Emergency Managers Weather Information Network

The Emergency Managers Weather Information
Network (EMWIN) allows emergency managers, public
safety officials, and any others to obtain timely weather
forecasts, warnings, and other information directly from
the National Weather Service. This paper describes the
tranmission of EMWIN via GOES Satellite. EMWIN
will become part of the United States Low Resolution
Information Transmission via GOES starting with
GOES-N (aproximately 2002). The format for the
EMWIN products has not been determined, but will be
available early in 2000.

The information contained in this paper was extracted from various National Weather Service web sites on EMWIN. The main site can be found at: http://iwin.nws.noaa.gov/emwin/index.htm.

This paper is informational only.

Emergency Managers Weather Information Network

The Emergency Managers Weather Information Network – EMWIN -- is a service that allows anyone to obtain weather forecasts, warnings, and other information directly from the National Weather Service (NWS) in almost real time. EMWIN is intended to be used primarily by emergency managers and public safety officials who need timely weather information to make critical decisions. However, anyone with a personal computer running Windows can be an EMWIN user.

EMWIN basically consists of:

   1. A round-the-clock data feed of current weather warnings, watches, advisories, forecasts, and other products issued by the National Weather Service.

   2. A suite of methods to obtain this data feed and display the products on a personal computer.

Two of the methods for obtaining the EMWIN feed are direct satellite broadcast and repeat radio broadcast. With direct satellite, the EMWIN feed is received directly from one of the satellites broadcasting the signal.

To use the direct satellite method, special hardware to receive the EMWIN feed is needed. The hardware information is available by contacting one or more of the EMWIN vendors listed on the Commercial Vendors page of the EMWIN web page at: http://iwin.nws.noaa.gov/emwin/index.htm.

Special software is required for storing, managing, and displaying the products on a personal computer. One version of this software is a commercial Windows-based program called WeatherNode. Among its many features, WeatherNode allows one to set up audio or visual alarms that will promptly alert one to the receipt of any specific product; for example, tornado or flood warnings issued by the NWS for specified counties. To learn more about WeatherNode, go to the following web site: http://weathernode.com/info/. Many of the hardware vendors offer complete 'turnkey' systems that include the WeatherNode software.

As an integral part of its mission, the NWS recognizes the need to provide the emergency management community with access to a set of NWS warnings, watches, forecasts, and other products at no recurring cost. Toward that end, the EMWIN system was developed. In partnership with the Federal Emergency Management Agency (FEMA) and other public and private organizations, EMWIN is now evolving into a fully operational and supported NWS service.

The NWS broadcasts EMWIN on our own GOES 8 and GOES 10 satellites. GOES 8 is at 75 degrees West, elevation 45 degrees (from the latitude of Washington, DC). GOES 10 is at 135 degrees West. Data is uplinked to satellite from the NOAA Command and Data Acquisition (CDA) Station on Wallops Island, VA.

The NWS GOES downlink frequency used for the 9600 baud EMWIN datastream is 1690.725 MHZ, 275 KHz lower than the standard WEFAX 1691.0 MHZ signal. The signal is passed through a down convertor, received as if a Radio signal at 137.225 MHZ for example, and then demodulated to 9600 baud. With GOES-N, EMWIN will be included in the Low Rate Information Transmission (LRIT).

The EMWIN system contains many categories of weather data products, with over 6,500 unique products. The current EMWIN datastream contains all generally available public products from the NWS Telecommunications Gateway, including the following product categories:

Analyses
    Environmental/Air Pollution, Hydrological/Marine, Surface, Misc
Climatic Products
    Daily Surface, Monthly Surface, Misc
Forecasts
    Aerodrome, Aviation Area, Extended, Flash Flood Guidance, Headwater Guidance, Hydrological, Iceberg, Local/Area, Misc, Public, Recreation/Travelers, River, Shipping Area
Graphics
    Charts and map overlays
Images
    GOES satellite
Misc
    Civil Emergency Messages, Public Weather Statements
Reports
    Radar, Seismic, Synoptic, Hydrological River, Drifting Buoy, Ice
Severe Weather
    Warnings, Summaries, Statements, Advisories
Warnings
    Tsunami/Tide, Tornado, River Flood, Lakeshore/Marine, Typhoon/Hurricane, Marine/Coastal Flood, Severe Thunderstorm

Text

These "readable text" products, include the local and national watches and warnings, and many other reports and forecasts.

Graphics

There are over 200 different subtypes, including: clouds, dewpoint, fronts, humidity, isohyets, lightning, marine, precipitation, pressure, radar, temperature, winds, and so on.

Imagery

These are images that depict national radar, cloud cover and many other weather conditions.

CURRENT CODE INFORMATION

Universal Generic Code

There are certain important messages that the NWS issues, such as watches and warnings, in which the CCCNNNXXX message header alone does not contain sufficient information for identifying specific geographic areas. To provide this information, text products may contain one or more additional coded lines containing one or more UGC (Universal Generic Code) groups. These give specific FIPS county or NWS zone identifier numbers.

UGC Elements

A code group consists of 6 alphanumeric characters, as a 3 alpha-character prefix and a 3 numeric-character suffix, followed by a dash (-). There are additional format rules, given below, about catenated groups and omitted prefixes. The final UGC element, after all code groups, is the product-purge time (previously called the expiration time) in UTC (Coordinated Universal Time) aka GMT (Greenwich Mean Time). This is the time after which the product should no longer be broadcast or viewed.

A generic UGC line, with some catenated groups, looks like:

SSFnnn-(nnn-nnn>nnn-...SSFnnn-SSFnnn-...)DDHHMM-

in which:

    SS   = 2-letter state identifier (USPS code).
    F   = UGC format, either:
           = 'C', indicating the nnn following represents a county or
                an independent city, or
           = 'Z', indicating the nnn following represents an NWS
                public-forecast zone (or part or all of the state).
    nnn   = after 'C', the FIPS country or independent city number, or
           = after 'Z', the NWS zone number, or ALL (all zones in the
                state), or 000 (an undesignated part of the state).
    DDHHMM = the product-purge date's day (DD), hour (HH), and minute (MM).

UGC Format

There are certain conventions or rules for interpreting a UGC series of catenated groups, in which repeated prefix elements can be omitted.

    If two or more counties or zones from the same state are included in the UGC, the state SS will not be repeated, only the particular nnn's. For example: SSFnnn-nnn...nnn-DDHHMM-
    If two or more states are included in the UGC, the UGC for each new state will be a complete 6-character grouping.
    For example: SSFnnn-nnn-SSFnnn-DDHHMM-
    Consecutively numbered zones for a state may be indicated by an inclusive right-angle-bracket (">").

An example

ILZ001>003-005-IAC045-163-051200- means: the affected areas for the particular message include northern Illinois zones 1, 2, 3, and 5, and the (bordering) counties of southeast Iowa, Clinton and Scott, and the product is to be purged on the 5th day of the month at 1200 UTC.

UGC Placement

For most NWS message products, the UGC is placed on the third line of the header, immediately after the message identifier and the WMO header. For messages in the form of a collection of separate information, each affecting a different area but all under one message header, each separate information section begins with its own UGC line and ends with a $$ line as an end-of-section marker.

County Codes

An NWS UGC with a type 'C' (county) code uses the Federal Information Processing Standard (FIPS 6-3) 3-digit county numbers. A listing of these is available as a 17KB file.

Zone Codes

An NWS UGC with a type 'Z' (zone) code uses the public-forecast 3-digit zone numbers. A listing of these with supplemental boundary descriptions (circa 5/96) is available as an ASCII 22KB file. The latest update (circa 10/96) is available as a WP 5.1 47KB file, as a main document plus 3 sections for the Western Region, Colorado, and part of Virginia. Maps of the state zones and state county warning areas are available here.

Zone Code Background

Climate and usual weather features anywhere within a zone are similar. This allows a single zone forecast to serve as the local forecast for any community within the area--not just those locations where the NWS has offices. Weather conditions, however, are such that several zones typically can be grouped together under the same forecast.

In most cases, zones are numbered sequentially for a Weather Forecast Office's (WFO's) area of responsibility in each state generally from west to east and north to south. In other words, for a state served by one WFO (see Arkansas, for example), number 1 typically is the northwestern-most zone and the highest number in the state is the southeastern-most zone. Some variation to this numbering scheme occurs in certain states because of non-standard geographical orientation (see Kentucky, for example) or if served by more than one WFO (see Pennsylvania, New Jersey, Illinois, for example).

A zone that contains only a single county uses the county name and, therefore, does not need supplemental county identification. Similarly, a zone that is named by part of one or more counties (e.g., New York State zone 70, "Northern Westchester" [Co.]; New York State zone 71, "Southern Westchester" [Co.]; Minnesota zone 12, "Northern Cook/Northern lake [Cos.]) also does not need supplemental county identification.

A zone, however, that contains part of one or more counties but uses another recognizable geographical name needs supplemental county identification in the list. For example, South Dakota zone 25, "Northern Foot Hills," includes an entry in the supplemental county identification column of "N Lawrence, X SW Butte, part of SW Meade," which means the zone encompasses "north Lawrence Co., extreme southwest Butte Co., and part of southwest Meade Co."

FUTURE CODE

The EMWIN code, which will be part of LRIT, has not been determined at this point. It is under study and is expected to be developed in early 2000.

TRANSMISSION PROTOCOL

EMWIN is designed to be an open system. The format of the EMWIN datastream transmissions is public domain and presented here. This format is intentionally simple, for reception by a wide range of user hardware. This format, called the Quick Block Transfer (QBT) Protocol, is used across all of the EMWIN dissemination methods, whether Radio, Satellite, Internet or direct cable.

The EMWIN datastream consists of NWS weather products and other data files. Each product or file, whether ASCII text or binary data, is divided into 1 KB packets and sent as a series of async 8-bit bytes, N parity. For example, the Satellite broadcasts are async 9600,8,N,1.

Each product or file is sent as one or more packets, which are numbered 1..N within the given product. Because the data is packetized, a particular product can be gracefully interrupted by a high priority warning or alert product and then resume. Note: the broadcast is receive-only -- hence the receiver has no means of notifying the transmitter of any block errors or of requesting retransmission of individual blocks. Instead each product is usually transmitted at least twice, to "fill in" any blocks received in error.

Each packet of data contains 1116 bytes, in the following fields:

1. 6 bytes of ASCII 0 (NUL) to clear the receiver buffer.
2. "/PF" followed by an 8-character filename, a period, and a 3- character filetype.
3. "/PN" followed by the block number -- the number of this block (1..N) within this file.
4. "/PT" followed by the total number of blocks (N) being sent for this file.
5. "/CS" followed by a checksum number -- the sum of all bytes in the 1024-byte data portion of this packet, as a 16-bit unsigned decimal.
6. "/FD" followed by the date/time stamp of this file -- in the format of: MM/DD/YY HH:MM:SS AM, without space padding.
7. ASCII 32 (SP) fill -- to pad the total bytes in fields 2..8 to a full line of 80 bytes.
8. ASCII 13 (CR) and ASCII 10 (LF) to enhance readability.
9. the data, as a 1024-byte block; if the remaining data of the product is less than 1024 bytes, this block is NUL-filled so that each packet's data block is always 1024 bytes long.
10. 6 bytes of ASCII 0 (NUL) to clear the receiver buffer.

An example of a typical packet header is:

   /PFZFPSFOCA.TXT/PN 3   /PT 5   /CS 63366 /FD2/10/95 5:24:26 PM

The content of the NWS weather products (in the 1024-byte blocks) may be plain ASCII text or graphics or imagery. The products are not encrypted, but will often be compressed. Interpretation of the content of the products is up to the receiver's software. Details of the

particular text, graphics, imagery, and compression formats are given below.

Text :

Text products are transmitted in English and are usually public forecasts. However, some products may contain a variety of terse abbreviations or weather-specific acronyms, or may simply be "readable" tables of computer-summarized data. The content is generally 7-bit printable ASCII text, but often also contains hex bytes C5, 80, 03, or 83.

The first line of text of a product is our NWS so-called "WMO" heading, which includes a 4-6 character product identifier, a 4 character source site code, and a 6 digit origination date/time (GMT). The next line may contain a truncated message identifier, with the 4-6 character NNNXXX portion. In some products the next line (or embedded lines) may be a "UGC" (Universal Generic Code) line, giving specific states/zones/counties that this product is applicable for, plus a product-purge date/time (GMT).

Graphics :

Graphic products are transmitted in our NWS so-called Universal Transmission Format (UTF), a display-independent format. The UTF format includes vectors, characters, and gridded data, but not bitmaps or rasters, and was originally designed to be closely compatible with our "GDM" displays. The EMWIN UTF products are typically national or regional coarse radar images, that can be zoomed by the display software.

This format is described in AFOS Handbook 5, Volume 6, Part 2, Appendix B (29 pages), which is downloadable as a zipped file. This is in WP 5.1 format (90KB) as a text document plus 11 separate GIF diagrams. Also via download is a small Postscript form of the Handbook, plus source code for displaying products on Unix, from Maitland Bottoms.

If writing independent code, be aware of the "byte stuffing" described on page B-27. The first line of a graphic product is text, with the NWS product identifier. This is followed immediately by UTF code bytes, C1 hex and 01 hex, signaling further graphics (in UTF format) or arbitrary binary contents.

Imagery :

Satellite weather images (products from GOES) and other interesting pictures are transmitted in standard formats as indicated by the filetype/extension. Currently, .GIF and .JPG are used.

Compression :

Local data and watches/warnings/advisories are transmitted as clear text and not compressed. Other national data products, such as all SAOs for a given hour, are first packed into one "file" and then compressed and transmitted. The EMWIN "UNPACKER" software task will decompress these files upon receipt, and then unpack the constituent data products as if received normally.

The compression/decompression software used is the standard PKUNZIP Data Compression

format.