OPERATION AND CONTROL OF SAGE WEATHER NETWORK (ADTWC)

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1. GENERAL

1.01 This practice covers the operation of the Air Defense Tactical Weather Circuits (ADTWC), which uses an 83B2 Transmitter Polling System with specially designed outlying station control circuits in conjunction with the Programmed Automatic Transmitter Start System (PAX). This practice also covers testroom responsibilities for making pre-service tests and maintaining service on the network.

2. DESCRIPTION OF THE NETWORK

2.01 This system was designed because of the customers' requirement for a distribution system with a high degree of equipment reliability. The PAX system was added to back up the Master Control Station in case of failure. In addition certain other modifications were made at the outlying stations to improve transmission reliability. These modifications are detailed in succeeding paragraphs.

2.02 Certain airbase locations have a local circuit for disseminating information to On-Base locations. A switching arrangement is provided at one of the teletypewriter locations at these bases so transmissions for that location may be transmitted to the network or On-Base locations or to both simultaneously.

2.03 This service operates on a half-duplex basis with a maximum of twenty-nine stations on the circuit. The system is capable of operating with or without a master control station. Any portion of the circuit which may be cut off from the rest of the circuit can operate independently as a separate circuit, ie, if stations 7, 8, 9, and 10 were removed from the main circuit, the PAX system (which is described later) would operate independently until the circuit is restored.

2.04 System designs permit the transmission of message heading formats and end of message (EOM) codes automatically. This feature places the responsibility of preparing only the text tape on the customer.

2.05 Selective calling is used on the Weather Network. Some stations will receive all

messages while others will receive only the messages intended for their use as part of a group arrangement of stations. Stations that receive all messages are turned on (unblinded) by the Start of Message (SOM) code preceding each message. Here the Call Directing Code (CDC) function bars of the stunt box are coded CR and LF rather than a 2-character CDC. The SOM therefore serves as a broadcast type of code.

2.06 The priority feature of the 83B2 system is not utilized. This allows traffic to be collected on the first rather than on the second polling as in standard operation of the 83B2 system.

2.07 The 83B2 Transmitter Start Circuit is utilized at the master station to poll the outlying stations. This is the only station with 83B2 equipment. The outlying station equipment (to be described later) performs essentially the same function as the 83B2, normally responding to a transmitter start code (TSC) with either message traffic or a single character answer-back (V), but in addition inserts fixed teletypewriter characters preceding the message and adds fixed characters after the tape is sent.

2.08 Instead of the standard 83B2 End of Message (EOM) code (FIGS H LTRS), LF CR LTRS is used. It is generated automatically upon completion of the test transmission.

2.09 The bid portion of the 83B2 system is not utilized. The method of tape transmission at the master station is the same as described for outlying stations. Punched tape messages are sent only upon the receipt of a TSC or a PAX controlled start. Once tape transmission has commenced, it will continue until either the sixth pin is released to indicate the end of text tape, the taut tape arm operates, or an open line condition occurs which stops any transmission in progress.

2.10 The keyboard sending feature on the 28 ASR has been disabled. All traffic on the circuit is transmitted by means of tapes.

2.11 A set of normally closed contacts has been added to the AFG stunt box which opens on the receipt of the SOM (Start of Message) code and unblinds receiving only (RO) extension stations. The EOM (End of Message) code will release these contacts and blind the RO station to TSC (Transmitter Start Code) code.

2.12 If the EOM is not sent from an outlying station, the master station will time out on that particular station and send LF CR LTRS and then step to the start of TSC's. The use of code generators should eliminate the need for this function, except in the case of a trouble condition at an outlying station.

2.13 If a station does not send an answer-back or a message following its TSC, the master station will time out after two seconds. This brings in an alarm and causes the TSC generator to step to the next TSC code.

3. DESCRIPTION OF THE PROGRAMMED AUTOMATIC TRANSMITTER START SYSTEM (PAX)

3.01 The PAX is a packaged transmitter start arrangement for use with the WA-18261 Code Generating Station Control Circuit.

3.02 This sytem is used as a fail safe arrangement supplementing an 83B2 transmitter polling system. In the event the master control station fails, the PAX system will automatically start operating after fifteen seconds of idle circuit time. In addition, if a portion of a circuit is cut off from the main circuit, the cut off portion will operate on a self-contained basis via the PAX system while the other section will continue to operate under the control of the 83B2 equipment.

3.03 A maximum of twenty-nine stations can be assigned to each circuit of the weather network. The Haydon timer limits this number to twenty-nine and is explained under Section 4.

4. DESCRIPTION OF THE TIMING NETWORK

4.01 The timing network consists of four plug-in timing units plus a Haydon timer at each station. The mark timer (MT), space timer (ST), open line timer (OLT) and cumulative timer (CT) operate via an electronic control circuit. The Haydon timer (HY) operates from a 115-volt, 60-cycle synchronous motor, requiring twenty seconds for one complete revolution. Since some Commerical Power frequencies may vary somewhat between cities, such variations may in time cause the timing between stations to become so short that feasibly two transmitters could start simultaneously.

4.02 The first TSC that is transmitted operates the (DA) and (RSI) relays. This returns all

HY timers to a stop at their zero points. Thus, all timers are conditioned for an even start when the line again goes idle.

4.03 A maximum of twenty-nine stations may be provided in sequence on an interval of one second of idle time following the completion of a message. That is, assuming Station 1 is transmitting, one second after the message is completed Station 2 is given an opportunity to send. One second later, if tape is not available, or one second after the transmission of the message at Station 2 has been completed, Station 3 will be given an opportunity to send.

> ***Note:*** No station can hold the circuit for more than one transmission. Once a message has been transmitted, another message cannot be sent until the Haydon timer again cycles around to the station contacts.

4.04 The MT and ST operate by means of an electronic control circuit at each station. The MT watches for any interruption of the TSC's followed by a fifteen-second marking condition on the circuit. At the end of fifteen seconds of no TSC's, the MT will operate and send an open on the line. This open allows the ST to start timing, which in two seconds will operate and close the line. These timers, in conjunction with the OLT and CT, start the HY timer operating.

> ***Note:*** Due to the difference in 60-cycle supplies between cities, the two-second open may vary in length if more than one MT should operate at the same time. However, the Haydon timers will not start operating until the circuit does close.

4.05 The OLT fires after one second of an open line condition. The OLT, in conjunction with the CT and line relay, activates the start portion of the Haydon timer.

4.06 The CT fires after .120 second of idle circuit time and starts the Haydon timer. Once tape is being transmitted, the line relays operate continuously and deactivate the timer. At the end of transmission, the timer start circuit, in conjunction with the CT, restarts the Haydon timers to start another TD (Transmitter Distributer). This cycle continues until the master station transmitter polling is restored.

4.07 The TD start under PAX control is the same as described under the outlying station description of a start by a TSC. The code generator inserts fixed characters before and after the sending of the taped message.

5. DESCRIPTION OF THE OUTLYING STATION CONTROL AND CODE GENERATOR

5.01 This circuit is specifically designed for use on the Weather Network as an outlying station control circuit on the modified 83B2 system. The circuit responds to a transmitter start code with either message traffic or a single character "V" answer-back. The circuit inserts teletypewriter characters preceding the sending of a punched tape message and adds fixed characters after the tape has been sent.

5.02 The sum total of characters or functions (ltrs., figs., etc) which may be added before and after a punched message cannot exceed thirty-two. For example, nineteen characters inserted preceding a message allows only thirteen characters to be added after the message. A minimum of one character must be inserted before and after the taped message under this design.

5.03 Selective calling is used on the system to allow stations to receive reports from only certain selective transmitting stations. The code generators will generate a fixed CDC prior to the SOM, depending on which station is transmitting. This CDC will be prefixed to all messages from that station. (See par. 2.05.)

5.04 The added characters are fixed and are provided by strapping a diode matrix and a two-level selector as required to meet the customer's needs. All standard five-level teletypewriter characters are available. The diode matrix is composed of fifty-two diodes used to route battery to the TD to form the various teletypewriter characters.

5.05 Provision is made by the control circuit for visual and audible alarms if the teletypewriter line goes open for one second or longer. The circuit also functions to recognize a minimum of a 337-millisecond open on the line when the station is transmitting a message. Transmission is automatically stopped, requiring the tape to be removed from the transmitter and be reinserted, thus resending the tape in its entirety. The audible

alarm may be silenced by the operation of a push-button or by a thermal relay which operates after approximately twenty seconds.

5.06 Should a transmitting station include an EOM code in the message text, visual and audible alarms will operate and the TD will stop. The audible alarm will time out, but the OPEN LINE and RESET lamps will remain lighted until the tape is removed from the TD. This alarm feature is used to insure that if an EOM code is inadvertently punched in the text of a message and only a partial text is transmitted, the customer will be made aware.

5.07 A multicontact transmitter distributor (28G or equivalent) is used for transmitting purposes. The TD, in conjunction with the newly designed selector and diode matrix, can thus be used to send the fixed characters while the tape is inserted and held awaiting proper interval for the text to be transmitted. The transmitter contacts are disconnected from the distributor to prevent interference while a second shaft in the TD is used. After the message heading has been transmitted, the TD will resume control and the text will then follow.

> ***Note:*** Due to these special features incorporated in the transmitter distributor it is possible that in a trouble condition garbling may occur at the beginning or end of a message and yet the message text copy may be good, or vice versa. In such cases a check of the transmitter contacts through the (T) relay should be made, as well as a check for slow release of the (T) relay, (CL) relay operation, and distributor magnet release. If random characters of generated codes are garbled, trouble in the diode matrix may be suspected.

5.08 A solid state answer-back generator is utilized for sending a "V" answer-back when there is no tape in the transmitter gate or when the TD has been stopped during transmission and the tape has not been reinserted for resending. A mercury wetted relay is used for opening the signal path.

5.09 The code generator and outlying station equipment is also utilized when the PAX system is in use. The closure of the Haydon timer contacts acts as a TSC to the equipment and tape transmission occurs as though the polling device had sent a TSC. This is described under PAX system operation.

6. TESTING PROCEDURE FOR PRE-SERVICE TESTING OF THE MODIFIED 83B2 SYSTEM

6.01 Have the master station and all outlying stations remove the F1 and F2 fuses from the PAX system.

> ***Note:*** This will eliminate any possible contention between the 83B2 and the PAX, should the PAX be in trouble.

6.02 Each outlying station should have a test tape with his station identity code in the format. The contents of the message text is not important.

> ***Caution: Outlying stations should insure that EOM code is not inadvertently inserted in text portion of test tape for reasons stated in 5.06.***

6.03 The overall pre-service testing procedures may commence following the individual station pre-service tests covered in Section 660-204-011, excluding the priority test and CDC test for each outlying station. Special CDC tests are made on 28 ROTR's (Receiving Only Typing Reperforator) only. (See Par. 6.05.)

6.04 After it is determined that individual station pre-service tests on master and outlying stations have been completed, the testboard should have the maintenance man at the master station release the TSC's and allow them to cycle through several times. Each station should respond with a "V" answer-back. After all stations have answered back a few times, have the outlying stations insert their test tapes. This request should originate by a tape from the master station. This will insure that all stations are copying traffic from the master station. Where only ATR's are installed, contact will have to be made by phone.

> ***Note:*** Testboard personnel should not confuse the 28J distributor used for sending TSC's at a master station with the distributor described in 5.07. The 28J distributor used for TSC patterns is also used in connection with the Message Timing Arrangement described in Section 10.

6.05 The 28 ROTR, used at the Sage Sector locations, will copy only upon receipt of its own individual special three-character CDC, ie, XXA, XXB, etc. Here the special CDC is transmitted as part of the text, after the separation code. The three-character combination would be unlikely to ever be transmitted by any station as part of the text.

6.06 Upon completion of the above test, the testboard should request all stations to insert the F1 and F2 fuses in the PAX system and remove all tapes from the TD's. The master station will then resume polling. This will reset the Haydon timers on the PAX system for a synchronized start at all locations.

6.07 After several TSC polling cycles, have the master station turn off the TSC generator. After fifteen seconds of no TSC's, the PAX system should take control of the circuit.

> ***Note:*** The above test assures that the PAX will take control of the circuit if no TSC's are sent.

7. TESTING PROCEDURE FOR PRE-SERVICE TESTING OF THE PAX SYSTEM

7.01 Remove the station under test from the circuit.

> ***Note:*** When testing the master station, it will be necessary to disable the TSC generator.

7.02 Using a two-pen Brush recorder with one pen set for 60-cycle comparison, check the mark and space timers. This will be fifteen seconds of idle line time followed by a two-second open. Upon the conclusion of the two-second open, the Haydon timer will start and cycle around to the station being tested. The time interval from the conclusion of the two-second open to the starting of a message must also be checked on the Brush recorder to insure proper positioning of the station being tested on its Haydon timer.

> ***Note:*** On the initial start, the Haydon timer will make one complete cycle. Traffic will be picked up thereafter.

7.03 Send a few TSC codes for the station under test. This will reset the Haydon timer to its zero point. The station should now be put back on the circuit.

> ***Note:*** The test outlined in 7.02 and 7.03 is very important, and stations should not be turned up to the control office until the timers are functioning properly.

7.04 With all stations on the circuit, the master station will request that tapes be inserted in all TD's. The control testboard should observe that all stations start transmitting in their proper sequence.

> ***Note:*** Should two stations start transmitting at the same time, the stations involved should be removed from the circuit and rechecked for proper positioning on the Haydon timers. The timing sequence of the timing network should also be checked as in 7.02.

7.05 After several complete cycles of operation under PAX control, the master station should request all stations to remove the test tapes from their TD's.

7.06 The control testboard should now request all stations to reinsert their test tapes in the TD's and have the master station restart the TSC generator. Upon receipt of the first EOM code, the 83B2 will take control of the circuit and resume polling.

> ***Note:*** This test is to assure that the 83B2 system will take control of the circuit if the PAX system fails.

8. PRE-SERVICE TESTS OF THE 83B2 TO PAX OPERATION

8.01

(a) All stations have tapes in TD.

(b) Let 83B2 scan several cycles for normal traffic. Reinsert tape after each transmission.

(c) Disable TSC generator.

(d) After fifteen seconds of no TSC's, PAX will take control of circuit.

(e) Stations will start sending in assigned sequence.

(f) Let all stations send under PAX control.

(g) Restart TSC generator.

(h) On receipt of EOM code 83B2 will resume polling.

(i) Let all stations transmit from TSC scan.

Repeat (a) through (i) several times.

9. RESETTING THE HAYDON TIMERS

9.01 The purpose for resetting the Haydon timers is to remedy any fluctuation of the ac power supplies at the different locations. This operation prohibits the timer from gaining or losing time and thereby starting two or more transmitters at the same time even though originally assigned different slot numbers.

9.02 The Haydon timers will return to their zero settings when the 83B2 resumes control of the circuit. This is achieved by a relay circuit which operates after each TSC is transmitted. This operation will reset all Haydon timers and synchronize all stations when the PAX resumes control of the circuit.

9.03 If a testboard observes contention between two stations as the result of a trouble call, the following procedure may be used to clear such contention:

- Using the keyboard of a testroom teletypewriter monitor, send the EOM code followed by a TSC with the character "M", which should deactivate the PAX and simultaneously reset all Haydon timers.

10. DESCRIPTION OF THE Zulu TIME MESSAGE TIMING NETWORK

10.01 A Message Timing Arrangement (MTA) associated with the master station equipment is designed to automatically transmit a time of day in Zulu time after the transmission of a message from the master station or any outlying station on the network. The 28J distributor used to transmit the TSC's is also utilized in this circuit.

Note: Zulu time is a designation used to designate the time at 0 degrees longitude and is sometimes abbreviated "Z". This time is universally used by the Air Force to prevent confusion caused by different time zone—Greenwich Mean Time.

10.02 Stations which normally receive all traffic will in general be arranged to receive the time of day transmissions. Serving Test Centers should check PLSO's and/or Circuit Layout Cards for their particular circuit applications.

10.03 The first EOM code transmitted by a code generator actually blinds all receiving equipment which has just received traffic. However, the DA code which is then sent out by the MTA equipment unblinds the units which normally receive all traffic. Receiving stations coded on by regular CDC's will not receive any Zulu time transmissions.

10.04 After the transmission of the fourteen teletypewriter characters, the circuit furnishes an EOM indication to the transmitter start circuit, causing it to resume polling.

10.05 Should the MTA equipment develop a trouble and thereby be unable to send the time of day message, an attempt may be made to restore the circuit to a polling condition by depressing the RS key.

11. MONITORING THE SAGE WEATHER NETWORK AT THE TESTBOARD

11.01 When monitoring the circuit, a monitor that prints all functions should be used. The tape monitor is desired since the customer format utilizes letter characters and sequential codes for control purposes. If a page monitor is used, it may not be possible to tell if a line feed is transmitted before a carriage return or vice versa, each of which serves a specific purpose. Likewise, care must be exercised to avoid inclusion of the combination LF-CR in the text, since this is the EOM code.

11.02 Observation of the signals on the circuit should indicate whether the circuit is under control of the 83B2 system or the PAX system. If TSC's are observed, the 83B2 system has control. If traffic or an idle line is observed, the PAX system has control.

12. SPECIAL PRECAUTIONS FOR TESTBOARD PERSONNEL

12.01 When restoring any portion of a circuit to the main circuit, close coordination of restoration measures should be applied by testroom personnel to insure that circuit interruptions are held to a minimum.

12.02 The Weather Network should receive special attention from testboard personnel since the PAX portion of the circuit cannot take control until the circuit is closed and idle. This means an open leg or loop should be terminated as soon as possible.

12.03 When testing the timing features of the PAX system both initially and on a trouble basis, testroom personnel should be certain the Brush recorder is used to test the timing sequence. In some cases it may be necessary to request a distant testroom equipped with a recorder to perform these tests.

13. BSP AND DRAWING REFERENCES

References

(WA Drawings available through Long Lines Engineering—Western Area—San Francisco)

WA 13538-SD	Multi-wire Distributor
WA 14588-SD	On-Base Weather Dissemination Network
WA 18058-SD	Stunt Box Arrangement
WA 18261-SD,CD	Code Generator and Station Control
WA 18367-SD	"V" Answer-Back Generator
WA 18407-SD,CD	PAX
WA 18410-SD,ED	Station Assembly-28ATR Station
WA 18442-T	Modification of 83B2 for ADTWC Network
WA 18491-SD,ED	Station Assembly-28ASR Station
WA 18522-SD,CD	Message Timing Arrangement
SD 70831	Transmitter Start Circuit (83B2)
A 41447	Repeat Cycle Timer (20-Second Haydon Timer)
660-240-011	83B1 Pre-Service Tests