ORDER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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SUBJ: AIR TRAFFIC WEATHER NEEDS AND REQUIREMENTS

1. **PURPOSE.** This order establishes the air traffic weather needs for terminal, en route, and flight service options and provides guidance for the air traffic National Airspace System (NAS) planners and engineers. This order supersedes all other air traffic weather requirement documentation.

2. **DISTRIBUTION.** This order is distributed to the branch level in Washington Air Traffic, NAS System Engineering Service, Program Director for Weather and Flight Service Systems, Office of System Capacity and Requirements, Program Director for Automation, Research and Development Service, Associate Administrator for Contracting and Quality Assurance, FAA Technical Center, regional air traffic divisions, and all air traffic field offices and facilities.

3. **BACKGROUND.**

a. The Air Traffic Plans and Requirements Service has been charged with assessing and identifying Air Traffic's (AT) aviation weather needs to support current and future air traffic operations. In 1983, Air Traffic took a collective look at and documented aviation weather requirements. Since then, there have been significant advancements in meteorological data collection platforms such as Next Generation Radar (NEXRAD), Automated Weather Observing System (AWOS), Terminal Doppler Weather Radar (TDWR), numerical modeling and applications, and the use of interactive data bases for product display and user assistance. The Federal Aviation Administration (FAA) has undertaken numerous Capital Investment Plan (CIP) projects to take advantage of the latest technological advances to realize cost benefits through a safer and more efficient NAS. Nearly one-fourth of the CIP's cost-benefit realization will come from the plan's various weather projects.

b. The FAA is responsible for meeting the safety, service, and efficiency needs of a wide range of aviation users. As the NAS evolves, there will be a greater need to increase system capacity, reduce delays, improve flight system efficiency, and reduce the air traffic control specialist's (ATCS) workload. In order to achieve these goals, timely and accurate observations and forecasts of weather must be available throughout the NAS to support an increased number of aircraft operations and new types of operational procedures for traffic movement. In achieving these goals, FAA identifies requirements for meteorological data to meet users' needs, and the National Weather Service (NWS) and FAA jointly provide the needed information.

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c. In the past, weather needs were based on the capabilities of proven technology. Today, because of the explosive pace of emerging technologies, a shift toward defining a weather system in terms of user operational needs is essential to allow the operational systems planning process to make the best use of technologies. Within the NAS, air traffic control (ATC) is both the principal user and supplier of aviation weather products. It is incumbent upon AT to step back and reexamine its aviation weather needs to ensure that programmed and planned programs will meet operational needs. Therefore, in concert with the thrust toward system planning, the Air Traffic Weather Requirements Team (ATWRT) was created and assigned the responsibility of clarifying and documenting the operational weather needs for system planning use in the context of a modernized ATC and weather system. This order is a result of that effort and is derived from the Air Traffic Weather Requirements Report, published February 11, 1993.

4. **APPLICATION.** This order applies to all Air Traffic personnel and is for the guidance of all other organizational units.

5. **GUIDELINES.**

a. This order is the first step in the programmatic process of identifying, developing, focusing, and implementing technology to meet air traffic weather needs. Through comparing, contrasting, assessing, and evaluating the user weather needs presented in this order, programmatic decisions can be enhanced. System engineers, with AT personnel in consultation, will transform these operational weather needs into system-level weather performance requirements by allocating functionality to individual systems. Specificity will be added to the weather requirements at the design level. Proper analysis, simulation, and testing will be performed to verify that the systems meet the overall operational needs.

b. The AT position on weather needs has been stated in terms that do not suggest any particular type of technology solution to meet a stated need. This order will allow system planners, through an interactive process with AT, to effect the best use of technology and its application. System engineers and Air Traffic personnel shall work together to analyze the prioritization of weather needs and cost tradeoffs.

c. The expression of weather needs is predicated on two premises: (1) the need for weather data conversion, and (2) the need to tailor that information for a particular operational use. Weather data shall be transferred into unambiguous weather information products, ready to expedite decisionmaking without interpretation and/or coordination with other data. Appendix 1 contains the Appendix Table Of Contents. The air traffic high-level needs are discussed in Appendix 2. The high-level needs are organized into categories that describe the content of the information, the

communication needs, and the interpretation and tailoring of the information by the user to his/her purposes. The categories are useful to those performing weather program evaluations and integrating new products into the ATC system. The categories discussed are information collection, information dissemination, and information display.

d. The Air Traffic Weather Needs Data Base is described in Appendix 3. The Glossary of Terms and Data Base Supporting Information is depicted in Appendix 4. Four applications of the data base are demonstrated in Appendix 5. Users requesting additional data base applications can direct their specific needs to the Manager, NASP and Future Systems Branch, ATR-330, or the Manager, Aviation Weather Development Program, ARD-80. Appendix 6 describes a current and future operational scenario to allow a view of how the future weather products could be applied as compared to today.

6. ATWRT MEMBERS.

a. The ATWRT is comprised of field ATCS's from the terminal, en route, and flight service options, and representatives from Office of Air Traffic System Management, Air Traffic Plans and Requirements Service, Air Traffic Rules and Procedures Service, and NAS System Engineering Service with support members from the scientific, engineering, and meteorological communities. A current membership list shall be maintained by the NASP and Future Systems Branch, ATR-330.

b. The ATWRT will biennially review the appendices of this order to ensure that Air Traffic's needs and requirements are consistent with advances in procedures and operational concepts.

7. DEFINITIONS.

a. For purposes of this order, the term "Needs" is understood to be statements of weather information, services, or system capabilities necessary to fulfill an operational mission. Needs are expressed over broad time periods, starting in the present and continuing to the future.

b. In contrast, the term "Requirements" goes beyond needs by adding a level of specificity (how accurate, how often updated, what resolution) that is measurable and has both spatial and time components.

Bill F. Jeffers
Acting Associate Administrator
for Air Traffic

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APPENDIX 2. AIR TRAFFIC WEATHER NEEDS

This section specifies 21 high-level, aviation weather needs, identifies assumptions under which the needs were specified, expresses issues as they pertain to risk areas in the requirements definition process, and provides recommendations for improving the analysis, use, and dissemination of weather information.

2.1 NEEDS DEFINITION DEVELOPMENT

This order presents AT's baseline position on aviation weather needs to meet present and future operational requirements. These needs are the first expression of a detailed understanding of user needs from the AT perspective. The approach of understanding needs from the user perspective vis-a-vis the technological capability viewpoint is a change in the philosophy for identifying needs and requirements for specific systems and programs within the FAA today. Needs of the user community were identified independent of any type of technological solution. Therefore, these needs and requirements look quite different from those that provide numerical quantities that describe system operation. These needs may be fulfilled by a variety of designs and technological approaches (airborne, ground, or space-based platform).

High-level needs cover aviation weather information for all ATC options, positions, and operations, and are expressed as attributes which characterize the information AT uses to control air traffic operations. Specific AT oceanic aviation weather needs are very similar to a high altitude en route sector but the air traffic weather needs cannot be satisfied by current ground based sensors. Additionally, facilities such as center RAPCON or oceanic sectors may need to be addressed individually as products are developed. The needs were derived from an operational basis (how ATC is using the information) and the critical information used for successfully performing that operation. These needs express how to portray the information in a manner that is most useful to ATCS. The detailed needs presented in appendix 4 are specific in applicability, and apply only to a specific operation or position.

2.2 ASSUMPTIONS

Some aviation weather needs are based on the following assumptions:

- The United States Government will continue to be responsible for aviation weather service.

- The FAA will continue to be a user of aviation weather information and continue to be a provider of aviation weather information services.

- Weather support functions will be fully integrated into the ATC system decisionmaking process.

- The NAS modernization effort will continue essentially as planned.

- The flight service station (FSS) function will continue to provide aviation weather information to aviation operators; the flight service collection, analysis, and dissemination activities are expected to evolve and take advantage of technology enhancements.

- The basic mix of aviation operations will remain proportionate while the total numbers of operations will continue to increase.

- Aircraft equipage will continue to evolve. All aircraft will not be equipped with leading edge technology, and future systems must accommodate wide variations in equipage.

- Aircraft equipage will tend to become more sophisticated and capable for all classes of equipped aircraft. Basic communications, navigation, and surveillance equipment will be installed in nearly all aircraft, although some aircraft with little or no avionics will still be operating. Minimum avionics will be required for operation in certain terminal classes of airspace. Automatic control systems, automatic navigation computers, and flight management systems will be common for commercial and corporate aircraft.

- Although there will be a widening divergence of aircraft characteristics and capabilities, ground system characteristics and capabilities, and emerging operational concepts, air traffic management responsibilities will be much as they are today. Airspace management functions will assist the flight operations to safely and efficiently accommodate the pilot's request without unnecessary constraints. ATC will continue to have primary responsibility for separation assurance and conflict avoidance.

- Future AT oceanic aviation weather needs are projected to be closely aligned with domestic en route aviation weather needs.

2.3 HIGH-LEVEL NEEDS

The expression of weather needs are predicated on two premises: (1) the need for weather data conversion, and (2) the need to tailor that information for a particular operational use. Weather data should be transformed into unambiguous weather information products, ready to expedite decisionmaking without interpretation and/or coordination with other data. Furthermore, tailoring of weather information must be expressed or displayed in a form and to the extent that is unique to the ATCS's operation and decisionmaking process.

Inherent within the presentation and dissemination of weather information is the need to develop procedures that take full advantage of aviation weather products and that are effectively integrated into ATCS operations in a way to minimize or decrease overall workload.

The high-level aviation weather needs have been grouped into three categories that describe the content of the information, the communication needs, and the interpretation and tailoring of the information for the users. The following categories are: information collection, information dissemination, and information display. The categories are useful to those performing weather program evaluations. Each of these categories is discussed below.

Information Collection:

This category describes general content and scope of the information needed by the ATCS.

Applicability--Aviation weather products shall be tailored specifically to facilitate the ATCS in tactical and strategic decisionmaking process. Nonessential, purely scientific data which do not have an operational basis shall be avoided. ATCS's are concerned with the operational effects of the weather phenomena as opposed to the weather characteristics themselves.

Scope--The ATCS's shall have access to weather information adjacent to their area of responsibility. Airspace boundaries are expected to be more flexible in the future, and other benefits accrue from an ability to extend situational awareness.

Accuracy and Quality--The accuracy and quality of weather information/data shall support the level of operational decisions being made.

Weather Severity Index--A more objective, quantifiable description and assessment of hazardous weather (e.g., icing and turbulence) are needed. Severity indices shall be stratified such that they can be related by all users to aircraft type. Accurate spatial extent, temporal duration, and the rate of change of these quantities are highly desirable.

Forecasting--Accurate weather prediction is extremely important to ATC operations and planning activities. Forecast products shall have sufficient lead times to support both tactical and strategic operations. Improved forecast product will improve the effectiveness of oceanic sectors, traffic management effort, and flight service station.

Site Tailoring--Weather information shall be "tailored" to specific sites to accommodate seasonal and geographic variances of meteorological phenomena and conditions.

Information Dissemination:

This category identifies characteristics of weather information that apply to the dissemination of weather among all NAS users:

Data Timeliness--Weather data are highly perishable and should reach the user within a time limit appropriate to its operational use. Acquisition, consolidation, integration, processing, dissemination, and display times shall be considered when satisfying this need. Specific timeframes will need to be addressed individually depending on the duration, extent, and movement of the phenomena and weighed against the air traffic option that it will be displayed in.

Consistency--Users shall have access to weather information derived from a common data base. Pilots and ATCS's often receive weather data from different sensing platforms which result in weather products that differ in accuracy, resolution, and timeliness. It shall be a requirement to have consistent, tailored weather products formulated from a common data base, presented on ATCS and pilot displays to avoid confusion and facilitate decisionmaking.

Information Display:

This category describes characteristics of the display of weather information for ATC. The implementation of these needs will have to be explored and validated through simulation and analysis before becoming system requirements.

Weather Condition Changes--ATCS's need to know operationally significant changes in weather conditions as opposed to being inundated with a continuous flow of weather data. Recall of salient aviation weather parameters shall be available to the ATCS's upon request. Each option shall define operationally significant weather parameters for each required operational function.

Integrated Function--Detailed weather information shall be displayed so it does not interfere with mission-critical data for that position. ATCS's need a display that contains weather and air traffic surveillance information necessary to support that particular operational position.

Merged Weather Products--Groups of weather data shall be made available in a single product to enhance operational situational awareness. When the use of weather information is analyzed from the operational perspective, it becomes apparent that groups of weather information could be merged into a single weather product for ease of use. It is recommended that the following weather phenomena shall be explored for possible integration:

- Convective Activity (CA) with Lightning (LT), Hail (HL), Tornadic Activity (TN), and Precipitation (PC) to form a Weather Impacted Airspace product;

- Turbulence (TB), Clear Air Turbulence (CT), and Mountain Wave Turbulence (MW) into an indexed product; and

- Microburst (MB) and Low-Level Windshear (WS) into a single display product.

Graphics--To aid in the assimilation of large amounts of similar and dissimilar weather data, all weather data—where appropriate—shall be converted into graphical depictions. Graphical information products that portray the operational impact of weather phenomena requiring minimal user analysis are preferred.

Graphics Movement--Future position plots of weather areas shall be available to aid in the simulation of weather for the aircraft rerouting decisionmaking process where appropriate. Movement may be expressed in the form of vectors, past history traces, future position plots, or other graphic depictions.

Three-Dimensional Representation--The ability to display weather events, phenomena, and/or other atmospheric conditions in three dimensions shall be

available where appropriate. It is desirable to show altitude information in addition to aerial extent and position. Two-dimensional representations of three-dimensional weather such as perspective, flight profiles, and cross-sectional side views are desirable. True three-dimensional displays with real-time manipulation of the 3-D view should only be considered if human engineering studies indicate that this capability is optimal for a specific air traffic control option.

Color Attribute--The use of color shall be available to help the operator recognize developing patterns of weather conditions. Color shall be used judiciously to avoid masking surveillance information.

Blinking and Audio Alert Information--Blinking and flashing of display information shall be kept to a minimum. ATCS's are continually monitoring the progress of aircraft and weather information and do not need strobing data to highlight situations. Audio alarms shall be kept at minimum usage. Additionally, when audio alarms are required they shall be self-silencing. Controls for brightness of display and volume are required.

Alerts and Alarms--Adaptable weather severity thresholds shall be activated at the operator's discretion.

User Preferences--Displays shall be adaptable to the individual operator's preference of primary and ancillary information and screen arrangement and contain features that allow easy recall of saved screen setups.

Overlays--Weather products shall be available for overlay on the base surveillance data in a way that does not interfere with mission-critical functions.

Individual Flight Tailoring--Flight service personnel shall be provided with preflight and in-flight briefing weather data tailored to the specific flight.

Contraction Translations--A capability shall be developed to aid in the translation of contractions. A method of clarifying contractions included in the weather and notice to airmen (NOTAM) information messages is required to assist the user encountering unfamiliar contractions and acronyms and to avoid interpretation errors.

2.4 ISSUES AND CONCERNS

The following information contains issues and concerns expressed by AT. These items are included to inform the reader of risk areas in the requirements definition process, which follows the needs definition phase. These items will require coordination and simulation activities for resolution. Air Traffic considers these issues key to the successful definition and deployment of solutions which provide weather information to ATCS's.

Data Timeliness versus Accuracy--Tradeoffs need to be made between very accurate data presented after some delay in collection (e.g., NEXRAD reflectivity data) versus somewhat less accurate, lower resolution information that is obtained in a very fast, high update rate system (e.g., ARSR-4, ASR-9). ATCS's can assist system engineers in design decisions for tradeoff between highly accurate data and high update rates. It is recommended that data/product fusion be considered to optimize tradeoffs. Contractual obligations for new equipment need to be designed to support software improvements on hardware systems to meet the weather needs.

Pilot Reports (PIREP)--Collection and delivery of PIREP's on the same radio frequency often cause message conflicts (PIREP's versus ATC instructions) and frequency congestion. Expeditious handling of PIREP's is needed—information becomes less reliable as time passes (e.g., observed windshear). There is no effective, automated system such as a fully automated data link for collecting and disseminating PIREP's.

Automated PIREP's--When PIREP's are automated, it brings another concern—PIREP overload. Areas with dense aircraft operations will experience redundancies in PIREP reports. Automation will make it possible to process hundreds of PIREP's—not all need to be individually reviewed. A way to consolidate and categorize these reports by phenomena is needed so that ATC is not inundated with pilot reports which slow the system down and do not contribute new information to the weather situation data base.

Procedures--Procedures often take precedence over need. Technology may well define hazards but procedures may prevent its realistic use. Air Traffic believes that procedures should only be invoked as a last resort when technology cannot satisfy needs.

New Product Legality--Legal ramifications of engineering, computer-driven decisionmaking in terms of ATC operations need to be investigated and clarified prior to product design and implementation.

Training--Representatives from the Office of Air Traffic Program Management, Training Requirement Program, need to be involved at the development stage to ensure that training requirements for ATC personnel are met.

2.5 RECOMMENDATIONS

Air Traffic recommends the following actions as an extension of the weather needs and requirements management process initiated under its charter:

Weather Information Conduit--Eliminate the role of terminal and en route ATCS's as the conduit of routine weather information to the pilot. Any weather information provided by these ATCS's should be limited to enhancements or clarifications of the routine information (i.e., on a value added basis). The terminal and en route ATCS's will still need to access weather information to assist in tactical and strategic planning. However, preflight and in-flight services to the aviation community should continue to be provided by the flight service station ATCS.

Airborne Weather Reports (e.g., PIREP's)--Automate the airborne weather report collection and dissemination process. Automation will enhance the process and free voice channel frequencies to be used for ATC functions.

Presentation of Weather Information--Weather data should be consolidated and presented to ATCS's in easy-to-understand graphical format. The information should be tailored to the specific option/operation user's needs, but shall be based on the same data.

Operationally Significant Weather--Use automation to sort the weather data and alert the ATCS to operationally significant weather. A comprehensive spectrum of weather information should be available to the ATCS to aid in the decisionmaking process.

System Implementation--AT and NAS System Engineering Service need to continue to foster and promote the process set up to allow earlier involvement in the acquisition cycle. In the past, involvement of AT in the design of new systems has come too late to ensure AT needs are being met. AT involvement is

paramount in establishing mission need statements before system acquisition begins. AT also has an interest in development of new concepts and products.

Human Factors Involvement--Human factors engineering should be an integral part of all future AT system designs.

Expedite New Weather Products--Use of rapid prototyping and increased user participation in test and simulation activities that develop new aviation products and operational services are desirable and highly encouraged.

FSS Improvements--The FSS ATCS's need common workstations within the facilities. A common data base of all weather and flight data, which is operator selectable, is required. A vehicle is needed to incorporate specialist-generated (e.g., EFAS, CWSU), value-added information into the common data base for use by other users. The preflight and in-flight ATCS should have the most advanced weather displays and products available to provide quality services.

En Route Flight Advisory Service (EFAS) Display--There is a need for live aircraft position plots in addition to weather graphics information for both current and forecast weather on the EFAS operational display.

In-Flight/Preflight Weather Services--Improve in-flight and preflight services as upgraded equipment becomes available to FSS operations.

Broadcast Position--This position should be automated.

Other Aviation Data Bases--The establishment of other aviation data bases is desired to serve as sources of need for pilots, program mission need statements, and regulatory interests. This data base will allow corresponding data bases to be compared and contrasted with all existing needs data bases for coordination purposes.

APPENDIX 3. AIR TRAFFIC WEATHER REQUIREMENTS DATA BASE

Aviation weather needs can be evaluated on the basis of how they can be used and what properties they have that are essential to the operation. This order captures both the operational basis of how ATC is using weather information and the critical weather information necessary for successfully performing that operation. This section describes the process to collect the weather needs, presents descriptions of the data base output reports, and discusses the benefits of putting the needs into a data base.

3.1 DATA BASE

The purpose of the air traffic weather requirements data base is to function as the Air Traffic Plans and Requirements Service repository of AT needs. This repository offers a means of managing weather needs by setting up a baseline of information that identifies the weather needs for each ATC position and for each aircraft operation, along with the physical characteristics that describe the weather phenomena (e.g., tops of clouds, speed and direction of winds aloft) important to the decisionmaking process.

By capturing these needs and related information from the users and by documenting their basis and characteristics, relationships between operational weather needs and the functions they support may be explored and from them weather requirements can be derived.

3.2 DATA BASE USERS

The needs data base is available to all types of AT and non-AT users: managers, capacity planners, engineers, system developers, and pilot advocates. Each of the users has needs unique to its viewpoint and requires information from the data base tailored to its perspective. Appendix 4 contains examples of data base applications that could be used by various FAA and non-FAA agencies. For example: management may use the data base to evaluate the scope of AT operations for a particular position within the terminal option, or provide engineers a basis for determining requirements and design definitions of a data collection platform, or an ATCS's display device.

Since the data base is relational, it offers the ability to add new information on related subjects and connect this new information to the existing data, enhancing the value by providing a vehicle for further analysis. The data base could be used by other user agencies to address and compare their needs and possibly eliminate a duplication of effort. Only a limited sample of applications of the data base are constructed for inclusion in this order. Additional applications can be developed. Interested users can

direct their specific request to either the Manager, NASP and Future Systems Branch, ATR-330, or the Manager, Aviation Weather Development Program Office, ARD-80.

3.3 DATA BASE APPLICATIONS

The data base applications that are illustrated in Appendix 5 of this order are described below:

Table 1, WEATHER PROFILES, presents the weather characteristics needed to support operational decisions within each of the ATC options. Table 1-1, Table 1-2, and Table 1-3 list the weather profiles relevant to the terminal area, the en route centers, and the flight service stations. Weather systems which provide services to the ATC options shall not be considered responsive to the needs of AT unless all the requirements presented in the weather profile tables are satisfied by those systems.

Table 2, TACTICAL WEATHER USAGE BY PHASE OF FLIGHT, presents the ATC tactical use of weather information relative to phases of a typical flight profile, i.e., from the pilot's perspective. A pilot flying from one location to another executes the flight in segments called flight phases which have weather informational needs peculiar to that phase of flight. In this table, the weather needs for each phase of flight are shown along with the associated ATC operational justification. Each ATC operation has been associated with pilot-related activities which also require weather information.

Table 3, TACTICAL WEATHER USAGE BY AIR TRAFFIC CONTROL OPERATION, presents the ATC tactical use of weather information relative to each of the ATC operations identified by study by the team, i.e., from the ATC perspective. This table is similar to Table 2, TACTICAL WEATHER USAGE BY PHASE OF FLIGHT, and contains the weather needs for each ATC operation in the study along with the operational justification for the weather.

Table 4, WEATHER PRODUCT SAMPLES: ICING AND TURBULENCE REPORTS, presents two sample aviation weather product descriptions which could be incorporated into an ATC weather product directory. The product descriptions are an outgrowth of the information collected by the ATWRT. Two sample product descriptions are presented, an Icing Report and a Turbulence Report.

These four applications demonstrate the flexibility of the data base by depicting the data collected by the team in different perspectives. Table 1 shows the weather needs by ATC option. Table 2 shows the weather needs by the pilot. Table 3 shows the ATC tactical weather needs. Table 4 shows two individual weather perspectives compared to ATC operations.

3.4 CONVERTING NEEDS INTO REQUIREMENTS

The process by which needs are converted into requirements is by adding a level of specificity to the information, e.g., accuracy, resolution, precision, spatial, and temporal attributes. This is done by examining the operational usage of each need, identifying weather products which may be used to display the weather information to the AT user, and determining how a particular piece of information obtained from a sensor, numerical model, or human is used in an operational decisionmaking process. By providing this additional information to the weather needs, a baseline is established with operational rationale for conversion into weather requirements.

After the weather requirements have been identified, it will be possible to list the weather data and numerical quantities needed to produce the desired weather information displays. A list of the data needed is compiled, and then the weather data needs may be used to assess the capabilities of existing and planned weather programs to provide data sufficient to support the weather needs established as the baseline. Simulation and analysis are the key activities to defining the weather requirements at this stage.

3.5 BENEFITS

There are a variety of advantages for using a data base as a repository of weather needs. First, a data base offers flexibility of presentation to a variety of users because it takes advantage of the automation to organize and search through data for specific information. Second, it is easy to maintain, update, and modify the existing data base. Finally, since the data base is a relational, it offers the ability to add new information on related subjects and connects this new information to the existing data enhancing the value of effort established by the team. It has specific direct benefits which occur during the definition, design, and development of weather systems for the NAS, and indirect benefits that result from the deployment of systems better suited to the performance of ATC operations. Examples of the direct and indirect benefits are listed below:

Direct Benefits:

- Assure consistency between AT weather needs and NAS requirements;
- Reduce ambiguities in statements of aviation weather needs;
- Control program costs;
- Assure consistency of requirements among weather programs; and
- Assess and evaluate weather programs and projects.

Indirect Benefits:

- Enhance safety;
- Increase ATC efficiency of operations;
- Lessen ATCS workload;
- Identify desirable system features from AT perspective; and
- Reduce program life cycle costs.

APPENDIX 4.

GLOSSARY OF TERMS AND DATA BASE SUPPORTING INFORMATION

Throughout the discussions in developing this order, numerous terms and acronyms were used. This list describes the intended meaning for these terms.

ACRONYMS

AAR	Airport Acceptance Rate
AAS	Advanced Automation System
AFSS	Automated Flight Service Station
ARSR	Air Route Surveillance Radar
ARTCC	Air Route Traffic Control Center
ASR	Airport Surveillance Radar
ASOS	Automated Surface Observing System
AT	Air Traffic
ATC	Air Traffic Control
ATCS	Air Traffic Control Specialist
ATCSCC	Air Traffic Control System Command Center
ATCT	Airport Traffic Control Tower
ATIS	Automatic Terminal Information Service
ATM	Office of Air Traffic Management
ATWRT	Air Traffic Weather Requirements Team
AWOS	Automated Weather Observing System

CIP	Capital Investment Plan (replaced NAS Plan)
CWSU	Center Weather Service Unit
DUATS	Direct User Access Terminal Service
EDCT	Expected Departure Clearance Time
EFAS	En Route Flight Advisory Service
FAA	Federal Aviation Administration
FSS	Flight Service Station
HIWAS	Hazardous In-flight Weather Advisory Service
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LLWAS	Low-Level Windshear Alert System
NAS	National Airspace System
NEXRAD	Next Generation Weather Radar
NOTAM	Notice to Airmen
NWS	National Weather Service
OPS	Operations
PIREP	Pilot Reports
RNAV	Random Area Navigation
RVR	Runway Visual Range

SIGMET	Significant Meteorological Information
TIBS	Local Telephone Information Briefing Service
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control
TWEB	Transcribed Weather Broadcast
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WX	Weather

Weather Information Codes

AT - Altimeter Setting: The pressure value to which an aircraft altimeter scale is set so that it will indicate the altitude above mean sea level of an aircraft on the ground.

CA - Convective Activity: Deep, vertical cloud development varying in the horizontal extent (e.g., single-cell or multiple-cells) and intensity (magnitude) of upward and/or downward vertical motion. CA may include thunderstorms (lightning is present) with its other possible associated hazards of heavy rain, strong surface winds and wind gusts, windshear, strong updrafts/downdrafts, and sometimes hail. Convective activity is used to connote the condition of atmospheric instability.

CD - Clouds (includes ceiling): A visible accumulation of minute water droplets and/or ice particles suspended in the atmosphere. Ceiling is the height ascribed to the lowest opaque layer of clouds with a sky coverage of 0.6 or greater.

CT - Clear Air Turbulence: Is turbulence experienced with no clouds associated, a wide variation, over short distances, in wind speed and direction (both in horizontal and/or vertical direction). Although CT can occur at any altitude, it is commonly applied to high-altitude levels and in association with a jet stream.

DA - Density Altitude: DA is used in determining the criteria for performance capabilities of the aircraft. DA accounts for the effects of temperature with respect to a specific elevation of a particular location.

HL - Hail: Precipitation in the form of small circular ice balls or irregularly shaped pieces of ice resulting from liquid precipitation particles caught in a thunderstorm updraft, freezing, falling out of the updraft; but, possibly repeating the cycle several times over to form large size hail.

IC - Icing: May be in the form of rime, clear (glaze), or mixed (both rime and clear). Rime: a deposit of ice, produced by super-cooled cloud droplets. Clear: a coating of ice, frequently produced by the freezing of super-cooled drizzle or rain on exposed objects.

LT - Lightning: A sudden electrical discharge that takes place from or inside a cloud. Four types of discharges: cloud to ground, in-cloud, cloud-to-cloud, and cloud-to-air.

MB - Microburst: A small scale (2.5-mile diameter or less) wind event characterized by a narrow, high-speed descent (e.g., downdraft) of air, associated with strong convective activity, creating an outflow, and spreading horizontally near the surface in all directions or in a preferred direction depending on the horizontal translation of the downward-directed shaft of air.

MW - Mountain Wave Turbulence: A wide variation in wind speed and direction (mainly in the vertical) resulting from wind flow across and occurs downwind of a mountain ridge line.

PC - Precipitation: A hydrometer consisting of liquid or solid water particles (e.g., rain, virga, snow, drizzle, freezing rain/drizzle, ice pellets). When speaking of augmented operations, PC means virga only.

RV - Runway Visual Range: The horizontal distance a pilot will see down a runway from the approach end. It is based on seeing high-intensity runway lights or on the visual contact of other targets whichever yields the greater distance.

SW - Surface Winds: The horizontal motion of air past a given point at the surface and includes both speed and direction.

TB - Turbulence (non-CT): A wide variation, over short distances, in wind speed and direction (both in horizontal and/or vertical direction). Covers in-cloud turbulence as well as that associated with thunderstorms.

TC - Tropical Cyclone: A low pressure weather system in which the central core is warmer than the surrounding atmosphere. Tropical cyclones contain spiraling bands of thunderstorms, winds in excess of 74 miles per hour, and may extend above 40,000 feet. The United States definition of a Tropical Cyclone includes Tropical Depression, Tropical Storm, and Hurricane.

TD - Temperature/Dew Point: Temperature is the ambient air (dry-bulb) temperature. Dew point is the temperature to which a given parcel of air shall be cooled at constant pressure and water vapor in order for saturation to occur.

TN - Tornadic Activity: A violent, rotating column of air, forming a cloud and debris pendant, usually from a cumulonimbus cloud. TN includes the phenomena funnel cloud which is a cloud pendant not reaching the ground and waterspout. A waterspout occurs over water and is not necessarily associated with a thunderstorm and is generally less violent than a tornado.

VA - Volcanic Ash: Fine particles of rock powder blown from a volcano and may remain suspended in the atmosphere for long periods of time.

VS - Visibility: The ability to see and identify prominent unlighted objects by day and prominent lighted objects by night.

WA - Winds/Temperatures Aloft: Wind is the horizontal motion of air past a given point and includes both speed and direction. Temperature is the ambient air temperature.

WS - Low-level Windshear: A change in wind speed and/or direction (both in horizontal and/or vertical direction) over a short distance resulting in a tearing or shearing effect which produces a change in lift/ground speed of the aircraft. WS is usually associated with fronts and thunderstorms (e.g., gust front, microburst).

WV - Wake Vortex: Small scale vortices shed from the wing tips (fixed and rotary) resulting from the passage of an aircraft through the atmosphere.

Weather Profile Characteristics

A weather profile is a set of physical characteristics which may be used to describe weather phenomena. In the tables that follow, the weather profiles depict the essential information air traffic requires to support operational decisions in the terminal area, the en route centers, and the flight service stations.

ALT - Altitude of phenomena

AREA - Aerial extension or airspace coverage.

BASE - Lowest altitude of the phenomena (i.e., bases or base of turbulence)

CLASS - Type (e.g., type of icing or cause of visibility restriction)

DIR - Direction of phenomena movement (e.g., wind direction or cell heading)

FREQ - Frequency of occurrence

G/DK - Growth and decay (e.g., storm intensifying or decaying)

INT - Intensity (e.g., light, moderate, heavy, severe--depending on the phenomena)

LOCN - Location of the phenomena

LYR - Layers (e.g., clouds)

MVM - Direction of movement

TCRT - Time critical. This information needs to be disseminated immediately.

TIME - Time of occurrence

TOPS - Maximum altitude of the phenomena (i.e., tops of clouds or turbulence layer)

SPD - Speed of movement (e.g., windspeed)

STR - Straight parameter (e.g., an observed reading)

4CZ - Required forecast time to support this operation. Forecast information shall include the time of occurrence and a validity or duration factor.

DATA BASE SUPPORTING INFORMATION
ATC Position Definitions

Terminal Area

TRACON:

Supervisor:

The TRACON supervisor coordinates use of airspace, runway approach selection, procedures, manages equipment, coordinates nonstandard traffic and weather situations. The supervisor manages the rotation of personnel to meet the workload, monitors equipment for maintenance, and backup generator operation.

Traffic Management Coordinator (TMC):

The TRACON TMC coordinates use of arrival/departure gate closures and establishes airport acceptance rates (AAR), ARTCC/ATCT intrail restrictions.

Arrival/Departure:

The Arrival/Departure ATCS issues altitude, heading, airspeed changes to maintain aircraft separation and directs aircraft in an efficient manner through the terminal environment.

TOWER

Supervisor:

The tower supervisor coordinates use of runway and airport movement areas, including runway selection, establishment of control tower procedures, intrail departure sequence and coordinates nonstandard traffic and weather situations. The supervisor manages the rotation of personnel to meet the workload demands, monitors equipment for maintenance, and backup generator operation.

TMC:

The TMC coordinates with the TRACON TMC to establish the airport arrival rate based on the number of aircraft per hour average, weather, runway configuration, runways available and departure aircraft demand.

Local Controller:

The local control position is responsible for sequencing and separation of aircraft operating on the active runways of an airport.

Ground Controller:

The ground control position is responsible for aircraft and vehicular operations on the airport movement areas.

Flight Data:

The flight data position is responsible to maintain and update relevant information concerning aircraft, weather and air traffic control system.

Clearance Delivery:

The clearance delivery position is responsible for issuing IFR/VFR clearances and ensures the accuracy of the flight plan data.

En Route/Oceanic

ARTCC:

Area Supervisor:

The ARTCC area supervisor coordinates use of ARTCC airspace including selection of weather avoidance routes of travel, establishes ARTCC sector procedures, coordinates nonstandard traffic and weather situations, weather and flow forecasts and coordinates ground delay/stop programs. The area supervisor manages the sector airspace and ARTCC personnel to meet the workload.

Traffic Management Units (TMU):

The TMU controller coordinates the flow of aircraft through the ARTCC's airspace. Weather factors affecting aircraft congestion, overloaded sectors, or potential aircraft delays are important to the TMU. The TMU shall maintain operationally acceptable traffic levels and keep delays to a minimum. National Ground Delay Programs are administered by ATCSCC. Currently the TMU controller confers with the Center Weather Service Unit (CWSU) for weather information. (The CWSU's weather equipment needs to keep pace with weather improvements as they become available.)

Low Altitude Controller:

The low altitude controller issues altitude, heading or airspeed changes to maintain aircraft separation and directs aircraft as efficiently as possible through lower altitudes of the en route airspace assigned to the ARTCC facility. This includes guidance to avoid or resolve congestion.

High Altitude Controller:

The high altitude controller issues altitude, heading or airspeed changes to maintain aircraft separation and directs aircraft as efficiently as possible through higher altitudes of the en route airspace assigned to the ARTCC facility. This includes guidance to avoid or resolve congestion.

Oceanic:

Area Supervisor:

The oceanic area supervisor coordinates use of oceanic airspace including selection of weather avoidance routes of travel, establishes oceanic sector procedures, coordinates nonstandard traffic and weather situations, weather and flow forecasts and coordinates ground delay/stop programs. The area supervisor manages the sector airspace and oceanic personnel to meet the workload.

Oceanic Controller:

The oceanic controller issues altitude, heading or airspeed changes to maintain aircraft separation and directs aircraft as efficiently as possible through higher altitudes of the oceanic airspace assigned to the facility. This includes guidance to avoid or resolve congestion.

Flight Service Stations

Area Supervisor:

The FSS area supervisor manages personnel resources including shift staffing, position staffing and workload distribution, monitors equipment for maintenance, accident recovery, and backup generator operation.

En Route Flight Advisory Service (EFAS):

The EFAS specialist is required to provide en route aircraft with timely and pertinent real-time weather information and is not primarily for forecast or full briefings. The data is tailored to a specific altitude and route using the most current available sources of aviation meteorological information. Weather services are provided to a broad spectrum of aviation users including airlines, military, general aviation, and air taxi operations. En route aviation weather information is critical to this function. Weather information is often needed to assist with lost aircraft orientation. EFAS is not intended to be used for filing or opening flight plans; it is designed as a weather exchange service only.

In-flight Specialist:

The in-flight specialist provides complete weather briefing and flight planning services. This includes all weather advisories within 150 miles of the aircraft's position or route of flight. The specialist assists air evacuations and air ambulance flights in avoiding turbulence and other weather-impacted areas. Briefings are provided to a broad spectrum of aviation users. The in-flight position provides pilots with routine and hazardous weather information, relays Special VFR and IFR clearances, local airport advisory and provides density altitude information. Weather information is often needed to assist with lost aircraft orientation.

Preflight Specialist:

The preflight specialist translates, interprets and summarizes available weather data for flight routes within the U.S. as well as selected international locations. The preflight specialist has the responsibility to provide weather briefings to military, airline, civilian, and international pilots.

Broadcast Specialist:

The broadcast specialist is responsible for recording and continuously monitoring automated pilot weather information systems such as the Hazardous In-flight Weather Advisory Service (HIWAS), the Transcribed Weather Broadcast (TWEB) and the Telephone Information Briefing Service (TIBS).

Operations Definition

Below are the ATC operations. The phrase in capital letters is the name used in the data base to identify the operation described to its right.

Terminal Area

TRACON:

Supervisor:

The TRACON supervisor's functions include:

ACTIVE RUNWAYS	Determining the type of approach in use.
MGMT EQP/RES	Monitoring equipment availability through repair, maintenance, including AT staff position assignment, rotation of personnel, and backup generator operation.

TMC:

The TRACON TMC's functions include:

METERING/FLOW (TMC)	Organizing traffic flow. Metering (planning).

Arrival/Departure Controller:

The duties of the arrival/departure controller include:

ARRIVALS	Providing control instructions to arrival aircraft (sequencing and separation).
DEPARTURES	Providing control instructions to departure aircraft for separation.
OVERFLIGHTS	Providing control instructions to overflight aircraft.

ATC TOWER:

Supervisor:

The tower supervisor's functions include:

ACTIVE RUNWAYS	Determining active runway configurations.
MGMT EQP/RES	Monitoring equipment availability through repair, maintenance, including AT staff position assignment, rotation of personnel, and backup generator operation.

TMC:

The tower TMC's functions include:

TRAFFIC FLOW (TMC)	Establishing traffic flow routes for inbound and outbound aircraft and position assignment and rotation of personnel to meet traffic demands.
ESTABLISH AAR/INTRAIL	Establishing Airport Acceptance Rate (AAR) and Airport/ARTCC INTRAIL.

Local Controller:

The local controller's duties include:

STAGING DEPARTURES	Issuing taxi instruction and departure sequencing of all aircraft.
LAND/TAKEOFF CLR	Issuing landing/takeoff clearances.
ISSUE WX INFO/LOC	Relaying weather information relative to landing/takeoff.
SEQ LANDINGS	Sequencing landing aircraft.

Ground Controller:

The ground controller's functions include:

STAGING DEPARTURES	Issuing taxi instruction and departure sequencing of all aircraft.
GND SPT VEHICLES	Controlling ground support vehicles in all airport movement areas except active runways.
ISSUE WX INFO/GND	Issuing weather information to pilots.
ARRIVALS	Issuing taxi instructions to arriving aircraft.

Flight Data/Clearance Delivery:

The duties of the flight data/clearance delivery controller are:

ATIS ACCURACY	Recording and ensuring accuracy of the ATIS broadcast.
AUGMENT AUTO WX SYS	Augmenting automated weather systems (e.g., ASOS/AWOS) with appropriate weather information.
ISSUES CLEARANCES	Issuing clearances to IFR/VFR aircraft.

En Route/Oceanic

ARTCC: (general airspace coverage 18,000 feet and above)

Area Supervisor:

The supervisor's duties include:

MANAGE SECTOR AIRSPC	Managing area resources, including personnel, sector staffing, sector de/combination, and airspace usage.
INIT TM ACTIONS	Initiating traffic management actions.

Traffic Management Units (TMU):

TMU's duties include:

GROUND DELAY	Implementing ground delay programs.
GROUND STOP	Implementing ground stops.
EN ROUTE SPACING PROG	Implementing the En Route Spacing Program.
SWAP	Coordinating and implementing Severe Weather Avoidance Procedures (SWAP).
ARR SEQ PROG	Operating the center Arrival Sequencing Programs (ASP) (Metering).
SECTOR CAP MGMT	Managing the capacity of all sector airspace.
	Predicting oceanic track and weather modeling.
	Selecting and controlling Special Use Airspace.

Low Altitude Controller:

The low altitude controller's duties include:

ISSUE CTRL INSTRUCT	Issuing control instructions to aircraft to maintain separation.
	Issuing control instructions to aircraft to comply with Traffic Management (TM) requirements.
SELECT APPROACHES	Selecting approaches for arrival aircraft.
RELAY WX	Relaying pertinent weather information to pilots and supervisors.
ISSUE CLRNC/GND	Issuing clearances to departing aircraft.
VECTORS FOR APPROACH	Vectoring aircraft for approach.
ARRIVALS	Providing control instructions to arrival aircraft (sequencing and separation).
DEPARTURES	Providing control instructions to departure aircraft for separation.
OVERFLIGHTS	Providing control instructions to overflight aircraft.

High Altitude Controller:

The high altitude controller's functions include:

ISSUE CTRL INSTRUCT	Issuing control instructions to pilots in order to maintain separation and establish spacing between aircraft.
ISSUE WX INFO	Acquiring weather information (PIREP's) from pilots and relaying this information to other pilots and supervisors for dissemination.

Oceanic: (general airspace coverage 10,000 feet and above)

Area Supervisor:

The supervisor's duties include:

MANAGE SECTOR AIRSPC	Managing area resources, including personnel, sector staffing, sector de/combination, and airspace usage.
INIT TM ACTIONS	Initiating traffic management actions.

Oceanic Controller:

The oceanic controller's functions include:

ISSUE CTRL INSTRUCT	Issuing control instructions to pilots in order to maintain separation and establish spacing between aircraft.
ISSUE WX INFO	Acquiring weather information (PIREP's) from pilots and relaying this information to other pilots and supervisors for dissemination.

Flight Service Stations

Supervisor:

The supervisor is responsible for:

STAFF MGMT	Managing personnel resources including shift staffing, position staffing, and workload distribution.
EQUIPMENT MGMT	Monitoring equipment availability through repair, maintenance, and backup generator operation.

ACCIDENT RECOVERY	Forming decisions, coordinating with Airway Facilities for flight checks, restoring NAS to best capacity.

En Route Flight Advisory Specialist:

The en route flight advisory specialist's (EFAS) duties include:

DISSEM EN ROUTE WX	Disseminating real-time weather information tailored to specific altitude and route (especially hazardous weather information).
	Disseminating information to airborne aircraft.
FSS INT/EXT SUPPORT	Providing internal and external analysis and supporting specialists (both NWS and FSS)
SOLICIT AB REPORTS	Collecting airborne reports from pilots.

In-flight Specialist:

The in-flight specialist's duties include:

LOCAL AIRPT ADVISORS	Disseminating local airport information.
ISSUE WX INFO-PILOTS	Disseminating information to airborne aircraft.
SOLICIT AB REPORTS	Collecting airborne reports.

Preflight Specialist:

The preflight specialist's functions include:

PREFLIGHT BRIEFING	Providing weather briefings to pilots for the weather along the intended flight route.

Broadcast Specialist:

The duties of the broadcast specialist are:

RECORD BROADCAST WX	Recording aviation weather information for broadcast.

Basis Definitions

A key phrase is used to provide an abbreviated format while expressing the following basis in the table format.

KEY PHRASE	BASIS
AAR	Airport acceptance rate/optimum utilization and planning.
AAR LIMITED VISIBILITY	Limited visibility affects the approach in use and AAR.
AIRPORT WX	Procedurally driven; pass directly from weather information system to all users (terminal, flight service station, centers, and pilots).
ALTIMETER	Disseminate to aircraft at uncontrolled airports.
APPROACH CONTROL FUNCTION SEP	Separation planning.
APPROACH CONTROL FUNCTION HOLDING	Approach planning; major terminals for routing of aircraft over the arrival fixes for holding pattern planning.
APPROACH CONTROL FUNCTION PATH	Choose approach path.
APPROACH CONTROL FUNCTION SELECT	Separation planning; selecting approach path.
APPROACH CONTROL FUNCTION PLAN	Approach planning.
ARRIVAL SEQUENCING	Arrival sequencing.

KEY PHRASE	BASIS
AUGMENTATION	Require system to automate the augmentation of ASOS/AWOS to reduce workload on the ATCS. Currently, this person is required to look out the window and augment the system with tower visibility, presence of thunderstorms, volcanic ash, virga, freezing rain, hail and tornadic activity. NOTE: This tower position duty is a candidate for automation.
BACKUP GENERATORS	Managing equipment and resources. Turn on generators for service backup prior to/during active lightning.
BROADCAST REPORT	Hazardous weather, recorded and broadcast over specific navigational aids, provided to pilots along particular routes of flight.
CAPACITY	Tactical sector airspace saturation avoidance.
CLEARANCES	Determine aircraft arrival and departure interval.
DEICING	Deicing of aircraft.
DEICING INTERVAL	Ground deicing. It is time critical that aircraft become airborne within 15 minutes after deicing.
DENSITY ALTITUDE	Departure needs for runway selection/coordination.
DEPARTURE STOP	Ground Stops are implemented when unexpected conditions and short-term phenomena adversely impact AAR at departure airport.
DURATION PLANNING	Predicts the expected duration of hazardous weather presently occurring to be avoided.
EFAS IN-FLIGHT SUPPORT	EFAS IN-FLIGHT analysis - EFAS IN-FLIGHT specialist analyzes weather data to provide additional services and support to other AFSS positions (e.g., enhance charts, analyze graphics, GOES data, etc.).
FLIGHT WATCH ADVISORY	Provide pilot with pertinent en route weather information. Flight watch is the shortened term for air-ground contact with the En Route Flight Advisory Service (EFAS). EFAS is designed as a weather exchange service of tailored, pertinent weather conditions and hazardous information.

KEY PHRASE	BASIS
FLOW RATES	Weather avoidance - Reroute aircraft around the actual phenomena.
GA ADVISORY	For general aviation pilots' safety advisory under 10,000 feet.
HAZARD WX AVOIDANCE VECTOR	Vector aircraft around hazardous activity.
HAZARD WX AVOIDANCE SAFETY	Provide safety advisory; vector aircraft around hazardous activity.
HAZARD WX AVOIDANCE DIS	Disseminate hazardous weather information to aircraft departing uncontrolled airports.
HAZARD WX AVOIDANCE	Safety advisory; planning runway selection or separation intervals between arrival aircraft; issuance of vector changes.
HAZARD WX AVOIDANCE SEP	Vectors aircraft around hazardous activities; maintain appropriate aircraft separation.
IFR/VFR OPERATIONS	Affects airport acceptance rate; used to determine if IFR/VFR operations in effect.
IFR TO VFR DEP	IFR aircraft requesting to proceed to VFR conditions.
ILS CRITICAL AREA PROTECTION	This determines the interval between aircraft. As visibility decreases, dependency on ILS navigational signals increases (lower minimums). Area protection keeps ground vehicles from distorting ILS navigation signals to arriving aircraft.
IN-TRAIL SEPARATION	Spacing on final/optimum runway utilization.
IN-TRAIL SEPARATION VFR	Establish aircraft separation interval, issue vectors for re-establishment of VFR operations.
MANAGE RESOURCES	Workload planning/staffing; area configuration; situational awareness; special use airspace release; approval authority for NAS equipment outage.

KEY PHRASE	BASIS
METERING	Affect airport arrival rates; aircraft preferred routes' impact on airport capacity; weather impacted airspace avoidance; planning of delays at the appropriate points/fixes inbound to the destination airport (may be outside sector); all factors that affect AAR shall be provided to the TMU in the future to optimize the metering program by giving TMU the information necessary to anticipate AAR decisions and enhance metering from one center to another.
MINIMUMS	Maximum utilization of airport movement areas.
PLAN AAR PERSONNEL	Operating position and personnel decisions. AAR determination. Choice of approaches. Facility coordination. Simultaneous approach monitors.
PLAN AAR	Planning and airport acceptance rate.
PLAN RUNWAYS	Select inner/outer runways. Which runways favor arrivals/departures?
PLANNING MANAGE	Situational awareness; workload planning/staffing; area configuration; special use airspace release; approval authority for NAS equipment outage.
PLANNING SECTOR	Planning sector workload.
PLANNING PREFLIGHT	Preflight planning - Pilot bases his/her decision to fly or not to fly upon the preflight weather given by specialist.
PLANNING ASSESS WX	Assess the impact of weather on pacing airports and make a decision to delay aircraft on the ground to preclude airborne holding. National level programs require 4 hours minimum lead time to implement. Local programs can be implemented within 1 hour. Ground delay programs are not predicated on actual conditions, but rather on accurate forecasts of conditions for proper airspace management.
PROCEDURES	Procedurally driven requirements. (FAR regulations)
REROUTE	Planning of best routing for avoidance of sector saturation, accommodation of airport acceptance rates, economy and comfort of passengers.

KEY PHRASE	BASIS
RUNWAY ARR/DEP WX	Non time critical, pertinent weather information used to safely sequence arrivals and departures, and ensure proper runway separation exists between aircraft.
RUNWAY SELECTION	Runway selection.
RUNWAY SELECTION WIND	Surface winds determine airport configuration and affect on AAR.
RUNWAY USE	Optimize airport runways based on takeoff minimums/aircraft and pilot capabilities; delay systems, TMU information, severe weather avoidance plan; departure interval.
SAFETY WX ADVISORY SPACE	Safety, spacing, planning, safety advisories.
SAFETY WX ADVISORY SELECT	Routine selection; safety advisory.
SAFETY WX ADVISORY REROUTE	Safety advisory; reroute planning per minimum en route altitudes and facility letters of agreement.
SAFETY WX ADVISORY RELAY	Safety advisory (relay of weather information).
SAFETY ADVISORY	Safety advisory and traffic planning.
SAFETY ADVISORY L.L.	Low level hazard information for aircraft in landing configuration.
SAFETY ADVISORY AVOID	Safety advisory to avoid a hazardous activity.
SAFETY ADVISORY APPROACH	May adjust approach interval. Airport acceptance rate/optimum utilization and planning.
SAFETY WX ADVISORY PATH	Safety advisory; approach path selection.
SAFETY WX ADVISORY WARN	Safety advisories, warnings.

KEY PHRASE	BASIS
SAFETY WX ADVISORY RWY SELECT	Safety advisory and selecting runway.
SAFETY WX ADVISORY AAR	Airport acceptance rate/departure rate/optimum utilization and planning.
SAFETY WX ADVISORY ICING	Safety advisory; reroute planning per minimum en route altitudes and facility letters of agreement.
SAFETY WX ADVISORY UTIL	May adjust approach interval; airport acceptance rate/departure rate/optimum utilization and planning.
SAFETY WX ADVISORY VECTOR	Vector around activity; safety advisory.
SAFETY WX ADVISORY ALT	Safety advisory; altitude selection; route selection.
SECTOR SATURATION	Sector saturation avoidance.
SECTOR USAGE	Plan sector usage for aircraft sequencing.
SEQUENCING	Current only: Managing the traffic pattern; establishing the airport traffic flows and sequencing of arriving aircraft.
STAGING	Set departure sequence.
SUPERVISORY DUTIES	Coordination with Airway Facilities and other Air Traffic options after accident/incident to establish NAS involvement.
TIME CRITICAL WX	Critical flight safety information; hazardous weather avoidance information whose rapid detection, processing and dissemination are essential to the safety of the flight.
VALIDATE AAR	Validates AAR and other decisions made based on forecasts. Forecasts are more important than options.
VECTORING PLAN	Vectors to intercept flight plan course.
VECTORING	Vectoring.
VECTORING SAFETY	Vector around activity; safety advisory.

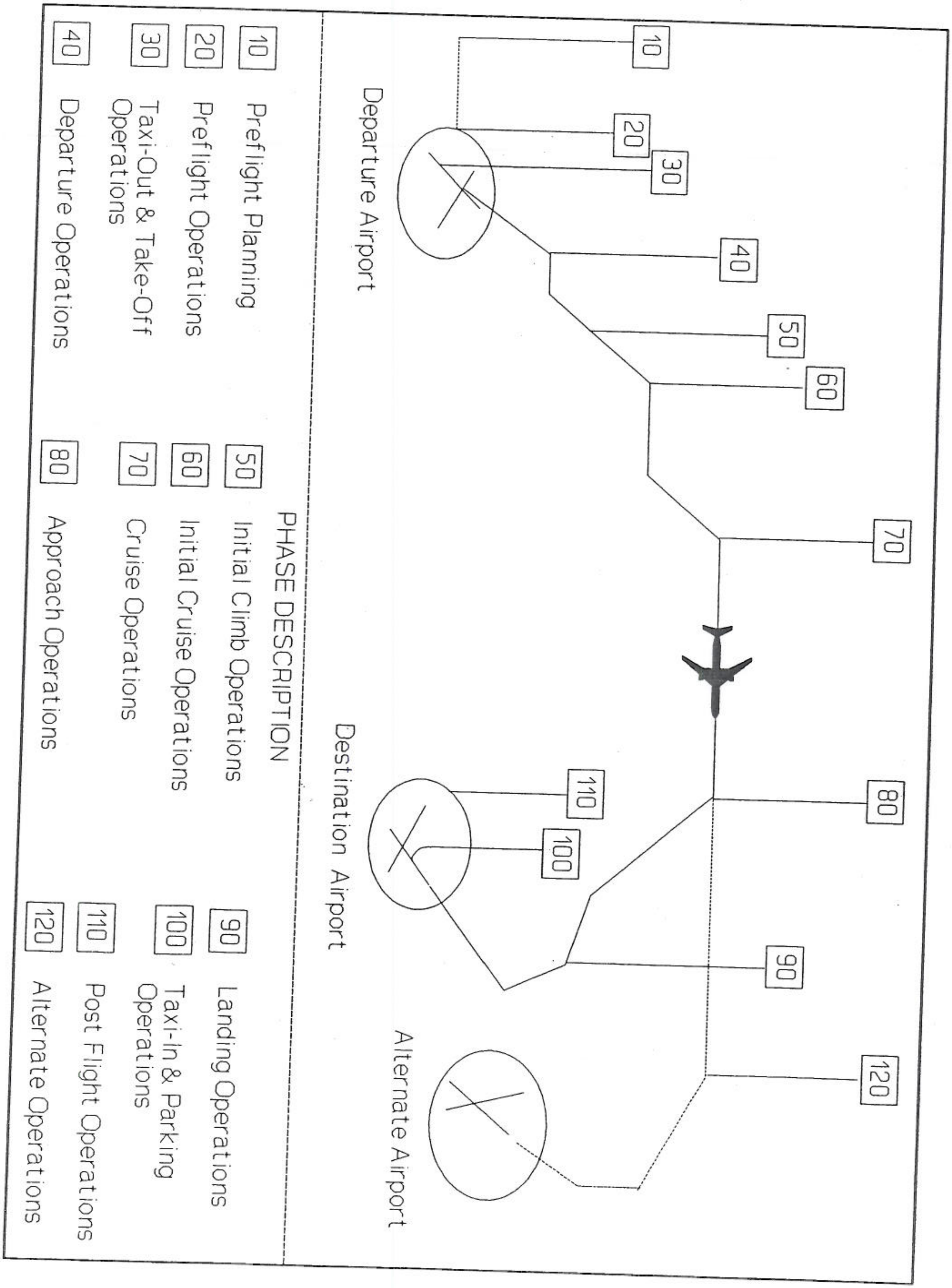
KEY PHRASE	BASIS
VECTORING SAFETY-OCN	Vector around activity; safety advisory. Provide support to hurricane reconnaissance aircraft.
VFR "ON TOP"	Issue IFR aircraft a VFR-on-top clearance.
WX COORD DATA	Planning/weather data for coordination with CWSU, NWS, users, other ATC facilities. Local airport advisories issued by NWS, CWA by CWSU.
WX COORD DATA-OCN	Planning/weather data for coordination with CWSU, NWS, users, other ATC facilities. Local airport advisories issued by NWS, CWA by CWSU. Provide support to hurricane reconnaissance aircraft.
WX DATA	Currently provided as an advisory service; would like to automate this mode of providing this service as a routine and only provide operationally significant weather. (Weather data may affect position, staffing, airport closures, or any part of the AFSS positions.)

Flight Phase Definition Table

In order to make further use of the weather information needed to support air traffic control, flight phases which correspond to pilot weather-related activities during each AT operation have been associated with those operations. Names and descriptions of the flight phases are listed below along with a reference number which suggest a general sequence of activities that occur during a typical flight.

Ref No.	Flight Phase	Description
10	Preflight Planning	Gather weather information necessary to file an IFR flight plan.
20	Preflight Operations	Prepare aircraft to taxi—warmup, deicing, taxi route planning.
30	Taxi-Out & Take-Off Ops	Perform taxi operations, receive clearance information; take off—airborne, determine final takeoff and initial climb requirements.
40	Departure Operations	A generic departure category reserved for strategic activities associated with departing aircraft.
50	Initial Climb Ops	That portion of flight operations between takeoff and the initial cruising altitude.
60	Initial Cruise Ops	That portion of flight when achieving an initial altitude or flight level used as a fix or standard to transition an aircraft from one controlled airspace to another, e.g., terminal to en route.
70	Cruise Operations	That portion of flight at an altitude or flight level maintained during en route level flight.
80	Approach Operations	That portion of flight operations which begins when an aircraft descends from its cruise altitude and begins to merge into the traffic flow for a specific destination airport; ends with the start of final approach.
90	Landing Operations	Begins when an aircraft is first aligned with a landing area and ends when the aircraft is exiting the arrival runway.

Ref No.	Flight Phase	Description
100	Taxi-In & Parking Ops	Perform taxi operations, starting with turn from the arrival runway to parking at terminal.
110	Post Flight Operations	Gather current and forecast surface conditions for layover.
120	Alternate Operations	Activities involved with selection of an alternate landing site. These activities are in addition to the approach, landing, and taxi operations needed to actually land at the alternate location.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Departure Airport
Destination Airport
Alternate Airport
PHASE DESCRIPTION
10 Preflight Planning
20 Preflight Operations
30 Taxi-Out & Take-Off Operations
40 Departure Operations
50 Initial Climb Operations
60 Initial Cruise Operations
70 Cruise Operations
80 Approach Operations
90 Landing Operations
100 Taxi-In & Parking Operations
110 Post Flight Operations
120 Alternate Operations

APPENDIX 5. DATA BASE APPLICATIONS

The following four tables demonstrate how the data base can be used to provide relevant weather information to those engaged in system planning and design. Users requesting additional data base applications can direct their specific needs to the Manager, NASP and Future Systems Branch, ATR-330, or the Manager, Aviation Weather Development Program, ARD-80.

TABLE 1

WEATHER PROFILES

Table 1-1, Table 1-2, and Table 1-3 list the weather profiles relevant to the terminal area, the en route centers, and the flight service stations. Weather systems which provide services to the ATC options shall not be considered responsive to the needs of AT unless the requirements presented in the weather profile tables are addressed by those systems. Refer to Weather Profile Characteristics, Appendix 4, page 4-6, for a listing of the weather characteristics needed to support operational decisions within each of the ATC options.

Column one, "TYPE," shows the two-digit weather codes described in Appendix 4. These weather code names have been repeated on each page for ease of use. The tables are further subdivided into two sections, labelled "Current" and "Forecast." The first section shows weather profiles for observations or current readings, and the second section shows the profiles for forecasted weather. Each line is a weather profile.

The columns to the immediate right of column one are the components of the weather profiles, i.e., the weather characteristics. Each profile contains an "X" in a column whose weather characteristic is relevant to operations in that ATC option. Note that the column labelled "4CZ" represents a rough idea of the magnitude of advance warning time a forecast piece of information would have to be issued to an air traffic user to be operationally significant. Time is indicated as "30," "6hr," or "30/6." The "30" represents an approximate 30-minute, short-term tactical type forecast that will include the duration of the event. The "6hr" represents a preferred 6 hours or better advanced notice of expected weather conditions that will support long-term strategic planning. The "30/6" entry indicates that both types of forecast are required. These values may need to be tailored to accommodate operations at individual facilities. Furthermore, FSS, oceanic, and ATCSCC operations may require forecast products that cover at least a 24-hour period. At this time, these numbers are not to be interpreted as specific forecast requirements.

TABLE 1-1: Terminal Area Weather Profiles

TYPE	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
Current:																	
AT	X																
CA	X	X	X	X	X	X											X
CD	X	X	X	X		X	X										
CT	X	X	X	X	X	X	X										
DA	X																
HL	X	X	X	X	X	X			X								X
IC	X	X	X	X	X	X	X										
LT	X	X		X		X			X								
MB	X	X		X	X	X											
MW	X	X	X	X	X	X			X								
PC	X	X	X	X	X	X	X										X
RV	X																
SW	X																
TB	X	X	X	X	X	X	X						X	X			X
TD	X																X
TN	X			X		X											
VA	X	X	X	X	X	X			X								X
VS	X			X	X						X						
WA	X						X										
WS	X	X		X	X	X						X	X	X			X
WV	X			X		X			X								X
Forecast:																	
CA	X	X	X	X	X	X		X							30/6	X	
CD	X	X	X	X		X	X	X							30/6		
CT	X	X	X	X	X	X	X	X							30		
DA	X							X							30/6		X
HL	X	X	X	X	X	X		X							30/6		
IC	X	X	X	X	X	X	X	X							30/6		
LT	X	X		X		X		X							30/6		
MB	X	X	X	X	X	X		X							30/6		X
MW	X	X	X	X	X	X	X	X							30/6		
PC	X	X	X	X	X	X		X							30/6		
RV	X							X							30/6		X
SW	X							X							30/6		X
TB	X	X	X	X	X	X	X	X					X	X	30/6		X
TD	X							X							30/6		
TN	X			X		X		X							30/6		X
VA	X	X	X	X	X	X		X			X				30/6		
VS	X			X	X			X							30/6		
WA	X							X							30/6		
WS	X	X		X	X	X		X				X	X	X	30/6		
WV	X			X		X		X							30		X
															30/6		

AT-altimeter setting CA-convective activity CD-clouds CT-clear air turbulence DA-density altitude HL-hail IC-icing LT-lightning MB-microburst MW-mountain wave PC-precipitation RV-runway visual range SW-surface winds TB-turbulence TC-tropical cyclone TD-temperature/dew point TN-tornado activity VA-volcanic ash VS-visibility WA-winds/temperature aloft WS-low level wind shear WV-wake vortex

TABLE 1-2: En Route Sector Weather Profiles

TYPE	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
Current:																	
AT	X																
CA	X	X	X	X	X	X											X
CD	X	X	X	X		X	X										
CT	X	X	X	X	X	X	X										
HL	X	X	X	X	X	X			X								X
IC	X	X		X	X	X	X										
LT	X	X		X		X			X								
MB	X	X		X	X	X											
MW	X	X	X	X	X	X			X								
PC	X	X	X	X	X	X	X										
RV	X																
SW	X					X											
TB	X	X	X	X	X	X	X						X	X			X
TC	X	X	X	X	X	X											X
TD	X			X													
TN	X			X		X			X								
VA	X	X	X	X	X	X					X						X
VS	X			X			X										
WA	X				X							X	X	X			
WS	X	X		X	X	X			X								X
Forecast:																	
CA	X	X	X	X	X	X		X							30/6	X	
CD	X	X	X	X		X	X	X							30/6		
CT		X	X	X	X	X	X	X							30/6		
HL	X	X	X	X	X	X		X							30		
IC	X	X		X		X		X							30/6		
LT	X	X		X	X	X		X							30/6		
MB	X	X	X	X	X	X		X							30		
MW	X	X	X	X	X	X		X							30/6		
PC	X	X	X	X	X	X	X	X							30/6		
RV	X							X							30/6		
SW	X	X	X	X	X	X	X	X					X	X	30/6		X
TB	X	X	X	X	X	X		X							30/6		X
TC	X	X	X	X	X	X		X							30/6	X	
TD	X			X		X		X							30		X
TN	X			X	X	X		X			X				30/6		
VA	X	X	X	X	X	X		X				X	X	X	30/6		
VS	X			X	X	X		X							30/6		
WA	X																
WS	X	X		X	X	X		X							30		

AT-altimeter setting CA-convective activity CD-clouds CT-clear air turbulence DA-density altitude HL-hail IC-icing LT-lightning MB-microburst MW-mountain wave PC-precipitation RV-runway visual range SW-surface winds TB-turbulence TC-tropical cyclone TD-temperature/dew point TN-tornado activity VA-volcanic ash VS-visibility WA-winds/temperature aloft WS-low level wind shear WV-wake vortex

TABLE 1-3: Flight Service Weather Profiles

TYPE	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
Current:																	
AT	X																X
CA	X	X	X	X	X	X											
CD	X	X	X	X		X	X										
CT	X	X	X	X	X												
DA	X																X
HL	X	X	X	X	X	X			X								
IC	X	X	X	X	X	X	X										
LT	X	X		X		X	X										
MB	X	X		X	X	X			X								X
MW	X	X	X	X	X												
PC	X	X	X	X	X	X	X										
RV	X																X
SW	X												X	X			X
TB	X	X	X	X	X		X										
TD	X																X
TN	X			X	X	X			X								
VA	X	X	X	X	X	X					X						
VS	X			X	X		X										
WA	X											X	X	X			X
WS	X	X		X	X	X			X								X
WV	X			X		X											
Forecast:																	
AT	X							X							6HR		X
CA	X	X	X	X	X	X		X							30/6	X	
CD	X	X	X	X		X	X	X							30/6		
CT	X	X	X	X	X			X							30/6		
DA	X							X							6HR		X
HL	X	X	X	X	X	X		X							30/6		
IC	X	X	X	X	X	X	X	X							30/6		
LT	X	X		X		X	X	X							30/6		
MB	X	X		X	X	X		X							30/6		
MW	X	X	X	X	X			X							30/6		
PC	X	X	X	X	X	X	X	X							30/6		
RV	X							X							30/6		X
SW	X							X					X	X	30/6		X
TB	X	X	X	X	X		X	X							30/6		
TD	X							X							30/6		X
TN	X			X	X	X		X							30/6		
VA	X	X	X	X	X	X		X			X				30/6		
VS	X			X	X			X							30/6		
WA	X							X				X	X	X	30/6		
WS	X	X		X	X	X		X							30/6		
WV	X			X		X		X							6HR		

AT-altimeter setting CA-convective activity CD-clouds CT-clear air turbulence DA-density altitude HL-hail IC-icing LT-lightning MB-microburst MW-mountain wave PC-precipitation RV-runway visual range SW-surface winds TB-turbulence TC-tropical cyclone TD-temperature/dew point TN-tornado activity VA-volcanic ash VS-visibility WA-winds/temperature aloft WS-low level wind shear WV-wake vortex

TABLE 2

TACTICAL WEATHER USAGE BY PHASE OF FLIGHT

Tactical weather usage by phase of flight presents the tactical use of weather information relative to phases of a typical flight profile, i.e., from the pilot's perspective. A pilot flying from one location to another executes the flight in phases which have weather informational needs peculiar to that phase of flight. In this table, the weather needs for each phase of flight are shown along with the associated operational justification. Each ATC operation has been associated with pilot-related activities which also require weather information. This table shows the relationship between air traffic control and pilot use of weather in each flight phase. The introductory material below contains a description of pilot activities associated with each flight phase and a pictorial diagram which shows the sequencing of the flight phases.

Table 2 shows, for each flight phase, a list of ATC operational activities which rely on weather information. Column one, "Key Phrase," names ATC activity described in Appendix 4 which is the basis, i.e., supports operational decisions, within that phase of flight. The columns to the immediate right of column one show the types of weather information needed during that flight phase. Each weather type is specified by a two-digit weather code described in Appendix 4. These weather code names have been repeated on each page for ease of use. Directly below the line of weather codes are indicators of the need for the weather for that weather type. If the operational activity (key phrase column) requires a weather observation or current reading, a "C" will be shown directly below the weather code. If the operational activity (key phrase column) column requires a forecasted type of weather, an "F" will be shown directly below the weather code. Weather needs may be "C," "F," or "CF" (when both are desired). A blank indicates that the operational activity column has no need for that type of weather.

TABLE 2: Tactical Weather Usage by Phase of Flight

Flight Phase: #10 Preflight Planning

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
LOCAL CTLR	DURATION PLANNING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LOCAL CTLR	RUNWAY ARR/DEP WX	F	F	F	F			F		F		F		F				F	F		F		
LOCAL CTLR	TIME CRITICAL WX	C	C					C		C	C	C		C	C				C				
				C	C													C			C		

Flight Phase: #20 Preflight Operations

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
GROUND CTLR	MINIMUMS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		CF	CF	CF	CF			CF		CF	CF	CF		CF	C			CF	CF		CF		

Flight Phase: #30 Taxi-Out & Take-Off Ops

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
GROUND CTLR	DEICING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GROUND CTLR	STAGING							CF															
INFLGHT SPEC	DENSITY ALTITUDE										CF	CF		CF	C				C				
INFLGHT SPEC	GA ADVISORY															C							
INFLGHT SPEC	RUNWAY SELECTION	C	C	C	C					C	C	C	C		C		C	C	C	C	C		
LOCAL CTLR	CLEARANCES	C	C	C	C					C	C	C	C	C	C		C	C	C	C	C		
LOCAL CTLR	ILS CRITICAL AREA PROTECTION																C						
LOCAL CTLR	PROCEDURES										C	C		C									
LOCAL CTLR	SAFETY WX ADVISORY WARN		C	C	C					C					C			C	C		C		

Flight Phase: #50 Initial Climb Ops

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ARR/DEP	ALTIMETER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ARR/DEP	GA ADVISORY														C								
ARR/DEP	HAZARD WX AVOIDANCE DIS							CF	CF														
ARR/DEP	HAZARD WX AVOIDANCE SAFETY		CF			CF	CF			CF											CF		
ARR/DEP	HAZARD WX AVOIDANCE VECTOR	CF																CF				CF	
ARR/DEP	VFR "ON TOP"										CF												
EFAS	EFAS SUPPORT	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	FLIGHT WATCH ADVISORY	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C	C		CF	CF	CF	CF	CF	
EFAS	WX COORD DATA	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	WX DATA	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C			CF	CF	CF	CF	CF	

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

Flight Phase: #50 Initial Climb Ops (continued)

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
INFLGHT SPEC	DURATION PLANNING	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	
INFLGHT SPEC	PROCEDURES	C	C	C	C	C	C	C	C	C	C	C	C	CF	C	C	C	C	C	C	C	C	
INFLGHT SPEC	SAFETY WX ADVISORY WARN								C	C	C	C	C		C				C				
LOW ALT CTLR	APPROACH CONTROL FUNCTION SEP										C								C				
LOW ALT CTLR	IFR/VFR DEP							CF															
LOW ALT CTLR	SAFETY WX ADVISORY ALT							CF												CF		CF	
LOW ALT CTLR	SAFETY WX ADVISORY RELAY	CF	C																				
LOW ALT CTLR	SAFETY WX ADVISORY REROUTE	CF	CF			CF	CF																
LOW ALT CTLR	SAFETY WX ADVISORY SELECT								CF														
LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	CF	C	C	C		C	C	C	C	C	C	C	C	C			CF	C	C		C	
LOW ALT CTLR	VECTORING																						
LOW ALT CTLR	WX DATA																						

Flight Phase: #60 Initial Cruise Ops

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
EFAS	EFAS SUPPORT	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	FLIGHT WATCH ADVISORY	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C	C		CF	CF	CF	CF	CF	
EFAS	WX COORD DATA	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	WX DATA	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C			CF	CF	CF	CF	CF	
HI ALT CTLR	SAFETY WX ADVISORY ICING							CF															
HI ALT CTLR	SAFETY WX ADVISORY RELAY								CF											CF		CF	
HI ALT CTLR	VECTORING	CF				CF	CF											C					
HI ALT CTLR	VECTORING SAFETY	CF	C			CF	CF	CF	C		C							CF		CF		CF	
HI ALT CTLR	WX COORD DATA	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F		F	F	F	
INFLGHT SPEC	DURATION PLANNING	C	C	C	C	C	C	C	C	C	C	C	C	CF	C	C	C	C	C	C	C	C	
INFLGHT SPEC	PROCEDURES							CF	C	C	C	C	C		C			C	C				
INFLGHT SPEC	SAFETY WX ADVISORY WARN	CF				CF	CF		CF		C									CF		CF	CF
INFLGHT SPEC	WX DATA	CF	C															C		CF		CF	CF
OCEANIC CTLR	SAFETY WX ADVISORY ICING																						
OCEANIC CTLR	SAFETY WX ADVISORY RELAY																						
OCEANIC CTLR	VECTORING																						
OCEANIC CTLR	VECTORING SAFETY-OCN																						
OCEANIC CTLR	WX COORD DATA-OCN																						

Flight Phase: #70 Cruise Operations

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ARR/DEP	ALTIMETER														C						CF	CF	
ARR/DEP	GA ADVISORY		CF			CF	CF	CF	CF												CF	CF	
ARR/DEP	HAZARD WX AVOIDANCE SAFETY	CF							CF	CF													
ARR/DEP	HAZARD WX AVOIDANCE SEP	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
ARR/DEP	HAZARD WX AVOIDANCE VECTOR	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C	C		CF	CF	CF	CF	CF	
ARR/DEP	VFR "ON TOP"	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	EFAS SUPPORT	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C			CF	CF	CF	CF	CF	
EFAS	FLIGHT WATCH ADVISORY																						
EFAS	WX COORD DATA																						
EFAS	WX DATA																						

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

Flight Phase: #70 Cruise Operations (continued)

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
HI ALT CTLR	SAFETY WX ADVISORY ICING							CF															
HI ALT CTLR	SAFETY WX ADVISORY RELAY																						
HI ALT CTLR	VECTORING																						
HI ALT CTLR	VECTORING SAFETY								CF											CF		CF	
HI ALT CTLR	WX COORD DATA	CF				CF	CF																
INFLGHT SPEC	DURATION PLANNING	CF	C			CF	CF	CF	C		C							C					
INFLGHT SPEC	PROCEDURES	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	CF		CF		CF	
INFLGHT SPEC	SAFETY WX ADVISORY WARN														C			F	F	F	F	F	
INFLGHT SPEC	WX DATA	C	C	C	C	C	C	C	C	C	C	C	C	CF	C	C	C	C	C	C	C	C	
OCEANIC CTLR	SAFETY WX ADVISORY ICING								C	C	C	C	C		C				C				
OCEANIC CTLR	SAFETY WX ADVISORY RELAY							CF															
OCEANIC CTLR	VECTORING																						
OCEANIC CTLR	VECTORING SAFETY-OCN								CF											CF		CF	
OCEANIC CTLR	WX COORD DATA-OCN	CF				CF	CF																
		CF	C								C							C					CF
																		CF		CF		CF	CF

Flight Phase: #80 Approach Operations

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ARR/DEP	ALTIMETER																						
ARR/DEP	ARRIVAL SEQUENCING																						
ARR/DEP	HAZARD WX AVOIDANCE	CF	CF			CF	CF	CF	C	C					C								
ARR/DEP	IFR/VFR OPERATIONS			C	C																		
ARR/DEP	RUNWAY SELECTION																						
ARR/DEP	SAFETY ADVISORY AVOID	CF	CF	C	C						CF	CF		CF									
ARR/DEP	SAFETY ADVISORY L.L.	CF								CF	CF	CF		CF			CF	CF	CF		CF		
INFLGHT SPEC	DENSITY ALTITUDE			C	C												CF	CF			CF		
INFLGHT SPEC	GA ADVISORY									CF											CF		
INFLGHT SPEC	RUNWAY SELECTION	C	C	C	C											C							
LOW ALT CTLR	APPROACH CONTROL FUNCTION PATH	C	C	C	C					C	C	C	C		C		C	C	C	C	C		
LOW ALT CTLR	APPROACH CONTROL FUNCTION PLAN	CF	C							C	C	C	C	C	C		C	C	C	C	C		
LOW ALT CTLR	APPROACH CONTROL FUNCTION SELEC							C			F												
LOW ALT CTLR	APPROACH CONTROL FUNCTION SEP														C								
LOW ALT CTLR	APPROACH CTRL FUNCTION HOLDING													C									
LOW ALT CTLR	IFR/VFR DEP																		C				
LOW ALT CTLR	IN-TRAIL SEPARATION VFR																		C				
LOW ALT CTLR	SAFETY WX ADVISORY										C												
LOW ALT CTLR	SAFETY WX ADVISORY ALT			C	C						C	CF											
LOW ALT CTLR	SAFETY WX ADVISORY PATH							CF															
LOW ALT CTLR	SAFETY WX ADVISORY RELAY																						
LOW ALT CTLR	SAFETY WX ADVISORY REROUTE																	C					
LOW ALT CTLR	SAFETY WX ADVISORY SELECT							CF												CF		CF	
LOW ALT CTLR	SAFETY WX ADVISORY SPACE	CF	C																				
LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	CF	C																				
LOW ALT CTLR	VECTORING	CF	CF			CF	CF																
LOW ALT CTLR	VECTORING PLAN								CF														
LOW ALT CTLR	WX DATA								C														
		CF	C	C	C		C	C	C	C	C	C	C	C	C			CF	C	C		C	

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

Flight Phase: #90 Landing Operations

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
LOCAL CTLR	CLEARANCES	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LOCAL CTLR	DURATION PLANNING																C						
LOCAL CTLR	ILS CRITICAL AREA PROTECTION	F	F	F	F			F		F		F		F									
LOCAL CTLR	PLANNING MANAGE													C				F	F		F		
LOCAL CTLR	PROCEDURES	CF	CF	CF	CF			CF		CF	C	C		C									
LOCAL CTLR	RUNWAY ARR/DEP WX										CF	CF		CF	C		C	C	C		C		
LOCAL CTLR	SAFETY WX ADVISORY WARN	C	C					C		C	C	C		C	C				C		C		
LOCAL CTLR	SEQUENCING		C	C	C					C					C				C				
LOCAL CTLR	TIME CRITICAL WX	C	C	C	C			C		C	C	C		C	C		C	C	C		C		
				C	C					C							C	C			C		

Flight Phase: #100 Taxi-In & Parking Ops

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
GROUND CTLR	MINIMUMS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GROUND CTLR	RUNWAY USE	CF	CF	CF	CF			CF		CF	CF	CF		CF	C			CF	CF		CF		
								CF			CF	CF		CF	C				C				

Flight Phase: #120 Alternate Operations

ATC Position	Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
EFAS	EFAS SUPPORT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EFAS	FLIGHT WATCH ADVISORY	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
EFAS	WX COORD DATA	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C	C		CF	CF	CF	CF	CF	
EFAS	WX DATA	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
INFLGHT SPEC	DENSITY ALTITUDE	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C			CF	CF	CF	CF	CF	
INFLGHT SPEC	DURATION PLANNING															C							
INFLGHT SPEC	GA ADVISORY	F	F	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	
INFLGHT SPEC	PROCEDURES	C	C	C	C					C	C	C	C		C		C	C	C	C	C		
INFLGHT SPEC	RUNWAY SELECTION														C								
INFLGHT SPEC	SAFETY WX ADVISORY WARN	C	C	C	C					C	C	C	C	C	C		C	C	C	C	C		
INFLGHT SPEC	WX DATA	C	C	C	C	C	C	C	C	C	C	C	C	CF	C	C	C	C	C	C	C	C	
									C	C	C	C	C		C				C				

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

TABLE 3

TACTICAL WEATHER USAGE BY AIR TRAFFIC CONTROL OPERATION

Tactical weather usage by air traffic control operation presents the ATC tactical use of weather information relative to each of the ATC operations identified in the study by the team, i.e., from the ATC perspective. This table is similar to Table 2, Tactical Weather Usage by Phase of Flight, and contains the weather needs for each ATC operation in the study along with the operational justification for the weather.

Table 3, column one, "Key Phrase," lists the ATC weather related activity which is the basis supporting operational decisions. The columns to the immediate right of column one show the types of weather information needed during that operation. Each weather type is specified by a two-digit weather code described in Appendix 4. These weather code names have been repeated on each page for ease of use. Directly below the line of weather codes are indicators of the need for the weather for that weather type. If the operational activity (key phrase column) requires a weather observation or current reading, a "C" will be shown directly below the weather code. If the operational activity (key phrase column) column requires a forecasted type of weather, an "F" will be shown directly below the weather code. Weather needs may be "C," "F," or "CF" (when both are desired). A blank indicates that the operational activity column has no need for that type of weather.

TABLE 3-1: Terminal Tactical Weather Usage

Operation: ARRIVALS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ALTIMETER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IFR/VFR OPERATIONS														C								
HAZARD WX AVOIDANCE			C	C						CF	CF		CF									
SAFETY ADVISORY L.L.			C	C					CF													
SAFETY ADVISORY AVOID	CF																			CF		
ARRIVAL SEQUENCING	CF	CF			CF	CF	CF	C	C							CF	CF			CF		
RUNWAY SELECTION	CF	CF	C	C					CF	CF	CF		CF			CF	CF	CF		CF		

Operation: DEPARTURES

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ALTIMETER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VFR "ON TOP"														C								
HAZARD WX AVOIDANCE DIS										CF												
GA ADVISORY									CF													
HAZARD WX AVOIDANCE SAFETY		CF			CF	CF	CF	CF												CF		
HAZARD WX AVOIDANCE VECTOR	CF																CF				CF	

Operation: GROUND SUPPORT VEHICLES

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
RUNWAY USE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
							CF			CF	CF		CF	C				C				

Operation: ISSUE WEATHER INFO/GROUND

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
MINIMUMS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	CF	CF	CF	CF			CF		CF	CF	CF		CF	C			CF	CF		CF		

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

Operation: ISSUE WEATHER INFO/LOCAL

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
TIME CRITICAL WX	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RUNWAY ARR/DEP WX			C	C													C			C		
DURATION PLANNING	C	C					C		C	C	C		C	C				C				
	F	F	F	F			F		F		F		F				F	F		F		

Operation: LANDING/TAKEOFF CLEARANCE

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
CLEARANCES	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PROCEDURES																C						
ILS CRITICAL AREA PROTECTION														C				C				
SAFETY WX ADVISORY WARN		C	C	C					C	C	C		C			C	C			C		

Operation: OVERFLIGHTS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
ALTIMETER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VFR "ON TOP"														C								
HAZARD WX AVOIDANCE SEP										CF												
GA ADVISORY								CF	CF													
HAZARD WX AVOIDANCE SAFETY		CF			CF	CF	CF	CF												CF		
HAZARD WX AVOIDANCE VECTOR	CF																			CF	CF	

Operation: SEQUENCE LANDINGS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
SEQUENCING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PLANNING MANAGE	C	C	C	C			C		C	C	C		C	C		C	C	C		C		
	CF	CF	CF	CF			CF		CF	CF	CF		CF	C		C	C	C		C		

Operation: STAGING DEPARTURES

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
STAGING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DEICING							CF			CF	CF		CF	C				C				

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

TABLE 3-2: En Route Tactical Weather Usage

Operation: ISSUE CLEARANCE/GROUND

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
APPROACH CONTROL FUNCTION SEP IFR/VFR DEP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SAFETY WX ADVISORY ALT										C								C				
SAFETY WX ADVISORY SELECT	CF	C					CF															

Operation: ISSUE CONTROL INSTRUCTIONS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
SAFETY WX ADVISORY RELAY VECTORING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SAFETY WX ADVISORY ICING								CF											CF		CF	
SAFETY WX ADVISORY REROUTE							CF															
VECTORING SAFETY							CF															
VECTORING SAFETY-OCN	CF				CF	CF																
SAFETY WX ADVISORY VECTOR	CF				CF	CF											C					
	CF	CF			CF	CF											C					CF

Operation: ISSUE WEATHER INFO/HIGH ALTITUDE

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
WX COORD DATA-OCN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WX COORD DATA	CF	C								C							CF		CF		CF	CF
	CF	C			CF	CF	CF	C		C							CF		CF		CF	

Operation: RELAY WEATHER

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
WX DATA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	CF	C	C	C		C	C	C	C	C	C	C	C	C			CF	C	C		C	

Operation: SELECT APPROACHES

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
APPROACH CTRL FUNCTION HOLDING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SAFETY WX ADVISORY PATH																		C				
APPROACH CONTROL FUNCTION PLAN																	C					
APPROACH CONTROL FUNCTION SELEC														C								
IN-TRAIL SEPARATION VFR													C									
SAFETY WX ADVISORY			C	C						C	CF											
APPROACH CONTROL FUNCTION PATH	CF	C					C			F												

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

Operation: VECTORS FOR APPROACH

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
VECTORING PLAN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SAFETY WX ADVISORY SPACE	CF	C						C														

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

TABLE 3-3: Flight Service Tactical Weather Usage

Operation: DISSEM ENROUTE WX

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
FLIGHT WATCH ADVISORY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C	CF	C	C		CF	CF	CF	CF	CF	

Operation: FSS INT/EXT SUPPORT

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
EFAS SUPPORT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WX COORD DATA	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
WX DATA	CF	CF		CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	C		C			CF	CF	CF	CF	CF	
													CF	C			CF	CF	CF	CF	CF	

Operation: ISSUE WX INFO-PILOTS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
PROCEDURES	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WX DATA														C								
SAFETY WX ADVISORY WARN	C	C	C	C	C	C	C	C	C	C	C	C		C								
DURATION PLANNING	F	F	F	F	F	F	F	F	F	F	F	F	CF	F	C	C	C	C	C	C	C	
														F	F	F	F	F	F	F	F	

Operation: LOCAL AIRPT ADVISORS

Key Phrase	CA	LT	MB	WS	CT	TB	IC	WA	PC	CD	VS	TD	RV	AT	DA	WV	HL	SW	VA	TN	MW	TC
DENSITY ALTITUDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GA ADVISORY															C							
RUNWAY SELECTION	C	C	C	C					C	C	C	C		C		C	C	C	C	C		
	C	C	C	C					C	C	C	C	C	C		C	C	C	C	C		

CA-convective activity LT-lightning MB-microburst WS-low level wind shear CT-clear air turbulence TB-turbulence IC-icing WA-winds/temperature aloft PC-precipitation CD-clouds VS-visibility TD-temperature/dew point RV-runway visual range AT-altimeter setting DA-density altitude WV-wake vortex HL-hail SW-surface winds VA-volcanic ash TN-tornado activity MW-mountain wave TC-tropical cyclone

TABLE 4

WEATHER PRODUCT SAMPLES: ICING AND TURBULENCE REPORTS

Weather product samples: icing and turbulence reports present two sample aviation weather product descriptions which could be incorporated into an ATC weather product directory. The product descriptions are an outgrowth of the information collected by the ATWRT. Two sample product descriptions are presented, an Icing Report and a Turbulence Report.

Each report in Table 4 is organized first by air traffic option. Each option that uses the report information is listed along with the weather types (icing or turbulence) broken into either current observations or forecast weather needs.

Note that the column labelled "4CZ" represents a rough idea of the magnitude of advance warning time a forecast piece of information would have to be issued to an air traffic user to be operationally significant. Time is indicated as "30," "6hr," or "30/6." The "30" represents an approximate 30-minute, short-term tactical type forecast that will include the duration of the event. The "6hr" represents an approximate up to 6-hour advanced notice of expected weather conditions that will support long-term strategic planning. The "30/6" entry indicates that both types of forecast are required. These values may need to be tailored to accommodate operations at individual facilities. Furthermore, FSS, oceanic, and ATCSCC operations may require forecast products that cover at least a 24-hour period. At this time, these numbers are not to be interpreted as specific forecast requirements.

Each of the weather type needs for weather, current or forecast, is then followed by a table which shows the ATC operations using the report in column one, the ATC Position that uses the information (for dissemination planning) in column two, the key phrase, or operational justification for the weather usage in column three (further detail on usage is in Appendix 3) and the dominant characteristics or weather "profile" relevant to each operational usage in the remaining columns.

These weather product reports form the basis for a weather product directory which describes the information needs, usage, dissemination requirements, and operationally significant parameters of weather for FAA ATC operational requirements planning.

TABLE 4: Icing Report Description

Option: AFSS

Weather Type: Current Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ACCIDENT RECOVERY	AREA SUP/FSS	SUPERVISORY DUTIES	X	X	X	X	X	X	X										
EQUIPMENT MGMT	AREA SUP/FSS	BACKUP GENERATORS	X	X	X	X	X	X	X										
STAFF MGMT	AREA SUP/FSS	PLANNING MANAGE	X	X	X	X	X	X	X										
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X		X										
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X		X										
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X		X										
ISSUE WX INFO-PILOTS	INFLGHT SPEC	SAFETY WX ADVISORY WARN	X	X	X	X	X		X										
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X		X										

Weather Type: Forecast Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ACCIDENT RECOVERY	AREA SUP/FSS	SUPERVISORY DUTIES	X	X	X	X	X	X	X	X									
EQUIPMENT MGMT	AREA SUP/FSS	BACKUP GENERATORS	X	X	X	X	X	X	X	X							30/6		
STAFF MGMT	AREA SUP/FSS	PLANNING MANAGE	X	X	X	X	X	X	X	X							30/6		
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X		X	X							30/6		
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X		X	X							6HR		
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X		X	X							30		
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X		X	X							30		
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X		X	X							30		
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X		X	X							30		
ISSUE WX INFO-PILOTS	INFLGHT SPEC	DURATION PLANNING	X	X	X	X	X		X	X							30		
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X		X	X							6HR		
																	6HR		

Option: ARTCC

Weather Type: Current Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X										
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	HI ALT CTLR	SAFETY WX ADVISORY ICING	X	X	X	X	X	X	X										
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X										
ISSUE CLRNC/GND	LOW ALT CTLR	SAFETY WX ADVISORY ALT	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY REROUT	X	X	X	X	X	X	X										
RELAY WX	LOW ALT CTLR	WX DATA	X	X	X	X	X	X	X										
SELECT APPROACHES	LOW ALT CTLR	APPROACH CONTROL FUNCTION	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	OCEANIC CTLR	SAFETY WX ADVISORY ICING	X	X	X	X	X	X	X										
ARR SEQ PROG	TMU	METERING	X	X	X	X	X	X	X										
ENROUTE SPACING PROG	TMU	DEICING INTERVAL	X	X	X	X	X	X	X										
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X										
SWAP	TMU	REROUTE	X	X	X	X	X	X	X										

Option: ARTCC
Weather Type: Forecast Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X	X									
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X	X							30/6		
ISSUE CTRL INSTRUCT	HI ALT CTLR	SAFETY WX ADVISORY ICING	X	X	X	X	X	X	X	X							30/6		
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X	X							30		
ISSUE CLRNC/GND	LOW ALT CTLR	SAFETY WX ADVISORY ALT	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY REROUT	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	OCEANIC CTLR	SAFETY WX ADVISORY ICING	X	X	X	X	X	X	X	X							30		
ARR SEQ PROG	TMU	METERING	X	X	X	X	X	X	X	X							30		
ENROUTE SPACING PROG	TMU	DEICING INTERVAL	X	X	X	X	X	X	X	X							30		
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X	X							30/6		
SWAP	TMU	REROUTE	X	X	X	X	X	X	X	X							30/6		
																	30/6		
																	30/6		

Option: ATCT
Weather Type: Current Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ACTIVE RUNWAYS	AREA SUP/TWR	SAFETY ADVISORY APPROACH	X	X	X	X	X	X	X										
TRAFFIC FLOW(TMC)	AREA SUP/TWR	SAFETY WX ADVISORY UTIL	X	X	X	X	X	X	X										
GND SPT VEHICLES	GROUND CTLR	RUNWAY USE	X	X	X	X	X	X	X										
ISSUE WX INFO/GND	GROUND CTLR	MINIMUMS	X	X	X	X	X	X	X										
STAGING DEPARTURES	GROUND CTLR	DEICING	X	X	X	X	X	X	X										
ISSUE WX INFO/LOC	LOCAL CTLR	RUNWAY ARR/DEP WX	X	X	X	X	X	X	X										
SEQ LANDINGS	LOCAL CTLR	PLANNING MANAGE	X	X	X	X	X	X	X										
SEQ LANDINGS	LOCAL CTLR	SEQUENCING	X	X	X	X	X	X	X										

Weather Type: Forecast Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ACTIVE RUNWAYS	AREA SUP/TWR	SAFETY ADVISORY APPROACH	X	X	X	X	X	X	X	X									
TRAFFIC FLOW(TMC)	AREA SUP/TWR	SAFETY WX ADVISORY UTIL	X	X	X	X	X	X	X	X							30/6		
GND SPT VEHICLES	GROUND CTLR	RUNWAY USE	X	X	X	X	X	X	X	X							30/6		
ISSUE WX INFO/GND	GROUND CTLR	MINIMUMS	X	X	X	X	X	X	X	X							30		
STAGING DEPARTURES	GROUND CTLR	DEICING	X	X	X	X	X	X	X	X							30		
ISSUE WX INFO/LOC	LOCAL CTLR	DURATION PLANNING	X	X	X	X	X	X	X	X							30		
SEQ LANDINGS	LOCAL CTLR	PLANNING MANAGE	X	X	X	X	X	X	X	X							30		
																	30		
																	30		

Option: TRACON
Weather Type: Current Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES	X	X	X	X	X	X	X										
MGMT EQP/RES	AREA SUP/TRA	PLANNING MANAGE	X	X	X	X	X	X	X										
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X										
DEPARTURES	ARR/DEP	GA ADVISORY	X	X	X	X	X	X	X										
OVERFLIGHTS	ARR/DEP	GA ADVISORY	X	X	X	X	X	X	X										

Option: TRACON
Weather Type: Forecast Icing

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES	X	X	X	X	X	X	X	X							30/6		
MGMT EQP/RES	AREA SUP/TRA	PLANNING MANAGE	X	X	X	X	X	X	X	X							30/6		
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X	X							30		
DEPARTURES	ARR/DEP	GA ADVISORY	X	X	X	X	X	X	X	X							30		
OVERFLIGHTS	ARR/DEP	GA ADVISORY	X	X	X	X	X	X	X	X							30		

TABLE 4: Turbulence Report Description

Option: AFSS

Weather Type: Current Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X												
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X												
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X												
ISSUE WX INFO-PILOTS	INFLGHT SPEC	SAFETY WX ADVISORY WARN	X	X	X	X	X												
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X												

Weather Type: Current Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X												
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X												
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X												
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X												
ISSUE WX INFO-PILOTS	INFLGHT SPEC	SAFETY WX ADVISORY WARN	X	X	X	X	X												
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X												

Weather Type: Current Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X		X										
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X		X										
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X		X										
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X		X										
ISSUE WX INFO-PILOTS	INFLGHT SPEC	SAFETY WX ADVISORY WARN	X	X	X	X	X		X										
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X		X										

Weather Type: Forecast Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X			X							6HR		
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X			X							30		
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X			X							30		
ISSUE WX INFO-PILOTS	INFLGHT SPEC	DURATION PLANNING	X	X	X	X	X			X							6HR		
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X			X							6HR		

Weather Type: Forecast Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X			X							6HR		
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X			X							30		
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X			X							30		
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X			X							6HR		
ISSUE WX INFO-PILOTS	INFLGHT SPEC	DURATION PLANNING	X	X	X	X	X			X							6HR		
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X			X							6HR		

Weather Type: Forecast Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
RECORD WX INFO	BROADCAST	BROADCAST REPORT	X	X	X	X	X		X	X							6HR		
DISSEM ENROUTE WX	EFAS	FLIGHT WATCH ADVISORY	X	X	X	X	X		X	X							30		
FSS INT/EXT SUPPORT	EFAS	EFAS SUPPORT	X	X	X	X	X		X	X							30		
FSS INT/EXT SUPPORT	EFAS	WX COORD DATA	X	X	X	X	X		X	X							30		
FSS INT/EXT SUPPORT	EFAS	WX DATA	X	X	X	X	X		X	X							30		
SOLICIT AB REPORTS	EFAS	DURATION PLANNING	X	X	X	X	X		X	X							6HR		
ISSUE WX INFO-PILOTS	INFLGHT SPEC	DURATION PLANNING	X	X	X	X	X		X	X							6HR		
PREFLIGHT BRIEFING	PREFLT SPEC	PLANNING PREFLIGHT	X	X	X	X	X		X	X							6HR		

Option: ARTCC

Weather Type: Current Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X										
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	HI ALT CTLR	VECTORING SAFETY	X	X	X	X	X	X	X										
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	OCEANIC CTLR	VECTORING SAFETY-OCN	X	X	X	X	X	X	X										
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X	X										
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X										X
SWAP	TMU	REROUTE	X	X	X	X	X	X	X										X
																			X

Weather Type: Current Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X											
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X											
ISSUE CTRL INSTRUCT	HI ALT CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X											
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X											
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X											
RELAY WX	LOW ALT CTLR	WX DATA	X	X	X	X	X	X											
ISSUE CTRL INSTRUCT	OCEANIC CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X											
ISSUE WX INFO/HIALT	OCEANIC CTLR	WX COORD DATA-OCN	X	X	X	X	X	X											
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X											
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X											
SWAP	TMU	REROUTE	X	X	X	X	X	X											

Weather Type: Current Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X										
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	HI ALT CTLR	VECTORING SAFETY	X	X	X	X	X	X	X										
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	X	X	X	X	X	X	X										
RELAY WX	LOW ALT CTLR	WX DATA	X	X	X	X	X	X	X										
ISSUE CTRL INSTRUCT	OCEANIC CTLR	VECTORING SAFETY-OCN	X	X	X	X	X	X	X										
ARR SEQ PROG	TMU	METERING	X	X	X	X	X	X	X										
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X	X										
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X										
SWAP	TMU	REROUTE	X	X	X	X	X	X	X										

Weather Type: Forecast Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X	X									
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X	X							30/6		
ISSUE CTRL INSTRUCT	HI ALT CTLR	VECTORING SAFETY	X	X	X	X	X	X	X	X							30/6		
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	OCEANIC CTLR	VECTORING SAFETY-OCN	X	X	X	X	X	X	X	X							30		
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X	X	X							30		
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X	X							30/6		
SWAP	TMU	REROUTE	X	X	X	X	X	X	X	X							30/6		
																	30/6		

Weather Type: Forecast Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X		X									
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X		X							30/6		
ISSUE CTRL INSTRUCT	HI ALT CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X		X							30/6		
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X		X							30		
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X		X							30		
ISSUE CTRL INSTRUCT	OCEANIC CTLR	SAFETY WX ADVISORY RELAY	X	X	X	X	X	X		X							30		
ISSUE WX INFO/HIALT	OCEANIC CTLR	WX COORD DATA-OCN	X	X	X	X	X	X		X							30		
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X		X							30		
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X		X							30/6		
SWAP	TMU	REROUTE	X	X	X	X	X	X		X							30/6		
																	30/6		

Weather Type: Forecast Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
MANAGE SECTOR AIRSPC	AREA SUP/CTR	MANAGE RESOURCES	X	X	X	X	X	X	X	X							30/6		
MANAGE SECTOR AIRSPC	AREA SUP/OCN	MANAGE RESOURCES	X	X	X	X	X	X	X	X							30/6		
ISSUE CTRL INSTRUCT	HI ALT CTLR	VECTORING SAFETY	X	X	X	X	X	X	X	X							30		
ISSUE WX INFO/HIALT	HI ALT CTLR	WX COORD DATA	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	LOW ALT CTLR	SAFETY WX ADVISORY VECTOR	X	X	X	X	X	X	X	X							30		
ISSUE CTRL INSTRUCT	OCEANIC CTLR	VECTORING SAFETY-OCN	X	X	X	X	X	X	X	X							30		
ENROUTE SPACING PROG	TMU	SECTOR USAGE	X	X	X	X	X	X	X	X							30/6		
SECTOR CAP MGMT	TMU	CAPACITY	X	X	X	X	X	X	X	X							30/6		
SWAP	TMU	REROUTE	X	X	X	X	X	X	X	X							30/6		

Option: ATCT
Weather Type: Current Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
TRAFFIC FLOW(TMC)	AREA SUP/TWR	PLAN AAR	X	X	X	X	X	X											

Weather Type: Current Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
TRAFFIC FLOW(TMC)	AREA SUP/TWR	SAFETY WX ADVISORY WARN	X	X	X	X	X	X	X										

Weather Type: Forecast Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
TRAFFIC FLOW(TMC)	AREA SUP/TWR	PLAN AAR	X	X	X	X	X	X		X							30/6		

Weather Type: Forecast Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
TRAFFIC FLOW(TMC)	AREA SUP/TWR	PLAN AAR	X	X	X	X	X	X	X	X							30/6		

Option: TRACON
Weather Type: Current Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X										
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X										
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X										

Weather Type: Current Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES																	
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X											
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X											

Weather Type: Current Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES																	
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X										
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X										
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X										

Weather Type: Forecast Clear Air Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X	X									
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X	X							30		
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X	X							30		
																	30		

Weather Type: Forecast Mountain Wave Turbulence

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES																	
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X		X							30/6		
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X		X							30		
										X							30		

Weather Type: Forecast Turbulence (Non-CAT)

Operation	Position	Key Phrase	LOCN	TOPS	BASE	AREA	INT	MVM	CLASS	TIME	TCRT	FREQ	LYR	ALT	SPD	DIR	4CZ	G/DK	STR
METERING/FLOW(TMC)	AREA SUP/TRA	FLOW RATES																	
ARRIVALS	ARR/DEP	ARRIVAL SEQUENCING	X	X	X	X	X	X	X	X									
DEPARTURES	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X	X							30/6		
OVERFLIGHTS	ARR/DEP	HAZARD WX AVOIDANCE SAFET	X	X	X	X	X	X	X	X							30		
										X							30		

APPENDIX 6. OPERATIONAL SCENARIOS

These scenarios are examples and are not meant to be regulatory in nature.

Scenario One: 1994

DATE:	December 1, 1994
Departure Airport:	Washington National, Washington, DC
Arrival Airport:	Pittsburgh International, Pittsburgh, PA
Aircraft:	N1234A, BE30/A
Proposed Departure Time:	1045 Zulu (Z)

While planning a flight from the Washington National Airport to the Pittsburgh International Airport, the pilot of N1234A telephones the Leesburg Automated Flight Service Station (AFSS) to request a standard weather briefing from the air traffic control specialist (ATCS).

The ATCS identifies and reads, verbatim, three flight precaution advisories, one for instrument flight rules conditions, one for icing, and a Convective Significant Meteorological Information (SIGMET) report of thunderstorm activity that is near the aircraft's intended route of flight. Radar reports from four radar sites provide the intensity, movement, and cloud tops of the thunderstorm activity described in the Convective SIGMET. These radar reports are 45 minutes old and will not be updated for at least another 15 minutes. The data contained in these written reports does not match the depiction of thunderstorms displayed on the ATCS's weather radar presentation.

Notice to Airmen (NOTAM) information provided for the route of flight is 2 pages long and includes all special purpose NOTAM's for the United States. The pilot interrupts the ATCS twice to locate or confirm unfamiliar locations.

The ATCS issues the forecast freezing level and winds aloft, including temperature data, based in part, on data observed from the previous day. Pilot Weather Reports (PIREP's) are not available describing tops of the cloud layer where icing is forecasted. The ATCS notes that terminal forecasts will be reissued shortly. The area forecast and flight precaution advisories have been updated; however, this data does not coincide with the current Washington National terminal forecast.

After completing the preflight briefing, the pilot of N1234A files a flight plan. The AFSS ATCS enters the flight plan into a computer that transmits the flight plan to the HOST computer at the Washington Air Route Traffic Control Center (ARTCC). An

air traffic control (ATC) clearance, in the form of a paper strip, will be posted at the Washington National clearance delivery position in the tower cab.

The pilot of N1234A obtains an alphanumeric weather update from one of two FAA-funded Direct User Access Terminal Service (DUATS) vendors. The pilot sifts through numerous pages of data to determine which information is pertinent to the flight, translating, interpreting, and resolving disparities in coded text data to form a mental image of expected flight conditions.

The pilot, now seated in the aircraft, radios Washington National clearance delivery (CD) approximately 15 minutes prior to the proposed departure time to obtain an ATC clearance to Pittsburgh International Airport. The ATCS at CD relays the ATC clearance to N1234A. However, due to restricted ceiling and visibility and wet runway conditions at the destination airport, N1234A encounters a 1-hour ground delay at the Washington National Airport. CD issues an Expected Departure Clearance Time (EDCT) of 1145Z, the time N1234A can expect to depart. This is an unanticipated delay. The pilot remains in the aircraft, monitoring CD position for any possible update to the EDCT.

The CD manually passes the ATC clearance, including the EDCT, to the Washington National ground controller (GC). At the appropriate time, the GC issues taxi instructions to N1234A. Due to reduced visibility and fog, the GC is not able to observe N1234A taxi. This requires the GC to maintain a mental picture of the aircraft's location. The GC solicits and receives position reports from N1234A. This verbiage continues until the aircraft reaches the active runway. N1234A is then instructed to contact the Washington National local control (LC).

The LC issues the current wind, runway visual range (RVR), departure instructions, and a take-off clearance to N1234A. Once airborne, N1234A is instructed to contact Washington National departure control. The aircraft is now under radar control.

While N1234A is climbing out from the airport, the pilot hears the departure controller broadcast a SIGMET report concerning a layer of icing south of Washington National Airport. The area described does not impact the flight of N1234A. The departure controller solicits from N1234A a report of the cloud bases and tops. This information is provided but due to ATCS workload it is not given distribution outside of the radar facility. N1234A is instructed to contact the Washington ARTCC.

As the aircraft flies through the ARTCC airspace, the pilot asks an ARTCC ATCS for the weather conditions. The controller advises the pilot to contact the Flight Watch, the En Route Flight Advisory Service (EFAS), for Convective SIGMET's and weather radar information. The Flight Watch ATCS manually plots the position of the aircraft,

based on navigational aid information, to determine the aircraft's position in reference to the thunderstorms depicted on the radar display. The Flight Watch ATCS has the capability of relaying live weather data to the pilot, however, supplemental information such as thunderstorm intensity and movement is now 1-hour old and may not be applicable.

The Flight Watch ATCS issues PIREP's from other aircraft in the same vicinity indicating all aircraft are reporting no icing at N1234A's altitude. N1234A provides a PIREP to the Flight Watch ATCS on tops of clouds along the route. The ATCS, now being contacted by two other aircraft, cannot enter the PIREP into the computer until all other contacts have been completed. Additionally, the pilot has been off the ARTCC frequency while the weather question is being answered.

Some time later, another ARTCC ATCS solicits from N1234A a top of clouds report and inquires as to any additional cloud layers above. The ATCS passes this information on as a PIREP. N1234A is able to climb to an altitude that is above the clouds and precipitation. The freezing level is no factor during this portion of the flight. The ARTCC ATCS broadcasts a center weather advisory. This advisory has no impact on N1234A's flight.

N1234A has the same concerns entering the Pittsburgh terminal airspace as experienced on climb-out from Washington National. The pilot is concerned with cloud tops, thunderstorms, freezing levels, turbulence, etc. N1234A is also concerned with airfield conditions and equipment status.

N1234A listens to the Automatic Terminal Information Service (ATIS) before being instructed to contact the Pittsburgh approach controller. The ATIS does not provide all the information N1234A would like to have. Though this information is current at the time of broadcast, conditions are changing very rapidly, requiring most of this same information to be reissued, verbally, by the terminal ATCS.

N1234A hears the terminal ATCS broadcast a SIGMET. This information describes an area affected by a line of thunderstorms. The pilot, not familiar with the description of the affected area, checks a map to locate the area described. The area is 40 miles northwest of Pittsburgh and does not affect the flight.

There are thunderstorms around much of the Pittsburgh International Airport. These thunderstorms echoes, depicted on the ATCS's display, are derived from a ground-based ASR-9 sensor. The pilot's airborne weather radar depicts the contours of the thunderstorms differently in area and intensity, and does not show thunderstorm activity behind the first significant return. The terminal ATCS plans to vector the aircraft to the north side of the thunderstorms. The pilot's display indicates clear passage to the

south side. The pilot and ATCS are receiving weather information from different sources. Each are trying to describe the presentation they see to the other.

The terminal ATCS solicits a PIREP from N1234A. Due to a sustained increase in workload, it is not passed on to the appropriate AFSS for 20 minutes.

N1234A is issued the runway braking action and RVR by the terminal ATCS, then receives an approach clearance with instructions to contact the Pittsburgh tower local controller (LC). The LC reissues to N1234A wind information, runway braking action, and the RVR. N1234A receives a clearance to land.

In retrospect, N1234A received weather information which was often incomplete, inconsistent, and outdated. The AFSS ATCS spent valuable time interpreting alphanumeric data. Radar information was often too old to be useful by itself. The Flight Watch ATCS was unable to relay accurate information on thunderstorm cells and the exact location of potential icing and turbulence. The PIREP's were not disseminated at their time of receipt due to equipment limitations.

The terminal and ARTCC ATCS's were overly involved with the issuance of routine weather information. The exchange of weather information between pilot and ATCS was time-consuming, work-intensive, and caused frequency congestion that affected airspace capacity and ATC efficiency.

Scenario Two: 2015

DATE:	December 1, 2015
Departure Airport:	Washington National, Washington, DC
Arrival Airport:	Pittsburgh International, Pittsburgh, PA
Aircraft:	N1234A, BE30/S
Proposed Departure Time:	1045 Zulu (Z)

While planning a flight from the Washington National Airport to the Pittsburgh International Airport, the pilot of N1234A obtains a detailed weather briefing from the ATCS at the preflight position at the Leesburg AFSS.

The AFSS has composite display available for the pilot's entire route of flight which allows the specialist to describe individually flight tailored information which indicates precisely where a line of thunderstorm activity will be located. The display is capable of overlaying individual areas with annotations of tops, intensity, and movement. The need for Convective SIGMET and radar reports has been eliminated by current and forecast annotated radar information. NOTAM information for the route of flight is displayed only for navigational aids and landing areas pertinent to the route of flight.

Turbulence, icing, and winds aloft information is denoted into a weather severity index by route and altitude and displayed graphically, eliminating the need for vague and extensive weather advisories. Radar reflectivity information is confirmed by satellite data which can be looped and overlaid over other graphics. PIREP's have been automatically received via data link from aircraft inflight and are included in the graphic display. The ATCS is no longer required to read, verbatim, routine alphanumeric data.

The ATCS queries the computer for the most favorable flight altitude for the BE30. The most favorable altitude and associated wind data are displayed graphically for the route. The location of wind direction and speed changes is clearly depicted.

The pilot of N1234A could have obtained the same graphics and weather presentation by accessing the DUATS located at a fixed base operator or through a home personal computer. The data base and graphics utilized by DUATS are the same data base utilized by the Leesburg AFSS.

The pilot of N1234A files a flight plan via a computer terminal. It is transmitted to the HOST computer at the Washington ARTCC. An ATC clearance is electronically posted at the Washington National clearance delivery position in the tower cab. Simultaneously, the pilot of N1234A receives an ATC clearance to the Pittsburgh International Airport through the predeparture clearance delivery function at

Washington National ATCT. N1234A receives an EDCT of 1145Z, a 1-hour ground delay at the Washington National Airport, due to restricted ceiling and visibility and wet runway conditions at the destination airport, Pittsburgh International. The pilot is able to plan for this delay in departure.

Having no need to reconfirm any clearance information, N1234A calls Washington National ground control (GC) for taxi instructions. GC has prior notification that N1234A will call due to a scroll of an EDCT list. The controller is aware that the pilot has been delayed on the ground and that the ATC system is now able to allocate airspace for this aircraft. Automation tools help direct the aircraft to the appropriate runway as reduced visibility and fog restrict the ATCS's ability to see the aircraft taxi. GC monitors N1234A's progress on the airport surface detection equipment. Some limited verbal communications are still required.

The Washington National local controller (LC) issues departure instructions and a takeoff clearance to N1234A. The aircraft is data link equipped; this is annotated electronically on the ATCS's display. The requirement to issue wind and runway visual range (RVR) information is no longer necessary, as this information is transmitted via data link. Data link technology enables the LC to devote more time and attention to the separation and sequencing of aircraft. Once airborne, N1234A is instructed to contact Washington National departure control. The aircraft is now under radar control.

While N1234A is climbing out from the airport, pertinent weather affecting the route of flight is transmitted via data link to the aircraft, with no ATC involvement. N1234A files a PIREP on the bases and tops of cloud layers via data link. This PIREP is automatically disseminated to users in need of such information, including ATC.

Throughout the flight, N1234A receives and solicits weather information through a common data base via an on board computer. Wishing to confirm the exact location of predicted thunderstorm activity, N1234A contacts Flight Watch. The Flight Watch ATCS enters the aircraft's identification into the computer. The aircraft's position is automatically depicted on the display along with the projected route of flight. The Flight Watch ATCS is able to provide N1234A with individually flight tailored information that depicts the exact location of hazardous weather and projections of movement in time and distance along the route of flight.

The Washington ARTCC receives information indicating a severe thunderstorm in the flight path of N1234A. The ARTCC ATCS's are able to depict this, in three dimensions, on their common console. Planning commences to direct N1234A, and all other affected aircraft, from this thunderstorm. Before N1234A reaches this thunderstorm, a reroute is received from ATC via data link ensuring clearance from it.

N1234A, able to depict the same presentation of the thunderstorm on its on-board computer, has anticipated the reroute. PIREP and NOTAM information are similarly transmitted via data link to the aircraft.

N1234A listens to the ATIS before being instructed to contact the Pittsburgh approach controller. The ATIS broadcast, along with the accurate weather information received throughout the flight, prepares the pilot for arrival to Pittsburgh.

Both the pilot of N1234A and the approach controller share the same weather information, in graphic presentation. N1234A is vectored around hazardous thunderstorms north of the airport. The pilot anticipated the situation and was able to plan for this reroute.

N1234A, during the arrival phase of flight, receives continuous wind, braking action and RVR information from the heads-up display which interfaces with the data base. The terminal ATCS issues an approach clearance to N1234A with instructions to contact the Pittsburgh tower local control (LC). The LC, at this point, issues a clearance to land to N1234A. The LC also receives continuous wind, braking action, and RVR information, for ATC planning purposes, from the heads-up display in the tower cab.

In retrospect, N1234A and the ATC system received weather information which was complete, consistent, pertinent, and accurate. The pilot was able to obtain an individually tailored preflight briefing from the AFSS ATCS in a minimum amount of time. The ATCS was able to focus on providing a service versus spending a large amount of time analyzing and interpreting data. The terminal and en route ATCS's utilized weather information for strategic and tactical ATC planning. The terminal and ARTCC ATCS's, no longer a conduit of routine weather information, were able to provide much better ATC services to N1234A.