

# The Sivam Project: weather radar network for the Amazon region

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**Abstract.** The SIVAM (Sistema de Vigilancia da Amazonia) Meteorological Radar Network, will consist of 10 radar strategically located in the Amazon region, allowing the coverage of the North region of Brazil. It comprises S-band Doppler weather radars and a wide area networked data processing system, allowing the automatic processing of weather phenomena data at radar site and the dissemination of information in real time. The SIVAM network permits the monitoring of the weather conditions continuously, supporting the SIVAM meteorology organs to effectuate the meteorological vigilance of the area under its responsibility – ATC (Air Traffic Control), hydrology, environmental supervision. Additionally it will allow the CINDACTA I and III (ATC control sectors in the southern/eastern part of Brazil) to observe the prevailing meteorological conditions in the adjacent flight control sectors.

All radars are remote-controlled from the CRV (Centro Regional de Vigilancia) , Manaus center through 4 remote operation stations. The meteorological products generated by each radar are combined to a composite which is distributed in the SIVAM network. A minimum of 27 visualization stations will to be deployed in the area where SIVAM operates and in the CINDACTA I and III area. All radar are subject to continuous remote control and supervision through supervision stations installed in the CVA (Centro de Vigilancia Aerea) Manaus center.

## 1 Introduction

This paper describes the capabilities provided by the Data Processing System of the SIVAM Meteorological Radar System. The Data Processing System comprises the GAMIC FROG – MURAN software suite and GAMIC signal ENIGMA Doppler signal processor, responsible for the processing and display of meteorological products and the

control and monitoring of the radar sensors.

### 1.1 System overview

The SIVAM Meteorological Radar System is comprised of 10 S-band meteorological radars located in the Amazon region (Boa Vista – UV, Tefé – UVT, Porto Velho – UV, Cruzeiro do Sul – UVT, Tabatinga – UV, Macapá – UV, Belém – UV, Santarém – UV, São Gabriel da Cachoeira – UV e Manaus – UV, UV = Unidade de Vigilancia), allowing the coverage of the North region of Brazil.

At each radar site and at the processing center at the Manaus CVA and CRV, automated software controls the radar data processing, product generation and data dissemination for visualization and distribution of meteorological information. Figure 1 shows the locations of the weather radar system (WRS) sites and Manaus center.

The SIVAM Weather Radar System will be comprised of radar equipment, radar data processing workstations and meteorological workstations located at the radar sites and in the meteorological center in the CVA and CRV at Manaus.

The system will be equipped with computer equipment, allowing the automatic processing of detected data at radar sites and the dissemination of its information in real time through the SIVAM wide area network (WAN). Each radar site will be connected to the WAN network and then to the center in the CVA and CRV at Manaus. The interconnection of radar sites permits the monitoring of the weather conditions in a continuous way, supplying the SIVAM meteorology team, an effective meteorological vigilance upon the area under its responsibility. It will allow the CINDACTA I and III to receive information about the prevailing meteorological conditions in the adjacent FIR (Flight information area).

The radars are remote-controlled from the CVA/CRV Manaus through four remote operation stations. The meteorological products generated at each radar site will be integrated through the Mosaic Composition, making available the meteorological information of the whole region for distri-

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System Functional Element	Description
Radar equipment	EEC radar DWSR 8500S and antenna and Radar Control Computer (RCC)
Radar monitoring workstation	Monitoring workstation for the radar
Signal Data Processor ( <b>SDP</b> )	Radar data processing equipment
Radar Data Computer ( <b>RDC</b> )	Primary interface for radar control and data acquisition from SDP, situated at the radar site
Local Weather Radar Station ( <b>LWRS</b> )	Workstation for product definition, generation and visualization and radar scan control situated at the radar site

System Functional Element	Description
Weather Remote Control Station ( <b>WRCS</b> )	Workstation for product definition and visualization and radar scan control situated at the Manaus center Total of 4 workstations
Radar Status Monitor ( <b>RSM</b> )	Workstation for product gathering, system monitoring and control, situated at the Manaus center. Total of 2 workstations
Mosaic Composition Station ( <b>Mosaic</b> )	Workstation for mosaic composition and visualization display situated at the Manaus center Total of 2 workstations

- Controls the radar functions via control line to RCC (Radar Control Computer);
- Receives status and BITE information from the RCC (Radar Control Computer); Provides radar maintenance tools: Calibration, BITE requests, status;
- Provides real time data visualization of the radar output: PPI (Plan Position Indication, RHI (Range Height Indication), A-scope, Antenna position indication, Trigger outputs;

## 5 Local Weather Radar Workstation

The Local Weather Radar Station (LWRS) workstation is provided in order to be used by a local operators, situated at the radar site. The LWRS performs the following main functions:

- Local control of SDP and RDC;
- Local control of sweeps;
- Local scan control;
- Local control of schedules;
- Local control of data flow;
- Processing of 3D volume data for 2D product generation;
- Product visualization for local operator.

## 6 Weather Remote Control Station

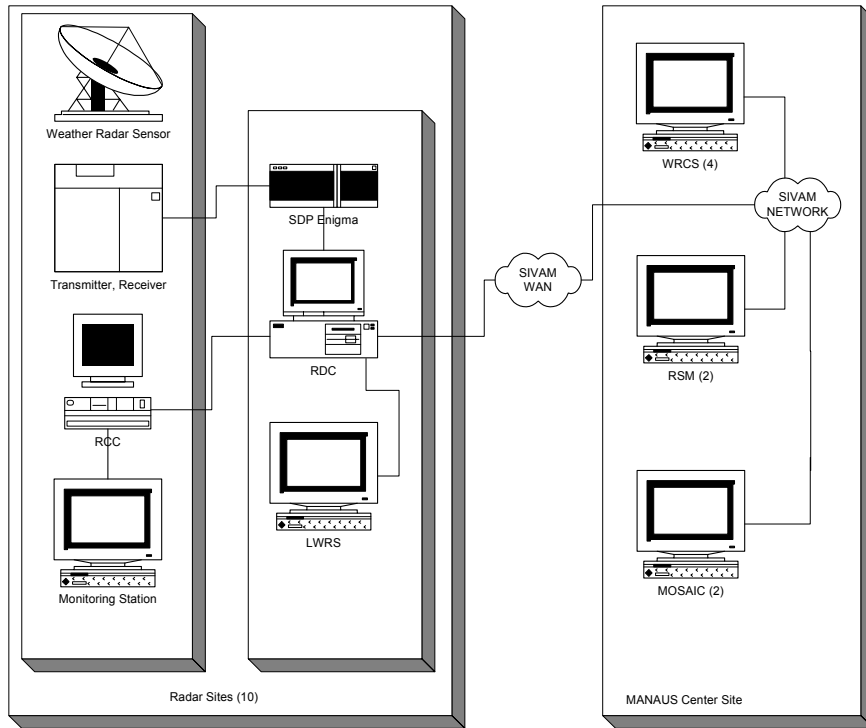
The Weather Remote Control Station (WRCS) is the main operation position for meteorologists. It will be situated at the CRV Weather Surveillance location and will be able to control up to 4 radars simultaneously. The WRCS performs the following main functions:

- Remote control of SDP and RDC;
- Remote control of sweeps;
- Remote scan control and scan scheduling definition;
- Remote control of data flow of products and commands;
- Product visualization for a remote operator.

## 7 Mosaic Composition Station

The Mosaic Composition Workstation receives product data from all radars in the system, processes and generates a resulting composite product containing meteorological data for all radar sites. The Mosaic composition performs the following main functions:

- Re-projection and reformatting into the target coordinate system;
- Composite generation according to the radar mosaic algorithm;



**Fig. 2.** Processing Stations at SIVAM sites

- Generation of the composite output product in PNG (Portable Network Graphics) format;
- Display of the composite product on MOSAIC workstation(s);
- Transfer of the composite product to MSW's (Meteorological Surveillance Workstation) via MSWCOM.
- Supervision and graphical status of each station;
- Concentration and distribution of products originated from the radar sites;
- Verification of radar remote BITE;
- Visualization of product thumbnail.

## 8 Radar Status Monitor

Radar and Network Status Monitor Station (RSM) performs the following functions: Control and supervision of the whole system;

## 9 Outlook

As the first radar systems will be operational in summer 2002 the paper will present weather phenomena examples from the Amazon region and first operational experiences.