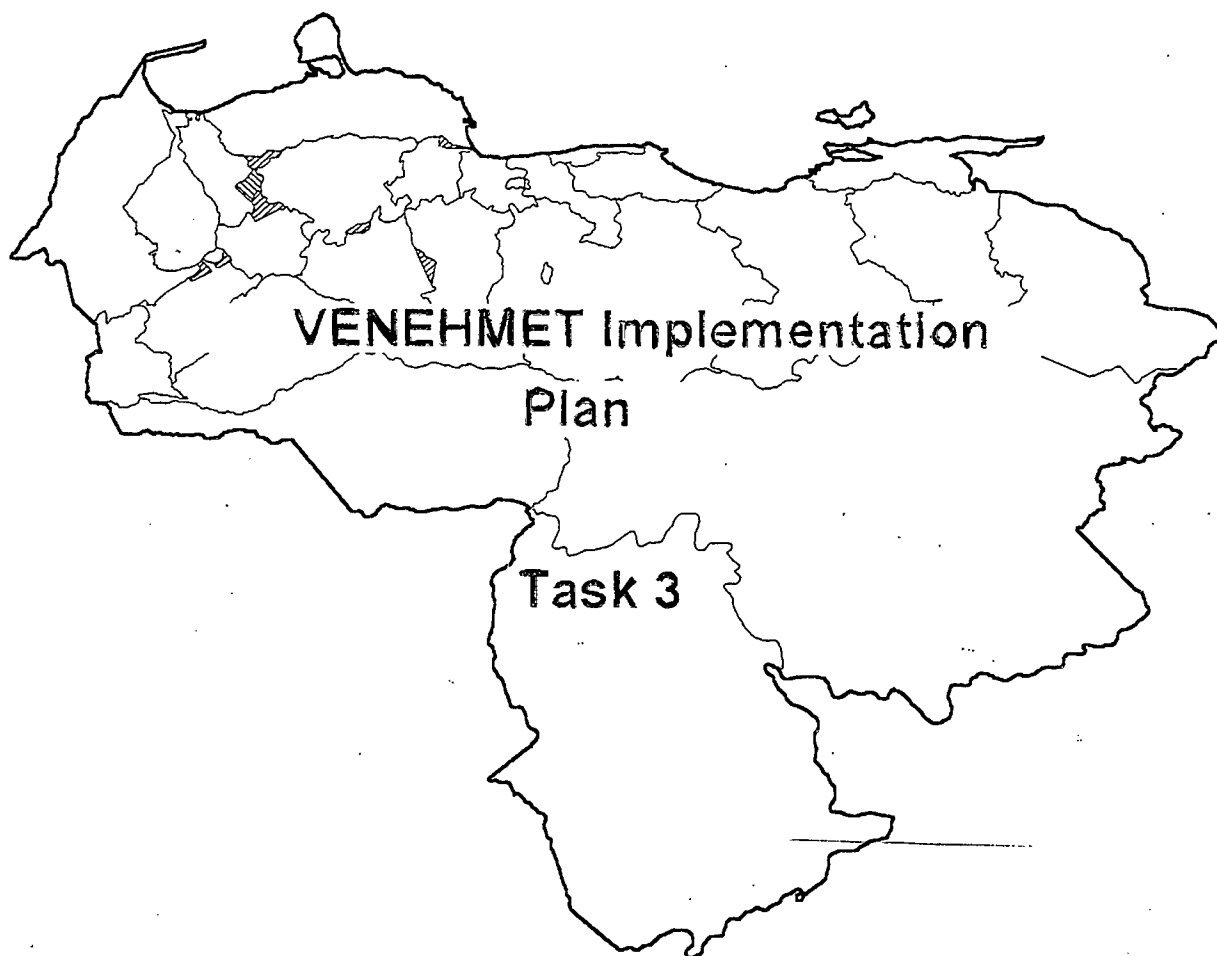
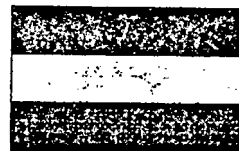




TDA No. 93-502

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VENEHMET IMPLEMENTATION PLAN

TASK 3

1.0 INTRODUCTION

1.1 OPERATIONAL CONCEPT

The Government of Venezuela is planning to improve weather and hydrological services to support the national economy and improve public safety. This is in response to a mission need that is documented in the **Operational Concept Document, Hydrometeorological Services, Venezuela**. This need is as follows:

It is the mission of the Government of Venezuela to provide the hydrometeorological services necessary to ensure the safety of the citizens, to permit the efficient operations of the nation's commerce, to preserve the nation's natural resources, and to permit the safe and efficient operations of the military.

The specific hydrometeorological mission needs are:

- Provide accurate and timely weather observations and forecasts for the public, aviation, agriculture, surface transportation, ships at sea, coastal marine activities, offshore oil industry, military and civil defense.
- Provide severe and hazardous weather warnings to the public, aviation, maritime industry and commerce.
- Provide accurate and timely flood warnings and forecasts for the public and commerce.
- Maintain climatological records.
- Monitor and advise the public and government sector of air and water quality.

The **Operations Concept Document** also identified the following major elements as necessary and in need of major improvements to meet these mission needs:

- Organization of weather and hydrological services
- Observation systems or equipment
- Communications
- Processing
- Dissemination of observations, warnings and forecasts
- Logistic support

VENEHMET Implementation Plan

1.2 ALTERNATIVES ANALYSIS

An alternatives analysis was conducted to determine the optimum approach to implement these major elements to meet the mission needs. The study considered alternative methods to meet the needs through the Analytical Hierarchical Process of comparison of alternatives considering: (1) life-cycle cost, (2) the ability of the alternative to meet the needs, (3) the technical and programmatic risks, and (4) the ability to support the alternative within the limits of expected monetary and human resources. The **VENEHMET Alternative Analysis** document presented the results of this study and recommended specific approaches to implement the above major elements. This document recommended that the major elements be implemented as follows:

1.2.1 Organization

Create a new central processing center under the joint interagency management and maintain the current decentralized weather service infrastructure.

1.2.2 Automated Remote Observation Stations

Replace all stations to be automated with completely new equipment. ✓

1.2.3 Upper Air Systems

Keep the existing upper air systems operational as they are while adding GOES data transmission. When the technology or equipment becomes obsolete, or maintenance is no longer available, the stations will be replaced with stations utilizing GPS navigation and automated data handling.

The four new stations required by the network should use GPS and automated systems technology.

1.2.4 Doppler Weather Radar

Implement a national network of Doppler weather radars which will cover the major portions of Venezuela, including the Guri watershed.

1.2.5 Lightning Detection and Display

Implement a national Lightning Location System (LLS) as part of the overall VENEHMET program.

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1.2.6 Airport Weather Stations

Replace all stations with completely new automated equipment including automatic broadcast equipment.

1.2.7 Communication Needs

The VENEHMET communication needs will be met with a VSAT system utilizing a commercial satellite space segment.

The Automated remote data collection network will use the NOAA/GOES transponder DCS network.

Existing communication services will be maintained to supplement VENEHMET and provide back-up for the network.

1.2.8 Data and Product Processing

The data will be collected and processed at a central facility.

1.2.9 Dissemination of Observations, Warnings and Forecasts

The standard VENEHMET products and data will be distributed to each of the participating agencies using the VSAT network.

Product dissemination which is the responsibility of the agency is accomplished using the technologies and means presently in use.

A new product distribution service will be set up using the VENEHMET VSAT distribution service to receive only terminals.

1.2.10 Logistic Support

Maintenance:

All on site maintenance of the VENEHMET equipment and systems will be performed by personnel from a support contractor located in Venezuela.

Training:

Training for the operations and maintenance of the VENEHMET equipment and systems will be performed by personnel established by the Central University of Venezuela.

Supply Support:

All supply support will be performed by personnel from a support contractor located in Venezuela.

VENEHMET Implementation Plan

1.3 IMPLEMENTATION PLAN OVERVIEW

This VENEHMET Implementation Plan will present an optimum low-risk approach to implement the recommended alternative to meet the national mission needs for hydrometeorological services in Venezuela. The VENEHMET definition, overall goals, scope, assumptions, participating organizations, and plan structure are as follows:

1.3.1 VENEHMET is defined to include:

- ✓ The management structure to implement the program,
- ✓ Contracting for supporting the implementation management,
- ✓ New state of the art meteorological, hydrological, climatological and oceanographic observing and processing systems and equipment,
- ✓ Increased meteorological support to civil and military aviation,
- ✓ A new comprehensive data communications system,
- ✓ New data dissemination equipment,
- ✓ All software required to implement the features of the plan,
- ✓ The organizations to operate the systems and equipment,
- ✓ Integrated logistics support and services,
- ✓ Professional training of meteorologists,
- ✓ Interim commercial weather services,
- ✓ Support to the Center for Advanced Research in Tropical Climatology (CEACT), and
- ✓ Implementation of a regional numerical prediction model for the country of Venezuela.

1.3.2 The Goal for the plan is to:

- ✓ implement VENEHMET with international support,
- ✓ build a Venezuelan infrastructure to support the organization and systems with minimal external help,
- ✓ implement VENEHMET within six years.

1.3.3 The Scope of the Plan is:

- ✓ To include all Venezuelan governmental and government supported commercial hydrometeorological services,
- ✓ Provide all needed observing systems and equipment.

VENEHMET Implementation Plan

- ✓ Procure and install all needed data processing systems,
- ✓ Implement all data collection and product dissemination communications,
- ✓ Provide integrated logistics support for the above,
- ✓ Build domestic Venezuelan research and development to support meteorology, hydrology and tropical climatology.

1.3.4 Assumptions:

- ✓ Limited funding will be available in 1994 for time critical program management tasks.
- ✓ full funding will be available for VENEHMET in 1995.
- ✓ the National Committee for Hydrometeorology approves the plan.
- ✓ the plan should be implemented in stages to reduce risk.

1.3.5 Participating Organizations:

- ✓ National Committee for Hydrometeorology
- ✓ MARNR
- ✓ FAV
- ✓ FONAIAP
- ✓ Armada
- ✓ EDELCA
- ✓ Ministry of Communications and Transportation
- ✓ Central University of Venezuela
- ✓ Center for the Advanced Research in Tropical Climatology

1.3.6 Structure of the Implementation Plan

- ✓ Introduction
- ✓ Four-stage implementation
- ✓ Plan of the organization of VENEHMET
- ✓ Plan for professional meteorologist training
- ✓ Integrated logistics support

VENEHMET Implementation Plan

- ✓ Architecture and Engineering
- ✓ Communications
- ✓ Observing instrumentation
- ✓ Central and regional processing systems
- ✓ Support for CEACTION
- ✓ Development and implementation of a regional forecasting capability

1.4 SCHEDULE OF MAJOR ELEMENTS

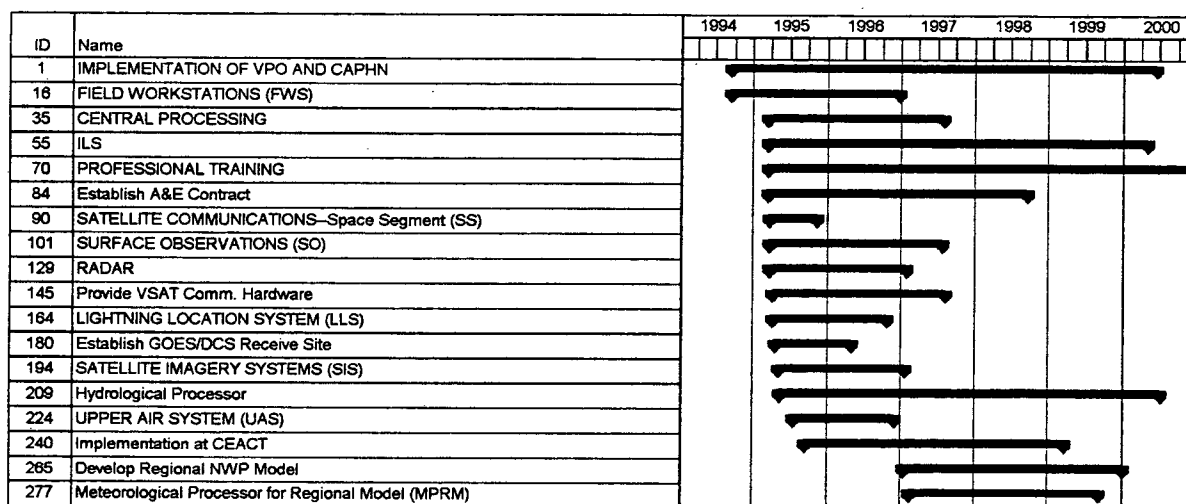


Figure 1
Schedule of Major Elements

VENEHMET Implementation Plan

2.0 STRATEGIC VIEW OF A STAGED IMPLEMENTATION OF VENEHMET

2.1 STAGE 1--APPROVAL, FUNDING, AND PLANNING

- ✓ Plan approval by the NCHM and the Congress
- ✓ Supplemental appropriations from Congress for Stage 1
- ✓ Funding is approved and appropriated for Stage 2
- ✓ Form a VENEHMET Program Office
- ✓ Contract for program management support
- ✓ Prepare for Stage 2

2.2 STAGE 2--BUILD THE VENEHMET INFRASTRUCTURE AND PROVIDE INTERIM SERVICES

- ✓ Implement the supporting organizations
- ✓ Begin a university training program to build human resources
- ✓ Contract for integrated logistics support (including operator and maintenance training)
- ✓ Contract for Architecture and Engineering
- ✓ Contract for interim weather service support from a commercial source in the U. S.
- ✓ Acquire, install and begin operations of automated observing systems, communications, processing systems, and product dissemination equipment
- ✓ Weather and hydrologic products are disseminated to users from CAPHN

2.3 STAGE 3--OPERATE VENEHMET AT INITIAL OPERATING CAPABILITY LEVEL

- ✓ World Area Forecast Center forecast guidance for Venezuelan generated weather forecasts
- ✓ National hydrological processing network is operational
- ✓ Interactive graphics processors and weather radars provide weather and flood warning capability
- ✓ Short-term forecast improvements to support aviation
- ✓ Aviation hazard warnings are provided to Air Traffic Control in graphic format

VENEHMET Implementation Plan

- ✓ Regional offices are implemented
- ✓ Regional offices disseminate weather and hydrological products to users
- ✓ Begin cooperative international studies at CEACTION

2.4 STAGE 4—UPGRADE VENEHMET TO PROVIDE IMPROVED SERVICES AND BECOME SELF-SUSTAINING

- ✓ Implement a high resolution forecast capability at CAPHN for high quality weather and hydrological forecasts
- ✓ Effect a transfer of all management responsibilities to CAPHN and the participating agencies

These four stages are shown in Table 1 below:

Stage 1	Stage 2	Stage 3	Stage 4
Plan approval, Interim funding, form VPO & plan Stage 2	Build infrastructure, Provide interim weather & hydrological services from CAPHN (extensive foreign support)	Operate VENEHMET with forecast & warnings from CAPHN and regional offices (reduced foreign support)	Add regional model & Transition to self-sustained operations
1994	1995... ... 1996	1997... ... 1998	1999

Table 1
Staged Implementation of VENEHMET

VENEHMET Implementation Plan

3.4 ORGANIZATION FOR THE IMPLEMENTATION OF VENEHMET

The implementation of VENEHMET involves the transfer of technologies which are not resident in Venezuela at this time. In addition to the technology issues, there are no management organizations which can efficiently supervise the technology transfer as well as the implementation of the various aspects of the program. To address these issues, the implementation plan proposes to use outside technical consultants in advisory capacities in support a Venezuela based organization.

To minimize bureaucratic overhead, VENEHMET is to be implemented under a transitional organization. This organization will be developed using existing resources from several Hydrometeorological organizations, combined with outside technical support. Since the goal is to transition through the implementation to an operational VENEHMET the organization structure, itself, must be adaptive through this process. A temporary organization will be needed during the transitional implementation, changing to an operational structure once the implementation is complete. The goal is to minimize both the organization complexity and implementation time.

VENEHMET Implementation Plan

3.4.1 Implementing The VENEHMET Organization Structure

The temporary organization structure for VENEHMET program implementation will be as shown in figure 1 below:

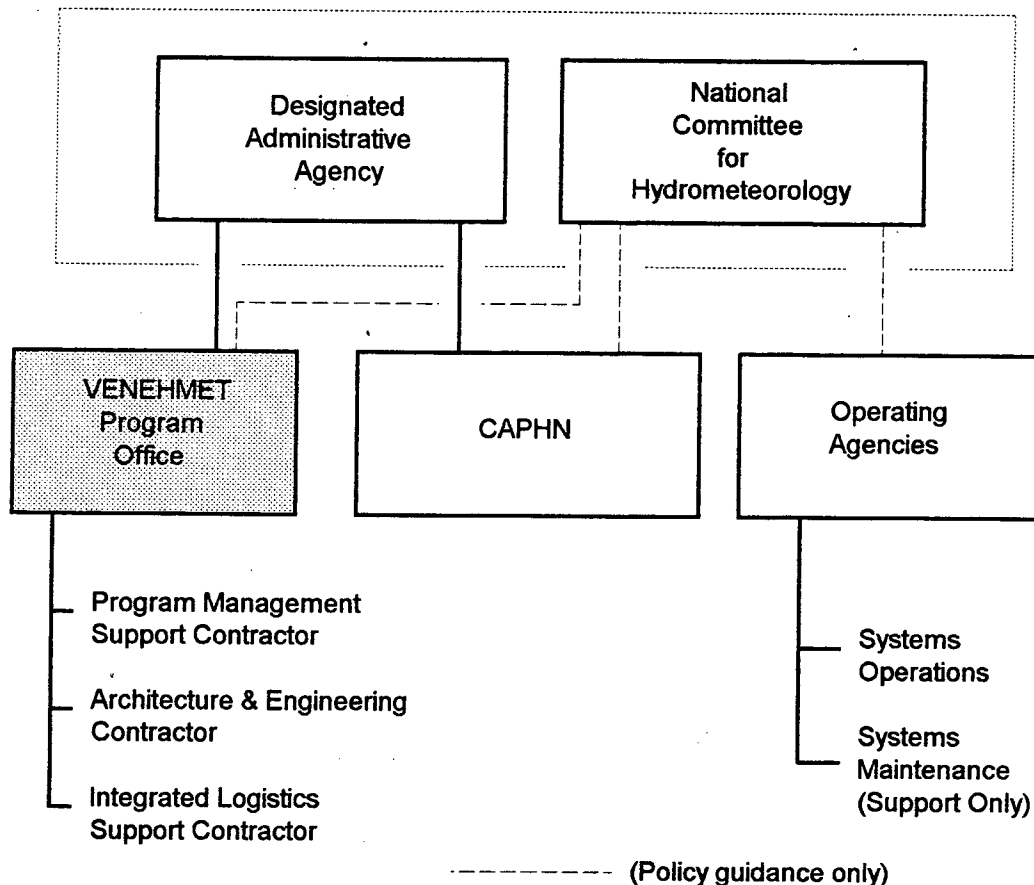


Figure 2
VENEHMET Implementation Organization

Each of the boxes within the implementation organization shown in figure 1 has either an administrative and/or operational responsibility. A brief description of the organization element responsibilities are as follows :

National Committee for Hydrometeorology

A administrative policy making organization defined in the VENEHMET Concept of Operations Document. The NCHM will provide policy guidance for the VPO, CAPHN, and the operating agencies(in regard to VENEHMET only).

VENEHMET Program Office (VPO) :

A transitional organization contractually responsible for the implementation of all phases of the VENEHMET modernization.

VENEHMET Implementation Plan

Designated Administrative Agency :

A participating VENEHMET agency (e.g. FAV, MARNR etc.) designated by the National Committee for Hydrometeorology with the responsibility for providing facilities and administrative support for the CAPHN and VPO.

CAPHN :

The operational National Center for Hydrometeorology as defined in the VENEHMET Concept of Operations.

Operating Agencies :

The participating agencies who have VENEHMET operational responsibilities (FAV, MARNR, Armada, FONAIAP, EDELCA, etc.).

The administrative responsibilities are :

The **VPO** and **CAPHN** will report an agency as designated by the NCHM, that agency will provide office space, electrical power, and air conditioning. They will also provide procurement functions for the VPO and will manage the procurement process in accordance with that agencies policies and procedures. They will pay the salaries and benefits for the employees of VPO and CAPHN, which will be the same as for other employees of the same grade within the agency. If necessary to attract employees with the required experience and capabilities, a salary supplement may be required. }

The **Operating Agencies** will be responsible for the operations of the systems and equipment assigned to them by the NCHM. They will also be responsible for providing a minimum level of on-site maintenance in support of the Integrated Logistics Support (ILS) Contractor.

3.4.1.1 The Transition From VENEHMET Implementation To Operational Status

Following full implementation of VENEHMET, an operational readiness test, will be performed by the VPO in accordance with a readiness test plan approved by the NCHM. The test results will be presented to the NCHM. After acceptance of the test results from the VPO by the NCHM, the temporary program management organization will be dissolved and the permanent supporting organizations will perform all management functions. The VENEHMET Program Office function will become a staff support to the NCHM and will retain only a minimum staff. The supporting program management and systems engineering & integration contracts will be terminated. The ILS contractor will be assigned to a director within an agency as designated by the NCHM.

CAPHN will remain in the agency to which it was assigned, and that agency will assume total management for the CAPHN. That agency will be required to follow the policy guidance, in regard to CAPHN, as provided by the NCHM.

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The permanent organization will then be as follows:

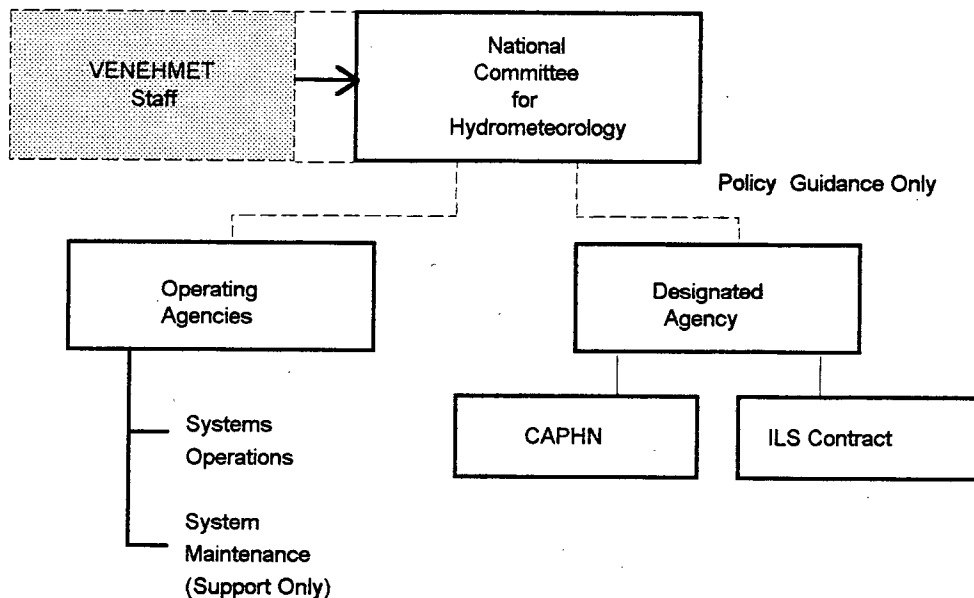


Figure 3
Permanent Organization

3.4.2 The National Committee on Hydrometeorology (NCHM), as a Board of Directors for the VENEHMET Program , will:

- ☒ Approve the Implementation Plan for VENEHMET
- ☒ Present the Plan and Budget Request to the National Congress ?
- ☒ Obtain funding and have that funding assigned to the appropriate agencies
- ☒ Approve the Charter for the Director, VENEHMET Program Office
- ☒ Appoint the Director, VENEHMET Program Office
- ☒ Determine when VENEHMET is ready for operational status and transfer control to the operating agencies
- ☒ Assign instrument calibration to one facility

3.4.3 Program Management, VENEHMET

In order to plan for the implementation of VENEHMET, a program management office will be formed during Stage 1. The National Committee of Hydrometeorology (NCHM) shall charter a **VENEHMET Program Office** to implement VENEHMET and specify the agency and level within that agency to which this Program Office will administratively report. The NCHM shall select and appoint the director of the VENEHMET Program Office (VPO). The

VENEHMET Implementation Plan

Director, VPO will report administratively to the specified agency, but will be under the direction of the NCHM. The Director, VPO shall hire the necessary personnel to perform the mission of the VPO and shall manage the organization to perform their mission in accordance with their charter and within the established budget. The agency to which the Director, VPO reports shall be responsible for obtaining funds for the implementation of VENEHMET. The VPO will report to the NCHM for policy direction during the first three stages of implementation. The VPO will be reduced to a small staff reporting directly to the NCHM after VENEHMET is determined to be self-sustaining without foreign help during Stage 4.

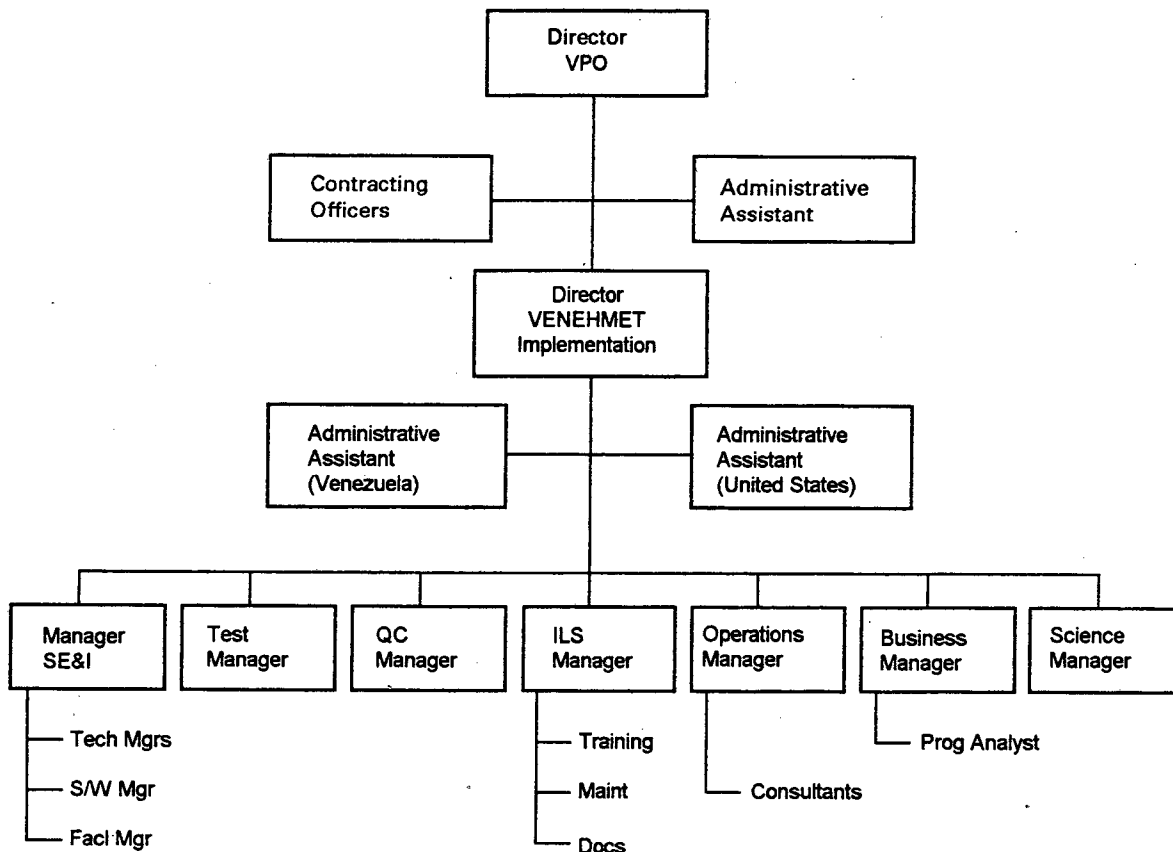


Figure 4
VENEHMET Program Office
Organization

Funding for the VPO organization, operations and contracting will be provided by the NCHM as authorized by the National Congress. The funding for implementation will be assigned to the supporting agency for use by the Director, VPO during the first three stages of implementation. The Minister, or Director General of the assigned agency will be responsible for the accounting of all funding supplied to the VPO for procurement and shall be responsible that the funds were allocated and managed in accordance with Venezuelan national law.

*por la agencia con
visto bueno
la NCHM.*

VENEHMET Implementation Plan

The Director, VPO shall be responsible for:

The implementation of the VENEHMET program in accordance with this implementation plan, as approved by the NCHM,

- Contracting for program management, systems engineering, and integration support for the implementation of VENEHMET,
- Planning and implementing the supporting infrastructure to provide the necessary human resources, systems and equipment, and communications for VENEHMET in accordance with this implementation plan,
- Contracting for interim commercial weather forecast services to assist CAPHN prior to the time at which CAPHN is supplied the necessary systems and resources and it is demonstrated that they have a self-sustaining weather forecast capability.
- Contracting for the equipment and systems required to operate VENEHMET,
- Contracting for the integrated logistics support for VENEHMET, including all training except for university training, maintenance of VENEHMET equipment and for supply support. Contracting for support to establish a sustaining meteorology department at the Central University of Venezuela ?
- Contracting for the development of numerical models for the prediction of medium-scale weather events in and off-shore Venezuela,
- Contracting for support for expanding the capabilities and developing international participation at the Center for Advanced Research in Tropical Climatology at the University of the Andes,
- Managing the costs of the program within an approved budget,
- Ensuring that each major element of the program (other than the Organization to meet the Needs of Hydrometeorological Services) meets the requirements of the associated VENEHMET specification
- Obtaining and maintaining adequate office space and equipment for the VENEHMET Program Office staff.
- Administrative, travel and clerical support for the contract program management support staff
- Management of customs clearances for imported systems and equipment
- Carpool to support the VPO and the program management support contractors
- Perform an operational readiness test and report the results to the NCHM

VENEHMET Implementation Plan

3.4.3.1 Program management, systems engineering and integration support contract

Shortly after establishing the VENEHMET Program Office, the Director, VPO will contract for program management support. The program management support will assist the Director, VPO in carrying out his charter to implement VENEHMET. It is believed that the management and engineering skills necessary to implement VENEHMET do not exist today in Venezuela. The purpose of the support contract is to provide these skills to assist the Venezuelan program director implement VENEHMET and to provide the guidance needed to build these skills in Venezuela for the continuing support of VENEHMET after implementation. The program management support staff will have offices in Venezuela, collocated with the Director, VPO and in the United States. All program management staff personnel will speak the Spanish language prior to being assigned to the program or will receive training in the Spanish language to be able to communicate with persons in Venezuela. This contract will provide contract support in the following areas:

○ Program management

- ✓ Manager, VENEHMET Implementation Office
- ✓ Program Schedule and Resource Control (human and financial) management
- ✓ Assist in the coordination of VENEHMET management with the supporting Venezuelan organizations, such as, the NCHM, MARNR, FAV, FONAIAP, Armada, EDELCA, CUV, CEACT, and Civil Aviation
- ✓ Technical management of all of the contracts to provide for the implementation of VENEHMET
- ✓ Management of the A&E contractor
- ✓ Management of the Integrated Logistics Support contract
- ✓ Management of the scientific support to VENEHMET and the Central University of Venezuela
- ✓ Administrative and clerical support in the United States

○ Systems engineering and integration

- ✓ Facilities engineering & site surveys
- ✓ Communications support
- ✓ Interface management
- ✓ Configuration Control
- ✓ Software management
- ✓ Integrated Logistics Support management
- ✓ Quality control and test management

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- Scientific, operations and human factors management support
 - ✓ Professional training standards and curricula in cooperation with the CUV
 - ✓ Establishment of observation, forecast and warning standards and procedures to serve the public, civil aviation, water resource management, agriculture, civil defense, fisheries, Navy, private industry, etc.
 - ✓ Establishment of product standards and formats in cooperation with the various users
 - ✓ Assistance in creation of cooperative international tropical meteorology and climatology projects

The details of the organizational structure of a combined program management office in Venezuela with additional United States based support should be worked out between the Director, VPO and the Deputy Program Manager (contract support) as soon as the two have been appointed.

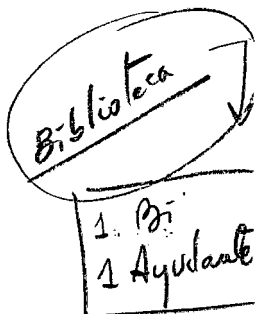
3.4.4 Organization and management of the Centro de Alerta y Prognostico Hydrometeorologico Nacional (CAPHN)

Three alternative solutions to the management of hydrometeorological services for Venezuela were considered in the VENEHMET Alternatives Analysis document. The recommended approach is to form a central hydrometeorological processing center that will serve the present agencies. This center will receive all of the input observations, process these observations and generate forecast guidance for the participating agencies. The participating agencies will use the guidance for specific forecasts to serve their customers.

In order to implement this approach, the National Committee of Hydrometeorology (NCHM) shall charter an organization to manage and operate the CAPHN and specify the agency and level within that agency to which this organization will administratively report. The NCHM shall select and appoint the director of CAPHN at the beginning of Stage 2.

The Director, CAPHN will report administratively to the specified agency, but will be under the direction of the NCHM during Stages 2 and 3. The Director, CAPHN shall hire the necessary personnel to perform the mission of the CAPHN and shall manage the organization to perform their mission in accordance with the charter and within the established budget. During Stage 4, CAPHN will be assigned to an operating agency by the NCHM.

The agency to which the Director, CAPHN reports shall be responsible for obtaining funds for the organization and operation of CAPHN in accordance with a budget approved by the NCHM. The agency shall provide adequate office space in which CAPHN will operate and provide for all of the necessary services to support that office, such as, lighting, telephones, cleaning, maintenance, furniture and air conditioning. Equipment for the performance of the duties of the CAPHN will be provided by the VENEHMET Program Office.

[illegible]

- Managing the CAPHN resources
- Providing weather and hydrological observation, forecasts and warnings to the regional offices for dissemination to users and for direct dissemination in the Caracas area.

Other than the operations of CAPHN, each participating agency shall operate their own organizations to provide hydrometeorological services to their customers in accordance with their charters. Each agency will be responsible for obtaining the necessary funding to accomplish their respective mission.

Observing, local display and dissemination equipment provided by the VPO for the operations by an agency shall be operated by that agency and that agency shall provide for the funds for those operations.

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3.4.6 Logistics management oversight

The Director, VPO shall have the ILS management oversight during the Stages 2 and 3. During Stage 4, this management will transition to an agency to be designated by the NCHM.

3.5 IMPLEMENTATION SCHEDULE

3.5.1 Organization schedule

The following schedule is a GANTT chart for the establishment of the organization and support to implement VENEHMET:

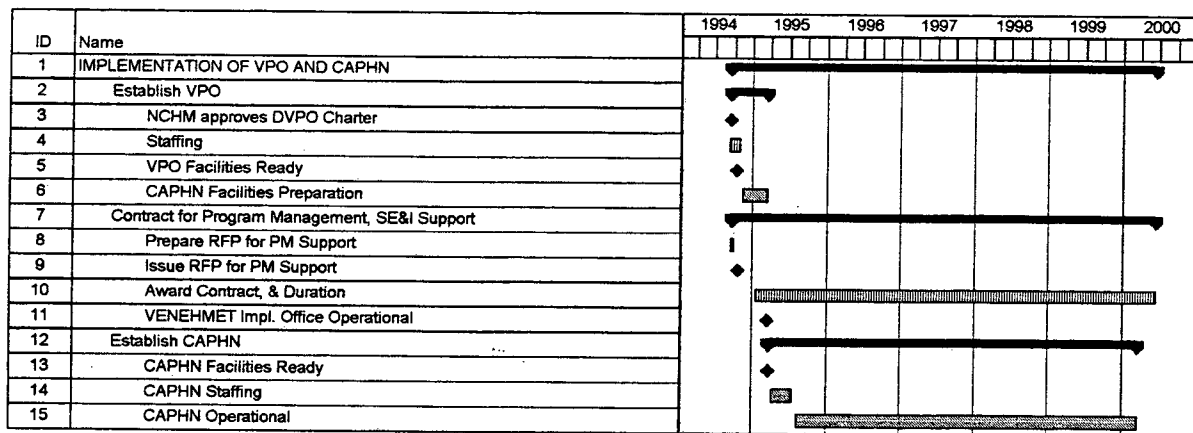


Figure 6
Implementation Schedule

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4.0 PROFESSIONAL METEOROLOGIST TRAINING

A major requirement for the success of the VENEHMET program is to build a cadre of professional meteorologists and sustain the ranks of the professional meteorological staff at the CAPHN and field offices. The Central University of Venezuela has the facilities and infrastructure needed to support such a goal, but the meteorology department must be enhanced in order to meet the goals of the program. The state of the hydrology department is currently satisfactory to maintain the hydrology needs of the VENEHMET system.

4.1 GOALS:

- Establish a self-sustaining department of atmospheric sciences at the Central University of Venezuela (CUV) with sub-tracts in climatology, hydrometeorology, instrumentation, numerical modeling and research.
- Graduate 15 students per year at the B.S. level at the CUV by end of year 5
- Establish an advanced degree (atmospheric sciences) program using the resources of U.S. Universities. Graduates of this program will provide the required faculty at CUV.
- Establish a curriculum of short courses at CUV to include training and educational offerings in:
 - ✓ meteorology
 - ✓ hydrometeorology
 - ✓ aviation meteorology
 - ✓ tropical meteorology
 - ✓ computer applications
 - ✓ climatology
 - ✓ facilities management
 - ✓ Short courses would be given using a combination of visiting professors and multi-media computer self-training with COMET (a multimedia program, developed by the University Corporation for Atmospheric Research (UCAR), Boulder, Colorado, USA) modules.

4.2 SCOPE:

- Plan the training/education program in coordination with the National Committee on Hydrometeorology and the CUV.

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- Contract with appropriate U.S. universities to participate in advanced degree program.
- Contract with individual U.S. professors to teach courses (both regular degree courses and short courses) at CUV.
- Develop specialized Cooperative Program for Operational Meteorology, Education and Training (COMET) courses and COMET computer-based learning modules for short course program at CUV.
- Provide existing COMET modules to meet specific needs.
- Consult with the National Committee on Hydrometeorology and the CUV on an annual basis to review progress and plan for future needs.

4.3 ASSUMPTIONS :

- Students will enter CUV atmospheric sciences program after satisfactorily completing a two-year curriculum of preparation in science, engineering, computer technology, mathematics, liberal arts and English language; followed by a competitive examination to ensure proper preparation and aptitude.
- Scholarships will be available to students that have completed the two-year college level preparation program to attract an adequate student population.
- Visiting professors will be used to complement the CUV staff during the first five years of the program.
- CUV meteorology curriculum will be established jointly by the CUV Department Head, and a working group of U.S. university atmospheric sciences faculty members led by the University Corporation for Atmospheric Research.
- The hydrology program is currently satisfactory to meet the needs of Venezuela.
- Advanced degrees in meteorology will be provided outside of Venezuela.
- Short courses would be offered to all Spanish-speaking meteorologists in WMO Regions III and IV.
- CUV would become UCAR International Affiliate.

4.4 IMPLEMENTATION PLAN FOR PROFESSIONAL TRAINING

- Contract for the services of the University Corporation for Atmospheric Research (UCAR) in the United States to provide:
 - ✓ University programs in the United States, in consultation with the CUV and the NCHM, to train potential professors at the M.S. and Ph.D. levels in meteorology, where the contract price would include establishment of a tailored program to meet the needs of Venezuela, continuing review of the

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progress and performance of the program to ensure an adequate level of training, and all expenses for the students while in the United States,

- ✓ To assist the CUV in the establishment of a meteorology curriculum at the CUV to meet the needs of VENEHMET,
- ✓ To hire visiting professors from U. S. universities for teaching at the CUV until the advanced degree program provides sufficient faculty at the CUV,
- ✓ To provide COMET multimedia training to students at CUV and professional meteorologists within the supporting agencies,
- The VPO would provide funds to the CUV for scholarships for undergraduate students for their last two years of training in meteorology and the atmospheric sciences,
- The CUV will provide the salaries for the faculty of the department of meteorology or atmospheric sciences, and for the classrooms and laboratories for about 30 undergraduate students,

4.5 SCHEDULE FOR PROFESSIONAL TRAINING

The following schedule is a compressed GANTT chart for the implementation of training from the detailed Program Management Schedule which is included in full as Appendix A:

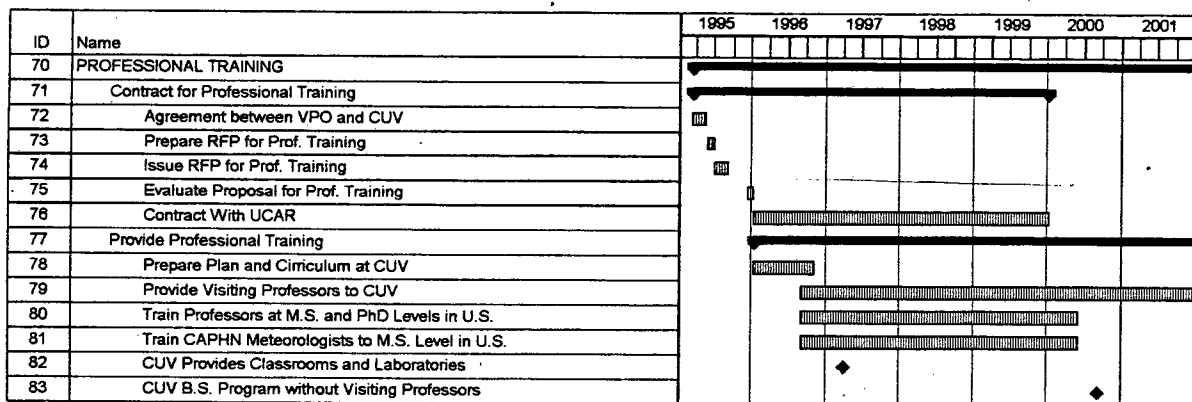


Figure 7
Schedule for Professional Training

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5.0 INTEGRATED LOGISTICS SUPPORT (ILS)

5.1 GOALS

- Provide an integrated ILS system for the support of VENEHMET
- Maintain VENEHMET to achieve an overall availability of hydrological and weather forecasting of 99%
- Provide a sustainable in-country ILS system with purchasing from original equipment manufacturers.
- Maintain a fully trained force of operators and technicians
- Provide for the accurate calibration of instrumentation
- Maintain a technical document library
- Maintain configuration control over VENEHMET
 - ✓ Remote Sensing Systems
 - ✓ Sensors
 - ✓ Computer Configurations
- Maintain the software of VENEHMET

5.2 SCOPE

- All systems, equipment, software, operators and technicians related to VENEHMET

5.3 ASSUMPTIONS

- The contractor will provide the personnel for ILS
- The contractor will provide the facilities for the ILS functions
- The contractor will provide for shipping of supplies and repaired items
- The operating agencies will provide for packaging and shipping of items for depot repair

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5.4 IMPLEMENTATION PLAN FOR LOGISTICS SUPPORT

5.4.1 Maintenance

On-site and depot maintenance of VENEHMET systems and equipment will be provided by a private contractor located within Venezuela. Government personnel at the operating sites will provide minimal support to the contractor in helping to identify problems. The contractor shall provide the following services:

- Training for the maintenance and operation of all systems and equipment provided as part of VENEHMET,
- Configuration control of all VENEHMET hardware and software,
- Maintenance of a technical documentation library with all documentation relating to VENEHMET hardware and software,
- Providing on-site and depot maintenance of all VENEHMET hardware,
- Providing a software program support facility and operations to maintain the software within VENEHMET,
- Providing supply support for all equipment and systems within VENEHMET, including a supply depot and a stock replenishment operation.

5.4.2 Calibration

Facilities and operations will be established to provide the following:

- On-site calibration equipment is to be furnished by the original equipment manufacturer and performed by the Logistics Support Contractor or the operator of the equipment, according to the manufacturers procedures,
 - ✓ Upper-air Sounding Systems
 - ✓ Weather Radars
 - ✓ Wind Profilers
- Hydrometeorological and oceanographic instruments will be calibrated at a facility located at and operated by one of the operational agencies to be assigned by the NCHM. The VENEHMET Program Office will be responsible for the purchase and installation and training of all calibration equipment.

5.4.3 Training

All training for the operations and maintenance of the VENEHMET equipment and systems will be performed by personnel from a support contractor located in Venezuela or by the Central University of Venezuela. The VENEHMET Program Office will contract for training services.

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5.4.4 Supply support for VENEHMET

All supply support of the VENEHMET equipment and systems will be performed by personnel from a support contractor located in Venezuela. It is assumed that government personnel at the operating sites will provide minimal support to the contractor by controlling on-site spares and packing and shipping items determined to require repair. The support contractor will implement a computerized supply management system.

5.5 SCHEDULE FOR THE IMPLEMENTATION OF INTEGRATED LOGISTICS SUPPORT

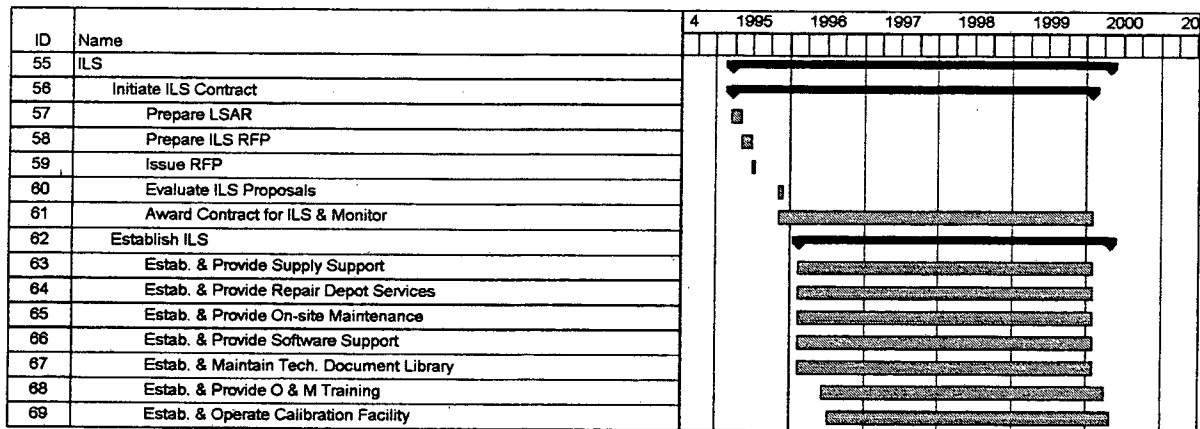


Figure 8
Schedule for the Implementation of Integrated Logistics Support

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6.0 ARCHITECTURE AND ENGINEERING

The Architecture and Engineering (A&E) function is to perform site surveys, obtain the necessary permits and clearances, prepare the sites for installation, and provide for the installation of electricity, water and telephone service, where required, for VENEHMET subsystems and equipment. The VPO will contract for A&E services to meet the requirements of VENEHMET. The A&E contractor will be a Venezuelan company experienced in architectural design and engineering of facilities to support electronic instrumentation and computer facilities. Drawings and requirements for site preparation will be provided by the suppliers of the VENEHMET subsystems and equipment through the VPO. The supporting agencies will be expected to provide assistance to the VPO and the A&E contractor for planning, site access, existing documentation, etc.

6.1 GOALS:

- Survey the location for each installation of VENEHMET subsystems and equipment as designated by the VPO
- Obtain all necessary permits and clearances for the preparation of the site, for installation and operation of equipment at the locations designated by the VPO
- Prepare the site in accordance with the engineering documentation provided by the subsystem or equipment manufacturer via the VPO and all other work needed to make the site ready for installation
- Provide all needed utilities as specified in the engineering documentation

6.2 SCOPE:

- All sites for VENEHMET subsystems and equipment, except for the facilities to be provided by other contractors, such as, the ILS contractor and the CUV
- Utilize existing sites where applicable and designated by the VPO
- Install all equipment and subsystems

6.3 ASSUMPTIONS:

- Existing sites meeting the location criteria will be preferred to new sites
- The VPO will designate the location or general vicinity for the location of all sites
- The participating agencies will grant access to designated sites that are owned or leased by the agency, to the A&E contractor
- The manufacturers of each VENEHMET subsystem or equipment will train the A&E contractor personnel how to install and/or supervise the installation of subsystems or equipment
- The A&E contract will be a cost plus fee contract with incentives for meeting schedules

VENEHMET Implementation Plan

6.4 IMPLEMENTATION PLAN:

6.4.1 Tasks to be performed by the VENEHMET Program office

- ☐ Contract with the VENEHMET subsystem and equipment suppliers for engineering documentation regarding the requirements for site selection and site preparation
- ☐ Contract for A&E services
- ☐ Provide the A&E contractor the engineering documentation for all sites
- ☐ Provide the A&E contractor with the location or vicinity for each site
- ☐ Coordinate site locations with the participating agencies
- ☐ Determine if existing equipment or subsystem sites are suitable for new equipment or subsystems
- ☐ Manage the site survey and site preparation cost and schedule
- ☐ Manage the schedule for delivery and installation of VENEHMET subsystems and equipment

6.4.2 Tasks to be performed by the A&E contractor

- ☐ Site surveys
- ☐ If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the participating agencies, will either approve the site location or request a new survey
- ☐ Facility preparation
- ☐ Installation of equipment and subsystems

6.4.3 MARNR, FAV, EDELCA, FONAIAP, CAA (MOT) and the ARMADA implementation tasks

- ☐ Assist the A&E contractor as required

6.5 A & E IMPLEMENTATION SCHEDULE

ID	Name	1995				1996				1997				1998			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
65	Establish A&E Contract																
66	Contract for A&E Services																
67	Prepare RFP for A&E Contract																
68	Issue RFP for A&E Contract																
69	Evaluate A&E Proposals																
70	Award Contract for A&E & Monitor																

VENEHMET Implementation Plan

7.0 COMMUNICATIONS

The communication requirement includes all communication aspects of the VENEHMET system. The system function is to collect real time data from the automated remote sensing systems, automatic airport weather sensing systems, weather radars, upper-air systems and manual observation sites located throughout Venezuela. This data will be received and archived at the CAPHN center where application specific products will be generated. These products, in turn, will be distributed throughout Venezuela to the various users by a communication system(s) which is also included as part of this design. Because of the diversity of data throughput requirements between data collection and product distribution, a hybrid communication design will be considered.

Very Small Aperture Terminals (VSATs) satellite communications will be used for the collection of weather radar and automatic airport weather sensing systems and will consist of a hub station located at the CAPHN site in Caracas, for product broadcast and data reception. Smaller earth stations supported by a LAN and equipped with work stations will be situated at the remote offices of the various agencies throughout Venezuela. The VSAT system will use a purchased space segment representing a fractional transponder bandwidth from either IntelSat or PanamSat.

GOES satellite communications will be used for the collection of the surface synoptic, climatological, hydrological, oceanographic and upper-air data.

7.1 GOALS:

- Collect accurate and timely observation data at CAPHN
- Disseminate weather and hydrological products to regional offices
- Disseminate weather observation, forecast, warning, and climatological products to end users
- Disseminate hydrologic observation, forecast, and warning products to end users

7.2 SCOPE:

- All weather and hydrologic service data communications in Venezuela

7.3 ASSUMPTIONS:

- VENEHMET participants include MARNR, FAV, FONAIAP, Navy, EDELCA, the Civil Aviation Administration of the Ministry of Communications and Transportation, Central University of Venezuela, and the Center for the Advanced Research in Tropical Climatology

VENEHMET Implementation Plan

7.4 IMPLEMENTATION PLAN:

7.4.1 VPO implementation tasks

- ✓ Contracts for VSAT communications systems
- ✓ Contracts for the VSAT space segment
- ✓ Negotiate Memorandum of Agreement with the U.S. National Oceanographic & Atmospheric Administration (NOAA/NESDIS)
- ✓ Contracts for the GOES/DCS receive site
- ✓ Interface VSAT ground stations to weather radars, ALDF sensors, airport observing systems
- ✓ Interface VSAT ground stations to field office and Air Traffic Control workstations
- ✓ Accepts systems for the government

7.4.2 A&E contractor tasks

- ✓ Site surveys
- ✓ Site preparation
- ✓ Installation

7.4.3 ILS contractor tasks

- ✓ Training for the operations and limited on-site maintenance
- ✓ On-site maintenance
- ✓ Provides supply support
- ✓ Provides depot repair of failed items

7.4.4 CAPHN Processor contractor tasks

- ✓ Interface VSAT hub to CAPHN processors

7.4.5 MARNR, FAV, EDELCA, FONAIAP and the Armada implementation tasks

- ✓ Site preparation at their regional offices

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7.4.6 Civil Aviation Administration (MCT)

- ✓ Site preparation at ATC facilities

7.5 SCHEDULE FOR SATELLITE COMMUNICATIONS

The following schedule shows the implementation for the various elements of the communication systems installation.

7.5.1 Schedule for Satellite Space Segments

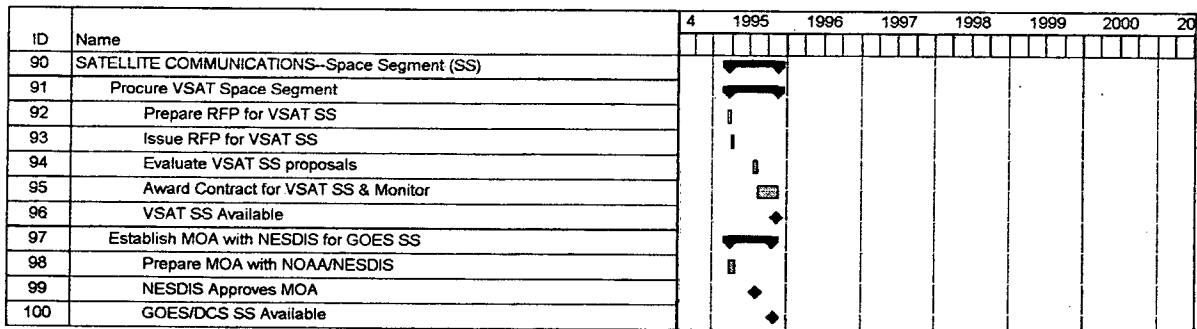


Figure 9
Schedule for Satellite Space Segments

7.5.2 Schedule for VSAT Communications System

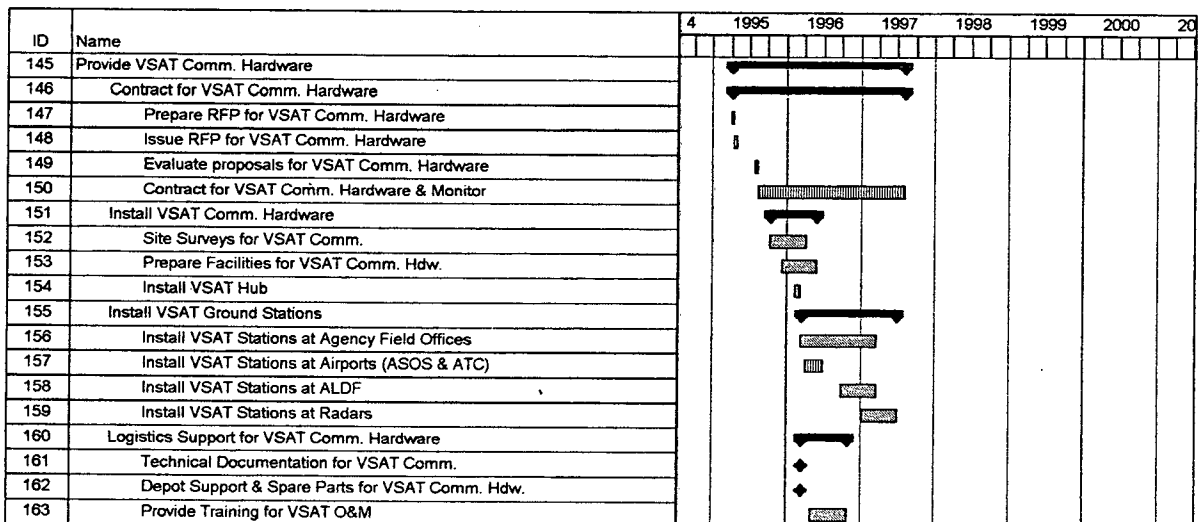


Figure 10
Schedule for VSAT Satellite Communications

VENEHMET Implementation Plan

7.5.3 Schedule for GOES Data Collection System

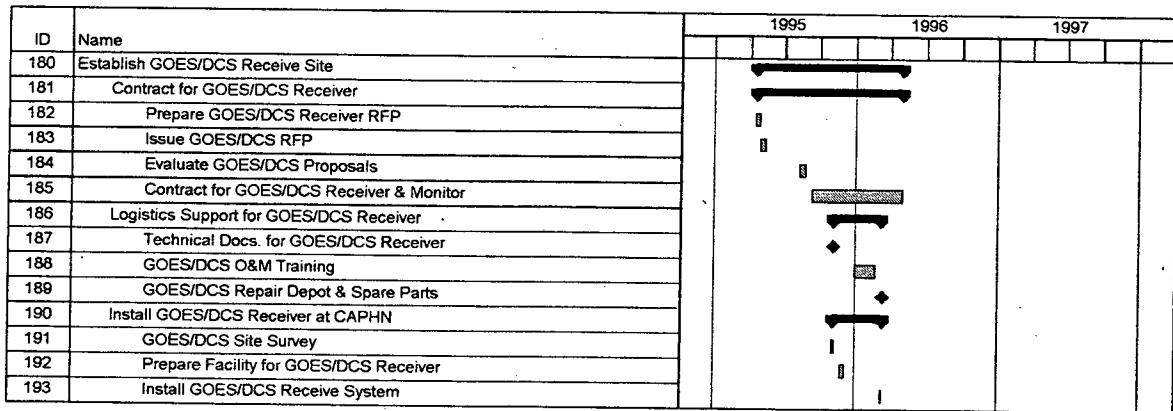


Figure 11
Schedule for GOES/DCS Satellite Communications

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8.0 WEATHER RADARS

Weather radars are needed to measure the precipitation over the northern portions and Guri Dam watershed areas of Venezuela. The VENEHMET Alternative Analysis showed that Doppler weather radars were preferred over conventional non-Doppler radars. Six radars are needed to cover the northern portion of Venezuela.

8.1 GOALS

- Measure rainfall over the northern Venezuelan watershed with a resolution of 1 sq. km. every 15 minutes
- Generate a composite map of rainfall over northern Venezuela in digital form for use by both hydrologists and meteorologists every 15 minutes
- Detect storms that will be a hazard to aviation and create a composite map of these storms every 15 minutes
- Create precipitation accumulation maps of northern Venezuela, updated every hour

8.2 SCOPE

- Select appropriate sites for these weather radars
- Prepare facilities, and access to the facilities if required
- Procure the radars, supporting software, documentation, spare parts, and special test equipment
- Install radars
- Communicate individual radar data to CAPHN for compositing of the data
- Maintain the radar hardware and software
- Train for local maintenance support, operations and interpretation of the data

8.3 ASSUMPTIONS

- Funding will be provided
- Radars will be operated by FAV personnel
- Limited on-site maintenance will be provided by FAV personnel
- Permits for construction can be obtained from local authorities
- All radars will be identical and have Doppler capability

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- The radar specifications are as provided in the VENEHMET Design Specifications Document, Chapter N

8.4 RADAR IMPLEMENTATION PLAN

8.4.1 Tasks to be performed by the VENEHMET Program Office

- Prepare the procurement documentation with the assistance of the supporting agency for the weather radars, automatic data communications and the central weather radar processing systems.
- Assign site survey responsibilities to the A&E contractor for the sites designated in the systems design document and supervise their work. The site location criteria will be as specified by the weather radar manufacturer.
- Supervise the acceptance tests and accept the systems for the government
- Assign site preparation, equipment installation, training, supply support and on-site maintenance responsibilities to the ILS contractor.
- Integration of the weather radar data from all sites with the CAPHN processors.

8.4.2 Tasks to be performed by the A&E contractor

- Site surveys. If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the participating agencies, will either approve the site location or request a new survey
- Preparation of the facilities, including the building to shelter the radar equipment, storage space for consumable supplies, and footings for the tower for the antenna. The requirements will be as specified by the weather radar manufacturer, and local building codes.
- Install equipment under the supervision of the original equipment contractor.

8.4.3 Tasks to be performed by the ILS support contractor

- On-site maintenance with the support of the FAV operators that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the weather radars.

8.4.4 Tasks to be performed by the FAV

- Provide assistance to the SEI contractor in the site surveys

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- Review and approval of the site surveys
- After acceptance of the systems, provide for the operations and limited on-site maintenance support of the weather radars.

8.4.5 Tasks to be performed by the manufacturer of the weather radars

- Manufacture and delivery of the weather radars, the automatic data communications equipment and central processing system, including spare parts, special test equipment, and technical documentation
- Provide installation requirements
- Supervise the installation
- Perform the acceptance test procedures
- Correct any deficiencies

8.4.6 Tasks to be performed by CAPHN

- Operate and provide limited on-site maintenance support for the central radar processing system.

8.5 SCHEDULE FOR IMPLEMENTATION OF THE WEATHER RADARS

The following is the schedule for the implementation of the weather radars.

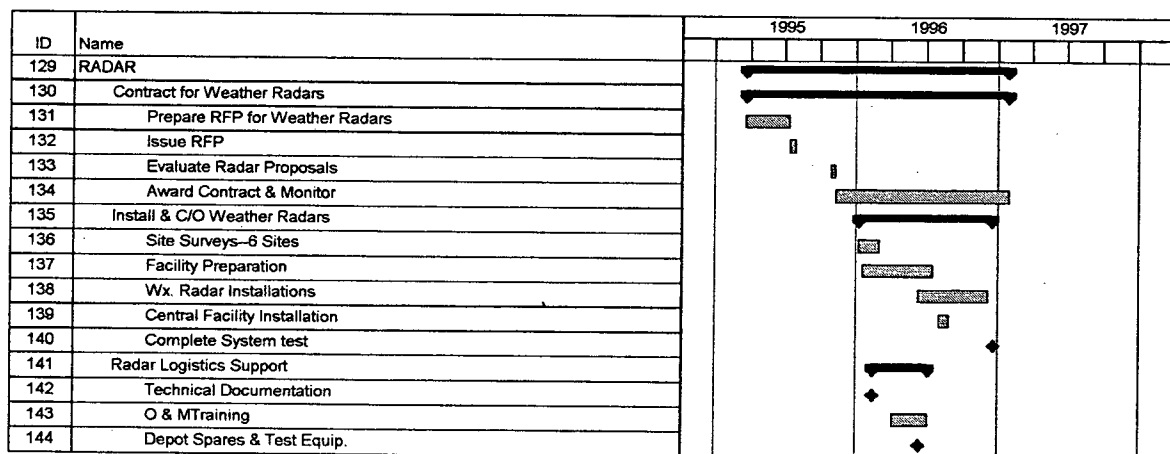


Figure 12
Schedule for Implementation of the Weather Radars

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9.0 Airport , Synoptic, Hydrological, Oceanographic, and Climatological Observation Systems

The plan for implementation of the airport , synoptic, hydrological, oceanographic, and climatological observation systems are grouped together in this plan because each element of this group provides the same basic function of observation, data formatting, and transmission to the CAPHN; each element should be installed at about the same time as the others in the group; and the work breakdown tasks for each element of this group are identical. The Alternative Analysis Document shows that each system in this group should be fully automated from the observation to the transmission of the data to the CAPHN.

9.1 GOALS

- Reliably and accurately observe weather, hydrologic, oceanographic or climatological phenomena and transmit these data to the CAPHN,
- Reduce observation costs by reducing the cost of labor,
- Improve the timeliness of the observations

9.2 SCOPE

- Replace all airport, synoptic, hydrological, oceanographic, and climatological observation equipment with automatic systems,
- Add sensors where required to meet the mission needs, as specified in the VENEHMET Systems Design Document.
- Provide for the calibration of the instruments and systems

9.3 ASSUMPTIONS

- Observing equipment will be located in accordance with the VENEHMET Systems Design Document,
- The Director General for Civil Aviation will be responsible for obtaining the site locations for the airport observing systems and for limited on-site maintenance support (which may be delegated to the FAV at the discretion of the DG Civil Aviation),
- The FAV and MARNR will be responsible for obtaining the site locations for the climatological stations and for limited on-site maintenance support,
- The MARNR and EDELCA will be responsible for obtaining the site locations for the hydrological stations and for limited on-site maintenance support,

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- The FAV will be responsible for obtaining the site locations for the synoptic stations and for limited on-site maintenance support,
- The Navy will be responsible for obtaining the site locations for the oceanographic stations and for limited on-site maintenance support,
- The A&E contractor will perform the site surveys,
- The A&E contractor will install and test the observing equipment and associated processing equipment, under the supervision of the original equipment manufacturer
- The program management contractor will connect the observation system data output to the communications ports and be responsible for data input to the CAPHN.
- Logistics support will be provided by the Integrated Logistics Support Contractor.

9.4 IMPLEMENTATION PLAN

9.4.1 Tasks to be performed by the VENEHMET Program Office

- Prepare the procurement documentation with the assistance of the supporting agency for the various automatic observing systems and instrumentation, and the automatic data communications.
- Assign site survey, site preparation, and equipment installation responsibilities to the A&E contractor for the sites designated in the systems design document and supervise their work. The site location criteria will be as specified by the WMO.
- Supervise the acceptance tests and accept the systems and instruments for the government
- Assign training, supply support and on-site maintenance responsibilities to the ILS contractor.
- Integration of the observation data from all sites with the CAPHN processors.

9.4.2 Tasks to be performed by the A&E contractor

- Site surveys. If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the participating agencies, will either approve the site location or request a new survey
- Preparation of the facilities, including the building to shelter the radar equipment, storage space for consumable supplies, and footings for the tower for the antenna. The requirements will be as specified by the weather radar manufacturer, and local building codes.
- Install equipment under the supervision of the original equipment contractor.

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9.4.3 Tasks to be performed by the ILS support contractor

- On-site maintenance with the support of the FAV operators that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the instruments and systems.
- Provide support for the calibration of the observing instruments.
- Provide operations and maintenance training

9.4.4 Tasks to be performed by the FAV and/or FONAIAP and/or MARNR and/or EDELCA

- Provide assistance to the SEI contractor in the site surveys
- Review and approval of the site surveys
- After acceptance of the systems, provide for the operations and limited on-site maintenance support of the observing instruments and systems.

9.4.5 Tasks to be performed by the manufacturer of the observing instruments and systems.

- Manufacture and delivery of the observing instruments and systems, including spare parts, special test equipment, calibration equipment and technical documentation
- Provide installation requirements
- Supervise the installation
- Perform the acceptance test procedures
- Correct any deficiencies

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9.5 IMPLEMENTATION SCHEDULE FOR THE OBSERVING SYSTEMS

The following is the schedule for the implementation of the remote observation stations.

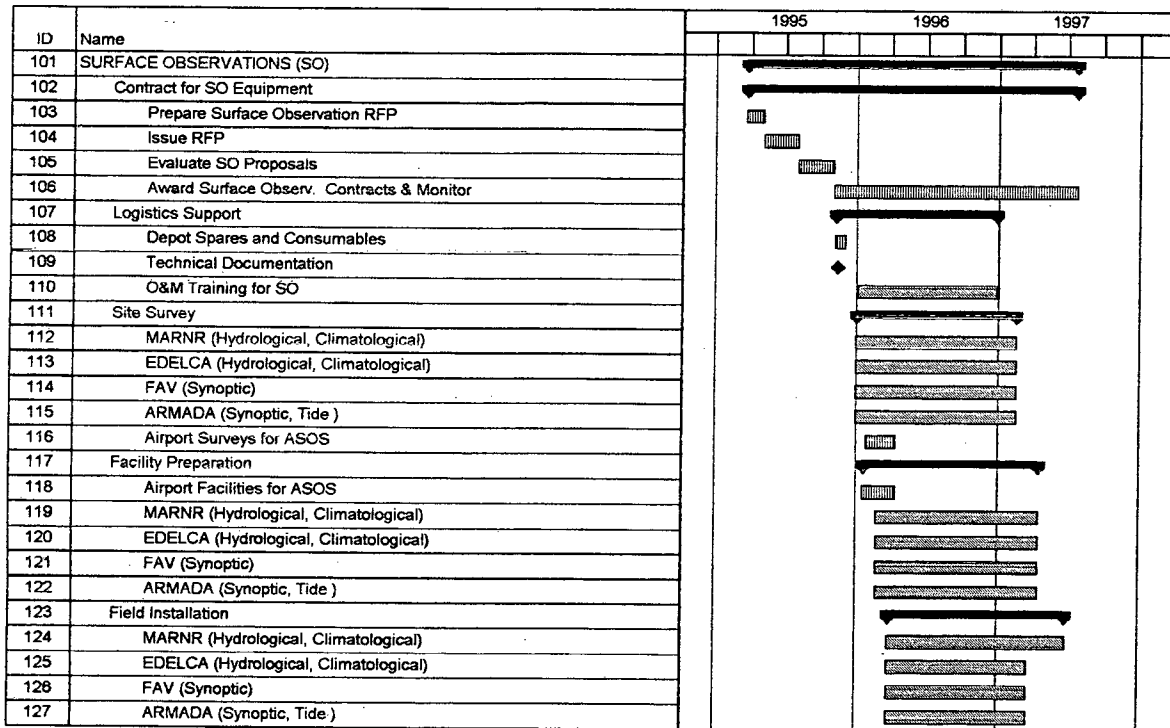


Figure 13
Implementation Schedule for the Observing Systems

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10.0 Lightning Detection and Location Systems

The utility and communications industries employ lightning data in a number of ways. Real-time data are used in the timely mobilization of repair crews and the redistribution of load. User databases are used by protection engineers to detect and classify faults, and to evaluate design improvements. The large archived database can help define protection requirements based on lightning flash densities. In the airline industry, real-time lightning data are used by meteorologists and dispatchers to identify the location of thunderstorms. Dispatchers, in conjunction with pilots, determine the safest and most efficient route to the aircraft's destination.

Lightning is the leading cause of electric utility outages and equipment damage throughout the world. Demand for power quality is increasing as customer operations become more sensitive to power fluctuations and disruptions. Competitive pressure and dwindling profit aggravates the scenario, making it essential to properly identify the areas to invest money in line upgrades and construction. In recent years, lightning detection networks have increasingly helped to address these problems by identifying and tracking thunderstorm conditions and by providing detailed information for evaluating faults. Knowledge of lightning stroke times to the millisecond, along with strike points and peak lightning currents, allows lightning events to be precisely correlated with relay operations and fault analysis systems. A lightning detection system provides real-time and historical lightning data, and precise timing is maintained through a network of sensors employing GPS timing devices. Use of these data for line reliability studies and detailed fault analyses of transmission systems is increasing annually.

10.1 GOALS

The utility industry worldwide employs national lightning data in a number of ways. Real-time data are used by electric utilities in the timely mobilization of repair crews and the redistribution of load. A study by Idone and Orville (1990) demonstrated that real-time access to lightning location data allows power utilities to provide more timely warning for the threat of lightning, and to accurately determine when it is safe to return to normal operation. Summaries of regional and national lightning flash densities are used in planning for line placement and line upgrades. A Lightning Protection Design Workstation (LPDW) which utilizes this flash density data has been developed under EPRI funding (EPRI, 1992).

- Measure lightning strikes (position and polarity) over the northern Venezuelan power lines in real time during lightning activity..
- Generate a composite map of lightning strike positions, in real time, over northern Venezuela in digital form for use by EDELCA and both hydrologists and meteorologists during significant lightning events
- Detect storms that will pose hazard threats and create a composite map of these storms in real time.

VENEHMET Implementation Plan

10.2 SCOPE

- Select appropriate sites for the Automatic Lightning Direction Finders (ALDFs).
- Prepare facilities, and access to the facilities if required
- Procure the Lightning Location Systems, sensors automatic position analyzer, supporting software, documentation, spare parts, and special test equipment
- Install LLS system.
- Communicate individual Sensor data to EDELCA for compositing of the data
- Maintain the LLS hardware and software
- Train for local maintenance support, operations and interpretation of the data

10.3 ASSUMPTIONS

- Funding will be provided
- The LLS system will be operated by EDELCA personnel
- Limited on-site maintenance will be provided by EDELCA personnel
- Permits for construction can be obtained from local authorities
- All Sensors will be identical and use IMPACT technology.
- The LLS specifications are as provided in the VENEHMET Design Specifications Document, Chapter N

10.4 LIGHTNING LOCATION SYSTEM IMPLEMENTATION PLAN

10.4.1 Tasks to be performed by the VENEHMET Program Office

- Prepare the procurement documentation with the assistance of the supporting agency for the LLS System, automatic data communications and the central APA processing systems.
- Assign site survey, site preparation, and equipment installation, responsibilities to the A&E contractor and supervise their work. The site location criteria will be as specified by the LLS System manufacturer.
- Supervise the acceptance tests and accept the systems for the government
- Assign training, supply support and on-site maintenance responsibilities to the ILS contractor.

VENEHMET Implementation Plan

- Integration of the ALDF Sensor data from all sites with the EDELCA APA processors.

10.4.2 Tasks to be performed by the A&E contractor

- Site surveys. If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the participating agencies, will either approve the site location or request a new survey
- Preparation of the facilities as specified by the LLS manufacturer, and local building codes.
- Install equipment under the supervision of the original equipment contractor.

10.4.3 Tasks to be performed by the ILS support contractor

- On-site maintenance with the support of the EDELCA personnel that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the weather radars.
- Provide operations and maintenance training

10.4.4 Tasks to be performed by EDELCA

- Provide assistance to the A&E contractor in the site surveys
- Review and approval of the site surveys
- After acceptance of the systems, provide for the operations and limited on-site maintenance support of the LLS system and sensors.

10.4.5 Tasks to be performed by the manufacturer of the LLS System

- Manufacture and delivery of the ALDF sensors and APA, including spare parts, special test equipment, and technical documentation
- Provide installation requirements
- Supervise the installation
- Perform the acceptance test procedures
- Correct any deficiencies

VENEHMET Implementation Plan

10.4.6 Tasks to be performed by CAPHN

- Operate and provide limited on-site maintenance support for the central lightning data

10.5 SCHEDULE FOR IMPLEMENTATION OF THE LIGHTNING LOCATION SYSTEM

The following is the schedule for the implementation of the LLS.

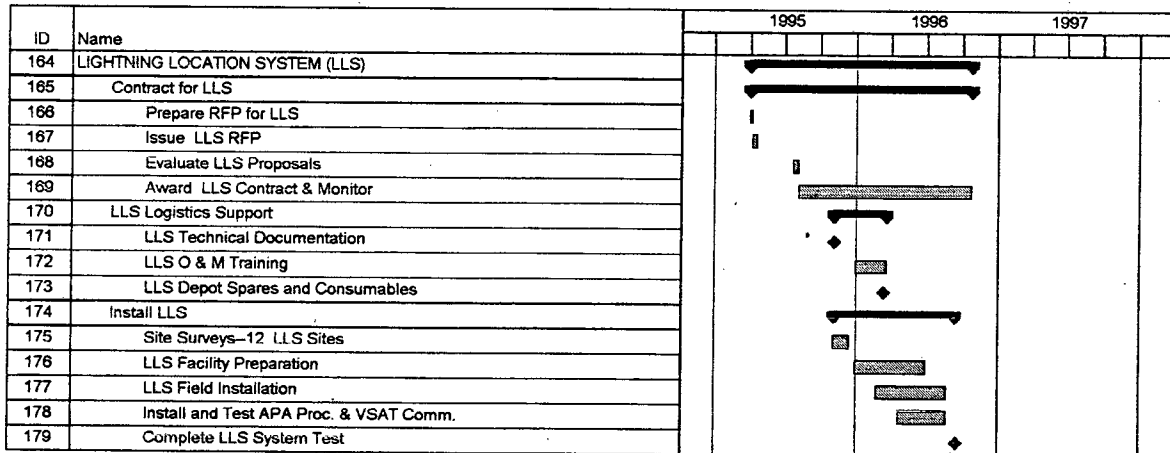


Figure 14
Schedule for Implementation of the Lightning Location System

VENEHMET Implementation Plan

11.0 Upper Air Sounding Systems

11.1 GOAL:

To provide an upper-air sounding system that will provide reliable, accurate and timely soundings of the upper atmosphere.

11.2 SCOPE:

Add to existing 3-station upper-air sounding systems the capability to automatically transmit the sounding data via GOES satellite, and add 4 new automatic GPS systems with the automatic data transmission equipment.

11.3 ASSUMPTIONS:

The 3 existing systems are in good working order and an automatic data transmission system can be retrofitted to these systems.

11.4 IMPLEMENTATION PLAN:

11.4.1 Tasks to be performed by the VENEHMET Program Office

- Prepare the procurement documentation with the assistance of the supporting agency for the upper-air systems and automatic data communications systems. It is expected that the procurement will be of systems identical to the 3 systems now in use and will be procured from the same manufacturer. This is a cost effective approach to provide for common logistics support between the present and new systems. The automatic data communications will be procured from the same source as the basic upper-air systems, where 3 will be for retrofit of the existing systems and 4 will be integral with the new systems.
- Prepare the procurement documentation with the assistance of the supporting agency for the hydrogen generation equipment for the 4 new facilities.
- Assign site survey responsibilities to the A&E contractor for the sites designated in the systems design document and supervise their work. The site location criteria will be as specified by the WMO.
- Supervise the acceptance tests and accept the systems for the government
- Assign site preparation, equipment installation, training, supply support and on-site maintenance responsibilities to the ILS contractor.
- Integration of the data with the CAPHN processors.

VENEHMET Implementation Plan

11.4.2 Tasks to be performed by the A&E contractor

- Site surveys. If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the FAV, will either approve the site location or request a new survey
- Preparation of the facilities, including the building of a balloon inflation shelter with hydrogen generation facilities, storage space for consumable supplies, and sufficient level land area for safe launching of balloons. The requirements will be as specified by the upper-air system manufacturer, the manufacturer of the hydrogen generation equipment, and local building codes.
- Install equipment under the supervision of the original equipment contractor.

11.4.3 Tasks to be performed by the ILS support contractor

- On-site maintenance with the support of the FAV operators that have received maintenance support training.
- Provide an initial supply of bulk chemicals for the hydrogen generation from local suppliers.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the upper-air equipment
- Provide operations and maintenance training

11.4.4 Tasks to be performed by the FAV

- Provide assistance to the A&E contractor in the site surveys
- Review and approval of the site surveys
- After acceptance of the systems, provide for the operations and limited on-site maintenance support of the upper-air systems

11.4.5 Tasks to be performed by the manufacturer of the upper-air systems

- Manufacture and delivery of the upper-air equipment and the automatic data communications equipment, including spare parts, special test equipment, and technical documentation
- Provide installation requirements
- Supervise the installation
- Perform the acceptance test procedures
- Correct any deficiencies

VENEHMET Implementation Plan

11.5 IMPLEMENTATION SCHEDULE:

The following GANTT chart illustrates the implementation of the VENEHMET upper air systems

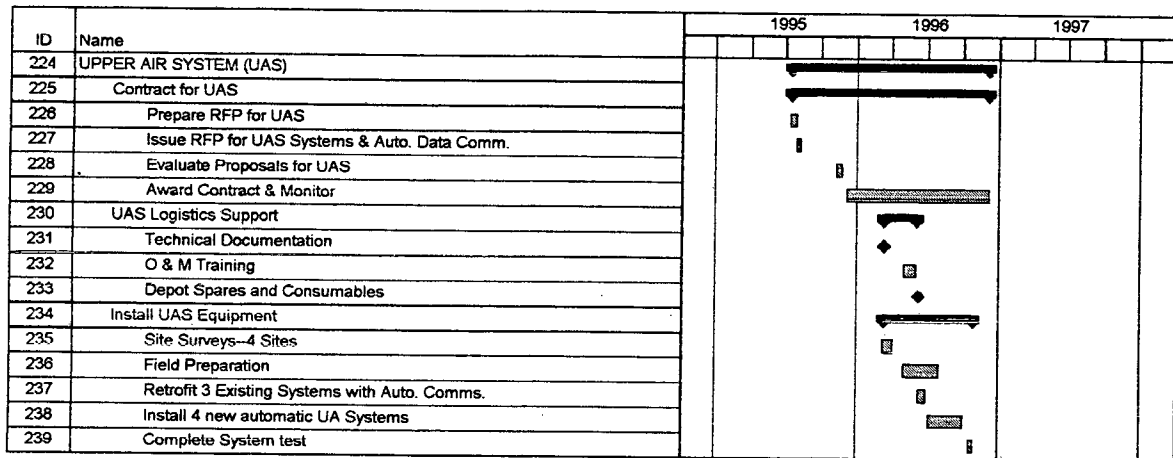


Figure 15
Upper Air Implementation Schedule

VENEHMET Implementation Plan

12.0 Satellite Imagery Receiving Systems

12.1 GOAL:

To provide the central CAPHN facility with satellite receiving systems for the Geostationary Meteorological (GOES, GOES Next, METEOSAT) and Low Earth Orbiting (NOAA/TIROS) Satellites. These satellite systems are the basis for all satellite imagery used in composite product generation, forecasting and nowcasting products disseminated by the CAPHN.

12.2 SCOPE :

Add fully redundant satellite imagery receiving systems compatible with the following satellites:

- Geostationary
GOES, GOES Next
METEOSAT
- Low Earth Orbiting
NOAA/TIROS Series

12.3 ASSUMPTIONS:

- The Satellite Receive Systems will be installed at the CAPHN facility
- The receiving systems will be supplied by the same vendor, however, two separate satellite systems will be used one for each of the different satellite types (i.e. Geostationary or Low earth orbiting). The GMS satellites will be capable of being received by a single system with the simple re-pointing of the antenna and changing the software in the demodulation and data recovery portions of the system.

12.4 IMPLEMENTATION PLAN:

12.4.1 Tasks to be performed by the VENEHMET Program Office

- Prepare the procurement documentation with the assistance of the supporting agency for the procurement of the satellite imagery systems.
- Prepare the procurement documentation with the assistance of the supporting agency for the site preparation and civil works involved with antenna installation.
- Assign site survey, site preparation, equipment installation, responsibilities to the A&E contractor for the sites designated in the systems design document and supervise their work.

VENEHMET Implementation Plan

- Supervise the acceptance tests and accept the systems for the government
- Assign training, supply support and on-site maintenance responsibilities to the ILS contractor.
- Integration of the data with the CAPHN processors.

12.4.2 Tasks to be performed by the A&E contractor

- Site surveys. If the VPO has only designated a general location for the site, the A&E contractor will recommend a specific location, and the VPO, in consultation with the FAV, will either approve the site location or request a new survey
- Preparation of the facilities, for the installation of the computer and antenna assemblies. The location is to be as determined by the VPO approved site survey. The requirements will be as specified by system manufacturer, in terms of RFI, wind loading, and local building codes.
- Install equipment under the supervision of the original equipment contractor.

12.4.3 Tasks to be performed by the ILS support contractor

- On-site maintenance with the support of the CAPHN operators that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the satellite imagery equipment
- Provide operations and maintenance training

12.4.4 Tasks to be performed by the manufacturer of the upper-air systems

- Manufacture and delivery of the satellite imagery systems, including spare parts, special test equipment, and technical documentation
- Provide installation requirements
- Supervise the installation
- Perform the acceptance test procedures
- Correct any deficiencies

VENEHMET Implementation Plan

12.5 IMPLEMENTATION SCHEDULE:

The following GANTT chart illustrates the implementation of the VENEHMET satellite imagery systems

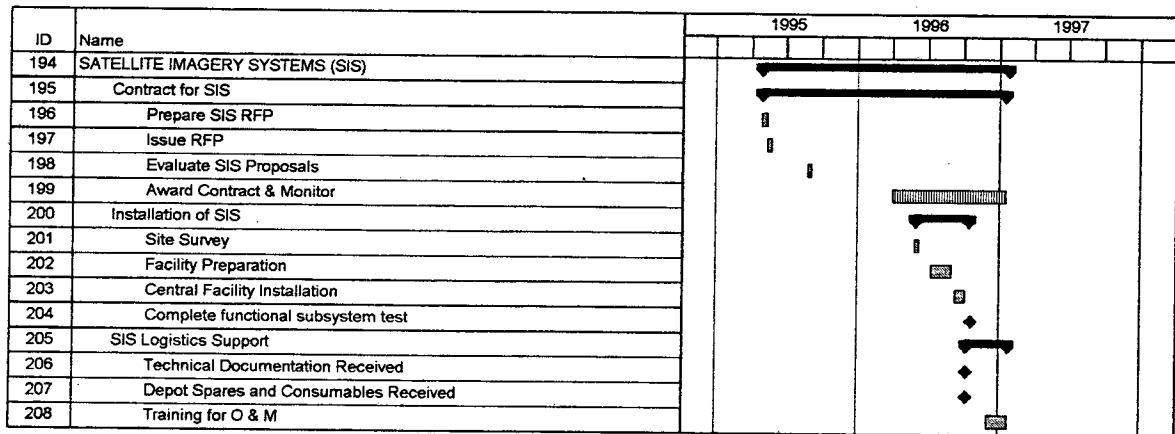


Figure 16
Satellite Imagery Systems Implementation Schedule

VENEHMET Implementation Plan

13.0 Central Processing Systems for CAPHN

13.1 GOALS

- Provide interim weather support during Stage 2 which is moderately superior to the present weather services
- Provide end-state level of hydrologic observation, forecast and warning services near the end of Stage 2
- Provide moderate improvement in weather forecast and warning capabilities in Stage 2
- Provide end-state level of weather forecast and warning services with substantial improvements in Stage 4
- Provide interim weather and hydrological observation, forecast and warning dissemination services to the Caracas area during Stage 2

13.2 SCOPE

- CAPHN is to be the sole provider of central weather and hydrological observation, forecast, warning and archive services to the participating organizations in Venezuela
- CAPHN processing is to be considered the hub of all weather and hydrologic services in Venezuela

13.3 ASSUMPTIONS

- The VPO will provide all processors required for CAPHN operations

13.4 IMPLEMENTATION PLAN FOR THE PROCESSING SYSTEMS TO SUPPORT CAPHN

13.4.1 Tasks to be performed by the VENEHMET Program Office

- Stage 2:
 - ✓ Lease commercial weather services, and processors with graphic workstations for use at CAPHN for a 2 year period (for one year overlap with Stage 3 operations);
 - ✓ disseminate end-user products to Caracas users, to regional offices and airport towers
 - ✓ provide professional training for the use of the commercial weather services

VENEHMET Implementation Plan

○ Stage 3:

- ✓ Install interactive graphic workstations to support both hydrology and meteorology;
- ✓ install an end-state hydrology processor;
- ✓ install an interim capability weather forecast and warning processor;
- ✓ disseminate digital data to regional workstations for end-user product generation
- ✓ disseminate video graphics to television stations from workstations
- ✓ provide professional training for the preparation of forecasts by CAPHN personnel
- ✓ provide professional training for the interpretation and dissemination of the forecasts by field personnel

○ Stage 4:

- ✓ Install a processor and software to run a regional numerical weather prediction model
- ✓ Utilize the Stage 3 workstations
- ✓ Provide professional training for the preparation of forecasts by CAPHN personnel

13.4.2 Tasks to be performed by the commercial weather service company (Stage 2):

- Provide weather maps depicting current and forecast weather conditions in Venezuela and vicinity, updated at least every 6 hours
- Provide weather warning maps and text products for Venezuela and vicinity, updated as conditions warrant
- Provide weather satellite imagery products covering the Caribbean Sea and northern South America, updated hourly

13.4.3 Tasks to be performed by the A&E contractor:

- Site surveys
- Facility preparation
- Installation of equipment

VENEHMET Implementation Plan

13.4.4 Tasks to be performed by the ILS contractor:

Stages 3 and 4

- On-site maintenance with the support of the CAPHN operators that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the processing systems
- Provide operations and maintenance training

13.5 SCHEDULE FOR THE IMPLEMENTATION OF PROCESSORS AT CAPHN

13.5.1 Hydrologic Processor Implementation

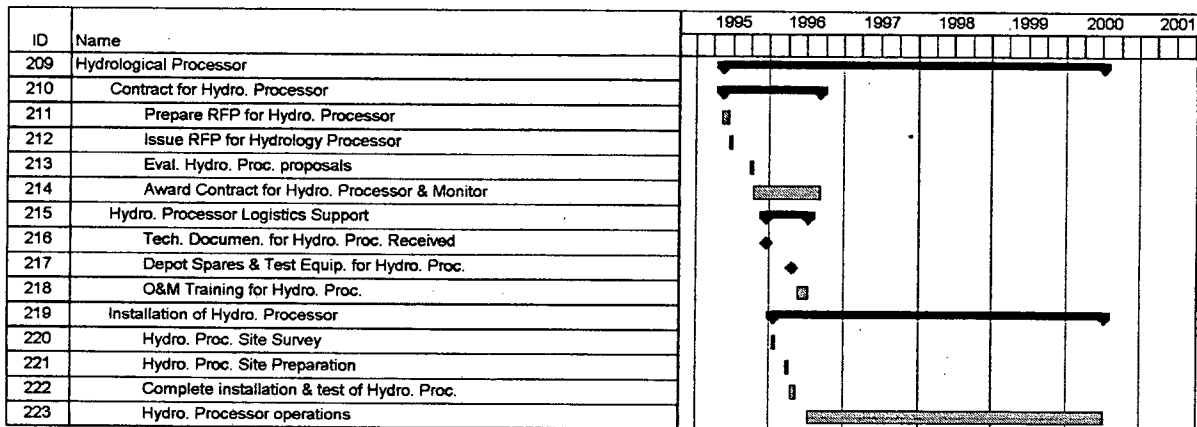


Figure 17
Schedule for the Implementation of the Hydrologic Processor at CAPHN

VENEHMET Implementation Plan

13.5.2 Implementation of the Central Meteorological Processing

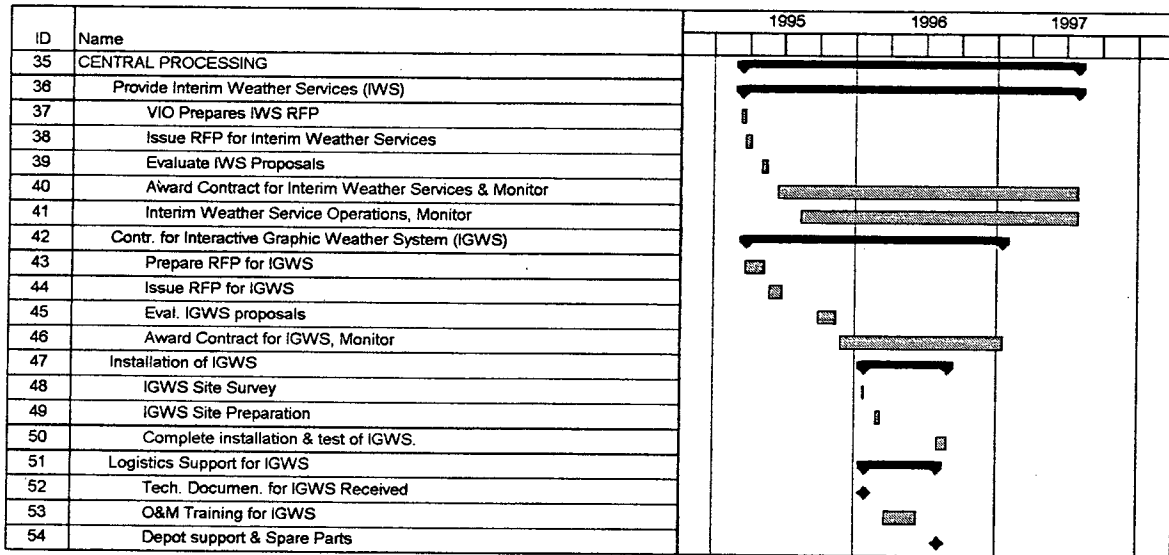


Figure 18
Schedule for the Implementation of the Meteorological Processor at CAPHN

VENEHMET Implementation Plan

14.0 Workstations for Field Offices (including air traffic control facilities)

14.1 GOAL

- Stage 2: Provide equipment to receive CAPHN products in facsimile and text formats
- Stage 3 and 4: Provide PC type workstations to display and disseminate guidance from CAPHN

14.2 SCOPE

- All regional offices of the participating organizations involved in providing weather and hydrological services to users in Venezuela
- All air traffic control facilities in Venezuela

14.3 ASSUMPTIONS

- Data communication is in place as scheduled
- Offices are staffed with professional personnel

14.4 IMPLEMENTATION PLAN FOR FIELD OFFICES

14.4.1 Tasks to be performed by the VENEHMET Program Office:

- Personal computer style work stations will be provided at all regional offices and air traffic control facilities to process and display guidance information from CAPHN. In stage 1, they will receive facsimile and test products. In later stages they will receive graphic products. These workstations will be used to disseminate end-user products via facsimile and digital data circuits.
- Provide for data communications between CAPHN and the field offices
- Provide for professional training for field meteorologists

14.4.2 Tasks to be performed by the A&E contractor:

- Site surveys
- Facility preparation
- Installation

VENEHMET Implementation Plan

14.4.3 Tasks to be performed by the ILS contractor

- Operator and maintenance training
- On-site repair
- Depot repair
- Supply support

14.4.4 Tasks to be performed by the participating agencies:

- Provide facilities for the workstations

14.5 SCHEDULE FOR THE IMPLEMENTATION OF THE FIELD OFFICE WORKSTATIONS

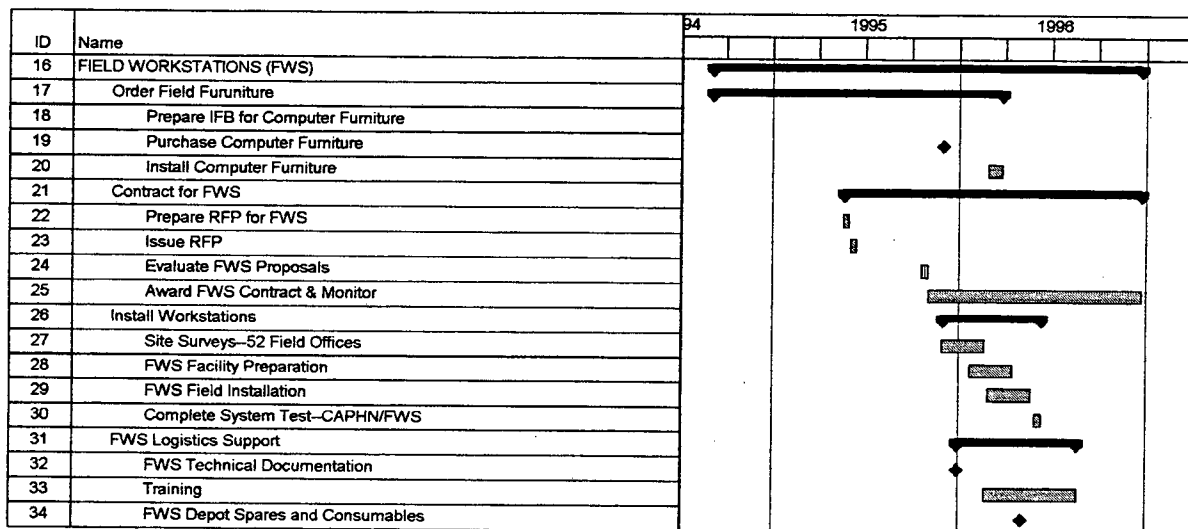


Figure 19
Schedule for the Implementation of the Field Office Workstations

VENEHMET Implementation Plan

15.0 Support for CEACT (The Center for Advanced Research in Tropical Climatology)

15.1 GOALS:

- Expand international cooperative research in tropical climatology.
- Add a Global Climate Change element to the scope of studies.
- Provide access to global climate change model output from the U.S. National Center for Atmospheric Research (NCAR).

15.2 SCOPE:

- Plan to meet the goals through coordination with the CEACT Board of Directors.
- Solicit cooperative research through UCAR, NSF and the (International Climate Change organization).

15.3 ASSUMPTIONS:

- High quality climatic records for Venezuela are available in suitable computer media.
- Automated climatic and synoptic instrumentation will be installed in Venezuela according to the Implementation Plan.

15.4 IMPLEMENTATION PLAN

15.4.1 Tasks to be performed by the VENEHMET Program Office:

- Contract for the services of the University Corporation for Atmospheric Research (UCAR) in the United States to:
 - ✓ Assist the CEACT Board of Directors in the establishment of an International Tropical Climatology Program Office (ITCPO) at the University of the Andes to solicit and organize international cooperative research in the area of tropical climatology,
 - ✓ Assist the ITCPO to create a global climate change project with international participation,
 - ✓ Provide global climate change model output from NCAR to ITCPO,
- Contract for the purchase of a processor with work stations to assist researchers in tropical climatology to access climatological data bases at the CAPHN and model output from NCAR.

VENEHMET Implementation Plan

15.4.2 Tasks to be performed by the A&E contractor:

- Site surveys
- Facility preparation
- Installation

15.4.3 Tasks to be performed by the ILS contractor

- Operator and maintenance training
- On-site repair
- Depot repair
- Supply support

15.4.4 Tasks to be performed by CEACT:

- CEACT will provide space and workstations for foreign visiting scientists

15.5 SCHEDULE FOR CEACT EXPANSION

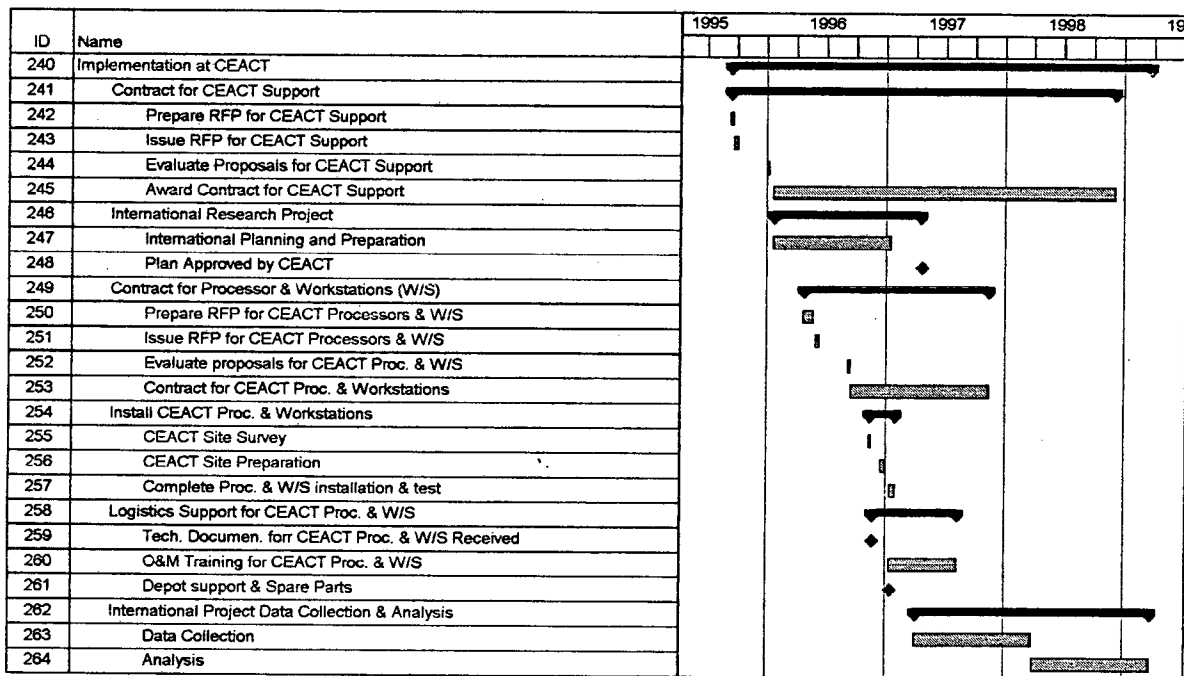


Figure 20
Schedule for CEACT Expansion

VENEHMET Implementation Plan

16.0 Regional Mesoscale Numerical Weather Prediction model for Venezuela

16.1 GOALS:

- Develop, deliver and initiate a regional model to predict mesoscale events in Venezuela: quantitative rainfall, aviation impact variables, and tropical cyclones.
- Initiate strong, focused technology transfer from the NCAR to the Venezuela National Hydrometeorological Center in the area of mesoscale modeling.

16.2 SCOPE:

- Modify MM5 mesoscale model for regional application in Venezuela.
- Generate aviation impact variables from the MM5 model (suitable for a tropical climate)
- Generate quantitative rainfall predictions from the MM5 model.
- Rehost model on computer for use in the Venezuela National Hydrometeorological Center.
- Document software and operating procedures.
- Train Venezuelan meteorologists on the operations and use of the model and its output.

16.3 ASSUMPTIONS:

- NMC forecast guidance is available.
- Observation systems as specified in the VENEHMET implementation plan are provided.
- ACARS meteorological measurements are available from operations to and from Caracas, Maricao and Port of Spain.
- Minimum of one modeler from Venezuela National Hydrometeorological Center assists in modification of model at the NCAR.
- High-resolution grid data for terrain depiction in MM5 model is available.

VENEHMET Implementation Plan

16.4 IMPLEMENTATION PLAN

16.4.1 Tasks to be performed by the VENEHMET Program Office:

- Contract for the services of the University Corporation for Atmospheric Research (UCAR) in the United States to provide:
 - ✓ A regional mesoscale model to predict mesoscale events in Venezuela: quantitative rainfall, aviation impact variables, and tropical cyclones,
 - ✓ Rehost this model on computer for use in the CAPHN,
 - ✓ Document software and operating procedures,
 - ✓ Train Venezuelan meteorologists on the operations and use of the model and its output,
 - ✓ Initiate strong, focused technology transfer from the NCAR to the Venezuela National Hydrometeorological Center in the area of mesoscale modeling.
- Provide the computers and workstations required to run the regional mesoscale model at the CAPHN.
- Provide the data communications and interfaces needed to assimilate the observation data and NMC generated analyses and forecasts for use in the model.

16.4.2 Tasks to be performed by the A&E contractor:

- Site surveys
- Facility preparation
- Installation of equipment

16.4.3 Tasks to be performed by the ILS contractor:

- On-site maintenance with the support of the CAPHN operators that have received maintenance support training.
- Provide depot repair support, technical manual storage and maintenance, software support and supply support for the processing systems
- Provide maintenance training

16.4.4 Tasks to be performed by CAPHN

- The CAPHN will run the regional mesoscale model on a production schedule after the model is verified to meet the needs of Venezuela, about five years after the beginning of VENEHMET.

VENEHMET Implementation Plan

16.5 SCHEDULE FOR CREATING AND OPERATING A REGIONAL MESOSCALE MODEL FOR VENEZUELA

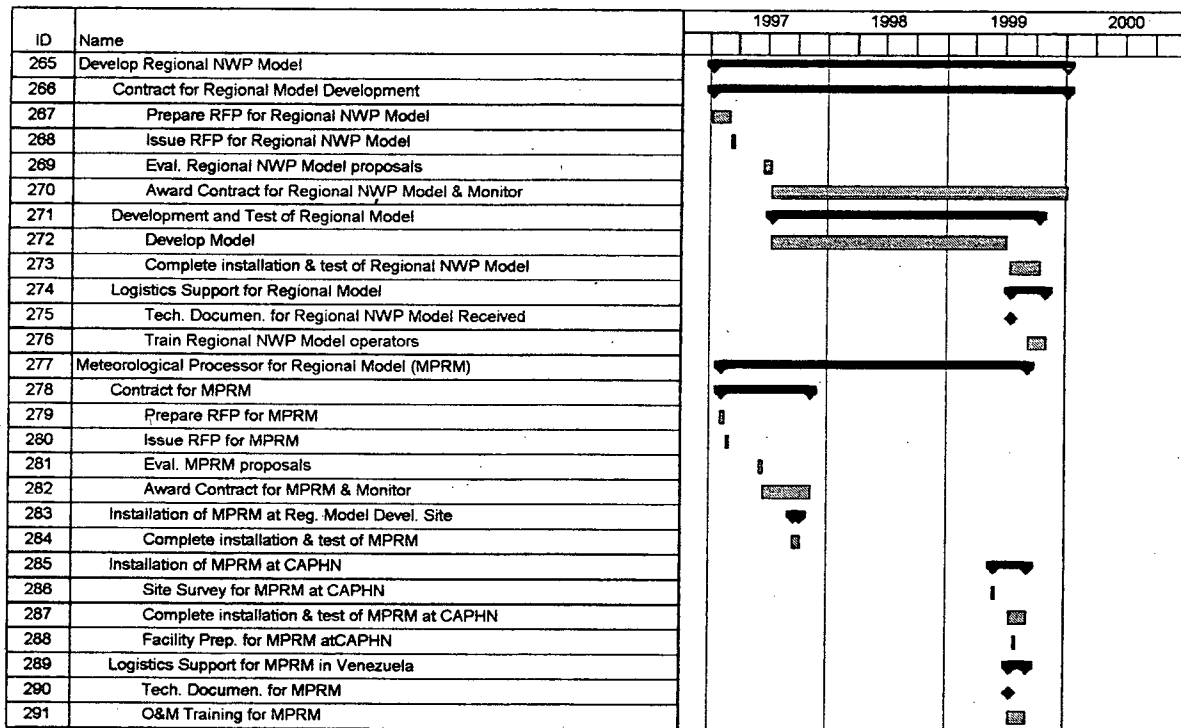


Figure 21
Schedule for Creating & Operating a Regional Mesoscale Model for Venezuela

UNIVERSIDAD CENTRAL DE VENEZUELA

FACULTAD DE INGENIERIA

Dpto. de Ingeniería Hidrometeorológica



ORGANIZACION METEOROLOGICA MUNDIAL

CENTRO REGIONAL DE FORMACION

Y ENSEÑANZA PROFESIONAL



Nº _____

DPTO. DE INGENIERÍA HIDROMETEOROLÓGICA.

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PLAN VENEHMET

***PROPUESTA PARA UN PROGRAMA DE FORMACIÓN
DE RECURSOS HUMANOS***

Caracas, marzo de 1998

1.- INTRODUCCIÓN

Por espacio de varios años Venezuela ha mantenido una participación activa en lo atinente al conocimiento de los fenómenos atmosféricos y en lo relativo a la medición de las diferentes variables que conforman el Ciclo Hidrológico. Los registros centenarios del Observatorio Cagigal y la evolución de la red de mediciones Hidrometeorológicas así lo evidencian.

A partir de la década de los años cincuenta, comienzan a crearse estaciones de medición de variables Climatológicas e Hidrológicas con criterios de red de cobertura nacional, por parte de organismos oficiales, entre los que pueden destacarse los ministerios de Obras Públicas y de Agricultura y, posteriormente, otros como el Instituto Nacional de Obras Sanitarias, el Instituto Agrario Nacional, la Electricidad del Caroni, los Servicios de Meteorología de la Comandancia General de la Marina y de las Fuerzas Armadas, y particulares como la Electricidad de Caracas, etc., etc..

Ya en la década de los sesenta, la red ha alcanzado un grado de desarrollo que la sitúa a nivel de las más desarrolladas de la América Latina, con cerca de 1470 estaciones climatológicas y 880 hidrológicas, cubriendo una parte significativa del territorio nacional.

Desde sus comienzos hasta el presente, se han realizado esfuerzos por mantener, ampliar y modernizar la red, para adecuarla a las necesidades que se derivan del avance acelerado de los conocimientos en Meteorología, Hidrología y Oceanografía, así como en lo correspondiente a la prestación de un servicio eficiente y confiable para los usuarios. Consecuentes con esta actuación, el ministerio del Ambiente y de los Recursos Naturales Renovables contrató recientemente con la Agencia para el Desarrollo Comercial de los Estados Unidos, la elaboración de un programa para la modernización del sistema de pronóstico Nacional, que tiene como principales objetivos los siguientes:

- Desarrollo de recursos humanos en el área de la Hidrometeorología
- Instalación de redes básicas de datos Hidrometeorológicos dotadas de instrumental moderno
- Implantación de modelos e instrumentos de pronóstico modernos.
- Ampliación y actualización de los sistemas de telecomunicaciones para la recolección y la diseminación de la información en tiempo real.
- Creación de un Centro Hidrometeorológico Nacional
- Creación de un Sistema Integrado de Soporte Logístico.

2.- FUNDAMENTOS DEL PROGRAMA DE FORMACIÓN DE RECURSOS HUMANOS

2.1.- ALCANCE

El plan está desarrollado sobre la base de la utilización de los avances tecnológicos más recientes en materia de informática y sensores remotos. En su aspecto operativo, se considera la creación de un Centro Hidrometeorológico Nacional de alerta y pronóstico que, bajo la dirección del Comité Nacional de Meteorología e Hidrología, coordinará la centralización de la información proveniente de las redes que actualmente operan instituciones como la Armada, EDELCA, CADAPE, FAV, FONALAP, MARNR y la Aviación Civil, para la formación de una base de datos que servirá para la generación de productos tales como:

- Observaciones y pronósticos meteorológicos
- Alertas sobre eventos meteorológicos severos y peligrosos
- Alertas sobre inundaciones
- Acopiar estadísticas de datos climatológicos
- Suministrar información sobre calidad del aire y del agua
- Manejo de recursos hídricos e hidroeléctricos
- Observaciones y predicciones oceanográficas

Estos productos estarán disponibles para ser utilizados por usuarios como el Ministerio de Relaciones Interiores a través de Defensa Civil; el Ministerio de Transporte y Comunicaciones en servicios para la aviación civil; Oficinas Gubernamentales de planeamiento; Medios de Comunicación como prensa, radio y televisión; Compañías Petroleras en sus operaciones costeras y labores de planificación; el Sector Privado en actividades de comercio y construcción, agricultura, recreación, deporte y turismo.

Respecto a los recursos económicos requeridos, el plan está concebido de forma de minimizar las inversiones, utilizando la infraestructura existente para la dotación de:

- Sistemas de Radar Meteorológico
- Sistemas de detección y localización de rayos
- Sistemas de sondeo de altura

- Sistemas de observación automática de superficie (para aeropuertos)
- Red automática de observaciones remotas
- Sistemas de observación de niveles y calidad de aguas
- Sistemas de observación de variables oceanográficas

Mediante esta dotación las redes permitirán obtener la información necesaria sobre:

- Presión atmosférica
- Temperatura a diferentes niveles
- Evaporación
- Humedad
- Localización de Rayos
- Imágenes de satélites meteorológicos
- Tasas de precipitación
- Humedad y temperatura del suelo
- Radiación solar
- Horas de sol
- Velocidad y dirección del viento
- Reflectividad de radar
- Altura de niveles freáticos
- Niveles de ríos
- Altura de mareas
- Altura de olas

2.2.- PROPUESTA DEL PLAN SOBRE LA CONFIGURACION DE LA RED AUTOMÁTICA DE OBSERVACIONES REMOTAS

En el cuadro 1 siguiente, se indican las instituciones a cuyo cargo estará la operación de la red automatizada de observaciones remotas, así como el número de estaciones que atenderán estas, discriminadas según sean medidoras de precipitación, climatológicas, sinópticas, agrícolas, de observaciones de niveles de ríos, de oleaje y de calidad del agua.

Organismo	Estación		Vdv	Pb	Ta	Hr	P	Rs	Ds	Ts	Hs	E	Na	M	Ca
	Clase	Cantd	Agrícolas												
			Climatológicas												
			Sinópticas												
Marni	Prec	300					300								
	Clim	59	59	59	59	59	59	59	59			18			
	Na	97											97		
	Ca	75													75
	Tot.	531													
Edelca	Prec	40					40						12		
	Clim	28	28	28	28	28	28	28	28				16		
	Na	3											3		
	Tot.	71													
Fav	Sinop	34	34	34	34	34	34								
Fonlap	Agre	23	23	23	23	23	23	23	23	23	23	23			
Armada	Sinop	10	10	10	10	10	10							3	
Mtc	Sinop	10	10	10	10	10	10								
Total		604	154	154	154	154	504	110	110	23	23	41	128	3	75

Cuadro 1 - Red automática de observaciones remotas propuesta en el plan

Abreviaturas utilizadas en el cuadro para designar la clase de estación :

Prec = Estación medidora de precipitación
 Clim = Estación climatológica
 Na = Estación medidora de niveles de agua
 Ca = Estación medidora de la calidad del agua
 Sinop = Estación sinóptica

Abreviaturas utilizadas para designar el tipo de variables que se observan en las diferentes clases de estaciones:

Vdv = Velocidad y dirección del viento
Ta = Temperatura del aire
P = Precipitación
Ts = Temperatura del suelo
E = Evaporación
M = Mareas
Ca = Calidad del agua

Pb = presión Barométrica
Hr = Humedad Relativa
Rs = Radiación Solar
Ds = Duración del sol (Horas de sol)
Hs = Humedad del suelo
Na = Niveles de agua

2.3.- DIAGNÓSTICO DE LOS SERVICIOS, REALIZADO POR LA MISIÓN TÉCNICA DE LA OMM, CON MOTIVO DEL ESTUDIO DE FACTIBILIDAD DEL PROYECTO CLIMA IBEROAMERICANO

Durante los días 15 al 17 de octubre de 1997, con motivo de la realización del estudio de factibilidad del proyecto Clima Iberoamericano, una misión de la OMM, integrada por consultores de DELCAN (Canadá), TASC inc. (Estados Unidos), INN y Dirección General de Obras Hidráulicas y Calidad del Agua (España), presentó las siguientes conclusiones de diagnóstico sobre los Servicios Meteorológicos e Hidrológicos de Venezuela:

- La observación Meteorológica es llevada a cabo por diferentes organismos de la administración del Estado, lo que se traduce en dispersión y pérdida de esfuerzos y, consecuentemente, en la calidad de los servicios.
- Casi ninguna red opera completamente (con excepción de la de EDELCA), debido, principalmente, a cuestiones presupuestarias: Suministro de diferentes equipos, antigüedad de los mismos, personal de observación, mantenimiento - calibración, infraestructuras, etc.. El instrumental y la tecnología de cada una de las redes es diferente.
- Los datos registrados en las redes se almacenan y difunden en bases de datos diferentes en cuanto a software y hardware.
- La información de imágenes digitales, en la mayoría de los casos, no se administra en bases de datos.
- Los procesos de distribución de datos se realizan por medios convencionales como fax, copias en medios magnéticos y, eventualmente, por redes de computadores.
- No existe una política común de comercialización de productos
- La cantidad de personal calificado es notablemente insuficiente en casi todas las instituciones estudiadas

3.- PROGRAMA DE FORMACIÓN DE RECURSOS HUMANOS (PFRH)

Un componente importante dentro del plan, es el que se refiere al entrenamiento profesional del personal que tendrá la responsabilidad futura de la gerencia, el mantenimiento y la garantía de los servicios que a través de éste deberán prestarse.

Bajo la dirección y la supervisión de una universidad de los Estados Unidos, asociada al plan, se contemplan las siguientes acciones generales:

- La U.C.V. tendrá participación en los planes de entrenamiento.
- Una universidad de los Estados Unidos, afiliada al plan, dirigirá y supervisará el entrenamiento profesional de Meteorólogos, Hidrólogos y Pronosticadores dentro y fuera de Venezuela
- Contratación de 3 profesores de la universidad afiliada en los Estados Unidos, para que impartan entrenamiento profesional en la U.C.V., durante la fase de implantación del plan (4.5 años).
- Crear incentivos estudiantiles, por medio de becas, para estimular la selección de carreras en las áreas de las ciencias meteorológicas.
- Crear un programa de becas para seguir estudios de postgrado (cuarto nivel) en la universidad afiliada de los Estados Unidos.

En el marco de estas posibilidades, podrían considerarse acciones de dos tipos:

- 1.- Inmediatas
- 2.- De corto plazo

3.1.- ACCIONES INMEDIATAS

La puesta en práctica del plan requiere de un personal que, de manera inmediata, asuma las responsabilidades que se derivan del mismo. Con este propósito podría entrenarse el que actualmente se desempeña en los servicios que pertenecen a las instituciones anteriormente referidas, luego de un entrenamiento apropiado. Paralelamente a ello, se propone un programa que requiere de un tiempo mayor, tal como se especifica más adelante.

3.1.1.- Cursos para instructores

Para asegurar el desarrollo presente y futuro del personal que el plan requiere, será necesario comenzar por ofrecer cursos de entrenamiento para el personal docente del Departamento de Ingeniería Hidrometeorología (DIH), que en lo sucesivo se desempeñarán como instructores y que tendrán bajo su responsabilidad todo lo referente a la preparación del recurso humano. Estos cursos podrían realizarse en períodos de 3 meses en Venezuela o

en el exterior, de común acuerdo con los proveedores del instrumental o de los equipos previstos, comenzando con un mínimo de 2 ó 3 profesores.

3.1.2.- Cursos para el personal técnico existente

Si tomamos en consideración que el principal objetivo del plan es el de la modernización de la red utilizando tecnología de punta para la obtención, el procesamiento, transmisión y la diseminación de datos, se hace necesaria la creación de cursos breves de entrenamiento del personal técnico con que hoy cuentan los servicios, en áreas como:

- Sistemas de telecomunicaciones para la transmisión y recepción de datos en tiempo real
- Sistemas automáticos de observación remota
- Sistemas de sondeos de altura
- Receptores y procesadores de imágenes provenientes de satélites
- Radares meteorológicos
- Sistemas automáticos de observación en superficie
- Sistemas de detección de relámpagos

Estos cursos podrían realizarse varias veces durante un año, dependiendo de la cantidad de aspirantes y de las necesidades del servicio, por períodos de un mes distribuido en clases teóricas y prácticas.

Los recursos económicos a considerar serían los gastos de matrícula y de viáticos del personal que tenga que trasladarse a Caracas para recibir el entrenamiento.

3.1.3.- Cursos de entrenamiento para el personal profesional existente

De manera similar a lo propuesto para el personal técnico existente, y atendiendo a las mismas razones antes expuestas, se propone ofrecer cursos breves, con duración de uno a dos meses, para entrenar al personal profesional que actualmente presta sus servicios en esas instituciones. Estos se diferenciarán de los dirigidos a los técnicos, haciendo énfasis en todo lo referente a los sistemas de obtención, transmisión y diseminación de datos; uso de software, uso de los modelos que vayan a utilizarse en Meteorología, Hidrología, Oceanografía, Sistemas de Observación Geográfica y Teledetección por Satélites.

3.1.4.- Cursos de nivelación para profesionales de áreas diferentes de la Ingeniería Hidrometeorológica

Tradicionalmente han trabajado en el área de la Hidrometeorología, ingenieros Agrónomos, Forestales, Civiles; Geógrafos etc., que adquieren su formación en este campo luego de un determinado período de ejercicio profesional. Esta experiencia podría aprovecharse para preparar personal profesional en un tiempo breve, mediante la oferta de cursos de 1 año de duración que pueden organizarse en la U.C.V. por órgano del Departamento de Ingeniería Hidrometeorológica, con la categoría de Cursos de Ampliación de Conocimientos.

3.2.- ACCIONES DE CORTO PLAZO

Desde el año 1960, el DIH de la Facultad de Ingeniería de la U.C.V., ha venido formando profesionales en las áreas de Meteorología e Hidrología, con los que se han satisfecho parte de la demanda del país. Tradicionalmente el número de estudiantes de esta carrera ha sido bajo, por lo que, para aumentarlo y adecuarlo a los requerimientos del plan en el corto y mediano plazo, será necesario prever acciones de promoción que destaquen, entre otras cosas, tanto para la carrera como para el plan, su importancia, su alcance en el tiempo y sus posibilidades de progreso y superación profesionales.

3.2.1.- Formación de Técnicos Superiores en Hidrometeorología

Utilizando la infraestructura existente en la Facultad de Ingeniería de la U.C.V., a través del DIH, y de la condición de Centro de formación para América Latina de la Organización Meteorológica Mundial, pueden crearse los cursos para técnicos superiores siguiendo el marco general de referencia que recomienda esta organización para el personal clase II. De esta forma, en un plazo relativamente corto, contaríamos con un recurso importante de alto nivel, para la creación de lo que dentro del plan se ha denominado el Sistema Integrado de Soporte Logístico, destinado a mantener la utilización óptima del mismo durante una vida útil no menor de 20 años. Estos profesionales se formarían, de acuerdo con el programa que se propone, en un período de estudios de 5 semestres. La oferta de estos cursos en el país satisfaría las necesidades en cuanto a formación de profesionales que son requeridos por instituciones como las FAV, La Armada y el FONAIAP, entre otras.

3.2.2.- Formación de Ingenieros Hidrometeorologistas

Haciendo uso de la experiencia de la U.C.V. y del apoyo de la Organización Meteorológica Mundial, junto con un programa de becas para estudiantes de pregrado y postgrado, para lo cual se prevén recursos en el plan, se podría fortalecer el programa actual de formación de profesionales con cinco años de carrera, con una proyección como la que se indica en el cuadro 3 y en las gráficas 1 y 2, que proporcionaría cerca de 90 ingenieros al término de unos 10 años. Estos programas deberían revisarse para incluir la formación, como asignaturas obligatorias, en Oceanografía, Sistemas de Información Geográfica y Teledetección por satélites. Así mismo, actualizar, ampliar y dar una mayor importancia a la

formación en materia de pronósticos, campos estos en los que los tres profesores que vendrán de la universidad afiliada, prestarían un aporte invaluable.

Año	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ingresos	20	20	15	15	12	12	12	10	10	10	10	10	10	10
Matricula	20	40	55	70	82	94	91	86	81	76	71	61	56	51
Egresos						15	15	15	15	15	15	15	15	15
Egreso acun.						15	30	45	60	75	90	105	120	135

Cuadro 3 - Programa de formación de Ingenieros Hidrometeorologistas y prospección de matrícula

PROGRAMA DE FORMACION DE INGS. HIDROM.

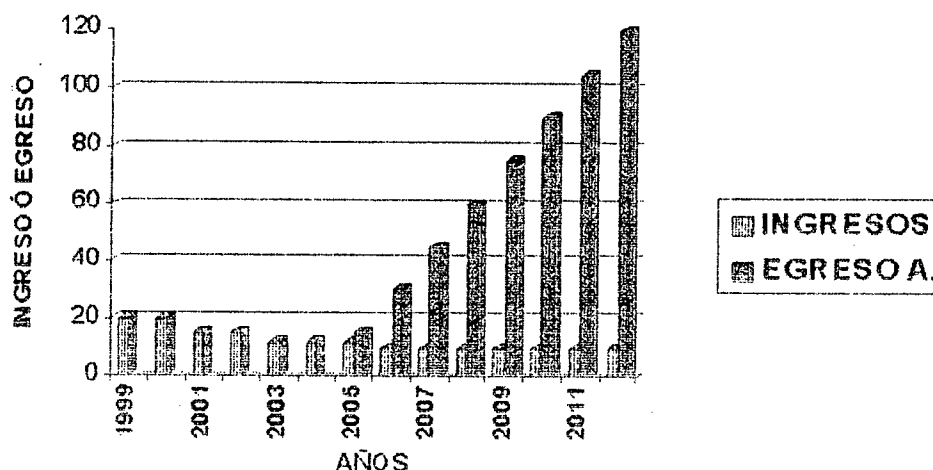


Figura 1.1 - Comparación entre ingreso y egreso anual

Desde el punto de vista de la variación de la matrícula como consecuencia de los ingresos estimados, se alcanzaría un pico de aproximadamente 94 estudiantes en el año 2004, que ameritaría aumentar la plantilla actual del DIH, al menos en 2 profesores para cada una de las áreas de Oceanografía, Meteorología e Hidrología, tomando en consideración, además, que para esa fecha se habrá jubilado la totalidad del profesorado actual.

Si se inicia el plan durante el año actual o, al menos el PFRH, mediante la puesta en vigencia del programa de becas para estudios de cuarto nivel en la universidad afiliada de los Estados Unidos, se podría solventar esa situación. La figura 1.2 ilustra la variación de la matrícula con los ingresos.

FORMACIÓN DE INGS. HIDROM.

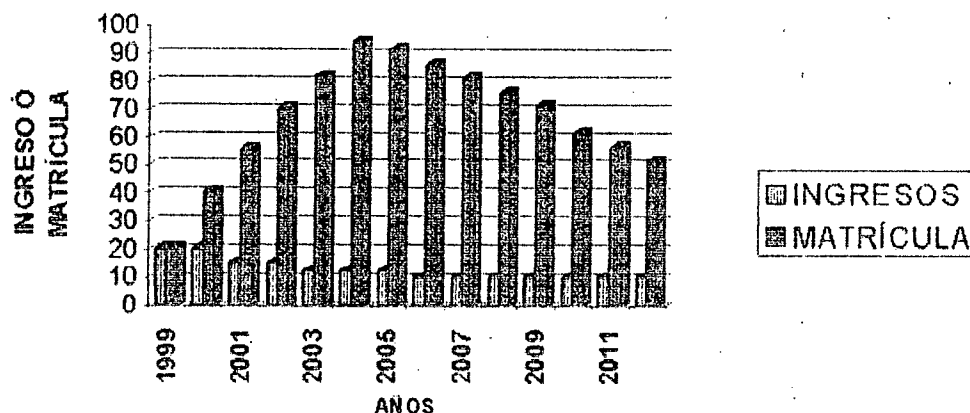


Figura 1.2 - Comparación entre ingreso y matrícula anual

3.2.3.- Cursos de Especialización (cuarto nivel)

Haciendo uso de las posibilidades de becas previstas en el plan, podría implantarse de inmediato un programa de Maestrías y Doctorado en la universidad afiliada de los Estados Unidos, al cual tendrían posibilidades de acceso los ingenieros en áreas como Hidrometeorología, Civil, Agronomía, Forestal, etc., que actualmente trabajen en los diferentes servicios. En estos cursos podría también solicitarse la participación del CIDLAT, tomando en consideración su experiencia sobre el particular.

4.- ALCANCE GENERAL DE LOS CURSOS PROPUESTOS

4.1.- Cursos para Instructores

- Descripción del plan VENEHMET
- Estructura de la red de observaciones remotas
- Instrumentos y equipos que conformarán la red
- Sensores remotos
- Radar meteorológico
- Teledetección por satélites
- Software a ser utilizados en Meteorología, Hidrología y Oceanografía
- Modelos que serán montados para pronóstico y alertas.
- Sistemas de Información Geográfica

Requisitos: Profesor universitario en áreas de Meteorología, Hidrología, Oceanografía

Duración: 3 meses

Institución: Clases teóricas en Universidades del país o del exterior impartidas por expertos en el plan, y clases prácticas en Centros de entrenamiento de las empresas suministradoras de equipos.

4.2.- Cursos para el personal técnico existente

- Sistemas de telecomunicaciones utilizados para la transmisión y recepción de datos en tiempo real
- Sistemas automáticos de observación remota
- Sistemas de sondeo en la altura
- Receptores y procesadores de imágenes provenientes de satélites
- Radar meteorológico
- Sistemas automáticos de observación en superficie
- Sistemas de detección de relámpagos

Requisitos: Bachilleres que trabajen en algún servicio

Duración: 20 horas de teoría y 20 de prácticas durante dos semanas

Institución: U.C.V. - Departamento de Ingeniería Hidrometeorológica (DIH)

4.3.- Cursos de entrenamiento para el personal profesional existente

- Sistemas de obtención, transmisión y disseminación de datos
- Radiación y teledetección
- Sensores
- Comprensión y uso de software a utilizar en meteorología, hidrología y oceanografía
- Modelos a ser implantados para pronóstico y alertas
- Sistemas de Observación geográfica

Requisitos: Profesionales pertenecientes a algún servicio

Duración: 1 mes

Institución: U.C.V. - DIH

4.4.- Cursos de nivelación para profesionales de áreas diferentes de la Ingeniería Hidrometeorológica

- Meteorología General
- Meteorología Tropical
- Hidrología Superficial
- Hidrología Subterránea
- Oceanografía
- Instrumentos y Observaciones
- Sistemas de Observación Geográfica

Requisitos: Ingenieros Agrónomos, Civiles, Forestales; Geógrafos.

Duración: 1 año

Institución: U.C.V. - DIH

4.5.- Carrera de Técnicos Superiores en Hidrometeorología

Ver pensum anexo.

Requisitos: Bachiller en ciencias

Duración: 5 semestres

Institución: U.C.V. - DIH

4.6.- Carrera de Ingeniero Hidrometeorologista

Ver pensum anexo.

Requisitos: Bachiller en ciencias

Duración: 5 años

Institución: U.C.V. -DIH.

4.7.- Cursos de Especialización (cuarto nivel)

Ver prospecto de estudios de la universidad afiliada en los Estados Unidos

Requisitos: Ingenieros

Duración: 2 a 5 años

Institución: Universidad afiliada

5.- FACTIBILIDAD DEL PROGRAMA DE FORMACIÓN DE RECURSOS HUMANOS (PFRH)

Analizaremos en este aparte la factibilidad del PFRH, tomando en cuenta las previsiones que se han tomado en el plan, en cuanto a la educación a niveles de pregrado y postgrado, apoyo docente de la universidad afiliada y la infraestructura educacional existente.

5.1.- Instituciones Docentes

En Venezuela solamente la Universidad Central cuenta con una estructura consolidada a lo largo de más de 30 años de experiencia, para la formación de profesionales en el área de la Hidrometeorología, en las opciones de Meteorología e Hidrología. El DIH cuenta con el reconocimiento de la OMM como Centro Regional de Formación para la Región de América Latina, con planes de estudio que se enmarcan, en general, dentro de sus requisitos para profesionales clase I.

Otras instituciones han incursionado exitosamente en la oferta de estudios a niveles de maestrías, principalmente en áreas de la Hidrología y de la Planificación y manejo de los Recursos Hidráulicos, aunque sólo de una manera muy esporádica. Tales han sido los casos de la U.D.O., la U.S.B. y el CIDIAT.

Comenzando por las acciones de carácter inmediato, se daría inicio al programa con el entrenamiento en el exterior, preferentemente, de 3 profesores del DIH, durante 3 meses. A su regreso estos darían comienzo a los cursos de preparación del personal técnico y profesional existente en las instituciones que prestan los servicios, de manera simultánea según se muestra en el cuadro 2. Las instalaciones del Núcleo experimental El Laurel de la U.C.V. y las del DIH en Caracas, satisfarían las necesidades en materia de salones y de otra índole.

Descripción del curso	M e s e s												Cursantes	Institución
	1	2	3	4	5	6	7	8	9	10	11	12		
Preparación de instructores	■	■	■										Profesores U.C.V.	Exterior
Preparación del personal técnico	■												Personal técnico disponible actualmente	U.C.V. Hidrometeorología
Preparación de personal profesional	■	■											Profesionales disponibles actualmente	U.C.V. Hidrometeorología
Entrenamiento	■	■	■	■	■	■	■	■	■	■	■	■	Profesionales de ingeniería de otras especialidades	U.C.V. Y CIDIAT

Cuadro 2 - Cronograma de acciones inmediatas
Fecha de inicio: a determinar

Los cursos de entrenamiento para profesionales de otras especialidades de ingeniería pueden comenzarse de inmediato, bajo la responsabilidad del DIH y del Instituto Tecnológico. De ser necesario podría considerarse la posibilidad de incorporar en este programa al CIDIAT.

En cuanto al programa de acciones a corto plazo, podrían considerarse dos etapas: una, la continuación de la carrera actual de IH, con las modificaciones antes sugeridas para adecuarla a los requerimientos del plan y, otra, la creación de la carrera de Técnico Superior.

Las modificaciones que se harían a la carrera actual de IH, podrían llevarse a cabo al comenzar el plan con la ayuda de los tres profesores de la universidad afiliada de los Estados Unidos que, como se ha señalado, permanecerán en el país durante 4,5 años en la fase de implantación. De esta forma se irían preparando los profesionales de relevo que la universidad y el país necesitan para asegurar la continuidad y el éxito del plan.

La carrera de Técnico Superior, destinada a formar los recursos profesionales intermedios, tomará un tiempo mayor para su entrada en vigencia. Pues, si bien se han adelantado gestiones en tal sentido, faltan por concretarse otras en las instancias administrativas de la U.C.V. y del C.N.U., para su definitiva aprobación.

Los cursos de cuarto nivel, comenzando con un plan de maestrías en las áreas de Meteorología, Pronóstico y Oceanografía, tendrán que realizarse en el exterior, con los recursos considerados para ello en el plan.

Sobre las maestrías en las áreas de Hidrología, valdría la pena considerar las posibilidades que en tal sentido ofrecen instituciones como la Universidad Simón Bolívar y el CIDIAT. En el cuadro número 4 se muestra la simultaneidad con que podrían iniciarse estas acciones

Curso	Años					Institución
	1	2	3	4	5	
Técnicos superiores	■	■	■			U.C.V.-DIH
Ing. Hidrometeorologista	■	■	■	■	■	U.C.V.-DIH
Maestría	■	■	■			CIDIAT
Doctorado	■	■	■	■	■	EXTERIOR

Cuadro 4 - Cronograma de acciones a corto plazo
Fecha de inicio: Inmediata

Finalmente los cursos de doctorado tendrán que realizarse en universidades calificadas del exterior.

5.2.- Instituciones prestadoras de servicios

Para minimizar los costos el plan se ha estructurado tomando en cuenta la infraestructura de servicios existente. Es así como se continuarían operando redes bajo la responsabilidad de la FAV, la Armada, el FONAIAP, EDELCA, el MTC, el MARNR, Etc., todas con sus propios recursos humanos actuales.

La implantación definitiva del PFRH, habrá de comenzar, entonces, con una evaluación de la plantilla con que actualmente cuentan esas instituciones, así como de sus necesidades de entrenamiento. Por ello para poder precisar fechas de inicio y los recursos necesarios, deberá contarse, cuanto antes, con una evaluación pormenorizada en este sentido.

La difusión del plan y del PFRH entre los niveles administrativos que puedan decidir sobre el particular es, en consecuencia, prioritaria.

6.- RECOMENDACIONES

6.1.- Precisar la fecha de inicio del plan, habida cuenta que se había previsto para el año 1994.

6.2.- Divulgar el plan VENEHMET y el PFRH entre las instituciones involucradas, en procura de la necesaria unidad de criterios para poder garantizar su éxito.

6.3.- Evaluar las necesidades de entrenamiento de los recursos humanos disponibles actualmente en cada institución, lo que permitiría concretar, entre otras cosas, recursos económicos y la programación, a fecha cierta, de los cursos.

6.4.- Concretar, de inmediato, los cursos de entrenamiento para instructores (Renglón 4.1), con representantes del Republic Group (TRG), tomando en consideración su papel como autores del plan y la participación que tendrán como ejecutores del mismo, así como el hecho de ser el principal consorcio de fabricantes de equipos y sistemas ambientales e hidrometeorológicos en los Estados Unidos. Deberán detallarse los contenidos específicos, a la luz del alcance del plan y de las especificaciones generales que proponemos en el Curso para Instructores, la duración de los mismos, las instituciones en los Estados Unidos que los ofrecerían, los costos y las fuentes de financiamiento, las posibilidades de entrenamiento práctico, etc. El inicio de estos cursos vendría a significar el comienzo efectivo del Programa de Formación de Recursos Humanos.

6.5.- Determinar la organización que administrará los planes de becas, tanto para estudiantes como para graduados, habida cuenta que este programa puede iniciarse de inmediato.

6.6.- En cuanto a los cursos de postgrado se recomienda dar prioridad a las áreas de Meteorología y a personal que desempeñe labores docentes en la U.C.V., para asegurar su participación en el plan y la continuidad en el futuro del Programa de Formación de Recursos Humanos en Venezuela.

6.7.- Acometer, cuanto antes, reformas en los planes de estudio del Departamento de Ingeniería Hidrometeorológica de la U.C.V., que incluyan, como asignaturas obligatorias del pensum actual, Oceanografía, Sistemas de Información Geográfica y Teledetección por Satélites; reforzando, actualizando y dándole una mayor importancia a la formación sobre pronósticos. Para ello será necesario y posible reconsiderar los contenidos específicos de varias de las materias que actualmente se dictan, para reagruparlas en un número menor, dándole cabida, de esta forma, a las que se proponen.

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