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INSTRUCTOR'S GENERAL GUIDE

DESCRIPTION OF THE COURSE

D58A is intended to serve a dual purpose. It may be used as an introduction to TC D58B, C or D or it may be used alone as an Appreciation Course for those Bell System people who require only general background information on the 82B1 Teletypewriter Switching System but whose responsibility will not extend to direct maintenance. No student material is supplied because of the general nature of the subject matter. Class time will approximate 3 hours.

CLASS FACILITIES AND ORGANIZATION

The course lends itself to great flexibility in number of students, meeting place, etc. Space to be used will be dictated by the size of the group to be accommodated and may range from small conference rooms to large school rooms. Provision should be made for Vu-Graph projection but this imposes little space restriction. Classes of about 10 people will be the usual size although numbers up to about 25 would be acceptable.

INSTRUCTORS

There should be an Instructor-in-Charge and an Assistant Instructor for each class in order that the Vu-Graph projection may be handled smoothly. The Instructor-in-Charge should have comprehensive knowledge and experience with the entire System and should be able to handle general questions competently.

PLAN OF INSTRUCTION

The introductory material immediately preceding the projected subject matter should be used as a guide for an opening statement. This should be followed by the Vu-Graphs, in the order given. Sufficient discussion should be encouraged after the presentation of each Vu-Graph to insure adequate grasp of content by the class. Although the instruction must, of necessity, be largely by lecture all pertinent discussion should be fostered. The course should consume in the order of 3 hours with a short break midway in the session. Quizzes will not be used and there will, of course, be no study period.

FINAL REPORTS

The class completion report Form P766 (Report of Class Enrollment) should be prepared for each class and forwarded in accordance with local instructions for the purpose of crediting the employee's service record.

TEXT MATERIAL

Instructor: D58A Instructor's Guide
Student: No material provided.

VISUAL AIDS

One set of 29 Vu-Graph transparencies of Sketches 1 - 29 listed under ATTACHMENTS in Table of Contents.

Vu-Graph 10" Projector
Projection Screen

INSTRUCTOR'S LECTURE GUIDE

GENERAL

The general nature of the material to be presented has determined largely the approach and format of the course. An opening statement is provided to establish the broad parameter. It is written as narrative text and may be used as given or may be modified to fit any particular class. The remainder of the material is presented in outline form and sketches with matching Vu-Graph transparencies. It is intended that the appropriate transparency be projected while the information is presented. The Vu-Graphs are reasonably complete and self-explanatory but they will provoke questions which will require the Instructor to have additional knowledge of the System. This will be especially true in presenting the message format and block diagram projections. However, it should be borne in mind that this is an appreciation course devoted to the broader purposes and principles of operation and exhaustive treatment of any one feature of the System is outside the scope of the course.

A lecture guide is furnished, to assist in presenting an explanation of message format. It is intended that this part of the lecture follow Sketch 9. The photograph transparencies can be used as desired but probably will be most effective following the discussion of message format.

LECTURE NO. 1 - INTRODUCTION

A. REQUIREMENT FOR 82B1 SYSTEM

The things military communications systems are expected to do have become increasingly complex with the passing centuries. The first demands were simply for tactical signals which were met through signal fires, flashing shields, etc. The first messages were carried by runners and horsemen. As military units grew in size and range and as they attempted involved and far-flung operations the communications problem became acute. The battle of New Orleans and the Charge of the Light Brigade are classic examples of poor communications. By the 18th century semaphore signaling was a significant factor and in the 19th century the military telegraph came into its own. The requirements of today for the transmission of military intelligence are but a culmination of an age old demand intensified by modern technology as to amount and types.

In the beginning, the military telegraph could handle only point-to-point traffic such as a message from Army headquarters to a general in the field. Or, we might say A to B or B to A. If point C were involved with the same message then the line circuit would have to be extended from A through B to C or the operator at B would have to copy the message from A and then resend it to C and so on. Conversion to teletypewriter and the introduction of tape transmission followed by the development of the reperforator provided a degree of mechanization. Now tapes could be sent, recreated and resent by machines. Message relay could be performed in a relay center by taking tapes from incoming reperforators and placing them in outgoing transmitters. Essentially this is the "Manual Tape Relay System" of today.

Continuing effort toward further mechanization of the whole process between the writer of a message and delivery to one or more addressees has evolved a number of switching systems among the various communications companies. Perhaps the most familiar are the 81 types of the Bell System. Many of the design considerations for the 82B1 came about as the result of our experience with the 81 systems. These were almost completely automatic. Once a message was typed with a corresponding perforated paper tape the system could deliver it to any connected station or stations without further human intervention.

Military requirements, however, demanded many capabilities which the 81 systems were not designed to meet. The new system must be sufficiently flexible to conform to a changing military situation with the size of the switching center expanding or contracting to fit the needs of the moment. It must require a comparatively short installation interval. It must recognize and process messages of any of six different degrees of priority. It must handle multi-address traffic without the use of additional conditioning codes or group codes, and without capacity limitations. Switching must be done electronically and cross-office speeds would have to be higher. It must accept messages of any length and it must be compatable with military message procedure. Altogether a large order.

The 82B1 System is concerned only with message transmission although the intelligence can be in any form that can be represented by our normal alpha-numeric characters in current teletypewriter practice. That is, the message text can be in "clear" language or in any encoded form which does not require a special alphabet or symbols. The system must accept a message at any sending station and deliver it, automatically, to any receiving station or stations anywhere in the system with minimum delay. The system must also have automatic safeguards against lost or misdirected messages and transmit, in order, messages of varying degrees of priority. It must do all these things and still provide for routine maintenance and trouble clearance. It must be "fail safe".

In addition to these broad requirements the 82B1 System meets many other specific objectives in ways that will be apparent from the following outlined general description.

B. GENERAL FEATURES - SWITCHING CENTER

This material should be presented using Vu-Graph transparencies of Sketches 1 through 4, supplemented as required for clarification by use of Vu-Graph transparencies of Sketches 13 through 29.

C. GENERAL OPERATING FEATURES

This material should be presented using Vu-Graph transparencies of Sketches 5 through 9, supplemented as required for clarification by use of Vu-Graph transparencies of Sketches 13 through 29.

LECTURE NO. 2 - MESSAGE FORMAT

Notes on Presentation

Message format is to be described in terms of the purposes of the various elements of the complete message. The reference Vu-Graphs should be projected as indicated and held until the next reference.

A. GENERAL - JANAP (Joint Army-Navy Administrative Procedures) — References

1. Message format can be divided into 4 parts. — Sketch 10

   a. Start of Message code and channel number

   b. Routing line

   c. Text

   d. End of Message code

2. Preparation of message tape.

   a. SOM code and channel numbers are not typed by operator but are generated by equipment

   b. All other elements must be typed by the operator

3. Purpose of codes and fixed format.

   a. Transmission from sender to receiver is fully automatic

   b. Equipment can respond to codes in a fixed pattern only

   c. Requirements for order and character accuracy are rigid

B. MESSAGE AS PREPARED BY OPERATOR

1. Start of Routing Line - CR, CR, LF.

   a. These characters will condition the Sw. Ctr. to receive the precedence prosign

2. Precedence Prosign.

   a. This determines the priority rating

   b. This is 2 letter code designating 6 levels

      (1) ZZ = Flash, YY = Emergency, OO = Operational Intermediate

      (2) PP = Priority, RR = Routine, MM = Deferred.

c. The System recognizes only groups (1) and (2)

(1) All 6 levels are important in handling at the destination

d. The Sw. Ctr. will alarm on ZZ and YY so operator personnel can follow the progress of the message through the Center

e. The Space character following the Prosign indicates the end of the Prosign and the beginning of the Routing Indicators

(1) The Space readies the Center to receive a Routing Indicator

3. Routing Indicators.

a. This is a 4 to 7 letter code designating a particular station

(1) The first letter is either R or U and identifies the start of a routing indicator

(a) Only R used at present. U also provided for at Navy request for possible future use

(2) The second letter designates the network serving a group activity such as service branch or nation.

(a) 16 letters are available of which 10 are assigned

(3) The third letter designates the geographical area

(a) 16 letters are available of which 14 are assigned

(4) The fourth letter designates the switching center within the area

(a) All 26 letters may be used

(5) The fifth and sixth letters may be used separately or together to designate a station

(a) 20 letters may be used in each position

(b) A maximum of 400 stations may be served by a switching center

(6) The seventh letter serves no useful function in the Sw. Center

(a) It is used as an additional indicator beyond the station

b. The system can accept an unlimited number of Routing Indicators for the same message

c. If the message is addressed to another military switching system the maximum number of Routing Indicators is 9

(1) If 9 is exceeded the Center is alarmed and the message is diverted to Miscellaneous Intercept

d. Subsequent Routing Indicators are preceded by a Space

4. End of Routing Line - CR, CR, LF, DE.

a. This code triggers the action of the Sw. Ctr. in completing the connection to the outgoing line or lines

(1) The E is treated as part of the text

5. Message Text.

a. This may be of any length and in any alphanumeric form

b. JANAP sets a normal maximum of 600 words

6. End of Message Code - LF, N, N, N, N.

a. At the station this code activates the control unit which in turn signals the Center that a complete message is waiting.

(1) No transmission will take place until a complete message is available

b. The Sw. Ctr. then polls the line and will start the station transmission process in its turn

c. The polling sequence is not required on a single station line

d. At the end of the transmission this code will cause the Center to release the cross-office connection

C. MESSAGE AS RECEIVED BY SWITCHING CENTER

1. The Start of Message code is inserted automatically by the station control unit - Blank, Z, C, Z, C.

   a. The Blank character performs no useful function in the 82B1 System but is required for compatability with other military systems

   b. ZCZC as received in the Center starts the switching function

2. The Channel Number also is inserted automatically by the station control unit.

   a. The 3 letter portion identifies the originating station

   b. The 3 digit number is supplied sequentially for each message

      (1) Sw. Ctr. circuitry compares each incoming number with that in its memory section

      (2) Number discrepencies alarm the center

   c. The first letter determines which of the 5 comparators available in the ICL cabinet, for this line, are to be used

      (1) On multi-station lines the first letter must be A, S, I, D, or R

3. The remainder of the message is identical with that above.

D. INCOMING MESSAGE - VIA ANOTHER SWITCHING CENTER TO STATION ON MULTI-STATION LINE Sketch 11

1. The essential difference here is the addition of a second message number.

2. Each Sw. Ctr. adds its own channel number ahead of the message number.

   a. NWA 210 has been inserted by the previous center

   b. RNB 015 is the number as transmitted by the originating station

3. The change in precedence prosign from MM to RR is for illustration.

4. The remainder of the message is identical to that previously described.

References

E. OUTGOING MESSAGE - AS DELIVERED TO STATIONS ON MULTI-STATION LINE

1. This assumes that the 2 stations RBE PRM and RBE PRR are on the same outgoint multi-station line.

2. The Start of Message code is dropped in the Sw. Ctr. since it would perform no function at a station.

3. The outgoing channel numbers for the 2 stations have been added, individually, by the center.

   a. The first letter of each of these codes, A and S are now the individual station connect codes

4. The next element is the incoming channel number which was generated by the previous Sw. Ctr.

5. The channel number of the originating station has been dropped by the Center circuitry.

   a. Only the last incoming channel number is transmitted

6. The remainder of the message is identical.

F. INCOMING MESSAGE - FROM TRUNK TO STATION ON MULTI-STATION LINE

Sketch 12

1. Departures here are due to Flash precedence (ZZ).

2. The repeated upper case J and S characters are typed by the originating operator.

   a. These perform no function in the Sw. Ctr.

   b. They produce bell signals at the destination station

      (1) Both J and S are used for compatability with all systems

      (2) The bell signals alert the receiving operator to a high priority message

3. This is now a single address message with only one routing indicator.

4. The remainder of the message is identical to that previously described.

G. OUTGOING MESSAGE - AS DELIVERED TO STATION ON MULTI-STATION LINE

1. The various elements have functions similar to those in the previous outgoing message.

2. Note that the code CR, CR, LF is used in 2 places.

   a. The first function is to indicate the end of the outgoing channel numbers containing station connect codes

      (1) This will release the station control unit

      (2) It is inserted by the center circuitry

   b. The second function is to indicate the start of the routing line

GENERAL FEATURES - SWITCHING CENTER

A. MADE UP OF 2 TYPES OF PACKAGES - INCOMING CABINET AND OUTGOING CABINET

1. Incoming Cabinet
   a. Terminates 2 Inputs - Incoming lines or trunks.
   b. Contains 2 Typing Reperforator Transmitters for receiving incoming messages.
   c. Contains 1 director with an associated non-typing Reperforator Transmitter for switching messages.
   d. Contains 6 Channel Number Comparators - Sufficient for 1 multi-station line and 1 single station line or trunk.
2. Outgoing Cabinet
   a. Terminates Outputs - Outgoing Lines, Single or multi-station - Outgoing Trunks - Intercepts, Intentional or Miscellaneous.
   b. Contains 4 non-typing Reperforator Transmitters with complete flexibility of assignment.
   c. Contains 2 Bid Receivers - Capable of serving 2 outlets.
   d. Contains 1 Transmitter Start Circuit for use with a multi-station line if required.
   e. Contains Channel Number generating equipment sufficient for 1 multi-station line and 2 Single Station or Trunk channels.

B. SIMPLE INSTALLATION JOB - PACKAGES COMPLETELY SELF-CONTAINED

1. No common equipment - each cabinet contains:
   a. Its own alarm circuits and control panel.
   b. Its own rectifiers for DC power requirements.
   c. Each Incoming Cabinet - Its portion of the sequence circuit.
2. Interconnection entirely by cords and plugs
   a. Eliminates cabling by installer, thus minimizing installation interval.
   b. Provides utmost flexibility for expansion or contraction in size.
3. Permits factory testing.
   a. Minimizes the time required for post installation testing.

GENERAL FEATURES - SWITCHING CENTER (Cont'd)

C. SERVES SMALL OR LARGE TELETYPEWRITER NETWORKS

1. One or more switching centers.
2. Maximum practical size center - 100 Inputs and 100 Outlets.
   a. Each outlet may consist of up to 10 cutgoing channels.
   b. 5 outlets of a center can serve up to 20 outgoing channels.
3. Minimum practical size center - 2 Inputs and 4 Outlets (including Intercepts).
4. Up to 40 Multi-Station Lines per switching center.
   a. Up to 5 stations per Multi-Station Line.
5. Up to 220 Outlet Routes per Switching Center.
   a. An Outlet Route is:
      (1) A station on a multi-station line.
      (2) One or more lines to same station.
      (3) One or more trunk channels to another center.

D. UNLIMITED CAPACITY FOR HANDLING MULTIPLE ADDRESS MESSAGES

1. All Directors capable of handling multiple address messages without resort to a special code.
2. Multiple address message handling capacity limited only by total message handling capacity of system as a whole.

GENERAL FEATURES - SWITCHING CENTER (Cont'd)

E. USES NEW 28-TYPE REPERFORATOR TRANSMITTERS

1. Cross-office transmission at 200 words a minute.
   a. Greatly reduced probability of finding all machines of an Outlet busy to cross-office switching.
   b. Greatly reduces delay when all outlet machines are found busy.
2. Line speeds of 60, 75 or 100 words a minute.
3. Each machine a self-contained unit.
   a. It includes its own tape supply and tape handling facilities.
4. Tape supply - 3000 foot roll.
   a. Infrequent replenishing.
   b. Lasts 24-30 hours under normal service conditions.
   c. New supply spliced to end of old, therefore, unnecessary to stop machine to change tape.
5. Gear shift feature permits rapid interchange of machines, regardless of speed of operation.

GENERAL FEATURES - SWITCHING CENTER (Cont'd)

F. DESIGNED TO FUNCTION ON THE MILITARY FORMAT SPECIFIED IN JANAP

1. Compatable with other military switching systems.

2. Meets following special Navy requirements:

a. Permits R or U as first character of routing indicator.

b. Switches on a 4 to 7 character routing indicator.

c. Routes complete message to Miscellaneous Intercept when a routing indicator is non-valid.

d. Adds Car. Ret., Line Feed, automatically if outlets register more than 9 routing indicators.

e. Permits routing a message to Miscellaneous Intercept if it contains more than 9 routing indicators for a trunk to another military system.

f. Provides for immediate switching to pre-engineered alternate routes.

g. Tape feed-out at all line speeds - nominally 12 letter characters.

h. Monitoring copy independent of line transmission - no loss of copy even if line fails.

G. DISTINCTIVE VISUAL AND AUDIBLE ALARMS

1. Flash or Emergency message precedence alarm - Amber Pilot - steady high frequency tone.

2. Major Alarm - Red Pilot - high frequency tone interrupted at 60 I.P.M.

3. Minor Alarm - White Pilot - low frequency tone interrupted at 30 I.P.M.

GENERAL OPERATING FEATURES

A. INCOMING CABINET

1. Terminates two 60, 75 or 100 W.P.M. incoming lines or trunks (one of which may be a multi-station line).
2. Perforates and types incoming message.
3. Distinguishes between high and low precedence (Alarms on "Flash" and "Emergency" messages).
4. Counts number of messages stored in bin (Alarms if count exceeds 7).
5. Checks incoming message channel number (Alarms if channel number sequence is broken).
6. Reads and checks all routing indicators (Automatically routes to intercept any message with a non-valid routing indicator).
7. In cooperation with other incoming cabinets, sequences the switching of messages to insure against simultaneous seizure of the same cross-office path by 2 or more directors.
8. Switches high precedence messages immediately and low precedence messages in approximately the order in which they were received.
9. Establishes cross-office paths to outgoing cabinets (Checks continuity of each cross-office path and operation of outgoing cabinet machine).
10. Transmits message cross-office (Performs routing line segregation in process).
11. Disconnects cross-office path at end of message.
12. Provides alarms, both audible and visual, to indicate any irregularities in message format or in functioning of the equipment.
13. Provides means for manually restoring automatic operation of incoming circuit involved in cases where such operation was interrupted by an alarmed condition.

GENERAL OPERATING FEATURES (Cont'd)

B. DIRECTOR FUNCTIONS

1. Serves 2 Incoming Lines.
   a. Gives preference to high precedence traffic.
   b. Alternates between lines for low precedence traffic.
2. Automatically checks incoming channel number.
3. Stores incoming channel number, precedence prosign and routing indicators in Reperforator-Transmitter tape.
4. Reads, analyzes, and checks routing indicators.
5. Bids for desired outlets.
6. Transmits incoming channel number and precedence prosign to all desired outlets.
7. Distributes individual routing indicators to the particular outlets involved.
8. Generates Space or CR, CR, LF as required.
9. Transmits ends of Routing Line Code to all outlets involved.
10. Places incoming line machine in condition to transmit message text to outlets involved.

GENERAL OPERATING FEATURES (Cont'd)

C. OUTGOING CABINET

1. Terminates up to 2 outlets (One of which may be a multi-station line serving up to 5 stations).
2. Capable of terminating up to 4 channels of a 10 channel line or trunk.
3. Accepts bids from Directors via the Sequence Circuit.
4. Distinguishes between high and low precedence (Alarms on "Flash" and "Emergency" messages).
5. Selects idle machines to receive messages from incoming cabinets. (Picks high precedence machines for "Flash", "Emergency" or "Operational Immediate" messages, if machines are assigned for this purpose.)
6. Connects idle machines to cross-office paths.
7. Introduces outgoing message channel numbers into tapes of outgoing machines when messages are directed to multi-station lines.
8. Receives messages from incoming cabinets at 200 W.P.M. (Checks continuity of cross-office paths and operation of outgoing machines).
9. Associates idle line or trunk channels with machines having messages for outgoing transmission.
10. Introduces outgoing channel numbers ahead of messages when messages are transmitted to single station lines or trunks.
11. Transmits outgoing messages to lines or trunks at 60, 75 or 100 W.P.M.
12. Polls the stations of a multi-station line for incoming traffic.
13. Provides alarms, both audible and visual, to indicate any conditions demanding operator attention.
14. Provides a key for each destination to permit the intentional interception of all messages for that destination.

GENERAL OPERATING FEATURES (Cont'd)

D. OUTLYING STATION

1. Uses 28 type teletypewriter equipment.
   a. Permits 60, 75 or 100 speed operation.
   b. Low maintenance.
2. Continuous tape operation from sending machine.
   a. Machine equipped with pivoted head (Climbing Transmitter).
3. Optional auxiliary transmitter for torn tape operation.
   a. Used for transfer of off-line traffic into the system.
   b. Used for traffic prepared on an additional perforator.
4. Station Control Unit for stations on multi-station lines.
   a. Controls one sending and one receiving teletypewriter.
   b. Performs following major functions:
      (1) Connects receiving teletypewriter on proper code.
      (2) Alarms receipt of a non-valid code and connects receiving teletypewriter at master station.
      (3) Provides non-interfering tape feed-out between messages received on a typing reperforator.
      (4) Alarms an open receive line.
      (5) Starts transmitter in response to start code if complete message is available.
      (6) Recognizes availability of complete message when operator perforates end-of-message code or when tape is inserted in auxiliary transmitter.

GENERAL OPERATING FEATURES (Cont'd)

D. OUTLYING STATION (Cont'd)

(7) Sends a no-traffic response when transmitter is tested and has no traffic available.

(8) Automatically requests a transmitter start when sending line is idle and complete message is available.

(9) Automatically controls transmission of 1 message at a time.

(10) Stops either transmitter in response to a stop code from Sw. Ctr.

(11) Automatically generates start-of-message code and channel number.

c. Provides a form of circuit assurance.

d. Employs transistor circuitry to minimize probability of failure.

5. Station Unit for sending stations on single station lines.

a. Performs following major functions.

(1) Insures that transmission takes place only when complete messages are available.

(2) Recognizes availability of complete message when operator perforates end-of-message code or when tape is inserted in auxiliary transmitter.

(3) Permits station to send continuously when complete messages are available.

(4) Automatically generates start-of-message code and channel number.