J11.3 Aviation service enhancements across the National Weather Service Central Region

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1. INTRODUCTION

In 2009, the New York Center Weather Service Unit (CWSU) began the production of specialized forecast products designed to help traffic managers at the Terminal Radar Approach Control (TRACON) and other Federal Aviation Administration (FAA) decision makers. First was a TRACON thunderstorm forecast which represented the probability of thunderstorms impacting an arrival or departure gate (Smith 2010). This involved CWSU forecaster interpretation of forecast information into a pre-formatted Microsoft PowerPoint slide which was then uploaded to the CWSU website. Other PowerPoint slide forecasts included compression winds and icing probabilities in wintertime.

The added services were so well-received by FAA decision makers that the Chicago Weather Forecast Office (WFO) and Chicago Center Weather Service Unit (ZAU) were charged with implementing this service and developing a plan to provide other enhanced services to the Chicago-area air traffic decision makers. The Central Region plan included: holding customer meetings, developing tactical decision aids, and implementing WFO aviation product enhancements.

2. FAA CHANGES: NEXTGEN

The FAA is beginning a path to a Next Generation Air Transport System (NextGen) which will rely on GPS technology to track aircraft locations. Aviation weather will be a key piece to this transition since traffic management is heavily dependent on current and forecast weather (Souders 2010). Enhanced aviation weather capabilities will include a common weather picture for all decision makers and aviation users, integration of weather information directly into decision support tools, and leveraging of web-like dissemination for flexibility and cost savings. This important and significant change will help steer the direction of aviation service enhancements and keep focus on potential changes in the future. The Central Region tactical decision aids were designed using the core NextGen tenets of a common picture of the weather for all transportation decision-makers and aviation system users and weather being integrated directly into sophisticated decision support capabilities to assist decision-makers.

3. CENTRAL REGION SERVICE ENHANCEMENTS

3.1 Customer Meetings

In January 2010, National Weather Service (NWS) Central Region Headquarters (CRH) personnel visited Eastern Region Headquarters, the New York CWSU and WFO to gain a better understanding of the service enhancements that went on there. In order to ensure that the Chicago area would be able to provide similar tailored services to meet local user needs, the first in a series of meetings began. In February, CRH along with WFO and CWSU personnel visited with FAA managers from the ZAU Air Route Traffic Control Center (ARTCC), TRACON and O'Hare tower to gain a better understanding of weather impacts that were most important to them. Summertime convection was immediately identified as any storms pose a hazard to air traffic and can easily shut down departure or arrival gates, which in turn impacts arrival and departure rates. This ultimately leads to air traffic delays, cancellations or diversions to other airports. Any of these situations can be costly to the airline industry and national economy not to mention creating traveler inconvenience.

The other primary weather impact for Chicago and surrounding airspace is wind direction and wind speed and resulting preferred runway

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configuration. Chicago O'Hare is the third busiest airport in the United States and a major hub for many airlines. In order to keep traffic flowing in and out, and on time, proper runway configuration is crucial. To help FAA decision makers ensure runway configurations are optimized and to notify of potential changes in advance, CRH developed a web-based tactical decision aid (TDA) using National Digital Forecast Database (NDFD) wind data along with critical runway configuration thresholds provided by the FAA. By using forecast wind data, the tactical decision aid is able to alert officials of any wind change forecast information that may impact runway configurations, which in turn will help advance planning of such changes, keeping traffic flowing as smoothly as possible.

3.2 Tactical Decision Aid Development

Convection and critical tailwind TDA displays were developed to support operations at the TRACON, ARTCC, and air traffic control towers by increasing the situational awareness of current and future weather conditions. The TDA displays categorized the weather events into impact levels to allow the operator to quickly ascertain the impact of weather on aircraft operations. The web-based TDA displays are populated directly from the WFO gridded forecast using the MapClick web service available on the NWS consolidated internet farms. This allows the displays to be dynamic and to always reflect the latest forecast information from the WFO. These displays have been implemented at Chicago (ZAU), Denver (ZDV) and Minneapolis (ZMP) as of October 2010.

The convective TDA (Figure 1) displays a continuously updated 30-minute loop of composite reflectivity or echo tops along with an hourly thunderstorm forecast for the next six hours for the arrival and departure gates. The arrival and departure gates are annotated on the display which allows it to be used tactically (when does the loop show thunderstorms entering/exiting the gate) and strategically (when will thunderstorms develop around a gate).

Denver Area Convective TDA

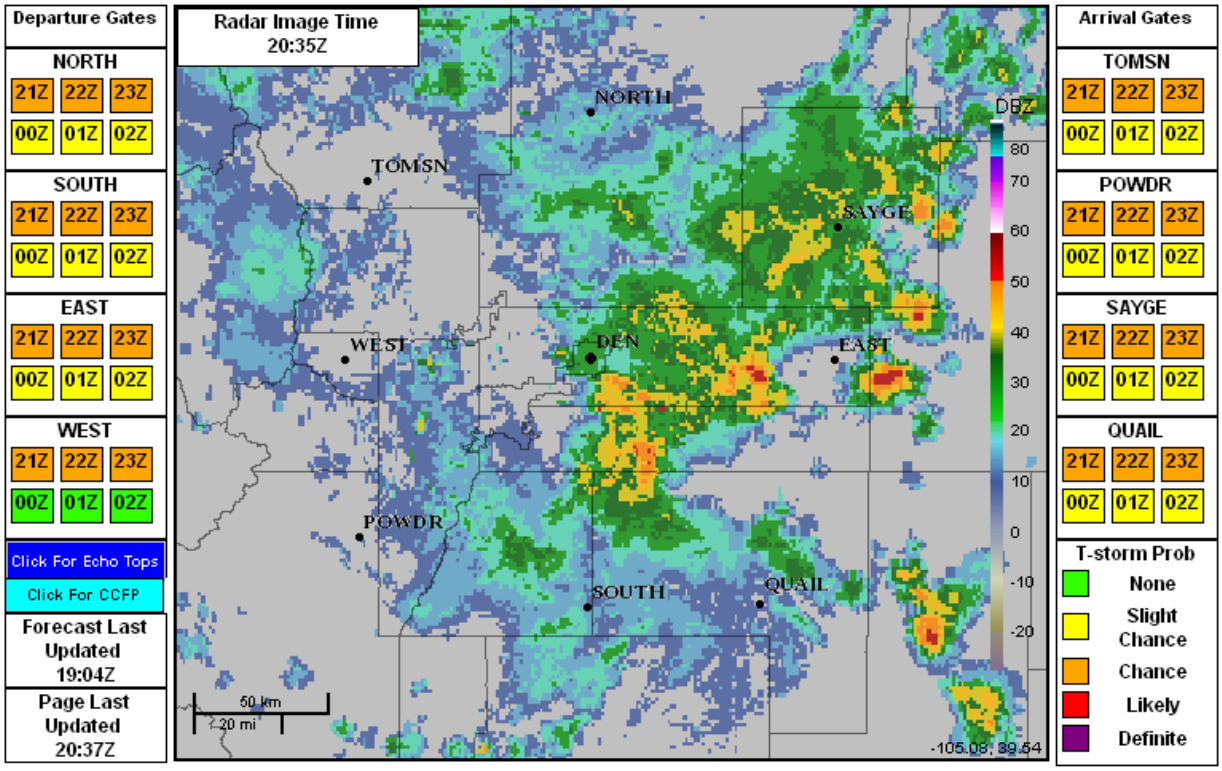

Figure 1 – A screenshot of the convective tactical decision aid showing convection in the ZDV area of operations.

The critical tailwind TDA display (Figure 2) displays the current surface observations for the vicinity around the airport along with hourly forecasts of surface wind for the next six hours for the airport. The impact levels displayed on the TDA are based on the selected runway configuration for the airport. The runway configuration can be switched by the user to understand how the wind will have an impact to certain runway configurations. This also serves as a helpful visualization of wind forecast scenarios. The TDA provides situational awareness to wind impacts and advance notice of unfavorable runway configurations. Discussions with the O'Hare tower have shown that a pre-planned configuration change can be accomplished in half the time (20 minutes versus 45 minutes) of an unplanned change, so this tool is helpful to maintain situational awareness to help save precious time.

The integration of weather databases like NDFD with FAA impact thresholds delivered by a website supports the NextGen concept. It paints a common weather picture, integrates weather information and decision support tools, and uses a website delivery allowing broad access.

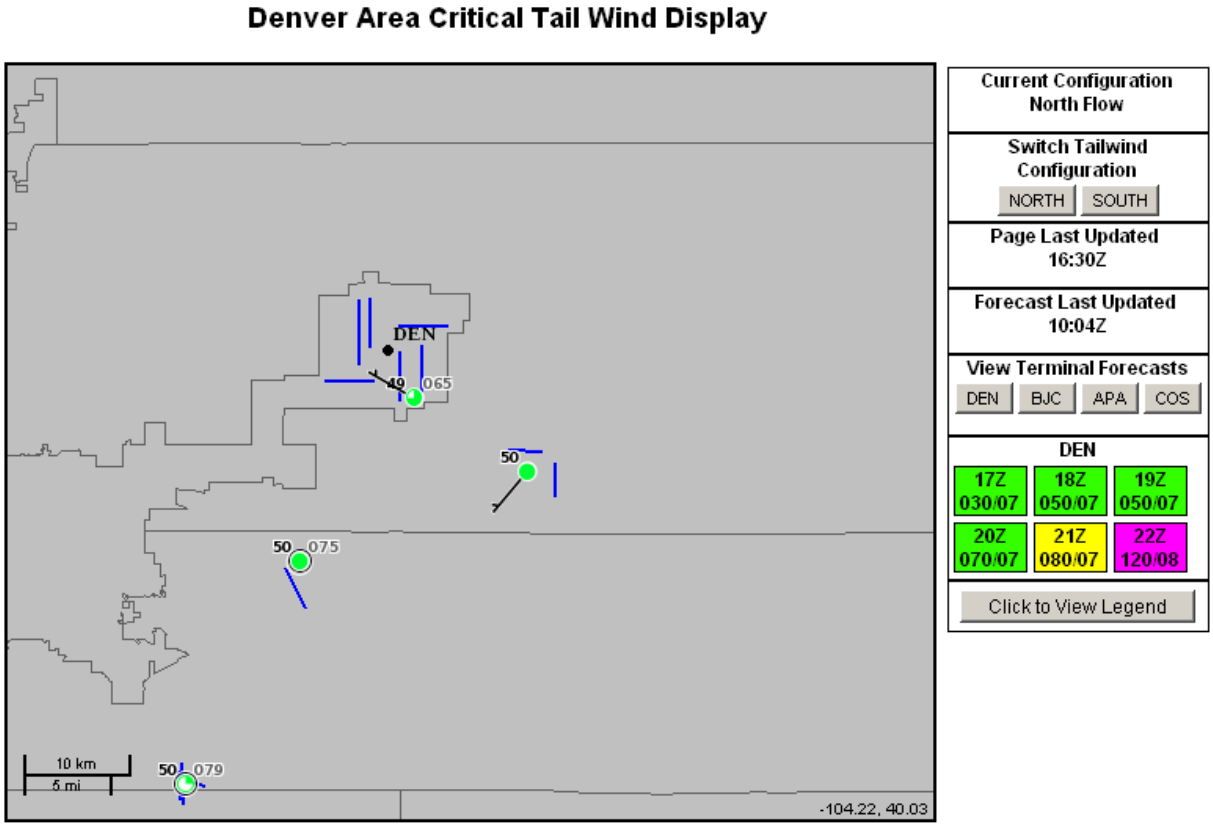

Figure 2 – A screenshot of the Critical Tailwind Display at ZDV showing the north flow configuration.

3.3 WFO Service Enhancements

In March 2010, the WFO and CWSU hosted an aviation workshop which included NWS, FAA, airline industry, and general aviation (GA) interests. Based on feedback received from the previous FAA meetings and this workshop, several enhancements were made to the aviation services originating from the National Weather Service Forecast Office in Romeoville, Illinois (WFO LOT).

The first enhancement was to issue an area forecast discussion (AFD) with an expanded

aviation section (Figure 3). The aviation section of the AFD was expanded to cover the entire seven-day operational period. The discussion focused on explaining timing details in the current terminal aerodrome forecast (TAF) as well as providing categorical outlook information in the later periods to assist with National Airspace System (NAS) planning. Another need identified through these meetings was a way to convey forecast confidence. The AFD was also adapted to include this information to communicate other possible weather scenarios.

The next enhancement was to increase the TAF issuance frequency from the normal six-hour cycle to every two hours. This better coincides with FAA strategic planning teleconference calls that are used to manage air traffic across the entire NAS. Traffic managers and decision makers are then ensured they have the most up-to-date weather information.

The WFO also adopted the categorical amendment criteria (CAC) method for updating TAFs. This uses critical thresholds that are based on aviation impacts and regulatory needs instead of solely using cloud ceiling height and visibility to determine updates to the forecast. CAC allows amendments to be based on airport minimums, alternate minimums, instrument flight rules (IFR) conditions, marginal visual flight rules (MVFR) conditions, fuel alternates, and local thresholds as determined in coordination with local air traffic management officials. By moving to CAC, forecasters can eliminate unnecessary TAF amendments and concentrate on those that directly impact the aviation community.

Latest Discussion

(EXTRACTED FROM FXUS63 KLOT 101735) NATIONAL WEATHER SERVICE CHICAGO/ROMEOVILLE IL 1135 AM CST WED NOV 10 2010 //ORD AND MDW CONCERNS...UPDATED 18Z..

SOUTHEAST WIND GUSTS THIS AFTERNOON

CIGS LOWERING TO 3-4KFT THURSDAY AFTERNOON

WINDS SHIFTING FROM SOUTHWEST TO NORTHWEST THURSDAY

CMS //DISCUSSION...UPDATED 18Z..

OVERALL...MAINLY QUIET WEATHER EXPECTED THRU THE PERIOD WITH A FEW ITEMS OF NOTE. IN THE SHORT TERM...RATHER THICK DECK OF HIGH CLOUDS CONTINUES TO SLOWLY MOVE ACROSS THE REGION...THOUGH IT IS SHOWING SIGNS OF THINNING. WITH MORE SUNSHINE...LOW LEVELS SHOULD BEGIN TO MIX BY EARLY AFTERNOON AND STILL EXPECT SOME GUSTS IN THE 15-18KT RANGE. DIRECTION WILL REMAIN SOUTHEAST THRU THE EVENING HRS AND THEN SHIFT SOUTHERLY OVERNIGHT AND SOUTHWESTERLY THURSDAY MORNING AHEAD OF A WEAK COLD FRONT THAT WILL MOVE ACROSS THE AREA THURSDAY AFTERNOON. WIND DIRECTIONS THURSDAY WILL BE PROBLEMATIC WITH THIS FRONT NEARBY. THE OVERALL TREND SHOULD BE FOR SOUTHWEST WINDS TO SHIFT TO NORTHWEST AS THE FRONT PASSES WITH WINDS POSSIBLY SHIFTING TO NORTHEAST BY THURSDAY EVENING

A FEW SHOWERS ARE POSSIBLE WITH THIS FRONT BUT OVERALL COVERAGE IS EXPECTED TO BE ISOLATED AND ANY SHOWERS THAT DO DEVELOP SHOULD BE RATHER LIGHT. SO AT THIS POINT HAVE KEPT THE FORECAST DRY. IN ADDITION AS THIS FRONT APPROACHES NORTHWEST IL OVERNIGHT...WIND SPEEDS WILL DROP OFF AND DEPENDING ON THE EXTENT OF CLOUD COVER SOME PATCHY FOG IS POSSIBLE

BKN/OVC HIGH CLOUDS WILL LIKELY CONTINUE TO THIN THIS AFTERNOON WITH VFR CIGS OF 4-5KFT DEVELOPING OVERNIGHT AND LOWERING TO 3-4KFT BY THURSDAY AFTERNOON. DOES NOT APPEAR ANY WIDESPREAD OR PREVAILING MVFR CIGS WILL DEVELOP THRU THURSDAY AFTERNOON. CMS //ORD AND MDW CONFIDENCE...UPDATED 18Z..

HIGH CONFIDENCE OF VFR CONDITIONS THRU THURSDAY AFTERNOON

HIGH CONFIDENCE ON WIND FORECAST THRU SUNRISE THURSDAY...MEDIUM CONFIDENCE ON WIND FORECAST THURSDAY. CMS //OUTLOOK FOR ORD/MDW FOR 06Z FRIDAY-12Z WEDNESDAY...UPDATED 18Z..

THURSDAY NIGHT...CHANCE OF SHOWERS

FRIDAY...CHANCE OF SHOWERS/THUNDER...MAINLY FRIDAY NIGHT

SATURDAY...CHANCE OF SHOWERS

SUNDAY...VFR

Figure 3 – A sample enhanced aviation forecast discussion from the National Weather Service office in Romeoville IL.

3.4 Additional CWSU Website Design

In addition to the web-based TDA development, an overhaul of the entire CWSU website was initiated after the first round of FAA customer meetings. Website users requested a more useful format that would serve more as an information portal. In close coordination with users of the site, the main page was redesigned to be a single, consolidated source of weather information on a single page. The menu items were also refined, so overall, the page became more clean, simple, and easy to use. Instead of focusing on the amount of information, it focused on the use of the information ensuring easier interpretation of weather data. This was a new approach to web design and was a prototype-feedback-refinement approach. This collaborative process will continue to ensure usability.

4. FUTURE ENHANCEMENTS

Future plans include: additional enhancements to provide additional decision support tools for elements such as turbulence, icing, and compression, planning additional customer workshop forums in Chicago, Denver and Minneapolis, developing a verification scheme, and collaborating with NOAA's Earth System Research Laboratory Global Systems Division to prototype aviation forecast tools using High-Resolution Rapid Refresh model ensemble output.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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