

# NOAA Hydrometeorology Testbed Charter and Terms of Reference

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# WEATHER & CLIMATE



*"The air moves like a river  
and carries the clouds with it." DA VINCI*

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## Mission and Vision Statement

NOAA's Hydrometeorology Testbed (HMT) conducts research on precipitation and weather conditions that can lead to flooding, and fosters transition of scientific advances and new tools into forecasting operations. HMT's outputs support efforts to balance water resource demands and flood control in a changing climate. HMT aims to:

- accelerate the development and prototyping of advanced hydrometeorological observations, models, and physical process understanding,
- foster infusion of these advances into operations of the National Weather Service (NWS) and the National Water Center (NWC), and
- support the broader needs for 21st Century precipitation information for flood control, water management, and other applications.

## National Context

HMT has been developed to respond to the increased criticality of water to our nation's well-being. Severe weather events such as hurricanes, intense rainstorms, and subsequent flooding and/or flash flooding, droughts, and concerns with the impacts of climate change have led to a number of initiatives directed to improving our capacity for observing, forecasting, and warning of these phenomena. The importance of these issues is highlighted in the 2010 National Research Council report [When Weather Matters](#) (The National Academies Press, 181 pp.).

To accomplish these goals, a priority is being placed on the design and development of integrated mesoscale observing networks and operational forecasting systems focused on regional needs. HMT is comprised of regional projects called "testbeds" and local projects known as mini-testbeds (see Fig. 1). Deployment of a regionally-oriented testbed approach was a primary recommendation of a U.S. Weather Research Program workshop report [Multifunctional Mesoscale Observing Networks](#) (Bull. Amer. Meteorol. Soc., vol. 86, pp. 961-982, July, 2005), and was also highlighted in the 2009 National Research Council report [Observing Weather and Climate from the Ground Up](#) (The National Academies Press, 234 pp.).

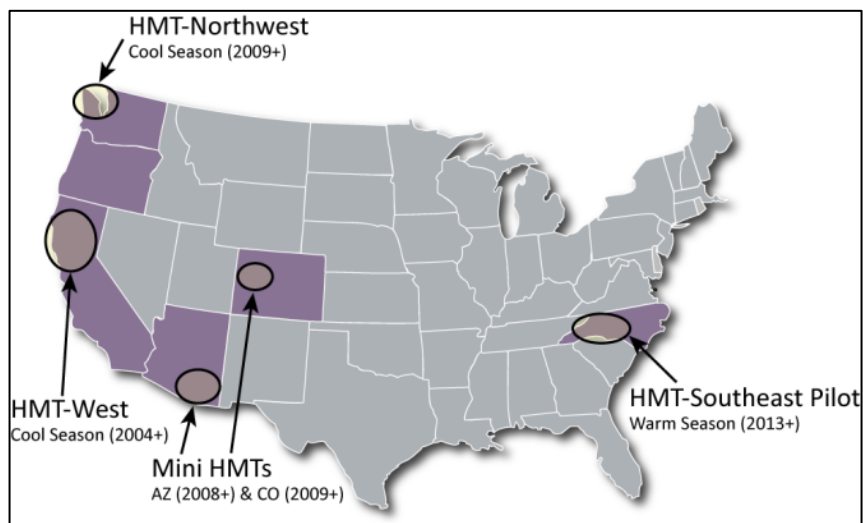


Figure 1: Location of HMT regional demonstration and mini- testbeds

## NOAA Context

HMT is aligned under:

- **Climate Adaptation and Mitigation Goal** – *An informed society anticipating and responding to climate and its impacts*
  - Improved scientific understanding of the changing climate system and its impacts
- **Weather-Ready Nation Goal** - *Society is prepared for and responds to weather-related events*
  - Reduced loss of life, property, and disruption from high-impact events
  - Improved freshwater resource management

of the [NOAA Next Generation Strategic Plan](#). HMT activities address the NOAA Administrator’s Annual Guidance Memorandum priority to:

*“Define the future of NOAA’s weather and water services: As science and technology evolve, we must develop a new vision of weather and water service delivery for the future and build the scientific, technological, and organizational capacity required to achieve that vision.”*

NOAA leads the Integrated Water Resources Science and Services ([IWRSS](#)) consortium, a multi-agency effort on collaborative science, services and tools to support integrated and adaptive water resources management. IWRSS is being implemented through an innovative federal consortium that will engage the public through in-region stakeholder participation and develop products disseminated through a single portal of water information. NOAA’s NWS is planning a National Water Center ([NWC](#)) to support and implement IWRSS. HMT’s research, development, and prototyping on hydrologic forcings are aimed at supporting the IWRSS and NWC enterprise. Furthermore, HMT’s regionally deployed observing networks can support and/or serve as a framework for IWRSS regional pilot studies. HMT is also directly linked to a number of NWS Weather Forecast Offices (WFOs).

## Regional Context

In addition to NOAA partners, HMT works with a number of stakeholders to address regional water management concerns, which range from supply to urban drainage/storm water runoff issues. In HMT-West (Fig. 1), regional stakeholders include the California Department of Water Resources (<http://www.water.ca.gov/>), the Sonoma County Water Agency (<http://www.scwa.ca.gov/>), the San Francisco Public Utilities Commission (<http://www.sfwater.org/>), and the Seattle Public Utilities (<http://www.seattle.gov/util/>). Engagement with regional stakeholders allows for improved situational awareness of local water management issues and provides an additional pathway to develop observing systems, models, and forecasts that can complement traditional NWS tools.

## Core Competencies

HMT brings the following core competencies to bear on the execution of its mission:

- Development of state-of-the art observing systems
- Deployment and maintenance of regional observing networks
- Execution of focused observational programs
- Identification and analysis of critical water cycle processes
- Improving the representation of key physical processes in numerical models

- Development of diagnostic, predictive, and decision support tools to advance water science and applications
- Building critical connections linking science, stakeholders, and NOAA services

## Products and Services

HMT provides a wide array of products and services, including:

- Advances in observing system technologies
- Regional observational data
- Fundamental scientific studies published in peer reviewed journals
- Improved hydrometeorologic and hydrologic models
- New forecast and decision support tools
- Rapid response observing, analysis, and decision support capability
- Link to stakeholder networks and stakeholder engagement on water management issues
- “Honest broker” advice to external community on wide array of regional water cycle issues

## Partners and Stakeholders

HMT engages a wide variety of partners and stakeholders. Current examples include:

### NOAA Research

- ESRL/Global Systems Division
- ESRL/Physical Sciences Division
- National Integrated Drought Information System
- National Severe Storms Laboratory

### NOAA NESDIS

- Center for Satellite Applications & Research

### NOAA Regional Climate Centers

- Western Regional Climate Center

### NOAA NWS

- California Nevada River Forecast Center
- Collaborative Science Technology and Applied Research Program
- Colorado Basin River Forecast Center
- Eastern Region Headquarters
- Eureka, CA WFO
- Hydrometeorological Prediction Center
- Los Angeles/Oxnard, CA WFO
- San Francisco Bay Area/Monterey, CA WFO
- National Operational Hydrologic Remote Sensing Center
- NCEP Environmental Modeling Center
- Office of Hydrologic Development
- Raleigh, NC WFO
- Reno, NV WFO
- Sacramento, CA WFO
- Seattle, WA WFO

- Southeast River Forecast Center
- Southern Region HQ
- Western Region HQ

#### **Other Federal Agencies**

- U.S. Army Corps of Engineers
- U.S. Geological Survey

#### **State Agencies**

- California Department of Water Resources
- Renaissance Computing Institute

#### **Local Agencies**

- Sacramento Regional Flood Control Agency
- Sonoma County Water Agency
- San Francisco Public Utilities Commission
- Seattle Public Utilities

#### **Academic Institutions**

- Developmental Testbed Center
- Colorado State University
- University of Colorado
- University of Washington
- Scripps Institution of Oceanography

#### **Related Organizations**

- California Energy Commission (CalWater)

More details related to the mission, vision, context, core competencies, products and services, and partners and stakeholders can be found in the HMT Strategic Plan and HMT Implementation Plan (see below).

## **Program Structure**

### **Guidance and Reporting Documents**

The HMT Program is codified in 6 primary documents:

- **HMT Charter and Terms of Reference:** The Charter and Terms of Reference provide the context for the HMT program and outline its operating procedures. It serves as the “operating manual” for the program.
- **HMT Strategic Plan:** The Strategic Plan identifies the drivers of the HMT Program, its long-term strategic objectives, and outlines a broad approach for reaching those objectives. The plan has a rolling 5 year horizon.
- **HMT Implementation Plan:** The Implementation Plan outlines the specific short-term tasks required to meet long-term strategic objectives. The plan has a rolling 5 year horizon.
- **HMT Annual Operating Plan:** The Annual Operating Plan is derived from the Implementation Plan and identifies short-term (annual) tasks required to reach fiscal year goals. The plan also highlights specific fiscal year constraints that impact the program.

- **HMT Annual Summary Report:** The Annual Program Summary provides an overview of fiscal year accomplishments. It also identifies obstacles and concerns, and identifies required program adjustments.
- **HMT Program Assessment Report:** Prepared annually, this report assesses the state of the program in four areas: progress toward transitioning HMT science and technology advances into applications/operations, progress toward meeting HMT Demonstration GPRAs, alignment of current HMT scientific priorities with stakeholder needs, and efficacy of HMT organization and procedures. It also suggests adjustments if required. The combination of the Operating Plan, Summary Report, and Assessment Report provides a coherent summary of annual program activities, concerns, and adjustments.

## Organization Chart

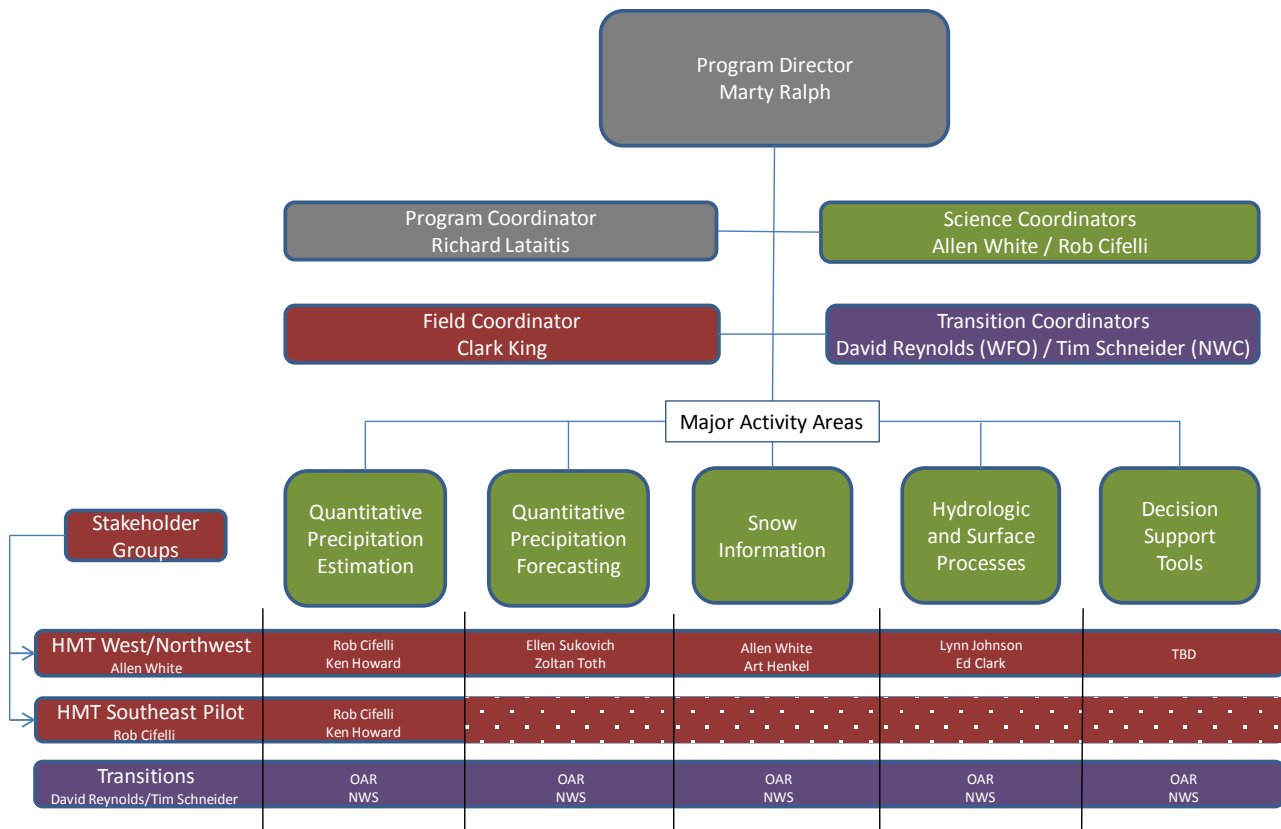


Figure 2. Organizational structure of the HMT Program. The dotted cells represent areas of future activity.

## Functional Roles and Responsibilities

The HMT Program is led by the Water Cycle Branch of the Physical Sciences Division within the Earth System Research Laboratory. The current **Program Director** is the Chief of the Water Cycle Branch. The Program Director is fully responsible for the direction, execution, and financial support for the program.

HMT is supported by four Infrastructure Support Functions:

- **Program Coordination:** Ensure effective management, planning, coordination, and execution of HMT objectives



- **Field Coordination:** Deploy observing systems and networks and execute comprehensive field studies
- **Science Coordination:** Ensure effective coordination of science activities across the five Major Activity Areas (MAAs) and two regional foci
- **Transition Coordination:** Coordinate the effective transition of HMT science and technology advances to applications/operations

that span five primary HMT Major Activity Areas (MAAs):

- **Quantitative Precipitation Estimation (QOE):** Improve QPE estimates derived from radar
- **Quantitative Precipitation Forecasting (QPF):** Improve QPF through advanced observations and model enhancements
- **Snow Information (SI):** Improve snow level and snow information derived from radar and surface observations
- **Hydrologic and Surface Processes (HASP):** Provide hydrologic evaluation of advanced observations of rain, snow, hail, temperature, and soil moisture
- **Decision Support Tools (DST):** Develop and apply decision support tools to improve extreme precipitation and flash flood response

MAA activities are integrated across two current regional foci, with an emphasis on transition to operations in each region:

- **HMT West/Northwest:** With a focus on severe west coast storms (atmospheric rivers) and extreme precipitation in California and the Pacific Northwest
- **HMT Southeast:** With a focus on severe east coast storms (including hurricanes) in North Carolina and the Atlantic Southeast
- **Transitions:** Ensure HMT advances are efficiently transitioned into regional applications/operations.

**Stakeholder Groups** provide advice on regional needs and priorities.

## Individual Roles and Responsibilities

### Program Director:

- Provides leadership to and is fully responsible for the direction and execution of the program
- Is responsible for the financial health of the program, and works with NOAA and external sponsors to maintain and attract funding
- Serves as primary spokesman for the program
- Interacts with NOAA executives, regional leaders, and key stakeholders to ensure the program is aligned with national, NOAA, and regional priorities
- Seeks guidance and input from various sources, but holds ultimate decision making authority for the program
- Represents the program to Congressional leaders and staffers as needed

### Program Coordinator:

- Works with the Program Director to coordinate program activities
- Develops and maintains HMT guidance and reporting documents
- Ensures completion of identified action items
- Provides candid advice to Program Director on HMT coordination and execution strategy

### Field Coordinator:

- Responsible for the deployment, operation, and maintenance of HMT systems and networks

- Provides candid advice to Program Director on HMT field operations

**Science Coordinators:**

- Work with the Program Director to ensure proper alignment and efficient execution of HMT science priorities
- Represent and serve as spokesmen for the program as assigned by Program Director
- Provide candid advice to Program Director on the scientific direction of program

**Transition Coordinators:**

- Provide guidance to program on transition opportunities
- Establish R2O linkages and enable transitions as needed
- Track and ensure timely execution of all identified HMT transition activities
- Provide candid advice to Program Director on transition opportunities and activities

**Major Activity Area Co-Leads:**

- Develop and maintain 5-yr MAA Implementation Plan
- Identify Annual Operating Plan (AOP) objectives and associated tasks
- Ensure effective completion of AOP tasks
- Provide quarterly updates to Program Director
- Develop Annual Summary Report of MAA activities

**Regional Leads:**

- Engage regional stakeholders through annual meetings
- Ensure effective alignment of MAA objectives and regional priorities

## Program Execution

The HMT Program is executed through five governance groups which meet regularly to plan, coordinate, execute, and evaluate HMT activities. The members in each group and its function, and the program meeting schedule and purpose, are highlighted below.

## Governance Structure

**Program Management Team:** Primary leadership/management team for the program

- Program Director
- Program Coordinator
- Field Coordinator
- Science Coordinators
- Transition Coordinators

**Program Coordination Team:** Ensures coordination across all program activities

- Program Director
- Program Coordinator

**Science Management Group Team:** Provides scientific leadership to the program

- Program Director
- Science Coordinators
- Transition Coordinators

**Science Execution Team:** Ensures effective execution of HMT science tasks

- QPE Co-Leads
- QPF Co-Leads

- SI Co-Leads
- HASP Co-Leads
- DST Co-Leads

**Regional Implementation Team:** Ensures HMT objectives are aligned with regional priorities and HMT science and technology advances are effectively transitioned to applications/operations

- Regional Leads
- Regional MAA Co-Leads
- Transition Coordinators

**External Stakeholder Group:** Provides external stakeholder advice to Regional Implementation Team

- Various regional stakeholders as solicited by Regional Implementation Team

## Meeting Schedule and Purpose

Program Meeting Schedule		
Frequency	Purpose	Primary Participants
Day-to-Day	Program Coordination	Program Coordination Team
Weekly	Program Management	Program Management Team
Quarterly	MAA Reporting, Evaluation, and Planning	Science Management Team Science Execution Team
Annually	Program Reporting, Evaluation, and Planning	Program Management Team Science Execution Team
Annually	Stakeholder Coordination and Feedback	Regional Implementation Team Science Execution Team External Stakeholder Team

The **Program Coordination Team** meets informally as often as needed to ensure the program is running smoothly and all identified actions items are being addressed. The meeting can be called by either the Program Director or Program Coordinator. The duration is typically much less than one hour.

The **Program Management Team** holds regularly scheduled weekly meetings, but often meets less often due to member conflicts. The intent is to meet at least bi-weekly. The group addresses all issues facing the program, and provides advice to the Program Director regarding pending decisions. The meeting is convened by the Program Coordinator, who solicits agenda items prior to the meeting. The duration is generally limited to one hour.

The **Science Management Team** meets quarterly with the individual MAA Co-Leads to review progress in specific Major Activity Areas. MAA Co-Leads submit a progress report in the form of a quad chart that includes the following information:

- Overview of annual tasks
- Timeline for completing tasks
- Progress towards accomplishing quarterly tasks
- Obstacles and concerns

This information is reviewed and adjustments made as needed. The Program Director convenes the quarterly meetings. The meeting duration is generally limited to two hours.

The **Annual HMT Management Meeting** is typically held in the fall of each year. It includes the Program Management Team, Science Execution Team, and selected key individuals as approved by the Program Management Team. The purpose of the meeting is to:

- Provide a venue for a face-to-face gathering of the full **HMT Team**
- Review the State of the Program as presented by the Program Director
- Review the evolving HMT program structure, and associated documentation and procedures
- Review prior fiscal year accomplishments
- Plan for current fiscal year activities
- Enable team and key individual feedback on science, organizational, and procedural issues

The primary deliverables are:

- Prior year Annual Summary Report
  - Summarizes primary accomplishments and impacts
  - Identifies shortfalls and tasks to be carried forward or discontinued
  - Identifies obstacles and required adjustments
  - Includes HMT Team and key individual recommendations
- Current year Annual Operating Plan
  - Identifies primary activities from MAA Implementation Plans
  - Proposes program adjustments given prior year concerns
  - Identifies potential risks and obstacles
  - Evaluates proposed resources and distribution
  - Identifies specific tasks-milestones-deliverables
  - Includes HMT Team and key individual recommendations
- Action item list of required program adjustments

The meeting is convened by the Program Director. The duration is typically 1-2 days.

An **Annual HMT Stakeholder Meeting** is typically held in the spring of each year for each regional focus. It includes the Regional Implementation Team, External Stakeholder Group, and selected key individuals as approved by the Program Management Team. The purpose of the meeting is to engage stakeholders in a discussion of regional priorities, ensure that the HMT Program is aligned with those priorities, and to identify a way forward for the transition of key HMT science and technology advances into regional applications/operations. The deliverable is a report summarizing the proceedings and action items needed to address regional concerns. The meeting duration is typically 1 day.

## Program Assessment

The Program Management Team will devote one of its weekly meetings shortly after the HMT Annual Management Meeting to assess the state of the program in four areas:

- Progress toward transitioning HMT science and technology advances into applications/operations
- Progress toward meeting HMT Demonstration GPRAs
- Alignment of current HMT scientific priorities with stakeholder needs
- Efficacy of HMT organization and procedures

The deliverable will be a Program Assessment Report with recommendations for adjustments as needed. These adjustments will be implemented in the current year Annual Operating Plan. The

combination of the prior year Operating Plan, Summary Report, and Assessment Report provides a coherent summary of annual program activities, accomplishments, concerns, and adjustments.