



DOCUMENT 384-09

**GUIDELINES FOR ORGANIZING RCC INTERCOMPARISONS OF  
RADIOSONDES**

**WHITE SANDS MISSILE RANGE  
REAGAN TEST SITE  
YUMA PROVING GROUND  
DUGWAY PROVING GROUND  
ABERDEEN TEST CENTER  
NATIONAL TRAINING CENTER  
ELECTRONIC PROVING GROUND  
HIGH ENERGY SYSTEMS TEST FACILITY**

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NAVAL AIR WARFARE CENTER WEAPONS DIVISION, CHINA LAKE  
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, PATUXENT RIVER  
NAVAL UNDERSEA WARFARE CENTER DIVISION, NEWPORT  
PACIFIC MISSILE RANGE FACILITY  
NAVAL UNDERSEA WARFARE CENTER DIVISION, KEYPORT**

**30TH SPACE WING  
45TH SPACE WING  
AIR FORCE FLIGHT TEST CENTER  
AIR ARMAMENT CENTER  
ARNOLD ENGINEERING DEVELOPMENT CENTER  
BARRY M. GOLDWATER RANGE**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)**

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RADIOSONDES**

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## TABLE OF CONTENTS

PREFACE.....	v
ACRONYMS.....	vii
<b>CHAPTER 1: INTRODUCTION.....</b>	<b>1-1</b>
1.1 Overview and Assumptions .....	1-1
1.2 Defining the Objectives of an Intercomparison .....	1-1
<b>CHAPTER 2: SPECIFIC ACTIONS FOR INTERCOMPARISONS.....</b>	<b>2-1</b>
2.1 Pre-planning by the Host Facility and Organizational Committee (OC).....	2-1
2.2 Participation .....	2-1
2.3 Responsibilities .....	2-2
2.4 Rules During the Intercomparison .....	2-3
2.5 Data Acquisition .....	2-3
<b>CHAPTER 3: CONCLUSIONS AND FINAL REPORT OF INTERCOMPARISONS 3-1</b>	
3.1 Data Processing and Analysis .....	3-1
3.2 Final Report of the Intercomparison .....	3-1

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## PREFACE

This document presents the results of work performed by the Meteorology Group (MG) of the Range Commanders Council (RCC) under Task MG-21. This document is aimed at providing clear and effective guidance on the methodology to use for radiosonde comparisons between ranges. The scope and specific objectives of the task were to review and compare the current guidance with existing World Meteorological Organization (WMO) or American Society for Testing and Materials (ASTM) standards as these standards may replace the current standard. The review was also aimed at resolving issues with the Reagan Test Site (RTS) and radiosonde intercomparisons between test ranges.

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## ACRONYMS

AFFTC	Air Force Flight Test Center
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
MG	Meteorological Group
NASA	National Aeronautics and Space Administration
OC	Organizing Committee
OSS	Operations Support Squadron
OSW	Operations Support Wing
PL	Project Leader
POC	Point of Contact
PM	Project Manager
RCC	Range Commanders Council
RTS	Reagan Test Site
U.S.	United States
WMO	World Meteorological Organization

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Overview and Assumptions

These guidelines assume the procedures that may be established by various test facilities are consistent with procedures established by other national and international organizations. The guidelines assume that an Organizing Committee (OC) will be formed of participants (members) interested in comparing radiosondes and at least one non-participant with the ability to provide guidance for conducting the intercomparison will be included. The involvement of an independent non-participant is important in order to avoid bias during the planning of the intercomparison. Consideration must also be given to whether radiosonde manufacturers' personnel should actively participate or whether independent operational personnel of the host (site where test is performed) should prepare and fly such radiosondes.

1.1.1 Intercomparisons Differ. All intercomparisons differ from each other to some extent. Therefore, these guidelines are to be construed only as a generalized checklist of tasks needing to be accomplished. Modifications should be made by the OC as required, but the validity of the results and scientific evaluation should not be compromised.

1.1.2 Value of Previous Intercomparisons. The final reports of previous intercomparisons and organizational meetings may serve as examples of the methods that can be adopted for the intercomparison. These previous reports should be maintained and made available as needed.

#### 1.2 Defining the Objectives of an Intercomparison

The OC is tasked to examine the achievements to be expected from the radiosonde intercomparison and to anticipate and identify potential problems. The OC's role includes providing guidance, preparing clear and detailed statements of the main objectives, and achieving agreement on the criteria to be used in evaluating the results. The OC should also use the knowledge and accumulated experience gained from previous intercomparisons to clearly define the objectives, list the expected results of the intercomparisons, and to identify how the results will be disseminated.

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## CHAPTER 2

### SPECIFIC ACTIONS FOR INTERCOMPARISONS

#### 2.1 Pre-planning by the Host Facility and Organizational Committee (OC)

The host facility and the OC personnel should perform advance planning as shown below.

2.1.1 Host Facility Project Leader (PL). The host facility should take the following actions.

- a. Identify a Project Leader (PL) who will be responsible for the day-to-day operation and act as the facility point of contact (POC).
- b. Provide the OC and the participants with a description of the proposed intercomparison site and facility (locations, etc.), environmental conditions, climatological conditions, and site topography.

2.1.2 OC Site Visit. The OC should visit the proposed site to determine the suitability of facilities and to propose changes as necessary.

2.1.3 Site and Environmental Description from the PL. After the OC agrees that the site and facilities are adequate, the PL should prepare a site and environmental description and distribute this information to the participants.

The PL, who is familiar with his facility's schedule, must decide the start date and duration of the intercomparison. A copy of this schedule should be delivered to the OC.

2.1.4 Start Date. In addition to the starting date of the intercomparison, the PL should propose a date when his facility will be available for the installation of the participants' equipment and he should then arrange for connections to the data acquisition system. Time should be allowed for all of the participants to check and test equipment prior to starting the intercomparison. Additional time should also be allowed for the operators to become familiar with the procedures of the host facility.

#### 2.2 Participation

2.2.1 Invitations from PL and OC. As required, the PL and/or OC should invite participation of members. However, once participants are identified, the PL should handle all further contact.

2.2.2 Participant Questionnaire. The PL should prepare a detailed questionnaire to be sent by the Meteorology Group (MG) Chairman to each participant in order to obtain information on each proposed type of instrument to be compared. The participants are expected to identify physical space requirements for their equipment as well as other special requirements. Examples of special requirements include those relating to communication equipment, unique

hardware hookups, and software characteristics. Participants should also provide adequate documentation describing their ground and balloon-borne instrumentation.

2.2.3 Radiosonde Calibration Procedures Versus Standards. It is important that participants provide information about their radiosonde calibration procedures against recognized standards. Although it is expected that operational radiosondes will be intercompared, this may not always be the case. New or research-type radiosondes may be considered for participation (with the agreement of all participants, the PL, and the OC).

## 2.3 Responsibilities

### 2.3.1 Participants.

- a. The participants shall be responsible for the transportation of their own equipment and costs associated with this transportation.
- b. The participants should install and remove their own equipment with the cognizance of the PL. The host facility shall assist with unpacking and packing of equipment, as appropriate.
- c. The participants shall provide all necessary accessories, mounting hardware for ground equipment, signal and power cables, spare parts, and expendables unique to their system. The participants shall have available (in the event assistance from the host facility becomes necessary) detailed instructions and manuals needed for equipment installation, operation, maintenance, and, if applicable, calibration.

### 2.3.2 Host Facility.

- a. The host facility should assist participants in the unpacking and installation of equipment as necessary and also provide storage capability to house expendables, spare parts, manuals, etc.
- b. The host should provide auxiliary equipment as necessary (if available).
- c. The host should assist the participants with connections to the host facility's data acquisition equipment, as necessary.
- d. The host shall insure that all legal obligations relating to upper-air measurements are properly met. The legal obligations relate to the host site aviation regulations, Federal Aviation Administration (FAA) regulation in the United States (U.S.), frequency utilization, etc.
- e. The host facility may provide information on accommodations, local transportation, daily logistics support, etc. However, the host is not obligated to subsidize costs associated with personnel accommodations.

### 2.3.3 Project Lead (PL).

- a. Equipment Log. The PL shall maintain an equipment log of the performance of all equipment in the intercomparison. This log should chronicle everything that may have an effect on the intercomparison, including host equipment, participant equipment, and events disturbing to the conduct of the intercomparison.
- b. Balloon Launch Log. The PL shall maintain a record log of each balloon launch to identify information such as the radiosonde types participating in each flight, balloon release information such as release time, surface observation information, instrument serial numbers, burst height, reason for flight termination, other weather information, and frequencies.

## 2.4 **Rules During the Intercomparison**

The PL shall exercise control of all tests and the following rules will apply.

- a. Changes in equipment or software will be permitted with the cognizance and concurrence of the PL. Notification to the other participants is necessary.
- b. Minor repairs such as fuse replacement and other actions that do not affect instrumentation performance are allowed. The PL should be made aware of these minor repairs and enter the information into the record log.
- c. Calibration checks and equipment servicing by participants requiring a specialist or specific equipment will be permitted after notification to the PL.
- d. Any problem compromising the intercomparison results or the performance of equipment shall be addressed by the PL.

## 2.5 **Data Acquisition**

The following are the guidelines governing data acquisitions.

- a. The PL, in consultation with the OC, shall prepare a site exposure layout.
- b. The PL should make an effort to include a reference instrument traceable to a recognized standard. If none exists, a method should be agreed upon to determine a comparison reference. The reference could be one or more instruments which are acceptable to the participants.
- c. Emphasis on the meteorological variables that are to be measured must be decided as to their importance in the success of the intercomparison, to include temperature, relative humidity, etc.
- d. The PL is responsible for providing final data to all participants. Therefore, the host facility must be able to receive all individual data files from each participant.

- e. All data acquisition hardware and software provided by the host facility should be well tested before commencement of the intercomparison.
- f. The OC should agree on appropriate data acquisition procedures such as measurement frequency, sampling intervals, data averaging, data reduction, data formats, real-time quality control, post-analysis quality control, and data reports. Note: Data reduction may be limited to the individual participant's capability.
- g. The PL is responsible for checking data prior to analysis, the quality control steps that are followed, and delivery of the final data.
- h. The time delay between observation and delivery of data to the PL shall be established by the PL and agreed to by the participants. A time delay of one hour following the observation (balloon burst) is normally considered adequate.
- i. After taking into consideration the capability of the host facility, the PL decides which data storage media shall be used. The media used to return final test data to participants may vary in accordance with each participant's computer capability. Direct comparisons against a reference instrument(s) shall be included in all data products when possible.



## CHAPTER 3

### CONCLUSIONS AND FINAL REPORT OF INTERCOMPARISONS

#### 3.1 Data Processing and Analysis

##### 3.1.1 Processing and Database Availability.

- a. All essential meteorological and environmental data shall be stored in a database for further use and analysis by the participants. The PL shall control these data.
- b. The PL, in collaboration with the participants, shall propose common data formats which should be reviewed by the OC prior to approval.
- c. The participants should agree upon near real-time quality control checks and validation monitoring. The PL is responsible for performing these actions.
- d. After completion of the intercomparison, the PL shall provide a complete set of all of the data to each participant.

3.1.2 Analysis Framework. A framework for data analysis should be encouraged and decided upon prior to beginning the intercomparison. This framework should be included as part of the experimental plan.

- a. The participants must agree on methods of data conversion, calibration and correction algorithms, terms and abbreviations, constants, and a comprehensive description of proposed statistical analysis methods.
- b. The OC should verify the appropriateness of the analysis procedures selected.
- c. The OC should review the results of the intercomparisons and consider the contents and recommendations given in the final report.

#### 3.2 Final Report of the Intercomparison

Preparation of the summary documentation will be accomplished as described below.

- a. The PL shall prepare the draft report and coordinate it with the OC and participating members for comment. A time limit for reply should be specified.
- b. After comments are returned, the PL will make appropriate changes and prepare the report for final coordination and approval by the OC. Inputs of significance from step 3.2a above should be shared with the OC.

- c. The OC may call a meeting for discussions, if necessary, in order to discuss any unresolved differences. The PL retains final approval authority in those cases.
- d. After approval of the final document, the PL will publish the report and distribute it to the OC and all participants.