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INTERNATIONAL COLLABORATION: PROVIDING SEAMLESS, CROSS-BORDER AVIATION WEATHER PRODUCTS TO FACILITATE TRAFFIC MANAGEMENT

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1. INTRODUCTION

In November 1996, Canada made aviation history when it became the first country in the world to entrust its air navigation service to a private company. The creation of NAV CANADA was an act of political will on the part of the Company's four key stakeholder members: airlines, owners and operators of aircraft, the Government of Canada, and employees. Since its creation on November 1st 1996, the Company has made customer service a major area of focus. As a result, delays related to air traffic services have been significantly reduced. This is partly due to improved collaboration with its partners and stakeholders and the targeted application of technology.

The Corporation's priorities in terms of weather are to establish an efficient and effective ANS without compromising on the safety of the users. The Meteorological Service of Canada (MSC) produces the aviation weather forecasts, among other services, under contract for NAV CANADA. The collaboration between the MSC and NAV CANADA goes beyond the privatisation of the ANS in 1996 and both organisations are working together to develop new and innovative products.

2. HISTORY

In many areas, Canada became a leader in service innovation for aviation. For example, NAV CANADA is a pioneer in the application of text-based messaging over the North Atlantic, the busiest oceanic airspace in the world with some 1,000 flights per day. Another innovation is the Graphic Area Forecast or GFA (Chretien, 2000). Jointly developed by NAV CANADA and the MSC, the GFA replaced the antiquated alphanumerical FA product by an equivalent graphical display of the weather over Canadian domestic airspace.

The business viewpoint of NAV CANADA requires improvement in air traffic management over its airspace in busy summer weather convection days. Prior to 2002, the MSC's Ontario Weather Centre in Toronto monitored the Collaborative Convective Forecast Product (CCFP) weather-chat session when active weather was located in the busy Southern Ontario airspace. This MSC participation in CCFP was viewed as a prototype for a similar convective forecast product for Canadian aviation users during the past few years.

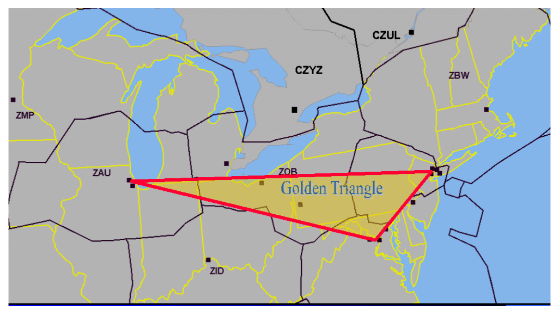

Figure 1 - FIR Regions in Northeast USA and Southern Canada

Subsequently, in May 2002 NAV CANADA approached the U.S. National Weather Service (NWS) to propose extending the CCFP over (part of) Canada. The NWS responded favourably to NAV CANADA's request for an extension of the CCFP over the area of interest to the major carriers (Southern Ontario and Southern Quebec) on the condition that MSC would also participate in the co-production of the product. The expansion of the CCFP into Canadian airspace was welcomed in the United States as a professional contribution that would improve air traffic management in the already congested corridor of the north eastern CONUS. Prior to 2003, the CCFP remaining blank north of the US border, air traffic was being routed into Canadian airspace, not knowing if active convection was also occurring in Canada, which sometime was the case, causing more grief than good to users and to the efficiency of the NAS.

In 2003, southern Canadian Airspace was introduced in CCFP. Extending the CCFP over the area south of latitude 49^0 North (over Ontario and Quebec) allows air traffic managers in both countries to move traffic more

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efficiently into and through Canadian airspace when severe weather affects that area.

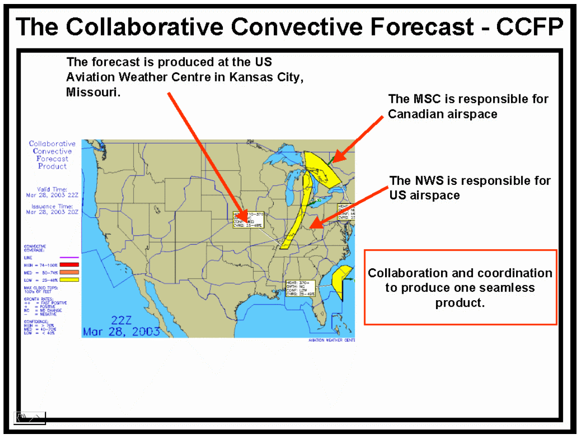

Figure 2 - CCFP Process

In conjunction with the CCFP, the Corridor Integrated Weather System (CIWS) platform takes advantage of the high density of existing FAA and US National Weather System weather sensors (radar and lightning). This system provides en route traffic flow managers with accurate, automated, high update rate information on storm locations and echo tops, along with 2-hour animated growth and decay forecasts of storms. It is a tactical tool designed for use in the 0-2 hour planning period wherein dynamic adjustments are made to the strategic plans developed with the CCFP.

In the United States, CIWS allows traffic managers to achieve more efficient tactical use of the airspace, reduce controller workload, and significantly reduce delay. The CIWS "tactical" traffic flow management products now complement the longer-term "strategic" (2-6 hour) national CCFP forecasts that are also needed for flight planning and traffic flow management.

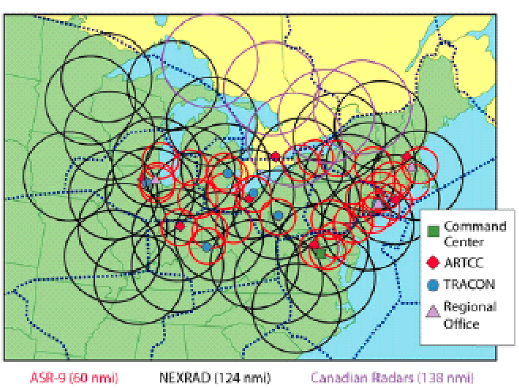

Figure 3 - 2004 CIWS Coverage

Prior to 2004, CIWS coverage supported tactical decisions over the northeastern United States, specifically the Golden Triangle corridor, and marginally over a portion of Toronto's airspace.

A trial of the Internet version of CIWS by NAV CANADA's Toronto Terminal Management Unit (TMU) and National Operation Centre (NOC) staff during the summer of 2003 indicated that this tool had the potential to facilitate short-term tactical decisions in the Toronto TMU environment as they relate to severe convective weather (thunderstorms). For example, CIWS shows areas of growth and decay. This information can be used to anticipate when routes will open or close within the TMU environment because of thunderstorms. This benefit would not be fully realized without ingest of data from six Canadian weather radars into the CIWS platform.

Enhancement of CIWS coverage via ingest of Canadian weather radar data greatly enhanced the benefit to NAV CANADA by improving coordination with the FAA (see figure 3). In June 2004, MIT Lincoln Lab integrated the Canadian radar data covering Southern Ontario and Southern Quebec into CIWS.

3. MSC PREPARATION OF THE CCFP

The production of the CCFP is quite different than any other product. Firstly, the frequency of the product (every 2 hours) makes for very challenging days when weather is not cooperative. Even though forecasters need to focus on organized convection only, we all know that to forecast such areas at the right time and at the right place, is one of the most difficult tasks to achieve.

In the very first stages of CCFP production, focus is placed on analysis and diagnosis to assess what the triggers are. Once this is done, the forecaster needs to decide if that trigger will materialize to set-off the convection. When he or she believes so, that's when we roll up our sleeves and prepare for fun.

This may look pretty simple from the outside, but we have to keep in mind that we try to maximize our accuracy in both time and space, while trying to provide as much lead time and the highest level of confidence as possible.

Users agree that, in general, the 13Z issue of the CCFP is the most critical one of the day, as it is used to plan several transcontinental flights (west to east) that are schedule to arrive around the peak time for convection. This means that we try to anticipate convective weather with older Numerical Weather Prediction (NWP) guidance and upper air soundings.

Throughout the day, forecasters must stay on top of the convective development by looking for any sign of convection. Particular attention must be paid to problematic areas and associated triggers. As new NWP and upper air soundings come in, forecasters reassess the situation and make modifications as they see fit.

Chronologically, production of the 13Z issue of the CCFP would be as follows (timelines are the same for every issue):

From:

1100Z to 1150Z: The 3 CCFP panels are produced and transmitted to the Aviation Weather Centre (AWC) Kansas City.

1150Z to 1210Z: Coordination takes place between the AWC and MSC forecasters.

1215Z to 1245Z: The CCFP chat session takes place.

1245Z to 1255Z: Modifications (if necessary) are made to the CCFP and the forecast is transmitted.

As you might expect, production tools and data used to produce the CCFP differ from one office to another. This is especially true for the CCFP, where the two offices reside in different countries and have different information available to them. While this makes for a challenging situation when it comes time to fine tuning the product and it emphasizes the requirement for good coordination.

Currently, coordination between both offices is working well. Preliminary discussions have take place to enhance existing tools or to develop new tools that would make the coordination process more efficient and therefore, leave a few more precious minutes available to the forecasters.

4. NEXT STEPS

The current CCFP coverage over southern Ontario and Quebec supports strategic initiatives in co-ordination with the FAA, especially concerning the use of the Canadian off-load routes over Ontario and Quebec. Continuous growth in air traffic is demanding more efficient air traffic management across Canada and a seamless transition across national boundaries, i.e. the Canada/US airspace boundary.

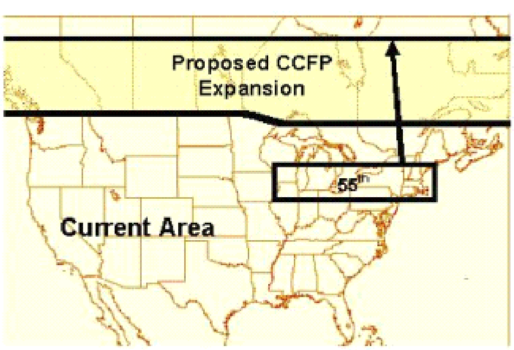

Figure 4 - Proposed CCFP Expansion

The NAV CANADA National Operations Centre is responsible for the coordination of Canadian air-traffic management initiatives and decisions, cross-border initiatives with the United States, and for the coordination of international initiatives, such as the collaborative North Atlantic track selection process.

To ensure an efficient traffic flow, better products will need to be developed or existing ones expanded. Study is underway at NAV CANADA to extend the CCFP from coast to coast up to 55 latitude north. This extension in coverage will enable a better management of the east-west air traffic over southern Canada and the traffic flow in and out the transatlantic routes. Such expansion is planned for 2006.

NAV CANADA and the MSC will also be addressing the issue of verification of the CCFP over Canadian airspace using the same verification methodology that is currently being used to verify the US portion of the forecast.

5. CONCLUSIONS

Weather information is required to address anticipated significant weather events that could adversely affect the flow of air traffic across Canada, between Canada and the United States, and between Canada and Eurocontrol. With the appropriate weather observation and forecast information at hand, flow management controllers can prepare efficient mitigation measures in advance of a weather event.

The weather tools currently available should be continuously improved to meet the needs of the changing and increasing demand, especially for cross-border air traffic. At the other end, some areas of air traffic management are currently not being supported by specific weather products, and would benefit from the development of new products or services adapted to their needs.

The CCFP is a unique product in terms of forecast content and production methodology that meets some of the needs in convective forecasting. A seamless merging of forecasts from two countries through the use of technology and collaboration provides traffic-managers and the air carriers with the information that they need to support their decision-making processes.

The collaboration between MSC, NAVCANADA in Canada, and the FAA and NWS in the USA have set a standard for cooperation and improvements in aviation weather services. Starting with CCFP forecasts, and continuing with the CIWS observing and forecast system, mutual benefits to both countries have been derived. The flying public is the ultimate recipient of these benefits that they see in terms of safety and efficiency of the national air transportation system in both countries.

All existing and future products should consider the evolution of technology, weather forecasting, and the evolution of air traffic management as new regulations will take place in the years to come. Development of a suite of products should consider the interaction of all key players involved in the day-to-day operations – from pilots, dispatchers, air traffic controllers to meteorologists. The utility and the design of these weather products and tools will therefore be improved and accepted in day-to-day operations. Products and tools should go through an ongoing assessment and verification to ensure they are meeting the intended need and achieving the intended result.

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