Project Report
ATC-325

Assessment of Air Traffic Control Productivity Enhancements from the Corridor Integrated Weather System (CIWS)

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16. Abstract

The Air Traffic Control (ATC) productivity benefits attributed to the Corridor Integrated Weather System (CIWS) were assessed using real-time observations of CIWS product usage during three multi-day thunderstorm events in 2005 at eight U.S. Air Route Traffic Control Centers (ARTCCs). CIWS improved ATC productivity by:

- Reducing the time required to develop, coordinate, and implement weather impact mitigation plans
- Increasing the number of safety and capacity-enhancing plans that were executed (e.g., more efficient, proactive rerouting and greater ability to keep routes open)
- Assisting with FAA staffing decisions.

Time savings per convective weather day for Traffic Management Coordinators (TMCs) in an ARTCC typically were 20–95 minutes.

The overall frequency of capacity-enhancing decisions increased by 177% relative to the CIWS benefits study conducted in 2003. The annual CIWS delay savings are in excess of 92,000 hours. Corresponding airline direct operations cost (DOC) savings exceed $94 M and passenger value of time (PVT) savings exceed $201 M. Annual jet fuel savings exceed 11 M gallons.

The ability of the Cleveland ARTCC to develop and execute weather impact mitigation plans improved significantly (e.g., by 50–80%) when CIWS products were available to Area supervisors as well as to the TMCs.

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We would like to note the contribution by Mike Klinker (formerly the Traffic Management Officer at ZDC; now at MITRE CAASD) who suggested that CIWS displays be provided to the Area Supervisors as well as to the TMCs. His operational insight was clearly very helpful in helping the CIWS program provide better service to the NAS users.

Diana Klingle-Wilson provided substantial assistance in collecting, organizing, and mining all of the data collected at the FAA facilities during the 2005 CIWS field-use assessment campaign. Finally, Beth Ducot carefully read the report and made a number of excellent suggestions that improved the final presentation of our results.

ABSTRACT

The Air Traffic Control (ATC) productivity benefits attributed to the Corridor Integrated Weather System (CIWS) were assessed using real-time observations of CIWS product usage during three multi-day thunderstorm events in 2005 at eight U.S. Air Route Traffic Control Centers (ARTCCs). CIWS improved ATC productivity by:

- Reducing the time required to develop, coordinate, and implement weather impact mitigation plans
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Time savings per convective weather day for Traffic Management Coordinators (TMCs) in an ARTCC typically were 20–95 minutes.

The overall frequency of capacity-enhancing decisions increased by 177% relative to the CIWS benefits study conducted in 2003. The annual CIWS delay savings are in excess of 92,000 hours. Corresponding airline direct operations cost (DOC) savings exceed $94 M and passenger value of time (PVT) savings exceed $201 M. Annual jet fuel savings exceed 11 M gallons.

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EXECUTIVE SUMMARY

In an era of significant federal government budget austerity for civil aviation operations, it has become essential to improve Air Traffic Control (ATC) productivity. This report summarizes the results of an exploratory field measurement program conducted during summer 2005 to assess ATC productivity benefits of the Corridor Integrated Weather System (CIWS). Real-time observations of CIWS product usage during multi-day thunderstorm events were carried out at eight U.S. Air Route Traffic Control Centers (ARTCC). The real time observations data were used in conjunction with specific in-depth case study analyses to assess the CIWS productivity enhancements associated with convective weather impact mitigation plan development and implementation. Comparisons of ARTCC operations between facilities with and without access to CIWS were also made to further identify CIWS contributions to improved ATC productivity.

The results of this study show that productivity was enhanced in two ways: (1) less time to develop and implement operationally effective plans and (2) significant increases in the number of such plans implemented per convective weather day. This CIWS-derived increase in FAA operational efficiency resulted in significant delay and cost savings benefits to the National Airspace System (NAS) customers (e.g., airlines and passengers) [over 92,000 hours of delay saved per year with a monetary value of $90 M per year in airline direct operating cost (DOC) savings and $200 M per year in passenger value of time (PVT) savings].

Motivation for this Study

Improvements in ATC productivity are essential given the projected increases in air traffic anticipated in the next 10 years, coupled with an austere funding for NAS operations. The latest FAA aerospace growth forecast projects a 30% increase in ARTCC air carrier operations between 2004 and 2015 (FAA, 2005). An important component of this traffic growth that is not captured in the overall statistics is the growth in high altitude en route traffic due to the air carrier transition from turbo props to regional jets and the increased business aircraft use of jets.

Improved productivity in air traffic management during convective weather events is particularly important due to:

1. The current difficulties in managing convective weather impacts in highly congested airspace, as exemplified by the Great Lakes and Northeast NAS corridors and

2. Projections by the FAA that by 2014, with projected traffic growth of 27%, there could be 29 days of delays that exceed the worst single day of delay in 2004 (Hughes, 2006).

CIWS and other weather and traffic flow decision support tools aid in executing the operational weather impact mitigation decision loop shown in Figure ES-1. The challenge is that the process of determining ATC impacts, developing appropriate mitigation plans, and selecting from among them must be accomplished in a time period commensurate with the time variations in capacity impacts of convective weather.

This is particularly difficult to do in the congested Great Lakes and Northeast corridor airspace in which CIWS is deployed. Both within an ATC facility and between separate facilities, traffic management interactions associated with convective weather impacts in this region of the NAS need to be very extensive since actions taken within one facility can easily impact many other facilities (Figure ES-2). Hence, improving coordination through common situational awareness of the convective weather impacts among all affected users is very important in developing a robust traffic management plan.

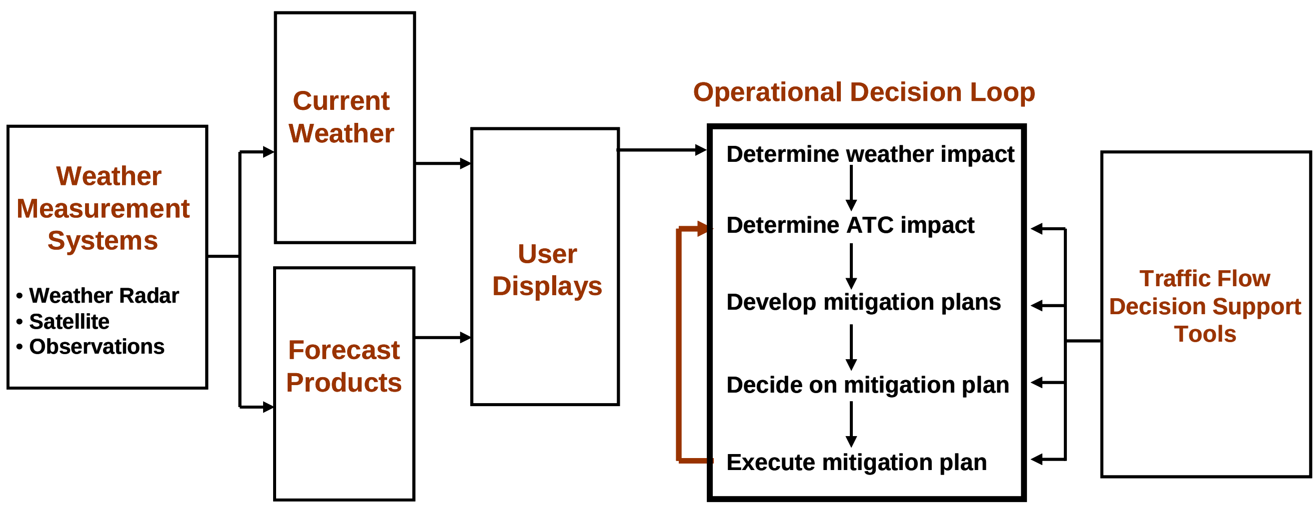

Figure ES-1. Overall convective weather impact mitigation process. The ATC (and airline) workload associated with convective weather management includes all 5 elements shown in the "operational decision loop."

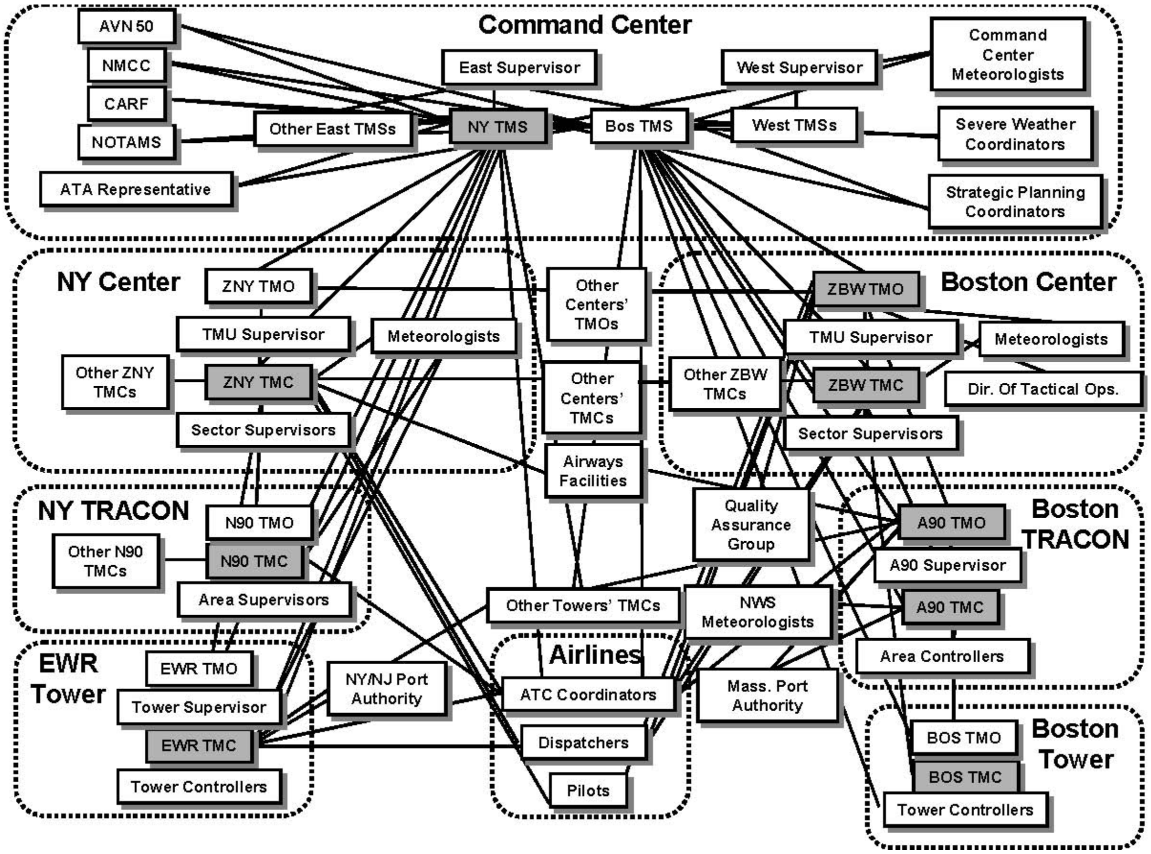

Figure ES-2. Complexity of NAS system coordination process associated with solving traffic flow management problems at just two facilities within the CIWS domain (ZNY and ZBW). Complexity grows significantly with each additional facility required for traffic management coordination [from Davison and Hansman, (2001)].

During convective weather impact events, MIT Lincoln Laboratory and FAA observers at select ARTCCs obtained feedback from traffic managers (and Area Supervisors) on:

1. Convective weather impact mitigation decisions made using CIWS products

2. The time to monitor existing convective weather impact mitigation initiatives

3. The time associated with the mitigation plan development and execution process in relation to expected workload for similar convective events prior to CIWS.

Additionally, observers sought to determine whether there were substantive differences in the frequency and operational effectiveness of convective weather impact mitigation plans developed with and without CIWS.

The FAA facility participants for the 2005 CIWS field-use assessment included the Boston (ZBW), Chicago (ZAU), Cleveland (ZOB), Minneapolis (ZMP), New York (ZNY), and Washington, D.C. (ZDC) ARTCCs. These facilities were selected because they all must make highly complex traffic management decisions, particularly during adverse weather. ZMP was a relatively new user of CIWS, whereas the other five ARTCCs had been CIWS users since 2001.

Observations were also conducted at two non-CIWS facilities [the Atlanta (ZTL) and Jacksonville (ZJX) ARTCCs] to obtain supplementary data. These data were used to confirm current CIWS users' estimate of the workload associated with weather impact mitigation planning had they not had access to CIWS.

Finally, observations were taken at ARTCCs both with and without CIWS displays at Area Supervisor positions. During the 2003 CIWS benefits study, it was found that ZDC made capacity enhancing decisions 50–100% more frequently per convective weather day than any of the other ARTCCs. A key difference between ZDC and the other ARTCCs in 2003 was that only ZDC had CIWS displays at Area Supervisor positions in addition to the Traffic Management Unit (TMU). It was hypothesized that greater effectiveness at ZDC in achieving delay reduction benefits may have arisen in part from more efficient ATC decision support capabilities, due to enhanced, common situational awareness between the TMU and Area Supervisors. This hypothesis was confirmed experimentally in this study.

Results of the Study

Real time observations of ATC decision making at ARTCCs with varying levels of access to CIWS (i.e., no CIWS, CIWS in TMU only, CIWS in TMU and some Areas, CIWS in TMU and all Areas) were conducted on 14 convective weather impact days in 2005. The principal results are as follows:

> ***CIWS reduced the time required by the TMU to develop, coordinate, and implement weather impact mitigation plans by <u>20–95 minutes</u> per thunderstorm day per ARTCC***

Total TMU time savings attributed to CIWS per convective weather day, demonstrating productivity enhancements for individual elements of the operational impact mitigation planning loop (see Figure ES-1), are shown in Figure ES-3. CIWS proved most beneficial to traffic managers when identifying and prioritizing thunderstorm impact concerns and developing high-quality impact mitigation plans. On average, for all ARTCCs studied, 70% of total time savings in the TMU attributed to CIWS was in the plan *development* stage of the operational weather impact decision loop.

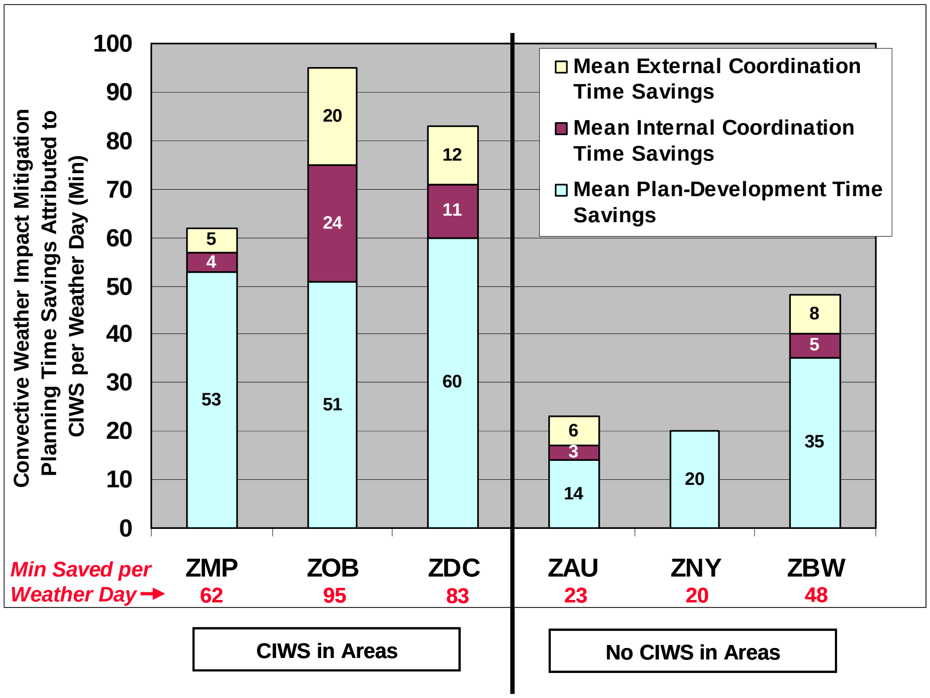

Figure ES-3. TMU time-savings attributed to CIWS at each ARTCC investigated in 2005. Productivity enhancements per convective weather day are segmented to demonstrate CIWS contributions to the specific legs of the operation decision loop for weather impact mitigation. ARTCCs with and without access to CIWS displays in the Areas are noted.

Availability of CIWS in ARTCC TMUs and sector Areas significantly increased ATC productivity and the frequency of realized operational effectiveness benefits

Time-saving results for TMU weather impact mitigation in Figure ES-3 demonstrate a significant relationship between enhanced TMU productivity and availability of CIWS displays in ARTCC Areas. Total time-savings by TMU traffic management coordinators (TMC) from the 3 ARTCCs with CIWS in both the TMU and the Areas was 164% greater than TMC time-savings from 3 ARTCCs with CIWS only in the TMU. ATC observations during weather impact events revealed that collaborative efforts between an ARTCC TMU and an Area involving traffic plan development, coordination, and monitoring required less time and effort when both parties had direct access to CIWS displays.

Analysis of specific weather impact events suggests that significant reductions in TMU workload at ZOB, ZDC, and ZMP (ARTCCs with CIWS in TMU and Areas) were achieved when Area Supervisors used CIWS to *avoid* the use of traffic management initiatives. These workload reductions derived from Area use of CIWS often extended to other ATC facilities.

The frequency of implemented en route capacity-enhancing decisions, another measure of ATC productivity, was also substantially higher at ARTCCs with CIWS displays in both the TMU and Areas.

Figure ES-4 shows that for the five most common CIWS en route capacity enhancement benefits, the frequency of these improved decisions at ARTCC with access to CIWS in both the TMU and the Areas was 140% greater than ARTCCs with CIWS only in the TMU.

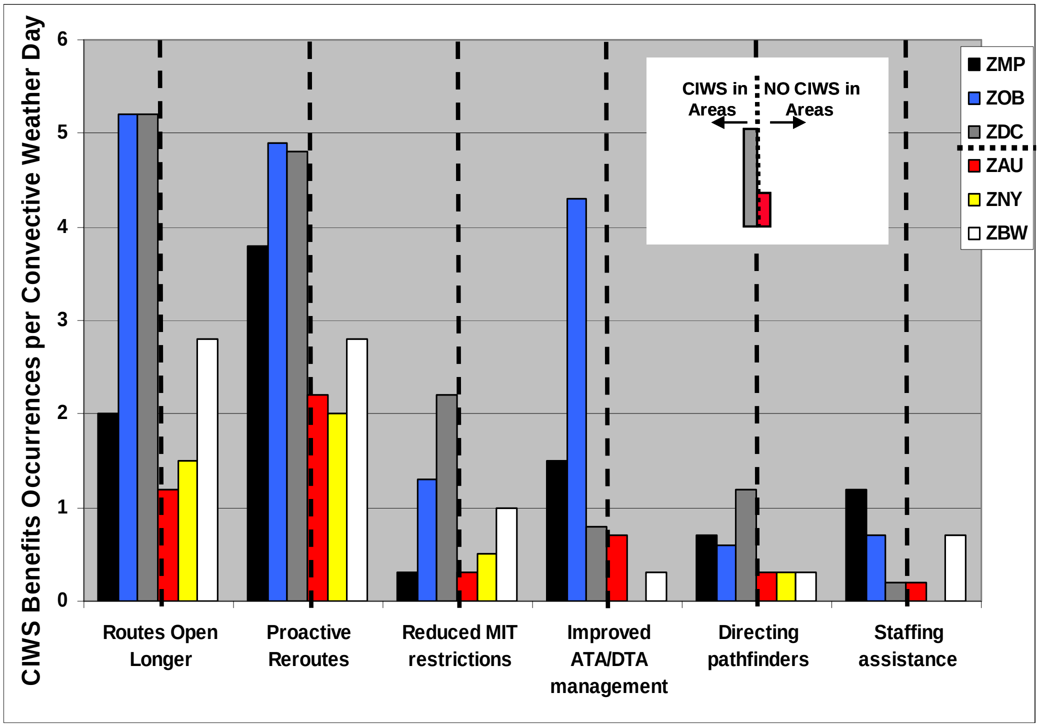

Figure ES-4. CIWS benefits per convective weather day at each ARTCC included in the 2005 CIWS field use assessment. Benefit categories shown here are typically considered key en route delay reduction benefits attributed to CIWS at ARTCCs. The benefit category, "FAA staffing assistance," is also included. ARTCC results are separated into two groups: those facilities with access to CIWS at Areas Supervisor positions and those without. ZMP was a new CIWS user in 2005, while ZBW had several very intensive users in the TMU.

Improvements in ARTCC-TRACON transition airspace management in ZOB demonstrates the importance of common situational awareness of high-quality tactical weather information provided by CIWS

The frequency of CIWS benefits occurrence (see Figure ES-4) show that the rate at which improved arrival/departure ARTCC-TRACON transition airspace (ATA/DTA) management decisions are made at ZOB was 180–1300% greater than any other ARTCC under study in 2005. A principal reason for this significant difference is that ZOB plan development, coordination, and execution decisions for improved ARTCC/TRACON transition airspace management were facilitated by providing access to CIWS at all of the primary FAA inter/intra-facility coordination points (Table ES-1). In particular, our observations of ZOB operations during weather impact events found that direct access to CIWS by the TRACON facility significantly improved ZOB productivity when managing traffic flows to/from TRACONs within the parent-ARTCC (e.g., Detroit TRACON within ZOB) while these flows are disrupted by thunderstorms.

TABLE ES-1
CIWS Availability Comparisons

CIWS available at:	ZOB	ZDC	ZMP	ZNY	ZAU	ZBW
ARTCC TMU	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
All TMU spacing positions	**YES**	**No**	**No**	**No**	**No**	**No**
ARTCC Areas	**YES**	**YES**	**YES**	**No**	**No**	**No**
Large TRACONs within parent-ARTCC	**YES**	**No**	**No**	**YES**	**YES**	**No**
All neighboring ARTCCs	**YES**	**No**	**No**	**YES**	**YES**	**YES**

Use of CIWS helped address FAA staffing issues during convective weather impact events

Field-use observations in 2005 identified a number of uses of CIWS weather products to assist in FAA staffing decisions, including:

- Justifying controller/TMC overtime based upon weather impacts forecasted by CIWS
- Adding "D-side" controllers to reduce radar controller workload based upon current or pending weather impacts as depicted by CIWS
- Optimizing Area controller break schedules based upon CIWS weather information
- Managing ATC staffing in super-high sectors based upon CIWS Echo Tops and Echo Tops Forecast products
- Determining Area/TMC staffing levels needed for diversion recovery programs
- Avoiding controller/TMU overtime (staffing levels acceptable, despite convective weather impacts, based upon CIWS weather depictions and forecasts).

Staffing decisions made by Area Supervisors using CIWS to add or extend overtime for controllers at first glance appears counter to FAA goals to reduce operating costs. However, from an air traffic management perspective, these staffing decisions, which decrease individual controller workload and thus maintain or increase sector capacity, allow ARTCCs to proactively address convective weather impact concerns. The potential end result of this proactive staffing approach in the Areas, based upon CIWS, was often reduced air traffic delays and reduced duration of late evening impacts, when controller staffing is extremely limited and costs for off-peak ATC overtime (needed to handle ongoing peak traffic demand) would be significantly greater.

The estimated frequency of annual CIWS operational effectiveness benefits increased significantly when based on the 2005 field-use observations

The frequency of higher-quality ATC decisions derived from CIWS, resulting in greater airspace capacity and more efficient routing strategies during convective weather, increased 177% from 2003 to 2005. A comparison of the estimated annual frequency of beneficial CIWS decisions is shown in Figure ES-5. These estimates are based on observations in 2003 and 2005 at ARTCCs with access to CIWS in both years and the 20+ year thunderstorm climatology for the various ARTCCs. Annual occurrences of the two primary CIWS en route capacity enhancement benefit categories, "More Proactive Reroutes" and "Keeping Routes Open Longer," to which substantial delay/cost savings were attributed in the 2003–2004 CIWS field-use study, increased 142% from 2003 to 2005. The increased frequency in all operational effectiveness benefits is likely due to a combination of (a) CIWS product enhancements such as the introduction of the 0–2 hour Echo Tops, (b) increased confidence by ATC users in the CIWS products, and (c) increased availability of CIWS displays at ARTCC Area Supervisor positions. With continuing increases in air traffic demand, particularly in high altitude en route airspace, it is encouraging that the number of times CIWS is used per thunderstorm to make capacity enhancing decisions has also increased.

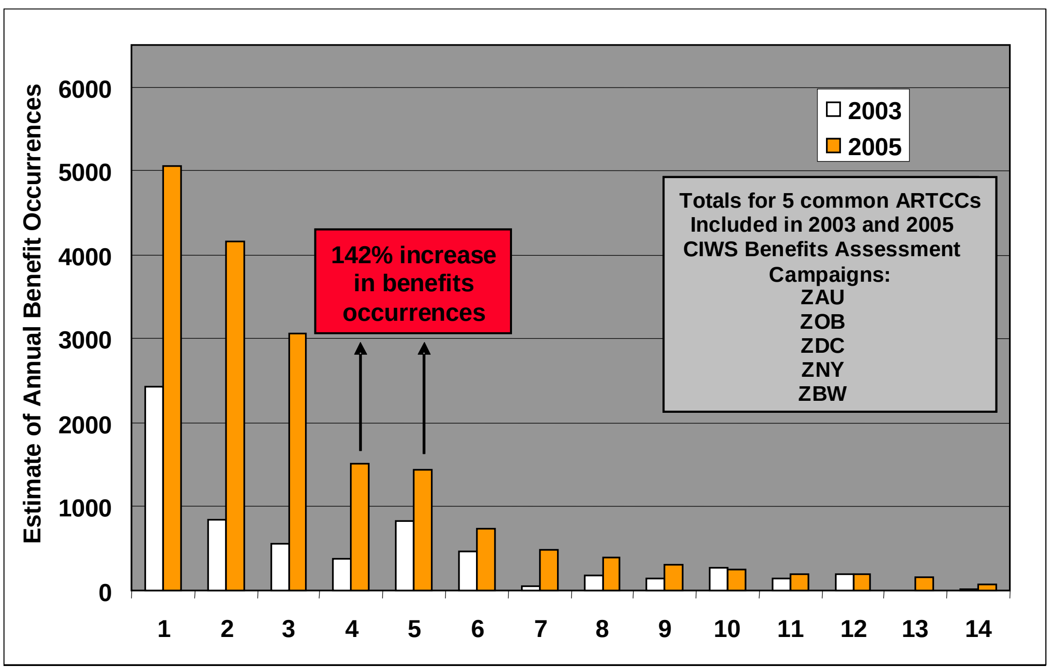

Figure ES-5. Estimate of annual occurrences of CIWS benefits realized at 5 ARTCCs in 2003 vs. 2005. Two specific en route benefit categories, "Proactive Reroutes" and "Keeping Established Routes Open Longer/Reopening Closed Routes Earlier," are highlighted to indicate the increased user frequency for realizing these significant delay and workload saving applications.

Estimated annual CIWS delay reduction benefits increased substantially from 2003 to 2005

The results in Figure ES-5 were converted to estimates of the annual CIWS delay reduction in hours and airline cost savings by using the 2003 case benefits analyses together with the 2005 fuel costs and ARTCC thunderstorm climatology records. The annual hours of delay saved and total cost savings in 2005 attributed to CIWS usage in "keeping jet routes open longer" and "proactively and more efficiently rerouting traffic" exceeded **92,000 hours and $295 M**; increases of 121% (hours saved) and 126% (costs saved) compared to the estimates based on 2003 benefits frequency data. Since the same methodology was used for converting annual CIWS benefits frequencies to delay/cost savings as in the 2003 CIWS study, the significant increase in CIWS delay reduction benefits in 2005 are attributed solely to the combination of increased benefits frequencies per ARTCC (see Figure ES-5) and increased fuel costs. The annual CIWS delay savings results based on the 2005 benefits frequency data are considered conservative for several reasons, including the fact that the annual ZMP benefits (21% of the total beneficial decisions observed in the six ARTCCs with access to CIWS visited in 2005) and the ZKC benefits were not considered in the annual delay reduction benefits calculations.

The projected annual CIWS delay reduction benefits are greatest at ZOB, where benefits increased 250% from 2003 (Figure ES-6). This increase is not surprising given that, of the five ARTCCs under study in 2003 and 2005, ZOB is the only facility where access to CIWS at Area Supervisor positions was added after 2003.

Annual jet fuel cost and consumption savings for commercial airlines attributed to CIWS usage at six ARTCCs in 2005 exceeded $18.6 M and 11.4 M gallons. The 2005 jet fuel consumption savings increased 136% since 2003, an increase directly related to improved ATC proficiency in implementing higher-quality, capacity-enhancing convective weather impact mitigation plans. The 2005 jet fuel cost savings attributed to CIWS increased 355% since 2003, due to a combination of the increased rate of achieved capacity-enhancement benefits by ATC and the 94% increase in jet fuel cost from 2003 to 2005. Given forecasts for fuel prices to remain high through at least 2007, these jet fuel savings derived from CIWS are a significant benefit to airlines and passengers, and also support national efforts to reduce oil consumption.

Field observations at ARTCCs without access to CIWS suggest access to this tool would improve the quality of some weather impact mitigation plans

Traffic management decisions at the Atlanta ARTCC (ZTL), made using convective weather decision support tools other than CIWS, often occurred just as quickly as the CIWS-based decisions made in an adjacent CIWS facility (ZDC) and the weather impact mitigation plans generally yielded good results. However, post-analysis identification of opportunities to utilize available capacity and/or decrease airspace complexity (and thus ATC workload) that were missed suggests that CIWS could have improved the quality of weather planning decisions at ZTL.

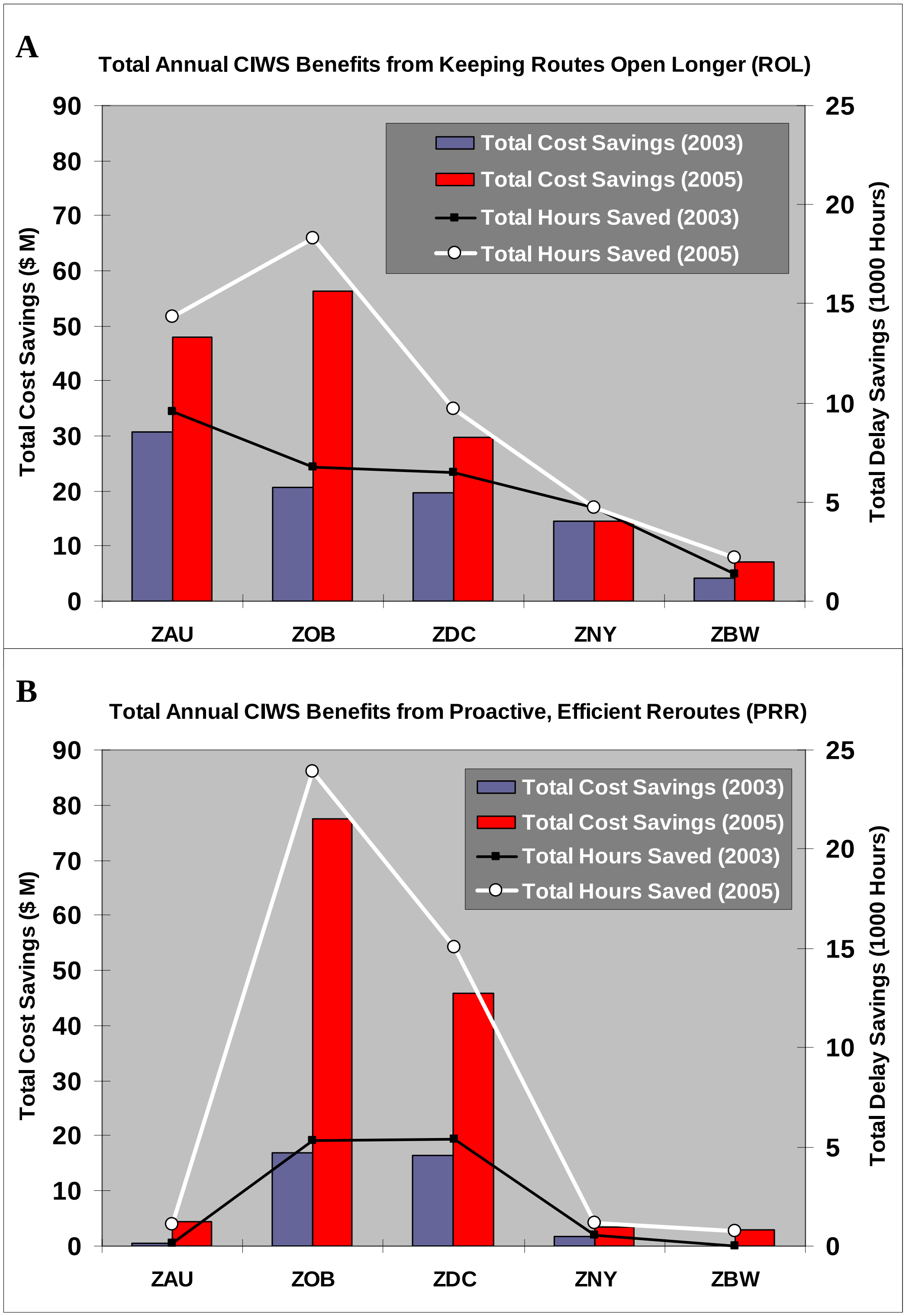

Figure ES-6. Total annual CIWS delay reduction benefits by ARTCC, in terms of operating and passenger cost savings (bars) and hours of delay saved (lines), from (A) keeping routes open longer (ROL) and (B) more proactive, efficient reroutes (PRR).

Based on the 2005 ZTL observations, we projected that the primary benefits of CIWS in ZTL would be:

1. Improved operational efficiency of ARTCC-TRACON transition airspace management, including improved tactical reroute efficiency
2. Improved use of departure restrictions
3. Improved efficiency in managing holding stacks
4. Improved Ground Stop and Ground Delay Program efficiency.

Next Steps for CIWS Productivity Enhancement and Delay Reduction Benefits Studies

Several analysis tasks are planned to extend the 2005 CIWS benefits results presented in this report, including:

- Use of sector/route capacity assessment models to quantify improvements in effective sector capacity attributed to CIWS-derived convective weather impact mitigation plan enhancements
- Detailed analyses of weather and aircraft flight track data in ARTCCs with and without access to CIWS in order to independently confirm that the use of CIWS results in fewer missed opportunities for mitigating the adverse impacts of convective weather.

More work is also required to reduce the uncertainty associated with overall CIWS delay reduction benefits. The limited sample size for quantifying CIWS delay savings, upon which projected annual delay/cost savings are based, is recognized by the authors as a significant caveat to CIWS benefits results to date. The effects of the limited sample size are as follows: The CIWS delay reduction benefits associated with a given decision are modeled as random variables drawn from a statistical ensemble whose probability distribution has slowly decreasing tails. Since there were typically two or three events analyzed per ARTCC, the statistical variance associated with the mean or median benefits is undoubtedly high and has not been quantified. A two-phase approach is recommended to address this CIWS delay reduction statistical uncertainty issue:

1. Analyze additional (e.g., 3–5) cases for quantified beneficial decisions in both ZDC and ZOB, since those two ARTCCs account for the bulk of the overall CIWS delay reduction benefits. These cases should be drawn from the 2005 observed events (especially for ZOB) to see if there is any substantive difference between the TMU-only beneficial decisions versus TMU-Area Supervisor collaborative beneficial decisions.
2. Develop automated tools that could reduce the time to carry out individual case analyses. These tools should include the use of algorithms to accomplish near optimal traffic flow management with time varying en route and terminal capacities. The development and validation of such tools is a non trivial, but important, undertaking.

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1. INTRODUCTION

In the era of significant federal government budget austerity for civil aviation operations, the Federal Aviation Administration (FAA) has established improving Air Traffic Control (ATC) productivity as one of its principal goals. Both the FAA Flight Plan 2005-2008 (FAA, 2004) and the FAA Air Traffic Organization Fiscal Year 2005 Business Plan (FAA, 2005) discuss the need to provide FAA services more efficiently, such that operations costs can be reduced while improving safety and capacity.

Previous benefits assessments of the Corridor Integrated Weather System (CIWS) have focused on quantifying operational benefits to the FAA's "customers" (the airlines) and the "owners" (e.g., passengers) in terms of aviation delay reduction (Robinson et al. 2004). Figure 1-1 shows the results of the 2003 CIWS delay reduction studies (Robinson et al. 2004). Note that three of the five most frequently observed benefits (improved situational awareness, interfacility coordination, and reduced user workload) are related to increased ATC operational productivity. However, CIWS ATC productivity benefits were not quantitatively assessed in the 2003 benefits assessment campaign.

A quantitative study of the CIWS contributions to ATC productivity enhancements was conducted in 2005. As part of this effort, real-time observations of CIWS product usage and the time to accomplish weather impact mitigation planning decisions during multi-day thunderstorm events were carried out at 8 U.S. Air Route Traffic Control Centers (ARTCCs).

Two elements of ATC productivity improvements were analyzed:

1. Reduced workload and increased operational efficiency, as characterized by the amount of time required to develop and implement convective weather mitigation plans and the enhanced support for weather-related staffing decisions

2. Increased frequency of capacity-enhancing decisions

A description of the design (and methodological challenges) for the 2005 exploratory field campaign are presented in Section 2 of this report. Results demonstrating how CIWS helped traffic managers improve workload management and increase operational efficiency are presented in Section 3. Important factors such as the variation in performance from ARTCC to ARTCC are discussed. Specifically, it is shown that a very important factor in the productivity of an ARTCC is whether the Area Supervisors at the ARTCC have direct access to CIWS products.

In Section 4, observations of weather impact mitigation planning at an ARTCC without access to CIWS (Atlanta: ZTL) are discussed and analyzed in the context of ATC productivity enhancement findings at ARTCCs with access to CIWS.

In Section 5, annual delay reduction and airline operating and passenger cost saving benefits based upon the 2005 rates of observed CIWS-derived capacity-enhancing decisions per thunderstorm day are compared with similar results from 2003. Annual airline jet fuel cost and consumption savings attributed to CIWS usage in 2005 are also calculated and compared with similar results from 2003. The final section of this report summarizes results and discusses future plans for CIWS ATC productivity enhancement investigations.

The motivation for this study is discussed in the remainder of this Section.

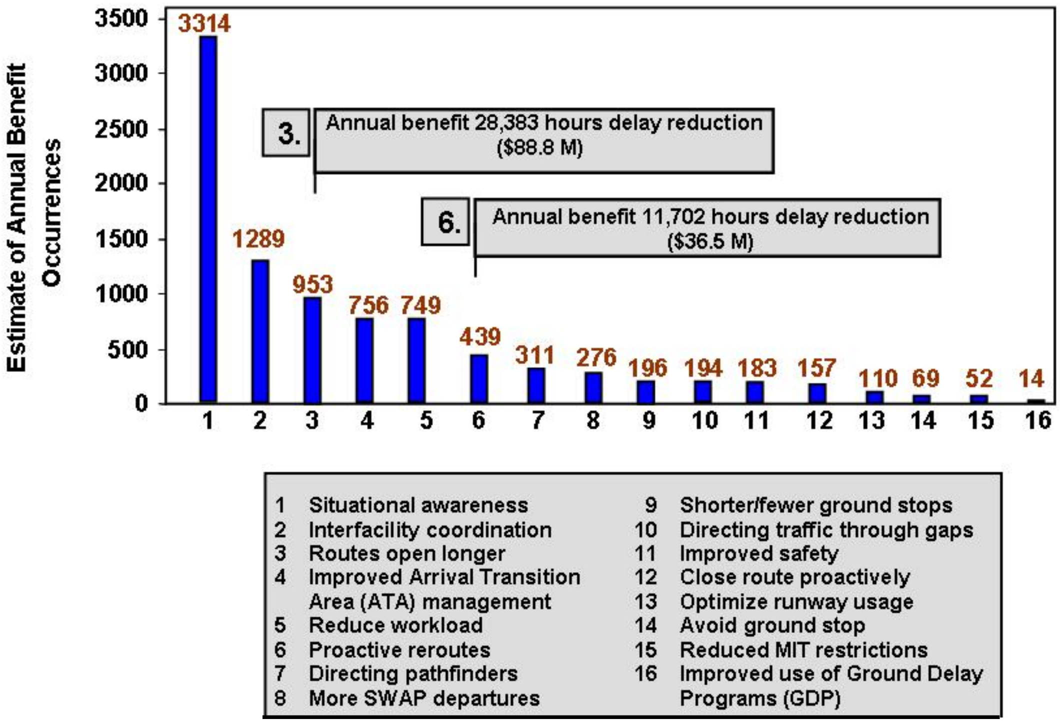

Figure 1-1. Summary of CIWS annual operational benefits identified in 2003 real-time ATC facilities observations from (Robinson et al. 2004). The delay reduction associated with benefits categories 3 and 6 were quantified in 2003-04. Benefit categories 1, 2, and 5 contain usage observation results from ARTCCs and the Air Traffic Control System Command Center (ATCSCC). These specific benefits could not be easily separated by facility and may in fact have been more important at ATCSCC than elsewhere in terms of enacting efficient delay mitigation schemes. Benefits 4, 8, 9, 13, and 16 would be shared (to varying degrees) with the Integrated Terminal Weather System (ITWS). The ATC productivity enhancements associated with benefit categories 1, 2 and 5 have been quantified in the 2005 assessment study described in this report.

MOTIVATION FOR THIS STUDY

In view of the projected increases in traffic anticipated in the next ten years, and a very austere FAA funding situation, improvements in ATC productivity are essential. For example, the country's commercial air traffic industry, including both large carriers and regional and commuter carriers, transported 641.4 million passengers in 2003. According to the FAA's aerospace forecast for fiscal 2004 through 2015 (issued March 2005), it is estimated that this number will grow to nearly 1.1 billion passengers annually by 2015. The latest FAA aerospace growth forecast (FAA Office of Aviation Policy and Plans, 2005) projects a 25% increase in Instrument Flight Rules (IFR) operations and a 30% increase in ARTCC air carrier operations by 2015. An important component of this traffic growth that is not captured in the overall statistics is the growth in high altitude traffic within the ARTCCs due to the transition to regional jets plus the increased business aircraft use of jets[1].

Improved productivity in air traffic management during convective weather events is particularly important due to:

1. The delays associated with the convective weather season (Figure 1-2)

2. The difficulty in managing convective weather impacts in highly congested airspace, such as is present within the current CIWS domain (Figure 1-3)

3. The concerns of the FAA Air Traffic Organization (ATO) Strategy Office that there will be significant escalations in delays due to convective weather in the coming years as a result of increased air traffic demand[2]

In Figure 1-3, it is apparent that the bulk of the aircraft are flying along well described routes. In the area to the west of the New York and Philadelphia airports, the traffic is constrained to closely spaced, parallel routes in order to effectively manage the transition of traffic from en route airspace to a number of major airports that are in close proximity (DeArmon et al. 2000). One of the important characteristics of the highly congested airspace inside the CIWS coverage contour (shown in Figure 1-3) is that there is often little or no excess capacity available when severe weather occurs. For example, rerouting aircraft around areas of actual or predicted weather can be very difficult when one must be concerned about controller overload in the weather-free sectors. To illustrate, when convective weather occurs in Ohio, traffic from the western portion of the U.S. to the New York, Boston and Philadelphia airports may need to be rerouted into Canada (north of Toronto) and/or via Georgia (MITRE CAASD, 2001). When major terminals are also within the affected en route airspace boundaries, convective weather has even greater impacts, particularly if this adverse weather occurs frequently.

The current principal users of the CIWS prototype are Traffic Management Units (TMU) at ARTCCs in the heavily-congested and workload-intensive Midwest and Northeast Corridors of the National Airspace System (NAS). During thunderstorm impacts, TMU Traffic Management Coordinators (TMC) use CIWS and other weather and traffic flow decision support tools to execute the operational weather impact mitigation decision loop shown in Figure 1-4. The problem in executing this decision loop is that the

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[1] FAA analyses show that high and super high altitude traffic increased by 20% in many of the ARTCCs between 2000 and 2005 (Knorr, 2006).

[2] FAA projections suggest that by 2014, with a 27% increase in air traffic demand, there could be 29 days of delays that exceed the worst single day of delay in 2004 (Hughes, 2006).

process of determining ATC impacts, developing appropriate mitigation plans, and selecting from among them must be accomplished in a time period commensurate with the ability to accurately forecast the weather impact.

This is particularly difficult to do in the congested airspace in which CIWS is deployed because convection in this region is often chaotic and disorganized (Figure 1-5) and thus difficult to predict in advance. Moreover, convective weather in this region of the NAS causes a significant coordination workload, both within an ATC facility and between facilities, due to the highly complex nature of the traffic flows in this region and the likelihood of delay ripple effects from one ARTCC to another. Hence, common situational awareness of the convective weather impacts within both the user's facility and other adjacent facilities is very important in developing a robust traffic management plan.

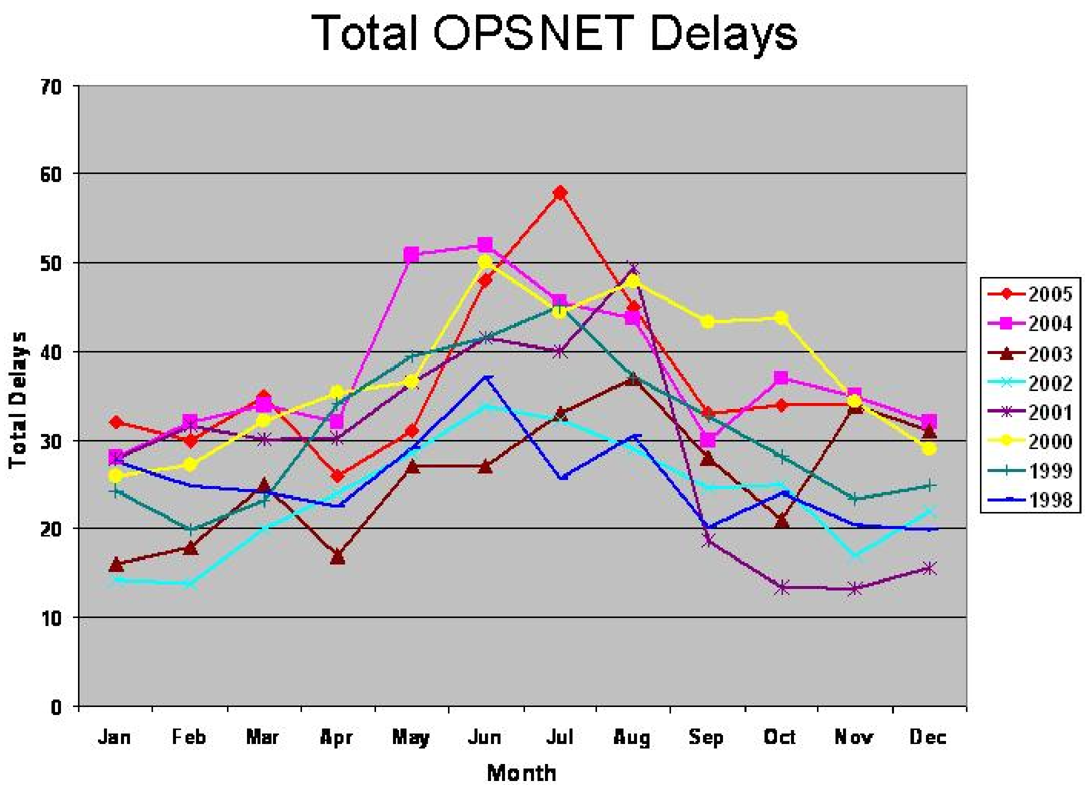

Figure 1-2 U.S. OPSNET delays by month for an eight-year period. OPSNET delays are delays of 15 minutes or more that are reported by the FAA's Air Traffic Operations Network. These delays are attributable to single FAA facilities, which assign causality to the event. Typically, approximately 70% of the OPSNET delays are attributed to weather (e.g., wind, rain, snow/ice, low cloud ceilings, low visibility, hurricanes or thunderstorms). Note that the delay is greatest during the summer months when thunderstorms are most frequent and that the summer increase in delays was greatest in the higher traffic years (2000, 2001 before 9/11, 2004 and 2005).

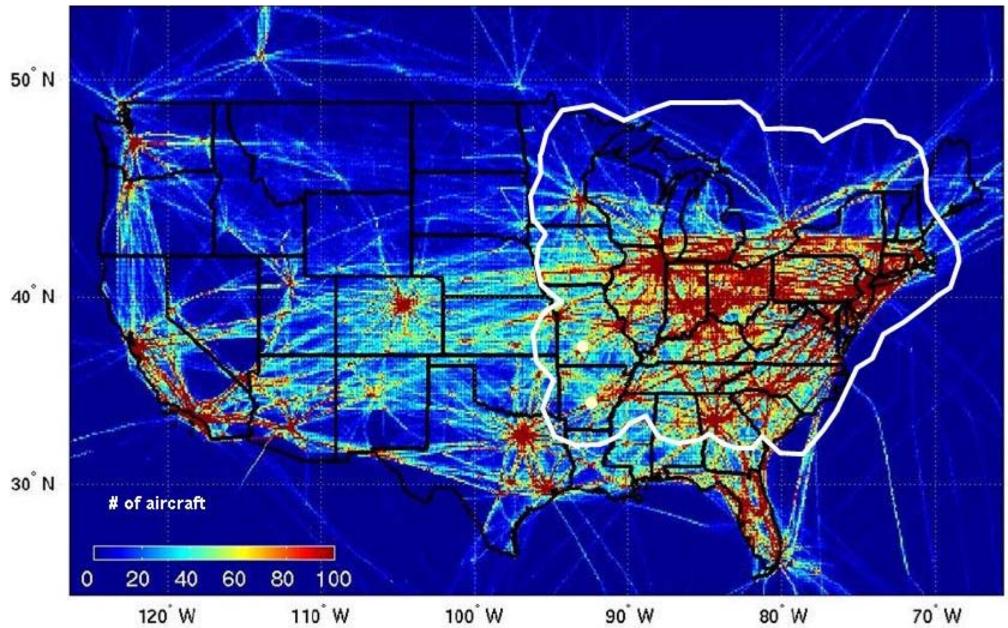

Figure 1-3. Density of traffic in the U.S. over a 24 hour period starting at 1000 UTC on 12 September 2002, with an overlay of the 2005 CIWS spatial coverage. Note that aircraft are concentrated on particular routes as opposed to being randomly distributed in space.

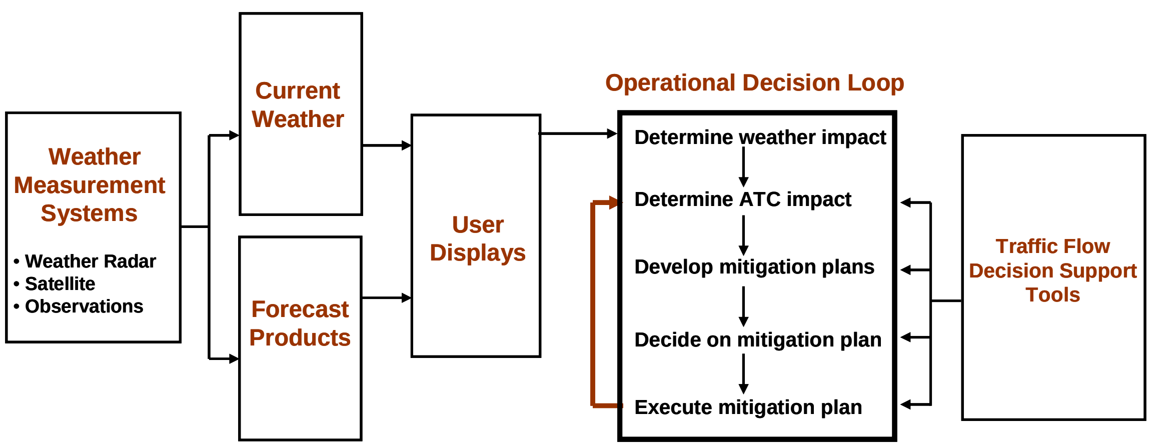

Figure 1-4. Overall convective weather impact mitigation process. The ATC (and airline) workload associated with convective weather management includes all five elements shown in the "operational decision loop."

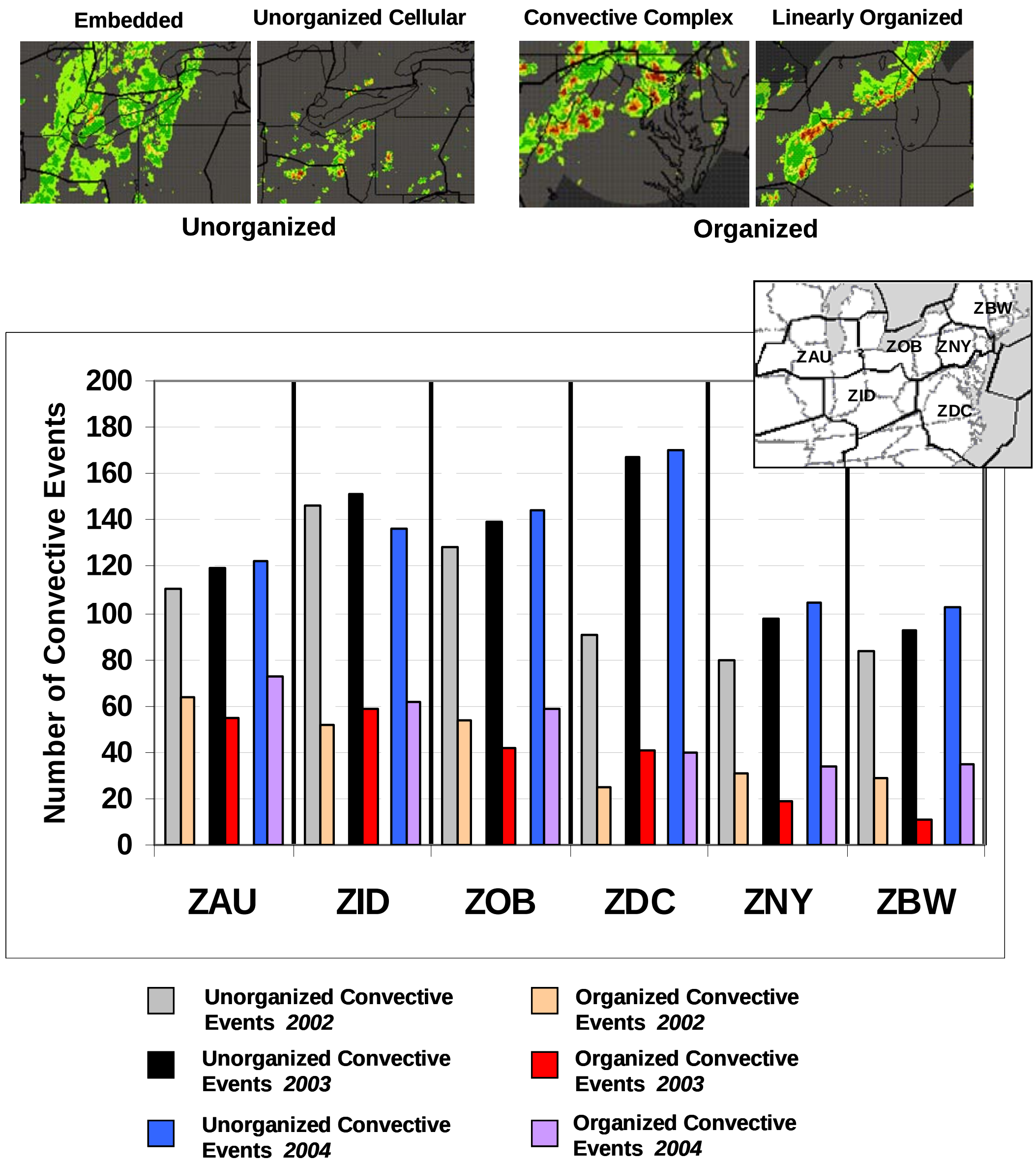

Figure. 1-5. Frequency of various types of convective weather observed in the CIWS domain in 2002–2004. The spatial patterns of unorganized events changes fairly rapidly with time and are difficult to forecast two or more hours in advance. Hence, weather impact mitigation plans must be continually adjusted during such convective events since the capacity impacts are continually changing. The various ARTCCs in this domain typically experience convective weather impacts 40–75 % of the days during May–August.

2. METHODOLOGY

Several challenges were encountered in quantifying the CIWS ATC productivity enhancements:

First, there seems to be no generally accepted methodology for assessing productivity of TMU personnel for accomplishing the class of air traffic management problems typified by convective weather impacts on the NAS.

Second, based on the experience in analyzing the various CIWS benefits cases from the 2003 observations, and more general combinatorial arguments on the likelihood of finding identical convective weather impacts within an ARTCC for different weather events (Appendix A), the details associated with convective weather impact situations will in general be relatively unique both for an individual facility and between various facilities. Thus, comparing air traffic management outcomes between different time periods and/or different ATC facilities when convective weather occurs is much more difficult than is the case with fair weather air traffic management systems.

Third, the lack of facility observations prior to the CIWS installation in 2001 presented an additional challenge in quantifying the "pre-CIWS" baseline productivity. It was not practically feasible to simulate the decision making environment within the CIWS domain, nor was it be feasible to turn CIWS off during the summer months of 2005, since (a) CIWS is now the preferred "tactical" weather product for severe weather planning for 0-2 hours by the ARTCCs and the Air Traffic Control System Command Center (ATCSCC) and (b) the magnitude of NAS convective weather delays in 2004 was high.

The manner in which these and other methodological challenges associated with the CIWS ATC productivity enhancement assessment have been addressed is discussed in the following subsections.

2.1 ASSESSING TRAFFIC FLOW MANAGEMENT PRODUCTIVITY

We have not been able to find any published literature on TMU workload that specifically addresses the bulk of the operational decision loop elements shown in Figure 1-4. The study that was most helpful in guiding our CIWS productivity enhancement investigations was the Master's Thesis of Haley Davison of M.I.T. (Davison and Hansman, 2001). Through a series of site visits to the Boston (ZBW) and New York (ZNY) ARTCCs, as well as the Air Traffic Control System Command Center (ATCSCC), Davison and Hansman noted that the TMC was a critical decision maker for achieving efficient airspace management, particularly during periods disrupted by weather.

General TMC tasks that were identified by Davison and Hansman include:

- Controlling airspace availability and traffic rates into and out of a facility
- Monitoring operations within a facility to ensure appropriate controller workloads
- Communicating and negotiating with other facilities' TMCs to coordinate appropriate traffic management initiatives
- Communicating initiatives and restrictions to tactical controllers in a timely manner

Additional details for a number of these tasks are provided in Appendix B (e.g., communications per day and the number of other ATC personnel that a TMC would interact with in the course of a day).

It is known that the functions accomplished by TMCs (and partially by the en route Area Supervisors) when attempting to mitigate the impacts of severe convective weather include:

- Monitoring of the current and forecasted impacts of convective weather on the traffic flow management plans that are currently in place, to determine if modifications to the existing plans and/or new mitigation plans need to be created[3]

- Conceptualizing appropriate approaches to handle the problems that have been identified

- Intra- and inter-facility communication[4] and coordination associated with the development of new plans and/or modifications

An example of the TMC coordination tasks for just two ARTCCs is shown in Figure 2-1 (from Davison and Hansman, 2001). Completion of critical ATC tasks listed above, in such a complex coordination environment for traffic plan development and implementation, requires much more effort during convective weather. However, there are no generally accepted workload models for these functions. The time to accomplish the tasks above clearly is an important factor since many decisions are required during rapidly changing convective weather. However, one must also be concerned with the quality of the decision. A conceptual model for the tradeoff between decision quality and decision time at various levels of productivity is presented in Figure 2-2.

Hence, in this study, ATC productivity is quantified in terms of both the time required to make decisions and the quality of those decisions, as measured by the number of effective traffic flow management decisions made by various facilities on a convective weather impact day.

[3] This monitoring function corresponds to the "situational awareness" CIWS benefits category in Figure 1-1.

[4] This inter-facility coordination function corresponds to the "Interfacility coordination" CIWS benefits category in Figure 1-1.

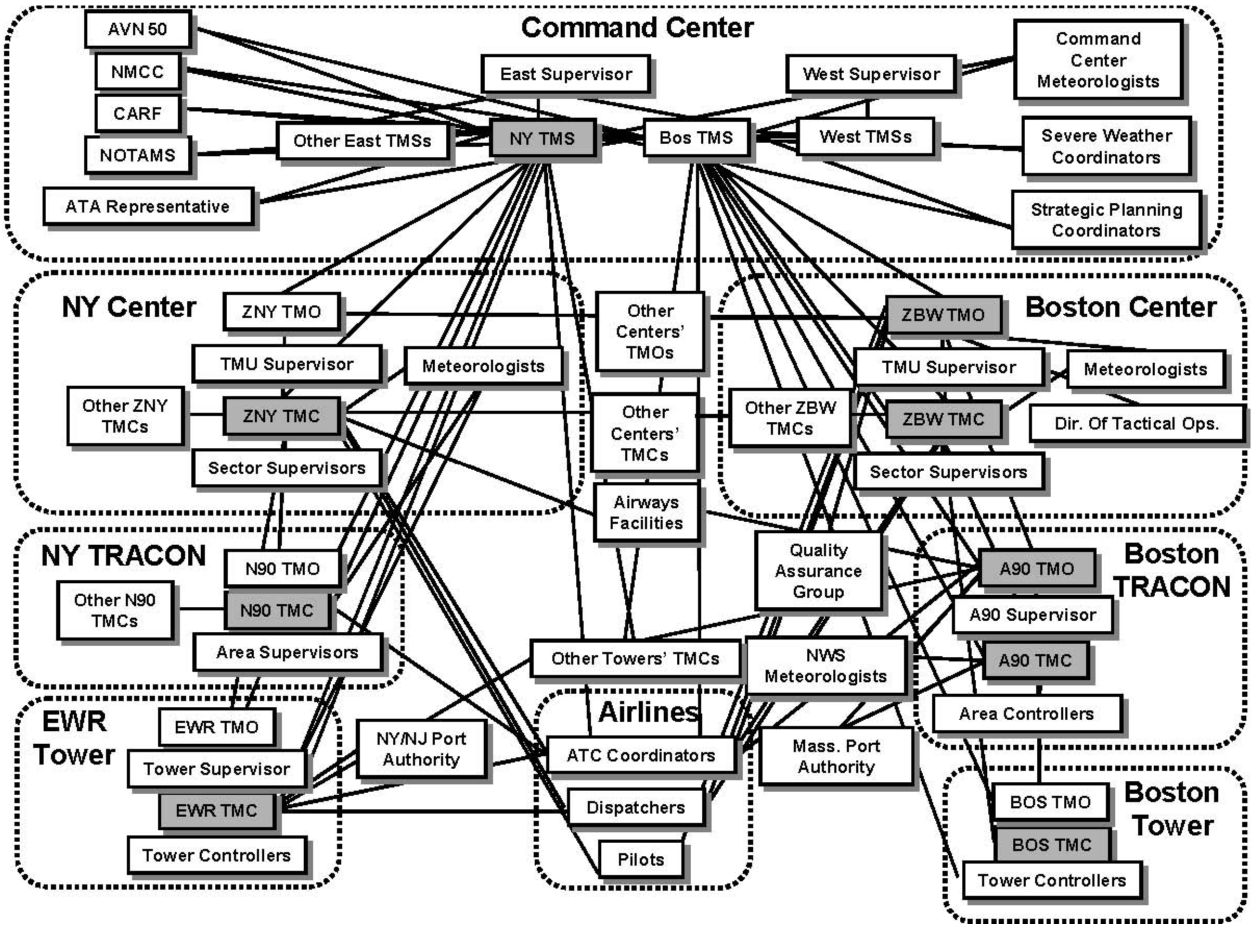

Figure 2-1. Complexity of NAS system coordination process associated with solving traffic flow management problems at just two facilities within the CIWS domain (ZNY and ZBW). Complexity grows significantly with each additional facility required for traffic management coordination [from Davison and Hansman, (2001)].

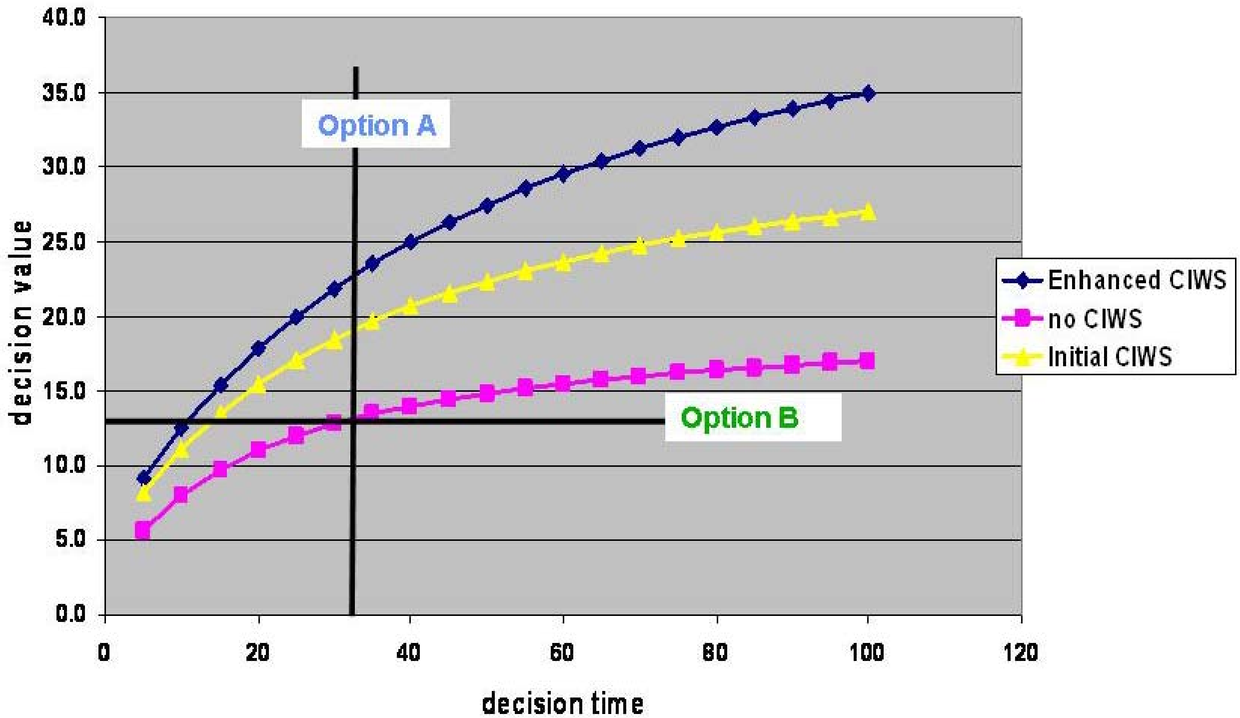

Figure 2-2. Conceptual framework for the tradeoff between traffic flow management decision time and decision quality (as measured by a positive impact on system operations) with different levels of productivity. Note that improved productivity can reduce the time to reach a decision while keeping the quality of the decision fixed or keep the time to make a decision constant while making a better decision. Many combinations of shorter decision time and greater decision value are clearly possible if one increases productivity.

2.2 FAA FACILITY OBSERVATION STRATEGY FOR ASSESSING CIWS PRODUCTIVITY ENHANCEMENT BENEFITS

The CIWS operational benefits studies conducted in 2003 broke new ground in terms of methodology employed to assess convective weather delay reduction benefits (Robinson et al. 2004). The 2003 data collection design used knowledgeable observers at a number of FAA facilities during convective weather events to identify operational CIWS uses. Annual delay and airline cost savings benefits, estimated also per case study, per traffic management benefit category, and per facility, were explicitly identified by using the following data gathered during convective weather events:

- Observations of traffic managers using CIWS displays
- Statements by users describing ATC decisions made using CIWS products
- TMC expert feedback on alternative decisions for specific situations had CIWS not been available

This benefits assessment approach was adopted as the design basis for the CIWS 2005 productivity-enhancement assessment study. In conducting this experiment, the importance of measuring CIWS-related ATC productivity enhancements against a non-CIWS baseline can not be overlooked. Both the choice of facility and observation strategy within a facility reflected this concern.

2.2.1 Tasks of CIWS field use observers

During convective weather impact events, observers at select ARTCCs obtained feedback from traffic managers (and Area Supervisors) on:

1. Convective weather impact mitigation decisions made using CIWS products

2. The workload associated with monitoring existing convective weather impact mitigation initiatives

3. The workload associated with the mitigation plan development and execution process in relationship to the expected workload for similar convective events prior to CIWS availability

Additionally, observers sought to determine whether substantive differences existed in the operational effectiveness of convective weather impact mitigation plans developed with and without CIWS. Results (see Section 3) suggest that, in assessing ATC productivity, the quality of the convective weather impact mitigation decisions facilitated by CIWS can be even more important for achieving ATC productivity enhancements than the use of CIWS to decrease the time required for traffic managers to develop a worthwhile plan.

2.2.2 FAA facilities included in 2005 CIWS assessment

FAA ARTCCs selected for in situ CIWS usage observations in 2005 satisfied one or more of the following criteria:

1. ARTCC exhibited a high frequency of 2003 CIWS delay reduction benefits and/or requires highly complex TMU decisions with significant impact on the NAS

2. ARTCC was a "new CIWS user"

3. Facility inclusion would help achieve a mix of facilities with and without access to CIWS displays at Area Supervisor positions

4. ARTCC had no access to CIWS

The facility participants for the 2005 CIWS field-use assessment are shown in Figure 2-3. Chicago (ZAU), Cleveland (ZOB), New York (ZNY), Washington, D.C. (ZDC), and Boston (ZBW) ARTCCs satisfied the first criterion for inclusion in this study. The authors felt it was important to include at least one ATC facility which has had CIWS for a relatively short time period, since those ATC users would have much more recent experience at mitigating weather impacts without CIWS. The Minneapolis ARTCC (ZMP) was considered a new CIWS user (criterion 2), since 2005 was its first full Severe Weather Avoidance Plan (SWAP) season with access to this convective weather decision support tool.

Significant care was taken to ensure observations were taken at ARTCCs both with and without CIWS displays at Area Supervisor positions (criterion 3). During the 2003 CIWS benefits study, it was found that ZDC achieved the major delay reduction benefits 50-100% more frequently per convective weather day than any of the other ARTCCs (Robinson et al. 2004, Table 7-3). A key difference between ZDC and the other ARTCCs in 2003 was that only ZDC had CIWS displays at Area Supervisor positions in addition to the TMU. It was hypothesized that greater effectiveness at ZDC in achieving delay reduction benefits may be due in part to more efficient ATC decision support capabilities, resulting from enhanced, common situational awareness between the TMCs and Area Supervisors. However, it was not possible to rule out the possibility that the differences were due to some other factor specific to ZDC (e.g., a greater willingness of the TMCs to use the CIWS products).

Given the coordination efforts associated with TMC weather impact mitigation plan development and execution (see Figure 2-1) it was hypothesized that use of CIWS in the Areas would not only benefit sector supervisors and tactical controllers, but also help reduce TMU workload during significant convective events. The following facility observation scheme used in 2005 allowed us to explicitly explore this hypothesis:

- ZDC: CIWS available in TMU and all Area Supervisor positions
- ZOB: CIWS available in TMU and 4 of 8 Area Supervisor positions
- ZMP: CIWS available in TMU and 5 of 6 Area Supervisor positions
- ZAU, ZNY, ZBW: CIWS available in TMU only

Observations were conducted in the TMU in all cases and in the sector Areas at facilities where CIWS was available to Area Supervisors.

Finally, observations were conducted at two non-CIWS facilities [Atlanta (ZTL) and Jacksonville (ZJX) ARTCCs] to obtain supplementary data for the study (criterion 4). These data were used to confirm estimates of the workload associated with weather impact mitigation planning made by the CIWS users assuming the absence of the CIWS decision support tool. These “non-CIWS” observations represent baseline measurements of ATC productivity against which CIWS productivity enhancement results are compared.

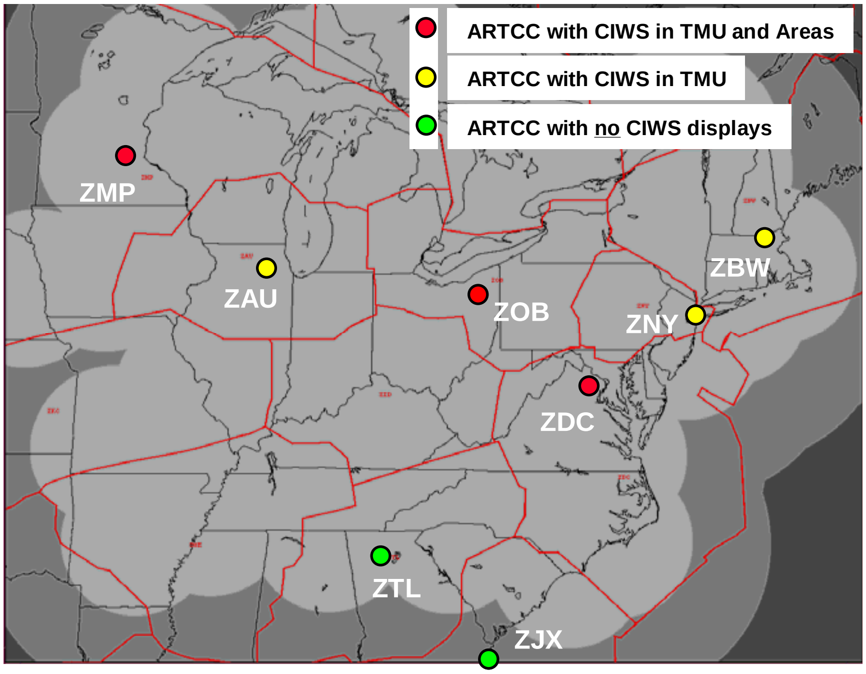

Figure 2-3. FAA ARTCC facility participants for the 2005 CIWS Benefits Assessment Campaign. ARTCCs in red had CIWS displays in both the TMU and Area Supervisor positions (though CIWS access at all Areas was available only at ZDC). ARTCCs in yellow had CIWS displays only in the TMU. ARTCCs in green had no access to CIWS displays.

2.3 IN SITU OBSERVATION CHALLENGES

During SWAP events, ARTCC TMCs and Area Supervisors are extremely busy. Observers sought to document not only each time the CIWS decision support tool was applied for traffic management assistance, but also to directly query the user in order to capture (a) the effect of weather on air traffic, (b) how CIWS was being used to address the weather impact, (c) what plan would have been devised (and using what tools) had CIWS not been available, and (d) the effort required for any potential, alternative plans. Table 2-1 shows the worksheet used by the observers to record their observations.

Obtaining this information at a time when TMU personnel were at their busiest was difficult. Moreover, anywhere from 3 to 7 TMCs in a TMU could be handling different weather impact concerns at the same time, all potentially using CIWS to assist in planning. Ideally, all of these CIWS field uses would be observed (a difficult task for 1–2 observers). For those facilities with CIWS displays in Areas as well as the TMU, the number of CIWS applications increased significantly, further stretching limited observation resources.

CIWS Assessment Worksheet

Facility Visited: ____________________ **Date: __________________**

A	**Time wx-impact concern identified (w/CIWS)**	**C**	**Time mitigation plan coordinated internally (w/CIWS)**
A'	**Estimated time wx-impact concern noted w/o CIWS**	**C'**	**Estimated time plan coordinated internally w/o CIWS**
B	**Time mitigation plan devised (w/CIWS)**	**D**	**Time mitigation plan coordinated externally (w/CIWS)**
B'	**Estimated time mitigation plan devised w/o CIWS**	**D'**	**Estimated time plan coordinated externally w/o CIWS**

Convective Wx Impact on Air Traffic (Note A and A')	**Weather Impact Mitigation Plan**	**Wx-Info Used to Devise Plan** (CIWS Products, WARP, ETMS, CWSU)	**Time When Mitigation Plan was:**						**CIWS Used in Areas for:**	

Table 2-1. Worksheet for recording observations of workload reduction associated with convective weather impact mitigation. The ATC personnel estimated time required to accomplish various functions with and without CIWS available was noted for the specific actions taken to mitigate the adverse impact of convective weather.

3. CIWS BENEFITS EVALUATION RESULTS

FAA facility observation visits in 2005 for real-time evaluation of CIWS field usage were conducted on the following dates:

- 4–7 June
- 27 June–1 July
- 12–15 July (all except ZMP), 3 August (ZMP)

Convective weather present during these three intensive observation periods varied among large, organized squall line systems, short-lived quasi-organized clusters, large-scale disorganized thunderstorm outbreaks, typical summertime air mass convective events, and nontrivial embedded stratiform rain systems. Since each major type of storm organization and coverage regime occurred at each of the facilities in 2005, these observation periods were considered a representative sampling of the population of significant convective weather events.

ATC impacts caused by convective weather during these three observation periods ranged from minor to extraordinarily severe. Reported air traffic delays on 13 July 2005, for example (during the third observation period), set an all-time daily record for delays. On this day, prolonged en route and terminal convective weather impacts from southern Canada to Florida to Texas greatly reduced NAS capacity. Observations of CIWS usage during heavy TMU workload events such as 13 July were valuable in analyzing both airspace capacity and ATC productivity enhancements provided by CIWS.

CIWS benefits evaluation results discussed in this Section include:

1. TMU plan development and implementation time savings attributed to CIWS
2. Benefits (including ATC staffing assistance) attributed to CIWS product access in ARTCC Areas
3. Quality vs. time-for-decision relationship for CIWS-derived ATC decisions
4. CIWS operational effectiveness changes from 2003 to 2005
5. Improved coordination of ARTCC/TRACON weather impact planning attributed to CIWS

3.1 TMU PLAN DEVELOPMENT AND IMPLEMENTATION TIME SAVINGS ATTRIBUTED TO CIWS

The primary task of observers during the 2005 CIWS field-use assessment was to determine how long it took traffic managers to complete the operational decision loop (see Figure 1-4), with and without the use of CIWS. Specifically, for each weather impact addressed in part with CIWS, observers documented:

- When the potential weather impact was first identified
- How long it took for ATC to develop an impact mitigation plan

- How long it took to coordinate the plan (internally and with other facilities), and how long to execute

When possible, these direct observations of CIWS plan management timelines for individual ATC decisions were then followed immediately by interviews of TMU personnel, soliciting their expert opinion as to how long it would have taken to achieve each element of the operational decision loop without access to CIWS. TMC responses to these frequent, impromptu user interviews generally consisted of one of the following:

1. Without CIWS, it would have taken X minutes longer to make this decision because of Y

2. We would have made the same decision in the same amount of time without CIWS

3. We would not have been able to make this decision without CIWS

4. No time was available for the users to discuss the decision

With these interview responses, coupled with CIWS field-use observation data, detailed statistics were calculated for ARTCC weather impact plan management time savings attributed to CIWS.

Table 3-1 shows estimated CIWS time-savings at each individual ARTCC. At most facilities, several critical TMU weather impact mitigation decisions per day (e.g., keeping routes open, where to reroute aircraft, directing pathfinders, etc.) were made approximately 10 minutes faster by using CIWS. Due to the difficulty in interviewing the CIWS users during severe convective events (discussed above), we estimate that these "more timely" decisions constitute only 21-36% of total observed CIWS usage (varying from facility to facility), due to the following:

- Some CIWS decisions yielded no plan development/coordination time savings.

- Other times, TMCs were unable to comment on the workload associated with a specific CIWS-derived traffic plan because of the extremely busy SWAP environment.

- TMCs <u>often</u> informed observers that a particular CIWS-derived decision would not have been possible without CIWS, and they would have had to settle for a less-beneficial plan instead.

TABLE 3-1
TMU Time-Savings Attributed to CIWS for Convective Weather Impact Mitigation Plan Development and Implementation, Normalized by Convective Weather Day**

ARTCC	Number of CIWS Time Saving Decisions	% of Total Observed CIWS Applications	Mean Plan - Development Time Savings (min)	Mean INTERNAL Coordination Time Savings (min)	Mean EXTERNAL Coordination & Implementation (min)	Mean TOTAL CIWS Time Savings (min)	Time-Saved Decisions where CIWS used in Areas for COORDINATION	TMU Decisions Proactively Developed and/or Managed in Area via CIWS (Area INITIATION)	CIWS Assistance with FAA Staffing Decisions
ZMP	6.2	36%	8.6	0.6	0.8	10.0	3.0	1.2	1.2
ZAU	2.7	21%	5.0	1.1	2.4	8.5	-	-	0
ZOB	8.2	30%	6.2	2.9	2.4	11.5	5.3	5.8	0.8
ZDC	8.2	31%	7.3	1.4	1.5	10.2	4.3	4.0	0.2
ZNY	1.8	23%	11.0	0	0	11.0	-	-	0
ZBW	5.0	23%	7.1	1.0	1.5	9.6	-	-	0.7

*** Time-savings results from the 2005 CIWS Benefits Assessment Campaign*

Total TMU time savings attributed to CIWS per convective weather day are presented in Figure 3-1. These time savings, which demonstrate productivity enhancements for individual elements of the operational impact mitigation planning loop (see Figure 1-4), yield two primary results:

1. *Most of the time saved is in the plan development stage of decision loop.*

CIWS proved most beneficial to traffic managers when identifying and prioritizing thunderstorm impact concerns and developing high-quality impact mitigation plans. When interviewed, TMCs routinely pointed out that if a particular impact plan could still be considered as an option without CIWS, extra time would have been required to either:

- Query the ARTCC Center Weather Service Unit (CWSU) meteorologists on duty for the needed weather information[5],
- Make manual extrapolations, estimates, and educated guesses of perceived weather situations using other convective weather decision support tools, or
- Scour the Internet for additional sources of weather information (least frequent).

Since taking extra time to secure this tactical weather information is often not possible, traffic managers explained regularly that without CIWS, the impact mitigation plan in question would either (a) not have been devised or (b) been devised in the same amount of time with other weather decision support tools, but with far less confidence in the decision.

2. *Amount of TMU time-savings is related to availability of CIWS in ARTCC Areas.*

[5]The ARTCC CWSU is normally not staffed by a meteorologist after 10 PM local. If significant weather occurs late in the evening, extending beyond 10 PM, traffic managers must rely even more heavily on convective weather decision support tools. TMCs using CIWS for weather impact mitigation planning after CWSU meteorologists have left for the evening were often unable to cite specific plan development time-savings. Instead, they often stated that without CIWS, an alternate (and usually less-beneficial) plan would have been devised and implemented.

Results highlighting total TMC weather impact planning time-savings per day from CIWS demonstrate a significant relationship between enhanced TMU productivity and availability of CIWS displays in ARTCC Areas (see Figure 3-1). Total TMC time-savings from the 3 ARTCCs with CIWS in both the TMU and the Areas was 164% greater than TMC time-savings from 3 ARTCCs with CIWS only in the TMU. The relationship between improved TMU productivity and availability of CIWS displays at ARTCC Area Supervisor positions is discussed in detail in the next Section.

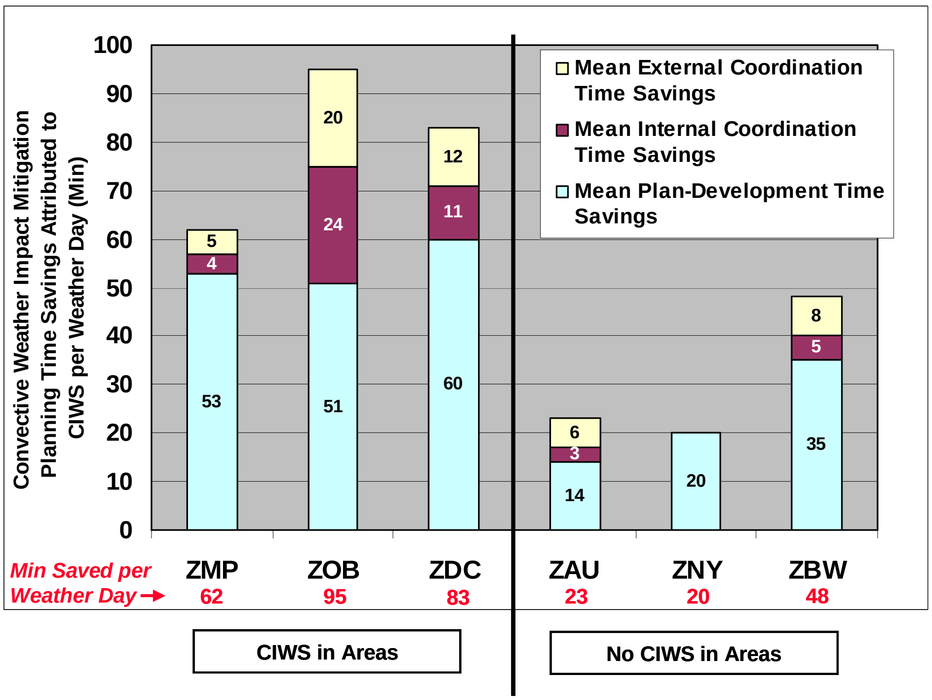

Figure 3-1. TMU time-savings attributed to CIWS at each ARTCC investigated in 2005. Productivity enhancements per convective weather day are segmented to demonstrate CIWS contributions to the specific stages in the operation decision loop for weather impact mitigation. ARTCCs with and without access to CIWS displays in the Areas are noted.

3.2 BENEFITS CONTRIBUTIONS ATTRIBUTED TO CIWS USAGE IN ARTCC AREAS

In situ field use assessments of FAA decision support tools are valuable not only for determining operational benefits of a system, but also for observing how ATC operates during traffic impact events. During both the 2003 and 2005 CIWS field-use assessment campaigns, observations at ARTCCs and discussions with traffic managers revealed that all operational ATC positions in an En Route Traffic Center, from controller to Area Supervisor to TMC, need to function as a tightly knit team. Decisions made at the TMC level directly affect Area personnel (supervisors and controllers). Similarly, decisions made by controllers and Area personnel will also impact TMU planning decisions. Given this synergistic ARTCC environment, it stands to reason that any benefits gained in the TMU through use of a convective weather decision support tool such as CIWS should increase when Areas have access to the same tool. Mutual availability of a decision support tool increases common situational awareness of air traffic management concerns throughout the facility. Decisions made by Area personnel are an important component of the overall traffic management plans (personal communications and interviews with

ARTCC Traffic Management Officers, TMCs, and Area Supervisors). The availability of decision support information in the Areas, such as provided by CIWS, can therefore greatly assist in plan development and implementation efficiency, resulting in traffic management decisions that increase airspace capacity while minimizing the adverse affects on controller workload.

As discussed in Section 2, the design of the 2005 CIWS benefits assessment campaign experiment explicitly allowed for an assessment of the impact of having CIWS products available in the Areas (see Figure 2-3).

Four primary benefits of having CIWS available to Area Supervisors (in addition to the TMU) were identified:

1. Improved weather impact plan coordination
2. TMU plan development/monitoring workload eased by enhanced Area initiative via CIWS
3. Increased frequency of higher-quality weather impact mitigation decisions
4. FAA staffing assistance

3.2.1 Improved ARTCC plan coordination with Area CIWS access

CIWS availability in the Areas at ZOB, ZDC, and ZMP ARTCCs greatly increased TMU time-savings for weather impact mitigation plan development (compared to ARTCCs with CIWS only in the TMU). At these three ARTCCs, Area personnel were often more involved at the plan development stage, since they were able to utilize CIWS to quickly affirm a plan proposed by the TMU or to offer a high-quality "counter-plan". Once weather impact plans were devised in the TMU (with or without Area Supervisor assistance), CIWS availability in the Areas helped reduce the TMU-Area coordination time. (See Figure 3-1, "mean internal coordination time savings").

The following observation at ZDC at 1909 UTC on 29 June 2005 was typical of the documented TMU-Area plan coordination assistance provided by CIWS during the benefits assessment period:

- Convection impacting J48, moving towards J75 (parallel north-south routes through ZDC servicing heavy New York and Atlanta traffic flows)
- TMU uses 1-hour CIWS Precipitation Forecast to develop reroute for flights over GVE/DAILY fixes, required with expected J75 closure in 45-60 minutes
- STMC visits Areas 5, 6, and 7 and, using CIWS Displays at Area Supervisor positions, quickly illustrates to Area personnel (a) why reroutes will be needed, (b) when reroutes will need to be implemented, and (c) reason specific reroutes plans were chosen
- With CIWS, all Area Supervisors recognize pending weather impacts and quickly agree to proactive reroute strategy
- The STMC confirms that without CIWS available in the Areas, extra time would have been required to explain the specifics of the reroute strategy and why it needed to be planned proactively; STMC confirms that TMU-Area plan coordination is often less complicated and time consuming with CIWS

Mean, daily internal coordination time savings attributed to CIWS at ZOB and ZDC were roughly three times greater than mean savings at ZAU, ZNY, and ZBW. Internal plan coordination time-savings at ZMP lagged the other facilities with CIWS in Areas and the TMU, likely because TMCs at this ARTCC were relatively new users of this decision support tool; thus, experience in utilizing CIWS for Area collaboration was still limited.

Figure 3-2 demonstrates the higher rate at which plan coordination and TMU workload reduction benefits were achieved at ARTCCs with CIWS available in both the TMU and Areas. Also, observed use of CIWS for "situational awareness" of convective weather impacts on air traffic was generally higher at ZOB, ZDC, and ZMP (ARTCCs with Area CIWS displays), though it is important to note that CIWS was used heavily within the ZBW TMU, which helped this facility overcome some plan development and coordination challenges associated with not having CIWS in the Areas (discussed further in Section 3.2.3).

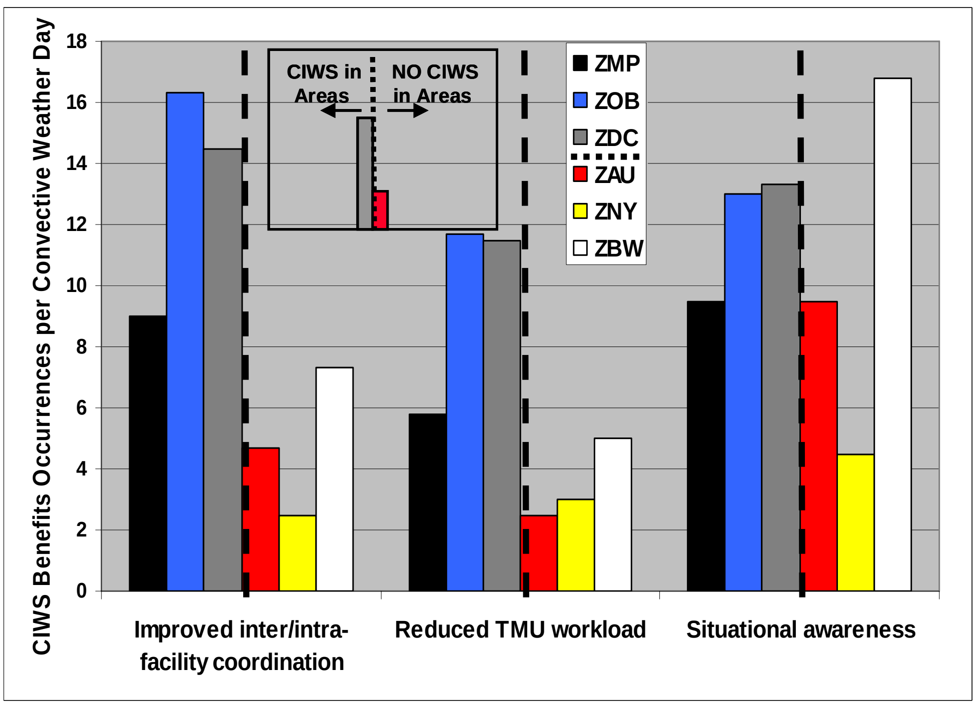

Figure 3-2. Operational benefits per ARTCC per convective weather day for three specific CIWS benefits categories. ARTCC results are separated into two groups, those facilities with access to CIWS at Area Supervisor positions and those without.

3.2.2 TMU workload reduction from enhanced Area initiative via CIWS

Observations at ZOB, ZDC, and ZMP in 2005 revealed that substantial reductions in TMU workload were achieved when Area Supervisors utilized CIWS to avoid traffic management initiatives (TMI). This is illustrated by the following observation of Area usage of CIWS at ZDC after 2000 UTC on 13 July 2005:

- Strong storms impacting northeast ZDC airspace (key en route airspace for NY/PHL traffic)

- ZDC Area Supervisor uses CIWS Growth and Decay Trends product to note that these storms are dissipating; based on CIWS, Supervisor keeps the route open, without restrictions

- ZDC Area Supervisor convinces NY ATC that this decision is the right one

- ZDC TMU involvement not required for this decision

In an interview after this air traffic management decision was made, this Area Supervisor stated that had CIWS not been available, he would have requested the ZDC TMU to either close this route completely or implement significant Miles-in-Trail (MIT) restrictions. By using CIWS to keep this route open with no TMI, the TMU did not have to develop a plan for this route impact. Moreover, if a plan for this route were implemented, it would have required constant, iterative monitoring and revisiting by the TMU. The impact on heavy NY traffic would have been substantial, with significant delays, and pressure to remove TMIs on this route as quickly as possible would have been immense. Keeping the route open not only reduced ZDC TMU workload, but also potentially reduced ATC workload for:

- ZDC Area controllers: allowing traffic to stay on route limited/prevented air traffic complexity issues that increase controller workload

- ZNY: TMU and Areas did not have to react to a TMI, which would otherwise have been needed

- NY TRACON: large terminals in their airspace avoided the adverse operational impacts that would have resulted from the alternative TMI

- NY/Philadelphia ATC Towers: avoided airport departure slowdowns, backups of aircraft, building "queues", and increased airport surface management workload that otherwise would have resulted from the alternative TMI

- Airline System Operations Centers (SOC) and dispatchers: extra workload required in seeking alternative routes for aircraft impacted by route TMI, accounting for downstream delay impacts, flight crew timeout concerns, etc., was avoided

Finally, and perhaps most important, this decision, made independently of the TMU by an Area Supervisor using CIWS, increased airspace capacity and helped save considerable delay on a day when air traffic impacts were already at record levels[6].

Access to CIWS in the Areas was also observed to enhance the ability of Area Supervisors to develop plans for weather impact mitigation and present them to the TMU for implementation. With ARTCC Area Supervisors using CIWS to determine the feasibility of various air traffic capacity enhancement strategies, the TMU is able to focus its efforts towards other TFM concerns. Moreover, when the Areas present potential tactical plans to the TMU, time and effort are saved by the TMCs because (a) the impact mitigation situation has already been identified, (b) research into plan feasibility has already been conducted, and (c) TMCs do not need to take time to explain or convince the Areas of the plan since the Area Supervisors are presenting it to the TMU in the first place.

[6]Recall, it was noted earlier in Section 3 that reported air traffic delays on 13 July 2005 set an all-time daily record. Without CIWS-enabled decisions such as the one described here, both delays and ATC workload concerns on this day would have been much worse.

Numerous convective-weather related air traffic disruptions throughout a Center may simultaneously require TMU attention. Therefore, Area Supervisors, focusing on a smaller sub-region of airspace within an En Route Center, may at times be more able to readily identify proactive, capacity-enhancing opportunities through the use of CIWS. An observation of Area use of CIWS in ZOB at 2320 UTC on 28 June 2005 illustrates this productivity and delay-saving benefit scenario (Figure 3-3):

- Strong storms impacting J80 jet route through ZOB (a heavily-used route serving several large airports)
- Despite strong storms surrounding J80, Area 2 Supervisor uses the CIWS Echo Tops Forecast product to determine that a developing gap in high-topped convection will persist, allowing the route to reopen
- Area 2 Supervisor presents the plan to reopen J80 to the TMU, citing CIWS evidence
- TMU quickly reopens J80

At the time of this decision, the TMU was inundated with thunderstorm impact concerns throughout the Center (see Fig. 3-3A). Specifically, in addition to the J80 impacts, strong storms were directly affecting all three large TRACONS in ZOB (Detroit, Cleveland, and Pittsburgh), the heavy Chicago O'Hare (ORD) eastbound departure flows near the ZAU/ZOB Center boundary, the heavily-traveled J36, J60, and J64 east-west jet routes through the Center, and key routes into and out of ZBW. Strong convection in all Centers bordering ZOB also likely increased TMU workload at this time. By using CIWS to recognize an opportunity to reopen J80 early, and presenting the plan to the TMU, the Area Supervisor helped reduce TMU workload. This CIWS-enabled Area initiative also ensured an earlier implementation of a delay-saving decision benefiting multiple FAA facilities (increased efficiency), airlines (reduced delay and operating costs), and passengers (reduced delay).

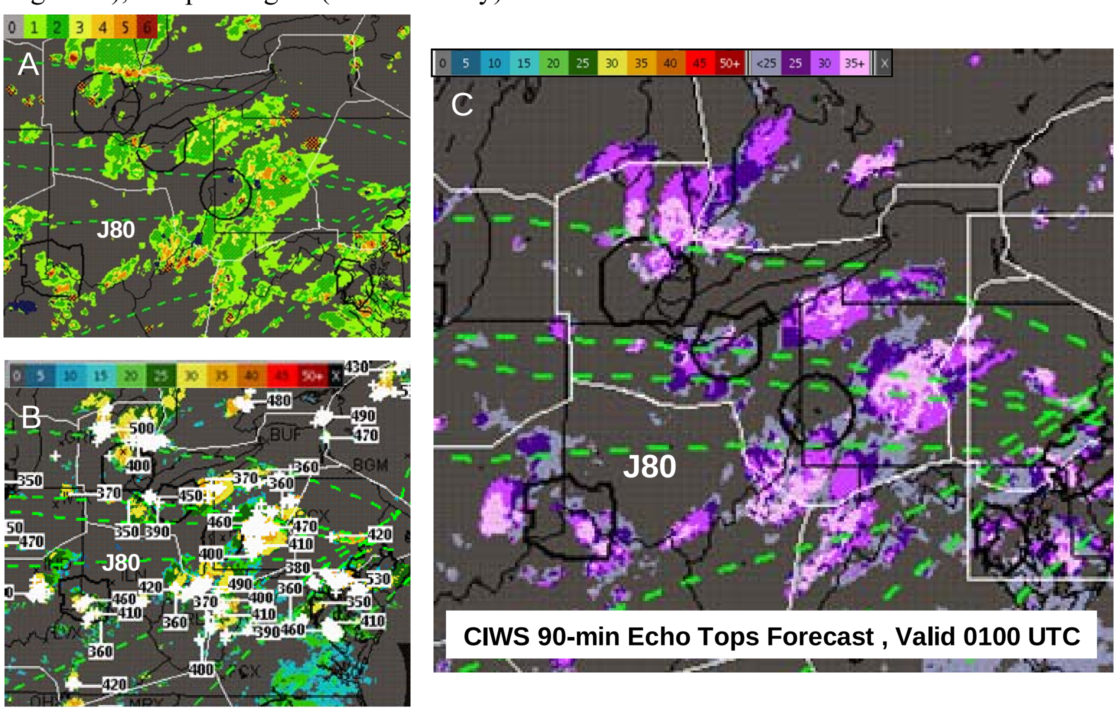

Figure 3-3. (A) CIWS VIL Precipitation, (B) Echo Tops Mosaic and Lightning, and (C) Echo Tops Forecast products at 2330 UTC on 28 June 2005. The J80 jet route is labeled.

3.2.3 Increased frequency of higher-quality weather impact mitigation decisions enabled through CIWS use in Areas

Figure 3-4 compares the number of times per convective weather day that key en route delay reduction benefits were observed at each ARTCC under study during the 2005 CIWS usage assessment. Overall, CIWS en route airspace efficiency and capacity enhancement benefits at ZOB, ZDC, and ZMP (CIWS in Areas) were significantly greater than the corresponding CIWS benefits at ZAU, ZNY, and ZBW (CIWS in TMU only). On average, for the 5 CIWS en route benefit categories shown in Figure 3-4, ARTCCs with CIWS in the Areas and TMU implemented capacity-enhancing TMIs *140% more often* than ARTCCs with CIWS only in the TMU.

The outlier in this analysis was ZBW, which compensates for the lack of Area displays through prolific use of CIWS in the TMU, where this decision support tool is consulted regularly during convective weather events. Even with such strong TMU use at ZBW, the frequency of high-quality CIWS delay saving decisions at ZBW such as "Keeping Routes Open Longer", "Proactive Reroutes", and "Improved Management of Arrival/Departure Transition Areas (ATA/DTA)" was lower than the frequency of the same benefits decisions at ZOB and ZDC. Since TMC use of CIWS at ZOB and ZDC is comparable to that at ZBW, we attribute this higher overall ARTCC efficiency for executing beneficial weather impact mitigation plans to the Area use of CIWS[7] at those facilities.

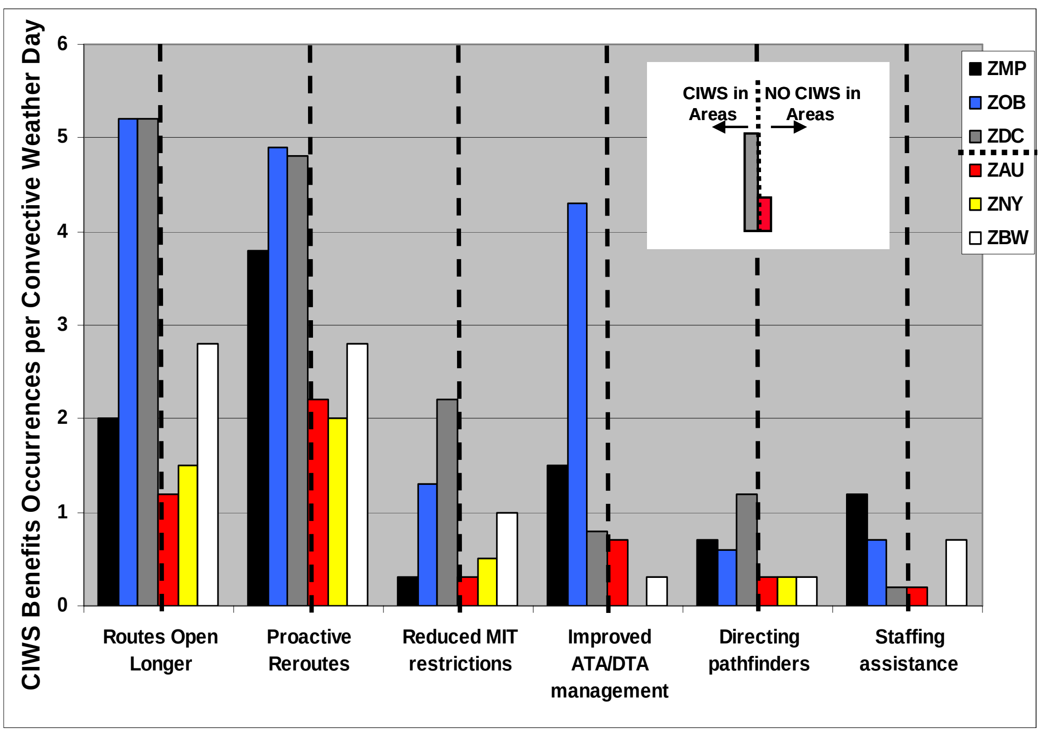

Figure 3-4. CIWS benefits per convective weather day at each ARTCC included in the 2005 CIWS field use assessment. Benefit categories shown here are typically considered key en route delay reduction benefits attributed to CIWS at ARTCCs. ARTCC results are separated into two groups: those facilities with access to CIWS at Areas Supervisor positions, and those without.

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[7]The frequency of some CIWS en route benefits at ZBW (CIWS in TMU only) exceeded the rate of achieved benefits at ZMP (CIWS in TMU and Areas), as the latter "new user" group was still becoming accustomed to using this decision support tool. This operational "burn-in" period was seen at almost all FAA facilities during their first year of CIWS usage.

The following three examples illustrate typical observations of ARTCC operations during the 2005 storm season where CIWS use in the Areas enabled higher-quality weather impact mitigation decisions:

1. ZOB: 06 June 2005 - 0015 UTC: Strong, high-topped thunderstorms moved into the high sectors in Area 4 (western ZOB airspace). A high sector controller, without access to CIWS, felt that traffic northbound to DTW, through his sector, should be stopped or severely restricted. Despite the direct impact by squall line convection, the Supervisor, noting a general decaying trend in echo top heights, and the persistence of gaps in high-topped weather (predicted by the CIWS Echo Tops Forecast), convinced the controller working the southwest ZOB airspace position that northbound DTW arrivals could continue (Figure 3-5). The Area Supervisor confirmed that had CIWS not been available in his Area, he would have agreed with the controller's suggestion and requested that the TMU place heavy MIT restrictions or stop the northbound DTW traffic flow though his high sectors. In this example, use of CIWS in the Areas reduced DTW arrival delays and potentially prevented airport ground stops to DTW. An increase in TMU workload was also prevented since concerns associated with this thunderstorm impact were managed entirely within the ARTCC Areas.

2. ZOB: 06 June 2005 - 0100 UTC: Despite the presence of a strong, nearly solid north-south squall line through western ZOB airspace, the TMU developed a plan to send pathfinders on the J554 jet route in the hopes of reopening it earlier. The Area 4 Supervisor was concerned about this decision but agreed based upon a declining trend in echo top heights along this route, as evident in the "past-weather" loop of the CIWS Echo Tops Forecast product (Figure 3-6). Using this CIWS information, the Area 4 Supervisor worked with controllers to direct three successful pathfinders through the "echo tops gap" along J554 in western ZOB airspace, allowing the route to reopen early. Without CIWS, the Area Supervisor confirmed that he would not have been comfortable with the decision to attempt to reopen J554 early with pathfinders and the route may have remained closed.

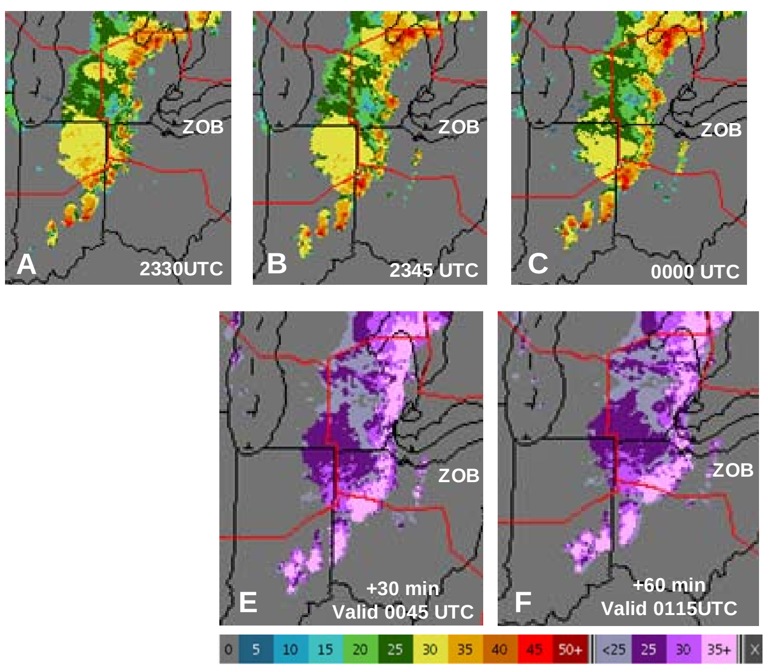

Figure 3-5. CIWS Echo Tops Mosaic at (A) 2330 UTC, (B) 2345 UTC, (C) 0000 UTC, and (D) 0015 UTC, and 30 and 60 min Echo Tops Forecasts issued at 0015 UTC, valid at (E) 0045 UTC and (F) 0115 UTC, respectively.

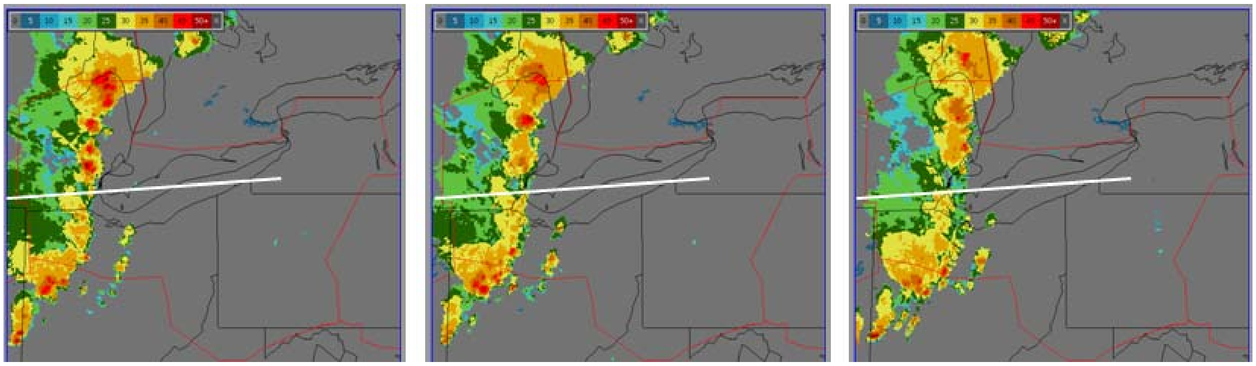

Figure 3-6. CIWS Echo Tops Mosaic at 0030 UTC, 0045 UTC, and 0100 UTC on 06 June 2005. The J554 jet route is represented by the white line.

3. ZMP: 29 June 2005 - 2240 UTC: At 2210 UTC, strong storms southeast of Minneapolis-St. Paul (MSP) TRACON forced the closure of the RST departure gate. With this gate closed, RST departures were added to the ODI departure fix, but MSP delays increased due to limited weather-constrained capacity (Figure 3-7A). Weather impacts at the RST fix were still significant at 2240 UTC (see Figures 3-7C, 3-7D), but the Area 3 Supervisor used animated CIWS Precipitation and Echo Tops Forecast information to proactively identify improving conditions in this airspace region (Figure 3-7E). The Area 3 Supervisor presented this evidence to the TMU, and after quick consultation with MSP and Northwest Airlines (NWA), the RST departure fix was reopened early (Figure 3-7B). Without CIWS in the Area, identification of improving conditions would not have occurred as quickly (in this instance) and higher SWAP departure rates at MSP would have been delayed.

Since the facility observation scheme (see Section 2) for this benefits assessment campaign included two ARTCCs (ZOB and ZMP) where CIWS displays were available in most but *not all* Areas, observations of weather impact planning and coordination amongst Areas with and without access to CIWS and the TMU were also made. Several instances were documented where the TMU and Area with access to CIWS, using weather products from this decision support tool, agreed on a convective weather impact mitigation plan, but another Area involved in plan coordination, without access to CIWS, did not (see Appendix D). In these cases, the TMU (sometimes with the help of the Area Supervisor with access to CIWS) may take extra time to try to convince the other Area Supervisor of the validity of the plan. Most often though, without agreement amongst all intrafacility coordinating parties, the CIWS-derived plan would either be postponed, to be re-addressed later in the event, or never implemented.

The following observation from ZMP at 1725-1740 UTC on 29 June 2005 is an example of this specific plan coordination scenario, involving the TMU, and Area Supervisors with and without direct access to CIWS:

- TMU, using the CIWS VIL Precipitation and Precipitation Forecast products, develops a plan to resume MSP departures out towards the FAR fix, with 20 MIT restrictions
- Area 2 and 3 Supervisors, with access to CIWS, and viewing the same weather products, agree to the plan
- Area 4 Supervisor, without access to CIWS, does not agree with plan
- Plan is not implemented

It has been previously demonstrated that improved weather impact mitigation plans derived from CIWS can save substantial delay, as well as airline operating and passenger costs (Robinson et al. 2004). In the context of the 2005 CIWS productivity enhancement assessment, improved *quality* of decisions also proves important in reducing controller and traffic manager workload. Results in this Section demonstrate that realized productivity benefits, through improved weather impact planning using CIWS, increase at facilities with CIWS available at Area Supervisor positions. A discussion of the impact of traffic management plan *quality* on facility and NAS operational efficiency is presented in Section 3.3.

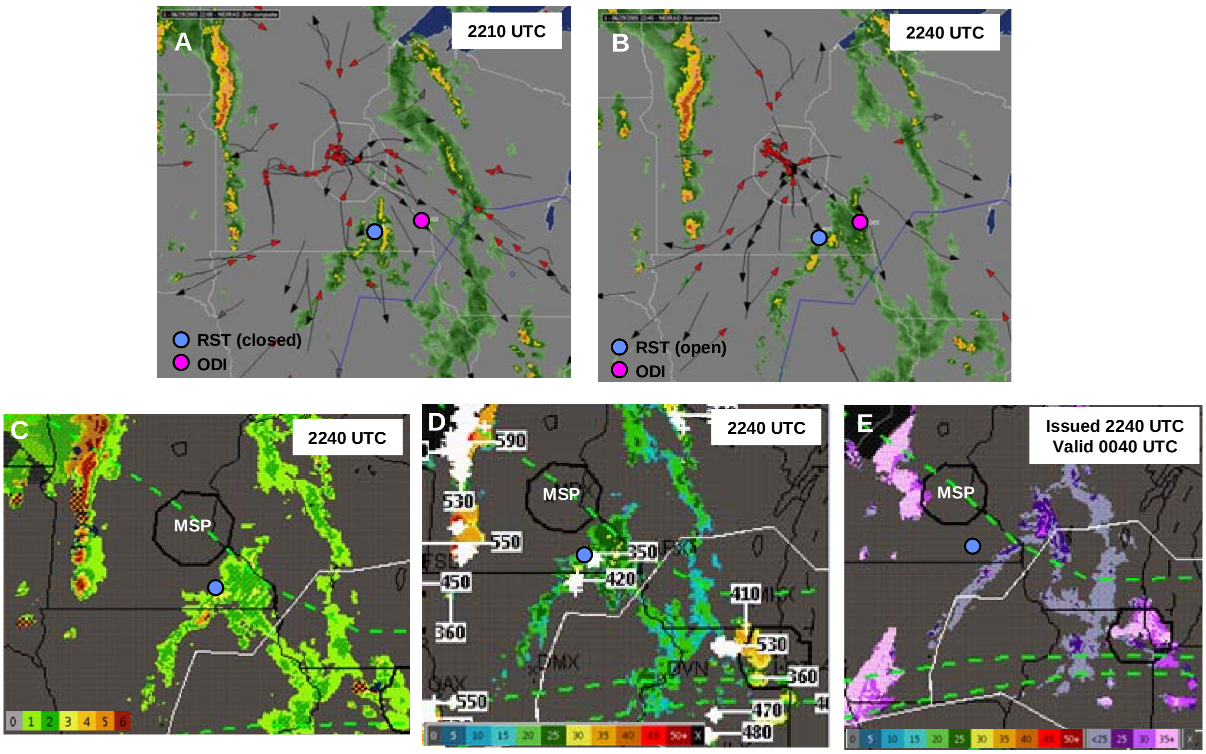

Figure 3-7. Flight track and WSI composite reflectivity information, provided by Flight Explorer, at (A) 2210 UTC and (B) 2240 UTC, depicting MSP arrivals (red) and departures (black), and CIWS (C) VIL Precipitation and Growth (hatched orange) and Decay (dark blue) Trends products, (D) Echo Tops Mosaic (with Echo Top Annotations) and Lightning products, and (E) 2-hour Echo Tops Forecast product at 2240 UTC on 29 June 2005. The blue circle in each figure marks the location of the RST departure fix.

3.2.4 Increased FAA staffing assistance through CIWS use in Areas

Availability of CIWS displays at Area Supervisor positions also provided more opportunities to consult this decision support tool to assist with ATC staffing decisions. The frequency of CIWS-assisted FAA staffing decisions per ARTCC is presented in Table 3-1. Though the trend is not as clear as the relative rates of achieved en route benefits, results suggest that CIWS availability in ARTCC Areas increases the use of this decision support tool for assistance with staffing decisions. Observations from the 2005 field-use assessment (Appendix D) captured a number of uses of CIWS weather products in the Areas to assist in making staffing decisions, including:

- Justifying controller overtime based upon weather impacts forecasted by CIWS
- Adding "D-side" controllers to reduce radar controller workload based upon current or pending weather impacts as depicted by CIWS
- Optimizing Area controller break schedules based upon CIWS weather information
- Managing ATC staffing in super-high sectors based upon CIWS Echo Tops and Echo Tops Forecast products
- Determining controller staffing levels needed for diversion recovery programs
- Avoiding controller overtime (staffing levels acceptable, despite convective weather impacts, based upon CIWS weather depictions and forecasts)

Staffing decisions made by Area Supervisors using CIWS to add or extend overtime for controllers at first glance appears counter to FAA goals to reduce operating costs. However, from an air traffic management perspective, these staffing decisions, which decrease individual controller workload and thus maintain or increase sector capacity, allow ARTCCs to proactively address convective weather impact concerns. The potential end result of this proactive staffing approach in the Areas was often reduced air traffic delays, managed airport departure queues[8], and reduced duration of late evening impacts, when controller staffing is extremely limited and costs for off-peak ATC overtime (needed to handle ongoing peak traffic demand) would be significantly greater.

CIWS was used in the TMU to assist in making staffing decisions as well, although less frequently than in the Areas due to fewer TMC personnel working per shift. Table 3-2 shows that CIWS was used at ZBW nearly once per convective weather day to help manage TMU staff scheduling. As in the Areas, CIWS current weather depiction and forecast products proved useful in the TMU for determining the appropriate staff force given ongoing or pending convective weather impacts.

[8] Airport queuing delays (Robinson et al. 2004; Allan et al. 2001; Evans, 1997) invariably occur at high demand/limited capacity terminals serviced by routes through the CIWS domain (i.e., Chicago O'Hare, Newark, LaGuardia, JFK, Teterboro, Boston, Dulles, Washington National, Baltimore, Cincinnati, and Detroit airports).

TABLE 3-2
Frequency of CIWS-Assisted FAA Staffing Decisions per ARTCC

ARTCC	FAA Staffing Decisions Made with CIWS per Convective Weather Day
ZMP	1.2
ZOB	0.7
ZDC	0.2
ZAU	0.2
ZNY	0.0
ZBW	0.7

CIWS in TMU and Areas (ZMP, ZOB, ZDC)

CIWS in TMU only (ZAU, ZNY)

CIWS in TMU only, but prolific usage (ZBW)

3.3 QUALITY VS. TIME-FOR-DECISION RELATIONSHIP FOR CIWS-DERIVED ATC DECISIONS

Recall from earlier discussions of CIWS plan development time savings (Section 3.1) that a significant fraction of TMC responses to CIWS workload assistance queries were that a specific impact mitigation plan would not have been devised and implemented without CIWS[9]. TMCs stated that, in the absence of CIWS, there would most likely not have been enough time to obtain the necessary information from the CWSU meteorologists (e.g., storm movement, evolution, height, and forecast) needed to make an educated tactical traffic management decision. Moreover, ATC personnel explained that other convective weather decision support tools, available in the TMU, lacked most of the specific weather information provided by CIWS. Therefore, without CIWS, they would not have been aware that more optimal storm impact mitigation plans could be developed.

CIWS proved extremely valuable in the fast-paced, workload-intensive SWAP environment in an ARTCC TMU by exposing options for weather impact mitigation that were better than the other alternatives (in terms of enhancing capacity and/or addressing controller workload concerns), yet could still be incorporated into a plan and iteratively monitored in a timeframe acceptable within the limits of tactical airspace management. Moreover, with additional storm severity information provided by CIWS, higher quality mitigation options might be proposed, and the resulting impact mitigation plans selected, even though more work by the TMU might be required initially to put the plan in place.

The following three examples illustrate typical observations of ARTCC operations during the 2005 storm season where CIWS enabled higher-quality weather impact mitigation plans at the expense of increased, near-term TMU workload:

[9]If, without CIWS, the impact mitigation plan would have been different, the CIWS-derived decision was not included in workload time-savings calculations. This is because estimates for the time required to devise and implement a plan with and without CIWS in these instances would have been for two completely different TMIs and thus not comparable.

1. ZDC TMU, 29 June 2005, 1430-1630 UTC: A large cluster of storms was present along the Mid-Atlantic coast, along which several high demand en route ZDC airways run (serving New York, Boston, and Florida traffic). At the same time, an organized thunderstorm complex was directly impacting ZNY airspace, causing mounting delays at the major metro NY airports. Additional strong storms began building in northern ZDC airspace after 1400 UTC. Given the significant weather already affecting NY traffic flows at this time, additional storm-related capacity reductions in ZDC would have severely hampered NAS operations along the East Coast (and likely beyond). Even though the thunderstorms were strong (level 5 intensity in the CIWS VIL precipitation product[10]), ZDC TMCs used CIWS Echo Tops products to identify that en route over flight traffic on high demand airways could continue (Figure 3-8). This particular event was very dynamic as thunderstorms continued to build in the airspace region of concern. Therefore, the decision to keep key routes through northeast ZDC open required continuous TMU monitoring to be sure this plan remained safe and operationally viable (Table 3-3). TMU personnel and Area Supervisors were observed "conferencing" around the CIWS Situation Display (SD) at approximately 20–30 min intervals to reassess the decision to keep routes open based upon echo tops information. Increasing echo top heights finally led to the closure of the route at 1630 UTC.

Post-decision interviews confirmed that without CIWS, this heavily-traveled route would have closed two hours earlier. NY airport arrival/departure rates were already reduced because of convection in ZNY airspace; an earlier closing of this ZDC route servicing NY traffic would have further reduced terminal throughput at several large airports, resulting in rapid, nonlinear escalations of queuing delays.[11] Airports affected would have included metro NY (3 airports), Atlanta, Orlando, Tampa, Miami, Boston, Hartford, Providence, and surely others.

In this traffic management example, the decision to keep routes in ZDC open based upon CIWS required more work from (a) TMCs to iteratively monitor and assess the route impact, (b) Area controllers who were still handling traffic through their sectors despite heavy weather and occasional, local pilot deviations, and (c) Area Supervisors, working with both the TMCs and controllers to ensure that this traffic plan remained manageable. However, this decision enhanced en route airspace capacity during a SWAP event, providing relief for several high demand airports and minimizing delays. Moreover, given that the NAS operates as a network, not only in terms of general air traffic flow, but also in terms of the symbiotic relationship between the ATC facilities managing this flow, the extra effort at ZDC to postpone intrusive TMIs and increase en route capacity helped improve operational productivity elsewhere during the 2-hour benefit period.

2. ZAU, 05 June 2005 - 2230 UTC: A solid, north-south squall line in eastern ZAU at 2100 UTC forced large reroutes for many destinations, including arrivals to MSP (Figure 3-9A). As the line moved towards the ZAU/ZOB boundary over the next 90 min, ZAU TMCs monitored the evolution of the convective system using multiple CIWS products. At 2230 UTC, ZAU, ATCSCC, and ZOB conferred at length, using CIWS for common situational awareness, about reroute modifications, specifically in regards to en route MSP arrivals from the east coast. At ZAU (where primary observations of this three-way conference were conducted), the TMC took extra time to consult numerous CIWS products in order to determine the highest-quality reroute decision. Storms in northwest ZOB, where MSP arrivals had been routing, were intensifying (CIWS Growth Trends product; Figure 3-9C) and tracking over the same

[10]Robinson et al. (2002) demonstrated that weather depictions based upon CIWS VIL precipitation, although commonly less intense than the weather depictions available from other decision support tools such as WARP or ETMS, are a more accurate representation of en route storm severity. Therefore, a level 5 storm on 29 June 2005, as depicted by CIWS, likely looked even more severe (and thus, of greater operational concern) on other weather decision support tools.
[11]See Appendix B in Robinson et al. (2004) for quantified CIWS delay savings case studies involving route-based queuing delays.

locations (CIWS Storm Motion vectors; Figure 3-9C). Meanwhile, convection south of this intense cluster exhibited lower echo tops and less frequent lightning (CIWS Echo Tops Mosaic and Lightning products; Figure 3-9D), and an explicit decay trend (CIWS Decay Trends product; Figure 3-9C) was evident in convection near J60 through ZOB and ZAU. Finally, the CIWS Forecast products for Precipitation (Figure 3-9E) and Echo Tops (not shown) demonstrated that the broken nature of convection in this airspace region would persist. By using CIWS during this conference, all parties were able to agree on a reroute strategy that would allow MSP arrivals from the east coast to utilize gaps in weather near J60 and/or, at the pilot's discretion, smaller holes in the line between Chicago and Detroit (Figure 3-9B).

After the conference between ZAU, ZOB, and ATCSCC had concluded, the ZAU TMC involved was asked if the use of CIWS in this instance had provided any time or workload savings. The TMC stated that in this case, using CIWS actually increased the time required to conduct the conference because it opened up more avenues for discussion and there was much more information to share. The TMC felt that because of this, the conversation was more fruitful and may have encouraged ZOB to attempt using gaps in convection along the ZAU/ZOB border. By utilizing these gaps, some MSP arrivals from the East did not require longer routes through Canada, thus minimizing potential route-based queuing delays on the MIT-restricted Canadian "Playbook" routes in use. These flights also avoided longer routes around the south end of the squall line where the likelihood for greater delay would have increased since routes in this region were already under high nominal and reroute demand.

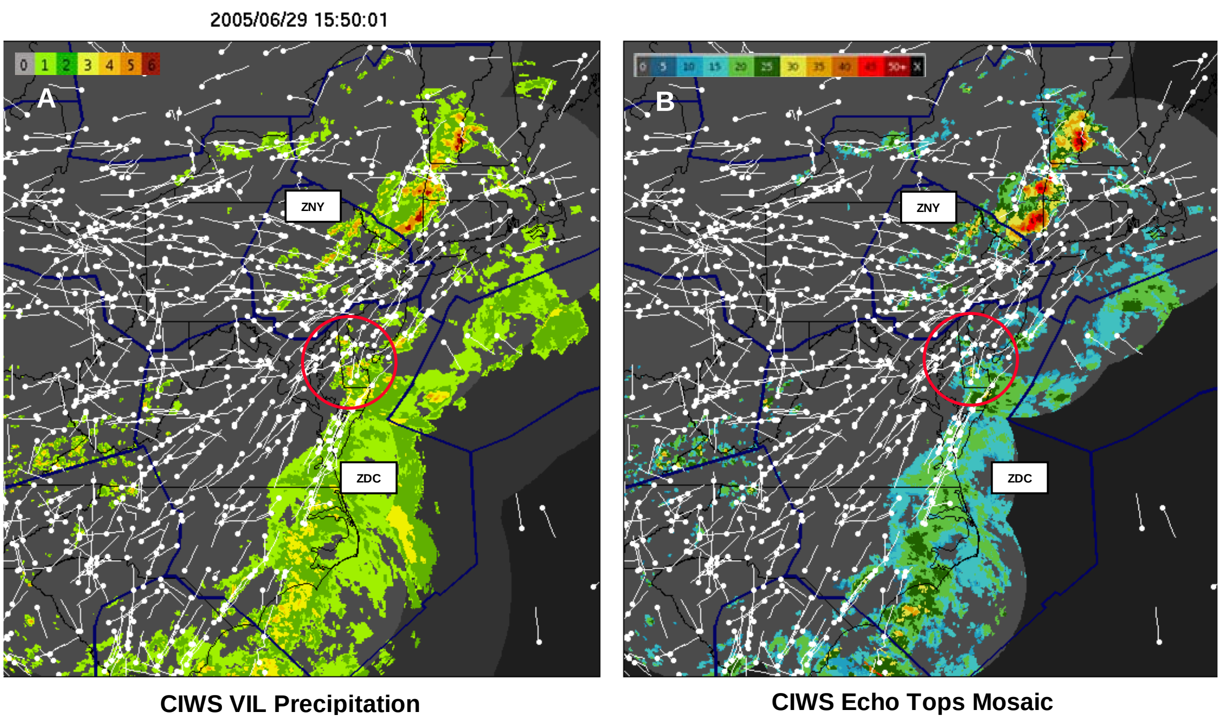

Figure 3-8. CIWS weather depictions showing (A) VIL precipitation and (B) Echo Tops at 1550 UTC on 29 June 2005. Overlaid on CIWS weather products are all flight tracks for aircraft at or above 16,000 feet. The ZDC airspace region where CIWS was used to keep heavily-traveled jet routes open (despite level 3-5 intensity) based upon CIWS echo tops information is circled in red. At this time, strong, high-topped thunderstorms in southern NY and PA had closed key airways servicing metro NY traffic. This resulted in additional traffic volume on routes west and south from NY. Without CIWS, ZDC TMU personnel confirmed that routes through the circled airspace region would have closed two hours earlier, resulting in increased demand on fewer available routes and thus, increased air traffic delays for numerous airports.

TABLE 3-3
Observed, Iterative Use of CIWS at ZDC TMU on 29 June 2005

Weather Impact Plan Management Using CIWS	Without CIWS
• **1436 UTC:** Level 3-5 storms near OOD/SBY (key ZDC airspace for en route NY traffic) southbound traffic deviating – conference between TMCs and Area Sups at TMU CIWS display, discussing stopping OOD departures or heavy MIT restrictions. Realizing significant impact on NY departures, ZDC use CIWS (Precip, Echo Tops, Lightning, Growth and Decay Trends products) to reach decision to leave route open without restrictions, and absorb deviations.	Route heavily restricted or closed; if closed, no more TMU work on this plan until weather clears or deviations cease
• **1504 UTC:** Strong storms still near OOD/SBY fixes. Area Sup uses CIWS to note echo tops at 34 kft, increasing from 30 kft – feels still acceptable and leaves route open.	Route closed - concern for deviations and airspace complexity cease until route reopened
• **1533 UTC:** Storms near SBY fix. Area Sup tells TMU (using CIWS) that flights are still deviating and echo tops are 30 kft. STMC notes "positive growth" is NOT present in CIWS Growth and Decay Trends product. Deviations larger now, and near military warning areas, so 30 MIT restriction implemented on route. TMU confirms route would have closed completely without CIWS – route remains open 55 min longer.	Route closed – concern for deviations and airspace complexity cease until route reopened
• **1550 UTC:** Strong storms still near SBY fix. Area Sup and STMC (using CIWS) discuss NY/PHL departures deviating around weather. STMC decides to continue to keep route open because CIWS shows "manageable" echo tops and no lightning. CIWS does show "growth" (via Trends product), which is a concern and thus impact is continuously monitored.	Route closed – TMU workload reduced until decision to reopen route
• **1630 UTC:** Route finally closed.	
• **Conclusion:** **Decision made using CIWS to keep route open saved considerable delay, but iterative plan monitoring required more work in TMU**	

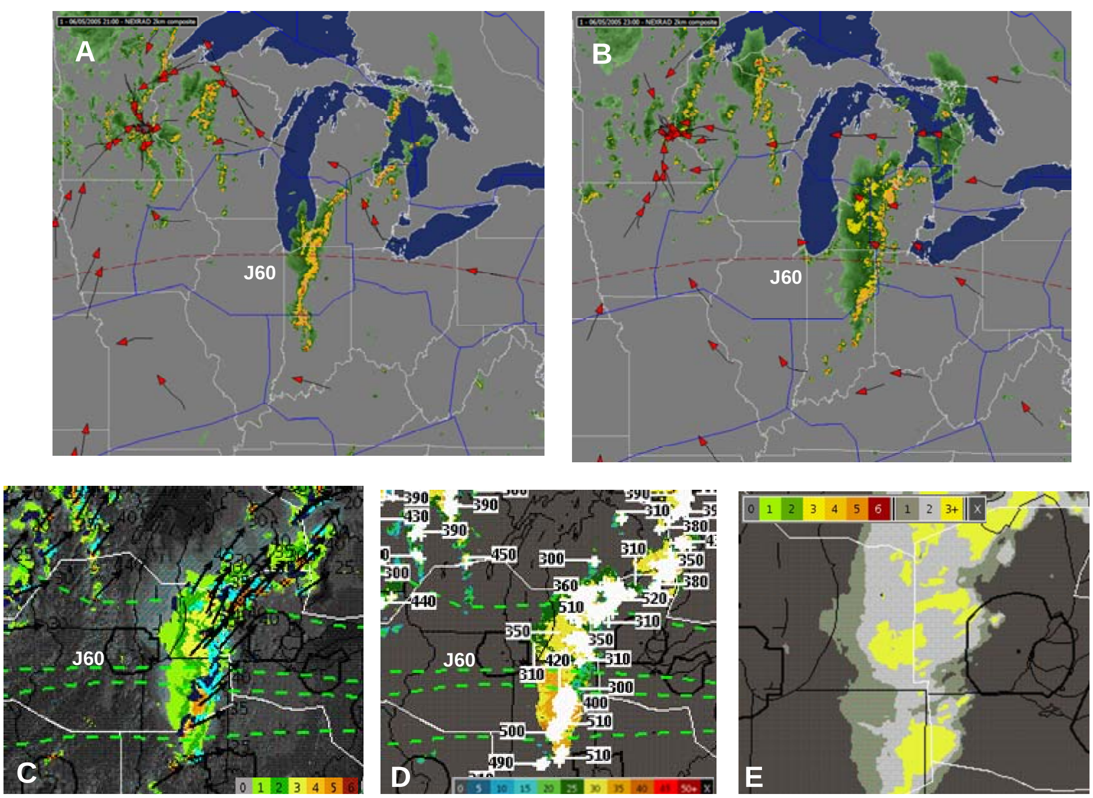

Figure 3-9. Flight track and WSI composite reflectivity information, provided by Flight Explorer, at (A) 2100 UTC and (B) 2300 UTC, depicting MSP arrivals (red), and CIWS (C) VIL Precipitation, Growth (hatched orange) and Decay (dark blue) Trends, and Storm Motion products, (D) Echo Tops Mosaic (with Echo Top Annotations) and Lightning products, and (E) 1-hour Precipitation Forecast product issued at 2230 UTC on 05 June 2005.

3. ZBW, 06 June 2005 - 1800 UTC: At 1730 UTC, multiple, heavy traffic flows continued on quasi-nominal routes over the CAM fix in central ZBW, despite the eastward progression of an intense, solid squall line, as well as scattered strong storm cells along the NY/VT border (Figure 3-10A). As the line continued eastward, it intensified, and new convection developed both along the line and in association with the storm cluster further northeast, suggesting that discrete convective elements would merge and form a solid line, blocking all key routes. If this convective weather merge were to occur, and traffic was still routing near the CAM fix, deviations, holding aircraft, and sectors filling towards capacity would result in excessive air traffic complexity concerns.

ZBW TMCs used CIWS extensively at 1800 UTC to weigh options and determine whether traffic could continue through Upstate NY or be ground stopped until weather conditions improved. Based upon CIWS forecasts for a persistent gap in level 3+ weather near the CAM fix in ZBW (Figure 3-10C), and high 30, 60, and 120-minute forecast accuracy scores (Figure 3-10C, inset), the ZBW TMU decided to keep multiple routes open through central ZBW. The ZBW TMU Supervisor then called ATCSCC and explained, in detail, the routing decision and CIWS evidence which supported it. Based upon CIWS, heavy traffic flows, including SWAP reroutes servicing metro-NY arrivals, continued (Figure 3-10B).

After this decision, the ZBW TMU Supervisor was interviewed and he confirmed that had CIWS not been available, he would have had much less confidence in his determination that routes between the two thunderstorm complexes could safely continue. He surmised that, without CIWS, he may have been convinced that the large gap in weather was going to fill in based upon only WARP or ETMS. He added that the "easier" decision (measured in terms of the time he took to use CIWS to diagnose the situation and then, after the decision, to iteratively monitor continued traffic flows through a weather-impacted region) would have been to shut off the routes in question, ground stop traffic, and wait for improvements. Had this alternate decision been reached, increased delays at multiple airports would have been substantial.

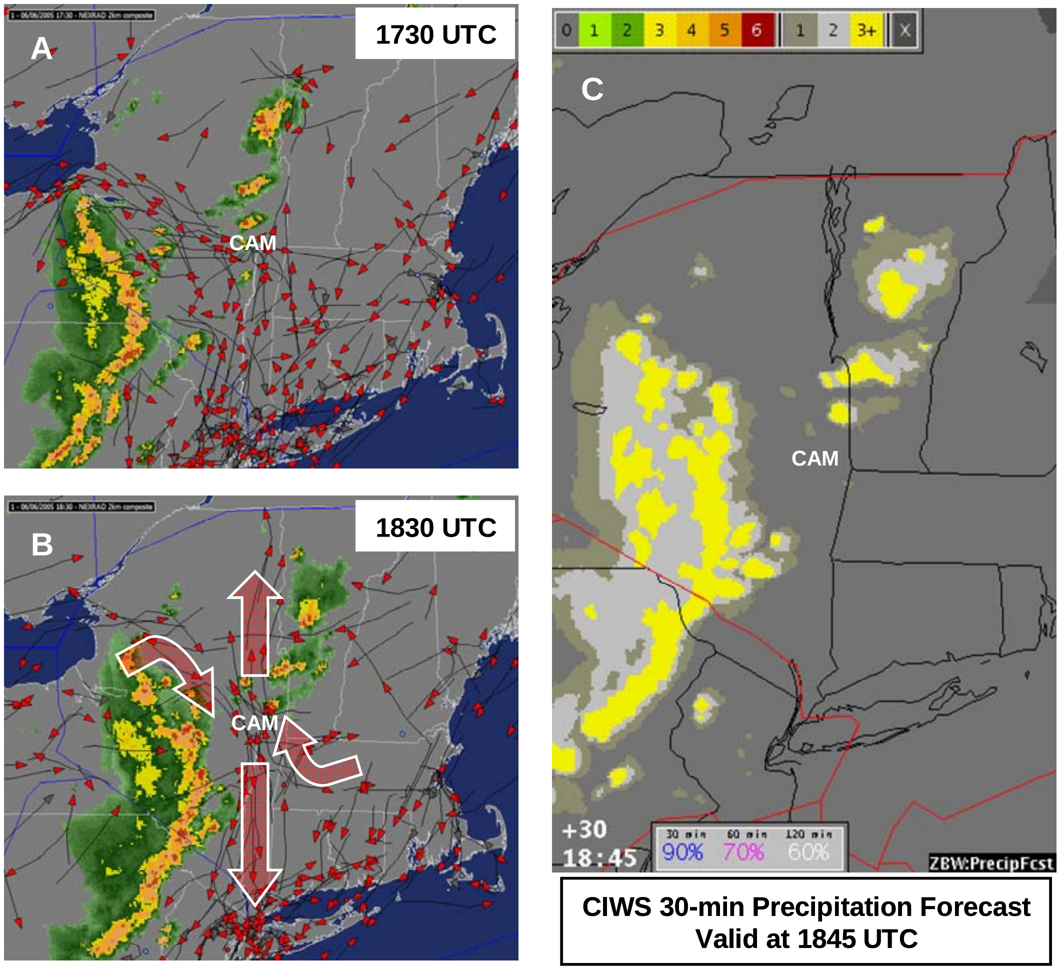

Figure 3-10. Flight track and WSI composite reflectivity, provided by Flight Explorer, at (A) 1730 UTC and (B) 1830 UTC on 06 June 2005, depicting all airborne aircraft at each respective time, and (C) the CIWS 30-min Precipitation Forecast product.

High-quality, CIWS-assisted ATC decisions, such as those exemplified in this Section, requiring extra near-term effort to reap significant airspace capacity enhancement benefits, were observed at each ARTCC and on every convective weather day studied in the 2005 CIWS benefits assessment campaign. This delicate balance between the quality of weather impact mitigation plans and the time/effort required to develop and implement plans must be considered when attempting to assess ATC productivity enhancements attributed to decision support tools, especially since extra work at one facility may result in significant workload savings at others.

3.4 CIWS OPERATIONAL EFFECTIVENESS CHANGES FROM 2003 TO 2005

Two other important objectives of the 2005 CIWS operational effectiveness assessment were to:

- Confirm previously established CIWS benefits categories and identify new applications
- Determine if the frequency of realized CIWS delay reduction benefits had changed since 2003

The CIWS operational effectiveness benefits categories and their frequency per ARTCC per convective weather day are presented in Table 3-4. Frequencies of CIWS benefits are color-coded to denote increases or decreases in the rate of CIWS usage per ARTCC in 2003 vs. 2005. The rate at which CIWS improved the quality of ATC weather impact planning decisions has increased significantly since 2003[12]. For example, use of CIWS to improve convective weather rerouting (Table 3-4, Category 3) increased by more than 100% since 2003 at all ARTCCs included in both studies.

TABLE 3-4
CIWS Benefits Categories and Frequency per ARTCC per Convective Weather Day

Benefit Category	ZMP	ZAU	ZOB	ZDC	ZNY	ZBW
(1) Keeping routes open longer and/or reopening closed routes earlier	2.0	1.2	5.2	5.2	1.5	2.8
(2) Closing routes proactively	0.2	0.2	0.9	0.5	1.5	0.8
(3) Proactive, efficient reroutes	3.8	2.2	4.9	4.8	2.0	2.8
(4) Improved Ground Stop program management (shorter/fewer stops, ground stops avoided, more efficient use of ground stops)	0.5	0.5	1.1	1.2	0.5	1.2
(5) Reduced MIT restrictions (proactive management of routes in use)	0.3	0.3	1.3	2.2	0.5	1.0
(6) Traffic directed through gaps	0.5	0.5	0.6	0.2	0.5	0.5
(7) Improved management of weather impacts on terminal ATA/DTA's	1.5	0.7	4.3	0.8	0.0	0.3
(8) Optimization of runway usage; enhanced runway planning	0.0	0.0	0.0	0.0	0.0	0.0
(9) Improved Ground Delay program management	0.0	0.0	0.6	0.2	0.0	0.0
(10) Greater departures during SWAP	0.5	0.5	0.9	0.3	0.0	0.3
(11) Directing pathfinders	0.7	0.3	0.6	1.2	0.3	0.3
(12) Interfacility, intrafacility coordination assistance	9.0	4.7	16.3	14.5	2.5	7.3
(13) Improved safety	0.2	0.0	0.4	0.7	0.0	0.0
(14) Reduced workload (includes proactive impact mitigation planning)	5.8	2.5	11.7	11.5	3.0	5.0
(15) FAA facility staffing assistance	1.2	0.2	0.7	0.2	0.0	0.7
(16) Situational awareness	9.5	9.5	13.0	13.3	4.5	16.8
# Days LL/FAA observers present	*6*	*6*	*9*	*6*	*4*	*6*

0 – 100% increase from '03
> 100% increase from '03
decrease from '03
no change from '03 or new user

***ZMP did not have CIWS in 2003*

Category #15 (staffing assistance) was new CIWS benefits classification in 2005

[12]See Robinson et al. (2004; Table 7-3) for frequency of ARTCC CIWS benefits in 2003.

Results per ARTCC in Table 3-4 were multiplied by common annual, climatologically-adjusted convective weather day metrics in order to estimate annual occurrences of CIWS operational effectiveness benefits. Complete details on ARTCC convective weather day statistics and the methodology used to incorporate long-term trends in thunderstorm activity are presented in Appendix C. A comparison of cumulative estimates of annual CIWS benefit occurrences for ARTCCs included in both 2003 and 2005 field use assessment campaigns is shown in Figure 3-11. The increased frequency in operational effectiveness benefits is likely due to a combination of (a) CIWS product enhancements such as the introduction of the 0-2 hour Echo Tops Forecast (Dupree et al. 2006), (b) increased confidence by ATC users in the deployed CIWS prototype, and in some cases, (c) availability of CIWS displays at ARTCC Area Supervisor positions (see Section 3.2).

Occurrences of two key CIWS en route operational effectiveness benefits categories, "Proactive Reroutes" and "Keeping Routes Open Longer", both of which were analyzed and modeled in great detail by Robinson et al. (2004), increased by 142% from 2003 to 2005 (see Figure 3-11) . A comparison of CIWS product usage in 2003 vs. 2005 for these two types of ATC benefits illustrates the greater reliance on established and new CIWS technology (Figure 3-12). Usage of all CIWS products increased in 2005. The 0–2 hour Echo Tops Forecast, which was developed in response to the observed importance of echo tops to traffic management, was not introduced until 2005. Despite being a new product previously unfamiliar to FAA field users, use of Echo Tops Forecasts in 2005 for enhanced jet route management exceeded the rate of use of established Precipitation Forecasts in 2003, underscoring the importance of storm height predictions to air traffic managers.

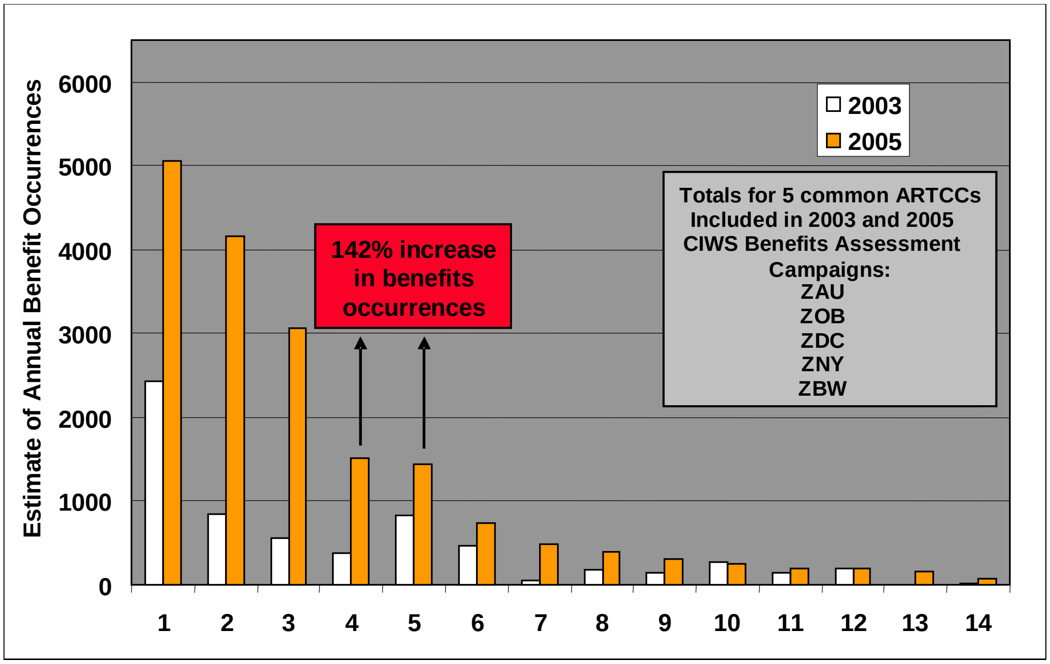

Figure 3-11. Estimate of annual occurrences of CIWS benefits realized at 5 ARTCCs in 2003 vs. 2005. Two specific en route benefit categories, "Proactive Reroutes" and "Keeping Established Routes Open Longer/Reopening Closed Routes Earlier", are highlighted to indicate the increased user frequency for realizing these significant delay and *workload saving applications.*

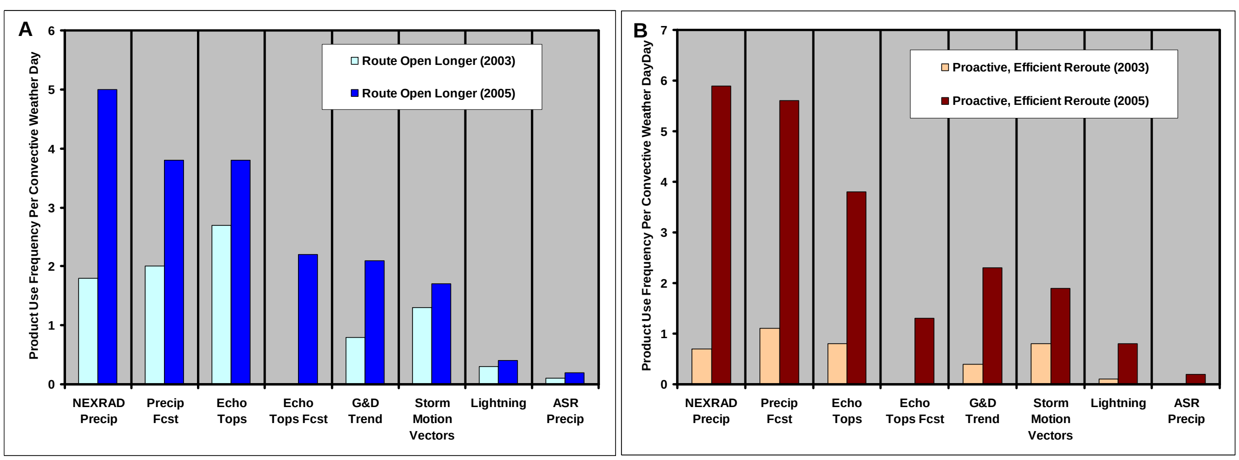

Figure 3-12. Frequency of CIWS Product Usage in 2003 vs. 2005 to achieve two primary CIWS en route operational effectiveness benefits: (A) Keeping Routes Open Longer and (B) More Proactive, Efficient Reroutes. Results demonstrate (1) the substantial increase in usage of all CIWS products for realizing these two types of benefits, and (2) the importance of Echo Tops information for achieving improved jet route management benefits.

3.5 ARTCC/TRACON WEATHER IMPACT PLAN COORDINATION ENHANCEMENTS ATTRIBUTED TO CIWS

Effective management of aircraft as they transition between en route and terminal airspace within an ARTCC is essential for optimal, seamless ATC operations in the NAS network. Its importance is amplified in the Great Lakes and East Coast traffic corridors, where large, high-demand terminals coexist in a high-demand en route airspace environment nominally operating near full capacity. Mitigation of convective weather impacts on transition airspace operations can not only reduce air traffic delay, but can greatly reduce airspace complexity that may otherwise limit ATC productivity.

Significant benefits pertaining to improved decisions in arrival/departure transition areas (ATA/DTA) have been achieved through the use of CIWS (Robinson et al. 2004; Figure 3-11, this Report). During the 2005 benefits assessment campaign, traffic managers and Area Supervisors were observed using CIWS products during several weather impact situations to develop and execute more proactive, higher-quality ATA/DTA traffic routing decisions. Below is an example of ARTCC applications of CIWS that enhanced ATA/DTA management.

ZOB, 30 June 2005, 1415-1600 UTC: As a large, solid squall line approached Detroit (D21) TRACON, traffic managers at ZOB, D21, and Northwest Airlines (NWA), for which DTW airport serves as a hub, were concerned that the convective weather would reach the terminal before the completion of a large East Coast arrival push (Figure 3-13A). There was additional concern as to the continued availability of ATA/DTA airspace south of D21 as the squall line progressed towards this region. Collaborations amongst these parties based upon the CIWS 60, 90, and 120 min Precipitation Forecasts led to the decision that arrivals from the east could safely land at DTW before the squall line reached the terminal, and thus were allowed to proceed at nominal demand (Figure 3-13B). As thunderstorms impacted DTW ATA/DTA airspace south of the TRACON, CIWS VIL Precipitation, Storm Motion, Growth and Decay Trends, Echo Tops, and Precipitation and Echo Tops Forecast products were used by ZOB to keep routes open longer by way of tactical deviations (when needed). In addition, using impact timing based upon CIWS Forecast and Storm Motion products, ZOB was able to delay the closure of DTW southwest arrival and departure fixes, thus postponing moving this traffic to the southeast cornerpost and avoiding delays that would have resulted due to prolonged capacity restrictions.

In this instance, improved management of en route/terminal transition airspace derived from CIWS information helped increase ATC productivity. This increase resulted in significant air traffic delay reductions since the use of available airspace during a highly-intrusive convective weather impact was optimized. Specifically, by ensuring that controllers had aircraft in their sectors when the weather was in their favor and limited traffic in their sector when convective weather prevented efficient traffic routing, controller efficiency was maximized, and productivity was high.

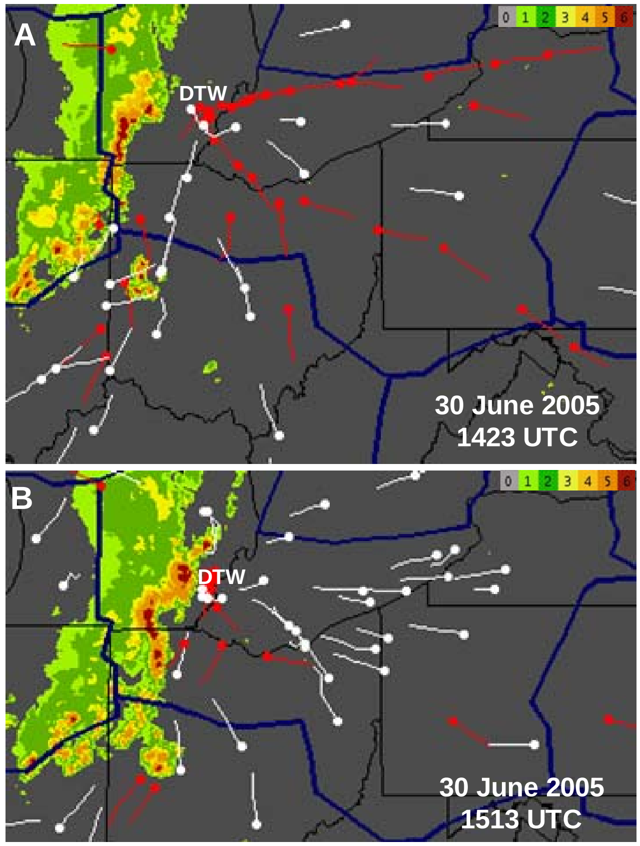

Figure 3-13. CIWS VIL Precipitation and DTW arriving (red) and departing (white) traffic at (A) 1423 UTC and (B) 1513 UTC on 30 June 2005.

The ability to develop and execute these weather impact mitigation plans in a timely manner was likely enhanced through common situational awareness on the part of all traffic management facilities impacted by the event. During this storm impact event, traffic managers at D21 TRACON, NWA, and at ZOB (in Areas, and numerous positions within the TMU) all had access to CIWS, and used it to improve interfacility plan coordination. Observations of traffic management operations demonstrate that common access to CIWS weather products is extremely beneficial when attempting to coordinate plans that are aggressive and seek to maintain significant traffic demand despite what at first glance appears to be extremely disruptive thunderstorm events.

Of all ARTCCs with access to CIWS where TFM observations were conducted in 2005, ZOB proved to be most proficient in realizing CIWS benefits relating to improved management of ARTCC/TRACON transition airspace during convective weather impacts (Table 3-5). In fact, ZOB made improved transition airspace management decisions, derived from CIWS, at a rate approximately 30% greater per convective weather day than all other facilities under investigation *combined*. Reasons for this disparity may likely be due to unique ZOB attributes pertaining to proliferation of CIWS displays and available TMU staff. Only at ZOB were plan development, coordination, and execution decisions for improved ARTCC/TRACON transition airspace management facilitated by CIWS access at <u>all</u> of the following FAA inter/intra-facility coordination points (Table 3-6):

1. ARTCC TMU
2. All ARTCC TMU spacing positions
3. ARTCC Areas Supervisor positions
4. All large TRACONS within parent-ARTCC
5. All neighboring ARTCCs

At ZOB, all four nominally-manned spacing positions in the TMU have direct access to CIWS displays. There are seven total CIWS displays in the ZOB TMU. Each of the three largest TRACONS in ZOB airspace, Detroit (D21), Cleveland (CLE), and Pittsburgh (PIT), also has access to dedicated CIWS displays. In addition, CIWS displays were also available at some ZOB Area Supervisor positions. Common access to CIWS among these FAA parties allows for direct coordination of plans addressing transition airspace concerns between the TMU Supervisor, TMU spacing positions, TMU Area Supervisors, and TRACON traffic managers. This in turn increases the likelihood of implementing aggressive TFM strategies that increase ATC productivity and reduce delay when ARTCC/TRACON boundaries are impacted by convection. Increased benefits however are not only due to improved coordination through common viewing of CIWS products, but also because more traffic managers are able to utilize CIWS to recognize opportunities and devise plans for more effective transition airspace management, further increasing productivity. Moreover, given that effective, proactive transition airspace impact planning often involves tactical management at time and flight distance horizons beyond the impacted ARTCC, coordination of CIWS-enabled ATA/DTA decisions within ZOB is further aided by common situational awareness of this weather decisions support tool by all neighboring ARTCCs (ZAU, ZID, ZDC, ZNY, and ZBW).

By comparison, ZDC currently lacks many of the elements that allow ZOB to achieve increased ARTCC/TRACON transition airspace management enhancements. Specifically, unlike ZOB, ZDC:

- Does not man all TMU spacing positions
- Does not have access to CIWS at all TMU spacing positions
- Contains a large TRACON (PCT) that does not have access to CIWS
- Has neighbors that do not have access to CIWS (ZTL, ZJX)

Although more detailed analysis is needed, our TMU observations and preliminary analyses strongly suggest that greater proliferation of dedicated CIWS displays both within the ARTCC TMU (Areas, TMU spacing positions), at TRACONS within the ARTCC, and at all neighboring ARTCCs significantly increases ARTCC/TRACON transition airspace management benefits.

TABLE 3-5
CIWS ARTCC/TRACON Transition Airspace Management Benefits per ARTCC in 2005

ARTCC	Use of CIWS for Improved Management of Weather Impacts on ARTCC/TRACON Transition Areas *(per Convective Weather Day)*
ZMP	1.5
ZOB	4.3
ZDC	0.8
ZAU	0.7
ZNY	0.0
ZBW	0.3

TABLE 3-6
CIWS Availability Comparisons

CIWS available at:	ZOB	ZDC	ZMP	ZNY	ZAU	ZBW
ARTCC TMU	YES	YES	YES	YES	YES	YES
All TMU spacing positions	YES	No	No	No	No	No
ARTCC Areas	YES	YES	YES	No	No	No
Large TRACONS within parent ARTCC	YES	No	No	YES	YES	No
All neighboring ARTCCs	YES	No	No	YES	YES	YES

4. WEATHER IMPACT PLANNING AT ARTCC WITHOUT CIWS

The design of the 2005 CIWS benefits assessment campaign included CIWS "baseline" observations at two ARTCCs without access to CIWS: Atlanta (ZTL) and Jacksonville (ZJX). With in situ observations available at ZTL and ZJX, comparisons of TMU operations, with and without access to CIWS, can be made and CIWS benefit estimates can be better validated. To date, analysis of observation data has been completed only for ZTL, which is therefore the focus of this Section.

Observations of TMU activity at ZTL during seven convective weather days revealed three primary points of emphasis, as they relate to productivity benefits of CIWS and comparisons with this "non-CIWS" ARTCC:

1. ZTL operations, where primary focus is placed on servicing ATL traffic flows, is very different from the neighboring ARTCCs (specifically ZDC, where CIWS is widely accessible)

2. ZTL airspace management is aggressive, and weather impact mitigation decisions are made as quickly as at neighboring ARTCCs with CIWS, using other decision support tools

3. ZTL TMU personnel acknowledge, and post-analyses confirm, that their weather planning decisions, though often made quickly, can at times be less proactive and thus less optimal (from standpoint of delay reductions and ATC complexity mitigation) than they would be with access to tactical decision support information provided by CIWS

Each of these points is discussed below.

4.1 ZTL OPERATIONS AND GENERAL COMPARISONS TO ZDC

The busiest passenger airport in the world is Atlanta Hartsfield-Jackson International Airport (ATL). ATL is the primary hub for Delta Air Lines, and serves as a major connection point for destinations throughout the U.S., as well as international flights. Arrivals and departures to and from this one airport account for 25–30% of all air traffic within ZTL. Servicing en route traffic to and from ATL is the primary operational task of the ZTL TMU.

Given high and nearly continuous, daily ATL traffic demand, ZTL, working closely with the Atlanta TRACON (A80) and ATL Tower, seek to keep constant pressure on the airport to ensure that use of available arrival and departure slots are optimized and delays are minimized. The sector configuration of ZTL, with ATL in the middle and sectors funneling into and out of A80 in all directions, helps facilitate optimal ATL traffic efficiency (Figure 4-1). The terminal-centric airspace design of ZTL differs significantly from the airspace configuration of ZDC, where over-flight traffic is more predominant and sectors are configured to optimize traffic flows between the Northeast (metro NY, PHL, and BOS) and ATL and Florida (see Figure 4-1).

Analyses of flight tracks through ZTL reveal the aggressive traffic flow management approach of the TMU. Jet routes are rarely closed during convective weather events. Instead, aircraft are often allowed to deviate around weather as necessary, returning to their prescribed flight path when able. Reroutes are commonplace, but in comparison to other ARTCCs, are generally more localized and short-lived.

Due likely to differences in airspace configuration and over flight air traffic demands, route closures and increased reroutes are a greater necessity in ZDC during convective weather impacts. ZDC sectors, running northeast to southwest and surrounding key over flight jetways, are narrower than ZTL sectors, which means there is less room to deviate before coordination with a neighboring sector (and extra controller workload) is required (see Figure 4-1). Conversely, ZTL may be more apt to leave routes open, with considerable deviations. The reason for this is that ZTL has much more short-term control of airborne volume in their airspace, since roughly one in four flights in this Center is bound for, or departing from, ATL. If route deviations within ZTL become too severe, the TMU can request a departure stop at ATL and receive almost immediate volume relief. Then, once this airborne traffic concern is met, ATL can be released and nominal flows resume just as quickly.[13] ZDC, however, often manages traffic from large airports outside of their Center and therefore can not quickly stop/restart flows for tactical route management. Instead, routes in ZDC with significant deviations are often closed to prevent sector overloads that can not be more quickly protected against, as in ZTL.

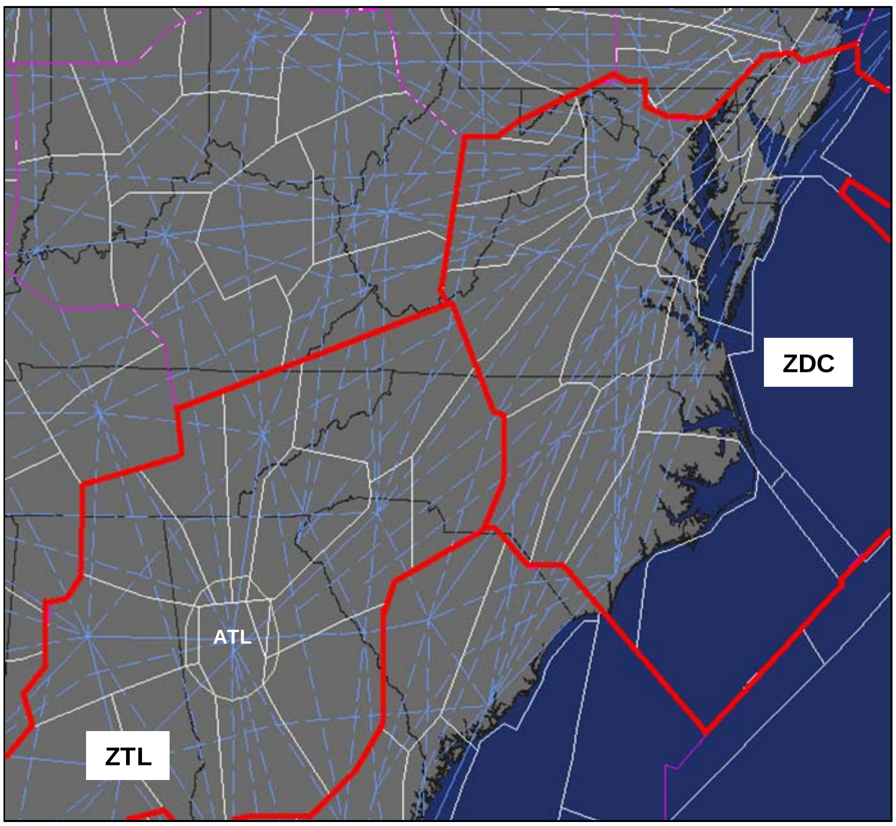

Figure 4-1. ZDC and ZTL ARTCCs (boundaries in red), showing high sector boundaries (white) and high-altitude jet routes (dashed blue). Circle in ZTL ARTCC marks the Atlanta TRACON (A80) boundary, with ATL airport in the center.

[13] It is important to note that a total ATL departure stop would be extremely rare. Most often, departure restrictions would be used, and would only be placed on the departure gates necessary to resolve the problem at hand (e.g., single stream out of north gate, two streams (standard) but with MIT restrictions (10-20), or completely close a gate or two based on weather). Only after all other restrictions out of all gates failed to resolve the problem would a full ground stop be placed on ATL.

Additionally, given the sector configuration of ZTL (wider sectors, designed to service ATL operations), and the ability for ZTL to quickly restrict the dominant flows in the Center, ZTL is in better position to accommodate holding stacks than ZDC. Knowing that holding is still a reasonable option should airborne volume swamp routing capabilities during storm impacts, ZTL may be more apt to keep routes open during what appears to be a significant convective weather event. Because of the large, daily ATL traffic demand, holding is standard operating procedure in ZTL and can happen numerous times per day, regardless of weather[14].

4.2 ZTL TMU "HIGH-QUANTITY" WEATHER IMPACT MITIGATION DECISION-MAKING

ZTL TMU observations during convective weather impacts revealed that in general, convective weather impact mitigation planning decisions were made just as quickly as at ARTCCs with access to CIWS. As ZTL traffic managers sought to keep constant pressure on ATL, even during thunderstorm events, they were forced to make rapid decisions based upon weather decision support tools available. These tactical planning decisions were the best possible decisions based upon the information available. But, lacking specific tactical convective weather decision support information provided by CIWS, some decisions may not have been optimal and at times, missed opportunities for more efficient TFM occurred.

Recall from Figure 2.2 that there is a tradeoff in traffic flow management between the time available to make a decision and the quality of that decision. Increased TFM productivity can reduce the time needed to make a decision, improve the quality of the decision, or both. At ZTL, where CIWS is unavailable, traffic managers were often unaware that potentially higher-quality plans, illustrated by this decision support tool, were a possibility and thus, made very quick decisions based on other tools at their disposal. By contrast, ZDC, bordering ZTL and managing traffic during similar convective weather impacts, made decisions in roughly the same time as ZTL, but decisions derived from CIWS were considered higher quality, as measured by both the increased efficiency in using available airspace and the confidence in these decisions by ARTCC personnel. ZDC traffic management personnel informed observers that they often do not consider themselves fully informed to make a weather impact mitigation decision without the detailed CIWS information on echo tops, growth and decay trends, and high-resolution precipitation and storm height forecasts. Since they have come to expect these data, estimates from TMCs of time savings for devising a plan and implementing it at ZDC were based upon what extra time they felt would have been needed to either obtain similar, detailed weather information from the CWSU, or to attempt to extrapolate this information from other tools, had CIWS not been available. In other words, CIWS has allowed this ARTCC to devise higher quality weather impact mitigation plans in a much more timely manner. ZTL excels at aggressive airspace management during convective weather impacts, and makes decisions quickly with the TMU tools available, but access to CIWS would also likely improve the quality of some planning decisions and further improve TFM in this ARTCC.

4.3 IMPROVING ZTL WEATHER IMPACT MITIGATION PLAN QUALITY WITH CIWS

In Section 3.3, it was discussed that in addition to TMU plan development time savings, another, potentially more important manner in which ATC productivity enhancements from CIWS are defined is in terms of the development of proactive, <u>higher-quality</u> decisions that reduce airspace complexity and decrease airspace management workload at multiple facilities, *even at the expense of increased near-term plan development effort.* Observations confirmed that the ZTL TMU makes quick weather impact decisions. The potential difference between ZTL and other ARTCCs with access to CIWS, such as ZDC,

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[14] Allan and Evans (2005) has a number of figures that show the extent of holding both within ZTL and in ARTCCs north and west of ZTL when convective weather is present in this ARTCC.

is that the quality of some decisions at ZTL may not have been optimal. Access to CIWS at ZTL may have provided more opportunities to improve traffic flow management efficiency. Identification of potential missed opportunities for proactive and/or more efficient plan development and execution at ZTL is considered by the authors as the best approach for using non-CIWS ARTCC observations to support productivity enhancement assessments at CIWS-enabled ARTCCs.

During the 2005 storm season, ZTL TMU personnel, without access to CIWS, but with basic knowledge of the information it provides, were already aware of limitations of their available weather decision support tools and how CIWS could address deficiencies in weather impact mitigation planning. Following is a sample of ZTL TMC feedback gathered during the CIWS field campaign documenting examples of current tactical planning shortcomings, and how CIWS may help to address these concerns:

- **ZTL, 27 June 05 – 2027 UTC:** Significant storms were present along the ZTL/ZJX border. The ZTL TMU was having a difficult time deciding on a reroute. The STMC stated, "[CIWS] growth and decay info and a forecast loop would have saved us 10 – 20 minutes".

- **ZTL, 27 June 05 – 2222 UTC:** Weather was blocking Charlotte Airport (CLT) westbound departures. Weather was decaying but it took the TMU 10 minutes to confirm this trend (using ITWS, WARP, CWSU). The STMC stated that explicit storm trends information (available via CIWS) would have given him "at least a 15 minutes heads-up".

- **ZTL, 29 June 05 – 1748 UTC:** ZID requests that northbound flights be capped at Flight Level (FL) 230 because they are unable to get above the thunderstorms. ZTL honors the request, but complains that the only storm tops reports they have are on ETMS. ETMS at the time showed many scattered storms in the area, but only one tops report of 45 kft covering over 100 miles of airspace. With only this echo tops information, ZTL could not identify a more suitable plan.

- **ZTL, 29 June 05 – 1859 UTC:** ATL arrivals from NY were landing over the Macey fix, northeast of the airport. The TMU was unsure if convective activity would build and intensify. A three-step contingency plan was developed should storms grow and impact the Macey fix. Storm activity did not intensify, the fix remained clear, and the extra planning was not required.

- **ZTL, 29 June 05 – 2145 UTC:** A level 3 storm was present immediately northwest of the ATL runways. The TMU was concerned about the potential impact on a heavy arrival push expected over next hour (115 aircraft). The storm strengthened to level 4, but precipitation fell on only the western half of the runways during the push. No action was taken by the TMU because they "had no idea what this cell was doing". A TMC stated that the CIWS Trends product would have been extremely helpful in this situation.

Based upon analysis of flight track data, and what is known of the specific, "airport-centric" airspace configuration, significant traffic management tasks for a single terminal, and operational approaches that stress aggressive route management (described in Section 4.1), the primary potential benefits of CIWS in ZTL are considered to be:

1. Improved operational efficiency of Arrival/Departure en route Transition Areas (ATA/DTA), including improved tactical reroute efficiency
2. Improved use of departure restrictions
3. Improved efficiency in managing holding stacks
4. Improved Ground Stop and Ground Delay Program efficiency

Two ZTL "missed opportunity" examples, where CIWS may have increased operational efficiency and reduced ATC workload, are as follows:

1. 12 July 2005, 1700 - 1900 UTC: A cluster of thunderstorms developed in central ZTL, just west of A80 TRACON, after 1600 UTC. This cluster intensified slowly for the next hour, then began rapidly to fill in and form a near-solid line after 1700 UTC. During this period, ATL west gate arrivals and departures were allowed, at reduced rates, to pick through gaps in en route ZTL convection. However, by 1745 UTC, aircraft arriving at ATL refused to penetrate weather just outside the A80 TRACON, resulting in several unexpected and disruptive deviations (Figure 4-2A).

Specifically, at least 12 ATL arrivals in en route airspace made sharp deviations as they scrambled to other weather-free arrival fixes. This resulted in significant increases in ZTL workload since, with little notice, controllers and traffic managers had to react to:

- Arriving traffic deviating into neighboring sectors. Each of these flights required that controllers call neighboring sectors when they approached 2.5 miles of the sector boundary. Since deviations were unexpected, some aircraft, particularly those deviating near the TRACON boundary required immediate coordination and attention for reroutes and sector hand-offs, likely causing controllers to scramble to complete these tasks.

- Arrivals unexpectedly deviating and crossing departure flows close to the TRACON boundary, significantly increasing complexity and safety concerns, and controller workload. This situation also resulted in increased ATL departure delays as one of two westbound departure streams had to be stopped to accommodate the deviating arrivals.

- Inbound ATL traffic, outside of ZTL, still on this now-closed route. As a result, quick, unplanned reroutes that must be coordinated with neighboring ARTCCs [Figure 4-2A; circled flights in Memphis ARTCC (ZME) airspace] were required.

In addition, after initially accommodating the unexpected deviations, unscheduled reallocation of ATL arrivals to fixes that remained open had to be coordinated (Figure 4-2B), further increasing traffic management and controller workload. One possible consequence of scenarios such as this is an increased safety concern, as affected controllers likely had less time to provide extra attention in directing aircraft lacking onboard weather radars through weather-impacted airspace.

A comparison of CIWS and CCFP convective weather forecast information (Figures 4-2C, D) demonstrate how CIWS availability at ZTL may have allowed for more proactive decision-making. While the CCFP forecast, valid at 1700 UTC, predicted, with low confidence, only a small "low coverage" region of potential convective weather, the CIWS one-hour forecast, predicting an intensifying, solid squall line of convection west of A80, more accurately represented the seriousness of the thunderstorm impact. Had this CIWS forecast information been available at ZTL, traffic managers would have had a better understanding of the expected convective weather impact on key en route/terminal transition airspace northwest of ATL, possibly motivating them to proactively develop SWAP reroute plans.

It is worth noting that even with the unexpected deviations due to weather, and subsequent workload and airspace complexity concerns, ZTL and A80 TRACON still managed to react quickly and adopt a well-devised reaction plan that maintained significant ATL traffic flows. However, the ability to react to unexpected, chaotic traffic flow patterns may be constrained now that the new, fifth ATL runway is available (Figure 4-3). With now three arrival runways, ATL arrival capacity increases by 33%. The need for improved weather decision support information provided by CIWS will be even more important if increases in operational efficiency are to keep pace with projected increases in air traffic.

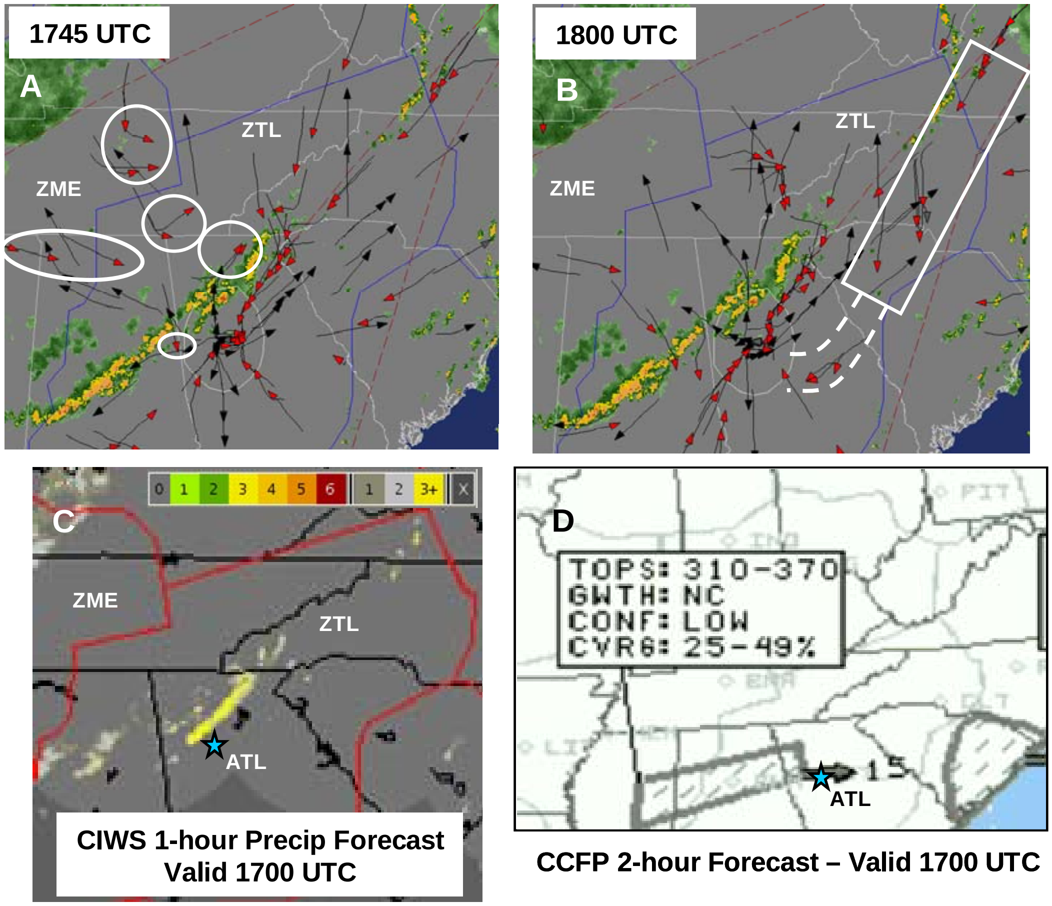

Figure 4-2. Flight tracks and WSI composite reflectivity information, provided by Flight Explorer, showing ATL arrivals (red) and departures (black) at (A) 1745 UTC and (B) 1800 UTC on 12 July 2005, and (C) CIWS 1-hour Precipitation Forecast product, valid at 1700 UTC, and (D) CCFP 2-hour forecast, valid at 1700 UTC. ATL arriving flights that deviated unexpectedly are circled in (A). Boxed region in (B) denotes ATL arrival stream moved unexpectedly to another arrival fix in order to accommodate deviating arrivals from the west.

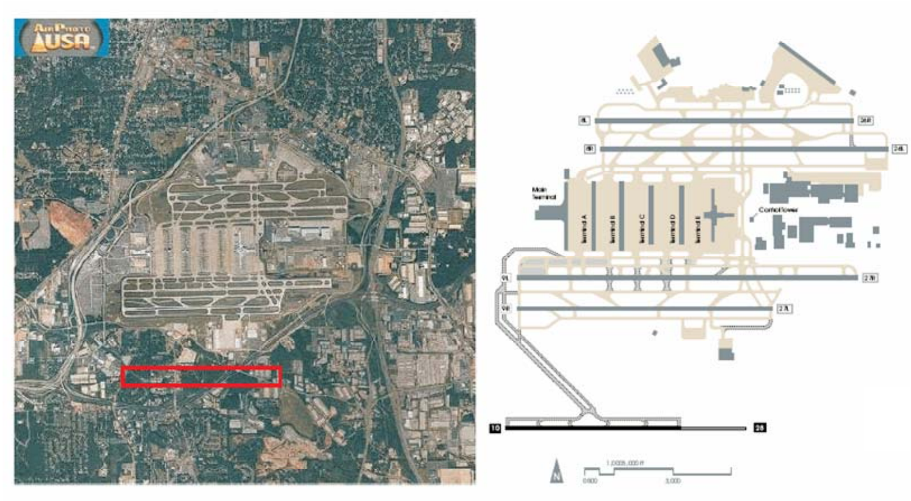

Figure 4-3. Available ATL runways after completion of southernmost, fifth runway (red box) (FAA, 2003).

2. 14 July 2005, 2100 UTC: Numerous clusters of unorganized convection were present throughout ZTL airspace. Holding stacks for ATL arrivals were intermittently required to help manage short-lived convective weather impacts on A80 arrival cornerposts. At 2100 UTC, ATL arrivals were holding at published holding areas southeast and northwest of A80 TRACON (Figure 4-4; NW holding pattern circled in white). At this time, the sector controller managing holding aircraft in a published stack northwest of the airport accepted additional aircraft in the sector, to be added to this stack. Once the sector controller accepts these aircraft, they are his/her responsibility and passing them back to the delivering sector is unlikely. Unfortunately, storms present in this sector intensified before these additional aircraft could be added to the published holding stack. As a result, these flights were forced to hold in an unpublished holding stack in the northwest corner of this sector (Figure 4-4; red circle).

From the standpoint of pilot and controller workload, considerably less effort is required to hold aircraft at published holding locations. When using published holding patterns, controllers can quickly advise pilots to "hold as published" at a specific hold location. When aircraft are forced to hold at unpublished locations, controllers must describe the holding location in detail to each pilot going into the stack. Moreover, use of unpublished holding areas often requires on-the-spot investigations by the controllers as to whether holding in a particular area satisfies legal safety standards, such as (a) is the holding stack too close to neighboring sectors, or (b) will the stack impact other flows, etc. In these situations, more coordination and controller workload is required.

During the 14 July convective weather event, if ZTL ATC personnel had had access to CIWS, use of the storm Growth Trends product may have alerted traffic managers and controllers that the storm cluster northwest of the TRACON was intensifying and would prevent flights from reaching the published holding stack. In that case, ZTL might have instead held these additional aircraft at the published ATL holding area immediately west of the unpublished holding stack. This would have significantly reduced short-term controller workload and mitigated ZTL airspace complexity issues.

Finally, as discussed in the previous "missed opportunity" example, ZTL productivity enhancements and improvements in operational effectiveness will become more important once the fifth ATL runway (third arrival runway) becomes available and traffic volume substantially increases. In 2005, With four ATL runways available, there were more than 100 ATL arrivals within one hour of the airport during peak traffic periods. With the opening of the fifth runway in 2006, there could be more than 150 arrivals within one hour of ATL airport. Given the numerous thunderstorms in ZTL during the summer SWAP season, and the aggressive management style of ZTL, A80, and ATL tower, efficient management of holding patterns will become even more important in the near future. Access to CIWS at ZTL could prove to be useful in meeting high ATC productivity standards as traffic volume and resultant complexity concerns continue to grow.

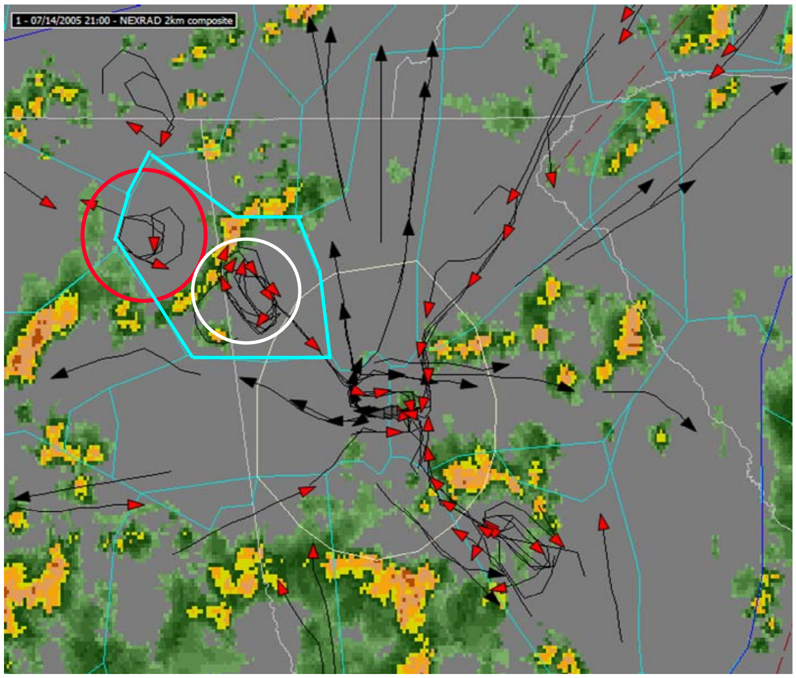

Figure 4-4. Flight tracks and WSI composite reflectivity information, provided by Flight Explorer, at 2100 UTC on 14 July 2005. ATL arrivals are in red, while departures are black. Circled aircraft denote two holding patterns within one sector: white circle denotes a published holding stack, which requires less controller workload to set up and manage; red circle denotes an unpublished holding stack, requiring more controller workload to coordinate. Depictions of intensifying convection between these two holding region (e.g., through the CIWS Growth Trend product (not shown)) may have alerted ZTL traffic management that additional aircraft en route to the published holding stack should be held at the published holding area in the neighboring sector to the west. This would have reduced controller workload and airspace complexity.

5. QUANTIFIED 2005 CIWS DELAY SAVINGS

The results presented in Section 3 show that an important component of improved ATC productivity provided by CIWS is the identification and implementation of higher *quality* weather impact mitigation plans. In this context, higher quality plans are those which increase the use of available capacity and/or maintain nominal airspace structure and traffic flow predictability. In this Section, this enhanced effective capacity during adverse weather is translated into delay and cost savings for the NAS stakeholders and customers (particularly, the commercial airlines and air travel passengers).

Based on the 2003 observations, the preliminary estimates of annual CIWS delay and operating/passenger cost savings, attributed to improved jet route capacity and more proactive, efficient rerouting schemes, exceeded 40,000 hours and $125M [15] (Robinson et al. 2004; Tables 7-10, 7-11). Substantial increases in 2005 in the rate of capacity-enhancing decisions made with CIWS (see Table 3-4, Figures 3-11, 3-12; this report), combined with higher airline operating costs (largely due to historical gains in jet fuel prices), suggest that CIWS delay savings have increased dramatically compared to the 2003 estimates.

Presented in this Section is a review of the methodology used in past studies to estimate annual delay and cost savings based upon daily CIWS observations. Using 2005 benefits frequencies and airline operating cost metrics, the annual CIWS delay savings estimates have been recalculated. Finally, jet fuel cost and consumption savings, attributed to beneficial traffic management decisions derived from CIWS are presented.

5.1 METHODOLOGY OVERVIEW FOR ESTIMATING ANNUAL CIWS DELAY SAVINGS

The method for quantifying annual CIWS delay savings based upon field-use observations in 2005 uses the methodology in the benefits assessment studies conducted in 2003-2004 (Robinson et al. 2004). Complete details of this methodology are available in Chapters 5 and 7 of Robinson et al. (2004).

A summary of the approach for estimating annual delay savings within the framework of an in situ field-use observation campaign is presented in Figure 5-1. Specifically, with this approach, annual CIWS delay savings attributed to specific benefits applications (e.g., keeping jet routes open longer) can be determined when the variables in the following equation are known quantities, and results are summed up for all ARTCCs under study:

$$A_{Bi} = \sum_{ARTCC}[M_{Bi}*(FD_{Bi}*Y)] \qquad \text{(Eq. 5-1)}$$

A_{Bi}: Annual Delay Savings for Benefits Category, B_i, where i ranges from 1 to N
M_{Bi}: Mean/Median ARTCC delay savings benefit (time or monetary) per decision for Category, B_i
FD_{Bi}: Frequency of Benefit B_i per Convective Weather Day per ARTCC
Y: Climatologically-based frequency of convective weather days per ARTCC per year

Summing annual delay savings from all individual CIWS benefits categories, B_i to B_N, yields total annual savings.

[15] These CIWS delay reduction benefits estimates do not include downstream airline operating cost savings.

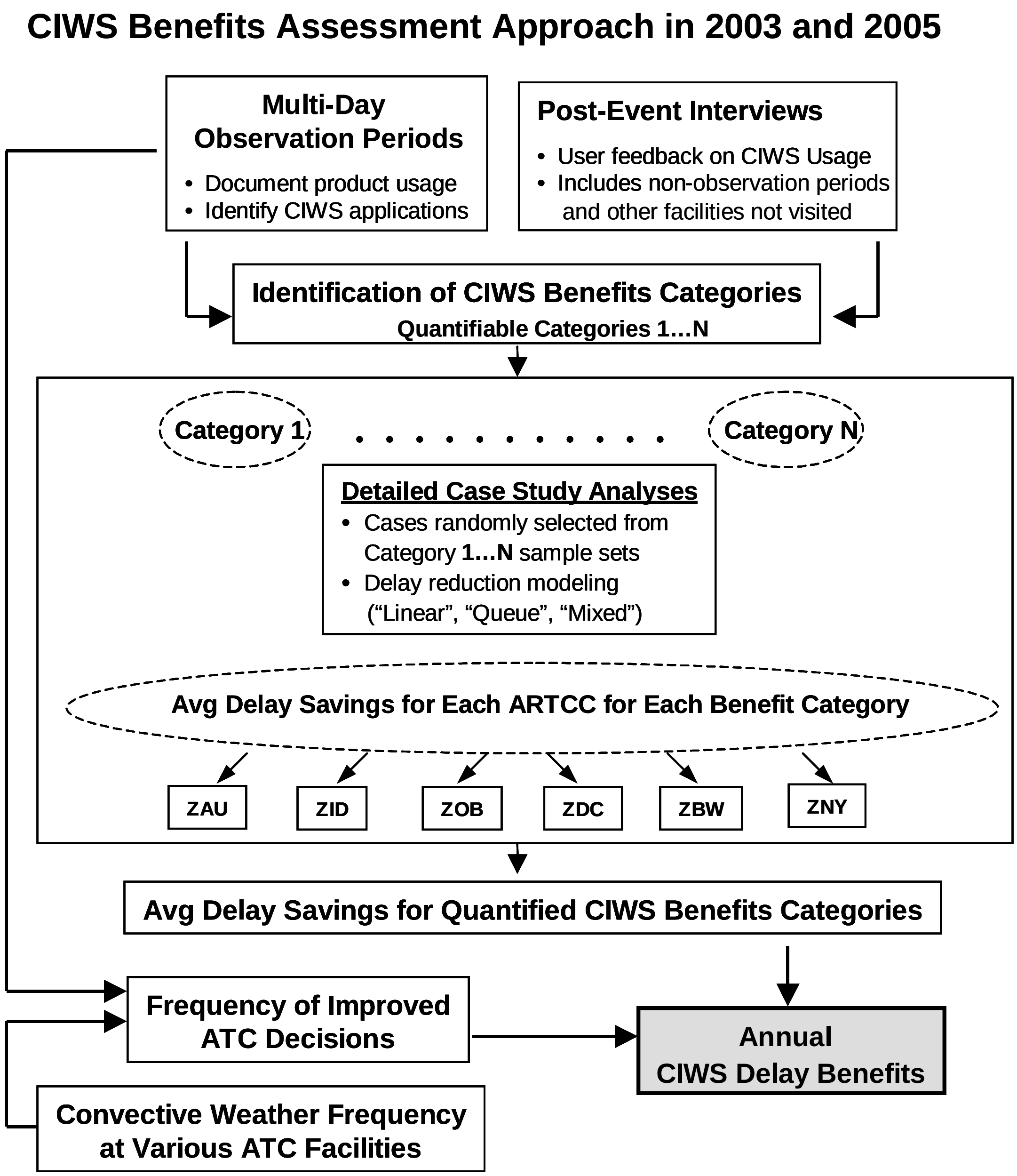

Figure 5-1. Methodology used to estimate 2003 and 2005 CIWS annual delay reduction benefits. The 2003 results for ‘Average Delay Savings for CIWS Benefits Categories’ were used with 2005 estimates of the ‘Frequency of Improved ATC Decisions’ to arrive at the 2005 annual delay benefits estimate.

5.2 ANNUAL FREQUENCY OF BENEFICIAL DECISIONS DERIVED FROM CIWS

Delay savings estimates in 2003 and 2005 focus on two primary CIWS benefits categories: Keeping Jet Routes Open Longer (ROL) and Proactive, Efficient Reroutes (PRR). Observed ROL and PRR benefits per convective weather day per ARTCC in 2003 and 2005, rolled-up by annual, climatologically-adjusted convective weather days (see Appendix C) to determine ARTCC benefit frequency per year, are presented in Table 5-1. The results in the right columns correspond to the term (FD * Y) in Eqn. 5-1.

TABLE 5-1
2003 and 2005 CIWS Benefits Frequencies per ARTCC for Categories, "Keeping Routes Open Longer" (ROL) and "Proactive, Efficient Reroutes" (PRR)

ARTCC	2003 ROL per Storm Day	2005 ROL per Storm Day	'05/'03 ROL Ratio	2003 PRR per Storm Day	2005 PRR per Storm Day	'05/'03 PRR Ratio	Climo-based Annual Storm Days	2003 Annual ROL	2005 Annual ROL	2003 Annual PRR	2005 Annual PRR	2003 Annual Combined	2005 Annual Combined
ZAU	0.8	1.2	1.5	0.3	2.2	7.3	111.2	89.0	133.4	33.4	244.6	122.4	378.0
ZID	1.1	N/A	N/A	0.4	N/A	N/A	103.5	113.9	113.9	41.4	41.4	155.3	155.3
ZOB	1.9	5.2	2.7	1.1	4.9	4.5	90.2	171.4	469.0	99.2	442.0	270.6	911.0
ZDC	3.4	5.2	1.5	1.7	4.8	2.8	102.8	349.4	534.6	174.8	493.4	524.6	1028.0
ZBW	1.7	2.8	1.6	0.1	2.8	28.0	68.7	116.8	192.4	6.9	192.4	123.7	384.8
ZNY	1.5	1.5	1.0	1.0	2.0	2.0	69.3	104.0	104.0	69.3	138.6	173.3	242.6
TOTAL	10.4	17.0		4.6	17.1			944.5	1547.3	425.0	1552.4	1369.9	3099.7
ZMP *	N/A	2.0	-	N/A	3.8	-	111.2 †	N/A	222.4	N/A	422.6	N/A	645.0
TOTAL+ZMP	10.4	19.0		4.6	20.9			944.5	1769.7	425.0	1975.0	1369.9	3744.7

- ROL benefits statistics shaded blue
- PRR benefits statistics shaded yellow
- 2005 CIWS benefits statistics in red

* CIWS benefits frequencies for ZMP were only available for 2005
† Limited resources prevented development of ZMP climatologically adjusted annual convective weather day statistic, so annual storm day metric from nearest ARTCC (ZAU) was used

The annual ROL and PRR benefit frequencies for 2003 in Table 5-1 differ from annual benefit tallies in Robinson et al. (2004). These latest results are considered more accurate because, unlike the earlier study, annual ARTCC convective weather day metrics now account for climatology (Appendix C) and are therefore not biased by transient trends in annual thunderstorm occurrences. The ratio of ROL and PRR benefits in 2005 vs. 2003 is presented for each ARTCC. Since Indianapolis ARTCC (ZID) was not included in the 2005 CIWS field-use assessment, 2005/2003 benefits ratios for this facility were set to 1.0. The assumption that the achieved benefits frequencies within ZID in 2005 matched those of 2003 is very conservative, given that realized ARTCC benefits from 2003 to 2005, particularly for those ARTCCs immediately bordering ZID (ZAU, ZOB, ZDC), increased substantially.

The annual benefit frequencies in Table 5-1 for 2003 vs. 2005 further highlight the increases in CIWS-derived capacity-enhancing decisions in 2005 already discussed in Section 3-4 (see Table 3-4, Figures 3-

11, 3-12). Even with conservative estimates for ROL and PRR benefit frequencies at ZID, the annual frequency of CIWS benefits increased 126% from 2003 to 2005.[16]

5.3 2003 AND 2005 CIWS ANNUAL DELAY AND COST SAVINGS ESTIMATES

5.3.1 Methodology used to estimate CIWS cost savings from the annual frequency of various benefits

To determine 2003 annual delay savings for a specific CIWS benefit category, randomly selected case studies from each ARTCC were analyzed to determine mean/median delay reduction benefits (Robinson et al. 2004). These average delay savings per beneficial decision provide the term (M_{Bi}) in Eqn. 5-1. Analysis of 27 benefit case studies in 2003 was challenging, as each case was unique, often requiring a mix of delay modeling assumptions (linear, queue, or mixed-mode delay estimation techniques), airborne vs. on-the-ground incurred delays, direct vs. downstream delays, and airline operating vs. passenger cost estimates. The following are documented in Robinson et al. (2004):

- Details for case study modeling techniques, estimating downstream delay savings, and converting hours of delays saved to monetary estimates (Chapter 5)

- Detailed results from each 2003 case study analysis (Appendices B and C)

- Discussion of case study results for benefit categories, ROL and PRR (Section 7.2)

The following multipliers and/or cost conversions were used to estimate the 2003 total delay reduction benefits for the various ARTCC case studies:

1. 2003 airline direct operating cost, airborne = $2635 per hour for scheduled commercial aircraft [FAA APO (2002)]
   2003 airline direct operating cost, ground = 0.6 * $2635 = $1581 per hour for scheduled commercial aircraft [Robinson et al. (2004)]

2. 2003 passenger cost = $2173 per hour for commercial flights [Robinson et al. (2004)]
   - 2003 passenger time cost = $28.60 per passenger per hour for commercial flights [APO Bulletin, APO-03-01 (2003)]
   - 2003 avg passengers per flight = 76 [Robinson et al. (2004); Allan et al. (2001)]

3. Total downstream delay = .80 of direct delay [e.g., Beatty et al. (1999); Boswell and Evans (1997); Hartman (1993); DeArmon (1992)]

4. Downstream operating cost savings = 0

5. Downstream passenger cost = 0.8 of direct passenger cost [Robinson et al. (2004)]

Once delay savings from each case study were determined, mean and median CIWS delay reductions per CIWS-derived beneficial decision were calculated for ROL and PRR benefit categories. Since case study

[16] The annual rate of achieved ROL and PRR benefits in 2005 is 142% greater than in 2003 when estimates include only the five common ARTCCs included in both CIWS field-use assessment campaigns (i.e., excluding ZID), matching results presented in Figure 3-11.

results from 2003 revealed wide spreads in hours/cost of delay saved, representing a wide variety of queue situations arising in highly-congested airspace (Robinson et al. 2004), median results per ARTCC were used when feasible. However, due to limited resources, some ARTCCs had only two case studies, and for these facilities mean delay savings results were used.

The limited sample size for quantified CIWS delay reduction case study events, upon which annual delay/cost savings in 2003 and 2005 are based, is recognized by the authors as a significant caveat to CIWS benefits results to date. The 2003-04 CIWS case study results showed that delay reduction benefits for a given type of decision within one ARTCC could vary by as much as a factor of 50 (Robinson et al. 2004; Table 7-6). This high degree of variability is what one would expect from a network operating close to capacity, with the various network links impacted differently from one convective weather event to another (Evans et al. 2006).

The CIWS delay reduction benefits associated with a given decision are modeled as random variables drawn from a statistical ensemble whose probability distribution has slowly decreasing tails. Since there were typically 2 or 3 events analyzed per ARTCC in Robinson et al. (2004), the statistical variance associated with the median (or mean) benefits is undoubtedly high and has not been quantified.

The limited number of cases analyzed per ARTCC in 2003-04 was a consequence of the high analyst workload associated with analyzing an individual case. In the CIWS domain, the NAS is quite congested and air traffic flows are complex. Hence, determining what might have been done if a route had not been kept open can be very difficult. It involves finding a TFM solution for rerouting a number of aircraft in a situation where the few available alternative routes are highly congested, and this requires considerable effort.

Limited resources also prevented case study analyses of 2005 CIWS-derived improvements to convective weather impact mitigation decisions, though several empirical case study investigations were presented in Sections 3 and 4 of this report. Therefore, ARTCC case study results from 2003 were used to generate the 2005 CIWS delay savings presented here. All of the above computational metrics from 2003 were still utilized in 2005, with the exception of estimates for airline direct operating costs (DOC).

Jet fuel prices increased 94% from 2003 to 2005: (Bureau of Transportation Statistics, 2006)

- 2003 average annual jet fuel price = $0.84 per gallon
- 2005 average annual jet fuel price = $1.63 per gallon

Therefore, DOC estimates for 2005 required recalculation. DOC statistics for 18 different air carrier aircraft types [FAA APO, APO-098-8 - Form 41, 1998 (inflated to 2003)] show that the average percentage of total DOC attributed to fuel equals 33%. The following arithmetic describes how the 2005 DOC estimate for airborne aircraft is determined:

- 33% of $2635 (2003 DOC) = $870 — Avg airborne fuel cost per hour per commercial aircraft in 2003
- 94% increase from $870 = $1688 — Avg airborne fuel cost per hour per commercial aircraft in 2005
- $1688 + ($2635 - $870) = $3453 — DOC (airborne) per hour per commercial aircraft in 2005

- 2005/2003 airborne DOC per hour = 1.31

The 2003 CIWS benefits case study results showed significant case-to-case variability in delay savings characteristics, including whether delay reduction benefits per aircraft were achieved in the air or on the ground (Robinson et al., 2004: Appendices B and C). Therefore, as in 2003, CIWS cost saving estimates must account for significant variations in fuel burn when airborne vs. on-the-ground. In 2003, the ground DOC metric used to convert on-the-ground hourly delay reductions to cost savings was 60% of the airborne DOC metric. The decrease in airborne DOC by 40% represents the significant reduction of fuel use while on the ground (recall above, 33% of airborne DOC cost in 2003 was for fuel), as well as reduced flight crew costs when not airborne, as identified by commercial airline industry representatives (Robinson et al. 2004).

Significantly higher jet fuel prices in 2005 suggest the airborne DOC estimates should be reduced by greater than 40% to represent the 2005 on-the-ground DOC metric. Re-examining DOC statistics for the 18 air carrier aircraft types in the 2003 FAA APO estimate [FAA APO, APO-098-8 - Form 41, 1998 (inflated to 2003)], substituting 2005 fuel costs, shows the the average percentage of total airborne DOC attributed to fuel equals 47%, an increase of 14% since 2003. Therefore, decreasing the 2005 airborne DOC by an additional 14% compared to 2003 (40% in 2003 to 54% in 2005) yields the following on-the-ground DOC metric for 2005:

- 0.46 * $3453 = $1588/hr (54% reduction in 2005 airborne DOC)
- 2005 (on-the-ground) DOC/hr ≈ 2003 (on-the-ground) DOC/hr

On-the-ground DOC estimates for 2003 and 2005, accounting for differences in fuel prices, are within $7/hr of each other. For computational ease, and increased conservatism, the 2003 on-the-ground DOC metric of $1581/hr is used to estimate ground-based cost savings in 2005 as well.

Finally, estimates of average airline direct operating costs (and thus CIWS operating cost savings) in 2005, which account for steep fuel price increases, are considered more representative of out-year DOC estimates than DOC estimates averaged across previous years (e.g., 2003–2005). The basis for this assumption is that, despite unprecedented oil supply disruptions in 2005 caused by Hurricanes Katrina and Rita, resultant higher 2005 fuel prices are more similar than past-year prices to forecasts for fuel costs through 2007 (Figure 5-2: U.S. Department of Energy, 2006).

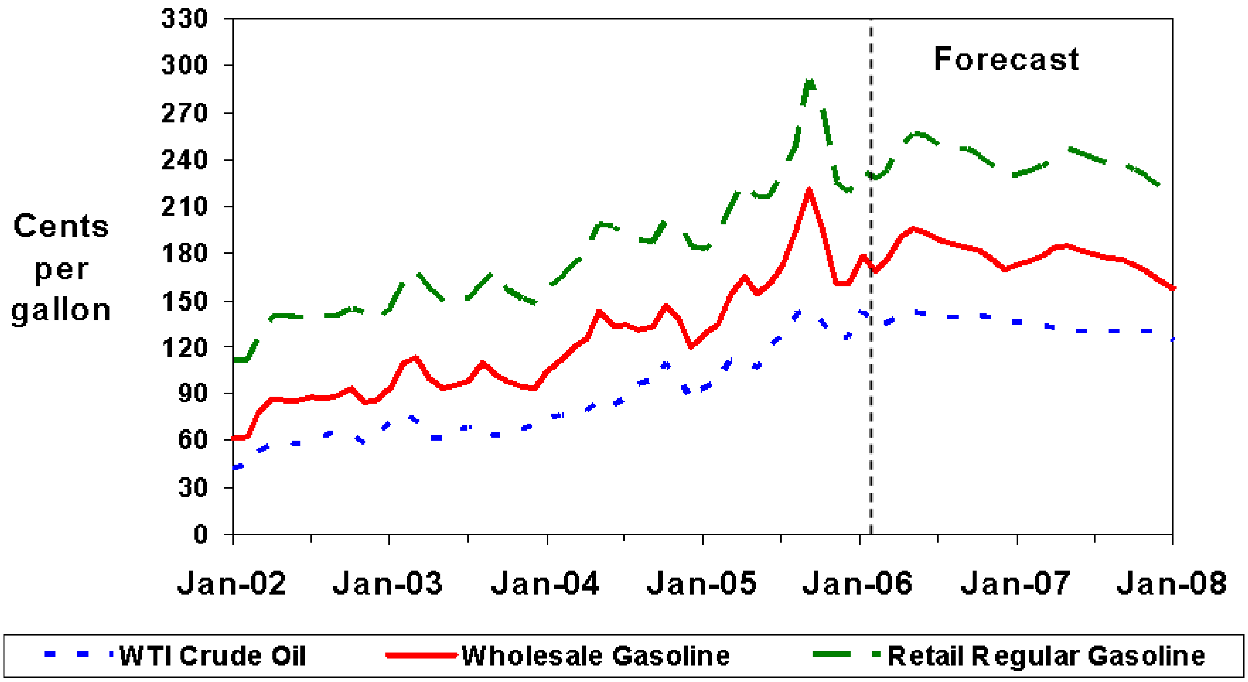

Figure 5-2. Realized crude oil and gasoline prices and cost forecasts through 2007 (U.S. Department of Energy, 2006). WTI = West Texas Intermediate

5.3.2 CIWS annual delay and cost savings results

Total annual CIWS delay savings, in hours and operations and passenger costs, based on the 2003 and 2005 data for the frequency of ROL and PRR benefits are presented in Tables 5-2 and 5-3, respectively. For both categories, annual CIWS delay savings increased significantly. By applying the methodology described above for computing hourly and cost savings, the increased CIWS delay reduction benefits arise from the combination of increased benefit frequency per ARTCC and increased jet fuel costs. In other words, in 2005, CIWS capacity enhancement decisions were being made much more frequently, and the monetary benefits from the resulting delay reductions were increased by the higher cost required to operate commercial aircraft.

Total annual CIWS delay savings attributed to the increased use of nominal jet routes during convective weather impacts (ROL: Table 5-2), in terms of hours of delay saved and total cost savings, increased approximately 70%. Even more notable, total hours and cost of delay saved from CIWS-derived traffic reroute enhancements (PRR: Table 5-3) increased approximately 255%. The tremendous increase in annual CIWS savings from PRR benefit applications is a direct reflection of the substantial gains in certain key ARTCCs in making proactive rerouting decisions since 2003 (see Table 5-1; '05/'03 PRR ratio), which outpaced the still appreciable gains in the frequency of improved decisions to keep routes open longer (see Table 5-1; '05/'03 ROL ratio). **Combined for both benefits categories, 2005 annual CIWS delay reduction benefits, in terms of hours of delay saved and total cost savings, exceeded 92,000 hours and $295 M; increases of 121% and 126%, respectively, compared to the estimates based on 2003 data.** The yearly airline direct operating cost savings provided by CIWS increased to $94 M from $40 M. In addition to conservative estimates for expected ZID benefits, annual 2005 CIWS delay savings are also considered conservative because they do not include delay reduction estimates from ZMP, where CIWS usage was observed to be frequent (see Table 3-1), or other facilities that actively used CIWS but were not included in the 2005 field-use assessment (e.g., ZKC and ATCSCC).

The CIWS ROL and PRR delay reduction benefits are compared by ARTCC in Figure 5-3. Relative ARTCC by ARTCC comparisons of CIWS delay savings clearly show that the largest benefits, based on the 2005 benefits frequency data, were realized in ZOB. Moreover, CIWS delay savings increases from 2003 to 2005 were also most pronounced in ZOB. These results are not surprising given that, of the five ARTCCs under study during both years, ZOB is the only facility where access to CIWS at Area Supervisor positions was added after 2003. By providing Area Supervisors with access to the same weather decision support tool already well established within the TMU, where aggressive, innovative, and safe ATC decisions based upon CIWS have been routinely implemented since 2002, ZOB improved its annual rate of implemented capacity enhancement decisions by 250%. Results presented in Sections 3.2 and 3.3 have already described the ATC productivity (through improved weather impact planning and coordination) and capacity enhancement benefits achieved when both an ARTCC TMU and Areas have direct access to CIWS. Varying results amongst all ARTCCs, in terms of overall rates of achieved benefits and relative improvements from year to year, also reinforce the premise that individual ATC facilities are unique, and must be considered individually in benefits assessments for systems such as CIWS.

TABLE 5-2
2003 and 2005 Median Annual CIWS Delay Savings from Keeping Routes Open Longer (ROL)

	2003								2005						
	HOURS			MONETARY VALUE ($)					HOURS			MONETARY VALUE ($)			
ARTCC	Direct	Down-stream	Total	Operations	Passenger Direct	Passenger Down-stream	TOTAL	'05/'03 ROL ratio	Direct	Down-stream	Total	Operations	Passenger Direct	Passenger Down-stream	TOTAL
ZAU *	5318	4254	9572	10,011,477	11,556,014	9,243,942	30,811,433	1.5	7977	6382	14359	16,869,631	17,334,021	13,868,086	48,071,738
ZID	547	438	985	1,440,607	1,188,631	951,774	3,581,012	1.0	547	438	985	1,887,323	1,188,631	951,774	4,027,729
ZOB	3771	3017	6788	6,015,797	8,194,383	6,555,941	20,766,121	2.7	10182	8146	18328	16,575,867	22,125,486	17,701,258	56,402,611
ZDC	3599	2879	6478	5,689,630	7,820,627	6,256,067	19,766,324	1.5	5399	4319	9718	8,705,426	11,732,027	9,385,187	29,822,640
ZNY *	2626	2101	4727	4,233,944	5,706,298	4,565,473	14,505,715	1.0	2626	2101	4727	4,297,696	5,706,298	4,565,473	14,569,467
ZBW *	759	607	1366	1,314,175	1,649,307	1,319,011	4,282,493	1.6	1214	971	2185	2,322,076	2,638,022	2,109,983	7,070,081
TOTAL	16,620	13,296	**29,916**	28,705,630	36,115,260	28,892,208	**93,713,098**		27,945	22,357	**50,302**	50,658,019	60,724,485	48,581,761	**159,964,265**

2003 airborne DOC metric = $2635/hr
2003 on-the-ground DOC metric = 0.6 * 2635 = $1581/hr

2005 airborne DOC metric = 1.31* 2003DOC = $3452/hr
2005 on-the-ground DOC metric = 2003 metric = 0.46 * 3452 ≈ $1581/hr

*** MEAN** CIWS delay reduction results are provided as a proxy for median benefits results for this category since only two cases were analyzed for ZAU, ZNY, and ZBW.

TABLE 5-3
2003 and 2005 Mean Annual CIWS Delay Savings from Proactive, Efficient Reroutes (PRR)

	2003								2005						
	HOURS			MONETARY VALUE ($)					HOURS			MONETARY VALUE ($)			
ARTCC	Direct	Down-stream	Total	Operations	Passenger Direct	Passenger Down-stream	TOTAL	'05/'03 PRR ratio	Direct	Down-stream	Total	Operations	Passenger Direct	Passenger Down-stream	TOTAL
ZAU	84	67	150	220,039	181,446	145,156	546,641	7.3	610	488	1098	2,104,233	1,325,530	1,060,424	4,490,187
ZID	307	245	552	517,086	665,807	532,602	1,715,495	1.0	306	245	551	542,464	664,938	532,385	1,739,787
ZOB	2951	2361	5312	5,392,611	6,412,958	5,130,453	16,936,022	4.5	13280	10624	23904	25,537,876	28,857,440	23,085,952	77,481,268
ZDC	2980	2384	5364	4,711,909	6,476,192	5,180,867	16,368,968	2.8	8345	6676	15021	13,300,090	18,133,685	14,506,948	45,940,723
ZNY	319	255	574	504,019	692,752	554,115	1,750,886	2.0	638	510	1148	1,008,038	1,386,374	1,108,230	3,502,642
ZBW	15	12	27	35,090	32,160	25,641	92,891	28.0	414	331	745	1,230,013	899,632	719,263	2,848,908
TOTAL	6,655	5,324	**11,979**	11,380,754	14,461,315	11,568,835	**37,410,904**		23,593	18,874	**42,467**	43,722,714	51,267,589	41,013,202	**136,003,505**

2003 airborne DOC metric = $2635/hr
2003 on-the-ground DOC metric = 0.6 * 2635 = $1581/hr

2005 airborne DOC metric = 1.31* 2003DOC = $3452/hr
2005 on-the-ground DOC metric = 2003 metric = 0.46 * 3452 ≈ $1581/hr

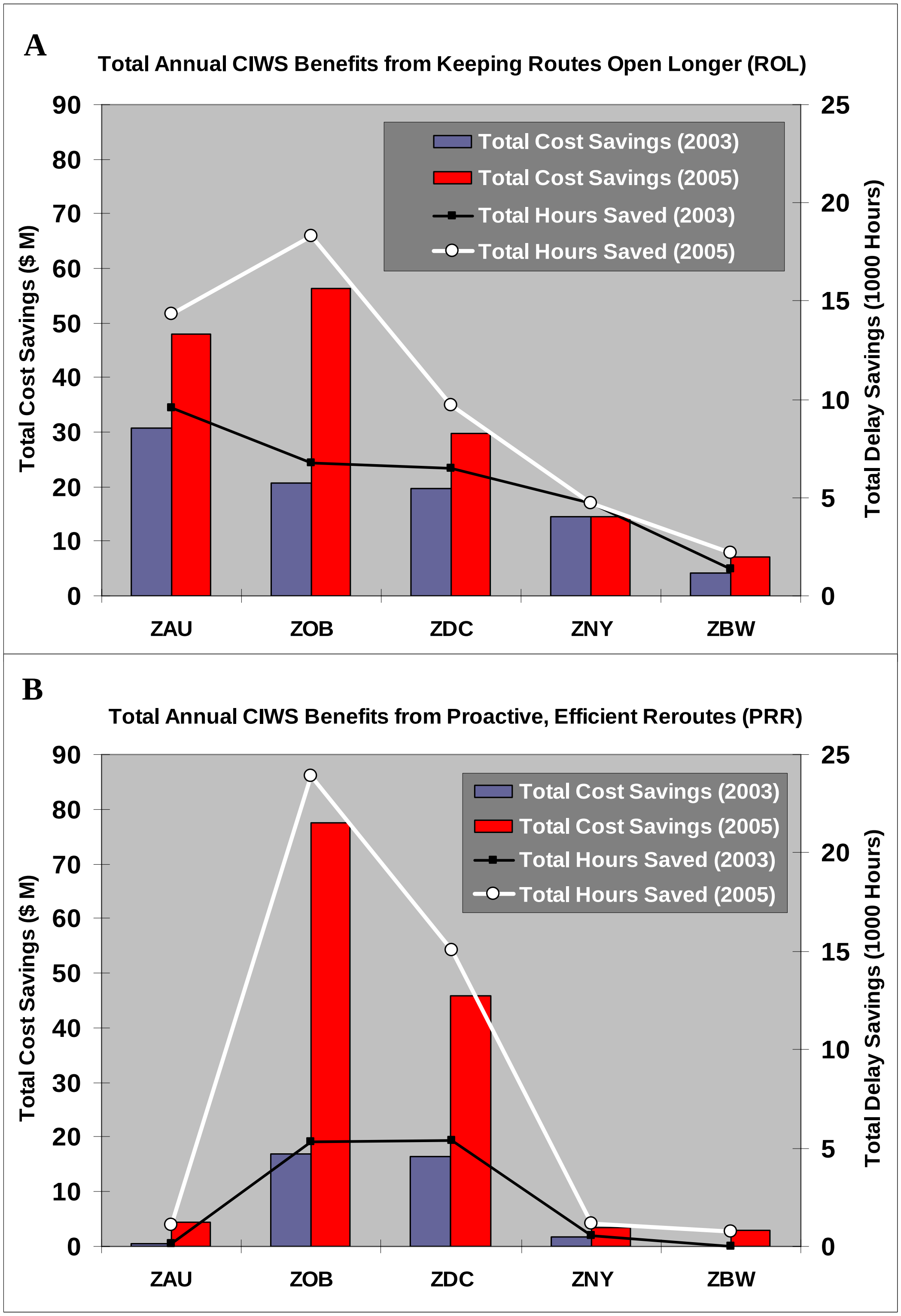

Figure 5-3. Total annual CIWS delay reduction benefits by ARTCC, in terms of operating and passenger cost savings (bars) and hours of delay saved (lines), from (A) keeping routes open longer (ROL) and (B) more proactive, efficient reroutes (PRR).

5.4 ANNUAL AIRLINE JET FUEL SAVINGS ATTRIBUTED TO CIWS

The average price of a gallon of commercial jet fuel has increased by 115% over the past three years. During 2003, the average annual cost of a gallon of jet fuel was $0.84. By January 2006, that cost had increased to $1.81 (Bureau of Transportation Statistics, 2006). Jet fuel is the second largest expense (after labor) for all U.S. commercial airlines [FAA APO, APO-098-8 - Form 41, 1998 (inflated to 2003)]). Given current jet fuel prices, and forecasts for these prices to remain well above $1.20 per gallon beyond 2010 (FAA, 2006), it is imperative that airlines take full advantage of all opportunities to reduce fuel consumption in order to reduce costs and ensure profits. Previously described CIWS benefits related to increased ATC productivity, decreased airspace complexity, increased capacity, and reduced delay result in significant jet fuel cost and consumption savings.

5.4.1 Methodology for computing jet fuel savings attributed to CIWS

The following metrics are used to calculate jet fuel savings attributed to CIWS:

- Average jet fuel cost per commercial aircraft per hour, 2003 and 2005
- Average consumption per commercial aircraft per hour, 2003 and 2005

Recall, the average airborne fuel costs per hour in 2003 and 2005 were defined in the previous Section to equal $870 and $1688, respectively. Dividing these hourly jet fuel costs by the fuel price per gallon in both years yields airborne hourly fuel consumption metrics:

\$ 870 / \$0.84 \$1688 / \$1.63 = 1036 gal	Average jet fuel consumption per airborne commercial aircraft per hour, 2003 and 2005

Estimates of annual CIWS jet fuel savings are computed by applying these metrics to the estimated hours of direct delay saved in 2003 and 2005 for benefits categories, ROL and PRR, presented in Tables 5-2 and 5-3. As discussed earlier, 2003 CIWS benefit case study results, upon which 2003 and 2005 delay savings are based, demonstrate significant variability in airborne vs. ground-based delay savings, signaling the pervasiveness of queuing situations and/or ground hold events within various ARTCCs and during varying storm impact occurrences (Robinson et al. 2004; Appendices B and C). Therefore, differences in airborne vs. on-the-ground jet fuel consumption must first be taken into account by tabulating the ratio of airborne/ground PRR and ROL CIWS delay savings.

Average percentages of airborne vs. on-the-ground CIWS delay savings for ROL and PRR benefits categories, determined through re-analysis of each individual benefits case study in the Appendices of Robinson et al. (2004), are shown in Table 5-4. These results illustrate the greater propensity for ground-based queuing delay savings in the congested airspace immediately servicing metro NY traffic (ZNY, ZOB, and ZDC).

The average fuel burn for a nominal "on-the-ground" airport taxi for A320/A310, B737, and B757 commercial aircraft types is 271 gal/hr while jet fuel use when delayed prior to takeoff is approximately 25% of standard taxi burn, or 68 gal/hr (U.S. commercial airline ATC dispatch manager, personal communication). This latter rate of fuel burn is used to compute the component of jet fuel savings achieved on-the-ground, and in combination with airborne jet fuel usage metrics, and CIWS delay savings results in Tables 5-2, 5-3, and 5-4, provides a quantitative estimate of annual jet fuel savings attributed to CIWS.

TABLE 5-4
Airborne Delay Savings, as Percentage of Total CIWS ROL and PRR Delay Reduction Benefits per ARTCC

ARTCC	ROL	PRR
ZAU	28	100
ZID	100	50
ZOB	1	30
ZDC	0	0
ZNY	3	0
ZBW	16	71

5.4.2 CIWS jet fuel savings results

Annual jet fuel savings based on the 2003 and 2005 benefits frequency data, attributed to CIWS usage in keeping jet routes open longer or reopening closed routes earlier (ROL) and more proactive, efficient reroutes (PRR), are presented in Table 5-5. In addition, Table 5-6 lists the total annual jet fuel consumption savings in terms of three different units of measure, each commonly associated with fuel purchasing and consumption in the aviation, energy, and financial oversight arenas. Annual CIWS jet fuel cost and consumption savings in 2003 exceeded $4.1M and 4.8M gallons, respectively. **In 2005, annual commercial airline jet fuel cost and consumption savings attributed to CIWS exceeded $18.6M and 11.4 M gallons, respectively.** To put these jet fuel savings in perspective, 2005 CIWS fuel consumption savings of 77.3 M lbs (see Table 5-6) is equivalent to 2,664 transcontinental flights from Los Angeles International Airport (LAX) to NY or 4,293 flights from Chicago O'Hare International Airport (ORD) to NY.[17] These estimates of jet fuel cost savings, which increased 355% since 2003, are considered conservative, since documented delay reduction benefits from other CIWS-equipped facilities (e.g., ZMP, ZKC, Large TRACONs, NavCanada, etc.) were not included.

Finally, in addition to the obvious financial benefits for the airlines afforded by these significant jet fuel cost savings, substantial fuel consumption reductions attributed to CIWS contribute to national energy initiatives to increase fuel use efficiency and reduce oil consumption (from which jet fuel is refined). Specifically, the contribution of CIWS towards reduced fuel consumption are pertinent to the mandates of the U.S. Energy Policy Act of 2005 which seeks to "promote conservation, reduce our growing dependence on unstable Middle Eastern oil, improve our economy, and create new jobs (U.S. House of Representatives, Committee on Energy and Commerce, 2005). More recently, the President, in his 2006 State of the Union address, introduced the Advanced Energy Initiative, which ultimately seeks to replace "more than 75% of our oil imports from the Middle East by 2025" (U.S. White House, 2006). Improved air traffic efficiency during convective weather impacts, resulting in reductions in commercial airline jet fuel usage, assists in meeting these and other federal initiatives to reduce unnecessary oil consumption.

[17] The average jet fuel consumed by a 757 commercial aircraft flying in Visual Flight Rule (VFR) conditions from LAX and ORD to NY is 29,000 lbs and 18,000 lbs, respectively (U.S. commercial airline ATC dispatch manager, personal communication).

TABLE 5-5
Annual CIWS Commercial Air Carrier Jet Fuel Cost and Consumption Savings in (A) 2003 and (B) 2005

2003

A	Annual Direct Delay Savings (Hours)			Annual Jet Fuel Cost Savings ($)			Annual Jet Fuel Consumption Savings (Gallons)		
ARTCC	ROL	PRR	Total	ROL	PRR	Total	ROL	PRR	Total
ZAU	5318	84	5402	1,513,683	73,080	1,586,763	1,802,976	87,024	1,890,000
ZID	547	307	854	475,890	142,701	618,591	566,692	169,948	736,640
ZOB	3771	2951	6722	245,841	887,712	1,133,553	293,212	1,057,348	1,350,560
ZDC	3599	2980	6579	205,143	169,860	375,003	244,732	202,640	447,372
ZNY	2626	319	2945	213,909	18,183	232,092	255,040	21,692	276,732
ZBW	759	15	774	141,636	9,798	151,434	133,516	11,668	145,184
TOTAL	16,620	6,656	**23,276**	2,796,102	1,301,340	**4,097,436**	3,296,168	1,550,320	**4,846,488**

2005

B	Annual Direct Delay Savings (Hours)			Annual Jet Fuel Cost Savings ($)			Annual Jet Fuel Consumption Savings (Gallons)		
ARTCC	ROL	PRR	Total	ROL	PRR	Total	ROL	PRR	Total
ZAU	7977	610	8587	4,418,570	1,029,680	5,448,250	2,711,148	631,960	3,343,108
ZID	547	307	854	923,336	276,935	1,200,271	566,692	169,948	736,640
ZOB	10182	13280	23462	1,291,056	7,756,848	9,047,904	791,112	4,759,552	5,550,664
ZDC	5399	8345	13744	599,289	926,295	1,525,584	367,132	568,072	935,204
ZNY	2626	638	3264	416,069	70,818	486,887	255,040	43,384	298,424
ZBW	1214	414	1628	440,692	509,592	950,284	270,344	312,744	583,088
TOTAL	27,945	23,594	**51,539**	8,089,012	10,570,168	**18,659,180**	4,961,468	6,485,660	**11,447,128**

TABLE 5-6
Annual CIWS Jet Fuel Consumption Savings in Gallons, Barrels, and Pounds

	2003			2005		
ARTCC	**Gal**	**Barrels**	**lbs**	**Gal**	**Barrels**	**lbs**
ZAU	1,890,000	45,000	12,757,500	3,343,108	79,598	22,565,979
ZID	736,640	17,539	4,972,320	736,640	17,539	4,972,320
ZOB	1,350,560	32,156	9,116,280	5,550,664	132,159	37,466,982
ZDC	447,372	10,652	3,019,761	935,204	22,267	6,312,627
ZNY	276,732	6,589	1,867,941	298,424	7,105	2,014,362
ZBW	145,184	3,457	979,992	583,088	13,883	3,935,844
TOTAL	**4,846,488**	**115,393**	**32,713,794**	**11,447,128**	**272,551**	**77,268,114**

- 1 Barrel = 42 gal
- 1 gal = 6.75 lbs

6. CONCLUSIONS AND FUTURE WORK

The initial results of the 2005 study of ATC productivity enhancement benefits associated with the use of the Corridor Integrated Weather System (CIWS) have been presented in this report. Although improving productivity in conducting ATC operations is now a principal objective of the FAA, to date, there have been very few publicly available studies of traffic management productivity in managing convective weather impacts.

Observers, knowledgeable in both CIWS products and ATC operations, were stationed in ARTCCs for three multi-day periods during thunderstorm impacts. Their task was to note real-time uses of CIWS products and the time required to devise, coordinate, implement, and iteratively monitor weather impact mitigation plans. Feedback from ATC experts at these FAA facilities was used to estimate the workload associated with the mitigation plan development and execution process for:

(a) The convective weather events observed in 2005, and

(b) Similar convective weather events that occurred prior to the availability of CIWS.

ARTCC TMU traffic management coordinators (TMCs)—the current, principal users of the deployed CIWS prototype and critical decision makers for achieving efficient airspace management—were the primary focus of CIWS productivity enhancement studies. Additionally, the observers assessed the role of CIWS at sector Area Supervisor positions in enhancing ARTCC productivity during convective weather events.

<u>The principal results were as follows:</u>

1. CIWS reduced the time required by the TMU to develop, coordinate, and implement weather impact mitigation plans by 20–95 minutes per thunderstorm day per ARTCC.

2. On average, for all ARTCCs studied, 70% of total time savings in the TMU attributed to CIWS was in the plan *development* stage of the operational weather impact decision loop, which also includes internal/external plan coordination, implementation, and iterative monitoring.

3. CIWS was used to help address FAA staffing decisions such as whether or not overtime was needed, managing breaks based upon current or pending weather impacts, assessing super-high sector staffing requirements, proactively planning staffing levels needed for diversion recovery programs, and adding “D-side” controllers to ease ATC workload concerns.

4. Use of CIWS facilitated the development and execution of higher <u>quality</u> weather impact mitigation plans that resulted in greater airspace capacity, more efficient routing strategies, and reduced air traffic delay, *even at the cost of increased near-term TMU workload*. Extra ARTCC TMU effort in developing high-quality plans using CIWS often reduced ARTCC controller workload by reducing airspace complexity and increasing traffic flow predictability. Moreover, these plans, and resulting benefits, positively affected ATC operations at other FAA facilities, thus contributing to overall NAS efficiency and productivity improvements.

5. Availability of CIWS in ARTCC TMUs and sector Areas *significantly* increased ATC productivity and the frequency of realized operational effectiveness benefits. Specifically, when comparing use of CIWS at ARTCCs with and without CIWS displays in the Areas:

    a. Time savings for intrafacility coordination of traffic management initiatives at ZOB and ZDC (CIWS in TMU and Areas) were three times greater than the savings at ZAU, ZNY, and ZBW (CIWS in TMU only).

    b. Analysis of specific weather impact events suggest significant reductions in TMU workload at ZOB, ZDC, and ZMP (CIWS in TMU and Areas) were achieved when Area Supervisors used CIWS to avoid traffic management initiatives. Traffic management workload reductions from these CIWS-derived ARTCC Area decisions often extended to other ATC facilities.

    c. The frequency of implemented CIWS en route capacity-enhancing decisions was significantly higher at ARTCCs with CIWS displays in both the TMU *and* Areas. For the five most common CIWS en route capacity enhancement benefits[18], plan implementation rates (e.g., beneficial decisions per convective weather day) at ARTCCs with access to CIWS in the TMU and Areas (ZMP, ZOB, and ZDC) was *140% greater* than at ARTCCs with CIWS only available within the TMU (ZAU, ZNY, ZBW).

    d. Areas Supervisors used CIWS to assist with controller staffing decisions during convective weather impacts.

6. The frequency of annual CIWS operational effectiveness benefits increased 177% from 2003 to 2005. With continuing increases in air traffic demand, it is encouraging that the frequency per thunderstorm day of capacity-enhancing benefits has also increased.

7. Development, coordination, and execution of traffic flow management plans that reduce convective weather impacts and subsequent delays by increasing ATC productivity in managing ARTCC/TRACON transition airspace was facilitated by common situational awareness and increased access to CIWS by traffic managers at multiple positions in the ARTCC TMU, in ARTCC Areas, at TRACONS within the parent ARTCC, and at all neighboring ARTCCs. ZOB, the only ARTCC with CIWS displays at all these internal and external coordinating positions, realized improved ATA/DTA management benefits at a rate 180-1300% more often than any other ARTCC under study in 2005.

8. Decisions made using other convective weather decision support tools at an ARTCC without access to CIWS (ZTL) often occurred just as quickly as they did in an adjacent CIWS facility (ZDC). However, the quality of the decisions made without CIWS (in terms of missed opportunities for utilizing available capacity) was not as high as those made at the adjacent CIWS-equipped facility. A number of specific examples of how CIWS could have improved the quality of weather planning decisions at ZTL and increased ATC productivity were presented. These examples included ATC weather impact events for which CIWS Forecast and Growth and Decay Trends products might have prevented chaotic, unexpected deviations of ATL arrivals in ARTCC/TRACON transition airspace, and allowed for more efficient management of aircraft in holding patterns.

[18] The five most common CIWS capacity enhancement benefits include (1) more proactive, efficient reroutes, (2) keeping routes open longer and/or reopening closed routes earlier, (3) Improved ATA/DTA management, (4) reduced MIT restrictions, and (5) directing pathfinders.

9. By combining the 2005 data for the frequency of CIWS benefits decisions and fuel costs together with the 2003 case benefits results and the average ARTCC thunderstorm climatology, it was determined that:

   a. The annual hours of delay saved and total cost savings attributed to CIWS usage in "keeping jet routes open longer" and "proactively and more efficiently rerouting traffic" exceeded **92,000 hours and $295 M**. This annual estimate is an increase of 121% (hours saved) and $126% (costs saved) from results based on 2003 data for the frequency of CIWS benefits and fuel costs. The yearly airline direct operating cost savings provided by CIWS increased to $94 M from $40 M. Delay savings results based on the 2005 CIWS benefits frequency are considered conservative for several reasons, including the fact that the annual frequency of ZMP delay benefits (which accounted for 21% of the total number of beneficial decisions associated with the six CIWS-equipped ARTCCs visited in 2005) and ZKC delay benefits were not included in the annual delay reduction benefits calculations.

   b. Projected annual CIWS delay reduction benefits per ARTCC were greatest at ZOB. Calculated benefits using 2005 data for the frequency of CIWS capacity-enhancing decisions were 250% greater than estimated benefits based upon the frequency of CIWS-assisted decisions in 2003. This increase is not surprising given that, of the five ARTCCs under study during both years, ZOB is the only facility where access to CIWS at Area Supervisor positions was added after 2003.

   c. The annual jet fuel cost and consumption savings for commercial airlines exceeded $18.6 M and 11.4 M gallons. The jet fuel consumption savings attributed to CIWS increased $136% relative to 2003, an increase directly related to increased ATC proficiency in implementing higher-quality, capacity-enhancing convective weather impact mitigation plans. The jet fuel cost savings attributed to CIWS increased 355% since 2003, due to the combination of the increased rate of achieved capacity-enhancement benefits by ATC and the 94% increase in jet fuel cost from 2003 to 2005. Given forecasts that fuel prices will remain high through at least 2007, these jet fuel savings derived from CIWS are a significant benefit to airlines and passengers, and also support national efforts to reduce oil consumption.

In summary, we have found that CIWS provided improved productivity by reducing the time to make and execute decisions and by improving the ability to better use available capacity in convective weather. These productivity enhancements resulted in significant delay reduction benefits.

The authors recognize that the limited number of individual ARTCC case studies in the 2003–2004 data analysis is a significant caveat to the annual delay reduction CIWS benefits estimates above. The 2003-2004 individual case studies for a given ARTCC varied greatly in the delay reduction achieved. With only 2-3 case studies per ARTCC, the statistical variance associated with mean or median CIWS benefits is undoubtedly high and has not been quantified. The case study sample set was small because our workload associated with analyzing individual delay events was quite high. This high workload was due to the difficulty in determining alternative traffic management options for weather impact mitigation in the complex and heavily congested airspace in which CIWS is deployed.

It would be highly desirable to reduce the overall CIWS delay reduction benefits uncertainty by analyzing more cases. A two-phase approach is recommended:

(1) Analysis of 3–5 more cases for quantified beneficial decisions in both ZDC and ZOB, since those two ARTCCs account for the bulk of the overall CIWS delay reduction benefits. These cases should be drawn from the 2005 observed events (especially for ZOB) to see if there is any substantive difference between the TMU-only beneficial decisions versus TMU-Area Supervisor collaborative beneficial decisions.

(2) Develop automated tools that could reduce the time to carry out individual case analyses. Bertsimas and Stock-Patterson (1998) discuss the use of mixed integer optimization techniques for optimal TFM with time varying en route and terminal capacities. Such optimization techniques for practical use are becoming more feasible due to the rapidly dropping costs for powerful computers, and enhancements derived from NASA funded research at estimating en route capacity with convective weather (Martin et al. 2006). The development and validation of such tools is a nontrivial, but important, undertaking.

<u>Future investigations to extend the results presented in this report will include:</u>

- Continued examination of ZTL and ZJX TMU operations (ARTCCs with no CIWS displays in 2005) pertaining to convective weather impact management. Additional data analyses will seek to further validate estimates from ATC experts as to how long impact mitigation plans would have taken had CIWS not been available. In addition, we anticipate that the analysis will show further instances where the quality of decisions made during thunderstorm events could have been improved using CIWS.

- Detailed analyses of weather and aircraft flight track data in ARTCCs with and without access to CIWS, to independently confirm that the use of CIWS results in fewer missed opportunities for mitigating the adverse impacts of convective weather.

- Additional investigations of potentially improved decisions and plan coordination time savings between TRACONs and ARTCC TMUs resulting from increased access to CIWS at both types of facilities.

- Use of sector/route capacity assessment models to quantify improvements in effective sector capacity attributed to CIWS-derived convective weather impact mitigation plan enhancements. Implications of these results with respect to both delay savings and ATC productivity improvements will be explored.

- Comparisons of Aviation System Performance Metrics (ASPM) delays during convective weather events before and after CIWS deployment, where the delay data are normalized to account for differences in weather severity and traffic demand.

GLOSSARY

ARTCC	Air Route Traffic Control Center
ASPM	Aviation System Performance Metrics
ATA	Arrival Transition Areas
ATC	Air Traffic Control
ATCSCC	Air Traffic Control System Command Center
ATM	Air Traffic Management
CCFP	Collaborative Convective Forecast Product
CDM	Collaborative Decision Making
CIWS	Corridor Integrated Weather System
CWSU	Center Weather Service Unit
DOC	Direct Operating Cost
DTA	Departure Transition Areas
DTW	Detroit, MI Metropolitan Airport
EIA	Energy Information Administration
ETMS	Enhanced Traffic Management System
EWR	Newark, NJ International Airport
FAA	Federal Aviation Administration
GDP	Ground Delay Program
ITWS	Integrated Terminal Weather System
JFK	John F. Kennedy International Airport
LL	Lincoln Laboratory
MSP	Minneapolis St. Paul International Airport
NAS	National Airspace System
PCT	Potomac TRACON
PHL	Philadelphia TRACON
PRR	CIWS "Proactive, Efficient Reroute" Benefit Category
ROL	CIWS "Keeping Routes Open Longer" Benefit Category
STMC	Supervising Traffic Management Coordinator
SWAP	Severe Weather Avoidance Plan
TFM	Traffic Flow Management
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
UTC	Coordinated Universal Time
ZAU	Chicago ARTCC
ZBW	Boston ARTCC
ZDC	Washington ARTCC
ZID	Indianapolis ARTCC
ZJX	Jacksonville ARTCC
ZKC	Kansas City ARTCC
ZME	Memphis ARTCC
ZMP	Minneapolis ARTCC
ZNY	New York ARTCC
ZOB	Cleveland ARTCC
ZTL	Atlanta ARTCC

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APPENDIX A
CHALLENGE IN FINDING SIMILAR CONVECTIVE EVENTS FOR CIWS

One of the important issues in assessing performance of a system such as CIWS is whether it is possible to find comparable weather events before and after CIWS was installed in order to compare weather impact mitigation decisions or performance metrics such as the FAA Aviation System Performance Metrics (ASPM) delays.

Practical experience has shown that this is very difficult. There are two elements of this difficulty:

1. Variability in spatial patterns of convective weather

2. Sensitivity of delays to differences in the convective weather

Each of these elements are discussed below.

1. Spatial patterns of convective weather

MITRE CAASD (DeArmon, 2004) attempted to use cluster analyses to find similar convective weather events. DeArmon formed 16 clusters of 197 days of convective weather. The spatial extent of the convective weather shown in pictures of the various clusters is generally quite extensive except for the case of “generally fair weather throughout the NAS”. No results were shown for the differences between elements of a cluster and the clustering considered only a single sample of very coarsely quantized convective weather in a day.

A combinatorial argument can be made that suggests that finding identical convective weather spatial distributions within the CIWS domain will be extremely difficult. The general argument is that different convective weather events can be viewed as assigning a “weather present” indicator to each of N possible spatial regions that would characterize the weather picture. ARTCCs such as ZID and ZOB typically have about 25 high altitude sectors with a diameter of approximately 75 nmi (150 km).

In Figure 1-5, we showed that the bulk of the convective activity in the CIWS domain is “unorganized” convection, such as air mass thunderstorms. For such weather, the spatial distribution of weather present or not present in each of these sectors is modeled. One finds that the number of possible unique assignments is roughly 2**25 which clearly is so large that the likelihood of identical assignments is very small.

One might hope that it might be easier to find highly similar or identical organized convection cases, especially squall lines, since there is a high spatial correlation between weather being present at adjacent locations for this type of convective weather. However, squall lines are not uniform with respect to reflectivity and echo tops along the squall line. Based on an examination of squall lines observed in the Great Lakes corridor, our model considers both echo tops and reflectivity as separately assigned elements each 20 nmi (40 km) along the squall line. Examination of a number of cases suggests that the number of unique assignments for squall line structures within an ARTCC is on the order of 2**18, which is also very large.

Some examples of north-south oriented squall lines observed to the east of the New York airports in 2004 and 2005 are shown in Figures A-1 through A-4. These weather events differ considerably in the regions of high reflectivity and high echo tops. For example, there are major differences in the degree to which high reflectivity/high echo tops storms are present in upstate New York and in Maryland as well as through Pennsylvania. In Figure A-5, major departure routes from the New York airports are shown. Comparing Figures A-1 through A-4 with Figure A-5, major differences arise among these cases in terms of the specific departure routes impacted.

2. Sensitivity of delays and ATC workload to differences in the impact of convective weather on capacity

Differences in the convective weather spatial pattern result in differences in the effective capacity of en route sectors. Weber et al. (2005) show an example of this for relatively unorganized storms observed in the CIWS domain in 2004, while Figures A-1 through A-5 show that the east-west routes impacted by north-south squall lines in ZNY can differ significantly between the different squall line events.

Considered next is how sensitive the delays would be to changes in the effective capacity of the en route airspace. Based on:

1. Analysis of 27 different convective weather cases in the northeast quadrant of the NAS (Robinson et al. 2004),

2. the FAA OEP (FAA, 2001) statement that "air travelers are experiencing increased flight delays and cancellations from a growing imbalance between their demand and the ability of the system to handle the air traffic. The mismatch is most pronounced during peak flying periods at major hubs. In addition, congested airspace and complex traffic flows can cause delays to ripple through large portions of the country",

3. MITRE analyses of specific cases of widespread disruptions due to severe weather (MITRE, 2001), and

4. the current work in the CDM program (http://cdm.metronaviation.com) to develop approaches for simultaneously constraining demand in portions of en route airspace and at terminals,

it is reasonable to conclude that convective weather impacts on highly congested regions of en route airspace lead to complicated, multiple queues in the "NAS network."

Queue delays have a very nonlinear dependence on demand, capacity, and the time duration of events[19]. In the simplest case, the fair-weather capacity (C_V) of airspace under the control of an ATC facility (e.g., an airport or an en route sector) is reduced by convective activity to a lower convective weather capacity (C_W) for a time duration, T. Typically, C_V is greater than the demand, D, but $D > C_W$. For this case of constant capacities and constant demand, the accumulated delay, DS, for all the aircraft involved in the queue can be shown (Andrews, 1993) to be:

$$DS = 0.5\,T^2\,(D-C_W)\,(C_V-C_W)/\,(C_V - D) \qquad \textbf{(A-1)}$$

[19] The queue model discussed here is the classical deterministic model used in traffic analysis (Daganzo, 1997). With this model, one can operate close to capacity without incurring delays. With random process (e.g., Poisson process) queues, delay rises rapidly as the demand approaches the capacity.

The delays in the above equation could be taken on the ground or in the air. The generalization of equation (A-1) to consider the case where C_W and D change with time was validated with Atlanta thunderstorm event data in Appendix A of Allan and Evans, (2005). The queue delay is very sensitive to changes in the convective weather capacity and the duration of the convective weather event. Hence, both the differences in spatial pattern of the convective weather at a given time instance and over time can make major differences in the delays.

We know of no equation similar to equation (A-1) for the TMC workload associated with a given situation. However, since the complexity of the decision making process may be related to the sensitivity of outcomes (e.g., delays) to the actions taken, one would suspect that decision making workload increases in high queue delay situations. For example, one can certainly envision that air carrier interactions with the TMCs would increase in situations where there are high queue delays.

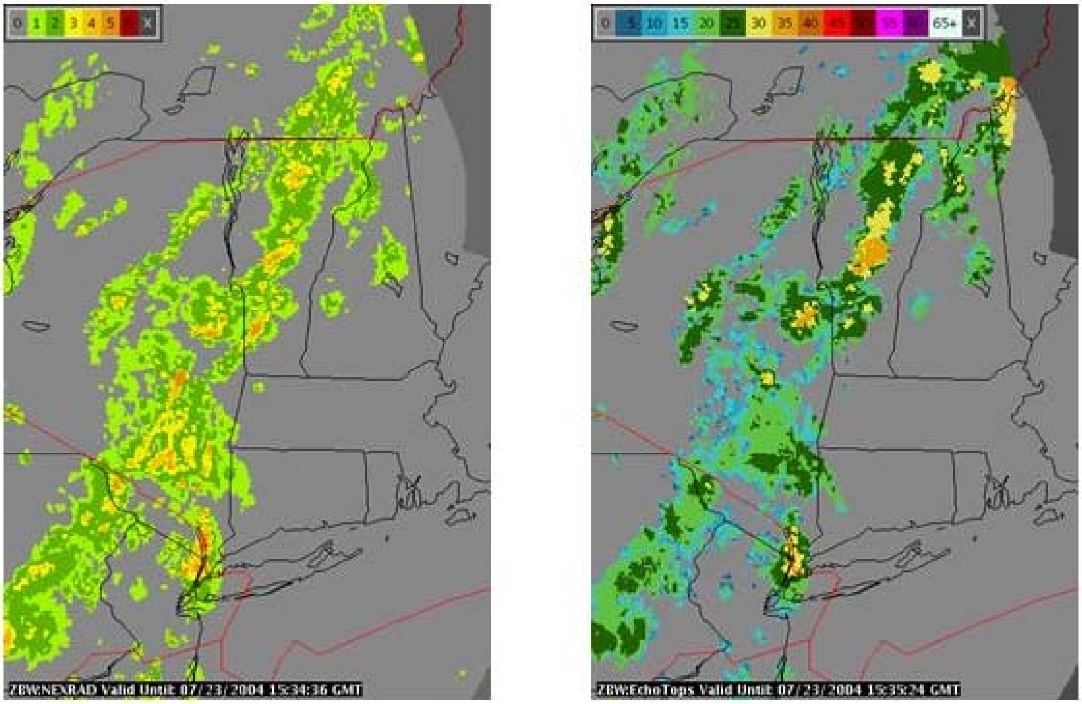


Figure A-1. Squall line in eastern NY on 23 July 2004. CIWS VIL Precipitation (left) and Echo Tops (right) are shown.

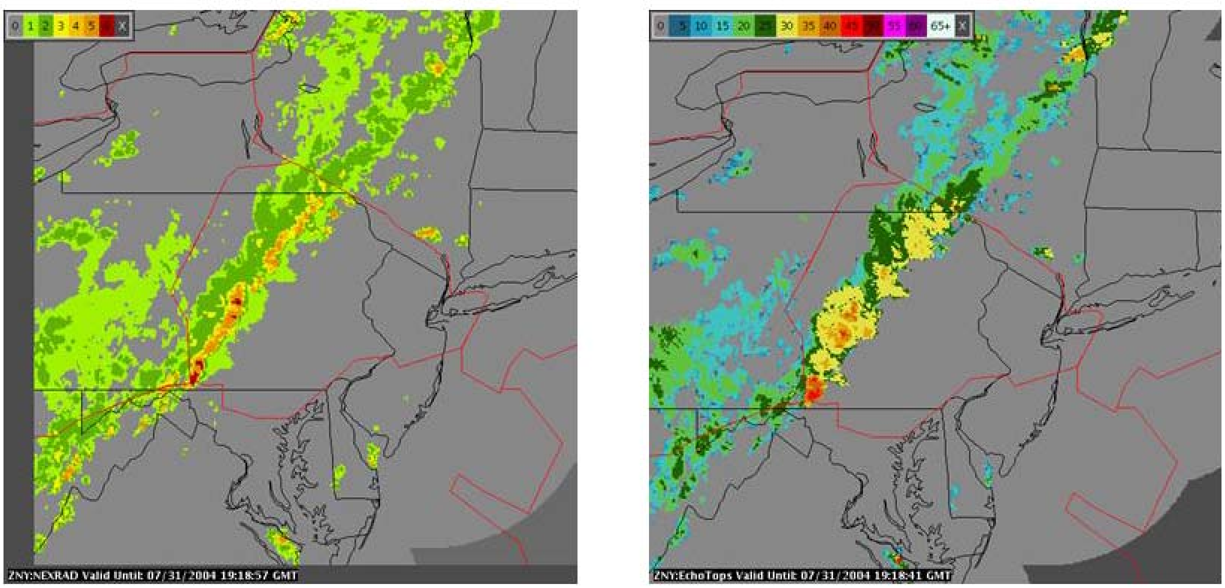


Figure A-2. Squall line in ZNY and ZBW on 31 July 2004. CIWS VIL Precipitation (left) and Echo Tops (right) are shown.

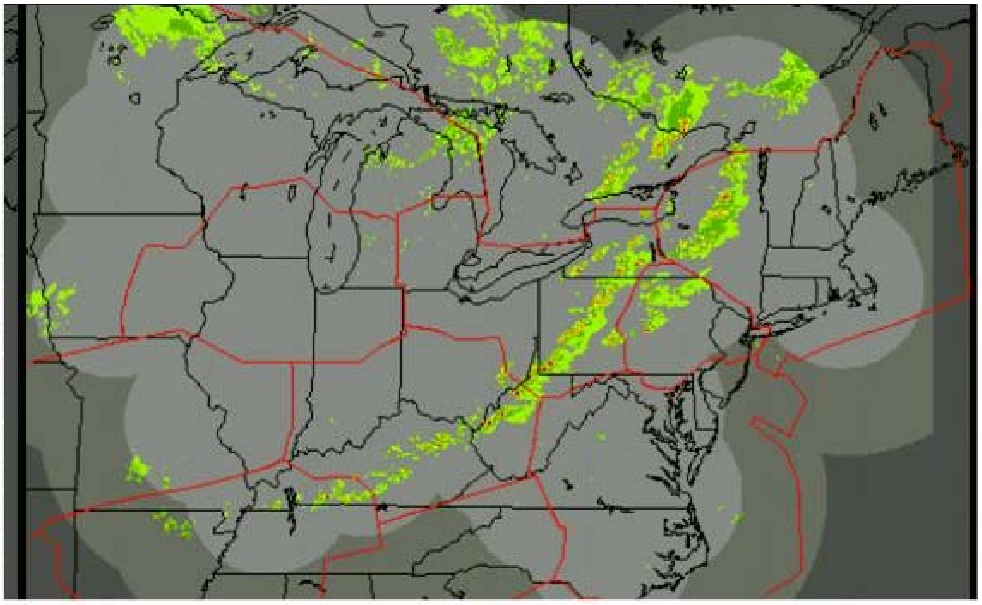


Figure A-3. Squall line in ZNY and ZBW on 10 August 2004. CIWS VIL Precipitation is shown.

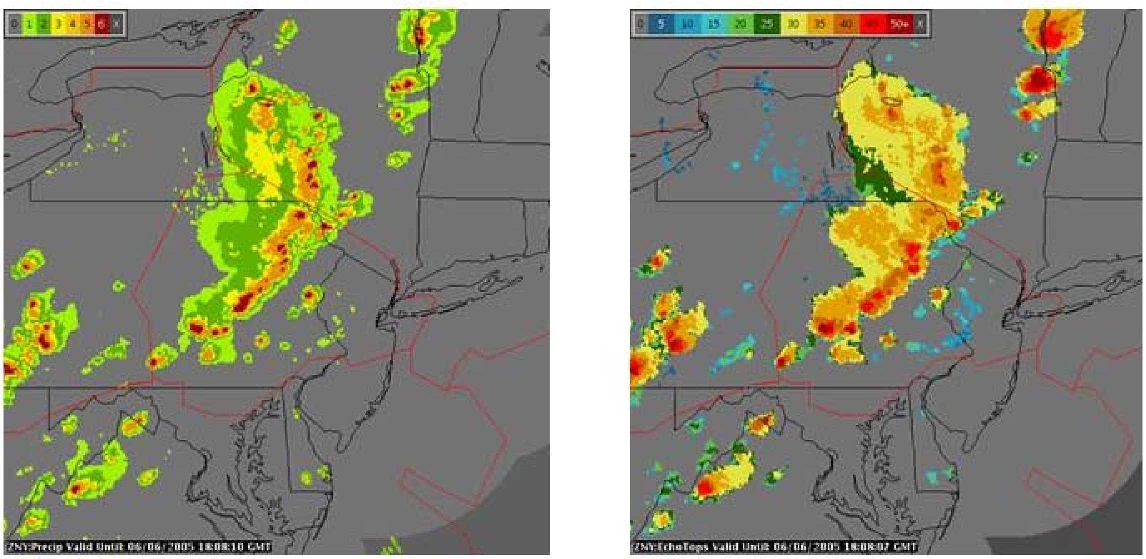


Figure A-4. Squall line in ZNY and ZBW on 6 June 2005. CIWS VIL Precipitation (left) and Echo Tops (right) are shown.

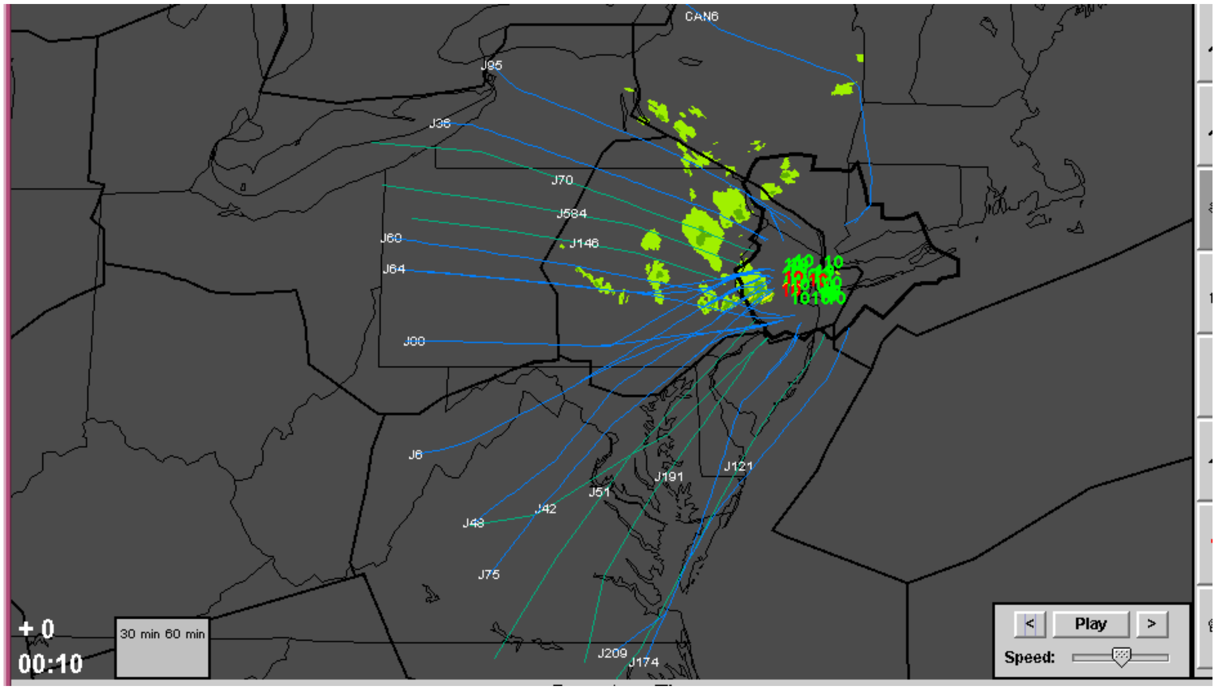


Figure A-5. Major departure routes from the New York airports [as seen via the NY Route Availability Planning Tool (RAPT: DeLaura and Allan, 2003) display].

APPENDIX B
PAST WORK ON TRAFFIC MANAGEMENT WORKLOAD ASSOCIATED WITH CONVECTIVE WEATHER IMPACT MITIGATION

We have not been able to find any published literature on TMC and Area Supervisor workload that specifically addresses the bulk of the elements shown in the operation decision loop in Figure 1-4. Additionally, we have discussed the TMC workload issue with key CDM TMU researchers (Prof. Mike Ball at Univ. of MD, Prof. Phil Smith at Ohio State University) and they knew of no published work that would be germane.

We also discussed TMC and Area Supervisor workload with Mr. Mike Klinker who was the Traffic Management Officer at ZDC for a number of years. Mike commented that traffic management in convective weather is best accomplished when the TMCs and Area Supervisors work as a team, adding that pertinent FAA orders (7210.3 Chapter 17) associated with these positions present this team approach. Mike further commented, "It is beyond the scope of a TMU within a facility to effectively coordinate all the actions needed for a busy SWAP event. It takes a team of folks to make it work." However, he knew of no formal studies of either TMC or Area Supervisor workload in managing air traffic during convective weather.

There are a number of studies by MITRE and other organizations in the context of TMU workload reduction associated with the entering of aircraft reroutes into the Host computer during convective weather as a part of the TFM-M benefits studies. Although improving the ability to quickly enter reroutes is very important for the implementation of a mitigation plan, it is hard to see how the approach used to assess workload reduction for a fairly straightforward task such as entering reroutes into the Host computer is germane to assessing the workload associated with the first four elements of the operational decision loop in Figure 1-4.

The most pertinent study related to the proposed CIWS productivity enhancement investigation was the Master's Thesis of Haley Davison at M.I.T. (Davison and Hansman, 2001). A series of site visits were performed at Boston and New York ARTCCs as well as at the Air Traffic Control System Command Center (ATCSCC). The results of those site visits were used to determine the current communication and coordination structure of Traffic Management Coordinators (TMCs). A number of the site observations were of convective weather management situations.

Some of their observations are particularly pertinent to the CIWS productivity benefits study. In their Section 1.1, they state[20]:

> "The ATC position that performs both local and national inter-facility communication is the Traffic Management Coordinator (TMC), located at each facility. The TMC position in the ATC facility is responsible for coordinating the traffic flows into and out of the facility though communications with other ATC facilities. The TMC is the most critical link between facilities in the system.

20 We have added numbering to various statements on TMC Function to facilitate referencing the specific Function in a later section of this plan.

Function1: While tactical controllers allow aircraft into the facility on a flight-by-flight basis, the TMCs control whether fixes and jet routes into and out of the facility are open and the rate at which traffic can flow through specific fixes.

Function 2: The TMCs are also responsible for monitoring operations within the facility, determining when the tactical controllers are overloaded with aircraft, and responding.

Function 3: The TMCs communicate and negotiate with other facilities' TMCs to coordinate appropriate traffic initiatives to reduce demand into the facility.

Function 4: They are also responsible for communicating initiatives and restrictions to the tactical controllers in a timely manner.

Traffic initiatives are used by the TMCs as an organized means of reducing demand into one or multiple facilities. Two types of traffic initiatives can be implemented to prevent airspace from being overloaded: national or local initiatives.

Function 5: Often TMCs address traffic overload first through local traffic initiatives such as Miles-In-Trail (MIT) or Departure Sequence Planner (DSP). These local initiatives are short-term traffic solutions that are often implemented by Tower, TRACON or Center facilities. MIT restrictions require the upstream facility to maintain a certain minimum number of miles between each aircraft entering the restricted facility.

Function 6: If traffic demand is predicted to be high for longer periods of time, the facility TMCs will coordinate with the Command Center to implement a national traffic initiative such as a Ground Delay Program (GDP). "

Based on the site observations and analyses of their data in the context of literature on attributes of multi-person communication, as related to

- organization structure,
- physical environment in which the communication takes place,
- information flow (including content) and,
- organizational culture,

Davison and Hansman identified a number of key issues that needed to be addressed to improve the efficiency of strategic communication and coordination within the ATC system. These included:

Ambiguity of the organizational structure in the current ATC system

Awkward coordination between ATC facilities

Information flow issues

Organizational culture issues, and

Negotiation behaviors used to cope with organizational culture issues

Figure 2-1 showed the complexity of the intra- and inter-facility coordination process for two facilities in the CIWS domain (from Davison and Hansman, 2001). An indication of the workload associated with this coordination process is shown in Figures B-1 and B-2, which show the number of phone calls and the number of other ATC staff with whom the TMCs coordinate.

Unfortunately, Davison and Hansman do not provide any explicit estimates of the time required to accomplish the TMC communication and coordination functions they describe for air traffic management during convective weather. Discussions were held with Ms. Davison (now Ms. Reynolds) who is currently a PhD candidate[21] at MIT regarding subsequent or related research on TMC workload assessment. She was unaware of any related literature.

[21] Her PhD thesis is involved with ATC controller cognitive processes.

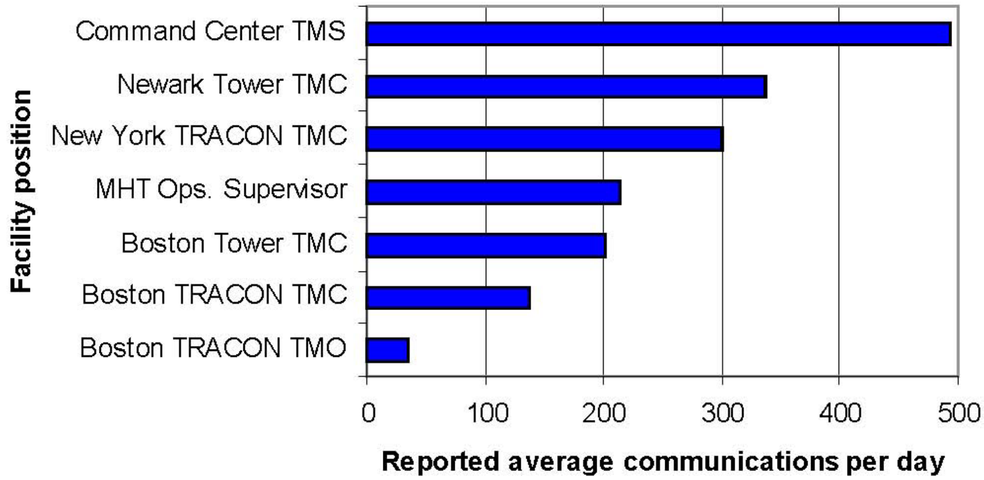


Figure B-1. Communications per day for various TMCs identified in Figure 2-1 (from Davison and Hansman, (2001)).

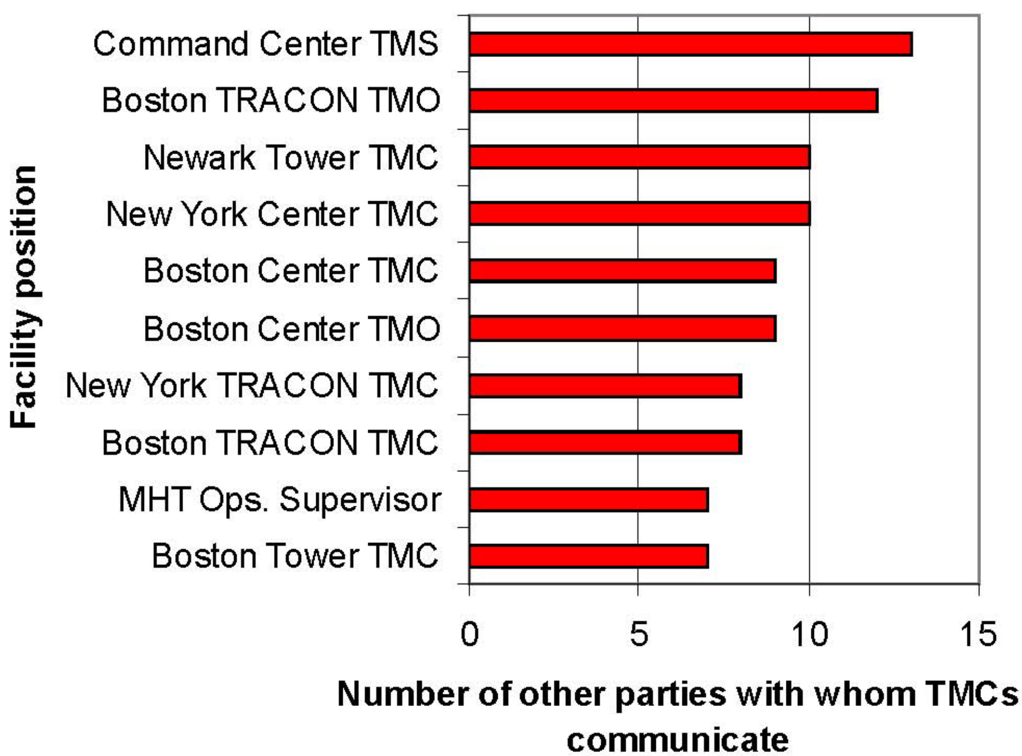


Figure B-2. Interactions with other ATC personnel for various TMCs identified in Figure 2-1 (from Davison and Hansman, (2001)).

APPENDIX C
CLIMATOLOGICAL ADJUSTMENTS TO ARTCC CONVECTIVE WEATHER DAY STATISTICS IN CIWS DOMAIN

The model for identifying, categorizing, and quantifying CIWS delay savings benefits during the 2003 storm season involved an extrapolation of observed CIWS applications during benefits assessment campaigns using a metric for annual convective weather frequency [complete details on methodology employed to estimate annual CIWS delay savings are available in Robinson et al. (2004)]. Specifically, in situ observations of CIWS usage, normalized by the number of days each participating ARTCC was visited, were scaled up by the number of convective weather days per ARTCC per year to determine the annual frequency of the various CIWS operational benefits. In Phase 1 CIWS benefits investigations [ATC-313; Robinson et al. (2004)], the number of convective weather days for each of the six participating ARTCCs in the Midwest and Northeast was determined by averaging total storm days observed in each ARTCC between April and September (i.e., storm season) for 2002 and 2003.

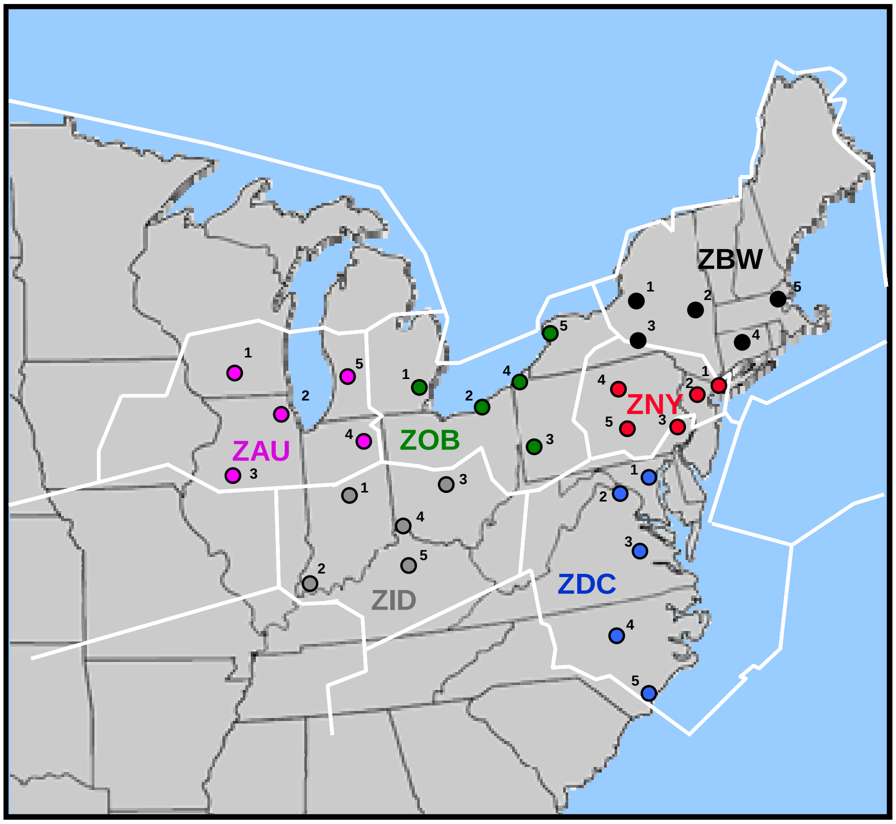
In order to improve estimates of annual CIWS delay savings , it was recognized that statistics for ARTCC convective weather days (used to extrapolate from “daily-observations” to annual benefits) must account for both long-term thunderstorm climatology within the regions of interest, as well as convective weather activity outside of the period from April to September. Described in this Appendix are the methodology and results of modifying averaged 2002–2003 ARTCC convective weather day statistics employed in the Phase 1 CIWS Benefits Study to account for long-term climatology and “non-seasonal” thunderstorm activity. Once ARTCC convective weather day metrics are scaled to account for climatology, they can be used to estimate annual CIWS benefits during other years (e.g., 2005).

C-1 ACCOUNTING FOR LONG-TERM CLIMATOLOGY IN ARTCC CONVECTIVE WEATHER DAY STATISTICS

Thunderstorm climatology data from five cities in each of the six ARTCCs in the 2003 study were used to determine ratios of historical storm days to storm days in 2002 and 2003. Multiplying 2002–2003 convective weather day statistics used in the Phase 1 CIWS Benefits Study by these ratios, which are based upon a suite of observation stations within each En Route Center, creates a metric for ARTCC-scale storm day statistics that more adequately represents historical thunderstorm activity in the CIWS domain.

All cities selected within each ARTCC for climatological comparisons possessed at least 20 years of historical thunderstorm day statistics. Moreover, care was taken to select cities where standard reporting of meteorological observations included thunderstorm days with and without precipitation, as reports of convective activity *in the vicinity* of reporting stations is worthwhile when tabulating storm day statistics over the large domains of en route air traffic centers. Finally, cities were selected in a manner that allowed spacing as uniform as possible throughout the En Route Center.

Figure C-1 depicts the five cities chosen for climatological comparisons in each ARTCC studied in the Phase 1 CIWS benefits analysis (30 cities total). Previous studies have discussed potential drawbacks of employing conventional “point-source” thunderstorm day statistics to represent, and thus, likely underestimate, the frequency of thunderstorms in a larger region containing the weather observation stations [e.g., Bieringer et al. (1999)]. However, the authors feel that by utilizing data from several, adequately-spaced, observation stations, results averaged by all "ARTCC-cities" would be an acceptable proxy for use in climatological scaling of observed ARTCC convective weather day statistics.



ZAU:

1. Madison, WI
2. Chicago (ORD), IL
3. Peoria, IL
4. Fort Wayne, IN
5. Grand Rapids, MI

ZID:

1. Indianapolis, IN
2. Evansville, IN
3. Columbus, OH
4. Cincinnati, OH
5. Jackson, KY

ZOB:

1. Detroit, MI
2. Cleveland, OH,
3. Pittsburgh, PA
4. Erie, PA
5. Buffalo, NY

ZDC:

1. Baltimore, MD
2. Dulles, VA
3. Richmond, VA
4. Raleigh, NC
5. Wilmington, NC

ZNY:

1. NY (JFK), NY
2. Newark, NJ
3. Philadelphia, PA
4. Williamsport, PA
5. Harrisburg, PA

ZBW:

1. Syracuse, NY
2. Albany, NY
3. Binghamton, NY
4. Hartford, CT
5. Boston, MA

Figure C-1. Observation stations chosen within each ARTCC to determine ratios of thunderstorm day statistics for long-term climatology versus observations in 2002 and 2003.

For each observation station, monthly and annual thunderstorm days statistics were collected for 2002, 2003, and the long-term climatological average. All data were retrieved from the National Climatic Data Center. The number of years included in the historical averages varies from city to city based upon availability, but the records for each city extend beyond at least 20 years. Thunderstorm day statistics for each "ARTCC-city" are presented in Tables C-1 through C-6.

TABLE C-1
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZAU Observation Stations

ZAU	Climatology		2002		2003	
CITY	J F M A M J J A S O N D	Annual	J F M A M J J A S O N D	Annual	J F M A M J J A S O N D	Annual
Madison, WI	0 0 2 4 5 7 8 7 5 2 1 0	41	0 0 2 3 5 7 8 7 3 2 1 1	39	0 0 0 4 5 3 9 6 0 1 2 0	27
Chicago, IL	0 0 2 4 5 6 6 6 4 2 1 1	37	1 0 2 4 6 7 4 7 2 1 0 2	36	0 0 1 3 8 1 13 5 1 0 1	33
Peoria, IL	0 1 3 5 7 9 8 7 5 2 1 1	49	0 0 3 6 7 7 4 7 1 0 0 2	37	0 0 3 3 6 5 10 5 3 4 1 0	40
Fort Wayne, IN	0 1 2 4 5 7 7 6 4 2 1 0	39	0 1 1 3 7 9 5 6 4 0 1 0	37	0 1 4 2 11 2 9 9 4 1 0 0	43
Grand Rapids, MI	0 0 2 4 4 6 6 5 4 2 1 0	34	0 1 1 2 5 4 7 7 2 2 0 0	31	0 0 2 5 5 2 8 11 1 0 3 0	37
ARTCC Average		**40**		**36**		**36**

TABLE C-2
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZID Observation Stations

ZID | Climatology | 2002 | 2003

CITY	Climatology J F M A M J J A S O N D	Climatology Annual	2002 J F M A M J J A S O N D	2002 Annual	2003 J F M A M J J A S O N D	2003 Annual
Indianapolis, IN	1 1 3 5 6 7 8 6 3 2 1 0	43	2 1 3 6 11 11 4 5 3 0 1 1	48	0 1 4 2 11 2 15 10 5 2 0 0	52
Evansville, IN	1 1 4 5 6 7 7 5 3 2 2 1	44	2 0 4 8 8 6 8 3 3 0 5 1	48	0 1 3 6 14 5 7 5 2 2 2 0	47
Columbus, OH	0 1 2 4 6 8 8 6 3 1 1 0	40	0 1 4 4 11 9 5 4 4 1 2 0	45	0 1 3 4 12 5 11 11 3 0 0 0	50
Cincinnati, OH	1 1 3 4 6 7 8 6 3 1 1 0	41	1 1 1 6 11 6 5 6 3 0 1 0	41	0 1 3 3 9 2 12 9 3 1 1 0	44
Jackson, KY	0 1 3 4 8 10 12 8 3 1 1 0	51	2 1 4 6 10 11 12 10 3 0 3 0	62	0 0 3 7 14 6 10 14 3 0 1 0	58
ARTCC Average		**44**		**49**		**50**

TABLE C-3
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZOB Observation Stations

ZOB | Climatology | 2002 | 2003

CITY	Climatology J F M A M J J A S O N D	Climatology Annual	2002 J F M A M J J A S O N D	2002 Annual	2003 J F M A M J J A S O N D	2003 Annual
Detroit, MI	0 0 2 3 4 6 6 5 4 1 1 0	32	0 0 0 3 4 9 8 5 4 1 1 0	35	0 0 3 3 5 5 8 12 4 0 1 0	41
Cleveland, OH	0 0 2 3 5 6 6 5 3 2 1 0	33	0 0 2 6 6 6 5 7 5 0 2 0	39	0 1 1 3 8 2 8 10 4 1 1 0	39
Pittsburgh, PA	0 0 2 3 5 7 7 6 3 1 1 0	35	0 1 3 6 7 6 7 7 2 1 1 0	41	0 1 2 3 8 4 9 11 4 0 0 0	42
Erie, PA	0 0 2 3 4 6 7 7 4 2 1 0	36	0 0 0 4 6 7 5 3 4 0 1 0	30	0 0 1 3 7 1 10 9 7 2 0 0	40
Buffalo, NY	0 0 1 2 3 5 6 6 4 2 1 0	30	0 0 0 3 5 4 6 4 2 0 1 1	26	0 0 0 0 5 3 3 11 4 1 2 0	29
ARTCC Average		**33**		**34**		**38**

TABLE C-4
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZDC Observation Stations

ZDC | **Climatology** | **2002** | **2003**

CITY	Climatology J F M A M J J A S O N D	Climatology Annual	2002 J F M A M J J A S O N D	2002 Annual	2003 J F M A M J J A S O N D	2003 Annual
Baltimore, MD	0 0 1 2 4 5 6 5 2 1 0 0	26	0 1 2 4 7 3 2 3 0 0 1 0	23	0 1 1 0 3 7 10 12 6 0 1 0	41
Dulles (IAD), VA	0 0 1 2 4 6 6 5 2 1 1 0	28	0 0 2 5 7 11 2 6 1 0 1 0	35	1 0 1 1 8 8 8 12 6 0 1 0	46
Richmond, VA	0 0 2 3 6 8 10 8 3 1 1	42	0 0 2 6 4 3 3 4 1 0 1 0	24	0 0 3 2 8 4 9 12 2 0 0 0	40
Raleigh, NC	0 1 2 3 6 7 11 8 3 1 1 0	43	0 0 3 3 1 5 12 8 1 1 1 0	35	0 1 3 2 3 2 11 13 1 0 0 0	36
Wilmington, NC	0 1 2 3 6 8 12 9 4 1 1 0	47	0 0 5 2 3 6 12 9 5 2 3 1	48	0 1 6 1 10 5 12 6 3 1 0 1	46
ARTCC Average		**37**		**33**		**42**

TABLE C-5
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZNY Observation Stations

ZNY | **Climatology** | **2002** | **2003**

CITY	Climatology J F M A M J J A S O N D	Climatology Annual	2002 J F M A M J J A S O N D	2002 Annual	2003 J F M A M J J A S O N D	2003 Annual
New York, NY	0 0 1 1 3 4 5 4 1 1 0 0	20	0 0 0 3 3 4 3 4 1 0 1 0	19	0 0 0 0 4 4 5 3 1 0 1 0	18
Newark, NJ	0 0 2 3 6 9 11 8 4 2 1 0	46	0 0 2 3 4 7 4 5 2 0 1 0	28	0 1 1 0 5 6 6 6 0 0 1 0	26
Philadelphia, PA	0 0 1 2 4 5 6 5 2 1 1 0	27	0 0 1 4 6 7 3 3 0 0 1 0	25	0 1 0 0 2 3 8 9 6 0 0 0	29
Williamsport, PA	0 0 1 2 5 7 8 6 3 1 1 0	34	1 1 3 6 10 10 6 7 2 1 0 0	47	1 1 2 5 6 1 7 13 6 3 0 0	45
Harrisburg, PA	0 0 1 2 5 6 7 5 3 1 1 0	31	1 0 3 10 8 9 7 8 3 1 1 2	53	0 2 1 4 11 7 9 17 8 3 6 1	69
ARTCC Average		**32**		**34**		**37**

TABLE C-6
Climatology, 2002, and 2003 Thunderstorm Day Statistics for ZBW Observation Stations

ZBW | **Climatology** | **2002** | **2003**

CITY	Climatology J F M A M J / J A S O N D	Climatology Annual	2002 J F M A M J / J A S O N D	2002 Annual	2003 J F M A M J / J A S O N D	2003 Annual
Syracuse, NY	0 0 1 2 3 5 / 6 5 3 1 1 0	27	0 0 1 1 6 7 / 2 5 4 1 0 0	27	0 0 0 0 2 1 / 2 9 1 2 1 0	18
Albany, NY	0 0 1 1 3 5 / 6 5 2 1 0 0	24	0 0 1 1 4 9 / 4 5 2 0 0 0	26	0 0 0 0 3 2 / 3 5 2 0 0 0	15
Binghamton, NY	0 0 1 2 4 6 / 7 5 3 1 0 0	29	0 0 2 2 5 11 / 4 2 2 0 0 0	28	0 0 2 3 6 1 / 5 5 3 1 2 2	30
Hartford, CT	0 0 1 1 2 4 / 5 4 2 1 0 0	20	0 1 5 4 4 11 / 4 2 2 0 0 0	37	0 3 2 1 7 8 / 6 11 3 5 3 2	51
Boston, MA	0 0 1 1 2 3 / 4 3 1 1 0 0	16	0 0 0 3 6 5 / 6 1 1 0 0 2	24	0 0 0 0 1 0 / 3 6 1 0 0 0	11
ARTCC Average		**23**		**28**		**25**

Thunderstorm day statistics shown in Tables C-1 – C-6 are used to calculate climatological scaling factors for each ARTCC. Determining the climatological scaling factor to be used to adjust the ARTCC convective weather day metric from the Phase 1 Benefits Study involves these steps:

1. Average the historical number of thunderstorm days from the five stations in each ARTCC (ARTCC Climatological Average: C)

2. Average the number of thunderstorm days from the five stations in each ARTCC during 2002 and 2003 (2002-2003 ARTCC Thunderstorm Day Average: S)

3. Compute the climatological scaling factor (F) for each ARTCC by dividing the Climatological Average ARTCC Thunderstorm Days (C) by the 2002–03 ARTCC Average ARTCC Thunderstorm Days (S)

Since the Phase 1 ARTCC convective weather day statistics include thunderstorm activity during only the months from April to September, all ARTCC climatology scaling factor computations from "ARTCC-cities" are also based only on this six-month period defining the storm season in the CIWS domain. Hence, results shown in Table C-7 represent climatologically-modified ARTCC convective weather day statistics for only the *seasonal* period from April to September and are therefore considered preliminary. Historical and 2002–2003 thunderstorm day statistics from the identified observation stations in each ARTCC are further employed to extend the seasonal climatologically-modified ARTCC convective weather day metric to annual storm day statistics.

TABLE C-7
Seasonal (April – September) ARTCC Convective Weather Day Statistics Modified to Account for Long-Term Climatology

April - September

ARTCC	Climatological Average (C)	2002-03 Thunderstorm Day Average (S)	Climatological Scaling Factor (F)	Modified Convective Weather Day Frequency
ZAU	34	31.5	1.08	89.5 * 1.08 = 96.7
ZID	36	42.0	0.86	102.0 * 0.86 = 87.7
ZOB	29	33.0	0.88	91.5 * 0.88 = 80.5
ZDC	33	37.0 **	0.89	104.0 * 0.89 = 92.6
ZNY	28	31.5	0.89	69.5 * 0.89 = 61.9
ZBW	21	20.0 **	1.05	60.0 * 1.05 = 63.0

** Only 2003 storm day statistics used for ARTCC-City average since ZDC/ZBW convective weather days in Phase 1 study only include 2003

Values in Phase 1 Report

Modified *Seasonal* ARTCC Storm Day Frequency

C-2 CONVERTING FROM SEASONAL TO ANNUAL CLIMATOLOGICALLY-MODIFIED ARTCC CONVECTIVE WEATHER DAY STATISTICS

The averaged percentage of total annual storm days from stations within an ARTCC occurring between October–March is the non-seasonal scalar used to convert climatologically-modified ARTCC convective weather days from *seasonal* (shown in red box in Table C-7) to *annual*. Table C-8 shows the final, modified convective weather day statistics for the six ARTCCs included in the Phase 1 CIWS Benefits Study (in red), now accounting for both long-term climatology as well as thunderstorm activity occurring outside the period from April – September. Also included in this table are the seasonal, climatologically-adjusted ARTCC storm day statistics from Table C-7 (column 2) which are multiplied by the non-seasonal thunderstorm day scalar (Table C-8, column 3) to obtain final results. The original, unmodified ARTCC convective weather day statistics from Phase 1 analyses are included in Table C-8 (column 5) for direct comparison with ARTCC thunderstorm day metrics adjusted for climatology and full-season activity.

TABLE C-8
Annual ARTCC Convective Weather Day Statistics Modified to Account for Long-Term Climatology as well as Thunderstorms Occurring during October - March

ARTCC	Seasonal, Climatologically-Adjusted Convective Weather Day Frequency (from Table 1-7)	Non-Seasonal Climatological Storm Day Scalar **	Annual, Climatologically-Adjusted Convective Weather Day Frequency	Unmodified Phase 1 Convective Weather Day Frequency
ZAU	96.7	1.15	111.2	89.5
ZID	87.7	1.18	103.5	102.0
ZOB	80.5	1.12	90.2	91.5
ZDC	92.6	1.11	102.8	104.0
ZNY	61.9	1.12	69.3	69.5
ZBW	63.0	1.09	68.7	60.0

** For example, with ZAU: On average for the 5 cities within ZAU airspace, monthly long-term climatology statistics demonstrate that 85% of annual thunderstorm days occur during April – September (defined as "seasonal"). Therefore, the climatologically-modified seasonal convective weather day frequency for ZAU is increased by 15% to ensure annual storm frequency representation.

When comparing Phase 1 ARTCC convective weather day statistics to the modified metrics, it is interesting to note that the statistics are very similar for most of the En Route Centers included in the analyses. Final, historically-adjusted annual convective weather day statistics for ZID, ZOB, ZDC, and ZNY are all within 1% of original, seasonal statistics presented in the Phase 1 CIWS Benefits report. For these Centers, the above-average seasonal thunderstorm activity during 2002 and 2003 (e.g., climatological adjustment resulted in *decreased* storm day metrics) was nearly equally balanced by the under-representation of annual storm activity caused by not including the period from October – March in Phase 1 tabulations (e.g., non-seasonal storm-day adjustment resulted in 11-18% *increase* in metric). Ratios of seasonal to non-seasonal historical thunderstorm day statistics for ZAU and ZBW are similar to the other ARTCCs in this analysis. However, final, climatologically-adjusted annual convective weather day statistics for ZAU and ZBW are decidedly larger than counterpart-metrics presented in the Phase 1 report. Unlike the other En Route Centers in these analyses, the historical average number of seasonal thunderstorm days across ZAU and ZBW was *greater* than the number of storm days occurring in April – September in 2002 and 2003. Therefore, once confirmed that seasonal thunderstorm activity across ZAU and ZBW Centers in 2002-2003 was below-average, convective weather day statistics were increased accordingly, which in turn resulted in increases in CIWS benefits calculations that rely on this metric for extrapolation.

APPENDIX D
2005 CIWS PRODUCTIVITY ENHANCEMENT ASSESSMENT CAMPAIGN

OBSERVED CIWS APPLICATIONS: OBSERVATION PERIODS 1 – 3

TABLE OF CONTENTS

Index 1: CIWS Benefits Categories Identified During Blitz Campaigns *

1. Routes open longer and/or reopening closed routes earlier
2. Proactively close routes
3. Proactive, efficient reroutes
4. Shorter/fewer ground stops, ground stops avoided (Improved Ground Stop Program management)
5. Reduced MIT restrictions; Proactive management of routes in use
6. Traffic directed through gaps in weather
7. Improved management of weather impacts on Area Transition Areas (ATA) and/or Departure Transition Areas (DTA)
8. Improved optimization of runway usage; Enhanced runway planning
9. Improved Ground Delay Program management
10. Greater departures during Severe Weather Avoidance Program (SWAP)
11. Directing pathfinders
12. Interfacility, intrafacility coordination assistance
13. Improved safety
14. Reduced workload (includes proactive impact mitigation planning)
15. FAA facility staffing assistance
16. Situational awareness

***** Applicable benefits categories assigned to each observed usage of CIWS during Observation Periods 1-3 of 2005 Benefits Assessment Campaign

Index 2: Impact Planning Categories Assigned to Blitz Observations **

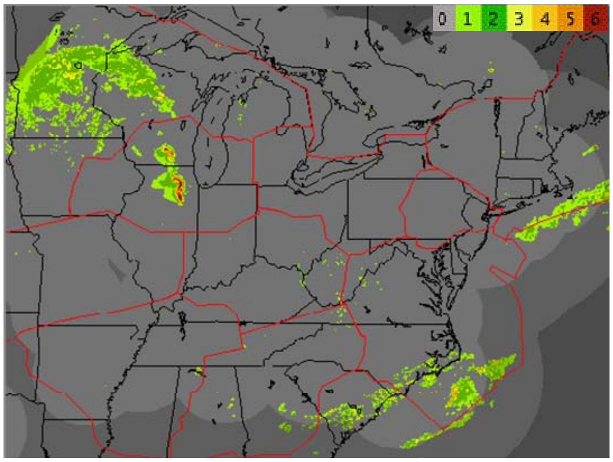
1. Route closures and reopenings; Nominal route management
2. Reroute planning
3. Terminal management
4. Arrival Transition Area (ATA)/Departure Transition Area (DTA) management
5. Situational awareness

****** Applicable impact planning categories assigned to each observed usage of ATC weather decision support tools (e.g., CIWS, ETMS, WARP, WARP-DSR, CWSU) during Observation Periods 1-3 of 2005 Benefits Assessment Campaign

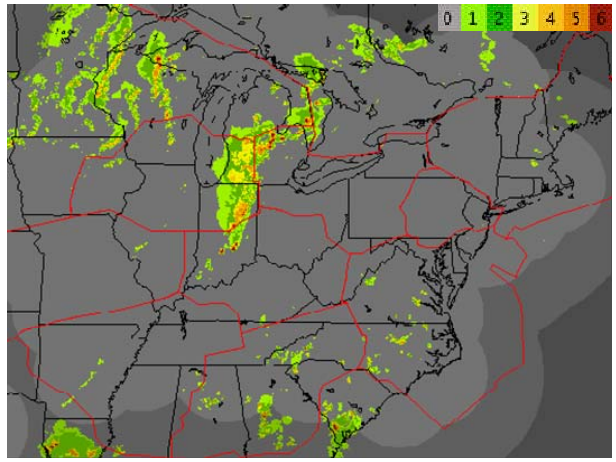
OBSERVATION PERIOD 1: 4-7 June 2005

Facilities Visited: ZMP, ZAU, ZOB, ZDC, ZNY, ZBW

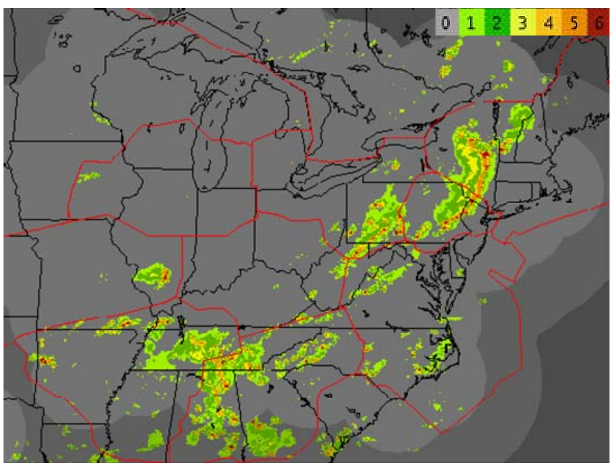
Examples of CIWS NEXRAD VIL Precipitation During Period 1:



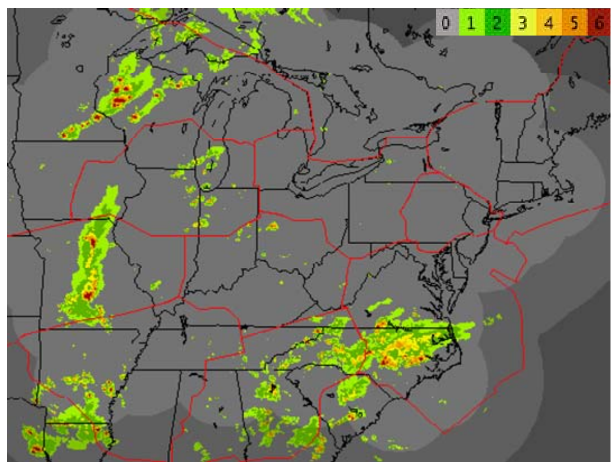
04 June 2005, 1830 UTC



05 June 2005, 2230 UTC



06 June 2005, 1930 UTC



07 June 2005, 2330 UTC

CIWS Benefits Assessment
Observation Period #1 Observations Summary
Day 1 - June 4, 2005

Participating Facilities: ZMP

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
		ZMP			
ZMP-1-1	1015	AT 1015, the STMC used CIWS to determine that weather would impact FOD and MCW streams through ZMP to ORD. As a result, at the 1115 SPO, he suggested a modified Bradford (BDF) playbook route for traffic through ZMP arriving ORD over FOD/MCW. SCC did not implement the plan because the CCFP did not forecast weather in the area of concern. However, UAL heard the suggestion on the telecon and filed their LA traffic further north.	CIWS CWF, Echo Tops	2	3, 12
ZMP-1-2	1355	ZAU reports that aircraft are deviating on the FOD and MCW streams. They request a single stream. The ZMP STMC and TMC determined that the best option was to take the traffic into ZDV over ONL and then into Area 5 via FOD. Traffic will then arrive ORD via BDF	CIWS CWF, Echo Tops Forecast	2	3, 12
ZMP-1-3	1415	STMC still wants a modified BDF playbook route. He is concerned that if weather impacts BDF, as forecasted by CIWS, Area 5 will be shut off by ZAU and have to hold aircraft.	CIWS CWF, Echo Tops	5	16
ZMP-1-4	1515	SPO: SCC discussed that weather in Midwest is decreasing as forecasted. (Note: CIWS Echo Tops Forecast and CWF indicate little activity above 35 kft and/or greater than level 3). SCC indicated that they may want to implement a modified BDF playbook route later.		5	16
ZMP-1-5	1610	STMC beginning to think about a plan for ORD arrivals if JVL is impacted.	WARP, CIWS CWF, Echo Tops Forecast, VIL	5	14, 16
ZMP-1-6	1625	ZMP and ZAU discuss the possible JVL impact. ZAU thinks the weather will dissipate. Currently BDF is closed, but ZAU does not expect the weather to affect JVL. However, just after this conversation, ZAU requested a 15 MIT restriction on JVL.		1	12, 14, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZMP-1-7	1715	SPO: STMC expressed concern that JVL would be impacted before BDF was clear. No plan was discussed, but STMC wanted users to have a heads-up.	CIWS CWF, Echo Tops Forecast	5	16
ZMP-1-8	1815	TMC attempting to design a plan for ORD landing traffic. He does not think they should go north to GRB and around because they will get caught on the wrong side of the weather after it passes ORD. He expects that ZMP will have to hold them or they will have to divert. He consulted Area 1 about staffing for this situation.	CIWS CWF	2	3, 12, 15
ZMP-1-9	1820	ORD ground stop until 1930 for all traffic from the west and south.			
ZMP-1-10	1830	Area 1 may potentially be taking many additional aircraft. With the ORD ground stop and weather east of ORD, ZOB flights headed for ORD will likely have to fly through Area 1. TMC is considering opening the super-high sector due to volume.	CIWS CWF	5	14, 15, 16
ZMP-1-11	1855	CWSU briefed TMC that weather near ORD should dissipate soon. TMC decided not to implement a playbook route for MSP arrivals, which are now going further north over GRB instead of BAE. TMC coordinated with Area 1 Sup. The location of the weather is already causing a problem for Area 1 and a playbook route would probably not work with current staffing issues.	CWSU, CIWS VIL, CWF	2	3, 15
ZMP-1-12	1910	TMC expects weather to clear ORD and allow a return to BDF route. Area 1 (with staffing issues) is holding for ORD. TMC wants to start moving the aircraft toward BDF. ORD ground stop is extended to 2000.	WARP, CIWS CWF	1	14, 16
ZMP-1-13	1930	TMC now agrees with keeping the BDF playbook going. It is working well enough at present, but Area 1 manpower issues could change this.			
ZMP-1-14	1940	ORD arrivals from ZOB are currently routed over GRB to DLL. TMC expects that this route will be impacted by weather soon. TMC warned Area 2 to expect problems with additional deviations. TMC coordinated with ZAU to determine if this route could be changed to accommodate the weather.	WARP, CIWS CWF	2	12, 14, 16
ZMP-1-15	2010	STMC wants to implement MSP-EAU-2 playbook to avoid deviations near GRB into Area 1. Coordinated with ZNY, ZOB, and ZBW. Request denied, but ZAU is allowing traffic back over PMM which will reduce volume in short-staffed Area 1.	WARP, CWSU, CIWS VIL, CWF, Echo Tops	2	12, 14, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZMP-1-16	2130	Area 3 Sup used CIWS to study echo tops forecast. Area 3 Sup asked Area 6 Sup to notify Area 3 if the weather in ZKC began to cause problems for Area 6. This would result in a chain reaction as traffic deviated to the north. Area 3 Sup informed TMC about this coordination and TMC promised to monitor the situation closely. This Area initiative results in a reduction in TMU workload because the Area Sup handled the situation without TMU involvement.	CIWS Echo Tops Forecast	5	12, 14, 16
ZMP-1-17	2320	ZKC was shut off by a line of weather oriented north-south. ZKC requested a route through ZMP. ZMP offered to take about 7 aircraft through Area 5 over FOD on J94.	WARP (for areas west of CIWS coverage), ETMS, CIWS VIL, CWF	2	3, 12
ZMP-1-18	0030	Weather in NE and IA is causing concern. TMC and Area 3 Sup discussed swapping MSP westbounds into Area 3 airspace. Area 3 Sup said this would create a lot of work and thought he would need extra people The MIT restriction helped keep volume manageable. Turns out there was not much added work because MIT restrictions were placed on some of the routes south.	WARP (for areas west of CIWS coverage), CIWS CWF	2	3, 12

CIWS Benefits Assessment
Observation Period #1 Observations Summary
Day 2 - June 5, 2005

Participating Facilities: ZMP, ZAU, ZOB

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
		ZMP			
ZMP-1-19	1710	Weather is building near MSP-ATA-KASPR/TWOLVES. MSP arrivals are being rerouted at these fixes. STMC reported this on the SPO. CWSU is watching CIWS precipitation forecast to determine when south and west fixes will be impacted.	CIWS CWF	4, 5	7, 12, 16
ZMP-1-20	1745	TMC and STMC discuss a possible playbook route for MSP arrivals over EAU/KASPR to avoid the weather forecasted to develop over western WI. This will likely mean that Area 1 will need overtime. CIWS was used to coordinate the play with NWA.	CCFP, CIWS CWF and VIL	2, 5	3, 12, 14, 15
ZMP-1-21	1820	Weather near MSP is causing SWAPs to be implemented. CWSU used CIWS for his briefing. The ODI-DLL1 traffic will go to WLSTN. The Nodine traffic is deviating. TMC coordinated with tower and ZAU using CIWS.	CIWS VIL, CWF, Echo Tops	2	3, 12
ZMP-1-22	1900	Super high sector 14 will open as soon as Area 1 gets their over-time people in. The decision to call in over-time was based on the weather forecast and volume concerns.	CIWS CWF	2	14, 15
ZMP-1-23	2005	Pathfinder was successfully sent over ODI-DLL. This will help open up the route. CIWS was used.	CIWS Echo Tops Forecast, ASR Precip	1	1
ZMP-1-24	2030	A pathfinder was routed over ODI1 based on CIWS forecast. In about 1 hour, they will transition to DLL1. The Areas 2 Sup used CIWS to coordinate this with the TMC working the MSP. The pathfinder was OK, so 6 more departures were sent on this route. TMC stated that this would not have been accomplished without CIWS.	CIWS CWF	1	1, 11, 12

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZMP-1-25	2050	CIWS is being used frequently for situational awareness and tactical reroutes in many Areas and sectors.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Lightning	5	12, 16
ZMP-1-26	2055	MSP TMC position used CIWS to plan for departures in the next hour. He wants to take them over EAU.	CIWS CWF, Echo Tops Forecast	3, 4	7, 10, 14
ZMP-1-27	2100	TMC commented that CIWS coverage into Canada that is (not provided by WARP) is very helpful, especially when CAN playbook routes are being used.	CIWS VIL, CWF, Echo Tops Forecast	5	16
ZMP-1-28	2115	SPO: MSP ground stop due to weather at terminal.			
ZMP-1-29	2135	MSP ground stop lifted.			
ZMP-1-30	2145	Pathfinder being sent out over ROC.			
ZMP-1-31	2150	TMC is trying to determine a plan for MSP arrivals and departures. Departing aircraft are deviating in Areas 2 & 3 near arrival airspace. Coordinated with NWA and Areas 2 & 3 to decide to propose trying EAU-2 playbook. TMC called SCC at 2205 to propose MSP-EAU-2 playbook route. SCC said they would get back to him.	WARP, CIWS Echo Tops, CWF, and VIL	2	3, 12
ZMP-1-32	2220	TMC decided to send a pathfinder over ABR1 to open the route. He used WARP for information where CIWS lacked coverage and CIWS otherwise. He decided that the weather was showing enough decay to start sending departures that way.	WARP for weather to west of CIWS coverage, CIWS otherwise	1	1, 11
ZMP-1-33	2240	TMC talked with Area 3 Sup. Aircraft are going out the RST1 SID and picking through the weather near RST. Sup expects them to deviate further south based on what he sees on the CIWS forecast.	CIWS CWF	5	12, 16
ZMP-1-34	0140	Area Sup asked if ROC departures to the south could be swapped to ODI because they were deviating into arrivals.	ETMS for deviations, CIWS CWF	2, 5	12, 14, 16

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		ZAU			
ZAU-1-1	1430	At 1430Z, the 1900Z forecasted CCFP showed impact on KUBBS arrivals. The STMC discussed with ORD Arrival position the possibility of a playbook route to take traffic from the east fixes to the back side of the weather.	CCFP	2	
ZAU-1-2	1515	SPO: ZAU expects thunderstorms in the terminal area and scattered throughout airspace. Warned users to expect trouble on the east side. ZOB stated that much of the traffic had been moved out of their airspace so they should be able to handle ORD landing traffic. They asked SCC to consider moving the Florida-to-ORD traffic west of the expected weather. Things remained quiet for a while. CIWS was consulted often by the ORD Arrival, en route, and STMC positions. Finally around 1800 an Area reported that an aircraft deviated at BEARZ. There was no radar echo at this time but satellite showed some developing cumulus. (Radar echo appeared around 1814.)	CIWS CWF, VIL, Satellite, Growth and Decay Trends, Storm Motion	5	16
ZAU-1-3	1815	Westbound traffic departing ORD are deviating due to weather.			
ZAU-1-4	1820	A storm rapidly developed over Grand Rapids (GRR) to 51 kft and is disrupting traffic. ORD Arrival talked to ZOB and quoted CIWS.	CIWS Echo Tops, Storm Motion, and Growth and Decay Trends	5	12, 16
ZAU-1-5	1825	DTW push is impacted by weather over GRR. ORD Arrival position called Area to discuss moving the route.	CIWS VIL, Echo Tops, CWF	2	14, 16
ZAU-1-6	1826	ORD Arrival coordinated for a long time (about 6 minutes) with SCC SvrWx and ZOB concerning NW corner arrivals to DTW. ORD Arrival decided to call a ground stop for internals to DTW for 45 min until a plan could be defined.	CIWS VIL, Echo Tops, CWF	2	12, 14, 16
ZAU-1-7	1830	DTW ground stop void 1915 for ZAU internals as an intermediate measure while trying to agree on a plan with SCC.			
ZAU-1-8	1832	ORD Arrival coordinated with the Areas (E, NE, N, and NW) to take DTW traffic over Litchfield with 20 MIT.	CIWS VIL, Echo Tops, CWF	2	3, 4, 12

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZAU-1-9	1835	MSP call-for-release to DTW. TMC is allowing one more departure then stopping.			
ZAU-1-10	Inter-view	TMC was asked if CIWS saved time from 1820, when problem was identified to 1835 when plan was implemented. He was unable to provide minutes-of-savings for each step in the process but estimated that CIWS saved 10 to 15 minutes. He indicated that he would not have been proactive about developing the plan without CIWS. He would have waited for the Areas to report the problem. CIWS helped set up an orderly transition to LCH and aided in coordinating between facilities.			
ZAU-1-11	1839	ORD Arrival position called SCC to warn them to expect 1st tier holding for ORD landing traffic. CIWS was referenced extensively throughout the conversation. Asked SCC to warn ZID and ZOB of impending 1st tier ground stop.	CIWS Storm Motion, Growth and Decay Trends, VIL	3	4, 12, 14
ZAU-1-12	1840	ORD Arrival called Area to shut off ZID and ZOB.			
ZAU-1-13	1841	TMC is trying to find a route to MSP for westbound traffic out of ZOB. Determined J34, Badger, Pullman, Green Bay, Duluth, BRD, Goffer5. 15 MIT for ZMP, 30 MIT over FTW and 20 over Litchfield for ZID/ ZOB. Restrictions needed to merge streams.	CIWS VIL, CWF	2	3, 14
ZAU-1-14	1851	Staffing: DTW and MSP traffic moved to a new position to reduce the workload on the ORD Arrivals position. TMC was asked if CIWS saved time from 1839 to 1851. He commented on how much this weather situation was like "last night" when their solution was to take traffic over Joliet/Gipper using the SBN approach route. He said that because of CIWS it was obvious that the solution from the previous night would not work for this situation and he didn't waste time trying to design and coordinate the same plan for tonight. He saved himself the effort and just shut the flow off and coordinated the J34... plan.			

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ZAU-1-15	1905	TMC hand-off briefing using CIWS. Outgoing TMC indicated that CIWS showed that MDW would be impacted.	CIWS CWF, VIL, Satellite, Growth and Decay Trends, Storm Motion	5	14, 16
ZAU-1-16	1915	SPO: ZAU indicated that ZOB was not sending traffic over Pullman because ZOB traffic couldn't get to it. "O'Hare is going to be a 2-fix airport with 1 departure route." ZOB quoted CIWS with respect to the expected closing of the Pullman route. SCC said there would be a ground stop for the east and southeast traffic headed to ORD and that users should expect a GDP. At this time, ZAU reported 45 minute departure delays and an arrival rate of 76. They told users to expect the AR to drop because they couldn't get departures out. After this, activity at the arrival and over-flight positions decreased. CIWS was used extensively for situational awareness. A trainee staffed the ORD Arrival position with a trainer who uses CIWS extensively. The trainee was eager to try to open up routes through the weather but trainer kept reminding him that the airspace he was trying to use didn't belong to ZAU and the problems he was trying to solve were problems for the other centers to solve. Nonetheless, he continued to identify gaps in the weather that could be used.	CIWS	5	16
ZAU-1-17	2007	TMC at DTW/MSP position used CIWS to coordinate ORD traffic to DTW. There was a gap at the north end of the line, but this could not be used because it would interfere with traffic departing westbound from DTW. Traffic was routed to the south end of the line of weather lying between ORD and DTW. This route carried aircraft south behind the weather nearly to Evansville, IN before turning them north on the east side to DTW. TMC talked to D21 about a cell on their approach and quoted CIWS motion, tops, etc. D21, using CIWS, determined that the cell would be out of the way by the time the traffic got there.	CIWS Echo Tops, Storm Motion, CWF, VIL,	2, 3, 5	3, 10, 12
ZAU-1-18	2102	TMC at ORD Arrival position was asked if CIWS had saved any time during the day. He said he couldn't quote a number but he had been using CIWS almost exclusively from the time he took the position.	CIWS		

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ZAU-1-19	2108	Using CIWS, ORD Arrival TMC identified a possible gap developing in the line of weather near BEARZ. He brought this to the attention of the departure position and indicated he would leave it available for departures. Getting departures off ORD is the highest priority at this time.	CIWS VIL, CWF	1, 2	6, 12, 14
ZAU-1-20	2147	TMC stated that the best thing about CIWS is having all of the weather information available on one screen.			
ZAU-1-21	2158	MSP/DTW position hand-off briefing used CIWS.	CIWS	5	16
ZAU-1-22	2221	Westbound aircraft are using the gap near BEARZ identified by the TMC at 2108. TMC suggested this gap may be used by eastbound ORD departures. However, an eastbound UAL flight refused the route, possibly because it looked worse from the west than from the east.	CIWS VIL	1	1, 6, 10
ZAU-1-23	2232	TMC at En route position used CIWS when conferring with SCC SvrWx & ZOB about traffic to ZMP on J60. TMC noted decay and holes developing. If ZOB can get the traffic to ZAU, ZAU can handle it since the weather has nearly cleared their airspace. TMC was asked if CIWS saved any time during this exchange. He said in this case it actually increased the time used because there was a lot to discuss and lots of information to share. However, the conversation was more fruitful and may have encouraged ZOB to attempt to use the holes. Without CIWS, he would have said "If you can get them here, we can take them."	CIWS VIL, Growth and Decay Trends, CWF	1	1, 6, 12
ZAU-1-24	2235	ORD Arrival TMC quoted CIWS during a conversation with ZOB about routes. When asked if this saved time, he said yes because ZOB has CIWS and the coordination was easier. How much? "A couple of minutes." It was noted that there was no echo tops forecast displayed on the SD. TMC said that the product was not that useful at the ORD Arrival position. However when he works the en route position, he uses echo tops forecast extensively. At Arrival, he really likes to use the verification contours.	CIWS VIL, CWF	2	3, 12, 14
ZAU-1-25	2300	All fixes to ORD are open, but ZID and ZOB are having trouble getting traffic to ZAU now that the weather is in their airspace.			

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		ZOB			
ZOB-1-1	1430	Based on 6-hr CCFP, STMC requested CAN and BNA or VUZ playbook routes implemented by 1315 but was denied. SCC wants to "wait and see."	CCFP	5	
ZOB-1-2	1515	SPO. SCC approved CAN5 and BNA playbook routes starting 1630. PNH1 suggested for ZID/ZME. SCC suggested implementing playbook routes at 1600 but airline users complained that this did not give them enough time to change flight plans. SCC agreed to implement at 1630.	CCFP	2, 5	
ZOB-1-3	1515	CIWS was quoted over SPO to call attention to storms developing in Canada (may affect plans for CAN5 route).	CIWS	5	14, 16
ZOB-1-4	1700	Storms developing south and east of C90-CCFP forecast area appearing on CIWS. CWSU briefed TMU using WARP. Lake breeze visible on WARP and CIWS. On pre-SPO planning call, ZAU expressed concern about playbook routes and ZID expressed concern about tactical reroutes. ZOB STMC stated that tactical reroutes would be needed because the plan was not implemented soon enough	CCFP, WARP, CIWS, and ETMS	5	12, 16
ZOB-1-5	1755	Storms are developing along the lake breeze front in MI and isolated cells developing in KY. Greatest concern now is DTW arrivals over POLAR (NW fix). Will allow deviations and tactical reroutes for D21 traffic to NE arrival fix. ZAU was consulted about traffic over POLAR. Area 2 Sup was concerned that storms may grow into C90 ATA and requested an OXI-OKK reroute for 1810.	CIWS Growth and Decay Trends, VIL, Satellite, CWF	4	7, 12
ZOB-1-6	1820	ESP TMC indicated that without CIWS he would have placed a 30-MIT restriction on the route. STMC suggests moving traffic to the SW fix.	CIWS VIL, CWF, Echo Tops Forecast, Storm Motion	1	1, 12, 14
ZOB-1-7	1831	Area 1 Sup visited TMU to assess the weather situation. Told TMC that a plan would be needed.	CIWS CWF, Echo Tops Forecast, VIL, Growth and Decay Trends, Storm Motion	5	12, 16

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ZOB-1-8	1835	TMC called SCC SvrWx to work out a plan for traffic arriving DTW.	CIWS CWF, VIL, Echo Tops Forecast, Growth and Decay Trends, Storm Motion	4, 5	7, 12
ZOB-1-9	1845	Storms on the ZAU-ZOB border. MIT restrictions for traffic over POLAR ranging from 20 to 40 MIT, depending on ATA. CIWS was used for coordination between ESP position and D21 TMC. Area 1 Sup visited TMU again to consult CIWS. This is a 1-minute round trip for the Area Sup, which implies that he thinks it is worth his time to come to the unit to consult CIWS.	CIWS VIL, CWF, Echo Tops Forecast, Storm Motion	4, 5	7, 12
ZOB-1-10	1848	TMC called ZMP to work out a plan to get traffic from DTW to ZMP. Decided to move all westbound DTW traffic onto J34 with no restrictions to GRB.	CIWS VIL, CWF, Echo Tops Forecast	2, 5	3, 12
ZOB-1-11	1850	BEARZ and PLANO impacted by weather. Ground stop for all east coast traffic departing for ORD is implemented due to en route weather. SCC issued OXI-OKK reroute for traffic to C90.	CIWS VIL, CWF, Echo Tops Forecast	5	16
ZOB-1-12	1915	Thunderstorms with tops of 40+ and 50+ kft are blocking ATA for C90 and D21. MSP is also impacted. SPO: ORD at 30+ min departure delays. May extend the BNA routing. CAN1 is extended until 2000. J29 reroute is cancelled and the OXI-OKK reroute was discussed	WARP, ETMS, CIWS CWF and VIL	5	16
ZOB-1-13	1930	Area 2 Sup used CIWS to brief controllers on reroute and holding. Area 2 Sup used CIWS CWF to plan the opening of arrival routes. He also used CIWS to hold-over a controller and open the "D" side to better manage controller workload.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, ASR Precip, Storm Motion	1, 5	1, 12, 14, 15

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-14	1940	Storms are near MSP and blocking ZMP-ZOB routes. TMC at the route coordinator position started working on a plan to stop ZMP traffic. The OXI-OKK reroutes was stopped by ZID due to volume. CIWS was used to coordinate with ZMP.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	1	2, 12
ZOB-1-15	1945	Storms on the west side of C90 are decaying. A modified OXI-OKK routing was coordinated that did not include ZOB airspace.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	2	3, 12
ZOB-1-16	2004	Storms have developed in D21 near DTW. DTW stopped all westbound departures. ESP TMC used CIWS to coordinate the closure with D21.	CIWS VIL, CWF	3, 5	4, 12
ZOB-1-17	2041	Line of level 5 & 6 weather across eastern ZAU (east of C90) is blocking routes. East coast traffic is released to ORD. MDW ground stop is in effect. ZAU opened routes and J29 was opened with 60 MIT restrictions. The CAN1 playbook was allowed to expire.	CIWS VIL, CWF, Growth and Decay Trends	1	1, 12
ZOB-1-18	2115	SPO: Line of thunderstorms across IN and MI with strong cells north of DTW and storms in the vicinity of MSP. J29 is open with 60 MIT. ORD reports 165 min departure delay. East departures are stopped and swapping to the north. The storms are too high to fly over. SCC asked for help getting departures out of ORD. DTW is ground stopped for westbound traffic. ZMP and MSP are having problems with the weather.	CIWS, WARP, CCFP, ETMS	5	16
ZOB-1-19	2120	Storms are blocking the north ZOB-ZMP border and all ZOB-ZAU borders. There is one gap to ZMP.	CIWS VIL	5	16
ZOB-1-20	2140	Gap in line remains northwest of DTW. Pathfinder from DTW over DUNKS DTA and along J70. The pathfinder deviated. Not clear that D21 used CIWS, but the ESP position worked the plan with Area 2.	CIWS VIL, CWF	2, 5	6, 11, 12, 14
ZOB-1-21	2150	ZID stopped taking ZOB internals due to increased volume caused by the BNA playbook route.			
ZOB-1-22	2200	Storms continue to block eastern ZAU airspace. ZAU is running CLE traffic over the weather in ZAU and through ZOB, descending them on the east side of the storms.			

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ZOB-1-23	2302	Strong line of storms west of DTW with a second line developing ahead of it. TMC is trying to determine when to close arrivals and when the storm will hit DTW. CIWS provides a more accurate picture. Without CIWS, the TMC would have to guess. TMC identified to SCC SvrWx the last aircraft allowed to go to DTW based on the CIWS forecast. However, ZKC released about 6 aircraft after ZOB requested the stop. All six diverted to CLE or Erie, PA. ESP TMC coordinated with ZKC TMU using CIWS.	CIWS VIL, CWF, Growth and Decay Trends, ETMS	1, 3, 5	4, 7, 12, 14
ZOB -1-24	2315	SPO: OXI-OKK route removed. SCC SvrWx suggests all reroutes should be tactical from now on. DTW impact expected to end by 0000.			
ZOB-1-25	2332	The storms are becoming more isolated on the south end of the line with level 6 storms west of DTW. The TMC stated that CIWS reduces his workload by helping him make better decisions. With weather preventing westbound traffic through ZOB and with the multiple reroutes in effect, ZOB has little to do now. All TMC's agree that they are using CIWS more.			
ZOB-1-26	2335	ESP working D21 used ETMS and CIWS to try to get the last few aircraft into DTW before weather shuts them down. TMC coordinated with TMC at D21 using CIWS.	CIWS VIL, Echo Tops, CWF	3, 4	4, 7, 12
ZOB-1-27	2350	Area 2 Sup is using CIWS to coordinate with TMU. The line west of DTW is approaching DTW. The small line that developed ahead of the main line will impact DTW first. Arrival flow is continuing with concerns that aircraft will not be able to land before the weather. TMC is trying to determine which aircraft will have to divert and plan a route for them. CIWS CWF and Echo Tops were used specifically to determine where planes could safely divert.	WARP, ETMS, DSR CIWS CWF and Echo Tops	3, 4	7, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-28		Observer comments: While the time savings using CIWS was not extensive during this event, the internal coordination was faster and resulted in less workload on both the Area Sup and TMU. The bigger impact was that 6 planes had to divert. The TMU indicated that had the external coordination (with SCC SvrWx) been quicker, 4-5 of those planes would have landed before the weather and would not have diverted. The Area Sup indicated that CIWS provided better planning at the Area level and that the Controllers were also coming over to look at the display.			
ZOB-1-29	2355	Storms about to impact DTW. Area 1 Sup came into the unit to work out a plan for the aircraft on the wrong side of the weather.	CIWS CWF	3, 4	7, 14
ZOB-1-30	0013	High-topped storms moved into Area 4 High Sectors. Area Sup consulted CIWS echo tops, but no over flight traffic is possible. Area Sup also used CIWS to convince a controller to keep traffic flowing north to DTW. Without CIWS, they would have used MIT restrictions or stopped the DTW traffic in their sector.	CIWS CWF, VIL, Echo Tops, Echo Tops Forecast	1, 5	1, 12, 14
ZOB-1-31	0025	Area Sup and controllers continue to use CIWS after DTW is impacted. They are allowing traffic to deviate based on CIWS.	CIWS VIL, Echo Tops, Echo Tops Forecast	1	1, 12, 14
ZOB-1-32	0105	Echo tops are lowering south of D21. The Area 4 Sup used CIWS to take three pathfinders tactically over weather on J554.	CIWS Echo Tops	1	1, 11, 12, 13, 14
ZOB-1-33	0105	Sector controller in Area 2 is providing CIWS echo tops information to pilots to help them fly over the weather at the south end of the line, rather than around it. Pilots continue to deviate, but the deviations were smaller for 2 or 3 aircraft than without CIWS information. This helped aircraft return to regular routes sooner since they didn't have to wait for PIREPs or pathfinders.	CIWS VIL, Echo Tops	2, 5	3, 12, 14
ZOB-1-34	0115	SPO: DTW is swapping traffic to the south. D21 and ZOB TMC coordinated using CIWS.	CIWS VIL, Echo Tops, Echo Tops Forecast	2	3, 12

CIWS Benefits Assessment
Observation Period #1 Observations Summary
Day 3 - June 6, 2005

Participating Facilities: ZOB, ZBW, ZNY, ZDC

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
		ZOB			
ZOB-1-35	1030	Storms developed in ZOB airspace in Areas 3 & 4. Level 6 weather moving east with tops in the 40kft. Aircraft deviating on J80. J36 has 20 MIT per strat. J60 and J64 as one with MIT.	CIWS VIL, CWF, Growth and Decay Trends, Echo Tops	5	16
ZOB-1-36	1040	Storms around J80. STMC decided to hold off restricting all traffic on J80. Instead, a 10 MIT per strat for CVG only was implemented.	CIWS VIL, Echo Tops Forecast	1	1
ZOB-1-37	1115	Storms in central ZOB/OH have been growing for the last hour. CIWS shows growth on the south end. CWSU briefed STMC that storms should decay on the south end over the next 2 hours No change to plans based on CWSU forecast.	CWSU, CIWS CWF, Growth and Decay Trends	5	16
ZOB-1-38	1115	SPO: SCC holds all plans until 1315. J36 MIT, J60/J64 as one (J64 closed), and ZOB en route constraints			
ZOB-1-39	1120	Storms encroaching on J80. Area 6 requests 10 MIT due to some deviations.	CIWS VIL, Growth and Decay Trends, Echo Tops, CWF, Lightning	5	12, 16
ZOB-1-40	1138	Storms growing on J60/J64 and new development is occurring on J80. STMC used CIWS to keep J80 and J60/J64 open as long as possible.	CIWS VIL, Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	1	1

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-41	1144	Storms in east ZOB are at least 33kft and too high for most to over-fly. Gap in Area 3 and Area 6. Area 3 does not have CIWS. Area 3 is getting over loaded and has become very reactive. Area 3 Sup walked to Area 6 to consult CIWS.	CIWS VIL, CWF, Echo Tops	5	12, 14
ZOB-1-42	1211	Area 7 Sup indicated that CIWS forecasts could be used to help anticipate overtime or placement of controllers on D-sides.	CIWS CWF, Echo Tops Forecast	5	14, 15, 16
ZOB-1-43	1220	Storms did not decay as forecasted by CWSU. Storms impact from J145 on the north to J80 on the south. Echo tops are in the upper 30kft and low 40kft and cells are growing on J80. J80 is running with MIT but J60/J64 is closed due to high tops and deviations. STMC estimates that using CIWS, he was able to keep J60/J64 open as much as 60 minutes longer. STMC is watching CIWS to determine if and when J80 will close. ZDC traffic is all 25 MIT due to storms in Area 6.	CIWS CWF, Growth and Decay Trends, VIL, Echo Tops, Echo Tops Forecast	1, 5	1, 16
ZOB-1-44	1222	Weather is impacting Areas 4, 6, 7. J60 is closed, J80 has 10MIT and J36 has 20MIT.			
ZOB-1-45	1225	Storm in PIT TRACON. PIT TMC used CIWS to find the best swap reroute for south and west departures.	CIWS VIL, CWF	3, 4	3, 10, 12
ZOB-1-46	1230	Area 6 is using CIWS to determine if south end of weather is going to close J80. Based on CIWS G&D, Area and TMU is going to wait to request more MIT from ZNY.	ETMS, CIWS Echo Tops, Echo Tops Forecast, Growth and Decay Trends, Satellite	1	5
ZOB-1-47	1232	Storms moving off J36. STMC used CIWS to end J36 MIT about 30 minutes earlier than without CIWS. TMC called Area to open J36, at which time the Area Sup walked across the isle to consult CIWS.	CIWS VIL, Echo Tops Forecast	1	1, 12
ZOB-1-48	1235	J60/J64 still open for MDW-ORD traffic. Found gap in tops.	CIWS Echo Tops, Echo Tops Forecast	1	1, 12
ZOB-1-49	1238	Area 6 reports planes are starting to go back over ZANDR (AIR on J80) and additional MIT will not be needed.			

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ZOB-1-50	1247	Area 5 came over to look at CIWS (in Area 6) to determine impacts on J64. Determining whether or not to reopen J64.	CIWS CWF, Echo Tops Forecast	5	12, 16
ZOB-1-51	1248	Storms blocking most of ZOB routes. Early implementation of CAN1. STMC says it is an hour too late. CCFP shows weather in ZID, so the BNA playbook may not be used today.			
ZOB-1-52	1256	Area 5, based on echo tops forecast, asked TMU to reopen J64. After further consideration, TMU chose to keep J64 closed. TMU used CIWS as well as ETMS to make determination.	ETMS, WARP, CIWS CWF, Echo Tops Forecast	5	12, 16
ZOB-1-53	1300	New CCFP 6-hr forecast suggests most of ZOB airspace will be impacted with moderate confidence for weather on ZOB/ZNY border. CAN playbook may also have problems.			
ZOB-1-54	1300	TMU coordinates with Area 6 Sup regarding J152. TMU wants to know if J152 should be restricted. Area Sup delays implementation of 40 MIT from ZAU and ZID for J152 based on CIWS forecasts.	ETMS, CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	1, 5	1, 12
ZOB-1-55	1315	SPO: A line of level 6 weather exists from PIT to N PA with cells developing ahead of the line and to the south around J80. Tops to 45kft. CAN1 for all traffic north of and including OAK-DNV. GDPs for NY metros are being discussed. FAA requested that airlines cancel flights; SPT concludes at 1352Z.	CIWS, ETMS, WARP, CCFP	5	16
ZOB-1-56	1400	Storms blocking most routes. Forecast shows J36, currently being used for ORD/MDW traffic, may close. Broken level 6 storms in Area 6 & ZDC. STMC studies CIWS forecasts to see if he can open J60/J64 before he has to stop J36. Without CIWS, work load would include a specialized CWSU forecast, so CIWS usage results in time saving.	CIWS VIL, Echo Tops, Echo Tops Forecast	5	14, 16
ZOB-1-57	1400	Area 6 Sup says CIWS was used for external coordination with ZDC areas directly for tactical reroutes. ZBW is taking NYC traffic and feeding it to Area 3. The ZOB TMC coordinated with Areas 1, 2, & 3. TMC stated that the Area 2 coordination was made easier because of CIWS in the Area. This reduced planning time by about 20 minutes.	WARP, CIWS VIL, CWF, Echo Tops	2	3, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-58	1415	GDPs for all east coast airports issued by SCC and east coast Centers.			
ZOB-1-59	1425	Area 6: Planes are deviating a great deal. CIWS echo tops seem reliable. Trying to determine impact on ZNY. No immediate mitigation plan is being considered at this time. Area Sup feels that CIWS reduces his personal workload because if he used the CCFP forecast he would guess more and have more uncertainly as to the forecast. He felt that the CIWS CWF 2 hr forecast was much better then the 2 hr CCFP and therefore wasted less time on the question of whether the forecast was correct or not.	ETMS, CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	12, 14, 16
ZOB-1-60	1430	ZID requested 10 MIT on J80 for volume.			
ZOB-1-61	1440	Solid line of weather in west central PA. About 60 minutes from ZNY and weakening to the south.			
ZOB-1-62	1442	Gaps in Area 3 weather closing in as storms track east. ZOB TMC called ZBW and ZNY to request help off loading some traffic through ZBW. Area 3 Sup concerned about traffic. CIWS was used to design the plan. The TMC said this saved about 10 minutes.	WARP, CIWS VIL, CWF	2	3, 12, 14
ZOB-1-63	1442	Area 6: J80 restriction has been lifted due to weakening from south. J152 is remaining open and is only inbound route for PHL from ZAU and ZID. If J152 closes, it causes significant deviation around weather. Area Sup never restricts J152 (Inbound PHL flow from ZAU and ZID). This results in workload reduction for Area Sup and TMU since extensive internal and external coordination is not needed. It is important to note that Area Sup would have requested 40MIT J152 restriction. TMU may not have implemented it. If the TMU had, there may have been an efficiency benefit as well based an approximate 60-90 min block of time that J152 might have had 40MIT from ZAU/ZID in place (time estimate from Area Sup).	CIWS VIL, Echo Tops, Growth and Decay Trends	1	1, 12, 14
ZOB-1-64	1455	Storms exiting ZOB and entering ZNY. Tops have lowered on J64. STMC used CIWS to decide to open J64.	CIWS VIL, Echo Tops, Echo Tops Forecast, Lightning	1	1

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-65	1512	Storms have moved onto J36 and it has been closed, using CIWS, because of many deviations. As the STMC hoped, J64 opened before J36 closed. However ZNY will not send traffic on J64 due to deviations in their airspace.	CIWS CWF	5	16
ZOB-1-66	1515	SPO: CCFP shows storms remaining in western PA until 2300.CIWS shows high-topped, level 6 storms in central PA with tops to 50kft. Storms also in northern ZDC. SCC said CAN1 would expire soon and ZDC expressed concern over losing routes. ZBW voiced concerns about deviations in west sectors and wanted to send traffic south through ZNY.	WARP, CCFP, ETMS, CIWS	5	16
ZOB-1-67	1557	Most storms are in ZNY, ZDC, and ZBW now. GDPs are stopping most east coast traffic. Area 6 and 7 Sups are using CIWS.		5	12, 16
ZOB-1-68	1605	CIWS used in Area 7 to find over flight routes. Area Sup and controllers are using CIWS to take 7 aircraft over Slate Run fix.	CIWS Echo Tops, Echo Tops Forecast	2	3, 12, 14
ZOB-1-69	1630	Area 6 planning reroute for the DC metros. Area Sup visited TMU to discuss options for plan and tactical reroute with ESP TMC.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	2	3, 12, 14
ZOB-1-70	1715	Level 6 storms with tops to 54kft are developing in Area 6. A squall line exists from north ZNY-ZOB border with level 6 and tops 40 to 50 kft. Reroute plans were not implemented due to unforecasted development of weather. Area 6 Sup comments that CIWS needs convection initiation forecast.			
ZOB-1-71	1800	Area 6 using CIWS to tactically reroute the few remaining aircraft traffic in their area. Area 6 is closed to through traffic. Area 3 has a gap but getting overloaded.	CIWS VIL, CWF, Echo Tops, Growth and Decay Trends	2	3, 12, 14
ZOB-1-72	1829	PIT southwest arrivals and south departures stopped. Storms growing in western PA again, extending from J6 to J146 with few breaks and tops to 55kft. There is a gap on J60, but no NY traffic getting out. TMC used CIWS to work out SWAP. Otherwise, GDPs and reroutes have moved most of the traffic out of ZOB.	CIWS VIL, CWF, Storm Motion, Lightning	3	10

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-1-73	1841	Area 6 continues to take a few PIT/ZOB internals around thunderstorms, using CIWS for tactical reroutes.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	2	3, 12, 14
ZOB-1-74	1903	Area 6 Sup came to TMU and requested all stop on J518 and J211 (DC metros) due to weather. CIWS was used during the conversation.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Satellite	1	2, 12, 14
		ZBW			
ZBW-1-1	1240	Weather near SYR. STMC expects J547 to close. STMC called ZOB to inquire about deviations. ZOB is letting them deviate. The STMC stated that he would have used a template on the TSD to look at CCFP. This would have taken a minute or two extra, but he felt it would have been less accurate.	CIWS CWF, VIL, Storm Motion, Echo Tops	1	1, 12, 14, 16
ZBW-1-2	1252	Weather over SYR. STMC expects to hear from ZOB soon about impacts. STMC discussed the weather with the Area Sup.	CIWS VIL, Storm Motion, Echo Tops, CWF	5	16
ZBW-1-3	1309	STMC reports that ZOB is starting to reroute traffic north of SYR on J547 as weather builds			
ZBW-1-4	1338	Trying to get CAN1-East route. Severe thunderstorm watch (?) issued for NY through 6PM			
ZBW-1-5		STMC, when asked about CIWS and its benefits, said "It's a huge tool for us." He indicated that he often advises SCC SvrWx to "stand up and look at their CIWS display" to see what he is explaining. With respect to workload, he says it helps control the flow for area sectors and allows them to plan ahead to reduce saturation, etc.			
ZBW-1-6	1359	SCC is slowing down the system by ground delay programs. Slowing BOS from 68 to 30 to relieve strain on ZNY.			
ZBW-1-7	1428	Area Sup came to the TMU to report that two ALB inbounds deviated due to a rapidly building thunderstorm over Hancock. He pointed out the location to the TMC using the TSD.	ETMS	5	

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-1-8	1430	ZOB is rerouting. SCC called to include PIT. Swapping NY arrivals into ZBW for EWR and LGA. Want to come through ZBW (airborne only).			
ZBW-1-9	1443	10 MIT as one. No traffic to go over ATL.			
ZBW-1-10	1444	STMC and TMCs are planning reroutes using CIWS.	CIWS CWF, Echo Tops	2	3, 12
ZBW-1-11	1609	Area Sup visiting TMU to thank TMC for MIT restriction. "It's busy but manageable."			
ZBW-1-12	1628	A line of potentially severe weather (tornado and severe thunderstorm watches issued) is developing in the NY area. Area A is experiencing deviations. They are running the CAN1 route over Hancock, using SYR to ALB and then south. This route was coordinated between the Area and TMU.	CIWS CWF	2	3, 12
ZBW-1-13	1640	SCC SvrWx wants to run a route between storms into upstate NY (towards MSS). Suggests using CAN7 between ALB and SYR. Without CIWS, external coordination would have been less accurate.	CIWS CWF, Echo Tops	2	3, 12
ZBW-1-14	1658	STMC wants to be very conservative with westbound traffic. CWSU visits the TMU and uses CIWS to discuss the line developing bow characteristics. The TMC used CIWS forecast to estimate the time to impact.	CWSU, CIWS VIL, CWF	5	12, 14, 16
ZBW-1-15	1701	Using CAN7 between ALB and SYR toward MSS.			
ZBW-1-16	1706	Area Sup and Ops Manager visit TMU to ask about westbound traffic deviating south. Discuss taking traffic over Lebanon and back down.	WARP	2	
ZBW-1-17	1715	Route J75 closed by ZNY			
ZBW-1-18	1717	Thunderstorm headed toward NY arrival. Area Sup visit TMU to express concern.			
ZBW-1-19	1718	CAN7 out of NY; BOS, PVD, MHT traffic going up and over significant weather			
ZBW-1-20	1721	BOS ground stop			
ZBW-1-21	1800	Second line of weather developed in western PA and a line is developing on the VT/NY border. Planning for routes from the east heading west for timing of line. BOS/Bedford/MHT traffic deviating to the north. CIWS was used for internal coordination between Area Sups. Without CIWS, this would have taken 10 to 15 minutes longer. They would have consulted the CWSU and likely may not have tried to move traffic north towards MSS.	CIWS Storm Motion, CWF	2	3, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-1-22	1805	The line of weather is going to shut off traffic. STMC called SCC SvrWx. Would like to take advantage of the gap between the lines of storms.	CIWS CWF	2	3, 6, 12, 14
ZBW-1-23	1813	STMC speaks with Area Sup and points out gaps in weather using CIWS; Deciding best place to hold traffic	CIWS VIL, Storm Motion	5	6, 12, 13
ZBW-1-24	1822	The Ops Manager tells TMU to shut off everything into Area A right away. The sector is inundated and lost 3 frequencies. Everything westbound into ZOB, NYC, and Toronto Center is ground stopped.			
ZBW-1-25	1827	Frequencies are back up.			
ZBW-1-26	1835	TMC monitors the second line of weather on the CIWS SD.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	16
ZBW-1-27	1840	STMC states that sector 8 cannot take anymore traffic right now. Everything is ground stopped anyway.			
ZBW-1-28	1842	Area B just closed. Can't get over SYR for a while.			
ZBW-1-29	1843	The only way out of ZBW is over Hampton. NY. TRACON called to see if ZBW could take their departures on J6, but J6 will soon be impacted by weather on the NY/VT border. Internal ground stop is implemented so arrivals can get in.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	14, 16
ZBW-1-30	1918	STMC uses CIWS to discern pending impacts on NYC metro airports.	CIWS CWF	5	16
ZBW-1-31	2121	Line of weather in western MA is decaying. CWF shows dissipation in 1 to 2 hours. TMC coordinates with Area Sup to give advance notice	CIWS CWF, Growth and Decay Trends	5	14, 16
ZBW-1-32	2132	Even though CIWS is at the TMC desk, he walk across the room to view WARP. Planes were allowed to go.	WARP	1	
ZBW-1-33	2134	TMC uses DSR to send a pathfinder.	DSR scope	1	
ZBW-1-34	2209	Echo tops for storms in New Eng at 30 kft (as seen on CIWS). Echo Tops Forecast shows all tops at or below 30 kft. Some flights were released due to low tops. Area Sup came to the TMU to ask about Echo Tops Forecast and was told it was "good for over flights."	CIWS Echo Tops, Echo Tops Forecast	1	1, 12
ZBW-1-35	2220	STMC, after viewing CIWS, claimed that they were ready to release BDL, MHT, and BOS traffic.		1, 3	1, 10

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-1-36	2250	Area Sup used CIWS to determine echo tops. Suggests aircraft can probably start going over SYR now.	CIWS Echo Tops	1	1
ZBW-1-37	2312	TMC coordinates with Area Sup to proactively take GREKI swaps.			
ZBW-1-38	0044	STMC uses CIWS to see weather impacting the route from ZDC. STMC coordinates with Area Sup tempers concerns regarding the small cell and vectoring aircraft around it.	CIWS VIL, Storm Motion, CWF	1, 5	1, 12, 16
ZBW-1-39	0130	SCC called to express concern with the weather at BOS. STMC believes, according to CIWS, BOS will be OK.	CIWS VIL, Storm Motion, CWF	3	4
ZBW-1-40	0130	Two overtime staff are approved. STMC, talking to SCC, claims BOS will be fine based upon CIWS	CIWS VIL, CWF	3	4, 15
		ZNY			
ZNY-1-1	1410	ZOB en route deviations on J95. ZOB wanted to close the route but ZNY, using CIWS echo tops, kept it open; J36 was expected to close soon.	Primary CIWS Echo Tops, Secondary ETMS	1	1, 12
ZNY-1-2	1443	ZBW reroutes possible. Offload in CAN airspace west of Maine.	CIWS Echo Tops	2	3, 12
ZNY-1-3	1446	Reroute traffic off J36	ETMS TSD	2	
ZNY-1-4	1449	J36 traffic stopped. Decision verified/confirmed by TMC using CIWS.	CIWS Echo Tops	1	2, 14
ZNY-1-5	1448	J6 needs to close.	CIWS Echo Tops	1	2, 14
ZNY-1-6	1454	Coordinating offloads with ZOB for en route traffic.	CIWS	2	3, 12
ZNY-1-7	1521	Open J64, close J95.	CIWS VIL, Echo Tops, ETMS, WARP	1	1
ZNY-1-8	1536	Running out of airways/jetways. J80 in trouble - must offload/reroute	ETMS	2	
ZNY-1-9	1536	SCC asked about reactivating SERMN routes (BUR, ROC, Ottawa, Toronto). ZNY answered yes immediately using CIWS	CIWS	1	1, 12, 14
ZNY-1-10	1554	Cell building along J80. Coordinated the offloading of traffic with SCC SvrWx.	CIWS	2	3, 12

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZNY-1-11	1601	J64 filling in and might have to close. J64 closed proactively based on extensive use of CIWS.	CIWS Echo Tops	1	2, 14
ZNY-1-12	1619	J110 is heavily impacted; TMC moved J110 traffic south by 20nmi. Reroute developed and coordinated between TMC and Area Sup using CIWS	CIWS	2	3, 12
ZNY-1-13	1630	Ground stop ORD. Routes closed.	CIWS, ETMS, WARP		
ZNY-1-14	1636	Tornado watch	CWSU briefing, WARP		
ZNY-1-15	1650	SCC called arrival TMC to inquire why he was shutting down so many jetways. ZNY TMU was surprised that SCC had to ask, given coverage of strong storms	All	5	16
ZNY-1-16	1750	CWSU briefed that thunderstorms are expanding into more jetways.	CWSU briefing	5	
ZNY-1-17	1801	TMC noticed gap in the line of thunderstorms where plane are making it through.	DSR	2, 5	
ZNY-1-18	1832	Statement that most routes will be unavailable in about 60 minutes.	CIWS CWF	5	14, 16
ZNY-1-19	1900	J48 will be shut off within 10 - 15 minutes. Reroute of J48. J48 closed by sector at 1907	CIWS, ETMS, CWSU	5	16
ZNY-1-20	1909	J75 will close. STMC planned to reroute off J75 in 60 minutes. J75 eventually closed at 2006.	ITWS/TCWF	2	3, 14, 16
ZNY-1-21	1954	Route coordination between OMIC and SCC.	CIWS	5	12, 16
ZNY-1-22	2006	J75 closed. One-hour CIWS, prototype ITWS TCWF forecasts verified	ITWS/TCWF	5	16
ZNY-1-23	2010	JFK closure anticipated and planned for by STMC. Would have waited approximately 90 minutes for PIREPs to determine if JFK would close.	CIWS CWF	3, 5	4, 14, 16
ZNY-1-24	2015	Airports impacted by thunderstorms: Ground stops expected by CWSU for weather impact from squall line: EWR @ 2100, LGA @ 2115, JFK @ 2140. CWSU used CIWS and WARP for the briefing. Impact forecasts coincided with CIWS CWF depiction.	CWSU briefing, WARP, CIWS CWF	3, 5	4, 16

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ZNY-1-25	2058	Gap in squall line. OMIC and STMC noted that the air traffic scopes showed no gap in a line of thunderstorms while CIWS, with better resolution, showed a gap. A Mesaba aircraft used the gap.	CIWS VIL ASR Precip, DSR	2, 5	3, 6, 12, 16
ZNY-1-26	2058	Possible JFK closure. Potential ground stop	ETMS, Area Sup displays, DSR	5	
ZNY-1-27	2155	Gates and jetway closures. Area Sup came to TMU to advise of potential problems. No specific mitigation plan was devised.	WARP, ETMS, DSR	5	
ZNY-1-28	2227	Line of thunderstorms collapsing just west of NYC. Excellent CIWS forecasts. Most big routing decisions and actions now being driven by ZDC.		5	16
ZNY-1-29	2304	Some decisions on routing change.	TSD	2	
ZNY-1-30	0000	Another line of storms will hit the NY metro area within 60 min. CWSU advised that most airports will be in the clear by 0130.	CWSU final briefing	3, 5	
		ZDC			
ZDC-1-1	1330	Weather developing near Beckley that was not forecasted by CCFP. STMC used CIWS to monitor convection.	CIWS VIL, Echo Tops, Lightning, Satellite	5	16
ZDC-1-2	1335	Isolated storms causing deviations on J211 and J518 in ZOB airspace. Monitoring weather using CIWS.	CIWS VIL, Echo Tops, Growth and Decay Trends, Lightning, Satellite	5	16
ZDC-1-3	1412	Weather impacting J6. Tops at 37kft and showing growth (according to CIWS). 20 MIT on J6. LDN/AML as 1 stream. IAD 15 MIT, BWI/DCA 20 MIT (for two hours).	CIWS VIL, Echo Tops, Growth and Decay Trends	1, 5	1

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-1-4	1514	IAD westbound departures deviating into arrival airspace. Level 5/6 storms with tops at and above 35kft are in the area. LDN/AML departures stopped at 1514. Final departure gets through impact area by 1535. Departures restarted as single flow with 20 MIT. CIWS was used for situational awareness, but no decisions were made based on it. TMC wants to bring traffic south of the weather, but storms are filling in. Hoping aircraft can be "hand carried" through.	CIWS	5	16
ZDC-1-5	1600	TMC is considering moving ZNY departures to ATL/CLT over White/Wavey (along east coast). West coast traffic too. J121/J4 rerouted due to concerns about storms in eastern NC. Consulted CIWS, noting growth, and concerned that this weather will be an issue.	CIWS VIL, Echo Tops, Growth and Decay Trends, WARP BREF	2, 5	3, 14
ZDC-1-6	1615	ZDC activating hotline. Weather is building. 20 MIT per strat on J48			
ZDC-1-7	1616	Request for ZDC to take ZOB to EWR/LGA through Johnstown, Gordonsville with 30 to 40 MIT (Very tactical). TMU discusses plan with Areas 4, 7, asking for something better than GVE once east of weather. CIWS was used for situational awareness. Decision was initiated elsewhere. Plan allowed assuming tactical deviations.	CIWS VIL, Echo Tops, Growth and Decay Trends, CWF	2, 5	12, 14, 16
ZDC-1-8	1620	Weather near J6/J80. Request for "long haulers" to utilize J6/J80. Denied, citing CIWS echo tops and explicit growth trend. Route open, but nothing extra. Will handle planes in the air.	CIWS Echo Tops, Growth and Decay Trends	2	4, 13, 14
ZDC-1-9	1626	Area Sup concerned with eastern NC weather causing deviations. Area Sup devised a plan for DAILY MIT restrictions based on CIWS forecast. Without CIWS, the Area Sup would not have presented the plan to the TMU and the TMU would have had to devise a plan.	CIWS VIL, Storm Motion, CWF	1	12, 14
ZDC-1-10	1725	SPO: J6/J48/J75 expanded MIT. ATL routes open with MIT running on the east side of the weather. There is concern about DOKKS arrivals from ZOB/ZID due to building weather. CIWS was consulted for situational awareness.	CIWS	5	16
ZDC-1-11	1727	Volume concerns for ZDC37 (BKW hole in the weather).			
ZDC-1-12	1735	ZBW called looking for alternate routes. ZDC TMC consulted CIWS to note that "J75 should be clear for the next 2 hours." and BOS to CLT can use this with MIT rather than further east where weather is present.	CIWS VIL, Growth and Decay Trends, CWF	2, 5	12, 14, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-1-13	1742	IAD arrivals having difficulty getting in over DRUZZ/DOKKS. Contemplating LDN/AML departures be stopped to give arrivals room to get in. Consulted CIWS when on the phone with Area 4 discussing DOKKS problems.	CIWS VIL, Echo Tops, Growth and Decay Trends	3, 4	7, 12
ZDC-1-14	1745	Metro DC second tier ground stop for 1.5 hours.			
ZDC-1-15	1750	Need to move inbound NYC traffic heading for BKW. Devised a plan to bring them further south over Pulaski then GVE (EWR), FAK, HCM, (JFK). CIWS alone was used to determine feasibility of this reroute.	CIWS VIL, Echo Tops, Growth and Decay	2	3, 12, 14
ZDC-1-16	1805	Ground stops in place but numerous DC arrivals in the air that need to be accommodated. Devised a plan, using CIWS and ETMS in tandem, to send metro DC's over MOL and tactically bring arrivals in near LDN/AML. (Swap: LDN/AML are nominally departure fixes.)	CIWS VIL, Storm Motion, CWF	2	3
ZDC-1-17	1854	Small but strong cell on J209 could be a problem. Noted that though cell is small, it is "growing" based on CIWS and with Warning Areas active, only have 15 mile channel to get through. Area 5 Sup asking for military airspace to be available for commercial aviation. If not, will have to proactively slow up traffic in Area 5. Area Sup said he used CIWS echo tops and movement to see where cell is moving. Currently the cell is not impacting flows, but if it moves further east, flows will be shut off. He informed TMU of this early to give them a heads-up and prepare for it but he will make proactive decisions. Further south in Area 5, storms near ORF are scattered enough for deviations. CIWS was used for situational awareness.	CIWS VIL, Echo Tops, Growth and Decay Trends	1	12, 14, 16
ZDC-1-18	1925	Weather in NE ZDC. W-386 released by military (based upon request from Area Sup, using CIWS to determine its need). Area 5 Sup informed TMU that weather is light and will have about 2-hour window to accept JFK departures southbound. CIWS was used for situational awareness.	CIWS VIL, Echo Tops, Growth and Decay Trends, Storm Motion	5	12, 14, 16

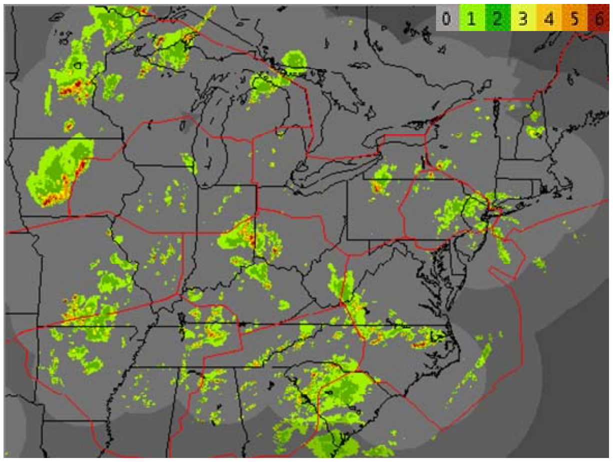
Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZDC-1-19	1945	Line of weather approaching N90. In-air arrivals appear to have landed and airspace is more open, but STMC cautions TMC to monitor calls-for-release from ZJX to ZNY because CIWS shows south end of line dragging and potentially hanging across ZDC/ZNY border, shutting off flow. (Proactive planning, securing efficiency and protection from sector overloads.); Line does indeed become hung up east-to-west along ZNY-ZDC border	CIWS CWF	1, 5	12, 14, 16
ZDC-1-20	2000	Releasing southbound ZNY traffic through ZDC, given J48/J75 not an option. Devised plan to accept ZNY departures south over CLASSY, PXT to FAK, then west out of ZDC (proactive, efficient reroute). Used CIWS exclusively to develop this plan.	CIWS VIL, Echo Tops, CWF	2	3, 12
ZDC-1-21	2030	ZNY arrivals hoping to restart after the line of storms moves through. STMC used CIWS to convince SCC that line is sagging east-west and that the north-south line in central PA is "growing" and expanding. ZDC does not want ZNY traffic resumed through their airspace. SCC will re-plan all GDPs for even more reduced rates. CIWS was the only weather suite consulted.	CIWS VIL, Echo Tops, CWF	1, 5	2, 9, 12, 14, 16
ZDC-1-22	2110	Area 5 Sup informs TMU that NY southbound departures into his Area can be handled easily. CIWS was used to confirm that weather was not a concern for Area 5. The supercell over PHL will not block Area 5 for at least an hour.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends, CWF	1, 5	1, 10, 12, 16
ZDC-1-23	2110	ZDC released from NY ground stop but traffic can not get there. Coordinated with SCC to reinstate metro DC ground stop for ZNY until 2300 based on CIWS. CIWS forecast confirms PHL ground stop can continue to be postponed. Another facility complained about the ZDC ground stop. The STMC reiterated that the traffic cannot get to DC.	CIWS VIL, Echo Tops, CWF	3	3, 12
ZDC-1-24	2200	Weather dissipating near DRUZZ fix. Coordinated sending pathfinder. ZOB said that they had tried earlier, but the aircraft would not penetrate the weather. TMC consulted CIWS and noted that weather had and continues to decay so attempting a pathfinder is reasonable.	CIWS VIL, Growth and Decay Trends	1	11, 12

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-1-25	2215	Looking for DC inbound route from ZOB (CLE). Identified another pathfinder (CHQ7853) opportunity using CIWS and coordinated internally and externally. Pathfinder did not make it through.	CIWS VIL, Growth and Decay Trends, Echo Tops	1	11, 12
ZDC-1-26	2245	Weather impacting DRUZZ (near IAD). Pathfinders couldn't make it through the weather and deviated into the departure fix. STMC told ZOB that it would be about 40 minutes until IAD arrival fixes were clear but by then the weather may be at the airport.	CIWS VIL, CWF	4, 5	7, 12
ZDC-1-27	2250	IAD GDP running 55 arrival rate.			
ZDC-1-28	2257	Weather near J518 in ZDC. ZOB released pathfinder to try IAD arrival via J518. STMC indicated earlier, using CIWS, that pathfinders on J518 could be used.	CIWS VIL, CWF, Growth and Decay Trends	1, 5	11, 12
ZDC-1-29	2320	Strong thunderstorm over ARTCC; ZDC lost power for about 30 seconds. CIWS came back; WARP did not.			
ZDC-1-30	2330	Volume concerns and pending weather on White/Wavey. Area 8 Sup shut down Wavey due to volume then informed TMU. TMU was OK with this. CIWS was the only weather product available in the Area because WARP is still down.		5	16
ZDC-1-31	2338	East coast sector volumes reaching saturation. Bay7 shut off Bay8 who needs to pass this back to Wavey, White, and BOS. ZDC50, 58, and 59 volumes "in the red".		5	16
ZDC-1-32	2340	SWAN/PALEO shut down due to volume and weather.		5	16
ZDC-1-33	2340	Weather clearing over DRUZZ and IAD. STMC notifies Bay4 that ZOB has OK'd restarting IAD arrivals on normal routes. Weather is still on IAD, but (using CIWS) the STMC determined that the weather would move away from the terminal in time for the arrivals.	CIWS VIL, CWF, Storm Motion	1	1, 12
ZDC-1-34	2350	White restarted with normal routes but 40 MIT.			
ZDC-1-35	2355	STMC changed SD configuration to show DC metro airports close up.		5	16
ZDC-1-36	0000	Pending impact at DCA/BWI. Stopped BOS/NY departures to BWI/DCA because of ongoing, pending impacts. DCA ground stop proactively planned by Area 8 Sup and passed to TMU to implement.	CIWS VIL, CWF	3	2, 4, 12, 14

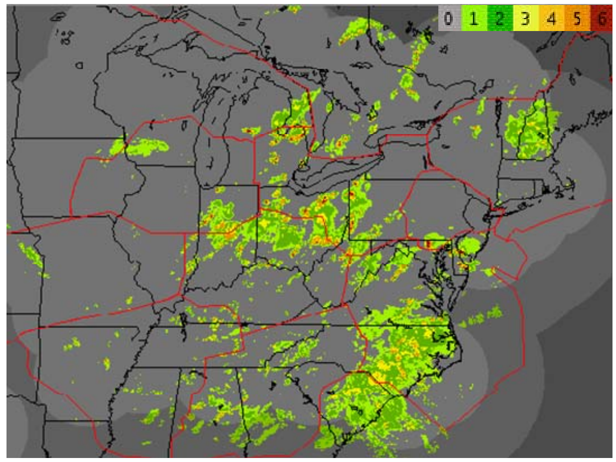
OBSERVATION PERIOD 2: 27 June - 1 July, 2005

Facilities Visited: ZMP, ZAU, ZOB, ZDC, ZNY, ZBW, ZTL, ZJX

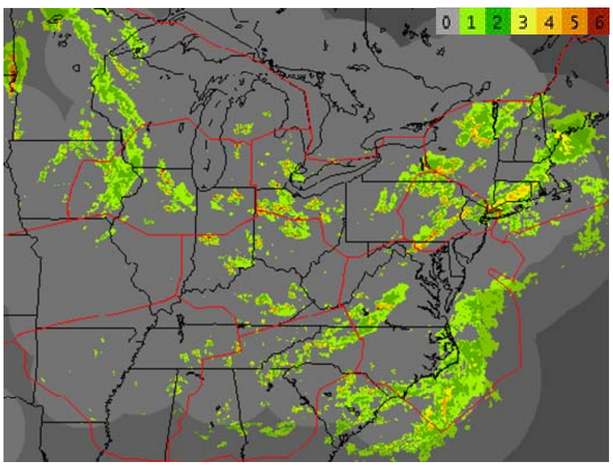
Examples of CIWS NEXRAD VIL Precipitation During Period 2:



27 June 2005, 2300 UTC



28 June 2005, 2100 UTC



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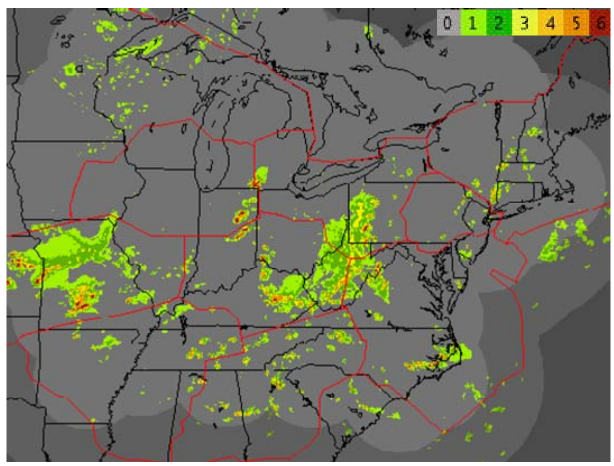

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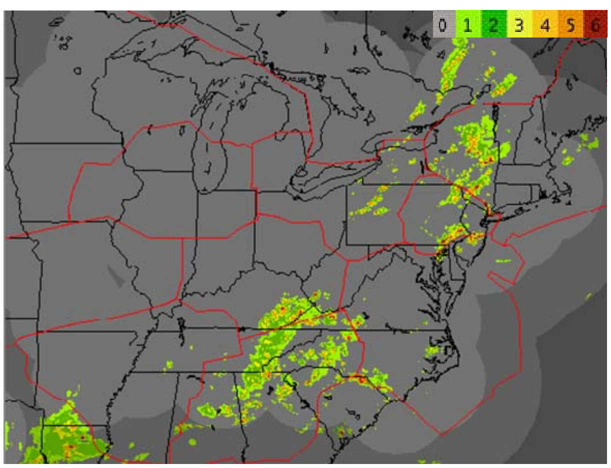

01 July 2005, 2030 UTC

CIWS Benefits Assessment
Observation Period #2 Observations Summary
Day 1 - June 27, 2005

Participating Facilities: ZMP, ZTL, ZJX

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
		ZMP			
ZMP-2-1	2120	The KASPR playbook is impacted by storms over FOD, ALO, DSM area. MSP_KASPR playbook is being implemented to get aircraft from the south up to MSP. NWA likes the plan. ZMP posted the plan on the pre-telecon web page after talking with NWA. STMC indicated that having the playbook routes as overlays helps him develop the plan and saves time. Without CIWS, he would have had to estimate based on WARP.	CIWS VIL, CWF	2,5	3,12
ZMP-2-2	2150	CWSU noted a cell that developed 8 to 10 nmi west of MSP. He pointed it out to the MSP position TMC. They noted that CWF showed the cell moving northeast and that it would skirt the airport but it appears to be moving away quickly. CWSU briefed STMC indicating that he expects that not all holes will fill but the area around MSP would probably fill in. CIWS was used for situational awareness.	CIWS VIL, CWF	5	16
ZMP-2-3	2210	Weather is developing around MSP terminal. A solid line exists to the northwest. TMC used CIWS and ITWS to monitor conditions for arrivals. Current SWAPs are: ABR over ONL, FAR over BRD, WLSTN over DLH, DLL over ODI. MSP position TMC believes there is enough room between cells around MSP that arrivals will be able to pick their way through. As a result she is not going to restrict arrivals. However, she is concerned that departures to the northwest in 30 minutes may need to be swapped. CIWS shows that the strong storms in this location will still be there in 30 minutes.	ITWS, CIWS VIL, CWF	1	1
ZMP-2-4	2220	MSP position received a call from Bemidji Airline asking about possible delays tonight. TMC consulted CIWS and indicated that she expected delays and maybe even a ground stop. When the push hits, they may be slowed down by weather. She has not defined a plan yet but is using CIWS for situational awareness. She uses it frequently to determine whether or not to discuss swaps for MSP departures.	CIWS VIL, CWF, Echo Tops Forecast	5	12,16

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZMP-2-5	2225	Area 2 Sup reports that DLL/ODI can now be used if the tower is OK with the plan. (The tower initially implemented the restriction.) Area 2 Sup used CIWS CWF to determine that the fixes were OK to use.	CIWS VIL, CWF	1, 5	1, 12, 14
ZMP-2-6	2245	Cells building fast southwest of MSP. TMC is considering an internal ground stop. However, no inbound flights were being delayed, so held off on the ground stop.	CIWS VIL, CWF	3, 5	16
ZMP-2-7	2305	Since much of the volume is filing out places other than north (No WLSTN, DLH, BRD, ABR), three are no problems with traffic. Currently OK, but thinking about what will happen with the cell. CIWS indicates that a cell will miss the airport, but CWSU briefs TMC that further development could change the forecast.	CIWS VIL, CWF	3, 5	16
ZMP-2-8	2335	Gust front approaching. STMC, CWSU, and MSP TMC are discussing whether to try to land SE. CWSU argues against plan because gust front will soon shift winds to NW a 35 kt. CIWS is used to determine how long the window will stay open. MSP position TMC is considering options, which are limited because of the possible squeezing of the airport. May have to hold.	ITWS, CIWS VIL, CWF, Growth and Decay Trends	3, 5	7, 16
ZMP-2-9	0001	TMC is using CIWS and ITWS to issue a ground stop. (NWA called and agreed that a ground stop was best.) CWF shows that the airport will be impacted, there is nowhere to hold, and there is a lot of traffic already airborne. TRACON called and said they didn't think the airport would be impacted and questioned the necessity for the ground stop. Not sure what the TRACON was using.	ITWS, CIWS VIL, CWF, Growth and Decay Trends	3, 5	4, 12, 14
ZMP-2-10	0045	SKTR and KASPR are going to be opening for arrivals at the top of the hour. However, the first tier ground stop will be extended because the weather-free window is small. TMC called Area 3 Sup to notify them they would be getting traffic again soon. Area Sup was not very receptive because he saw weather on his CIWS, but TMC told him that CIWS showed an opening at the top of the hour.	CWSU, CIWS VIL, CWF, Echo Tops Forecast	4, 5	1, 7, 12, 14
ZMP-2-11	0055	MSP TRACON called to warn that the airport will probably shut down again when the line approaching from the west arrives. Currently, traffic is only landing on runway 04. Areas 1 and 2 are holding. There is no need to change based on what is coming from the west. STMC said he would have seen this on WARP eventually and expected another stop.	CIWS VIL, CWF	5	16

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZMP-2-12	0112	Rapidly changing situation with opening and closing of arrival and departure transition areas. TRACON shut off all departures. All arrivals closed except TWINZ. They are trying to keep this fix open as long as possible and will run until someone says "no." The TMC and Area 3 Sup developed fluid, tactical plans using CIWS. The Area 3 Sup wanted to be sure that all departures were shut off because traffic was deviating and he didn't want to hold a lot of aircraft.	CIWS VIL, CWF	4, 5	7, 12, 14
ZMP-2-13	0115	TRACON shut airport off again.			
ZMP-2-14	0120	MSP ground stop extended to 0245 due to weather at the airport. ZMP is trying to stage the holds to let them come in right after the weather clears the airport. They expect diversions based on continued holding. Area 2 is getting them now. NWA referenced a weather forecast on the SPO (not clear if it was CIWS) and indicated that they would reduce some of the volume by diverting some of their flights.	ITWS, CIWS VIL, CWF	4, 5	7, 12
ZMP-2-15	0125	Area 3 now holding. Area Sup wanted to make sure that no departures came to them. TMC expects holding for 15+ minutes based on CIWS forecast.	CIWS VIL, CWF	4, 5	7, 16
ZMP-2-16	0135	TMC is considering moving traffic to the south to resume operations when weather moves off airport but CIWS has picked up the rapid development of a new line west of the current weather. TMC worries that this will overload Area 3. STMC indicated that without CIWS, they would probably have opened up south arrivals just to close them off again.	CIWS VIL, CWF, Echo Tops, Growth and Decay Trends	1	2, 12
ZMP-2-17	0140	Some departures can now leave MSP on runway 04. STMC and TMC considered where to route these departures. Determined to allow DLL/ODI departures to the east coast if they can get to the fix from the airport. The TMC told the TRACON that he didn't see any holes, but if the aircraft to get to the fixes they could use the route. STMC called NWA to tell them that they might get some departures off if the pilots agreed to the route (ODI1/DLL1 as one with 10 MIT). TMC's used CIWS to determine how departures would turn after departing 04 and to determine that there really was no opportunity to go east. Without CIWS, this would not have been obvious.	ITWS, CIWS VIL, Echo Tops, Echo Tops Forecast	3, 5	7, 12, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-2-18	0150	Slight window of opportunity with break in the weather over the airport. Area 3 Sup informs TMU he is willing to take traffic over RST1 with 15 MIT.	Unknown	1, 5	1, 12, 14
ZMP-2-19	0200	SCC/NWA/ZMP telecon to discuss diversion recovery. There are 21 diversions so far and the STMC expects that a lot of controllers will be held overtime to handle the diversion recovery. STMC used CIWS to determine when they might be able to start diversion recovery.	CIWS VIL, CWF	3, 5	12, 15, 16
ZMP-2-20	0210	CWSU is gone for the night so TMC relying exclusively on CIWS for forecasts. Weather is sinking to the south and they might lose south departures. CIWS used to determine if this southward movement would continue. Decided to use ONL1/ORSKY1 over ABR1 SWAP. The Area 3 Sup was told to expect traffic out west and north. TMC and STMC planned to start departures north and west as the south departure closed again.	CIWS VIL, CWF	3, 5	3, 10, 12, 14
ZMP-2-21	0225	NW552 "white hat" flight requested special permission and special routing. LGA Port Authority requested the special handling. STMC called for help getting a custom route. MSP was unable to move the aircraft to the front of the departure queue.	CIWS CWF	5	16
ZMP-2-22	0230	TRACON wants to try departures over ORSKY. Arrival and departure delays are +75. Area 3 Sup came to the TMU to request an increase in the MIT restriction because aircraft are maneuvering around the weather. He identified the weather on the CIWS. STMC indicated that CIWS saved time because he could glance at the forecast and get what he needed rather than studying WARP.	CIWS CWF	1, 5	5, 12, 14
ZMP-2-23	0235	Training cells just south of MSP airport. SCC wants to extend first-tier GS another 20 min, but end internal GS to give priority to diversion recovery. Numerous SWAPs in place at this time.	CIWS CWF, Echo Tops Forecast	3, 5	4, 12
ZMP-2-24	0240	Continued impact around MSP, especially south of the airport. NWA asked if they could get a pathfinder out over ODI1 and DLL1. STMC feels this is not feasible because he doesn't see any holes. STMC wonders what NWA is seeing that he isn't.	CIWS VIL, CWF, Echo Tops Forecast	5	12, 16
ZMP-2-25	0245	Crew time-out issues are playing a big role now. NWA is looking for help for specific flights. If they don't get moved up they will have to be cancelled. TMU is working diversion recovery as the highest priority.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-2-26	0245	TRACON called to say they are grid locked. ZMP may have to shut off arrivals. Ground stop extended to 0330 with the exception of some diversion recovery. The departure restriction over ORSKY is reduced to 10 MIT. STMC used CIWS to determine that there are minimal routes south and east. While weather is still an issue, the crew time-outs and curfews at certain airports (e.g., LGA) are the main considerations now.	CIWS VIL, CWF	5	16
ZMP-2-27	0310	There are still nine diversions to recover. The unit is currently staffed by one STMC and one TMC. All others have already worked overtime. The south and east departure routes continue to be impacted by 30 kft tops and little room to maneuver. ORSKY (pushing out to ONL1) is the only departure route available. Departures are beginning to deviate into arrival corridor so arrivals are being moved further west.			
ZMP-2-28	0320	Ground stop (external) cancelled because there are only 2 diversions left to recover and departures have enough room to maneuver.			
ZMP-2-29	post-event	After 04Z, some aircraft that landed took 3 more hours to reach a gate due to the gridlock situation. At the 1945 weather briefing, the STMC told the Area Sups that CIWS was invaluable in trying to keep one step ahead of things. At the worst, 160 aircraft were parked at MSP. The STMC said that without CIWS, the whole night would have gotten out of control. NWA was satisfied and that is usually a good indication that ZMP did well.			
ZMP-2-30	post-event	STMC stated that based on weather and diversion recovery, he made a determination of which Areas are likely to need overtime help and passed this suggestion to the Operations Manager. The Operations Manager then discussed overtime with the Areas. CIWS was important in determining current needs as well as how the weather would impact diversion recovery.		5	12, 14, 15, 16
		ZTL			
ZTL-2-1	1831	Three showers are west of CLT impacting arrivals. Traffic is slowed with a 10 MIT restriction for 1 to 2 hours.	ITWS	3	
ZTL-2-2	1853	Lots of pop-up thunderstorms. ZTL was given a 10 MIT restriction for traffic landing CLT. Extended departure restriction of 10 MIT to 2000Z	ITWS, ETMS	1	

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZTL-2-3	1857	Northeast and northwest arrival routes into CLT are impacted by weather. Traffic will be allowed to deviate; TMC voices displeasure with TSD weather depictions	ITWS, ETMS	4	
ZTL-2-4	1857	Weather building in north ZTL airspace (mountain effect). Traffic will be allowed to deviate. TMC stated "It would be nice to have Growth and Decay Trends and a looping forecast."	DSR, ITWS	1	
ZTL-2-5	1911	Flights are deviating around the west side of the weather near CLT. 2x workload, tops 38 kft from ITWS. Users wish they had Growth and Decay Trend. Without forecast, they are "going on past gut because they know things are popping."	ITWS, ETMS	1	
ZTL-2-6	1915	Terminal constraints because of weather. Prelisted on telecon.	ITWS	3	
ZTL-2-7	1939	Level 4 cell on northwest arrival fix at CLT. One flight went around on the south side. STMC wanted to route traffic to north side but the cell is moving northeast. STMC is working on a reroute. Took a while to get a reroute because there is no Growth and Decay or forecast loop product.	ITWS	2, 3	
ZTL-2-8	1944	Weather building around CLT on the north side. Weather also building south and east of ATL.			
ZTL-2-9	1951	12/14 props/jets stack northbound out of CLT between showers. Two cells: 1 level 4 cell northwest moving northeast at 10 kt and one level 1 cell northeast. Weather in wrong place for CLT. Busy time in TMU.	ITWS	3, 4	
ZTL-2-10	2004	Same cells for CLT "wrong spot". TMC checked tops (43 kft).	ITWS	3, 5	
ZTL-2-11	2010	MCO flows re-rerouted back to normal			
ZTL-2-12	2012	Reroute all MCO traffic to coast and in Atlantic. Reroute all MCO-bound traffic from all airports. Lots of extra work. Tried to let them run.	WARP, ETMS	2	
ZTL-2-13	2027	Lots of weather on ZTL/ZJX border. Coordination for moving several flights back to Valdosta. Having tough time deciding what to do for a reroute. "Growth and decay and forecast loop would save us time; 10 to 20 minutes, maybe."	WARP, DSR	2, 5	
ZTL-2-14	2035	CLT operates at about 70%. They still have vivid memories of the USAir crash and don't go higher or near showers.			
ZTL-2-15	2040	Level 4 weather northwest and north of CLT not leaving any room for north departures. Too much deviating.	ITWS, WARP, DSR	3, 4, 5	
ZTL-2-16	2045	TMC estimates that a looping forecast would give them 15 to 30 minutes of lead time on coordinating weather operations.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-2-17	2101	Shift change for CLT position TMC. Used ITWS and DSR for hand-off briefing. ZJX has lots of weather. Letting traffic deviate.	ITWS, DSR, WARP	5	
ZTL-2-18	2115	SPO: MCO traffic is moving on the east coast and then turns west over Ormond Beach.			
ZTL-2-19	2148	Weather in surrounding Centers has resulted in many reroutes from other centers. There is significant weather in central FL and now the west gates at MIA are impacted.	WARP, ETMS		
ZTL-2-20	2154	Level 5 weather building 20 to 60 nmi south of CLT. Moving north at 5 kt. MIT restriction for CLT south arrivals increased due to deviations.	ITWS, DSR, WARP	1, 5	
ZTL-2-21	2209	FL covered with weather. Many reroutes. MIA reroutes all around. ZJX likes reroutes and the tactical nature of them. They do a reroute for 30 minutes, cancel it and do another reroute. ZTL aims aircraft at the weather knowing they will deviate.			
ZTL-2-22	2222	Showers blocking west CLT departures. Volume problems in sector 50. ITWS is showing decay. It took about 10 minutes to confirm that the cell was decaying and sector 50 volume problems were easing also. ("Growth and Decay Trends would have given us at least 15 minute heads-up.")	ITWS	3, 5	
ZTL-2-23	2245	Level 4 cell approaching CLT from the south. Ground stop for CLT. Used CLT ITWS to determine that weather would impact the terminal, stopping traffic for about one hour.	ITWS	3, 5	
ZTL-2-24	2305	Storms over CLT. ITWS ASR product up and down during this time. Traffic is already ground stopped. Wondering how to get traffic in.	ITWS	3	
ZTL-2-25	2315	Took 10 min to devise plan for CLT, using ITWS			
ZTL-2-26	2317	CLT ITWS precip product unavailable. Trying to keep aircraft out of sectors 49 and 50 due to volume.			
ZTL-2-27	2328	Weather still over CLT slowly moving off. Holding at all fixes for CLT.	ITWS	3, 4	
ZTL-2-28	2330	Storms slowly decaying in FL and ZTL.			
		ZJX			
ZJX-2-1	1300	No weather impact currently but watching an area in GOMEX and along east coast.	SAT/IR2, NEXRAD, WARP	5	
ZJX-2-2	1354	Showers building southeast of Charleston and west of ZJX. STMC says "We can handle it."	NEXRAD, ITWS	5	

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZJX-2-3	1402	Weather west of ZJX. Southbound aircraft are deviating east. Tops at 24 kft but aircraft are above that. Weather is not a significant factor as yet.	SAT/IR2, NEXRAD, WARP	5	
ZJX-2-4	1440	Monitoring weather north from ZJX along east coast.	SAT/IR2, NEXRAD	5	
ZJX-2-5	1500	SPO: Weather in Dayton area. Aircraft are being allowed to deviate as needed.			
ZJX-2-6	1512	STMC mentions that "bad decisions have been made" using CCFP. Weather along the Atlantic Route northeast of ZJX is impacting airways but aircraft have shifted to the east. This won't last long because the military operations areas east of FL/GA are active. Weather in Tampa area is developing quickly and will impact the airport soon.			
ZJX-2-7	1603	Arrivals to TPA are stopped. Not weather-related.			
ZJX-2-8	1604	TPA open again.			
ZJX-2-9	1632	STMC checks ITWS to monitor weather developing around MCO. The cell northeast of MCO is building.	ITWS	3, 5	
ZJX-2-10	1645	Working with military to get two military operations areas open above 30 kft. Blow off from storms along the coast is causing aircraft to deviate further east.			
ZJX-2-11	1658	MOA area released at or above 31 kft. Controller notified Area Sup that traffic is in position to move east and over MOAs. This releases some of the pressure due to weather along the coast.			
ZJX-2-12	1700	SPO: Weather in FL and along east coast. Scattered in KY and New England. No questions directed to ZJX concerning their plans.			
ZJX-2-13	1745	Traffic along the east coast is compressing. Request MIA departures as single stream.			
ZJX-2-14	1758	Thunderstorm southeast of MCO is moving northwest. Traffic is not restricted, but MCO wants ZJX to push as many as possible between cells around MCO.	ITWS	3, 5	
ZJX-2-15	1800	Weather at MCO. Traffic landing MCO is restricted. ZJX is working with MCO on the weather restriction.	NEXRAD, ITWS, WARP	3, 5	
ZJX-2-16	1820	Traffic landing MCO is shut off. Weather over MCO. Northeast traffic is being routed to LEESE. Traffic in the Big Bend area is being routed to MINNI. ZJX will hold if aircraft get to the fix before MCO opens.			

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZJX-2-17	1846	East coast Atlantic routes are blocked with weather and traffic cannot move further east due to military operations. Traffic is rerouted to the west side of the weather and into ZJX north sector. Controllers and TMC complaining that MCO stopped traffic too soon.	NEXRAD, WARP, SAT/IR2	1, 5	
ZJX-2-18	1852	MCO is now taking traffic over LEESE and MINNI. Holding is released.	ITWS	3	
ZJX-2-19	1911	Traffic at TPA is being affected by cells near the airport. TPA and ZJX coordinated to allow deviations as needed.		3	
ZJX-2-20	1948	TPA still open. MIA watching weather in their area. Moving aircraft over NC to MCI/MIA to available Atlantic Routes.	WARP	1	
ZJX-2-21	2008	TPA closed to arrivals. Arrivals and departures are deviating into each other's airspace. Both were stopped. Holding at BLOND. Arrivals were 40 MIT at the time, so traffic was spread out.			
ZJX-2-22	2100	TPA open.			

CIWS Benefits Assessment
Observation Period #2 Observations Summary
Day 2 - June 28 2005

Participating Facilities: ZMP, ZTL, ZJX, ZAU, ZDC, ZOB, ZNY

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
		ZMP			
ZMP-2-31	2000	Much quieter today than yesterday, so far. The only significant weather is in eastern ZMP near the upper peninsula of MI. Area 1 is tactically rerouting aircraft due to deviations around weather. CAN6_East and CAN7_West are in effect due to weather in the middle of the country.			
ZMP-2-32	2055	Sector ZMP01 has weather but the CAN playbooks are making everyone file around it. Aircraft are deviating but there are no problems so far. STMC said he likes VIL with lightning for situational awareness. He has a window that occupies half of the SD screen.	CIWS VIL, Lightning, CWF	5	16
ZMP-2-33	2200	Not much weather in ZMP. Plans are being made by other Centers where weather is located.			
ZMP-2-34	0000	No weather in ZMP, no restrictions into ZMP.			
		ZTL			
ZTL-2-29	1502	At CLT, there is a large area of level 1-2 with embedded level 4 moving north at 15 kt. At ATL, there is an area of level 1-3 weather south and east (about 20 - 60 nmi southeast.			
ZTL-2-30	1509	CCFP forecasts lots of weather in the eastern half of ZTL and into ZDC, ZJX, and western part of ZTL.		5	
ZTL-2-31	1624	CWSU visited TMU to warn that "things are beginning to pop."		5	
ZTL-2-32	1715	SPO: ZID reports weather on J6 (small cell). All traffic is expected to come through ZTL. Westbound departures were stopped for a while but have restarted. CAN7 will be westbound. General strategic plan ignored the low confidence forecast on CCFP and concentrate on high confidence because there is lots of stuff on the east coast. There may be a GDP for east coast airports.			
ZTL-2-33	1750	NOTE: There is very little weather information available at ZTL: (1) ITWS with CLT and ATL, (2) WARP displays, and (3) ETMS displays.			

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZTL-2-34	1750	Weather is impacting FL departures. Telecon with ZJX and SCC SvrWx to move FL traffic over Canook. ZTL wants to remove the DC metro traffic landing ATL on No_J6 off the Canook stream due to weather in NC and SC.	ETMS	1, 2, 5	
ZTL-2-35	1819	Air mass thunderstorms in southwest ZTL. Moved J36 traffic landing HOU and DTW to J22. The preferred route is J6, but ZDC won't allow it. Telecon with SCC SvrWx continues until 1826. ZTL can't argue effectively against the No-J6 plan because they have no echo tops, storm motion, on the ETMS.	ETMS	2, 5	
ZTL-2-36	1828	SCC SvrWx calls again to continue the discussion of No_J6 traffic that started during the SPO and continued during the 1819 observation.			
ZTL-2-37	1915	SPO: Internal departures landing ATL landing are ground stopped due to deviations.			
ZTL-2-38	1931	No_J6 cancelled.			
ZTL-2-39	2000	STMC does not rely on CCFP because he feels it does not well represent ZTL weather. Today is a good example of this in that ZTL has weather in the southwest and CCFP did not forecast it. CCFP forecasted weather in the east but there is little weather there now.			
ZTL-2-40	2056	Today is much quieter than yesterday because weather is not near ATL or CLT. However, ZTL is reactive by letting aircraft pick their way through and react when a problem arises. The main problem today has been reroutes from other facilities.			
ZTL-2-41	2115	ATL departure delays are around 100 minutes due to military activity and missile launch.			
ZTL-2-42	2147	USAir flight 599 from DTW to CLT fueled for a long route but the longer route has been cancelled. Aircraft is now too heavy to land and must burn off or dump the excess fuel.			
		ZJX			
ZJX-2-23	1230	Military operations are scheduled in the Palatka MOA at 1600 today. Aircraft will enter the MOA from the east coast along an east-west corridor to the MOA from 19 to 23 kft. Currently there is no weather except for showers in the Big Bend area.			
ZJX-2-24	1312	Weather streaming out of GOMEX through the FL panhandle and northeast along the east coast. Los of blow-off to the east, but no affect on traffic as yet.	NEXRAD, SATIR2	5	

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ZJX-2-25	1330	Rain in the FL panhandle. Minor deviations as needed.			
ZJX-2-26	1340	Weather in Tallahassee area is causing controllers to shift east-west traffic a little to the south.			
ZJX-2-27	1402	Thunderstorms along GA/FL coast north to Savannah.			
ZJX-2-28	1600	Military operations begin. Aircraft northbound and southbound are having to adjust altitudes to stay clear of the 19–23 kft corridor. Weather is not a factor at this point.			
ZJX-2-29	1622	Weather along the east coast from Jacksonville north is starting to push traffic to the east. Aircraft can't go too far east due to military operations. Weather building in central part of FL. If aircraft deviate too far east, the route will be closed and traffic will be routed west of the line of storms and into ZJX north sector.	NEXRAD, SATIR2, WARP, ITWS	1, 5	
ZJX-2-30	1641	Weather continues to build in central FL. MCO has called to indicate that the airport may be shut down in 20 min. ZJX does not believe this.			
ZJX-2-31	1647	STMC and TMCs are studying ITWS for MCO.	ITWS	3, 5	
ZJX-2-32	1752	TMU is using work-around for restrictions due to military operations. Aircraft are deviating some around cells.			
ZJX-2-33	1756	LAKE arrival closed due to military operations.			
ZJX-2-34	1822	Military operations still in progress along the east coast. Weather in central FL is being handled with necessary deviations.			
ZJX-2-35	1834	LAKE arrival open.			
ZJX-2-36	1839	MCO is not accepting traffic due to weather over the field. They estimate the field will be closed for 30 minutes. TMU is planning to hold inbound MCO landers over Waycross for aircraft north of there and over LEESE for aircraft south of Waycross.	ITWS	5	
ZJX-2-37	1850	Ground stop for MCO.			
ZJX-2-38	1858	Aircraft are being release from the hold. Aircraft over Waycross were released with 20 MIT. MCO is taking LEESE arrivals.			
ZJX-2-39	1901	MCO open.			

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		ZAU			
ZAU-2-1	1410	Arrived at ZAU. Storms are oriented N-S along the IA/IL border. Some scattered storms are east of Lake Michigan approaching the ZAU/ZOB border. The TMC working the C90 arrival position stated he had been using CIWS since 5AM. He moved the MDW/ORD traffic off from the east to the southeast arrival corridor based on echo tops and motion. He stopped the DTW landing traffic from IND going over the FTW fix based on the 2-hour forecast, which scored greater than 50%. He also "turned it back on" based on the forecast. "It worked well." Currently the DTW landing traffic is on normal routes.	CIWS VIL, Echo Tops, Storm Motion, CWF, Forecast Accuracy	1, 4	1, 2, 7
ZAU-2-2	1417	Observer helped the arrival position TMC set up the SD. He wanted to display echo tops and precipitation forecasts.			
ZAU-2-3	1425	The weather between C90 and D21 has dissipated and the ZAU TMC thinks the 30 MIT restriction to DTW can be reduced. He discussed this with ZOB and suggested they call SCC SvrWx to get a reduction and a pass-back to ZID.	DSR, ETMS	1, 5	
ZAU-2-4	1430	Hand-off of the arrival position to another TMC. The "new" TMC reports using CIWS a lot at the departure position.			
ZAU-2-5	1507	ZID/ZOB/ZAU coordination for DTW landing traffic. ZOB quoted CIWS to ZID user who stated that ZID would not want anyone on the FTW route. There was lots of discussion, but the ZAU TMC didn't use CIWS.	ETMS, DSR	1, 5	
ZAU-2-6	1534	ZBW and ZLA traffic will go over DSM/Badger. Other west Centers will use Capital/Joliet with 40 MIT. FTW/MIZAR closed. Void 1800 departure time.	ETMS, DSR	1, 2	
ZAU-2-7	1535	The next 5 aircraft will use VHP/FTW to DTW then move to the north route. This was coordinated with ZID and ZOB without CIWS.	ETMS, DSR	2, 5	
ZAU-2-8	1613	Weather building on PLANO ATA. TMC used CIWS for situational awareness. If weather moves east, arrivals may deviate into departures.	CIWS VIL Echo Tops, CWF	5	16
ZAU-2-9	1635	Moved DTW operations back to C90 arrival position. The arrival position is always staffed. When this position becomes too busy for one person, enroute operations and DTW/MSP arrivals are moved to a second (and sometimes third) TMC position. When activity dies down, operations are consolidated back into the C90 arrival position.	ETMS, DSR		

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ZAU-2-10	1715	SPO: The CWSU briefed the arrival position TMC that the line of weather from northwest IN to east IL will fill in and impact C90 SE arrivals. TMC reported this to STMC who suggested on the SPO that the ORD-OXI-OKK playbook be considered. The STMC studied CIWS during the telecon.	CWSU, CCFP, CIWS VIL, Echo Tops, Storm Motion, Lightning	2, 5	3, 16
ZAU-2-11	1743	SCC called to extend restrictions for DTW landing traffic (Capital/Joliet). DTW, MSP, and CVG operations are moved to a new TMC position.			
ZAU-2-12	1823	Current restrictions: PHL 30 MIT, LGA 40 MIT, EWR 40 MIT, JFK 30 MIT. DC metro traffic as 1 with 20 MIT extended to 2100.			
ZAU-2-13	Inter-view	TMC was asked why he didn't have an echo tops forecast window open on the SD. He commented that these air mass storms popped up and died down (pulsed), rendering the forecast almost useless. The SD currently shows one precipitation window with precipitation levels 2 through 6, echo tops, 2-hour forecast contours, satellite, lightning, and storm motion.			
ZAU-2-14	1853	SCC called to warn that the westbound east coast traffic will soon be shut off by ZOB. SCC suggests splitting the flow to take some through ZID and some along J60/J64. ZAU requested that the traffic be kept north of Badger. ZAU TMC used DSR and ETMS throughout the conversation.	DSR, ETMS	2, 5	
ZAU-2-15	1910	STMC reports that CWSU expects development over Gipper in the next two hours. He gave a heads-up to all TMU positions using the DSR.	DSR, ETMS	5	
ZAU-2-16	1915	SPO: CVG is ground stopped to traffic from the east and north due to weather. J64, and J80 are closed. J6 just opened. Military use of airspace is causing problems for ZNY. In ZAU, ORD has 30 minute departure delays. If visibility drops below 8 miles, the arrival rate reduces to less than 80 due to equipment issues. The CWSU expects visibility to drop below 8 miles. The STMC studied CIWS during the telecon.	CIWS VIL, Echo Tops, Storm Motion, Lightning	5	16
ZAU-2-17	2046	SCC called. Traffic is having difficulty getting to CLE because they can't go through ZID. A route was determined (SGF/Joliet/SBN/Waterville/Toledo). ZAU TMC used DSR and ETMS only.	DSR, ETMS	2, 5	

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ZAU-2-18	2115	SPO: J80 and J64 are still closed. The STMC quoted the CWSU forecast during the telecon. Weather in southeast ZAU is moving out of the Center. There is weather in ZID and ZOB preventing use of routes in ZAU (traffic can't get to them). All is very quiet at ZAU.	CWSU	5	
		ZDC			
ZDC-2-1	1300	Only small coverage of convection in ZDC; isolated cells along east NC coast. Lots of traffic being rerouted through ZDC because of weather in ZOB, ZAU, ZKC, and north ZID.			
ZDC-2-2	1330	SPO: STMC consulting CCFP as long-term strategic reroute plans are negotiated on SPT.	CCFP on ETMS without traffic	2, 5	
ZDC-2-3	1430	No significant weather in ZDC. TMC hand-off at the RC position included a 5-second weather discussion, using WARP, of the storm cluster in ZTL and decaying storms out near Chicago.	WARP	5	
ZDC-2-4	1430	Discussion of returning to normal as reroutes continue to expire. No_J6 playbook route still in place for DFW-MEM traffic. TMC consulted WARP and asked why the playbook was still used. CIWS shows level 4-5 storms with some growth along J6 in ZID. "Oh, that's probably why."	CIWS VIL, Echo Tops, Growth and Decay Trends	5	16
ZDC-2-5	1445	CWSU pre-SPO weather briefing for STMC indicated that CCFP forecasted low coverage in metro DC area.	CCFP	5	
ZDC-2-6	1525	Growing cell on J6. STMC consults CIWS and notes 38 kft. top with growth. STMC states that this cell may cause problems.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	16
ZDC-2-7	1530	Scattered level 3-5 cells in east NC with tops to 33 kft. STMC confirmed that weather is east of significant traffic flow so not a big concern at this time.	CIWS VIL, Echo Tops, Storm Motion, Lightning, Growth and Decay Trends	5	16

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZDC-2-8	1534	Growing cell on J6. TMC observes growth in CIWS and asks STMC if LDM/AML metro-DC departure restriction can be proactively put in place before problems (i.e., large deviations) occur. Metro DC westbound departures are restricted 15 as one over LDN fix. At 1541, the CWSU confirmed the potential for weather impacts in this region. Without CIWS, the TMC would not have proactively managed the airspace. This may have resulted in multiple deviations in tight airspace and increased complexity (and workload) for controllers and Areas. This would likely have resulted in even more severe restrictions when the weather impacted with full traffic load.	CIWS VIL, Echo Tops, Growth and Decay Trends	1	5, 14
ZDC-2-9	1545	STMC and TMC's are busy in spurts preparing special-use airspace in Raleigh/Fayetteville region. Presidential movement.			
ZDC-2-10	1550	Scattered storms in ZDC. STMC consults CIWS for situational awareness update (impacts on J6, storms in southeast ZDC).	CIWS VIL, Echo Tops, CWF, Lightning, Growth and Decay Trends	5	16
ZDC-2-11	1602	Storms along J6. En route traffic on J6 still flowing, but deviating around cells (some deviations are large near arrival flows). STMC said light traffic this time of day (on J6) is helping keep the route open.	DSR, CIWS VIL, Echo Tops, Growth and Decay Trends	1, 5	1

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-12	1604	Area Sup informs TMU of "hefty" J6 deviations due to weather. Area Sup and STMC discuss a plan using CIWS. STMC shows DC restrictions already in place. Area Sup points out CIWS tops, showing weather now high enough to affect over-flight traffic. Area 4 joined discussion with Area 3 and TMC, saying DC departures are deviating way north. Traffic cannot be rerouted south because of Arlington demand over the next 30 minutes. STMC decides to stop BWI/DCA traffic temporarily and will then reassess before delays grow there. Without CIWS, the TMC decision would have taken longer (5 to 10 minutes) because not all of the weather information provided by CIWS is readily available on other systems. The lack of clear jetway/navaid overlays available on CIWS would have hampered Area/TMC decision-making and collaboration. The TMC would have been more unsure of the decision, concerned about growth, and unsure of the weather movement. The STMC stated that he needed WARP for the coverage not offered by CIWS, but otherwise CIWS shows him everything he needs.	CIWS VIL, Echo Tops, CWF, Storm Motion, Growth and Decay Trends	5	12, 14, 16
ZDC-2-13	1623	Weather near J6/J134. Traffic departing metro DC landing ORD are rerouted on J134 and are deviating. STMC uses CIWS to inspect weather in ZID (who originally requested the reroute) and determine feasible routes. STMC coordinated with RC position TMC using CIWS and asked him to call ZID to see if they could take traffic further north. ZID agreed. CIWS was used for situational awareness for weather in neighboring Centers and to suggest an alternate reroute for ZID. Because CIWS was available to both ZDC and ZID, the shared situational awareness enhanced airspace negotiations and may have resulted in a workload reduction for ZID.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends	2, 5	3, 12, 14, 16
ZDC-2-14	1629	DD position opened as weather begins impacting metro DC.			
ZDC-2-15	1629	Weather on J6 at LDN/AML region. TMC adds DRUZZ, DOCCS, and BARIN fixes to CIWS Precip window to improve situational awareness.	CIWS VIL	5	16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-16	1636	J6 storms building toward DOCCS flow. STMC uses CIWS products to note progression of weather towards DOCCS fix, the IAD arrival flow from west coast. ETMS shows 20+ IAD arrivals in the air across the country heading for DOCCS. STMC tells TMC to start planning for these flights.	CIWS VIL, Echo Tops, Storm Motion, CWF, Growth and Decay Trends	5	14, 16
ZDC-2-17	1654	Pre-SPO telecon with SCC Svr Wx. CIWS consulted during planning coordination's. NY will use No_J6 playbook into ZOB. ZOB cites CIWS tops (which are currently low) for weather currently in ZAU.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	12, 16
ZDC-2-18	1704	Weather building in ZDC. CIWS consulted to assist with decision to ask for permission to hold TMC over (overtime) for this evening.	All CIWS products	5	15, 16
ZDC-2-19	1724	Storms near DOCCS/DRUZZ. During SPO, STMC discusses plans needed for when weather impacts these fixes. CIWS was used to gauge pending impacts; CWF for movement towards the key fixes, satellite for development not yet detected by radar.	CIWS VIL, Echo Tops, CWF, Satellite, Lightning, Growth and Decay Trends	5	12, 14, 16
ZDC-2-20	1745	Weather west of metro DC. TMC consults CIWS, using filtered VIL, and notes some gaps in the VIL and echo tops. TMC consults DSR and considers trying to get a plane thought the gap. Could not follow through due to report of moderate turbulence near RDU. STMC changes CIWS view to southern ZDC.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	16
ZDC-2-21	1748	Evening shift STMC arrives and goes directly to CIWS to identify weather concerns.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-2-22	1750	Storms in southern ZDC. Area Sup informs TMU that sector 36 traffic deviating into sector 38. White/Wavey/Woodstown departures stopped for 30 min. During STMC hand-off briefing, STMC noted that long range CCFP showed no east coast concerns so ZDC did not request VA-Capes airspace. Now weather is present and traffic is getting squeezed. This implies that with a better strategic forecast, they would have requested the airspace, resulting in greater capacity for a longer period of time.			
ZDC-2-23	1800	There are 4 TMC's in the unit; STMC, RC, DD, Spacing positions. An additional TMC is approved for overtime and will be on position soon.			
ZDC-2-24	1807	Storms near Ft. Bragg. STMC adds Ft. Bragg airport to CIWS SD. POTUS is scheduled to land there at ~19Z.			
ZDC-2-25	1820	STMC comments that not enough staff are on duty for this SWAP event, especially given Presidential movement. At 1830Z, STMC set up the Severe Weather position in the TMU to handle POTUS.			
ZDC-2-26	1840	Storms have developed in northeast ZDC. STMC confers with Area 5 Sup. TMU wants to start moving traffic southbound with 20 to 40 MIT restriction, but Area Sup explains that there is no room available. Pawtuxet and W-386 (MOAs) are hot. In addition, a missile shot is planned in VA-Capes airspace so those areas will not be released.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends	2, 5	12, 16
ZDC-2-27	1847	Storm building on J75. STMC uses CIWS to note developing storm on the route and proactively places a 10 MIT restriction on the route. STMC explained that he wanted to set up the flow before deviations occurred to keep the route running smoothly. Had CIWS growth depiction not been available, the TMC would not have noticed the developing storm. The call for MIT restrictions would not have occurred until Area reported deviations. At that time, (a) the plan may have called for greater restrictions or route closure and (b) likely would have taken longer to devise more severe plan and a few minutes longer to coordinate with Area (with limited weather information).	CIWS VIL, Echo Tops, Growth and Decay Trends	1	5, 14

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZDC-2-28	1912	Weather in ZID and ZOB. STMC uses CIWS to coordinate a SWAP plan for NY metro traffic.	CIWS VIL, Growth and Decay Trends	2	3, 12
ZDC-2-29	1920	Weather on J80 in ZID/ZOB. ZNY requested a reroute onto J6 then J134 west. The reroute was approved with a 30 MIT restriction after the TMC consulted CIWS. The reroute request came from a neighboring Center, so they developed and coordinated the plan. The STMC confirmed that J6 was allowed because CIWS showed that over flights would be feasible. The reroute would not have been allowed without CIWS.	CIWS VIL, Echo Tops, Growth and Decay Trends	2, 5	3, 12, 14
ZDC-2-30		STMC adds lightning to ETMS to view the weather and traffic flows in a particular area.	ETMS	5	
ZDC-2-31	1925	Strong storms in northeast ZDC. Area 5 Sup, using CIWS, informs the TMC and another Area Sup that the airspace is being closed off by two large cells in the vicinity of OOD and the hot MOAs. Area Sup confirms that the Area can handle a "trickle" of PHL traffic and those already in the air, but not much more.	CIWS VIL, Lightning, Growth and Decay Trends	5	12, 14, 16
ZDC-2-32	1937	Strong storms near OOD. Area 5 Sup tells TMU that 40 MIT per route isn't enough. PHL departures are deviating into PXT MOA. Conference at CIWS to illustrate significant weather issues.	CIWS VIL, Echo Tops, Lightning, Growth and Decay Trends	5	12, 14, 16
ZDC-2-33	2007	Level 6 weather with 50+ kft still impacting OOD region (northeast ZDC). Area 5 Sup using CIWS at his position to note slow movement of storms. Convection shows no sign of weakening and lots of lightning. Sup says only hope is release of W-386 but that won't happen because of the 21Z scheduled missile launch. Area controller confirms that military aircraft are in the airspace.	CIWS VIL, Echo Tops, CWF, Lightning	5	12, 14, 16
ZDC-2-34	2018	Very busy in the unit. J518 was closed by ZOB.			

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ZDC-2-35	2045	Storms impacting J48. Area 1 Sup and STMC coordinate J48 reroute for en route traffic by using CIWS. Route via Martinsburg/MOL to get behind weather which is moving slowly eastward, according to CWF contours. TMC tells ZNY that if traffic needs to deviate, go west behind the weather and stay above 32 kft to top the weather. Without CIWS, it is possible that the reroute would not have been suggested with weather so close to MOL. CIWS showed that MOL was clear. The TMC says that extra time would have been needed to discuss the MOL weather with the CWSU.	CIWS VIL, CWF, Echo Tops, Lightning, Growth and Decay Trends	2, 5	3, 12, 14
ZDC-2-36	2058	Significant complexity concerns in the Areas, as routes are restarted, reroutes are added and modified and then so much weather that deviations are numerous (into other sectors, other Areas, etc). There is little chance to apply CIWS for proactive management at this time - all eyes on route coordination, timing for restrictions, volume, etc.			
ZDC-2-37	2130	Storms impacting metro DC departures to NY. RC position TMC coordinated with SCC SvrWx on reroutes for DC to NY, offering backdoor using J220 north then east to NY in ZNY airspace. Used CIWS to identify and confirm viability of this reroute. CWF shows route clear for more than 60 minutes. Without CIWS, either ZDC or SCC would have had difficulty quickly identifying which reroute options were clear of weather or may not have offered the reroute at all. Even if the reroute had been offered, it may have taken longer to do so.	CIWS VIL, CWF	2, 5	3, 12, 14
		ZOB			
ZOB-2-1	1455	ESP TMC used CIWS to plan ZAU to DTW flow. They settled on an OKI reroute with 15 MIT and allowing deviations due to weather in ZAU.	CIWS VIL, CWF, Echo Tops, Storm Motion, Growth and Decay Trends	2, 5	3, 12
ZOB-2-2	1530	Storms south of D21. MIT restrictions and tactical reroutes are in effect for south departures and southeast arrivals. Area 2 Sup comes into unit to talk to ESP position TMC, where a CIWS SD is present. TMC and Area Sup used ETMS.	ETMS	2, 5	

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-3	1600	ESP TMC changed the CIWS SD to a single window and is using it for situational awareness.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends	5	16
ZOB-2-4	1640	There are thunderstorms on J64 with tops to 28 kft, storms north of J80 with tops to 48 kft, and level 6 storms on J80 with tops to 46 kft. J80 is blocked. ZDC requested that J518 be rerouted to J64 due to storms in WV. TMC looked at storms in ZAU on J64, notes that tops are low, and approves the reroute. When asked if CIWS saved time, the TMC said it was hard to say. He thought a likely scenario would have been that he would have called ZAU to request the reroute, costing about 2 to 5 minutes of coordination time. Then ZAU would have requested PIREPS, costing 5 to 15 minutes.	CIWS VIL, Echo Tops, Storm Motion	2, 5	3, 12, 14
ZOB-2-5	1655	Most of the storms are in east ZAU airspace. ESP TMC uses CIWS for echo tops information at PIT and NYC (situational awareness).	CIWS VIL, Echo Tops, Storm Motion	5	16
ZOB-2-6	1658	Storms in eastern ZAU are tracking east at 20 kt. Tops are now 45 kft. Coordinator position TMC is talking to SCC SvrWx in preparation for the SPO telecon. He is concerned that if the storms grow, tactical reroutes will be needed.	CIWS VIL, Echo Tops, Storm Motion, CWF	5	12, 14, 16
ZOB-2-7	1702	Storms behind those on J80 developed to level 6 and 45 kft in 15 minutes. Now J64 may be blocked. TMC tells TMC working the ORD position to monitor the route.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	14, 16
ZOB-2-8	1715	Coordinator position TMC says the SCC SvrWx did not coordinate the J29 reroute out of ZBW with ZID or ZAU. He called SCC SvrWx and told them that the reroute would not work, based on current weather and CCFP forecast.	CCFP, CIWS CWF, Growth and Decay Trends	2, 5	5, 12, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-9	1718	Storms across IN and in northern MI are showing a lot of growth. All storm development is currently outside ZOB. Coordinator TMC is concerned that if the line fills in, there will be problems with traffic deviating.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	16
ZOB-2-10	1730	Storms are growing east and south of C90, developing in ZID, and developing near Lake Erie. The CWSU told the STMC that storms would be in clusters. C90 is stopping southeast arrivals. SCC SvrWx wanted to send ZBW, ZNY, and ZDC traffic to the northeast through ZOB. ZOB cant' take all of that traffic due to volume concerns. ZOB agrees to take two pathfinders.	CIWS VIL, CWF, Echo Tops Forecast	2, 5	3, 11, 12
ZOB-2-11	1746	Thunderstorms in ZDC with tops to 47 kft. ZAU traffic landing DC metro and PHL will go through ZOB as one with 20 MIT restriction. (There is no weather in Area 6 but the Sup requested 15 MIT. The STMC increased it to 20 MIT.) ZOB will not take any DC metro traffic from ZID. Aircraft are deviating before they get into ZDC airspace. The observer asked the STMC if CIWS was used for this decision. STMC said CIWS was not used because the weather was already there and there is always a MIT restriction due to volume at this time of day. CIWS was used during the discussion between the STMC and Area 6 Sup.	WARP, ETMS, CIWS VIL, CWF, Echo Tops	5	12, 16
ZOB-2-12	1756	Tactical reroute from Bellaire to Henderson. The STMC used CIWS for situational awareness.	CIWS VIL, CWF, Echo Tops Forecast	5	16
ZOB-2-13	1820	The STMC has been consulting CIWS frequently for situational awareness. Most of the decisions now concern MIT restrictions and how to space aircraft.	CIWS CWF, Echo Tops, Growth and Decay Trends	5	16
ZOB-2-14	1829	Level 5 storms are tracking into western ZOB airspace (Area 2) with tops to 41 kft. Area 4 also has storms developing. CIWS indicates decay. The CLE TMC consulted CIWS for situational awareness and set up the SD to support his focus. Observer noted a gap on J60 in ZAU airspace and learned at 1915 that the J64 traffic had been swapped to J60.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	12, 14, 16

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZOB-2-15	1840	Storms just entering ZOB with tops to 42 kft and showing growth. STMC uses CIWS to assess DTW impact by 2230.	CIWS CWF	5	14, 16
ZOB-2-16	1850	CWSU forecasts storm development in southern MI. ESP TMC uses CIWS to start developing a plan for DTW flow and coordinating with ZDC. Traffic moved to POLAR (northwest) fix.	ETMS, CIWS VIL, CWF, Lightning, Storm Motion, Echo Tops	4, 5	7, 12, 14
ZOB-2-17	1856	Storms blocking traffic to DTW from south. ESP TMC comments that he is glad he isn't working ZID tonight. J85 northbound to DTW is stopped due to weather. TMC uses CIWS to determine that FTW fix will remain open so 6 to 8 aircraft are rerouted to FTW. Area 8 and Area 2 are informed of the reroute. The aircraft will be descending when the cross into ZOB. Without CIWS, it is likely that ZID would have held these aircraft in their airspace.	CIWS VIL, CWF, Echo Tops, Lightning	2, 5	3, 12, 14
ZOB-2-18	1904	Area 4 Sup reports holding in Area 4. Consults CIWS for situational awareness.	CIWS Echo Tops, CWF	5	16
ZOB-2-19	1911	Thunderstorms near Jamestown on J36. Storms are tracking northeast with tops of 39 to 42 kft. Area 3 Sup visits TMU to tell the Coordinator TMC that traffic is deviating west into Canadian airspace.	CIWS VIL, CWF, Satellite, Storm Motion	5	16
ZOB-2-20	1912	Storms on J80 in ZID airspace. While Coordinator TMC is planning a reroute for traffic from ZNY to ZID, J80 closes.	CIWS VIL, CWF, Echo Tops Forecast	2, 5	14, 16
ZOB-2-21	1920	SCC SvrWx implements an OXI-OKK reroute.			
ZOB-2-22	1944	Storms in eastern ZAU are tracking east 20 kt. Coordinator position TMC is talking to SCC SvrWx in preparation for the SPO telecon. He is concerned that if the storms grow, tactical reroutes will be needed. Traffic was moved from J29 to J60 to get 4 to 6 aircraft per hour out of ZBW. This plan had to be approved by SCC and ZAU. STMC says he believes CIWS is reducing coordination time. J29 should remain open for 45 minutes.	CIWS VIL, Storm Motion, Growth and Decay Trends	2, 5	3, 12, 14

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZOB-2-23	1953	DTW ESP TMC is concerned about storms around ROD that might close routes. He wants to open J85, if possible, into DTW. He used CIWS to suggest the plan to the STMC. The ESP TMC is worried that aircraft will deviate when they see storm anvils.	CIWS VIL, CWF, Echo Tops, Storm Motion, Growth and Decay Trends	1, 5	1, 12, 16
ZOB-2-24	2020	Storms decaying in central OH. ESP TMC is using CIWS to find routes for northbound traffic out of ZID to DTW. TMC relied on decay trend to boost confidence in aggressive route opening decisions; CIWS used to coordinate decisions with Area 2.	ETMS, CIWS VIL, CWF, Echo Tops, Growth and Decay Trends	1	1, 12, 14
ZOB-2-25	2032	Weather blocking most of J518. There is a gap in the weather at the north end of J518. Area 6 requested that traffic on J518 be stopped. STMC tried to convince the Area Sup to keep J518 (DC metro arrivals) open wit MIT restrictions, based on CIWS. Area Sup would not allow.	CIWS VIL, CWF, Storm Motion	5	16
ZOB-2-26	2115	SPO: Storms decaying on the west end of Lake Erie. Storms are still strong in Area 6 between ZOB and ZDC. ZDC requested normal routes but ZOB cannot get traffic to them. A pathfinder was sent to Area 6. STMC told observer that Area 6 was using gaps for internal traffic.	WARP, CCFP, ETMS, CIWS VIL, CWF	1, 5	1, 6, 12
ZOB-2-27	2140	Storms continue to impact traffic into and out of DTW. STMC and ESP TMC said DTW would have had a ground stop and GDP without CIWS. The CIWS forecast showed storms missing DTW. ZOB coordinated extensively with D21 to keep DTW open and the TMC referenced CIWS by name when working with D21.	CIWS VIL, CWF, Forecast Accuracy	3, 5	4, 9, 12, 14, 16
ZOB-2-28	2148	Level 6 storms developing rapidly north and west of DTW with tops to 47 kft, moving east. Area 1 Sup visited the TMU to tell the ESP TMC that POLAR is being impacted by weather. POLAR will remain open for now. The Area Sup had to come to the TMU to see CIWS and used the SD to explain the situation to the STMC.	CIWS VIL, Echo Tops, CWF	4, 5	7, 12
ZOB-2-29	2150	Storms developing near ZNY border. ZNY is looking to reroute LGA landing traffic. The Coordinator TMC used CIWS for situational awareness as he coordinated with ZNY.	CIWS VIL, CWF	5	12, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-30	2155	Pathfinder for ZDC/Area 6 launched from DTW.			
ZOB-2-31	2233	Storm tops lowering on J80. Coordinator TMC noted lowering tops and consulted with STMC to open J80 at or above FL 340. TMC called ZNY to request a pathfinder. Coordinator TMC said that CIWS was the only reason he considered opening J80. ZNY did not send a pathfinder, but Area 6 used local traffic to open J80. ZNY did not send traffic on J80 until 2315.	CIWS Echo Tops, Echo Tops Forecast	1, 5	1, 12
ZOB-2-32	2300	Thunderstorms are tracking south and east of DTW again. ESP TMC said he continues to depend on CIWS for arrival and departure reroutes.	CIWS VIL, CWF	4	7
ZOB-2-33	2315	SPO: Storms in ZOB are decaying and most tops are lowering. J80 was discussed on the SPO. Coordinator TMC wants J80 open. A PIREP from Area 6 traffic indicated that there were no problems at FL320. J80 was finally opened with 15 MIT restriction. This was changed to 30 MIT per strata by 2320.	CIWS Echo Tops, Echo Tops Forecast	1	1
ZOB-2-34	2326	Weather is clearing J518. Coordinator TMC used CIWS during conversations with the Area Sup. Area Sup sees weather is clearing and puts in request to TMU for 30 MIT on J518. Using CIWS, the Area Sup felt that he is making request at least 30 minutes sooner	CIWS VIL, Echo Tops, CWF, Echo Tops Forecast, Satellite, Storm Motion	1, 5	1, 12, 14
ZOB-2-35	2350	Storms decaying around DTW. They were able to get the push in with few delays.			
ZOB-2-36	0035	Storms decaying in western PA. J64 was opened early by the STMC. STMC said he would have waited at least 30 minutes more without CIWS. Also coordinating the reopening was easier.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	1, 5	1, 12, 14
ZOB-2-37	2030 post event	Weather impacting traffic in ZOB67 and ZOB69 along J80 at 19:00. Area Sup used CIWS to shut down J80 an estimated 10 minutes sooner, possibly saving some deviations along the route. May have led to controller workload reductions but Area Sup unsure.	PIREPS, CIWS VIL, CWF, Echo Tops Forecast	1, 5	2, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-38	2036 post event	Weather is impacting J518 in ZOB67. J518 is shut down.	PIREPS	1	
ZOB-2-39	2040 post event	Weather was impacting DTW inbounds at ZOB48 at 1900. Increased MIT from 30 (from ZDC and ZNY) to 40. Area Sup felt that using CIWS saved 10 minutes in increasing MIT which may have helped controller workload (uncertain).	PIREPS, WARP, CIWS Echo Tops Forecast, Storm Motion	1, 5	5, 12, 14
ZOB-2-40	2155	Area 6 - J80 and J518 still being impacted with weather. Area Sup made request of TMU to keep J80 and J518 closed longer (Closure was extended, however, observer did not see interaction with TMU.)	PIREPS, WARP, CIWS CWF, Echo Tops, Echo Tops Forecast, Storm Motion	1, 5	5, 12
ZOB-2-41	2246 post event	Weather was impacting DTW at 21:00 particularly the departures in ZOB27. Choose not to deviate departures from DTW and put in no restrictions. Used typical 10 MIT on departures over SE fixes (WINGS, TYCOB). Had the Area Sup not had CIWS, he would have requested 15 MIT with reroutes over the two fixes at 21:00 and asked that the program be left in place for at least 45 minutes. Given the weather, the Area Sup also used CIWS to staff the D-sides at 21:00 due to the weather and forecast to the SE. He staffed 2 D-sides because of CIWS which he said was the right call.	WARP, CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Growth and Decay Trends	4, 5	7, 12, 14, 15
ZOB-2-42	2320	Weather seems to be clearing along J80 in Area 6 (higher altitudes). Area Sup wants to open J80 at 340+ with 20MIT. Using CIWS forecast but also looking for a pathfinder. Put the request in 35 minutes ago (22:45). TMU put the request through within about 5 minutes but still no pathfinder. Area Sup said he would have waited until things were clearing for sure before requesting a pathfinder, even though he knew the pathfinder would take some time to get.	WARP, CIWS CWF, Echo Tops, Echo Tops Forecast	1, 5	11, 12, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-2-43	2323	Weather clearing along J80 in ZOB67. Area Sup is not going to wait for pathfinder and puts in request to TMU for 20MIT on J80 with no altitude restriction. Using CIWS, the Area Sup felt that he is making request at least 30 minutes sooner than he would have. He still doesn't see a pathfinder and no longer wants to wait for one. Area Sup is requesting the route opening due to CIWS even thought the pathfinder did not go.	CIWS CWF, Echo Tops, Echo Tops Forecast	1, 5	1, 12, 14
ZOB-2-44	0040	Weather is decaying along J518 in Area 6. Going to request that ZOB lowers its restrictions on J518 to 20 MIT. Even though CIWS was consulted, the PIREPs played a bigger role in this decision as the pilots are not deviating as much and able to go at lower altitudes.	PIREPS, CIWS CWF, Echo Tops, Echo Tops Forecast	1, 5	1, 12, 14
ZOB-2-45	0041	Weather is developing along J584. Aircraft are deviating but are not having a big impact on air traffic.	PIREPS, WARP	1, 5	
ZOB-2-46	0051	Weather is moving onto and developing along J36. Aircraft are deviating but are not having a big impact on air traffic.	PIREPS, WARP	1, 5	
		ZNY			
ZNY-2-1	1820	CIWS was used to view weather impacting J80 in ZOB airspace. ZNY concluded J80 wouldn't be available much longer. At 1839 ZNY shut off ZBW traffic on J80 in anticipation of ZOB closing the route. ZBW flew north to compensate. ZOB shut down J80 at 1910. If ZNY had not stopped ZBW J80 traffic when they did, these flights would have required in flight route modifications - which means more controller/TMC workload. Instead, traffic proactively rerouted, using CIWS, saving workload and potentially reducing complexity. Heavy convection outside ZNY airspace to north ZBW, west ZOB, and southwest ZDC. ZNY SWAP began at 1820 and was imposed by ZDC	CIWS	1, 5	2, 12, 14
ZNY-2-2	1823	White/Wavey traffic stopped by ZDC.			
ZNY-2-3	1832	White/Wavey open with MIT restrictions.			
ZNY-2-4	1840	J80 from ZOB/ZBW closed until 2000. Reroutes requested.			
ZNY-2-5	1844	White/Wavey fixes closed again.			
ZNY-2-6	1855	Internal discussion on how to get planes out with all the closures and restrictions imposed by other Centers.			
ZNY-2-7	1858	Departure Desk playing catch-up and can't physically type restrictions into the computer fast enough.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZNY-2-8	1902	At the stand-up weather briefing, the CWSU forecasted that storms will form along the western boundary of ZNY and J75 in Chesapeake Bay. CWSU used CIWS to identify areas of future trouble.	CWSU, CIWS VIL	5	16
ZNY-2-9	1907	Departures Desk points out to observer that there is very little weather in ZNY airspace, yet there is significant impact to ZNY traffic.			
ZNY-2-10	1909	STMC, using CIWS, anticipated a problem in ZOB on J36 due to strong cell approaching from the south. He discussed this with OMIC & Departure TMC. They planned to offload onto J95 when J36 closed. ZNY stopped ZBW on J36 to minimize traffic when offload occurred. Once cells came off J36 and toward J95 they would reverse the offload back to J36. The forecast did not pan out, cell died, and no restrictions ever happened on J36 or J95.	CIWS VIL, CWF, Echo Tops Forecast	2, 5	14, 16
ZNY-2-11	1910	Internal briefing that problems are starting at the MULRR intersection (southwest boundary of ZNY) and IAD arrivals want to deviate into Potomac airspace. ZNY sector controller was the first to bring up this problem and the Departure Desk agreed. Departure Desk informed SCC SvrWx.	DSR, ETMS, CIWS VIL, Echo Tops	5	16
ZNY-2-12	1941	Much like with J36 & J95, STMC anticipated the closure of J64 due to weather in ZOB. WARP showed weather filling in (Departure TMC suggest not looking at WARP since it always looks worse). OMIC and STMC offload half of their flights from J64 to J60 and stop NY metros on J64 only allowing PHL to fly it (to easy the congestion at PHL). No external Coordination required since ZOB didn't have any restrictions on J64 at that time.	WARP	1, 2	2, 3, 14
ZNY-2-13	2007	At 2006 J6 became available again. Departure TMC was going to send flights & OMIC, using CIWS, said No. Due to weather in DC, he felt ZDC would shut it back down rather quickly and they would have to hold planes. STMC felt it never should have been opened. At 2013, J6 was shut down by the ZNY Area Sup who said deviations were getting too large.	CIWS VIL, CWF	1, 5	2, 14, 16
ZNY-2-14	2015	ZNY TMC behind the power curve and is simply reacting to events rather than planning for them			
ZNY-2-15	2034	Getting sector-to-sector route openings which is upsetting the Departure Desk, who indicates that route openings must only come from SCC.			

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ZNY-2-16	2038	Difficulty day at ZNY - likely because the significant weather is primarily outside of ZNY airspace and TMU is just reacting to decisions made for them.			
ZNY-2-17	2042	J75 opened and planes are getting through.			
ZNY-2-18	2042	J64 officially closed.			
ZNY-2-19	2049	At 2043, J75 was used for PHL traffic only. With weather improving on J75 and worsening on J48, they wanted to send Metro NY traffic on J75 with PHL. J6 had a high MIT restriction as did J48. This was NOT approved internally by Area.			
ZNY-2-20	2121	J75 traffic stopped. ZDC can't take any more planes.			
ZNY-2-21	2208	Based on CIWS, TMC wanted a pathfinder on White and/or Wavey. ZDC did NOT agree but would discuss later when weather improved.	CIWS VIL, Echo Tops, CWF	1, 5	5, 16
ZNY-2-22	2235	ZDC opened White with 40 MIT.			
ZNY-2-23	2237	J60 had been closed internally because the Area could not handle the volume with the deviations. STMC looking at weather and flow (both of which had improved) asked if they could start sending again. Area said yes. ZOB had no restrictions in place at the time so no external coordination was needed.	WARP, CIWS	1, 5	1, 16

CIWS Benefits Assessment
Observation Period #2 Observations Summary
Day 3 - June 29 2005

Participating Facilities: ZMP, ZTL, ZJX, ZAU, ZDC, ZOB, ZNY, ZBW

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
		ZMP			
ZMP-2-35	1620	Storms from the morning are weakening. Some swaps north are still in effect, but mostly back to normal routes. MSP arrival rate is 56. (The normal rate is 60, but wet runways drop the rate to 56.) Current restrictions are FAR over BRD, ABR over ONL, ONL and ORSKY single stream with 10 MIT. The STMC said they coordinated with the tower.	CWSU, WARP, CIWS VIL, CWF, Echo Tops	5	16
ZMP-2-36	1640	Based on CIWS, ZMP did not allow the use of CAN playbook routes earlier. CIWS showed weather remaining in the area. They are working on a hybrid playbook route and waiting for SCC to get back to them.	CWSU, WARP, CIWS VIL, CWF	2	3
ZMP-2-37	1705	Weather over ABR is showing decay. Area 2 Sup reports that aircraft are not making it up through BRD or FAR, so they are going to try ABR. They called MSP for a pathfinder. TRACON will look for two pathfinders. The TMC said she would have used her DSR and WARP had CIWS forecast not been available. She estimated that CIWS would have saved 5 minutes.	CIWS VIL, CWF, Echo Tops	1, 5	11, 12, 14
ZMP-2-38	1720	CWSU says that there is new development in the Dakotas that may develop into a line in ZMP airspace. He thinks the weather southeast of DSM and MCW should weaken by 21Z.	CWSU, CIWS VIL, CWF	5	16
ZMP-2-39	1725	TMC consulted CIWS to determine if FAR departures could start again. Area 2 was consulted and were willing to take traffic, but Area 4 could not (Area 4 does not have CIWS).	CIWS VIL, CWF	5	12, 16
ZMP-2-40	1730	Arrival rate now at 60. The TMC at MSP position said she put pressure on the airport by letting more traffic in and thereby got the rate up to 60.	DSR, CIWS VIL, CWF		
ZMP-2-41	1740	TMC is working with the Areas to determine which departure fixes are best. Area 3 is OK with FAR departures with 20 MIT. Area 4 (who has no CIWS) does not agree. TMC feels that having CIWS in the Areas saves them a trip to the Area to discuss plans.	DSR, CIWS VIL, CWF	4, 5	7, 12, 14

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ZMP-2-42	1755	Pathfinders over ABR were able to get out so ABR is now open.			
ZMP-2-43	1800	Only swaps in place now are FAR/BRD over DLH or ABR. Echo tops are low enough to allow most traffic to get out on their planned departure fixes with some minor deviations. The TMC continued to monitor CIWS for situational awareness that routes continue to be usable.	CIWS VIL, CWF, Echo Tops Forecast	5	16
ZMP-2-44	1810	ORD landers from ZDV and west are being rerouted to FOD/ALO/DBQ. ZAU doesn't want this traffic coming in over BDF due to weather near that fix and traffic from the south. The ESP TMC told Area 6 to have traffic deviate north of weather in IA, not south; TMC and Area Sup confirm CIWS helped reach consensus on plan more quickly.	CIWS VIL, CWF	2, 5	3, 12, 14
ZMP-2-45	Inter-view	Observer interviewed Are 3 Sup concerning his use of CIWS. He said he really likes it and uses it frequently to coordinate plans with the TMU. He has 6 or 7 saved window configurations. They aren't afraid to initiate something with the TMU if they see an opportunity.			
ZMP-2-46	1900	The weather in ZMP is benign now. FAR & BRD traffic is still swapped over DLH and ABR. The weather south of the TRACON has tops to 30 kft but most of the tops are lower. Higher tops are located over northern MN (at BRD and FAR). The weather in IA is scattered and not causing problems. The ESP and MSP TMCs are keeping a close eye on CIWS, especially because the CWSU and CCFP are calling for further development.	CWSU, CCFP, CIWS	5	16
ZMP-2-47	1910	The many GDPs in effect for the east coast are slowing traffic coming to ZMP. This pushes everything later (potential staffing concern).			
ZMP-2-48	1915	Some deviations are starting around ODI. As a result, Area 2 requested ODI/DLL are single stream with 10 MIT. The TMC agreed to the restriction and said this would likely have happened even without CIWS because it was in response to deviations and they have other weather products. The Area Sup said he used CIWS as part of his overall situational awareness.	DSR, CIWS VIL, CWF	5	16
ZMP-2-49	2010	MSP TMC doesn't think FAR departures need to be swapped any longer. He called Area 2 and TRACON/tower to ask if they can cancel the swap. Without CIWS he likely would not have initiated the cancellation for a while. He noticed the FAR overlay on CIWS and that prompted him to consider opening the route.	CIWS VIL, CWF	1, 5	1, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZMP-2-50	2020	MIT for ABR departures is increased to 20 because they are heading to an area of building weather. Deviations are increasing, resulting in the request for increased MIT.	PIREPS, CIWS VIL, CWF	5	16
ZMP-2-51	2130	SCC wants to use CAN6 to the west to get BOS flight out to the Pacific Northwest. CAN6 playbook approved by TMC who also wants any deviations to go north of the route. This CAN6 routing was set by SCC and ZMP approved the request with the caveat for deviations. The STMC was concerned that the BOS departures might think they could follow CAN6 without problems, but CIWS shows they may have to deviate way north. The STMC also used CIWS to prepare for the SPO.	CIWS VIL, CWF	2, 5	3, 12
ZMP-2-52	2140	The line is filling in along the MN/Dakotas border. Aircraft are getting squeezed. They are going to start swaps. ABR/FAR over BRD to the north or over ORSKY to the southwest. BRD is 15 MIT, ORSKY is 10 MIT. Strong growth trend information on CIWS allowed for quicker SWAP decision.	CIWS VIL, CWF, Growth and Decay Trends	2	3, 14
ZMP-2-53	2150	Adding RST over ODI as another swap. The Area 3 Sup came to the TMU and pointed out, using DSR and CIWS, that no one was going over RST. The MSP TMC agreed to call the TRACON and swap RST departures. CIWS may have produced a slight savings, but it was not possible to talk to the TMC who is busy now.	DSR, CIWS VIL, CWF	2, 5	3, 12, 14
ZMP-2-54	2205	RST departures swapped over ODI. The Area 3 Sup looked at the movement of the weather and said that he was hopeful the cells impacting RST would move off and allow RST to open again. The TMC said he would monitor the situation - referenced CIWS CWF for timing of weather progression.	DSR, CIWS VIL, CWF	1, 5	5, 12
ZMP-2-55	2225	The TMCs are concerned about being "squeezed off" as the line of weather to the west expands and lengthens to the south and weather to the south closes all routes out. Currently traffic can only use ORSKY to go west and south, but that route will close. The TMCs warned the Area Sups about the potential need to route traffic north to get MSP departures out and to get ORD departures to the west.	CIWS VIL, CWF	1, 5	12, 14, 16
ZMP-2-56	2245	The TMC asked the CWSU about the which lines would fill in and about the timing of the potential airport impact. The TMC wants to move MSP arrivals around behind the weather. Right now there is too much uncertainty to make a definite plan.	CWSU, ETMS, CIWS VIL, CWF	5	16

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ZMP-2-57	2255	TMC is considering options for getting MSP landers from the west in around the line of weather. They consult with NWA and suggest MSP/GEP/SKTR, but NWA thinks that only the south half is the best way to go. The STMC agreed since some aircraft are already airborne. ZDV, ZBQ, ZOK, ZLA traffic is on the south part. Coordination with NWA using CIWS CWF and Echo Tops Forecast estimated to save 10 min in developing plan.	CWSU, ETMS, CIWS VIL, CWF, Echo Tops Forecast	2, 5	3, 12, 14
ZMP-2-58	2310	Canceling RST swap. The Area 3 Sup visited the TMU and said that they would take RST departures again based on the CIWS weather. (Refer to 2205.)	ETMS, CIWS VIL, CWF	1, 5	1, 12, 14
ZMP-2-59	2330	Volume in Area 5 is becoming too high due to deviations in their airspace. The MSP TMC increased the ORSKY MIT restriction. Two aircraft routed over ORSKY can now go over RWF (back to normal arrival stream). This will help Area 5. CIWS is showing holes in the previously solid line of weather.	CIWS VIL, CWF	1	1, 6
ZMP-2-60	2340	There are too many aircraft in the high sectors (17, 18, 19). Arrivals are coming into MSP too high. They need to get arrivals down sooner and keep departures lower longer. To alleviate volume issues in Areas 3 and 5, some departures going southwest will be capped at 32 kft to insure separation. Higher altitudes are used by en route traffic.	DSR, ETMS, CIWS VIL, CWF	5	16
ZMP-2-61	2345	Even though CIWS shows holes in the weather over RWF, aircraft are still not willing to go through due to the look of the anvil. CIWS echo tops and satellite products were used to confirm tops were high	CIWS VIL, Echo Tops, Satellite	5	13, 14, 16
ZMP-2-62	0000	The TMC asked the CWSU if the weather to the west that exhibits decay will continue to weaken. If so, they will cancel the playbook and bring arrivals in over RWF. The CWSU suggested leaving the playbook in place and tactically rerouting traffic back over RWF for now.	CWSU, CIWS CWF, Echo Tops	5	16
ZMP-2-63	0005	Departures are deviating around weather at ODI and DLL. The MSP TMC is going back to single stream with 10 MIT for ODI/DLL.	ETMS, DSR	5	
ZMP-2-64	0010	TMC is hoping to swap some of the DLL traffic over WLSTN. She called the Area 1 Sup to check if he could take the additional volume. He agreed to take some, but not all. The weather looks OK, but the TMC also used sector volume numbers to make this decision.			
ZMP-2-65	0020	SCC called to get ORD traffic to BOS onto CAN6 east.			

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ZMP-2-66	0035	Weather is showing holes over ABR, which is currently being swapped over BRD. The STMC called the Area 4 Sup and told him to expect a pathfinder out over ABR. The STMC said using CIWS may have saved 5 to 10 minutes, but the decision might also have been made based on the DSR.	WARP, DSR, CIWS VIL, Echo Tops	1	11
ZMP-2-67	0100	ABR1 is open for departures. Many swaps are now going over ABR. Volume is being driven by the weather, but volume is now a big issue.			
ZMP-2-68	0110	CIWS products show FAR departure fix now looks usable. TMC checks with Area, whom are willing to try this route. Without CIWS, the FAR/ABR route, now a significant outlet, would have remained closed.	CIWS VIL, CWF, Echo Tops, Storm Motion	1, 5	1, 12, 14
ZMP-2-69	0120	Volume in ZMP for MSP should be low enough after 0200 that the program for MSP will not have to be extended. Weather is still present but the volume is decreasing. CIWS shows weather impacting MSP at about 0230. They coordinated with SCC to take MSP out of the plan.	CWSU, WARP, CIWS VIL, CWF	3, 5	4, 12, 14, 16
ZMP-2-70	0220	Weather is within 20 nmi of MSP. ORSKY, RST, ONL, and ODI are all closed. Traffic is using DLL or ABR. Only a few departures left. It would have been much worse if the weather had reached the airport earlier. They were able to work around the weather while it was at a distance and were happy with how things worked out. The remaining TMC on duty said that she was more comfortable using CIWS because the observer had been conducting on the job training and showing them more things the last few days. The TMC might not have tried to get the two aircraft out over DLL before the hole closed.	CIWS VIL, CWF, Echo Tops Forecast	4	10

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		ZTL			
ZTL-2-43	1523	Thunderstorms are developing throughout the NAS with the heaviest concentrations in ZJX and ZDC. Storms are growing in ZTL airspace. Both the northern Centers and SCC wanted ZTL TMU to implement at GDP for ATL to accommodate SWAP – but ZTL TMU said it was unnecessary, and that they would rely on MIT as long as possible. There was a possibility that ATL would need to be "turned around" – which can have a significant impact on ZTL if it occurs at the beginning or mid-way through an arrival push. ZTL wasn't certain that SCC would not override their decision, but at the telecon SCC announced ZTL's plan.	ETMS, CWSU	3, 5	
ZTL-2-44	1619	ATL south departures are deviating in the departure gate. Three streams are combined into a single stream over Thrasher (west gate) for ATL south departures. Coordination was between Area 4, TMU and ATL, so it happens very quickly (no need for national coordination) in effect 1622z to 1715z (eventually extended to 2000z, then canceled prior to 2000z).	WARP	4, 5	
ZTL-2-45	1632	Thunderstorms growing in ZDC. BOS departures to be re-routed from over Macey arrival (NE) to the SINCA arrival (SE) by ZDC at ZDC request.			
ZTL-2-46	1718	DC area departures landing ATL are re-routed from over Macey (NE) to SINCA (SE) by ZDC at ZDC request.			
ZTL-2-47	1729	ZTL reports during the SPO that they are experiencing limited airborne holding (landing ATL). A GDP is possible, but they still believe that MIT will accommodate deviations. Operations are running as expected from the plan developed this morning. Reports from the Areas indicate that the plan is working.	ETMS, CWSU	3	
ZTL-2-48	1748	ZID requests northbound aircraft be capped at FL230 because they are unable to get on top of storms. ZTL honors the request, but complains that the only tops reports they have are on ETMS. Numerous scattered storm in the area, but there is only one tops report covering over 100 miles of airspace – "450". ZTL could not propose a more suitable plan because they had no good information available on that weather. The impact was in ZID airspace, but the restriction was placed on ZTL.	ETMS	1	

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ZTL-2-49	1801	Deviations on Macey arrival (near Shine). No action taken. Deviations are tolerable and the original plan continues to work.			
ZTL-2-50	1816	The ATL TMC noted that an aircraft departed through the weather to the south of ATL and confirmed that the single stream restriction was still needed. The Area reported that the pilot was "inexperienced." The restriction continues.	DSR	5	
ZTL-2-51	1859	Aircraft landing ATL over Macey (NE corner of ZTL) from the NY area are deviating. If this gets worse, ZTL will propose a routing to keep the aircraft on the north side (versus rerouted over SINCA) because DC and Boston area traffic is already rerouted over SINCA. If ZDC balks, ZTL will have ZJX move their SINCA arrivals to Tiroe (SW). SCC called to discuss the situation and was notified of the plan. However deviations remained acceptable so the plan was never implemented.	WARP, ETMS	2, 5	
ZTL-2-52	1936	Holding at SINCA for volume. This is normal. No action taken.			
ZTL-2-53	1945	CWSU advises that they were preparing a CWA for the area of weather south and southwest of ATL, but a SIGMET is being issued that will cover it.	CWSU	5	
ZTL-2-54	1955	Holding at Macey. Holding normal at ZTL, no action taken. Macey sector was restricted to 30 MIT feeding ATL to favor the SINCA sector, which was working many of the re-routed (by ZDC) Macey arrivals.			
ZTL-2-55	1955	1st tier MIT restriction for aircraft landing ATL is extended. The plan is working so it is extended.			
ZTL-2-56	1958	ZDC reports that aircraft near Gordonsville/J48 are deviating. ZTL shows no weather over J48. No action taken.	ETMS	5	
ZTL-2-57	1958	Weather is still blocking the eastern half of ATL south departures. The single stream restriction is extended until 2100z. Also, the west departure restriction (2 streams, 10 MIT) was extended, but this was due to volume. No national coordination was required so this went quickly.	WARP	2	
ZTL-2-58	2010	ZDC calls to say J48 is closed. ZTL still sees no level 3+ weather on J48. (It appears to be south of J48.) Deviations continue in ZTL, but still acceptable.	ETMS	5	

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ZTL-2-59	2017	CLT departures over MOPED are deviating into MAJIC arrivals. Altitude restrictions are coordinated with CLT and the Areas. Jets are at FL140, props at FL120 over ROBAY with 10 MIT until 2200. No national coordination was required so this went quickly.			
ZTL-2-60	2035	A tuck restriction had been implemented (need to see TMU logs for additional info). The restriction was to keep aircraft arriving over Collier at low altitudes to handle the additional volume because of the Macey arrivals being rerouted over SINCA. The restriction is no longer needed and was lifted at the request of the Area.			
ZTL-2-61	2041	Single stream restriction for ATL south departures is lifted at the request of the Area.			
ZTL-2-62	2145	Level 2 precip is over the west end of the ATL runways with a level 3 storm just beyond, and northwest of, the runways. Since ATL was on west operations there was no impact, but TMU was concerned of the potential impact. A push with 115 aircraft due in 1 hour had already begun. The weather eventually became a level 4 northwest of the runways, with precip on western half of runways during arrival push. TMC noted that with CIWS they could see growth, decay and forecast movement – but that they didn't have one. No action was taken because they had no idea what this cell was doing. The Area monitored the TRACON ATL final display for missed approaches or go-arounds – there were none. No problems reported by ATL. No action taken. Had the storm impacted ATL, arrival sectors would have been placed in holding – a major event for an arrival sector to have the door slammed during a busy inbound push (with deviations occurring).	ITWS	3, 5	
		ZJX			
ZJX-2-40	1225	Showers over the Atlantic Routes. The STMC says that traffic is picking its way through. There are no other impacts at this time. Military operations again today.	NEXRAD, WARP, Satellite	5	
ZJX-2-41	1406	Some showers in Big Bend extending northeast and along the east coast. Normal flow.			
ZJX-2-42	1450	STMC is checking weather east of Daytona that might possibly effect military operations, which in turn may effect civilian traffic.	WARP, Satellite	5	
ZJX-2-43	1500	Normal flow. TMU is watching the weather along the east coast.			
ZJX-2-44	1511	ZJX/MCO AR-6 route not available for flights to MCO.			

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ZJX-2-45	1711	SPO: ZJX will stay in normal operations with tactical deviations as needed.	NEXRAD, WARP	1, 5	
ZJX-2-46	1800	Northwest section of the military operations area is open for civilian traffic above 31 kft.			
ZJX-2-47	1845	Weather over MCO. STMC is watching weather over MCO on ITWS. A large cell is covering most of the airport. LIZARD arrival is closed to inbound traffic. Traffic will be held over Taylor for 15 to 20 minutes.	ITWS	4, 5	
ZJX-2-48	1908	Holding released into MCO with 15 MIT.			
ZJX-2-49	1915	SPO: No initiatives but possible holding for TPA. Pilots are allowed tactical deviations as needed.			
ZJX-2-50	2015	Flows are good. Some military operations coordination.			
		ZAU			
ZAU-2-19	1345	Weather just barely reaching ZAU/ZMP western border. ORD departing traffic is impacted by weather in ZMP. They can't depart north or west, so ATC is taking all departures south around the end of the weather. The observer noted a gap on J2 suggesting they could take departures westbound now. STMC countered that the volume was low and no one was complaining. At this time, weather is dissipating. Only the C90 arrival and Traffic Coordinator positions are staffed. Very quiet in the unit.			
ZAU-2-20	1700	Weather developing south of Lake Michigan is impacting C90 departures. Stationary movement but building to the northwest. Departures are deviating. Southbound departures are nearly shut off. No impact en route except small deviations. Weather is located on the western ZAU/ZMP border.	CIWS VIL, Storm Motion, Echo Tops	5	16
ZAU-2-21	1758	The C90 arrival position SD is set up with one maximized precipitation window showing storm motion, satellite, lightning, and filtered echo tops. The C90 Arrival TMC stated that he likes CIWS because it saves him the time of finding a CWSU to give him a briefing.	DSR, CIWS VIL, Storm Motion, Satellite, Lightning, Echo Tops	5	16

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ZAU-2-22	1800	Sector 44 has no aircraft but is full of weather anyway. Observer set up the SD at the en route position with a 5-window configuration. No changes were made to this configuration by the users. The en route TMC stated that he doesn't use CIWS much at that position. "The flows are already established." AT this time, there are EDCTs for BOS, EWR, JFK, PHL, IAD, TEB, LGA, BWI, DCA; ESPs FOR MSP, CVG, PHL, CLE, IAD; ground stops for EWR, LGA, MMU, TEB, HPN; and SWAPs for DEN. The ORD arrival rate is 100 and south departures are stopped.			
ZAU-2-23	1835	The TMC at the arrival position set up the SD with one maximized Precip Forecast window showing 1-hour verification contours. The observer asked this TMC if he used CIWS at the en route position. He stated that he did not use it as much there because it is too tactical for en route operations. He likes CIWS and stated that it is better than CCFP.	CIWS CWF, Verification Contours	5	16
ZAU-2-24	1841	ORD lost its triple runway configuration due to a small cell. Traffic is being held in the SW and NE areas. They are trying to keep the NW Area open because "that's where all the planes are."			
ZAU-2-25	1846	ZID reports deviations over BKW.			
ZAU-2-26	1848	PLANO is out of the hold but is expecting to go back into the hold very soon.			
ZAU-2-27	1851	Observer asked Arrival TMC why he didn't use satellite. He says he normally does, but just didn't turn it on. He commented that the satellite image appears to have a better resolution than before. Currently there are ESPs for PHL, DC Metros, NY metros; ground stops for EWR, LGA, MMU, HPN, TEB; EDCTs for BOS, PHL, TEB, NY metros, and DC metros.			
ZAU-2-28	1854	Arrival TMC noted to other TMCs in the unit "See that cell that just popped up west of ORD?"	ITWS, DSR, CIWS CWF, VIL, Satellite, Lightning, Storm Motion	5	16

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ZAU-2-29	1910	STMC asked TMC to stay for overtime due to weather. It is unclear if the STMC used CIWS to make this decision. STMC reports to observer that the CWSU used the CIWS SD at the STMC desk to brief STMCs.	CIWS VIL, CWF, Echo Tops, CWSU	5	16
ZAU-2-30	1943	A cell with an echo top of 51 kft west of ORD was the topic of discussion between the Arrival position TMC and ZKC. No action was taken and no plan was discussed. This was just a heads-up.	CIWS VIL, Echo Tops	5	16
ZAU-2-31	1948	C90 called to offer to send pathfinders from MDW with 30 MIT. TMC notified Area Sup.	CIWS VIL, Echo Tops	1, 5	10, 11, 12, 14
ZAU-2-32	1958	SCC SvrWx/ZAU/ZKC telecon concerning the 51-kft cell. ZKC is expecting to lose the route. Traffic is currently picking a way through the weather. The TMC notified the Area that ZKC was expecting to have to shut them off. When this happens, traffic will go west and north of the weather. TMC estimates CIWS saved about 10 minutes: 5 minutes for identifying the potential impact and 5 minutes in coordinating externally.	CIWS VIL, CWF, Echo Tops, Storm Motion, Echo Tops Forecast	2, 5	3, 12, 14
ZAU-2-33	2006	ZKC called ZAU to decide where to break the traffic stream and start taking them west of the weather. TMC studied CIWS and ETMS.	CIWS VIL, Echo Tops, CWF, ETMS	2	3, 12
ZAU-2-34	2012	SCC/ZAU/ZOB telecon trying to determine a route to DTW. CETUS is closed. Weather is moving southeast but building. Traffic from ZID is single stream with 20 MIT over VHP, ZKC is single stream with 20 MIT over Kirksville/Badger/POLAR/POLAR1, ZAU is single stream with 20 MIT to ZOB for DTW.	CIWS VIL, Echo Tops, Storm Motion	2, 5	5, 12, 16
ZAU-2-35	2102	Arrival and En Route positions are very busy, but are using DSR and ETMS almost exclusively.	DSR, ETMS	5	
ZAU-2-36	2115	During the SPO, the NW Area Sup reported to the STMC that traffic was deviating in his area. STMC asked CWSU to brief the Arrival position TMC on weather at ORD.	CWSU	5	
ZAU-2-37	2120	North Area Sup studied CIWS at C90 Arrival position during the CWSU briefing. Weather is building slowly. CWSU briefed STMC. STMC thinks that weather will go over ORD, but CWSU believes weather will pass south of ORD as it tops the high pressure ridge.	CIWS VIL, Storm Motion, Echo Tops, CWSU	5	16

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ZAU-2-38	2135	STMC used CIWS to report on the motion of the weather in ZAU during the SPO. CAN6 west will be used for ZBW departures only. ZMP expects deviations and prefers deviation to the north rather than trying to get traffic around the southern end of the weather. Jet Link offers to be a pathfinder for ZBW.	CIWS VIL, Storm Motion, Echo Tops, Lightning	5	16
ZAU-2-39	2200	All positions are very busy now; very reactive. The southwest approach to ORD is still closed and there are no routes through ZOB. All DC and NY metros are swapped south.			
ZAU-2-40	2224	Internal ground stop for ORD landing traffic due to volume.			
ZAU-2-41	2233	C90 Arrival position TMC on the phone a long time. Not sure with whom or for what. Consulted CIWS for situational awareness.	CIWS VIL, Storm Motion, Satellite, Lightning, Echo Tops	5	16
ZAU-2-42	2240	C90 Arrival position TMC asked the observer about the 41 kft echo top with level 2 precip. This is the storm anvil.	CIWS VIL, Echo Tops	5	16
ZAU-2-43	2234	Internal and first tier ground stop for ORD landing traffic void 2330.			
ZAU-2-44	2301	ORD ground stop cancelled			
ZAU-2-45	0055	East coast (EWR) starting to open. Not much CIWS usage in the past hour or more. Actually, not much use of any weather products.			
		ZDC			
ZDC-2-38	1430	A north-south plume of embedded level 3 to 5 convection is in southeast ZDC airspace. There are some local deviations and turbulence concerns, but no big concern. Scattered level 3+ cells are developing west of ROA near the ZID/ZDC border. This area is not indicated in the CCFP. The STMC is concerned because CIWS satellite shows storms building in relatively clear air.	CIWS VIL, Echo Tops, Satellite	5	16

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ZDC-2-39	1436	Level 3 to 5 cells are near OOD. (The weather is near/over SBY.) The Area Sup explains to the TMU that southbound aircraft are deviating west around the weather, then north, then south because PXT is hot. They conference at the CIWS display, discussing stopping OOD departures or heavier restrictions. The STMC is hesitant to restrict because tops are only 30 kft and there is no lightning. "If I was a pilot and saw a big cloud, I'd want to deviate too. But they have to realize that that has consequences." Rather than restrict the route at this time, they decided to wait and see. Without CIWS, they might have restricted or closed the route.	CIWS VIL, Echo Tops, Lightning, Growth and Decay Trends	1, 5	1, 12, 14
ZDC-2-40	1448	Concern for weather near ZID/ZDC. SCC calls to discuss weather concerns. The STMC references CIWS, noting (with satellite) that weather is building in an area of good surface heating. He comments that just because CCFP doesn't forecast anything there, it doesn't mean we should not be concerned.	CIWS VIL, Echo Tops, Satellite, Growth and Decay Trends	5	16
ZDC-2-41	1500	Weather concerns in western ZDC. The STMC conferred with the CWSU who said that maximum heating should contribute to thunderstorms in western ZDC after 19Z. Thunderstorms into IAD were a possibility. The STMC tells SCC of these concerns.	CWSU	5	
ZDC-2-42	1504	Storms are near SBY. The Area Sup uses CIWS to show tops at 34 kft and notes that aircraft are deviating. . Tops have increased from 30 to 34 kft over the last 30 minutes. OOD is still open. They also noted training weather.	CIWS VIL, Echo Tops, Storm Motion	1, 5	1, 12
ZDC-2-43	1504	A big concern now is the 17 international arrivals slated for IAD over SBY from 1700 to 1930 The STMC, TMC, and Area Sup conference at the CIWS to discuss what will happen weatherwise. The STMC asks if the flights will have enough fuel to hold for an hour if needed. CCFP shows no weather forecasted for this area.	CIWS VIL, Echo Tops Satellite, Lightning, CWF, Storm Motion	1, 5	12, 14, 16
ZDC-2-44	1515	SPO: Heated discussions between Airlines and ATC regarding GDPs in support of swaps.			
ZDC-2-45	1518	ZNY shut off J220 for ZDC due to weather.			

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ZDC-2-46	1533	Storms near SBY. Area Sup tells TMU (using CIWS) that flights are deviating. CIWS tops show 30 kft. The STMC notes "positive growth" is not present in the Area. The Area Sup suggests 30 MIT on White/Wavey and OOD for NY/PHL departures to slow down traffic and help manage deviations near warning areas. This is a heavy restriction for the route, but it would have been shut off completely without CIWS. This plan kept the route open about 55 minutes longer. The STMC passes the restriction information on during the SPO.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	1, 5	1, 12
ZDC-2-47	1540	Weather west of metro DC. The STMC notes a thin line of cumulus west of metro DC and turns the precip filter off. Some level 1 VIL is present within the developing cumulus line. The STMC leaves the filter off to better monitor the weather.	CIWS VIL, Satellite	5	16
ZDC-2-48	1550	Storms near SBY. The Area Sup and STMC (using CIWS) discuss NY/PHL departures deviating around the weather. They check the DSR which shows some aircraft are getting through. The STMC wants to keep the route open because of the manageable tops and no lightning. However, CIWS shows growth and this is a concern.	CIWS VIL, Echo Tops, Growth and Decay Trends, Lightning, Satellite, Storm Motion, CWF	5	12, 14, 16
ZDC-2-49	1555	Storms in northeast ZDC. The Area Sup informs the STMC that based on the CIWS forecast, they may have to put NY arrivals through northeast ZDC on a single stream soon. As the storms move closer to the ZNY border, the arrivals will be at lower altitudes and will require more room for deviations. The STMC tells the Area Sup to let him know when this is needed. The plan was developed and initiated in the Area. CIWS was used to implement only a limited restriction for now, as the one-hour forecast shows room to get through north ZDC before the weather hits. ("Run them as long as we can.") The TMU defers the entire decision to the Area, who will monitor CIWS and trigger the decision on his own. This saves TMU workload.	CIWS VIL, CWF, Echo Tops, Growth and Decay Trends	1, 5	5, 12, 14

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ZDC-2-50	1609	SWANN departures are deviating around weather in NE ZDC. The Area Sup consults CIWS and develops a MIT plan for SWANN departures. The TMU accepts and implements the plan. Without CIWS, the timing may have been the same but (a) the TMU would likely have worked out the specifics and (b) the decision may have been different (e.g., closing departures).	CIWS VIL, CWF, Echo Tops, Storm Motion	1, 5	5, 12, 14
ZDC-2-51	1630	Weather in southern NJ. ATL/CLT flights agree getting through fine via storm over flights. There are some local deviations, but these are being allowed based on CIWS echo tops. The DC Metro arrivals from ZBW cannot get through, so they are implementing a 30 MIT restriction for these flights. Without CIWS, the ATL/CLT flights would have been included in this restriction.	CIWS VIL, CWF, Echo Tops	1, 5	1
ZDC-2-52	1633	Scattered storms in ZID. ZID passes a 20 MIT per strat restriction on J6.			
ZDC-2-53	1638	Weather is impacting metro DC departures. The Area Sup develops a plan for PALEO departure restrictions (BWI 20 MIT, DCA/IAD 20 MIT as one). The plan was initiated and implemented by the Area Sup using CIWS to restrict rather than close. He used CIWS to see that room existed to keep the route open with restrictions for at least 20 minutes.	CIWS VIL, CWF	1, 4, 5	1, 7, 12, 14
ZDC-2-54	1640	Weather in northeast ZDC. Area wants OOD closed. The TMU argues extensively to keep the fix open, based upon manageable volume (in the short time) and manageable weather (based on CIWS). A 30 MIT restriction was implemented instead of closing the fix. Without CIWS, OOD departures would have been closed. CIWS allowed ZDC to keep the fix open with restrictions.	ETMS, CIWS VIL, Echo Tops, Growth and Decay Trends	1, 5	1, 12
ZDC-2-55	1700	Weather in northeast ZDC. PALEO departures are stopped. The Area Sup tells the Departure Desk TMC that the stop should be only about 45 minutes, as the CIWS forecast shows weather sweeping east of WHITE by that time.	CIWS CWF	4, 5	7, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-56	1708	Weather in northeast ZDC. PCT called to express concern about the international arrivals landing IAD over ZIZZY. PCT wants to bring them around the north end of the weather but the weather is moving north and the flights could get pushed into ZNY. The STMC uses CIWS to show that ZIZZY route will still be an option and decides to bring the international traffic south around the weather. He kept the route open rather than reroute the traffic toward ZNY where interfacility coordination would complicate things.	CIWS VIL, CWF, Storm Motion, Echo Tops	1, 5	1, 14
ZDC-2-57	1712	Weather in northeast ZDC. ZDC is ground stopped for EWR and LGA. This was proactively planned by the Area Sup after noting movement and expansion of storms over the next hour impacting these fixes. TEB was left out of the ground stop because The CIWS forecast shows the Morristown fix (used by TEB) remains clear. Without CIWS, TEB would have been stopped as well. Also, they would have waited to implement the swap until deviations and traffic complexity concerns arose.	CIWS CWF, Echo Tops Forecast	3, 5	4, 12, 14
ZDC-2-58	1725	Storms are building along J48. A proactive reroute (swap) to take DC departures landing ATL south over GVE. The reroute was planned before there were deviations and traffic going into neighboring sectors (traffic and coordination complexities) became a problem. CIWS was used to identify the pending problem. Without CIWS, they would have waited until deviations and traffic complexity became a problem.	CIWS VIL, CWF, Echo Tops, Storm Motion, Lightning, Growth and Decay Trends	2	3, 14
ZDC-2-59	1815	Weather in northeast ZDC. There are volume concerns now as many of the pending NY flights into ZDC are routed east of the weather. BOS traffic was slowed to manage sector loads. The Area Sup is trying to take northbound flights through a gap in the weather, as seen in CIWS VIL.	CIWS VIL	2, 5	3, 6, 12, 14
ZDC-2-60	1825	Cluster of air mass storms in western ZDC. There is concern if the IAD arrival push from the west will be able to get in over DOCCS. The Route Coordinator TMC consults CIWS, noting storms are sinking slowly southeastward and away from DOCCS flow. He checks the satellite to see that even though weather is moving away, cumulus build-ups may indicate future concerns for this flow. Also, IAD traffic may not even be able to get to DOCCS because of weather in ZID.	CIWS VIL, CWF, Satellite, Storm Motion	5	14, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-61	1909	Weather impacting J48 is heading towards J75. The STMC analyzes CIWS and uses the one-hour forecast to brief the other TMCs that a GVE/DAILY swap will likely be needed for DC departures in 45 to 60 minutes, when J75 will be lost. The STMC visited Areas 5, 6, and 7 to share these concerns with the Area Sups, using CIWS in the Areas to illustrate. The STMC develops a plan with the Areas for taking FL traffic to DAILY at 5 to 7 planes per hour. Without CIWS, the STMC confirmed that he would have waited to make a decision, possibly until an Area informed the TMU of deviations. At that time, with the SWAP route not in place, he may have had to ground stop FL departures over GVE.	CIWS VIL, CWF, Echo Tops	2, 5	3, 4, 12, 14
ZDC-2-62	1920	The Operations Manager commented that "CIWS is the best damn tool we've got."			
ZDC-2-63	1929	Isolated storms are developing northwest of IAD. During the SPO, UAL reported an IAD flight "returning to field." The STMC consulted CIWS and notes growth on the cell near IAD and tells UAL he will inquire further.	CIWS VIL, Growth and Decay Trends	5	16
ZDC-2-64	1942	A line of storms is located along J48. The Area 3 Sup complains of Area 1 traffic deviating into their airspace and wants additional airway stops. The STMC explains that massive GDP plan in support of SWAP has greatly reduced the traffic volume ("and it's doing a super job") so the Area should be able to cope with the deviations.	CIWS VIL, CWF	5	16
ZDC-2-65	2054	A line of weather is near J75. MOL was reopened for metro DC southbound departures with 15 MIT as one for IAD/DCA and 25 MIT BWI.			
ZDC-2-66	2056	Weather near J48. ATL/CLT arrivals from ZBW are continuing down the east coast because they can't get to ZDC airspace on normal routes. CIWS was consulted to confirm that traffic can use normal routes if they can get to them. There is weather in ZBW and ZNY and the aircraft can't get there.	CIWS VIL, CWF	5	16

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ZDC-2-67	2108	Weather along J75. Ten airports are in GDPs supporting swaps or due to thunderstorms en route. Six airports are ground stopped. Traffic from ZNY is still trickling down J75.The Area 1 Sup reported that they are deviating into the neighboring sector. The STMC tells the Severe Weather position TMC to call ZNY and remind them that J75 is closed and will remain so for another 45 minutes or so (using CIWS forecast).	CIWS VIL, CWF	5	12, 16
ZDC-2-68	2114	Weather on J6 in ZNY. ZNY asked ZDC for a reroute using J48 and catching J6 further south. Sever Weather TMC asks the STMC, who quickly analyzes CIWS and says "absolutely." The TMC works out the specifics of the reroute: J48 with deviations as needed to north of BWI (where there is room because the GDP has thinned traffic), then pick up J6 again near COLNS. Without CIWS, it would have taken longer with WARP to decisively see the viability of J48 in north ZDC, given the close proximity of weather It would have taken even longer if the STMC had to consult the CWSU. Also, it is likely that a different decision would have been made. (e.g., Saying no to the request resulting in traffic being held in ZNY.)	CIWS VIL, CWF	2, 5	3, 12, 14
ZDC-2-69	2135	Widespread NAS weather. The ZDC TMU offers IIU (Louisville) Playbook route with 30 MIT per airport and using J42 for NY metro and DC metro traffic from the west. He used CIWS to confirm J42 should remain in the clear for an extended period. The STMC tells the SPO the viability of the Playbook route and SCC hurries to work out the details.	CIWS VIL, CWF, Echo Tops	2, 5	3, 12
ZDC-2-70	2150	Five TMCs are all on the phone in different conversations.			
ZDC-2-71	2152	Line of weather in north ZDC on J6/J48. The Area 7 Sup visits the TMU and tells the STMC that the line will be in sector 18 in 90 minutes, based on CIWS forecast. He is worried that by that time all J42 playbook flights for NY will be there too. Area Sup wants the TMU to have a back-up plan ready. The STMC thanks the Sup for being proactive and says a plan to siphon off traffic will be developed should weather impact the playbook route.	CIWS CWF, Echo Tops Forecast	2, 5	12, 14, 16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-72	2158	Weather near J48 and over J75. The STMC says that J48 needs to be reopened (confirmed using CIWS) and J75 needs to remain closed for now. There are 46 kft tops on J75. J48 is opened with normal routes from NY to ATL with 30 MIT. The Area Sup wanted J48 closed, but the STMC talked him out of it using CIWS. Without CIWS, J48 would have remained closed.	CIWS VIL, CWF, Echo Tops	1, 5	1, 12, 14
ZDC-2-73	2230	The observer set up a new CIWS window configuration at the request of the Area 6 Sup.			
ZDC-2-74	2237	Ten airports are in GDPs, nine airports are currently ground stopped.			
ZDC-2-75	2242	Weather southwest of GVE is decaying. The STMC tells the TMC to call the Area 1 Sup and ask him to open GVE with MIT. A pathfinder is sent.	CIWS VIL, Echo Tops, Echo Tops Forecast, Growth and Decay Trends	1, 5	1, 11
ZDC-2-76	2244	Weather is near IAD. IAD is ground stopped.			
ZDC-2-77	2247	A line of storms is near IAD. The STMC consults CIWS for situational awareness and notes storms are growing in a "great" spot on the southwest end. He is hoping the airspace southeast of IAD will remain clear as long as possible so that EWR/LGA traffic on the J42 playbook can get through.	CIWS VIL, CWF, Growth and Decay Trends	5	16
ZDC-2-78	2250	Storms are approaching EWR. The STMC calls SCC to ask when they think EWR will be impacted. The STMC consults the NY prototype ITWS and ETMS during the conversation, trying to plan for the pending EWR playbook push. The STMC requests that SCC stop the IIU playbook for any aircraft not yet airborne based on expected weather impacts in ZDC and ZNY. Without CIWS, the IIU playbook cancellation request would have been made 30 minutes earlier.	NY ITWS, ETMS, CIWS VIL, CWF, Growth and Decay Trends	1, 5	1, 12
ZDC-2-79	2340	An east-west line of storms stretches across the DC metro airports. The STMC consults CIWS and notes decay between DCA and BWI but the tops are still 40+ kft. STMC comments that it will be a while until the weather is weak enough to "attack."	CIWS VIL, Echo Tops, Growth and Decay Trends	5	16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZDC-2-80	2341	There is a small pocket of storms west of J48. The STMC notes a large region of decay. He keeps this in mind should deviations in this region occur. He will know that the problem is only temporary and will leave the airspace open if that decision needs to be made.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	14, 16
ZDC-2-84	2350	Weather is near the DC metro airports. The IIU playbook is due to close any minute now. The STMC called ZID to tell them to expect to hold about 6 EWR/LGA flights any time now. Six to eight extra flights were released onto the IIU playbook after ZDC requested the stop at 2250. (ZDC's timing of how long the route would be viable, using CIWS, was correct.)			
ZDC-2-82	0010	Ten airports are in GDPs, nine airports are ground stopped. IAD, BWI, DCA, EWR, and LGA are second-tier stopped.			
ZDC-2-83	0017	Richmond asks about getting out YEAST departures. The STMC looks at CIWS and says yes. Without CIWS, this would have taken at least 5 minutes to talk to the CWSU. (WARP went down during a lightning strike at 2325. It is still not up in the TMU.)	CIWS VIL, CWF, Echo Tops	4	10, 12, 14
ZDC-2-84	0035	The Operations Manager came into the TMU to look at the CIWS for situational awareness. He commented that he doesn't like the weather presentation on the ETMS.	CIWS	5	16
		ZOB			
ZOB-2-47	1315	Storms in ZMP and along east coast including ZBW. SPO : ZOB Met listened in with the STMC and told him that he expects storms in ZNY airspace this morning to grow. SCC SvrWx wanted GDPs in early today as yesterday(6/28) was such a mess. All the airlines balked at any plan.	CCFP, WARP, ETMS, CIWS VIL, CWF, Storm Motion, Echo Tops, CWSU	5	16
ZOB-2-48	1515	Storms in ZMP decaying some while storms growing north of N90. ZOB and ZAU are clear as are most routes in ZNY. SPO: SCC indicated that GDPs for the east coast will be implemented by 1630.	CWSU, CIWS VIL, CWF, Storm Motion, Echo Tops	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-2-49	1645	Storms have developed across most ZNY routes on the N90 boundary. ZNY has ground stopped all ZOB traffic for ZNY with only J152 open for 5 to 7 aircraft landing PHL.			
ZOB-2-50	1820	Storms are growing in Areas 2, 3 and 5. Storms stretch from J584 to J60 in ZOB airspace with tops only to 25 kft. Growth west of DTW has tops of 42 kft and J95 has a storms with tops to 48 kft. Most Areas are not using CIWS as of yet. Most reroutes are being handled tactically. Area 2 Sup says that he did use CIWS to keep one eastbound route open from DTW TYCOB and WINGS (as one). Area 4 Sup says she will not use CIWS precip forecast. Area Sup worked with ESP TMC for DTW. Area Sup said that if CIWS was not available, he would have used WARP. However, he would have been less confident about keeping the route open, but he doesn't believe any time was saved using CIWS.	CIWS VIL, CWF, Echo Tops	1, 5	1, 12, 14
ZOB-2-51	1858	Storms building to level 6 in Area 2, 4, and 8. CWSU came into the TMU and briefed the STMC and Coordinator TMC on storm development.	CWSU, CIWS VIL, Lightning, Growth and Decay Trends, CIWS Overlays in Areas	5	16
ZOB-2-52	1904	Area 4 Sup is concerned about storms blocking DTW arrival fix (CETUS). Area 4 Sup used CIWS to see forecast for CETUS fix. He is concerned that fix may close. He starts a plan to bring traffic to SPICA and also uses CIWS precip and tops to add a MIT restriction for ZOB47. The Area Sup used CIWS to plan the flow rate into DTW and to restrict flow through ZOB47, which was getting overloaded. He would have used WARP in the absence of CIWS and would have delayed his decision by 15 minutes or so because of the lack of CWF.	CIWS VIL, CWF	1, 4, 5	2, 7, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-53	1909	Area 4 Sup called TMU about J60/64 overload due to level 6 cells on routes in ZOB47. ORD traffic is deviating on J60/64 (mostly internal ZOB traffic). Sup asks for an "as one" restriction. Area 4 Sup needed to reduce traffic in ZOB47. The plan was coordinated internally. Area Sup indicated that the 20 MIT restriction was not being met, requiring the further "as one" restriction.	CIWS VIL, CWF, Echo Tops	5	16
ZOB-2-54	1910	Storms around CLE. Observer questioned Area 4 Sup about CLE departures. They are coming out on normal routes with no problems.			
ZOB-2-55	1916	Storms are forcing Area 3 traffic into Area 7. Area 7 SUP says that he is more willing to take extra traffic with CIWS in his Area. Sup says he likes CIWS much more then WARP. Aircraft are being rerouted tactically at this time.	CIWS VIL, CWF, Echo Tops	1, 5	1, 12, 14
ZOB-2-56	1920	Notes: Area 6 Sup says that he is using CIWS to watch storms developing on J80 in NYC airspace. Says “ZNY holds the keys today.” During SPT, CWSU used CIWS to give STMC a rundown on weather threat.	CIWS VIL, CWF, Echo Tops, Storm Motion	5	16
ZOB-2-57	1934	Storms in Area 4. Area 4 Sup comes to TMU to complain about spacing of traffic. Warp was used to explain the problem to Coordinator TMC.	WARP	5	
ZOB-2-58	1940	Area 2 Sup called TMU about level 6 storms blocking C90 to DTW routes. CIWS was used to explain deviations on routes in ZOB29.	CIWS VIL, Echo Tops	5	12, 16
ZOB-2-59	1956	Storms continue to build between ZID, ZOB, and DTW. STMC is concerned that DTW traffic will end up being held in ZOB47. He used CIWS to find tactical routes. The STMC indicated that CIWS helped coordination with Area 4 Sup. Without CIWS, he would have used WARP but may have delayed his decision.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Storm Motion	2, 5	3, 12, 14
ZOB-2-60	2002	Storms on J80 in ZID airspace. ZID closed J80.			
ZOB-2-61	2010	Storms around DTW ATA and DTA. Area 2 Sup says that the biggest problem is getting traffic into DTW in the next hour, as an arrival push is coming. CIC told the observer that he has been able to use CIWS to get traffic out of ZAU and plan tactical reroutes. Areas seem very reactive now.	CIWS CWF, ASR Precip	2, 4, 5	3, 7, 12, 14
ZOB-2-62	2013	The Operations Manager used CIWS during a phone call.			

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ZOB-2-63	2022	Storms in Areas 26 and 29. Area Sup told observer that CIWS was instrumental in reducing holding for DTW.	CIWS VIL, CWF, Storm Motion	4, 5	7, 12, 13, 14
ZOB-2-64	2050	Storms in Area 2. CIWS is used for MIT and GDP for southbound departures off CLE.	CIWS VIL, CWF	1, 3	5, 9
ZOB-2-65	2055	Storms in ZNY have blocked all routes from ZOB. The greatest effort is planning to get internals around the weather in the Areas. The STMC noted that Area 4 was getting traffic around storms in the high sector, ZOB49.			
ZOB-2-66	2250	Scattered storms in ZOB with tops in mid 30 kft. East coast is stopped and most of their decisions are being made at the controller level, with a few aircraft making their way through gaps. He indicated that CIWS was being used very little at this time.			
ZOB-2-67	0055	Storms decaying on J80 but still strong in ZNY. A gap has developed on J80. J80 is open with 20 MIT/strat until 0300. It is unclear that ZNY will be able to get traffic to J80. The Area 6 Sup used CIWS to see that storms on J80 were decaying. This prompted him to request that the Coordinator TMC open the route.	CIWS Echo Tops Forecast, CWF	1, 5	1, 6, 12, 14
ZOB-2-68	0120	ZNY requested that route J584 be open for EWR traffic. ZOB opened route with 20 MIT. The request came from ZNY, but ZOB opened the route based on CIWS. Without CIWS, the decision may have been delayed by 20 minutes.	CIWS Echo Tops Forecast, CWF	1	1, 12, 14
ZOB-2-69	0140	PHL ESP position using CIWS.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	16
ZOB-2-70	1810	Weather is in ZNY/ZBW. Using CIWS to determine where NY flights are going to go later in the day. J80 traffic is not going to be a problem because ZNY is going to lose J80 before it gets to ZOB.	CCFP, CIWS Echo Tops Forecast, CWF	5	16

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ZOB-2-71	1821	Used CIWS tops to decide to bring NY flights in over J70 at FL370 to get them in over the weather.	CIWS Echo Tops, Echo Tops Forecast, CWF	2	3
ZOB-2-72	1835	Weather is moving into DTW area, particularly toward MIZAR. Detroit ESP TMU position is trying to determine when the weather is going to close or impact MIZAR (DTW arrival fix). Using CIWS to determine that they will probably lose the fix in about 1 hour. He is looking at how to move the arrivals from ZID based on the CIWS forecast.	WARP, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF	4, 5	7, 14
ZOB-2-73	1840	Weather still moving toward DTW. Detroit ESP TMU position has decided to keep traffic over POLAR for now and is watching the CIWS forecast to determine when to offload the MIZAR and CETUS arrivals.	WARP, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF	4	7
ZOB-2-74	1927	Weather is approaching the DTW arrival fixes. Detroit ESP TMU position tried putting a plan into place for arrivals over CETUS with the severe weather desk at ATCSCC at 1900 in anticipation of the 21Z arrival push. Severe weather was hesitant to put a plan in place based on the 90–120 forecast.	WARP, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF	4	7, 9, 12, 14
ZOB-2-75	1935	Weather is close to DTW. Detroit ESP TMC is using CIWS to move the DTW arrivals. He is putting 30 MIT on the FWA fix, J85, and the POLAR fix. Had to put the MIT on the fixes because he couldn't get a GDP planned earlier through severe weather.	ETMS, WARP, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF	4	7
ZOB-2-76	2010	Weather starting to come toward CLE. CLE ESP is using CIWS to determine when and if CLE is going to be impacted. No specific plans are being initiated at this time.	WARP, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF	5	16

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ZOB-2-77	0022	Weather is in ZNY and most traffic is shut off.			
		ZNY			
ZNY-2-24	1555	ZNY entered SWAP. A line of storms from northwest CT to northern NJ is moving east at 10 kt.			
ZNY-2-25	1605	Departure Desk TMC told STMC that PHL route will be affected by weather that is building along the route.	DSR	1, 5	
ZNY-2-26	1625	Area Sup came into TMU to shut off J64. Controllers are complaining and aircraft are getting squeezed.			
ZNY-2-27	1640	Pathfinders will be sent out over COATE, as coordinated by Departure Desk TMC and Area Sup.			
ZNY-2-28	1645	TMC called EWR tower to launch pathfinders when possible. Two pathfinder aircraft were identified RAPT showed COATE/J36 as red, but pilots wanted to go. STMC said that even if RAPT shows red, the pathfinders will likely stay below the weather inside the TRACON.	ITWS	1	
ZNY-2-59	1707	The first pathfinder refused to go after re-evaluating the weather. The second deviated.			
ZNY-2-30	1801	Stopping north gates because of too many restrictions.			
ZNY-2-31	1807	The STMC developed a plan to run J70 arrivals over JFK and the water because they can't deviate south.	DSR, ETMS, CIWS VIL, Echo Tops	2	3
ZNY-2-32	1833	All north traffic stopped.			
ZNY-2-33	1849	J80 closed based on Area Sup input to Departure Desk TMC.	ETMS	1	
ZNY-2-34	1910	CWSU forecasts that J75/J48 will close; exact time not given. CIWS shows impact in more than two hours.	CWSU	5	
ZNY-2-35	1925	NY metro traffic closed off to the rest of the world.			
ZNY-2-36	2026	J6 closed. Area Sup demanded the closure due to volume.	DSR	1	
ZNY-2-37	2154	Conference about J80/J6 opening based on DSR and CIWS. Possible route through gap in weather in northern NJ and out through ELIOT gate.	DSR, CIWS VIL, Echo Tops	1	1, 6
ZNY-2-38	2213	General aviation aircraft flew to ELIOT at 17 kft without problems. GA pilot is more likely to attempt a route than a commercial pilot.			
		ZBW			
ZBW-2-1	1200	No STMC on duty today; using CIC.			
ZBW-2-2	1216	There are a few convective cells along VT/CAN and NH/CAN borders.			

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ZBW-2-3	1225	ZOB called to ask if weather in northern NY is going to impact ZBW today. CIC said it should be no problem. The cell in PA, if it continues to grows and move east, will be a bigger problem for NY metros. Also, the weather off the coast to the south would be a problem if it was located to the west along J174 and J121. CIC said it would have taken longer to answer ZOB's question without CIWS because extra time would have been needed to set up ETMS TSD with weather and routes.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	12, 14, 16
ZBW-2-4	1248	CIC is concerned about staffing is the weather continues to grow.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	15, 16
ZBW-2-5	1253	The CWSU came to the TMU to brief the CIC after the CCFP collaboration. He says to plan on weather building around 17Z with tops to 30 kft and isolated 40 kft.	CWSU, CIWS VIL, Echo Tops	5	16
ZBW-2-6	1259	SCC SvrWx using CIWS called to ask if ZBW will take offloads over GREKI due to weather near N90 north gates. ZBW agreed to take them over SYR/BUL/Toronto until 1500.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	2	3, 12
ZBW-2-7	1308	External request for a route. TMC set up the CIWS SD with overlays to develop a route to CLE.	CIWS VIL	2	3, 12
ZBW-2-8	1315	CIC uses CIWS to show weather near Sparta during the hand-off briefing. ZBW has not yet called ZNY because not an imminent concern.	CIWS VIL, Echo Tops, CWF, Echo Tops Forecast, Growth and Decay Trends	5	16
ZBW-2-9	1330	Aircraft are deviating south of Albany.			
ZBW-2-10	1333	ZBW is going to start rerouting some BOS departures to MHT and Lebanon.	CIWS	2	3

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ZBW-2-11	1333	Storms are moving northeast towards and near EWR. The CIC called Area E Sector 5 to see if the Area was having problems with EWR traffic yet. Without CIWS, the CIC would have used the CWSU or DSR for weather information.	CIWS CWF	5	16
ZBW-2-12	1345	Cells near ALB and SAX are growing with tops above 35 kft. TMC is using WARP and then CIWS for situational awareness. He would prefer that the Echo Tops Forecast show higher tops in darker colors.	CIWS Echo Tops Forecast, Growth and Decay Trends	5	16
ZBW-2-13	1403	The Area B Sup visited TMU to use CIWS to assess tops on the weather near SAX. He coordinated with the Area A Sup on the phone. He wants to prepare for the possibility that they may be getting some MIT restrictions from ZOB because they are already rerouting BOS.	CIWS Echo Tops, VIL	1, 5	12, 14, 16
ZBW-2-14	1409	ZNY called concerning weather over SAX. They are implementing a 20 MIT restriction over SAX, excluding IAD traffic, and 20 MIT on J80, J48, and J77. ZBW is implementing 6 minutes in trail for MHT westbound departures. This is proactive to reduce confusion/workload later.			
ZBW-2-15	1412	There are numerous deviations due to a cluster of cells near SAX with tops to 46 kft. There is growth in the cells along the NY/VT border near ALB with tops to 37 kft.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends	5	16
ZBW-2-16	1420	The Area Sup is in the TMU to coordinate routes. All N90 arrivals are shut off to the Area.			
ZBW-2-17	1423	Areas A and E claim that the weather is moving fast. BOS departures going to EWR and LGA are ground stopped for about half an hour.			
ZBW-2-18	1452	CIC is watching echo tops decaying over SAX in the next two hours.	CIWS Echo Tops Forecast	5	16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-2-19	1501	The CIC questions the CWSU about the latest CCFP. ZNY wants ZBW to take GREKI offloads based on the CCFP. The 17Z CCFP forecast shows a large area of medium coverage. SCC is also asking ZBW about the weather scenario for the afternoon. ZBW will slow down BOS arrivals.	CWSU, CIWS Satellite, Growth and Decay Trends.	5	16
ZBW-2-20	1516	The CIC calls the Area to ask if they can start taking planes in order to help get out of the EWR/LGA ground stop.			
ZBW-2-21	1518	Area B Sup reports that the line is filling. He used CIWS to show a small hole left in the line. The CIC asks the Area Sup to let him know when the Area can't take any more traffic.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	16
ZBW-2-22	1519	EWR/LGA ground stop is extended until 1600.			
ZBW-2-23	1523	J6 is ground stopped. There is no place to put the aircraft.			
ZBW-2-24	1527	All westbound departures from BOS are ground stopped. Area is swamped.			
ZBW-2-25	1529	CWSU points out significant growth in the line. His confidence goes up because the earlier satellite image showed heating potential and growth possibilities. This justifies his earlier thinking. The Area B Sup visits the TMU to look at CIWS.	CIWS CWF, Growth and Decay Trends, Satellite	5	12, 16
ZBW-2-26	1536	PVD tower calls questioning the ground stop out of BOS. TMC asks if they have a weather display that shows the line to the west.			
ZBW-2-27	1538	ZBW calls ZOB to shut down traffic to N90. Everything into Area A is shut off until 1630. Everything over SAX is shut off.			
ZBW-2-28	1540	Traffic needs to go to Montpelier to get north of the weather. The CIC is on the phone coordinating with the Area. A new reroute position is being opened to distribute the workload. CIWS use has been curtailed for a while due to the reactive nature of the operations.			
ZBW-2-29	1636	Only traffic filed over SYR or HAMPTON are leaving ZBW.			

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ZBW-2-30	1639	A solid line of weather extends form Concord (NH?) down to the western CT/NY border with tops of 31 to 51 kft. Looking at weather to give 60 minute time estimate on phone to Nantucket tower (TMC too swamped to ask timing)	CIWS VIL, Echo Tops, CWF, Echo Tops Forecast	5	12, 14, 16
ZBW-2-31	1654	MHT and Lebanon departures stopped for 30 minutes.			
ZBW-2-32	1655	BOS has +90 min departure delays. Areas B and D can't take any departures.			
ZBW-2-33	1700	The CIC is briefing the TMO. Flights are getting in but not out.			
ZBW-2-34	1701	The TMO uses CIWS CWF to note weather still west of BOS in two hours and will not hit BOS for several hours; approximately 21Z.	CIWS VIL, CWF	3, 5	16
ZBW-2-35	1721	TMU is checking the two-hour forecast to note the location of the weather and for BOS impact. He wants to try a pathfinder over SAX.	CIWS CWF	1, 3, 5	11
ZBW-2-36	1738	Weather is stretching from Lebanon, NH to PA. BOS tower calls to coordinate reroutes. The Area E Sup reports that VICTOR 40 (Newark satellites) needs to be ground stopped.	CIWS VIL, Storm Motion	5	16
ZBW-2-37	1744	Reroute position TMC is looking for pathfinders for J6			
ZBW-2-38	1749	Traffic over SAX and Carmel are restricted 30 MIT, but these fixes are currently closed. Pathfinders are needed.			
ZBW-2-39	1754	A line of weather with tops to 48 kft, growth, and lightning is over BDL. CIWS indicates lots of growth in southern NH.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	5	16
ZBW-2-40	1810	The CIC uses CIWS to explain the weather scenario during a hand-off briefing.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	16
ZBW-2-41	1817	Weather is impacting BDL. The Area E Sup visits the TMU to question BOS arrivals. CIC provides 30 MIT.			
ZBW-2-42	1830	The Reroute position TMC briefs the CIC on the latest route issue.			
ZBW-2-43	1834	Ground stop to DC metros.			

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ZBW-2-44	1838	The CIWS forecast shows the line of weather impacting BOS in one to two hours. The TMC estimates that BOS will be shut down when the weather arrives around 1930. TMC believes a 1st and 2nd tier and Canadian ground stop is needed. CIC will call SCC to coordinate. He uses CIWS to estimate two hours. Without CIWS, the CIC estimates that it would have taken about one hour to determine BOS impact timing. He would have gone to the CWSU and checked other tools. Because the SCC was on top of the situation, coordination for the national ground stop was simpler.	CIWS VIL, CWF, Lightning, Storm Motion	3, 5	4, 12, 14
ZBW-2-45	1844	The TMO is looking at the forecast for situational awareness. He is using the two-hour forecast to extrapolate to four hours.	CIWS CWF, Lightning	5	16
ZBW-2-46	1854	All traffic landing BOS is ground stopped except the Cape. Area wants to slow down all BOS traffic.			
ZBW-2-47	1900	Area D is holding traffic from EWR to PHL for Area C.			
ZBW-2-48	1903	Level 3/4 weather with tops to 40 kft at MHT. A flight from MHT needs a route westbound and is willing to depart in this weather.			
ZBW-2-49	1908	Area A wants 10 MIT regardless of altitude going westbound.			
ZBW-2-50	1911	Sector in Area A can only be stopped, traffic can't be slowed down any more. They are complaining that Area B traffic won't take the turn because of the weather.			
ZBW-2-51	1915	Ground stop for BOS to 2100.			
ZBW-2-52	1919	BOS tower calls to ask if ZBW can use a reroute west of the weather to take flights to BWI.	CIWS VIL, Echo Tops, Storm Motion	5	12, 16
ZBW-2-53	1920	Ground stop for PHL.			
ZBW-2-54	1923	ZBW and SCC are determining when to come out of the ground stop to BOS based on when the weather will clear BOS. The TMC tells SCC, "Using CIWS, believe it completely." The TMC estimated that without CIWS, would have taken considerably longer to plan GS cancellation (get timing right, revisions, etc.)	CIWS VIL, CWF, Lightning, Storm Motion	3, 5	4, 12, 14
ZBW-2-55	1925	Weather at PHL. ZNY may keep ZBW shut off after the line passes.			
ZBW-2-56	1932	STMC is using ITWS to see the gust front information and timing.	ITWS	3, 5	

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ZBW-2-57	2005	Weather building in upstate NY near MSS. CWSU says Hancock weather is going to continue to grow and develop. Pathfinders out of PVD are not working because they can't get him above BOS approach. The TMC, looking at CIWS, says it doesn't make sense and that they need to get them out now.	CIWS VIL, Echo Tops, CWF, Lightning, Growth and Decay Trends	5	16
ZBW-2-58	2013	Heavy weather impacting BDL. STMC uses CIWS to determining time of impact at BOS. Most of the weather is north of BOS currently. On a telecon with SCC and BOS, they agree with CIWS that it will be at least an hour before weather hits BOS. They are concerned with the time it will clear.	CIWS CWF	3, 5	4, 12, 14
ZBW-2-59	2030	STMC comments that CIWS shows weather is dissipating. Weather is in the shape of a V in upstate NY down to PA, to NY metro, and up to BOS and Maine. They are starting MHT with 5 minutes in trail. The are not coming out of the ground stop for LGA because they can't get to it.	CIWS CWF	3, 5	10
ZBW-2-60	2047	STMC is looking at decay just west of BOS. By the time BOS departures are ready to go, SYR will be closed.	CIWS Growth and Decay Trends	5	16
ZBW-2-61	2047	The line of weather is decaying; thinning out and breaking up. They are trying to send one aircraft along the coast. There are 75 cancelled flights for BOS. Aircraft are penetrating the line with no problems.	CIWS VIL, Echo Tops, Growth and Decay Trends	3, 5	10
ZBW-2-62	2057	STMC is looking at CIWS and on the phone with ZMP and SCC. They will coordinate with Canada to use CAN5. All are using CIWS to see the hole over SYR. They want to open an new route to SWAP over SYR/CAN routes. ZMP wants CAN7, but ZBW can't do this because there is too much weather. ZBW compromises with the CAN5 route. ZMP tells ZBW that they too are using the CIWS tops information. The STMC says that without CIWS the route would never have been opened.	CIWS VIL, Storm Motion, CWF, Growth and Decay Trends, Echo Tops	2, 5	3, 12, 14
ZBW-2-63	2118	Weather is dissipating and ground stop will end soon. Coming out on a 30 rate due to en route weather. The airport is clear. No traffic is going over Sparta.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-2-64	2121	TMC is using CIWS for internal coordination. He is briefing a TMC that the weather is moving northeast and building near NY.	CIWS VIL, Storm Motion	5	12, 16
ZBW-2-65	2123	25 in-trail to PHL.			
ZBW-2-66	2124	Weather over CT and RI is extending to NY metro and north towards BGM. Ground stop extended another 1.5 hours because no one can get to BOS. ZBW will let internals go.			
ZBW-2-67	2157	The TMO is showing an Area Sup the Growth and Decay, VIL, and Storm Motion products.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	16
ZBW-2-68	2224	Coastal flights are release with some MIT restrictions.			
ZBW-2-69	2228	The cell over JFK is causing problems for flights to BOS, but ZBW can get to JFK.			
ZBW-2-70	2238	Weather southwest of EWR with tops of 44 to 48 kft is moving east at 10 kt. The TMC is on a telecon with SCC, N90, ZNY, and ZDC. The TMC is asking about EWR weather and timing impact. EWR is ground stopped, but CIWS shows that the weather impact on J6 is two hours away. They will continue to run MHT flights. Without CIWS, they would not have had the timing. This allows them to keep the route open longer so more plane can go and allows them to postpone the decision to shut down.	CIWS VIL, Storm Motion, CWF	1, 5	1, 12, 14
ZBW-2-71	2242	Weather near J6 west of ALB is showing growth. The TMC is using CIWS to estimate the time to impact on J6.	CIWS VIL, CWF, Storm Motion	1	5
ZBW-2-72	2249	A solid line of weather extends from ALB to HNK. Aircraft can't get there. All flights routed over HNK are ground stopped. IAD is ground stopped until 00Z.			
ZBW-2-73	2313	Weather developed in upstate NY extends down towards Albany. There was evidence of growth in the satellite data over an hour earlier. ALB is impacted.	CIWS VIL, Satellite, Echo Tops, CWF, Growth and Decay Trends	5	16
ZBW-2-74	2318	Departure delays at BOS are +120 min.			

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ZBW-2-75	2330	Weather is bad and growing near ALB. The route closing is due to expire, but SCC can't see how they can get through 51 kft tops. The will likely end up with large deviations. The route was not reopened. Without CIWS they would have used WARP and ETMS and would probably have let the flights go, likely resulting in very significant complexity concerns.	CIWS VIL, Echo Tops	1	2, 14
ZBW-2-76	2350	All flight to ZBW have been ground stopped since 3PM. There are no available routes.			
ZBW-2-77	0010	Canada won't take CAN7. Toronto can take CAN6. Sectors 8 and 9 can't be split because of frequency. Traffic at FL270 and below are restricted 30 MIT from ZAU and ZMP.			
ZBW-2-78	0012	Severe turbulence is reported 10 miles southeast of Cambridge.	PIREP	5	
ZBW-2-79	0023	A second line of weather stretching from NY/VT to ALB to NY metro is still hanging together with tops to 46 kft and moving east-southeast at 10 to 15 kt.	CIWS VIL, Echo Tops, Storm Motion	5	16
ZBW-2-80	0039	ZBW will take a few flights over White Plains.			
ZBW-2-81	0043	Echo tops are down from 51 kft to 46 kft. Maybe ZBW can take some traffic through ALB in about a half hour. (There have been about 109 cancellations at BOS today.)	CIWS Echo Tops, Echo Tops Forecast	1, 5	5, 16
ZBW-2-82	0048	Most of the international flights got through in over flights.			
ZBW-2-83	0104	A flight is one hour from LGA. They will use him as a pathfinder to see if he can get through. SCC is letting one through a gap south of ALB. Airports are opening but there are not routes available. East coast looks OK, but weather near BWI is a problem. Without CIWS, the pathfinder would not have been allowed to go from SYR to LGA. CIWS also helped with the coordination between ZBW and SCC.	CIWS VIL, Echo Tops, Storm Motion, CWF, Growth and Decay Trends	1, 5	11, 12
ZBW-2-84	0112	Level 3 weather is over BWI. The BWI ground stop is extended. The TMC customized the overlay colors on the SD for better visibility. Without CIWS, they may have waited longer.	CIWS VIL, Overlays	5	16

CIWS Benefits Assessment
Observation Period #2 Observations Summary
Day 4 - June 30 2005

Participating Facilities: ZTL, ZJX, ZAU, ZOB, ZBW

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
		ZTL			
ZTL-2-63	1825	North departures off ATL are deviating. The Area Sup requested restrictions due to deviations. Departures are being restricted with 20 MIT over Summit and Nugget, treated as one stream. No national coordination was needed because the restriction was between ATL and ZTL.			
ZTL-2-64	1848	ZDC says J48 is closed. ZTL weather displays indicate no storms blocking the airway. ZTL agrees to accept Boston departures on a southern route (due to weather in ZDC).	WARP	2	
ZTL-2-65	1952	North departures off ATL are still deviating. The restriction is extended until 1825. Because this was an extension, minimal coordination between ZTL and ATL was required.	Aircraft deviations and area request	3, 4	
ZTL-2-66	2006	North departures off ATL continue to deviate, impacting high-altitude departure sector (volume and weather). ATL north departures are now restricted 20 MIT at or above FL 240. This is an expansion of the above restriction to accommodate the high altitude departure sector (37) for volume and weather.	Aircraft deviations and area request		
		ZJX			
ZJX-2-51	1216	Weather north of TPA-Sarasota to southeast of MCO. Showers are east of St. Augustine. Arrival routes are open. Aircraft are picking their way through.	NEXRAD, WARP, SATIR2, ITWS	5	
ZJX-2-52	1340	Weather is allowing for deviations as needed. The military operations area east of JAX is active.			
ZJX-2-53	1512	Operations in the Palatka MOA started early. This will affect both the LEESE and LIZARD arrivals.	WARP, ETMS	4, 5	

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ZJX-2-54	1608	Central routes covered over … Weather in central FL extends from Ocala southwest to GOMEX. Traffic is using east coast routes and west coast routes. There are military operations in the center of the state.			
ZJX-2-55	1658	Weather in central FL is moving over the east coast routes. ZJX plans to bring traffic to west and down central FL west of Palatka MOA. Weather in this area has begun to dissipate.	NEXRAD, WARP, ITWS	2	
ZJX-2-56	1745	Weather is moving toward MCO. ATC is planning to take traffic to LEESE for holding.	WARP, ITWS	3, 4	
ZJX-2-57	1757	The east runways are clear.	ITWS	3	
ZJX-2-58	1816	There is weather east of MCO. Aircraft are inbound to MCO from LEESE.			
ZJX-2-59	1820	Weather is building near TPA. ATC is watching and conferring with TPA.			
ZJX-2-60	1821	Weather is on TPA final approach. TPA is not accepting traffic. ZJX is holding at TPA arrival fix and north of there.			
ZJX-2-61	1830	TPA open.			
ZJX-2-62	1920	Weather across FL is beginning to dissipate. Resuming normal flow with only military restrictions.			
		ZAU			
ZAU-2-46	1243	SW Area shut off arrivals from ZKC to ORD. ZKC called looking for an alternate path. VHP, Boiler, BEARZ but concerned that gap in weather southeast of ORD will close. Observer came in on the end of the conversation so plan was explained to the observer using CIWS. The Arrival position SD was set up with one maximized precipitation window showing Growth & Decay, lightning, 2-hr contours, and echo tops.	CIWS VIL, Storm Motion, Lightning, Satellite	2, 5	3, 12
ZAU-2-47	1249	Coming out of the MDW stop as 1 stream with 50 MIT. Want aircraft from the east over VHP, traffic from Texas will go to the northwest arrival fix over MZV with 20 MIT, traffic from the southeast will go to the southwest arrival fix.			
ZAU-2-48	1253	ORD east departures are restricted at 2 x 30.			

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ZAU-2-49	1253	DTW/MSP landing traffic has no restrictions on the northern stream. East coast traffic is routed north using POLAR. The TMC handling DTW and MSP landing traffic used CIWS to plan arrivals to DTW because a few aircraft are deviating. He coordinated with SCC about the possible loss of the POLAR (northeast) fix to DTW. He expects this route to close by the time traffic gets there. He wanted to give SCC a heads-up. Observer asked if CIWS saved any time. TMC said that no time was saved; the savings came in coordinating early to get routes set up. The plan may not happen but SCC now has a heads-up. When asked about the decay indicated by CIWS, the TMC said that the storms were pulsing so even though CIWS indicated decay, the storms might grow again so he couldn't count on the decay.	CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning, CWF	2, 5	3, 12
ZAU-2-50	1253	TMC at the coordinator position reported trying to use CIWS on June 29, but needed coverage further north and west. At this time, everyone was hurting so ZAU was open to ideas. Currently the transcons from the northwest centers are over PVX, southwest Centers are going south. All transcons are going south of ZAU.			
ZAU-2-51	1305	A pathfinder from IND to ORD was coordinated using DSR. The VHP/Boiler/BEARZ route is not good.	DSR	1	
ZAU-2-52	1313	SCC/ZAU conference call asking for help for ZMP.			
ZAU-2-53	1315	SPO: STMC reported that the west fixes were open, east fixes are 30 MIT. 50 aircraft are waiting to depart with 45+ minutes of departure delay. During the SPO, the STMC noted on CIWS that the northeast fix would be clearing and traffic could move off the northwest and back to the northeast. The STMC took this information to the arrival position and told him to choose which flight to move back northeast. Observer overheard the following comment from Coordinator position during SPO "I'm seeing more decay. We need more blue and less orange."	CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning, CWF	4, 5	7, 12, 14

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZAU-2-54	1345	Area in northeast KS is developing and appears to move across southern ZAU in a few hours. TMC expresses concern about the impact on south departure fixes.	CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning, CWF	5	14, 16
ZAU-2-55	1354	Arrival position TMC used DSR, CIWS, and WARP for situational awareness. Discussed a possible DTW to ORD path through the weather with ZOB.			
ZAU-2-56	1426	Coordinator TMC discussed DTW inbound from west with the Arrival TMC. By the time the traffic gets to DTW, weather will be impacting the airport. They don't want to try to take the traffic east of the weather because the traffic will get caught on the wrong side of it. They agreed that ZAU would take the eastbound DTW landing traffic as long as possible then ground stop and hold. Arrival TMC then passed a heads-up to ZKC.	WARP, CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning, CWF	3, 5	4, 12
ZAU-2-57	1434	Arrival position TMC asked about growth. He wants to take traffic over GSP at 2x instead of 1x. He noted growth in the cell in northeast MO and thought the 2x might not work. The NE Area Sup came to the TMU and reported that aircraft were flying through the weather there. TMU is working on coordinating the 2x and the cell now shows decay.	CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning	1	5
ZAU-2-58	1458	ZAU/ZID coordinated a pathfinder to try to open OKK. Traffic is currently going over PLANO. ZAU TMC told ZID to pull an aircraft out of the KY stream. SE Area Sup reports significant deviations, so the TMC thinks the pathfinder may not work. Emphasized to ZID that "only one" aircraft should be used. SCC called to try to get the route open.	DSR, ETMS, CIWS VIL, Growth and Decay Trends, Echo Tops, Lightning	1, 5	1, 11, 12

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ZAU-2-59	1505	Arrival position TMC asked observer questions about CIWS. He was looking at Growth and Decay and said that it gives the impression of growth. However, the loop of past weather on CIWS and on WARP suggests that the storms are dissipating. Observer explained that Growth and Decay Trends product is picking up short-term changes in the weather while overall the system is dissipating.	WARP, CIWS VIL, Growth and Decay Trends, CWF	5	16
ZAU-2-60	1515	SPO: UAL complained about the GDP program instituted yesterday (29 June). She felt airports without weather were penalized. SCC is calling for GDPs for PHL, IAD, TEB, and NY metro airports. Hoping to let ZBW and ZDC "run." The ZAU STMC indicated that they were hoping to open OKK to the southeast arrival gate and hoping that the weather doesn't redevelop.	CWSU, CIWS VIL, Lightning, Echo Tops, Storm Motion	5	16
ZAU-2-61	1600	OKK open but not sure for how long. Observer assumes that the pathfinder sent at 1458 worked.			
ZAU-2-62	1621	ORD has lost runway 22 due to a bird strike. Holding over BEARZ but expect the runway to be available soon.			
ZAU-2-63	1628	Back to three-runway operations at ORD.			
ZAU-2-64	1632	SCC wants to bring east coast traffic (ZDC, ZTL, ZJX) through ZID. ZID TMC suggests that by the time the traffic gets to ZAU, they will be able to use the usual DAY transition. ZID argues that DAY will probably not be open in 45 minutes (CIWS?), but may be open in 60 min. ZTL, ZJX, ZDC, will use VHP/MIZAR with 10 MIT. If DAY is not open, ZNY will use VHP/FWA/MIZAR with 10 MIT and transition to DAY/MIZAR with 20 MIT when DAY does open.	ETMS	1, 5	
ZAU-2-65	1700	ZAU nearly clear of weather. CWSU expects development between 18Z and 22Z east of Lake Michigan.	CWSU	5	
ZAU-2-66	1713	SCC/ZAU/ZMP discuss routing for DTW landing traffic of single stream DELLS/BADGER/Muskegon. ZAU TMC consulted CIWS for situational awareness.	CIWS CWF, Satellite	5	16
ZAU-2-67	1717	Hand-off briefing at Arrival position using CIWS to brief on the weather.	CIWS CWF, Satellite	5	16
ZAU-2-68	1819	No weather in ZAU.			
ZAU-2-69	1839	A line of weather exists in ZID along the Ohio River. Arrival position TMC points this out to the Departure position TMC as a heads-up. If it fills in, ZID may shut off departures southbound through ZID.	CIWS	5	12, 14, 16

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ZAU-2-70	Inter-view	TMC commented that he liked CIWS because the high resolution and rapid update allowed him to see weather develop about 15 minutes earlier than WARP. This allows him to start planning 15 minutes earlier that without CIWS.	CIWS	5	12, 14, 16
ZAU-2-71	1915	SPO: ZID reports losing J6 at ZDC border and (along with SCC) discussed echo tops over PVX. ZAU STMC reports that ORD is at a 96 arrival rate and that there are 27 departure restrictions for ORD. As a result, there is concern that ORD will lose the three-runway operation and have to go to an 80 rate. Westbound departures are OK, but east- and southbound departures are impacted.			
ZAU-2-72	1945	Still no weather in ZAU.			
		ZOB			
ZOB-2-78	1305	Area 2--Weather approaching DTW Approach. Area 2 Area Sup is using the Growth and Decay Trends and CIWS forecast to determine when weather will impact DTW arrival fixes. No immediate plans are being made.	CIWS CWF, Echo Tops, Growth and Decay Trends	4, 5	7, 12, 14, 16
ZOB-2-79	1355	Area 4 (ZOB45): Weather is moving toward J64/60. Area Sup used CIWS along with WARP to make the request to close J64/60. Area Sup noted that given the nature of the weather, CIWS did not save any time in the decision or delay the decision; however, he felt more confident in his decision to close the routes.	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	1, 5	2, 12, 14
ZOB-2-80	1415	Weather noted above. TMU initiated a reroute to the south of J64/60 via ROD…VHP…BVT…BVT2…MDW,	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	2	3

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-81	1401	Weather is moving into Area 2. Area Sup is watching the forecasts. He is confident that the DTW departure and arrival push will get through.	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	5	14, 16
ZOB-2-82	1500	Weather is in Area 2. Area Sup is watching the forecasts and monitoring the DTW push.	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	5	16
ZOB-2-83	1501	Weather is in Area 4. Area Sup is watching the forecasts and monitoring weather specifically for ZOB45.	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	5	16
ZOB-2-84	1507	Weather is moving onto DTW arrival and departure fixes. Area Sup is watching ZOB28/27. Watching forecasts and most planes will get in. Any holding will be manageable with the GS that was put into place.	WARP, ETMS, CIWS Echo Tops, Echo Tops Forecast, VIL, CWF, Growth and Decay Trends, Storm Motion	4, 5	7, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-2-85	1540	Weather is moving from ZAU toward ZOB. ESP West is using CIWS forecast to determine when weather in ZOB airspace will deteriorate. Starting to plan reroutes. CIWS forecast is being used as primary tool; however, time savings is not really noticeable since the storm is moving so methodically. TMU noted that large line storms are "no brainers" from the planning perspective. He is using CIWS speed and direction information to determine when and if they will lose a route. TMU noted that last night that he used CIWS more because there was more uncertainty. CIWS helped in determining when to open and close routes and allowed them to rely less on PIREPS so they could plan more proactively.	CIWS Echo Tops, Echo Tops Forecast, CWF, Growth and Decay Trends	2	14, 16
ZOB-2-86	1647	Area 4: Weather is in area. Area Sup is looking at ET and direction to see if certain routes will stay open. Really just looking for Situational Awareness. No decisions being made	CIWS Echo Tops, Storm Motion	5	16
ZOB-2-87	1705	Area 6 weather in area along J80. Area Sup is using CIWS to determine whether they can reroute over PSK along J80. Used PIREP to make final decision.	CIWS Echo Tops, Storm Motion	2, 5	3, 12, 14
ZOB-2-88	1701	Area 6: Area Sup is keeping D-Side staffed based on CIWS forecast	CIWS VIL, Echo Tops Forecast	5	12, 14, 15, 16
ZOB-2-89	1200	Cold front is forcing large thunderstorms from northern MI into ZKC. Storms with tops to 51 kft are tracking east at 25 kts. CWSU came into the TMU to talk with STMC about storms and said that low level jet was responsible for overnight storms. Storms stayed strong over Lake Michigan so the CWSU expects storms to remain strong and not decay as storms cross the Lake. STMC had made early decision and used CIWS to see that they could take traffic to west ZOB on J36 and into ZMP because they could not use Canadian airspace. CIWS was used to coordinate with ZAU and ZMP as well as SCC, ZNY, and ZBW. STMC is concerned that plan to run traffic from PXV – J29 with west coast traffic would cross PXV around 1700 when storms will be in ZOB airspace. STMC also used CIWS to see if J36 could be used as an offload if J60/64 closes.	CWSU, CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Storm Motion, Growth and Decay Trends	2, 5	3, 12, 14

Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZOB-2-90	1240	Storms are two hours out of D21 TRACON, three hours to DTW. TMC used CIWS to help plan DTW arrivals and deviations around weather.	CIWS CWF (with extrapolation to 3 hours)	2	3
ZOB-2-91	1300	CCFP shows gap in ZOB airspace out to 19Z. STMC calls SCC SvrWx concerned that CCFP showing gap may encourage more traffic through ZOB than they can handle. CWSU has indicated he believes more coverage than CCFP shows.	CCFP, CWSU	5	
ZOB-2-92	1315	SPO: CAN routes not available this morning, but requested for afternoon. Possible MGM reroute for storms in ZNY.			
ZOB-2-93	1400	DTW ESP tried to put a ground stop in for DTW due to weather impact at DTW. SCC would did not take it. Wanted to go to FTW and hold. ESP used CIWS to make request and referenced CIWS to SvrWx.	CIWS VIL, CWF, Storm Motion	3, 5	12, 16
ZOB-2-94	1415	Solid line of storms from central IN to central MI blocking most of western ZOB. SCC SvrWx called Coordinator position TMC to ask for an earlier turn to the north to get around line of weather in west ZOB. TMC used CIWS to see what tops were and decided to leave stream alone based on storm motion and tops to 41 kft. Rejected over flight (even though some tops were in the low 30 kft) based on east-to-west direction of travel. TMC said aircraft will not accept over flight when approaching the leading edge of a storm.	CIWS Echo Tops, VIL, CWF	2, 5	12, 16
ZOB-2-95	1500	CWSU tells STMC that storms may decay before impacting DTW. CIWS showing growth in that area. CWSU basing decision on change in lightning polarity. No change in plan based on CWSU forecast.	CWSU, CIWS VIL, CWF, Lightning, Growth an Decay Trends	5	16
ZOB-2-96	1715	Storms decaying as they cross western Lake Erie. Storms blocking J146, J60, and J64. ESP TMC for DTW used CIWS to see gap in storms over Lake and opened one east departure route early (TYCOB and WINGS as 1 with 10 MIT). MIT because arriving traffic was deviating. The ESP TMC used CIWS to coordinate with Area 2 for departures for DTW. Without CWF, he may not have made the decision and may have held, ground stopped, or swapped.	CIWS VIL, CWF, Growth and Decay Trends	1, 3, 5	1, 6, 10, 12

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-2-97	1725	ESP working CLE wants to know what was going to happen by 1815. Questioned if Lake would stay clear of storms.	CIWS CWF, Growth and Decay Trends	5	16
ZOB-2-98	1757	Thunderstorms are developing along the south shore of Lake Erie with a few now on Lake. Storms impacting CLE. ESP at CLE indicates traffic still departing. He is keeping an eye on CIWS.	CIWS VIL, CWF, Growth and Decay Trends	5	16
ZOB-2-99	1800	Few cells developing in Area 6. Coordinator position TMC looking at CIWS and trying to plan what reroute will be needed for J518, J211, J80, and J60/64. TMC indicated that CIWS saved time because he could study the forecast with routes on the display.	CIWS VIL, Echo Tops, Echo Tops Forecast	2	3, 14
ZOB-2-100	1804	Storms continuing to grow along Lake Erie and decay on the north end of the lake. STMC opened J60 for 60 minutes to try to get some traffic over the line near CLE. Same problem; traffic approaching line from the east J60 over Iowa City, 30 MIT as one. Small gap on J60 with tops in mid 30's kft	WARP, CIWS CWF, Echo Tops Forecast	1	1, 6
ZOB-2-101	1831	Note: STMC spent a few minutes looking for possible RR on CIWS. Used jet routes overlays. J80 closed in ZID airspace. J64 closed.	CIWS VIL, CWF	5	16
ZOB-2-102	1847	Storms developing ahead of line in Areas 6 and 5. DC jet routes now being considered.	CIWS	5	16
ZOB-2-103		Observer visited Areas. Area 2 Sup is using CIWS for a weather overview. Area 4 Sup is using CIWS but is too busy to talk.	CIWS VIL, CWF, ASR, Lightning, Echo Tops	5	12, 16
ZOB-2-104	1900	Storms remain on coast but most impact now in ZID. STMC opens J36 early based on CIWS information.	CIWS VIL, CWF, Growth and Decay Trends	1	1
ZOB-2-105	1915	Radar outage caused drop of DBZ levels in ZOB. Eastern NEXRADs dropped off line. TMC's first thinks that storms are decaying. CIWS mostly unusable now.	CIWS Growth and Decay Trends		

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-106	1950	CIWS eastern radars still down. Watched Coordinator TMC make a decision on J518 without CIWS coverage. He made a comment about how much he needed CIWS then proceeded to use WARP. He said that he placed a 30 MIT on J518 that he may not have used if he had CIWS information.	WARP	2, 5	
ZOB-2-107	2000	Eastern radars back on line. Storms developing ahead of line. STMC noticed a gap in tops on J64 but rejected using it because of developing storms ahead of main squall line. Aircraft on J64 are deviating over the lake well before OH border. STMC calls it a "sucker hole".	CIWS Echo Tops, CWF, Growth and Decay Trends	5	16
ZOB-2-108	2140	Isolated cells have developed in southwestern MI and IN. CWSU comes to TMU to brief that a line may develop in ZAU, track into ZOB, and impact DTW again. STMC and DTW ESP start paying close attention to the CIWS for storms near DTW.	CWSU, CIWS CWF, Echo Tops Forecast, Growth and Decay Trends	5	16
ZOB-2-109	2200	Cells growing in MI and IN. Area 2 Sup is using CIWS to move DTW arrivals from POLAR to MIZAR well in advance of storms. ESP TMC moves northbound traffic to DTW to over FTW to get aircraft behind storms.	CIWS CWF, Growth and Decay Trends	4, 5	7, 12, 14
ZOB-2-110	2220	Storms with tops to 49 kft are on the boundary of sector 29. ORD ESP (west position) is looking at CIWS (switching) to see that storms are impacting flow and aircraft are deviating. Area 2 Sup comes into TMU. Coordinator TMC calls ZAU to plan the deviations. Area 2 is OK with deviations based on storm Motion. Reroutes are tactical and handled at controller positions. No MIT restrictions. CIWS was used by the ESP TMC, Coordinator TMC, and Area 2 Sup on three different displays during this planning. The ESP TMC and Area Sup said they might have stopped the flow without CIWS information.	CIWS CWF, Storm Motion, Growth and Decay Trends	1, 5	1, 12, 14
ZOB-2-111	2230	Echo tops are lowering in the line and storms ahead of line are decaying. STMC is using CIWS to plan J60 opening and to let a pathfinder on J60. No J64. Concern is that ZNY traffic will over fly first line only to encounter problems with the developing line in ZAU. Observer learned at 0010 that no pathfinder was sent on J60.	CIWS VIL, Echo Tops, Echo Tops Forecast, CWF	1	1

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-112	2340	The line in eastern CIWS coverage is decaying while storms in western ZOB growing. Area 4 is using CIWS to anticipate storms in their airspace and to plan tactical reroutes. The Area Sup told the observer that he was working in controller breaks based on CIWS precipitation forecast.	CIWS VIL, CWF, Echo Tops	2, 5	3, 12, 14, 15
ZOB-2-113	2340	Area 2 Sup said CIWS was being used to time DTW impact. He expects the impact to be 75 minutes from now so he is keeping flow rate up.	CIWS CWF	3, 4, 5	7, 9, 12, 14
ZOB-2-114	2356	Storms decaying in Area 6 with tops decreasing. Coordinator TMC requests a path finder on J80. Area stops plan based on deviations.	CIWS Echo Tops, Echo Tops Forecast	1, 5	16
ZOB-2-115	2359	Storms southwest of DTW are forming into a very strong line of level 6 cells. STMC/ESP TMC indicated that all decisions are being made with CIWS. Aircraft are being moved to POLAR so that they will be on back side of the weather. A ground stop has been saved and GDP ended early based on CIWS forecast. The forecast shows storms tracking to south of DTW runways.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast, Storm Motion, Satellite, Lightning, ASR Precip, Growth and Decay Trends	4, 5	4, 7, 9, 12, 14
ZOB-2-116	0015	The line of storms is now mostly in ZOB. Area 6 Sup used CIWS to see that tops J80 were decreasing. He walked to TMU and used CIWS to explain to the Coordinator TMC that J80 should be opened.	CIWS Echo Tops	1, 5	1, 12, 14
ZOB-2-117	0015	Coordinator TMC requested a pathfinder on J80 again based on coordination with ZID. The plan is stopped due to weather in ZID. CIWS was used to coordinate with ZID.	CIWS VIL, CWF	5	16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZOB-2-118	0022	Storm developed in the northwest part of the western-most storm in line west of DTW. DTW was in the clear until this cell developed just outside of storm blow off. The CIWS forecast shows this cell hitting DTW. ESP TMC is using CIWS to plan a 20-aircraft departure push from DTW. The aircraft will depart south until they are stopped. ESP hopes to get all traffic out because he is concerned that new cell west of DTW will close runways. TMC is also watching the storms decay.	CIWS VIL, CWF, Growth and Decay Trends	3, 5	4, 12
ZOB-2-119	0030	Storms in ZID airspace remain strong. J80 is closed until 0300 per ZID request.			
ZOB-2-120	0050	Storms are lined up south of DTW. ZID misunderstood a request and removed a swap for DTW traffic. They were flying traffic to FTW to get them to MIZAR/POLAR for the back of the storms. ZID moved traffic back to CETUS. ESP caught the mistake mainly using ETMS. CIWS was used to make the initial plan to move traffic.	CIWS, ETMS	2	7
ZOB-2-121	0130	Area 2 used CIWS to plan the arrival traffic to DTW that was moved to POLAR based on the CIWS forecast.	CIWS CWF	4, 5	7, 12, 14
ZOB-2-122	0140	Area 2 is using CIWS to plan more DTW departures.	CIWS CWF	3, 5	10, 12, 14
ZOB-2-123	0150	Most storms are in ZID, with a cell west of DTW decaying. Area 4 is still impacted. All routes are clear to ZNY but J60/64 is still blocked in ZOB airspace. Coordinator TMC used CIWS to approve a plan to move ORD departures for ZDC from J146 to DJB/J518. He used the CIWS forecast to estimate to ZAU that J518 would be impacted in two hours.	CIWS CWF	2, 5	3, 12
		ZBW			
ZBW-2-85	1315	Some level 3/4 weather off NJ coast and south of Long Island with tops around 35 kft. Line stretching from MI to IN with embedded level 4/5 and tops 33 to 55 kft. ZBW is ground stopped to NY. ORD landing traffic from ZNY is routed through ZBW.			
ZBW-2-86	1409	J47/J75 has a 20 MIT restriction to NY due to weather. CIWS shows no weather on the airways in ZDC. STMC calls ZNY to ask about the restriction. ZNY says the restriction is due to volume, not weather.	CIWS VIL, CWF	5	16
ZBW-2-87	1442	Sectors 8 and 9 are split.			
ZBW-2-88	1445	All IAD arrivals going over ALB. Area B (sectors 36, 37, 38, 39, 52/53) are "getting slammed."			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-2-89	1448	J6 traffic is moving to J48. Some J48 traffic is moving to J75. J6, J80, and J48 have restrictions: 20 over SPARTA as one excluding IAD, 20 over CARMEL/J75. Observer is not sure what the problem is on J6 and surmises it may be a ZID problem. There is currently no weather on the route.			
ZBW-2-90	1455	A 7 minutes-in-trail restriction is placed on traffic out of MHT going over Putman, Chester, Cambridge due to sector volume.			
ZBW-2-91	1456	ZBW is ground stopped to DTW due to weather.			
ZBW-2-92	1504	Heavy traffic in Area 3, could be excessive due to the holiday (July 4). Everything above FL240 is stopped for 30 minutes due to sector volume. General Aviation flights will "kill" ZBW tonight. Thursday is the busiest day.			
ZBW-2-93	1515	SPO: CCFP shows route constraints in east. SCC expects GDPs. Airlines arguing strongly against GDPs; "shouldn't have used GDPs yesterday and we all know it." STMCs from many Centers supported the GDPs yesterday saying that without them NAS would have been unmanageable."...			
ZBW-2-94	1548	Departure delays for west coast traffic filed over ALB to BOS due to en route problems.			
ZBW-2-95	1922	Lost radar coverage over east coast. CWSU was using tops for briefing when the radars were lost.	CIWS Echo Tops	5	16
ZBW-2-96	2115	Cells over Gardner are causing some problems as well as cells on NY/CT border. No BOS forecast coverage due to radar outage. STMC watching storm motion on cells near Gardner that are causing some problems for aircraft on final approach to BOS. Tops at 31 kft. Motion in many cells is erratic, likely due to weak motion. Cells are nearly stationary.	CIWS VIL, Storm Motion	5	16
ZBW-2-97	2150	J48 closed for ZBW, open for ZNY. ZNY has requested 30 MIT but won't share with ZBW.			
ZBW-2-98	2221	Cell on CT/NY border with tops to 44 kft. STMC is concerned about the impact of this cell. It is stationary but growing. STMC briefed CIC using CIWS SD.	CIWS Echo Tops, Growth and Decay Trends	5	16

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-2-99	2227	Cell growing on NY/CT border over GREKI fix. TMC is surprised that the cell is not causing problems for sector 20. J6 has some restrictions, but tops are high and aircraft are picking their way through. TMC is not receiving complaints. J6, J80, J48 ground stopped.	CIWS VIL, Echo Tops	5	16
ZBW-2-100	2250	Storms over GREKI exhibiting tops of 41 to 44 kft. SCC SvrWx and TMC discuss bringing ZNY and ZDC traffic over GREKI. ZBW denies the request due to cells over GREKI. TMC consults ETMS for weather and tops and CIWS for motion. Clutter on CIWS SD obscured the motion estimate so TMC guesses that GREKI will be impacted for another 30 minutes. ZNY will check back. ZBW asks why they can't run west with only two dots of thunderstorms. SCC says the route is being used mostly just to offload ZNY.	CIWS VIL, Storm Motion, ETMS	2, 5	12, 14, 16
ZBW-2-101	2308	Ground stop N90 traffic to BOS due to holding in the sector over PVD and Gardner.			
ZBW-2-102	2309	BOS wants to hold all approach fixes. Ceilings are low and can only land on one runway.			
ZBW-2-103	2316	Ground stop GREKI. Sector 19 is too busy with deviations.			
ZBW-2-104	2319	TMC used CIWS during a conversation with ZOB. STMC looking at CIWS for GREKI situation. Looking at sectors 6 and 19 and doesn't know why they can't go over GREKI. STMC took about one minute to set up the SD to support his needs.	DSR, CIWS VIL, Storm Motion, Growth and Decay Trends	5	16
ZBW-2-105	2325	Weather Over GREKI decaying and has moved southwest of GREKI. STMC used CIWS to prepare for SPO. BOS 4L runway not available due to low ceilings; best AAR is 38.	DSR, CIWS	5	16
ZBW-2-106	2331	J48 open with 20 MIT.			
ZBW-2-107	2334	STMC is getting pressured to open GREKI but the Area Sup is not willing to take traffic due to weather.			
ZBW-2-108	2336	Operations manager consults CIWS for tops near GREKI. ZNY doesn't want 40 MIT on GREKI. Give them a crazy route, but not fair to users. Shoot the holes send them over MERID (sector 46 issue?)	CIWS Echo Tops	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-2-109	2343	Sending traffic over GREKI with 40 MIT as pathfinder opportunity. Operations Manager spoke with the Area Sup. When asked (by observer) if CIWS in the Area would have helped make this decision quicker, the Operations Manager said it was a personnel issue. However, the STMC later said that if the Area had CIWS, they would have understood the scenario. "We stopped them for 30 minutes. We shouldn't have stopped them at all." Bottom line: GREKI was shut down for 30 minutes. If CIWS had been available in the AREA, they would have potentially kept the route open for that 30 minutes. In addition, it took approximately 15 to 20 min of coordination with Operations Manager, STMC, several TMCs, and Area Sup using CIWS with ETMS and WARP. STMC says that general CIWS knowledge of very little storm movement made him confident in the decision to open GREKI. CIWS would not have helped with the personnel issue, but would have aided coordination greatly.	CIWS VIL, Storm Motion, Echo Tops, CWF	1, 5	1
ZBW-2-110	2359	Ground stop for TEB cancelled.			
ZBW-2-111	0004	CIWS forecast indicates that the cell near GREKI is diminishing. STMC points this out to the TMC to support in the earlier decision.	CIWS CWF	5	16
ZBW-2-112	0006	Cells in central MA are showing growth and decay. Area Sup visits TMU to assess growth and decay and plan for sector management.	CIWS Growth and Decay Trends	5	16
ZBW-2-113	0010	STMC used the ASR window on the SD and asked why there was no storm motion outside ASR coverage. Observer explained. STMC removed the ASR window, created a Precip window and zoomed in on BDL.	CIWS VIL, Storm Motion	5	16
ZBW-2-114	0010	Weather is beginning to impact J75. TMC consults CIWS and decides to let planes go.	CIWS	1	1, 14
ZBW-2-115	0041	Weather near Gardner is causing problems. Airport is closed. Aircraft are deviating to the west, north and east around weather.			
ZBW-2-116	0056	Weather over Gardner. STMC is coordinating with Area regarding timing of weather near Gardner.	CIWS VIL, CWF, Storm Motion	5	12, 16
ZBW-2-117	0059	Briefed Operations Manager using CIWS.			

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-2-118	0103	Cells over Gardner. STMC uses CIWS to pre-plan for traffic that is 45 minutes from the fix. He wants to be able to let the aircraft continue over Gardner rather than reroute them unnecessarily. Without CIWS, reroutes likely	CIWS VIL, Echo Tops, CWF	1	1

CIWS Benefits Assessment
Observation Period #2 Observations Summary
Day 5 – July 1, 2005

Participating Facilities: ZBW

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
		ZBW			
ZBW-2-119	1830	A cell near ALB contains level 5/6, echo tops of 56 kft, and lightning. A line of weather with embedded level 3/4 cells is located in Canada. This line is preventing use of Canadian routes. Currently this is not causing a problem, but if/when weather develops in ZNY, the situation may change.			
ZBW-2-120	1900	Cell near Hancock developed in the past 1/2 hour. Airlines are at 95% load capacity and won't cancel flights tonight.	CIWS VIL, Growth and Decay, Echo Tops	5	16
ZBW-2-121	1914	Cell near Hancock (HNK) showing lots of growth. Aircraft are going through a gap between HNK & ALB. If this gap fills, there could be big problems.	CIWS VIL, Growth and Decay Trends	5	16
ZBW-2-122	1916	Lots of stratus over NH and down to eastern MA. The TMO asked "What did we do before this stuff (referencing CIWS)?". The STMC answered, "We deviated." The gap between HNK and ALB continues to be used for traffic arriving at the NY metro airports. They can't let traffic head to Cambridge, so Cambridge is stopped.	CIWS VIL, Growth and Decay, Storm Motion (Extrapolated Positions)	5	6, 16
ZBW-2-123	1925	CWSU doesn't expect weather to be as bad as earlier expected. CWSU informs STMC that he doesn't think the gap between HNK and ALB will close based on previous days with similar scenarios.	CWSU	5	16
ZBW-2-124	1933	Storms growing; lots of growth near southwest NJ. ZBW is holding for LGA.			

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ZBW-2-125	1937	Storms are starting to build between the Great Lakes west of Buffalo along a boundary feature identifiable in the satellite data.	CIWS VIL, Satellite, Storm Motion, Growth and Decay Trends	5	16
ZBW-2-126	1947	During the stand-up briefing, the CWSU noted decay in severe thunderstorms in eastern NY and western MA. Center Weather Service Advisory over upstate NY. BOS should remain IFR. Showers in BOS possibly only after midnight; ground stop for ATL, internal ground stop for EWR and LGA. Area C is taking aircraft down the east coast for internationals. BOS at 38 rate.	CWSU	5	
ZBW-2-127	1955	CWF unavailable fore a short time			
ZBW-2-128	1958	National ground stop for traffic landing PHL until 2100.			
ZBW-2-129	1959	The gap between HNK and ALB is filling. The STMC shut off ZOB in preparation for the gap closing. By the time aircraft get there, there will be no specific route. The route the STMC suggested will take traffic toward ALB and south.	CIWS VIL, Storm Motion, Growth and Decay Trends	1, 2	2, 3
ZBW-2-130	2006	The weather near ALB is exhibiting lots of growth. J6 is back to normal.	CIWS VIL, Growth and Decay Trends	5	16
ZBW-2-131	2009	BWI is ground stopped for one hour.			
ZBW-2-132	2013	BDL is ground stopped due to communications problems. BWI is released on reroute.			
ZBW-2-133	2019	CARMEL, SPARTA 20 MIT per route.			
ZBW-2-134	2021	Proactively rerouting MHT/BOS departing traffic to go Burlington/SYR, rather than ALB. Used CIWS to see that the gap was closing. This move prevented gridlock.	CIWS VIL, Echo Tops, Growth and Decay Trends	2	3

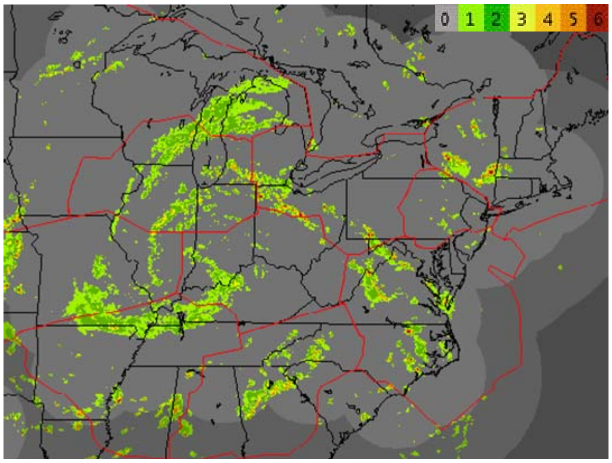
Identifier	*Time (UTC)*	*ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments*	*Weather Products Used*	*Impact Planning Category*	*CIWS Benefits Category*
ZBW-2-135	2024	Weather in upstate NY north and west of ALB has tops of 30 to 47 kft with lots of lightning and growth. The TMC and STMC are consulting CIWS to plan a route north of ALB.	CIWS VIL, Echo Tops, Storm Motion, CWF, Lightning	2	3
ZBW-2-136	2040	CWSU shows STMC breaks in stratus along southeastern New England coast using satellite in the CWF loop. CWSU warns that they could see some development in eastern MA.	CIWS CWF, Satellite Loop	5	16
ZBW-2-137	2051	The Areas are quiet now because so much traffic is stopped everywhere. There is little traffic on J60, J80 is OK, J75 is closed and traffic is rerouted down the coast on J121.			
ZBW-2-138	2054	Ground stop ATL due to weather at the airport.			
ZBW-2-139	2056	There is bad radial data in the NEXRAD data. Two BDL departures are going to try to pick their was through a few gaps towards SYR.	CIWS VIL, WARP	5	16
ZBW-2-140	2111	Weather moving in over Glen's Falls. Area Sup asked about weather moving toward SPARTA. The TMC estimates that weather will move over SPARTA in one hour. The observer asked if the absence of CIWS would have caused him to close the route sooner? TMC said probably not, but he may not have been able to give the Area Sup a time and might have estimated 15 minutes. Plan was devised and coordinated with the Area Sup to continue to run SPARTA traffic for one hour. Without CIWS, they may have used the route only 15 minutes longer.	CIWS CWF	1, 5	1, 12
ZBW-2-141	2117	Area E Sup came into TMU to use CIWS to see that the storms northwest of GREKI are moving east.	CIWS VIL, Storm Motion	5	16
ZBW-2-142	2134	Weather is east of J75. J75 should be open to ZBW now, based on VIL and storm motion. STMC asked TMC to contact ZNY to see if they would open the route. ZNY denied request. STMC and TMC don't understand why they won't open the route.	CIWS VIL, Storm Motion	5	16
ZBW-2-143	2139	Cell west of ALB is exhibiting lots of growth. Aircraft are still running through the gap west of ALB but TMC is not sure if that will continue. On the other hand, Sector 38 has little volume. SCC says there is no ground stop for EWR. If ZBW can get the planes there, they should send them.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-2-144	2142	The STMC is still relying on the CWSU's earlier comment about weather shutting down east of Connecticut River. Area Sup and STMC study WARP. If weather goes north of PVD, they will need to shuffle routes.	WARP	5	
ZBW-2-145	2215	The line of weather over SPARTA filled in. Hyannis ground stop cancelled; 20 MIT. Ground stop everything over SPARTA because no route is available.	CIWS VIL, CWF	5	16
ZBW-2-146	2220	Area Sup visits STMC to report that a Jet Blue flight from Canada is going about 150 miles out of his way. CARMEL and SPARTA routes are merging and they need some MIT restrictions. The STMC uses the DSR weather display to make decisions. He glances at CIWS for overall situational awareness.	DSR, CIWS	5	16
ZBW-2-147	2228	Ground stop LGA continued to 2330.	DSR		
ZBW-2-148	2230	Ground stop everything over Chester sector. Carmel not getting through. Ground stop Carmel traffic. May try Chester/Sparta. TMC uses CIWS forecast to estimate the impact on routes J121/J174 in one hour.	CIWS CWF	1, 5	14, 16
ZBW-2-149	2233	Weather over Jersey.			
ZBW-2-150	2240	TMC used CIWS to reopen J174 and unloaded some traffic onto another route. Without CIWS, it would have taken another half hour to find a route.	CIWS VIL, Echo Tops, Growth and Decay Trends, CWF	5	16
ZBW-2-151	2245	Chester traffic is not making it through; deviating to Gardner.			
ZBW-2-152	2247	Weather on NY/CT border northwest of GREKI is causing problems. Gap isn't big enough for planes to use.			
ZBW-2-153	2304	All BOS traffic is coming in low via a gap between ALB and BOOS.			
ZBW-2-154	2307	BDL closed due to weather.			

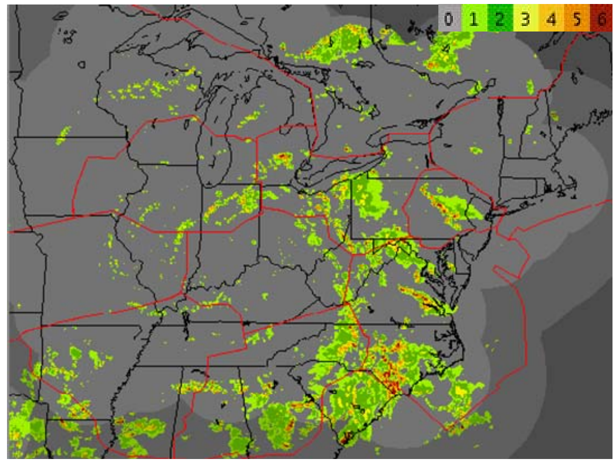
Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-2-155	2312	TMC, looking at SAX fix, thinks Burlington and ALB can make it down J6 to Sparta (SAX). TMC called ALB tower who accepts the routing. TMC contacts MHT and Burlington, offering route. Approximately 9 aircraft were off early because of CIWS usage. Without CIWS, route would have remained closed extra 30-60 min.	CIWS VIL, Storm Motion, CWF	1	1, 14
ZBW-2-156	2316	Keep Merit open for about one hour. Close GREKI.	CIWS VIL, CWF	1, 5	2, 12
ZBW-2-157	2325	TMC is on the phone with ZNY to pre-plan the closing of the Merit route in one hour. After Merit closes, they will move traffic to BETTE. Without CIWS, the TMC would have used ETMS. However, the quality of the decision was better with CIWS because of the Storm Motion product, which the TMC prefers.	CIWS VIL, Storm Motion	1, 5	2, 12, 14
ZBW-2-158	2328	Weather moving east and should be over JFK in 30 minutes. TMC referenced CIWS for JFK timing. The Area asked about traffic level. They are losing 4 staff in one hour and need to keep two if possible.	CIWS VIL, Storm Motion, CWF	3, 5	14, 15, 16
ZBW-2-159	2331	Cells over NY metro are level 3 and breaking up. J174 up the east side is opened with 30 MIT.			
ZBW-2-160	2340	Sending a pathfinder over Barnes/Sparta.			
ZBW-2-161	2355	TMC is thinking of trying to open the route over Carmel/Sparta, using CIWS. Carmel currently has weather, but by the time aircraft get there (30 min), the route may be open. No aircraft volunteer to be pathfinders.	CIWS VIL, Storm Motion, CWF	1, 5	14, 16
ZBW-2-162	0003	Area Sup and TMC are looking at the west and east approaches to NY to see if they can get planes through.	CIWS VIL, Storm Motion	5	16
ZBW-2-163	0018	Cells over Merit and GREKI. Merit will be closed for a short time.	CIWS VIL, Storm Motion, CWF	5	16
ZBW-2-164	0031	There were two missed approaches at BOS. If they get another, they will hold.			
ZBW-2-165	0034	Cells with tops to 48 kft are sitting over Carmel (CMK)/Merit/GREKI. The TMC is using the 30 min forecast to judge when CMK will be clear for NY arrivals. Currently using BETTE.	CIWS CWF	5	14, 16
ZBW-2-166	0050	SCC reports that the RVR at BOS "dipped" and is causing problems.			

Identifier	***Time (UTC)***	***ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments***	***Weather Products Used***	***Impact Planning Category***	***CIWS Benefits Category***
ZBW-2-167	0102	There are 65 min departure delays at JFK.			
ZBW-2-168	0105	Level 3 weather over BDL is moving east. Level 4/5 weather at ALB. Line west of ALB shows growth. Area E Sup (sector 19, Danbury) is asking about weather over BDL. (Area Sup was in TMU two years ago and is familiar with CIWS.) Area Sup asks observer to see the CIWS forecast . He is thinking of bringing planes around to the west.	CIWS VIL, CWF, Storm Motion	2, 5	3, 12
ZBW-2-169	0123	A second line of weather is developing near ALB. Area Sup visits TMU to assess the weather on CIWS. The STMC is calling SCC SvrWx for ZOB. ZBW can't take any of their traffic from the west.	CIWS VIL, Storm Motion, Lightning, CWF	5	12, 16
ZBW-2-170	0130	Stop EWR and LGA out of SYR.			

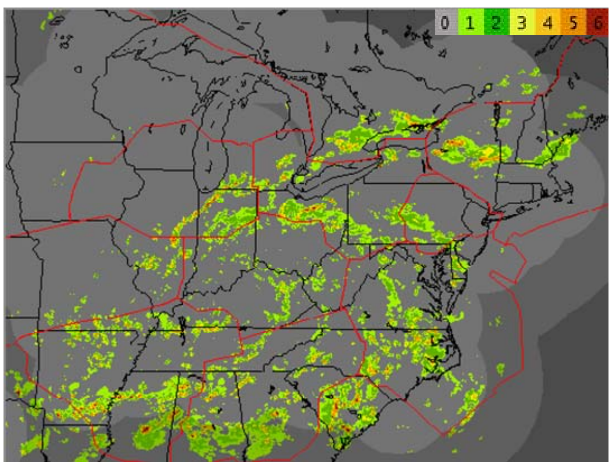
OBSERVATION PERIOD 3: 12-15 July, 3 August 2005
Facilities Visited: ZMP, ZAU, ZOB, ZDC, ZNY, ZBW, ZTL, ZJX
Examples of CIWS NEXRAD VIL Precipitation During Period 3:



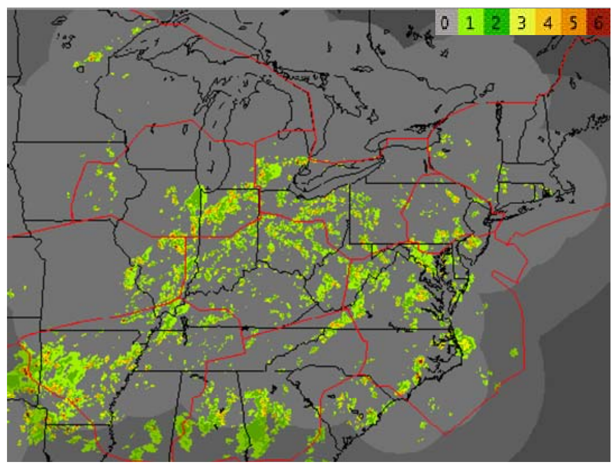
12 July 2005, 2130 UTC



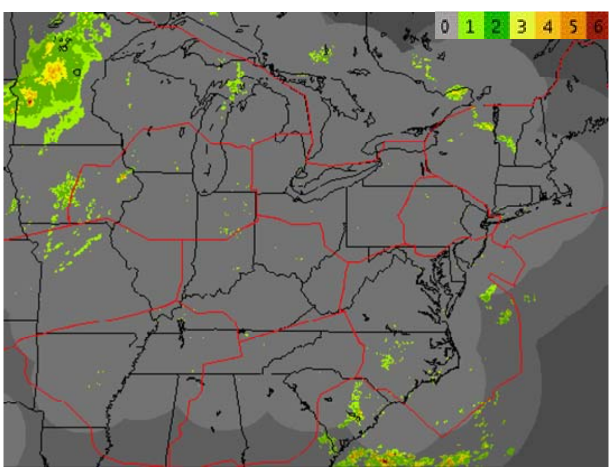
13 July 2005, 2130 UTC



14 July 2005, 2100 UTC



15 July 2005, 2000 UTC



03 August 2005, 1130 UTC

CIWS Benefits Assessment
Observation Period #3 Observations Summary
Day 1 – July 12, 2005

Participating Facilities: ZAU, ZOB, ZJX, ZTL

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZAU			
ZAU-3-1	1311	Currently, level 2 with embedded level 3+ exists across the middle of ZAU. Tops to 31 kft. Arrival position and Coordinator position only staffed at this time. The weather is causing no problems at this time. Tops and levels are low. CCFP does not show weather in ZAU for the next 6 hours.	CIWS VIL, Echo Tops, Storm Motion	5	16
ZAU-3-2	1408	Weather benign. No impact at this time			
ZAU-3-3	1500	Coordinator position TMC explained that the Departure position is not normally staffed. Departures are handles at the Coordinator position unless restrictions cause a need for additional staff. In the current configuration (X-ray) triple runway operations can be accomplished even if the runways are wet. Demand doesn't exceed capacity until 1800 so ORD is on "autopilot."			
ZAU-3-4	1830	Scattered light precipitation with low tops. No impact on ZAU traffic.	CIWS VIL, Echo Tops	5	16
ZAU-3-5	1900	Departure aircraft are deviating south and east. There is no precipitation showing on the radar but satellite shows hard convection.	CIWS VIL, Echo Tops, Satellite, DSR	5	16
ZAU-3-6	1915	SPO: ZAU is restricted heavily eastbound due to weather. STMC asked that CDRs be listed in the plan. He used CIWS extensively during the telecon for situational awareness. He changed the SD to a four-window configuration: Cleveland and ORD Precip Forecast and Precip windows. Observer asked why he did not display the echo tops products. STMC indicated that he uses those windows sometimes, but prefers the echo tops labels. NWA was overheard asking ZOB what the CWSU was forecasting for DTW.	CIWS VIL, Storm Motion, Echo Tops, Lightning, CWF	5	12, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-7	1930	The SD configurations have been changed by the TMCs at all positions. Weather is beginning to build from east of Lake Michigan to central IL with embedded 30 kft tops and level 3 cells. The En route position TMC reports no impacts due to weather even though the departures are deviating.	CIWS VIL, Storm Motion, Echo Tops, Lightning, CWF	1, 5	1, 16
ZAU-3-8	2001	Enroute position TMC reported 41 kft echo tops south of Lake Michigan to the Coordinator TMC. He wanted to give him a heads up.	CIWS Echo Tops	5	16
ZAU-3-9	2001	Observer interviewed TMC concerning his use of the forecast products. TMC stated that he preferred Growth and Decay to the forecasts because it shows him what he needs to know at a glance. His preferred SD configuration is a Precip window with Satellite, Storm Motion, Lightning, Echo Tops, and Growth and Decay.			
ZAU-3-10	2023	Coordinator TMC briefed Arrival TMC on items from the CWSU stand-up briefing. According to the CWSU, the only possibility of convective activity is at breaks in the cloud deck where the sun reaches the ground, particularly in middle of MI from the thumb to Lake Michigan. No significant problems at this time.	CWSU	5	
ZAU-3-11	2025	STMC asks Coordinator position for an update on the arrival flow. Arrivals are standard. Eastbound departures are 2 X 15 and there are restrictions on the southbound departures. STMC suggests slowing arrivals to help reduce the expected departure queue. TMC says it may be too late for that. Traffic that will hurt is already in the air from the west. Observer asked why departures were impacted/restricted but not arrivals? Landing traffic is under pressure to land and will penetrate weather. The weather looks worse to departing traffic and they are not as likely to penetrate. Currently, tops are at 45 kft, so departures can't get above the weather.	CIWS VIL, Echo Tops	5	16
ZAU-3-12	2030	STMC explains that south and east departures were deviating (at 1900) so the flow was restricted 2 x 15 for eastbound and southbound 20 MIT over RBS and 1 x 20 over EON. STMC plans to discuss this on the SPO.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-13	2035	Coordinator TMC talked to SCC and another Center about a reroute. The Coordinator TMC quoted CIWS echo tops for situational awareness.	CIWS Echo Tops	5	16
ZAU-3-14	2040	A line of weather south of ORD has tops to 40 kft. En route TMC reported tops to the West Area Sup for situational awareness. The West Area Sup has to reroute traffic bound for ZOB north of the weather.	CIWS Echo Tops	2, 5	3, 12, 16
ZAU-3-15	2051	Arrival TMC used CIWS to identify growth along the ZID/ZOB border. ZID called to move traffic off DAY to VHP due to the growing weather.	CIWS VIL, Growth and Decay	5	16
ZAU-3-16	2100	STMC requested an update on arrivals to ORD. TMC reported no problems so far and no reports of departure back-ups.			
ZAU-3-17	2101	SCC and ZOB called the Arrival TMC to take traffic headed for ZOB north of the weather. ZID traffic cannot go over MIZAR.			
ZAU-3-18	2111	SCC and ZOB called to say that FWA, DAY, and LCH will close soon. Requesting to reroute ZKC traffic landing DTW over CAP/MKG/POLAR1. Traffic from the east (ZTL and east coast) will go over DRYER east of the weather.			
ZAU-3-19	2115	SPO: CCFP shows no weather south of ORD. SCC was overheard to say that thunderstorms on ITWS show an impact at ATL and warned to expect a first tier GS for ATL. ZAU reported that users could expect a back-up on departures soon. The push is coming. The weather east has low tops and will not cause a problem for arrivals "close in." It is too late to slow arrivals, but departures should be OK by 0700 LT. The STMC used CIWS throughout the discussion.	CIWS VIL, Storm Motion, Echo Tops, Lightning, CWF	1, 5	1, 16
ZAU-3-20	2114	Observer overheard the Coordinator TMC discussing growing weather with an unknown caller. He used ETMS.	ETMS	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-21	2143	The STMC discussed the weather with the observer. The STMC explained that generally, as long as traffic is deviating, an Area Sup will want to keep a restriction in place. CIWS is of value to the unit because if they see dissipation, they "won't go to extremes or over-react" (i.e., they will try to minimize restrictions). CIWS showed weather dissipating south of ORD. Departure delays at this time were 15 min. STMC states that it is the Area's call to reduce restrictions. Sometimes the TMU will call the Area to challenge or prod them to reduce the restriction, but generally they let the Area handle the situation. The Areas do not use CIWS.			
ZAU-3-22	2150	East Area Sup reported deviations. Coordinator position TMC called ZOB to get 15 MIT over Pullman on the NE stream. Departure delays are +30. TMC expects to lose the third runway soon.			
ZAU-3-23	2159	Weather to the south now showing decay	CIWS VIL, Growth and Decay Trends	5	16
ZAU-3-24	2207	Departure delays +45 but the queue doesn't appear to be very long. Observer asked why the queue was short. The aircraft are only listed on the display when they leave the gate. TMC hypothesized that the aircraft were just staying at the gate. East departures were stopped because landing traffic was deviating into the departure path.			
ZAU-3-25	2217	TMC agrees to take two pathfinders off EVV headed for CLE to see if they can get through the east-west line of weather into ZOB.	DSR, ETMS	1	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-26	2222	TMU quiet now. Hand-off at Arrival position. Southbound departures are 15 MIT over RBS and EON. East departures are listed as 1x15, but east departures are stopped. Departure Delays + 60. Area Sup came to TMU and studied CIWS. ZOB agreed to accept the pathfinders and Sup is concerned about what happens to the pathfinders when they get to the weather which is in ZAU airspace. Which direction with they deviate? Area of concern shows growth. Still no effort to reduce southbound restrictions. On the other hand, tops are at 30 kft.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	5	16
ZAU-3-27	2232	Eastbound departures still stopped.			
ZAU-3-28	2233	STMC and Operations Manager discuss the weather situation over Dryer fix using CIWS.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	4, 5	7, 12, 16
ZAU-3-29	2243	Area Sup reports that the pathfinders do not like the route. They deviated. The Area Sup does not want more traffic on the route. (Note: Area of growth on CIWS not observed in TMU when pathfinder decision was initially made).			
ZAU-3-30	2258	STMC showed the observer the CCFP forecast. At the last SPO. CCFP showed no weather in ZAU. The updated CCFP still has no weather in ZAU even though weather currently exists there. The STMC explained that the weather does not meet the CCFP criteria, yet it causes ATC problems. The STMC said they "can take the CCFP and get rid of it. This (CIWS) tells me what I need to know."	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	5	16
ZAU-3-31	2300	Departure delays at ORD are +90 minutes for south departures and +45 for east departures. Restrictions are east 1x20, south 15 MIT over RBS and EON. The east-west line of weather in ZOB is very persistent. Weather south of ORD continues to dissipate very slowly.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-32	2307	ZOB offered a route over FWA/MIZAR based on pathfinders. The Area doesn't want anyone over FWA. ORD is still using three runways. SCC is considering a ground stop to push traffic out to the next hour.			
ZAU-3-33	2309	The CWSU visited the unit, apparently to hang out. Observer did not see the CWSU provide weather information to anyone.			
ZAU-3-34	2315	SPO: GDPs for ATL, EWR, and PHL. The STMC reports that CCFP shows a null forecast for ZAU but they are dealing with lots of tactical reroutes. ORD departure delays are +30 minutes. A second tier ground stop for ORD begins 2330 with an 80 AAR. STMC asks for routes north to the east. ZOB denies the request due to volume. J56/J95 route is very busy. ZOB suggested capping. STMC reports tops to 27 kft, so capping is not a good idea. BOS landing traffic is routed through Toronto and ZNY traffic is over VHP/ROD/J29. These routes should help shorten the ground stop.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	2, 5	3, 12, 16
		ZOB			
ZOB-3-1	1900	Storms are developing across the CIWS domain as remnants of Hurricane Dennis spin in southern IL. Two lines of thunderstorms have developed in OH, one blocking much of the east to west routes (J60 and J64 with tops to 48 kft). The Area 4 Sup used CIWS to proactively find routes southbound out of DTW DTA and then informed the ASP of the routes. The Sup indicated that, without CIWS, he might have waited until the TMC worked out the plan, but with CIWS he found a reroute and then informed the ASP TMC. He believed it may have saved some departure delay (possibly 15 minutes).	CIWS VIL, Storm Motion, CWF	2, 5	3, 12, 14, 16
ZOB-3-2	1940	Storms continue to grow in Areas 4 and 5 causing major deviations on J60 and J64.			
ZOB-3-3	Inter-view	Area 4 Sup said that CIWS was used to make the decision to join J60 and J64. The observer believes that this decision was being worked out both by the TMC and the Area Sup at the same time.	CIWS VIL, Storm Motion, Lightning, Echo Tops,	2, 5	3, 12, 14, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-4	2000	The observer noted that the STMC split the ESP position that works DTW and ZDC so that one TMC can concentrate on each location. The STMC said that CIWS played a part in opening the position.	CIWS VIL, CWF, Growth and Decay Trends	5	14, 15, 16
ZOB-3-5	2010	More storms have developed in southern portions of DTW airspace. Southern DTAs are becoming blocked from DTW. Area 4 Sup came into the TMU and discussed options for SWAPs with the TMU.	CIWS VIL, CWF, Echo Tops	5	12, 16
ZOB-3-6	Inter-view	The ESP TMC said "There 15 MIT is a disaster." when referencing the spacing they were getting from PIT for west bound traffic.			
ZOB-3-7	1935	Weather is moving along J60. J60 is closed and traffic is moved down to J64 with 15 MIT per strat. Deviations precipitated the move, not CIWS.	PIREPs, CIWS VIL, Echo Tops, CWF, Lightning	5	16
ZOB-3-8	1942	Weather is moving into the BWI area. ATCSCC called ZOB and ZDC to coordinate what to do with BWI traffic. CIWS forecast was used. No significant time savings, but coordination seemed to flow more easily compared to other calls.	ETMS, CIWS Echo Tops Forecast, CWF	2, 5	3, 12
ZOB-3-9	2007	Weather is approaching CLE and may impact westbound departures. Area 4 Sup came to talk with the TMC (CLE ASP) about moving CLE westbound departures for the 5pm push. Trying to coordinate whether to do SWAPs with Chicago traffic. Area Sup suggests taking CLE over Carleton. Area Sup says CIWS forecast made her initiate the conversation with TMC about 25 minutes sooner than she would have without CIWS. This allowed a pathfinder to go before the 5pm push. Ended up with 30 MIT on westbound departures out of CLE instead of a 45-60 minute GS for all CLE westbound departures.	ETMS, CIWS Echo Tops Forecast, CWF	4, 5	7, 12, 14
ZOB-3-10	2012	Weather approaching CLE and may impact westbound departures. At 2012, the TMC (using CIWS forecast and ETMS traffic) decides to wait on the wholesale SWAP and asks for a pathfinder from CLE to Midway. If the pathfinder can pick its way through, then route will stay in place with minor MIT. If not, then they will go to wholesale SWAPs and reroute all Westbound in the 5pm push.	ETMS, CIWS Echo Tops Forecast, CWF	1	1

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-11	2037	Weather is approaching CLE and may impact westbound departures. A pathfinder is up and picking his way through the weather. All looks good. TMC puts in 30 MIT on westbounds out of CLE over normal departure routes. If the Area Sup had not come in as soon as she had, the TMC would not have had time to request a pathfinder. Without the pathfinder, the TMC would have put in a GS for all CLE westbounds for 45-60 minutes during the 5pm departure push. Significant delay would have mostly likely happened.	CIWS Echo Tops Forecast, CWF	3, 5	4, 12, 14
ZOB-3-12	2300	Weather over PIT. PIT is in a GS due to weather over the airport. No real CIWS usage.			
ZOB-3-13	2338	Area 6 has weather but the aircraft are just deviating and the Area Sup doesn't see a problem.	CIWS Echo Tops Forecast, CWF	5	12, 16
ZOB-3-14	2355	J60 is still closed with traffic along J64. J152 is still flowing into NY metro and PHL. Some storms are developing along J80; however, they are staying to the north so it is not a problem. As long as they do not deviate into ZID, everything will be fine. Watching CIWS forecast, but no real issues at this time.	CIWS Echo Tops Forecast, CWF	5	16
ZOB-3-15	0013	Using mostly winds to determine en route spacing.	ETMS	1, 5	
ZOB-3-16	0039	Really using WARP a lot tonight with ETMS winds.			
ZOB-3-17	0105	Weather moving into DTW. DTW DSP made a call at 0030 using CIWS forecasts to move MIZAR traffic over POLAR and CETUS traffic over SPICA. While CIWS played a role, TMC saw no time savings, although he believes CIWS resulted in less workload and more confidence in decision.	ETMS, WARP, CIWS Echo Tops Forecast, CWF, VIL, Echo Tops	4	7

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-18	0125	Weather moving out of DTW to east and south. DTW DSP used CIWS forecast to take DTW southbound departures out east, wide around CETUS and then south. No real time savings but improved internal coordination, increased situational awareness, and decreased workload.	ETMS, WARP, CIWS Echo Tops Forecast, CWF, VIL, Echo Tops	4	7, 12, 14, 16
		ZJX			
ZJX-3-1	1200	Military operations are scheduled for today. TMU has received the NOTAM for the shuttle launch tomorrow.	NEXRAD, WARP, ITWS	5	
ZJX-3-2	1300	No weather at this time. STMC is working out plans for reroutes tomorrow due to the shuttle launch.			
ZJX-3-3	1400	No weather.			
ZJX-3-4	1515	SPO: ZJX requested routine constraints for TPA/MCO because the CCFP is forecasting thunderstorms in those areas.	CCFP	5	
ZJX-3-5	1558	Weather is developing in the center of FL, north of MCO, and along the southeast coast.	WARP	5	
ZJX-3-6	1700	The east coast sea breeze is pushing the showers along the southeast coast inland. Showers over Cross City (Big Bend area) are moving slowly to the south.	ITWS, NEXRAD	5	
ZJX-3-7	1724	Storms are developing between MCCO and Cape.	ITWS, NEXRAD	5	
ZJX-3-8	1752	Showers building around MCO.			
ZJX-3-9	1810	Storms are 10 nmi northwest of MCO with wind shear/microbursts present.	ITWS	5	
ZJX-3-10	1853	Weather over the outer approach area of MCO. Traffic is still landing.	NEXRAD	3, 5	
ZJX-3-11	1900	Area of thunderstorms north and northeast of TPA are blocking the airway into TPA. They are moving traffic from the LEESE arrival to MINNI.	ITWS, NEXRAD	3, 5	
ZJX-3-12	1905	MCO arrivals to MINNI. MCO changed to north operations. The MOA at Palatka is active. Volume has slowed so the weather is not causing much of a problem.	NEXRAD, WARP, ITWS	3, 5	
ZJX-3-13	1928	TPA is holding traffic due to storms. MINNI arrival is closed.			
ZJX-3-14	1929	West of MCO is closed off. They are changing arrivals to BITHO24.			
ZJX-3-15	2010	Weather is beginning to dissipate.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZTL			
ZTL-3-1	1650	A broken line of weather is forming west and north of the airport. A GDP is already in effect for ATL.	WARP, ETMS	5	
ZTL-3-2	1653	ATCSCC SvrWx called to talk about the 19Z hour, during which 89 aircraft are scheduled to arrive. They decided to do nothing.			
ZTL-3-3	1713	A line of thunderstorms extends to the west and northwest. Four flights in ZAB were moved to the southeast arrival gate for ATL (too much volume with weather at 1915 - 1930).	ETMS	4, 5	
ZTL-3-4	1715	SPO: Weather formed earlier and stronger than expected. The CCFP 6-hour forecast shows earlier dissipation.	CCFP	5	
ZTL-3-5	1727	A line of thunderstorms extends north and west of ATL. The ZTL STMC called ZME and ZHU to reroute all traffic west and south of ZME south to Jackson, MS and Montgomery then to the southwest arrival fix for ATL. (The northwest ATL arrival fix is impacted.) WARP and ETMS were the primary tools for this decision, but ITWS was used for storm motion.	WARP, ETMS, ITWS	2, 5	
ZTL-3-6	1731	Weather extends from Houston to New Orleans. Aircraft will be routed though the gap, around the south side of the weather, and to the southwest arrival fix. They are hoping the gap stays open.	WARP, ETMS	4	
ZTL-3-7	1735	Considering what to do if the gap in the weather closes. The Area Sup is concerned about aircraft avoiding ROME (the northwest fix) where weather is approaching.	WARP, ETMS	5	
ZTL-3-8	1736	The line of weather is moving over ROME. ROME arrivals are shut off. ZTL is performing tactical reroutes, some into departure gates. They are considering a modified ROME playbook for traffic from the northwest (ZID and ZAU). Traffic needs to make it east to J186. They are concerned about when weather will move onto the reroute.	WARP, ETMS, ITWS	2, 5	
ZTL-3-9	1740	Too many deviations are making the traffic flow too complex. To get a handle on things, a first tier ground stop for ATL landing traffic is implemented. ATL is concerned that the airport may close, but "ITWS shows it is OK for now."	ITWS	3, 5	
ZTL-3-10	1743	Still trying to get a handle on traffic. A MIT restriction is added to all ATL arrivals.	WARP, ETMS	1, 5	
ZTL-3-11	1745	An ATL ground stop for first tier, ZFW, and ZKC, update 1845. (They might be able to handle some internals.)	WARP, ETMS	3	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-12	1748	20 MIT for all ATL arrivals until 2030. ZTL coordinated with ZJX to slow FL traffic to ATL. It is likely this traffic will deviate and there is lots of traffic heading for the south fixes.	ETMS	1	
ZTL-3-13	1755	CWSU briefs TMU about weather moving over MACEY (northeast and most heavily used fix) at 1915 - 1930 and 2000 - 2100 and about the possible loss of the northeast fix and moving traffic to the southwest fix.	CWSU	4, 5	
ZTL-3-14	1826	Traffic is light so the ground stop is ending early to keep pressure on ATL. They are trying to increase the GDP rate. They settled on a 68 rate for the next 2 hours. (This was coordinated with A80 at 1835.)	ETMS	3	
ZTL-3-15	1840	Aircraft are deviating around weather. Traffic is single stream over Dooley and Murser (over Athens). This is a result of a request from Area 2. Northeast arrivals are deviating into east departures.			
ZTL-3-16	1859	The line of weather is progressing slowly southeast. Area 5 plans to stop west departures in 10 more minutes due to too many deviations.	Area 5, ETMS	3	
ZTL-3-17	1906	Weather is due to impact ATL in 90 minutes. They will have to pick a side of the weather to be on. CLT will be impacted at 22Z.	CWSU	3, 5	
ZTL-3-18	1915	SPO: Losing the northeast fix.			
ZTL-3-19	1945	A near-solid line of weather 15 nmi west and north is still moving toward ATL. TMU is trying to decide if a GS is needed and when to swap traffic to the north side. They will try to run as long as possible.	ETMS	3, 4, 5	
ZTL-3-20	1955	TMC is talking to the TRACON. They plan to run another hour before the weather hits ATL.	ITWS, ETMS	3	
ZTL-3-21	2008	The airport will not be impacted as soon as originally thought. The impact on the fixes may be delayed too. The CWSU reports that the weather is moving slower and will not impact the airport as quickly as expected.	CWSU, ITWS	3, 5	
ZTL-3-22	2031	It now appears that the airport will remain open.			
ZTL-3-23	2049	A small cell popped up over ATL, but traffic is not being affected yet.	CWSU, ITWS	3	
ZTL-3-24	2054	Level 4 cell over ATL.	ITWS	5	
ZTL-3-25	2058	Level 4 cell over ATL with 20 kt wind shear and alert.	ITWS	5	
ZTL-3-26	2059	25 kt wind shear.	ITWS	5	
ZTL-3-27	2101	Cell collapsing; now level 2. No go-arounds; normal landing.	ITWS	3, 5	
ZTL-3-28	2114	More cells are popping up very close to ATL (within 10 nmi). Everyone is concerned that the airport will close.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-29	2116	A first tier ground stop is implemented to slow traffic into the TRACON; update 2215. Too much weather with deviations.	ITWS	3	
ZTL-3-30	2118	SPO: ITWS was referenced on the telecon. ATCSCC is using ITWS.			
ZTL-3-31	2120	A80, ATCSCC, and Delta all referenced ITWS for ATL.	ITWS	5	
ZTL-3-32	2126	Southwest arrival fix shut off.	WARP	4	
ZTL-3-33	2136	All arrivals are shut off; holding at all fixes. Level 5 cell is west of ATL. Ground stop extends to the second tier now; update 2215.	ITWS, ETMS	3	
ZTL-3-34	2144	Roughly 60 planes are holding for ATL.	ETMS		
ZTL-3-35	2152	CWSU briefs TMU on weather approaching from the west.	CWSU, ITWS	5	
ZTL-3-36	2204	Accepting traffic slowly off all fixes. Level 2 weather is over ATL and level 3 - 5 weather is southeast, east, and northeast at 7 nmi.	ITWS	5	
ZTL-3-37		A GDP is in effect with rates of 70/70/86/86/88.	FSM		
ZTL-3-38	2208	Hold times average 30 minutes.			
ZTL-3-39	2211	Aircraft landing ATL do not like the weather and are refusing to land. Two fixes are lost and ground stop is not cancelled, but extended to 2230. The weather depiction on ITWS doesn't look that bad, but aircraft are refusing.	ITWS, ETMS	3, 5	
ZTL-3-40	2225	Some internals are trying the approach routes.			
ZTL-3-41	2233	Ground stop cancelled. All weather is east of ATL and they are slowly coming out of the holds.	ITWS, ETMS	5	
ZTL-3-42	2243	Departure delays are approaching 45 minutes.			
ZTL-3-43	2250	Working east departure gates to cut down on departure delays.			
ZTL-3-44	1726	Weather is building over the RMG (ERIN/DALAS) arrival fix (NW arrivals to ATL). The line will soon prevent use of this fix for arrivals. ZME, ZFW, ZHU contacted via ATCSCC and advised to reroute RMG arrivals via JAN MGM LGC TIROE ATL. SCC coordinated the reroute with other Centers.	Mosaics, aircraft movement, Area reports, ETMS	4, 5	
ZTL-3-45	1731	RMG arrivals now unable to cross into TRACON airspace because of weather. The few remaining RMG arrival aircraft are rerouted to other ATL arrival fixes.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-46	1732	Aircraft are being rerouted internally from over RMG (NW arrivals to ATL) to over MACEY (NE arrivals to ATL). Now very high volume. There is concern in the ZTL TMU that the reroutes (aircraft from ZME, ZHU, and ZFW) could end up on the southeast side of the weather after the line passes over ATL. ZTL comments that undoing a program is often much more difficult than implementing it (which really means that once a decision is made, you're usually stuck with the outcome) CIWS should allow for more effective initial decisions.	Mosaic, ETMS	4, 5	
ZTL-3-47	1740	Deviations continue with traffic volume building rapidly at remaining (still open) arrival fixes. A first tier (plus ZKC and ZFW) ground stop to ATL in implemented. Local departures already on APREQ (ZTL airports are required to request approval (APREQ) for departures to ATL). Departures are released (or delayed) as appropriate. Lack of available weather information (despite lots of help from CWSU) prevented a better plan, though delays were guaranteed with an arrival fix closed. The implemented plan did correct the problem over RMG, but resultant traffic over the SE arrival fix caused the ground stop.	Mosaic, ITWS, ETMS	4	
ZTL-3-48	1741	The Area calls concerning deviating traffic near the ZDC boundary. A call was made to ZDC for 15 MIT on J75. DC area (ATL) departures are to be rerouted over SINCA (SE arrival fix to ATL).	Aircraft movement	2	
ZTL-3-49	1747	Convective weather is near the TIROE (SW arrival) fix. A call was made to ZJX for 20 MIT on like types landing ATL, followed by call to ZME for 10 MIT (now) landing ATL, and 15 MIT ASAP.	ETMS	4	
ZTL-3-50	1827	One aircraft got through the weather (BHM RMG ATL) however, concern remains that numerous aircraft may be on the south (wrong side) of the line when the weather passes over ATL. Still in a first tier ground stop for ATL.	WARP, ETMS	5	
ZTL-3-51	1837	SW arrival sector (Tiroe 09) reports ATL west departures deviating south into arrivals. The ZTL TMU is considering implementing CDRs.	Sector reports, aircraft movement	5	
ZTL-3-52	1840	Macey arrivals to ATL (from NE) are deviating south into east departure sector. ATL east departures are restricted to 15MIT and northernmost east departure fix closed.	Sector reports, aircraft movement	4	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-53	1859	ATL west departures are deviating south into Tiroe (09) arrivals. Tiroe (09) Area Supervisor advises TMU to anticipate shutting off west departures in 10 minutes.	Aircraft movement	5	
ZTL-3-54	1906	One of numerous CWSU briefings is to expect thunderstorms crossing ATL @2030 until 2200. Weather is expected to be clear of RMG at 2100, expect impact at Macey (NW) arrivals for about 3 hours. Impact at CLT 2100-2200.	CWSU	5	
ZTL-3-55	1910	Weather deviations continue for SW arrivals. Area 5 (LGC/Torie arrivals) requests at or below FL330 for aircraft landing ATL.	Aircraft movement	5	
ZTL-3-56	1914	ATL west departures continue to deviate into SW (LGC/Tiroe) arrivals. ATL west departures stopped, CDRs in use, aircraft will be rerouted out south departure gate.	Aircraft movement	3, 5	
ZTL-3-57	1925	Logan fix (NW/Macey arrivals) shutting down due to thunderstorms. NW arrival deviations will be accommodated in east departure sector, by restricting east departures to single stream over southernmost east departure fix. The time to coordinate this plan was lengthy because the TMU was very busy.	Aircraft movement	4	
ZTL-3-58	1926	Arrival traffic volume continues to build for aircraft over LGC/Tiroe (SW). Deviations continue. NW arrivals still being routed over this fix. Area Supervisor tells TMU to advise ZME to expect to hold some ATL arrivals. Observer did not see the TMC call ZME.	Traffic volume, Deviations, Aircraft movement	3, 4	
ZTL-3-59	1930	Traffic volume in LGC/Tiroe (SW) arrival sectors (still deviating) is an issue. Three ATL arrivals near TPA (ZJX airspace) are to be rerouted out of LGC/Tiroe sectors and into ATL via the SE arrival gates (to reduce SW volume). The coordination with ZJX took extra time because ZJX would not answer the phone.	ETMS	4	
ZTL-3-60	1938	Area 5 (SW arrivals LGC/Tiroe) continues high volume, high workload, and deviations due to thunderstorms. Area 5 Supervisor requests 15 MIT on like types departing west off of CLT and RDU (near immediate relief for traffic volume is available when departures are restricted – a tool often used by ZTL that avoids reroutes and associated workloads).	Traffic volume	4	
ZTL-3-61	2008	CWSU briefing indicates that ATL will not close due to thunderstorms as soon as predicted. Expect to lose LGC/Tiroe arrival fixes in 30 minutes. RMG (NW arrivals) will reopen later than predicted.	CWSU	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-62	2012	Stop CLT west departures.			
ZTL-3-63	2049	CWSU reports level 3 thunderstorms over the west side of runways at ATL.	CWSU, ITWS	5	
ZTL-3-64	2055	ATL reports thunderstorms over the runways. Anvils are spreading and visibilities are reduced.			
ZTL-3-65	2057	20 to 25 kt wind shear on north runways.	ITWS	5	
ZTL-3-66	2101	Runways clear of storms.	ITWS	5	
ZTL-3-67	2114	The ZTL TMU is concerned with growing weather west of ATL runways. Impact unknown.	ITWS	5	
ZTL-3-68	2115	ATL weather concerns grow. First tier ground stop for ATL.	ITWS	3, 5	
ZTL-3-69	2121	CWSU briefs the TMU concerning ATL weather.	CWSU	5	
ZTL-3-70	2136	ZTL holding aircraft at all fixes landing ATL, expect 15 min delay. Expecting 88 aircraft holding – 66 already in airspace. CIWS could have helped here – no good weather information on thunderstorm growth or movement. Large delay and workload in sectors.			
ZTL-3-71	2142	North departures stopped.			
ZTL-3-72	2210	ATL shuts off Macey (NE) arrivals due to weather.	ATL	4	
ZTL-3-73	2214	ATL shuts off RMG/DALAS (NW) arrivals due to weather.	ATL	4	
ZTL-3-74	2230	ATL ground stop lifted; resuming normal operations.			

CIWS Benefits Assessment
Observation Period #3 Observations Summary
Day 2 – July 13, 2005

Participating Facilities: ZAU, ZOB, ZJX, ZTL, ZDC, ZBW, ZNY

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZAU			
ZAU-3-35	1413	A line of weather oriented northeast-southwest across upper MI to northwest IL and north of Chicago is dissipating. The greatest weather impact at this time is low ceiling ground stop. Current restrictions are: east 2x7, south EON/DNV x20 per route and at or above 240. The restriction over DNV may have come from ZID. LGA and PHL are ground stopped and there is an ESP for CVG due to volume. There are departure delays for south- and westbound traffic. The ceiling is at 600 and has caused parallel "9" operations. Departures take off on runway 4 and get backed up. GDP for ORD in affect. Four or five NASA Ames observers are in the unit today. With this many observers, it will be difficult for the observer to interview the TMCs.			
ZAU-3-36	1444	ATL was added to the ESP (call for release).			
ZAU-3-37	1447	GDP for LGA. The ground stop is cancelled and EDCTs will be issued.			
ZAU-3-38	1519	GDP for PHL void 0359 due to low ceilingground stop. Ground stop EWR update 1330			
ZAU-3-39	1515	SPO: The GDP for ORD is cancelled and the AAR is now 100. STMC warns users to expect reroutes due to weather in ZAU. The STMC consulted the CIWS display throughout the discussion. Current departure restrictions include ESPs for CVG and ATL, EDCTs for LGA, ATL, and PHL, east 2x7.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay Trends	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-40	1550	Arrival position TMC identified a potential problem with EWR arrivals. Currently EWR is ground stopped (first tier) but there is no GDP in place for when the ground stop is cancelled. The Arrival TMC is concerned that when the ground stop is cancelled, there will be too much overhead traffic to launch the ORD departures and that there might be sector overload. The TMC does not want to put a restriction on ZKC without a restriction from ZOB. The En Route TMC position was opened to handle the problem.			
ZAU-3-41	1605				
ZAU-3-42	1607	En Route TMC called ZOB to discuss plans and concerns. ZOB has not passed back any restrictions. The En Route TMC is prompting ZOB to take some action sooner rather than later. ZOB "didn't know about the weather" at EWR. ZOB thinks they are going to hold and told ZAU to plan for a 30 MIT restriction from ZOB. ZAU will pass back a 60 MIT restriction to ZKC for EWR landing traffic starting 1715 for traffic on the north and 30 MIT for others.			
ZAU-3-43	1613	SCC called to acknowledge the issue.			
ZAU-3-44	1639	Ground stop for EWR expired but the GDP on the log has not yet been coordinated. No significant weather in ZAU at this time. All activity is preparing for EWR push. No significant CIWS usage at this time.			
ZAU-3-45	1647	Holding over PLANO. This is used as a "speed bump."			
ZAU-3-46	1700	30 as 1 on DC Metro departures going into ZID and ZOB.			
ZAU-3-47	1715	SPO: Departure delays at ORD are 60 10 180 for NY metro landers, 60 for DC metro landers, and 15 for PHL/CVG (due to weather). Northbound routes from ZDC to ZBW are closed. They are dialing back the rates on the GDPs. N90, when referring to JFK, was overheard saying "looking at CIWS we should be pretty good for a couple of hours." Current restrictions are ESP for CVG, CLE, EWR, JFK, and DC metros; EDCTs for LGA, ATL, PHL, TEB, EWR, and IAD; ground stops for EWR, LGA, ATL, and IAD; SWAP for LGA.	CIWS VIL, Echo Tops, Storm Motion, Growth and Decay Trends	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-48	.	The observer asked the Departure position TMC about CIWS use. He stated that opening routes early is "huge". It wasn't used yesterday (7/12) as much because there was not much that could be done. Traffic was shut off east and had no where to go. In this case, the Area opens the airspace. CIWS does save time on internal coordination. The TMC says CIWS is the "best information I've got" to open fixes.			
ZAU-3-49	1802	ZOB is holding for IAD "in a bad place." ZAU is expecting to be shut off. Ground stop for IAD update 1915. EWR/LGA 30 MIT as 1.			
ZAU-3-50	1818	ATL landing traffic is over J73/TTH with 35 MIT from 1930 to 2045. Weather is building in the southeast corner of ZAU. If it continues to move west, it could impact southeast arrivals.	CIWS VIL, Growth and Decay Trends, Echo Tops, Storm Motion, CWF	5	16
ZAU-3-51	1823	EWR and LGA are 30 MIT per airport (easing the restriction).			
ZAU-3-52	1833	No-notice hold for PHL landing traffic is passed back from ZOB. PHL is ground stopped.			
ZAU-3-53	1855	Observer asked the Arrival TMC why he used WARP over CIWS. He likes the higher-resolution satellite presentation better.			
ZAU-3-54	1858	Cumulus are building on the IN/MI border. There is concern that east departures will be impacted. The Arrival TMC briefed the STMC on the situation using the CIWS SD and asked that someone be assigned to work on the problem. The Departure position was opened and the STMC (using CIWS) asked the Departure TMC to call SCC about getting some routes for east departures. Currently, traffic to PHL is shut off. They are looking for a route north. An ORD pathfinder will go over JST.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	2, 5	3, 12, 14, 15, 16
ZAU-3-55	1910	ZAU will stay in the ground stop for IAD. The ground stop is ending with a GDP, but no reroute is available through ZOB. ZAU decided to stay in the ground stop rather than let aircraft depart and hold.			
ZAU-3-56	1913	Current restrictions are east 2x7; south - EON/DNV 20 MIT per route at or above 240; ESPs for CVG, CLE, DC metros, EWR, JFK, ATL, DTW, and MSP.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-57	1915	SPO: Departure delays for NY are less than last reported, but expecting increase. The STMC reports that he expects problems with departures around 5PM. Arrivals are coming in but no departures are able to leave. During the briefing, the STMC put route overlays on the SD and used the Pan Mode to assess weather in other Centers. Departure delays are reaching 120+ for all NY airports. PHL is out of the ground stop and using a south route with 30 MIT for over flights through ZOB. ZOB is trying a pathfinder for J80. ZID questioned the route for PHL traffic through ZID. They quoted storm motion (using CIWS). They are trying to use pathfinders to open J80 and suggest IAD traffic over Louisville with 40 MIT to ZID.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	5	12, 16
ZAU-3-58	1924	ZAU is holding for JFK.			
ZAU-3-59	2015	ZOB wants the FWA stream over LCH. The ZAU TMC states that "CIWS shows weather at LCH in 90 minutes." The TMC refused the request until after the CWSU briefing. CWSU says weather is moving toward LCH, so both fixes (FWA and LCH) may be impacted. Weather is firing where the sun reaches the ground. Possible isolated thunderstorms in the west of the Center for the next two hours. ORD is at a 100 AAR using the X-plan. IAD traffic is going south through ZID, PHL departures are south with over flights through ZOB. Expect weather on routes with departures likely to be impacted.	CWSU, CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay, CWF	2, 5	3, 12, 14
ZAU-3-60	2030	Arrival position SD has forecast contours displayed. The TMC is coordinating with SCC and ZOB to determine a good route. The ZOB TMC reported that he was using CIWS to determine FWA and LCH impacts. They decided to wait and see. CIWS was used to strengthen their argument.	CWSU, CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay, CWF	5	12, 16
ZAU-3-61	Inter-view	The observer asked the Departure position TMC how he uses CIWS. He stated that he mostly uses ETMS. He uses CIWS for Growth and Decay Trends and echo tops because CIWS updates faster.			
ZAU-3-62	2104	Normal routes to PHL with 20 MIT.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-63	2106	Opening DAY to MIZAR for DTW landing traffic. Traffic swapped over DAY now. They are not using LFD because weather is developing there.	CIWS VIL, Growth and Decay Trends	5	16
ZAU-3-64	2115	SPO: JFK is backed up with departures. They are looking for pathfinders. Programs are being considered to reduce arrival demand to help launch departures. All NY metros airports are experiencing significant delays. ZAU and ZOB are stopped to JFK. All other Centers are going north through ZBW. ZOB reports J80 will be closed for a while. Weather is rebuilding with tops to 39 kft. SCC is asking ZOB to identify pathfinder opportunities to open J80.			
ZAU-3-65	2145	Departure position TMC consulted CIWS and WARP. He is concerned about southbound departure corridor. Weather is moving southwest onto J73 at GUIDO. CIWS shows impact in one hour. Tops 30 - 40 kft.	CIWS VIL, CWF, WARP	2, 5	14, 16
ZAU-3-66	2153	TMC called SCC SvrWx to discuss concerns. SvrWx said, "They are getting out right now. Good." and hung up. CIWS forecast show impact in one hour.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay, CWF	5	16
ZAU-3-67	2154	TMC called ZKC to move traffic. He wants traffic landing in the west Centers (Oklahoma, TX, and desert southwest) through ZKC. Traffic from ZJX, Miami Center, and ZTL over Moline/Kirksville. He told ZKC to expect deviations first then reroute EON/RBS/ENL.			
ZAU-3-68	2158	TMC is coordinating the above with the Areas. They are moving RBS now to accommodate deviations. They are trying to dry up the stream; leaving a few through ZID. Traffic is 2 x 20 and 2 x 30 for satellites.			
ZAU-3-69	2205	East Area Sup requests east departures at 2 x 10 and 1 x 15.			
ZAU-3-70	2206	TMC called the TRACON to notify them of the plan.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-71	2213	ZID route to IAD is closed. Ground stop IAD. Radar coverage is missing. STMC asked about the loss of data.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	5	16
ZAU-3-72	2253	DC metro landers are back to normal routes with 30 MIT per airport.			
ZAU-3-73	2303	STMC reported status of radar outage. He went to the CWSU, who referred him to Airways Facilities. STMC says, "I'm a patient man, but I need my tools back."			
ZAU-3-74	2305	LGA ground stop cancelled; EWR still in ground stop. CIWS use is nil now due to loss of coverage.			
ZAU-3-75	2310	Coordinator TMC worked out a route south through ZID for EWR/LGA landers. No CIWS coverage at this time. TMC tried to set up a SWAP to reduce the amount of typing needed to issue the new route. Did not work. (Not sure if it didn't work because the powers that be didn't want to call it a SWAP or because it wasn't an "official" SWAP route and the computer would not accept it.)			
ZAU-3-76	2322	Eastbound traffic is shut off. STMC says he needed CIWS because he was surprised by this decision. He would have known if CIWS had been up. It would have saved about 30 minutes because he could have coordinated alternate routes sooner and not been shut off completely. Thunderstorms with 21 to 40 kft tops fill the east departure sector.			
ZAU-3-77	2315	SPO: 3.5 to 4 hour departure delays are reported for NY metro airports; 1 to 1.5 for DC metros. STMC notes that CIWS is coming back (completely back by 2321). STMC says he was blind until CIWS came back. STMC reported echo tops on the SPO. Observer helped STMC set up an echo tops window on the SD and explained the products. STMC thanked the observer saying it was "very helpful." SCC quoted CIWS tops and lightning over DUNKS during the SPO.	CIWS VIL, Storm Motion, Echo Tops, Lightning, Growth and Decay	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZAU-3-78	Inter-view	Observer called ZID to ask about CIWS usage. The ZID TMC said they used CIWS to plan over flights and reroutes.	CIWS Echo Tops, Storm Motion		
ZAU-3-79	0003	PHL ground stop ended.			
ZAU-3-80	0020	En Route TMC tells Departure TMC that weather between DTW and Lake Michigan is dissipating and asked why they weren't using the east departure route. The Departure TMC reported that ZOB would not allow this. The Departure TMC then talked to the East Area Sup and ZOB got the route open. They can use the SWAP route south until 02Z to "bail out."	WARP, CIWS VIL, Growth and Decay Trends	1, 5	1, 12, 16
		ZOB			
ZOB-3-19	1330	Traffic problem this morning… getting traffic into and out ZBW due to level 6, FL 400+ thunderstorms in western NY. Storms also developing in the ZNY metro area. Traffic problems had been worked out before 1300 Z and weather was decaying.	Unknown (TMC's suggested that they had been using CIWS)		
ZOB-3-20	1410	Thunderstorms in the NYC metro area have resulted in a ground stop for traffic inbound to NYC and have caused holding in ZOB sectors. CIWS has been used by STMC, CP and Area Sups to plan the extent of the ground stops.	CIWS CWF	3, 5	4, 12, 16
ZOB-3-21	Note	TMU was short staffed this morning and had to call in a STMC to work E ESP position.			
ZOB-3-22	1515	SPO: Thunderstorms are already developing in an area that the 17Z CCFP shows as a low probability area of development (W PA). Storms continue to develop around the NYC metro airports. Big issue now are the storms in the N90 TRACON. The STMC explains to me that Airlines understand GDP's when airports have reduced capacity but complain to no end when GDP's are in place because enroute airspace is at reduced capacity. Choke points will be used.	CIWS VIL, CWF, WARP, CCFP, ETMS	5	16
ZOB-3-23	1610	Very few storms in the ZOB airspace, Area 6 has a few storms. Area 6 Sup said that he used CIWS to see that there would be problems on J80 and J152 and then called the TMU and ask them to start planning for deviations based on what he was seeing on CIWS.	CIWS VIL, ASR-mosaic, CWF, Echo Tops.	2, 5	3, 12, 14, 16

Identifier	Time (UTC)	ATC C
ZOB-3-24	1625	Storms in N SvrWx and ZNY airspac J80. Based test.
ZOB-3-25	1650	20 MIT restr
ZOB-3-26	1705	Storms cont and storms i doesn't have controllers w Routes were requested. C The Area Su Some workl used. Estima coordination
ZOB-3-27	1715	SPO: STMC ZOB airports
ZOB-3-28	1715	During the S at CIWS and
ZOB-3-29	1725	MET and ST for open rou information restrictions. to weather i
ZOB-3-30	1745	Growth cont of DTW (Are Sup called i one look at Area Sup re said that it r coordinate.

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-31	1800	Thunderstorms have developed around Erie PA and on J29 (Area 7). CP and STMC are concerned that they may lose J29 (feeding ZBW). Both look at CIWS and conclude that they can keep the route open with deviations (north over Lake Erie). (Note -- Storms stayed south of Lake Erie all day keeping J29 open.)	CIWS VIL, Growth and Decay Trends	1	1, 14
ZOB-3-32	Inter-view	The STMC and TMCs have noticed the area of showers near the low center. CIWS has been showing low tops and no growth in the area (ZID airspace). Talking to the ESP working DC traffic. He indicated that he had requested a route through ZID but SCC SvrWx would not entertain the plan. The TMC suggested that SCC SvrWx would rather try to keep working traffic around known weather than move traffic into an area of unknown and possible growing weather.	CIWS Echo Tops, Growth and Decay Trends	5	16
ZOB-3-33	1815	SvrWx called STMC about Can RR. CAN 1 will be tried. (Users need at least an hour before RR so they can get AC ready)	CIWS VIL, Echo Tops	3, 5	5, 12, 16
ZOB-3-34	1820	Level 6 thunderstorms in Areas 5, 6, and 7. Area 5 Sup came into the TMU to talk to the STMC about planning J60 traffic. Area Sup later indicated that he looked at Area 6's CIWS before coming to TMU. Traffic coming from ZNY is deviating on J60 and 64. STMC and Area Sup decide to take J60 and J64 as one with 20 MIT.	WARP, CIWS VIL, Echo Tops, CWF, Storm Motion, Satellite, Lightning	1, 5	2, 12
ZOB-3-35	1838	The east-west line of thunderstorms is blocking the north routes to DTW over ROD. ASP is devising a plan to bring aircraft around the weather to the east and then in from the SPICA ATA.	CIWS ASR Precip, VIL, CWF	2	3, 7
ZOB-3-36	1840	Interesting, SWA called CP and ask if they could get out a PIT for PHL and fly E at 7 kft. CP said they could but they would not get any higher for quite some time (until ZNY) on J152. Sounded like a very strange request. SWA was told not to expect or request any higher. Later found the flight never departed	CIWS VIL	5	16
ZOB-3-37	1845	NOTE: CAN 1 westbound reroute running.			
ZOB-3-38	1850	Storms decaying on J152. CP Oked two pathfinders for J152.	CIWS VIL, Echo Tops	1	11
ZOB-3-39	1857	Ground stop EWR, LGA due to storms west of NYC.			
ZOB-3-40	1911	Storms blocking J60 and J64 as well as inbound NYC traffic. Area 5 Sup comes back into TMU and tells STMC that he needs the J60/64 route closed.	DSR	1, 5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-41	1913	Storms are closing down routes to DC (J518, J211) and the DC metros are all ground stopped. The ESP TMC used CIWS to try to make plan to get the few aircraft enroute to BWI through the weather. Only airborne inventory.	CIWS VIL, CWF, Echo Tops	2	3, 12
ZOB-3-42	1920	Area 6 sup used CIWS to look at J80. Called CP wanted to make sure J80 was still closed	CIWS VIL, Echo Tops	5	16
ZOB-3-43	1922	J64 and 60 finally closed. SvrWx requested they stay open as one. STMC indicated that he was able to keep them open longer as one because of CIWS tops and precip. CP referenced CIWS in closing and SvrWx came back with "Uh yea, OK close the route" after only a few minutes. CP believed that CIWS saved time in arguing for the route closing	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	1	1, 12, 14
ZOB-3-44	1925	Pathfinders on J152 are deviating around storms in west PA. Area 6 Sup called CP to request no J152 route. J152 remains closed	CIWS VIL	5	16
ZOB-3-45		Observer noted CP on phone with ? defending keeping J80 closed. SCC SvrWx requested a pathfinder during the SPO.	CIWS VIL, Echo Tops	1, 5	2, 12, 16
ZOB-3-46	1940	Only level 2 on J80 now with some developing weather on ZOB / ZID border. Area Sup used CIWS before calling CP and requesting a pathfinder for J80.	CIWS VIL, Growth and Decay Trends	1, 5	11, 12, 14
ZOB-3-47	1952	Storms south of J80 as well as weather developing on the route. STMC is concerned that J80 traffic could be a problem, so after much consideration no path finder was approved.	CIWS VIL, CWF. Growth and Decay Trends, Echo Tops, Echo Tops Forecast	5	13, 14, 16
ZOB-3-48	1958	New storms are developing north of DTW. ASP uses CIWS to find routes to north ATAs	CIWS VIL, ASR Precip, Storm Motion, CWF	4	7
ZOB-3-49	2005	Storms around PIT in west PA have decayed some and tops are down. STMC made a decision to open J60/64 again as 1 with 15 MIT. Said CIWS was used to open route early.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	1	1

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-50	2009	Post event: ESP working DC traffic said that CIWS was used to request that ZDC traffic be moved to flow through ZID	CIWS VIL, CWF, Echo Tops Forecast	2	3
ZOB-3-51	2012	A line of thunderstorms extends north and south of DTW with isolated cells developing in east OH. Area 2 Sup used CIWS to coordinate westbound DTW traffic.	CIWS VIL, CWF, Storm Motion, Growth and Decay Trends	2, 5	3, 12, 14
ZOB-3-52	2030	J80 has one weak cell along the ZOB portion. CP takes repeated calls to open J80. CP, STMC and Area 6 sup discuss situation and decide to keep J80 closed due to volume in Area 6. STMC indicates that they opened J60/64 to give ZNY a route west. Can't open J80 as well.	CIWS VIL, Echo Tops	5	16
ZOB-3-53	2044	Storms continue to decay from central PA south. CP under pressure to remove as 1 restriction from J60/64. CP uses CIWS to see storm development in Area 4 on J60 and refuses request.	CIWS VIL, CWF, Storm Motion, Satellite	5	12, 13, 14, 16
ZOB-3-54	2055	Thunderstorms developing in north IN and MI. DTW ASP requests that traffic from ZAU to DTW be brought over LFD (Litchfield). ZAU CWSU on phone with ASP tells him she expects storms over LFD within the hour. ASP looks at CIWS which shows no development around LFD now. Note storms did develop over and around LFD within the hour. A convective initiation product could have saved time here.	CIWS VIL, CWF, ASR Precip, Growth and Decay Trends, Storm Motion	5	16
ZOB-3-55	2110	United flight just topped storms on J64 at 340			
ZOB-3-56	2142	Line of storms growing together from west IN to north of DTW with large level 6 cell north of DTW. More storms developing in east ZOB with thunderstorms on J80 and on J60 and J64 in Area 4. Storms have developed around LFD as ZAU CWSU had forecast. Area 1 Sup came to TMU to look at CIWS. A conference ensued between STMC, ASP and Area 1 Sup around the CIWS SD.	CIWS VIL, CWF, Growth and Decay Trends, ASR Precip, Satellite, Storm Motion, Echo Tops	5	12, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZOB-3-57	2156	Line of storms across west Area 6 as well as along the ZDC/ZOB boundary. Route from ZDC J211 – JWT to DJB staying open with MITs based on CIWS information. J80 stays closed so that ZDC traffic can pick there way out on J211.	CIWS VIL, CWF, Growth and Decay Trends, Echo Tops. Storm Motion	1	1, 12
ZOB-3-58	2210	Storms across central OH and blocking most of the routes east-west and into ZDC. ZDC ESP checks CIWS to see if a route is available in Area 6 for traffic into BWI. ZDC is having trouble taking inbound traffic due to storms in PCT.	CIWS Growth and Decay Trends, CWF, Lightning, Storm Motion, Echo Tops	5	16
ZOB-3-59	2215	Central region out of mosaic until after 2320Z. ASP for DTW thought storms to west of DTW were decaying because of lack of radar data.	CIWS CWF, Growth and Decay Trends		
ZOB-3-60	2222	J80 open to PIT; SvrWx asks about all of J80. CP says that solid line of weather is blocking J80 on ZID ZOB boundary. SvrWx says OK We see weather, CIWS referenced. Over the next 20 minutes there were 4 more calls concerning opening J80. Route is open for PIT to PHL	CIWS VIL, Echo Tops. Growth and Decay Trends, Storm Motion, CWF, Echo Tops Forecast	5	12, 16
ZOB-3-61	2227	Area 8 Sup in TMU looking at CIWS. Indicates that ZID restricting traffic off of DTW. Area Sup wanted to know what the weather was like in ZID, he believes that they should take traffic after looking at CIWS	CIWS VIL, Echo Tops	5	12, 16
ZOB-3-62	2235	Area 7 initiated opening J70 for Traffic to ZNY. Used CIWS to Call CP. The external coordination took some time because ZNY would not take traffic. Sup and East ESP both said they would not have pushed for the route without CIWS.	CIWS VIL, CWF, Echo Tops	1, 5	1, 12, 14
ZOB-3-63	2240	Plan is awaiting ZNY approval.			

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ZOB-3-64	2305	JFK ground stop ended but ZOB still holding internals do to back log of en route aircraft			
ZOB-3-65	2320	Storms still strong on J80 in west Area 6 (level 6 with tops to 40+ kft). ZOB is still running ZNY traffic into ZBW as ZNY will not take traffic	CIWS CWF, Echo Tops Forecast	5	16
ZOB-3-66	2330	J80 is opened with 15 MIT based on CIWS showing route will be open within the next hour	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	1	1
ZOB-3-67	0000	Storms in ZOB on J70 but no storms in ZNY airspace on J70. Area 1 Sup in TMU looking at CIWS for situational awareness.	CIWS VIL, CWF	5	16
ZOB-3-68	0012	East ESP is trying to follow up on opening J70 as the Area Sup requested			
ZOB-3-69	0018	LGA, EWR and JFK all open. ZNY will not take traffic on J70. East ESP and CP are still pushing ZNY SvrWx to open route.			
ZOB-3-70	0040	One pathfinder approved for J70.			
ZOB-3-71	0040	J70 now open. East ESP said that without CIWS he would not have pushed for route to open as he did.	CIWS VIL, CWF	1	16
		ZJX			
ZJX-3-16	1245	Traffic from northeast is being routed through ZJX due to weather in ZDC. Traffic is routed down the AR routes to Columbus to ATL. ZJX is clear of weather at this time. Military operations are planned in the warning area east of Mayport. TFR preparations for the shuttle launch are underway. The restricted area is centered over pad 35 and extends out to 30 nmi and up to infinity and 45 nmi and up to infinity. Carrier aircraft are allowed to fly through the 35 nmi ring over 19kft but not directly over the pad.	SAT IR2, NEXRAD, ITWS, WARP	5	
ZJX-3-17	1322	Normal routing ground stop out of DC/NY.			
ZJX-3-18	1508	Showers developing from the west to east coast in central FL and moving east.	WARP	5	
ZJX-3-19	1627	Weather is on the airway, but aircraft have been allowed to deviate around it.			

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ZJX-3-20	1730	AR routes are being closed. Traffic is shifted to the center of the state and onto west coast routes. This is being done because of the shuttle launch.			
ZJX-3-21	1738	Unofficially, the shuttle launch has been scrubbed.			
ZJX-3-22	1740	J75 is being impacted by weather near Columbus. Controllers are allowing deviations around the weather.	DSR, WARP	1, 5	
ZJX-3-23	1741	The MOA is active. The LaGrange arrival route in GA is closed due to weather.			
ZJX-3-24	1751	LEESE arrival is still in use at MCO (Snowbird 5). The TFR should be removed in 90 minutes.			
ZJX-3-25	1820	TPA is holding due to thunderstorms.	WARP	5	
ZJX-3-26	1904	Thunderstorms extend northeast from north of TPA to Daytona. These are air mass thunderstorms, widely scattered with large areas of level 1 and 2. Routes to MCO are being closed off due to weather and military operations at the MOA. Trying to work out a routing to MCO with the possibility of an MCO ground stop.	WARP, ITWS	4, 5	
ZJX-3-27	1920	Trying to get some air space restrictions on altitude lifted to have more optimum routing to MCO.			
ZJX-3-28	1922	Mission desk requests for Sea Lord lifting restriction in the MOA corridor.			
ZJX-3-29	1924	Sea Lord lifts and releases air space for the next two hours.			
ZJX-3-30	1930	Sector areas involved are updated as to free airspace. TFR still on. Tactical reroutes will be the order for the next two hours.			
ZJX-3-31	1947	Reroutes as needed in keeping with the TFR and released air space from MOA.			
		ZTL			
ZTL-3-75	1458	The six-hour CCFP (valid 2100) shows high confidence/high coverage over ATL and high/sparse over all of ZTL and FL.	CCFP	5	
ZTL-3-76	1515	SPO: There is a GDP for ATL. Departure delays for NY airports are 1 to 1.75 hours.			
ZTL-3-77	1554	Most of the airports in the northeast are ground stopped.			
ZTL-3-78	1559	NRP is suspended for all traffic through ZTL where high/high is expected. ZDC and ZNY are nervous about the high/sparse coverage areas.	CCFP	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-79	1610	ZTL is trying to coordinate northbound reroutes with ZID, SCC, and SCC SvrWx. ZID is complaining but finally agreed to help ZTL with no MIT.			
ZTL-3-80	1617	Rotation from TD Dennis is located along the north side of ZTL and weather is developing everywhere. A level 4 storm was 10 nmi west of the airport within the last 10 minutes. (Note: ZTL's highest priority is to keep ATL slots filled).	ETMS, ITWS	5	
ZTL-3-81	1659	Lots of rapidly growing thunderstorms with tops to 50+ kft. ZTL is talking to A80 about lowering the GDP rate because of deviations. There was a long discussion between ZTL, airlines, and A80 about the GDP rate.	ETMS, FSM	3, 5	
ZTL-3-82	1715	SPO: Departure delays of 1 to 3 hours at PHL, NYC, and DC. There is an internal and second tier ground stop.			
ZTL-3-83	1724	ATL is ground stopped because of loss of northwest fix and weather growing everywhere.	ITWS	3	
ZTL-3-84	1748	Weather is around ATL. Delta called to discuss the ground stop. ZTL STMC referenced ITWS with Delta. Both agree that weather 5 nmi west has dissipated. No change to the ground stop.	ITWS	3, 5	
ZTL-3-85	1758	Weather is all around ZTL and rapidly growing.			
ZTL-3-86	1810	Internal ground stop is cancelled.			
ZTL-3-87	1818	STMC explained that users want pressure on ATL at all times to NOT miss a slot. The southwest arrival fix is closed and there are deviations over the northeast fix. Weather in the southeast is expected to continue to develop, leaving the northwest fix the only reliable fix. There is amazing work going on at ZTL, given that tops to 50 kft are throughout the airspace.	ETMS, ITWS	4, 5	
ZTL-3-88	1828	Interesting (check Tim's notes_ - if ZTL had better weather, then maybe no ground stop because now lifted. Didn't have growth and decay Trend or CWF and not sure what to do. *missed opportunity*. Note: The 340 nmi range ring is one hour of flight time. They count the number of planes inside to figure airport rate then count the planes outside to estimate the new demand.	ITWS	5	
ZTL-3-89	1910	Weather throughout ZTL. Traffic is still picking it's way through.	CWSU, WARP, ETMS	5	

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ZTL-3-90	1915	SPO: MCO ground stop update at 2030. There are delays everywhere in the northeast. The airlines are upset because NY-bound aircraft are being held in ZAU.			
ZTL-3-91	1938	Weather near the ZDC/ZTL border is causing some problems for west arrivals to CLT. Planes are deviating and traffic must be moved from ZID to merge with ZDC from the northeast. If traffic is not rerouted, there are only 12 miles to sequence into CLT.	ETMS	2, 5	
ZTL-3-92	2000	A line of weather is approaching CLT. USAir called ZTL. They think CLT will be lost. ZTL thinks this will happen in one hour. "If I had CIWS, I could tell them exactly when."	ETMS, ITWS	3	
ZTL-3-93	2018	Note: it seems as though nearly all coordination phone calls happen under one minute (for cross-reference on worksheet B).			
ZTL-3-94	2040	A line of level 5 storms is approaching CLT from the northwest and west. TMU is talking about ground stop for CLT.	ETMS, ITWS	3	
ZTL-3-95	2042	A gust front is going to cross CLT in 45 minutes. The CWSU said that CLT will be landing a while longer because they will switch to north operations and land more.	CWSU	3, 5	
ZTL-3-96	2048	Level 5 thunderstorms west northwest of ATL. The ZTL TMC is talking to A80 trying to figure out what it will look like in twenty minutes.	WARP, ITWS	3	
ZTL-3-97	2048	Same problem in CLT. The TMU is having difficulties deciding what to do because they do not know what the weather will look like in 20 minutes.	WARP, ITWS	3	
ZTL-3-98	2101	Storms seven to 20 nmi west northwest and northwest of CLT. The TMC is attempting to estimate impact time. They are using ITWS storm motion and extrapolated position lines to estimate the impact time.	CWSU, ITWS	3	
ZTL-3-99	2118	CLT restarted westbound departures. There is level 6 weather north of CLT. Cells west of CLT decayed, but ITWS didn't show this. "It would have been nice to see growth and decay so we could have been more proactive."	ITWS	3	
ZTL-3-100	2130	Thinground stop are getting quiet. There are still delays.			
ZTL-3-101	1655	Thunderstorms are impacting RMG/Erlin/Dalas (NW arrivals) and aircraft are deviating. CWSU confirms thunderstorms will hit ATL. MIT restrictions on surrounding facilities increased for ATL arrivals via RMG.	CWSU, aircraft movement	5	

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ZTL-3-102	1700	Ground Delay program (GDP) now in effect for landing ATL (based on landing rates of 80-84 aircraft per hr (ILS approaches, volume). Average EDCT delay is 47 min, max delay of 100 min. Hectic messy workload in TMU – all the phones are ringing (standard with bad weather).	Conference with ATL; CWSU	3	
ZTL-3-103	1717	North departures off ATL are deviating. Area supervisor advises that north departures may have to be stopped.	Area report, aircraft movement		
ZTL-3-104	1720	Thunderstorm over runways appears to be imminent. Ground stop to ATL. Comments on ground stop: ZTL called for the ground stop based on the best (but very limited) information that they had. ZTL thought that the thunderstorms would hit the airport (they did not). A better short term (CIWS) forecast could have prevented the ground stop (STMC: agrees – the ground stop was helpful because of growing weather problems – but with a better short term forecast, a less drastic action would probably have been taken. ATL now showing 87 min arrival delays.)	ITWS, WARP	3	
ZTL-3-105	1724	RMG (NW) and Macey (NE) arrival fixes holding. Increased restrictions on ATL arrivals: 25 MIT from ZME, ZJX, ZHU until 2200z	Holding patterns		
ZTL-3-106	1725	Thunderstorm conditions worsen. ZTL TMU reports ground stop to ATL is imminent.	Deviations, ETMS, CWSU, ITWS	3	
ZTL-3-107	1756	SINCA (SW) arrival aircraft refuses to fly arrival. ZTL TMU concerned with volume if the SINCA (SW) arrivals need to be rerouted into NW (Macey) arrival sector (major arrival push in progress).	Area report, aircraft movement, ETMS	4	
ZTL-3-108	1758	LGC/Tiroe (SW) arrivals refuse to fly arrival. ZFW, ZHU, ZME are told to reroute their ATL arrivals over RMG (NW). ZJX told to reroute their ATL arrivals over SINCA (SE).	Aircraft movement	4	
ZTL-3-109	1812	ATL thunderstorm is no longer a factor. Ground stop cancelled.	ITWS, WARP	5	
ZTL-3-110	1815	Continuing thunderstorms in ATL and arrival airspace. GDP for ATL arrival rate reduced to 80 aircraft/hr. Average EDCT delay now 87 min, max delay now 228 min.	Aircraft movement, CWSU. ATL	3	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-111	1824	Volume, weather, and deviations over LGC/Tiroe sectors. ATL arrival aircraft from FL panhandle to be rerouted over SINCA (SE) (normal routing is via LGC/Tiroe).	Area reports, aircraft movement, ETMS	4	
ZTL-3-112	1835	ATL reports south runway may become unusable due to thunderstorm.			
ZTL-3-113	1910	CWSU reports ATL OK for a few hours. Thunderstorms now at CLT airport. (They had been scattered around the arrival fixes for some time.)	CWSU	5	
ZTL-3-114	1948	Heavy NE arrival traffic to CLT, aircraft deviating. Call to ZID – unanswered. ZTL TMU asked Ops Supervisor to call ZID and request they answer phone. Two aircraft moved from CLT NE arrival fix to CLT NW arrival fix (while in ZID airspace)	ETMS, WARP, aircraft movement, area reports	4	
ZTL-3-115	2010	Holding at CLT due to thunderstorms. CLT shut down the arrival fix even though aircraft were willing to fly between cells. (This is not standard procedure – aircraft are usually run until the pilot refuses.) – Perhaps CIWS at CLT would allow for better decisions.			
ZTL-3-116	2010	Holding/deviating at CLT. USAir rep calls TMU seeking information on length of time CLT will be impacted. STMC says around 40 minutes. But after hanging up, says that was his best guess, as no better information (CIWS) is available.	ITWS, ETMS	3	
ZTL-3-117	2017	CLT north departures deviating into arrival traffic, which is now in holding pattern due to decision by CLT not to allow aircraft to deviate through weather (see 2010 above). CLT north departures stopped.	Aircraft movement	4	
ZTL-3-118	2045	Level 5 thunderstorms in vicinity of ATL runways. Aircraft arriving over RMG (NW) and SINCA (SE) unable to hold due to thunderstorms throughout the holding areas. Discussion between ZTL and ATL on storm movement and arrival rate (still 80 from GDP). ATL advises they may need to shut off RMG arrivals.	CWSU, aircraft movement, area reports, ITWS	3, 4	
ZTL-3-119	2052	Thunderstorm near runways at CLT. Appears that storm will eventually impact CLT runways, but no one knows when. (CIWS would help with planning here.)	WARP, ITWS	3	

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ZTL-3-120	2058	TMU considering a ground stop for CLT – unable to tell when/if thunderstorms will halt operations. North departures still stopped. CIWS would be helpful again – difficult to make these decisions with such limited information.			
ZTL-3-121	2124	Level 5 thunderstorms west and northwest of CLT. ITWS indicates NE movement of weather and not an impact to the runways.	ITWS	3, 5	
ZTL-3-122	2132	CLT North departures deviating into arrivals. CLT north arrivals stopped (again).	Aircraft movement, area reports		
		ZDC			
ZDC-3-1	1345	Observer arrived at ZDC. The weather impact has diminished since earlier, but direct N90 impact and significant ZDC east coast convection. Strict ZNY restrictions (terminal and over flight) are in place. White/Wavey restricted. Upon arrival, STMC points out a sliver of missing high-quality coverage in ZDC denoting radar outage. The STMC stated that he wanted access to NWS to prevent planned outages during key operational times. ZDC depends on the LWX radar in the CIWS mosaic.	CIWS, CCFP	5	16
ZDC-3-2	1405	Short line of storms impacting N90 region. ZNY requests J220 offloads for metro DC traffic (with 30 MIT) for the next 30 minutes because of J42 impacts (for arrivals to NY/BOS). Using CIWS, ZNY and ZDC determined in tandem that the reroute, and the impact on J42, should only last 30 minutes.	CIWS VIL, CWF	5	12, 14, 16
ZDC-3-3	1415	TMC and STMC confer about what weather is expected later this afternoon. They consulted CCFP and noted three areas of forecasted convection in the 6-hour forecast. They noted that the forecast for weather on the east coast and along the ZTL border. The potential metro DC impact is a concern. The STMC displays satellite on CIWS to see if heating is occurring in the DC metro area.	CCFP, CIWS Satellite	5	14, 16

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ZDC-3-4	1420	Weather on and near J42 in ZNY. ZDC, using CIWS, initiates a request (suggestion) with ZNY for J42 pathfinder from ZDC. Without CIWS, they would not have had the confidence in the weather information to make this request.	CIWS VIL, Echo Tops, Storm Motion, Lightning, Growth and Decay Trends, CWF	1	11, 12
ZDC-3-5	1422	J42 is impacted in ZNY. ZNY, through SCC, checks with ZDC about releasing ZJX, ZMA, ZTL, ZID, etc. from the ZBW ground stop. CIWS shows J42 clear in 60 minutes and these flights will take 60 minutes to reach the impacted area. The TMC and STMC consult CIWS CWF and agree to the early release from the ground stop. The STMC estimated it would have taken five minutes longer to agree/disagree to the plan without CIWS. This extra time would have been needed to consult with the CWSU on the short-term forecast. Observer noted new development behind the area of existing weather and west of J42. This may be a potential problem.	CIWS CWF	1, 3, 5	1, 4, 12, 14, 16
ZDC-3-6	1440	DIX radar is down. The STMC calls SCC to see if they can contact NWS about getting the radar back, if it is down for routine maintenance. The STMC is trying to emphasize that they really depend on the availability of NEXRADs.			
ZDC-3-7	1444	Weather has developed in ZNY west of J42. The STMC calls SCC and advises that they should keep an eye on this region, given recent release of ZTL, ZMA, and ZJX traffic to ZBW that was contingent on the availability of J42.	CIWS VIL, Echo Tops, CWF, Lightning, Growth and Decay Trends	5	12, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-8	1451	Weather is on J42 in ZNY. The ZDC TMC and STMC coordinated a reroute for ZJX, ZMA, and ZTL using FAK, Brook, AML, JSI, (or some close variation). The reroute uses J220 with 40 MIT. The reroute was requested through SCC and developed using only CIWS. Without CIWS, the ZDC TMU would not have been intimately aware of the J42 impact in neighboring Centers. The proactive request for the reroute (which better protects ZDC from increased complexity and possible holding later) would not have occurred.	CIWS VIL, CWF	2, 5	3, 12, 14
ZDC-3-9	1525	ZBW has lost use of the warning area. Without it, they cannot utilize the J220 reroute for ZJX and ZMA to ZBW. They will likely have to stop this traffic.	CIWS VIL, CWF	5	16
ZDC-3-10	1550	Scattered storms have developed in northwest ZDC (west of the metros). They are decreasing the MIT restrictions on metro DC LDN/AML departures from 30 to 20 MIT. CIWS shows that weather is tolerable and does not deserve more severe restrictions. (There more severe restriction was earlier requested by an Area Sup not using CIWS.) PCT TRACON folks were upset about the severe restriction, stating "it's hard to believe these restrictions are desired for this little bit of weather."	CIWS VIL, CWF, Growth and Decay Trends, Echo Tops	1	5
ZDC-3-11	1600	Large mesoscale convective cluster impacting ZDC's southeast airspace. White/Wavey departures are allowed to run even with jet route impacts because space exists for deviations to remain within the impacted sector (using CIWS products). They are concerned that new storms will back build to the west, forcing deviations into the neighboring sector. At that time, the flow will have to be shut off. (Note: the STMC used Echo Tops Forecast for the forecasted motion of high tops, satellite for the area of heating/convective development (clear skies) northwest of the cluster, and constantly used Growth and Decay Trends).	CIWS VIL, Echo Tops Forecast, Satellite, Lightning	1, 5	1, 12, 16
ZDC-3-12	1610	PHL is ground stopped with mounting delays and is in need of routes. The STMC adds PHL to the CIWS display to study possible reroutes. He developed a reroute going south to OOD then west. He coordinated with three Area Sups, who signed off on the plan. He phoned PHL Approach and offered the reroute, should any of their flights want to use it.	CIWS VIL, Echo Tops, Echo Tops Forecast, Growth and Decay Trends	2, 5	3, 12, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-13	1630	An east-west line of level 3-5 storms are in the NY TRACON. Several LGA arrivals are holding near RBV in ZDC. These flights may have to divert. The STMC called ZNY to see if they could be brought around the west side of the weather then north at low altitudes.	CIWS VIL	2	3, 12
ZDC-3-14	1635	Scattered, unorganized, strong storms are developing and closing off ZID flows into ZDC. The STMC tells ZID to start slowing up traffic. He then tells the Area Sup to expect that traffic will be slowed. This activity is strong but disorganized (according to CIWS) and therefore he will need to be able to easily identify reroutes that will persist. Conversely he doesn't want to close off airspace when impacts from disorganized convection will be temporary.	CIWS VIL, CWF, Storm Motion, Echo Tops	5	16
ZDC-3-15	1644	Heavy development in southeast ZDC. All AR traffic is rerouted inland to the west side of the weather, but still within the sector. Thus not completely shut off.	CIWS VIL, Storm Motion, Growth and Decay Trends, Echo Tops Forecast	2	3, 12
ZDC-3-16	1705	Widespread convective coverage in ZDC, ZTL, ZJX, and southeast ZOB. GDPs and ground stops are implemented at numerous airports, along with MIT restrictions, single stream flows, etc.			
ZDC-3-17	1710	Storms are located just south of N90 and in north ZDC. Two different TMCs are using CIWS to work out separate reroutes. They are holding about 15 LGA arrivals in ZDC. They are releasing EWR traffic over Yardley and LGA aircraft holding in ZDC airspace, but do not release LGA traffic still on the ground and filed for this route.	CIWS VIL, Growth and Decay Trends	2	3
ZDC-3-18	1720	Pandemonium in the TMU due to too many impacts. The TMCs are struggling to keep up.			
ZDC-3-19	1721	An east-west line of storms is located on the ZNY/ZDC border. SCC requests release of FL traffic to the northeast using J42. ZDC denied the request because the CIWS 1-hour forecast shows J42 still impacted in 60 minutes.	CIWS VIL, CWF	1	12, 14, 16
ZDC-3-20	1723	Weather everywhere. Five Area Sups are waiting in line to voice concerns to the STMC.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-21	1735	SCC wants ZDC to release ZBW traffic filed through the east-west line of weather on the ZNY/ZDC border. CIWS still shows impact for 45 to 60 minutes.	CIWS VIL, CWF	1	12, 14, 16
ZDC-3-22	1740	STMC hand-off briefing using only CIWS.	CIWS	5	16
ZDC-3-23	1751	There is an embedded cluster in extreme northeast ZDC in the east-west line of weather. This area previously impacted N90. Significant weather is now almost completely in ZDC (out of ZNY) so they can be proactive if they choose to be. The STMC consulted CIWS to see whether routes are available for N90 traffic. They deduce that route openings are imminent.	CIWS VIL, Echo Tops, CWF, Lightning, Growth and Decay Trends	5	16
ZDC-3-24	1755	Atlantic City to CVG traffic needs a reroute, but ZNY can't supply a route. The STMC at ZDC devised a route over BWI to get west, using CIWS. This reroute would not have been implemented without CIWS.	CIWS VIL, Echo Tops, Echo Tops Forecast, Growth and Decay Trends	2	3
ZDC-3-25	1759	Weather is in extreme northeast ZDC. The Area Sups and TMU coordinate for JFK arrivals via ZBW. They are considering taking LGA traffic over RBV, opening J42 for NY, and allowing DC metro departures over SWANN to flow.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends	1, 2	1, 3, 12
ZDC-3-26	1814	JFK/LGA traffic is back on J42 over RBV with 10 MIT. ATL to NY is reopened on JFK route, but with 40 MIT.	CIWS VIL, Echo Tops, Growth and Decay Trends, CWF	5	16
ZDC-3-27	1823	Weather is everywhere and they are looking for routes from BOS to ATL. The RC TMC worked out a route for ATL arrivals coming over RDU to J209 to MACEY. The STMC approved the route instantly using CIWS.	CIWS VIL, CWF, Growth and Decay Trends	2	3, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-28	1833	With respect to the weather in northeast ZDC, the Area Sup and STMC are trying to bring over flight traffic to NY/ZBW via J42. ZNY is not answering. The Area Sup used CIWS to identify the route but understands if the route is denied because the nearby Warning Area is active. However, he believes ZNY should accept the route on the west side of the weather.	CIWS VIL, Echo Tops, Storm Motion, Lightning, Growth and Decay Trends, CWF	2	3, 12, 14
ZDC-3-29	1840	The Area close J48/J75to ZNY due to strong convection. J6 is also closed.			
ZDC-3-30	1842	J42/J79 to ZNY is open.			
ZDC-3-31	1846	Weather is west of metro DC. The Area and TMU coordinated a pathfinder release to test the viability of LDN/AML. The pathfinder deviated 20 miles northwest.	CIWS VIL, Echo Tops, Growth and Decay Trends, CWF	1	11, 12, 14
ZDC-3-32	1903	More strong storms are building in ZNY. Traffic for NY metro airports is ground stopped.			
ZDC-3-33	1912	Weather in ZOB. ZNY shut off J220 for westbound traffic, despite the fact that all weather is in ZOB. ZDC is trying to reroute directly into ZOB. J220 is open for normal traffic, but not SWAP traffic.			
ZDC-3-34	1940	Weather dissipating over White/Wavey. ZNY requests the reopening of White departures. ZDC TMC agrees after checking CIWS.	CIWS VIL, Echo Tops, Growth and Decay Trends, Lightning	1	12, 14, 16
ZDC-3-35	1955	Weather in south ZDC. Sector 38 traffic is deviating into sector 36. The Area Sup requests moving CLT/ATL northbound traffic (normally on J209) further west over GSO. The TMU agrees with the plan after consulting CIWS. CIWS is the weather system of choice to confirm the feasibility of a plan, but the plan likely would have been evident with WARP. It may have taken slightly more time to develop the plan or there might have been less confidence in the decision without CIWS.	CIWS VIL, Storm Motion, Growth and Decay Trends	2	3, 12, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-36	2000	Storm cell near OOD. Some planes are deviating. The Area Sup noted explicit decay in this weather via CIWS and decided the route could be kept open without restrictions. He convinced NY ATC of this decision as well. The TMU did not need to be involved in the discussion, thus reducing workload. The entire decision to keep the southbound NY traffic route open was initiated and coordinated externally by the Area Sup (using CIWS). This reduced TMU workload.	CIWS VIL, Echo Tops, Growth and Decay Trends	1	1, 12, 14
ZDC-3-37	2003	Storms are growing and filling in southeast ZDC. The Area 5 Sup uses CIWS to illustrate his concerns that White/Wavey departures southbound (NY, BOS, PHL departures) need to be stopped. The aircraft are deviating into the warning airspace. This is a huge impact on the NAS, but after consulting CIWS, the STMC agrees to the plan. The concern was identified in the Area (traffic deviations), cross-checked with weather impacts via CIWS, and then quickly "sold" to the TMU using CIWS.	CIWS VIL, Echo Tops, Storm Motion, Lightning, Growth and Decay Trends	1	2, 12, 13, 14
ZDC-3-38	2015	Thunderstorms are in ZNY and there are en route concerns. The ground stop for EWR, LGA, and JFK is extended with an update at 2130.			
ZDC-3-39	2035	VACapes-Echo is released at 290 and above. This should free up valuable airspace for ZDC.			
ZDC-3-40	2040	Storms on J6. J6 is reopened via tactical reroute onto LDN, J134, and back to J6 to get NY flowing on this route again. The STMC, using CIWS, devised the plan and coordinated with the Area Sup. The route would likely have remained closed without CIWS.	CIWS VIL, Echo Tops, Growth and Decay Trends, Storm Motion	1, 2	1, 3, 12, 14
ZDC-3-41	2050	Klinker (now with MITRE) visited to observe SWAP operations. He consulted CIWS and said, "This thing has got to get on ETMS."			
ZDC-3-42	2053	Weather along/near J48/J75. J48/J75 is reopened single stream for ZNY departures normally filed on this route. CIWS was not used in this decision.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-43	2109	Weather in northwest ZDC. The STMC coordinates a tactical reroute over LDN after someone called to request NY inbounds to ZDC via Martinsburg or AML. The STMC used CIWS to direct the reroute decision. He stated that the normal J6 route may be open in about 30 minutes, but agreed to use LDN for a tactical SWAP for now.	CIWS VIL, CWF, Storm Motion, Growth and Decay Trends	4	7
ZDC-3-44	2130	Impacts on J48/J75. N90 asks if "as one" restrictions on J48/J75 are still needed. STMC, using CIWS, allows J48 and J75 to run as separate routes.	CIWS VIL, Storm Motion, Growth and Decay Trends	1	1, 14
ZDC-3-45	2130-ish	Storms are impacting northern Chesapeake area. There are some deviations around this cell over tightly packed routes. The Area Sup consulted CIWS and noted relatively low tops and decay. He decided to keep the route open without restrictions. Without CIWS, he would have asked for restrictions, thus increasing his workload (as he would have had to take time to pass along the TMI need to the TMU). CIWS was used to keep the route open without restrictions, which prevented not only more NY delays, but extra Area/TMU coordination workload.	CIWS VIL, Echo Tops, Growth and Decay Trends	1	1, 12, 14, 16
ZDC-3-46	2210	Weather is decaying west of metro DC, but is still causing deviations. Only IAD traffic was going over LDN (with 10 MIT) because of the massive delays at this airport. LDN is now open to DCA and BWI westbound traffic with 40 MIT. This decision was made based on volume, delays, equitable accountability, and just a cursory weather recall.			
ZDC-3-47	2222	Storms are building south of metro DC. DAILY southbound departures from metro DC airports are stopped for all.	CIWS VIL, Echo Tops, Growth and Decay Trends, Lightning	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-48	2235	Strong storm cluster in central ZDC. ZJX and ZMA are seeking route opportunities (and reduced restrictions) through central ZDC. The TMC and STMC confer using CIWS and note that the one-hour forecast is showing the solid line moving very little and weather "blowing up" on the Echo Tops Forecast product. The request is denied.	CIWS VIL, CWF, Echo Tops Forecast	1, 5	12, 14, 16
		ZBW			
ZBW-3-1	1730	Morning weather caused some problems. Storms continued to develop, yet fizzled out upon observer's arrival. Cells over SYR are beginning to decay. Traffic is being sent over SYR until someone complains.	CIWS VIL, Growth and Decay Trends	5	16
ZBW-3-2	1750	J80 is closed. Cells south of NY metro are moving south. Restrictions include ground stops for ATL and IAD until 1830 and reroutes for BWI/IAD (1719 - 2100 via J75), IAD (1721-2100 via SYR-J59 with possible playbook), and J80 (1751-0400 via SYR).			
ZBW-3-3	1757	The CIC briefed the TMC using CIWS. Weather over SYR is dying out; metro is clear. No route to IAD is available, possibly due to the cell on J48.	CIWS VIL, CWF, Storm Motion	5	16
ZBW-3-4	1805	IAD ground stop is extended until 1915. Area B is now vectoring out of Glen's Falls heading to TEB to avoid LGA EDCT.			
ZBW-3-5	1812	A small line is developing in VT. No known problems at this time. ZNY sectors are saying that the only thing available is J48.	CIWS VIL, Growth and Decay Trends	5	16
ZBW-3-6	1822	J6 is closed, so the traffic will be ground stopped.			
ZBW-3-7	1829	Carmel and Sparta closed. HNK shut off too, except for PIT.			
ZBW-3-8	1831	A briefing was conducted using CIWS. Weather in upstate NY is dissipating.	CIWS VIL, CWF, Growth and Decay Trends	5	16
ZBW-3-9	1857	Weather over SYR is gone. The TMC used CIWS for a briefing. ZNY and SCC are on the phone. There is a ground stop due to military activity over the coast (J174).	CIWS Echo Tops	5	16
ZBW-3-10	1903	The CWSU briefed the STMC There are no problems at BOS but the STMC mentioned that flights can't get out.	CWSU	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-11	1906	The STMC is talking to SCC regarding IAD. J6 route is available for at least 2 hours. The STMC tells SCC that weather is not moving. The route is available, but they are waiting for SCC to make the call on using it.	CIWS VIL, CWF, Storm Motion	5	12, 16
ZBW-3-12	1910	The STMC is concerned with gridlock. ZBW is only moving planes out of SYR right now.			
ZBW-3-13	1916	The STMC called ZNY to ask if they are using CIWS. He explained that the weather is not really moving and wants to send traffic on J6. Traffic is let go with 30 MIT; good for two hour (using J6 to IAD).	CIWS VIL, CWF, Storm Motion	1, 5	1, 12
ZBW-3-14	1920	Only a few small convective cells are in ZBW (VT). Routes to NY are available but the airports are ground stopped due to approaching gridlock.			
ZBW-3-15	1945	Weather in southeast NJ. J121/174 is closed for NY traffic, but the echo tops are low so over flights should be possible. The TMC is consulting with the Area. There are currently four planes in the air above and they are doing OK. There are another half-dozen that could go if ZBW can get the route opened. J174 was proactively opened allowing at least six aircraft through above 24 kft.	ETMS, CIWS VIL, Echo Tops, Storm Motion	1	1, 14
ZBW-3-16	1947	J174 is closed by ZDC. The TMC doesn't understand why. Tops are above 30 kft on the route, but level 3 is west of the route. VIL shows only level 1 and 2 on the route.	CIWS VIL, Echo Tops	5	16
ZBW-3-17	2006	J174 closed again.			
ZBW-3-18	2029	ZBW can use J121-174 to Wilmington.			
ZBW-3-19	2032	Sectors 8 and 9 are combined because there is not enough staff.			
ZBW-3-20	2107	The CIC was briefed using CIWS. J6 should stay open.	CIWS CWF	5	16
		ZNY			
ZNY-3-1	1800	An east-west line of storms already moved through metro NY airports and is now located from central NJ into the Atlantic, moving south at 15kts. Building storms in western PA, northern VA and VA. Large supercell in northeast PA. Chaos in ZNY and chaos also personally observed in N90. Extremely busy in ZNY, even though there was not much weather inside the airspace.			
ZNY-3-2	1807	Departure Desk (DD) asked N90 for a pathfinder into WAVEY.			
ZNY-3-3	1814	Arrival Desk (AD) upset that someone cut the flow off to Phillipsburg, NJ.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZNY-3-4	1815	J75, J80, and J48 already closed.			
ZNY-3-5	1818	ZDC closed J6. DD asked what to do with the 5 planes already in the air. WAVEY and WHITE gates closed.			
ZNY-3-6	1841	Ground stop all west gates. DC shut the door to everything to the southwest.			
ZNY-3-7	1851	Area Sup came into the TMU to state that planes were deviating into JFK/J70. Weather and volume impact JFK, arrivals into JFK, and also J70. Ground stop JFK.	WARP, ETMS	5	
ZNY-3-8	1908	DD upset with ZDC about running too many planes into weather.			
ZNY-3-9	1913	AD on the phone with ZBW because JFK arrivals are deviating all over the sky. ZBW wants ZNY to look at ITWS and CIWS but ZNY AD had already decided to use the SPARTA routes with 30 MIT.			
ZNY-3-10	1919	ZBW will not take any more reroutes (per AD)!			
ZNY-3-11	1928	AD using WARP and ETMS to discuss where the weather is and their flow strategy.	WARP, ETMS	1, 5	
ZNY-3-12	1938	OMIC requested that I (Richard) don't stand near the AD and DD controllers and that I move near the OMIC corner of the TMU. Controllers were upset that they could not speak freely – in the heated environment. Conditions deteriorated between ZNY and N90.			
ZNY-3-13	1933	Due to a large active cell northwest of ZNY, it was determined (using CWF) that J36 was soon going to become unavailable. The STMC chose to move all the traffic off of J36 and onto J95 to avoid spinning aircraft to force them into the J95 flow. Four minutes after the decision to move aircraft, ZOB shut down J36.	CIWS CWF	2	3, 14, 16
ZNY-3-14	1908	Using the CWF, the OMIC and STMC felt there was a chance that the cell on J36 would move onto J6 and block their only route to IAD. The forecast never panned out and J6 did NOT become blocked, however, a plan was developed which would take flights locally up J36 toward SYR and then down J59 toward IAD.	CIWS CWF	2	5, 16
ZNY-3-15	1934	STMC and OMIC both noticed weather west of ZNY was breaking up and there were many holes. J60, 64, J36 and J80 were all shut down. ZNY had no west routes. ZNY felt, based on CIWS, that they could begin to get traffic through. A pathfinder was requested by ZNY on J80. ZOB agreed and one was launched and didn't have to deviate very much.	CIWS VIL, CWF	1, 5	1, 11, 12

CIWS Benefits Assessment
Observation Period #3 Observations Summary
Day 3 – July 14, 2005

Participating Facilities: ZJX, ZTL, ZDC, ZBW

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZJX			
ZJX-3-32	1300	Weather over DC (small area) is causing an offload from J37 to J75 into ZJX airspace for reroutes to the west. ZJX is tucking/tunneling traffic on J75 as military operations are still in progress. Light showers are located north of TPA. Warning area W366 is active east of Chesapeake Bay. Aircraft from the northeast are coming down AMBER 796 to avoid ZDC airspace. Traffic flow in ZJX is light due to lack of traffic from the northeast.	NEXRAD, WARP, SAT IR2, ITWS	2, 5	
ZJX-3-33	1500	ZJX weather is clear except for thunderstorms at the ZJX/ZDC border.	NEXRAD, ITWS	5	
ZJX-3-34	1610	Weather is developing across central FL north of TPA, north of Cape, and on the north boundary of the MCO TRACON.			
ZJX-3-35	1704	Weather is still building but no impact on traffic at this time.	NEXRAD, ITWS	5	
ZJX-3-36	1717	White/Wavey is now open.			
ZJX-3-37	1802	Weather still building slowly. ZJX is normal routes.	NEXRAD, ITWS	5	
ZJX-3-38	1915	J75 is impacted with thunderstorms. Aircraft are maneuvering through and around the weather. The TMU verified that the Palatka MOA was NOT hot and placed a 30 MIT restriction on traffic to MCO.	WARP	2, 5	
ZJX-3-39	1958	TMU is requesting use of airspace over Palatka MOA from Sea Lord.			
ZJX-3-40	1959	Sea Lord releases Rainbow F at 12 kft and above. The STMC is going to use the airspace primarily for arrivals, but for some departures too.			
ZJX-3-41	2030	Flow returning to normal routes.			
		ZTL			
ZTL-3-123	1438	The TMU is discussing NYC and DC metro arrivals and what route they should take. A small band of weather (Dennis) covers all of north ZTL.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-124	1451	The new CCFP is published and looks very similar to the last three days. Lots of weather is expected in ZTL. The TMU is talking to A80 about expected AAR.	ATL Arrival	5	
ZTL-3-125	1458	The TMU is discussing what to expect from 18Z to 22Z. Thunderstorms are expected near ATL (more likely south near Montgomery) but low ceilings are gone. CLT 18-22Z, low ceiling then 18 - 22Z thunderstorms. They are trying to figure out rates. A80 is suggesting 86, but weather is coming later and the demand is too high. The GDP will be started at 1600 with 86/84/84/82/82/82/86/90/90, exempt JFK/LGA/PHL/EWR because of GDPs at those airports.	CWSU, A80	3, 5	
ZTL-3-126	1515	SPO: CAN 1 and 7 can run east or west unrestricted beginning 2130.			
ZTL-3-127	1715	SPO: TMU has been very quiet. The CCFP shows lots of weather in ZTL at six hours (2100). Northeast traffic to FL will use White/Wavey (probably determined using CIWS).			
ZTL-3-128	1738	Level 5 weather now developing south of ATL and growing rapidly. A80 called to ask if this was causing problems. A80 doesn't expect it to be a problem.	ITWS	5	
ZTL-3-129	1750	Level 5 weather is 3 to 10 nmi southwest, south, and southeast of ATL and moving east northeast at 15 kn. No change to flow at this time, but the area is expected to shift north over time. The CWSU provided an update on the weather.	CWSU	3, 5	
ZTL-3-130	1834	The Unit is much quieter today. So far weather is developing throughout ZTL. J75 is close to closing.	FSM, ETMS	5	
ZTL-3-131	1852	Weather south of the airport.			
ZTL-3-132	1915	SPO: A shower developed west of ATL. Traffic is still flowing for now.	ITWS	5	
ZTL-3-133	1933	Wind shear is located just off the airport. This was referenced on the SPO. ATL is still OK.	ITWS	5	
ZTL-3-134	1936	Weather throughout the Center. Planes are deviating so traffic is holding at SINCA.	WARP, aircraft movement	4, 5	
ZTL-3-135	1941	A level 4 cell is just off the end of the ATL departure runway with 25 kt wind shear. No alerts yet. No arrival problems.	ITWS	5	
ZTL-3-136	1943	Level 3 cell over ATL runways is stronger just off the west end of the airport. No arrival problems yet.	ITWS	5	
ZTL-3-137	1951	Heavy rain over ATL. Traffic is holding on the east side ~25 minutes.	ITWS	3, 4, 5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-138	1956	Wind shear alert with 25 kt loss on 3 mile final. A80 closed the door. They are going to a single runway at ATL.	ITWS	3, 5	
ZTL-3-139	1956	A small level 4 cell is over ATL. An internal and second tier ground stop is implemented.	ITWS	3, 5	
ZTL-3-140	1956	Weather over the airport. All fixes are hold at ZTL. "We can't recover with a GDP. We have to go to second tier."	ITWS	3, 5	
ZTL-3-141	1959	Weather developing all over ZTL and they are losing holding space. There are lots of problems finding holding space. Note: ZTL likes to keep pressure on the airport at a maximum and let them run as long as possible, then react.	ITWS	4	
ZTL-3-142	1958	107 aircraft within one hour or already holding.	ITWS	3, 4	
ZTL-3-143	2007	The shower is till over ATL, but ZTL has asked A80 to release 1 fix with 15 MIT.	ITWS	4	
ZTL-3-144	2012	Shower over ATL dissipating. ZTL is still feeding A80 one fix.	ITWS	4	
ZTL-3-145	2018	Shower is down to level 1 now. Speed at all fixes and flowing again.			
ZTL-3-146	2045	ATL ground stop cancelled.			
ZTL-3-147	2131	Visual at ATL. Internals are released to increase landing rate to 92.	CWSU, A80		
ZTL-3-148	1442	Weather is building in the southwest corner of ZTL. ZTL approves J22 VUZ SJI routing for aircraft destined to IAH/HOU.	ETMS	2, 5	
ZTL-3-149	1458	CWSU briefing: Possible thunderstorms between 18-22z at ATL. Best convection will be south of MGM and north northwest of VUZ/BHM at 1700z or sooner.	CWSU	5	
ZTL-3-150	unknown	Ground Delay Program (GDP) entered for ATL due to low ceilings, en route thunderstorms.			
ZTL-3-151	1650	ZTL considers revising the GDP numbers, as weather is better than expected.			
ZTL-3-152	1744	Level 4/5 thunderstorms just southwest of ATL show movement (ITWS) towards runways at ATL. CWSU and ATL agree that weather is moving east and will not impact runways at ATL (assessment proves correct).	ITWS, CWSU, ATL	3, 5	
ZTL-3-153	1843	J75 starting to close.	Area Sup report		
ZTL-3-154	various	ATL departures are deviating. Numerous MIT and stream restrictions on ATL departures.	Area request		

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZTL-3-155	1920	Level 3 thunderstorm a few miles west of ATL runways. ILS approaches to ATL.	ITWS, ATL	5	
ZTL-3-156	1923	Level 4 thunderstorm 7 miles west of ATL runways.	ITWS	5	
ZTL-3-157	1936	ATL advises holding possible at SINCA (SE arrivals to ATL) due to deviations.			
ZTL-3-158	1940	ATL reports dark skies at west end of runways.			
ZTL-3-159	1940	SINCA deviations continue. ATL stops accepting aircraft from SINCA. SINCA in holding.			
ZTL-3-160	1941	Level 4 at west end of runways. Level 3 over runways.	ITWS	5	
ZTL-3-161	1946	Level 5 thunderstorm at west end of runways. 25 kt wind shear.			
ZTL-3-162	1951	ATL calls to tell ZTL to hold all Macey and SINCA arrivals. Macey and SINCA in holding.			
ZTL-3-163	1956	25 kt wind shear 3 miles from final.			
ZTL-3-164	1956	ATL requests ZTL hold all arrivals, all fixes, to ATL. All arrival fixes in holding.	ITWS		
ZTL-3-165	1958	107 aircraft airborne and within 1 hour of ATL – or already entering the holding pattern. Ground stop all internal, first and second tier departures destination ATL.			
ZTL-3-166	2007	Thunderstorms weaken. All arrival fixes except RMG now open -- holding patterns continue to fill.	ATL	5	
ZTL-3-167	2015	ZDC refusing handoffs from CLT east departures stopped.			
ZTL-3-168	2016	Weather at ATL continues to improve.			
ZTL-3-169	2023	Weather at ATL continues to improve. All arrival fixes to ATL now open – all fixes still have significant number of aircraft in holding. ATL announces an 86 aircraft/hr arrival rate.			
ZTL-3-170	2037	SINCA reports some aircraft have been in holding 45+ minutes.			
ZTL-3-171	2045	ATL ground stop canceled, normal operations, en route deviations continue.			
		ZDC			
ZDC-3-49	1250	Cluster of storms with level 5 and tops to 44kft extends from OTT to SBY in northeast ZDC	CIWS VIL, Echo Tops, CWF	5	16
ZDC-3-50	1310	Storms are in northeast ZDC. Five BOS flights to the south were let go (not supposed to) so ZDC is now trying to accept them.			

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-51	1315	SPO: CCFP 6-hour forecast shows clear east-west path through ZDC (BKW to SBY). Time was spent coordinating the Louisville playbook through ZDC. The STMC is very concerned.	CCFP	5	
ZDC-3-52	1342	A short cluster is located in northeast ZDC. LWX and DIX radars are down now. The STMC is not happy and mentions the outage on the SPO. Note: When DIX went down, convection on WARP became significantly weaker due to the loss of the radar data. With CIWS, the TMU knows when radars are missing and that the "weaker precipitation" is due to data loss. There is not indication of missing data on WARP.	CIWS VIL, WARP	5	13, 14, 16
ZDC-3-53	1430	During the TMC hand-off briefing at the severe weather position, the TMC described various weather and volume concerns. TMC points out immediately that two NEXRADs are down (CIWS) and weather in this is lower quality and less reliable. He tells the relief TMC that this is also true on WARP, but there is no indication of it on that system. Relief TMC is warned to be wary of reroutes or route openings through this area. Planes will still likely be deviating through weather that may look weak and that may not be the "safest play". Information of radar outages in CIWS is a safety benefit as well as a workload benefit.	CIWS VIL, Coverage pattern	5	13, 14, 16
ZDC-3-54	1435	DIX is back in the CIWS mosaic.			
ZDC-3-55	1440	Weather on J75 in northeast ZDC with tops to 31 kft. The STMC is contemplating keeping routes open at FL320 or FL340 and above by using CIWS echo tops and echo tops forecast. He is holding off closing the route for now because low altitude flights are deviating but being handled and higher altitude flights are going over the weather. Without CIWS, the STMC would likely have closed the route.	CIWS VIL, Echo Tops, Echo Tops Forecast	1	1
ZDC-3-56	1447	Weather in northeast ZDC. The STMC made a proactive request of the Area Sup to ask for release of VACapes airspace using the CIWS echo tops forecast.	CIWS VIL, Echo Tops Forecast	2	5, 12

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-57	1453	Storms are along the coast. The STMC is considering White/Wavey flows. He consults CIWS echo tops, noting that tops at 35 kft. No growth or decay detected and the STMC is considering opening high altitudes. He wants to wait a bit longer.	CIWS VIL, Echo Tops, Growth and Decay Trends, Echo Tops Forecast	1	1
ZDC-3-58	1500	ETMS developers are visiting the TMU to observe how ETMS is used and what upgrades could be useful. When discussing the use of ETMS in the TMU, the TMC continues to point to CIWS for weather information.	CIWS	5	16
ZDC-3-59	1505	Storms in north ZDC. The TMC is using CIWS echo tops to plan for White/Wavey traffic at high altitudes. He is estimating the J6 impact. He called the Area Sup, referencing maximum tops at 32 kft and discusses opening White/Wavey and BOS departures at 35 kft. J121/J174 are opened at and above 35 kft for BOS departures using CIWS. Pathfinders are needed on White/Wavey for New York departures because they don't have as much time to climb as BOS. The moderator on the SPO thanked ZDC for this route opening, saying it was "a big help." Without CIWS, the departure route over White/Wavey would have remained closed.	CIWS VIL, Echo Tops, Growth and Decay Trends	1, 5	1, 11, 12
ZDC-3-60	1525	CWSU provides an informal briefing for the STMC. He uses CIWS to note tops are status quo. The next area of development is expected to be in east-central ZDC.	CIWS VIL, Echo Tops	5	16
ZDC-3-61	1540	There is concern about the weather four to six hours from now. The STMC consults CCFP, which at 21Z has broad high-confidence area across north ZDC to the coast. Current Louisville playbook brings west coast through ZDC to EWR/LGA. The STMC voices concern for this plan and potential for these planes to get cut off.	CCFP	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-62	1545	Weather in northeast ZDC. The weather seems to be weakening (tops are dropping according to CIWS). The Area Sup and STMC, using CIWS, agree to request more White/Wavey departures. The BOS southbound route is now open at and above 34 kft (instead of 35 kft). The are still waiting to see what initial White/Wavey flights (now airborne) will do when they reach the impact area. Without CIWS, they would not have opened BOS at and above 34 kft and would not have requested more White/Wavey traffic from NY. Without CIWS, it would have taken more time to consult with the CWSU on tops and White/Wavey may not have been opened.	CIWS VIL, Echo Tops, Echo Tops Forecast	1, 5	1, 12, 14
ZDC-3-63	1555	Weather in northeast ZDC. The tops of the weather in northeast ZDC are lowering. The STMC confers with the Area Sup (using CIWS) about keeping an eye on this area. Once a concrete report from an aircraft that the route is open, they will try a full opening over White/Wavey.	CIWS VIL, Echo Tops	5	12, 16
ZDC-3-64	1700	Weather near White/Wavey had decayed.			
ZDC-3-65	1715	Weather impact north of IAD near NY/DC border. ZNY seeks to take arrivals through their airspace further east, away from weather. The STMC is trying to understand why this is needed given that weather looks relatively benign, then notes that even though weather is within the CIWS close-range coverage, the closest radar (LWX) is missing. He contributes the look of the weather to underestimation due to loss of coverage.	CIWS VIL, Echo Tops, Storm Motion, Coverage pattern	5	16
ZDC-3-66	1725	LWX radar is back			
ZDC-3-67	1730	SPO: ZDC was asked to provide a weather update. The STMC examined CIWS to comment that no "build-ups" were evident at this time and the current weather situation is better than yesterday.	CIWS VIL, Echo Tops, Growth and Decay Trends	5	16
ZDC-3-68	1800	Weather building in ZDC. The STMC used CIWS for a hand-off briefing.	CIWS VIL, Echo Tops, CWF, Growth and Decay Trends, Echo Tops Forecast	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZDC-3-69	1840	Weather building in northeast ZDC. The Area Sup uses CIWS to reference weather to STMC, telling him that weather is building and that CLT and ATL traffic needs to be slowed.	CIWS VIL, Echo Tops, Growth and Decay Trends	1, 5	5, 12, 14
ZDC-3-70	1905	Weather building throughout ZDC. The STMC uses CIWS to monitor various weather impacts. He uses storm motion and CWF to gauge pending impacts and growth and decay to become aware of particularly serious impacts.	CIWS VIL, CWF, Storm Motion, Growth and Decay Trends, Echo Tops	5	16
ZDC-3-71	1924	Weather cluster building in northeast ZDC. Area 5 Sup reports over flights are still working and CIWS tops confirm that over flight opportunities (i.e., BOS southbound departures) can continue. However, the low-altitude traffic (departures over White/Wavey/OOD from PHL/NY) are deviating. Given the active MOA, these departures must be stopped. Over flights can continue for now. Without CIWS, White/Wavey departures would still have been stopped by the Area Sup, but over flight traffic would have been stopped also. CIWS allowed ZDC to keep over flight traffic moving. The decision was initiated by the Area Sup, saving TMU workload in developing, coordinating externally, and implementing an additional/different plan.	CIWS VIL, Echo Tops, Echo Tops Forecast, Growth and Decay Trends	1, 5	1, 12, 14
ZDC-3-72	1950	Weather in ZDC near metro area. SWANN/PALEO stopped for 30 minutes per Area Sup request.	Unknown		
ZDC-3-73	2009	Weather in northeast ZDC. SWANN/PALEO reopened as one.			
ZDC-3-74	2010	Significant NEXRAD radar outage. It looks like only southern region and Canadian radars remain.			
ZDC-3-75	2045	NEXRAD coverage still missing. The STMC customizes a weather display on the ETMS for long-haul flights	ETMS	5	
ZDC-3-76	2100	NEXRAD coverage returns.			
ZDC-3-77	2115	Scattered storms in northeast ZDC. J174 reopened. The call was made by the Area Sup using CIWS, saving TMU workload.	CIWS VIL, Echo Tops, Growth and Decay Trends.	1, 5	1, 12, 14

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZBW			
ZBW-3-21	1500	Weather in ZDC caused problems this morning for J121/J174 traffic. J48 traffic is ground stopped to NY from 1244 to 1600 due to volume. J121/J174 is rerouted south of ORF from 1309 to 2200.			
ZBW-3-22	1535	A cluster of level 5 cells is located northwest of ALB with tops to 51 kft and moving east at 25 kt. CIWS shows growth on the leading edge. These storms are currently not causing problems for ZBW because they are between routes. As they move east, they will cause problems with inbound traffic over ALB.	CIWS	5	16
ZBW-3-23	1601	Weather is northwest of ALB. The STMC stated that he likes CIWS CWF. It shows that there is no growth on the southwest edge of the line, which would cause problems. The CWSU briefs that weather will grow on the southwest edge and move slightly south. CIWS is used for situational awareness. Planes on J6 are reporting overhangs. The TMU uses contours to judge the location of the weather two hours from now.	CIWS VIL, CWF, Storm Motion, Forecast Contours	5	16
ZBW-3-24	1611	J75 is ground stopped due to weather; no route is available. ATL international flights have no route either. The STMC called ATCSCC SvrWx.			
ZBW-3-25	1622	J121/J174 is open above FL340. ZDC and ATCSCC made this decision due to issues with ATL traffic.			
ZBW-3-26	1624	There are 52 kft echo tops north of ALB. The STMC passes this information to the TMU.	CIWS Echo Tops	5	16
ZBW-3-27	1630	The TMC asked the STMC why J75 is closed to ZBW. The STMC says that NY is using it because J6 is closed. J48 is clear. There is only a small cell over J6 with echo tops to 30 kft. The TMC complains that J48 should be open.	CIWS VIL, CWF, Echo Tops, Storm Motion	5	12, 16
ZBW-3-28	1631	The Area B Sup came to the TMU to ask why J75 is closed. CIWS is used for situational awareness.	CIWS VIL, CWF, Echo Tops, Storm Motion	5	12, 16
ZBW-3-29	1634	The CWSU questions why the echo tops on the weather north of ALB seem higher on WARP than CIWS. The observer captured an image.	CIWS Echo Tops		
ZBW-3-30	1643	The TMC is looking at CCFP regions and notes motion. He thinks the regions will collide.	CCFP	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-31	1645	The STMC consults CIWS precipitation and comments that he is happy that the forecast has been accurate. He studies new growth behind and south of J547. This is going to cause problems if they all develop around ALB. CIWS is used for situational awareness. IAD is ground stopped until 1730 due to thunderstorms.	CIWS VIL, CWF, Growth and Decay Trends, Storm Motion	5	16
ZBW-3-32	1734	Weather is over IAD. The STMC displayed the MULLR fix. Level 2 weather is moving north over MULLR. The STMC asked Potomac TRACON about MULLR. The STMC can't understand why ZNY can't take all internationals.	CIWS Storm Motion, ASR Precip	5	12, 16
ZBW-3-33	1744	J80 and J6 are closed except for IAD international flights.			
ZBW-3-34	1745	Weather south and west of ALB is growing and moving southeast at 5 to 10 kt. Weather is growing in central NH. Traffic is holding over HNK.	DSR	5	
ZBW-3-35	1748	One TMC is working in the Area tonight. The STMC would prefer to have all six TMCs on position. CIWS is used for situational awareness.	CIWS	5	16
ZBW-3-36	1750	The STMC wonders why they can't go to IAD. A Sup in the NY Center said "no."			
ZBW-3-37	1753	The STMC questions ZNY use of CIWS. Sector 11 shows only level 2 weather. He wonders why "this piece of equipment is not being used."	CIWS VIL, CWF, Storm Motion, ASR	5	12, 16
ZBW-3-38	1807	The CWSU briefs the TMC. Weather over ALB is growing. The line of weather in Ontario is the front and will fill in. This might cause problems with NY reroutes. The TMC is concerned with weather over IAD.	CWSU, All CIWS products	5	12, 16
ZBW-3-39	1827	The TMO is concerned with MHT-Cambridge weather. His plane will be using this route in three hours, but won't be able to go over HNK by then.	CIWS VIL, CWF, Storm Motion	5	16
ZBW-3-40	1828	The STMC briefs the Operations Manager about the weather scenario. The Operations Manager says they will have to "spread out" sector 10 for relief since weather is sliding into the sector.	CIWS VIL, CWF, Storm Motion	5	12, 14, 16
ZBW-3-41	1829	The TMO and Operations Manager are discussing CIWS	CIWS	5	16
ZBW-3-42	1834	MHT will be impacted.	CIWS VIL, Forecast Contours	3, 5	4, 7, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-43	1839	ZBW needs to ground stop BOS departures over MHT. The Area B Sup asks the STMC to take the first two planes with reroutes.	DSR, CIWS VIL, Forecast Contours	3, 5	4
ZBW-3-44	1840	The TMO and TMC are using CIWS to estimate J174 traffic and weather.	CIWS	1	5, 14, 16
ZBW-3-45	1844	Staffing is good. The STMC released one TMC to Area C, bringing the count to 6. There are continued MIT restrictions for eastbound traffic due to weather.			
ZBW-3-46	1848	Sector 10, Area A reports deviations due to weather near ALB. They are requesting 20 MIT as on. The STMC doesn't want to implement the "as one" restriction, but the Area is demanding it.			
ZBW-3-47	1854	J174 restriction is extended and increased.			
ZBW-3-48	1859	The STMC is using CIWS to plan a new route for MHT two hours from now. He is wondering how long Gardner will be available. He used CIWS for situational awareness and pre-planning.	CIWS VIL, CWF, Storm Motion, Forecast Contours	2, 5	3, 4, 14
ZBW-3-49	1903	There is no route to CLT. They can't go down the coast.			
ZBW-3-50	1905	The TMC used CIWS to determine a route for traffic east of the weather. The route is Kennebunk/Augusta/Plattsburg/SYR with 5 minutes in trail until 21Z.	CIWS VIL, CWF, Storm Motion, Forecast Contours	2	3
ZBW-3-51	1919	The Operations Manager asked the TMC why they want to go up over MSS. There is no CIWS display in the Operations Manager's area.	WARP	5	
ZBW-3-52	1922	The STMC is concerned about the line of weather in NH (tops to 51 kft). It is stretching and they are losing GDN. They can't take NY traffic through MSS because they expect to lose that route very soon due to weather. Everything in Toronto is shut due to weather.	CIWS VIL, CWF, Echo Tops, Forecast Contours, Growth and Decay Trends, Storm Motion	5	3, 14, 16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-53	1935	The STMC called SCC SvrWx. CAN7 west is in the plan, but this route doesn't look feasible due to weather. The STMC is coordinating with SvrWx to shut the route early.	CIWS VIL, CWF, Storm Motion, Forecast Contours	1, 5	2, 12, 14, 16
ZBW-3-54	1942	MHT is launching jets. They should be ground stopped. The Area Sup visited the unit.			
ZBW-3-55	1946	The CWSU used CIWS and WARP during the stand-up briefing for situational awareness. BOS is expected to be impacted around 6PM. Staffing includes one CIC; weather coordinator. The STMC pulled himself out to handle Area calls.	CIWS/WARP	5	16
ZBW-3-56	1953	BWI and DCA traffic is ground stopped.			
ZBW-3-57	1954	Weather is forecast to be out of NH and over the coast in two hours. Weather at the southern end of the line is decaying in the forecast loop, which indicates that the weather will stay north of BOS. BOS may become grid locked later because they are having trouble getting traffic out now.	CIWS VIL, Growth and Decay Trends, CWF	3, 5	4, 14, 16
ZBW-3-58	1958	ALT ground stop.			
ZBW-3-59	2000	DTW ground stop.			
ZBW-3-60	2001	BOX and BGM radars have dropped out.			
ZBW-3-61	2003	Area B/Gardner is impacted. BOS arrivals are SCUPP to BOS.			
ZBW-3-62	2004	Many radars have dropped out of CIWS coverage along the east coast.			
ZBW-3-63	2010	The TMC notes that weather is dissipating in NH. The Area Sup came to the unit and mentioned the decay.	CIWS VIL, CWF, Storm Motion, Forecast Contours	5	14, 16
ZBW-3-64	2011	The TMC is curious about the tops near MHT. The radars are down so there is no coverage. He would have used CIWS products if they had been available.	WARP, DSR	5	
ZBW-3-65	2013	AREA A should take arrivals now.			
ZBW-3-66	2021	The line of weather dissipated on the coast. The TMC used WARP due to missing coverage in CIWS. General Aviation Traffic is on J174 going west of storms.	WARP	5	

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-67	2027	The DSP TMC is looking at WARP for weather information.	WARP	5	
ZBW-3-68	2029	CIWS remains very limited.			
ZBW-3-69	2033	A restriction was sent to ZNY regarding Concord and Lacoma traffic. Ground stop Chester Cambridge. The Area Sup came to the unit to report sector 38 overload.			
ZBW-3-70	2036	Weather is clear at the coast. They are taking BOS to SCUPP and out through gaps in the weather.	WARP	5	
ZBW-3-71	2059	Radars are returning in CIWS coverage. The line through MHT dissipated.			
ZBW-3-72	2104	Level 5 weather with lightning is over ALB and approaching western MA in two hours, but it is dissipating. DTW is ground stopped due to a microburst on the field.	CIWS VIL, Lightning, Growth and Decay Trends	5	16
ZBW-3-73	2127	Weather is over ALB. GREKI traffic is being moved over to MERIT. SCC, the Severe Weather TMC, and N90 are coordinating on the phone.	CIWS VIL, CWF	2, 5	3, 12
ZBW-3-74	2135	The weather over DCA is showing growth. There is no ground stop for Montreal. ZNY is holding for DCA and it is possible that ZBW will be holding also. The Area Sup is in the unit. DCA is ground stopped for one hour.	CIWS VIL, Growth and Decay Trends	5	12, 16
ZBW-3-75	2155	The STMC is on the phone with BOS TRACON regarding weather at ALB. ALB traffic is being kept on the ground but SYR is released.	CIWS VIL, Echo Tops, Growth and Decay Trends, CWF	3, 5	4, 12, 16
ZBW-3-76	2158	BOS arrivals are being impacted. They are coordinating with the TMC to identify a route to send them out and around the weather.	CIWS VIL, Echo Tops, CWF	2, 5	3, 12
ZBW-3-77	2200	The TMC is asking if weather in MA will dissipate. He is using the CIWS display to assess the two hour forecast and estimate the time of impact for BDM and BDL.	CIWS VIL, CWF, Growth and Decay Trends, Lightning, Forecast Contours	3, 4	4, 7

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZBW-3-78	2218	The Burlington arrivals from the west are going via SYR because they expect GDM to be impacted. They will coordinate with ZOB, rerouting to the north.	ETMS, CIWS VIL, CWF, Storm Motion, Forecast Contours	2	3
ZBW-3-79	2225	DTW MIT is cancelled.			
ZBW-3-80	2226	Sector 22 is overloaded.			
ZBW-3-81	2229	A line of weather is located over BDL. Traffic is stopped. The TMC is coordinating on the phone. CIWS is used for situational awareness.	CIWS VIL, Storm Motion	5	16
ZBW-3-82	2231	No BOS departure delays reported. They have been able to keep them going.			
ZBW-3-83	2246	J75 is ground stopped, excluding DC metro.			
ZBW-3-84	2257	J6/J48 are closed again.			
ZBW-3-85	2301	A decaying line of weather is located west of ALB. There are gaps in the level 3 cell over ALB. Aircraft are navigating the gap. CIWS is used for situational awareness.	CIWS VIL, Storm Motion, Growth and Decay Trends	5	16
ZBW-3-86	2313	ZOB wants three airports stopped. BWI via J75 is ground stopped.			
ZBW-3-87	2318	The STMC claims that westbound traffic is doing OK, but southbound traffic is an issue.			
ZBW-3-88	2324	The STMC points out that weather in MA is moving slowly. He pointed out that the leading edge is decaying and the back edge is growing, causing the appearance of slow movement.	CIWS CWF	5	16
ZBW-3-89	2328	The TMC and STMC discuss the weather south of ALB.	WARP	5	
ZBW-3-90	2337	TEB GDP cancelled.			
ZBW-3-91	2338	The STMC is questioning the weather northwest of BDL. The line in central NY has dissipated. It is now level 3. BDL departures over Cambridge are OK.	CIWS VIL, Storm Motion	3, 5	4, 16
ZBW-3-92	0009	Weather dissipating in MA. Traffic should return to normal soon.			

CIWS Benefits Assessment
Observation Period #3 Observations Summary
Day 4 – August 3, 2005

Participating Facilities: ZMP

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
		ZMP			
ZMP-3-1	1240	The MCS decaying as it moves from western MN (most lightning is gone). New activity has developed over eastern IA and southwest WI (in ZAU), with tops to 43kft in a broken line. Some MIT's and CDR's to west are the only real restrictions (no SWAP's are in place). Configuration is 30 RWY's with 56 AAR.	CIWS VIL, CWF, Echo Tops Forecast, Growth and Decay Trends	5	16
ZMP-3-2	1255	CWSU came into TMU to say the weather to west was diminishing quite fast and it would not make it to the terminal area. He also mentioned that the DMX NEXRAD has been producing spikes and it's been breaking through in CIWS in the form of extra high echo tops. TNO plans/restrictions needed because the weather continues to diminish to west.	CWSU, CIWS VIL, CWF	5	16
ZMP-3-3	1315	Continued decrease in weather area to west. The thin line of activity over northwest ZAU is also forecasted to decrease in the next couple hours (per CCFP). CIWS CWF doesn't show it all decreasing rapidly. CCFP shows no appreciable weather in MSP area for next 6 hours.	CCFP, CIWS CWF	5	16
ZMP-3-4	1335	The only weather having any substantial impact is well north (in Area 4. They do not have CIWS.) Weather over eastern ZMP is low-topped and not a major factor to traffic. Area 1 SUP said he's really not having any major issues. He's got CIWS but said right now things are pretty smooth.	CIWS VIL, Echo Tops	5	12, 16
ZMP-3-5	1430	Weather to west continues to decay. Couple tops reach up to 30 kft. Traffic going west (i.e. ABR1 SID) is sometimes making small deviations, but not a big deal. CIWS is mostly used for situational awareness at this time.	CIWS VIL, Echo Tops	5	16
ZMP-3-6	1515	Weather in ZAU space is still there, not diminished like CCFP suggested it would. This is causing some single streams going out of ZMP into ZAU to east over DLL, but not big deal for ZMP.	CIWS VIL	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-3-7	1530	The weather in the northwest part of ZAU now has ZAU telling ZMP they want increased restrictions in that area. ZAU will only take MSP traffic that is routing over DLL, so ZMP decides best way to accommodate that is by swapping ODI over DLL with 20 MIT. This was driven by ZAU, so while they saw they were okay to do this SWAP looking at various weather tools, they really weren't using weather tools to determine what to do. ZAU would only take DLL traffic, so this was the best way to keep as much going that way as possible. The end will be dictated by ZAU again accepting routing into their space over fixes other than just DLL, but could be some pushing from MSP tower or TRACON if it gets to point where they cannot get all of their traffic out.	CIWS VIL, CWF, Echo Tops Forecast, Growth and Decay Trends	5	12, 16
ZMP-3-8	1600	Regarding the swap of ODI over DLL, TMC sees weather is now more over DLL than ODI, and growth and decay trends and forecast show it more intense to north with more breaks/weaker to south. He feels it would make more sense to have the single stream over ODI and not DLL. He calls ZAU to say this – they'll get back to him.	CIWS VIL, CWF, Growth and Decay Trends	2, 5	3, 12, 16
ZMP-3-9	1615	The weather near DLL and BAE is diminishing. ZAU has given ZMP the ODI route back, with 20 MIT, per TMC's suggestion a bit ago. This effectively ends the SWAP of ODI over DLL. The plan was basically based on the suggestion of TMC at ZMP, even though decision had to come from ZAU. The time saved was a result of TMC seeing weather decaying in CIWS. Without CIWS, he wouldn't have made the suggestion when he did. The TMC indicates that 5 minutes is a conservative estimate of the savings. He said it may have taken even longer before he would have recognized there was the potential to end the SWAP.	CWSU, WARP, CIWS VIL, CWF,	2	3, 12, 14
ZMP-3-10	1650	The weather in ZMP not really an issue at this time. Normal routes with exception of the 20 MIT restriction ZAU still wants out of ZMP over DLL. TMC asking ZAU if they think the restriction can be lifted, as weather appears to be not very substantial that vicinity. ZAU says let it go for a few more flights, then can be lifted.	CIWS VIL, CWF	1	1, 12

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-3-11	1800	Right now very minimal impact from weather. Some weather still over ZAU in the vicinity of BAE & JVL, and isolated cells over N MN. Only current restrictions are the 20 MIT on departures over ODI, and they are still helping out ZAU by having some of the DLL departures go out over RST on the RST1 SID (but not a SWAP).	CIWS VIL, CWF, Growth and Decay Trends	5	16
ZMP-3-12	1850	Weather impact is minimal. They are waiting for expected new development as afternoon goes on. Observer checked with areas and they are all seemingly in pretty good shape as well. Area 1 has some weather over north WI and the Upper Peninsula of MI, but he said it's not causing any issues.			
ZMP-3-13	2000	Some activity continues over far north MN – not in an area that causes much in way of impacts. Also some cells over northeast IA, but not very intense and not currently an issue for traffic. No weather related restrictions. STMC says he is watching for the predicted development and wants to be right on it should anything happen, since it's somewhat unknown as to where things may initially develop.	CWSU, CCFP, CIWS VIL,	5	16
ZMP-3-14	2110	Some development over northwest MN, but still minimal. Largest concentration of weather continues to be over far north and northeast MN. They are still watching and waiting, but currently running smoothly. Latest CCFP (from 2100 Z) shows area of thunderstorms developing north of MSP by 2300 and filling in more by 0100 to encompass south and east MN. From this time, if storms develop, the impact will be marginal as it gets later in day.	CWSU, CIWS VIL, Growth and Decay Trends	5	16
ZMP-3-15	2210	No weather over majority of ZMP. What weather there is remains to the north and is causing very minimal impact. Still have all routes open, no restrictions. Watching to see if there will be increased coverage of storms.	CWSU, WARP, CIWS VIL	5	16
ZMP-3-16	2250	The thunderstorms in ZAU southeast of DLL have intensified somewhat. ZAU said they are starting to get too many deviations around that area and told ZMP that no more routes will be accepted over DLL, similar to earlier in day when ZAU shut off this arrival fix. TMC at ZMP has decided they will merge the stream that normally goes over DLL with the stream going into ZAU over MCW. This is instead of the SWAP they implemented this morning. There is more traffic at this time from west using DLL, as opposed to more MSP departures, so it makes more sense to blend it with MCW traffic into ZAU.	CIWS VIL, CWF, and Echo Tops	2, 5	3, 12

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-3-17	2320	Weather to the west is starting to impact ZMP traffic to/from ZDV. ZDV asking for some specific routing into their air space. This is being driven by weather west of the CIWS domain.			
ZMP-3-18	2325	Weather in ZAU approaching ORD is causing new routing. ZAU is now only accepting 1 stream into ORD, via LMN, BDF (the BDF3 STAR for ORD). No JVL, DBQ, or DLL. While it impacts ZMP, it's still mostly a ZAU issue.			
ZMP-3-19	2340	Weather over SD is causing some flights bound for ORD to deviate further north. Area Sup suggested that the flights already deviating north into ND may be better off going from GRB to PMM to ORD, rather than trying to get them back south on the LMN to BDF to ORD route. There are gaps in weather between GRD and PMM so this looks very possible. ZAU agreed to allow the 3 flights already in ND to use this suggested routing with 20 MIT. Even though ZAU had to officially allow this, it was brought up as a result of Area 1 SUP, who wanted to use this route because it was shorter to fly for the flights deviating into ND and available when he looked at CIWS. (Echo tops were low for weather that existed between GRD and PMM). The TMC referenced both CIWS and WARP.	WARP, CIWS VIL, CWF, Echo Tops	2, 5	3, 12, 14
ZMP-3-20	0008	The weather has finally developed, but it is still well to west over east SD. Currently the weather is between the ABR1 and ONL1 SIDS, so it's not really causing the west departures any problems yet.	WARP, CIWS VIL, CWF	5	16
ZMP-3-21	0025	Weather is to the west. Some flights going out ABR1 SID to the west are starting to deviate around cluster of storms over MN/SD border, but not enough to need MIT's yet – per Area Sup.	WARP, CIWS VIL, CWF, Echo Tops Forecast	5	16
ZMP-3-22	0058	The TMU is closely watching when the ABR1 west departure route is going to be impacted. They would rather not have to SWAP, so may instead make a single stream or something creative.	WARP, CIWS VIL, CWF, Echo Tops	5	16

Identifier	Time (UTC)	ATC Concern, Planning Decision, CIWS Applications (if applicable), and Comments	Weather Products Used	Impact Planning Category	CIWS Benefits Category
ZMP-3-23	0120	Cluster of storms to the west. Both TMCs are looking at weather and looking at options for ABR1 and ONL1 SIDS to the west. They decided to put out a 15 MIT restriction on ABR1 effective at 0215. Note: that may be increased subsequent to a call that deviations were starting to increase out over ABR1. The TMC estimated that he saved 10 minutes because the CIWS forecast showed him that ABR1 and ONL1 would likely be impacted in one hour. They want to "manually" SWAP to the FAR1 SID. Rather than enter an official SWAP, which requires the tower to route aircraft way north, a manual SWAP allows ZMP and the tower to coordinate taking aircraft out over FAR, then cutting them back to the west as soon as they clear the weather. In this way, the aircraft can get onto the back end of the more favorable route (ABR1 or ONL1). However, this is more work for ZMP and the tower, whereas the SWAP comes with a set CDRs.	CIWS VIL, CWF, Echo Tops	2	3, 14
ZMP-3-24	0150	Storms are approaching from the west. Going to a single stream with 15 MIT now for ABR1 and ONL1, and they (the tower) can manually swap some of the departures over BRD as well to help get them all out ahead of weather. CIWS may not have saved time up front, but CIWS likely may have added quality to decision, which will help in overall benefit realized.	CIWS VIL, CWF, Echo Tops, Echo Tops Forecast	2	3
ZMP-3-25	0215	The cluster of cells to west is now within 75 miles of MSP. The tower wants SWAPs officially turned on. They don't want to do the manual CDR's because there is a lot of work involved in coordinating with individual flights. Therefore, the SWAP is on for ABR1 over FAR1, and ONL1 over ORSKY1. This was just a sort of formality because they were going to let the SWAPs be done manually, but now the SWAP is officially being used.	CIWS VIL, CWF, Echo Tops	5	12, 16