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TERMINAL DATA LINK OPERATION EVALUATION

DATA LINK SERVICE DESCRIPTIONS

FEDERAL AVIATION ADMINISTRATION

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INTRODUCTION TO THE TERMINAL DATA LINK SERVICE DESIGNS

This document presents a detailed functional description of the design of four terminal Data Link ATC services and functions implemented in the ARTS IIIA Data Link Test Bed for operational evaluation. A brief overview of the services and of the major features of the designs is presented below to assist the reader in approaching the detailed descriptive materials which follow.

SERVICE DEFINITIONS

The initial terminal Data Link services have been designed to permit a controller to send discretely addressed, digitally coded ATC messages to aircraft for visual display on the flight deck. The services also include an ability for the controller to receive downlinked responses to the ATC messages. The following services and functions are included in the designs:

Transfer of Communication (TOC)

This service permits the controller who has handed off control of an aircraft to a new sector to send an automatically prepared message instructing the pilot to transfer to a new radio frequency. Options include the ability to automatically send the TOC upon acceptance of a hand off, or to "hold" the TOC for uplink at a later time.

Initial Contact (IC)

IC acts as a substitute for the check-in call from a pilot after the aircraft has been assigned a new frequency. The controller is presented with a downlinked message containing the aircraft's assigned altitude.

Terminal Information (TI)

This service permits the controller to select predefined TI messages from a menu for uplink. While primarily intended for sending reports of terminal operating conditions and expected approach clearances to aircraft entering the terminal airspace, the TI menu also may contain other, repetitively-used and often lengthy messages required within a sector.

Control Instructions or Menu Text (MT)

MT permits the controller to send control clearances (altitudes, headings and speeds) either by selecting the clearance from a predefined menu, or by composing the clearance using a shorthand keyboard input.

GENERAL SYSTEM FEATURES

Sending Messages

Data Link messages are sent using keyboard/trackball inputs. To minimize manual entries, implied functions, and default options are employed where possible. Message composition is simplified by using menus from which messages can be selected for uplink and by relying on automatic message composition when possible. When the controller must manually compose a message, shorthand inputs are used.

Displays

List and data block display features are used to: 1) indicate whether an aircraft is equipped with Data Link and whether the controller is eligible to send messages to the aircraft, 2) provide the controller with information about the content and status of an ongoing Data Link transaction (e.g. type of clearance sent and whether it has reached the aircraft or the pilot has responded), 3) provide a history of past Data Link messages wilcoed by an aircraft, and 4) present menu lists of available messages for uplink.

All lists are moveable and suppressible by the controller to reduce display clutter and improve ease of reading.

Operational Features and Options

A number of features have been included in the designs to enhance the operational utility of the services. In many cases, multiple means of selecting and sending messages are provided to meet varying operational needs. To further permit tailoring of the system to specific controller and airspace requirements, broad options for creating predefined messages are provided, and a high level of flexibility is permitted for combining multiple messages into a single uplink.

ORGANIZATION OF THE FUNCTIONAL DESCRIPTIONS

The descriptions are divided into seven sections:

General Data Link Features
Status List and Data Block Transaction Status Displays
History List
Initial Contact
Terminal Information Service
Transfer of Communications
Menu Text

In each section, the material is organized in the form of short subsections titled in **bold** print which describe available

functions, input requirements, and displays.

NOTE

In the following descriptions:

- The SLEW command should be interpreted as the action sequence of identifying the target with the trackball and pressing the trackball enter key.
- The ENTER command should be interpreted as pressing the keyboard ENTER key.
- Data as shown in a display or entered on the keyboard are presented in quotation marks. The quotation marks are not part of the display or entry.

GENERAL DATA LINK FEATURES

- Data Block Equipage and Eligibility Symbols

The terminal Data Link design uses graphic symbols in the first position of the first line of the data block to indicate whether an aircraft is equipped with a functioning Data Link system and whether the control position displaying the track is eligible to communicate with the aircraft. No symbol in the data block identifies an aircraft that does not have Data Link capability. A "plus sign" (+) indicates that the aircraft is equipped to communicate using Data Link. An asterisk (*) identifies an aircraft that has Data Link capability and indicates that the position displaying the asterisk is eligible to communicate with it using Data Link.

- Data Link Key

Several functions associated with the Data Link system require the controller to precede a command entry with a special keystroke. In the current design, this Data Link (D/L) key is F9 on the ARTS IIIA keyboard. When composing a Data Link message, pressing the F9 key causes "DL" to appear in the preview area.

In addition to the Data Link key, the F8 key is used as a prefix to commands associated with repositioning lists. When the F8 key is pressed, "LM" (List Move) appears in the preview area.

- One Transaction Per Aircraft

For all services, only one Data Link transaction per aircraft may be in progress at a time -- Except in the case of a "held" TOC, the controller may not uplink a new message until the previous message has been wilcoed or a transaction that has failed has been cleared from the data block display.

- Transaction Delete Command

An ongoing Data Link transaction, or one that has resulted in a failure, can be deleted by pressing the D/L key and a SLEW action. This input clears the data block and status list displays for the transaction and permits the system to accept the next message to the aircraft. The input does not recall the message or prevent it from reaching the aircraft. No provision for attempting to recall a message that has been sent is included in the design. If a transaction is deleted, intervention by voice radio is required.

- Message Resend Command

If a Data Link transaction is not completed because of a technical failure (NAK), the controller can resend the message by a SLEW action.

- Quick Look Capabilities

Current ARTS IIIA inputs to quick look an aircraft under the control of another sector will not display the third line of the data block containing information about an ongoing Data Link transaction. However, this information can be displayed if the quick look is initiated by pressing the D/L key (F9), pressing "Q" and a SLEW action to the aircraft. The quick look is deleted by repeating this input sequence.

In addition, the Data Link information contained in the data blocks of all of the aircraft under control of another sector can be quick looked by pressing the D/L key (F9), "Q", typing the controller identification letter of the sector to be quick looked, and ENTER. The quick look displays are deleted by repeating the "F9Q" ENTER input.

STATUS LIST AND DATA BLOCK TRANSACTION STATUS DISPLAYS

- Function

The status list contains information on the status of up to 15 ongoing Data Link transactions per sector. Each of the lines displays the content and status of a single transaction. The third line of an aircraft's data block also provides status and content information for an ongoing transaction.

- Status Messages

The abbreviations used for the status messages in the status list are "SNT" (message sent), "DLV" (message delivered to aircraft), WIL (pilot wilco received), "NAK" (technical failure of system to successfully deliver message to aircraft), "UNA" (pilot unable to comply with message), and TIM (pilot failed to respond to a delivered message within 40 seconds).

The third line of the data block does not display the message sent or Wilco status. The single letters "D", "N", "U" and "T" are used to indicate Delivered, NAK, Unable, and Time out.

- Time Out Indication

The data block and status list display a timeout message if the pilot fails to respond to a delivered message within 40 seconds. This display is an alerting message for the controller, and does not prevent the system from accepting a subsequent "WILCO" or "UNABLE" response. The transaction will remain open until one of these responses is received or the controller enters the transaction delete command.

- Status List and Data Block Format

Each line on the status list has three data fields displaying the Aircraft ID, the message content, and the current status of the transaction (e.g. "AAL123 TI*A SNT").

The third line of the data block presents the message content and the current status of the transaction (e.g. A120 D).

- Status List and Data Block TI and MT Message Content

The content of a Terminal Information (TI) message represented in the status list and in the third line of the data block is denoted by displaying the acronym "TI", an asterisk, and the alphabetic letter message identifier associated with the message in the TI list (e.g. "TI*A").

The content of a Menu Text message represented in the status list and the data block is represented by a

shorthand description of the clearance sent. Altitude, heading, and velocity change clearances are abbreviated by "A", "H", and "V", respectively. The letter is followed by a 3-digit number indicating the altitude level or compass heading, or a 2-digit number indicating speed (V) in hundreds of knots (e.g. "A120H150V15"). If a left or right turn direction was selected when sending a heading clearance, the "H" is replaced by an "L" or "R".

- Displays on Receipt of Wilco

When an aircraft downlinks a Wilco to a transaction contained in the status list, "WIL" is displayed for 8 seconds, after which all transaction information is deleted from the list. The Wilco response is indicated in the data block by immediately clearing all data on the third line.

- "Failure" Alerting Displays

If a transaction results in a NAK, Unable, or Time Out, the single letter indicator ("N", "U" or "T") shown in the data block flashes to alert the controller. The corresponding messages in the status list ("NAK", "UNA", "TIM") do not flash.

- Displays on Resend

If the controller resends a message that has technically failed (NAK), the failed message is cleared from the status list and a new status entry appears when the message is sent.

- Inputs to Display/Suppress Status List

The status list is displayed by pressing the D/L key (F9), typing "S" and ENTER. When the list is displayed, the identical input sequence will suppress the list.

- Inputs to Move the Status List

The status list can be moved to any position on the display by pressing the F8 key, typing "S" and SLEW. When making entries to move the list, pressing the F8 key causes "LM" (List Move) to be displayed in the preview area.

- System Recovery

If a system interupt occurs during the course of an ongoing Data Link transaction, the message content information on the third line of the data block is preserved. In addition, the field normally used to present the message status letter will display a flashing "I", to alert the controller that voice radio coordination with the aircraft may be required.

HISTORY LIST

- Function

The history list provides a record of the last 3 Data Link messages wilcoed by an aircraft. The first line of the list contains the ACID of the subject aircraft, while the remaining lines display the messages received. Messages are automatically sent to the history list when the wilco is received.

- Message Content Display

Individual messages contained in the history list are separated by a blank line. Thus, when a single message is longer than one line, no blanks are inserted between the multiple lines used to display the message.

In general, the content of messages represented in the history list is displayed with minimal use of abbreviations (e.g. FLY HDG 150). However, when a single message contains multiple elements, alternate representations are used to conserve display space. If a TI message is combined with an MT message, the content of the clearance portion of the message is abbreviated using the shorthand form used in the status list and data block displays.

When multiple MT clearances occur sequentially within a message they are displayed in the shorthand form on a single line of the history list separated by spaces (e.g. "H150 A060 V15").

- Message Order

The messages are listed in reverse chronological order of receipt, with the most recently received message appearing at the bottom of the list. The list scrolls up as new messages are received.

- Inputs to Display History List

The history list for an aircraft can be viewed by entering "HL" and SLEW, or by pressing the D/L key (F9) "H" and SLEW. The history list is displayed for 8 seconds after it is selected. Alternatively, entering the "HL" ENTER or D/L "H" ENTER command will manually remove the history list.

If the controller chooses to look at a new aircraft's history list during the interval that another is being displayed, the "HL" SLEW action will remove the old list and display the new list. The history list of any aircraft may be viewed, whether or not it is in the controller's sector.

- Location of History List

The history list replaces the status list. The location of the history list moves with the status list, and the status list reappears when the history list is automatically deleted after the 8 second display period, or when it is removed by a manual input.

INITIAL CONTACT (IC)

SERVICE DESCRIPTION:

- Initiation of IC

The IC is initiated when the aircraft pilot responds with a WILCO message to a preceding transfer of communication. The aircraft's assigned altitude is appended to the WILCO downlink response, and this value is sent via interfacility or intrafacility data channels to the receiving control position.

If the aircraft fails to append the assigned altitude to the TOC wilco, the system automatically sends an altitude request (AR) message to the aircraft. The ongoing status of this transaction is displayed in the receiving controller's status list and data block. An AR is also automatically sent to departing aircraft in order to initiate the IC for first contact.

- Display on Downlink of Assigned Altitude

When the aircraft downlinks its assigned altitude with the wilco to the TOC or in response to an AR, the third line of the data block displays the characters "IC" followed by the 3-digit altitude value (e.g. "IC 110"). The third line of the Data Block flashes to capture the controller's attention and signal a required response.

- Response to an IC Downlink

The controller response may be a TI message, initiation of a transfer of communication, one or more menu text messages, or a combination of a TI message and MT messages. Initiation of the uplink immediately deletes the "IC" display in the third line of the data block.

TERMINAL INFORMATION SERVICE (TI)

SERVICE DESCRIPTION:

- Initiation of TI

A message in the TI list can be sent at any time through a controller input action. When used immediately after receiving an initial contact message from an aircraft ("IC" and an altitude value displayed in the third line of the data block) a slew input can be used to send a commonly-used default TI message.

- TI List Display

TI messages are selected from a list display with the header "TI" at the top and containing four optional messages. Each message is preceded by an identifier letter (A - D). The message appearing on the first line (regardless of its identifier letter) is the default message. Each of the messages can be up to 40 characters long.

- Inputs to Change Default Message

The default message can be changed by pressing the D/L key followed by "D", the identifying letter of the new item desired (A to D), and ENTER. This action will move the selected item to the first line of the list and rearrange the remaining items in alphabetic order of their identifier letters. Items always retain their original identifier letters regardless of the item designated as the default message. Changing the default message automatically restores any suppressed items to the TI list (see suppressing individual TI messages below).

- Inputs to Reposition TI List

The TI list can be moved independently to any position on the ARTS display by pressing the List Move (F8) key, typing "T" and SLEW to position the list.

- Inputs to Suppress / Retrieve TI List

The entire TI list can be suppressed from the ARTS display by pressing the D/L key, typing "T" and ENTER. Repeating this sequence will retrieve the list. While the list is suppressed all items remain available for uplink.

- Suppressing Display of Individual TI Messages

If desired, fewer than 4 TI messages can be displayed in the list. Pressing the D/L key followed by the item identifier letter and ENTER removes the selected item from the list display. All other items maintain their original letter identifiers, and the suppressed item remains available for uplink by the normal data entries. Items can be retrieved to the list display by repeating the D/L key - item identifier entry. If all items in the list are individually suppressed, the "TI" header remains on the display to indicate the suppressed list location and to remind the controller that restoring the list will require individual entries rather than the entry used to retrieve the entire list if it had been suppressed using the F9T entry.

Changing the default message in the TI list will automatically restore all individually suppressed items to the list.

- Inputs to Send Default TI After IC

When a successful initial contact has been completed and the third line of the data block displays "IC" followed by an altitude value, the default TI message may be uplinked by a SLEW action.

- Inputs to Send TI Messages at Any Time

Messages can be uplinked at any time by typing "T", the message identifier letter from the TI list (e.g. "B") and SLEW.

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- Displays on TI Uplink

If a TI message is sent when "IC" and an altitude value are shown in the third line of the data block, the entry deletes the "IC" and altitude, and replaces it with "TI*" followed by the message letter selected from the list for uplink. The status list entry displays the identical message.

- Displays After Pilot WILCO

Upon receipt of a downlinked WILCO response from the aircraft, the "TI"/message letter display in the third line of the data block is deleted. WIL is displayed in the status list entry for 8 seconds before the entry is deleted.

- Combining TI with an MT Message

Any TI message can be sent together with up to two MT messages by typing the appropriate entries (e.g. "TDM4"). TI and MT messages can be combined in any order (e.g. M1TCM3, TCM1 3, etc.) The multiple MT message displayed on line 9 of the MT list can be combined with a TI message only if line 9 contains two clearances. When the IC message is flashing in the Data Block, the default TI message can be sent with a Menu Text message without specifying the TI message number (e.g. "TM4")

- Changing the Content of TI Messages

The content of any of the four TI messages can be changed by pressing the D/L key, "T", and the identifier letter of the message to be changed. These entries are followed by a space, the desired text message, and ENTER (e.g. "F9TB text message ENTER"). The text message may be up to 40 characters long.

TRANSFER OF COMMUNICATIONS (TOC)

SERVICE DESCRIPTION:

- TOC Function

The TOC message contains a new radio frequency for an aircraft. The TOC can be sent either automatically upon acceptance of the hand off, or held for later transmission by a manual entry. The automatic/manual mode is selectable by position.

- TOC Mode Indicator

TOC can be set to operate in either an automatic send or manual send mode. The active TOC mode is displayed in the Systems Data Area (SDA). "TC HOLD" is displayed when the system is in the manual send mode and "TC SEND" is displayed when the system is in the automatic send mode. When the ARTS program is started, TOC is in the manual or hold mode. Pressing the D/L key, "TH" and ENTER will change TOC to the automatic mode and cause the mode display to change to "TC SEND". Repeating the same entry will switch the mode back to "TC HOLD"

- Inputs to Send TOC - TC SEND Mode

If in the TC SEND mode, the TOC is automatically uplinked upon acceptance of the hand off when the sending controller completes the normal keyboard sequence for hand off initiation (HANDOFF key (F5), the receiving sector's Controller Symbol, and SLEW). Any other currently acceptable ARTS input sequence normally used to initiate a hand off will result in the same automatic uplink of TOC (e.g. F5-ACID-Controller Symbol- ENTER).

- Display on TC SEND TOC Uplink

"TC" is displayed in the third line of the data block and in the status list when the TOC message is uplinked.

- Inputs to Hold a Message When in TC SEND Mode

When in the TC SEND Mode, the TOC can be held for delayed uplink by adding an "H" prior to the SLEW entry for the Handoff (i.e. "F5, Controller Symbol, H, SLEW"). The system will revert to the TC SEND mode for succeeding TOCs unless the mode is changed or the "H" is again added to the handoff entry.

- Inputs to Send TOC - TC HOLD Mode

When in the TC HOLD mode, the controller may initiate the sector hand off but reserve communications eligibility until a later time by completing the normal keyboard sequence for hand off initiation (HANDOFF key (F5), the receiving sector's Controller Symbol, and SLEW). Any other currently acceptable ARTS input sequence normally used to initiate a hand off will result in the same held status of TOC (e.g. F5-ACID-Controller Symbol- ENTER). The TOC can then be sent manually by a SLEW action.

- Display on Manual (TC HOLD) Uplink

"TC H" is displayed in the third line of the sending sector's data block when a handoff has been completed in the hold mode. "SNT" and succeeding transaction states are displayed in the status lists of both the sending and receiving sectors when the SLEW is completed to manually send the TOC.

- Inputs to Automatically Send TOC When in TC HOLD mode

When in the TC HOLD Mode, the TOC can be sent automatically upon handoff acceptance by adding an "S" prior to the SLEW entry for the hand off (i.e. F5, Controller Symbol, S, SLEW). The system will revert to the TC HOLD mode for succeeding TOCs unless the mode is changed or the "S" is again added to the hand off entry.

- Display After Pilot WILCO

In both automatic and manual procedures the "TC" display in the third line of the data block is deleted when the aircraft downlinks a WILCO response. The status list entry will display "WIL" for 8 seconds after receipt of the wilco, and then will be deleted.

- Sending Other Messages When a TOC is in Held Status

An MT or TI message can be sent to the aircraft while a TOC is in the held status. Sending the new message will replace the "TC H" display in the data block with the type, content or identifier, and status of the TI or MT message. When the message is wilcoed, the "TC H" reappears in the data block.

If the controller appends an "S" to the TI or MT message sent while a TOC is in the held status (e.g. "M4S"), the TOC message will be sent automatically when the WILCO is received.

- Offering a Hand Off While a Data Link Transaction is in Progress

If a Data Link transaction (e.g. a clearance) is in progress when the sending controller wishes to hand off to another sector, the normal hand off entries will be accepted by the ARTS computer, and the hand off can be accepted by the receiving controller. The ongoing message status will continue to be displayed in the data block until it is wilcoed or until the controller enters the message delete command. The TOC message will then be automatically sent if 1) the handoff has been accepted and 2) the initiating position is set to the TC SEND mode or the controller added the "S" keystroke to the hand off entry in the TC HOLD Mode.

If the handoff is accepted and the system is in the TC HOLD mode or the controller added the "H" keystroke to the hand off entry in the TC SEND mode, the wilco or deletion of the prior transaction will cause the TC H display to appear in the data block, and the TOC will be sent when the SLEW is completed. In all cases, the receiving controller's status list (but not data block) will show the TOC status when the TOC message is sent.

- Inputs to Acquire Data Link Eligibility

The controller may acquire ("steal") eligibility for Data Link communications by pressing the D/L key, typing the letters "OK" and a SLEW action. This action also sends a TOC message to the aircraft.

- Transferring Communications to a Non-Default Sector

Under normal circumstances, the radio frequency message created upon hand off acceptance is automatically determined by the sector to which control has been transferred. However, the Data Link design also accommodates cases where it is necessary to transfer communications to a controller other than the one who has accepted the sector handoff.

In this situation, a TOC in the held status is cancelled using the standard transaction delete command (D/L key (F9) SLEW). The controller then initiates the desired TOC message by pressing the D/L key (F9), "X", the controller identification letter of the new sector [illegible] e.g."F9XE SLEW).

MENU TEXT (MT)

SERVICE DESCRIPTION:

- Function

The MT service permits the controller to uplink control instructions (speed, heading and altitude clearances) by selecting the required messages from a predefined menu or by composing clearances not contained in the menu.

- MT List Display

Available MT clearances are displayed in a list containing 9 lines. Each menu item is displayed on a single line preceded by an identifier number (1-9). Messages are selected using the identifier numbers.

The first 8 lines are dedicated to specific clearance types. Lines 1, 2 and 3 are for heading clearances and are preceded by the header "HDG". Lines 4, 5 and 6 are reserved for altitudes and are preceded by the header "ALT". Lines 7 and 8 are for speed control and are preceded by the header "VEL". Line 9 is preceded by the header "MULT", and is used for a multiple entry composed of any two or three items contained in lines 1 to 8. Only one of each clearance type may be entered on line 9.

- MT List Item Content

The content of each of the three clearance types is highly structured, and automation is used to produce a complete message from the structured data. In each case, clearances are displayed in the menu as a numerical value followed by "DEG", "FT", or "KTS". The direction of an altitude change (descend or climb) is added by the automation when the message is sent by comparing the aircraft's current altitude with the message data. The "increase" or "decrease" commands are added to a velocity message in a similar manner. Heading clearances are sent as "Fly Heading.." unless a special command is added to the menu selection as described below. The line 9 multiple clearance is displayed by the relevant item identifier numbers separated by slashes (e.g. "1/5/8").

- Inputs to Send a MT Message

A single MT item can be uplinked by typing "M" followed by the menu item identifier number, and a SLEW action.

- Controlling the Direction of a Turn in a Heading Clearance

The specific direction of a turn can be included in a heading message contained in the menu by typing an "L" or "R" after the menu identifier number (e.g. "M1R SLEW).

- Inputs to Reposition MT List

The position of the MT list on the ARTS display can be independently changed by pressing the F8 key (LM), typing "M", and completing a SLEW action to move the list.

- Inputs to Suppress / Retrieve MT List

The entire MT list can be removed from the display by pressing the D/L key and typing "M" and ENTER. The list is retrieved using the same sequence of key strokes.

- Suppressing Display of Individual MT Messages

If desired, fewer than 9 MT messages can be displayed in the list. Pressing the D/L key followed by the item identifier number and ENTER removes the selected item from the list display. All other items maintain their original number identifiers, and the suppressed item remains available for uplink by the normal data entries. Items can be retrieved to the list display by repeating the D/L key - item identifier entry. If all items in a particular category (HDG, ALT, VEL, MULT) are suppressed, the category header also will be suppressed. If all items in the list are individually suppressed, the "MT" header remains on the display to indicate the suppressed list location and to remind the controller that restoring the list will require individual entries rather than the entry used to retrieve the entire list if it had been suppressed using the F9M entry.

- Inputs to Send Multiple MT Messages

Up to three MT menu items can be sent in a single uplink by inserting spaces between the item numbers. (e.g. M1 4 8 SLEW would send menu items 1, 4 and 8). Item 9 cannot be combined with other items. The software will not permit attempts to send more than one of each clearance type (altitude, heading or altitude) in a multiple menu uplink.

- Bypassing the Menu

A heading (H), altitude (A) or velocity (V) not contained in the menu can be uplinked by pressing the D/L key, typing "H", "A" or "V" followed by the numeric value of the clearance and SLEW. One of each clearance type also can be combined in a single uplink in any order (e.g. "F9H230A030"). The third line of the data block and the status list entry display the clearance letters, and the numerical values entered (e.g."A 110") until the message is wilcoed. The direction of a turn for a heading clearance can be controlled by substituting "L" or "R" for "H" in the data entry.

- Inputs to Send MT Messages Combined with TI

Any TI message can be sent together with up to two MT messages by typing the appropriate entries (e.g. "TDM4"). TI and MT messages can be combined in any order (e.g. M1TCM3, TCM1 3, etc.) The multiple MT message displayed on line 9 of the MT list can be combined with a TI message only if line 9 contains two clearances. When the IC message is flashing in the Data Block,
the default TI message can be sent with a Menu Text message without specifying the TI message number (e.g. "TM4").

- Displays on MT Uplink

When an MT or By-pass uplink is initiated, the third line of the data block and the associated status list line displays a shorthand abbreviation of the message content (e.g. "H230A030")

- Displays After Pilot WILCO

A downlinked WILCO to an MT message or group of messages deletes the data in the third line of the data block and causes "WIL" to be displayed in the status list for 8 seconds.

- Modifying Numeric Values in Menu Items

The numeric value of a heading, speed or altitude clearance can be changed by pressing the D/L key, typing M and the one-digit identifier number of the menu item to be changed, typing the new numeric value and pressing the ENTER key (e.g. "F9M3060".

If a SLEW action is substituted for the keyboard ENTER, the menu item will be changed AND the message will be uplinked to the slewed aircraft. For heading clearances, if "L" or "R" is appended to the entry prior to the SLEW (e.g. "F9M3060L") the directional turn clearance will be uplinked (e.g. "Turn Left Heading 060"), but the modified menu item will contain the generic heading message for future use (e.g. "Fly Heading 060"). In all cases, modified values will stay in the MT list entries until they are changed again or the program is restarted.

- Creating/Modifying Line 9 Combination Clearance

Line 9 permits the combination of up to three clearances shown in lines 1 to 8. This entry is created or modified by pressing the D/L key, typing "M9", the identifier numbers for two or three of entries 1 to 8 and ENTER. If a SLEW action is substituted for ENTER, the combined clearance will be entered in the list and simultaneously sent to the designated aircraft. One one clearance in each category can be included on Line 9.

TERMINAL DATA LINK DESIGN DESCRIPTION

BACK UP COMMUNICATIONS
UPLINK

- Function

The back up communications function permits the controller to compose and send free text messages up to 40 characters in length to eligible aircraft. A back up message created by the controller is stored and displayed on the radar screen, and can be sent to a single aircraft or to all eligible aircraft in a sector at any time. Only one back up message is available for uplink at any time. Creation of a new message deletes the previous message.

- Message Composition

A back up message can be composed by pressing the D/L key (F9) followed by "U", a space, the message text, and ENTER or SLEW (e.g. "F9U CHECK FOR STUCK MIC" ENTER).

- Sending and Storing Messages Immediately After Composition

If the message composition entry is followed by a SLEW action, the message will be sent to the designated aircraft and displayed for future use on the radar screen. If the message entry is followed by a keyboard ENTER, it is not sent, but is displayed for future use. However, if "F9UALL" is used to prefix the message, pressing ENTER will send the message to all eligible aircraft and display it for future use.

- Message Display

A communications back up message is displayed as an entry at the bottom of the Terminal Information (TI) list. The header "CU" is displayed below the last entry of the TI list. The last back up message created by the controller is displayed directly below the header.

- Sending a Currently Displayed Message

A message displayed below the "CU" header in the TI list can be sent to any one aircraft by pressing the D/L key (F9), "U" and completing a SLEW action to the aircraft ("F9U"SLEW). The message can be sent to all eligible aircraft in a sector by entering "F9UALL" followed by a keyboard ENTER.

- Transaction Status Display

The status of a communications back up message is displayed in the data block and status list using status indicators identical to those applied to other Data Link messages. Message type is indicated in the status list and the third line of the data block as "CU".

- Suppressing the Message Display

A message stored in the CU area of the TI list can be suppressed by typing "F9U" and a keyboard ENTER. Repeating this sequence retrieves the message display.