1.4 **PROGRAM MANAGEMENT FOR THE COLLABORATIVE CONVECTIVE FORECAST PRODUCT (CCFP)**

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1. INTRODUCTION

Weather related delays due to convective activity are the single most disruptive force within the National Airspace System. The Collaborative Convective Forecast Product (CCFP) seeks to reduce these disruptions by collaboratively creating a more accurate forecast of convective weather (see Figure 1 for an example). The purpose of this paper is to give the history of the CCFP; document the sustained growth, credit the multiple agencies that have supported the development; and provide a snapshot of the current status of the CCFP as an integral part of air traffic operations.

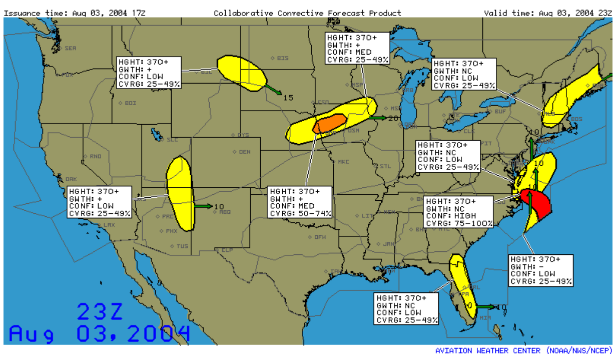

Figure 1. CCFP Example

2. CCFP DESCRIPTION

The CCFP is a 2-6 hour graphical forecast of convection developed specifically for use in the strategic planning and management of air traffic (Hudson and Foss, 2002). It is produced in a collaborative manner by the National Oceanic and Atmospheric Administration National Weather Service Aviation Weather Center (NOAA/NWS/AWC), the Meteorological Services of Canada (MSC), NWS Center Weather Service Units (CWSUs) located at the Federal Aviation Administration (FAA) Air Route Traffic Control Centers, and airline meteorology departments.

The geographical extent of the CCFP covers the contiguous United States extending into Canadian airspace and including the area south of a line from Thunder Bay, Ontario to Quebec City, Quebec.

Convection for the purposes of the CCFP forecast is defined (WAWG, 2004) as a polygon of at least 3000 square miles that contains:

1. A coverage of at least 25% with echoes of at least 40 dbZ composite reflectivity, and

2. A coverage of at least 25% with echo tops of 25,000 feet, or greater, and

3. A subjective forecaster confidence of at least 25% of the minimum threshold being met.

All three of these threshold criteria combined are required for any area of convection of 3000 square miles or greater to be included in a CCFP forecast. This is defined as the minimum CCFP criteria. Any area of convection which is forecasted not to meet all three of these criteria, will not be included in a CCFP forecast. Thus, isolated, single-cell storms are explicitly not included.

The primary users of the CCFP are air traffic management which includes both FAA and industry elements. The CCFP is the primary weather forecast product for collaboratively developing a Strategic Plan of Operations (SPO). The SPO is finalized during the collaborative teleconferences hosted by the Strategic Planning Team at the FAA Air Traffic Control System Command Center (ATCSCC) and conducted approximately every 2 hours. The current configuration for the CCFP has become the cornerstone weather forecast product for daily traffic management decisions.

The CCFP is issued during March through October, approximately the convective season. The framework for collaboration is the Weather Chatroom that is executed over the Internet using interactive software. To facilitate the Weather Chartroom, a preliminary forecast is produced by AWC with input from MSC prior to the chatroom discussion. Interactive software allows the collaborators to provide comments to the initial forecasts, graphically describe their alternative forecasts, and allow other collaborators and participants to quickly assimilate the essential points being made by viewing a graphical presentation. The objective of the collaboration is to produce a technically sound forecast that has the support of all the producers. Note that the forecast is collaborated, and it is not a consensus forecast (the average or the summation of all contributions).

The AWC is responsible for the operation of the Weather Chatroom. The Weather Chatroom is conducted prior to each CCFP forecast with sufficient time remaining to complete the final forecast and

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transmit it to the ATCSCC prior to the Strategic Planning Team teleconferences. The AWC also has the responsibility to insure consistency of other NWS products with the CCFP, e.g., Convective SIGMETS. The MSC has the same responsibility for consistency in Canadian airspace, and they collaborate with the AWC to insure a smooth transition across the international boundary.

All meteorological service providers are encouraged to give input to the Weather Chatroom for the development of the forecast within their area of responsibility or concern. For the forecast to meet the needs of service providers and system users, maximum participation is required.

3. CCFP ORIGINS

The origins of CCFP came from a NWS Task Force to commercial aviation (Rodenhuis, 1998) that established the idea of “rapid prototyping” of the development of weather products for use in aviation. The concept of combining weather forecasting with collaboration (Fahey, 1998) occurred in the context of increasing delays that challenged the efficiency of traffic flow management of the national airspace system. The prototype CCFP was the result of an extraordinary improvement in collaboration occurring at that time between commercial aviation and the ATCSCC. Just as efficient traffic management required collaborative efforts from all elements of the system to be successful, it was conceivable that it might also be used successfully in weather forecasting. As a result, in 1998, the AWC, the Minneapolis CWSU, and the Northwest Airlines Meteorology Department joined forces to develop the first CCFP. This first product was developed using only in-house resources. The product itself was limited in geographical coverage. In 1999, the CCFP was run as a test program and was expanded into its first full operational season in 2000.

4. CURRENT STATUS

From its humble beginnings, the CCFP has grown from a zero-funded effort to a multi-agency program, primarily through a “strategy of attraction”: attract resources by doing good work that serves the needs of users. The CCFP is now an explicit part of the FAA's performance goals and plans (FAA, 2004) and is a multi-faceted program. The operational CCFP has three components:

1. forecasting,
2. collaboration, and
3. application.

In addition, the operational delivery and the meeting of the continuous prototyping standards require the following supporting components:

1. training,
2. forecast verification,
3. operational evaluation and feedback, and
4. development and expectation of user needs in the out years.

Due to the multitude of current CCFP components, many agencies are now involved with the CCFP. Each agency contributes dedicated resources as follows:

FAA: The FAA currently oversees the program management of the CCFP jointly through its offices of Traffic Flow Management Research and System Operations. FAA traffic managers are one of the primary users of the CCFP. The Weather Unit at the FAA ATCSCC participates in and monitors the weather chatroom and also provides operational feedback. Another source of feedback is the Airspace Laboratory located at the ATCSCC. The Training Department at the ATCSCC has dedicated resources to the development of training packages which are used to update users to CCFP changes, enhancements, and applications. In addition to these personnel resources, the FAA also funds several CCFP-related activities. The most notable of these are verification activities at NOAA's Forecast Systems Laboratory and the National Center for Atmospheric Research, as well as evaluation activities conducted by FAA contractors.

NWS/AWC: The AWC is responsible for developing the initial forecast for U.S. airspace and leading the Weather Chatroom. Subsequently, AWC forecasters contribute to the collaboration process by contributing and responding to comments from other chatroom participants. During the convective season, AWC has dedicated CCFP forecasters working around the clock, 7 days a week. After the development of the forecast, AWC issues the final CCFP and makes it available on the AWC Internet site (http://aviationweather.gov). In addition to CCFP development, AWC contributes significant resources in the form of computer systems and technology support, ensuring the weather chatroom is available and updated with emerging technology. AWC also contributes internal training resources, verification of forecast procedures, monthly evaluations and feedback, and continual evaluation and improvement of the collaboration process.

NWS CWSUs: The CWSUs provide support to the CCFP collaboration process through their participation in the Weather Chatroom. Individual CWSU participation is related to the occurrence, or likelihood, of convection in their individual areas of responsibility. Thus, while each of the twenty contiguous U.S. CWSUs does not contribute to every CCFP, at any given chatroom there are multiple CWSU participants. In addition, CWSUs are responsible for training their FAA customers in each of their respective air traffic control centers.

Canada: From its inception as a limited geographical-coverage product, the CCFP has grown to become a truly international product. Two Canadian agencies, the MSC and NavCanada, participate. The MSC is responsible for an initial convective forecast in CCFP Canadian airspace and also participates in the weather chatrooms. NavCanada, as the counterpart to the U.S. FAA, participates as a product user of the CCFP and provider of operational feedback on performance and impacts.

Airlines: From its inception, the CCFP was designed as a collaboration between government and industry. This aspect continues today. Airline meteorology departments participate in CCFP production by providing comments and input to the weather chatroom. These participants include Delta Airlines, Northwest Airlines, United Airlines, Federal Express, United Parcel Services, and Weather News International (which provides meteorological support to several airlines). An emerging trend is the increased participation in the Weather Chatroom of airlines that do not have dedicated meteorological departments. The airlines are also a source of valuable feedback on the effectiveness and application of the CCFP.

Recalling that the initial CCFP was developed solely with in-house resources, the current state of the CCFP demonstrates how the "strategy of attraction" has been successful. Figure 2 is a graph which shows the approximate spending on the CCFP from its inception in 1998 to the present. Also included is an estimate of fiscal year 2005 resources that have been requested. Note that this funding is only an estimate of FAA and NWS resources, it does not include industry or Canadian resources. Even without these contributions, the rising trend in CCFP resources can clearly be seen.

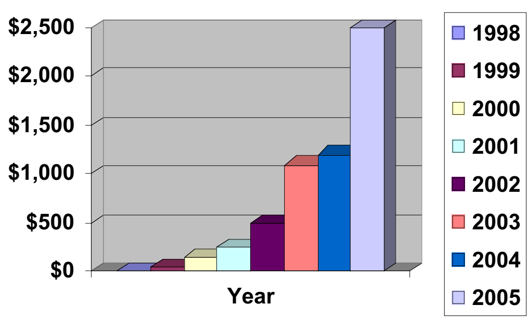

Figure 3. CCFP funding per year from 1998 to 2005 (estimated) in thousands of dollars

5. OUTLOOK

Commitment to a continuous evolution of the product is an intrinsic requirement of CCFP. In addition to improving the existing design, there is significant value to users of a commitment to develop new techniques or procedures that will enable the extended range forecasting of convection for which CCFP is the first concrete product. Work has been identified that needs to be initiated in order to meet user needs beyond CCFP in the current year; e.g.,

1. Computer-based instruction (CBI) and active training,
2. Enhanced verification techniques,
3. Route impact assessment, and
4. Reanalysis.

At this time, several trends in the development of capabilities that are valued by the users can be acknowledged. Thus, additional user needs can be identified as:

Forecasting: In subsequent years research results are expected to produce probabilistic forecasting of convection. These methods will be incorporated into the use of dynamic weather forecast models of convection.

Collaboration: The method and processes used for collaboration during the production of the CCFP need to be continually evaluated and improved, as necessary. Accuracy, as measured by both quality and value of the CCFP end-product, will be used as the measurement for initiating changes and for evaluating the impact of changes.

Application: The format of the CCFP as presented to the FAA and industry traffic flow managers needs to be continually evaluated and improved, as necessary. Again, accuracy, as measured by quality and value of the CCFP end-product, will be used as the measurement for initiating changes and for evaluating the impact of changes. In particular, development will need to be undertaken of application methodologies (decision-support tools) that will utilize uncertain weather forecasts stated in probabilistic terms to guide managers, dispatchers, and specialists in traffic flow management.

In summary, the CCFP has grown from a initial prototype capability into a cornerstone for traffic management in the National Airspace System (NAS). The CCFP is used daily in the planning of air traffic flow. Multiple agencies contribute to the success of the product. The program management by the FAA, together with input from the NWS, Canada, and industry partners, will continue to ensure the enhancement and the growth of utility of the CCFP.

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