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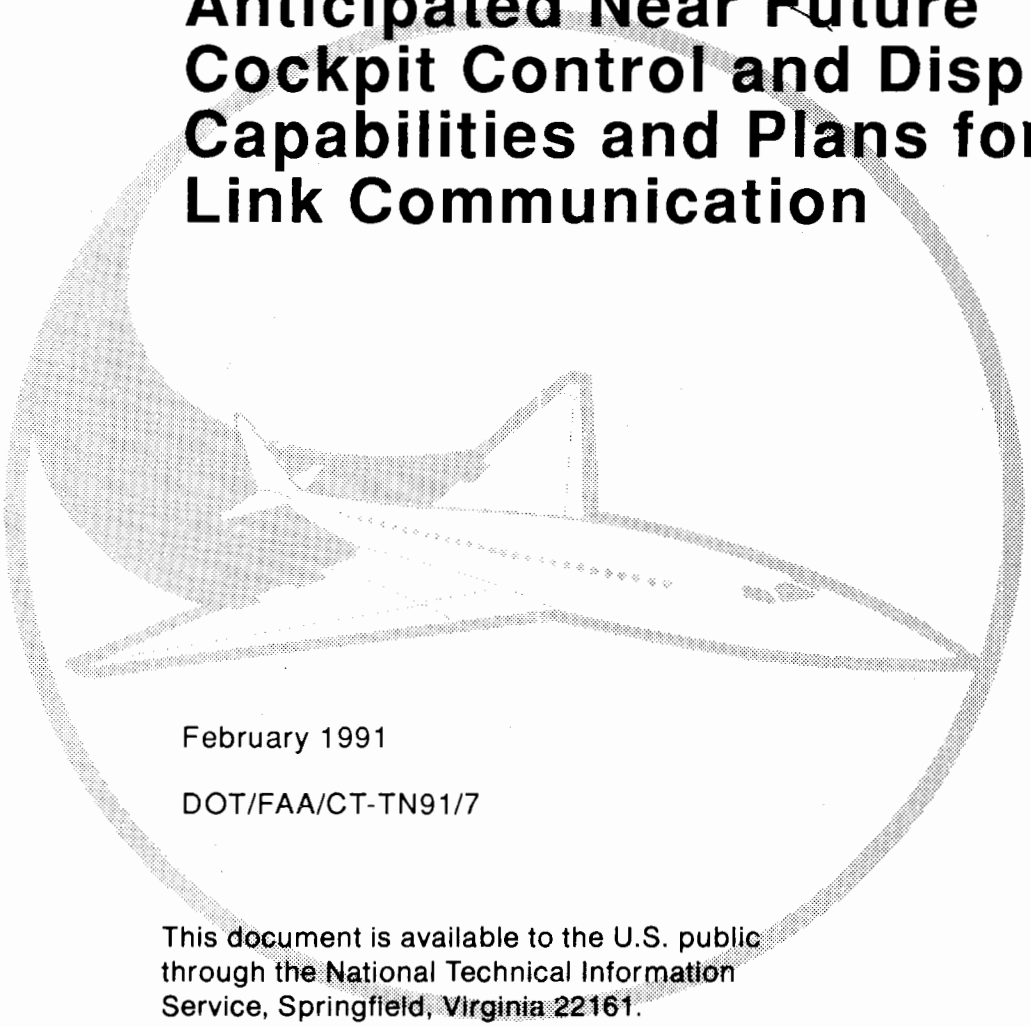
Report of Study on Airlines' Anticipated Near Future Cockpit Control and Display Capabilities and Plans for Data Link Communication



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U.S. Department of Transportation
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16. Abstract

This report reviews the findings of a study conducted by CTA Incorporated for the Federal Aviation Administration (FAA) Technical Center, Airborne Data Link Program. For each of seven airlines, the following was studied for their anticipated near future fleets: the quantity of each aircraft model; the cockpit control and display devices that would be onboard each aircraft model; which of those devices would be the primary Data Link display, and what form of annunciation would be used. These data were then compiled to determine the total studied fleet's capabilities, as well as their plans, for displaying Data Link information.

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PREFACE

This information was gathered, and is intended, for research purposes only. All of the information studied deals with the airlines' anticipation of the near future. In support of this effort, and in the interest of research, each of the studied airlines gave us their best estimates of the information herein. This study would not have been possible without such cooperation, and it should be recognized that these airlines do not commit themselves to this information.

This report is not intended to be a comparison of airlines, but a collective look at them to get an idea of what their anticipated near future control and display capabilities are, as well as their associated plans, for Data Link communication as a group.

The airline information reported in this document is based on estimates accurate up to the following dates: American Airlines, October 29, 1990; Continental Airlines, October 30, 1990; Delta Air Lines, October 22, 1990; Northwest Airlines, October 30, 1990; United Airlines, October 30, 1990; United Parcel Service, October 23, 1990; USAir, October 29, 1990.

ACKNOWLEDGEMENTS

Deserving of thanks are those individuals at the airlines who tolerated my many questions, phone calls, and facsimiles. In many cases, these individuals had to conduct research of their own just to provide me with the information I needed. Studies like this would not be possible without such cooperation. The individuals, and their associated airline, are as follows, in alphabetical order by airline: Don Dillman (American Airlines), Frank Cheshire (American Airlines), John Mitchell (Continental Airlines), Doug Twinam (Delta Air Lines), Dave Haapala (Northwest Airlines), Jon Pendleton (Northwest Airlines), Scott Stahr (United Airlines), Bob Hilb (United Parcel Service), and Don DeBlasio (USAir).

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EXECUTIVE SUMMARY

This report reviews the findings of a study conducted by CTA Incorporated for the Federal Aviation Administration (FAA) Technical Center Airborne Data Link Program. For each of seven airlines, the following was studied for their anticipated near future fleets: the quantity of each aircraft model; the cockpit control and display devices that would be onboard each aircraft model; which of those devices would be the primary Data Link display, and what form of annunciation would be used. These data were then compiled to determine the total studied fleet's capabilities, as well as their plans, for displaying Data Link information.

INTRODUCTION

PURPOSE.

In support of the FAA (Federal Aviation Administration) Technical Center Airborne Data Link Program (ACD-320), CTA Incorporated conducted a study of the airlines' anticipated near future cockpit control and display capabilities and associated plans for Data Link communication. This report reviews the findings of that study and will be used by the program as a planning reference.

BACKGROUND.

Data Link human factors research and development will become increasingly important to the FAA as Data Link communication inevitably becomes prominent in jet-transport category aircraft. Human factors issues are constantly arising as the uses for Data Link expand and the concepts and technology evolve, and these issues must be resolved for a more effective and safe Data Link system. The avionics equipment, that flight crews will interact with for Data Link communication, will have to be FAA certified. Many of the human factors issues are directly related to this equipment, and the FAA will require standards for minimum characteristics and capabilities that constitute a safe and effective piece of Data Link equipment. The FAA will also have to know what minimum capabilities will constitute a safe and effective full Data Link system design. Certain fundamental human factors principles must be inherent in any FAA advisories or mandates regarding Data Link, thus, they must be identified and defined. Human factors research must be performed as a vital step in addressing all of these Data Link communication issues.

The FAA Technical Center's Airborne Data Link Project encompasses many facets of such Data Link human factors research and development, addressing issues pertinent to both the FAA Certification Office and the airline industry. This work involves everything from the phase of researching Data Link human factors issues and concepts and carrying them all the way up, through a simulator operational evaluation phase and flight tests as necessary.

Most of the current Data Link human factors work revolves around, or at least involves, the interaction of the cockpit crew with the Data Link system to receive information (display) and to input information (control). For example, information may be displayed on a Flight Management System Control and Display Unit (FMS CDU), a weather radar screen or an Aircraft Communication Addressing and Reporting System (ACARS) screen; and information may be input via a touch sensitive screen or a keypad of some type.

There are many factors to consider when selecting control and display methods and devices for research. The selected system

should be an accurate representation of that typically used by a large portion of the industry fleet to ensure realism in the research and to make the results more useful and pertinent to a larger portion of the community. Concerns and needs of the airline industry must also be considered. For example, if the FAA's minimum requirements for Data Link control and display devices disallows an airline's existing devices, then that airline must bear the costly burden of purchasing new equipment, installation, and crew training. Therefore, any such requirements and recommendations should be as close as possible to the equipment that a large portion of the industry fleet plans to use, or has onboard, while still ensuring the safety and effectiveness of the system. This means a safe and effective Data Link system with as little financial impact as possible on the largest portion of the industry as possible.

DESCRIPTION OF STUDY

To obtain a cross section of the industry, the following seven airline companies were chosen for this particular study: American Airlines, Continental Airlines, Delta Air Lines, Northwest Airlines, United Airlines, United Parcel Service, and USAir. Most of the data gathered from the airlines was obtained via telephone conversations, facsimiles, and mail. For each of the seven airlines, the following pieces of information were studied for each of their aircraft models:

1. Name of the aircraft model (e.g., B737-300).

2. Approximation of anticipated quantity of that aircraft model for the near future. This includes the amount of the current inventory, the amount on firm order, and the amount on option which the company anticipates obtaining in the near future. Aircraft that the company anticipates phasing out in the near future are not counted.

3. List of all displays that the company anticipates being on that aircraft model in the near future (FMS CDU, Multi-Purpose Control and Display Unit (MCDU), Electronic Flight Instrumentation System (EFIS), ACARS, Engine Indication and Crew Alerting System (EICAS), weather radar, dedicated, navigation, etc.). Of those, which is the anticipated primary Data Link display and input method (keypad, touch sensitive screen, etc.).

4. The method which the company anticipates annunciating a message visually and aurally (if it has been determined) for that aircraft model.

This information for each of the airlines was individually summarized and tabulated. The following graphs and tables were then formed by compiling the statistics from the individual airlines:

1. A breakdown of the aircraft models that compose the studied fleet.

2. A cross matrix of aircraft models by cockpit display types indicating the percentage of the total studied fleet that will have a particular display type onboard a particular aircraft model.

3. A cross matrix of aircraft models by cockpit display types indicating the percentage of each aircraft model that will have a particular display type onboard.

4. A cross matrix of aircraft models by cockpit display types indicating the percentage of the total studied fleet that will have a particular display type as the primary Data Link display on a particular aircraft model.

5. A cross matrix of aircraft models by cockpit display types indicating the percentage of each aircraft model that the fleet will have a particular display type as the primary Data Link display.

REVIEW OF FINDINGS

GENERAL DISCUSSION.

There are several points that must be kept in mind while viewing the results of this study. All references to the quantities of aircraft are for the near future (within several years from now). Because they are for the future, some figures are estimates as opposed to guaranteed exact figures for what the future will hold. The lists of display capabilities (displays onboard) account for cockpit modifications that will be performed within the near future. Where airlines indicate the display, input method, and annunciation they anticipate using as their primary Data Link system, it is the system that they are currently considering and it is not a firm commitment. In order to help conceal information which may be considered sensitive by the airlines, all numbers are represented as percentages; i.e., the percentage of an airline's fleet, the percentage of the total studied fleet, or the percentage of a single aircraft type of the total studied fleet. Also, any numbers involving the entire studied fleet do not include the fleet of Delta Air Lines (see the "Delta Air Lines" subsection of the "Airline Specific Information" section for this explanation). In all of the tables and charts, the description of the displays is abbreviated to save space. The abbreviations are defined as follows:

1. "Wx Radar" represents weather radar.

2. "EFIS" represents Electronic Flight Instrumentation System.

3. "CDU/MCDU" represents the grouping of FMS CDU and MCDU.

4. "ACARS-IDU" represents ACARS Interactive Display Unit (IDU) units which have a touch sensitive screen.

5. "ACARS-sngl" represents ACARS units with a keypad for input and a screen capable of displaying only a single, or two, lines of text.

6. "ACARS-keys" represents ACARS units with a keypad for input but have a full screen, typically capable of displaying at least eight lines of text with 16 characters per line.

7. "EICAS" represents Engine Indication and Crew Alerting System.

8. "dedicated" represents CDU's that are dedicated to Data Link communication and are not used for onboard systems like an FMS CDU is.

9. "nav." or "navigation" represents navigation displays such as an Omega.

FLEET COMPOSITION.

Figure 1 illustrates the aircraft models that compose the studied fleet and the portion of the fleet each represents.

FLEET CONTROL and DISPLAY CAPABILITIES.

This section reviews the total studied fleet's display devices and their associated input methods and devices. Figure 2 is a summary of the percentage of the fleet that will have each of the specified displays onboard in the near future. These numbers reflect the actual physical display devices as opposed to the functions of different displays. For example, as seen in figure 2, 66 percent of the fleet have weather radar displays. This does not mean that only 66 percent have the weather radar function -- it means that 66 percent of the fleet have a weather radar display device, and in the remaining 34 percent of the fleet, weather radar is a function of some other display device. Therefore, in these cases it is the other display on which weather radar is a function, such as EFIS, that is counted and not the weather radar display.

Table 1 is a cross matrix of aircraft models, by display types, indicating the percentage of the studied fleet that are combinations of particular aircraft models that will have a particular display type onboard in the near future. For example, 2.16 percent of the total studied fleet are B767-200's that have, or will have in the near future, an EFIS display onboard. The last row of this table indicates the total percent of all aircraft models, of the studied fleet, having the specified type of display onboard. This table also indicates a relative comparison of aircraft models that will have a particular display type onboard.

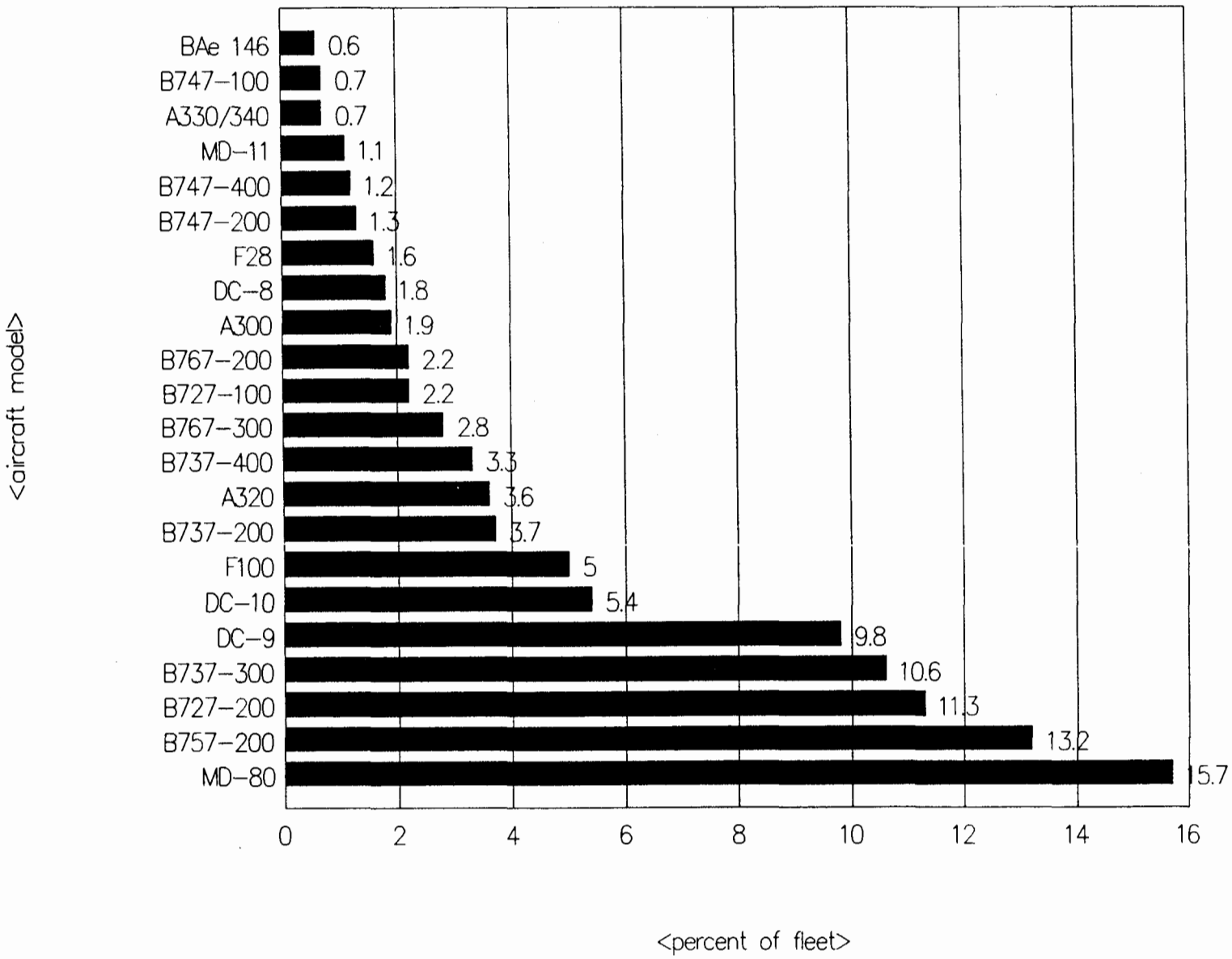

FIGURE 1. COMPOSITION OF STUDIED FLEET

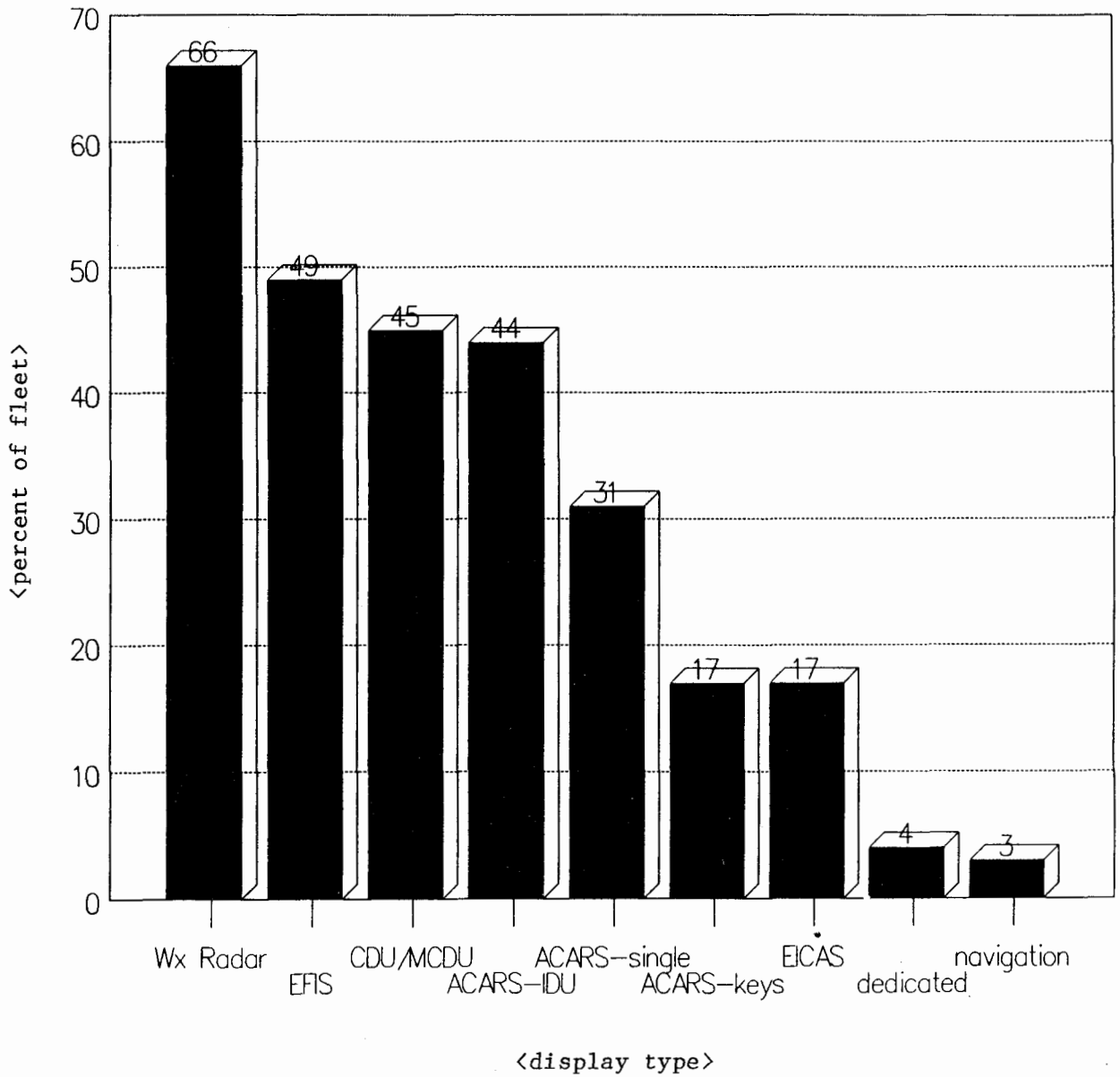

FIGURE 2. DISPLAY CAPABILITY OVER TOTAL FLEET

TABLE 1. DISPLAY CAPABILITY SUMMARY - TOTAL FLEET*

Aircraft Model	Wx Radar	EFIS	CDU/ MCDU	ACARS IDU	ACARS sngl	ACARS keys	EICAS	dedi-cated	nav.
B727-100	0.83%	1.40%		1.40%	0.50%	0.32%			1.40%
B727-200	11.3%			3.20%	5.86%	2.23%		2.63%	
B737-200	3.71%			2.30%	1.40%				
B737-300	10.6%	4.97%	10.6%	8.64%	1.98%				
B737-400	1.55%	1.80%	3.35%	3.35%					
B747-100	0.68%			0.25%	0.07%	0.36%			0.25%
B747-200	1.33%				0.25%	1.08%			
B747-400	0.54%	1.19%	1.19%	0.54%			1.19%		
B757-200	7.66%	13.4%	13.4%	6.48%		4.68%	8.74%		
B767-200	1.08%	2.16%	2.16%	1.08%	1.08%		1.08%		
B767-300	1.15%	2.77%	2.77%	1.15%	1.62%		1.15%		
DC-8		1.76%		1.76%					1.76%
DC-9	9.79%			2.66%	1.26%	5.86%			
DC-10	5.36%			1.65%	2.66%	1.04%		1.65%	
MD-11		1.08%	1.08%						
MD-80	7.66%	8.02%		1.83%	13.6%	0.29%			
A300	0.61%	1.33%	1.33%		0.61%	1.33%			
A320		3.60%	3.60%				3.60%		
A330/340		0.72%	0.72%	0.72%					
F100		5.04%	5.04%	5.04%			1.44%		
F28	1.62%			1.62%					
BAe 146	0.65%			0.65%					
TOTAL	66%	49%	45%	44%	31%	17%	17%	4%	3%

* Note: These numbers are the percentages of the total number of aircraft in the studied fleet - includes all the aircraft models in the fleet.

For example, there will be twice as many B737-200's than B767-300's that will have an ACARS-IDU display onboard. Additionally, of all the aircraft models that will have a CDU/MCDU onboard, B757-200's represent approximately 30 percent of them (13.4 / 45 = .2977). Figure 2, previously discussed, is a summary of table 1, as seen in the bottom row of table 1.

Table 2 is a cross matrix of aircraft models, by display types, indicating the percentage of each specified aircraft model that will have a particular display type onboard in the near future. For example, of all the B737-200's in the study: 100 percent will have a weather radar display, 62 percent will have an ACARS-IDU display, and 38 percent will have a single line ACARS display.

FLEET PRIMARY DATA LINK CONTROL and DISPLAY DEVICES.

This section reviews the studied fleet's anticipated primary Data Link displays. There may be more than one display on an aircraft that will display Data Link-related information. The interest here, however, is in the display that the flight crew will interact with the most to send and receive information such as air traffic control (ATC) services and weather services, and not information such as gate assignments and connecting flight information. For example, an airline may anticipate using an EICAS for visual annunciation of Data Link messages, an ACARS-IDU for company information, and a CDU/MCDU as the primary Data Link device. In cases where an airline uses a specific display type to receive Data Link messages and a different display type to send Data Link messages or responses, the display for receiving messages is counted as the primary Data Link display. Figure 3 summarizes the portions of the studied fleet that anticipate using each of the different display types as its primary Data Link display. When discussing primary Data Link displays, ACARS units with single line displays and EICAS are not mentioned after this point because 0 percent of fleet anticipates using them as a primary Data Link display.

Table 3 is a cross matrix of aircraft models by display types indicating the percentage of the studied fleet that will have a particular display type as the primary Data Link display on a particular aircraft model. For example, 1.15 percent of the total studied fleet are B767-300's that will have a CDU/MCDU as the primary Data Link display. The last row of this table indicates the total percent of all aircraft models of the studied fleet that will have the specified type of display as the primary Data Link display. This table also indicates a relative comparison of aircraft models that will use a particular display type as the primary Data Link display. For example, there will be approximately four times as many F28's than B767-200's that will have an ACARS-IDU display as the primary Data Link display. Additionally, of all the aircraft models that will have a CDU/MCDU as the primary Data Link display, B737-300's represent

TABLE 2. DISPLAY CAPABILITY SUMMARY - AIRCRAFT MODEL*

Aircraft Model	Wx Radar	EFIS	CDU/ MCDU	ACARS IDU	ACARS sngl	ACARS keys	EICAS	dedi- cated	nav.
B727-100	37%	63%		63%	23%	14%			63%
B727-200	100%			28%	52%	20%		23%	
B737-200	100%			62%	38%				
B737-300	100%	47%	100%	81%	19%				
B737-400	46%	54%	100%	100%					
B747-100	100%			37%	10%	53%			37%
B747-200	100%				19%	81%			
B747-400	45%	100%	100%	45%			100%		
B757-200	57%	100%	100%	48%		35%	65%		
B767-200	50%	100%	100%	50%	50%		50%		
B767-300	42%	100%	100%	42%	58%		42%		
DC-8		100%		100%					100%
DC-9	100%			27%	13%	60%			
DC-10	100%			31%	50%	19%		31%	
MD-11		100%	100%						
MD-80	49%	51%		12%	86%	2%			
A300	31%	68%	68%		31%	68%			
A320		100%	100%				100%		
A330/340		100%	100%	100%					
F100		100%	100%	100%			29%		
F28	100%			100%					
BAe 146	100%			100%					

* Note: These numbers are the percentages of the total number of aircraft in the studied fleet of the particular aircraft model.

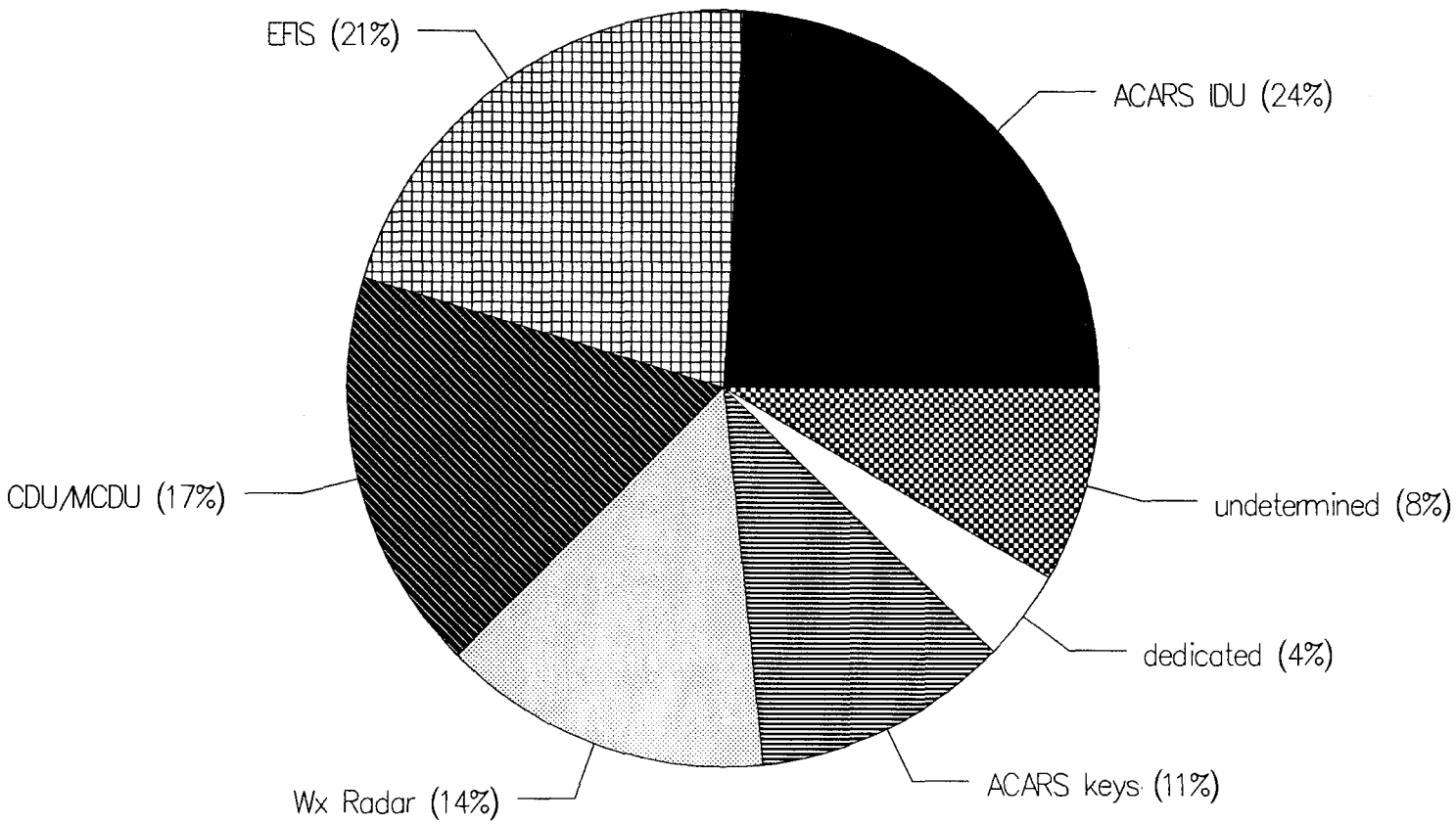

FIGURE 3. PRIMARY DATA LINK DISPLAY OVER TOTAL FLEET

TABLE 3. PRIMARY DATA LINK DISPLAY SUMMARY - TOTAL FLEET*

Aircraft Model	ACARS IDU	EFIS	CDU/ MCDU	Wx Radar	ACARS keys	dedi- cated	undeter -mined
B727-100	1.40%			0.50%	0.32%		
B727-200	0.58%			3.20%	2.23%	2.63%	2.66%
B737-200	2.30%			1.40%			
B737-300	3.67%		4.97%	1.98%			
B737-400	3.35%						
B747-100	0.25%			0.07%	0.36%		
B747-200				0.25%	1.08%		
B747-400			1.19%				
B757-200	1.08%	4.68%	5.40%	2.27%			
B767-200	0.40%	1.08%	0.68%				
B767-300		1.62%	1.15%				
DC-8	1.76%						
DC-9	2.66%			1.26%	5.86%		
DC-10				0.54%	1.04%	1.65%	2.12%
MD-11		1.08%					
MD-80	1.83%	8.02%		2.34%	0.29%		3.20%
A300		1.33%		0.61%			
A320			3.60%				
A330/340	0.72%						
F100	1.44%	3.60%					
F28	1.62%						
BAe 146	0.65%						
TOTAL	24%	21%	17%	14%	11%	4%	8%

* Note: These numbers are the percentages of the total number of aircraft in the studied fleet - includes all the aircraft models in the fleet.

approximately 29 percent of them (4.97 / 17 = .2923). The statistics illustrated in figure 3 are a summation of the data in table 3 and were taken from the bottom row of that table.

Table 4 is a cross matrix of aircraft models by display types, indicating the percentage of each specified aircraft model that will have a particular display type as the primary Data Link display. For example, of all the B737-200's in the study, 62 percent will have an ACARS-IDU as the primary Data Link display and 38 percent will have a weather radar display as the primary Data Link display.

AIRLINE SPECIFIC INFORMATION.

The tables in the appendix contain the data that were used to calculate all of the statistics in tables 1 through 7 and figures 1 through 3 of this report. There is a table for each of the airlines studied. The first page of the appendix illustrates the form that was used to record each airline's data, and describes each field of the table. Following that is the table for each of the airlines, ordered alphabetically. The tables may indicate duplicate displays onboard an aircraft which would be represented by the quantity of that display in parentheses following the name of the display type. For example, if an aircraft has two FMS CDU's, it would be shown as FMS CDU(2). In these cases, they are not counted more than once for the statistics.

This section contains a subsection for each of the airlines which discusses any notable airline specific information. Much of the information discussed here can also be seen in the tables of the appendix.

Table 5 summarizes the percentages of each airline's fleet that will use the different display types as the primary Data Link displays. For example, as seen in table 5, of United Airlines total fleet, 75 percent will use a CDU/MCDU display as the primary Data Link display, and 25 percent will use a dedicated display as the primary Data Link display.

AMERICAN AIRLINES. American Airlines is currently considering using an EFIS display as the primary Data Link display for most of their fleet. They have not yet determined what device or method the flight crew will use to input information into the system.

CONTINENTAL AIRLINES. For most of its fleet, Continental Airlines anticipates using a weather radar to display received messages and an ACARS-single device for the crew to input and send messages.

DELTA AIR LINES. As seen in the table in the appendix, Delta Air Lines responded with a comment instead of data. Regarding information such as the types of displays that will be in their aircraft in the near future and which of those will be used as primary Data Link displays, their response is "There are not enough

TABLE 4. PRIMARY DATA LINK DISPLAY SUMMARY - AIRCRAFT MODEL*

Aircraft Model	ACARS IDU	EFIS	CDU/ MCDU	Wx Radar	ACARS keys	dedi- cated	undeter -mined
B727-100	63%			23%	14%		
B727-200	5%			28%	20%	23%	24%
B737-200	62%			38%			
B737-300	35%		47%	19%			
B737-400	100%						
B747-100	37%			10%	53%		
B747-200				19%	81%		
B747-400			100%				
B757-200	8%	35%	40%	17%			
B767-200	18%	50%	32%				
B767-300		58%	42%				
DC-8	100%						
DC-9	27%			13%	60%		
DC-10				10%	19%	31%	40%
MD-11		100%					
MD-80	12%	51%		15%	2%		20%
A300		68%		31%			
A320			100%				
A330/340	100%						
F100	29%	71%					
F28	100%						
BAe 146	100%						

* Note: These numbers are the percentages of the total number of aircraft in the studied fleet of the particular aircraft model.

TABLE 5. PRIMARY DATA LINK DISPLAY SUMMARY - AIRLINE

Airline Name	ACARS IDU	EFIS	CDU/ MCDU	Wx Radar	ACARS keys	dedi- cated	undeter -mined
American		73%					27%
Continental	17%			83%			
Delta							
Northwest			24%	13%	63%		
United			75%			25%	
UPS	100%						
USAir	100%						

* Note: These numbers are the percentages of the total number of aircraft in the particular airline's fleet - includes all the aircraft models in each fleet.

FAA requirements regarding Data Link yet for Delta Air Lines to be able to determine this information." Even though they offered no statistical data, they were not excluded from the report because their comment was sincere, representing a legitimate position, and will therefore be recognized.

NORTHWEST AIRLINES. Northwest Airlines anticipates using an ACARS-keys unit as the primary Data Link display for most of their fleet. As the primary Data Link display for 13 percent of their fleet, they anticipate using a weather radar unit that is also used as an ACARS unit with a keypad.

UNITED AIRLINES. United Airlines anticipates using a CDU/MCDU as the primary Data Link display for most of their fleet. For 25 percent of their fleet, they anticipate using a dedicated smart CDU as their primary Data Link display. This CDU is different than an FMS CDU or MCDU because it will be dedicated to Data Link communication and would not be used for typical onboard systems such as the Flight Management Computer (FMC).

UNITED PARCEL SERVICE. United Parcel Service anticipates using an ACARS-IDU display as the primary Data Link display for 100 percent of their fleet.

USAIR. USAir anticipates using an ACARS-IDU as the primary Data Link display for 100 percent of their fleet.

DATA ANALYSIS

The FAA Technical Center Airborne Data Link Program plans to select two displays for its research that would reflect a cross section of the airline industry's plans for a primary Data Link display. Once the displays are selected, the Data Link Program wants to ensure the element of realism regarding the aircraft simulators that will be used in its evaluations. The simulators should be of aircraft models that will be equipped with the particular displays under test. For example, based on the studied fleet, it would not be realistic for the program to do an evaluation using an EFIS as the primary Data Link display in a B737-200 cockpit simulator because, as seen in table 1, 0 percent of the B737-200's studied will have an EFIS onboard. As well, the placement of the display in the cockpit simulator should correspond to its location in real aircraft of the particular aircraft model. If an aircraft model normally has more than one of the display type under test, then that too should be reflected in the cockpit simulator.

As seen in figure 3, the ACARS IDU is the studied fleet's most anticipated primary Data Link display, representing 24 percent of the aircraft installations. Table 3 shows that the aircraft model that represents the largest portion of the fleet that will have an ACARS IDU as the primary Data Link display is the B737-300. The

location of the display in the cockpit was then determined. This information is summarized in table 6. The table indicates that the location of the ACARS IDU, for all of the studied airlines that will have it in a B737-300, is in the aft pedestal on the right hand side. Table 6 also indicates the make and model of the ACARS IDU for each airline and the form of annunciation if the unit is to be used as the primary Data Link display.

Figure 3 shows that EFIS is the studied fleet's second most anticipated primary Data Link display, representing 21 percent of the fleet. The airline considering this alternative has not yet determined the device or method that the flight crew will use to input information into the system.

The studied fleet's next most anticipated primary Data Link display, according to figure 3, is a CDU/MCDU representing 17 percent of the fleet. According to table 3, the B757-200 is the aircraft type that represents the largest portion of the fleet that will have an CDU/MCDU as the primary Data Link display in the near future. Table 7 summarizes the location of the CDU/MCDU in the B757-200's of the airlines that will have that configuration in the near future. As seen in this table, the standard configuration for CDU/MCDU's in a B757-200 is in the center pedestal as follows: one unit at the Captain's right knee, and one unit at the First Officer's left knee. Table 7 also indicates the make of the CDU/MCDU for each airline and the form of annunciation if the unit is to be used as the primary Data Link display.

CONCLUSIONS

1. Two configurations that represent relatively large portions of the studied fleet are as follows: an Aircraft Communication Addressing and Reporting System (ACARS) Interactive Display Unit (IDU) in a B737-300 in the aft pedestal on the right side; and two Control and Display Unit/Multi-Purpose Control and Display Units (CDU/MCDU) in the center pedestal of a B757-200 with one at the Captain's right knee and one at the First Officer's left knee. These are two of the most common anticipated primary Data Link displays in the most common aircraft models using those displays as the primary Data Link display. These displays are the first and third most common anticipated primary Data Link displays, respectively.

2. Electronic Flight Instrumentation System (EFIS) is the fleet's second most common anticipated primary Data Link display. However, those who anticipate using the EFIS have not yet determined the method and device for inputting information into the system. Therefore, since the program's goal is to mimic the systems that the airlines would like to use, and this total system has not yet been determined, the program will not use EFIS at this time.

TABLE 6. B737-300's WITH ACARS IDU

Airline	Intended as Data Link Display	Display Make and Model	Location in Cockpit	Annunciation
USAir	Yes	Teledyne-21 (597) OR Teledyne-32 (724)	Aft pedestal on right side	Bottom of display has flashing message bar - selcal chime
United	No	Collins Model # 6228587-104	Aft pedestal on right side	X

TABLE 7. B757-200's WITH CDU/MCDU

Airline	Intended as Data Link Display	Display Make and Model	Location in Cockpit	Annunciation
American	No	Sperry/ Honeywell	Center pedestal - one at Captain's right knee & one at First Officer's left knee	X
Northwest	No	Honeywell	Center pedestal - one at Captain's right knee & one at First Officer's left knee	X
UPS	No	Honeywell	Center pedestal - one at Captain's right knee & one at First Officer's left knee	X
United	Yes	Honeywell	Center pedestal - one at Captain's right knee & one at First Officer's left knee	EICAS

APPENDIX A

AIRLINE INFORMATION

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Airline Name

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
1	2	3	4

1. Name of aircraft model(e.g., B737-300).

2. Approximation of anticipated quantity of that aircraft model for the near future. This includes the amount of the current inventory, the amount on firm order, and the amount on option which the company anticipates obtaining. Aircraft that the company anticipates phasing out in the near future are not counted. To conceal proprietary information, this figure is represented as a percentage of the individual airline's total fleet(rounded to 1%).

3. List of all displays that the company anticipates being on that aircraft model in the near future(FMS CDU, MCDU, EFIS, ACARS, EICAS, Weather Radar, dedicated, navigation, etc..). The anticipated primary Data Link display and input method(keypad, touch sensitive screen, etc.) are underlined.

4. The method which the company anticipates annunciating a message visually and aurally(if they are known) for that aircraft model.

American Airlines

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
MD-80	27%	EFIS(4), ACARS(single line)	EFIS & tone
	11%	Weather Radar, ACARS(single line)	undetermined
B757-200	16%	EFIS(6), FMS CDU(2), ACARS with keypad	EFIS & tone
F100	12%	EFIS(4), MCDU(2), ACARS IDU	EFIS & tone
B727-200	9%	Weather Radar, ACARS(single line)	undetermined
DC-10	7%	Weather Radar(2), ACARS(single line)	undetermined
B767-300	5%	EFIS(6), FMS CDU(2), ACARS(single line)	EFIS & tone
A300	5%	EFIS(6), FMC CDU(2), ACARS with keypad	EFIS & tone
B767-200	4%	EFIS(6), FMS CDU(2), ACARS(single line)	EFIS & tone
MD-11	4%	EFIS(6), MCDU(3)	EFIS & tone

Continental Airlines

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
B727-200	22%	Weather Radar(receive), ACARS(single line)(send)	undetermined
MD-80	16%	Weather Radar(receive), ACARS(single line)(send)	undetermined
B737-300	13%	Weather Radar(receive), ACARS(single line)(send), FMS CDU	undetermined
B737-400	12%	ACARS IDU, EFIS, FMS CDU	undetermined
B737-200	10%	Weather Radar(receive), ACARS(single line)(send)	undetermined
DC-9	9%	Weather Radar(receive), ACARS(single line)(send)	undetermined
A330/340	5%	ACARS IDU, EFIS, FMS CDU	undetermined
A300	4%	Weather Radar(receive), ACARS(single line)(send)	undetermined
DC-10	4%	Weather Radar(receive), ACARS(single line)(send)	undetermined
B727-100	3%	Weather Radar(receive), ACARS(single line)(send)	undetermined
B747-200	2%	Weather Radar(receive), ACARS(single line)(send)	undetermined
B747-100	1%	Weather Radar(receive), ACARS(single line)(send)	undetermined

Delta Air Lines

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
		There are not enough FAA requirements regarding Data Link yet for Delta Air Lines to be able to determine this information	

Northwest Airlines

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
DC-9	33%	ACARS with keypad, Weather Radar	flashing blue light & chime
A320	20%	FMS CDU, EFIS, EICAS	chime & maybe flashing blue light
B757-200	13%	Weather Radar(shared for ACARS with keypad), EFIS, EICAS, FMS CDU	flashing blue light & chime
B727-200	13%	ACARS with keypad, Weather Radar	flashing blue light & chime
B747-200	6%	ACARS with keypad, Weather Radar	flashing blue light & chime
DC-10	6%	ACARS with keypad, Weather Radar	flashing blue light & chime
B747-400	4%	FMS CDU, EFIS, EICAS	chime & maybe flashing blue light
B747-100	2%	ACARS with keypad, Weather Radar	flashing blue light & chime
B727-100	2%	ACARS with keypad, Weather Radar	flashing blue light & chime
MD-80	2%	ACARS with keypad, Weather Radar	flashing blue light & chime

United Airlines

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
B757-200	32%	FMS CDU, EICAS, EFIS, ACARS IDU, Weather Radar	EICAS
B737-300	29%	FMS CDU, EFIS, ACARS IDU, Weather Radar	undetermined
B727-200	15%	dedicated smart CDU, ACARS IDU, Weather Radar	undetermined
DC-10	10%	dedicated smart CDU, ACARS IDU, Weather Radar	undetermined
B767-300	7%	FMS CDU, EICAS, EFIS, ACARS IDU, Weather Radar	EICAS
B767-200	4%	FMS CDU, EICAS, EFIS, ACARS IDU, Weather Radar	EICAS
B747-400	3%	MCDU, EICAS, EFIS, ACARS IDU, Weather Radar	EICAS

United Parcel Service

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
DC-8	39%	ACARS IDU, EFIS(4), Litton LTN-92(navigation)(2)	chime
B727-100	31%	ACARS IDU, EFIS(4), Tracor Omega(navigation)	chime
B757-200	24%	ACARS IDU, FMS CDU(2), EFIS(4), EICAS(2)	chime
B747-100	6%	ACARS IDU, Weather Radar(2), Litton LTN-92(navigation)(3)	chime

USAir

AIRCRAFT MODEL	QTY (%)	DISPLAYS ON AIRCRAFT - ANTICIPATED PRIMARY DATA LINK DISPLAY AND INPUT METHOD ARE UNDERLINED	ANTICIPATED ANNUNCIATION
B737-300	22%	ACARS IDU, FMS CDU(2), Weather Radar	ACARS visual & chime
DC-9	16%	ACARS IDU, Weather Radar	ACARS visual & chime
B737-200	14%	ACARS IDU, Weather Radar	ACARS visual & chime
MD-80	11%	ACARS IDU, Weather Radar	ACARS visual & chime
F28	10%	ACARS IDU, Weather Radar	ACARS visual & chime
F100	9%	ACARS IDU, EFIS(4), FMS CDU(2), EICAS(2)	ACARS visual & chime
B737-400	9%	ACARS IDU, FMS CDU(2), Weather Radar	ACARS visual & chime
BAe 146	4%	ACARS IDU, Weather Radar	ACARS visual & chime
B727-200	3%	ACARS IDU, Weather Radar	ACARS visual & chime
B767-200	2%	ACARS IDU, EFIS(4), FMS CDU(2), EICAS(2), Weather Radar	ACARS visual & chime

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