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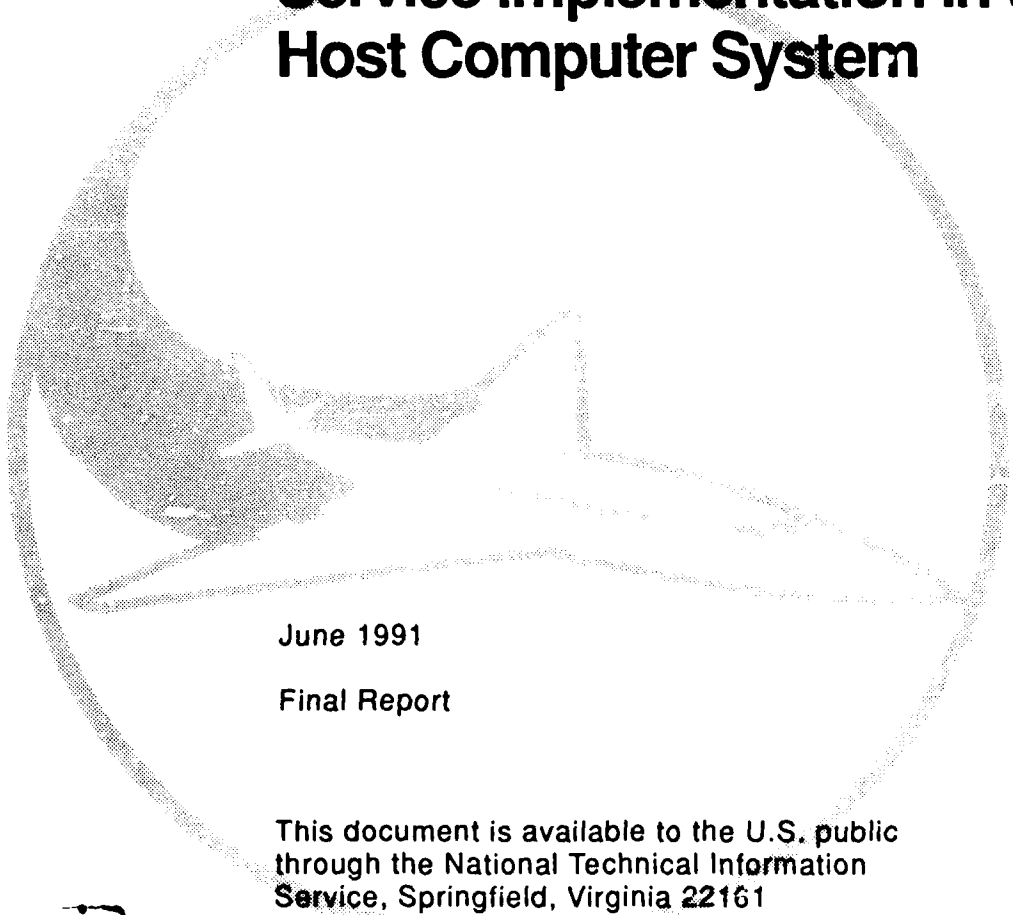
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Technical Center
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Functional Baseline Specification for ATC Data Link Service Implementation in the Host Computer System



June 1991

Final Report

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16. Abstract This specification defines the requirements for implementing the initial ATC Data Link services in the Host Computer System. In addition to describing how each of the initial services will operate in the context of current Host processing, the document defines the new controller data entries and display features associated with each of the initial Data Link services. System supervisory and support functions are also specified.			
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EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) is pursuing an initiative to develop and implement a Data Link system intended to enhance communications between ground-based air traffic control (ATC) and aircraft operating within the National Airspace System (NAS). By providing digital information transfer along with the ability to discretely address individual receivers, Data Link is expected to relieve frequency congestion on existing voice radio channels while increasing the safety and productivity of ATC operations.

In order to ensure that the introduction of Data Link will have an optimally positive impact on ATC, the FAA Technical Center is conducting a continuing program of research and development to guide the design of effective ATC services, evaluate their impact on system performance, and promote the integration of Data Link with the air traffic controllers who will use it.

Development of initial en route ATC Data Link services operational software and interfaces was authorized by approval of NCP 10341 in June 1988. To date, a set of initial, baseline en route ATC Data Link services for implementation in the Host Computer System has been defined, developed, tested, and evaluated in operational simulations at the FAA Technical Center, in conjunction with the members of the Air Traffic Data Link Validation Team (ATDLVT). Full scale operational evaluations were conducted using the Full Performance Level (FPL) air traffic controller members of the ATDLVT. Concurrently, aircrews flying simulated aircraft in the ATC scenarios evaluated the initial services and a preliminary flight deck/control device for Data Link communications. These evaluations indicated that the initial Data Link services would benefit ATC operations and are suitable for implementation in the current NAS en route system (reference 1). As a result, this functional specification was prepared, as a first of a series, to form the basis of implementing the baseline en route ATC Data Link services in the Host Computer System.

The baseline Data Link services addressed in this functional specification are Altitude Assignment; Transfer of Communication, indicating the identity and radio frequency of the next ATC contact; Voice Communications Backup; and a Menu Text function that permits the selective uplinking of predetermined ATC instructions, such as, restricted altitude assignments, speed instructions, and crossing restrictions. As the research and development efforts at the FAA Technical Center progresses, functional specifications for new, additional Data Link services will be prepared as these services are developed, tested, evaluated, and recommended for implementation.

SECTION 1

INTRODUCTION

The National Airspace System (NAS) plan calls for the development and implementation of Data Link services to enhance air-ground communications. To that end, a set of initial Air Traffic Control (ATC) Data Link services has been defined, tested, and evaluated in an operational simulation environment at the Federal Aviation Administration Technical Center (FAATC). These evaluations indicated (reference 1) that the initial Data Link services would benefit ATC operations and are suitable for implementation in the NAS en route system.

To implement these services, new and modified Host Computer System software will be required to process data transferred to and received from Data Link-equipped aircraft. The new Data Link functions will provide the means for sector controllers to uplink Data Link messages to pilots, and will process messages from pilots for display to sector controllers.

The Data Link services identified for initial implementation in the Host are as follows:

- Altitude Assignment

Altitude clearances will be uplinked as directed by controller input actions. Both assigned and interim altitudes will be included. In addition to uplinking the altitude information, all the current Host functions associated with assigned and interim altitude entries will be performed. If appropriate, an Altimeter Setting may be automatically included in the uplink message.

- Transfer of Communication

Instructions to switch to a new radio frequency will be communicated to the pilot via Data Link as directed by controller input actions. The Host will automatically determine the new radio frequency. If appropriate, an Altimeter Setting may be automatically included in the uplink message.

- Communications Backup

This service will comprise both controller-to-pilot and pilot-to-controller message processing. For controller-to-pilot message processing, controller-entered text will be uplinked to selected aircraft. For pilot-to-controller message processing, pilot-entered text will be downlinked to the sector having Data Link communications with the aircraft.

As part of the capabilities available to the controller when using Data Link, the system software will include a Menu Text function. Text will be prestored and displayed as a menu of entries for selective uplinking to one or more of the aircraft under sector control. In addition, portions of this text may be used, at controller option, to update the computer database, thus reducing the workload associated with controller keyboard entries.

1.1 PURPOSE OF THIS DOCUMENT

This document specifies the Host functional processing requirements for the initial implementation of Data Link ATC services. This specification addresses the use of Data Link services with current ATC procedures, controller inputs, and display outputs. In addition, requirements for supervisory functions and support software capabilities are identified.

1.2 BACKGROUND

The Data Link services specified in this document have been prototyped in the Host Computer System using the FAA Technical Center (FAATC) Data Link test bed. These services were developed, evaluated, and refined by the Air Traffic Data Link Validation Team, which was established to ensure the operational suitability of Data Link functions. Using the test bed, the initial Data Link services were subjected to several evaluations by full-performance level controllers. Test results to date (reference 1) have indicated that the Data Link services will reduce voice communications for ATC messages. At the time of this publication, activities are continuing in an effort to further develop, refine, and operationally evaluate Data Link capabilities.

1.3 SCOPE

This document and its companion document, the *Host Computer System (HCS)-Aeronautical Telecommunications Network (ATN) Communication Requirements Specification for Initial Data Link Air Traffic Control Applications* (reference 2), establish the requirements for implementing the initial Data Link services in the Host Computer System.

Figure 1-1 illustrates the relationship between these documents. The functions performed as part of the Applications Processing are specified herein, while those performed as part of the Communication Processing are described in the companion document. The Communication Processing function establishes Data Link active sessions with aircraft, and also builds and accepts the messages to and from the Data Link Processor (DLP).

The functional processing requirements specified in this document are itemized in section 1.3.1 below. These functional requirements are based on assumptions regarding the messages sent to and received from systems external to the Host. Those systems, shown in figure 1-2, are primarily the

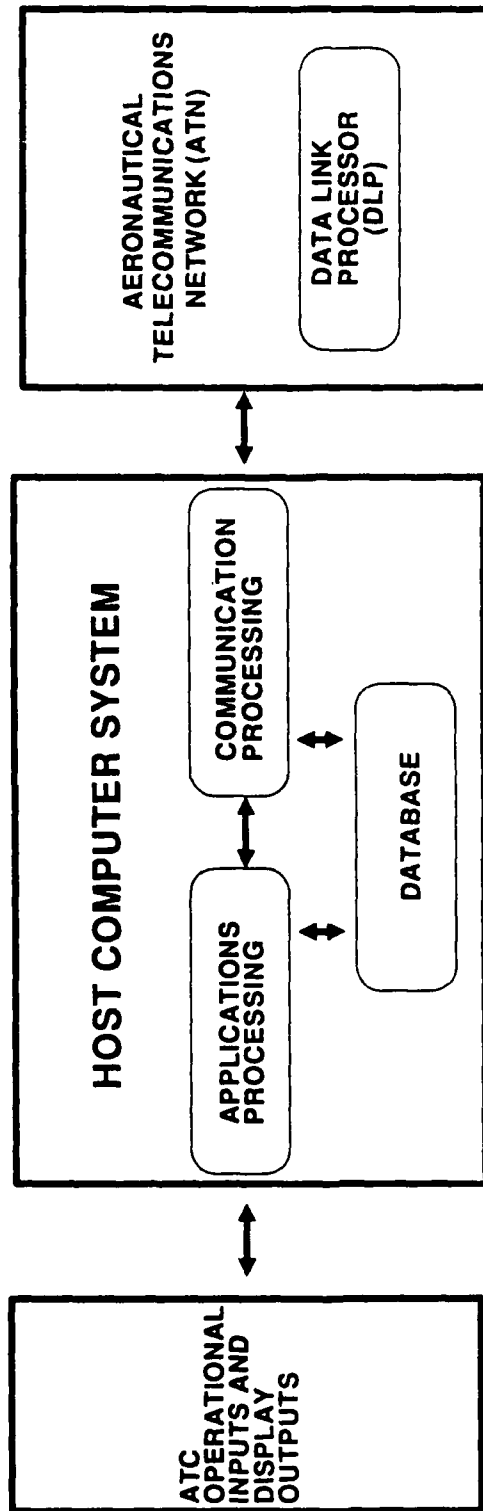


Figure 1-1. Data Link Processing

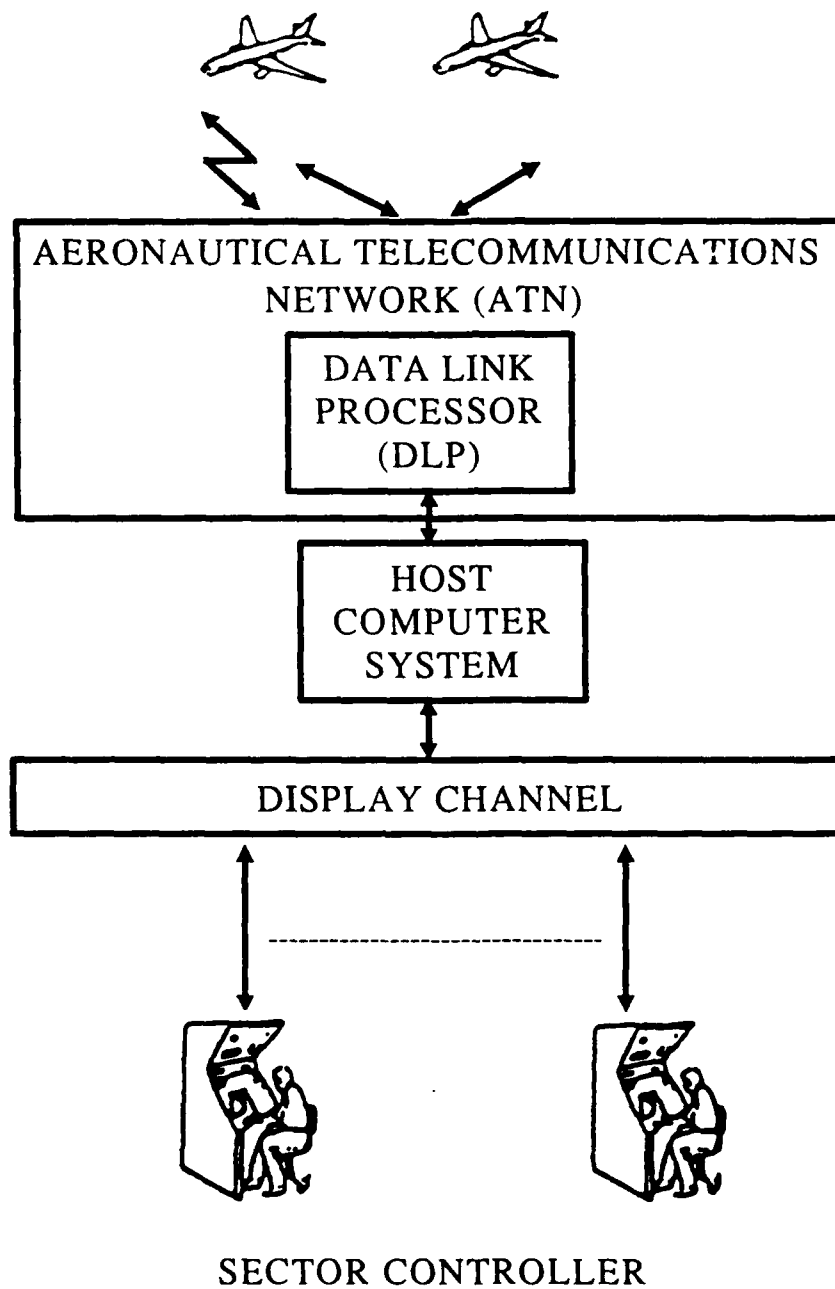


Figure 1-2. Data Link Configuration Overview

airborne Data Link avionics equipment, and the Aeronautical Telecommunications Network (ATN). These assumptions are addressed in section 1.3.2 below.

1.3.1 Host Functional Processing Requirements

The functional processing requirements described in this document include the following:

- Host processing and display requirements for uplink ground-to-air applications data.
- Host processing and display requirements for downlink air-to-ground applications data.
- Host processing and display requirements for messages to and from sector controller and supervisory positions.
- Host processing and display requirements for messages to and from adjacent ATC facilities.

1.3.2 Assumptions

The following assumptions pertain to the implementation of the initial Data Link functions:

- The Data Link functions specified herein are designed for implementation in the currently operational Host Computer System having interface to the Computer Display Channel (CDC) and Display Channel Complex (DCC).
- When the Data Link services specified herein are initially implemented, ATC operations will be conducted using essentially the current ATC procedures, with appropriate modifications as necessary to accommodate Data Link. Data Link will be deployed to supplement air-ground voice communications for routine ATC operations.
- The Host will perform the tasks necessary for ensuring a suitable Data Link interface between the telecommunications network and the Host. Tasks associated with establishing this interface will be performed as described in the companion specification (reference 2).

The characteristics of Data Link processing that will be performed in systems external to the Host are assumed to be as follows:

- A telecommunications network will handle the message traffic between the Host and airborne processors. With regard to operational use of Data Link, the network will appear transparent to the controllers and pilots, unless failure to communicate between air and ground is indicated on a sector or aircraft display.

- Messages transmitted and received on the telecommunications network will contain the identity of the message source, and a unique reference number for correlation with other related Data Link messages (e.g., a ground-to-air uplink message and an associated pilot response).

1.3.3 Intended Audience

The document assumes good knowledge of ATC procedures and the functional processing currently performed in the Host Computer System. For additional information, the reader should refer to the Host Computer Program Functional Specifications issued by the FAA (NAS-MD series).

1.4 APPROACH

This document specifies the functional processing requirements for Data Link services in the following sections:

Section 2 specifies the functional requirements for each of the initial services and associated Data Link functions including controller keyboard entries and display requirements.

Section 3 specifies the functional processing requirements for each Host input message used with the initial Data Link services. The section includes processing requirements for messages to and from the sector positions, supervisory position, and interfacility interfaces.

Section 4 specifies the functional capabilities required for failure recovery, real time quality control, and support software.

Section 5 specifies Host capacity and response time requirements for accommodating the new Data Link functions.

Appendices A through D provide operationally oriented examples of how the Data Link services may be applied in an ATC operational environment, and Appendix E specifies additional processing requirements applicable to the display of the Full Data Block.

SECTION 2

DATA LINK APPLICATIONS

This section addresses the operational use of the initial Data Link services. The integration of each service with currently used Host functions and existing ATC operational procedures is specified in section 2.1. Data Link processing requires capabilities for controlling the use of the new ATC services; these capabilities are specified in section 2.2. New controller keyboard entry messages for Data Link operational use are specified in section 2.3. Messages that must be transferred to and received from systems external to the Host are specified in section 2.4. New message data fields are specified in section 2.5. New system parameters are specified in section 2.6. Additions to system adaptation data are specified in section 2.7. Processing requirements for Altimeter Setting data in uplink messages are specified in section 2.8. Finally, a requirement for a new flight plan equipment qualifier for Data Link-equipped aircraft is specified in section 2.9.

2.1 DATA LINK SERVICES

Each of the Data Link services shall be integrated and consistent with the ATC functional processing currently performed in the Host. The following subsections specify the operational use of each of the initial Data Link services.

2.1.1 Altitude Assignment

In the current Host, the controller can change the value of either the assigned altitude (field 08) or interim altitude (field 76) via a keyboard entry. The capability to trigger Data Link processing shall be provided as part of the controller input action for assigned and interim altitude. Host Data Link processing shall generate a message for uplinking the controller-entered altitude information (and computer-selected Altimeter Setting data, if appropriate for the given clearance) to the selected aircraft.

An assigned altitude value shall be uplinked by using the normal assigned altitude key entry, and a single character indicating the uplink request.

An interim altitude value shall be uplinked by using interim altitude key entry. Three options shall be available to the controller:

- The interim altitude value shall be entered via keyboard input, as in the current operational system, with the addition of a single character indicating the uplink request.
- The interim altitude value shall be identified by a keyboard input reference to a text string, prestored as Menu Text.

- The interim altitude value shall be entered via input reference to the Menu Text in conjunction with a keyboard-entered altitude value.

Using the second option above, the entire text in the Menu Text entry shall be uplinked. Using the third option above, the same text shall be uplinked except that the interim altitude value in the message is entered by the controller. The interim altitude value in the Menu Text shall be a value that is entered at the time the Menu Text entry is composed at a supervisory position, and shall be changeable at a supervisory position. If the altitude field in the Menu Text is defined as variable, it shall be changeable at the controller's position.

The transmission of the uplink message for assigned and interim altitude shall initiate a Data Link transaction, which shall be monitored by the system and incorporated in the Data Link status displays described in section 2.2.4 below. A Host system parameter (section 2.6) shall limit the number of concurrent, active transactions for this service.

An optional character, enterable as part of the controller input action, shall direct the system to send the uplink message to the aircraft identified in the message. The functional requirements for these messages are specified in section 3.2.

The status of the uplink message shall be incorporated in the status displays (section 2.2.4). In addition, a computer-generated reference number for each message shall ensure that the proper association is maintained between the uplinked message and pilot responses. The status displays referenced by this number shall be cancelled as a result of selected input messages from either the controller or the pilot. Input messages that shall cancel these displays are a controller Delete, a controller Resend or a pilot-initiated message indicating compliance with the message content. A Resend shall cause a new transaction number to be generated. The cancellation resulting from a pilot initiated message shall occur a parameter time (section 2.6) after Host receipt of that message. (Functional requirements for these pilot-initiated messages are specified in section 3.11 below.)

While the actual terminology for operational response messages is to be established by the aviation community, the pilot-initiated message indicating compliance is herein referred to as a WILCO. Upon receipt of WILCO for an assigned altitude Data Link action, the Host shall update the Full Data Block (FDB) and NAS database (field 08), in accordance with the current processing of controller-entered altitude assignments. Further, upon receipt of WILCO for an interim altitude Data Link action, the Host shall update the FDB and NAS database (field 76) for interim altitude transactions, except for interim altitude Menu Text entries that are specified to preclude the updating of the FDB and NAS database.

2.1.2 Transfer of Communication

When a handoff of a Data Link-operational aircraft is accepted, a message shall be built for uplinking the appropriate radio frequency data (and computer selected Altimeter Setting data, if

appropriate for the aircraft altitude) to the selected aircraft. Control of this message shall remain at the sector initiating the handoff.

The generation of the uplink message shall initiate a Data Link transaction, which shall be monitored by the system and incorporated in the Data Link status displays described in section 2.2.4 below. A Host system parameter (section 2.6) shall limit the number of concurrent, active transactions per aircraft for this service.

An input action shall be provided at the sector initiating the handoff to uplink the Transfer of Communication message to the aircraft identified in the message. The uplink message for this controller input action shall be indicated in the status display. In addition, a computer-generated reference number shall ensure that pilot-initiated responses to this message reference the proper uplink message. The status displays referenced by this number shall be cancelled as a result of an input message from either the controller or the pilot. The input messages that shall cancel these status displays are a controller Delete, a controller Resend, or a pilot WILCO. A Resend shall cause a new transaction number to be generated. The cancellation resulting from a WILCO shall occur a parameter time (section 2.6) after Host receipt of the message. The retraction of a track transfer (/OK to a track originally handed to another sector, but still not accepted) shall not cause an uplink message to be built, unless specified in the input message. This capability shall be available at both the R- and D-Controller positions.

2.1.3 Communications Backup

This service shall be provided to facilitate Data Link communications between controllers and pilots in the event of radio failures or other special circumstances. This service comprises two functions: (1) messages shall be composed and uplinked as a result of input messages at Controller positions, and (2) messages originated in the aircraft shall be received by the Host and routed to the sector having Data Link eligibility for the aircraft. The processing requirements and display outputs for this service are described below.

2.1.3.1 Controller-to-Pilot Message Processing

The capability to build and uplink controller-to-pilot text messages using the keyboard and the Computer Readout Device (CRD) shall be provided. A message length parameter shall permit up to system parameter (section 2.6) characters of text. In addition, a capability shall be provided for the controller to uplink the messages to one or all Data Link-equipped aircraft for which the sector has Data Link eligibility.

The generation of the uplink message shall initiate Data Link transaction, which shall be monitored by the system and incorporated in the status displays described in section 2.2.4 below. In addition, as for other services, a computer-generated reference number shall correlate each uplink with the associated pilot responses. A system parameter (section 2.6) shall limit the number of concurrent, active transactions per aircraft for this service. The status of the transaction shall be displayed in the Status List together with a parameter (section 2.6) number of characters from the controller-entered message.

Once the message is uplinked, the text shall be removed from the CRD display and stored for future reference. A capability shall be provided for the controller to recall this message text for CRD display, and uplink a message containing it to one or all eligible Data Link aircraft under sector control. Only the most recent Communications Backup Uplink message text per sector position shall be recallable.

2.1.3.2 Pilot-to-Controller Message Processing

The capability to receive pilot-initiated text messages, display the messages at sector positions, and allow a controller-entered response shall be provided. Additionally, the capability shall be provided to display or print these downlink text messages on the sector flight data output devices.

The receipt of a Text message from an aircraft shall cause this message to be routed to the sector position with Data Link eligibility for the aircraft that sent the message. An audible alarm at the D-Controller position shall be triggered to signify that a downlink message is in the message queue. A controller keyboard entry (CRD ACK) shall then cause the message to be displayed on the D-Controller CRD. The message shall be removed from the D-Controller CRD when the controller makes a keyboard entry to clear the CRD update area, or to acknowledge a subsequent CRD update. Any indicated subsequent message in the message queue shall be displayed when the controller enters subsequent input actions to display the messages. The message shall be output on the sector flight data displays or printers immediately, or after a timeout, as determined by parameters defined in section 2.6. The displayed and recorded pilot-to-controller message shall contain the aircraft identification, computer-assigned identifying message referent number, time of message receipt, and text.

The capability to respond to the downlinked text message shall be provided (section 3.5.3). At the sector position where the message is displayed, a D-Controller new input message type shall identify the controller response to a pilot-initiated text message. The response message shall include the computer-assigned reference referent number to the displayed, downlinked message and a controller response.

2.1.4 Use of Menus for Message Composition

Prestored Data Link messages (Menu Text) shall be available for use at each controller position, and shall be selectable by using either the interim altitude key or an adapted Data Link function key. The content of Menu Text entries shall be adapted for each Fix Posting Area (FPA) and sector, and shall be constructed using a phrase or word dictionary, as described in reference 2. The usage of the menu capability is described herein as two functions, Menu Text Build and Menu Text Uplink.

2.1.4.1 Menu Text Build

A capability shall be provided to build and display Menu Text entries. Two methods shall be provided for the menu build:

- System adaptation data
- Supervisory entries

The system adaptation data shall be expanded to include a phrase and word dictionary (see reference 2), which would consist of standard terms pertaining to en route operations. These phrases and words shall be used to compose Menu Text messages.

Up to a system parameter (section 2.6) number of menu entries shall be provided for each Fix Posting Area (FPA) defined in the adaptation data. The maximum length of a displayed Menu Text shall also be a system parameter (section 2.6) characters.

Each of the menu text entries shall be distinguishable by a unique identifier of one to four characters (e.g., A, 1, Z, J21, or V123).

Menu Text entries shall include an optional character (e.g., *), indicating to the controller that the NAS database and Full Data Block for the referent aircraft are to be updated upon receiving a pilot WILCO for a transaction using the entry.

A capability shall be provided to optionally specify for each Menu Text entry the NAS database field (initially only interim altitude (field 76)) to be updated upon a pilot WILCO for a transaction using the entry (section 3.9.1).

Input messages at the supervisory positions shall be provided to enable additions and deletions to the Menu Text entries (section 3.9.1). In addition, the concatenation of ATC instructions and clearances shall be provided as part of the Menu Build function.

A capability shall also be provided to accommodate selected changes of Menu Text entries at the controller positions (section 3.4.2).

The menu shall be displayable on the controller's Plan View Display (PVD). The controller shall be provided with a capability to move the Menu List display to another location on the PVD, and to suppress or restore the Menu List display, or individual entries.

2.1.4.2 Menu Text Uplink

The capability shall be provided for the controller having Data Link eligibility for an aircraft to uplink Menu Text entries to that aircraft. Data displayed in a Menu Text entry shall represent the operational content of the uplink message. A Menu Text entry shall be selectable as part of an input action for Interim Altitude, or as a separate action under a dedicated Category Function or Quick Action key.

The status of transactions that use the Menu Text function shall be maintained in the Status List display together with a system parameter (section 2.6) number of characters of text.

2.2 DATA LINK OPERATIONAL CAPABILITIES

In conjunction with the processing of Data Link services described above, the Host Computer System shall provide general capabilities necessary for the application of these services. These capabilities shall include: sector setup display, aircraft active session indicator, Data Link eligibility control, Data Link transaction status display, Menu Text display, and supervisory position actions. Each of these operational capabilities is specified below.

2.2.1 Data Link Sector Setup Display

A set of symbols shall be displayable on the PVD to indicate the Data Link setup for each sector. The Data Link Sector Setup display shall indicate the following conditions:

- Data Link ON or OFF for the ATC facility
- Status List display ON or OFF for the sector
- Full Data Block Data Link displays ON or OFF for the sector
- Data Link services suppressed from display in the Data Link Status List

The Data Link setup display will be comprised of list items. An example is as follows:

- Data Link ON
- STAT Disp ON
- FULL DBLK ON
- STAT AA OFF
- STAT TC OFF
- STAT CB ON

The above example indicates that Data Link processing for the ATC facility is active, the Status List and Full Data Block displays for the sector are active, the transaction Status List displays for services Altitude Assignment and Transfer of Communications are inactive, and the transaction Status List display for Communication Backup Uplink is active.

2.2.2 Aircraft Active Session Indicator

A symbol shall be displayable in the Full Data Block, list displays, Meter Lists, Conflict Alert, and EMSAW displays to indicate that Data Link is operational for a flight. This symbol shall be controlled by the Communication Processing function (reference 2), which determines that an active session has been established for the aircraft. If an active session exists with an aircraft, the Data Link symbol shall be displayed. Otherwise, the Data Link symbol shall be removed.

2.2.3 Data Link Eligibility Control

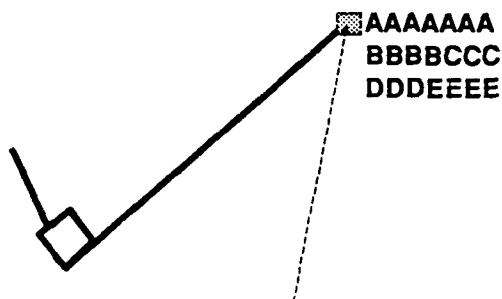
For each aircraft established with an active session, only one operational en route sector shall be eligible for initiating uplink messages and receiving downlink messages. The system shall determine this eligibility based on the following criteria:

- Data Link eligibility shall be assigned as a result of a controller input message (section 3.3.3).
- Data Link eligibility shall be assigned to the sector having track control when a Data Link transaction status for Transfer of Communication is changed to WILCO.
- For a flight transferred from an adjacent facility, a response of WILCO to a Transfer of Communication uplink shall be received as part of a message from the sending facility (section 3.10.1). The receipt of WILCO shall set the status for that transaction to WILCO and the Data Link eligibility shall be assigned to the sector that currently has track control.
- When a Data Link flight becomes active in the Host Computer System with no prior track transfer, a controller input action (section 3.3.3) shall be necessary to assign Data Link eligibility to a sector.

A symbol for indicating Data Link eligibility shall be displayed in the left-most position in the first line of the Full Data Block. This symbol shall be displayed only at the sector having Data Link eligibility, and the symbol shall be displayed in the same character position as that for indicating Data Link active session. When a Transfer of Communication transaction is currently active for this flight, this symbol shall be replaced with a symbol indicating the current status (described in section 2.2.4 below) for the most recent controller-initiated Transfer of Communication action. Figure 2-1 illustrates this symbology.

2.2.4 Data Link Transaction Status Displays

The controller, pilot, and system will provide a variety of responses to Data Link transactions depending upon operational needs. For each Data Link transaction, the Host shall maintain a status record of all Data Link actions and responses. As messages input to the Host from the DLP and from controller sector positions cause Data Link status changes, the record for each action shall be updated and displayed to sector controllers. The subsections below specify the Data Link status indicators and their display features.



AN ADAPTABLE SYMBOL SHALL OCCUPY
THIS POSITION:

ACTIVE SESSION

INDICATES DATA LINK SESSION IS ESTABLISHED;
THIS SECTOR IS ***NOT*** ELIGIBLE FOR DATA LINK COMMUNICATIONS
WITH THIS FLIGHT.

TRANSFER OF COMMUNICATION SENT/ DELIVERED

INDICATES A SECTOR TOC TRANSACTION IS IN PROGRESS
FOR THIS FLIGHT.

ELIGIBILITY

INDICATES DATA LINK SESSION IS ESTABLISHED;
THIS SECTOR IS ELIGIBLE FOR DATA LINK COMMUNICATIONS WITH
THIS FLIGHT.

Figure 2-1. Full Data Block Symbology For Data Link Eligibility

2.2.4.1 Data Link Status Indicators

The Host shall maintain the status of each of the following Data Link actions:

- **HELD**

This status shall indicate that the referent message was built and formatted for uplink, but requires a controller keyboard entry to send it to the Data Link Processor.

- **SENT**

This status shall indicate that the referent message was transmitted successfully from the Host to the Data Link Processor.

- **DELIVERED**

This status shall indicate that the referent message was received successfully by the aircraft referenced in the message. This status shall be displayed when a technical acknowledgment from the aircraft was received by the Host within a parameter time, as described in section 2.6.

- **FAIL**

This status shall indicate that a time parameter, specified in section 2.6, expired with no acknowledgment of aircraft receipt of the message, or that an error message was returned indicating a transmission failure.

- **Pilot Timeout**

This status shall indicate that the time parameter (section 2.6) for receipt of the pilot-entered response message for the referent message expired.

- **WILCO**

This status shall indicate that the pilot responded WILCO to the uplinked message.

- **ROGER**

This status shall indicate that the pilot responded ROGER to the uplinked message.

- **UNABLE**

This status shall indicate that the pilot responded UNABLE to the uplinked message.

The Host shall route the Data Link status information for display at appropriate sectors in accordance with the message processing requirements defined in section 3.

Upon successful completion of track transfer to another sector, any remaining failed transactions for the aircraft shall be deleted from the Status List displays.

2.2.4.2 PVD Status Displays

For each sector, the Host shall provide the capability, through sector controller input messages, to enable or inhibit the display of the Data Link status information. The surface for displaying this status information shall be selectable by the R-Controller position as one or both of the following:

- **PVD Status List**

A Data Link Status List shall be continuously updated and shall be available for display at sector PVDs. The display activation and inhibition and the location on the PVD of this list shall be controlled by controller input action, as defined in section 3.1. Figure 2-2 illustrates an example of this list and itemizes the contents of the data.

The Status List display on the PVD shall reflect each transaction and shall include a data value uplinked as part of the referent action. For a Transfer of Communication, the status display shall include the uplinked radio frequency. For an altitude assignment, the status display shall include the uplinked altitude. For Communications Backup messages, the status display shall include the uplinked text. If the uplinked text is of greater length than is specified for the data field in the Status List, the text shall be truncated. For any Menu Text message, the characters to be displayed in the Status List shall be defined at the time of menu build (section 3.9.1).

- **Full Data Block Status Display**

Specific Full Data Block fields shall continuously indicate the status of Data Link activities (figure 2-3). The status display in the Full Data Block shall always reflect the most recent state of the Data Link transaction.

The capability shall be provided via adaptation to specify for each service the Data Link status information that is displayable in the Status List. If a Data Link service is inhibited from being displayed, the status information for that service shall be forced in the Status List if the transaction fails (i.e., status of FAIL, UNABLE, or pilot timeout).

DATA LINK

<u>AID</u>	<u>SERVICE</u>	<u>DATA</u>	<u>STATUS</u>
.X NAL123	AA	*	SNT
.◇ AAL456	TC	*	SNT
.X N4443H	AA	*	WIL

LEGEND:

FIELD

PURPOSE

AID

DATA LINK SYMBOL AND IDENTITY OF AIRCRAFT INVOLVED IN THE TRANSACTION

SERVICE

TYPE OF DATA LINK ACTIVITY (E.G., ALTITUDE ASSIGNMENT, TRANSFER OF COMMUNICATION, COMMUNICATIONS BACKUP UPLINK)

DATA

*

STATUS

CURRENT STATE OF THIS TRANSACTION

- * Data formats and values vary, depending on the service in use for the action.

Figure 2-2. Example of Status List Display

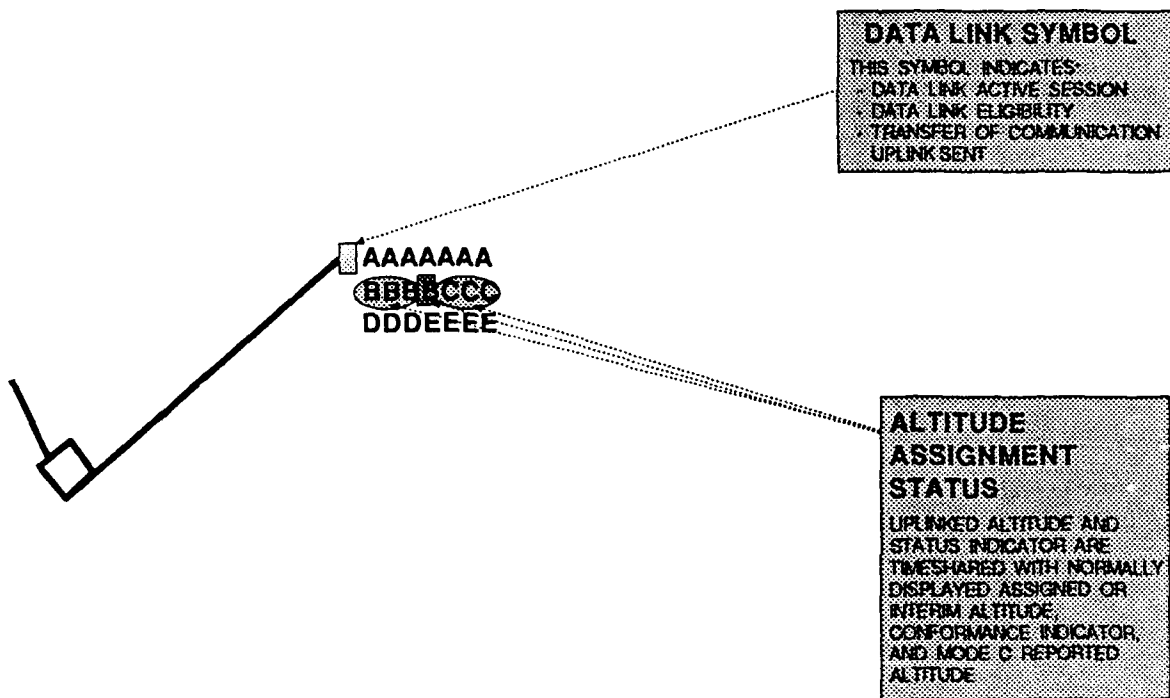


Figure 2-3. Full Data Block Data Link Status Indicators

2.2.4.3 Adapted Status Display Symbolology

To provide a flexible human-computer interface for Data Link displays, the displayed characters that indicate specific status information shall be defined in adaptation. Table 2-1 suggests one possible set of display characters for each transaction status.

As indicated in table 2-1, there are eight states for each Data Link message, as shown in the column labeled "Data Link Action Status." However, to accommodate future development, the maximum number of adaptable states shall be 16. For each state, an appropriate display symbol shall be generated for the Status List and Full Data Block displays. In the example shown in table 2-1, an up-arrow is used to indicate a SENT status for a Transfer of Communication. In this example, the display reverts to the current eligibility symbol if the status changes to UNABLE or FAIL. Upon receipt of WILCO, the eligibility transfers to the receiving sector and the eligibility symbol is switched from the sending to the receiving controller's display.

The altitude field in the Full Data Block shall display the uplinked altitude (ddd in table 2-1) and the current status for the Data Link transaction (optionally displayed as FAIL or a single character accompanying the uplinked altitude, as shown in table 2-1). The uplinked altitude and transaction status display shall alternate (timeshare) with the normally displayed altitude, conformance indicator, and Mode C reported altitude. The alternating display of both altitudes shall continue until a pilot response is received indicating a WILCO, or until a communications error, pilot timeout, or pilot UNABLE response occurs, which would result in a FAIL status display. If the status for the indicated action becomes FAIL, then the uplinked altitude and FAIL symbol display shall timeshare with the current altitude, conformance indicator, and Mode C reported altitude. For the example shown in table 2-1, a negative technical acknowledgment from the aircraft, might be displayed as FAI in the Status List and dddFAIL (where ddd is the uplinked altitude) in the Full Data Block.

2.2.5 Menu Text Display

2.2.5.1 Menu Text List

A capability to display on sector PVDs the text strings used in connection with the Menu Text uplink function shall be provided. The list shall be displayable at any controller-selected location on the PVD and shall be composed as specified in section 3.9.1, which details the input actions to establish the Menu Text contents. Figure 2-4 shows an example of a Menu Text List display, which contains text entries that shall be selectable as part of a controller input action. The Menu Text entries represent operational messages to be transmitted to aircraft. Message encoding,

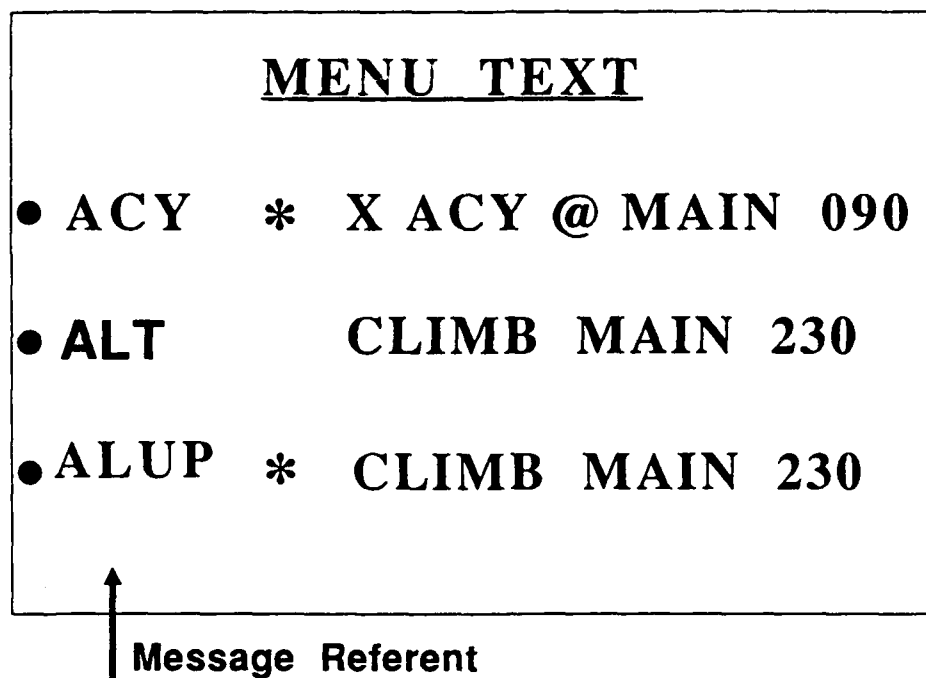
Table 2-1. Example of Status Display Adaptation

DATA LINK ACTION STATUS*	DISPLAY OUTPUT INDICATOR			
	STATUS LIST	FULL DATA BLOCK		
		Data Link Status Field (First Character in Line 1)** Sending Sector Receiving Sector		Altitude Field (Line 2) ***
HELD	HLD	⊗	◇	N/A
SENT	SNT	↑	↑	dddSccc
DELIVERED	DLV	↑	↑	dddSccc
COMMUNICATIONS FAILURE	FAI	⊗	◇	dddFAIL
PILOT TIMEOUT	FAI	⊗	◇	dddFAIL
WILCO	WIL	◇	⊗	dddWccc
ROGER	ROG	◇	⊗	(NOT APPLICABLE)
UNABLE	UNB	⊗	◇	dddFAIL

* Up to 16 status values shall be assignable.

** This field is used for the Transfer of Communication service and to indicate Data Link status.
The ⊗, ↑, and ◇ are suggested symbols.

*** This field is used only for the Altitude Assignment service. The seven characters shown shall timeshare with the normal display in Line 2 of the Full Data Block. The ddd indicates the uplinked altitude; ccc indicates the Mode C reported altitude.



The asterisk (*) indicates that a Database update shall occur only after a WILCO for a Data Link action using this entry has been received.

Figure 2-4: Example of Menu Text Display

interfaces to stored phrase and word dictionaries, and conversion to pilot display symbology are described in the Communications Requirements document (reference 2). The specific characters displayed at the sector position shall be defined as part of the menu build process.

An optional, adapted symbol (e.g., *) shall be included in the Menu Text List to indicate to the controller those menu entries that update the NAS database and Full Data Block upon a WILCO response. In the example shown in figure 2-4, an asterisk after the menu text message referent indicates to the controller that the menu entry contains data that shall amend the NAS database and Full Data Block upon receipt of the pilot's WILCO to an uplink message using this entry. If no such symbol is included (as in menu entry ALT), NAS database and Full Data Block updates shall not occur.

For transactions that include database and Full Data Block updates, all message acceptance checking shall be performed prior to building an uplink message and initiating an active transaction. Errors associated with the controller input message shall prohibit building a message for uplink transmission.

The portion of the menu entry that contains data for NAS database update shall be identified as part of the menu build process, as described in section 3.9.1.

2.2.5.2 Use of Menu Text for Interim Altitude Actions

The capability shall be provided to reference a Menu Text entry as part of an action using an adapted Category Function (C/F) or Quick Action Key (QAK). The Menu Text entry shall be identified by one to four characters, as specified in section 3.9.1. In addition, data eligible for updates to the NAS database for the selected aircraft shall be identified for each entry.

The Menu Text shall be accessed via the Interim Altitude QAK or Data Link C/F key. In the future, Menu Text will be used for other services and the menu entries may be accessed via other QAK and C/F keys. Therefore, the software design used to access the Menu Text entries shall accommodate future software changes when other QAKs and C/F keys are used for Menu Text uplink.

Upon input of an interim altitude, the system shall perform all processing currently associated with Interim Altitude QAK inputs, except NAS database updates. For data that update the NAS database after receipt of the pilot's response indicating compliance, error responses to the controller input, if warranted, shall be displayed before an uplink message is generated.

2.2.6 Supervisory Position Functions

The Host supervisory position shall have capabilities to monitor and control Data Link processing. These capabilities shall be as follows:

- Activate and inhibit Host Data Link processing.

A keyboard entry shall be provided at the supervisory position to enable and inhibit Host Computer System Data Link processing. If Data Link processing is inhibited, then no uplink messages and no Data Link status displays shall be generated in tabular list form nor in the Full Data Blocks. For Data Link transactions that were active at the time of a supervisory input message to inhibit Data Link processing, the status shall continue to be displayed and updated as if Data Link were active; however, no new Data Link messages shall be built or uplinked, and no new transactions shall be activated.

- Activate and inhibit selected Data Link services.
- Set the number of characters and lines to be displayed in the data area of the Status List.
- Request a summary output showing Real Time Quality Control data for Data Link (section 4.2).
- Modify the contents of sector and FPA adapted menus. The Menu Text entry contents shall be uniquely assignable per FPA (described in section 2.7.1), or per sector. This approach is compatible with the current resectorization command, combine sectors (CS) and provides automatic transfer of Menu Text entries as sectorization plans change.

When a message is entered to combine or decombine sectors (e.g., via a CS entry), the currently displayed status data shall be handled as follows:

- Full Data Block status and eligibility indicators shall be maintained at the controlling sector position.
- Status List displays shall be merged at the controlling sector position, rebuilt and shall be displayable as directed by controller-entered input actions.
- Menu Text Lists shall be merged and displayed at the sector positions having control of the applicable Fix Posting Area or sector associated with the adapted Menu Text entries.
- The Radio Frequency Table used for Transfer of Communication shall be updated to associate the proper radio frequencies with control sectors.

2.3 CONTROLLER DATA LINK KEYBOARD ENTRIES

While some new keyboard entries will be required, most of the entries that sector controllers will use for Data Link functions will consist of currently used entries, appended by new optional characters to effect selected Data Link actions (e.g., uplinking the assigned altitude). These controller messages and options are specified in detail in section 3.

In addition to the keyboard entries currently used at the R- and D-Controller positions, the following new entries shall be provided:

2.3.1 Acquire Data Link Eligibility

A controller input shall enable a sector position to acquire Data Link eligibility or assign Data Link eligibility to a sector (section 3.3.3). This capability shall be available at both the R- and D-Controller positions.

2.3.2 Assign Data Link Message Status Display

The display of Data Link transaction status shall be assigned to the Full Data Block or Status List, or both, as directed by a controller input action (section 3.1). This capability shall be available at the R-Controller position.

2.3.3 Assign Data Link Menu Text Display

The R-Controller position shall have the ability, via a controller input, to enable or disable the display of Menu Text.

2.3.4 Uplink a Held or Failed Message

A Data Link message with status set to HELD or FAIL shall be uplinked (or re-uplinked if the status is FAIL) as directed by a controller input action (sections 3.6 and 3.8). (Once uplinked, the status for that action shall be set to SENT.)

2.3.5 Delete a Transaction

A Data Link transaction shall be deleted as directed by a controller input action that includes an optional character signifying delete (e.g., D) (section 3.7). In addition, Full Data Block and Status List displays for that transaction shall be deleted. This capability shall be available at both the R- and D-Controller positions.

2.3.6 Uplink Free Text

As part of the Communications Backup capability, a controller input shall enable a sector position to compose and enter text, and to uplink the text to selected aircraft. Additionally, an input shall enable the controller to recall the last text that was composed and use it as part of an uplinkable message to selected aircraft. This capability shall be available at both the R- and D-Controller positions.

2.3.7 Change a Menu Entry

A controller input action shall provide the capability to select a Menu Text entry and change or insert a specific value in a field that represents interim altitude data (section 3.1.3). The changeable data field shall be identified during the Menu Build, as described in section 3.9.1. This capability shall be available at both the R- and D-Controller positions.

2.3.8 Receive and Respond to Downlinked Text

Downlinked messages resulting from pilot-initiated transactions (i.e., Communications Backup Downlinks) shall be queued for future display. When the D-Controller makes a CRD ACK entry at the D-Controller position, the pending downlinked text message shall be displayed. When the controller inputs an action to acknowledge the downlinked message, a controller acknowledgment shall be uplinked. This capability shall be available only at the D-Controller position.

2.4 HOST INTERFACE MESSAGES

As part of Data Link functional processing, the Host shall output messages to and receive messages from external systems. In the context of Data Link, external systems are the ATN and adjacent ATC facilities. ATN messages are output to and received from the Data Link Processor. Data Link interfacility messages are output to and received from adjacent ATC facilities. The contents of these messages are described below.

2.4.1 Data Link ATN Messages

The applications data contained in messages sent to aircraft shall conform to the functional requirements described in section 3, and shall be processed for message transmission and reception as described in the Communication Requirements document (reference 2). Table 2-2 identifies these data.

Messages received from the DLP will consist of air-to-ground technical acknowledgments, error messages, pilot-transmitted text, and pilot responses to uplinked messages. These messages shall contain applications data, which shall be processed as specified in the Communication Requirements document (reference 2). The contents of those messages (section 3.11) shall be used for updating the status of the referent Data Link actions.

2.4.2 Interfacility Status Update (SU) Messages

The Host shall send messages to and receive messages from adjacent ATC facilities for Data Link functional processing. Specific contents of these messages shall conform to the functional requirements described in section 3.10 for the Status Update (SU) message. The SU message shall contain information necessary for updating the status of specific Data Link transactions. Figure 2-5 contains an example SU message format. For each transaction involving interfacility Transfer of

Table 2-2. Air-Ground Applications Data

1. Ground-to-Air

APPLICATION -----	DATA CONTENT -----
Altitude Assignment	Altitude identified in input action, and Altimeter Setting if appropriate
Transfer of Communication	Radio frequency and identity of receiving sector, and Altimeter Setting if appropriate
Communications Backup Uplink	Controller-entered text
Menu Text	Text and data selected in connection with a prestored menu
Response to Communications Backup Downlink	Controller acknowledgment of pilot's message

2. Air-to-Ground

APPLICATION -----	DATA CONTENT -----
Communications Backup Downlink	Pilot-entered text
Response to Uplink Message	Pilot response to controller-initiated uplink

00 0102 XX₁ XX₂ XX₃ (02 XX₁ XX₂ XX₃)

00 Source Identification

01 Message Type (SU)

02 Flight Identification

XX₁ Data Link Service Type

XX₂ Transaction Reference Number

XX₃ Data Link Service Status

H - Held

S - Sent

D - Delivered

R - Roger

W - Wilco

U - Unable

F - Fail

T - Pilot Timeout

Figure 2-5. Status Update Message Format

Communication, the Host shall build an SU message, which shall be output to the adjacent facility. The status thus indicated shall be updated by subsequent SU messages.

Messages received from adjacent facilities shall contain data reflecting the status of Data Link transactions. The Host shall process inputs from the adjacent facility for status updates and output displays at the ATC operational positions, as specified in section 3.10.

2.5 NEW HOST MESSAGE FIELDS

NAS-MD-311 (reference 3), "Message Entry and Checking," specifies the standard Host input message fields. All of these fields shall be retained for Data Link processing. In addition, ten new fields shall be defined to accommodate Data Link functions, as described in table 2-3 and discussed below.

2.5.1 Reference Number

Each uplink and downlink message shall be assigned a reference number, which will be included with the message as it is communicated throughout the ATN. The method for generating, assigning, and maintaining these numbers is addressed in the Communication Requirements document (reference 2).

2.5.2 Service Type

The Service Type refers to the type of Data Link service and indicates the nature of the operational data within the referent message.

2.5.3 Application Data

The Application Data refers to the operational data within the message. These data will be encoded for output to the DLP for uplinks. The method for encoding and decoding these data is addressed in the Communication Requirements document (reference 2).

2.5.4 Menu Text Message Referent

Each menu entry shall be assigned a string of up to four alphanumeric characters when the menu is built (section 3.9.1).

2.5.5 Transaction Status

This field shall contain the current status of each Data Link transaction (section 2.2.4.1).

Table 2-3. New Host Message Fields

MESSAGE FIELD NAME	PURPOSE	# CHARACTERS
Reference Number	Identify the specific transaction	5 Bits
Service Type	Define the Data Link service to control functional processing by service	2
Application Data	Provide operational data needed for the the specific application	*
Menu Text Message Referent	Provide a unique identifier for each menu entry	1 to 4
Transaction Status	Indicate current status of Data	4
Display Identifier	Data Link action (section 2.2.4.1) Define controller input to establish the Data Link display setting (section 3.1.2.4)	1
Fix Posting Area	Define FPA for associated data	4
Frequency Value for Fix Posting	Define radio frequency value (section 3.9.4)	6
Communications Backup Downlink Response	Indicate controller response to a message originated by aircraft	1
Communications Backup Downlink Message Referent	Provide a unique identifier for each CB Downlink entry	2

* As required for each Data Link service

2.5.6 Display Identifier

This field shall contain the controller-entered data for the sector Data Link display settings.

2.5.7 Fix Posting Area

This field shall define the adapted FPA to be used for assigning frequency values.

2.5.8 Frequency Value for Fix Posting Area

This field shall contain the frequency value(s) to be assigned to a related FPA.

2.5.9 Communications Backup Downlink Response

This field shall contain the controller-entered response to a received Communications Backup Downlink message (section 3.5.3).

2.5.10 Communications Backup Downlink Message Referent

This field shall contain a unique identifier for a received Communications Backup Downlink message. The identifier shall be used for display in pilot-to-controller sector display output message, and the identifier shall be correlated with the downlinked pilot-to-controller message that generates the display output.

2.6 SYSTEM PARAMETERS

System parameters specific to Data Link functional processing shall be provided as part of the adaptation data. The parameters and associated ranges of values are specified in table 2-4 and discussed below.

2.6.1 WILCO/Roger Clear Time

This parameter shall define the time between receipt of WILCO or Roger and clearing of the transaction from the Status List and Full Data Block displays.

2.6.2 Communications Failure Time

For each message uplinked successfully, a technical acknowledgment response will be received indicating aircraft receipt of the message. This parameter shall define the time to wait for the technical acknowledgment response. If no technical acknowledgment is received within this time duration, the status for that transaction shall be changed to indicate a communications failure.

Table 2-4. Data Link System Parameters

<u>PARAMETER NAME</u>	<u>RANGE</u>	<u>NOMINAL VALUE</u>	<u>DESCRIPTION</u>
WILCO/ROGER CLEAR TIME	0 - 120	6	NUMBER OF SECONDS BETWEEN WILCO OR ROGER RECEIPT AND CLEARING THE TRANSACTION
COMMUNICATIONS FAILURE TIME	6 - 120	31	NUMBER OF SECONDS TO WAIT FOR AIR-TO-GROUND TECHNICAL ACKNOWLEDGMENT OF AN UPLINKED MESSAGE BEFORE DISPLAYING A FAILURE INDICATOR
PILOT RESPONSE TIMEOUT	6 - 300	45	NUMBER OF SECONDS BETWEEN THE TIME OF UPLINK AND THE PILOT'S RESPONSE TO AN UPLINKED MESSAGE BEFORE DISPLAYING A FAILURE INDICATOR
FDB TIMEOUT AFTER TOC	1 - 120	30	NUMBER OF SECONDS AFTER WILCO TO DROP FDB FROM SENDING SECTOR
CONCURRENT TRANSACTIONS	1 - 10	4	MAXIMUM TRANSACTIONS PER AIRCRAFT
CONCURRENT ALTITUDE ASSIGNMENT	1 - 3	1	MAXIMUM ACTIVE ALTITUDE ASSIGNMENT TRANSACTIONS PER AIRCRAFT
CONCURRENT TRANSFER OF COMMUNICATIONS	1 - 3	1	MAXIMUM ACTIVE TRANSFER OF COMMUNICATION TRANSACTIONS PER AIRCRAFT
CONCURRENT COMMUNICATIONS BACKUP	1 - 5	3	MAXIMUM ACTIVE COMMUNICATIONS BACKUP UPLINK TRANSACTIONS

Table 2-4. (Continued)

<u>PARAMETER NAME</u>	<u>RANGE</u>	<u>NOMINAL VALUE</u>	<u>DESCRIPTION</u>
RECOVERY RECORDING INTERVAL (SHORT)	1 - 40	1	NUMBER OF SECONDS BETWEEN RECOVERY RECORDINGS OF DATA LINK PROCESSING
RECOVERY RECORDING INTERVAL (LONG)	10 - 60	30	NUMBER OF SECONDS BETWEEN RECOVERY RECORDINGS OF DATA LINK PROCESSING
TEXT UPLINK LENGTH	10 - 200	40	MAXIMUM NUMBER OF CHARACTERS (INCLUDING SPACES) IN A COMMUNICATIONS BACKUP UPLINK MESSAGE
TEXT DOWNLINK LENGTH	10 - 200	40	MAXIMUM NUMBER OF CHARACTERS (INCLUDING SPACES) IN A COMMUNICATIONS BACKUP DOWNLINK MESSAGE
STATUS LIST TEXT LENGTH	6 - 20	6	MAXIMUM NUMBER OF CHARACTERS (INCLUDING SPACES) DISPLAYED IN TEXT FIELD OF THE STATUS LIST
MENU TEXT ENTRIES PER FPA	2 - 15	10	MAXIMUM NUMBER OF MENU TEXT ENTRIES FOR EACH FIX POSTING AREA
RECOVERY TIME	1 - 40	10	NUMBER OF SECONDS FOR DATA LINK RECOVERY PROCESSING FOLLOWING A SWITCHOVER OR STARTOVER
MENU TEXT DISPLAY LENGTH	6 - 40	20	MAXIMUM NUMBER OF CHARACTERS (INCLUDING IN THE TEXT FIELD OF THE MENU TEXT LIST)

Table 2-4. (Concluded)

<u>PARAMETER NAME</u>	<u>RANGE</u>	<u>NOMINAL VALUE</u>	<u>DESCRIPTION</u>
STATUS LIST DISPLAY LINES	1 - 5	1	MAXIMUM NUMBER OF LINES PER ENTRY IN THE STATUS LIST DISPLAY
FAIL CLEAR REQUIRED	0 - OFF 1 - ON	1	INHIBIT NEW DATA LINK TRANSACTIONS TO A PARTICULAR AIRCRAFT IF A TRANSACTION EXISTS WITH A FAIL STATUS FOR THIS AIRCRAFT
FULL DATA BLOCK FAILURE INDICATOR	0 - None 1 - Double-Bright 2 - Enlarge Line 1 3 - Both	1	INDICATE THE DISPLAY USED IN THE FULL DATA BLOCK FOR MESSAGE FAILURES
MENU TEXT VARIABLE FIELD INDICATOR	A single character	+	FLAG A VARIABLE FIELD (i.e., CONTROLLER CHANGEABLE WITHIN A MENU TEXT ENTRY)
FORCE STATUS LIST UPON FAILURE	0 - OFF 1 - ON	1	FORCE THE DISPLAY OF A FAIL TRANSACTION EVEN IF THE STATUS LIST DISPLAY IS INHIBITED
DOWNLINK MESSAGE PRINT	0 - OFF 1 - ON	1	PRINT COMMUNICATIONS BACKUP DOWNLINK MESSAGE ON FLIGHT STRIP PRINTER
CONTROLLER DOWNLINK RESPONSE TIMEOUT	0 - 10 MINUTES	1	TIME TO WAIT AFTER SYSTEM RECEPTION OF A CB DOWNLINK TO PRINT ON FLIGHT STRIP PRINTER

2.6.3 Pilot Response Timeout

After an uplinked message is successfully displayed to the pilot, a pilot-entered response shall be expected. The exact nature of this response will be prescribed by operational procedures. This parameter shall define the time between the uplink of the Data Link message and the receipt of the pilot-entered response. If no pilot response is received within this parameter time, the system shall display a failure indicator.

2.6.4 Full Data Block Timeout After Transfer of Communication

This parameter shall define the time between the receipt of a pilot WILCO response to a Transfer of Communication uplink and the dropping of the applicable Full Data Block on the sending controller's PVD. Appendix E describes the interaction of this parameter and the current system parameter for FDB drop after handoff accept.

2.6.5 Concurrent Transactions

This parameter shall define the maximum number of concurrent active Data Link transactions allowed for each aircraft. An input message to initiate a new transaction that would exceed this parameter shall result in an appropriate error message.

2.6.6 Concurrent Altitude Assignment

This parameter shall define the number of concurrent active Altitude Assignment transactions allowed for each aircraft. An input message to initiate a new transaction in excess of this parameter shall result in an appropriate error message.

2.6.7 Concurrent Transfer of Communications

This parameter shall define the number of concurrent active Transfer of Communication transactions allowed for each aircraft. An input message to initiate a new transaction in excess of this parameter shall result in an appropriate error message.

2.6.8 Concurrent Communications Backup

This parameter shall define the number of concurrent active Communications Backup Uplink transactions allowed for each aircraft. An input message to initiate a new transaction in excess of this parameter shall result in an appropriate error message.

2.6.9 Recovery Recording Interval (Short and Long)

These two parameters shall define the time interval between recordings of data stored for recovery of Data Link processing. These data are necessary to re-establish the sector controller display in the event of an automatic startover or switchover.

2.6.10 Text Uplink Length

This parameter shall define the maximum number of text characters, including spaces, allowable for a Communications Backup Uplink message.

2.6.11 Text Downlink Length

This parameter shall define the maximum number of text characters, including spaces, allowable for a Communications Backup Downlink message.

2.6.12 Status List Text Length

For the data portion of a status list entry, this parameter shall define the maximum number of characters, including spaces, displayable on one line. If this parameter must be exceeded due to message length, multiple lines may be displayed, where only the data portion is used for subsequent lines.

2.6.13 Menu Text Entries Per Fixed Posting Area (FPA)

This parameter shall define the maximum number of Menu Text entries that each FPA may be assigned.

2.6.14 Recovery Time

This parameter shall define the maximum time allowable for system Startover without re-establishment of Data Link sessions.

2.6.15 Menu Text Display Length

This parameter shall define the maximum allowable number of text characters, including spaces, in the text portion of the Menu Text list display.

2.6.16 Status List Display Lines

This parameter shall define the maximum number of lines displayable in the Status List for each entry.

2.6.17 FAIL Clear

This parameter, when set to ON, shall disable further Data Link messages to a particular aircraft when a transaction with a status of FAIL, pilot timeout, or UNABLE exists for that aircraft.

2.6.18 Full Data Block Failure Indicator

This parameter shall characterize the status display in the Full Data Block when a transaction failed (e.g., FAIL status). A value of 0 shall indicate no Full Data Block change. A value of 1 shall indicate the display of double-bright characters in the entire Full Data Block. A value of 2 shall indicate the enlargement of Line 1 of the Full Data Block. A value of 3 shall indicate the enlargement of Line 1 and displaying of double-bright characters in the entire Full Data Block. Regardless of the value of this indicator, all failed transactions shall be displayed in double-bright characters in the Status List.

2.6.19 Menu Text Variable Field Indicator

This indicator shall be used to specify a variable field in a Menu Text entry during the building of Menu Text. If the field following this indicator is included, that field shall be displayed as the initial variable data in the menu entry.

2.6.20 Force Status List Upon Failure

This parameter, if set to ON, shall force the display of failed transactions in the Status List, even if the Status List display is inhibited.

2.6.21 Downlink Message Print

This parameter, if set to ON, shall cause the operational portion of a Communications Backup Downlink message to be output on the flight strip printer at the sector having Data Link eligibility with the aircraft that originated the message.

2.6.22 Controller Downlink Response Timeout

If the Downlink Message Print parameter is set to OFF, a downlink message will be printed after the time interval defined by this parameter. This parameter indicates the number of minutes to wait for a controller input response before printing a CB downlink message on the flight strip printer.

2.7 ADAPTATION TABLES

The Host adaptation data shall include, in addition to the system parameter specified in section 2.6, data tables for use by the Data Link Applications Processing function. The following items shall be included in the adaptation database.

2.7.1 Adapted Entries for Menu Text Sector Displays

The Adaptation function shall be modified to permit defining a Menu Text List to be displayable at each sector position. A separate Menu Text table shall be established for each FPA. The Menu Text

entries shall be constructed based on a prestored phrase and word dictionary, as specified in the Communication Requirements document (reference 2).

2.7.2 Radio Frequencies for Sectors, FPAs, and Facilities

The adaptation data shall include a table of radio frequencies for use as part of the Transfer of Communication service. This table shall include all frequencies paired to sector positions, FPAs, and sectors in adjacent facilities (i.e., sectors sending and receiving handoffs). Frequencies shall also be changeable on-line by manual input at the supervisory positions (section 3.9.4). An indication of Data Link functionality at the facility shall be included.

2.7.3 Flight Identification Symbol

The system adaptation data shall be modified to permit defining Data Link symbols to be added to the aircraft identification. This table shall define the display symbols that will identify aircraft with Data Link communications active session and sector eligibility.

2.7.4 Status Display Indicators

The adaptation data shall be modified to create a table of characters (section 2.2.4.3) to display in the Data Link Status List and FDB as a function of the current status for an action of a particular type.

2.7.5 Altimeter Setting Data for Fix Posting Areas

For each Altimeter Setting (AS) reporting station, adaptation data shall allow pairing of one or more Fix Posting Areas (FPAs). The AS data stored for each reporting station shall also be stored for its paired FPAs.

2.7.6 Communications Backup Response Message Default

For the message entered in response to a pilot initiated downlink message (3.5.3) this table shall contain the default message response STBY.

2.8 PROCESSING REQUIREMENTS FOR UPLINKING ALTIMETER SETTING

AS data, including barometric pressure and reporting station, shall be appended to Transfer of Communication and Altitude Assignment uplink messages if any of the following is true:

- The aircraft interim or assigned altitude is 18,000 feet or below
- The current reported altitude is 18,000 feet or below

If AS data are to be uplinked, a specific AS reporting station shall be selected, as follows:

If the reported altitude equals 18,000 feet or below, select the AS reporting station paired with the FPA containing the aircraft track position. If the reported altitude is greater than 18,000 feet, but the altitude currently displayed in the Full Data Block is equal to or less than 18,000 feet, select the AS reporting station paired with the FPA that will contain the aircraft track position when it reaches the lower altitude. If an interim altitude exists for the flight, the interim altitude shall be used for determining the FPA.

2.9 EQUIPMENT QUALIFIER

Field 03 in the flight plan shall allow a set of single text characters to be used for indicating Data Link equipage. To be comprehensive, several different symbols would be required to indicate equipment combinations (e.g., VOR, DME, ATCRBS, etc.). These symbols and their values will be established as part of the activities of the Air Traffic Operations organization. In the context of this specification, the character S shall be used to indicate an aircraft equipped with Mode S, Data Link, Mode C, and DME.

SECTION 3

HOST INPUT/OUTPUT MESSAGE FUNCTIONAL PROCESSING

This section specifies the processing required in the Host Computer System for input and output messages used in conjunction with Data Link functions. The purpose, message contents, processing requirements, and display outputs are specified. This section parallels the outline of NAS-MD-311 in specifying the processing requirements for each message. While some Data Link functions utilize existing National Airspace System (NAS) messages, others require the definition of new message types. Table 3-1 summarizes the new Data Link message types, and includes the source, purpose, and a section reference for each of the new Data Link messages.

Data Link output messages will be built and transmitted by the Communication Processing function as described in the Communication Requirements document (reference 2). Data Link outputs described herein address the applications data uplinked to aircraft.

Similarly, Data Link inputs refer to the applications data downlinked from Data Link-equipped aircraft. The actual uplink and downlink message structures and processing requirements are specified in the Communication Requirements document (reference 2).

All message processing shall comply with the current Host specification (NAS-MD series). In particular, message acceptance checking, processing after acceptance, resultant output functions, logic requirements, and message field formats shall be as specified in NAS-MD-311. The additional requirements for Data Link processing are specified below.

3.1 CONTROLLER INPUT: DATA LINK DISPLAY SETTING

This section addresses the Host display setup messages that shall be available at each sector position. These include list display and repositioning functions.

3.1.1 Data Link Sector Setup Display

3.1.1.1 Purpose

The Data Link Sector setup display shall turn on and off the display of Data Link settings for a PVD sector position. The items to display and the display format are described in section 2.2.1.

Table 3-1. New Data Link Message Types

<u>Source</u>	<u>Message Type</u>	<u>Purpose</u>	<u>Section</u>
Controller	DS	1) Data Link Sector Setup Display	3.1.1
Controller		2) Activate/Deactivate Status List Display	3.1.2
Controller		3) Activate/Deactivate Full Data Block Status Display	3.1.2
Controller		4) Activate/Deactivate Menu Text Display	3.1.2
Controller		5) Suppress/Unsuppress Status List Display Service	3.1.3
Controller		6) Change Menu Entry	3.4.2
Controller		7) Menu Text Item Suppression	3.4.3
Controller		8) Menu Text Return to Default	3.4.4
Controller	DG	1) Uplink Transfer of Communication	3.3.3
Controller		2) Uplink Menu Text	3.4.1
Controller		3) Uplink Communications Backup	3.5.1
Controller	CZ	4) Acknowledgement of a Communications Backup Downlink	3.5.3
Controller	DG	5) Resend Uplink	3.6.1
Controller		6) Delete Data Link Transaction	3.7.1
Controller		7) Uplink HELD Message	3.8.1
Supervisory	MB	1) Build Menu Text	3.9.1
Supervisory	DL	1) Activate/Deactivate Data Link Function	3.9.2
Supervisory	SF	1) Radio Frequency Table Assignment	3.9.4
Internal	SU	1) Output Interfacility Data Link Status Update	3.10.1
Aircraft	Downlink	1) Pilot Response to Uplink	3.11.1
		2) Pilot-initiated Transaction	3.5.2

3.1.1.2 Message Content and Source

This message shall include the message type and an action type. The source shall be the DEC.

3.1.1.3 Acceptance Checking

The sector setup display message must contain a message type and an action type.

3.1.1.4 Format Requirements

1. Fields

Source

DEC

Fields

01 64 36

2. Field Contents

01

Message Type (DG)

64

Action Type (SS)

36

Action Indicator (ON/OFF)

3. Examples

DS SS

3.1.1.5 Logic Requirements

None

3.1.1.6 Processing After Acceptance

Retain an indication that the sector setup display is either displayed or not displayed, depending on the Action/indicator.

3.1.1.7 Resultant Output Functions

Display or suppress the display of the sector setup display. If displaying the list, position the list in the upper right hand corner of the PVD.

3.1.2 Controller Input: List Display

3.1.2.1 Purpose

The List Display message shall turn on and off the Data Link Status List, Full Data Blocks status information, and shall turn on and off the display of the Menu Test List. These settings shall apply to the sector at which the message is entered.

3.1.2.2 Message Content and Source

This message shall include the message type, a List Display Identifier and an action type. The source shall be the DEC.

3.1.2.3 Acceptance Checking

This message must contain both the proper message type, a valid List Identifier and an action type of ON or OFF.

3.1.2.4 Format Requirements

1. Fields

Source

DEC

Fields

01 XX 36

2. Field Contents

01

Message Type (DS)

XX

Display Identifier
(S = Status List, F = Full Data Block, M = Menu Text)

36

Action Indicator (ON, OFF)

3. Examples

DS S ON
DS S OFF

DS F ON
DS F OFF

DS M ON
DS M OFF

3.1.2.5 Logic Requirements

1. Logic Checks

a. The List Display Identifier shall be one of the following:

S = Status List Display

F = Full Data Block Status Display

M = Menu Text Display

b. The Action Type shall be either ON or OFF.

2. Error Indicators

NOT A VALID LIST ID

3.1.2.6 Processing After Acceptance

1. If the List Display Identifier is S, the Action Type is ON and the Status List display is currently off, display it at the requesting sector PVD.
2. If the List Display Identifier is S, the Action Type is OFF and the Status List display is currently on, turn it off at the requesting sector PVD.
3. If the List Display Identifier is F, the Action Indicator is ON and the Full Data Block status display is currently off, display it at the requesting sector.
4. If the List Display Identifier is F, the Action Indicator is OFF and the Full Data Block status display is currently on, turn it off at the requesting sector.

5. If the List Display Identifier is M, the Action Indicator is ON and the Menu Text display is currently off, display it at the requesting sector.
6. If the List Display Identifier is M, the Action Indicator is OFF and the Menu Text display is currently on, turn it off at the requesting sector.

3.1.2.7 Resultant Output Functions

Appropriate changes shall be made to the Status List and Full Data Block indicators in the Data Link Sector Setup display (section 2.2.1) at the initiating sector. Additionally, the displays of the Status List, Full Data Blocks, and Menu Text shall be activated or inhibited as indicated in the message.

3.1.3 Controller Input: List Reposition

3.1.3.1 Purpose

The Quick Action Key QP, which is currently used in the Host for repositioning list displays, shall include the capability to reposition the display of the Menu Text or Status List on the PVD.

3.1.3.2 Message Content and Source

This message shall include a message type, a list display identifier, and trackball coordinates. The source shall be the DEC.

3.1.3.3 Acceptance Checking

This message must contain the proper message type, a valid list display identifier, and valid trackball coordinates.

3.1.3.4 Format Requirements

1. Fields

Source

DEC

Fields

01 61 65

2. **Field Contents**

01	Message Type (QP)
61	List Display Identifier (L,T)
65	Trackball Coordinates (x,y)

3. **Examples**

QP L (x,y)

QP T (x,y)

3.1.3.5 Logic Requirements

1. **Logic Checks**

The List Display Identifier shall be one of the following:

L = Status List

T = Menu Text List

2. **Error Indicators**

NOT A VALID LIST ID

3.1.3.6 Processing After Acceptance

The new list position shall be determined and retained until a subsequent List Reposition action is entered at the sector, the sector becomes inactive, or a new sectorization plan is implemented.

3.1.3.7 Resultant Output Functions

The upper left-hand corner of the identified list shall be positioned at the display coordinates specified by the trackball.

3.1.4 Controller Input: Status List Message-Type Suppression

3.1.4.1 Purpose

This message shall provide the capability to suppress the display of one or more Data Link message types in the Status List display. In addition, this message shall be used to restore the display of the one or more Data Link message types in the Status List display.

3.1.4.2 Message Content and Source

This message shall include a message type, an action type to suppress or restore the Status List, and the service type descriptor. The source shall be the DEC.

3.1.4.3 Acceptance Checking

This message shall contain a message type, an action type, and one or more valid service type descriptors.

3.1.4.4 Format Requirements

1. **Fields**

Source

DEC

Fields

01 64 XX

2. **Field Contents**

01 Message Type (DS)

64 Action Type (LS or LD)

(LS = Suppress, LD = Display)

XX

Service Type Descriptor

3. **Examples**

DS LS AA

DS LD AA TC

3.1.4.5 Logic Requirements

1. **Logic Checks**
 - a. If the Action Type is not LS or LD, return an error message.
 - b. If the valid Service Type Descriptor is not specified, return an error message.
 - c. If the action type indicates to suppress a service that is currently suppressed, return an error message.
2. **Error Indicators**

INVALID ACTION TYPE

SERVICE TYPE INVALID

SERVICE TYPE ALREADY SUPPRESSED

3.1.4.6 Processing After Acceptance

1. If the Action Type is LS, and the specified service type is currently set for display in the Status List, do not display any Data Link messages for the specified service type in the Status List.
2. If the Action Type is LD, and the specified service type is not currently set for display in the Status List, then display the Data Link messages for the specified service type in the Status List.

3.1.4.7 Resultant Output Functions

1. If the Status List is displayed and the specified service type is suppressed from display in the Status List, do not display new messages for the specified service type in the Status List.
2. If the Status List is displayed and the specified service type information is not suppressed from display in the Status List, display the specified service type in the Status List.

3.2 ALTITUDE MESSAGES

This section describes the processing that shall be performed for Data Link-equipped aircraft for assigned and interim altitude uplinks. This processing includes an additional input to the current format for controller entries of assigned and interim altitude. An optional, adapted input character

(e.g., S) shall be used to indicate that an altitude clearance message is to be built and uplinked to the specified aircraft.

3.2.1 Controller Input: Assigned Altitude

3.2.1.1 Purpose

This action is used to change the assigned altitude or flight level for the specified flight. When the action is taken, a Data Link message shall be generated and uplinked to the specified flight if the input message contains the optional, adapted input character (e.g., S).

3.2.1.2 Message Content and Source

The Assigned Altitude message shall include a message type, an assigned altitude, and the flight identification (FLID). The source shall be the data entry console (DEC) or computer display channel (CED). An optional input (e.g., S), when present within the message, shall signify Data Link processing.

3.2.1.3 Acceptance Checking

The Assigned Altitude message must contain a message type, a valid assigned altitude, and a valid flight identification. In addition, a valid Action Indicator (e.g., S) may be included.

3.2.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 08 (94) 02

2. Field Contents

01

Message Type (QZ)

08

Assigned Altitude (as specified in NAS-MD-311, Appendix D)

94

Work Indicator (S)

02

Flight Identification

3. Examples

QZ 190 UAL120

QZ 190 S UAL120

QZ 090 2473

QZ 090 S 2473

3.2.1.5 Logic Requirements

1. Logic Checks

If the Work Indicator for uplink is present, perform the following:

- a. If the Data Link function is off, do not perform any processing, and return an error message.**
- b. If the Work Indicator is not the proper character for uplink (e.g., S), do not perform any processing for Data Link, and, return an error message.**
- c. If an active session does not exist for the specified aircraft, do not perform any Data Link processing, but return an error message indicating that the aircraft is unusable for Data Link.**
- d. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.**
- e. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.**
- f. If the sector making this action does not have Data Link eligibility, return an error message.**

2. Error Indicators

FUNCTION TIED OFF

INVALID DATA LINK INDICATOR

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

NOT YOUR DATA LINK CONTROL

3.2.1.6 Processing After Acceptance

Updates to NAS database and displays for assigned altitude, as currently performed in the Host, shall be suspended until a WILCO is received from the pilot (section 3.11).

1. If the Work Indicator is present and is the proper character for uplink, perform the following:
 - a. Generate a reference number for this Data Link message.
 - b. Build a Data Link Altitude Assignment message for the indicated aircraft, as specified in section 2.4.
 - c. Return an indication to update the Full Data Block, Status List, and NAS database for this Data Link message upon pilot WILCO.
 - d. Change the transaction status for this uplink to SENT.
 - e. Send the uplink message to the specified aircraft.

3.2.1.7 Resultant Output Functions

1. If the Status List is displayed and, if this service type is not suppressed, add the new Data Link display and its transaction status to the Status List display as shown in figure 2-2.
2. If the Full Data Block status information is displayed, timeshare the uplinked altitude and the transaction status with the current altitude in the Full Data Block of the aircraft, as shown in figure 2-3.

3.2.2 Controller Input: Interim Altitude

3.2.2.1 Purpose

This input is used to add or delete an interim altitude, modify the existing interim altitude, or add an interim altitude as a reported altitude. When the interim altitude is being added or modified, a controller option to build a Data Link message for uplink to the specified aircraft shall be provided. If the input message includes the Action Indicator for uplink, or references a Menu Text entry, a Data Link message shall be built as described below. No Data Link processing is required for deletion of an interim altitude.

3.2.2.2 Message Content and Source

The Interim Altitude message shall include the message type, an optional interim altitude, and flight identification. (The altitude may be omitted if the message is used to cancel an interim altitude.) The source shall be the DEC or CED. An optional, single character input, as defined in the adaptation data, shall signify that a Data Link message is to be built and uplinked. Data Link processing shall also take place if a Menu Text message referent is present in the message. If a Menu Text message referent is included in the controller input, the interim altitude shall be derived from the Menu Text entry or controller-entered altitude.

The interim altitude value shall be derived from one of two types of Menu Text entries. One type shall contain a predefined (fixed) interim altitude value that shall be changeable only at a supervisory position. The other type of Menu Text entry shall contain a controller-entered variable value that shall be changeable at a controller position or a supervisory position. This type of Menu Text entry shall be displayed on the PVD and contain a variable interim altitude. This variable altitude field shall be easily recognizable to the controller by using a special display feature (e.g., underlining) to distinguish this field from altitude values that cannot be changed. When this Menu Text entry is used to transmit the interim altitude to an aircraft, the interim altitude contained in the Menu Text entry shall be used, unless the controller entry contains an interim altitude, in which case the keyboard input interim altitude will be uplinked instead of the altitude contained in the Menu Entry (this holds true only if the specified menu entry is designated to have a variable interim altitude field at the time of menu building.)

3.2.2.3 Acceptance Checking

This message must contain the message type, a valid flight identification, and, optionally, a valid interim altitude; the interim altitude may be input as part of the message, or specified by a Menu Text message referent. If a Menu Text message referent is used, a valid interim altitude must be present within the specified Menu Text entry, or input with the Menu Text entry.

3.2.2.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 (XX) (76) (94) 02

2. Field Contents

01

Message Type (QQ) (DG if menu entry is used)

XX

Menu Text message referent (1-4 characters) (this is a new field, not defined in NAS-MD-311).

76

Interim Altitude (as specified in NAS-MD-311, Appendix D)

94

Work Indicator (S)

02

Flight Identification

3. Examples

QQ 230 EAL22

QQ 230 S EAL22

QQ 190 2473

DG Z 2473

DG A EAL22

DG J21 270 AAL14

(i.e., uplink the J21 Menu Text entry using 270 in the variable altitude field)

3.2.2.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, do not perform any processing.
- b. If the Work Indicator is present and is not an S, return an error message.
- c. If an active session does not exist for the specified aircraft, do not perform any Data Link processing, but return an error message indicating that the aircraft is unusable for Data Link.
- d. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.
- e. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.
- f. If the Menu Text message referent is present and a valid interim altitude is not contained within the Menu Text entry, return an error message.
- g. If the entering sector does not have Data Link eligibility, return an error message.
- h. If the interim altitude field is not numeric or the /OK is present, perform the processing after accept as defined in NAS-MD-311.

2. Error Indicators

FUNCTION TIED OFF

INVALID DATA LINK INDICATOR

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

INVALID MENU TEXT ENTRY

NOT YOUR DATA LINK CONTROL

3.2.2.6 Processing After Acceptance

Updates to NAS database and displays, as currently performed in the Host, shall be suspended until a WILCO is received from the pilot (section 3.11).

If the Action Indicator is present and is an S, or the Menu Text message referent is present and the menu entry contains a valid interim altitude, perform the following:

1. Generate a reference number for this Data Link message.
2. If the Menu Text message referent is present and is an R, identify the assigned altitude (field 08) as the altitude to be contained in the uplink message.
3. If the Menu Text message referent is present and is a Z, identify the altitude currently displayed in the Full Data Block of the aircraft as the altitude to be contained in the uplink message.
4. If the Action Indicator is present and is an S, identify the input interim altitude as the altitude to be contained in the uplink message.
5. If the Menu Text message referent is present and the Interim Altitude field is not present, identify the interim altitude contained in the Menu Text entry as the altitude to be contained in the uplink message.
6. If the Menu Text message referent is present and the Interim Altitude field is present and contains a valid interim altitude, identify the interim altitude contained in the Interim Altitude field as the altitude to be uplinked (instead of the altitude field in the Menu Text).
7. Build a Data Link interim altitude message for the indicated aircraft as specified in section 2.4.
8. If the Menu Text message referent is present and indicates Full Data Block and NAS database update, or the Action Indicator is present and is an S, retain an indication to update the Full Data Block and NAS database upon pilot WILCO.
9. Change the status of this uplink to SENT.
10. Send the uplink message to the specified aircraft.

3.2.2.7 Resultant Output Functions

If the Status List is displayed and this service type is not suppressed, add the new Data Link message and its transaction status to the Status List display as shown in figure 2-2.

If the Full Data Block status information is displayed, timeshare the uplinked altitude and the transaction status with the current altitude display in the Full Data Block as shown in figure 2-3.

3.3 TRANSFER OF COMMUNICATION MESSAGES

This section describes the processing required for the Transfer of Communication service in conjunction with handing off an aircraft between sectors and adjacent facilities. The Transfer of Communication service is used to change radio frequency and transfer the Data Link eligibility of an aircraft. This process is broken down into a three-step procedure: handoff initiation, handoff acceptance, which generates a Data Link message in HELD status and transfers track control, and transfer of Data Link eligibility. Alternatively, at the controller's option, the accept handoff action may automatically uplink a Transfer of Communication message to the aircraft. With either alternative, the Transfer of Communication transaction and transfer of Data Link eligibility are completed when the transaction status changes to WILCO.

3.3.1 Controller Input: Initiate Handoff

3.3.1.1 Purpose

This message shall function the same as specified in NAS-MD-311 for handoff initiation, except that it shall also allow for an additional optional, adapted character (e.g., S), which shall signify immediate uplink upon acceptance of the handoff.

3.3.1.2 Message Content and Source

This message shall include the output routing and flight identification. In addition, message type, logic check override, and an Action Indicator are optional inputs and may or may not be included in the input message. The source shall be the DEC or CED.

3.3.1.3 Acceptance Checking

The same checks as specified in NAS-MD-311, section 3.4, shall be applied. In addition, a valid Work Indicator may be included.

3.3.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 (60) (16) (94) 02

2. Field Contents

01	Message type QN or QZ (note: either type may be used; see NAS-MD-311, section 3.4)
60	Logic Check Override (/OK)
16	Output Routing
94	Work Indicator (S)
02	Flight Identification

3. Examples

22 AAL392

22 S AAL392

QN 22 AAL392

3.3.1.5 Logic Requirements

1. Logic Checks

a. If the Work Indicator for uplinks is present, perform the following:

- 1) If the Data Link function is off, do not perform any processing.
- 2) If the Work Indicator is not the character for uplink, do not perform any Data Link processing, but return a format error indicating an invalid Data Link indicator.
- 3) If an active session does not exist for the specified aircraft, do not perform any Data Link processing, but return an error message indicating that the aircraft is unusable for Data Link.
- 4) If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.
- 5) If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.

- 6) If the entering position does not have Data Link eligibility for the aircraft, return on error message.

b. If the Work Indicator is not present, no Data Link processing is required.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

INVALID DATA LINK INDICATOR

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

NOT YOUR DATA LINK CONTROL

3.3.1.6 Processing After Acceptance

1. If the Action Indicator is present, retain an indication to uplink a Data Link Transfer of Communication message upon acceptance of handoff for the aircraft identified in the input message.
2. If the Action Indicator is not present, no Data Link processing is required.

3.3.2 Controller Input: Accept Handoff

3.3.2.1 Purpose

A Data Link Transfer of Communication message shall be generated for a Data Link-equipped aircraft upon completion of the handoff process. The message status shall be set to HELD, for subsequent uplinking by the sector controller that initiated the handoff, unless the uplink optional input character (e.g., S) is used during the initiate handoff. If it is used, a Data Link Transfer of Communication message shall be built and uplinked upon acceptance of track control, and the transaction status shall be updated to SENT.

3.3.2.2 Message Content and Source

The handoff accept message shall include the message type and the flight identification with the source being the DEC or CED.

3.3.2.3 Acceptance Checking

The handoff accept message must contain both the message type and a valid flight identification.

3.3.2.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 (60) 02

2. Field Contents

01

Message Type (QN or QZ) (note: either type may be used; see NAS-MD-311, section 3.1)

60

Logic Check Override (/OK)

02

Flight Identification

3.3.2.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, no Data Link processing is to be performed.
- b. If an active session does not exist for the specified aircraft, do not perform any Data Link processing.
- c. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

3.3.2.6 Processing After Acceptance

1. Generate a reference number for this Data Link message.
2. Build a Data Link Transfer of Communication message for the indicated aircraft, as specified in section 2.4, using the frequency of the designated sector as the frequency in the Data Link message.
3. Retain the sector that initiated handoff as the sector in control of the Data Link transaction.
4. If the Work Indicator was not present in the handoff initiation, retain HELD as the status for this Data Link message in the Data Link status record.
5. If the Work Indicator was present in the handoff initiation, perform the following:
 - a. Retain SENT as the transaction status for this Data Link message in the Data Link status record.
 - b. Send the uplink message to the specified aircraft.
6. If the designated sector is an adjacent facility, a Data Link interfacility message (SU, as described in section 3.10.1) shall be sent to that facility.

3.3.2.7 Resultant Output Functions

1. If the status list is displayed, and this service type is not suppressed, add the new Data Link message and its transaction status to the Data Link Status List as shown in figure 2-2.
2. If the Work Indicator was present in the handoff initiation and the Full Data Block status information is displayed, update the Data Link eligibility indicator in the Full Data Block of the aircraft, as shown in figure 2-1, to reflect the current Data Link eligibility and message status. The eligibility indicator display shall be the same at the two sectors affected.

3.3.3 Control Input: Transfer Data Link Eligibility

3.3.3.1 Purpose

The purpose of this action is to transfer Data Link eligibility and voice communication (radio frequency) control to another sector. This action shall initially result in the uplinking of a Data Link Transfer of Communication message to the specified aircraft, and subsequently the transfer of Data Link eligibility.

3.3.3.2 Message Content and Source

This message shall include the message type and the flight identification, with the source being the DEC or CED. The uplink may also be initiated by trackballing a HELD Data Link message in the Status List. If the keyboard input method is used, a sector identifier may be included to specify the sector to which Data Link eligibility will be given. If that sector is different from that identified during the handoff accept, the frequency will be updated in the HELD message. Also, a logic check override (/OK) may be included with or without an S. The sector entering /OK shall acquire Data Link eligibility. A Data Link message shall be uplinked if the S is used in conjunction with the /OK.

3.3.3.3 Acceptance Checking

The Data Link eligibility control transfer must contain at least the message type and a valid flight identification or the trackball coordinates of the HELD TOC message in the Status List. In addition, several optional fields may be included: a logic check override (/OK) or a valid sector identifier, and a valid Work Indicator.

3.3.3.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 (60 or 14) (94) (02) (65)

2. Field Contents

01

Message Type (DG)

60

Logic Check Override (/OK)

14

Sector Identifier

94

Work Indicator (S,I)

02

Flight Identification

65

Trackball Coordinates

3. Examples

DG EAL124

[Trackball HELD Transfer of Communication message]

DG /OK EAL124

DG /OK S EAL124

DG 19 EAL124

3.3.3.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, no Data Link processing is to be performed.
- b. If an active session does not exist for the specified aircraft, do not perform any processing for Data Link, but return an error message indicating that the aircraft is not usable for Data Link.
- c. If the sector identifier is present and the sector identified does not exist, return an error message.
- d. If the sector identifier is present and the sector identified is not active, return an error message.
- e. If the Work Indicator is present and does not contain the character for uplink or character for inhibit (e.g., S or I), do not perform any Data Link processing, but return a format error indicating an invalid Data Link indicator.
- f. If the parameter for concurrent active transactions for this service would be exceeded by this action, return an error message.
- g. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.
- h. If the logic check override (/OK) and the sector identifier are both present, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

NON-ADAPTED SECTOR

SECTOR NOT ACTIVE

INVALID DATA LINK INDICATOR

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

INVALID INPUT SEQUENCE

3.3.3.6 Processing After Acceptance

1. If the logic check override (/OK) is present (i.e., DG/OK, (S), FLID), perform the following:
 - a. Identify the sector that currently has Data Link eligibility.
 - b. If a HELD Transfer of Communication message exists for the indicated FLID at any sector, delete the message from the Data Link status record.
 - c. If the Work Indicator is not present, (i.e., DG/OK, FLID), perform the following:
 - 1) Delete all FAIL, UNABLE, or Pilot Timeout messages for the specified aircraft.
 - 2) Delete any indication that the current sector has Data Link eligibility.
 - 3) Retain an indication that the sector taking this action has Data Link eligibility.
 - d. If the Work Indicator is present (i.e., DG/OK, S, FLID), perform the following:
 - 1) Generate a reference number for the Data Link message.
 - 2) Build a message for Transfer of Communication uplink to the indicated aircraft, as specified in section 2.4. Use the frequency of the sector taking this action as the frequency contained in the Data Link message.
 - 3) Retain SENT as the transaction status for this Data Link message in the Data Link status record.
 - 4) Send the Data Link message to the specified aircraft.
2. If the sector identifier is present (i.e., DG, Sector Identifier, (I) FLID), perform the following:
 - a. If a HELD Transfer of Communication message exists for the indicated FLID at any sector, delete the message from the Data Link status record.
 - b. If the Work Indicator (I) is present (i.e., DG, Sector Identifier, (I), FLID), perform the following:
 - 1) Delete all FAIL, UNABLE, or Pilot Timeout messages for the specified aircraft.
 - 2) Delete any indication that the current sector has Data Link eligibility.
 - 3) Retain an indication that the sector taking this action has Data Link eligibility.

- c. If the Work Indicator is not present (i.e., DG, Section Identifier, FLID), perform the following:
 - 1) Generate a reference number for the Data Link message.
 - 2) Build a message for Transfer of Communication uplink to the indicated aircraft, as specified in section 2.4. Use the frequency of the sector specified by the Sector Identifier as the frequency contained in the Data Link message.
 - 3) Retain SENT as the transaction status for this Data Link message in the Data Link status record.
 - 4) Send the Data Link message to the specified aircraft.
3. If the logic check override and the Sector Identifier are not present (i.e., DG, FLOD), perform the following:

(A HELD TOC message for the specified FLID must exist for this processing to occur.)

 - a. Retain SENT as the transaction status for the Data Link TOC message for the indicated aircraft.
 - b. Send the Data Link message to the specified aircraft.
4. If a Data Link message was SENT, for tracks transferred to adjacent facilities, build an SU message as specified in section 2.4.2 for output to the adjacent facility.

3.3.3.7 Resultant Output Functions

1. If the logic check override is present, perform the following:
 - a. Delete the status display of any TOC message from the status list of the sector who had Data Link eligibility prior to this action.
 - b. Add the Data Link Transfer of Communication message and its status to the Data Link Status List at the sector taking this action as specified in figure 2-2.
2. If the sector identifier is present, perform the following:
 - a. If a HELD Transfer of Communication message exists in the Data Link Status List, delete it from the controller display.

- b. Add the Data link Transfer of Communication message and its status to the Data Link Status List at the sector taking this action as specified in figure 2-2.
3. If the logic check override and the Sector Identifier are not present, update the status of the HELD message as specified in figure 2-2.
4. If the Full Data Block status information is displayed, update the Data Link eligibility indicator in the Full Data Block of the aircraft as shown in figure 2-1, reflecting the current Data Link eligibility and message status at all affected sectors.

3.4 MENU TEXT MESSAGES

3.4.1 Controller Input: Menu Text Uplink

3.4.1.1 Purpose

This message shall be used to send Predefined text to Data Link-equipped aircraft. The capability shall be provided to optionally send a message to an individually selected aircraft or to all aircraft under sector control.

3.4.1.2 Message Content and Source

This message shall include the message type, Menu Text message referent and either the flight identification or the word ALL. The source shall be the DEC or CED.

3.4.1.3 Acceptance Checking

This message must contain the message type, a valid Menu Text message referent and either a valid flight identification or the word ALL.

3.4.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 XX 02 or "ALL"

2. **Field Contents**

01	Message Type (DG)
XX	Menu Text Message Referent (1-4 characters) (This is a new field, not defined in NAS-MD-311.)
02	Flight Identification or ALL

3. **Examples**

DG A UAL123

DG JI ALL

DG J50 AAL789

3.4.1.5 Logic Requirements

1. **Logic Checks**

- a. If the Data Link function is off, no Data Link processing is to be performed.
- b. If an active session does not exist for the specified aircraft, do not perform any Data Link processing, but return an error message indicating that the aircraft is not usable for Data Link.
- c. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.
- d. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.
- e. If the sector taking this action does not have Data Link eligibility for the specified aircraft, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

NOT YOUR DATA LINK CONTROL

3.4.1.6 Processing After Acceptance

1. Generate a reference number for the Data Link message.
2. Build a message for uplinking the Menu Text to the indicated aircraft, as specified in section 2.4.
3. Retain SENT as the transaction status for this Data Link message in the Status List.
4. Send the Data Link message to the specified aircraft.

3.4.1.7 Resultant Output Functions

If the Status List is displayed, this message and its transaction status (see figure 2-2) shall be displayed in the Status List at the sector where the message was entered.

3.4.2 Controller Input: Change a Menu Entry

3.4.2.1 Purpose

This action shall be used to insert or change the data value for that portion of a Menu Text entry that is variable. The variable field is defined in the Menu Build process (section 3.9.1).

3.4.2.2 Message Content and Source

This message shall include a message type, action type, Menu Text message referent, and the new contents for the field to be changed. The source shall be the DEC or CED.

3.4.2.3 Acceptance Checking

The Menu Text change message must contain a message type, an action type of menu change, a valid menu entry identifier associated with the sector entering the message, and the new data.

3.4.2.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 64 XX 76

2. Field Contents

01

Message Type (DS)

64

Action Type (MC)

XX

Menu Text Message Referent (1-4 characters)
(This is a new field, not defined in NAS-MD-311.)

76

Interim Altitude (as specified in NAS-MD-311, Appendix D)

3. Examples

DS MC V123 230

DS MC A 190

3.4.2.5 Logic Requirements

1. Logic Checks

- a. If the identified Menu Text message referent is not assigned to the sector entering the message, return an error message.
- b. If the identified Menu Text entry does not contain one interim altitude variable data field, return an error message.

2. Error Indicators

INVALID MESSAGE REFERENT

NO VALID DATA

3.4.2.6 Processing After Acceptance

Replace the matched variable altitude data in the identified menu entry with the last altitude data in the input message.

3.4.2.7 Resultant Output Functions

The identified Menu Text entry shall contain the entered data as the variable field.

3.4.3 Controller Input: Menu Text Item Suppression

3.4.3.1 Purpose

This message shall be used to suppress the display of one or more Menu Text items on the PVD.

3.4.3.2 Message Content and Source

This message shall include a message type, an action type of menu suppression, and one or more Menu Text message referents. The source shall be the DEC or CED.

3.4.3.3 Acceptance Checking

The Menu Text Item Suppression message must contain a message type, an action type and one or more valid Menu Text message referents.

3.4.3.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 64 XX

2. **Field Contents**

01	Message Type (DS)
64	Action Type (MS)
XX	Menu Text message referent (1-4 characters) (This is a new field, not defined in NAS-MD-311.)

3. **Examples**

DS MS A

DS MS A B C4

3.4.3.5 Logic Requirements

1. **Logic Checks**

- a. If the identified Menu Text message referent is not assigned to the sector entering the message, return an error message.
- b. If the identified Menu Text is already suppressed, return an error message.

2. **Error Indicators**

INVALID MENU TEXT MESSAGE REFERENT

MENU TEXT ALREADY SUPPRESSED

3.4.3.6 Processing After Acceptance

Retain an indication that the identified menu text entries are suppressed for display.

3.4.3.7 Resultant Output Functions

Re-display the Menu Text on the PVD without the identified menu entries. Additionally, the remaining menu text entries should be compacted to reduce the size of the Menu Text list on the PVD display.

3.4.4 Controller Input: Menu Text Return to Default

3.4.4.1 Purpose

This message shall be used to re-display all Menu Text entries which have been suppressed. Also, this action will return any menu entries which have been changed by the Change a Menu Entry (section 3.4.2) input action to their default values (original values entered for the Menu Text when it was built).

3.4.4.2 Message Content and Source

This message shall include a message type and an action type of menu default. The source shall be the DEC or CED.

3.4.4.3 Acceptance Checking

The Menu Text return to default message must contain the message type and an action type of menu default.

3.4.4.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 64

2. Field Contents

01

Message Type (DS)

64

Action Type (MD)

3. Examples

DS MD

3.4.4.5 Logic Requirements

None.

3.4.4.6 Processing After Acceptance

1. Retain an indication that all menu entries for this sector are displayed.
2. Return all Menu Text values to their default values.

3.4.4.7 Resultant Output Functions

Re-display the Menu Text with all valid entries and their default variable field values.

3.5 COMMUNICATIONS BACKUP MESSAGES

This section describes the functional processing for messages related to sending and receiving text via Data Link in the event that voice communications are inadequate. Text shall be uplinkable to one aircraft at a time or to all aircraft within sector control. Additionally, a capability shall be provided to recall the last Text message entered, and use it for uplinking. The system shall allow for both uplinking (controller to pilot) and downlinking (pilot to controller) capabilities.

3.5.1 Controller Input: Communications Backup Uplink

3.5.1.1 Purpose

This message shall be used to compose, recall, and send an unformatted Text message to aircraft. The capability shall be provided to, optionally, send a message to individually selected aircraft or all aircraft under sector control.

3.5.1.2 Message Content and Source

This message shall include the message type, the character T, text or ↑, and either the flight identification or the word ALL. The source shall be the DEC or CED.

3.5.1.3 Acceptance Checking

This message must contain the message type, T, a text not exceeding the system parameter (section 2.6) characters or ↑, and either a valid flight identification or the word ALL.

3.5.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 36 11 (02) or ALL

2. Field Contents

01

Message Type (DG)

94

Work Indicator (T)

11

Text or ↑

02

Flight Identification or ALL

3. Examples

DG T CALL COMPANY TWA123

DG T CHANGE YOUR RADIO FREQUENCY TO 123.50 ALL

DG T ↑

3.5.1.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, no Data Link processing is to be performed.
- b. If an active session does not exist for the specified aircraft, do not perform any processing for Data Link, and return an error message indicating that the aircraft is not usable for Data Link.
- c. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.
- d. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.
- e. If the Work Indicator is not a T (indicating Text), return an error message.

- f. If the length of the Text message is not within a specified adaptable parameter (section 2.6), return an error message.
- g. If ↑ is input, a previous Text message for this sector must exist; otherwise, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

INVALID DATA LINK INDICATOR

MESSAGE TOO LONG

NO PREVIOUS TEXT MESSAGE EXISTS

3.5.1.6 Processing After Acceptance

1. If an aircraft identification is specified in the aircraft identification field, perform the following processing:
 - a. Generate a reference number for the Data Link message.
 - b. Build a message for the indicated aircraft, as specified in section 2.4.
 - c. Send the Data Link message to the designated aircraft.
 - d. Change the status of this uplink to SENT.
2. If the word ALL is specified in the flight identification field, perform the processing specified in item a above for each aircraft under the control of the sector entering the message.
3. If a flight identification, or the word ALL, is not present within the input message and the Remarks Field (11) is the symbol ↑, recall the last Text message entered at the sector and display it on the CRD.

4. A recalled Text message shall be uplinkable using the same entry as for a newly constructed Text message.

3.5.1.7 Resultant Output Functions

If a Text message was sent and the Status List is displayed and the service type is not suppressed, the message and its transaction status (see figure 2-2) shall be displayed in the Status List at the sector where the message was entered.

3.5.2 Communications Backup Downlink

3.5.2.1 Purpose

For a message received from an aircraft, the operational content will be routed to the sector having Data Link eligibility for the aircraft.

3.5.2.2 Message Content and Source

This message shall contain a reference number, the message type, valid flight identification, message time of receipt into the Host, and text. The source shall be the ATN described in reference 2.

3.5.2.3 Acceptance Checking

This message must contain the message type, valid flight identification, time, and text.

3.5.2.4 Format Requirements

1. Fields

<u>Source</u>	<u>Fields</u>
Aircraft	01 02 67 11

2. Field Contents

01	Message Type
02	Flight Identification
67	Time
11	Text

3. Example

DAL817 1930 RADIO OUT, DATA LINK COMM ONLY

3.5.2.5 Logic Requirements

The message shall be accepted for processing based on Communications Requirements (reference 2).

3.5.2.6 Processing After Acceptance

1. Identify the sector with Data Link eligibility for the aircraft.
2. Enter the downlink message into the Communications Backup Downlink queue.
3. Assign a referent number to the message (section 2.5.10).

3.5.2.7 Resultant Output Functions

The receipt of a Communication Backup Downlink message shall activate an audible alarm at the D-Controller position and shall cause (optionally) the message to be printed on the Flight Strip Printer at the sector with Data Link eligibility.

The displayable output message shall contain aircraft identification call sign, the time of receipt of the message, the computer-assigned referent number, and the text data from the message.

3.5.3 Controller Input: Response to a Communications Backup Downlink

3.5.3.1 Purpose

This message shall be used to respond to a Communications Backup Downlink message (section 3.5.2) at a controller sector.

3.5.3.2 Message Content and Source

This message shall contain the message type, the referent number and the response. The source shall be the CED.

3.5.3.3 Acceptance Checking

This message must contain the message type, a referent number and the response.

3.5.3.4 Format Requirements

1. Fields

Source

CED

Fields

01 XX (XX)

2. Field Contents

01

Message Type (CZ)

XX

Referent Number

(XX)Response (This is a new field, not defined in NAS-MD-311.) Allowable values are S, R, A, or U.

3. Examples

CZ 03 R

3.5.3.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is OFF, no Data Link processing is to be performed.
- b. If an active session does not exist for the specified aircraft, do not perform any processing for Data Link, and return an error message indicating that the aircraft is not usable for Data Link.
- c. If no referent downlink message exists, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK

NO REFERENT DOWNLINK

3.5.3.6 Processing After Acceptance

1. Build a controller response message

If no optional response field is entered, the uplink response shall Default to the adapted value, (section 2.7.6).

2. Send a Data Link message to the originating aircraft and include applications data as follows:

- a. If the controller entered input message defaulted to the adapted value, enter the adapted value in the Data Link message.
- b. If the controller-entered input message contained S, R, A or U, enter STANDBY, ROGER, APPROVED or UNABLE.

3.5.3.7 Resultant Output Functions

The uplink message to the aircraft shall reference the pilot-initiated downlink that was referenced by the controller-entered number.

3.6 RESEND A DATA LINK MESSAGE

3.6.1 Controller Input: Resend a Data Link Message

3.6.1.1 Purpose

A Data Link message may be resent when the previous transmission failed because of a communications failure, pilot timeout, or UNABLE response as described in section 2.3.4. A capability shall be provided to resend a Data Link message by trackballing to the message in the Status List on the PVD.

3.6.1.2 Message Content and Source

This message shall include the message type, service type descriptor and a valid flight identification or the trackball coordinates of the Data Link message in the Status List. The source shall be the DEC or CED.

3.6.1.3 Acceptance Checking

This message shall include the message type, service type descriptor and a valid flight identification or the valid trackball coordinates of the Data Link message in the Status List.

3.6.1.4 Format Requirements

<u>Source</u>	<u>Fields</u>
DEC or CED	01 XX 02 or 65
2. Field Contents	
01	Message Type (DG)
XX	Service Type Descriptor (AA, TC, CB)
02	Flight Identification
65	Trackball Coordinates (X, Y)
3. Examples	
DG AA UAL123	
Trackball message in Status List	

3.6.1.5 Logic Requirements

1. Logic Checks
 - a. If the Data Link function is off, do not perform any Data Link processing.
 - b. If an active session does not exist for the specified aircraft, do not perform any Data Link processing, and return an error message indicating that the aircraft is unusable for Data Link.
 - c. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.
 - d. If the trackball coordinates are used and do not correlate with a Status List entry, perform the normal processing as defined in NAS-MD-311.
 - e. If the trackball coordinates are used and correlate with a Status List entry, and that message has a status other than FAIL, pilot timeout, or UNABLE, return an error message.
 - f. If a valid service type descriptor and flight identification are not specified in the input message, return an error message.

2. **Error Indicators**

FUNCTION TIED OFF

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CANNOT RESEND - MESSAGE IN PROGRESS

INVALID SERVICE TYPE DESCRIPTOR

3.6.1.6 Processing After Acceptance

1. Initiate a new transaction with status of SENT.
2. Build and send an uplink message with the same operational content as in the prior transaction.
3. Delete the prior transaction.

3.6.1.7 Resultant Output Functions

1. Update the Status List display as shown in figure 2-2.
2. Update the transaction status in the appropriate field(s) in the Full Data Block, depending on the type of Data Link message resent.

3.7 DELETE A DATA LINK MESSAGE

3.7.1 Controller Input: Delete a Data Link Message

3.7.1.1 Purpose

This message shall be used to delete an existing Data Link message that is currently being HELD, or has failed (i.e., FAIL, UNABLE, or pilot timeout).

3.7.1.2 Message Content and Source

This message shall include the message type, optionally the Data Link service type, and a valid flight identification or the Action Indicator and trackball coordinates of the Status List entry. A capability shall be provided to delete a Data Link message by trackballing to the message in the Status List. The source shall be the DEC or CED.

3.7.1.3 Acceptance Checking

This message must contain the message type, optionally the Data Link service type, the Action Indicator, and the flight identification or the Action indicator and valid trackball coordinates of the Status List message.

3.7.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 (XX) 94 02 or 94 65

2. Field Contents

01

Message Type (DG)

XX

Service Type Descriptor (AA, TC, CB)
(This is a new field, not defined in NAS-MD-311.)

94

Work Indicator (D)

02

Flight Identification

65

Trackball Coordinates (x,y)

3. Examples

DG D AAL123

DG AA D UAL459

D Trackball message in Status List

3.7.1.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, no Data Link processing is to be performed.
- b. If the flight identification is specified, and no HELD or other Data Link message exists for this aircraft, return an error message.
- c. If the trackball coordinates do not specify a Data Link status message, perform the normal processing as defined in NAS-MD-311.
- d. If the trackball coordinates are used, and the identified transaction status of the Data Link Status Message is not HELD, FAIL, pilot timeout, or UNABLE, return an error message.
- e. If the service type descriptor is specified and does not contain a valid service type, return an error message.

2. Error Indicators

FUNCTION TIED OFF

NO DATA LINK MESSAGE FOUND

CANNOT DELETE - MESSAGE IN PROGRESS

INVALID SERVICE TYPE DESCRIPTOR

3.7.1.6 Processing After Acceptance

- a. If the service type is not specified in the input message, all HELD and completed Data Link transactions for the indicated aircraft shall be deleted from the Data Link status display.
- b. If the service type is specified in the input message, all HELD and complete Data Link messages for the specified service type for the indicated aircraft shall be deleted from the Data Link status display.

If the trackball coordinates are used, the identified Data Link message shall be deleted from the Data Link status display.

3.7.1.7 Resultant Output Functions

1. If the Status List is displayed, update it to reflect the deleted message(s).
2. Update the Full Data Block of the indicated aircraft. This processing includes eliminating FAIL indications in the appropriate areas of the Full Data Block depending on the service type and the status of other Data Link messages. The following shall apply:
 - a. If the deleted message had a FAIL indication in the Full Data Block, and no other Data Link messages for this aircraft have FAILED since the deleted message, return the Full Data Block to normal display.
 - b. If the deleted message is an assigned or interim altitude, and no other assigned or interim altitude messages have FAILED since the deleted message, and no other actions were taken to update the Full Data Block for altitude, discontinue timeshare of the FAIL and uplinked altitude.

3.8 UPLINK A HELD MESSAGE

3.8.1 Controller Input: Uplink a HELD Message

3.8.1.1 Purpose

This message shall be used to uplink a Data Link message that is currently in *HELD* status.

3.8.1.2 Message Content and Source

This message shall include the message type, the aircraft identification and optionally the Data Link service type or trackball coordinates of the Status List message. The capability shall be provided to send this type of message by trackballing to the HELD entry in the Status List display. The source shall be the DEC or CED.

3.8.1.3 Acceptance Checking

This message must contain the message type designator, a valid aircraft identification and optionally the Data Link service type descriptor or valid trackball coordinates of the Status List entry.

3.8.1.4 Format Requirements

1. Fields

Source

DEC or CED

Fields

01 02 (XX) or 65

2. Field Contents

01

Message Type Designator (DG)

02

Flight Identification

XX

Service Type Descriptor (This is a new field, not defined in NAS-MD-311.)

65

Trackball Coordinates (x,y)

3. Examples

DG DAL863

DG AAL619 (TC)

Trackball HELD message in Status List

3.8.1.5 Logic Requirements

1. Logic Checks

- a. If the Data Link function is off, no Data Link processing shall be performed.
- b. If the flight identification is used, and there is no HELD message which exists for this aircraft, return an error message.
- c. If an active session does not exist for the specified aircraft, do not perform any Data Link processing, and return an error message indicating that the aircraft is unusable for Data Link.
- d. If the parameter for concurrent active sessions for this service would be exceeded by this action, return an error message.

- e. If the Fail Clear parameter is ON and a FAIL message exists for this aircraft, return an error message.
 - f. If the trackball coordinates are used, and the indicated message status is not HELD, return an error message.
 - g. If the service type descriptor is used and does not contain a valid service type, return an error message.
2. Error Indicators

FUNCTION TIED OFF

NO HELD MESSAGE TO SEND

NO DATA LINK

TRANSACTION ACTIVE FOR THIS SERVICE

CLEAR FAIL MESSAGE

NO HELD MESSAGE TO SEND

INVALID SERVICE TYPE DESCRIPTOR

3.8.1.6 Processing After Acceptance

The processing of this message after acceptance shall be the following:

1. If the Data Link service type is not specified in the message, the first message in the Status List with HELD status for the specified aircraft shall be sent to the aircraft.
2. If the Data Link service type is specified in the message, the message with the specified service type for the aircraft designated shall be sent to the aircraft.
3. If a trackball coordinates are used, the selected message shall be sent to the aircraft.
4. Change the status of the uplink to SENT.
5. Uplink the message to the specified aircraft.

3.8.1.7 Resultant Output Functions

If the Status List is displayed, the transaction and its status (see table 2-1) shall be displayed in the Status List at the sector where the message was entered.

3.9 SUPERVISORY INPUT MESSAGES

This section describes the functional processing that shall be performed for supervisory input messages.

3.9.1 Supervisory Input: Menu Text Build

This section specifies the menu build requirements as related to the supervisory position. The intent is to capture the features of the menu build process without constraining the implementation to a specific technique (e.g., use of menus vs. command language).

The functional requirements in this section are presented at a different level of detail from the rest of section 3. Specification of requirements for the menu build process at the level of detail used elsewhere in section 3 cannot be done without making assumptions about the input/output procedures to be employed, procedures that have yet to be developed in detail and evaluated.

To support the sector Data Link menu function, the capability shall be provided at the supervisory positions to formulate and edit Data Link messages to be accessed via sector Data Link menus. The process shall consist of generating a message by adapting suitable predefined ATC phrases or by entering the desired message contents, assigning the message to appropriate sectors or Fix Posting Areas, and establishing the access and display attributes to be associated with the message. The capability shall also be provided to review and edit existing menu entries. The requirements of the menu build capability are further defined in the following sections.

3.9.1.1 Menu Entry Generation

The capability shall be provided to perform the following:

- Generate a message consisting of one or more predetermined ATC clearances or text of arbitrary content.
- Assign the message referent (code) to be used to identify the message for uplink in the Menu Text.
- Indicate at time of message composition a character to be used to indicate an update to the Full Data Block.

- Indicate a character to be used to denote a variable field for an interim altitude value that is changeable by the controller on-line.
- Designate the NAS database field to be updated with the specified data in the message.
- Establish the associated contents to be displayed in the menu.
- Assign the message to one or more FPAs.
- Establish the associated contents to be displayed in the data area of the Data Link Status List.
- Establish the desired message priority, if different from the default value.
- Concatenate messages of ATC instructions/clearances.

1. Menu Generation

The capability shall be provided to generate a message using either adaptation of predefined ATC phrases, the entry of text of arbitrary content, or a combination of the two. The requirements for the two approaches to message generation are detailed in the following two sections.

a. Application of the ATC Phrase Dictionary

The capability shall be provided to formulate Data Link messages by selection and adaptation of predefined ATC phrases. Phrases appropriate for en route ATC applications are tentatively defined in Appendix B of the Communication Requirements document (reference 2). The phrases contain nonvarying text elements (fixed text), text options, and variable data. Message generation using the dictionary consists of selecting an appropriate phrase, and, if applicable, making necessary selections from among text options and supplying values for variable data. The process is illustrated in the following example of an altitude assignment with a crossing restriction.

First, an appropriate phrase is selected from those available in the ATC phrase dictionary and adapted for en route applications. For this example, a suitable phrase might consist of the following:

CROSS (FIX) _____ (ALTITUDE)

AT AND MAINTAIN
AT OR ABOVE
AT OR BELOW

Next, the Data Link message is specifically defined by supplying the values of the variables, FIX and ALTITUDE in this example, and selecting one of three text options. The text and variable value selections define a specific message such as the following:

CROSS HOLTS AT AND MAINTAIN FL220

To provide additional operational flexibility, the capability shall be provided to leave variable values unspecified at the time of message generation. In this case, the value of the variable is to be entered at the sector position. Thereafter, the last entered value for the variable shall be used, unless a new value is specifically entered by the controller (using the Change Menu entry, as defined in section 3.4.2). The process for specification of a variable field using the menu build capability would appear as follows:

CROSS HOLTS AT AND MAINTAIN FL+

The "+" is used to indicate a variable field entry. (The "+" symbol is defined in adaptation as described in 2.6.19.)

If the variable value is to be prestored with the Menu Text entry when it is build, the Menu Text entry would appear as follows:

CROSS HOLTS AT AND MAINTAIN FL+220

In conjunction with the specification of certain variable values, the capability shall be provided to update or not update the Host database, as determined at the time of message generation. More specifically, when the variables of interest are determined, an optional operator [e.g., ()] and NAS database field indicator (as specified in NAS-MD-311) shall be used to indicate that the database is to be updated with the specified variable value. Using the above example, the operator, NAS database field and the variable value, e.g., (76) 220, would be entered to specify that field 76 (interim altitude) will be updated upon Pilot WILCO of this Menu Text entry and appear as follows:

CROSS HOLTS AT AND MAINTAIN FL(76)220

During uplink, the optional operator and the database field indicator (76) shall not be included in the contents of the message.

Also, an example using both the variable field specification and the NAS database update option appears as follows:

CROSS HOLTS AT AND MAINTAIN FL(76)+

b. Application of the Text Option

It may occur that the contents of predefined ATC phrases do not encompass the desired contents of a message. To establish the flexibility to define messages of arbitrary content, the capability shall be provided to enter message text of arbitrary content, without reference to predefined ATC phrases. In this case, the Data Link message transmitted will reflect the contents of the entered text. The content of these "text" messages is limited only by the coding technique employed; that is, message content is limited to words and word combinations contained in the ATC Word Dictionary and to character strings conforming to a specified six-bit character set, both defined in Appendix A of the Communication Requirements document (reference 2).

2. Specification of Message Attributes

a. Message Referent

To identify the Data Link message when its transmission is desired, the capability shall be provided to assign a message referent (a code representing the message that is intended to support efficient access). The message referent shall consist of between one and four alphanumeric characters, exclusive of the characters R and Z, which are reserved for altitude assignment applications. Also, the message referent shall begin with an alpha character, a numeric as the first character should be rejected as an invalid message referent. Assigned message referents shall be unique; that is, no two menu entries in the system shall possess the same message referent. An attempt to assign an existing message referent or the reserved referents R and Z shall result in the rejection of the assignment and the generation of an appropriate error message (e.g., Invalid Message Referent).

b. Data Link Menu Contents

Under ideal conditions, the Data Link menu display would contain the message referent and the contents of the message. In many cases, the contents of the message exceed in length the practical display capability of the Data Link menu (on a per item basis). To support the most effective representation of a message in the Data Link menu, the capability shall be provided to specify the contents of the Data Link menu to be used to represent the message, up to a maximum of system parameter (section 2.6). If unspecified, the default contents shall be the contents of the message or the initial characters of the message up to the allotted maximum. Additionally, a character shall be used in the menu contents description to indicate if a particular menu entry updates the database. An example of the menu entry at the sector position might appear as:

A1 * CROSS HOLTS @ FL230

Where the * indicates to the controller that this menu entry updates the database.

c. Sector/Fix Posting Area Association

The capability shall be provided to assign a Data Link menu entry indirectly by the specification of one or more FPAs. When an FPA is specified, the menu entry shall be assigned to the Data Link menu associated with the sector in which the FPA resides.

The menu entry display shall be associated with FPAs of which the sectors are composed. In the event of a resectorization, sector Data Link menus shall be reconstituted from menu entries associated with the FPAs of which new sectors are composed. A menu entry associated with more than one FPA in a sector shall appear only once in the sector Data Link menu.

d. Status List Display

In conjunction with menu entry generation, the capability shall be provided to specify the contents to appear within the data area of the Data Link Status List display. The data area contents shall consist of up to system parameter (section 2.6) characters. When unspecified, the default display shall be the Menu Text entry referent.

e. Message Priority

Application messages possess one of fifteen levels of priority, as described in the Communication Requirements document (reference 2). The relative priorities are used by application processes to determine the order in which Data Link messages are to be processed and displayed. For ATC Data Link applications, a single, predefined, implicit priority is associated with each Data Link message unless a priority is explicitly indicated in the message. To support the specification of message priority differing from that established implicitly, the capability shall be provided to specify a message priority in conjunction with message generation.

f. Message Update Character

The capability shall be provided to assign a character (e.g.,*) that identifies a Data Link message that will result in the data base for a flight being updated with the specified variable data, upon receiving a pilot WILCO to a transmitted message.

g. NAS Database Field Designation

To provide the flexibility to allow the variable data in the message to update the desirable NAS database field (initial implementation shall allow only field 76 to be specified), the

capability shall be provided to assign the specific NAS database field that will be updated with the variable data upon receiving a pilot WILCO to the transmitted message.

h. Variable Field Indicator

A capability shall be provided to specify at the time of message composition characters that bracket a variable input field in the message, (e.g., + variable field +).

i. Quick Action/Category Function Key Assignment

A capability shall be provided to assign the Menu Text entry to a specific Quick Action or Category Function key. Once the Menu Text entry is assigned a Quick Action or Category Function key, this key must be used to uplink the Menu Text message at the sector position.

3.9.1.2 Editing

The capability shall be provided to review and edit sector Data Link menus and individual Data Link messages in accordance with the following descriptions.

1. Review and Edit Sector Data Link Menus

The capability shall be provided to review and edit the contents of Data Link menus. The Data Link menu of a specific sector shall be accessible by specification of the sector number. The review and edit capability shall include the following:

- The capability shall be provided to examine the contents of a specified Data Link menu.
- The capability shall be provided to delete individual entries from a sector Data Link menu (also deleting specific sector FPA associations).
- The capability shall be provided to add or move an indicated Menu entry to the Data Link menu of another specified sector.
- The capability shall be provided to edit a selected message or associated attributes based on a menu entry.
- The capability shall be provided to concatenate selected messages on a sector Data Link menu.

2. Review and Edit Menu Data Link Messages

In addition to the capability to review and edit individual sector Data Link menus, the capability shall be provided to review and edit individual Data Link messages. Specific capabilities shall include the following:

- The capability shall be provided to display menu entries and associated attributes (message referent, sectors, functional category, and priority) in aggregate or by specification of attributes or combination of attributes of interest.
- The capability shall be provided to delete selected menu entries.
- The capability shall be provided to edit selected messages and message attributes.
- The capability shall be provided to concatenate selected messages.

3.9.2 Supervisory Input: Activate/Deactivate Data Link Processing

3.9.2.1 Purpose

This message shall be used to turn on or off all Data Link processing for the Host or for a specified Data Link service.

3.9.2.2 Message Content and Source

This message shall include the message type, optionally the service type identifier, and the action indicator. The source shall be the supervisory position keyboard video display terminal (KVDt).

3.9.2.3 Acceptance Checking

This message must contain both the message type and a valid action indicator. A valid service type descriptor may also be included.

3.9.2.4 Format Requirements

1. Fields

Source

KVDt

Fields

01 (XX) 36

2. Field Contents

01	Message Type (DL)
XX	Service Type Descriptor (AA, TC, CB) (This is a new field, not defined in NAS-MD-311.)
36	Action Indicator (ON, OFF)

3. Examples

DL ON

DL CB OFF

3.9.2.5 Logic Requirement

1. Logic Checks

- a. If the service type descriptor is used, but is not valid, return an error message.

2. Error Indicators

INVALID SERVICE TYPE DESCRIPTOR

3.9.2.6 Processing After Acceptance

An acceptable message shall result in an accept response being returned to the entering source. The acceptance of a Data Link ON message shall initiate the processing of Data Link activities. Conversely, the acceptance of a Data Link OFF message shall cease the processing of any Data Link activities.

3.9.2.7 Resultant Output Functions

The appropriate action shall be displayed as a message at the entering source.

3.9.3 Supervisory Input: Startover (STVR)

This message shall be used to cause an operational system startover as described in NAS-MD-317, sections 4.0 and 6.1.12. The startover processing shall include restoring the Data Link functions described in this document to the operational system state that existed prior to the entry of the STVR message. Refer to NAS-MD-317 (reference 7) for a description of the STVR message.

3.9.4 Supervisory Input: Radio Frequency Table Assignment

3.9.4.1 Purpose

This message shall be used to assign and modify the radio frequency table (section 2.7.2) for use as part of the Transfer of Communication service. The capability shall be provided to assign radio frequencies to sector positions, FPAs, and sectors at adjacent facilities.

3.9.4.2 Message Content and Source

This message shall include the message type, FPA, frequency value and optionally the sector number and adjacent facility identifier. The input source shall be the supervisory position KVDT.

3.9.4.3 Acceptance Checking

This message must contain the message type, a valid FPA and a valid frequency value. Optional contents of the message shall be a valid sector number and a valid adjacent facility identifier.

3.9.4.4 Format Requirements

1. Fields

Source

KVDT

Fields

01 XX (14) (13) XX

2. Field Contents

01

Message Type (SF)

XX

FPA Number (This is a new field, not defined in NAS-MD-311.)

14

Sector Number

13

Facility Identifier

XX

Frequency Value(s) (a new field)

3.9.4.5 Logic Requirements

1. Logic Checks

- a. If the sector number is not adapted, return an error message.
- b. If the frequency value is invalid, return an error message.
- c. If the FPA number is not adapted, return an error message.
- d. If the facility identifier is not adapted, return an error message.

2. Error Indicators

INVALID SECTOR

INVALID FREQUENCY

INVALID FPA

INVALID FACILITY

3.9.4.6 Processing After Acceptance

The radio frequency table shall be modified according to the input message.

3.9.4.7 Resultant Output Functions

A message indicating the appropriate response to the input message shall be displayed at the entering KVDT.

3.10 INTERFACILITY INPUT MESSAGES

The functional processing for interfacility input messages is specified in this section.

3.10.1 Status Update (SU)

Status updates are intended to be used as part of a Transfer of Communication between facilities. These messages are sent to convey information regarding the status of a Data Link transaction. Although this is intended to be used initially for Transfer of Communication, the capability should be provided for other future services.

3.10.1.1 Purpose

This message shall initiate and update transaction status and displays at the receiving facility.

3.10.1.2 Message Content and Source

The SU message content is defined in figure 2-5. The source shall be an adjacent en route or terminal facility.

3.10.1.3 Acceptance Checking

Processing requirements for intrafacility messages, as specified in reference 3, shall apply. The initial SU message shall be treated as a first order message. Subsequent SU messages for updates to a transaction shall be treated as second order messages. DA, DX, and DR messages shall be generated in accordance with standard interfacility transmission requirements.

3.10.1.4 Format Requirements

The following format requirements shall apply:

1. Fields

Source

Automated Radar Terminal
System (ARTS) or NAS

Fields

(As specified in reference 8).

2. Field Contents

Data shall be included in the message as indicated in the SU message field for Data Link Service Status.

3.10.1.5 Logic Requirements

If no transaction exists for the reference number in the SU message, establish a transaction. Set the status to that contained in the SU message.

If a transaction exists for the reference number in the SU message, update the status of the transaction to that contained in the SU message.

Display outputs and other processing for the referenced transaction shall be done as specified for the Data Link service.

3.10.1.6 Processing After Acceptance

The status of a Data Link transaction shall be updated upon the acceptance of an SU message.

3.10.1.7 Resultant Output Functions

Upon acceptance of an SU message, the facility sending the SU message shall receive an indication of a successful transmission of the SU message. Also, in the receiving facility, the status displays for the identified transaction shall be updated.

3.11 AIR-TO-GROUND MESSAGES

The functional processing for operational Data Link input messages received in the Host from the air-ground Data Link network is specified in this section.

3.11.1 Downlink Message

3.11.1.1 Purpose

This message shall contain a pilot or technical response to a previously uplinked message, or an air-to-ground message originated in the aircraft applications processor as part of the Communications Backup capability.

3.11.1.2 Message Content and Source

The received message shall include a reference number, the message type, valid flight identification, time, and data. The source shall be the ATN.

3.11.1.3 Acceptance Checking

The received message shall comply with the Communication Requirements document (reference 2).

3.11.1.4 Format Requirement

As defined in reference 2.

3.11.1.5 Logic Requirements

As defined in reference 2.

3.11.1.6 Processing After Acceptance

The processing after acceptance shall consist of matching the input message reference number with that of an outstanding transaction, and updating the transaction status. If no match is found, the message shall be treated as *pilot-originated Communications Backup Downlink* message; processing shall then be performed as specified in section 3.5.2. If a match is found, the transaction status shall be updated as follows:

1. If the response indicates a status of Delivered, Unable, communication failure, or pilot timeout, update the transaction status displays accordingly.
2. If the response is WILCO or ROGER, perform the following:
 - a. If the referent message is an assigned altitude uplink, update the NAS database as specified in NAS-MD-311, and display the WILCO or ROGER status as specified in section 2.2.4.
 - b. If the referent message is an interim altitude uplink, update the NAS database as specified in NAS-MD-311, and display the WILCO or ROGER status as specified in section 2.2.4.
 - c. If the response is a WILCO or ROGER for a Transfer of Communication, perform the following:
 - 1) If the sector designated in the message is within the current facility, transfer Data Link eligibility from the current sector to the receiving sector.
 - 2) If the sector designated in the message is within another facility, cancel Data Link eligibility for the current sector and for this facility, and send a Data Link interfacility message (SU, as described in section 3.10) to the proper facility.
 - 3) Delete any failed Data Link messages for the indicated aircraft at the sector which initiated the Transfer of Communication message.
 - d. Begin the WILCO or ROGER timeout period (section 2.6) for this Data Link transaction.

3.11.1.7 Resultant Output Functions

1. If the message is a pilot-originated Communications Backup Downlink, process the message as specified in section 3.5.2.
2. Update the Status List contents for the appropriate Data Link transaction.

3. If the Data Link message is an Assigned Altitude and the Full Data Block status information is displayed, perform the following:
 - a. Timeshare the uplinked altitude and downlinked message status with the current altitude in the Full Data Block of the specified aircraft.
 - b. If the downlink message status is WILCO or ROGER, perform the following:
 - 1) Discontinue the timeshare display in the Full Data Block after the timeout period specified in section 2.6.
 - 2) Update the altitude in the Full Data Block to reflect the uplinked altitude.
4. If the Data Link message is an Interim Altitude and the Full Data Block status information is displayed, the following processing shall be performed:
 - a. Timeshare the uplinked altitude and downlinked message status with the current altitude in the Full Data Block of the specified aircraft.
 - b. If the downlink message status is WILCO or ROGER, perform the following:
 - 1) Discontinue the timeshare display in the Full Data Block after the timeout period specified in section 2.6.
 - 2) Update the altitude in the Full Data Block to reflect the uplinked altitude. Indicate interim altitude, using T in the Full Data Block, for all interim altitude entries except the R Menu Text entry.
5. If the downlink message is WILCO or ROGER and the message was a Transfer of Communication, update the Data Link eligibility indicator in the Full Data Block of the aircraft as shown in figure 2-1 to reflect the current Data Link eligibility.

SECTION 4

SYSTEM FUNCTIONS

This section specifies the functions that shall provide on-line supervisory functions and off-line support for Data Link operations. The supervisory functions shall be controlled by input actions available at that position in the en route facility.

4.1 FAILURE RECOVERY

The startover and switchover processing described in NAS-MD-317, sections 4.0 and 6.1.12, shall be expanded to include restoring the Data Link functions to the operational system state that existed prior to the startover or switchover. See NAS-MD-317 (reference 7) for a description of the startover and switchover processes.

When the Host stops processing Data Link functions, a message to that effect shall be output to the DLP. In addition, a message shall be sent to the DLP to indicate startover and switchover completion.

A startover or switchover that results in system downtime less than a Data Link Recovery Time parameter (section 2.6) shall be followed by a reconstitution of Data Link to the state that existed when the startover or switchover occurred. To facilitate this capability, recovery recordings for Data Link actions shall be obtained. Data pertaining to the status of Data Link transactions and center eligibility for each track shall be continuously recorded every system parameter (section 2.6) seconds.

If the Data Link Recovery Time parameter (section 2.6) is exceeded, all active sessions shall be terminated, and all outstanding Data Link transactions shall be deleted.

4.2 REAL TIME QUALITY CONTROL

The interface between the Host and the telecommunications network shall be periodically verified for usability. This monitoring capability shall reflect the usability of specific interfaces to the DLP and session maintenance with specific aircraft.

A monitoring summary report shall be available for output at the supervisory position upon request. This summary report shall contain the following statistics for a specific time interval:

- Number of Data Link sessions.

- Number of Data Link-equipped aircraft.
- Number of uplink messages.
- Number of downlink messages.
- Counts for each type of uplink and downlink messages (e.g., assigned altitude, WILCO, UNABLE).
- Counts for each type of Data Link status (e.g., HELD, SENT, Delivered, FAIL, Pilot Timeout).

A special supervisory entry to request the above summary report, and specify the desired time interval, shall be provided. In addition, significant changes in Data Link functionality shall automatically generate an output to the supervisory position.

The monitoring capability shall also ensure that the Full Data Block symbology always reflects the Data Link eligibility status of each aircraft. Thus, if an aircraft loses Data Link accessibility, the eligibility symbol shall be changed accordingly.

4.3 DATA RECORDING

The Host System Analysis and Recording (SAR) subsystem shall include the recording of all information relevant to Data Link processing. The data recorded on the SAR medium (tape or disk) shall include messages between the Host Computer System and the DLP, Data Link display setting messages, supervisory and controller keyboard entries, uplink and downlink messages including text messages, interfacility messages, and data routed for display on the Host output devices, e.g., PVD, CRD, KVDT, and High Speed Printer. These data shall be recorded using the same methods used for the other NAS SAR data and conform to the standards established in the Host for SAR processing.

4.4 SUPPORT SOFTWARE

The Host support software shall be modified to accommodate the new data link services. The support software includes: Data Reduction and Analysis, Simulation Program (SIM), and Dynamic Simulation of Radar Data (DYSIM). The following sections describe the required changes for each of these software items.

4.4.1 Data Reduction and Analysis

The current Host Data Analysis and Reduction Tool (DART) shall be expanded to permit reducing and analyzing Data Link information from the SAR data. The modifications shall include assigning

input and output message values and report mnemonics for each type of the Data Link messages recorded by SAR. These changes shall follow the standard DART user procedures as identified in the *DART User's Manual* (reference 6). In addition, the capability shall be provided to permit filtering the Data Link messages by message type, (e.g., WILCO, UNABLE, interim altitude via Menu Text), message status, device identification (e.g., specific PVD), time, or aircraft identification.

In addition, data reduction software shall be provided to report the statistics provided by the Real Time Quality Control Function, as listed in section 4.2.

The counts shall be recorded on SAR for off-line reduction using either DART or new software. The off-line reduction program shall permit filtering the data by message type, message status, device type, device identification, time, or aircraft identification as is currently available using DART for the SAR data.

4.4.2 Simulation Program (SIM)

The Host Simulation Program (SIM) shall be modified to permit simulating the entry of any Data Link related message using any type of device capable of supplying input messages to the Host. These devices shall include the Data Link category function keys and Quick Action Keys. All controller-entered Data Link messages (e.g., Altitude Assignment, Communications Backup Uplink) and pilot entries (e.g., WILCO, UNABLE) shall be simulated. In addition, SIM modifications shall include simulating inputs and outputs between the Host and DLP. Also, interfacility messages related to Data Link shall be simulated.

4.4.3 Dynamic Simulation of Radar Data (DYSIM) Function

The Host DYSIM function shall be modified to include Data Link functions for Data Link testing and controller training. The modifications shall include displaying Data Link messages on the designated DYSIM pilot positions and provisions for the DYSIM pilot to enter responses (e.g., WILCO, UNABLE) for each message. In addition, the DYSIM pilot position shall include modifications for accommodating the Communications Backup Downlink and Uplink service. These modifications shall include an input method at the DYSIM pilot positions using the PVD and the CRD to format and send Communications Backup Downlink messages and receive Communications Backup Uplink messages.

4.4.4 Adaptation Assembler

The Host Adaptation Controlled Environment System (ACES) shall be modified as required to process adaptation data (e.g., databases, parameters, and input and output options) related to Data Link functions. These modifications shall conform to adaptation data requirements as specified in NAS-MD-326.

Operational phrase dictionaries, word dictionaries, and displayable Menu Text entries shall be assembled as part of the adaptation database. Either the interactive process for creating menus, as described in section 3.9.1 for supervisory inputs, or an alternative method for pre-building menus shall be used for assembling adaptation data.

SECTION 5

CAPACITY AND RESPONSE TIME REQUIREMENTS

The introduction of Data Link software functions in the Host Computer System will require new processing in addition to that currently operational in the field. In addition, expanded displays to indicate Data Link transaction status will increase the data transfer rate across the Host/Display Channel interface.

All the performance requirements for the current Host, as specified in NAS-MD-318 (reference 4) and NAS-MD-325 (reference 5), shall continue to be met with the addition of Data Link processing. Specific Data Link capacity and response time requirements are specified below.

5.1 HOST CAPACITY

The maximum load used for Host Data Link testing shall be as defined in NAS-MD-318, Appendix A, with the following additions:

- 50 percent Data Link eligible aircraft.
- One controller-initiated uplink message per aircraft per minute, with randomly distributed intervals between uplink initiations, and uniform distribution for message type.
- 80 percent pilot WILCO or ROGER responses; 10 percent pilot UNABLE responses; 10 percent pilot timeout.
- 1/4 pilot-initiated Communication Backup Downlink per aircraft per minute.
- 5 percent Data Link communication failure rate.
- Full Data Block, Status List, and Menu Text List (ten entries) displays at each sector.
- 25-character Communication Backup Uplink and Downlink messages.
- Complete Data Link recording (see section 4.3).

5.2 HOST RESPONSE TIME

The response time for controller and supervisory-entered Data Link messages shall be as defined in NAS-MD-318, section 1.3 and table 3-1, for flight data input. In addition, the response time for input Data Link messages (e.g., time between a downlink entry and its display) shall be as defined in NAS-MD-318, section 1.3 and table 3-1, for inputs from remote sources.

LIST OF REFERENCES

1. Talotta, et al, September 1989, *Operational Evaluation of Initial Data Link Air Traffic Control Services*, DOT/FAA/CT-90/1.1, Atlantic City Airport, NJ.
2. Liggan, M. E., September 1989, *Communication Requirements Specification for Initial Data Link ATC Applications*, MITRE WP-89W00337, McLean, VA.
3. FAA, Computer Program Functional Specification, 30 September 1988, *NAS-MD-311, Message Entry and Checking*.
4. FAA, Computer Program Functional Specification, 30 September 1988, *NAS-MD-318 Performance Criteria*.
5. FAA, Computer Program Functional Specification, 30 September 1988, *NAS-MD-325, Software Design Requirements*.
6. FAA, NASP-9247-H02, 30 September 1988, *Data Analysis and Reduction Tool (DART) User's Manual*.
7. FAA, Computer Program Functional Specification, 30 September 1988, *NAS-MD-317, Monitor*.
8. FAA, Computer Program Functional Specification, 30 September 1988, *NAS-MD-315, Remote Outputs*.

APPENDIXES

Appendices A through D provide operationally-oriented information to illustrate Data Link capabilities from the controller viewpoint. The examples provided in the appendices are not meant to specify a final design, but only to show examples of how Data Link might work in an operational environment. Familiarity with current ATC procedures is necessary for comprehending the appendices. Each Data Link service is discussed in a separate appendix as follows:

- Appendix A - Transfer of Communication Uplink
- Appendix B - Assigned and Interim Altitude Uplink
- Appendix C - Communications Backup Uplink
- Appendix D - Communications Backup Downlink

In addition, Appendix E is provided to specify the processing requirements for clearing Full Data Block displays at the sending sector after Transfer of Communications.

APPENDIX A

TRANSFER OF COMMUNICATION UPLINK

This appendix contains information describing the Transfer of Communication (TOC) service. The following information is provided:

1. Full Data Block display.
2. Controller inputs to build and send a TOC message.

The transfer of an aircraft from one sector to another will consist of a two step process. The first is the handoff of track control, and the second is the transfer of data link eligibility and voice communication.

The normal procedure for transferring control begins with the sending sector handing off the aircraft to the receiving sector. When the receiving sector acknowledges receipt of the aircraft, track control will be given to the receiving sector. At the same time, a Data Link Transfer of Communication message will be generated at the sending sector. This message will be placed in a HELD status, ready for uplinking at the discretion of the sending controller.

When the sending sector has finished communicating with the aircraft, the controller will make a Category Function or Quick Action Key (QAK) input to uplink the Transfer of Communication message; this message will instruct the pilot to switch to the receiving sector's frequency. Upon a positive response from the pilot (WILCO or ROGER), Data Link eligibility will be assigned to the sector with track control. The pilot will then change the aircraft's radio to the receiving sector's frequency.

The following sections describe the changes in the Full Data Block display, and controller inputs to build and send a Transfer of Communication message.

A.1 FULL DATA BLOCK DISPLAY

Transfer of Communication status information will be presented in the first line of the Full Data Block. A symbol preceding the Aircraft ID (AID) will denote that an aircraft has Data Link capability.

Three different symbols are required to describe the Data Link communication status of a Data Link-equipped aircraft:

- a) Σ Sector has Data Link eligibility.

- b) ◇ Sector does not have Data Link eligibility.
- c) ↑ A TOC uplink was sent, but a WILCO response not yet received.

Figure A-1 illustrates an example of the events, inputs, and Full Data Block displays associated with the TOC.

A.2 CONTROLLER INPUTS

To build and send a Transfer of Communication uplink, two options will be available to the controller, as described below.

A.2.1 Handoff of Track Control Separate from Data Link Eligibility

When a sector hands off track control, Data Link eligibility would normally remain at the sector (except as described in A.2.2). A sector can have Data Link eligibility without having track control.

When a sector has transferred track control (by entering the sector number and FLID), but still has Data Link eligibility, that sector will only be able to uplink a TOC message to the aircraft. All other Data Link transactions will be rejected, except an interim altitude Z Menu Text message, as described in Appendix B. This is done to accommodate a special handoff practice used in some Air Route Traffic Control Centers (ARTCCs). An interim altitude Z Menu Text message may be sent only when the TOC message is in a HELD or FAIL status. No Data Link actions may be taken when a TOC message is in a SENT or DELIVERED status.

The TOC uplink message will be built when the handoff entry is made and will be placed in a HELD status to be uplinked at the sending sector's discretion. The TOC message will contain the frequency of the receiving sector, the ID of the ATC facility to be contacted and altimeter setting data, if appropriate for the aircraft's altitude. To send the TOC message, the controller will either select the DL category/function key, followed by TC and the FLID, or trackball the TOC message in the Status List display.

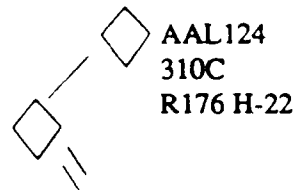
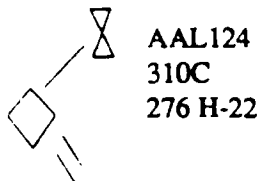
A.2.2 Handoff of Track Control and Data Link Eligibility Simultaneously

If a sector chooses to hand off track control and Data Link eligibility together, the sending controller will add the character S to the normal initiate handoff entry. To do this, the controller would enter the sector number, S, and the FLID. When the receiving sector accepts the handoff, a Data Link TOC message will be built and uplinked to the aircraft. Data Link eligibility will be given to the receiving sector upon receipt of the pilot WILCO. If a pilot WILCO is not received, the Data Link eligibility will remain at the sending sector.

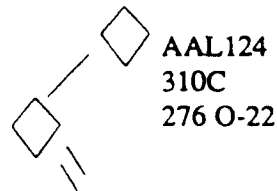
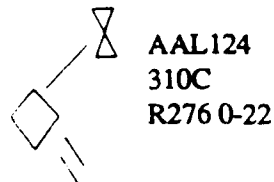
TRANSFERRING SECTOR

RECEIVING SECTOR

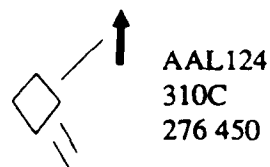
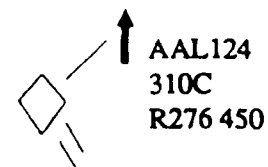
1. The aircraft approaches the sector boundary and handoff is offered.



2. Handoff is accepted.

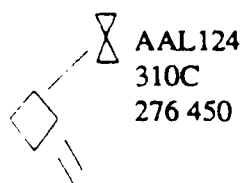
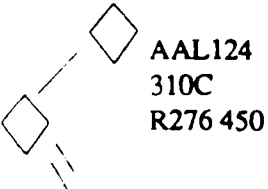


3. TOC message is sent.



The next event is 4a or 4b.

- 4a. TOC message is acknowledged by the pilot.



- 4b. A TOC message failure has occurred (i.e., negative technical acknowledgment, lack of pilot response, or pilot UNABLE response).

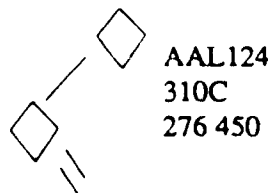
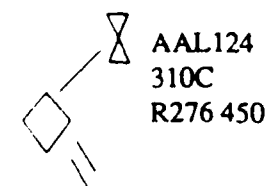


Figure A-1. Transfer of Communication Sequence of Events
and Full Data Block Display

APPENDIX B

ASSIGNED AND INTERIM ALTITUDE UPLINK

This appendix contains information describing the Altitude Assignment Data Link service for both assigned and interim altitudes. The following information is provided:

1. Full Data Block display.
2. Controller inputs to build and send an assigned or interim altitude uplinks.
3. Resending or deleting an assigned or interim altitude uplinks.
4. Interim altitude Menu Text.
5. Special case interim altitude Menu Text.

An assigned or interim altitude will be uplinked to an aircraft by entering a single character (e.g., S) in addition to the normal keyboard entry. The use of this character allows the controller to uplink an altitude clearance to an aircraft, as well as update the Full Data Block, by making a single keyboard entry (QQ or QZ). Thus, with the addition of an S in the controller entry, the use of voice for altitude clearances is eliminated.

The following sections describe the changes in the Full Data block display, and controller inputs to build, send, resend, and delete assigned or interim altitude uplinks.

B.1 FULL DATA BLOCK DISPLAY

The Full Data Block display will include the uplinked altitude and Data Link status information. Figure B-1 shows an example of the events and Full Data Block displays during an assigned or interim altitude uplink. As indicated in the figure, the uplinked altitude and message status will timeshare with the currently assigned or interim altitude, conformance indicator, and Mode C reported altitude in the second line of the Full Data Block.

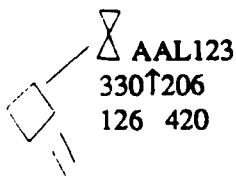
The following indicators are used to denote the Data Link message status:

S = Message SENT

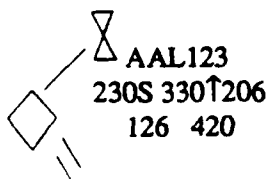
W = Message WILCOed

FAIL = Communications failure, no pilot response, or pilot UNABLE

1. Climbing aircraft; descending is similar.

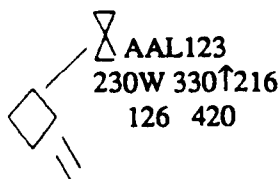


2. Message sent; uplinked altitude and status message timeshare with the currently displayed altitude and conformance indicator.



The next event is 3a or 3b.

- 3a. Message WILCOed; uplinked altitude and message status timeshare with the currently displayed altitude and conformance indicator for a specified time period.



- 3b. Message failed; the uplinked altitude with FAIL, indicating communications failure, no pilot reply, or pilot UNABLE, timeshare with the currently displayed altitude, conformance indicator, and Mode C reported altitude.

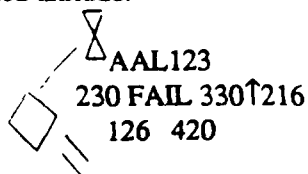


Figure B-1. Assigned or Interim Altitude Uplink Sequence of Events and Full Data Block Displays

If the message is WILCOed by the pilot (step 3a in figure B-1), the uplinked altitude and a W will timeshare with the old altitude and associated conformance indicator (if applicable) for a specified time (section 2.6), after which the old altitude will be replaced by the uplinked altitude.

If the message fails (step 3b in figure B-1), the uplinked altitude and the word FAIL will timeshare with the old assigned altitude, conformance indicator, and Mode C reported altitude and continue to do so until the controller takes an action to delete the FAIL.

B.2 CONTROLLER INPUTS

The following are examples of controller entries for uplinking assigned or interim altitudes:

QZ 240 S FLID	uplink the assigned altitude, and update the NAS database and Full Data Block upon receiving a pilot WILCO or ROGER.
QQ 240 S FLID	uplink the interim altitude, and update the Full Data Block upon receiving a pilot WILCO or ROGER.
QZ 240 FLID	do not uplink the assigned altitude; update the NAS database and Full Data Block upon receiving a pilot WILCO or ROGER.
QQ 240 FLID	do not uplink the interim altitude; update the Full Data Block upon receiving a pilot WILCO or ROGER.
QQ A FLID	uplink a Menu Text, and update the Full Data Block if so indicated by the menu item.
QQ A 240 FLID	uplink a Menu Text with 240 as the interim altitude, and update the Full Data Block upon receiving a pilot WILCO or ROGER, if so indicated by the menu item.

Where:	QZ	indicates assigned altitude Quick Action Key (QAK)
	QQ	indicates interim altitude QAK
	240	is the assigned or interim altitude
	S	indicates that the uplinking of the altitude is requested by the controller
	FLID	identifies the track; any of the following may be used: the aircraft ID, flight ID, computer ID, or trackball coordinates.
	A	indicates the Menu Text item.

B.3 RESENDING OR DELETING AN ASSIGNED OR INTERIM ALTITUDE MESSAGE

To delete the FAIL from the Full Data Block, the controller may retry uplinking the message to the aircraft. This would require re-entering the inputs as described above using the S. Alternatively, the controller may trackball to the respective line in the Status List and press a trackball enter. Also, if the controller chooses to contact the aircraft via voice, he may enter the assigned altitude again without the S. Additionally, the controller has the option to delete the data link message by selecting the DL function key, entering a D, and the flight identification (FLID).

B.4 INTERIM ALTITUDE MENU TEXT

An alternative method of sending an interim altitude is through the use of the Menu Text function. The interim altitude uplink via Menu Text will also give the controller the ability to either update the Full Data Block with the uplinked interim altitude, or uplink the interim altitude without Full Data Block update. A Memo Text entry with a blank altitude field (item E in the example below) will provide the controller with the capability to initially define (and subsequently change) the interim altitude value. In the example below, only the items indicated by the * will update the Full Data Block.

MENU TEXT

.A	*	MAIN FL230
.B		MAIN FL230
.C	*	X HOLTS AND MAIN FL270
.D		X HOLTS AND MAIN FL270
.E	*	X HOLTS AND MAIN FL__

B.5 SPECIAL CASES OF INTERIM ALTITUDE MENU TEXT

Two special cases of the interim altitude Menu Text have been developed to make the controller job easier when using Data Link. The letters "R" and "Z" have been reserved for these special cases and may not be used for other Menu Text entries.

The first case is the R Menu Text entry. This will allow a controller to uplink an aircraft's requested (assigned) altitude, if the controller has Data Link eligibility. It may be used when a climbing aircraft has an interim altitude displayed in the Full Data Block and the controller wants to clear the aircraft to its requested altitude. The use of the R Menu Text will uplink the aircraft's requested altitude, and in addition, will clear the interim altitude from the Full Data Block and replace it with

the assigned altitude upon a WILCO from the pilot. Also, this action will not update the NAS database or cause flight strips to be printed throughout the facility since the assigned altitude has not changed.

The other special interim altitude Menu Text is the Z entry. The Z will allow the controller to uplink the altitude currently displayed in the Full Data Block to an aircraft. This input would be as follows:

QQ Z FLID

If 250 is displayed in the Full Data Block, this action will uplink 250 to the aircraft. Additionally, this is the only message (except the TOC message) that can be uplinked to the aircraft after track control has been handed off to the next sector. This capability will be used when track control has been handed off to another sector and that sector has asked the sector with Data Link eligibility to clear an aircraft to a certain altitude. The controller at the sector having track control will update the Full Data Block with the new altitude, after which the controller at the sector having Data Link eligibility will uplink the altitude to the aircraft.

APPENDIX C

COMMUNICATIONS BACKUP UPLINK

This appendix contains information describing the Communications Backup Uplink service. The following information is provided:

1. Composing and sending a Communications Backup Uplink message.
2. Data Link Status List.

A Communications Backup Uplink capability will allow the controller to continue communicating with Data Link-equipped aircraft in the event of radio failure. The controller will compose and uplink unformatted text messages in real-time, thereby using a backup channel that supplements voice transmissions.

C.1 COMPOSING AND SENDING A COMMUNICATIONS BACKUP UPLINK MESSAGE

By using the keyboard, the controller will compose unformatted text messages, which will be displayed on the Computer Readout Display. To compose and uplink the message to a Data Link-equipped aircraft for which the sector has Data Link eligibility, the controller will take the following actions:

1. Press the DL Category Function key
2. Enter the letter T
3. Enter the text message
4. Enter the flight identification (FLID), or optionally the word ALL

The ALL option will cause the message to be sent to all Data Link-equipped aircraft for which the sector has Data Link eligibility.

C.2 DATA LINK STATUS LIST

The Data Link Status List will display the status information for each outstanding Communications Backup Uplink message. The message will remain in the Status List display for a specified time (section 2.6) after receiving the pilot WILCO.

APPENDIX D

COMMUNICATIONS BACKUP DOWNLINK

This appendix contains information describing the Communications Backup Downlink capability. The following information is provided:

1. Receiving a Communications Backup Downlink message
2. Controller Acknowledgment
3. Message Format

The Communications Backup Downlink capability will allow the pilot of a Data Link-equipped aircraft to compose and downlink text messages in real-time, thereby providing a communications channel that supplements today's voice transmissions.

D.1 RECEIVING COMMUNICATIONS BACKUP DOWNLINK MESSAGE

The Communications Backup Downlink message, upon its acceptance by the Host, will be routed to the sector that has Data Link eligibility for that aircraft. At the D-Controller position, an audible alarm will be activated to alert the controller to an awaiting downlink message. This message will also be printed on the Flight Strip Printer.

D.2 CONTROLLER ACKNOWLEDGEMENT

To display the downlinked message, the D-Controller will make a keyboard entry. This entry will also automatically generate an acknowledgment message to be uplinked to the aircraft that originally sent the message.

D.3 MESSAGE FORMAT

The Communications Backup Downlink message will be displayed on the D-Controller upon a controller acknowledgment, and will contain the aircraft identification, reference number, time of message receipt in hours and minutes, and text. For example:

UAL123 01 1201 NO RADIO, DATA LINK COMM ONLY

APPENDIX E

FULL DATA BLOCK DISPLAY CLEAR AFTER TRANSFER OF COMMUNICATIONS

This appendix contains the processing requirements for clearing Full Data Block (FDB) displays at the sending sector after Transfer of Communications (TOC). The relationship of display timing parameters is included.

E.1 TIMING PARAMETER RELATIONSHIPS

The three display timing parameters involved in Data Link Transfer of Communications are described as follows:

- **FDB Drop Interval** - This parameter, used in the current system, defines the time interval to continue displaying an FDB at the sending sector after track control has been accepted at another sector (herein referred to as a Handoff). This time interval begins when a Handoff is accepted.
- **FDB Timeout After TOC** - This parameter, described in section 2.6.4, defines the time interval, after receiving a downlinked WILCO/ROGER response to a Transfer of Communication uplink, to continue displaying the FDB at the sending sector.
- **WILCO/ROGER Clear Time** - This parameter, described in section 2.6.1, defines the time interval, after receiving a downlinked WILCO/ROGER for any service, to wait before clearing the transaction from the status list and FDB displays at all sectors.

Figure E-1 illustrates the timing relationship of these parameters. The "FDB Drop Interval" begins when a Handoff Accept action is processed to transfer track control to a new sector. In the current system, when the time indicated by "FDB Drop" occurs, the FDB ceases display at the sending sector.

As the figure illustrates, a TOC begins at Handoff Accept when a TOC message is built and set to the HELD state, or is SENT to the aircraft. The message can be SENT automatically at the time of Handoff Accept, if the Action Indicator "S" were used by the initiating sector, or the HELD message can be SENT manually and thus some time after the Handoff Accept action.

TIME

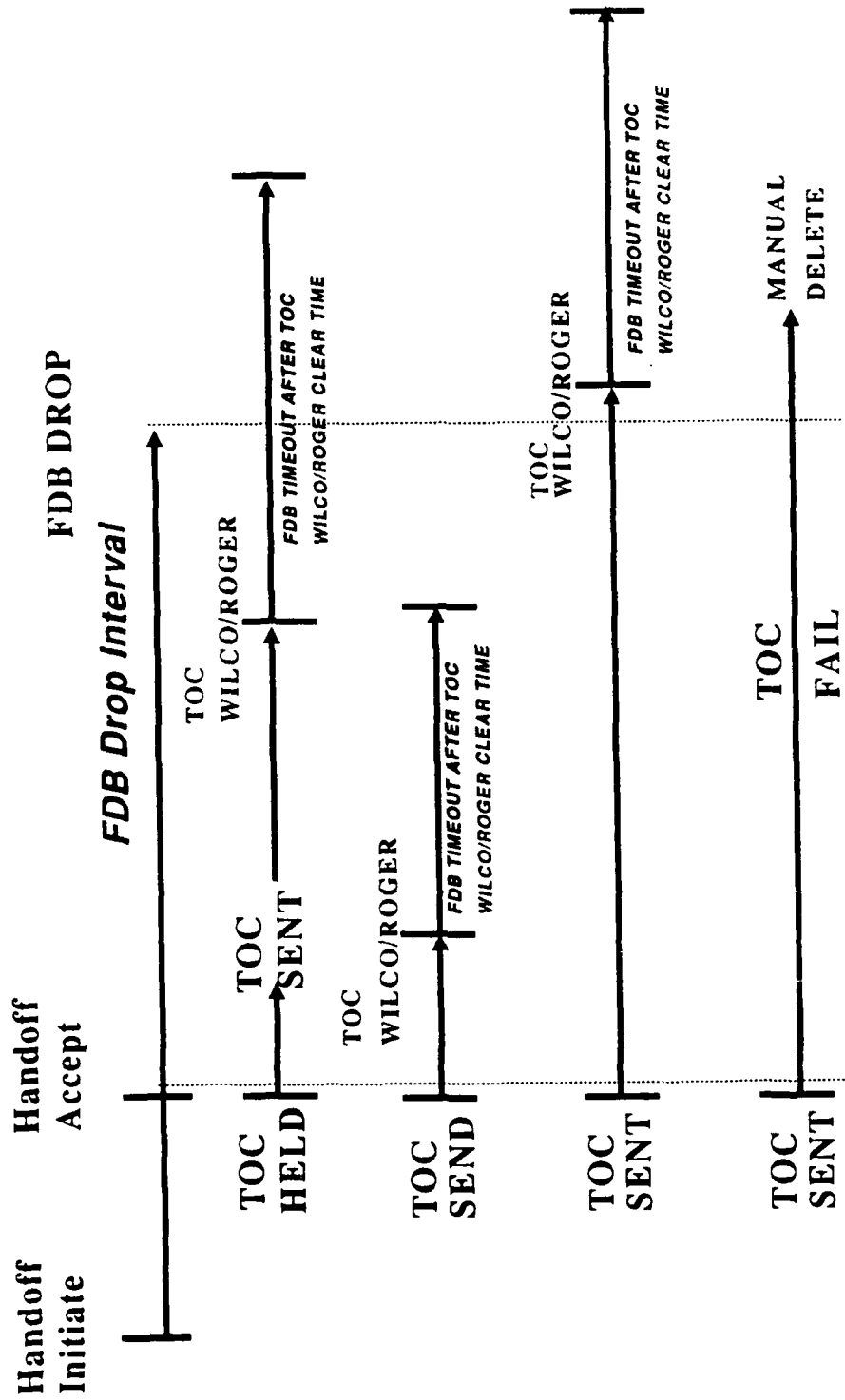


Figure E-1. Full Data Block Timing Parameter Relationship

The pilot-downlinked WILCO/ROGER response can occur either during or after the FDB Drop Interval.

When the pilot-downlinked WILCO/ROGER is received, the time intervals defined by "FDB Timeout After TOC" and by "WILCO/ROGER Clear Time" begin. The "WILCO/ROGER Clear Time" must always be set to a value equal to or less than the value of "FDB Timeout after TOC." As can be seen in figure E-1, for the time between TOC HELD or SENT and the end of the interval "FDB Timeout After TOC," controller cognizance at the sending sector is required. Therefore, the FDB shall continue to be displayed until the end of the "FDB Timeout After TOC."

If the TOC is unsuccessful, due to no response or due to a pilot-downlinked UNABLE, then the FDB display shall continue at the sending sector. A controller-entered action shall be necessary to clear the failed transaction.

E.2 PROCESSING REQUIREMENTS

To ensure that the required FDB display is present at the sending sector, the following processing is required:

- For a track that has been handed off (Handoff Accept action completed), at the end of the "FDB Drop Interval," determine if a TOC transaction exists. If one exists, continue to display the FDB at the sending sector until the expiration of the time defined by "FDB Timeout After TOC."
- For a track that has been handed off, at the end of the FDB Drop Interval, if no TOC transaction exists, determine if a WILCO/ROGER display exists (being timed out under control of the parameter "FDB Timeout After TOC"). If one exists, continue to display the FDB until the expiration of the time controlled by "FDB Timeout After TOC."
- For a track that has been handed off, at the end of the "FDB Drop Interval," if a FAIL exists for a TOC, the "FDB Timeout After TOC" will not be initiated, and the transaction shall remain active in the FAIL state until manually deleted. Continue to display the FDB until the TOC transaction is deleted.

GLOSSARY

ACES	Adaptation Controller Environment System
AID	Aircraft Identification
AS	Altimeter Setting
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATN	Aeronautical Telecommunications Network
C/F	Category Function Key
CDC	Computer Display Channel
CED	Computer Entry Device
CID	Computer Identification Number
CRD	Computer Readout Device
CS	Combine Sectors
DART	Data Analysis and Reduction Tool
DCC	Display Channel Complex
DEC	Data Entry Console
DG	Display Generator
DLP	Data Link Processor
DME	Distance Measuring Equipment
DYSIM	Dynamic Simulation of Radar Data
FAATC	Federal Aviation Administration Technical Center
FDB	Full Data Block
FLID	Flight Identification
FPA	Fix Posting Area
KVDT	Keyboard Video Display Terminal
NAS	National Airspace System
PVD	Plan View Display
QAK	Quick Action Key

SAR	System Analysis and Recording
SIM	Simulation Program
STVR	Startover
SU	Status Update
TOC	Transfer of Communication
VOR	Very High Frequency Omnidirectional Range