Core Commands Across
Airway Facilities Systems

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16. Abstract

This study takes a high-level approach to evaluate computer systems without regard to the specific method of interaction. This document analyzes the commands that Airway Facilities (AF) use across different systems and the meanings attributed to the different commands. Human factors researchers collected data on AF systems and equipment, identifying 25 different systems monitored and controlled by AF specialists. Different AF systems had different means of interfacing with the computer (e.g., graphical user interface, menus, and command line interface). The researchers summarized data on the interaction types across AF systems to find that most AF systems used menus as the primary means of interaction. Among the 25 systems monitored and controlled by AF, they uncovered more than 1500 options for accessing, interacting with, and controlling the equipment necessary to National Airspace System operations. They analyzed the options for frequency of occurrence and defined meanings for each of the most frequently used options. The result of this analysis is a set of core commands that are common across a number of systems.

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Executive Summary

In previous studies, researchers from the William J. Hughes Technical Center Human Factors Group (ACB-220) have catalogued Airway Facilities (AF) interactions with icons, function and shortcut keys, and mnemonics and menus (Ahlstrom & Muldoon, 2002; Ahlstrom & Muldoon, 2003a, 2003b). Each of these reports focused on a single aspect of interaction with AF computer systems. In this study, they take a higher-level approach and evaluate computer systems without regard to the specific method of interaction. This document analyzes the commands that AF specialists use across different systems and the meanings attributed to the different commands. This analysis results in a set of core commands that are common across a number of systems.

Human factors researchers compiled a list of potential core commands by analyzing computer-based instruction manuals and technical specifications and by obtaining input from subject matter experts. The researchers presented this list to AF specialists at 12 AF field sites. In addition, they collected specific, detailed information on the commands used on each system, including data on how specialists access the commands, the meaning of the commands, and the definitions of the commands. In this way, they were able to identify commands that were different in terminology but performed the same function and commands that were similar in terminology but performed different functions.

The researchers collected data on AF systems and equipment, identifying 25 different systems monitored and controlled by AF specialists. Different AF systems had different means of interfacing with the computer (e.g., graphical user interface, menus, and command line interface). They summarized data on the interaction types across AF systems to find that most AF systems used menus as the primary means of interacting with the system.

Among the 25 systems monitored and controlled by AF, this research uncovered more than 1500 options for accessing, interacting with, and controlling the equipment necessary to National Airspace System operations. The researchers analyzed the options for frequency of occurrence and defined meanings for the most frequently used commands.

They studied the meanings of the commands and identified commands with common meanings across systems as core commands. They extracted a list of potential core commands and presented it to field personnel for validation and verification.

Field personnel from various operational sites provided definitions for terms and validated information the researchers had collected on core commands. A table within this document presents this set of core commands along with recommendations for their use.

1. Introduction

Airway Facilities (AF) is the part of the Federal Aviation Administration (FAA) that is responsible for maintenance, monitoring, and controlling facilities, systems, and equipment in the National Airspace System (NAS).

AF consists of several components. These components include a National Operations Control Center, three regional Operations Control Centers (OCCs), Service Operations Centers (SOCs), and Work Centers. This report focuses on OCCs and SOCs. OCCs provide coverage for all services and have significant monitoring and control functions with the exception of telecommunications. SOCs cover all services and are responsible for complete monitoring and control for selected high impact Air Traffic (AT) facilities.

Over the years, an increasing number of systems have been added to AF's area of responsibility. Designers often develop or the FAA often procures these systems without considering existing systems or equipment. Often, this results in different commands used to accomplish the same functions or the same or similar term used to accomplish different functions.

1.1 System Interaction Methods

There are many methods of interacting with a computer system, including direct manipulation, command line interaction, and menu interaction. Often, computer systems rely on a combination of these methods.

Systems relying on direct manipulation have a Graphical User Interface (GUI), which involves the use of visual symbols (sometimes known as icons) to represent the functions of a software program. The user manipulates the symbols by using a pointing device such as a mouse. Various input devices including touch screens and keyboards also accomplish direct manipulation. Direct manipulation of a GUI is beneficial to casual system users as a means of enhancing a user's understanding of control actions or when offered as a simple alternative to learning a command language when computer response time is fast. In an earlier study, Ahlstrom and Muldoon (2002) examined visual symbols used for interaction with AF computer systems.

Systems that rely on command line interaction require the user to enter precise text sequences in the form of commands in order to interact with the system. Command line interactions are sequences of instructions input by the user that result in system actions. These instructions are usually a series of complete or abbreviated words or phrases that the user must recall and present in the particular order required by the system syntax. Command line interactions sometimes require multiple interactions (between the user and the computer) using text strings that the user needs to recall exactly for successful system performance. Command line text may be as simple as a two- or four-letter string entered via a keyboard. However, some interactions can involve lengthy sequences of text that require exact user responses to system prompts or the use of a particular syntax before the system can accept a command. In any case, recall from memory is a critical component of the interaction. Many people are familiar with command line interaction in the form of the DOS and UNIX programs. Command line interaction can be beneficial for tasks involving a wide range of control entries, where users may be highly trained and will use the system frequently and where control entries may be mixed with data entries in an arbitrary sequence.

Some software applications rely on menus to interact with the system. Menus have the advantage of being usable with little or no training on the part of the user (if the meanings of the options are clear). The disadvantages of menus are that they can occupy a considerable amount of display space and can slow down an experienced user if shortcut keys are not provided. Ahlstrom and Muldoon (2003b) examined menus and mnemonics for AF systems in a previous study.

Specialists often use function keys (F keys) and shortcut keys for tasks requiring only a limited number of control entries. They also use them in conjunction with other dialogue types as a ready means of accomplishing critical entries that must be made quickly and without syntax error. In other words, specialists can use F keys to complete involved interactions while minimizing the number of key presses or mouse clicks. This enables them to quickly and efficiently accomplish frequently used commands. The disadvantage of F keys is that the user must remember with which command the F key is associated. Templates placed on the keyboard can help the users remember which key is for which function. Similarly, the user must remember which key combination activates particular commands for shortcut keys. Ahlstrom and Muldoon (2003a) examined F keys and shortcut keys in a previous study.

Each system in AF has a set of commands that it uses to interact with the system. Specialists enable some of these commands through command interaction and through menus, F keys, form filling, or GUI. Previous studies have covered several of these methods of interacting with systems (Ahlstrom & Muldoon, 2002, Ahlstrom & Muldoon, 2003a, 2003b).

1.2 Purpose

This study takes information from each of the prior studies to examine the commands themselves, regardless of the means of interacting with the system. It identifies core high-level commands used across AF systems and how users currently enable these commands. It determines whether the commands are consistent in meaning and use across systems and identifies commands that designers could standardize across systems.

This study not only evaluates the core commands, but also evaluates the means of interacting with the AF systems and applications. Although the term core commands could imply the most important commands, for the purpose of this report, core commands refer to commands that are common across systems.

2. Method

A research team from the William J. Hughes Technical Center Human Factors Group (ACB-220) previously collected data on F keys, GUIs, and menus. Ahlstrom and Muldoon (2003a, 2003b) presented the results of the data collection in two technical notes. This study takes a broader look across systems and interaction modality based on the data collected in the previous efforts.

2.1 Site Visits

Researchers targeted 12 sites for their location and diversity and so they could visit more than one type of facility per location (i.e., an Air Route Traffic Control Center (ARTCC) and an OCC in one city). These sites are Chicago Terminal Radar Approach Control Facility (TRACON) and ARTCC; Seattle TRACON and ARTCC; Atlanta TRACON, ARTCC, and OCC; Dallas Fort Worth TRACON and ARTCC; and San Diego TRACON, ARTCC, and OCC.

2.2 Data Collection

To minimize the time needed for data collection at each site visit, researchers used computer-based instruction manuals and available software documentation to gather information on command conventions and command interaction for each system prior to conducting the site visits. They verified and expanded upon this information at the sites. The time and staffing constraints inherent to any busy operation and approval by union and management placed contingencies on their visits to these sites. Both the AF specialists and the research team ensured that data collection would not impact AF operations.

2.3 Procedure

A research team analyzed computer-based instruction manuals and system specifications and, with the help of Subject Matter Experts (SMEs), extracted a list of potential "Core" functions. If they found a function used by more than six systems during this preliminary investigation, they placed it in the list (Table 1).

Table 1. Potential Core Functions

Acknowledge	Next
Alarm	Open
Change	Previous
Clear	Print
Close	Save
Control	Search
Delete	Send
Edit	Start
File	Status
Find	Stop
Help	Time/Clock
Load	Validate
LogOff/On	

At each site, a member of the research team met the Points of Contact (POCs) and thanked them for their time. The researcher then explained the purpose of the study. The POCs and others available and interested in participating in this study received a brief, written description explaining its purpose and containing project contact information. He made available other pertinent coordination information upon request, including the names of management and union personnel with whom they coordinated prior to the study. He distributed a written statement of confidentiality and asked study participants to sign it. The researchers assured the participants that he would keep any responses to questions confidential and only a participant number would identify data.

The research team presented AF specialists with the list in Table 1. A researcher then paired with an individual and went through a system in detail. Which system the specialist felt most knowledgeable about and comfortable talking about determined the system discussed. With the system in clear view, the researcher asked the specialist, item by item, if that listed option was available with that system, how one would enable that option, and what kind of meaning that option held for that system. The researcher encouraged the specialist to comment on the list of core commands. This provided the team with information on options that were different in wording but similar in functionality. Additionally, this exercise provided some information on the frequency of use for different options. At each site, researchers observed the systems in use and decided whether the primary method of interaction was through command line interaction, F keys or shortcut keys, or a GUI.

In addition to the comments made on the list of potential core commands, researchers created a detailed list of options for each system. Additionally, they captured information on the system associated with the option, the meaning associated with the option, and the method of interaction (e.g., icon, shortcut key, F key, menu). They placed all of these options in a spreadsheet for analysis.

3. Results

Researchers identified 25 different systems used in AF operational environments. The majority of the systems display the status of NAS components for monitor and control purposes. These systems often present information either in the form of visual symbols indicating the NAS component being monitored with an accompanying color or state change indicating status, or through lists in which status is generally indicated by color change. One exception, a system that provides a means of event ticketing or event logging, uses form filling as the primary means of interaction.

3.1 Systems and Displays in the AF Environments

The researchers collected detailed information on how the AF specialists use each system and the primary and secondary means of interacting with the system. Table 2 summarizes these data.

Table 2. Individual System Information

System Name	Information for AF	Primary Access	Secondary Access
Automated Radar Terminal System (ARTS)	View status of AT radar positions, interact with files, create or change plots, reconfigure AT positions, monitor and control AT positions for radar, test AT radars	Pull-down menus with mouse	Command line (rarely used or taught)
Codex	View connectivity and network equipment status, monitor and control network connectivity, reconfigure communication networks, test network connectivity, interact with various communication layouts	Unique three-button mouse, icons (activating pop up menus)	Dedicated F keys from unique keyboard
Center TRACON Automation System (CTAS)	Not yet observed with AF interactions, expected use will be Acknowledge alarms, silence alarms, view object information, M&C network connectivity, see which system is in control, determine error rates and percentages, export data	Pull-down menus with mouse	Keyboard

System Name	Information for AF	Primary Access	Secondary Access
Data Acquisition Subsystem Real-time Status Display (DAS/RSD)	View events/status lists by subsystem or date/time, view connectivity and status of EDARC, provides scrollable lists of event data and allows acknowledgement of events, shows schematic of connectivity with EDARC screen	Point and Click with Mouse	Keyboard (rarely used)
Direct Access Radar Channel (DARC)	Interact with alarm/event files, backup system for Host.; will provide direct M&C for all n route radars; limited options and presentation compared to Host	Pull-down menus with mouse	Command line
Display System Replacement (DSR)	M&C Host, M&C EDARC, M& C Certification shows status, allows maintenance and control, allows certification	Point and click with Trackball, three button options and dedicated F keys from unique keyboard	
Digital Voice Recording System (DVRS)	View status logs, history logs, event logs; generates system alarms, monitors recordings, interfaces with VSCS	Pull-down menus with mouse	
Enhanced Traffic Management System (ETMS)	Shows maps of different regions with traffic overlays; AF performs monitor and control, navigate directory structure, print files, obtain help, and control data output	Pull-down menus with mouse	Command line
Event Manager (EM)	Used to input, manage, track and coordinate events	Form-filling using mouse clicks and standard keyboard entries	
Host	Direct M&C for en route radar positions; reconfigure AT positions, view event/ status lists, switchover to backup systems, run dynamic simulations for equipment checks	Command line	
Host Interface Device (HID) National Airspace System (NAS) Local Area Network (LAN)	Monitor and manage hardware and software applications	Pull-down menus with mouse	
Host and Oceanic Computer System Replacement (HOCSR)	Monitor and control including acquiring	Pull-down menus with mouse	
Interim Monitor and Control Software (IMCS)	Monitor and control subsystems; view subsystem status; provides phone line connectivity, assume relinquish control of subsystems, create event logs	Command lines and mouse click on pictograph icons used in conjunction	F keys and F keys with Shift as a modifier
Low Level Windshear Alert System (LLWAS)	View alarm/status lists; control of limited system statuses, acknowledge alarms	Viewed but not interacted with	
Low Density Radio Communications Link (LDRCL)	Monitor status, acknowledge alarms, phone line connect with field technicians	Mouse point and click	

System Name	Information for AF	Primary Access	Secondary Access
Maintenance Automation Software System (MASS)	Monitor and control subsystems; assume/relinquish control of subsystems; create event logs; view history, event, and system files; view system messages; drill down to a "Quick View" of a single event/subsystem; view subsystem status	Pull-down menus with mouse in conjunction with scrollable lists with mouse	Provides mnemonics, but never saw them used
Mode-S	View alarm/event lists, initialize and switch channels, request or release control of radar system for maintenance and testing	Pull-down menus and clickable text icons with mouse	
Random Access Plan Position Indicator (RAPPI)	View facility radar input equipment status, select/switch Radar Data Distribution Unit (RDDU), enable/disable alarms	Equal use of mouse and menus and keyboard dedicated number keys	
Radio Communications Link (RCL)	Switch operating channels, view commands status/progress, access information from other comms sites, search for alarms, view most recently used commands	Command line with 8 mouse-clickable options	F keys for the same 8 options
Rapid Deployment Voice Switch (RDVS)	This DOS based system incorporates pull-down menus to view status of Air-to-Ground (A/G) and Ground-to-Ground (G/G) communications at TRACON. AT positions can be monitored individually or en masse. View alarm lists, switch to backup systems, reconfigure AT positions	Pull-down menus with mouse	
Standard Terminal Automation Replacement System (STARS)	View status of AT radar positions, interact with files, create or change plots, reconfigure AT positions, monitor and control AT positions for radar, test AT radars	Point and click on Text icons with mouse	
Very High Frequency Omnidirectional Range/Tactical Air Co-located (VORTAC)	Acknowledge abnormal conditions, change channels/monitor control, control various system functions, change parameters, view history/event logs, monitor system data, troubleshoot and identify parameter deviations	Command line	
Voice Switching and Control System Maintenance Position Equipment Subsystem (VSCS [MPES])	Control alarm level, change from primary/secondary (manually), troubleshoot/diagnose system events, view fault/status lists, create/view reports, customizable by facility, reconfigure AT positions	Mouse clicks from pull-down menu bar	
VSCS Training and Backup System (VTABS)	Acknowledge alarms, control alarm volume, view connectivity status, view event details, change to primary (VSCS) manually, view/update AT position maps, reconfigure AT positions	Pull-down menus with mouse	
Weather and Radar Processor (WARP)	View weather map data, view alarm lists and logs, acknowledge alarms, view system messages, cascade weather images		Pull-down menus with mouse

They analyzed the overall list of options by the method of access. These data gave information on the most frequently occurring methods of access and the number of systems that use each method of access (see Table 3). The number of systems in the third column of Table 3 adds up to more than 25 because there are often redundant means of accessing options. For example, an icon, a menu bar, or a shortcut key could access the print command in the same system.

The primary means of interacting with most AF systems are menus with redundant keyboard entries, and the least common methods of interaction are command-line interface and form filling (not included in the table because only one system used this method and the options for that system were not examined in detail). The AF systems often used graphics either as a means of showing status or as part of a graphical menu rather than for the purposes of direct manipulation. Some AF systems have graphics, menus, and keyboard entries present as a means of interacting with the system.

Table 3. Method of Option Access Across Systems

Option Type	Options Accessed Through This Method	Percentage of Options	Systems Employing This Access Method
Menu Bar	834	55.3	15
Icon	215	14.2	17
F key	157	10.4	18
Shortcut Key	67	4.5	9

3.1.1 Frequency of Option Occurrence

Among the 25 systems monitored and controlled by AF, there were over 1500 different options identified for accessing, interacting with, and controlling the equipment necessary to NAS operations. The researchers analyzed the frequency of occurrence of these options. In other words, how many times did this term occur regardless of the method used to access the term? Table 4 shows the most frequently occurring terms, and many from Table 1 appear in Table 4.

There are several things that this analysis did not provide. First, it did not differentiate whether the option was a command or a means of navigation or categorization. For example, a means of navigation would be menu bar items that open additional menus. Many menu bars contain the Edit option, and when the user selects this, it generally opens a pull-down menu of other options. Thus, the Edit option serves more as a navigational tool or means of categorizing commands rather than a command in and of itself. However, operators could also use Edit as a command for some systems if using that option to actually edit an item. Secondly, they identified how often these items occurred in the different systems, but that did not provide them with information on how often specialists used these options. The potential core functions were the closest estimate of frequency of use for commands that they were able to get from the specialists. Third, the frequency counts did not differentiate items that occurred in isolation from those that occurred as part of a phrase.

Table 4. Most Frequently Encountered Options Across Systems

Command/Attribute	Frequency	Number of systems using
Alarm/Alert	42	17
Status	35	20
Print	33	20
Show	32	3
Delete	31	11
Help	31	17
Display	30	12
Clear	29	17
Save	27	15
Acknowledge	24	13
Close	23	14
Configure/Reconfigure	22	10
Find/Search	22	18
Change	20	18
Open	20	13
Edit	19	16
Next	19	13
View	18	10
Select	18	6
Report	17	11
System	17	7
Exit	16	12
Control	16	10
Login/Logout	16	14
Previous	14	11
Get/GoTo	14	5
Map	14	6
About	12	10
Start/Restart	11	11
Event	11	8

By taking the frequently occurring options and presenting them to AF specialists at operational field sites, the researchers were able to verify how they used these options and clarify the meaning of over 80% of the options. This allowed them to identify some different terms that accomplished a similar function. They also were able to identify commonalities in how operators used terms.

4. Conclusions

The researchers found several instances across AF systems where specialists use different terms to accomplish the same function. Some examples of these are Exit and Quit; Logout and Log Off and Sign Off; Show, Display and View; Print and Send to Printer; Clear, Erase, and Delete; Change, Go to, Switchover, Primary/standby, Channel change, Switch, and Change operational system; Refresh, Redraw, and Replot; and Restore and Default. There were also instances of the same command accomplishing slightly different functions, such as View and Edit. They also found inconsistencies in where commands were located and how they were activated in the system (e.g., function key, menu, typed in command). Tables 5 and 6 expand upon these instances.

In this document, the researchers identified frequently used methods of interacting with computer systems. They analyzed the frequency of occurrence for commands across systems

and identified definitions and recommendations for use based on the information provided by SMEs, human factors guidelines, and computer-based instruction manuals. These frequently occurring terms matched closely with the frequently used commands list provided in Table 1.

In this section, the researchers expand on the most frequently occurring terms, provide information about their use in AF systems, and recommend their use and access (Table 5). They recommend that when using these core terms, designers consult the definitions, placement, and terms for common AF function as described in the following tables. By standardizing the terms and how the terms are accessed (including where they are located) across systems, consistency among systems can be achieved, making it easier for specialists to use the systems.

Table 5. Common AF Commands

Command	Description	Recommendations
Alarm/Alert	Alarm is sometimes combined with the term Alert and used as an item in a menu bar. Alarm appears in several different forms across AF systems. The primary use is in conjunction with the word "Show" to open a list of alarms that often can be individually acknowledged, generally through the use of a pointing device. The location of this function (show a list of alarms/alerts) is inconsistent across AF systems. Sometimes it is located under Alarms/Alerts in the menu bar; in other cases it is under Fault, Alerts, Tools, View, Status, Utilities, and Screens.	The function "Alarm list" should use consistent terminology and be consistent in location. They recommend placing this item under the View menu where possible and using a single term to access the alarm status lists.
Status	Status is a very common command. It is used to access either overall single system status (health/heartbeat) or, in cases where systems monitor subsystems, the status of a subsystem. This option is accessed generally through the menu or through an F key. When selected, this option must display the status of relevant items. Status can also be accessed for some systems through an icon or manually entered core command, allowing the specialists to access status information for specific sites or pieces of equipment. Subsystem status displays are occasionally the default screen. For example, MASS presents the status of subsystems as default.	The term "Status" should be used to provide status for the system or for subsystems. It should appear in conjunction with the name of the item whose status will be displayed.
Status Bar	This option serves to display the status bar.	When selected, this option must display the status bar with systems that employ one.
Print	This option is used to send information to the printer. Print is sometimes assigned to a visual symbol. Print is sometimes accessed with a non-dedicated function key	When selected, this option must open a dialog box to request information necessary to print and then send a selected item to the printer. In a menu, this option must be followed by ellipses indicating that further information will be requested of the user. This option should be located in the File menu with menu driven systems, and should be indicated by the mnemonic P and assigned the shortcut Ctrl + P. When assigned to a visual symbol, Print should be signified by an icon that resembles a printer with a piece of paper sticking up on it.

Command	Description	Recommendations
Show/Display	"Show" is almost exclusively seen together with a noun or noun phrase. "Show" appears to be used synonymously with "Display" and occasionally "View." "Display" can be accessed through menu or F keys, primarily F key, and is seen primarily in a single system.	Choosing this option must make visible the indicated noun. The researcher recommend using the show option instead of display, as display could be used to indicate a physical display and thus is not as informative as show.
Delete	"Delete" (found in 11 systems) is used more than 20 times across systems. The delete command can be accessed either through a dedicated key on the keyboard or a menu option. It performs a function redundant with the clear function. The delete command serves to remove selected data from the active area.	The delete function is frequently redundant with the Clear option; it is recommended that either clear or delete be used, not both. The delete option should have the mnemonic D if used as a menu option and should appear in the "Edit" menu. One system uses the term "Erase" instead of Delete. Erase should be replaced with delete because it serves the same functionality. They recommend using the standard methods of highlighting and the delete key together with modifier keys, instead of the following submenu options: Delete Entire Line, Delete Last Word, Delete to End of Line, Delete Previous Character, and Delete Current Character. If placed in a menu, it should generally be located in the Edit menu. They recommend that a dialog box appear requesting that the user confirm the action and informing the user that the action cannot be undone for delete actions that cannot be undone.
Clear	"Clear" is used in two different ways across AF systems. In one instance the option clear is used alone and together with another word or words specifying exactly what should be removed from the current view (e.g., clear all flashing). "Clear" is also used to remove a selected portion of data without copying it to the clipboard or compressing the remaining data. Means of accessing this command vary greatly across AF systems. The most common methods of accessing this command are through menus and the F keys of either F2 or F3.	If "Clear" is used in the sense of removing a selected portion of data without copying it to the clipboard, they recommend that the command Delete be used for this function instead.
Help	"Help" occurs in the menu bar in menu driven systems and as a Non-Dedicated function key (F key) with other systems. "Help" is sometimes accessed through an icon in GUI systems.	Selecting "Help" from the menu bar should open the Help menu. The Help menu should be the last menu bar item on the right and should contain options that provide help to the user. The mnemonic for "Help" should be H in menu driven systems. The F key F1 should be used to access help.

Command	Description	Recommendations
Save	This command is seen frequently across systems as a means of saving information to the computer hard drive. This action is often accessed through menus, shortcut keys, or an icon.	This command should save a file to a storage device under the file's current name. If the file does not have a name, this command should open a dialog box, prompting the user to enter a file name. This command should be located under the File menu in menu driven systems, with the mnemonic S. It should have the shortcut Ctrl + S. When accessed through an icon, the symbol on the icon should resemble a diskette.
Acknowledge	The function of the acknowledge option is usually to acknowledge alarms or event occurrences. The use of this term varies. Sometimes this term is used to acknowledge all of the unacknowledged alarms, sometimes to acknowledge audible alarms, and sometimes to acknowledge visual alarms. The location of this option varies widely. In different systems it is under the View menu, a Utilities menu, a Software menu, and a Fault menu. In some systems, this option is given a dedicated F key; in other systems it is assigned to an F key; in another system a two-letter keyboard command is used. For some systems, selecting Clear All Flashing or Clear Selected Flashing accomplishes this same function from a menu. Other systems acknowledge alarms by clicking on an item with the mouse.	A major use of this function is to acknowledge auditory alarms. Specialists reported this option as a frequently used option. Thus, there should be a consistent means of acknowledging alarms across systems. In general, the authors recommend that, when this command is used, it should cause the auditory portion of the alarm to be temporarily silenced (with the visual portion of the alarm still indicating the problem until the condition is resolved). They recommend that an F key be assigned the function of acknowledging auditory alarms. The key assigned to this function should be consistent across systems. They recommend F5 for this function. Acknowledge Alarms should not be located in the View menu, as the View menu should be reserved for actions that do not change the data. Acknowledgment of visual alarms and the ability to acknowledge all alarms should be located consistently from one system to another. The use of the term acknowledge is preferable to the term clear for this function.

Command	Description	Recommendations
Close	The close option is used to close windows of an application. It differs from the Exit command in that "Exit" closes the entire application while "Close" only closes the subwindows of the application but leaves the application open. It is found in File, Map, and Windows submenus in AF systems. In the Windows submenu, it is used together with the modifier "All" (Close All). This option is usually only available in dialog boxes that provide status information or in dialog boxes that perform irreversible actions.	This command should only be used for applications that have multiple independent windows, not with applications that have single windows. This action must only close the current primary window and its associated sub windows and remove them from the workspace without ending the application. For most windowing systems, close can also be accomplished by clicking on X icon in the top right hand side of the window itself. It should have the mnemonic C when used in menus. If the Close all option causes all of the windows to be closed and the closing of the associated application, the command Exit is preferable to Close All. Before closing the window, the application must prompt the user to save any unsaved changes that might result in a loss of data. The Close option should be located in the File (or equivalent) menu for menu driven systems. Use Close to close subwindows of the application but not to close the entire application. When used in dialog boxes, this command should cause the dialog box to close without performing any of the specified actions.
Configure/ Reconfigure	"Configure," "Reconfigure," and "Configuration" are commands that are fairly unique yet very important to a monitor and control environment like AF. "Configure" and "Reconfigure" allow the user to modify settings, while configuration allows the user to view the current settings. The way these options are accessed in current AF applications varies widely, from icons to menus, to F keys. The location of the option in a menu varies widely from one system to another. It is located in the Options menu, Monitor menu, Configuration menu, and Status/Recon menu.	Due to the importance of this function for AF systems, they recommend placing the commands configure and configuration in a standard location across systems where possible. Where "Reconfigure" is used synonymously with "Configure," they recommend using "Configure." One possibility for the command configuration is to place it in the View menu for menu driven systems as it allows the current settings to be viewed but does not perform any transformations on the data.
Find/Search	The Find/Search command locates an item that matches a character string entered by the user. The need to search for data is common in applications that display system or subsystem status. It is important enough to rate dedicated symbols with Codex, EM, HNL, and HOCSR.	A search option should be prominent among the various display access methods. It is frequently found in the "Edit" pull-down menu of menu driven systems. For menu driven systems, the mnemonic should be F, indicated by an underline, and the shortcut Ctrl + F should be assigned to this function.
Change	Channel change is a core function for AF systems although it is accomplished through many different terms. This function is the switching from one system to another system (usually a backup). Some of the commands that result in a channel change are "Go To," "Switchover," "Primary/standby," "Channel Change," "Switch," and "Change operational system"	They recommend that only one term be used to identify this change functionality where practical across systems.

Command	Description	Recommendations
Open	The Open option opens an existing file (or map, depending on the application).	This option must first open a dialog box and prompt the user for the name of the file. If the completion of this operation will wipe out current changes to the file, a dialog box must appear, providing the user with the option of saving the changes before performing the action. This option should have the mnemonic O for menu driven systems. When in a menu, this option should be located in the first menu on the left of the menu bar (generally the File menu) where possible.
Edit	"Edit" is an item on a menu bar, common across many AF applications. In general, it is not a command per se, but rather a navigational or organizational item. This command is usually located on the menu bar immediately to the right of the File option. Selecting this item causes a submenu of options to become available. In some cases, "Edit" is used as a command, often with another word, specifying what will be edited. Those cases are considered separately and are not frequent enough for this list.	The Edit menu should be located consistently across systems to the right of the File menu. The Edit menu should contain the options Undo, Cut, Copy, Paste, Clear or Delete, Select all, Find, and Replace where appropriate.
Next	This command should be used to display the next item in a set of items or the next page or screen of information.	This command should be used to display the next item in a set of items or the next page or screen of information.
View	"View" is usually used as a navigational item on the menu bar rather than a command. "View" appears on the menu bar for several AF systems. It is generally the third item on the menu bar when read from left to right. Sometimes, however, "View" is used as a command to show some item.	Options placed in the view menu should allow the user to customize the appearance of the data in the window without altering the contents. The mnemonic for this menu option should be V when used in menus. They recommend not using "View" as a command, but using "Show" instead.
Select	This option appears followed by a noun or noun phrase specifying a category to be selected.	Selecting this option should open a dialog box allowing the user to select specific instances of the category.
Report	"Report" as a menu bar option for AF systems opens a set of options that allows the user to choose and perform actions on reports. Reports are also accessed with keyboards, icons, and typed in commands across the systems. It also appears under the Tools, Options, and Utilities submenus on other systems. This command appears both alone and with modifiers such as "Report Manager" and "Report Configuration." The function of this command is to generate, open, and allow the manipulation of a document with summary information on it.	Consistent terminology should be used across systems, and it should be located in a consistent location across systems.
System	"System" generally appears as an item in the menu bar, specifying the system menu with systems having menu driven interfaces.	When "System" is an option on a menu bar, it should appear as the first item to the left, prior to the File menu. The system menu should allow the user the additional options to log on or log off, or to restart the system as appropriate.

Command	Description	Recommendations
Exit	The Exit option should close the current application and all primary and secondary windows associated with it and end the processing. It is different than the Close option because Close leaves the application open.	The option should prompt the user to save any unsaved data. The mnemonic for this option should be X. "Exit" should be located in the File menu of menu driven systems. If the application does not have a File menu, "Exit" should be put at the end of the first pull-down menu. Some AF systems performed this same function using the word "Quit." As most AF systems use "Exit," it is preferable to use "Exit" rather than "Quit" for this function.
Control	This command appears in different forms across different systems. The primary function of this command is to allow the specialists to assume or relinquish control of a system. In some systems this is accomplished through the use of F keys, clicking on an icon representing the item to be controlled, through a submenu, or through the use of shortcut keys. "Control" is also used as a menu bar item and in one system is used to show control status. It also appears together with "Configuration" (control configuration) in a submenu on one system.	The means of assuming and relinquishing control of a system should be standardized across systems.
Login/Out; Log on/Log off	The Login command should open a dialog box requesting information to authenticate the user prior to allowing access to the system. This information should consist of at least a user name and a password. This menu option should be located under the system menu where possible. Some AF systems call this same function log on or sign on. Sometimes "Login" is one word, and sometimes it is two words. "Log off" should end processing by the system, close all of the windows on the workspaces, and stop all processing. It should request confirmation if unsaved changes have been made and allow the user to save the changes.	A dialog box should prompt the user for the information. This function should be named the same across systems. After the user is logged in, the Log on option should change automatically to the option Log off. If used as a menu option, it should be located under the system menu where possible.
Previous	This item is associated with the Next option. It is used to display the previous item in a set of items.	This command should be used to display the previous item in a set of items.
Map	"Map" is generally used as a replacement for the word File in the menu bar for systems that do not manipulate text. In general, the same rules that apply to the File menu apply to the Map menu in menu driven systems.	It should generally be the first item on the left of the menu bar. It should contain the same options as the File menu (New, Open, Print setup, Print, Close, Exit) as appropriate.
Event	Selecting the option Events (found in 8 systems) causes a list to appear displaying the current events. This option is available for many systems but is inconsistent in its location. "Fault" is another menu option. Fault, events, status, and alarms are all commands that are used to open a list displaying the current status of monitored items.	It is recommended that the location of this item be standardized across systems. The authors recommend putting a command that allows the user to view a list showing the current status of monitored items in the View menu when menus are used.

Command	Description	Recommendations
Get	"Get" is usually seen in conjunction with a modifier specifying what item to get. It returns a specific piece of information to the user.	When "Get" is used redundantly with the Find function, they recommend using the Find command instead of the Get command.
Go To	"Go To" is often accessed through a shortcut key or F key command. It takes the user to a specified location in a list of information or is used to switch channels on some systems.	They recommend not using the Go To command to change channels for a system. It can be placed in the Edit menu.
About	This option is generally found in menu driven systems and is followed by the name of an application or system.	This option should provide information about the application or system. It should be located under the Help menu. It should have the mnemonic A.

Additional commands that appeared at a frequency too low to make the most frequent list, but occurred often enough to warrant additional explanation appear in Table 6.

Table 6. Table of Additional Commands

Command	Description	Recommendations
Refresh/Redraw/ Replot	This option should redraw/update the contents of a window. In some systems that have "Map" instead of "File" in the pull-down menu bar, "Refresh" is generally placed in the Map menu.	For systems that have File in the main menu bar, this item should be placed in the View menu where possible.
Update	"Update" should check the status of a process and display the updated information. This option is often placed in the View menu. In some systems, "Refresh" is used to accomplish the Update function as well as redrawing the contents of the window. It is often assigned to the function key F9. Sometimes this function is accomplished through an icon on a graphic menu.	AF systems should use "Update" to display updated information.
Restore/Default	"Restore" is frequently used when retrieving lost or damaged files. In AF, "Restore" usually returns a system to a default state or setting. In other systems, default settings are restored by the command default. "Restore," "Default," and "Reset" are used synonymously in AF systems as a way of restoring default settings.	Only one term should be used to restore default settings. They recommend using the command Restore instead of Default as it is a verb commanding the system to restore settings. (The term Default can also be used as a verb, to mean fail to do as required.) This command should be used for restoring system, rather than screen, settings.
Reset	The command "Reset" cancels any changes made to the control settings that have not been applied and restores the settings to the values they had when first opened.	"Reset" should only be used to restore screen specific (not system) settings to the values held by that screen when first opened.
Options	"Options" is often available on the menu bar of AF menu driven applications. The contents of the Option menu will be application specific.	If "Options" is used on the menu bar, it should contain items that permit customization of the application. It should have a mnemonic of O.

Command	Description	Recommendations
Paste	Paste is currently used as an option with only three systems.	For systems that require the ability to copy and paste items, this option should be found in Edit pull-down menus. It should have the mnemonic P and the shortcut Ctrl + V.
Pause/Halt/ Freeze/Hold	All of these terms are used to interrupt operations. These options temporarily halt the task or computer actions and rendering in progress.	The term Pause should be used instead of the terms Halt, Freeze, or Hold. The action Pause should be used in combination with the command Resume. "Resume" must cause an action that was paused to begin again.
Stop	This term is used with three systems. "Stop" is also indicated often on a graphic menu by a red icon with either an x or the shape of a stop sign. "Stop" is slightly different than "Pause," as pause will not wait until the next possible breaking point, possibly leaving actions incomplete.	"Stop" should be used to end the task in progress at the next possible non-destructive breaking point.
Send	The "Send" command is used to send messages or commands to another system. Occasionally this command is used in conjunction with printer (Send to printer).	"Send to printer" should be abandoned for the simpler and more common Print command.

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Acronyms

AF	Airway Facilities
ARTCC	Air Route Traffic Control Center
AT	Air Traffic
FAA	Federal Aviation Administration
GUI	Graphical User Interface
NAS	National Airspace System
OCC	Operations Control Center
POC	Point of Contact
SME	Subject Matter Expert
SOC	Service Operations Center
TRACON	Terminal Radar Approach Control