

CROHMS - AN EXAMPLE OF SUCCESSFUL
INTERAGENCY COORDINATION IN DATA COLLECTION

660-79

by

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Introduction

In October 1978 the central computer facility for the Columbia River Operational Hydromet Management System (CROHMS) was placed in operation, thus marking a major step toward the completion of years of coordination between agencies in the Pacific Northwest in developing a shared data collection system. The purpose of CROHMS is to serve water management agencies by providing a "real-time" data collection, processing, and display system which will support the operation of the extensive reservoir system in the Columbia River and adjacent basins in the Northwest. At stake is the efficient regulation of some 80 dams which produce hydroelectric power generation and provide flood control, irrigation, and recreation benefits. With millions of dollars in benefits being realized annually and with an ever-increasing concern for the fisheries resource and other environmental factors, management of the reservoir system has become an increasingly sensitive process. The CROHMS system, with its rapid data reporting, frequent data updating, new hydromet stations, and extensive computer processing, will be an asset to water managers as they deal with this process.

This paper describes the development of CROHMS, and explains the concepts of the system as it is now functioning. It focuses particularly on the interagency coordination involved in its development and usage, as it has been accomplished by members of the Hydromet Data Committee and its parent organization, the Columbia River Water Management Group.

History of CROHMS Development

The coordinated management and development of the hydromet data collection system in the Northwest began formally in the early 1950's, through the work of the Task Force on Hydrometeorological Reporting Network, a task force of the Water Management Subcommittee of the Columbia River Basin Interagency Committee (CBIAC). Activities of the Task Force in the 1950's and early 1960's included the coordination of funding of gages for data reporting through the Columbia Basin Teletype Network (CBTT) and the establishment and funding of manual telemetry equipment at gage sites. In March 1966 the Task Force began coordinating agency plans for the development of automated data collection facilities, and it was shortly thereafter that the idea of a coordinated collection system with a common computer facility was conceived. At this time the earliest radio reporting network was being installed in the Clearwater River basin by the Corps of Engineers. In 1968 the Task Force pursued the conceptual definition of the data collection system by hiring a consultant, North American Rockwell Corporation, to assess agency needs and develop alternative configurations for data collection and processing. Their October 1968 report (3) contained a configuration that was adopted by the water management agencies, and that plan led to the development of the system as it now exists.

The concepts of an interagency data collection system were formalized in a June 11, 1970 Memorandum of Understanding signed by six Federal agencies. The stated purpose of this document was to:

- Prevent unnecessary duplication of facilities

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CROHMS REMOTE NETWORKS

Agency	Basin	Controller Location	Number of Stations	Parameter Report ¹	Type of Comm.	Current Status	Remarks
Automated Stations²							
Bonneville Power Adm.	Columbia	Vancouver, Wash.	57	WL,C	VHF,GOES	44 Stations Completed	Selected stations throughout Columbia River basin.
Corps of Engineers Portland District	Willamette	Foster Dam Oregon	84	WL,C,P	VHF	56 Stations Completed	Under contract with EG&G Co.
Corps Seattle District	Kootenai, West WA.	Seattle,	29	WL,C,P,S	VHF	14 Stations Completed	Includes Kootenai, Wynooches, Green Peter and Puyallup River basins
Corps Walla Walla District	Clearwater	Walla Walla WA.	18	WL,C,P,S	VHF	Complete	
Bureau of Reclamation	Yakima	Yakima, WA.	18	WL,C,P,S	VHF	Complete	Future additions to this network are planned.
Bureau of Reclamation	Upper Snake	Boise, ID.	60	WL,C		Contract to be awarded in 1979.	Future additions to this network are planned.
National Weather Service	Cascade Basins - WA. & OR.	Medford, Oregon	52	WL,C	GOES, Landline	Complete	Remote stations to be interfaced to CROHMS through AFOS in 1980.
B.C. Hydro-Canada	Upper Col., Kootenay	Burnaby, British Col.	11	WL,C,P,S	VHF	Complete	Additional automation of Canadian stations is planned.
Soil Cons. Service	Columbia	Portland, Oregon	121	C,S	Meteorburst	Partially complete	SNOTEL system is composed of a total of 311 stations throughout the Western United States.
U.S. Geological Survey, WA.	Cowlitz	Tacoma, WA.	23	WL,C,P,S	VHF, GOES	Complete	
Non-Automated Stations³							
Corps of Engineers CBTT	Columbia	Portland, Oregon	430	WL,C,P,S	Landline	Complete	

¹ WL=Streamgauge water level; C=Climatological (Precipitation, Temperature); P=Project (Forebay, generation, etc.); S=Snow

² Includes existing and stations to be installed within about one-year.

³ Limited to stations that report at least once every 24 hours.

Table 1. Summary of CROHMS Remote Networks

- Provide maximum utility and uniformity in collection and use of hydromet data
- Ensure the highest degree of reliability at a minimum of cost
- Gain the economics of multiple use of existing and proposed facilities consistent with individual agency responsibility

With the interagency aspects formally established, funding of new facilities could now be authorized and design plans developed. The North American Rockwell Information Systems Company was hired to begin the design process, and their October 1971 report (4) was accepted by the CRWMG in January 1972. It was about this time that the operational hydromet system was renamed "CROHMS". Several automated data collection systems were now functioning by this time, and were awaiting the completion of the central computer facility. Final design and specifications were developed by the Corps of Engineers, and a contract was awarded by the Corps to the EG&G Corporation for the data controller portion of this facility. In late 1978 CROHMS began functioning.

Description of CROHMS

CROHMS can be pictured as a number of independent data collection systems all forwarding data to a central data bank for processing and access by other users. It includes (1) remote data stations of many types, including both automated and manually reported sites; (2) data controllers, usually mini-computers, which obtain the data from remote sites; and (3) the Central Facility computer located at the Corps of Engineers Data Processing Center in Portland, Oregon. The entire system is shown schematically in Figure 1.

The data collection systems, including remote stations and controllers, have been developed by the various Federal water management agencies, coordinated through the Hydromet Data Committee. Included are major systems such as the Bonneville Power Administration's hydromet system (2), several Corps of Engineers systems, and the Soil Conservation Service SNOTEL network (1). Table 1 summarizes the characteristics of the systems that are or will soon be reporting data to the CROHMS Central Facility data bank.

As indicated by Figure 1, the CROHMS central facility consists of two separate pieces of computer hardware, the Central Facility Data Controller (CFDC) and the Corps' general purpose computer, an IBM 370-155. The CFDC is made up of twin redundant Interdata 7/32 computers that provide a high-reliability data management device that receives data, stores it temporarily, and provides a number of reports when requested by users. All data computations are performed on the IBM computer system which communicates with the CFDC, and which can also be accessed by users through a time sharing system. A typical sequence of operation for collection and reporting a piece of data is shown on Figure 2. Through-put time for this sequence can be less than 30 minutes, making the system essentially a "real-time" operation.

An important aspect of CROHMS is the software system which processes the data in the general purpose computer. Still under development, this software will include the complex data base management system, data validation routines, and various computer models currently in use for operational forecasting and reservoir regulation decision-making. The software system will ultimately permit virtually automatic preparation of data input for complex hydrologic models, a task that now requires a considerable amount of manual preparation.

Past Examples of Interagency Coordination

The 1970 interagency Memo of Understanding embodied several central principles relating to cooperative data collection development and implementation. These principles were:

- Agencies would make use of a centralized, shared, data processing facility.
- Agencies would have accessibility to "raw", real-time data.
- Hydromet network development would be scheduled and coordinated.
- Communication facilities would be shared where feasible.

CROHMS

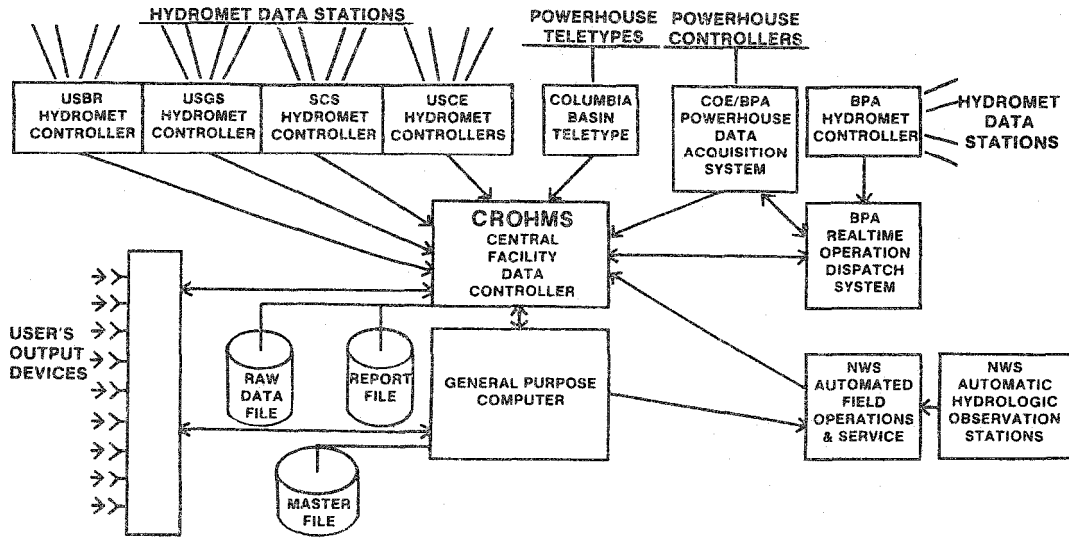


Figure 1. Schematic Diagram of CROHMS

CROHMS COLLECTION AND REPORTING SEQUENCE

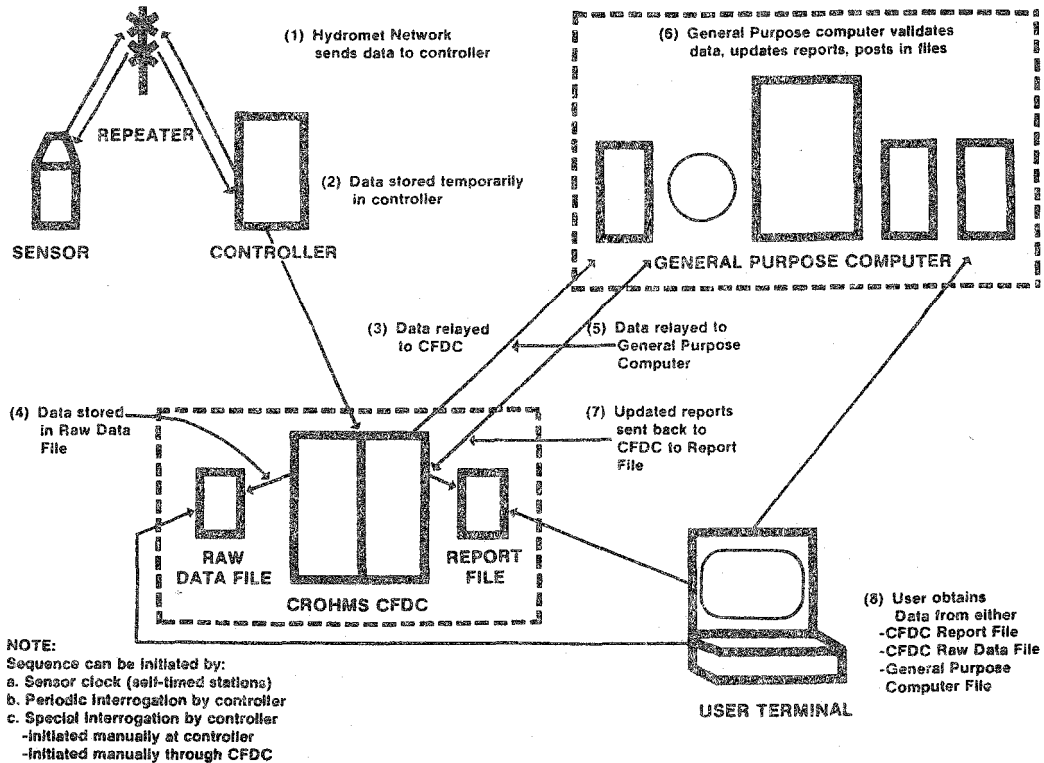


Figure 2. CROHMS Collection and Reporting Sequences

The coordinating body responsible for carrying out details of the Memorandum's guidelines is now the Hydromet Data Committee (HDC), the earlier task force designation having been changed in 1972. The membership of this committee and respective special interests of various agencies is depicted on Figure 3. The Hydromet Data Committee reports to the CRWMC, and refers decisions of major consequence to that parent body. It should be noted that neither the HDC nor CRWMC have in themselves any legal authority but rather are just coordinating bodies. Thus, legally binding agreements between agencies (such as the Memo of Understanding) are accomplished in writing between agencies outside of the committee. The following are several specific examples of coordination efforts that have been accomplished in the process of developing CROHMS:

Areas of Responsibilities - In order to distribute the burden of coordination details it was agreed to assign specific geographical areas to each agency for overall responsibility in remote station development. Processing of station equipment details, communications, maintenance problems, etc., could be handled by the responsible agency. The committee developed a series of forms that were used to process the details of planned equipment changes at gaging stations.

Remote Site Scheduling and Coordination - Periodic listings of planned agency automated development were (and are) made by the HDC to insure that each agency was aware of the other's development plans. This prevented unnecessary duplication of facilities, and in fact lead to agreements to exchange station development; i.e., one agency agreed to automate a gage in its hydromet network for another agency if the latter agreed to reciprocate.

Radio Frequency Coordination - A procedure was set up by which cooperating agencies would review proposed radio paths to see if interference with existing networks might occur. To review and discuss radio applications, a Radio Frequency Subcommittee was established. Through this process proposed radio paths could be sent for official approval to IRAC (Interdepartmental Radio Advisory Committee) already having been reviewed and approved regionally. One task of this subcommittee was to maintain a map showing hydromet stations and radio paths in use in the CROHMS network.

Sharing of Communication Facilities - An important aspect of interagency coordination established by the Memo of Understanding was the concept of sharing communication links. This resulted in the usage of the existing Bonneville Power Administration microwave trunklines as a backbone for several hydromet networks. This highly reliable radio system, which serves primarily as a powerhouse communications and control network, permitted economic utilization of VHF radio for a number of hydromet systems. Without it an extensive repeater network would have had to have been constructed at prohibitive cost.

Centralized, Shared Data Processing Facilities - One of the first and most important concepts established in the planning of CROHMS was that one central computer facility would be made available to all agencies for storage, processing, and retrieval of jointly-used operational hydromet data. This concept eliminates duplication of facilities and permits quick access by everybody to raw data, regardless of its origin. A significant precept embodied in this concept is that user agencies agree to accept the risk of data errors that are more inherent in the raw data being obtained from sensors on a real time basis. The raw data that is used operationally and stored in CROHMS is considered temporary and distinctly separate from published data that might eventually replace it.

Current Coordination Efforts

As CROHMS development has progressed over the recent years the Hydromet Data Committee's activities have tended to shift in emphasis from the planning and development of hydromet networks to the coordination of details of data processing and usage. Current items of coordination include:

- Establishment of procedures for data validation which will be used in the CROHMS software.

- Definition of reports that will be established on the readily accessible report file. Since this file is limited to 200 reports, this activity must be carefully coordinated to insure that users are best served by CROHMS.
- Development of rating and capacity tables, and procedures for rapid update of shifted ratings.
- Coordination of user training.
- Implementation of interfacing with final hydromet systems. The SNOTEL, B.C. Hydro, USGS, NWS, and BPA systems are not yet connected to CROHMS in a final automated mode.

One of the hardware development for CROHMS is complete and basic software is functioning, it is expected that refinements to improve the system will be a gradual, but necessary, process. A plan for the continuing evaluation of CROHMS has been contemplated (5), and undoubtedly the Hydromet Data Committee will be the focal point for coordinating future development and implementation for some time to come.

Summary and Conclusions

In the early 1960's, water management agencies in the Pacific Northwest recognized the need for the coordinated development of new automated hydromet facilities that were needed for new projects or for the upgrading of existing manual methods of data collection. Their efforts led to the CROHMS system that is beginning to be implemented today, a system that promises efficient utilization of hydromet data by water resource agencies, regardless of its origin. The past and ongoing coordination of CROHMS has minimized duplication, made the best use of existing facilities, and insured that CROHMS will serve the best interests of all water management agencies in the Northwest.

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**COLUMBIA RIVER BASIN
INTERAGENCY COORDINATION IN HYDROMET DATA COLLECTION**

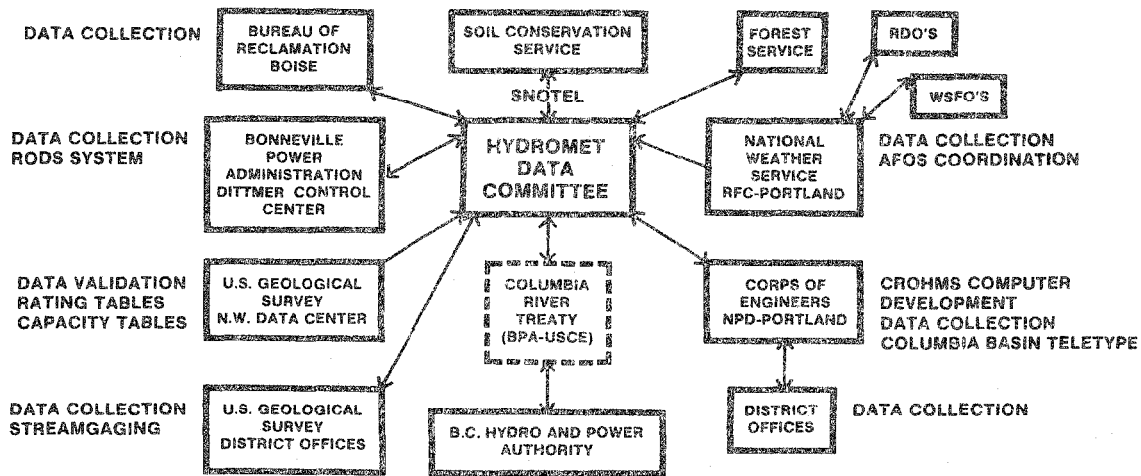


Figure 3. Interagency Coordination for CROHMS development