NBC Telemundo License, LLC
BloomMobile VMES Satellite Targeting System

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Introduction

Originally built in 2003 by NBC News Field Operations for coverage of Operation Iraqi Freedom, the BloomMobile, named after the late NBC Correspondent David Bloom, is a Vehicle Mounted Earth Station (VMES) using a 2003 Ford F-450 four wheel drive Flatbed truck with a SeaTel 1.5 Meter Ku-band stabilized marine antenna retrofitted by the Miramar, Florida-based company *Maritime Telecommunications Network (MTM)*. The BloomMobile was outfitted with live television and satellite transmission equipment capable of continuously broadcasting reports as US troops made their way through the Syrian Desert from Kuwait to Baghdad.

After the war, the BloomMobile was returned to NBC News Field Operations in Long Island City, NY and has been retrofitted for domestic use; in particular, serving the public interest by providing real-time hurricane coverage as it follows the track of a storm while broadcasting live pictures to people in the region who are anticipating danger to life and property, to search and rescue teams as they negotiate relief efforts in the wake of the storm, by first responders planning recovery strategies and by local authorities.

System Components

The major components of the BloomMobile'a pointing mechanism are as follows. Refer to the block diagram below during the system description portion of this document.

1) Antenna, 1.5M Ku-band: Cobham Sea-Tel 6009 Series Stabilized to 0.1 degrees RMS, 0.2 degrees MAX in presence of vehicle motion accelerations of 0.5G or less.

2) Antenna Control Unit (ACU) w/internal tracking receiver: Sea-Tel Model DAC-2202
3) Satellite Beacon Receiver: Comtech SDM-600L data satellite modem.
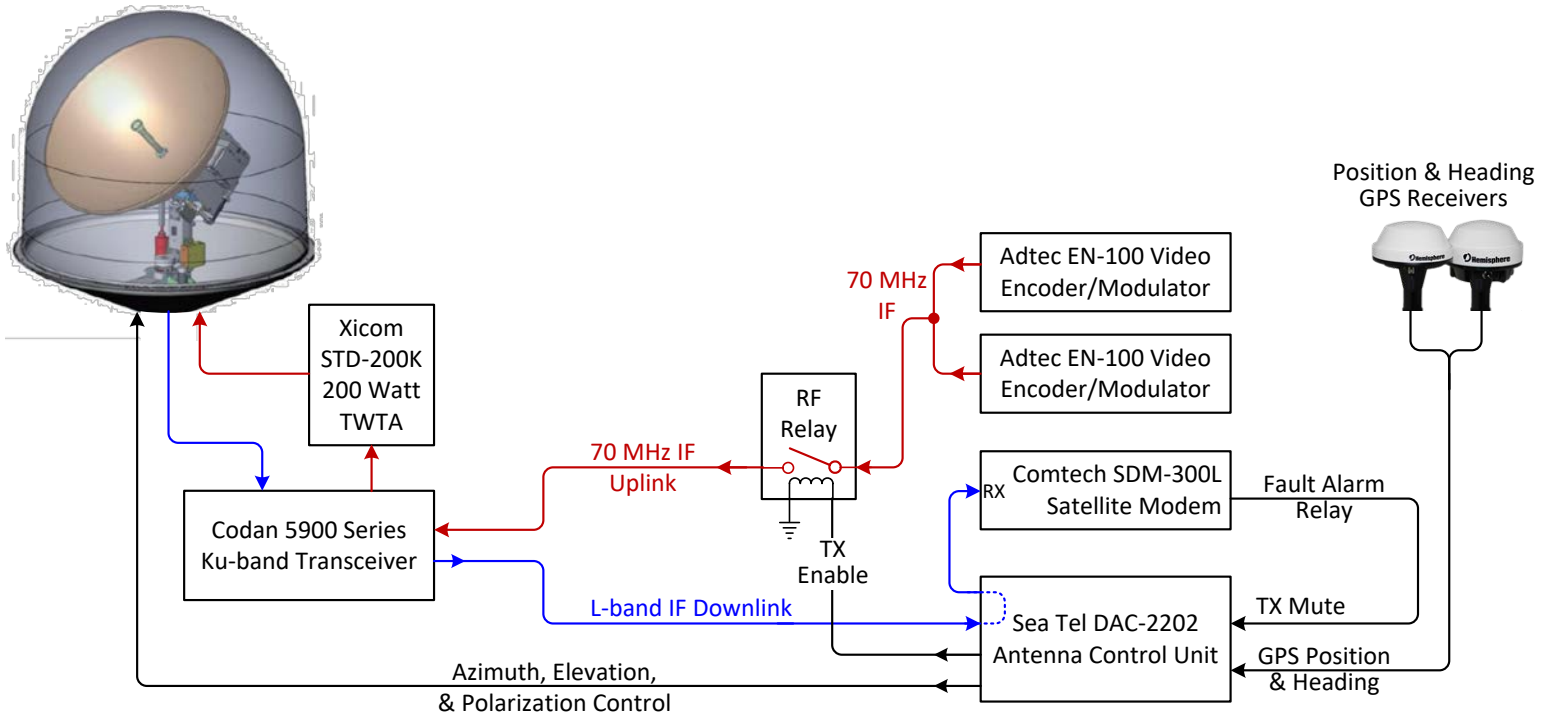4) Dual GPS receivers: Hemisphere Vector VS-101 GPS Compass with a heading accuracy of <0.30° rms.

Figure-2

Initial Satellite Acquisition

During the initial satellite acquisition process, the BloomMobile uses data from two GPS receivers mounted on the roof of the cab and compares their outputs to determine its geographic location and heading. With this information, the ACU calculates the look angles to the desired satellite and sends coarse azimuth, elevation & polarization coordinates to the antenna pedestal to roughly position the antenna. Once aimed within +/- 1.0 degree in the direction of the satellite, the ACU then commands the antenna to begin searching the sky in a horizontal & vertical spiral box pattern that scans a more limited search zone.

Search Pattern
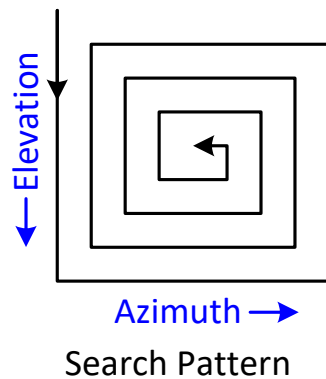
Identifying a Satellite

Eventually the ACU Tracking Receiver detects a carrier at the preset downlink frequency and generates an AGC signal with a level proportional to the strength of the carrier indicating there's RF energy at that frequency and the antenna is pointed at a satellite. However, the ACU's internal tracking receiver lacks the means of differentiating between satellites.

On Target Confirmation

Determining the correct satellite is accomplished with a Comtech SDM-600L satellite modem functioning as a beacon receiver and preset to the specific parameters of a full time carrier beacon uplinked by NBC's teleport in Washington, DC. The data stream contained within this beacon is used to provide positive identification of the desired satellite. When the modem's receiver establishes lock on the data stream, the fault condition is cleared and the alarm relay releases. The ACU interprets this change of state as an indication of the proper conditions being in place to activate the transmitter. Otherwise, if a lock condition on the data stream cannot be achieved within 30 seconds, the ACU returns to the search mode.


Figure-3

Activating the Transmitter

When the ACU senses the release of the error alarm relay in the data modem, it sends a voltage that activates a normally open electromechanical RF relay connecting the 70MHz IF output of two Adtec EN-100 video encoder/modulator to the input of the Codan-5900 Ku-band Transceiver mounted on the back of the antenna. As the BloomMobile uplinks the video signal, the ACU and antenna continually sweep a smaller target zone in a constant attempt to maximize the receiver AGC thus ensuring that the antenna is centered on the desired satellite.
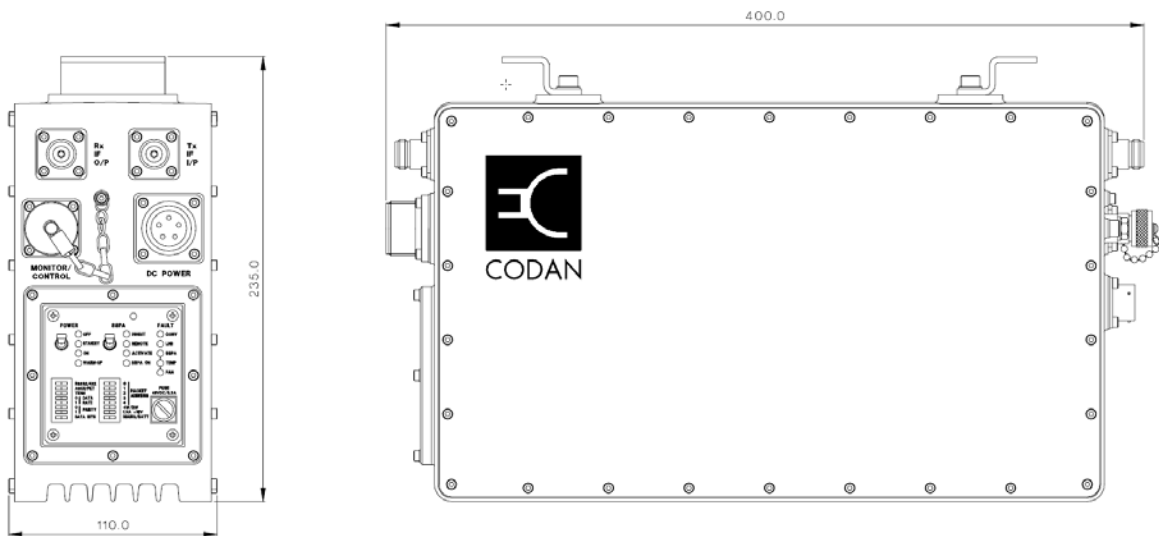
Automatic Transmitter Muting

If for any reason the antenna moves off the satellite by more than +/-0.5 degrees, the data modem's decoder loses data stream lock and the modem's fault relay closes indicating to the ACU an error condition exists. The ACU stops transmitting by cutting the voltage to the RF relay which extinguishes the IF drive to the Ku-band transceiver and muting the carrier. When the mute condition is due to antenna miss-pointing, transmission will not resume until the antenna's pointing error is within 0.2 degrees of the target. The sequence of events leading to the carrier shutdown takes place in less than 24 milliseconds as measured by a dual input oscilloscope monitoring the IF-TX carrier and the output of the LNB. The scope is triggered to measure the milliseconds between a loss of LNB output signal and the termination of the TX-IF carrier. The reaction time is directly related to the data rate. An unrecoverable error in the

trellis decoder is being detected, so the faster the data rate, the faster the error detection. This measurement was taken at 64Kbps.
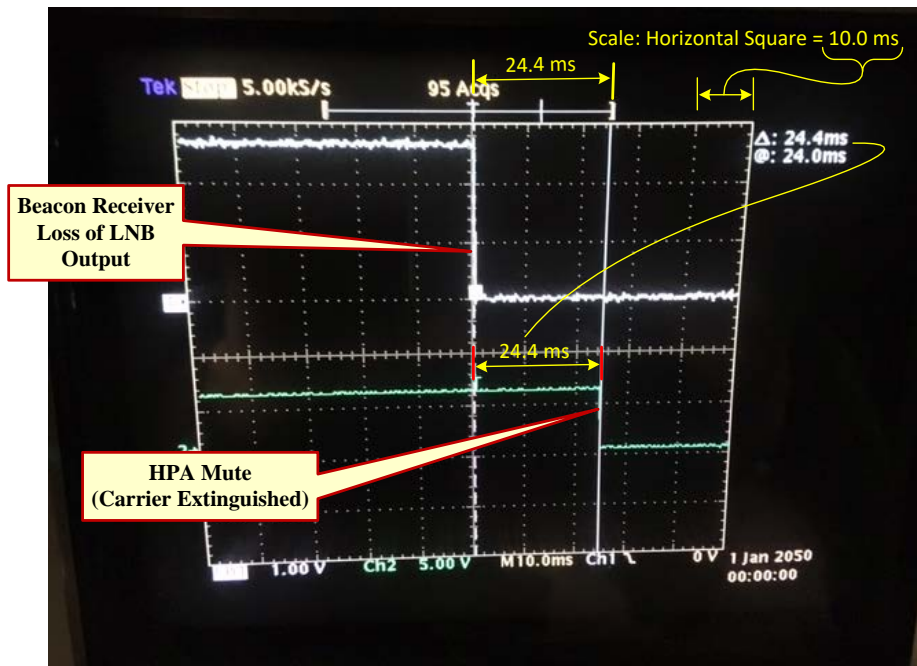
Satellite Reacquisition

If the Comtech modem decoder is unable to regain lock on the data stream within a reasonable time frame, the ACU commands the antenna to return to a hunt mode that uses the larger search zone pattern until reacquisition of the satellite is achieved by cycling through the entire process documented above all over again.