A M T E X

NAVTEX-Like Dissemination Procedures for Amateur Radio

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INTRODUCTION

This paper outlines procedures for transmitting and receiving amateur radio bulletins via MF/HF radio that are compatible with NAVTEX[1] equipment. NAVTEX transmissions are made using AMTOR FEC with specific character strings at the beginning and end of messages. These character strings permit receiving equipment to identify and ignore messages that have already been received without error. It's estimated that over 20000 amateur radio operators already have NAVTEX decoding equipment. As of this writing both the AEA PK-232 and MFJ-1278 multi-mode controllers have the ability take full advantage of transmissions compatible with NAVTEX. These decoders could be used to provide automatic reception of amateur radio bulletins without repeatedly printing the same message during subsequent broadcasts. It's a simple matter for any MF/HF amateur radio station that transmits bulletins using AMTOR FEC to include the proper strings at the beginning and end of messages so that those messages become NAVTEX compatible. This paper outlines transmission and reception procedures that are compatible with existing NAVTEX decoders.

NAVTEX

The NAVTEX radio network consists of many transmitters throughout the world on 518 kHz that are used to broadcast marine safety information to ships within 100 nautical miles of shore. AMTOR FEC (CCIR 476-2 Collective Broadcast Mode) is the specified transmission format (modulation and code) for NAVTEX. NAVTEX stations typically transmit a 20 to 40 minute broadcast every six hours. Transmit times are staggered to ensure that transmitters serving adjacent areas cause little or no interference.

Any equipment capable of receiving AMTOR FEC can copy NAVTEX bulletins, but non-NAVTEX equipment doesn't have the ability to ignore messages that have already been correctly received. ***NAVTEX compatible*** simply means that the decoder can automatically ignore messages that have already been printed without error.

NAVTEX messages always begin with a line that consists of "ZCZC $B_1B_2B_3B_4$"; where ZCZC is used to mark the beginning of a message; the symbol B_1 denotes coverage area; the symbol B_2 denotes type of message; and the symbols B_3B_4 denote a 2 digit sequence number. Additionally, each message ends with a line that consists of "NNNN".

1. NAVTEX is defined by CCIR Recommendation 540-l (1982).

The advantages of encapsulating the message between the strings ZCZC and NNNN, coupled with AMTOR's feature of error detection and correction, allows a NAVTEX decoder to print a message only once, no matter how many times the message is broadcast, provided the message was received with zero (or only a few) errors.

When a message is received the NAVTEX decoder checks the NAVTEX message ID ($B_1B_2B_3B_4$). If that message has not already been received, error free, the message will be printed. When the end of message marker is found (NNNN) the NAVTEX decoder counts the number of uncorrectable errors that occurred during the reception of that message. If the count is below some threshold (the threshold should be user programmable, perhaps from 0 to 10) the NAVTEX message ID is retained in the NAVTEX decoder's memory. During additional broadcasts of the same message the NAVTEX decoder won't print the message because it has been flagged as already received correctly.

Priority messages and emergency messages should always use a B_3B_4 value of 00. NAVTEX decoders always print messages, every time received, when the B_3B_4 value is 00.

AMTEX – NAWEX

Because the NAVTEX system operates on a specific frequency and the message content relates to marine safety, radio amateurs should not use the term NAVTEX to describe their transmissions, even though the transmission format is exactly the same as that of NAWEX. Instead, I recommend that the term **AMTEX** be used to describe a transmission system that is ***compatible*** with NAVTEX decoders. AMTEX retains the NAVTEX concepts of encapsulating a message between the strings ZCZC and NNNN as well as using the "two alpha symbols – two numeric symbols" message ID format. AMTEX. simply represents a name change and the reassignment of the message ID symbols for amateur radio needs.

MAKING BULLETINS AMTEX COMPATIBLE

Making amateur radio bulletins compatible with AMTEX involves adding only two lines to each bulletin or message. One line is inserted just before the first line of the current header (i.e., just before the "QST DE W1AW" line for W1AW bulletins). Another line is inserted just after the line that includes the closing "AR" pro-sign.

The line inserted at the beginning of the message consists of 9 characters: "ZCZC $B_1B_2B_3B_4$". The string ***ZCZC*** is a constant while the symbols B,, B_2 and B_3B_4 denote variables (a single space character separates the "ZCZC" and "$B_1B_2B_3B_4$" strings). The variable B_1 denotes the organization that originated the bulletin. Most bulletins are issued by the ARRL and, based on the AMTEX procedures document (see Appendix 1), the variable B_1 would be set to the letter "A". The variable B_2 denotes the type of bulletin. For example, general bulletins would have the variable B_2 set to "G", propagation bulletins would have the variable B_2 set to "P", etc. Again, see the AMTEX Procedures document (Appendix 1) for other symbol assignments. The sequence number B_3B_4 is arbitrary (except for 00). However, a new sequence number should be used for each new bulletin that uses the same values of B_1 and B,. Bulletins from W1AW would typically set the value of B_3B_4 to be the same as the two least significant digits as the BID number. However, for priority or emergency bulletins, a B_3B_4 value of 00 would be used because this would ALWAYS cause printing devices to show the message, every time it's received, even if it has already been correctly received.

AMTEX PROCEDURES

The proposed AMTEX procedures are outlined in Appendix 1. An example of text that is formatted for AMTEX is shown in Appendix 2. The current AMTEX procedures should be considered a starting point and subject to revision in the future. However, because of the large embedded base of NAVTEX equipment already in the hands of amateur radio operators it's unlikely that any changes to the AMTEX procedures would render it incompatible with existing NAVTEX decoders.

Appendix 1 – AMTEX Transmission and Reception Procedures

I. AMTEX transmissions should meet the following requirements.

1. Radio frequency emissions should conform to the specifications of AMTOR FEC (CCIR 476 or 625 Collective Broadcast Mode).
2. The transmitted character through-put rate should not exceed 180 characters (printable or non-printable) in any 30 second period (i.e, about 60 WPM).
3. Whenever phasing signals (idle signals) are transmitted, a minimum of six consecutive phasing signal pairs (PS1 in the RX position – PS2 in the DX position) should be transmitted.
4. Redundant letter and figures shift characters should be used in the message to reduce garbling.
5. The format of transmissions should be

Phasing Signals > 10 sec	ZCZC	One Space Char	$B_1B_2B_3B_4$	CR/LF	First Message	NNNN	CR/LF CR/LF

Phasing Signals > 5 sec	ZCZC	One Space Char	$B_1B_2B_3B_4$	CR/LF	Nth Message	NNNN	CR/LF CR/LF

Phasing Signals > 5 sec	ZCZC	One Space Char	$B_1B_2B_3B_4$	CR/LF	Last Message	NNNN	CR/LF CR/LF	EOM Signals $\alpha\alpha\alpha...\alpha$

in which

Phasing	is the AMTOR FEC phasing (also known as idle) sequence (PS1-PS2-PS1-PS2....)
z c z c	denotes that the message ID follows
Space	is a single space character
CR/LF	are the carriage return and line feed characters
$B_1B_2B_3B_4$	is the message ID

Message	is the message to be disseminated
NNNN	defines the end of the message
EOM α	is the AMTOR FEC end of message signal(s). Two seconds (15 symbols) would be the ideal length of the EOM signal. However, a transmission as short as 420 milliseconds (three symbols) is acceptable.

II. AMTEX reception devices should meet the following requirements.

1. The printer should only be activated if the message ID ($B_1B_2B_3B_4$) is received without errors.
2. Facilities should be provided to avoid printing the same message several times at the same station when that same message has already been printed with no more than a few errors.
3. The necessary information for the recommended operation of (2.) above should be deduced from the message ID ($B_1B_2B_3B_4$) and possibly the message contents.
4. A message should always be printed if B_3B_4 is 00.
5. Devices should be capable of ignoring messages with undesired B_1 values.
6. Devices should be capable of ignoring messages with undesired B_2 values, except that messages which have B_2 values of "A", "B" or "D" may not be ignored if the B_1 value is desired.

III. Message ID Symbol Assignments

1. *Message Originator Identifier – B_1*

The B_1 symbol indicates the source of the message and should be assigned as follows:

A	ARRL issued bulletins
C	CRRL issued bulletins
I	IARU issued bulletins
J	JARL issued bulletins
S	AMSAT issued bulletins
X	Miscellaneous (none of the above)
All Others	All other characters are available for future assignment. They may be used without advance notice.

2. *Message Type Identifies – B_2*

The B_2 symbol indicates the type of message and should be assigned as follows:

A	Emergency bulletins (always printed at least once)
B	Priority bulletins (always printed at least once)
D	RESERVED (always printed at least once)
E	DX bulletin

G	General bulletin
K	Keplerian bulletin
P	Propagation bulletin
S	Satellite bulletin
X	Miscellaneous (none of the above)
All Others	All other characters are available for future assignment. They may be used without advance notice.

3. *Sequence Number – B_3B_4*

The sequence number corresponds to a particular set of B_1 and B_2 symbols. The sequence number increments by one to create the next message ID for the next message with the same set of B_1 and B_2 symbols. The sequence numbers range from 01 to 99, with 01 being the first value of the sequence. When the sequence number is incremented past 99 it rolls over to 01 (00 is skipped). Any special message(s) should use the sequence number "00" as that will cause the message to be printed (or stored) *every* time it is received.

Appendix 2 – Example AMTEX Transmission

Below are examples of ARRL bulletins with the proper AMTEX lines added. The added information for AMTEX is shown in a larger point type and in **bold** face.

ZCZC **AG71**
QST DE **W1AW**
HR ARRL BULLETIN NR 71 **ARLB071**
FROM ARRL HEADQUARTERS
NEWINGTON CT JULY 9, 1988
TO ALL RADIO AMATEURS BT

PREREGISTERED CLUBS **IN WYOMING WILL** BE SIGNING THE
SPECIAL 200 **BICENTENNIAL** PREFIX **FROM** 0001 **UTC** JULY 9
THROUGH 2359 **UTC** JULY **15.**
-----text deleted for brevity **=====**
SHERIIMN AR **LEAGUE, W200GUX,**
UNIVERSITY ARC, **NQ200Q** AR
NNNN

zczcAP27
QST DE **W1AW**
HR PROPAGATION FORECAST BULLETIN NR 27 ARLP027
FROM ARRL **HEADQUARTERS**
NEWINGTON CT JULY 5, 1988
TO ALL RADIO AMATEURS BT

DURING JUNE **THE** SOLAR FLUX HIT THREE **NEW** CYCLE 22 HIGHS.
THE **MONTH BEGAN** WITH THE FLUX AT 150, A **RECORD** SWEPT
AWAY WHEN IT ROSE **TO** 165
===== text deleted for brevity **=====**
AMERICAN **SUNSPOT NUMBERS** FOR JUNE 23 THROUGH 29 WERE
BETWEEN 77 AND 111 **WITH A MEAN** OF 96.6 AR
NNNN

ZCZCAS93
QST DE **W1AW**
HR SATELLITE BULLETIN NR 192 ARLS192
NEWINGTON CT JULY 10, 1988
TO ALL RADIO **AMATEURS BT**

ALL INDICATIONS ARE **THAT** THE **SECOND AO13** KICK **MOTOR** BURN
PROCEEDED EXACTLY AS PLANNED AND THAT THE SATELLITE HAS
===== text deleted for brevity =====
JULY 12 **UO9** 00102 AT **65W UO11** 00332 AT 43W F012 **0119Z**
AT 46W **RS10 0039Z** AT 171W AR
NNNN