Addendum III

September 2005

RRS Site Component Commissioning Plan and Evaluation Package for NWS Field Office Use

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1 Introduction

The primary mission of the National Weather Service (NWS) upper air network is to monitor the upper atmospheric parameters of temperature, moisture, ambient pressure, and winds as part of the World Weather Watch. The Radiosonde Replacement System (RRS) is the next generation of upper air equipment to be fielded in order to replace the antiquated Micro-computer-based Automatic Radio Theodolite (MicroART) system, which has been in operation since the late 1980s.

The strategy for deploying and commissioning these systems will be discussed as well as their impact on the meteorological community as the transition takes place.

To meet the continuing requirement of a broad base of users for atmospheric upper air data, the NWS will replace the current upper air network with RRS to:

- Comply with Congressional direction to reduce the use of radio-frequency spectrum and implement the Federal Communications Commission's (FCC) plan to vacate the 1670-1675 MHZ frequency band,
- Maintain or increase system availability and data accuracy,
- Require less operator interaction and maintenance,
- Provide a complete high-resolution data set to users,
- Provide a balloon inflation and launch shelter capable of controlled balloon launches for use at NWS facilities that have space limitations, and
- Provide consistent and accurate measurement of surface weather parameters at the point of balloon release.
- Increase the vertical resolution of data provided to data users.

One of the major features of the RRS is its use of state-of-the-art Global Positioning System (GPS) radiosondes operating in the 1680 MHz radiosonde frequency. Until recently, commercial systems/radiosondes sold around the world were based on the 403 MHz frequency. Unfortunately, this band is very congested with thousands of licenses already issued. The NWS has been using the 1680 MHz band with its Radio Direction Finding (RDF) systems, almost exclusively, for over 50 years with minimal interference from other users.

1.1 Systems in Use Prior to RRS

RRS is replacing the currently fielded Micro-Computer Automatic Radio Theodolite (Micro-ART) and the Sippican W-9000. Micro-ART was fielded in the late 1980s at 92 locations as a replacement to the mini-computer-based Automatic Radio Theodolite (Mini-ART) system. Micro-ART automatically processes the pressure, temperature, and relative humidity data from the radiosonde as it ascends through the atmosphere. Winds are calculated from elevation and azimuth changes with the radio theodolite. Heights and other parameters are calculated from

these data. Special equipment has been installed into Micro-ART to translate the radiosonde signals into usable data for processing within the IBM XT computer.

In the mid-1990s, three Sippican W9000 systems were implemented at CONUS locations to solve various problems. The W9000 system is a 403 MHz system built with a YAGI antenna design to process LORAN or GPS winds. At Wallops Island, Va., use of the 1680 MHz frequency band is restricted, and thus, must use a 403-MHz system. Albany, NY and Charleston, SC required the use of a BILS to launch their balloons and YAGI antennae, since radomes/radio theodolites were too intrusive at these locations.

Appendix A delineates the types of systems in use today including the Micro-ART system (variants of the Automatic Radio-theodolite for the Ground Meteorological Device or GMD, and the Weather Bureau Radio-theodolite or WBRT), and the W9000 ® system purchased from Sippican, which can operate with either GPS or LORAN radiosondes. These will be the candidate sites for RRS. It also illustrates the types of radiosondes flown in the NWS network including the Sippican B2 ®, LORAN®, MARK II® variety, and the Vaisala RS 80-57H®. These radiosondes will be phased out of the NWS upper air network with the introduction of the new GPS radiosondes. Two radiosonde vendors, Sippican® and Intermet®, have developed radiosondes of this new design; however, only the Sippican radiosonde will be fielded, initially.

1.2 Applicable Documents

This plan has been prepared in accordance with National Directive System ***System Commissioning and Decommissioning Policy Directive, NWSPD 80-2,*** and ***National Weather Service Instruction 80-201***, ***System Commissioning Process***. In addition, this addendum is to the Site Commissioning Plan, dated July 1999, as a result of its interfacing with AWIPS. Refer to this plan for more information about AWIPS and its adjunct systems of which RRS will now become another one. The reader should also become familiar with the ***National Weather Service Instruction 80-202***, ***System Decommissioning Process***.

1.3 RRS CONFIGURATION

The RRS is a replacement system for the legacy systems fielded. It will introduce a state-of-the-art ground tracking system and a GPS based radiosonde in response to validated system obsolescence and reduced operating frequency requirements. The RRS is comprised of a new GPS tracking antenna, 1680 MHz GPS radiosondes and Signal Processing System (SPS), and a new Windows-based workstation. In addition to the deployment of the RRS, a new surface weather observing system called the Radiosonde Surface Observing Instrumentation System (RSOIS) has already been deployed at most upper-air stations. In addition, precision digital barometers have been deployed for accurate surface pressure measurements to all sites. Sites not receiving RSOIS will use the Automated Surface Observing System (ASOS) to enter the surface information, manually. GPS Repeaters will be installed to improve GPS reception within the office environment during radiosonde baselining procedures.

1.3.1 RRS Hardware

The RRS hardware consists of the following:

- A new GPS-based radiosonde to aid in wind data calculation
- Telemetry Receiver System (TRS), to acquire and track the radiosonde signal
- An SPS that uses differential GPS data to pre-process and format pressure and/or altitude, temperature, and humidity values, wind, and position data for the workstation.
- GPS repeater for improved signal reception indoors
- RSOIS containing a suite of equipment for providing surface readings during pre-flight.
- A Precision Digital Barometer (PDB) providing surface pressure during pre-flight.
- A Workstation to run the flight application, control flight operations, support limited telemetry analysis, provide local and National Climatic Data Center (NCDC) archival, and transmit messages to AWIPS via the Local Data Acquisition and Dissemination (LDAD) Local Area Network (LAN) connection.

Figure 1 delineates the RRS configuration as it will be deployed at NWS field sites, with the exception of certain OCONUS locations where AWIPS does not exist and some other form of telecommunications will be used.

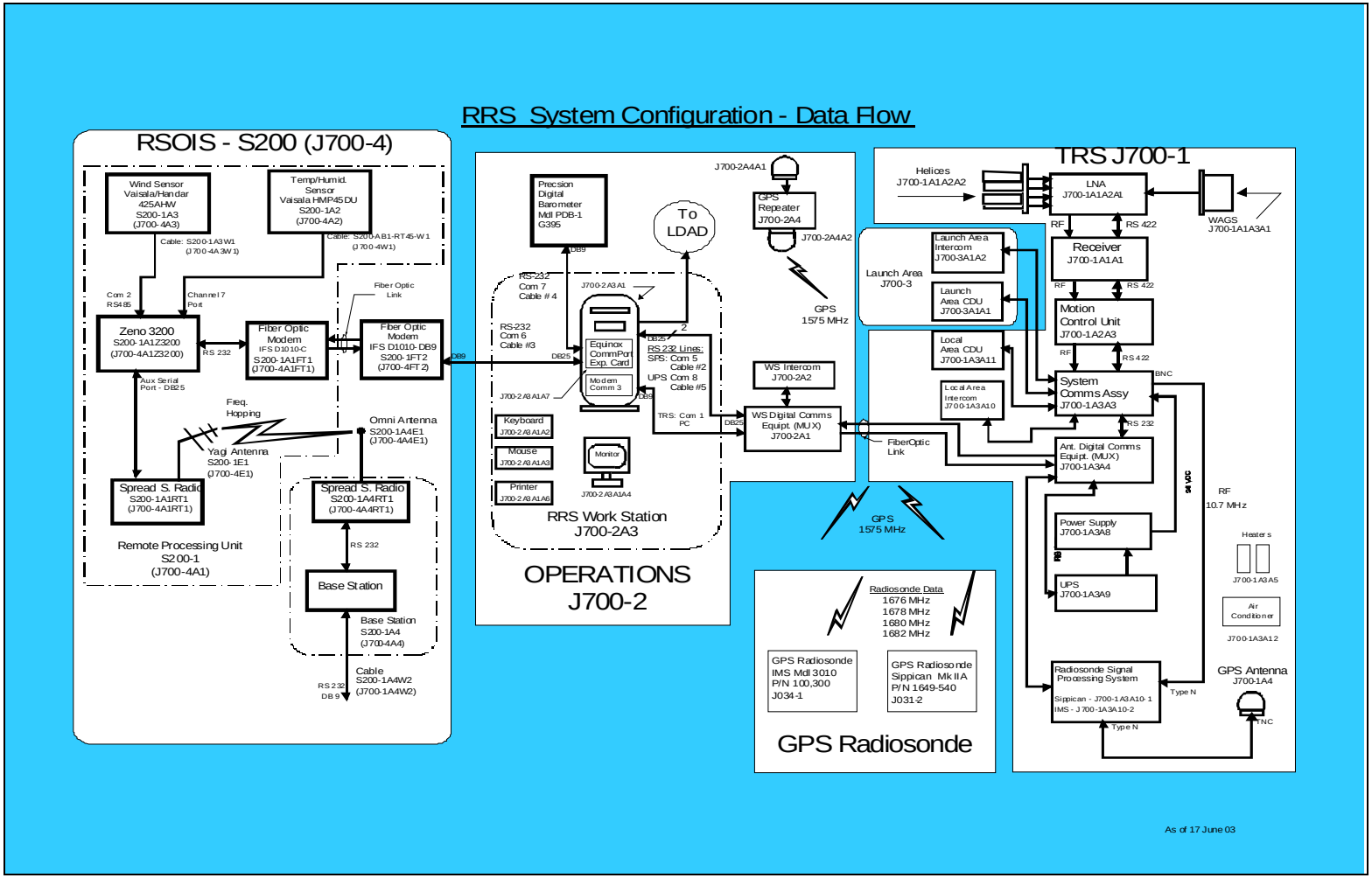

Figure 1. RRS System Configuration.

1.3.1 RRS Software

Software Build 1.1 or later is considered the minimum load required for replacing the legacy system on-site. This load is referred to as the "commissioning load" throughout this document. This load contains sufficient capabilities to perform the following functions:

- System administration functions such as establishing user accounts, creating station data unique to the site, and performing utility functions
- Pre-release functions including hardware status messages, surface data entries, baselining the radiosonde and acquiring satellite information for calculating GPS-derived winds
- Automatic launch detection
- In-flight processing including, data collection, graphical displays, quality control and message generation/transmission
- Flight termination and post-processing activities including housekeeping functions and data archival

1.3.2 LDAD Interface

One aspect the transition to RRS will be the switching of the LDAD modem configurations. The problem is due to different LDAD modem setup requirements for RRS and MicroART. RRS uses an LDAD modem configured as a PPP Interactive port (point-to-point connection used for Telnet or FTP protocols). The Micro-ART port is configured as a Csportd port (simulates a pseudo terminal). The plan is to have a select number of sites configured for RRS at non-Micro-ART locations, i.e., regional offices, to serve as backup sites until enough sites have removed their Micro-ART systems from LDAD to free up ports.

1.4 RRS RADIOSONDES

One of the major features of the RRS is its use of state-of-the-art GPS radiosondes operating in the 1680 MHz radiosonde frequency. Until recently, commercial systems/radiosondes sold around the world were based on the 403 MHz frequency. Unfortunately, this band is very congested with thousands of licenses already issued. The NWS has been using the 1680 MHz band with its RDF systems, almost exclusively, for over 50 years with minimal interference from other users. The NWS decided to require radiosonde vendors to interface their GPS signal processing with the 1680 MHz frequency radiosonde as part of the RRS. This caused a number of technological challenges for the commercial vendors. Two radiosonde vendors, Sippican® and Intermet®, have developed radiosondes of this new design. Both have completed Radiosonde Qualified Products List (QPL) evaluation; however, only the Sippican radiosonde will be fielded, initially. Other radiosonde vendors may be qualifying their type of 1680 MHz GPS radiosonde over the next few years.

One significant impact GPS radiosondes will have on operations will be changes to sensors for temperature, pressure, and relative humidity measurements, which have different characteristics

than current radiosondes fielded. As a result, data continuity studies are needed for assessing these sensors in a variety of climatic and meteorological conditions after RRS is deployed at selected climatic sites.

The strategy is to transition the NWS upper air network from current radiosonde types to the new radiosondes with the least amount of impact on both field and center operations. When the new RRS is fielded beginning in 2005, sites using the current variety of RDF and LORAN-C radiosondes will be transitioned to the new GPS types. However, NWS must manage the number of RDF radiosondes being purchased as the transition to the new radiosondes is occurring to ensure NWS is not left with too many of the RDF radiosondes after the transition.

2 UPPER AIR OPERATIONS

The following sections describe RRS as used in upper air operations. In general, NWS field offices are the first to receive and use upper air products in their daily warnings and forecast mission, followed by the NWS Telecommunications Gateway (NWSTG), and then the National Centers Environmental Prediction Center (NCEP) and other users receive and process them.

2.1 RRS Operations

RRS operations will be similar in scope to what is in the field today, namely, a mostly automated operation with minimal human interaction after the balloon is launched. The preparation of the radiosonde and launching will be similar with only the acquisition of the GPS satellites being different from the RDF mode of today's Micro-ART. The RRS workstation will be much more powerful than the antiquated micro-computer used with current systems and will be able to "window" a number of upper air displays for quality control and processing purposes.

Transmission of coded messages to the Advanced Weather Interactive Processing System (AWIPS) will be controlled by the observer. The radiosonde is prepared for flight in the weather office where the RRS workstation is located and released at the inflation shelter. Once the radiosonde begins to transmit data, the TRS tracks the signal and sends it to the SPS, which translates the signals into meteorological data. The SPS then computes pressures, temperatures, relative humidities, and winds for nominal 1-second time intervals for the entire flight.

During the radiosonde flight, the RRS workstation continuously monitors the course of the flight. The design of the RRS maximizes data acquisition capabilities whether the radiosonde is at low level elevation angles, or at the zenith relative to the ground receiving antenna. GPS-derived winds will allow much improved coverage over the use of elevation and azimuth angles that can be erroneous at low angles. The workstation displays tabular and graphical radiosonde flight data to aid the operator in evaluating the accuracy, completeness, and consistency of the meteorological data. The operator may delete data, or choose to perform another flight. RRS then generates upper air coded messages for transmission to data users. Note, RRS will be depicting temperature and relative humidity profiles within its coded messages at higher resolutions than Micro-ART. After the flight is completed, the entire flight 1-second data set is

packaged in a BUFR form, along with other text based archive products, and transmitted to NCDC for final archival.

The first software build (Build 1.1or later) will provide the standard WMO messages. Later builds will include a high resolution (i.e., 1-sec.) data product for transmission directly into NCEP models via AWIPS.

2.2 RRS Products

The following sections describe the products issued from RRS during operations.

2.2.1 Real-time Products

The upper air data is collected, processed, and then disseminated as World Meteorological Organization (WMO) TEMP-35/PILOT-35 messages to the meteorological community and the public. The RRS communicates these products through an interface to the AWIPS for transmission to the external community, and the FAA telecommunications service in the Pacific. The NWS is responsible for transmitting the Freezing Level (FZL– UXUS), Mandatory levels (MAN– USUS), Significant levels (SIG– UMUS), and levels above 100 hPA (ABV--UFUS). A software load after Build 1.1 may contain another message (ULG– NXUS) for data used to complete upper air forms and to populate the Management Information Retrieval System (MIRS) data base.

2.2.2 Transmission of Products

The following sections describe the telecommunications for transmitting RRS products.

2.2.2.1 AWIPS Telecommunications

For most of the NWS network, AWIPS will be used as the primary means for the transmission of messages described in Section 2.2.1. The rest of the network will use FAA's telecommunications or another method to communicate the observations to the NWSTG. The RRS/AWIPS interface is depicted in Appendix III-A and illustrates the telecommunications paths for RRS products after they leave the upper air site.

2.2.2.2 Backup Communications

Back up capabilities exist for AWIPS so RRS can transmit to one of several host systems, if their primary system is down. Non-AWIPS sites may also have back up plans established in case their primary telecommunications path is disrupted. Backup communications paths are illustrated in Appendix III-A. Note, transmission of upper air observations will not have their message headers change as a result of these different communications paths. Alaska Telecommunications

2.2.2.3 Alaska Communications

The plan is for Alaska region sites to use AWIPS to communicate their upper air observations. Currently they use the X.25 line to the NWSTG, which they will be able to continue to use for back up purposes.

2.2.2.4 Pacific Telecommunications

Currently, the Pacific Region upper air sites use the FAA's telecommunications system for the Pacific islands. This will continue to be the case, if or when, RRS arrives on-site. However, the software to support this connection will not be provided until another software load beyond Build 1.1 is delivered. One site, Guam, has a direct connection to AWIPS and can route their RRS products as other AWIPS locations.

2.3 Upper-air Forms B-85, B-29, and H-6

All forms in use today with MicroART will continue with RRS. Forms will be modified to allow entries for the RRS type of radiosondes and special codes for GPS-derived winds. A-1 and A-3 forms will be completed as part of the implementation process for the change in operations.

2.4 Performance Measures

The performance of all aspects of the RRS will be monitored by WSH and field offices. This will constitute a variety of performance measures and indicators on equipment/radiosonde and expendable performance. Examples include, performance scores, heights attained, data errors detected by NCEP and NCDC, and the number of rejected radiosondes. The Management Information Retrieval System (MIRS) will be used to collect some of this information and process it into spreadsheets, reports, and graphics. Figure 2 provides an example of these types of performance measure charts.

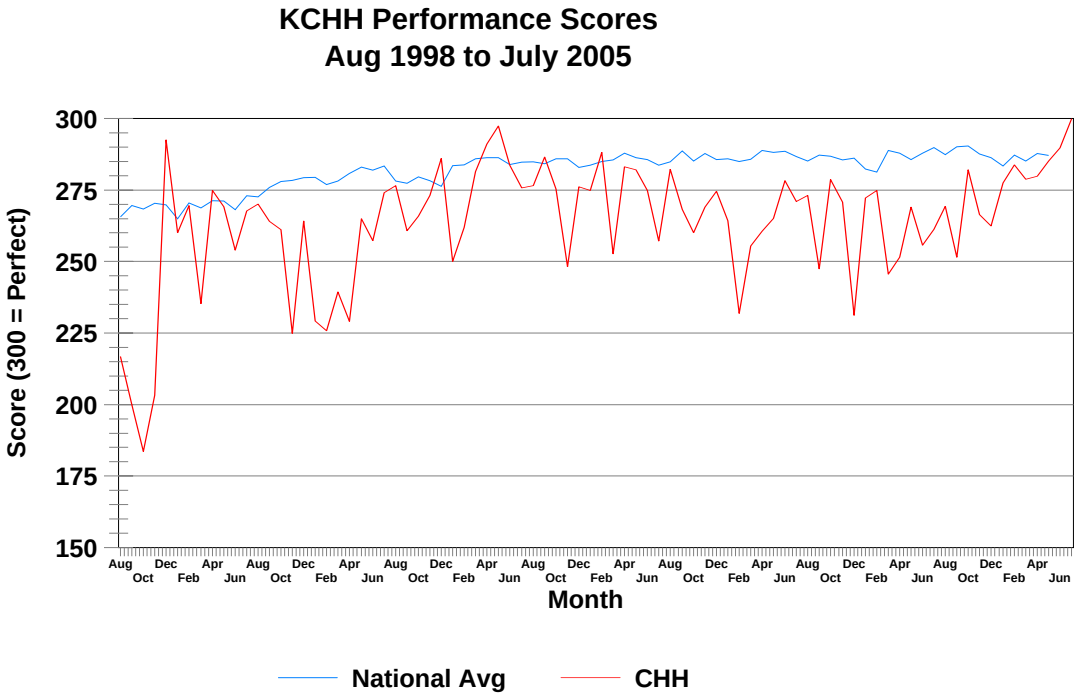

Figure 2. Performance Measure Example.

2.5 Impact on NWS Operations

The implementation of RRS also impacts NWS operations at NWS field offices and centers. The following sections describe some of these impacts.

2.5.1 Field Office Operations

A number of local AWIPS applications depend on upper air data as well as other locally - produced applications residing on office equipment. These applications are required to produce warnings and forecasts and other derived products, which are issued to NWS customers. The most widely used application on-site are plots of the upper air sounding of the temperature and dew point as a function of pressure or heights along with wind profiles. Examples of these include the Skew-T, Log-P, Stuve, and Cross-sections. A number of parameters for depicting the stability of the atmosphere are derived from upper air data including TOTAL-TOTALs, Lifted Index, CAPE, and Stability Index. These parameters assist the forecast staff with understanding the state of the atmosphere and estimate its stability for such phenomena as thunderstorms, severe weather, and heavy precipitation. The freezing level is also determined from the sounding, which is critical for winter weather forecasting and aviation purposes. The height of the tropopause and Jet Stream winds are other features derived from these soundings.

2.5.2 National Center Operations

Major NWS centers receiving and processing upper air data are the NWSTG and NCEP. The following sections describe their uses of these data.

2.5.2.1 NWSTG/NCF/NOAAPORT

Upper air products issued from RRS will be transmitted to the NWSTG via the NCF. Products arriving at the NCF are switched to NOAAPORT, automatically for distribution to NOAAPORT customers. The NWSTG switches products received from various communications paths to the Global Telecommunications System in a BUFR format for the global exchange between centers and in the "collective" format for other countries to receive and process. Coded messages are also decoded and data based at the NWSTG for issuance of the CLIMAT monthly message for NWS upper air sites within the Global Climate Observing Stations network. This message is used to produce monthly climate means for international exchange.

2.5.2.2 NCEP

NCEP use upper air data in the conduct of their mission. Upper air data are considered one of the most important data sets in the preparation of daily prognoses and analyses on the state of the atmosphere. NCEP assimilates radiosonde observations into its operational models to produce weather forecasting guidance. Examples of these are the various analysis charts, e.g., 850, 500, 100, and 20 hPa charts, freezing level charts, and the ETA model. The Tropical Prediction Center uses radiosonde soundings to help forecast the path and intensity of hurricances. The Hydrometeorological Prediction Center uses upper air data to ascertain coverage and amount of heavy precipitation and determining the intensity and duration of drought situations. The Climate Prediction Center uses upper air data for monitoring climate variability and change. Other centers use the data in research and in the development of new products.

2.5.3 Non-NWS Customers

Besides NWS, upper air data are used by a wide range of customers and require the data in both real-time and *post-facto*. As stated above, NWS uses the NWSTG and NOAAPORT to issue products in near real-time and NCDC (refer to Section 2.6) is the NOAA agency responsible for providing these products as well as higher resolution data sets post-facto to both government and non-NWS customers.

2.5.4 Satellite Calibrations

Upper air soundings are also used widely in satellite temperature and moisture retrievals. Radiosonde data are used to calibrate coincident satiellite observations. These calibrations are most important in data sparse areas such as over the oceans.

2.5.5 Notification of Users

The NWS has a responsibility to notify both government and non-NWS customers of significant changes occurring in the upper air network. At a minimum, the following events require a notification message to be issued over NWS telecommunications:

- At least 30 days before the legacy system has been decommissioned at a given site, notification messages will be issued by the site to customers about the loss of upper air observations during the downtime. A notification will be made from each site to NCDC alerting them to the transition.
- When initial RRS operations commence with the first official flight, users will be informed that the RRS is now operating in place of the legacy system.
- When RRS has been commissioned.

An example of the notice to be issued is found in Exhibit 1.

2.6 NCDC ARCHIVE

NWS is required to provide the NCDC all products issued over its telecommunications and higher resolution data sets for use by researchers and other users. NCDC also provides NWS with performance-related data for quality control purposes.

2.6.1 Service Record Retention System (SRRS)

RRS Official User Products issued over NWS telecommunications network are sent to NCDC via the FTP server within the NWSTG and also over NOAAPORT. These serve as official SRRS products for inclusion in the legal archive at NCDC. NCDC will verify each site is having their RRS Official User Products archived as part of the SRRS. Refer to Section 3.1.6 *Legal Archive* of the Site Component Commissioning Plan, July 1999, for further details on the SRRS.

2.6.2 Archive Products

In addition to the standard archive data set produced today for Micro-ART based on the Office of the Federal Coordinator for Meteorology Federal Meteorological Handbook No. 3, a high resolution 1-second dataset will also be generated and sent to NCDC, electronically. The plan is to use the BUFR format to produce this high-resolution data set of the upper air parameters. The plan is to transmit this product through an FTP protocol directly to NCDC's archival system. When transmitted to NCDC, it will provide researchers and other users of upper air data a complete summary of the data collected and flags for data inconsistencies. Of special interest will be the high resolution winds calculated from the GPS data.

Exhibit 1. Technical Information Notice Example

NOUS41 KWBC 171958
PNSWSH

TECHNICAL IMPLEMENTATION NOTICE 05-48
NATIONAL WEATHER SERVICE HEADQUARTERS WASHINGTON DC
355 PM EDT FRI JUN 17 2005

TO: FAMILY OF SERVICES /FOS/ SUBSCRIBERS...NOAA WEATHER WIRE SERVICE /NWWS/ SUBSCRIBERS...EMERGENCY MANAGERS WEATHER INFORMATION NETWORK /EMWIN/ SUBSCRIBERS... NOAAPORT SUBSCRIBERS...OTHER NATIONAL WEATHER SERVICE /NWS/ CUSTOMERS AND PARTNERS...NWS EMPLOYEES

FROM: MIKE CAMPBELL
CHIEF...OBSERVING SERVICES DIVISION
OFFICE OF CLIMATE WATER WEATHER SERVICES

SUBJECT: OPERATION ASSESSMENT TEST /OAT/ RADIOSONDE REPLACEMENT SYSTEM/RRS/ AND FLIGHT OF RECORD

ON JULY 25 2005... NWS STERLING... VIRGINIA... WILL TERMINATE UPPER AIR OBSERVATIONS USING THE RADIO DIRECTION FINDING RADIOSONDES AND TRACKING SYSTEM. THE UPPER AIR OPERATIONS WILL BE RESTORED USING THE RADIOSONDE REPLACEMENT SYSTEM WITH THE NEW GLOBAL POSITIONING SYTEM /GPS/ RADIOSONDES. THE SITE WILL BE OUT OF SERVICE UP TO TWO WEEKS. ONCE RESTORED SOME PARTS OF THE UPPER AIR CODED MESSAGES WILL BE SIGNIFICANTLY LONGER.

THE EFFECTIVE DATE OF THIS CHANGE IS SOONER THAN SPECIFIED BY NWS INSTRUCTION 10-1805. CHANGE NOTICE TIN05-34 ISSUED MAY 2 PROVIDES THE SPECIFIC CODING OF THIS CHANGE. AS A CONSEQUENCE OF THE CARIBOU TEST... NWS HAS BEEN COORDINATING WITH PARTNERS OVER THE LENGTH OF THESE MESSAGES. THE FORMAT HAS NOT CHANGED. A DELAY OF SCHEDULE WOULD BE COST PROHIBITIVE.

STARTING NO SOONER THAN THE 0000 COORDINATED UNIVERSAL TIME /UTC/ ON OR ABOUT AUGUST 1 2005... WITH THE IMPLEMENTATION OF THE RADIOSONDE REPLACEMENT SYSTEM AT STERLING... THERE WILL BE A CHANGE IN THE LENGTH OF CODED MESSAGES. THE FORMAT OF THE MESSAGES WILL BE THE SAME WMO FORMAT FOR CODED UPPER AIR MESSAGES IN USE WITH THE MICROART LEGACY SYSTEM. THE NUMBER OF LEVELS IN THE CODED MESSAGES WILL BE TWO TO THREE TIMES GREATER FOR THE TTBB AND TDD PARTS. THE NUMBER OF LEVELS IN THE TTAA... TTCC... PPBB... AND PPDD PARTS WILL BE RELATIVELY UNCHANGED. THESE CHANGES REFLECT UPDATED CODING PRACTICES AND HIGHTER RESOLUTION LEVEL SELECTION CRITERIA. THE MAXIMUM SIZE LIMITS OF THE PARTS OF THE CODED MESSAGES FOLLOW:

TTAA: 15 LEVELS
TTCC: 10 LEVELS
TTBB: 135 LEVELS
TTDD: 40 LEVELS
PPBB: 40 LEVELS
PPDD: 40 LEVELS

IN ADDITION THE 31313 MESSAGE INDICATOR ASSOCIATED WITH THE VARIOUS PARTS OF THE MESSAGE WILL BE INCLUDED WITH EACH PART OF THE THERMODYNAMIC MESSAGE PARTS. FOR ADDITIONAL INFORMATION ON THE MESSAGE REQUIREMENTS PLEASE REFERENCE THE WMO 306... MANUAL ON CODES... INTERNATIONAL CODES... VOLUME 1.1 PART A-ALPHANUMERIC CODES. AND WMO 306... MANUAL ON CODES... REGIONAL CODES AND NATIONAL CODING PRACTICES... VOLUME II. INFORMATION ON THE LEVELS SELECTION CRITERIA USED IN NWS CODING SOFTWARE AT THE FOLLOWING SITE UNDER THE NWS RADIOSONDE REPLACEMENT SYSTEM /USE LOWERCASE LETTERS/.

HTTP://WWW.UA.NWS.NOAA.GOV

IF YOU HAVE QUESTIONS OR FEEDBACK... CONTACT:

CARL BOWER
NATIONAL WEATHER SERVICE
W/OS7X2
1325 EAST WEST HIGHWAY
SILVER SPRING MARYLAND 20910
PHONE: 301-713-0722 EXT. 145
E-MAIL: CARL.BOWER@NOAA.GOV

THIS AND OTHER NWS TECHNICAL IMPLEMENTATION NOTICES ARE AVAILABLE ONLINE AT /USE LOWER CASE LETTERS/:

HTTP://WWW.NWS.NOAA.GOV/OM/NOTIF.HTM

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3 RRS DEPLOYMENT/IMPLEMENTATION STRATEGY

The deployment of RRS and the Intermet Systems (IMS) 1500C® system will occur in five distinct groups as follows:

1. Caribbean Hurricane Upper Air Stations (CHUAS)
2. First RRS units deployed to Operational Acceptance Test (OAT) sites
3. RRS deployed to non-Data Continuity Study (non-DCS) sites
4. RRS deployed to Data Continuity Study (DCS) sites
5. Wallops Island, which is a NASA site supported by NWS, and requires a 403-MHz system due to local restrictions.

3.1 CHUAS Deployments

CHUAS is the first group to be implemented with the IMS 1500C systems and this has already been completed. Since this system is considered a commercial-off-the-shelf (COTS) system, and is at non-NWS locations, it will not be commissioned.

3.2 OAT Deployments

The RRS will be deployed in a phased approach starting with WFO Sterling (LWX) and followed with the remaining upper air locations at Chanhassen, Salt Lake City, and Corpus Christi. The purpose of this test will be to validate installation of the system, evaluate system performance, and determine if any critical problems exist before full deployment commences. Separate OATs will be conducted as new types of GPS radiosondes are introduced from vendors. Since these radiosondes will be deployed on different schedules, different sites will be selected for the OAT. Each OAT site will commission their RRS at the completion of the OAT. Refer to the RRS OAT Plan for further details.

3.3 Beyond OAT

RRS will be deployed to both groups 3 and 4, above, throughout the deployment phase after OAT is completed, successfully. The current plan for RRS after OAT is to have at least one system deployed per month beginning in Fiscal Year 2005. The RRS Site Implementation Plan provides further details on the methodology to be used during the deployment process for each site as well as a facilities checklist for verifying a site's readiness for RRS. A Legacy System Decommissioning Plan and a Disposal Plan will be provided discussing the decommissioning and disposal activities for legacy systems. Upper air offices need to review these plans prior to the installation of the RRS.

3.3.1 Non-DCS Deployments

Below illustrates some of the key sequence of events during the deployment and commissioning of RRS at non-DCS upper air sites:

1. A kit including the RRS workstation with Build 1.1 or later software, the GPS repeater, etc. will be delivered to the site ahead of the rest of the RRS. Note, if RSOIS is required for the site, it will have already been installed and operating before delivery of the kit.
2. Site operations staff becomes familiar with the functions of the RRS workstation through training exercises using the on-line simulator and video. The electronics technician staff will be trained through in-residence training at the NWS Training Center (NWSTC) in Kansas City, Missouri.
3. The site staff will complete the legacy system decommissioning documentation in preparation for the removal of the system. The facilities checklist will also be completed ahead of time. In addition, the re-mapping of the LDAD modem as described in Section 1.3.3 is completed in preparation for connecting to RRS.
4. The legacy system is then removed and the remaining components of the RRS are installed and checked out. After the RRS unit is delivered and accepted, the system is configured to meet operational conditions. For example, the RRS has to be configured for local conditions, that is, station data is entered for the site. Non-synoptic and synoptic test flights are performed using test message headers to validate that the communications are operating, nominally.
5. When the tests are completed, the RRS computer will be re-initialized to now handle official upper air products, i.e., replace test message headers with the correct WMO headers. Official upper air products (e.g,, RADAT) are transmitted from the local office through the AWIPS WAN or the FAA communications network. At this point, operational staffs are able to depend on RRS for the conduct of upper air operations. Site staff members who are trained on the use of RRS will conduct their regular synoptic flights using RRS. This also marks the beginning of the commissioning process for the field site. Refer to Section 4 for further details.

3.3.2 DCS Deployments

A number of upper air sites will be participating in the DCS to develop transfer equations for transitioning between Micro-ART and RRS. These locations require MicroART to be left on top of the inflation building, while the RRS is situated on the ground in a temporary shelter. Both the RDF and GPS-type radiosondes will be flown together on the same flight train to compare temperature and relative humidity data. The DCS will take upwards of 1-year for a given site, except at locations which experience only 2 seasons, where it could be less. The commissioning of these sites will not occur, in most cases, until the DCS is over for that location; at which time, the RRS will replace the legacy system and the commissioning documentation can then be completed, see Section 4 for details.

3.4 Wallops Island (NASA)

NASA operates a 403-MHz W9000 system which cannot switch to RRS due to frequency limitations. As a result, no decision has been made concerning this site; however, in all probability, a COTS 403-MHz GPS system will be provided under some joint agreement with NASA.

4 COMMISSIONING RRS

Commissioning means RRS meets a predetermined standard level of operation at an individual upper air site. Commissioning is an established process within the NWS to determine if the RRS meets a set of evaluation criteria, which then places the system into full operation as an adjunct to AWIPS. These criteria are established in NDS 80-2 and 80-201. Appendix III-B delineates the criteria RRS must meet before it can become commissioned.

4.1 RRS Commissioning Process

The general commissioning process consists of the following four major phases:

1. Pre-commissioning Phase
2. Evaluation Phase
3. Recommendation/Approval Phase

4.1.1 Pre-commissioning Phase

The *Pre-commissioning Phase* is the period of time prior to the commissioning of the initial systems, during which the system is being installed and checked out in preparation for full use by the field. The intent of this phase is to focus attention on those aspects of the system requiring corrective actions before the first systems can be commissioned. The following items are the principal NWS RRS pre-commissioning activities, i.e., the determinants in the decision by the NWS to begin commissioning RRS:

1. The radiosonde thermodynamic and wind data are accurate and in compliance with the NWS radiosonde specifications.
2. Successful System Test and OAT on Build 1.1 supporting the site component commissioning, including interfaces to all telecommunications required for the successful transmission of upper air products.
3. Successful Demonstration of the NOAAPORT and NWSTG transmission of upper air products to external and internal users.
4. User Education - The user community (external users as well as users within the NWS) will be educated by WSH with regard to changes related to the introduction of RRS.

5. Product Availability Criterion - The NWS has an availability requirement of 98.5% and less than 1-minute for RRS products to reach the NCF, and a return to the field AWIPS of 5 minutes or less. For commissioning purposes, this availability/timeliness is measured based on the frequency with which upper air products are generated. The time period is a minimum of 30-days from the beginning of the commissioning process with extension required if these criteria are not met in the minimum period. The RRS will be evaluated during System Test Phase II to verify these criteria are being met.
6. Archive - The ability of sites to reliably archive data for legal and data retention purposes as well as the NCDC's ability to read that data will be demonstrated before beginning commissioning.
7. Policies, Plans, and Handbooks - Relevant policies, plans, and handbooks will be updated to incorporate changes related to the implementation of the RRS and then finalized.
8. Technical Manuals - The contractor-supplied technical manuals and others produced by the government will be of sufficient quality before commissioning begins and posted in final to the Engineering website or provided to the site.
9. Successful completion of the Physical Configuration Audit and the Functional Configuration Audit.
10. The Government acceptance of RRS installation is a prerequisite to the initiation of the commissioning process. The *Commissioning Evaluation Criteria* (Appendix III-B to this Addendum) requires the existence of a signed Facilities DD Form 250 accepting the RRS. For the purpose of initiating an RRS commissioning process, its acceptance must be complete, that is, all critical open items must have been satisfactorily resolved.

4.1.2 Evaluation Phase

Once NWS decides sufficient progress has been made, the next phase of the process commences, namely, the *Evaluation Phase*. During this process, an Evaluation Official (EO) at the local office evaluates the performance of the system components and the operational, maintenance, and system administration personnel's readiness to use and support RRS in routine operations. As part of the commissioning process, the system is evaluated using the evaluation criteria in Appendix III-B to demonstrate it meets the following major criteria:

- RRS can be used in the operational setting by the WFO and other customers for the preparation of upper air products.
- RRS can reliably transmit weather products over the appropriate telecommunications, using the WMO header format.
- RRS can archive the results of the upper air sounding and have them transmitted to the NCDC, reliably.

4.1.2.1 Determination of Operational Readiness (DOR)

With activation of the RRS and completion of the familiarization activities, the DOR period begins. DOR is the time when the RRS is utilized by the Government for the purpose of evaluating site components in accordance with prescribed RRS commissioning evaluation criteria specified in this addendum. Completion of the DOR period occurs when the EO submits the *RRS Site Component Commissioning Report* to the appropriate office/center management for approval.

The DOR period consists of three parts:

a. Familiarization and Proficiency Training

b. Operational Evaluation of RRS

c. Preparation of the *RRS Site Component Commissioning Report*.

During the DOR, the RRS is operated in an *operational mode* and RRS products distributed over the appropriate telecommunications to NWS customers.

4.1.2.2 Commissioning Evaluation Categories

Each of the commissioning evaluation areas constitute the headers for the specific criteria established in the *RRS Site Component Commissioning Evaluation Criteria,* Appendix III-B.

4.1.2.3 Work-arounds and Commissioning Notes

When commissioning criteria cannot be satisfied, and a component from a legacy system is still required to remain, a "work-around" must be invoked. A work-around is a temporary solution requiring a portion of the legacy system to remain in operation or requiring a temporary procedure due to a critical limitation of the new technology's functionality. Note, since MicroART must be removed, in almost all cases, before RRS can be installed, no work-arounds based on this definition will be invoked.

When commissioning criteria/elements are not being satisfied, the only path will be to suspend commissioning for the site, or if the problem is too great, a general halt is applied to all sites under commissioning evaluation. An example of this might be if too many upper air observations were missed due to a technical problem unforeseen during previous testing.

4.1.2.3.1 Commissioning Notes

Commissioning notes, unlike work-arounds, document temporary solutions as something still utilizing the new technology, which may affect the system baseline, but does not depend on a legacy system to remain. The temporary solution becomes part of the baseline configuration until the new technology has been upgraded to perform a similar function. An example of a commissioning note may be a piece of RRS software that is not functioning properly, is not critical to the operation of RRS, and can be handled through an operator procedure to not invoke this function. The note would mention the reason why the functionality is required and some expectation as to when it might be removed, i.e., another software load.

4.1.2.4 Completing the Evaluation

Each criterion is evaluated throughout the DOR and assessed as to whether it meets the criteria or whether a deficiency exists. Any deficiencies encountered during the evaluation phase are addressed through action coordinated at the local and regional levels, and possibly at the NWSH level. After the evaluation is completed (any deficiency having been resolved or addressed via an approved commissioning note), the RRS commissioning documentation and instructions (Appendix III-C) is used to record the results of the evaluation. **Official** use of RRS in the conduct of appropriate NWS service operations begins during the commissioning evaluation phase and continues through the day of commissioning. The system is not ready for commissioning until all the criteria have been satisfied in one form or another.

4.1.3 Recommendation and Approval Phase

The completed *Checklist* is then incorporated, by the EO, into an ***RRS Site Component Commissioning Report*** (Appendix IIII-C) and sent to the appropriate office/center management[1] for review and recommendation. This begins the *Recommendation and Approval Phase*. This is followed by regional and national-level reviews and recommendations. These recommendations to commission the RRS are sent to the Regional Director, for approval.

4.1.4 Implementation Phase

When the report has been approved at all appropriate levels, the approved commissioning is implemented with a notification to users from the local office responsible for the upper air observation. Notification to external users, describing the changes taking place upon commissioning, precedes the actual date.

4.2 System Commissioning

When the last of the RRSs have been commissioned, this will complete the network level, meaning all RRSs are now part of the NWS upper air network. Note some legacy systems may remain in the network due to funding shortfalls, or in the case of Wallops Island, no available 1680-MHz allowed at that locat

[1] Office management refers to the meteorologist-in-charge (MIC) or other designated official.