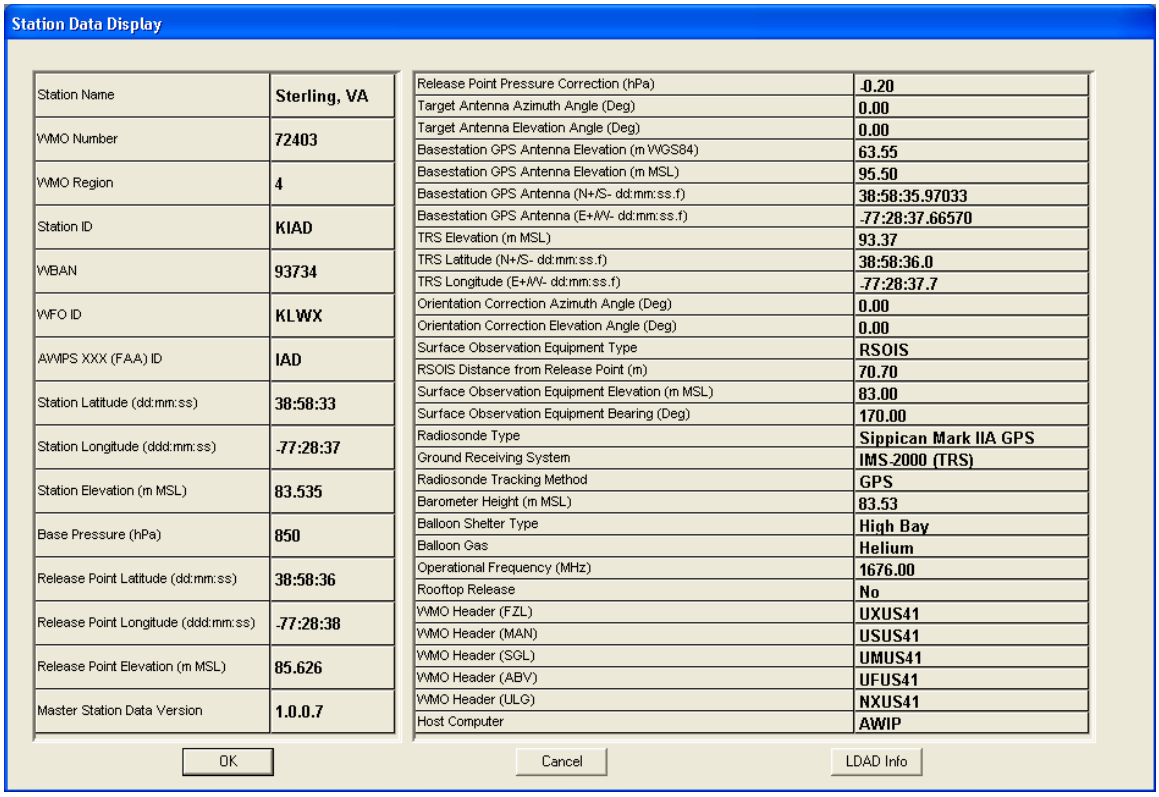


Exhibit 13-5 View Options

3. Select the **Station Info** from the *View* pull-down menu (Exhibit 13-5). The Station Data appears (Exhibit 13-6).



Station Data Display

Station Name	Sterling, VA
WMO Number	72403
WMO Region	4
Station ID	KIAD
WBAN	93734
WFO ID	KLWX
AWIPS XXX (FAA) ID	IAD
Station Latitude (dd:mm:ss)	38:58:33
Station Longitude (ddd:mm:ss)	-77:28:37
Station Elevation (m MSL)	83.535
Base Pressure (hPa)	850
Release Point Latitude (dd:mm:ss)	38:58:36
Release Point Longitude (ddd:mm:ss)	-77:28:38
Release Point Elevation (m MSL)	85.626
Master Station Data Version	1.0.0.7

Release Point Pressure Correction (hPa)	-0.20
Target Antenna Azimuth Angle (Deg)	0.00
Target Antenna Elevation Angle (Deg)	0.00
Basestation GPS Antenna Elevation (m WGS84)	63.55
Basestation GPS Antenna Elevation (m MSL)	95.50
Basestation GPS Antenna (N+/S- dd:mm:ss.f)	38:58:35.97033
Basestation GPS Antenna (E+/W- dd:mm:ss.f)	-77:28:37.66570
TRS Elevation (m MSL)	93.37
TRS Latitude (N+/S- dd:mm:ss.f)	38:58:36.0
TRS Longitude (E+/W- dd:mm:ss.f)	-77:28:37.7
Orientation Correction Azimuth Angle (Deg)	0.00
Orientation Correction Elevation Angle (Deg)	0.00
Surface Observation Equipment Type	RSOIS
RSOIS Distance from Release Point (m)	70.70
Surface Observation Equipment Elevation (m MSL)	83.00
Surface Observation Equipment Bearing (Deg)	170.00
Radiosonde Type	Sippican Mark IIA GPS
Ground Receiving System	IMS-2000 (TRS)
Radiosonde Tracking Method	GPS
Barometer Height (m MSL)	83.53
Balloon Shelter Type	High Bay
Balloon Gas	Helium
Operational Frequency (MHz)	1676.00
Rooftop Release	No
WMO Header (FZL)	UXUS41
WMO Header (MAN)	USUS41
WMO Header (SGL)	UMUS41
WMO Header (ABV)	UFUS41
WMO Header (ULG)	NXUS41
Host Computer	AWIP

OK Cancel LDAD Info

Exhibit 13-6 Station Data

13.3.1 Entering Individual Data Blocks

The entries in the right section of the Station Data Display may be entered by the site Manager/Administrator. It is important to remember changes in Latitude, Longitude, Elevation, Tracking System, Radiosonde Type, and others must be coordinated ahead of time to allow users to make the adjustments in their databases.

1. **Release Point Pressure Correction (hPa)** - Derived by finding the difference of elevation at the Station Elevation or baseline point and the release point. Enter to the nearest .1 hPa. See Table 13-1 for determining the correction.

   Correction: Positive if the release point height is lower than the baseline height
   Negative if the release point height is higher than the baseline height

NOTE: Release point height is the height of the inflation building's floor in meters + 1.2 meters. (Approximates the point where the instrument is typically released.)

Pressure Correction in hPa Applied to Radiosonde Baseline Station Pressure							
Barometer Height Minus Release Point Height (meters)	Barometer Elevation in Meters Mean Sea Level						
	-.5 to 299.4	299.5-599.4	599.5-899.4	899.5-1199.4	1199.5-1499.4	1499.5-1799.4	1799.5-2199.4
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	0.4	0.3	0.3	0.3	0.3	0.3	0.3
4	0.5	0.5	0.4	0.4	0.4	0.4	0.4
5	0.6	0.6	0.6	0.6	0.5	0.5	0.5
6	0.7	0.7	0.7	0.7	0.6	0.6	0.6
7	0.8	0.8	0.8	0.8	0.7	0.7	0.7
8	0.9	0.9	0.9	0.9	0.8	0.8	0.8
9	1.1	1.1	1.0	1.0	1.0	0.9	0.9
10	1.2	1.2	1.1	1.1	1.1	1.0	1.0
11	1.3	1.3	1.2	1.2	1.2	1.1	1.1
12	1.4	1.4	1.3	1.3	1.3	1.2	1.2
13	1.6	1.5	1.5	1.4	1.4	1.3	1.3
14	1.7	1.6	1.6	1.5	1.5	1.4	1.4
15	1.8	1.7	1.7	1.7	1.6	1.5	1.5
26	3.1	3.0	2.9	2.8	2.7	2.7	2.6
27	3.2	3.1	3.0	2.9	2.8	2.8	2.7
28	3.3	3.2	3.1	3.0	3.0	2.9	2.8
29	3.4	3.3	3.2	3.2	3.1	3.0	2.9
30	3.6	3.5	3.4	3.3	3.2	3.1	3.0

Table 13-1 Pressure Correction for Difference in Baseline and Release Point Heights

NOTE: If the release point height is higher than the baseline height then the correction is **NEGATIVE.**

Local Station Data

- **Target Antenna Azimuth Angle (Deg)**
  Enter to the nearest .01 of a degree. Azimuth relative to True North. (RDF only)
- **Target Antenna Elevation Angle (Deg)**
  Enter to the nearest .01 of a degree. (RDF only)
- **Basestation GPS Elevation (m WGS84)**
  Enter to the nearest 0.1 of a meter above MSL.
- **Basestation GPS Elevation (m MSL)**
  Enter to the nearest 0.1 of a meter above MSL.
- **Basestation GPS Latitude (N+S- ddmmss.f)**
  Enter to the nearest 0.1 of a second.
- **Basestation GPS Longitude (E+W- ddmmss.f)**
  Enter to the nearest 0.1 of a second.
- **TRS Elevation (msl)**
  Enter to the nearest 0.1 of a meter above MSL.
- **TRS Latitude (N+/S- ddmmss.f)**
  Enter to the nearest .1 of a second.
- **TRS Longitude (E+/W- ddmmss.f)**
  Enter to the nearest 0.1 of a second.
- **Orientation Correction Azimuth Angle (Deg)**
  Enter to .01 degrees with RDF only
- **Orientation Correction Elevation Angle(Deg)**
  Enter to .01 degrees with RDF only
- **Surface Observation Equipment Type**
  Toggle Options (RSOIS and Other). If RSOIS is not installed or inoperative, use Other.
- **RSOIS Distance from Release Point (m)**
  To the nearest 0.1 of a meter.
- **Surface Observation Equipment Elevation (m MSL)**
  Elevation of the Temp/RH unit to the nearest .1 of a meter.
- **Surface Observation Equipment Bearing (Deg)**
  Enter to the nearest .01 relative to True North.
- **Radiosonde Type**
  Toggle Options (Sippican Mark IIA GPS and InterMet 3010 GPS)
- **Ground Receiving System**
  Toggle Options -IMS-2000 (TRS), IMS-1500C, and Other
- **Radiosonde Tracking Method**
  Toggle Options (GPS and RDF)
- **Barometer Height (m MSL)**
  Enter the baseline height to the nearest 0.1 meters. This is the Station Elevation. Height of barometer and baseline point should be the same.
- **Balloon Shelter Type**
  Toggle Options (High Bay, Low Bay, BILS, Roof-Top BILS, and Not Specified)

- **Balloon Gas**
  Toggle Options (Hydrogen, Helium, and Natural Gas)
- **Operating Frequencies (MHz)**
  Operator entered value - Allowable Values (1676 MHz, 1678 MHz, 1680 MHz and 1682 MHz)
- **Rooftop Release**
  Toggle Options (YES and NO)
- **WMO Header (FZL)**
  Header for RADAT or Freezing Level Header information
- **WMO Header (MAN)**
  Header for Mandatory Levels SFC - 100 hPa
- **WMO Header (SGL)**
  Header for Significant Levels SFC - 100 hPa
- **WMO Header (ABV)**
  Header for Levels Above 100 hPa
- **WMO Header (ULG)**
  Header for Significant Levels Above 100 hPa
- **Host Computer**
  AWIP only option
- **LDAD Information**
  This information is required to ensure the coded messages are transmitted. The communication parameters allow the site to send the messages via the LAN or phone lines.

2. Clicking on the **LDAD Info** button at the bottom of the Station Data Display allows the observer to view the communication routes (Exhibit 13-7).

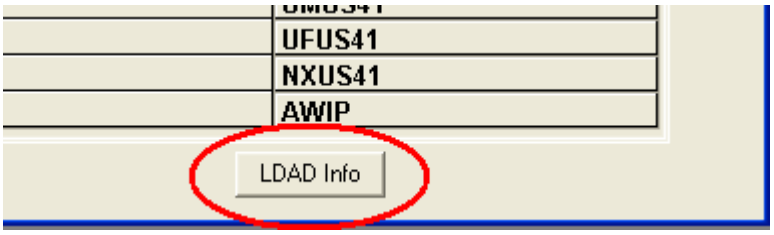


Exhibit 13-7 LDAD Information

3. The following window appears after the LDAD Info button is clicked upon. This window shows the LAN and multiple Phone lines options available. (Exhibit 13-8)

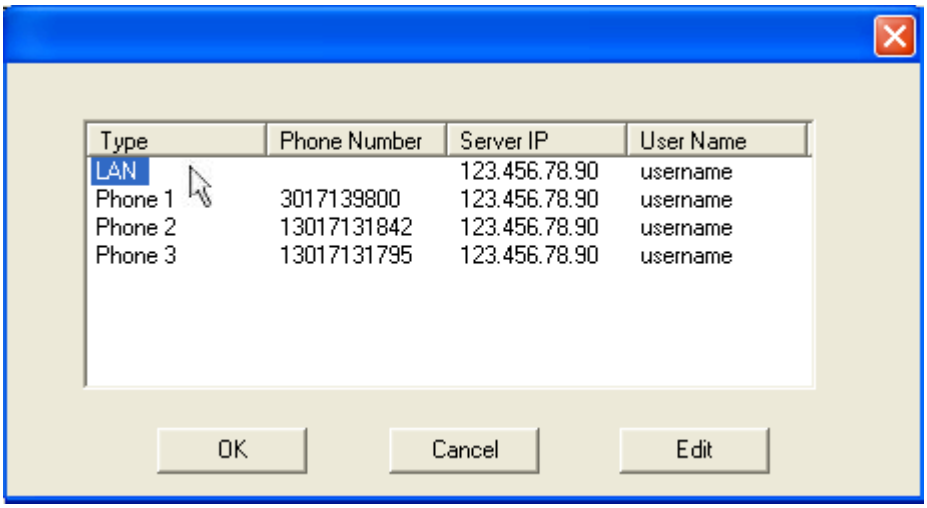


Exhibit 13-8 LAN and Phone Line Options

4. To edit, click the *Type* of communication line. Then click the **Edit** button.

5. The edit window appears for the communication line selected (Exhibit 13-9).

6. Click in the cell(s) to enter or edit the information. Click **OK** in the edit window, LDAD Info window and the Station Data window to save the edits.

Exhibit 13-9 Edit window for the communication lines

NOTE: If the LAN is down, the software will try each dial-up line 3 times prior to going to the next each additional backup line.

Chapter 13 – Station Data

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14. RWS Software Utilities

14.1 Introduction

The RWS software allows the users to go into the Tools option and select Utilities in the Offline mode. The RWS Software Utilities has three major subsets. (Exhibit 14-1)

- Flight Management Utilities
- Application Utilities
- Administrative Utilities

Utilities are used by the operator to accomplish numerous tasks and functions, such as archival, export, and system setup. The Site Manager or Site Administrator is allowed to accomplish other tasks that are not covered in this user's guide.

14.2 Flight Management Utilities

The Flight Management Utilities has three options. The observer or administrator may enter the following utilities or tool areas:

- NCDC Archive Utility
- Flight Export Utility
- Flight Summary Utility

NOTE: Selecting a flight to archive or export requires the operator to click on the far left column for the flight or ascension number desired, and then click the "Archive" or "Export" button.

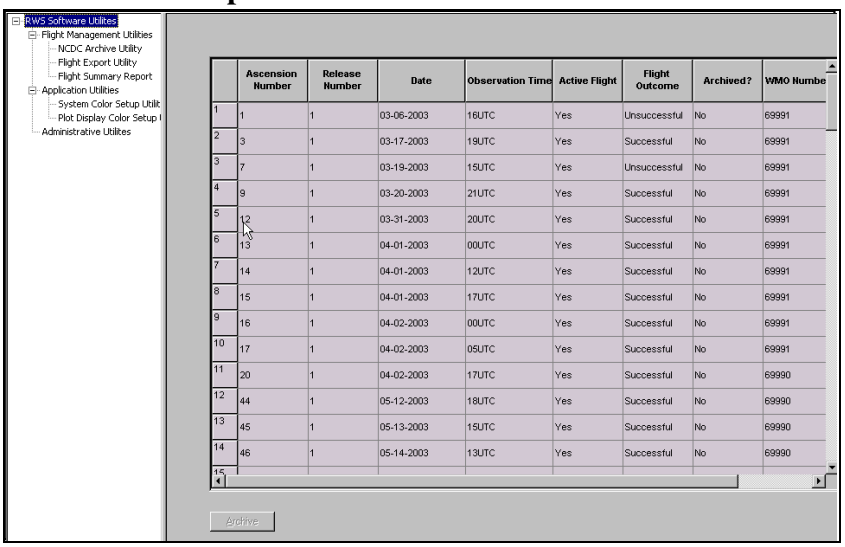
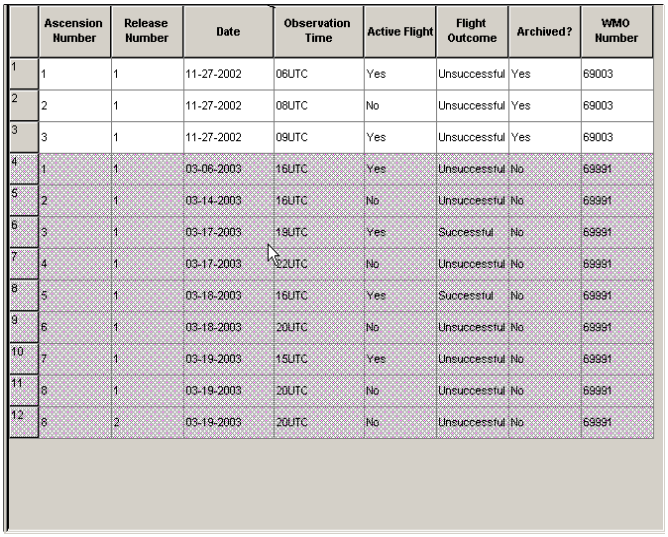


Exhibit 14-1 RWS Software Utilities

14.2.1 NCDC Archive Utility

Click on the NCDC Archive Utility option, Exhibit 14-2 appears. This utility allows the operator to see which flights have or have not been archived and also indicates which flights were successful or unsuccessful.

NOTE: Flights from other sites are grayed out. They can not be archived.

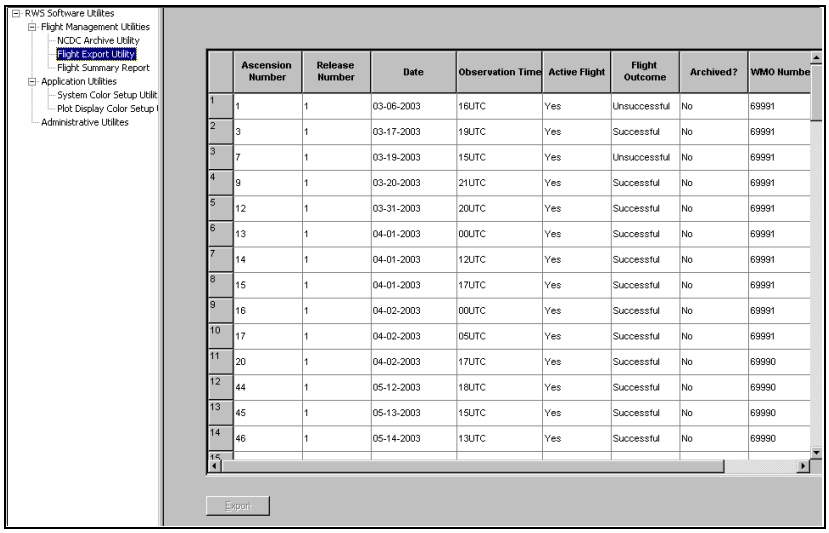


	Ascension Number	Release Number	Date	Observation Time	Active Flight	Flight Outcome	Archived?	WMO Number
1	1	1	11-27-2002	06UTC	Yes	Unsuccessful	Yes	69003
2	2	1	11-27-2002	08UTC	No	Unsuccessful	Yes	69003
3	3	1	11-27-2002	09UTC	Yes	Unsuccessful	Yes	69003
4	1	1	03-06-2003	16UTC	Yes	Unsuccessful	No	69991
5	2	1	03-14-2003	16UTC	No	Unsuccessful	No	69991
6	3	1	03-17-2003	18UTC	Yes	Successful	No	69991
7	4	1	03-17-2003	22UTC	No	Unsuccessful	No	69991
8	5	1	03-18-2003	16UTC	Yes	Successful	No	69991
9	6	1	03-18-2003	20UTC	No	Unsuccessful	No	69991
10	7	1	03-19-2003	15UTC	Yes	Unsuccessful	No	69991
11	8	1	03-19-2003	20UTC	No	Unsuccessful	No	69991
12	8	2	03-19-2003	20UTC	No	Unsuccessful	No	69991

Exhibit 14-2 Archive Window

14.2.2 Flight Export Utility

Click on the Flight Export utility, Exhibit 14-3 appears. The operator may enter this utility to send a file or flight information to another subdirectory or location.



	Ascension Number	Release Number	Date	Observation Time	Active Flight	Flight Outcome	Archived?	WMO Numbe
1	1	1	03-06-2003	16UTC	Yes	Unsuccessful	No	69991
2	3	1	03-17-2003	19UTC	Yes	Successful	No	69991
3	7	1	03-19-2003	15UTC	Yes	Unsuccessful	No	69991
4	9	1	03-20-2003	21UTC	Yes	Successful	No	69991
5	12	1	03-31-2003	20UTC	Yes	Successful	No	69991
6	13	1	04-01-2003	00UTC	Yes	Successful	No	69991
7	14	1	04-01-2003	12UTC	Yes	Successful	No	69991
8	15	1	04-01-2003	17UTC	Yes	Successful	No	69991
9	16	1	04-02-2003	00UTC	Yes	Successful	No	69991
10	17	1	04-02-2003	05UTC	Yes	Successful	No	69991
11	20	1	04-02-2003	17UTC	Yes	Successful	No	69990
12	44	1	05-12-2003	18UTC	Yes	Successful	No	69990
13	45	1	05-13-2003	15UTC	Yes	Successful	No	69990
14	46	1	05-14-2003	13UTC	Yes	Successful	No	69990
15								

Exhibit 14-3 Flight Export Utility

14.2.3 Flight Summary Utility

Click on the Flight Summary utility, a window similar to Exhibit 14-5 will appear. This utility allows the operator to view a Flight Summary file from any of the flights that have been stored. This is an excellent tool for determining site performance and a quick way to look at flights that may have had problems or need special attention.

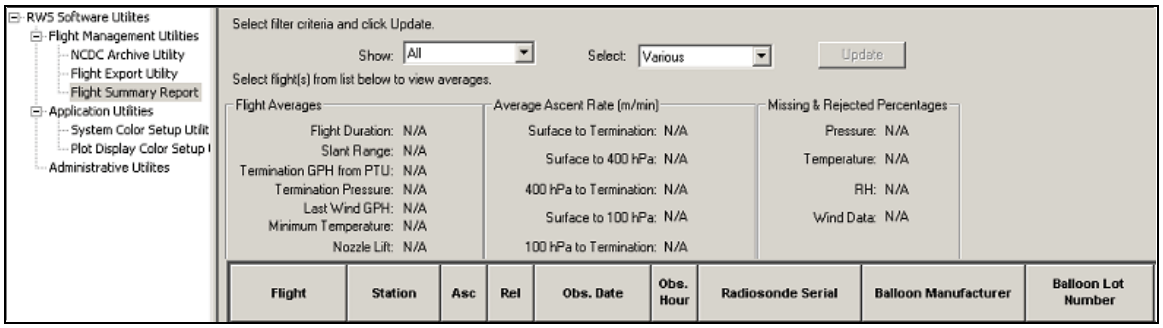


Exhibit 14-5 Flight Summary Selection Window

14.2.3.1 Flight Summary Options

At the top of Flight Summary Selection Window two different options may be used to select the type of flights to review or the month the flight was flown. After selecting the type of flights and the months, click on the "Update" button to list the flights meeting the selections chosen. (Exhibits 14-6 and 14-7)

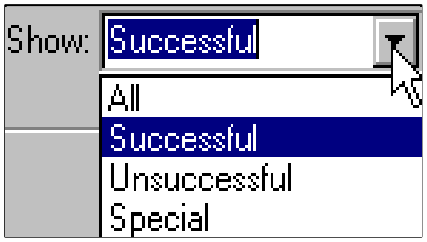


Exhibit 14-6 Types of Flights

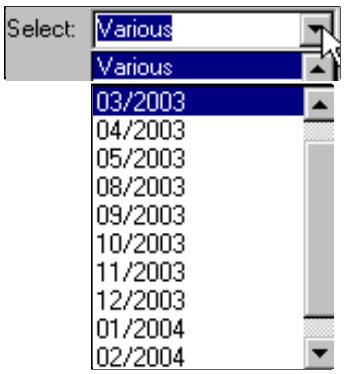


Exhibit 14-7 Month of Flight

14.2.3.2 Individual Flight Summary Display

The individual Flight Summary Report shows critical flight performance data. Select a flight, then click on the View button. A Flight Summary display similar to Exhibit 14-8 will appear.

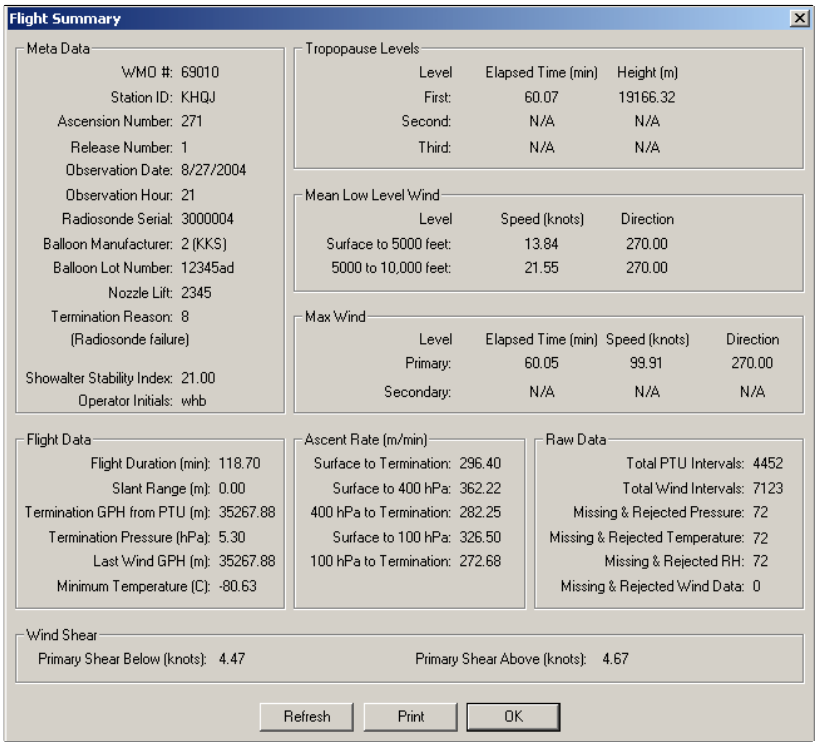


Exhibit 14-8 Flight Summary Display

14.3 Application Utilities

The Application Utilities allows the user to look at the color setup being used with the system for tabular data and plots. The administrator and operator may change these profiles. The two options are System Color Setup and Plot Display Color Setup. (Exhibits 14-9 and 14-10) Changing colors

requires only to click the left mouse button on the desired color, a window appears, and then select the color you wish. .

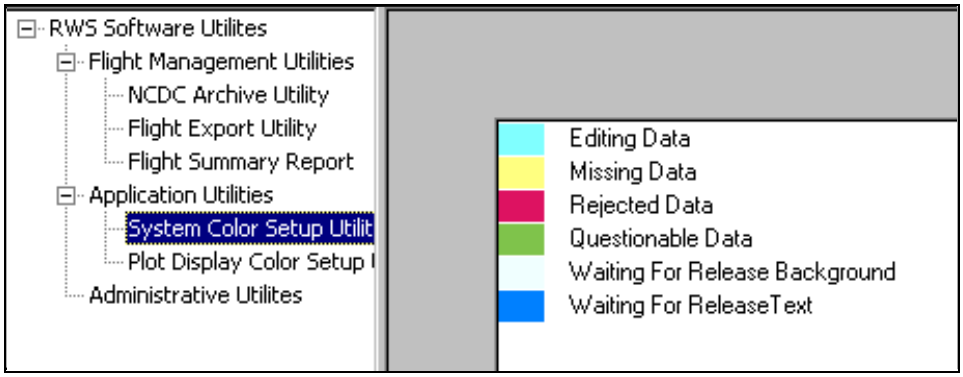


Exhibit 14-9 System Color Setup

NOTE: Each observer may change the system and plot colors. The change will not affect other users

.

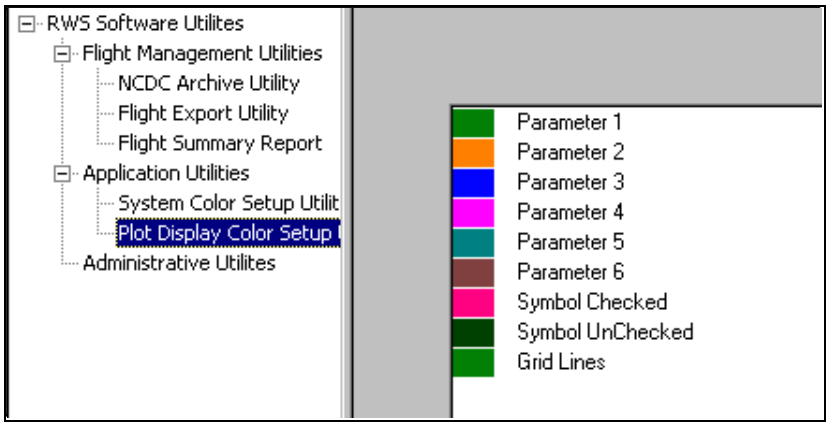


Exhibit 14-10 Plot Display Color Setup

Parameter 1	On all plots - The far left parameter descriptor
Parameter 2	On all plots - The 2nd parameter descriptor from the left
Parameter 3	The 3rd parameter descriptor from the left or if only 2 parameters shown - It will be used for an overlay plot
Parameter 4	The 4th parameter descriptor from the left or if 3 parameters shown - It will be used for an overlay plot
Parameter 5	The 5th parameter descriptor from the left or if 4 parameters shown - It will be used for an overlay plot

Parameter 6	The 6th parameter descriptor from the left or if 5 parameters shown - It will be used for an overlay plot
Symbol Checked	
Symbol Unchecked	
Grid Lines	Horizontal or vertical grid lines

Table 14-1 Parameter Description

NOTE: Changing the color of the grid lines will change both horizontal and vertical grid lines.

14.4 Administrative Utilities

The Administrative Utilities is not accessible to the trainee or operator.

15. Checking the System Status

15.1 Introduction

This chapter describes the hardware status checks. These checks must be performed before every flight. The checks may not be necessary for second and third releases if the known reason for the flight failure was other than hardware.. The hardware checks ensure the Signal Processing System (SPS), Global Positioning System (GPS), Telemetry Receiver System (TRS), the Radiosonde Surface Observing Instrumentation System (RSOIS), the Precision Digital Barometer (PDB), the printer, the Local Area Network (LAN), and the modem are functioning properly. The operator may check the Hardware Status and SPS Status displays at anytime during or after a flight, or when working in the offline mode.

15.2 Getting Started

To start the Hardware Status Check, follow these steps:

1. Turn on the RRS workstation and log in with the assigned User Name and Password.

2. The RWS will automatically start and the Security Warning window appears. Read and click [OK] to continue. (Exhibit 15-1)

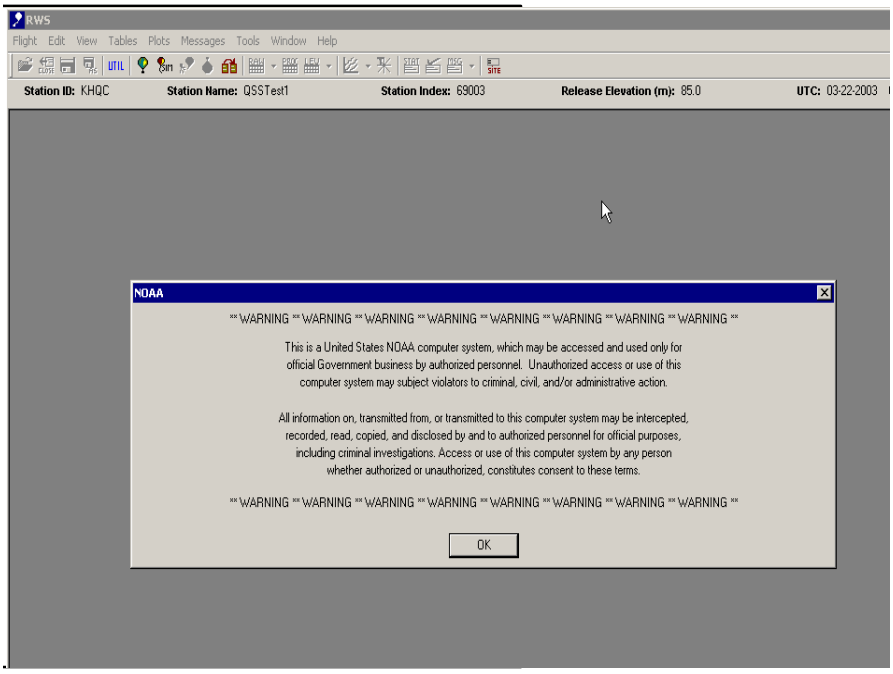


Exhibit 15-1 RWS Window with Security Warning Message

NOTE: Ensure the TRS and SPS equipment are on and have been allowed a minimum of 30 minutes to warm-up prior to starting the Baseline Check.

3. If it has been more than 12 hours since the last observation, the following window will appear. (Exhibit 15-2) Clicking "No" will bring the software to Exhibit 15-4. If the operator clicks "Yes" Exhibit 15-3 appears allowing a "No Data Message" to be generated by selecting the proper 101 groups from the drop-down list.

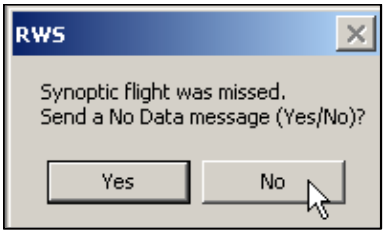


Exhibit 15-2 Missed Flight Window

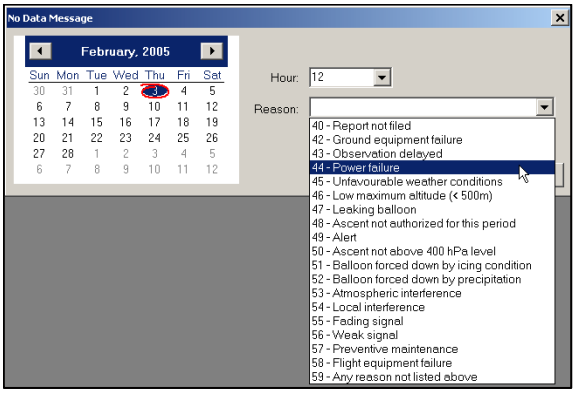


Exhibit 15-3 No Data Message Display with 101 Group Drop-down List

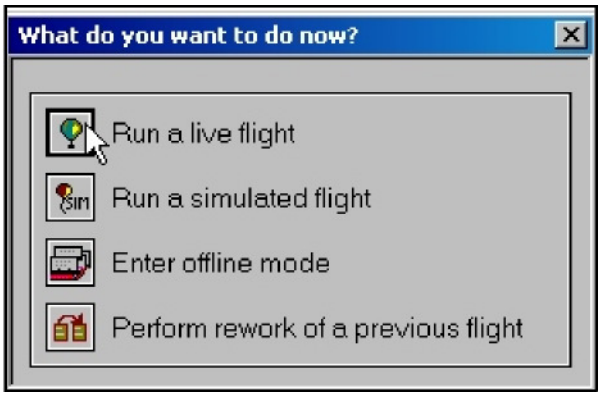


Exhibit 15-4 Flight Option Window

4. The Flight Option Window will appear and the Live Flight Option should be selected. (Exhibit 15-4)

5. The Hardware Status window appears (Exhibit 15-5). A warm-up period is required for the equipment and it is dependent on temperature. During cold periods a wait of at least 30 minutes may be necessary for all equipment checks to turn green. If any of the equipment status checks fail, close the window and retry. If the equipment continues to fail, print or capture the Hardware Status display, and contact the electronics technician.

NOTE: The SPS and GPS will have a clock icon until the baseline check. The PDB is shown Beyond Tolerance at startup due to not being connected for this flight. The PDB will also show Beyond Tolerance when the pressure is changing rapidly. ("Burst Mode On")

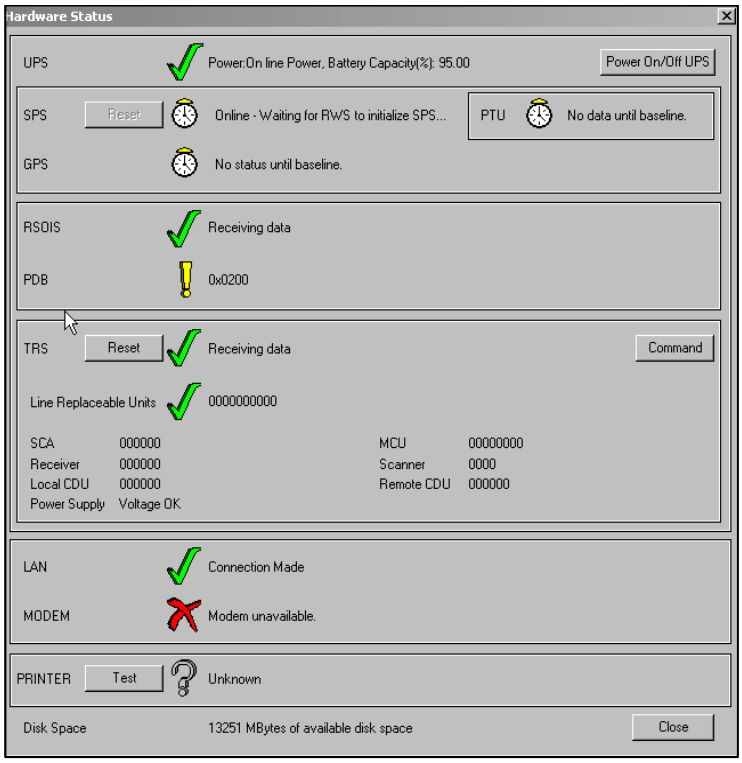
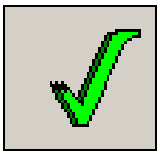
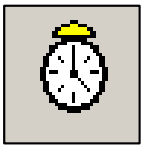
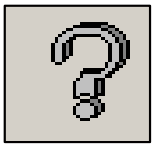


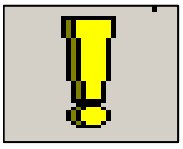
Exhibit 15-4 Hardware Status Window

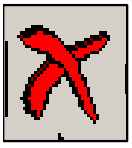
Hardware Status Icons:


Passed


Waiting


Unknown


Beyond Tolerance


Failed

The Hardware Status display indicates the status of the following hardware items:

UPS	(May be On/Off, Battery, Trim and Boost)
SPS	(May be Online, Waiting for RWS,)
GPS	(Will indicate "Waiting" until baselining the radiosonde)
RSOIS	(Receiving or Not Receiving Data)
PDB	(Beyond Tolerance - Exceeds Normal Parameters or Conditions)
TRS	(May Reset - Has Line Replaceable Units (LRU's)
LAN	(Connection Made or Unsuccessful)
MODEM	(Available or Unavailable)
PRINTER	(May Test)
DISK SPACE	(Shows Available Disk Space)

Chapter 15 – Checking the System Status

Uninterruptible Power Supply (UPS) - Located in the Radome with the TRS. The UPS ensures reliable power is supplied to the system in case of a power failure or fluctuation. The UPS provides at least 10 minutes of power to operate the entire TRS and launch area components. The battery capacity (0 - 100%) will be indicated to the right of the UPS Status Icon.

When the Hardware Status Display appears a message will appear requesting the operator to turn on the UPS. (Exhibit 15-5)

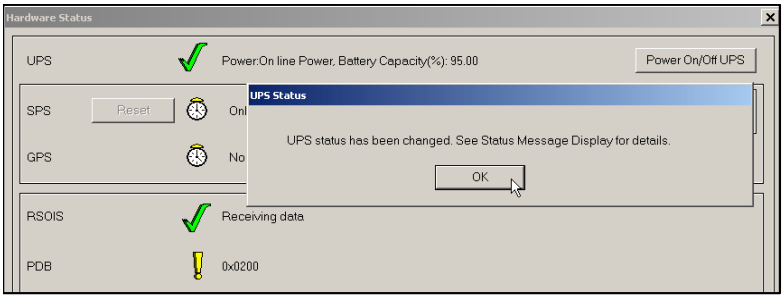


Exhibit 15-5 UPS Status Window within Hardware Status Display

Clicking the OK button in the window will turn the UPS on and generate a Status Message. (Exhibit 15-6)

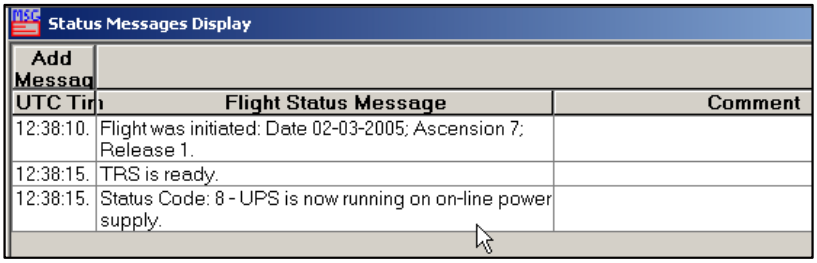


Exhibit 15-6 UPS Status Message within Status Message Display

It is important to remember that any time the UPS changes status a UPS Window will appear signaling the change and a Status Message will be generated. At flight termination the Window will appear and will not turn the UPS off without the operator clicking the OK button.

Signal Processing System (SPS) - The TRS is designed to receive telemetry from any radiosonde that meets the RRS requirements. The TRS delivers the radiosonde telemetry signal as a 10.7 MHz IF to the SPS. Each radiosonde requires a compatible SPS that will convert its unique signal into a standard format required by the workstation. SPS is checked at baseline.

Global Positioning System (GPS) - The GPS ground receiver provides position calculations to the SPS. The GPS is checked during the baseline process for the numbers of satellites received and accuracy of position data as compared to site position information stored in the station data file.

Radiosonde Surface Observing Instrumentation System (RSOIS) - Automated sensors located within 200 meters of the release point. Sensors include Temperature, RH, Wind Speed and Direction. If the RSOIS is inoperative or not used, in the Station Data Display enter "Other". Entries missing or in error must be manually entered by the operator.

Precision Digital Barometer (PDB) - Located within 15 feet of the RRS workstation and at the same height as the baseline height. The PDB provides pressure measurements for comparison to the radiosonde's pressure sensor during the baseline check.

Telemetry Receiver System (TRS) - The TRS consists of three units, the Antenna Unit, the TRS Workstation Unit, and the Launch Area Unit. The Hardware Status checks the Antenna and the TRS Workstation only. If a fault or problem exists a Hardware Status Icon other than a green check mark will be shown along with a non-zero hexidecimal code to the right of the respective component. During warm-up, 9999999999 will be to the right of the LRU Status Icon. The 9's will change to all zeroes once initialization is complete and all components check out trouble free. Remember a warm-up period is temperature dependent. Extended warm-up times may be expected at sites with very cold temperatures. Any time warm-up exceeds 30 minutes follow trouble shooting procedures in Appendix D.

Besides noting the status of each hardware component, the Telemetry Receiver System (TRS) provides a status for each Line Replaceable Unit (LRU). (Exhibit 15-7) If a problem exists with any of the LRU's, the numbers to the right will indicate digits other than zero. Print or capture the Hardware Status display and contact the electronics technician.

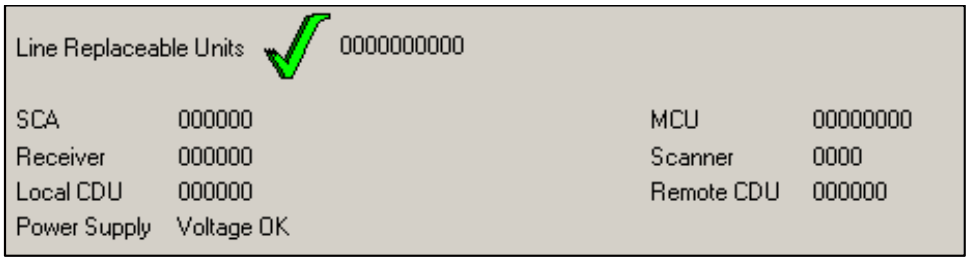


Exhibit 15-7 Line Replaceable Units within the TRS

Local Area Network (LAN) - Hardware Status Check will validate the connection to the LAN is operational.

MODEM - Hardware Status Check will validate the connection if a modem is available.

15.3 Printer Test

The printer test normally takes no more than a few seconds. If the Test button is pressed the Printer Status indicator should indicate a green check mark and within a few seconds print a test page. If the printer is non-functional a red "X" will appear.

If the printer is not ready for use, a question mark or red "X" will appear.

15.4 SPS Status Window

This window shows the number of satellites being received by the GPS receiver and the radiosonde. (Exhibit 15-8) A minimum of 4 matches are required to process winds and gather height information. The circles to the right of the SPS and GPS letters must be green for GPS lock to receive positional data. If the circles do not turn green and the Match number does not reach 4 or more within 200 seconds of beginning baseline, reinitialize the SPS and wait a minimum of 2 minutes.

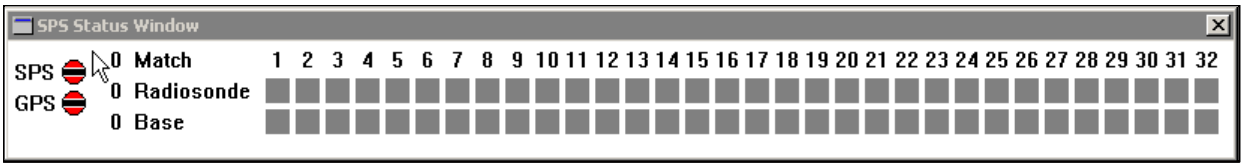


Exhibit 15-8 SPS Status Window

NOTE: This window will show no meaningful information prior to baseline.

15.5 Gathering Specific Data for Fault Isolation

NOTE: Prior to gathering data, if the Hardware Status window continues to indicate a problem reset the SPS, TRS or UPS.

If resetting the equipment does not work, print or capture the Hardware Status display, notify the electronics technician, and enter a problem report into the Engineering Management Reporting System (EMRS). If the problem does not prevent the flight continue the Pre-flight process.

If time permits or at a later time, close the RRS software and open the RRS Offline Maintenance software. Using the basic instructions from Appendix C, the operator may be able to assist the electronics technician in isolating the problem. This activity is expected to be a routine function for sites in Alaska and the Pacific without electronic technicians and at sites when maintenance is not readily available such as at night or during weekends.

A. Appendix A - Abbreviations and Acronyms

This appendix includes abbreviations, acronyms, and contractions; they are defined in accordance with their usage in this handbook.

ABV ..... Mandatory and Significant Levels Above 100 hPa
AC ..... Air Conditioner
AFC ..... Automatic Frequency Control
AGL ..... Above Ground Level
AWIPS ..... Advanced Weather Interactive Processing System
AZ ..... Azimuth

BILS ..... Balloon Inflation Launch Shelter
BMD ..... Begin Missing Data
BX ..... Box

C ..... Centigrade
CCB ..... Configuration Control Board
CCW ..... Counter-Clockwise
CD ..... Compact Disk
CDU ..... Control Display Unit
cm ..... centimeters
CM ..... Change Management
CONUS ..... Conterminous United States
CPU ..... Central Processing Unit
CW ..... Clockwise

db ..... Decibels
DCE ..... Digital Communication Equipment
Deg ..... Degree
DOC ..... Department of Commerce

EA ..... Each
EL ..... Elevation
EHB ..... Engineering Handbook
EMD ..... End Missing Data
EMRS ..... Engineering Management and Reporting System
ESA ..... Electronic Systems Analyst
ET ..... Electronics Technician

FAA ..... Federal Aviation Administration
FMH-3 ..... Federal Meteorological Handbook, Number 3
ft ..... Feet
FTM ..... Free Text Message

Appendix A – Abbreviations and Acronyms

FTP..... File Transfer Protocol
FZL .....Freezing Level

Gb.....Gigabyte
GDL .....Greatest Departure from Linearity
gm .....Gram
GPS .....Global Positioning System

hPa ..... Hecto Pascals
HPC..... Hydrometeorological Prediction Center

ICAO..... International Civil Aviation Organization
IF .....Intermediate Frequency
IP .....Internet Protocol
IR ..... Infrared Radiation

KHz .....Kilohertz
km ..... Kilometer
Kb.....Kilobyte
kt ..... Knot (nautical miles per hour)

LAN .....Local Area Network
Lat ..... Latitude
LCD .....Liquid Crystal Display
LCDU.....Local Control Display Unit
LDAD ..... Local Data Acquisition and Dissemination
LED..... Light Emitting Diode
LNA ..... Low Noise Amplifier
Long ..... Longitude
LORAN..... Long Range Navigation (system)
LOS .....Loss of Signal
LRU .....Line Replaceable Unit

m .....Meters
MAN ..... Mandatory Levels to 100 hPa
mb .....Millibar
Mb.....Megabyte
MCU ..... Motion Control Unit
MDO .....Meteorological (Met) Data Oscillator
MET ..... Meteorological
MHz .....Megahertz
MIC .....Meteorologist-in-Charge
Min.....Minute
mph .....Miles Per Hour
MSL .....Mean Sea Level

NAGS……..Narrow Angle Gathering Sensor
NAVAID…….....Navigation Aid (implied usage of radio based system
NCDC……..……..……..National Climatic Data Center
NCEP…….. .....National Centers for Environmental Prediction, formerly NMC
(e.g., AWC, NHC, MPC, SPC, and TPC)
NEC ..... National Electrical Code
NLSC…… .....National Logistics Support Center
Nmi…… .....Nautical Mile (6076 feet)
NOAA..... National Oceanic and Atmospheric Administration
NOTAM…….....Notice to Airman
NWS……..... National Weather Service
NWSTC……. .....National Weather Service Training Center
NWSTG…….....……National Weather Service Telecommunications Gateway
NWS-10-1401…….....Weather Service Observing Handbook, Number 10

OAR .....Office of Oceanic and Atmospheric Research
OBIT…….....Offline Built-In Test
OCCWS .....Office of Climate Water and Weather Services
OFCM…….....Office of the Federal Coordinator for Meteorology
OMS……..... Offline Maintenance Suite
OOS .....Office of Operational Services
OPS .....Office of Program Services
OQC…….....Operational Quality Control
OS ..... Observing Services
OS…… .....Operating System
OST…….....Office of Systems Technology

PCM…….....Pulse Code Modulation
PDB.....Precision Digital Barometer
PSA……..... Power Supply Assembly
PSI..... Pounds Per Square Inch
PTU……..... Pressure, Temperature, Humidity

QC……..... Quality Control

R/ACU……..Receiver - Antenna Control Unit
RADAT……Freezing Level Data
RCDU……Remote Control Display Unit
RDF……Radio Direction Finding
RF……..……..……..…Radio Frequency
RH…….....Relative Humidity
RMS .....Root Mean Square
RRS……..... Radiosonde Replacement System
RSMC ..... Regional Specialized Meteorological Centers
RSOIS .....Radiosonde Surface Observing Instrumentation System

Appendix A – Abbreviations and Acronyms

RWS…….Radiosonde Replacement System Workstation

SDM…….....NCEP Senior Duty Meteorologist
SCA……..... System Communication System
SCSI .....Small Computer Systems Interface
Sec…….....Second
SGL..... Significant Levels to 100 hPa
SID ..... Station Identifier
SIG ..... Significant Levels to 100 hPa
SIM…… ..... System Integration Manager
Sonde……. .....Radiosonde
SOO……. ..... Science and Operations Officer
SPC……. .....Storm Prediction Center
SPS……..... Signal Processing System

T-1……..... Connection capable of 1.544 million bits per second
TPC…….. ..... Tropical Prediction Center (National Hurricane Center)
TPMS…….. .....Transition Power Maintenance System
TRS……..... Telemetry Receiver System

UHF…… .Ultra High Frequency (radio)
UPS…… ….Uninterruptible Power Supply
USB…….....Universal Serial Bus
UTC .....Universal Time Coordinated

VAD…….....Velocity Azimuth Display

WAGS…….. ..... Wide Angle Gathering Sensor
WBAN……. .....Weather Bureau Army Navy
WBRT……...Weather Bureau Radio Theodolite
WCM……. ..... Warning Coordination Meteorologist
WFO……..... Weather Forecast Office
WMO……World Meteorological Organization
WS ..... Weather Service
WSH…….....Weather Service Headquarters
WSOM……..... Weather Service Operations Manual
WWW……..... World Weather Watch
WWW…….. ..... World Wide Web

B. Appendix B. Clouds/WX Codes

B.1 Introduction

This appendix provides the necessary tables and specific instructions to enter Clouds/Wx at the Surface Data screen. This guidance assumes no previous knowledge of synoptic code procedures. However, a basic understanding of clouds and weather is necessary.

For those already familiar with synoptic code, you will notice some departure from conventional WMO coding procedures. If you simply observe the elements requested and report them according to tables provided in this text, the intent of the Clouds/Wx entry will be fully met.

B.2 Getting Started

The Cloud/WX entry is a nine-digit, mandatory group. **All** nine digits must be entered, regardless of the presence **or** absence of clouds or significant weather conditions.

Operational Suggestion: If time before release is critical to where a proper Clouds/Wx coding cannot be made, simply enter <u>any</u> nine digits to complete the Surface Data screen. After release, properly code the clouds and weather. Edit the surface observation by clicking on "Tools" and selecting "Change Surface Data" enter the Clouds/Wx block with new data.

The WMO format for entry of clouds and weather has been modified in the RRS software to meet NCDC requirements. **All** stations using RRS software will follow this modified format, regardless of location; i.e., stations in either WMO Region IV or WMO Region V. A description of the nine-digit format follows:

1. Clouds/Wx group format: $\mathbf{N_hC_LhC_MC_HWWWW}$

   a. $\mathbf{N_h}$ **=** Amount (in oktas) of the sky covered by <u>all</u> low clouds ($\mathbf{C_L}$) observed or the amount of sky covered by all the middle clouds ($\mathbf{C_M}$) observed. In no case will the amounts of the low and middle clouds be combined to report $\mathbf{N_h}$. Use **Table B-1** to report the amount of low or middle cloud coverage.

   b. $\mathbf{C_L}$ **=** Type of low cloud, based on the priority given in **Table B-2**. A solidus (/) is reported if $\mathbf{C_L}$ clouds are not visible owing to fog or similar obscuring phenomena.

   Note: Clouds are divided into three families, classified as low, middle, or high. The general height ranges for these are: surface to 6500 feet for low; 6500 feet to 20000 feet for middle; and above 20000 feet for high. Remember, these ranges are not absolute, but given as a guide only. More consideration may be given to the cloud form than the height in many cases. Each cloud family is coded with a single digit, 0

through 9. The code figure 0 is used to indicate that clouds are not present for a given family.

c. **h =** Height of the base of the lowest cloud observed. The height reported is with respect to the surface. The height is coded as a solidus (/) if there is a total surface-based obscuration that prevents an observation of the clouds. Use **Table B-3** for the cloud base height.

d. C_M = Type of middle cloud, based on priority given in **Table B-4**. A solidus (/) is reported if C_M clouds are not visible owing to fog or similar obscuring phenomena, or because of a continuous layer of lower clouds.

e. C_H = Type of high cloud, based on priority given in **Table B-5**. A solidus (/) is reported if C_H clouds are not visible owing to fog or similar obscuring phenomena, or because of a continuous layer of lower clouds.

f. WWWW = Present weather coded in two groups of **WW**. These code groups are found in **Table B-6**. The coding starts with 99 (the highest priority) and descends to 00 (the lowest priority). Note that code figure 17 is placed out of numerical sequence to highlight its relative coding priority. You should note that present weather codes for some weather phenomena are events that have occurred during the past hour, not at observation time. When entering **WWWW**, go down **Table B-6** and use the first and second applicable code figures. Note that two **WW** groups must always be coded, even if that means using the same code figure twice.

(the Example Observations page at the end of Appendix B.)

Table B-1 Amount of Low/Middle Cloud N_h

Code Figure	Cloud amount in oktas (eights)	Cloud amount in tenths
0	0	0
1	1 okta or less, but not zero	1/10 or less, but not zero
2	2 oktas	2/10 - 3/10
3	3 oktas	4/10
4	4 oktas	5/10
5	5 oktas	6/10
6	6 oktas	7/10 - 8/10
7	7 oktas or more, but not 8 oktas	9/10 or more, but not 10/10
8	8 oktas	10/10
9	Sky obscured by fog and/or other meteorological phenomena	
/	Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made	

Note: If there are any breaks in the sky at all, such as an overcast with a mackerel sky (altocumulus perlucidus or stratocumulus perlucidus), $\mathbf{N_h}$ would be encoded as 7. If there are only a few patches of low or middle cloud in the sky, $\mathbf{N_h}$ cannot be encoded as 0 but is encoded as 1. A partial obscuration does not affect the coding of $\mathbf{N_h}$. A total obscuration is coded as 9, not 8 (overcast sky).

Table B-2 Coding of Low Cloud, C_L

This table presents the specifications for type of low cloud, $\mathbf{C_L}$, in order of priority. Go down the table and use the first applicable code figure.

Code figure	Coding criteria
	(a) Cumulonimbus present, with or without other C_L clouds
C_L = 9	If the upper part of at least one of the cumulonimbus clouds present is clearly fibrous or striated, use **C_L = 9.**
C_L = 3	If the upper part of none of the cumulonimbus clouds present is clearly fibrous or striated, use **C_L = 3.**
	(b) No cumulonimbus present
C_L = 4	If stratocumulus formed by the spreading out of cumulus is present, use **C_L = 4.**
C_L = 8	If the $\mathbf{C_L}$ code figure 4 is not applicable and if cumulus and stratocumulus clouds with bases at different levels are present, use **C_L= 8.**
C_L = 2	If the $\mathbf{C_L}$ code figures 4 and 8 are not applicable and if cumulus clouds of moderate or strong vertical extent are present, use **C_L = 2.**

(Table B-2 continues next page)

Table B-2 Coding of C_L (Continued)

Code Figure	Coding criteria
C_L = 1	If the **C_L** code figures 4, 8, and 2 are not applicable: use **C_L = 1,** if the **C_L** clouds present are predominantly[1] cumulus with little vertical extent and seemingly flattened or ragged cumulus other than of bad weather[2], or both;
C_L = 5	Use **C_L = 5,** if among the **C_L** clouds present, stratocumulus other than that formed by the spreading out of cumulus is predominant;
C_L = 6	Use **C_L = 6,** if the **C_L** clouds present are predominantly stratus in a more or less continuous sheet or layer, or in ragged shreds (other than ragged stratus of bad weather), or both;
C_L = 7	Use **C_L = 7,** if the **C_L** clouds present are predominantly pannus (ragged shreds of stratus of bad weather or ragged cumulus of bad weather), or both.
0	No **C_L** Clouds -- No cumulus, cumulonimbus, stratocumulus, or stratus.
/	**C_L** clouds not visible owing to fog or similar obscuring phenomena.

[1]Consideration of predominance is restricted to the clouds corresponding to **C_L** code figures 1, 5, 6 and 7, which have the same priority. Clouds of any one of these four specifications are said to be predominant when their sky cover is greater than that of the clouds of any of the other three specifications.

[2]'Bad weather' denotes the conditions which generally exist during precipitation and a short time before and after.

Table B-3 Height of Cloud Base Above Ground, h

Code figure	Reportable heights(ft)
0	0 or 100
1	200 or 300
2	400 to 600*
3	700 to 900*
4	1000 to 1900*
5	2000 to 3200*
6	3300 to 4900*
7	5000 to 6500**
8	7000 to 8000**
9	8500 or higher or no clouds
/	unknown or base of clouds below surface of station

* reported in 100 foot increments
** reported in 500 foot increments

Note: This group is used to report the height of the base of the lowest cloud seen, regardless of cloud amount. The height reported is with respect to the surface.

The lowest cloud height is coded with a solidus (/) if there is a total surface-based obscuration that prevents an observation of the clouds.

Table B-4 Coding of Middle Clouds, C_M

This table presents the specifications for type of middle cloud, C_M in order of priority. Go down the table and use the first applicable code figure.

Code figure	Coding criteria
	(a) Altocumulus present
C_M = 9	If the sky is chaotic, use **C_M = 9.**
C_M = 8	If the **C_M** code figure 9 is not applicable and if altocumulus with sprouting in the form of turrets or battlements or altocumulus having the appearance of small cumuliform tufts is present, use **C_M = 8.**
C_M = 7	If the **C_M** code figures 9 and 8 are not applicable and if altostratus or nimbostratus is present together with altocumulus, use **C_M = 7.**
C_M = 6	If the **C_M** code figures 9, 8, and 7 are not applicable and if altocumulus formed by the spreading out of cumulus or cumulonimbus is present, use **C_M = 6.**
C_M = 5	If the **C_M** code figures 9, 8, 7, and 6 are not applicable, and if the altocumulus present is progressively invading the sky, use **C_M** = 5.

*There are several definitions of **C_M = 7** and each has a different priority; therefore **C_M = 7** appears several times in this code table.

(Table B-4 continues next page)

Table B-4 Coding of Middle Cloud, C_M (Continued)

Code figure	Coding criteria
C_M = 4	If the **C_M** code figures 9, 8, 7, 6, and 5 are not applicable and if the altocumulus present is continually changing in appearance, use **C_M = 4.**
C_M = 7	If the **C_M** code figures 9, 8, 6, 5, and 4 are not applicable and if the altocumulus present occurs at two or more levels, use **C_M = 7.**
C_M = 7, 3	If the **C_M** code figures 9, 8, 6, 5, and 4 are not applicable and if the altocumulus present occurs at one level, use **C_M = 7** or **3** depending on whether the greater part of the altocumulus is respectively opaque or semi-transparent.
	(b) No altocumulus present
C_M = 2	If nimbostratus is present or if the greater part of the altostratus present is opaque, use **C_M = 2.**
C_M = 1	If there is no nimbostratus and if the greater part of the altostratus present is semi-transparent, use **C_M = 1.**
0	No **C_M** Clouds -- No altocumulus, altostratus, or nimbostratus.
/	**C_M** clouds not visible owing to fog or similar obscuring phenomena, or because of a continuous layer of lower clouds.

Table B-5 Coding of High Cloud C_H

This table presents the specifications for type of high cloud, $\mathbf{C_H}$, in order of priority. Go down the table and use the first applicable code figure.

Code figure	Coding criteria
$\mathbf{C_H = 9}$	If cirrocumulus is present alone or is more than the combined sky cover of any cirrus and cirrostratus present, use $\mathbf{C_H = 9}$.
	(a) Cirrostratus present
$\mathbf{C_H = 7}$	If the cirrostratus covers the whole sky, use $\mathbf{C_H = 7}$.
$\mathbf{C_H = 8}$	If the cirrostratus does not cover the whole sky and is not invading the celestial dome, use $\mathbf{C_H = 8}$.
$\mathbf{C_H = 6}$	If the cirrostratus is progressively invading the sky and if the continuous veil extends more than 45 degrees above the horizon but does not cover the whole sky, use $\mathbf{C_H = 6}$.
$\mathbf{C_H = 5}$	If the cirrostratus is progressively invading the sky but the continuous veil does not reach 45 degrees above the horizon, use $\mathbf{C_H = 5}$.

(Table B-5 continues next page)

Table B-5 Coding of High Cloud, C_H (Continued)

Code figure	Coding criteria
	(b) C_H = 9 not applicable and no cirrostratus present
C_H = 4	If the cirrus clouds are invading the sky, use **C_H = 4.**
C_H = 3	If the **C_H** code figure 4 is not applicable and if dense cirrus which originated from cumulonimbus is present in the sky, use **C_H = 3.**
C_H = 2, 1	If the **C_H** code figures 4 and 3 are not applicable: Use **C_H = 2,** if the combined sky cover of dense cirrus, of cirrus with sproutings in the form of small turrets or battlements and of cirrus in tufts is greater than the combined sky cover of cirrus in the form of filaments, strands or hooks; Use **C_H = 1,** if the combined sky cover of cirrus in the form of filaments, strands or hooks is greater than the combined sky cover of dense cirrus, of cirrus with sproutings in the form of small turrets or battlements and of cirrus in tufts.
0	No **C_H** Clouds -- No cirrus, cirrostratus, or cirrocumulus.
/	**C_H** clouds not visible owing to fog or similar obscuring phenomena, or because of a continuous layer of lower clouds.

Table B-6 Coding of Present Weather, WW

This table presents the specifications for present weather, **WW**, in order of priority. Go down the table and use the first and second applicable code figures. The code figure with the higher priority is reported as the first **WW** group and the code with the lower priority is the second **WW** group. (This convention is followed even if the higher priority code decribes weather that occurred during the preceding hour but not at the time of observation.) Note that two **WW** groups must **always** be coded, even if that means using the same code figure twice. (the Example Observations page at the end of Appendix B.)

ww = 99-50 Used for precipitation at the station at the time of observation.
ww = 99-80 Used for showery precipitation or precipitation with current or recent thunderstorms.

Note: By U.S. definition, a thunderstorm is occurring at the station when thunder is first heard.

99 Thunderstorm, severe, with hail, small hail, or snow pellets at time of observation.

There may or may not also be rain or snow or a mixture of rain and snow of any intensity.

98 Thunderstorm at time of observation combined with duststorm at time of observation.

There must also be some sort of precipitation at the time of observation, but it may not be seen because of poor visibility. Judgment must be used.

97 Thunderstorm, severe without hail, small hail, or snow pellets but with rain and/or snow at time of observation.

The rain or snow may be of any intensity.

96 Thunderstorm with hail, small hail, or snow pellets at time of observation.

There may or may not be rain or snow or a mixture of rain and snow of any intensity.

(Table B-6 continues next page)

Important: Never release a radiosonde while a thunderstorm is occurring. See Chapter 11.

Table B-6 Coding of Present Weather, WW (Continued)

95 Thunderstorm without hail, small hail, or snow pellets, but with rain and/or snow at time of observation.

---

ww = 94-91 Used if there was a thunderstorm during the past hour, and there is some sort of precipitation at the time of observation. In order to have this situation, the last thunder heard must have been more than 15 minutes before the observation, but less than 1 hour 15 minutes before the observation.

---

94 Moderate or heavy snow or rain and snow mixed or hail, small hail, or snow pellets at time of observation. Thunderstorm during previous hour but not at time of observation.

93 Light snow or rain and snow mixed or hail, small hail, or snow pellets at time of observation. Thunderstorm during previous hour but not at time of observation.

92 Moderate or heavy rain at time of observation. Thunderstorm during previous hour but not at time of observation.

No other forms of precipitation.

91 Light rain at time of observation. Thunderstorm during previous hour but not at time of observation.

No other forms of precipitation.

---

ww = 90-80 Used to report showery precipitation that is not associated with a thunderstorm. Showers fall from cumuliform clouds that are, by nature, isolated. Because of this, individual showers do not last very long. Code figure 89 is not reported under United States rules.

---

90 Moderate or heavy shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

ww = 88-87 Used if showers of snow pellets or ice pellets are observed at the station at the time of the observation. The snow pellets or ice pellets may or may not be mixed with rain or both rain and snow

---

88 **Moderate or heavy shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed.**

All of the precipitation must be moderate or heavy.

87 **Light shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed.**

All of the precipitation must be light.

ww = 86-85 Used if only snow showers are observed at the station at the time of observation.

---

86 **Snow shower(s), moderate or heavy.**

85 **Snow shower(s), light.**

ww = 84-83. Used if mixed rain showers and snow showers are observed at the station at the time of observation.

---

84 **Moderate or heavy shower(s) of rain and snow mixed. Intensity of either may be moderate or heavy.**

83 **Light shower(s) of rain and snow mixed. Intensity of both must be light.**

ww = 82-80. Used to report rain showers at the time of observation.

---

82 **Violent rain shower(s).**

Report a rain shower as violent if the rate of fall is at least 1.0" per hour or 0.10" in 6 minutes.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

81 Moderate or heavy rain shower(s).

80 Light rain shower(s).

ww = 79-50 Use code figures 79-50 for precipitation that is not showery.
ww = 79-70 Use code figures 79-70 to report solid precipitation not in showers.
ww = 79-76 Use code figures 79-76 to report types of solid, non-showery precipitation.

---

79 Ice Pellets.

Use this code figure regardless of the intensity of the ice pellets and regardless of whether the ice pellets are mixed with another type of precipitation.

78 Isolated star-like snow crystals with or without fog or ice fog.

77 Snow grains with or without fog or ice fog.

Use this code figure regardless of intensity.

76 Diamond dust (ice crystals) with or without fog or ice fog.

ww = 75-70 Use code figures 75-70 to report snow that is not in the form of showers at the station at the time of the observation. The code figure selected depends on a combination of intensity and whether the snow is intermittent or continuous.

---

75 Continuous fall of snowflakes, heavy at time of observation.

74 Intermittent fall of snowflakes, heavy at time of observation.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

73 **Continuous fall of snowflakes, moderate at time of observation.**

72 **Intermittent fall of snowflakes, moderate at time of observation.**

71 **Continuous fall of snowflakes, light at time of observation.**

70 **Intermittent fall of snowflakes, light at time of observation.**

---

ww = 69-60 Code figures 69-60 are generally used to report rain.
ww = 69-66 Use code figures 69-66 to report liquid precipitation that is mixed with snow or is freezing.

---

69 **Rain or drizzle and snow, moderate or heavy.**

68 **Rain or drizzle and snow, light.**

67 **Rain, freezing, moderate or heavy.**

66 **Rain, freezing, light.**

---

ww = 65-60 Use code figures 65-60 to report rain (but not freezing rain or rain mixed with snow) at the station at the time of observation. The code figure used depends on the combination of intensity and whether the precipitation is intermittent or continuous.

---

65 **Rain, not freezing, continuous, heavy at time of observation.**

64 **Rain, not freezing, intermittent, heavy at time of observation.**

63 **Rain, not freezing, continuous, moderate at time of observation.**

62 **Rain, not freezing, intermittent, moderate at time of observation.**

61 **Rain, not freezing, continuous, light at time of observation.**

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

60 Rain, not freezing, intermittent, light at time of observation.

ww = 59-50 Use 59-50 to report drizzle.
ww = 59-56 Drizzle mixed with rain, or freezing drizzle.

---

59 Drizzle and rain, moderate or heavy.

58 Drizzle and rain, light.

57 Drizzle, freezing, moderate or heavy.

56 Drizzle, freezing, light.

ww = 55-50 Use code figures 55-50 to report drizzle (but not freezing drizzle or drizzle mixed with rain) at the station at the time of observation.

---

55 Drizzle, not freezing, continuous, heavy at time of observation.

54 Drizzle, not freezing, intermittent, heavy at time of observation.

53 Drizzle, not freezing, continuous, moderate at time of observation.

52 Drizzle, not freezing, intermittent, moderate at time of observation.

51 Drizzle, not freezing, continuous, light at time of observation.

50 Drizzle, not freezing, intermittent, light at time of observation.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

ww = 49-00 Use code figure 49-00 when no precipitation is occurring at the station at the time of observation.
ww = 49-40 Use code figures 49-40 only if there is fog. The fog may be made of water droplets or ice crystals (ice fog). The visibility in fog or ice fog must be less than 5/8 mi. If the visibility is 5/8 mi or more, use code figure 10. The code figure used will depend on whether the fog has changed during the past hour and whether the sky can be seen (blue sky, stars or higher clouds).

---

49 Fog depositing rime, sky invisible.

Fog that deposits rime will be made up mostly of supercooled water droplets, not ice crystals.

48 Fog, depositing rime, sky visible.

47 Fog or ice fog, sky invisible. Fog has begun or has become thicker during the preceding hour.

46 Fog or ice fog, sky visible. Fog has begun or has become thicker during the preceding hour.

45 Fog or ice fog, sky invisible. Fog has shown no appreciable change during the preceding hour.

44 Fog or ice fog, sky visible. Fog has shown no appreciable change during the preceding hour.

(Table B-6 continues on next page)

Table B-6 Coding of Present Weather, WW (Continued)

43 Fog or ice fog, sky invisible. Fog has become thinner during the preceding hour.

---

42 Fog or ice fog, sky visible. Fog has become thinner during the preceding hour.

41 Fog or ice fog in patches. Fog has begun or has become thicker during the preceding hour.

40 For or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer.

---

ww = 39-30 Use code figures 39-30 to report a duststorm, sandstorm, or drifting or blowing snow.
ww = 39-36 In deciding among code figures 39-36, the following must be considered: snow that is being moved by the wind may be generally low (below about 6 ft) or generally high (above 6 ft). If the snow is low, it is drifting snow; if high, it is blowing snow. Code figure 37 is not reported under United States rules.

---

39 Heavy blowing snow, generally high (above eye level). Visibility less than 5/16 mi.

38 Light or moderate blowing snow, generally high (above eye level). Visibility 6 mi or less but not less than 5/16 mi.

36 Drifting snow, generally low (below eye level).

---

ww = 35-30 In deciding among code figures 35-30 the following must be considered: if the visibility at the station at the time of observation is less than 5/16 mi, there is a severe duststorm or sandstorm; if the visibility is at least 5/16 mi but less than 5/8 mi, there is a light or moderate duststorm or sandstorm. The code figure used depends on the intensity of the duststorm or sandstorm and any change in its intensity during the preceding hour.

---

35 Severe duststorm or sandstorm that has begun or has increased during the preceding hour.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

34 **Severe duststorm or sandstorm that has had no appreciable change during the preceding hour.**

33 **Severe duststorm or sandstorm that has decreased during the preceding hour.**

32 **Light or moderate duststorm or sandstorm that has begun or has increased during the preceding hour.**

31 **Light or moderate duststorm or sandstorm that has had no appreciable change during the preceding hour.**

30 **Light or moderate duststorm or sandstorm that has decreased during the preceding hour.**

---

ww = 29-20 Use code figures 29-20 to report precipitation, fog, ice fog, or thunderstorm at the station during the preceding hour but not at the station at the time of observation. Use code figures 29-25 if the precipitation was showery; otherwise use code figures 24-20.

---

29 **Thunderstorm (with or without precipitation).**

Since by U.S. definition, a thunderstorm ends 15 minutes after the last thunder is heard, the last thunder or lightning must have happened at least 15 minutes before the time of the observation.

28 **Fog or ice fog.**

The visibility in the fog or ice fog must have been less than 5/8 mi.

27 **Shower(s) of hail, small hail, or ice pellets, or of rain and hail, small hail, or ice pellets.**

26 **Shower(s) of snow, or of rain and snow.**

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

25 Shower(s) of rain.

24 Freezing drizzle or freezing rain, not falling as shower(s).

23 Rain and snow or ice pellets, not falling as shower(s).

22 Snow not falling as shower(s).

21 Rain (not freezing), not falling as shower(s).

20 Drizzle (not freezing) or snow grains, not falling as shower(s).

---

ww = 19-00 Use code figures 19-00 to report certain hydrometeors, electrometeors, lithometeors or no precipitation at the station at the time of observation or during the preceding hour.

---

19 Funnel cloud(s), tornado, or waterspout at or within sight of the station during the preceding hour of the time of observation.

Since the highest code figure is reported (except code figure 17), code figure 19 cannot be used if **WW** can be encoded as some higher number.

18 Squalls. By U.S. definition, a sudden increase of at least 15 knots in average wind speed and sustained at 20 knots or more for at least 1 minute. This must occur at or within sight of the station during the preceding hour or at the time of observation.

If a squall without any precipitation is observed, either at the time of observation or during the past hour, use code figure 18. If there was any precipitation, or if there was a thunderstorm with the squall, use one of the other code figures, possibly code figure 29 or one of the code figures 99-80. Select the one that best describes what happened.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

---

ww = 17 Thunderstorm, but no precipitation at time of observation. Code figure 17 has priority over code figures 49-20 and 16-00.

---

17 Thunderstorm, but no precipitation at time of observation.

A thunderstorm is an electrical storm that may or may not be accompanied by precipitation. Since by U.S. definition, a thunderstorm does not end until 15 minutes after the last thunder is heard, code figure 17 would be used if the thunderstorm occurred within 15 minutes of the observation.

16 Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station.

The precipitation must be 3 mi or less from the station, but not at the station to use code figure 16.

15 Precipitation within sight, reaching the ground or the surface of the sea, but distant; i.e., estimated to be more than 3 mi from the station.

14 Precipitation within sight, not reaching the ground or the surface of the sea.

Sometimes precipitation may fall from a cloud, but into air that is dry enough to evaporate it before it can reach the ground. This is fairly common in desert areas like some parts of the southwestern United States. This phenomena is called virga.

13 Lightning visible, no thunder heard.

There are two reasons you may see lightning but not hear thunder. The first is the lightning may be far enough away that the thunder doesn't reach the station. The other is that local sounds may muffle the thunder. Use code figure 13 to report distant lightning.

---

ww = 12-10 Use code figure 12 or 11 to report shallow fog. Continuous refers to covering half or more of the ground or sea; patchy refers to less than one-half coverage. The apparent visibility shall be less than 5/8 mi. Code figure 10 is used to report fog that is neither shallow nor has visibility less than 5/8 mi. (Code figures 49-40 are used to report fog that is not shallow but with visibility less than 5/8 mi.)

---

12 More or less continuous shallow fog or ice fog at the station; the fog or ice fog is not deeper than about 6 ft.

Table B-6 Coding of Present Weather, WW (Continued)

10 Mist

Code figure 10 refers only to water droplets and ice crystals. The visibility restriction shall be 5/8 mi or more but less than 7 mi. Use code figure 10 whether the mist is patchy or more or less continuous.

---

ww = 09-04 Use code figures 09-04 to report lithometeors.

---

09 Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour.

Visibility in dust or sand must be (or have been) 6 mi or less.

08 Well-developed dust whirl(s) (devils) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm.

07 Dust or sand raised by wind at or near the station at the time of observation, but no well-developed dust whirl(s) (devils) or sand whirl(s), and no duststorm or sandstorm seen.

Visibility at the time of observation must be 6 mi or less.

06 Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation.

This code figure may be used with any visibility, as long as there is dust in the air.

05 Haze

Code figure 05 is not restricted to the definition for reports of haze in the basic observation, but can be used if it is simply hazy, regardless of the visibility.

(Table B-6 continues next page)

Table B-6 Coding of Present Weather, WW (Continued)

04 **Visibility reduced by smoke; e.g., veldt or forest fires, industrial smoke, or volcanic ash.**

If the smoke is coming from a great distance, it will be spread through a deep layer of the atmosphere. In this case, use code figure 04 regardless of how much the visibility is restricted. If the smoke is coming from somewhere fairly close, then it will be pretty much layered in the lower atmosphere. In this case, the visibility has to be 6 mi or less before code figure 04 is used.

---

ww = 03-00 Phenomena without significance.

---

03 **Clouds generally forming or developing.**

Used only if there are clouds at the time of the observation, no other weather exists, and the clouds have increased or become more developed during the past hour.

02 **State of sky on the whole unchanged. This is the characteristic of the sky during the past hour.**

01 **Clouds generally dissolving or becoming less developed. This is the characteristic of the sky during the past hour.**

Used if the sky is clear at the time of observation, but there were clouds during the past hour. Also used when clouds have dissolved or become less developed during the past hour.

00 **Cloud development not observed or not observable. This is the characteristic of the past hour.**

Used if clouds were not observed during the past hour, whether the sky is clear or not at time of observation.

Appendix B – Clouds/WX Codes

EXAMPLE OBSERVATIONS

Sky: 3/8 moderate cumulus at 2100 feet, 1/8 stratocumulus at 5000 feet, 2/8 altocumulus (one level, opaque) at 12000 feet. State of sky generally becoming less developed during past hour.
Weather: Light rain shower ended 17 minutes before observation.
Code: 485702501

Sky: Clear sky with few patches of semi-transparent altocumulus at 15000 feet. Altocumulus covered 4/8 of sky during past hour.
Weather: None.
Code: 109300101

Sky: Surface-based obscuration in fog with 300 feet vertical visibility.
Weather: Fog with visibility 1/2 mile. Last hour had a partial obscuration (fog) and 8/8 stratus at 400 feet.
Code: 9////4747

Sky: 7/8 cumulonimbus (no anvil visible) at 1800 feet, 1/8 cirrus at 35000 feet, originating from cumulonimbus.
Weather: Moderate showers of rain and small hail. Lightning seen in distance (on horizon), but no thunder heard.
Code: 734038813

Sky: 8/8 stratocumulus (with breaks) at 4500 feet. State of sky unchanged during past hour.
Weather: None.
Code: 756//0202

Sky: 8/8 nimbostratus at 2100 feet. State of sky unchanged during past hour.
Weather: Light rain and drizzle. Patchy fog reducing visibility to 3 miles was present during past hour but not at time of observation. No other changes.
Code: 8052/5802

C. Appendix C - RRS Offline Maintenance

C.1 Introduction

This appendix includes basic instructions to allow the operator to provide maintenance personnel additional information beyond what is shown in the Hardware Status Window. The information provided can isolate problems with the RRS hardware, communications links, or surface observation reporting equipment. The RRS Offline Maintenance software may only be used when the RRS software is not in use.

C.2 Offline Maintenance Menu

The Offline Maintenance Menu shown in Exhibit C-1 is the primary window which provides the user with possible options to choose for further analysis or fault isolation. Activation of the options requires only a simple click of the mouse over the desired option and test. The possible options that may be entered for refined fault isolation include:

Intermet Maintenance	TRS Maintenance
Sippican Maintenance	UPS Maintenance
RSOIS Maintenance	AWIPS Test
PDB Maintenance	

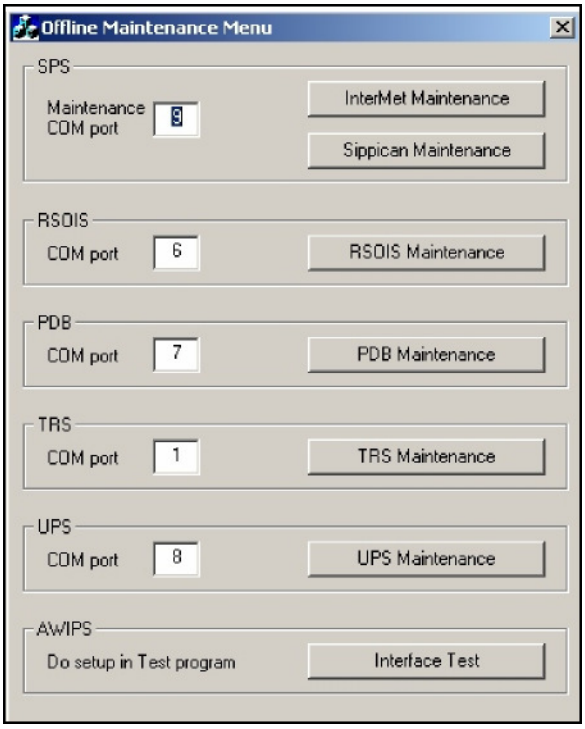


Exhibit C-1 Offline Maintenance Menu

Appendix C – RRS Offline Maintenance

C.2.1 InterMet Maintenance Option

The InterMet Maintenance Option when selected from the Offline Maintenance Menu provides the operator with detailed information on the Intermet SPS.

Not Available

C.2.2 Sippican Maintenance Option

The Sippican Maintenance Option when selected from the Offline Maintenance Menu provides the operator with detailed information on the Sippican SPS. Exhibit C-2A and C-2B provide an example of what information will be provided when this option is selected.

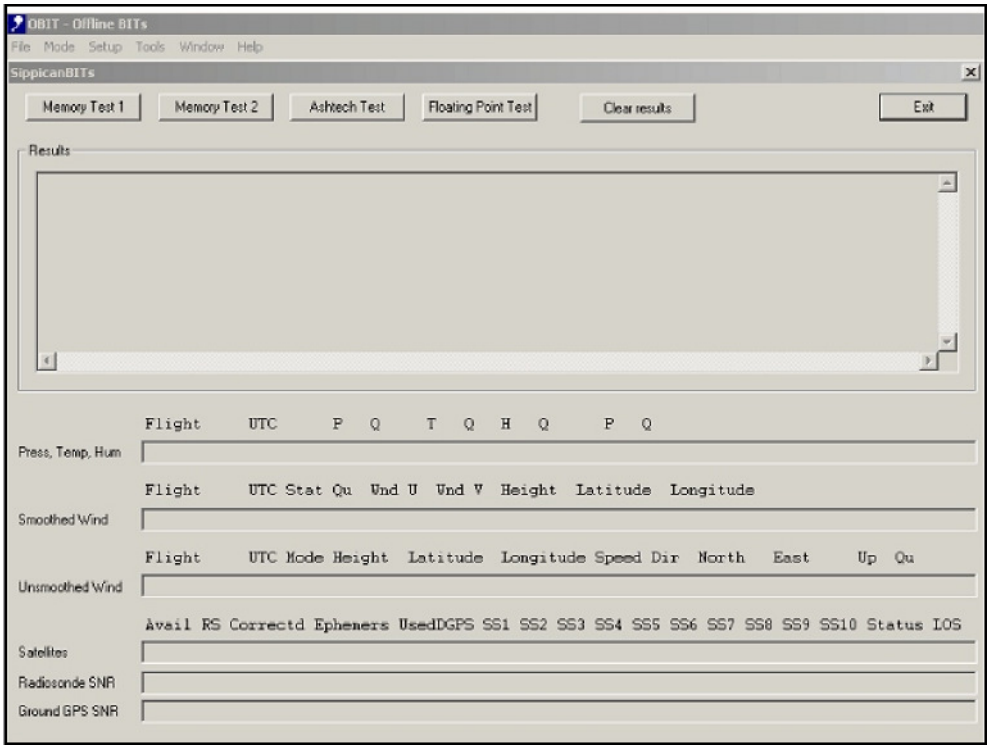


Exhibit C-2A Sippican SPS Maintenance Option

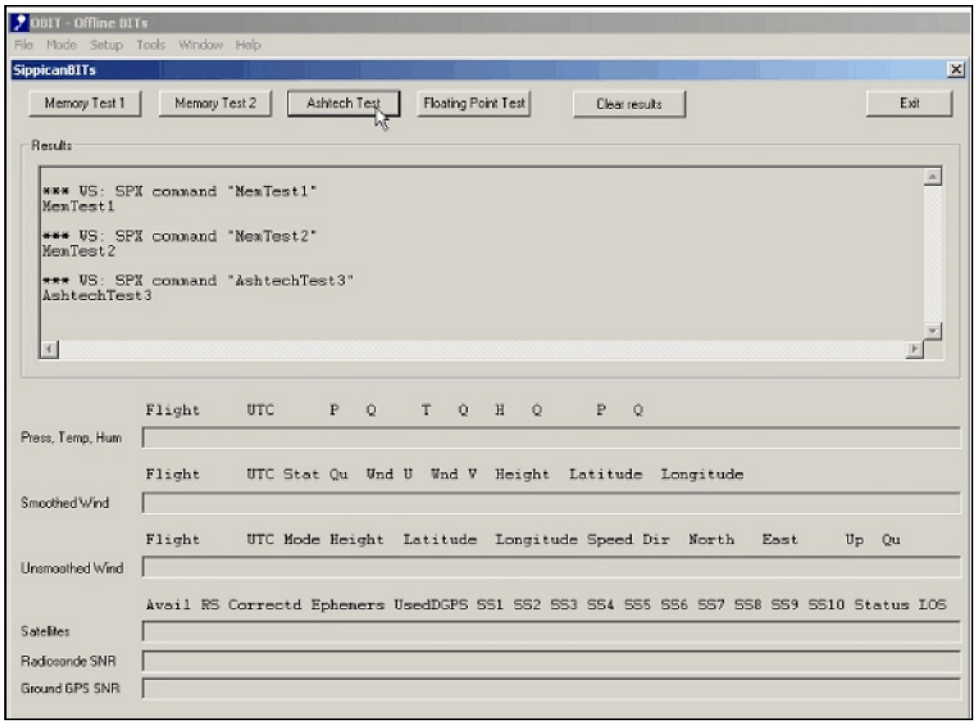


Exhibit C-2B Sippican SPS Ashtech Test

C.2.3 RSOIS Maintenance Option

The RSOIS Maintenance Option when selected from the Offline Maintenance Menu provides the operator with detailed information on the RSOIS. Exhibit C-3 provides an example of what information will be provided when this option is selected.

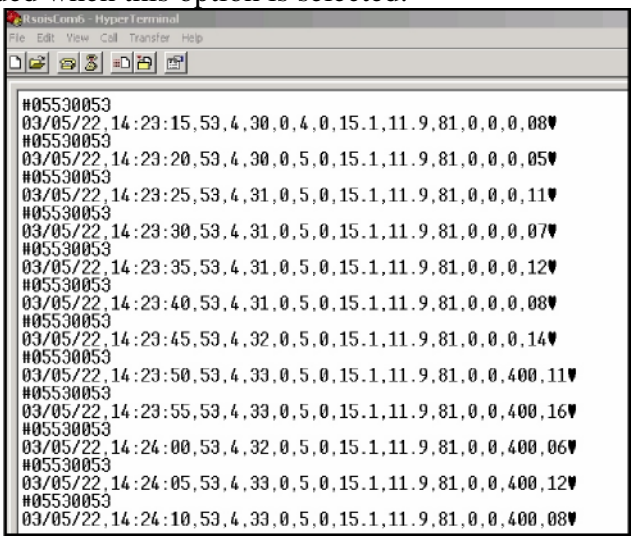


Exhibit C-3 RSOIS Maintenance

C.2.4 PDB Maintenance Option

The PDB Maintenance Option when selected from the Offline Maintenance Menu provides the operator with detailed information on the PDB. Exhibit C-4 provides an example of what information will be provided when this option is selected.

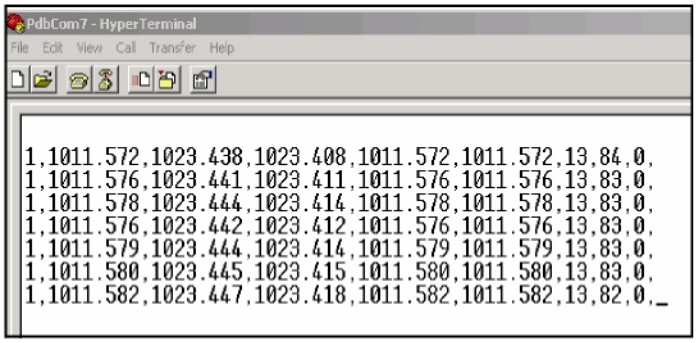


Exhibit C-4 PDB Maintenance

C.2.5 TRS Maintenance Option

The TRS Maintenance Option when selected from the Offline Maintenance Menu provides the operator with detailed information on the TRS. This option provides by far the most detailed information of the options that may be selected. Exhibit C-5 shows what options are available and C-5A provides an example of information when the SCA Test is initiated.

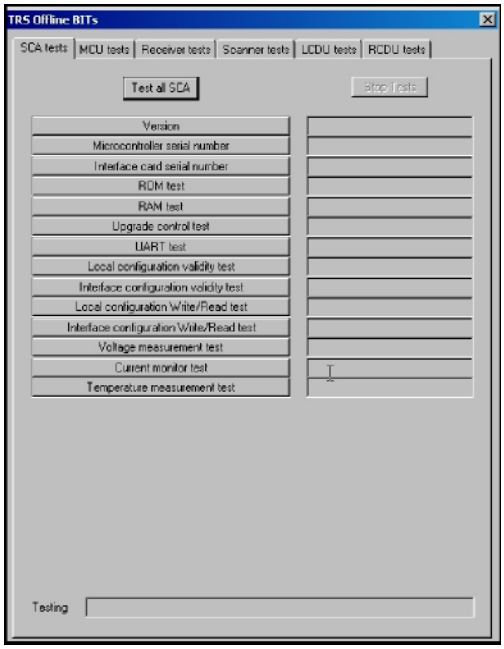


Exhibit C-5 TRS Menu

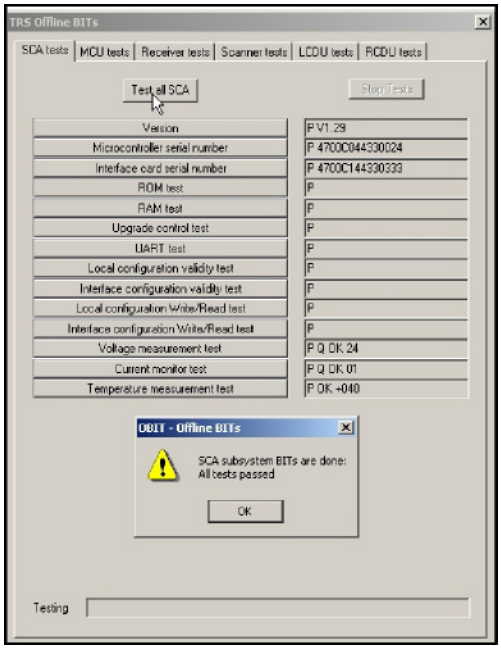


Exhibit C-5A SCA Tests

NOTE: When the TRS Offline Bits Menu is initially displayed the SCA Menu is displayed with the possible features that are tested.

C.2.5.1 MCU Tests

The MCU Tests is the second test series shown under the TRS Maintenance Option. When selected from the TRS Maintenance Window, it provides detailed information on the MCU. Exhibit C-5B provides an example of what information will be provided when this option is selected.

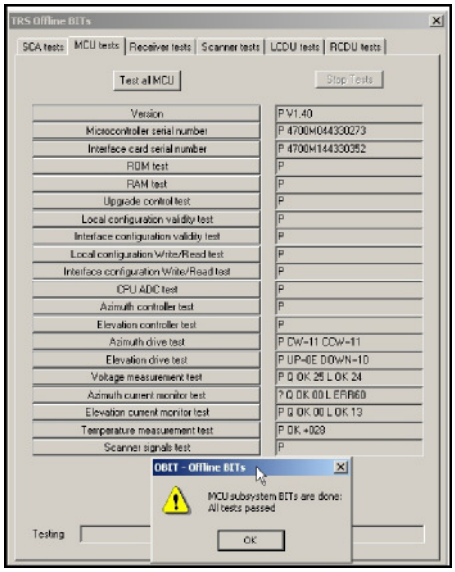


Exhibit C-5B MCU Tests

C.2.5.2 Receiver Tests

The Receiver Tests is the third test series shown under the TRS Maintenance Option. When selected from the TRS Maintenance Window, it provides detailed information on the receiver. Exhibit C-5C provides an example of what information will be provided when this option is selected.

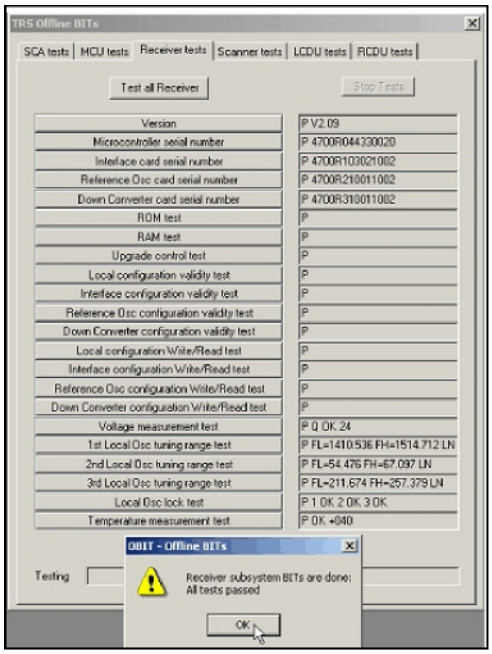


Exhibit C-5C Receiver Tests

C.2.5.3 Scanner Tests

The Scanner Tests is the fourth test series shown under the TRS Maintenance Option. It provides detailed information on the scanner. Exhibit C-5D shows the information provided.

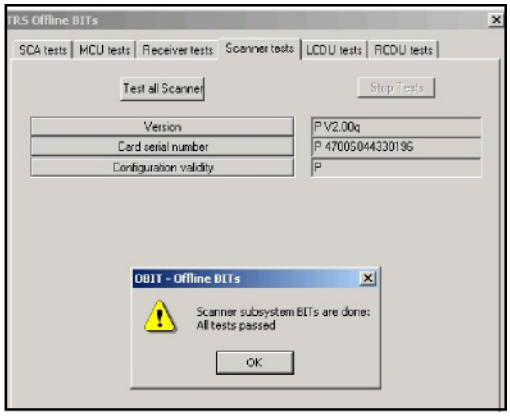


Exhibit C-5D Scanner Tests

C.2.5.4 LCDU Tests

The LCDU Tests is the fifth test series of the TRS Maintenance Option. It provides detailed information on the local control display unit in the radome. Exhibit C-5E shows the information provided. An RRS flight can be conducted without the use of the LCDU.

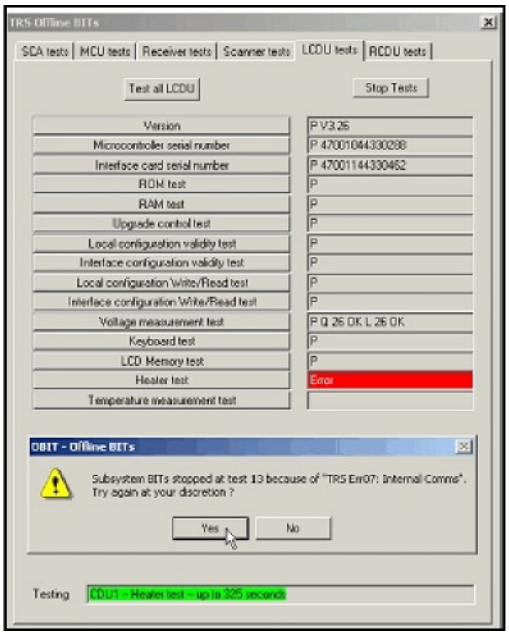


Exhibit C-5E LCDU Tests

C.2.5.5 RCDU Tests

The RCDU Tests is the final test series of the TRS Maintenance Option. It provides detailed information on the remote control display unit at the release point. Exhibit C-5F shows an “Error Message” requires maintenance notification and use of alternate release procedures until corrected. An RRS flight can be conducted without the use of the RCDU.

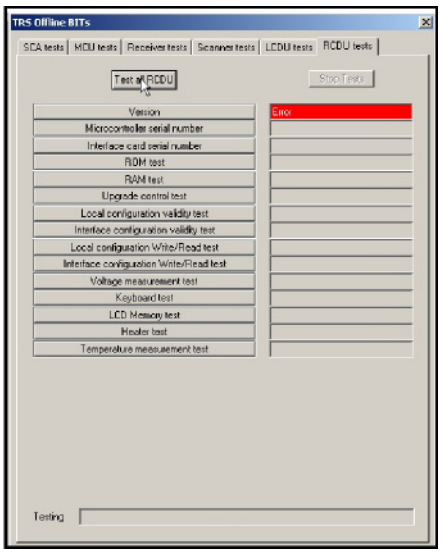


Exhibit C-5F RCDU Tests

C.2.6 UPS Maintenance Option

The UPS Maintenance Option from the Offline Maintenance Menu provides the operator with detailed information on the UPS. Exhibit C-6 shows the information provided.

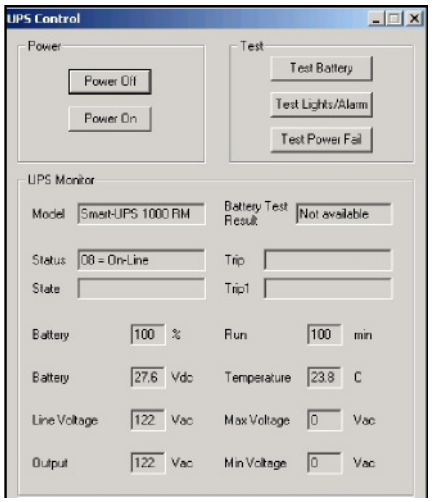


Exhibit C-6 UPS Tests

NOTE: The UPS Power options allows the operator to power on or off the power supply. TheUPS control window can also be used to test the battery, lights, alarm and do a test power failure. The window also provides detailed information on the battery strength, voltage, temperature, and output. The initiation of the Battery Test is shown in Exhibit C-6A.

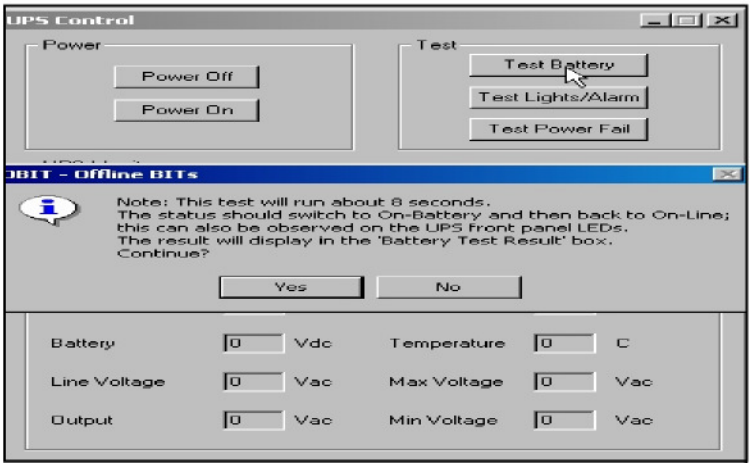


Exhibit C-6A Battery Test

D. Appendix D- Troubleshooting

D.1 Introduction

This appendix includes instructions for the operator to use if during pre-flight, in-flight, and post flight problems arise that require actions other than are typically needed for a normal flight.

D.2 Pre-flight Troubleshooting

There will be occasions when the ground equipment or the radiosonde does not function normally during the pre-flight sequence. It is up to the operator to try to diagnose the problem and take corrective action if possible. Even if the problem is beyond the operator's expertise, providing the electronics technician or others with what actually occurred before and after the event is vital to finding a solution.

NOTE: Document the problem by printing the display indicating the problem or do a screen capture by clicking the "Shift" button and the "Print Screen" button and saving the file to "Wordpad". (See paragraph D3.3)

D.2.1 Failure to Complete Warm-up and/or Initialization

The TRS may fail to complete warm up and/or initialization on occasions. The operator should first verify that the UPS is "ON" and if so, go ahead and click on the "Reset" TRS button in the Hardware Status window. (Exhibit D -1)

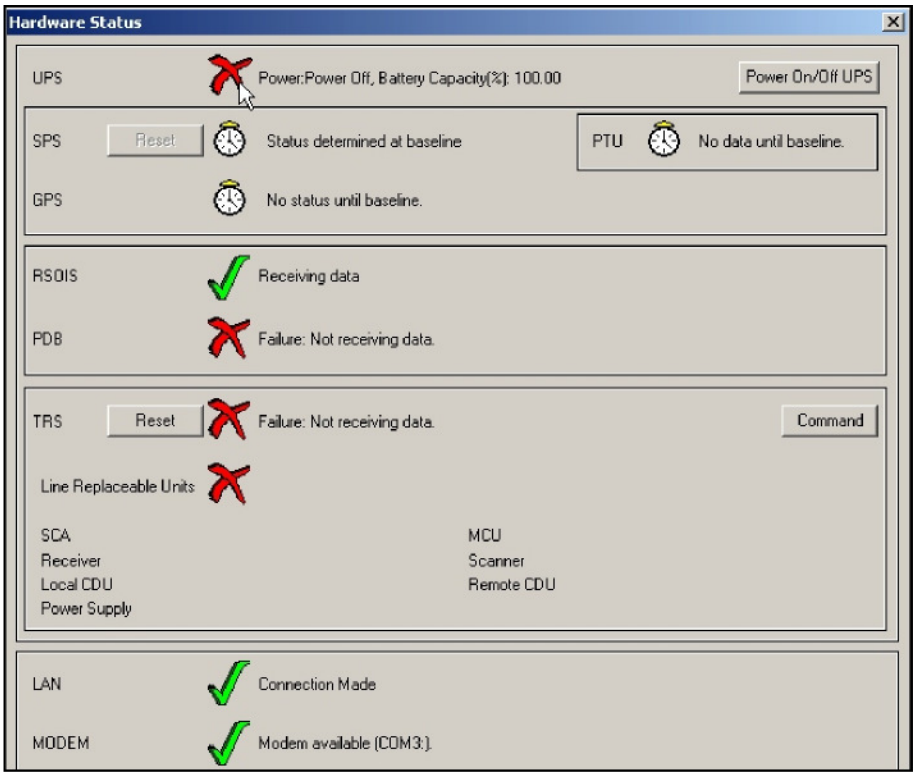


Exhibit D-1 Hardware Status Display

If the TRS fails to complete the warm up and/or initialization operation after reseting, turn the UPS off and wait 30 seconds before turning it on.

If the TRS stills fails to complete warm up and/or initialization, contact your site electronics technician for additional trouble shooting.

D.2.2 No Antenna Control – Corrective Actions

During warm-up and initialization the antenna can not be moved. After initialization, if the antenna can not be moved or is moving erratically or rotating. Do the following:

1. Open the Hardware Status window and reset the TRS.

2. If step 1 does not work, turn the UPS Off and back On.

3. If this does not work, contact your site electronics technician for additional trouble shooting.

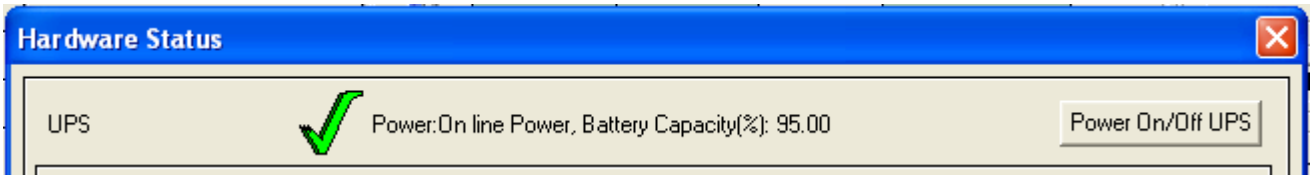


Exhibit D-2 UPS On/Off

D.2.3 SPS Failing to Initialize at Baseline

Occasionally the SPS will not initialize and the first step is to re-run the initialization process by clicking on the "Wait Again" button. Exhibit D-3 indicates the window during a normal initialization. Exhibit D-4 indicates the window when initialization fails.

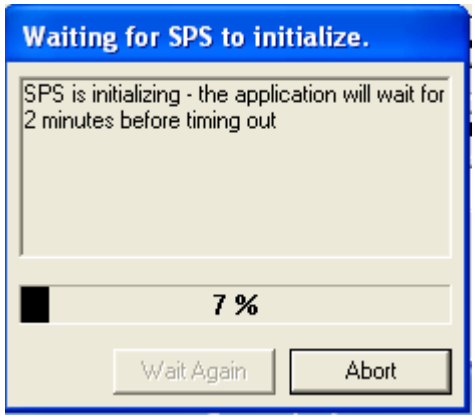


Exhibit D-3 SPS usually initializes by 13%

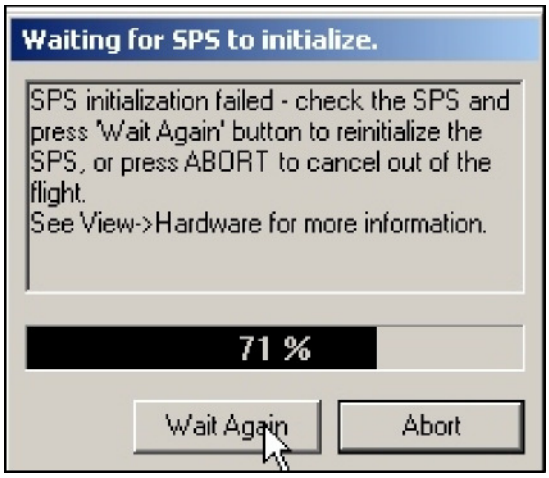


Exhibit D-4 SPS fails to initialize

At this point the options are click the "Wait Again" button or "Abort". The "Abort" button takes you completely out of the Pre-flight sequence and into the Offline mode. This should not be exercised until attempting several things.

1. Ensure you have a good signal strength and the receiver is locked on to the radiosonde (Ensure you have the TRS frequency set to the radiosonde frequency). This includes verifing the TRS antenna is pointing to the baseline position. Verify there is no interference or noise in the area causing a degradation of the signal being received.

2. Disconnect and re-connect the battery from the radiosonde. Disconnect the Positive or Red wire first and then the Ground or Black wire and wait at least 30 seconds before reconnecting Ground or Black wire first.

NOTE: The battery should be connected to the radiosonde a minimum of 5 minutes prior to beginning baseline. This allows the radiosonde circuitry and the battery to stabilize.

1. After following steps 1 and 2, go ahead and click on the "Wait Again" button. (See Exhibit D-5) If this does not work click the "Abort" button. (Shown in Exhibit D-7.)

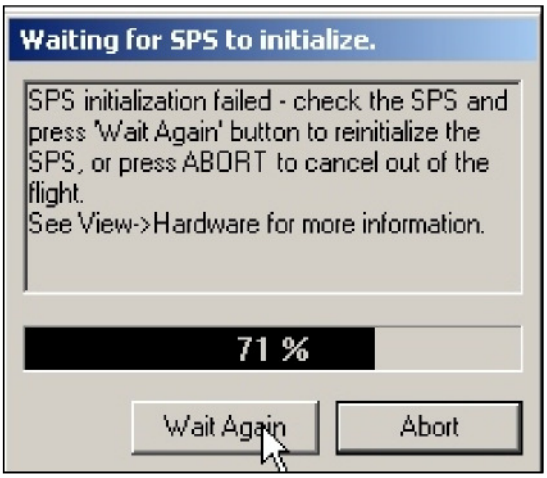


Exhibit D-5 Re-initializing the SPS

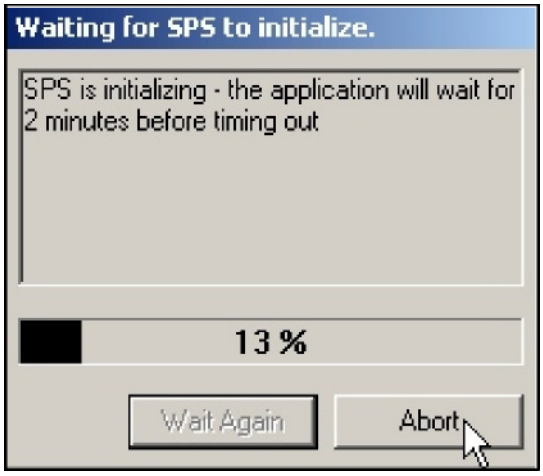


Exhibit D-6 Aborting Initialization

2. The next step prior to rejecting the radiosonde would be to go to the Hardware Status display and click on the SPS Reset button and re-attempt the baseline check.

3. If this does not work click the UPS Reset button, unplug the radiosonde battery, abort the flight, close down the RWS application, re-start a new "Live Flight". If this does not work set the instrument aside and try a new radiosonde.

D.2.4 No GPS at Baseline – Corrective Actions

If the SPS initializes, but there is no GPS, do the following (ensure you have waited 5 minutes):

1. Verify Signal Strength (See Exhibit D-7), and the bottom status bar (Exhibit D-8) is indicating GPS height. If GPS height information is available, then the RWS software is experiencing a display issue. This condition should not affect your flight and GPS should be available at release.

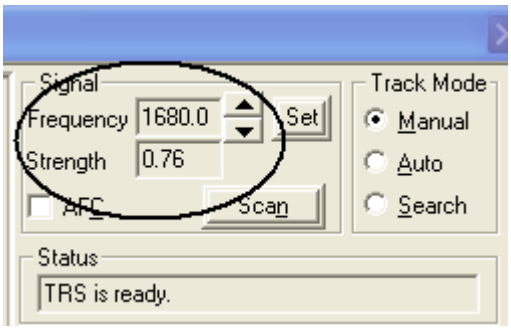


Exhibit D-7 – Check frequency and signal strength

Exhibit D-8 - GPS Height available

2. Disconnect the battery and wait 30 seconds, before re-connecting to the radiosonde.

NOTE: Always disconnect the Positive or Red wire first and reconnect the Black or Ground wire first.

3. Go to the Hardware Status Display and press the "SPS Reset" button. This re-initializes the SPS (This is a soft reboot). If this does not work

4. Click the "Power On/Off UPS" button on the Hardware Status Display. (This is a hard boot) It may require 15 minutes for the GPS module inside the SPS to reacquire the GPS almanac. - ***If this does not work, get another radiosonde***

D.2.5 GPS at Baseline but GPS Status window shows 0 Matches – Corrective Actions

1. Verify that bottom status (See Exhibit D-9) bar displays height values that are close to station Release Elevation. If GPS Height appears reasonable (Based on the latest station data) to the Station Release Elevation then the RWS is experiencing a display issue. This condition should not affect your flight and GPS should be available at release.

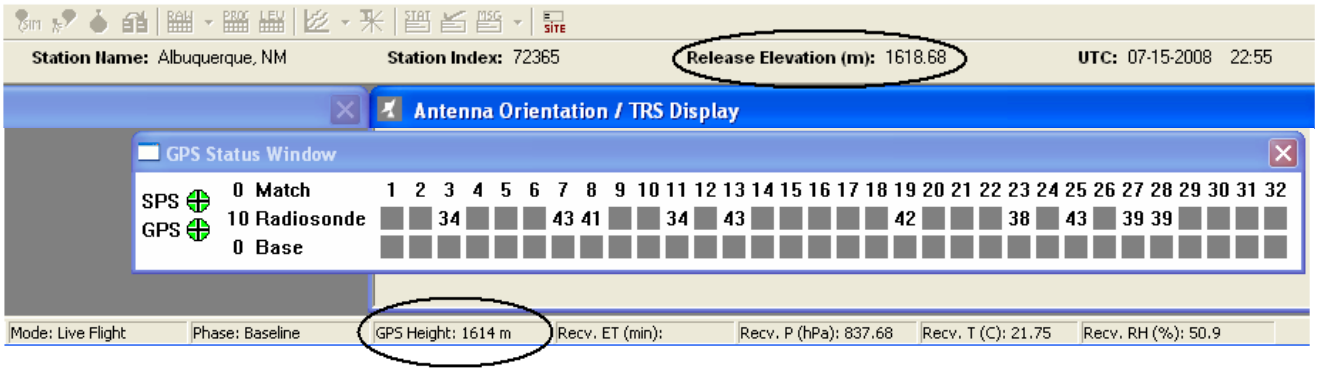


Exhibit D-9 - GPS Height available with 0 matches

D.3 In-flight Troubleshooting

There will be occasions during the flight when the operator must troubleshoot a problem before taking corrective action. A few problems that occur are:

- Signal Loss
- Missing Data
- Antenna Not Tracking Properly GPS Loss
- RWS fails to detect release
- MCU Overload with Rapidly Changing Angles

D.3.1 Signal loss - Corrective Actions

1. Signal loss may occur because of numerous reasons; the receiver may have shifted frequency, the radiosonde may have failed, the antenna may not be locked-on to the radiosonde. **If the signal strength shown in the Antenna Orientation/TRS Display drops to 14 or less the antenna will no longer be able to track properly.** One of the pop-ups that will alert this operator is the "Missing PTU " popup. (Exhibit D-10)

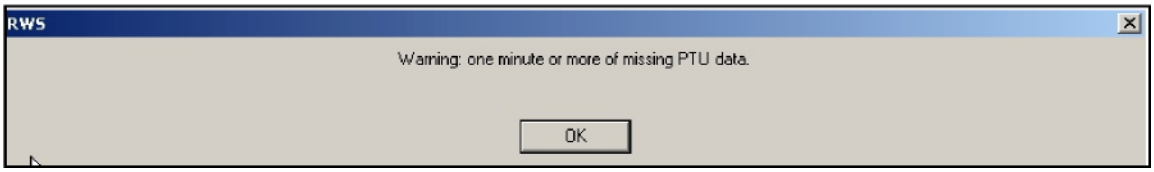


Exhibit D-10 1-Minute Missing PTU Popup

2. An audible alarm will accompany this popup. The popup will occur at 1 and 2 minutes. If the PTU is still missing after 3 consecutive minutes, a final popup comes up terminating the flight. (Exhibit D-11)

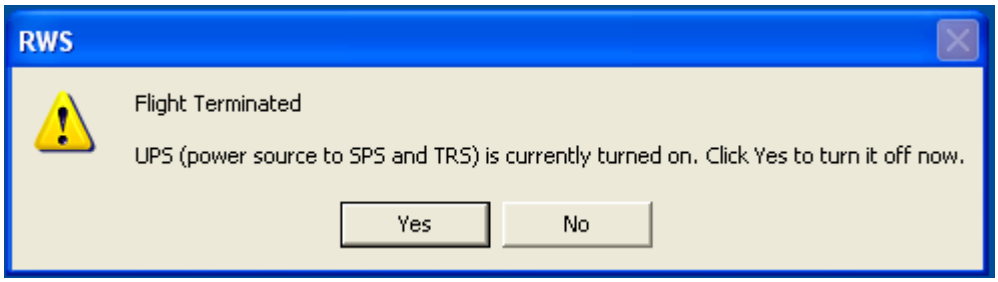


Exhibit D-11 Flight Terminated - UPS Turn Off Requested After 3 Minutes of Missing PTU

D.3.2 Missing Data – Corrective Actions

The operator must validate which problem exists when no signal is received. Missing data is the result of low or no signal strength. Low or no signal strength is the result of:

Incorrect frequency

1. Check the frequency - Go to the Antenna Orientation/TRS Display (Exhibit D-12). If the frequency has changed, the operator should:

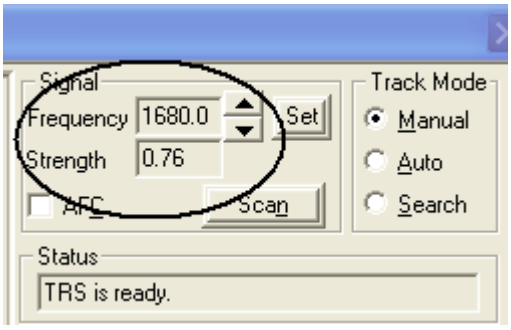


Exhibit D-12 Check frequency and signal strength

a. Press the "Set" button and type in the frequency (Exhibit D-13) selected during Pre-release.

b. Select the OK button.

c. Make sure the "AFC" is on. The signal should increase and data should be restored.

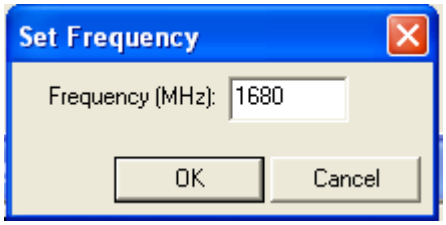


Exhibit D-13 Input desired frequency

D.3.3 Antenna Not Tracking Properly GPS Loss - Corrective Actions

1. Check the antenna tracking –

   a. Antenna Responds to Commands –

      i. If GPS is still being received, select the "Search" button (See Exhibit D-14). The Search routine will move the antenna to the last known GPS location.

NOTE: If the elevation is above 60 degrees or the radiosonde is expected to change direction and track back close to the release point do not use the "Search" feature. Once this condition no longer exists the search function may be used.

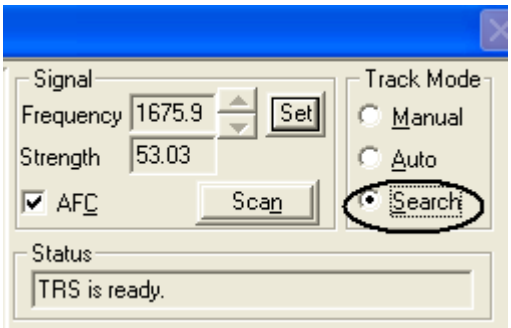


Exhibit D-14 Select Search track mode

      ii. If the GPS signal is lost, the operator must look at the last usable position data and then manually move the antenna to that location.

NOTE: Under "Tables" open "Processed PTU" the last azimuth and elevation data points are shown. If GPS was lost, scroll up to find the last data point.

   b. Antenna Control is lost - (Signal Strength shown in Antenna Display < 20)

      i. If control of the antenna is lost during the flight, and no response is given to commands entered through the Antenna Orientation/TRS Display. Two different options are available.

NOTE: Place the Antenna in Manual Mode. Before resetting the TRS, determine in the Status Message Display window the time the TRS took for warm-up and initialization. If the warm-up and initialization was longer than 3 minutes, the flight may terminate because of excessive missing data

NOTE: Write down the last azimuth/elevation and frequency.

ii. Press the TRS "Reset" button on the Hardware Status Display.

2. Once the TRS successfully completes initialization, the observer should verify the correct frequency and then manually move the TRS to the last known good position. Using the procedures listed in items 1 and 2. Remember, you must reacquire the signal within 3 minutes of the start of the missing data or the flight will automatically terminate due to "Excessive Missing Data".

D.3.4 RWS fails to detect release – Corrective action

1. After arriving back at the RWS, the observer notes that the RWS failed to detect release (See Exhibit D-15).

2. The observer should immediately click the yellow balloon icon above the flashing "Waiting for Target Release Time"

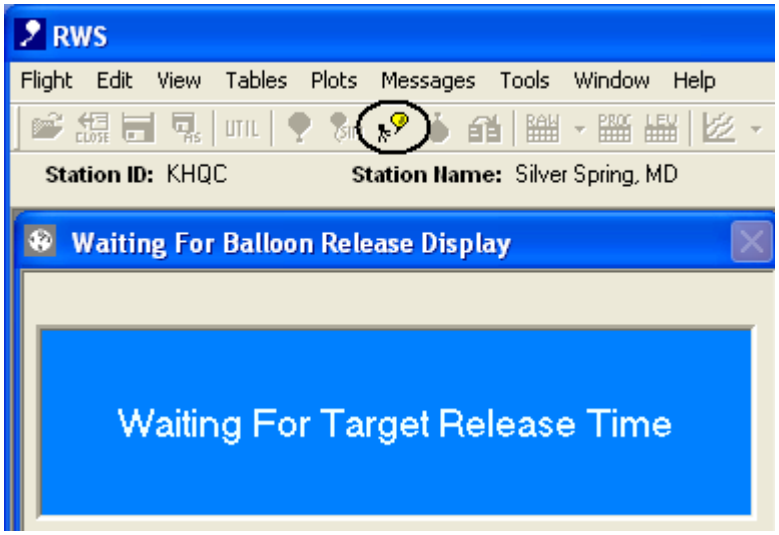


Exhibit D-15 Select yellow balloon icon to start flight

3. After the RWS completes its post release processing, the observer should open up the Received PTU Tabular Display and located the pressure point where the pressure decreases uniformly.

NOTE: You should also verify the Geo-potential Height is increasing in the Processed Tabular Display. The first data above the surface should show at least a 2 meter increase from the station data at time 0.0.

D.3.5 MCU Overload with Rapidly Changing Angles – Corrective Actions

1. It is not unusual especially with light winds, or while tracking on a side-lobe, for the elevation and azimuth angles to change rapidly over a short period of time. If the RAW azimuth and elevation angles from the TRS are changing rapidly the antenna motor current will increase and generate a TRS Status message if the condition exists for more than four seconds. The tracking will be suspended for eight seconds. The Status Message that comes up for the TRS is the MCU: 0x0800 errors. (See Exhibit D-16)

Status Messages Display

Add Message

UTC Time	Flight Status Message	Comment	
22:26:51.30	Flight was initiated: Date 12-10-2007; Ascension 696; Release 1.		
22:27:01.24	Status Code: 0 - UPS has been turned off.		
22:27:11.18	TRS initialization in progress.		
22:27:21.13	Status Code: 16 - UPS is now running on battery.		
22:27:26.40	Status Code: 8 - UPS is now running on on-line power supply.		
22:27:31.19	TRS busy with motor warm-up operations.		
22:42:06.51	TRS completed initialization successfully.		
22:42:06.51	TRS is ready.		
22:59:11.23	TRS Error Reported: LRU: 0000000000, SCA: 0000, MCU: 0x0001, Receiver: 0000, Scanner: 00, Power Supply: Voltage OK		
23:06:32.26	User added message	battery	
23:11:46.96	SPS has been initialized successfully.		
23:16:14.35	Radiosonde has been baselined successfully.		
23:22:12.04	Comparison flight is Ascension 695, Date 12-09-2007, Time 12UTC.		
23:22:12.04	Balloon release detected at 23:21:54.620 UTC.		
23:24:01.33	TRS Error Reported: LRU: 0000000000, SCA: 0000, MCU: 0x0800, Receiver: 0000, Scanner: 00, Power Supply: Voltage OK		
23:24:21.24	TRS Error Reported: LRU: 0000000000, SCA: 0000, MCU: 0x0800, Receiver: 0000, Scanner: 00, Power Supply: Voltage OK		
23:24:41.12	TRS Error Reported: LRU: 0000000000, SCA: 0000, MCU: 0x0800, Receiver: 0000, Scanner: 00, Power Supply: Voltage OK		
23:24:51.32	TRS Error Reported: LRU: 0000000000, SCA: 0000, MCU: 0x0800, Receiver: 0000, Scanner: 00, Power Supply: Voltage OK		
23:28:30.15	Successful release.		
23:28:47.40	Coded Messages were generated.		
23:44:49.23	Coded Messages were generated.		

Exhibit D-16 MCU 0x0800 Error Due to Difference in Raw and Processed Azimuth

2. If the Status Messages indicate a problem with the Motion Control Unit (MCU) the observer should take the antenna out of "Auto" track and place in "Manual" track mode until the azimuth and elevation angles are changing less rapidly. This condition is not unusual with high elevation angles or when a wind direction change occurs over a very short period of time. The inability for the TRS to drive the antenna over wide angular changes without exceeding the voltage again is the cause of the condition. ***If allowed to go unchecked, after five such MCU messages the antenna will go into "Overload" and the observer will no longer be able to control the antenna.***

3. If this occurs, the TRS will have to be "Reset" from the Hardware Status Display (See Exhibit D-17).

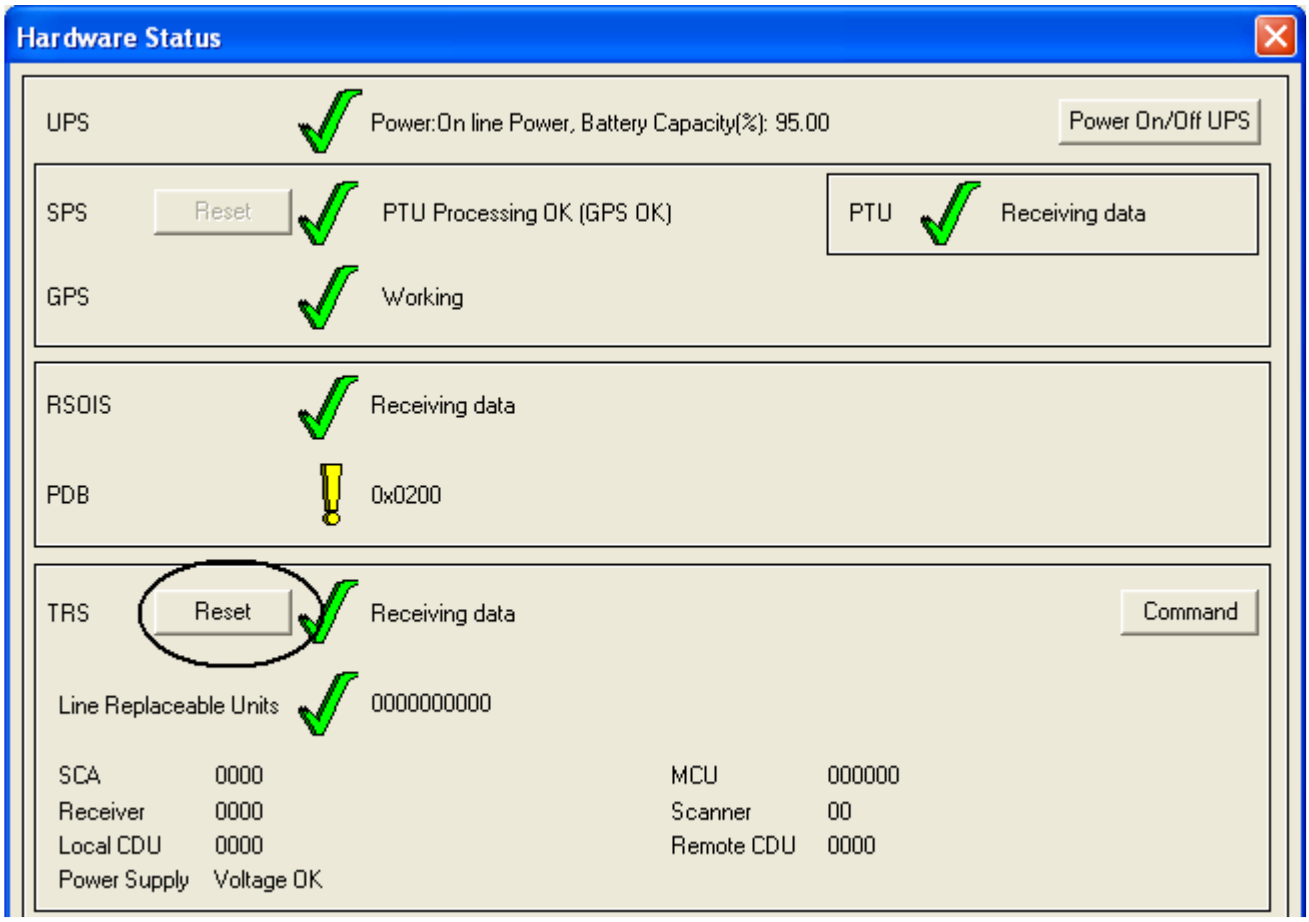


Exhibit D-17 TRS Reset button option

NOTE:	Overhead conditions exist, when elevation angles increase are 60 degrees or higher, go ahead and place the antenna into "Manual" track mode. The antenna should be kept in "Manual" track until the elevation angles shown in the Processed Data Set decrease and show less erratic change.

D.3.5.1 Avoiding MCU Overload Errors Through Launch Techniques

MCU 800 Error may be avoided by launching in "Manual" tracking and only placing the antenna into track after returning to the office. Upon returning to the office there should exist one of two conditions. Either the angle of the radiosonde in relation to the TRS is above or below 60 degrees as indicated on the Processed Tabular Display. The following procedure should be followed in those conditions when GPS is available:

a. If Elevation is below 60 degrees and is expected to remain below 60 degrees elevation, the observer should click on the "Search" button on the TRS display. The antenna should go into "Auto" track and "AFC" should be checked.

b. If Elevation is above 60 degrees or is expected to go above 60 degrees, manually enter the azimuth and elevation angles from the Processed Tabular Display into the TRS display every 5 minutes until the elevation drops below 60 degrees and is expected to stay there. Once this occurs, check for GPS and place the antenna in "Search". The antenna should go into "Auto" track and "AFC" should be checked.

D.4 Doing a Screen Capture

1. The first step in performing a screen capture is recognizing a problem. This may be by noticing a "Red X" on the "Hardware Status" display (See Exhibit D-18), seeing a Status Message, getting a Popup message, or just noticing an incorrect data in the tabular display or plot.

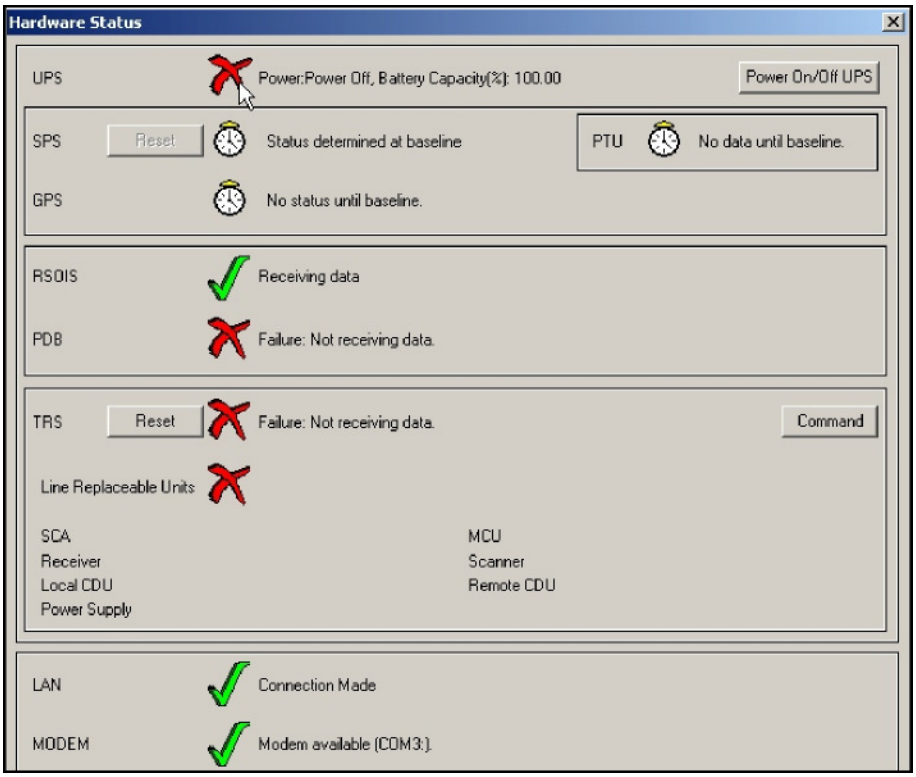


Exhibit D-18 TRS Reset button option

2. The second step to capturing the problem is after displaying the items you wish to capture is to hit the "Shift" key while pressing the "Print Screen" button. Minimize the RRS Program by clicking on the minimize icon. (See Exhibit D-19)

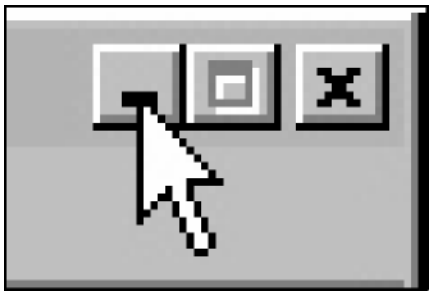


Exhibit D-19 Minimize Icon

3. The third step in capturing data or a display is to open WordPad. After opening WordPad do the following:

    a. At the "File" Option select "Page Setup" and select "Landscape" and click "OK".

    b. Click on the "Edit" Option and select "Paste".

    c. At the "File" Option select "Save As". Then, browse to the Desktop subdirectory and name the file and save it. Suggest using 3 letter Station ID and ascension number (See Exhibit D-21, i.e ABQ388 – Albuquerque ascension number 388)

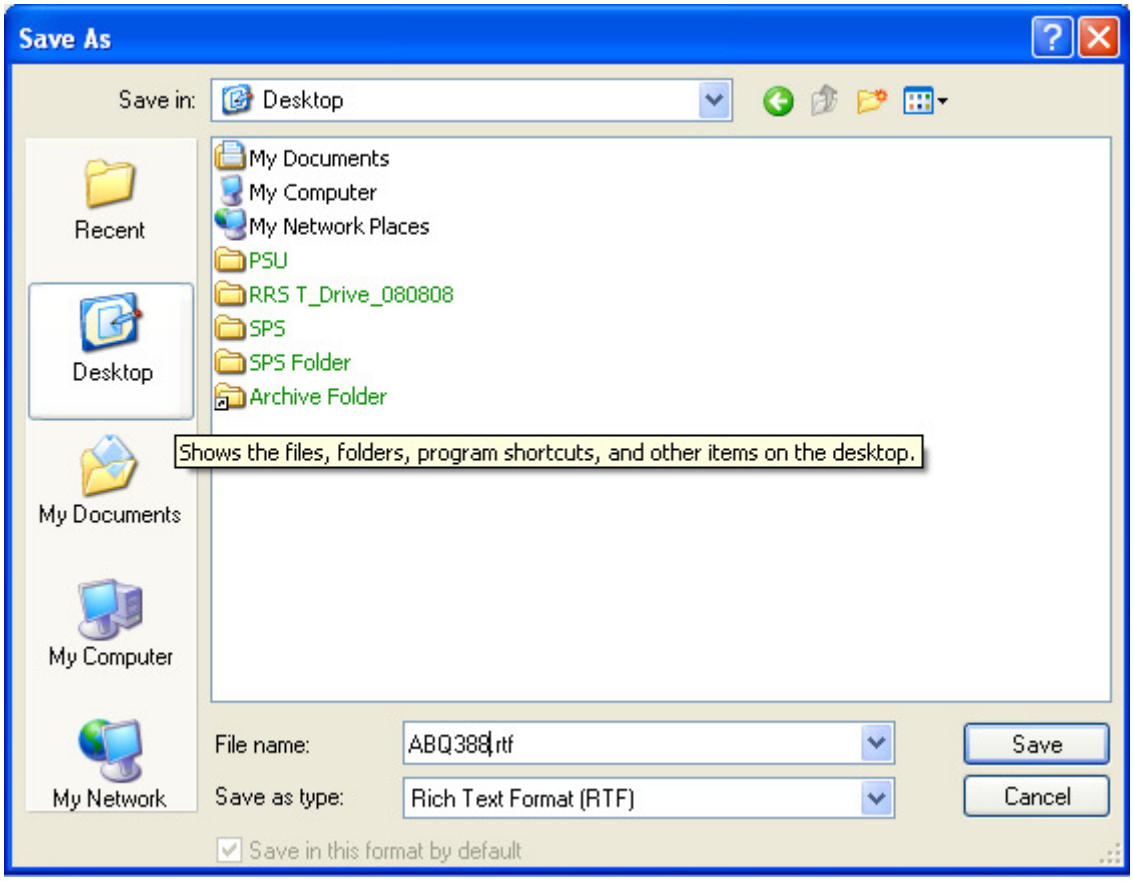


Exhibit D-20 Save screen capture on Desktop

D.5 Post-Flight Troubleshooting

If corrective action is taken to restore equipment operation and messages have not been transmitted. The observer may go into “Rework” and send the WMO Coded Messages up to 6 hours after flight termination.

Post-flight troubleshooting should also include going into the Offline Bit Utility (OBIT) and taking a closer look at equipment or Line Replaceable Unit indicating problems or failure. The data from the screen display after the diagnostics have run should be printed or captured for the electronics technician. An entry into the Engineering Management and Reporting System (EMRS) will be necessary.