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Final Report for the ATC Operational Evaluation of the Prototype Integrated Terminal Weather System (ITWS) at Dallas/Fort Worth and Orlando Airports (May-September 1993)

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March 1995

DOT/FAA/CT-TN95/01

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN95/1		

4. Title and Subtitle	5. Report Date
FINAL REPORT FOR THE ATC OPERATIONAL EVALUATION OF THE PROTOTYPE INTEGRATED TERMINAL WEATHER SYSTEM (ITWS) AT DALLAS/FORT WORTH AND ORLANDO AIRPORTS (MAY - SEPTEMBER 1993)	March 1995
	6. Performing Organization Code
7. Author(s) Thomas M. Weiss, ACW-200	8. Performing Organization Report No. DOT/FAA/CT-TN95/1
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405	10. Work Unit No (TRAILS)
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405	13. Type of Report and Period Covered Technical Note
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Integrated Terminal Weather System (ITWS) was developed by Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL). The ITWS processor acquires data from Federal Aviation Administration (FAA) and National Weather Service (NWS) weather sensors in the terminal area and provides an integrated set of safety and planning weather products to air traffic personnel. An operational evaluation of the ITWS functional prototype was performed from May through September, 1993 at Dallas/Fort Worth (DFW) and Orlando (MCO) airports. ITWS geographical situation displays (GSD) were located both at DFW and MCO as well as the Fort Worth Air Route Control Center (ARTCC)(ZFW) and Jacksonville ARTCC (ZJX). The purpose of testing ITWS at these sites was to evaluate various technical and operational issues of ITWS weather products and their display and usability on the GSD.

Terminal traffic managers, area supervisors, and area managers were asked to answer questionnaires at the completion of the demonstration.

This report summarizes the results of the questionnaire analysis performed by ACW-200D. A separate analysis of each set of questionnaires was performed (as opposed to a joint analysis) and are discussed separately, since product applicability and usage between the two sites varied.

The demonstration should be considered successful from the standpoint of (1) the users received invaluable experience with the ITWS prior to the 1994 DEMVAL OT&E, and (2) ITWS products were developed and refined as a result of user feedback from the 1993 demonstration for future OT&E.

17. Key Words	18. Distribution Statement
Integrated Terminal Weather System (ITWS) Demonstration/Validation (DEMVAL) Operational Test and Evaluation (OT&E)	Document is on file at the Technical Center Library, Atlantic City International Airport, NJ 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price
Unclassified	Unclassified	129	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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EXECUTIVE SUMMARY

The Integrated Terminal Weather System (ITWS) is a terminal area weather system developed to provide an integrated set of safety and planning products to air traffic area personnel. The dissemination of this weather information to these users is critical toward maintaining and enhancing terminal safety and air traffic planning during periods of hazardous weather; an additional benefit is decreased controller workload.

The outputs of various Federal Aviation Administration (FAA) and National Weather Service (NWS) sensors (e.g., Terminal Doppler Weather Radar (TDWR), Low Level Windshear Alert System (LLWAS), Airport Surveillance Radar (ASR-9), Next Generation Weather Radar (NEXRAD)) are processed by ITWS and displayed as real-time products on a geographic situation display (GSD) to the users in a manner that does not require meteorological interpretation.

The types of products that the ITWS offers are: gust fronts and gust front predictions, microburst alerts and predictions, terminal winds, storm motion and predicted movement, short and long range precipitation, storm cell information, and lightning. The ITWS is not limited to these products; it is an adaptive system, capable of expansion as additional sensors are developed in the future.

An operational demonstration of ITWS prototypes was conducted at Dallas-Forth Worth (DFW) and Orlando (MCO) airports during the summer of 1993. Various existing, new and modified products were evaluated at these sites as well as at the FAA Technical Center by ACW-200D. GSDs were operated at DFW, MCO, FAA Technical Center, Fort Worth Air Route Traffic Control Center (ARTCC ZFW), and Jacksonville ARTCC (ZJX). Questionnaires were distributed to the users at the end of the demonstration and were collected and analyzed by ACW-200D. This report contains the results of the analysis of the questionnaires.

1. INTRODUCTION.

The Integrated Terminal Weather System (ITWS) was developed by Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL). The ITWS processor acquires data from Federal Aviation Administration (FAA) and National Weather Service (NWS) weather sensors in the terminal area and provides an integrated set of safety and planning weather products to air traffic personnel. An operational evaluation of the ITWS functional prototype was performed from May through September 1993, at Dallas/Fort Worth (DFW) and Orlando (MCO) airports. ITWS geographical situation displays (GSD) were located both at DFW and MCO as well as the Fort Worth Air Route Control Center (ARTCC) (ZFW) and Jacksonville ARTCC (ZJX). The purpose of testing ITWS at these sites was to evaluate various technical and operational issues of ITWS weather products and their display and usability on the GSD.

Additionally, Delta Airlines and Northwest Airlines operated GSDs in Atlanta and Minneapolis, respectively.

Terminal traffic managers, area supervisors, and area managers were asked to answer questionnaires at the completion of the demonstration. These questionnaires dealt with the usability and display of various ITWS weather products (e.g. Storm Motion, Storm Extrapolated Position (SEP), Microbursts, Lightning, Long and Short Range Precipitation, Storm Cell Information, etc.).

The questionnaires were quantitative in nature, in that many of the questions dealt with the frequency of use of a product to perform certain activities, or their usefulness; they were also qualitative in that comments and suggestions were solicited about each product and its use for specific tasks.

1.1 PURPOSE.

This report summarizes the results of the questionnaire analysis performed by ACW-200D. A separate analysis of each set of questionnaires was performed (as opposed to a joint analysis) and are discussed separately, since product applicability and usage between the two sites varied, relative to specific products. For example, the users in MCO may not feel a particular requirement for the inclusion/use of Storm Extrapolated Position (SEP), since the storms in the Orlando area tend to move slowly, hence near-term storm position/location is intuitively obvious; on the other hand, users at the DFW may view it as much more useful, since storm cells there tend to move much more rapidly.

Appendices A and B contain the complete summary of the results of the surveys from DFW and MCO, respectively.

2. DOCUMENTS.

a. Test Plan for the Spring/Summer 1993, Integrated Terminal Weather System (ITWS) Demonstration at Dallas-Fort Worth, Texas (June 16, 1993)

b. Test Plan for the Summer 1993, Integrated Terminal Weather System (ITWS) Demonstration at Orlando, Florida (June 18, 1993)

c. Integrated Terminal Weather System Survey for Traffic Managers, Area Managers/CIC, and Area Managers (DFW)

d. Integrated Terminal Weather System Survey for Traffic Managers, Area Managers/CIC, and Area Managers (MCO)

3. TEST AND EVALUATION DESCRIPTION.

3.1 TEST SCHEDULE AND LOCATIONS.

The ITWS evaluation ran from July through the end of September 1993, at MCO, and from May through the end of September 1993, at DFW. The test plan called for the ITWS to be operational each day from noon to 1900, Monday through Friday; this was the timeframe in which severe weather was most likely to occur. However, the test plan gave MIT/LL the option, coordinated with the traffic manager, to suspend operations when no significant weather was expected. Since there was minimal adverse weather in Dallas last summer, the ITWS was rarely operational. The lack of operational exposure to the ITWS is reflected in some of the responses received from DFW users.

3.2 PARTICIPANTS.

MIT/LL personnel supported both test sites with technicians and engineers to maintain and monitor the equipment. Traffic managers, area supervisors/Controllers in Charge (CIC), and area managers used the ITWS GSD display in the tower and the Terminal Radar Approach Control (TRACON) facility. FAA Technical Center personnel monitored the evaluation on a random basis at each site, and were capable of viewing live data on the GSD that was maintained at the Technical Center, at any time that the system was operational.

3.3 TEST AND SPECIALIZED EQUIPMENT.

The product availability at each site varied in part due to the availability of input data. The MCO operation used Terminal Doppler Weather Radar (TDWR), Next Generation Weather Radar (NEXRAD) (from Melbourne, FL), and Airport Surveillance Radar Model 9 (ASR-9) data. Products included long and short range precipitation and storm motion, microburst and wind shear alerts, storm extrapolated position (SEP), lightning, and terminal weather text products.

At DFW, ITWS inputs were restricted to the output of the University of North Dakota radar (which served as a surrogate TDWR) until June 6, 1993, and two ASR-9 radars located approximately 28 miles east and west of the airport. This limited the exposure of the users to the various ITWS products. In addition, the uncharacteristically benign weather conditions in the Dallas area limited the actual "hands-on time" the users received in Dallas. Products at DFW included short range precipitation, storm motion, SEP, and microburst and wind shear alerts.

These conditions/limitations could skew questionnaire results, which is another reason for the separate analyses.

3.4 TEST OBJECTIVES.

The objectives of the demonstration were to evaluate ITWS prototypes in an operational environment, evaluate the technical merit of the ITWS weather products, evaluate the technical performance of the products (via off-line monitoring of the raw data - radar, lightning, etc.), evaluate the display techniques of the ITWS products, and other human factors issues (usability, selectability of products, readability of the display), and appropriateness of the products in specific weather environments. Pre-Demonstration and Validation (DEMVAL) Operational Test and Evaluation (OT&E) training with the ITWS system was also an objective.

3.5 DATA COLLECTION AND ANALYSIS METHOD.

The questionnaires were delivered and distributed to DFW users on September 11 and collected on October 6, 1993; the MCO questionnaires were distributed on September 23 and collected on October 7, 1993. The questionnaires were separated according to test site and the different answers to each question counted. Totals for each question were obtained and tabulated. Comments and suggestions specific to individual products were listed, as were any overall comments.

Twelve questionnaires were returned from both MCO and DFW; these small numbers should be considered when comparing response percentages. Also, since not all respondents answered all questions, questions that received the same number of particular answer actually have different percentages. For example, if 3 respondents answered a particular way to a certain question, the percentage would be either 25 percent or 27 percent depending on whether 11 or 12 people answered that question. The percentages are intended to indicate a particular trend. Absolute comparisons of percentage values are difficult when using a small baseline (e.g.,12).

The questionnaires were divided into sections that asked specific questions about the individual products, with additional sections for general questions and one for comments and suggestions by the respondents.

4. RESULTS AND DISCUSSION.

As stated, the results at each site will be discussed separately; it is important to note the differences in opinions at the two sites, relative to the differences in the weather conditions and weather sensor inputs.

4.1 DALLAS/FORT WORTH.

Due to the abnormally quiet summer weather-wise in Dallas, the ITWS was not exercised to its full extent. Several of the questionnaire respondents commented that there were products they never saw. Hence, constructive criticism from DFW users was limited.

Thirty questionnaires were delivered to DFW to be completed; 12 were returned.

4.1.1 DFW Questionnaire and Discussion.

4.1.1.1 General.

In the section of general questions, 33 percent thought that the ITWS would increase arrival/departure rates (at 7-12 aircraft an hour) during thunderstorm activity in the TRACON area, while 42 percent felt the rate would remain the same. Twenty-five percent thought that pilot deviation requests would decrease with ITWS use, while 58 percent felt it would remain the same and 17 percent did not know. (Note: In contrast, some Orlando users felt that pilot deviations requests would increase with the use of the ITWS.) Thirty-three percent felt that weather-related air to ground radio transmissions would decrease through ITWS use, while 50 percent felt it would remain the same.

Some of the positive comments received in this section were:

- DFW TRACON was able to re-route traffic around ITWS displayed weather before deviations occurred.

- Because pilots rely on airborne radar, deviation requests begin on initial contact; however, the ITWS provides controllers with earlier planning for routes to avoid known weather...

On the other hand, there were comments such as:

- Was not told the ITWS could be used to relay info to pilots.

- To my knowledge, we have not used the ITWS or had it available for use during periods of thunderstorm activity.

These last two comments are training issues to be addressed prior to the commencement of the DEMVAL OT&E.

4.1.1.2 Precipitation Product.

All respondents said that they used the precipitation product either "sometimes" (40 percent) or "often" (60 percent) to anticipate changes in the airport acceptance rate (AAR) during thunderstorm activity in the TRACON area. Some of the positive comments were:

- The ITWS is very useful for traffic planning.

- Weather display is much better than D-BRITE and used to anticipate effects on final approach courses.

- By using (the) product, it was easier to determine routes aircraft would fly.

On the other hand:

- At least once, erroneous routes were coordinated due to AP!

- The equipment was not available enough to make a fair assessment. (Note: It is probably just as accurate to say that weather was not available enough to make a fair assessment, since DFW had rather benign weather this summer.)

Eighty percent said they would "sometimes" (50 percent) or "often" (30 percent) use this product to change the AAR. A comment was received that they would use it to coordinate with ZFW TMU. Most respondents felt they would not use the precipitation product to anticipate changes in aircraft speeds or holds. All respondents felt they would use it to anticipate in-trail restrictions. Eighty-nine percent felt they would use it to anticipate weather induced restrictions on terminal routes and plan traffic flow.

Fifty-five percent thought that the weather situation depicted by the ITWS Precipitation Product was an accurate representation, while 27 percent felt that it was not. Some comments:

- ASR-9 with the ITWS sometimes gave false info.

- Too much AP problem to really evaluate this feature. If there is a route with no precipitation, the pilots fly there. (Note: There were 7 comments out of 12 questionnaires that spoke of the Anomalous Propagation (AP) problem in this section.)

Fifty percent thought that the update rate was adequate, while 10 percent felt it was too slow. (Note: The update rate of this product was the maximum achievable with the ASR-9.) Sixty-four percent said they had observed AP on the display, while the rest didn't know. In some of these cases, it may be that they did not have the opportunity or information to verify that it was in fact AP. Half of the respondents could not say if the AP clutter (on the display) was an operational problem; only one said it was. However, 27 percent said that AP behind

thunderstorms did create an operational problem. One comment spoke of Level 5 precipitation displayed in a clear area. Others spoke of deviation plans being made for nonexistent weather.

Of the comments on how to improve the precipitation product, two mentioned eliminating the AP, and the other asked for a window to display the source in order to know where to look for AP.

4.1.1.3 Storm Motion.

Seventy percent felt they would often use the storm motion product to anticipate changes in the AAR. Some comments:

- Great product.

- The ITWS was useful in anticipating change in AAR.

Forty-five percent seldom used Storm Motion to anticipate changes in aircraft speed; the rest never used it. Fifty-five percent sometimes used the Storm Motion product to anticipate holds; the rest never used it for this purpose. Eighty-nine percent used the Storm Motion product to anticipate in-trail spacing. Seventy-three percent often used it to anticipate clearing of terminal routes and for traffic planning. Some comments:

- Storm Motion helped give the pilots a more educated guess as to when weather would clear the area.

- Used it to adjust routes.

The vast majority of respondents felt that the Storm Motion speed and direction estimates were accurate. Forty-five percent felt the update rate was adequate, the rest either didn't know or felt it was too slow. Only one respondent felt the number of storm motion vectors was too many; the rest either felt the number was fine (73 percent) or did not know. Some comments:

- Eliminate symbol (box) to reduce clutter. (Note: this was done subsequently, for just this reason.)

- Have the length of the vector arrow correspond to speed.

- Make speed display optional, and available in a Storm Cell Information-like window. Not always readable in dark precipitation areas.

4.1.1.4 Storm Extrapolated Position (SEP).

This was a new product introduced near the end of the demonstration; coupled with the minimal number of thunderstorms in the DFW area this summer, this product did not get much use. Forty-five percent never or seldom used SEP to either change or anticipate changes in the AAR, while 55 percent sometimes or often used it. Comments indicated that this was a good product, when it was operational, that it was a good planning tool. Some respondents never saw it. Most did not see it as a useful tool to anticipate holds or changes in aircraft speeds. Fifty-seven percent used SEP to anticipate in-trail spacing and to anticipate weather induced restrictions on terminal routes. The same number felt it was at least moderately useful.

Fifty percent felt it was an accurate representation of storm movement; the rest did not know. Comments indicated that it was a useful tool that seemed a bit too slow to update.

4.1.1.5 Presentation of Information.

Sixty-three percent rated the ease of selecting the three products (Storm Motion, Precipitation, and Extrapolated Position) as at least good, that it was basic and easy to use, likewise for interpreting product availability. Some comments:

- Naming of the item and where to find it was difficult.

- Selections were easy to access.

Fifty percent felt the visual presentation of the SEP lines was good or better, but others said the color was difficult to see.

4.1.1.6 Training.

Only 55 percent felt the amount of training was sufficient. Given the number of comments received indicating that more training was desired, it would be safe to assume that not enough training was received. Comments indicated that users wanted more hands-on time and a representative to explain the system and options during weather. Sixty-four percent thought the User's Manual was useful, but others said they had never seen it. A most telling comment:

- ...it's difficult to hand a computer illiterate like myself a book and expect much learning to take place.

Only 18 percent felt the playback data capability was useful, but most probably did not know the capability existed or never used it this way.

4.1.1.7 Additional Comments and Observations.

The following comments were received under this section:

- The system needs to be available 7 days a week and at least 16 hours a day for a fair evaluation.

- The ITWS would be more useful if it remained on all the time or we had control to turn it on instead of having to call when weather develops.

- I was disappointed with the number of times that the ITWS was not available. There were a number of times when significant weather was in the area but the ITWS was inoperable.

- Display lightning strikes.

- The ITWS has the potential to be a useful tool within the TRACON area.

In addition, there were several comments on the problem of AP, and one comment to the effect that new products were brought on-line without proper training/briefing.

4.2 ORLANDO.

Forty questionnaires were delivered to MCO to be completed; a misunderstanding with the union prevented the questionnaires that the CICs completed from being returned; as a result, only 12 were completed and returned.

4.2.1 MCO Questionnaires and Discussion.

4.2.1.1 General.

In the section of general questions, 70 percent thought that the ITWS would increase arrival/departure rate at MCO during thunderstorm activity, at a rate of 7 to 12 aircraft per hour. Seventeen percent felt that pilot requests for deviations would increase and 25 percent felt they would decrease using the ITWS. Twenty-five percent thought that weather related air-to-ground radio transmissions would increase, and 33 percent thought they would decrease using the ITWS.

Fifty percent either often or always used the products to coordinate operations with Jacksonville Center (ZJX); 42 percent sometimes used it.

Some comments:

- Communication between MCO and ZJX was easier.

- Storm motion more useful than lightning.

- The ITWS confirmed ASR-9 weather data. The storm track and gust front data were very useful.

- Good presentation.

Seventy-five percent of respondents never used the products to coordinate operations with Delta or Northwest Airlines.

4.2.1.2 Short Range Precipitation Product.

The vast majority of the respondents felt that this was a very useful product that they used often to anticipate weather induced restrictions, clearing of traffic routes and traffic flow planning. This product was rarely used to anticipate airspeed changes. Most respondents felt this product to be useful to anticipate holds, gate holds, and in-trail spacing. Twenty-five percent never used this product to anticipate changes in the AAR or to make actual changes in the AAR. The rest used it to varying degrees.

Some comments:

- Color presentation excellent.

- Prediction and staying ahead of the weather is much easier with these products.

- Gust front prediction useful for planning runway changes.

- Most useful in preventing need to hold.

- AAR does not change drastically. A thunderstorm either allows us to land and depart or hold; ITWS helps us plan when to start holding.

All respondents felt that the short range precipitation product agreed with the actual weather and most felt the update rate was sufficient, although there were some (25 percent) that felt it was too slow --"Faster is better." (Note: The update rate was the maximum achievable with the current sensor suite.) Most felt it was at least as useful as the ASR-9 display in the TRACON. It was noted that they experienced attenuation in the area of the TDWR radar site.

Some comments:

- ASR-9 provides sufficient storm information, but the ITWS storm motion and gust front were very beneficial.

- Storm movement (motion) very useful.

- The color presentation is a plus.

Eighty-three percent of the respondents observed AP, but felt it was not a problem. The only suggestion for improving the short range precipitation product was to reduce invalid display caused by attenuation when heavy weather is close to the antenna.

4.2.1.3 Long Range Precipitation.

Most respondents used this product often to anticipate weather induced restriction both into and out of the terminal area. They felt it was a useful tool for traffic planning and coordination with ZJX and for getting an overall feel for what direction traffic would take. This product was used by some to open and close arrival and departure gates, but many felt that this was not the proper product for this job ("...short range precipitation adequate for this task, the long-range is more appropriate to ZJX"). Where some used the short range product for these tasks, others "relied on it." Most of the respondents found little use for this product when changing or anticipating changes to the AAR or in-trail spacing. However, comments varied:

- Short range precipitation product is adequate.

- Because we can better anticipate delays, we can increase/decrease in-trail accordingly.

This product was rarely used to start or stop gate holds or ground holds or to coordinate operations with Delta and Northwest, but users felt it was very useful in anticipating storm impact in the TRACON area and in coordinating operations with ZJX. Respondents were in unanimous agreement that the long range precipitation product agreed with their perception of actual weather; 73 percent thought the update rate was adequate, while the rest felt it too slow.

Thirty-six percent observed AP, while the rest either did not (45 percent) or did not know (18 percent). Ninety-one percent felt that AP during clear weather was not an operational problem, and 55 percent felt similarly for AP behind thunderstorms. Forty-five percent did not know.

4.2.1.4 Storm Cell Information.

This product did not get much use to assess storm severity and resultant re-routing or to anticipate storm growth or decay and flight path deviations; the short range precipitation display provided adequate information for that. Some comments:

- Although these products are "nice to have" their value is limited.

- NWS level 1-6 is sufficient.

- Base reports would make this product more useful.

- ...(Echo) tops is probably more useful to ZJX.

Likewise, there was very little use of this product for determining whether aircraft could fly over storms. Comments indicated that this was not a terminal area concern, since their airspace ceiling is 12,000 feet. None of the respondents could determine if the echo tops information was correct. Suggestions for product improvement were: echo bottoms and base reports.

- No use in the terminal. Give us bottoms.

- The top of terminal airspace is lower than any storm top.

4.2.1.5 Storm Motion.

Most of the respondents felt this was a useful product that they often used to anticipate weather-induced restrictions on terminal routes and to anticipate when these routes would be clear in order to plan traffic flow. Some comments:

- Excellent tool for planning.

- Best feature.

This product was rarely used to anticipate changes in airspace of approaching flights. Most found it more useful to anticipate gate holds, airborne holds and in-trail spacing. Comments on the use of this product to anticipate changes in the AAR were somewhat contradictory; while several of the respondents said that AAR is not affected by the weather (although the number of aircraft a sector can handle is affected), 75 percent at least sometimes used it to both anticipate and change the AAR. These comments and numbers do not agree. It is possible that there was some confusion on the part of the respondents when answering these questions. All respondents felt that the storm speed and direction as indicated by the storm motion product was accurate, and 75 percent felt the product update rate was adequate.

Ninety-two percent thought that the number of vectors was adequate, although one respondent asked for the ability to toggle storm cell vectors and speed on and off. Other comments:

- Storm motion vectors should default to the closest storm to the airport. I have seen weather (about to impact my airport) with no vector allocated. Bull!!

- It is one of the most useful if not the most useful of all ITWS products.

4.2.1.6 Storm Extrapolated Position.

This product received mixed reviews; while some found it extremely useful, others did not like it at all. The nature of storm movement in the Orlando area may be one cause for this contrast in opinion. As slow as the storms move in Orlando, controllers can generally tell where a storm will be in the very near term. This product is not as useful as it would be in a place like Dallas-Fort Worth, where storms can easily move at 40-50 knots. Also, storms tend to grow and decay rapidly in Orlando, making prediction of movement difficult. It is difficult to differentiate between growth and movement at times.

Twenty-five percent of respondents never used it to anticipate weather-induced restrictions on terminal routes or to anticipate when they would clear, but 25 percent always used it for these tasks, with an even mixture of levels of use in between these extremes. The comments back this up:

- Storm Motion is sufficient.

- The lines add too much clutter. The same results can be achieved with the Storm Motion product.

- Excellent for planning purposes.

This product was rarely used to anticipate changes in approaching aircraft airspeeds. Sixty-seven percent seldom or never used it to anticipate airborne holds, gate holds and in-trail spacing, but 25 percent always or often used it. Likewise, 67 percent seldom or never used this product to anticipate changes or to make changes in the AAR, but 25 percent always did. Eighty-eight percent felt it was an accurate product; 83 percent thought the update rate was adequate, 8 percent felt it too slow.

Forty-two percent felt the total number of SEP lines was too many, but it is unclear whether they meant that the three lines associated with each storm extrapolation was too many, the number of storms that had extrapolated positions was too many, or both. Eighty-three percent felt that this product was less useful than the Storm Motion product. Most comments concerned themselves with the clutter that this product added to the GSD. Suggestions on how to improve this product included:

- Eliminate!

- Lose it. This is not a useful tool...Absolutely no benefit here.

- Get rid of Storm Extrapolated Position product.

- Storm Motion does the same thing without the clutter.

4.2.1.7 Lightning.

This was another product that was not well received; 73 percent never used it and 18 percent seldom used it to turn on the backup generators. This is the reason this product was included. Most of the comments indicated that the users were aware when lightning was in the vicinity, due to the presence of significant weather; they automatically turn the generators on anyway. Some other comments:

- This is something you don't need a computer to tell you.
- ...I know when lightning is near the airport. I need to know how far it is.
- ...how many lightning strikes in a given cell might be helpful.
- Give us a product that gives us distance and degrees from the airport.

4.2.1.8 Terminal Weather Text Message Product.

This product was intended primarily for pilot use to reduce controller-pilot weather-related communications, thus reducing controller workload. The ITWS Controllers Working Group requested that the GSDs give the users the capability to see the messages that were transmitted to the pilots. The questions in the questionnaires were asked to determine the level of use and resultant benefit to air traffic users. The low percentages of favorable answers in this section do not necessarily indicate a poor product or design. In fact, interviews with pilots after the demonstration indicated that this product was well received. MIT/LL has the results of this pilot survey.

The tasks that this product was intended for are: (1) provide summary weather information to pilots, (2) keep abreast of information given to pilots, (3) improve safety of flight, (4) improve pilot situational awareness of weather, and (5) assist pilots in making operational decisions. This product was very rarely used for any of these tasks by air traffic personnel. Almost all of the respondents felt that requests for terminal weather briefings as a result of using this product remained the same; i.e., no impact. Some of the comments were:

- Most useful to pilots.
- Not my job.
- Pilots have commented on it and I believe it is slow.

These comments generally reflect the intention of primarily pilot use.

4.2.1.9 Training.

Twenty-five percent of the respondents felt the training was insufficient; 67 percent felt it was adequate. Unlike other responses, where one could make the assumption that "the majority rules", 33 percent is a high percentage of people (counting the ones who responded "did not know") who did not feel that they were adequately trained. There were several comments that indicated that users never saw the User's Manual, or that they were not aware of the playback capability.

4.2.1.10 Additional Comments and Observations.

Some of the comments received in this section were:

- ... Storm Motion is the most valuable of all the products at this time.

- If ITWS products could be "plugged in" site specific like a PC program, many more of these products would be useful...

- TDWR is great, WSP is great. Long Range Precipitation is good informationally, but not especially useful in the terminal area. Storm Cell Information - useless in the terminal area. Storm Motion needs work (Note: The type of work needed is not mentioned.) but even with work it is only marginally useful. Storm Extrapolated Position - useless. Lightning - lose it. Text Message Product - lose it.

- We must remember that these are tools that are supposed to make the supervisor/CIC job easier and more efficient. Too many products or too much time at the keyboard will render this objective impossible. The products should be easy to see, decipher and use. Emphasis should be placed in these areas, especially in ease of use.

- Although some of the products that were added this year were of limited use, the overall value of TDWR is immeasurable. The ability to clearly see the weather and to plan traffic around it, helped to make traffic flow much smoother. If only two products were available, I would chose Gust Front Projection and Storm Motion. We have learned to rely heavily on the TDWR and feel somewhat "blind" when it is off. Orlando had been the test site for many new pieces of equipment and we pride ourselves in giving the equipment a thorough and honest evaluation. Without a doubt, the TDWR has been the most useful piece of new equipment that we have seen. I will be sad to see it go.

5. CONCLUSIONS.

The demonstration should be considered successful from the standpoint of 1) the users received invaluable experience with the ITWS prior to the 1994 DEMVAL OT&E, and 2) ITWS products were developed and refined as a result of user feedback from the 1993 demonstration.

Given the wide disparity of comments on the utility of some of the products, it is important that the training be thorough, consistent, and across the board for all users in Orlando and Memphis for next year's DEMVAL OT&E. This accomplishes several things, among them: the FAA will get a better evaluation from the end-users of the products that are likely to be introduced; and the feedback that we get will be more believable in that the users will all have evaluated the same products and will have been given the same baseline of training and knowledge.

6. RECOMMENDATIONS.

Based on feedback received from the 1993 demonstration, the following recommendations are made:

- Users should be better informed about the ITWS and more thoroughly trained prior to the commencement of DEMVAL. This will facilitate better and more complete use of the ITWS system and its options, hence better feedback at the end from the users by virtue of their more complete use of the system.

- ITWS technical personnel from both the FAA Technical Center and MIT/LL should be more visible throughout the DEMVAL OT&E and users should be more easily able to contact these personnel either in person or via telephone in order to answer questions and solve problems. User confidence in the ITWS system is essential for a fair, unbiased, and thorough evaluation by them; if they are to be initially predisposed of the ITWS system, it is preferable that they be receptive versus reluctant.

- The questionnaires will be developed based on what is expected to be learned from the DEMVAL OT&E, and will be delivered earlier in the test period in order for the users to better understand the questionnaires and to evaluate their use of the system with the questionnaires in mind. This should yield more accurate and comprehensive responses. Quality feedback is requisite in order to go to Key Decision Point (KDP) 3 with the proper representation of the users.

7. ACRONYMS.

AAR	Airport Acceptance Rate
ACW-200D	Weather/Primary Radar Division
AP	Anomalous Propagation
ARINC	Aeronautical Radio, Inc.
ARTCC	Air Route Traffic Control Center
ASR-9	Airport Surveillance Radar Model 9
ATA	Arrival Transition Area
CBI	Computer Based Instruction
CIC	Controller in Charge
D-BRITE	Digital Bright Radar Indicator Tower Equipment
DEMVAL	Demonstration and Validation
DFW	Dallas-Ft. Worth International Airport/Tower
DTA	Departure Transition Area
ETG	Enhanced Target Generator
FAA	Federal Aviation Administration
GSD	Geographic Situation Display
ITWS	Integrated Terminal Weather System
KDP	Key Decision Point
MBA	Microburst Alert
MCO	Orlando International Airport/Tower
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratory
NEXRAD	Next Generation Weather Radar
NWS	National Weather Service
SEP	Storm Extrapolated Position
SFB	Sanford, FL Tower
TDWR	Terminal Doppler Weather Radar
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach CONtrol (facility)
TSTMS	Thunderstorms
WSA	Wind Shear Alert
WSP	Wind Shear Processor

WSU	Weather Service Unit
ZFW	Fort Worth, TX en route center (ARTCC)
ZJX	Jacksonville, FL en route center (ARTCC)

APPENDIX A

DFW EVALUATION QUESTIONNAIRE

DALLAS-FORT WORTH
INTEGRATED TERMINAL WEATHER SYSTEM
SURVEY FOR TRAFFIC MANAGERS, SUPERVISORS, AND AREA MANAGERS

Date:_____

Position (please check): Traffic Manager_____

ATC Supervisor_____

Area Manger_____

A. General

We have determined that the average AAR for DFW is about 70 aircraft per hour when there are thunderstorms in the TRACON area.

	Yes	No	Don't Know
1a) Given your experience to date with the ITWS products (either in real time or by viewing playbacks of recorded events), would you expect the use of ITWS when thunderstorms are in the TRACON area to result in an increase in arrival and departure rates at DFW?			

1b) If you would expect the use of ITWS to result in an increase in arrival rates, please check the number of additional aircraft per hour that could land at DFW when thunderstorms are in the TRACON area:

1 to 6 _____

7 to 12 _____

13 to 18 _____

more than 18 _____

Don't Know _____

Please complete the sentences below by placing a check mark [√] in the appropriate box.

	Increased	Decreased	Remained the Same	Don't Know
2) As a result of using ITWS, pilot requests for deviations				
3) As a result of using ITWS, weather-related air-to-ground radio transmissions				

Please explain why._____

_____

_____

C. Precipitation Product – a color display of the ASR-9 weather channel output in the standard National Weather Service six-level presentation.

Instructions: Rate how often you used the precipitation product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	How often did you use the Precipitation Product for the following tasks?					How useful was the Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response. _____

_____

2) change the AAR											

Please comment on the above response. _____

_____

	How often did you use the Precipitation Product for the following tasks?					How useful was the Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response. _____

_____

5) anticipate airborne holds											

Please comment on the above response. _____

_____

7) anticipate need for in-trail spacing											

Please comment on the above response._____

9) anticipate gate holds											

Please comment on the above response._____

15) anticipate weather-induced restrictions on terminal routes and plan traffic flow											

Please comment on the above response._____

17) anticipate when terminal routes would be clear and plan traffic flow											

Please comment on the above response._____

19) other task (please specify) _____											

Please comment on the above response._____

20) other task (please specify)											

Please comment on the above response._____

	Yes	No	Don't Know
22) Did the weather situation, as indicated by the precipitation product, agree with your perception (based on pilot reports) of weather-impacted areas?			

If "no," please explain._____

_____

_____

	Yes	No	Don't Know
23a) Was the product update rate of 30 seconds adequate for conducting operations?			

23b) If the precipitation product update rate was inadequate, please indicate the maximum time between updates that would be operationally acceptable._____

When non-standard atmospheric conditions exist, the energy from the ASR-9 radar beam is ducted toward the ground and produces ground clutter breakthrough on the display. This ground clutter break-through strongly resembles real weather echoes and is known as anomalous propagation (AP).

24) Did you observe anomalous propagation (AP)?			

If "yes," how did you determine that AP echoes were present?_____

_____

25) Did AP-induced clutter regions observed during clear weather conditions result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

_____

_____

26) Did AP-induced clutter regions observed behind thunderstorms result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

_____

27) Do you have any suggestions for improving the precipitation product?			

If "yes," please explain._____

_____

D. Storm Motion Product - provides estimates of storm speed and direction by the use of an arrow pointing in the direction of the motion and a number at the base of the arrow indicating storm speed.

Instructions: Rate how often you used the Storm Motion product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	How often did you use the Storm Motion Product for the following tasks?					How useful was the Storm Motion Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response. _____

_____

2) change the AAR											

Please comment on the above response. _____

_____

3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response. _____

_____

5) anticipate airborne holds											

Please comment on the above response. _____

_____

7) anticipate need for in-trail spacing											

Please comment on the above response._____

9) anticipate gate holds											

Please comment on the above response._____

_____

15) anticipate weather-induced restrictions on terminal routes and plan traffic flow											

Please comment on the above response._____

_____

	How often did you use the Storm Motion Product for the following tasks?					How useful was the Storm Motion Product?					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
17) anticipate when terminal routes would be clear and plan traffic flow											

Please comment on the above response._____

_____

19) other task (please specify) _____											

Please comment on the above response._____

_____

20) other task (please specify) _____											

Please comment on the above response._____

_____

21) Based on your perceptions, was the Storm Motion speed estimate accurate?			
22) Based on your perceptions, was the Storm Motion direction estimate accurate?			

If "No," please explain._____

_____

	Yes	No	Don't Know
23a) Was the product update rate of 4 minutes adequate for conducting operations?			

23b) If the Storm Motion product update rate was inadequate, please indicate the maximum time between updates that would be operationally acceptable._____

24a) Was the number of Storm Motion vectors presented on the display (a maximum of 8) adequate for conducting operations?			

24b) If the number of Storm Motion vectors was inadequate, please explain._____

_____

25) Do you have any suggestions for improving the product?			

If "yes," please explain._____

_____

E. Storm Extrapolated Position Product - extrapolates the leading edge of the precipitation echoes for 10 and 20 minutes and indicates the estimated location of the leading edge of the precipitation by a series of dashed blue lines.

Instructions: Rate how often you used the Storm Motion product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	How often did you use the Storm Extrapolated Position Product for the following tasks?					How useful was the Storm Extrapolated Position Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response._____

2) change the AAR											

Please comment on the above response._____

	How often did you use the Storm Extrapolated Position Product for the following tasks?					How useful was the Storm Extrapolated Position Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response._____

Please comment on the above response._____

5) anticipate airborne holds												

Please comment on the above response._____

7) anticipate need for in-trail spacing												

Please comment on the above response._____

	How often did you use the Storm Extrapolated Position Product for the following tasks?					How useful was the Storm Extrapolated Position Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
9) anticipate gate holds											

Please comment on the above response._____

	How often did you use the Storm Extrapolated Position Product for the following tasks?					How useful was the Storm Extrapolated Position Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
15) anticipate weather-in-duced restrictions on terminal routes and plan traffic flow											

Please comment on the above response._____

17) anticipate when terminal routes would be clear and plan traffic flow												

Please comment on the above response_____

19) other task (please specify) _____												

Please comment on the above response_____

_____

20) other task (please specify) _____												

Please comment on the above response_____

_____

	Yes	No	Don't Know
21) Based on your perceptions, was the Storm Extrapolated Position Product accurate?			

If "no," please explain._____

_____

22) If inaccuracies did occur, did the inaccuracies appear to arise primarily from erroneous cell motion?			
23) If inaccuracies did occur, did the inaccuracies appear to arise primarily from cell growth and decay?			

	Too Fast	Too Slow	Don't Know
24) Was the product update rate of 4 minutes .....?			

25) Please explain._____

_____

	Yes	No	Don't Know
26) Do you have any suggestions for improving the product?			

If "yes," please explain._____

_____

G. Information Selection, Interpretation, and Content

Please rate the following aspects of the ITWS GSD by placing a check mark [√] in the box that corresponds with your rating. Please list any comments related to each item, such as suggestions for improvements.

	Very Poor	Poor	Fair	Good	Very Good	Don't Know
1) ease of selecting Storm Motion Storm Cell Information and Storm Extrapolated Position Products						

Please comment on the above response._____

2) ease of interpreting whether a product is ON or OFF						

Please comment on the above response._____

3) ease of interpreting whether a product is available						

Please comment on the above response._____

	Very Poor	Poor	Fair	Good	Very Good	Don't Know
4) ease of accessing echo top report						

Please comment on the above response._____

5) ability to select a series of echo top reports and then scroll through the previously selected reports						

Please comment on the above response._____

6) ability to receive echo top report on the cell closest to the cell						

Please comment on the above response._____

_____

7) ease of accessing the Storm Extrapolated Position Product						

Please comment on the above response._____

_____

9) visual presentation of the Storm Extrapolated Position Product (dashed blue lines)						

Please comment on the above response._____

_____

H. Training

	Yes	No	Don't Know
1) Was the training you received sufficient?			

If you think the training could be improved or additional training should be provided, please comment

_____

_____

2) Was the "ITWS GSD Users' Manual" useful?			

Please comment_____

_____

3) Were the ITWS playback data useful?			

Please comment._____

_____

4) Were the ITWS playback data representative of actual weather observed at your location?			

Please comment._____

_____

I. Additional Comments and Observations:

APPENDIX B

DFW SURVEY RESULTS

APPENDIX B

SURVEY FOR DALLAS-FORT WORTH INTEGRATED TERMINAL WEATHER SYSTEM AIR TRAFFIC MANAGERS, AREA SUPERVISORS, AND AREA MANAGERS

SUMMARY OF QUESTIONNAIRE RESPONSES

This appendix is a summation of the results of the DFW questionnaire. The number of each of the possible answers for each question was totalled; the percentages of each answer are given. Each comment received from every questionnaire is listed following the question or section from which it was generated. The ITWS questionnaire was completed by 3 Traffic Managers, 8 Area Supervisors, and 1 Area Manager. All respondents did not answer all of the questions.

A. GENERAL

1a. 33% thought the ITWS would increase the arrival/departure rate when thunderstorms were in the TRACON area.
42% thought that there would be no increase.
25% did not know if there would be an increase.

1b. The 33% that thought that there would be an increase in the arrival rate felt that an additional 7-12 aircraft per hour could be accommodated.

2. 25% thought that pilot requests for deviations would be decreased as a result of using ITWS.
58% believed that it would remain the same.
17% did not know if there would be any change.

COMMENT(S): DFW TRACON was able to re-route traffic around ITWS displayed weather before deviations occurred.

Because pilots rely on airborne radar, deviation requests begin on initial contact. However, ITWS provides controllers with earlier planning for routes to avoid weather (known), therefore, some decrease in weather related transmissions likely.

Was not told that ITWS could be used to relay info to pilots.

To my knowledge, we have not used the ITWS or had it available for use during periods of thunderstorm activity.

The pilots tend to plan deviations around what they see on their equipment, rather than (or regardless of) what we advise them that we see on ITWS.

ITWS was "test status" and informational only to Air Traffic.

ITWS was not available to the controllers and/or has not been used in this way.

When we have more information about weather cells, we can provide better service to the users.

3. 33% thought that weather-related air-to-ground radio transmissions would decrease as a result of using ITWS.
50% believed that there would be no change.
17% did not know if there would be a change.

B. PRECIPITATION PRODUCT

1. 40% would sometimes use this product when thunderstorms were in the TRACON area to anticipate changes in the Airport Acceptance Rate (AAR).
60% would often use it.

COMMENT(S): ITWS very useful for traffic planning.

By using product, it was easier to determine routes aircraft would fly.

At least once, erroneous routes were coordinated due to AP display.

We have not used the ITWS at all.

By observing the product displayed (intensity and movement), it helped to anticipate whether or not pilots would refuse departure (or arriving) through that area.

The equipment was not available enough to make a fair assessment.

Weather display is much better than the D-BRITE and used to anticipate effects on final approach courses.

Used to plan how long aircraft would continue to miss approaches to a specific runway.

The only problem is that I work weekends and ITWS was not always available.

30% thought that it would be more than moderately useful.
70% thought that it would be very useful.

2. 10% would never use the product to change to AAR.
10% would seldom use the product to change the AAR.
50% would sometimes use the product to change the AAR.
30% would often use the product to change the AAR.

COMMENT(S): Used to coordinate with Fort Worth Center (ZFW) Traffic Management Unit (TMU) reference reducing flow rate when aircraft can no longer make approaches to runway.

The Traffic Manager Coordinator (TMC) Unit may have done this, but as the Tower Supervisor, I didn't.

We have not used the ITWS at all.

I used it not only to increase, but also to decrease rates.

10% thought that it would be moderately useful to assist in the change to the AAR.
20% thought that it would be more than moderately useful.
60% thought that it would be very useful.
10% did not know if it would be useful.

3. 56% thought that they would never use the Precipitation Product to anticipate changes in airspeeds of approaching aircraft.
22% would seldom use the product.
22% would sometimes use the product.

COMMENT(S): We didn't receive wind information.

Wind at altitude is not provided.

TRACON does this - Tower has little control over approach speeds on final.

We have not used ITWS at all.

Not observed.

I saw no relationship.

4. 30% would never use the product to anticipate airborne holds.
20% would seldom use the product to anticipate airborne holds.
50% would sometimes use the product to anticipate airborne holds.

COMMENT(S): Only in severe weather.

This could be very useful for thunderstorms on final approach course.

Used to give Fort Worth Center (ZFW) Traffic Management Unit (TMU) a heads-up as to when the airport might close because of weather.

Not a Tower function.

Not a Tower function, however, it is sometimes obvious when

weather is very severe.

We have not used the ITWS at all.

TRACON does not plan holding in terminal area, however, TRACON's early anticipation of reduced acceptance rates allows ZFW ARTCC to anticipate and execute holding procedures in a more timely manner.

We do no hold in our airspace.

13% thought that it would not be a useful product.
13% thought that it would be a somewhat useful product.
13% thought that it would be a moderately useful product.
13% thought that it would be a more than moderately useful product.
38% thought that it would be a very useful product.
13% did not know if it would be a useful product.

5. 50% thought that they would use the Precipitation Product sometimes to anticipate the need for in-trail restrictions.
38% thought that they would often use the product.
13% thought that they would always use the product.

COMMENT(S): During period of heavy weather.

Have not had the opportunity to experience thunderstorm shifts when ITWS was available. Believe it would be very useful.

When a corner post closes, we then coordinate for in-trail with ZFW.

Past history of restrictions due to weather usually assured that in-trail spacing will occur.

We have not used ITWS at all.

We'll be learning.

I would often ask Tower for more spacing when departure radar was having trouble with departure routes.

6. 33% thought that they would sometimes use the product to anticipate weather-induced restrictions on terminal routes and plan traffic flow.
6% thought that they would often use the product.
11% thought that they would always use the product.

COMMENT(S): We coordinate with ZFW TMU as to which arrival and departure routes are going to be in use.

If ITWS indicated weather saturating the east quadrant, one could

assume that restrictions on east bound traffic would occur.

We have not used the ITWS.

Very useful for determining routes aircraft will fly.

22% thought that it would be a more than moderately useful product.
78% thought that it would be a very useful product.

7. 38% thought that they would sometimes use the product to anticipate when terminal routes would be clear and plan traffic flow.
62% thought that they would often use the product.

COMMENT(S): When ITWS indicated condition in question 6 was clearing up, it was pretty safe to assume that restrictions would be canceled.

We have not used the ITWS.

This will definitely require some experience and learning, but this may be the most valuable function of ITWS.

Very useful to determine when finals to runway will be usable.

13% thought that this would be a somewhat useful product.
25% thought that this would be a more than moderately useful product.
63% thought that his would be a very useful product.

8. Other task: Anticipate Departure gate close.

COMMENT: Second most valuable function! (In my opinion)

9. Other task. D10, DFW, ZFW

COMMENT: The "only" piece of equipment common to all 3 facilities. Everybody's on the same page.

10. 55% thought that the weather situation depicted by the Precipitation Product agreed with their perception (based on pilot reports) of weather-impacted areas.
27% thought that it did not agree.
18% did not know if it agreed.

COMMENT(S): ASR-9 with ITWS sometimes gave false info.

What I observed no problem except with AP.

Except some AP.

During more than one occasion, a weather product would be indicated over the airport (level 1) when no actual precipitation was present (and no virga observed in the air).

Several times AP would show up as weather building but pilots and surface obs indicate other.

Too much AP problem to really evaluate this feature. Anyway, if there is a route with no precip, the pilots fly there.

Except when AP was a problem.

11. 50% thought that the Precipitation Product update was adequate.
10% thought that it was too slow.
40% did not know.

COMMENTS: Most of the time except for false info.

No problem except for AP.

Would always like fast updates to be closer to real time.

No problems in this area.

Nothing to compare it with.

12. 64% observed AP on the display.
36% did not know if they observed AP on the display.

COMMENTS: AP was verified by coordination with the ZFW weather unit.

Weather returns on ITWS while no weather in area.

Pilot reports and looking at ATC radar.

Pilot reports and visual observation.

Maybe that's what was occurring in question 10 (see comment under 10 regarding weather over airport) above - although we weren't using ASR-9.

Pilot reports, surface obs and actions of pilots.

Comparison with ARTCC WSU. (after aircraft reported nothing in the vicinity.

Through cross checks with our radar, weather service, and pilot reports.

13. 11% thought that AP clutter resulted in operational problems.
33% thought that AP clutter did not result in operational problems.
50% did not know if AP clutter resulted in operational problems.

COMMENTS: Yes, until we were able to determine for certain it was AP.

Never "on" w/o weather in area. Not a good way to intro new equipment!

14. 27% thought that AP clutter observed behind thunderstorms resulted in operational problems.
18% thought that it did not results in operational problems.
55% did not know.

COMMENT(S): After a cold front has passed, ITWS was displaying a line of level 5 thunderstorms that didn't exist.

We started planning for deviations, route changes on weather that was not there.

Blueridge arrival traffic was initially diverted to alternate route (6/25).

15. 27% had suggestions for improvements of the Precipitation Product.

COMMENTS(S): Eliminate AP.

Provide a window that displays sources, i.e. AZLE, DFW EAST, SASCHE, etc. This could help us to know when/where to look for AP and also know the extent of coverage.

Reduce AP.

C. STORM MOTION PRODUCT

1. 10% would never use the product to anticipate a change to the Airport Acceptance Rate (AAR).
20% would sometimes use it.
70% would often use it.

COMMENT(S): Great product.

Could be used often and be very useful - not observed.

The ITWS was useful in anticipating a change of acceptance rate.

Once I convinced myself that the display was valid, it became fairly easy to anticipate AAR changes - up or down.

It was useful in anticipating changes.

10% thought that the product was moderately useful.
10% thought that the product was more than moderately useful.
70% thought the product was very useful.
10% did not know if the product was useful.

2. 20% did not use the product to change the AAR.
20% used the product seldom to change the AAR.
30% used the product sometimes to change the AAR.
30% used the product often to change the AAR.

COMMENT(S): I could vary the AAR from time to time giving DFW the optional AAR.

TRACON TMC SUPS performed the function, however, I could anticipate the change.

Seems to me that is what this piece of equipment is designed to do.

I used it to increase and decrease rate when final or the airport was affected.

10% thought that the product would be somewhat useful.
10% thought that the product would be moderately useful.
10% thought that the product would be more than moderately useful.
50% thought that the product would be very useful.
20% did not know if the product was useful.

3. 55% did not use the product to anticipate changes of airspeed of approaching aircraft.
45% seldom used it.

COMMENT(S): No control, TRACON's responsibility.

Route change really what concerns TMC.

Saw no use.

36% thought that the product would not be useful.
9% thought that the product would be somewhat useful.
18% thought that the product would be moderately useful.
18% thought that the product would be very useful.
18% did not know if the product would be useful.

4. 45% did not use the product to anticipate airborne holds.
55% sometimes used the product to anticipate airborne holds.

COMMENT(S): Heavy weather.

Airborne holding not a DFW terminal function. All holding for weather delays accomplished outside TRACON airspace.

We do not hold.

27% thought that the product would not be useful.
18% thought that the product would be moderately useful.
9% thought that the product would be more than moderately useful.
27% thought that the product would be very useful.
18% did not know if the product would be useful.

5. 9% never used the product to anticipate in trail spacing.
82% sometimes used the product to anticipate in trail spacing.
9% used the product often to anticipate in trail spacing.

COMMENT(S): Storm Motion helped anticipate these restrictions.

Metering to AAR is normal way of spacing to DFW. However, after stopping arrivals to DFW miles-in-trail determination was more easily made after consulting ITWS.

Was used in some case to give in trail at the corner posts.

9% thought the product was not useful.
27% thought that the product was somewhat useful.
27% thought that the product was moderately useful.
27% thought that the product was more than moderately useful.
9% thought that the product was very useful.

6. 9% did not use the product to anticipate weather-induced restrictions on terminal routes and plan traffic flow.
9% seldom used the product to anticipate weather-induced restrictions.
27% sometimes used the product to anticipate weather-induced restrictions. 55% often used the product to anticipate weather-induced restrictions.

COMMENTS: Storm Motion helped anticipate these restrictions.

Was used in planning routes to get aircraft to airport.

18% thought the product was moderately useful.
27% thought the product was more than moderately useful.
45% thought that the product was very useful.
9% did not know if the product was useful.

7. 9% never used the product to anticipate when terminal routes would be clear and plan traffic flow.
18% sometimes used it.

73% often used the it.

COMMENT(S): Storm Motion helped the Tower give pilots more educated guess as to when the weather would be clear of the area.

Self explanatory I should think.

Used to adjust routes.

9% thought the product to be moderately useful.
27% thought the product to be more than moderately useful.
55% thought the product to be very useful.
9% did not know if the product was useful.

8. Other Task. Departure headings. Used to anticipate initial heading changes to avoid stopping DFW departures.

9. Other task. None.

10. 82% thought that the Storm Motion speed estimate was accurate.
18% thought that it was not accurate.

11. 91% thought that the Storm Motion direction estimate was accurate.
9% thought that it was not accurate.

12. 45% thought the Storm Motion update rate adequate.
9% thought that it was too slow.
45% did not know.

COMMENT(S): Concurred with ZFW weather unit radar.

Would always like faster update to be closer to real time.

No complaints in this area.

Don't remember the offered alternatives.

13. 73% thought the number of Storm Motion vectors presented on the display were adequate.
9% thought that there were too many.
18% did not know.

14. No question #14.

15. 27% had suggestions for improving the product.

COMMENT(S): Maybe have the length of the vector arrow indicate the speed of movement (along with the displayed speed).

Reduce clutter by eliminating the symbol, use arrow and number only.

Make vector "speed" display optional and also available in a remote window like the storm top info - not always readable in dark shaded precip areas.

D. STORM EXTRAPOLATED POSITION PRODUCT

1. 33% never used this product to anticipate changes in Airport Acceptance Rate (AAR).
11% seldom used this product to anticipate changes in AAR.
33% sometimes used this product to anticipate changes in AAR.
22% often used this product to anticipate changes in AAR.

COMMENT(S): Helpful for preplanning traffic flows.

Have not observed the product.

Good product when working properly. Good planning tool.

Never saw a Storm Extrapolated indication during this period.

Did not know we had this info available until the other day.

The only time Storm EXP was available it seemed frequently unable to keep up with the updates. Date 9/13. Nobody answered phone at DFW or Boston to report discrepancy.

11% thought this product to be somewhat useful.
11% thought this product to be more than moderately useful.
44% thought this product to be very useful.
33% did not know.

2. 33% never used this product to change the AAR.
11% seldom used this product to change the AAR.
33% sometimes used this product to change the AAR.
22% often used this product to change the AAR.

COMMENT(S): Helpful in preplanning traffic flow.

11% thought this product to be somewhat useful.
11% thought this product to be more than moderately useful.
44% thought this product to be very useful.
33% did not know.

3. 70% never used the product to anticipate changes in airspeeds of approaching aircraft.
10% seldom used it.
20% sometimes used it.

COMMENT(S): Helpful in preplanning traffic flow.

33% thought the product was not useful.
11% thought the product to be somewhat useful.
22% thought the product to be very useful.
33% did not know.

4. 63% never used the product to anticipate airborne holds.
12% seldom used the product to anticipate airborne holds.
25% sometimes used the product to anticipate airborne holds.

COMMENT(S): Helpful in preplanning traffic flow.

Airborne holding not a DFW terminal function. All holding for weather delays accomplished outside TRACON airspace.

38% thought the product was not useful.
12% thought the product was somewhat useful.
25% thought the product was very useful.
25% did not know.

5. 29% never used the product to anticipate need for in-trail spacing.
14% seldom used the it.
57% sometimes used it.

COMMENT(S): If update/tracking can coincide with real-time storm movement, this could be as valuable as the Storm Motion Product.

14% thought the product to be somewhat useful.
14% thought the product to be moderately useful.
14% thought the product to be more than moderately useful.
29% thought the product to be very useful.
29% did not know.

6. 29% never used this product to anticipate weather-induced restrictions on terminal routes and plan traffic flow.
14% seldom used it.
43% sometimes used it.
14% often used it.

COMMENT(S): Good product when working properly. Good planning tool.

14% thought this product to be somewhat useful.
14% thought this product to be more than moderately useful.
43% thought this product to be very useful.
29% did not know.

7. 29% never used this product to anticipate when terminal routes would be clear and plan traffic flow.
14% seldom used it.

43% sometimes used it.
14% would often use it.

COMMENT(S): If update/tracking can coincide with real-time storm movement, this could be as valuable as the Storm Motion Product.

14% thought this product to be somewhat useful.
14% thought this product to be more than moderately useful.
43% thought this product to be very useful.
29% did now know.

8. Other task. Departure heading used to anticipate initial heading changes to avoid stopping DFW departures.

9. Other task. SWAP Routes. Used to anticipate "severe weather avoidance programs" initiation, as well as direction of turn to SWAP routes and also duration of SWAP program.

10. 50% thought that the Extrapolated Position product was accurate based on perceptions.
50% did not know.

COMMENT(S): Sometimes it seemed to lag behind.

11. 25% thought that if inaccuracies did occur, that it was not primarily from erroneous cell motion.

75% did not know.

12. 25% thought that if inaccuracies did occur, that it was not primarily from cell growth and decay.
75% did not know.

13. 13% thought the Storm Extrapolated Position product update was adequate.
25% thought that the update rate was too slow.
63% did not know.

COMMENT(S): Would always like faster updates.

Lagged behind apparently since the leading edge of level 3 and 5 weather frequently "out ran" the zero minute time line.

14. 38% had suggestions for improving the product.
13% did not have any suggestions.
50% did not know.

COMMENT(S): There were days when weather movement (vectors) were indicated but no S.E.P.S. - I marked movement leading edge with a grease pencil. The S.E.P. would be a good feature to have.

Update at same rate as precip product.

Increase update rate.

E. PRESENTATION OF INFORMATION

1. 18% thought that the ease of selecting Precipitation, Storm Motion, and Extrapolated Position product was poor.
27% thought that it was good.
36% thought that it was very good.
18% did not know.

COMMENT(S): Basic and easy to use.

Except for Storm Extrapolation, which evidently wasn't working on our equipment, all selections were easy to access.

Equipment located on too high shelf to reach trackball/mouse.

Naming of the item and where to find them was difficult.

2. 9% thought that the ease of interpreting whether a product was on or off was poor.
9% thought that it was fair.
36% thought that it was good.
27% thought that it was very good.
18% did not know.

COMMENT(S): Basic and easy to use.

No problem.

A little "real: training would have helped.

3. 9% thought that the ease of interpreting whether a product is available was very poor.
9% thought that it was poor.
27% thought that it was good.
36% thought that it was very good.
18% did not know.

COMMENT(S): Basic and easy to use.

No problem.

Not enough training to know what display was telling me. And I still don't know since it's only been operational on 2 shifts.

4. 10% thought that the visual presentation of the Storm Extrapolated Position Product (blue lines) was fair.
30% thought that it was good.
20% thought that it was very good.
40% did not know.

COMMENT(S): Basic and easy to use.

Never saw these lines.

Color was hard to see.

F. TRAINING

1. 55% thought that training they received was sufficient.
36% thought that training they received was not sufficient.
9% did not know.

COMMENT(S): It was sufficient but would like additional training.

More training needed/along with more hands-on time for TMCs/Supervisors and more on-line time for ITWS would have been desirable.

Unable to evaluate the effectiveness of the training until I am able to use the equipment for a while.

Need to have a representative here during weather to explain and demonstrate.

An absolute "must", "hands-on" in the work environment is the only way to learn to use this equipment.

2. 64% thought that the "ITWS GSD Users' Manual" was useful.
9% thought that it was not useful.
27% did not know.

COMMENT(S): I've never seen it.

Not really - it's difficult to hand a computer illiterate (like myself) a book and expect much learning to take lace.

3. 18% thought that the ITWS playback data was useful.
9% thought the it was not useful.
73% did not know.

COMMENT(S): Never used.

Have not used.

Except for training, I never had the opportunity to playback data. I don't know that I actually had that capability.

I've never seen it.

Mostly because we had not training on the equipment when it was located in the ETG lab.

4. 18% thought that ITWS playback data was representative of actual weather observed at their location.
9% thought that it was not representative.
73% did not know.

COMMENT(S): Have not used.

Training data looked good but never saw any actual playback.

I've never seen it.

Playback data used doppler and NEXRAD (I think) we have one or 2 poorly placed ASR-9s.

ADDITIONAL COMMENTS AND OBSERVATIONS

The system needs to be available seven days a week and at least 16 hours a day for a fair evaluation.

Get rid of the AP.

ITWS has the potential to become a useful tool for weather information within the TRACON environment.

The current use of the equipment was unacceptable for the following reasons:

1. Lack of availability - it was not on 24 hours/day or could it be initiated from the TRACON.

2. At times, particularly on weekends, we could not contact anyone to initialize the equipment.

During times that the equipment was on, the AP created several false echoes and the true integrity of the equipment was not established.

During the 5 or 6 months that the equipment "should have been available for use" I only saw it on and with a presentation 2 days.

I was disappointed in the number of times that the equipment was not available. There were at least a couple of times when significant weather was in the area, but the ITWS was inoperative.

This was quite a comprehensive survey and I don't quite understand why it was conducted before the equipment has been extensively available and in use so that meaningful evaluations could be made.

AP was a problem. Because of this, the integrity of the product was diminished. Equipment was piecemealed together, thus a true evaluation is hard to determine. When we get the entire package driven off of all radar sites, then we need to evaluate the system. It appears that we are receiving new info added and are not receiving adequate briefings.

Without NEXRAD (or similar radar) and doppler, ITWS is certainly not going to be a very useful or reliable system.

Display lighting strikes.

I really believe the equipment has great possibilities, but due to the physical location in TRACON and the fact it was never turned "on", general acceptance is extremely low! Somebody needs to do a "sell job" now.

ITWS would be more useful if it remained on all of the time or if we had control to turn it on instead of having to call and have it turned on when weather develops.

APPENDIX C

MCO EVALUATION QUESTIONNAIRE

ORLANDO INTERNATIONAL AIRPORT (MCO)
INTEGRATED TERMINAL WEATHER SYSTEM SURVEY
FOR TRAFFIC MANAGERS, AREA SUPERVISORS/CIC, AND AREA MANAGERS

Position (please check): Traffic Manager_____ Area Supervisor/CIC_____ Area Manager_____

A. General

	Yes	No	Don't Know
1a) Given your experience to date with the ITWS products , would you expect the use of ITWS when thunderstorms are in the TRACON area to result in an increase in arrival and departure rates at MCO?			

1b) If you would expect the use of ITWS to result in an increase in arrival rates, please check the number of additional aircraft per hour that could land at MCO when thunderstorms are in the TRACON area:

1 to 6 _____ more than 18 _____
7 to 12 _____ Don't Know _____
13 to 18 _____

Please complete the sentences below by placing a check mark [√] in the appropriate box.

	Increased	Decreased	Remained the Same	Don't Know
2) As a result of using ITWS, pilot requests for deviations				
3) As a result of using ITWS, weather-related air-to-ground radio transmissions				

Please explain why._____

_____

GENERAL

Instructions: Rate how often you used the ITWS Products in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected " seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

In addition to the Orlando Tower/TRACON (MCO) facility, the ITWS products were available at the enroute (ZJX) Traffic Management Unit, Delta Airline Operations Center in Atlanta, GA and Northwest Airlines Meteorology Department in Minneapolis, MN.

	When thunderstorms were in the TRACON area, how often did you use the ITWS Products for the following tasks?					**How useful were the ITWS Products?**					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
4) coordinate operations with the enroute center (ZJX)											

Please comment on the above response._____

5) coordinate operations with Delta flights											

Please comment on the above response._____

6) coordinate operations with Northwest flights											

Please comment on the above response._____

B. Short-Range Precipitation Product – a color display of the ASR-9 weather channel output in the standard National Weather Service six-level presentation showing the location of precipitation within 60 nautical miles of the airport.

Instructions: Rate how often you used the Short-Range Precipitation Product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Short-Range Precipitation Product for the following tasks?					**How useful was the Short-Range Precipitation Product?**					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
1) anticipate weather-induced restrictions on terminal routes and plan traffic flow											

Please comment on the above response._____

2) anticipate when terminal routes would be clear and plan traffic flow											

Please comment on the above response._____

3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response._____

4) anticipate airborne holds											

Please comment on the above response._____

(Continued)

	When thunderstorms were in the TRACON area, how often did you use the Short-Range Precipitation Product for the following tasks?					How useful was the Short-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
5) anticipate need for in-trail spacing											

Please comment on the above response._____

6) anticipate gate holds											

Please comment on the above response._____

7) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response._____

8) change the AAR											

Please comment on the above response._____

9) other task (please specify) _____											

Please comment on the above response._____

(Continued)

	When thunderstorms were in the TRACON area, how often did you use the Short-Range Precipitation Product for the following tasks?					How useful was the Short-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
10) other task (please specify) _____											

Please comment on the above response._____

_____

	Yes	No	Don't Know
11) Did the weather situation, as indicated by the Short-Range Precipitation Product, agree with your perception (based on pilot reports) of weather-impacted areas?			

If "no," please explain._____

_____

	Ade-quate	Too Fast	Too Slow	Don't Know
12) The Short-Range Precipitation Product update rate was				

Please explain._____

_____

	Much Less Useful	Less Useful	Equally Useful	Some-what More Useful	Much More Useful	Don't Know
13) Compared to the ASR-9 precipitation displayed on the TRACON tower controller ARTS display, the ITWS Short-Range Precipitation Product was....						

Please explain._____

_____

(Continued)

SHORT-RANGE PRECIPITATION PRODUCT

When non-standard atmospheric conditions exist, the energy from the ASR-9 radar beam is ducted toward the ground and produces ground clutter breakthrough on the display. This ground clutter break-through strongly resembles real weather echoes and is known as anomalous propagation (AP).

	Yes	No	Don't Know
14) Did you observe anomalous propagation (AP)?			

If "yes," how did you determine that AP echoes were present?_____

15) During clear weather conditions, did observed AP-induced clutter regions result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

16) Did AP-induced clutter regions observed **behind thunderstorms** result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

17) Do you have any suggestions for improving the Short-Range Precipitation Product?			

If "yes," please explain._____

LONG-RANGE PRECIPITATION PRODUCT

C. Long-Range Precipitation Product – a color display of the NEXRAD long range precipitation in the standard National Weather Service six-level presentation showing the location of precipitation within 200 nautical miles of Melbourne, FL.

Instructions: Rate how often you used the Long-Range Precipitation Product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Long-Range Precipitation Product for the following tasks?					**How useful was the Long-Range Precipitation Product?**					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
1) anticipate weather-induced restrictions on routes into the terminal area and plan											

Please comment on the above response._____

2) anticipate weather-induced restrictions on routes out of the terminal area and plan											

Please comment on the above response._____

3) close arrival gates											

Please comment on the above response._____

4) open arrival gates											

Please comment on the above response._____

(Continued)

	When thunderstorms were in the TRACON area, how often did you use the Long-Range Precipitation Product for the following tasks?					How useful was the Long-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
5) close departure sectors											

Please comment on the above response._____

6) open departure sectors											

Please comment on the above response._____

7) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response._____

8) change the AAR											

Please comment on the above response._____

9) change in-trail spacing											

Please comment on the above response._____

(Continued)

	When thunderstorms were in the TRACON area, how often did you use the Long-Range Precipitation Product for the following tasks?					How useful was the Long-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
10) start gate holds											

Please comment on the above response. _____

_____

11) stop gate holds											

Please comment on the above response. _____

_____

12) anticipate storm impacts in the TRACON area											

Please comment on the above response. _____

_____

13) initiate ground hold programs for aircraft to MCO											

Please comment on the above response. _____

_____

14) cease ground hold programs for aircraft to MCO											

Please comment on the above response. _____

_____

(Continued)

LONG-RANGE PRECIPITATION PRODUCT

In addition to the Orlando Tower and TRACON (MCO) facility, the Long-Range Precipitation Product was available at the enroute (ZJX) Traffic Management Unit, Delta Airline Operations Center in Atlanta, GA and Northwest Airlines Meteorology Department in Minneapolis, MN.

	When thunderstorms were in the TRACON area, how often did you use the Long-Range Precipitation Product for the following tasks?					How useful was the Long-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
15) coordinate operations with											

Please comment on the above response. _____

_____

16) coordinate operations with											

Please comment on the above response. _____

_____

17) coordinate operations with											

Please comment on the above response. _____

_____

	Yes	No	Don't Know
18) Did the weather situation, as indicated by the Long-Range Precipitation Product, agree with your perception (based on pilot reports) of weather-impacted areas?			

If "no," please explain. _____

_____

(Continued)

LONG-RANGE PRECIPITATION PRODUCT

	Ade-quate	Too Fast	Too Slow	Don't Know
19) The Long-Range Precipitation Product update rate was				

Please explain._____

_____

When non-standard atmospheric conditions exist, the energy from the NEXRAD radar beam is ducted toward the ground and produces ground clutter breakthrough on the display. This ground clutter break-through strongly resembles real weather echoes and is known as anomalous propagation (AP).

	Yes	No	Don't Know
20) Did you observe anomalous propagation (AP)?			

If "yes," how did you determine that AP echoes were present?_____

_____

21) During clear weather conditions, did observed AP-induced clutter regions result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

_____

22) Did AP-induced clutter regions observed **behind thunderstorms** result in operational problems?			

If "yes," please describe the situation which occurred and the resulting operational problem(s)._____

_____

23) Do you have any suggestions for improving the Long-Range Precipitation Product?			

If "yes," please explain._____

_____

STORM CELL INFORMATION

D. Storm Cell Information Product - presents an estimate of storm echo top and lightning activity in a text box (located in the lower right corner of the display) when the user pushes the track ball button in the vicinity of a storm cell.

	When thunderstorms were in the TRACON area, how often did you use the Storm Cell Information Product for the following tasks?					How useful was the Storm Cell Information Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) assess severity of a storm and plan re-routing											

Please comment on the above response._____

2) anticipate storm growth and the need for flight-path deviations											

Please comment on the above response._____

3) anticipate storm decay and the resumption of normal operations											

Please comment on the above response._____

4) determine whether aircraft could fly over a storm											

Please comment on the above response._____

(Continued)

STORM CELL INFORMATION

	Yes	No	Don't Know
5) Did the echo top estimate, as indicated by the Storm Cell Information Product, agree with pilot reports?			

If "no," please explain._____

	Ade-quate	Too Fast	Too Slow	Don't Know
6) Was the Storm Cell Information Product update rate				

Please explain._____

	Yes	No	Don't Know
7) Do you have any suggestions for improving the product?			

If "yes," please explain._____

STORM MOTION PRODUCT

E. Storm Motion Product - provides estimates of storm speed and direction by the use of an arrow pointing in the direction of the motion and a number at the base of the arrow indicating storm speed.

Instructions: Rate how often you used the Storm Motion product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Storm Motion product for the following tasks?					**How useful was the Storm Motion product?**					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
1) anticipate weather-induced restrictions on terminal routes and plan traffic flow											

Please comment on the above response. _____

2) anticipate when terminal routes would be clear and plan traffic flow											

Please comment on the above response. _____

3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response. _____

4) anticipate airborne holds											

Please comment on the above response. _____

	When thunderstorms were in the TRACON area, how often did you use the Storm Motion product for the following tasks?					How useful was the Storm Motion product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
5) anticipate need for in-trail spacing											

Please comment on the above response._____

6) anticipate gate holds											

Please comment on the above response._____

7) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response._____

8) change the AAR											

Please comment on the above response._____

9) other task (please specify) _____											

Please comment on the above response._____

(Continued)

	When thunderstorms were in the TRACON area, how often did you use the Storm Motion product for the following tasks?					How useful was the Storm Motion product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
10) other task (please specify) _____											

Please comment on the above response. _____

	Yes	No	Don't Know
11) Based on your perceptions, was the Storm Motion speed estimate accurate?			
12) Based on your perceptions, was the Storm Motion direction estimate accurate?			

If "No," please explain. _____

	Ade-quate	Too Fast	Too Slow	Don't Know
13) The Storm Motion product update rate was				

Please explain. _____

	Ade-quate	Too Many	Too Few	Don't Know
14) The total number of Storm Motion vectors presented on the display was				

Please explain. _____

(Continued)

STORM MOTION PRODUCT

	Ade-quate	Too Many	Too Few	Don't Know
15) The number of the storm motion vectors displayed within 10nmi of the airport was				

Please explain. _____

16) The number of the storm motion vectors displayed between 10nmi and 30nmi of the airport was				

Please explain. _____

17) The number of the storm motion vectors displayed outside 30nmi of the airport was				

Please explain. _____

	Yes	No	Don't Know
18) In terms of **performance**, did you notice any differences in the Storm Motion product based on the Short-Range Precipitation and on the Long-Range Precipitation products?			

If "yes," please explain. _____

19) In terms of **utility**, did you notice any differences in the Storm Motion product based on the Short-Range Precipitation and on the Long-Range Precipitation products?			

If "yes," please explain. _____

(Continued)

	Yes	No	Don't Know
20) Do you have any suggestions for improving the Storm Motion product?			

If "yes," please explain._____

_____

STORM EXTRAPOLATED POSITION PRODUCT

F. Storm Extrapolated Position Product - extrapolates the leading edge of the level 3 precipitation for 10 and 20 minutes and indicates the current and estimated locations of the leading edge of the precipitation by a series of blue lines.

Instructions: Rate how often you used the Storm Extrapolated Position product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Storm Extrapolated Position product for the following tasks?					**How useful was the Storm Extrapolated Position product?**					
	Never	**Seldom**	**Some-times**	**Often**	**Always**	**Not Useful**	**Some-what**	**Moder-ately**	**More Than Moder-ately**	**Very Useful**	**Don't Know**
1) anticipate weather-induced restrictions on terminal routes and plan traffic flow											

Please comment on the above response._____

2) anticipate when terminal routes would be clear and plan traffic flow											

Please comment on the above response._____

3) anticipate changes in airspeeds of approaching flights											

Please comment on the above response._____

4) anticipate airborne holds											

Please comment on the above response._____

STORM EXTRAPOLATED POSITION PRODUCT

	When thunderstorms were in the TRACON area, how often did you use the Storm Extrapolated Position product for the following tasks?					How useful was the Storm Extrapolated Position product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
5) anticipate need for in-trail spacing											

Please comment on the above response. _____

6) anticipate gate holds											

Please comment on the above response. _____

7) anticipate changes in Airport Acceptance Rate (AAR)											

Please comment on the above response. _____

8) change the AAR											

Please comment on the above response. _____

9) other task (please specify) _____											

Please comment on the above response. _____

STORM EXTRAPOLATED POSITION PRODUCT

	When thunderstorms were in the TRACON area, how often did you use the Storm Extrapolated Position product for the following tasks?					How useful was the Storm Extrapolated Position product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
10) other task (please specify) _____											

Please comment on the above response. _____

_____

	Yes	No	Don't Know
11) Based on your perceptions, was the Storm Extrapolated Position product accurate?			

If "no," please explain. _____

_____

	Ade-quate	Too Fast	Too Slow	Don't Know
12) The Storm Extrapolated Position product update rate was				

Please explain. _____

_____

	Ade-quate	Too Many	Too Few	Don't Know
13) The total number of Storm Extrapolated Position lines presented on the display was.....				

Please explain. _____

_____

(Continued)

STORM EXTRAPOLATED POSITION PRODUCT

	Ade-quate	Too Many	Too Few	Don't Know
14) The number of Storm Extrapolated Position lines displayed within 10nmi of the airport was ……				

Pease explain._____

_____

15) The number of Storm Extrapolated Position lines displayed between 10nmi and 30nmi of the airport was ……				

Please explain. _____

_____

16) The number of the Storm Extrapolated Position lines displayed outside 30nmi of the airport was ……				

Please explain. _____

_____

	Much Less Useful	Less Useful	Equally Useful	Some-what More Useful	Much More Useful	Don't Know
17) Compared to the Storm Motion vectors, the Storm Extrapolated Position Product was....						

Please explain._____

_____

	Yes	No	Don't Know
18) Do you have any suggestions for improving the product?			

If "yes," please explain._____

_____

_____

LIGHTNING PRODUCT

G. Lightning Product – a panel located in the upper right corner of the GSD that turned yellow when lightning was within 20 nmi of the airport.

Instructions: Rate how often you used the Lightning Product in performing each task and then rate how useful the product was. Place a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" and "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Short-Range Precipitation Product for the following tasks?					How useful was the Short-Range Precipitation Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) anticipate need to switch to generator power											

Please comment on the above response._____

2) other task (please specify) _____											

Please comment on the above response._____

	Yes	No	Don't Know
3) Did the location of lightning, as indicated by the Lightning Product, agree with your perception of the location of lightning activity?			

If "no," please explain._____

4) Do you have any suggestions for improving the Lightning Product?			

If "yes," please explain._____

TERMINAL WEATHER DATA LINK PRODUCT

H. Terminal Weather Data Link Product – a text box that showed the terminal weather text messages being sent to arrivin and departing pilots via the ACARS data link.

Instructions: Rate how often you used the Terminal Weather Data Link product and then rate how useful the product was. Plac a check mark [√] in the appropriate boxes. After rating each item, please comment. For example, if you selected "seldom" an "very useful," why did you not use the product more often? Was the product unavailable, difficult to use, etc.?

	When thunderstorms were in the TRACON area, how often did you use the Terminal Weather Data Link Product for the following tasks?					How useful was the Terminal Weather Data Link Product?					
	Never	Seldom	Some-times	Often	Always	Not Useful	Some-what	Moder-ately	More Than Moder-ately	Very Useful	Don't Know
1) provide summary weather information to pilots											

Please comment on the above response._____

2) keep abreast of information being provided to pilots											

Please comment on the above response._____

3) improve safety of flight											

Please comment on the above response._____

4) improve pilot situational awareness of severe weather in the terminal											

Please comment on the above response._____

5) assist pilots in making operational decisions											

Please comment on the above response._____

(Continued)

	Ade-quate	Too Fast	Too Slow	Don't Know
6) The Terminal Weather Data Link Product update rate was				

Please explain._____

_____

	Increased	Decreased	Remained the Same	Don't Know
7) As a result of Terminal Weather Data Link messages, requests from **approaching** pilots for terminal weather briefings				
8) As a result of Terminal Weather Data Link messages, requests from **departing** pilots for terminal weather briefings				

	Yes	No	Don't Know
9) Do you have any suggestions for improving the Terminal Weather Data Link Product?			

If "yes," please explain._____

_____

PRESENTATION OF INFORMATION

I. Presentation of Information

Please rate the following aspects of the ITWS GSD by placing a check mark [√] in the box that corresponds with your rating. Please list any comments related to each item, such as suggestions for improvements.

	Very Poor	Poor	Fair	Good	Very Good	Don't Know
1) ease of turning products ON/OFF						

Please comment on the above response._____

2) ease of interpreting whether a product is ON or OFF						

Please comment on the above response._____

3) ease of interpreting whether a product is available						

Please comment on the above response._____

4) ease of accessing storm cell information						

Please comment on the above response._____

5) ability to select a series of storm cell information reports and then scroll through the previously selected reports						

Please comment on the above response._____

PRESENTATION OF INFORMATION

	Very Poor	Poor	Fair	Good	Very Good	Don't Know
6) ability to receive storm cell information report on the cell closest to the cell you are currently viewing (NEXT)						

Please comment on the above response._____

7) visual presentation of the Storm Extrapolated Position product (blue lines)						

Please comment on the above response._____

J. Training

	Yes	No	Don't Know
1) Was the training you received sufficient?			

If you think the training could be improved or additional training should be provided, please comment. _____

2) Was the "ITWS GSD Users' Manual" useful?			

Please comment. _____

3) Were the ITWS playback data useful?			

Please comment. _____

4) Were the ITWS playback data representative of actual weather observed at your location?			

Please comment. _____

APPENDIX D

MCO SURVEY RESULTS

APPENDIX D

ORLANDO INTERNATIONAL AIRPORT (MCO) INTEGRATED TERMINAL WEATHER SYSTEM SURVEY FOR TRAFFIC MANAGERS, AREA SUPERVISORS/CIC, AND AREA MANAGERS

SUMMARY OF QUESTIONNAIRE RESPONSES.

This appendix is a summation of the results of the MCO questionnaire. The number of each possible answer for each question was totalled and the percentages given. Each comment received is listed following the question or section from which it was generated. The ITWS questionnaire was completed by 2 Area Managers, 1 Traffic Manager, and 9 Area Supervisors. There were none completed by CIC personnel. All respondents did not answer all questions.

A. GENERAL:

1a. 70% thought that ITWS would increase the arrival/departure rates at MCO when thunderstorms were in the TRACON area.
30% did not believe that it would increase.

1b. 20% of those that thought there would be an increase in the arrival/departure rate felt that an additional 1-6 aircraft could be accommodated.

80% of those that thought that there would be an increase in the arrival/departure rate felt that an additional 7-12 aircraft could be accommodated.

2. 17% thought that pilot requests for deviations would be increased as a result of using ITWS.
25% thought that requests for deviations would decrease.
58% felt that requests for deviations would remain the same.

3. 27% thought that as a result of using ITWS, weather related air-to-ground radio transmissions would be increased.
27% thought that they would be decreased.
36% thought that they would remain the same.
9% did not know.

COMMENT(S): This facility has been utilizing ASR-9 radar system so weather information has been provided. Each pilot has their own comfort level when it involves choosing a course through and around weather areas.

Some pilots will deviate through areas where another pilot would not go near. So... requests for deviations will always be made and ASR-9 data is sufficient to plan the flow of air traffic for this purpose.

Better information received by controller is transmitted to pilots.

The better quality of information available allows us to give more detailed, timely (and positive) information to the user.

More information available to the controller and the controller relaying this information to the pilot.

Same as the ASR-9 display.

Because controllers have the ability to vector aircraft to areas not effected by weather.

Provided better vectors.

Although Delta and Northwest had the information, the deviations continue as before.

4. 8% seldom used the products to coordinate operations with the enroute center (ZJX).
42% sometimes used the products to coordinate operations with ZJX.
25% often used the products to coordinate operations ZJX.
25% always used the products to coordinate operations with ZJX.

COMMENT(S): ITWS provides a confirmation of the weather data displayed on the ASR-9. The storm track gust front data are very useful.

Not all ITWS products were of the same value, Ex. Storm Motion is much more useful than Lightning.

Traffic flow.

Good presentation.

The products are useful to select different departure or arrival gates based on weather movement predictions.

Long range 100 and 200 miles.

Sometimes helpful in opening and closing of departure and arrival areas.

Communication between MCO and ZJX was easier.

We are better able to "coordinate" arrival/departure route based on weather data from ITWS.

8% thought that the products were somewhat useful.
8% thought that the products were moderately useful.

83% thought that the products were very useful.

5. 75% never used the products to coordinate operations with Delta flights.
17% seldom used the products to coordinate with Delta flights.
8% often used the products to coordinate with Delta flights.

COMMENT(S): We normally don't have the luxury of coordinating with individual airlines.

It was impossible to know whether the Delta flights were using data derived from ITWS or relying on the same information passed by us.

No calls.

Don't coordinate with individual airlines.

My primary use was for aircraft arriving/departing the airport. I never spoke specifically to Delta.

No coordination with Delta.

55% thought the product to not be useful.
9% thought the product to be somewhat useful.
9% thought the product to be more than moderately useful.
9% thought the product to be very useful.
18% did not know.

6. Same questions and same responses by all but pertaining to Northwest Airlines.

B. SHORT-RANGE PRECIPITATION PRODUCT:

1. 18% never used the product to anticipate weather-induced restrictions on terminal routes and plan traffic flow.
45% often used the product.
36% always used the product.

COMMENT(S): Color presentation - excellent. I almost always selected levels 1-6.

Prediction and staying ahead of the weather is much easier with these products.

I do use this all the time to plan my traffic.

18% thought the product was not useful.
9% thought the product was moderately useful.
73% thought the product was very useful.

2. 17% never used the product to anticipate when terminal routes would be clear and plan traffic flow.
17% sometimes used the product.
25% often used the product.
42% always used the product.

COMMENT(S): Extremely useful.

Presentation was similar to my ATC ASR-9 weather radar but is a high visibility tool for a supervisor.

17% thought the product not to be useful.
8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
67% thought the product to be very useful.

3. 67% never used the product to anticipate changes in airspeeds of approaching flights.
17% seldom used the product.
8% sometimes used the product.
8% always used the product.

COMMENT(S): Not a concern. Gust front prediction very useful in planning runway changes.

When microbursts/wind shear impact the final, the aircraft won't penetrate the area. Therefore, the changing airspeeds are not a factor.

Airspeed changes are never the same regardless of the weather.

Deviations in the terminal area do not include a noticeable change in aircraft speeds.

Changing traffic flow with changes of weather is my primary use. The system is great!

Predicate airspeeds on storm speeds.

80% thought this product was not useful.
20% thought this product was very useful.

4. 17% never used the product to anticipate airborne holds.
8% seldom used the product.
17% sometimes used the product.
33% often used the product.
25% always used the product.

COMMENT(S): ASR-9 data is sufficient. There are times when need for airborne holding is obvious and no special equipment is needed to make that determination.

Most useful in preventing need to hold.

Only when MBA and WSA make it obvious no one will attempt an approach.

This product helps us to anticipate runway closures and allows us to shut off arrivals prior to being impacted.

17% thought the product not to be useful.
8% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
58% thought that the product was very useful.

5. 17% never used the product to anticipate need for in-trail spacing.
33% sometimes used the product.
25% often used the product.
25% always used the product.

COMMENT(S): Valuable tool.

Only when MBA and WSA make it obvious no one will attempt an approach.

17% thought the product not to be useful.
17% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
58% thought the product to be very useful.

6. 17% never used the product to anticipate gate holds.
8% seldom used the product.
17% sometimes used the product.
42% often used the product.
17% always used the product.

COMMENT(S): Gate hold only when ZJX stopped departures.

MBA and WSA will cause a stoppage of departures. This product does help anticipate gate holds.

I used the system more here than on the preceding 3 questions.

Anticipating departure delays based on weather activity.

29% thought this product not to be useful.
29% thought this product to be somewhat useful.
14% thought this product to be moderately useful.
29% thought this product to be very useful.

7. 25% never used the product to anticipate changes to the Airport Acceptance Rate (AAR).

25% sometimes used the product.
33% often used the product.
17% always used the product.

COMMENT(S): Anticipate arrivals by being able to anticipate "where the storm will be".

25% thought the product was not useful.
25% thought the product was moderately useful.
8% thought the product was more than moderately useful.
42% thought the product was very useful.

8. 25% never used the product to change the AAR.
8% seldom used the product.
17% sometimes used the product.
33% often used the product.
17% always used the product.

COMMENT(S): AAR does not change drastically. A thunderstorm either allows us to land and depart or hold. ITWS helps us to plan when to start holding.

25% thought the product not to be useful.
8% thought the product to be somewhat useful.
17% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
42% thought the product to be very useful.

9. Other task. Runway changes. Gust front prediction is a very good tool for planning runway changes.

COMMENT(S): Very useful in airport, flow and taxi planning.

10. Other task. I use it to predicate all ATC functions.

11. 100% thought that the weather situation, as indicated by the Short-Range Precipitation product, agreed with their perception (based on pilot reports) of weather-impacted areas.

12. 75% thought that the Short-Range Precipitation Product update rate was adequate.
25% thought that it was too slow.

COMMENT(S): Updates were sufficient.

Speed increased since initial installation. Faster is better.

Update should be quicker.

13. 17% thought that compared to ASR-9 precipitation displayed on the TRACON/Tower controller ARTS display, the ITWS Short-Range Precipitation Product was much less useful.

25% thought that it was equally useful.
17% thought that it was somewhat more useful.
42% thought that it was much more useful.

<u>COMMENT(S):</u> ASR-9 provides sufficient storm information but ITWS storm track and gust front were very beneficial.

No comparison (Much more useful was checked).

The only area that was less useful was in the vicinity of the TDWR site where we would get attenuation.
Storm movement very useful.

The color presentation is a plus.

Color presentation makes a world of difference.

14. 83% observed anomalous propagation (AP).
17% did not observe AP.

How did you determine that AP echoes were present?

<u>COMMENT(S):</u> Cross check with ASR-9 and pilot reports.

Pilot reports.

Pilot report or personal observation from the tower.

Conditions observed from the tower verified AP.

Aircraft saying they were in the clear.

Through pilot reports of the weather not existing.

On "ASR-9" appears as anywhere from level 1 to level 6... but AP not displayed on ITWS.

15. 8% observed that during clear weather conditions, AP clutter regions resulted in operational problems.
92% did not see this to be a problem.

Describe the situation observed and resulting operational problem.

<u>COMMENT(S):</u> On ASR-9 must get check from pilot to determine if actually exists.

16. 8% thought that AP-induced clutter regions observed behind thunderstorms resulted in operational problems.
58% did not believe there was a problem.
33% did not know.

COMMENT(S): Indicated level 3 weather when in fact there was no weather at all.

17. 10% had suggestions for improving the Short-Range Precipitation Product.
80% had no suggestions.
10% did not know.

COMMENT(S): Reduce invalid display caused by attenuation when heavy weather is close to the antenna.

C. LONG RANGE PRECIPITATION PRODUCT:

1. 8% never used the product to anticipate weather-induced restrictions on routes into the Terminal Area and plan.
8% seldom used the product.
33% sometimes used the product.
42% often used the product.
8% always used the product.

COMMENT(S): Short-Range provided adequate information to flow arrival traffic.

Self explanatory.

The long range, either 100 or 200 miles, is very useful in the overall traffic flow plan. We used it extensively during its short duration.

Generally, flow control restrictions are imposed on MCO by the time we would consider implementing them.

The product is extremely helpful in planning with the ARTCC for weather related route changes.

The 200/100 mile range has been with us for just a short time.

2. 8% never used the product to anticipate weather-induced restrictions on routes out of the Terminal Area and plan.
8% seldom used the product.
17% sometimes used the product.
58% often used the product.
8% always used the product.

COMMENT(S): More useful to anticipate flow restrictions implemented by ARTCC.

Could see routes impacted or about to be impacted.

The long range, either 100 or 200 miles, is very useful in the overall traffic flow plan. We used it extensively during its short duration.

It sometimes helps planning swapping departure transition areas.

This product is extremely helpful in planning with ARTCC for weather related route changes.

The 200/100 mile range has been with us for just a short time.

3. 25% never used the product to close arrival gates.
25% seldom used the product.
17% sometimes used the product.
25% often used the product.
8% always used the product.
COMMENT(S): Short-Range provided adequate information.

The 200/100 mile range has been with us for just a short time.

This product is extremely helpful in planning with the ARTCC for weather related route changes.

The long range function is too long for this.

More useful to ZJX ARTCC than MCO.

The long range, either 100 or 200 miles, is very useful in the overall traffic flow plan. We used it extensively during its short duration.

Could see routes impacted or about to be impacted.

18% thought the product not to be useful.
27% thought the product to be somewhat useful.
9% thought the product to be moderately useful.
45% thought the product to be very useful.

4. 27% never used the product to open arrival gates.
18% seldom used the product.
18% sometimes used the product.
27% often used the product.
9% always used the product.

COMMENT(S): Short-Range provides adequate information.

Could see routes impacted or about to be impacted.

The long range, either 100 or 200 miles, is very useful in the overall traffic flow plan. We used it extensively during its short duration.

More useful to ZJX ARTCC than to MCO.

The Long Range function is too long for this.

This product is extremely helpful in planning with the ARTCC for weather related route changes.

The 200/100 mile range has been with us for just a short time.

20% thought the product not to be useful.
20% thought the product to be somewhat useful.
10% thought the product to be moderately useful.
50% thought the product to be very useful.

5. 18% never used the product to close departure sectors.
45% seldom used the product.
9% sometimes used the product.
18% often used the product.
9% always used the product.

COMMENT(S): Short-Range information is sufficient.

Useful to ZJX ARTCC.

Too far out to use in Terminal Area.

Usually I used the 50 mile range for this function.

The 200/100 mile range has been with us for just a short time.

I rely on it.

40% thought the product to be somewhat useful.
10% thought the product to be moderately useful.
50% thought the product to be very useful.

6. 30% never used the product to open departure sectors.
30% seldom used the product.
10% sometimes used the product.
20% often used the product.
10% always used the product.

COMMENT(S): Short-Range information is adequate.

I rely on it.

The 200/100 mile range has been with us for just a short time.

Usually I use the 50 mile range for this function.

Too far out to use in Terminal Area.

Useful to ZJX ARTCC.

25% thought the product to be somewhat useful.

13% thought the product to be moderately useful.
50% thought the product to be very useful.
13% did not know.

7. 50% never used the product to anticipate changes in Airport Acceptance Rate (AAR).
40% seldom used the product.
10% often used the product.

COMMENT(S): Short-Range is sufficient.

Too far out to use in Terminal Area.

Usually I use the 50 mile range for this function.

Too far in advance to be useful here.

The 200/100 mile range has been with us for just a short time.

When weather was impacting the local area, we would use the Short-Range. The long range usually effects outside of 50 miles of MCO.

Not as much due to the "longer" distance flow impact.

11% thought the product was not useful.
56% thought the product was somewhat useful.
11% thought the product was very useful.
22% did not know.

8. 50% never used the product to change the AAR.
40% seldom used it.
10% often used it.

COMMENT(S): Short-Range is adequate.

Not as much due to the "longer" distance flow impact. Not as much an impact directly on the airport.

The 100/200 mile range has been with us for just a short time.

Usually I used the 50 mile range for this function.

Too far out to use in Terminal Area.

11% thought the product to not be useful.
56% thought the product to be somewhat useful.
11% thought the product to be very useful.
22% did not know.

9. 30% never used the product to change in-trail spacing.
20% seldom used the product.

30% sometimes used the product.
20% often used the product.

COMMENT(S): Short-Range information is sufficient.

Use it as an argument to get restrictions lifted.

We got to see why center shut us down.

Usually I used the 50 mile range for this function.

Because we can better anticipate delays we can increase/decrease in-trail accordingly.

The 100/200 mile range has only been with us for a short time.

Not my problem as much as ARTCC.

40% thought that the product was somewhat useful.
10% thought that the product was moderately useful.
20% thought that the product was more than moderately useful.
10% thought that the product was very useful.
20% did not know.

10. 80% never used the product to start gate holds.
10% seldom used the product.
10% sometimes used the product.

COMMENT(S): Short-Range information is sufficient.

Not appropriate.

The 200/100 mile range has been with us for just a short time.

The 200 mile range has only been available for short period. I see big potential for MCO and ZJX to use it.

Too far out for use in Terminal Area.

44% thought that the product was not useful.
22% thought that the product was somewhat useful.
11% thought that the product was moderately useful.
22% did not know.

11. 80% never used the product to stop gate holds.
10% seldom used the product.
10% sometimes used the product.

COMMENT(S): Short-Range information is adequate.

Too far out to use in Terminal Area.

Usually I used the 50 mile range for this function.

The 200/100 mile range has been with us for just a short time.

44% thought the product not to be useful.
22% thought the product to be somewhat useful.
11% thought the product to be moderately useful.
22% did not know.

12. 10% never used the product to anticipate storm impacts in the TRACON area.
10% seldom used the product.
40% sometimes used the product.
30% often used the product.
10% did not know.

COMMENT(S): Gives more information for planning traffic flows.

The 200/100 mile range has been with us for just a short time.

For me, this range just is a guesswork range for MCO operations.

Too far out to use in Terminal Area.

Remained on Short-Range most of the time.

See what is coming.

Long range view of storm activity helps in assessing probability for MCO impact.

11% thought the product to be somewhat useful.
22% thought the product to be moderately useful.
67% thought the product to be very useful.

13. 70% never used the product to initiate ground hold programs for aircraft to MCO.
20% seldom used the product.
10% sometimes used the product.

COMMENT(S): Short-Range is adequate.

Long range really not used for MCO ground hold.

Too far out to use in Terminal Area.

Usually I used the 50 mile range for this function.

The 200/100 mile range has been with us for just a short time.

This is basically a center traffic management function.

33% thought the product not to be useful.
22% thought the product to be somewhat useful.
11% thought the product to be moderately useful.
11% thought the product to be very useful.
22% did not know.

14. 70% never used the product to cease ground hold programs for aircraft at MCO.
10% seldom used the product.
20% sometimes used the product.

COMMENT(S): Short-Range information is adequate.

This is basically a center traffic management function.

The 200/100 mile range has been with us for just a short time.

Usually I used the 50 mile range for this function.

Long range really not used for MCO ground hold.

33% thought the product not to be useful.
22% thought the product to be somewhat useful.
11% thought the product to be moderately useful.
11% thought the product to be very useful.
22% did not know.

15. 9% never used the product to coordinate operations with the enroute center (ZJX).
18% seldom used the product.
9% sometimes used the product.
55% often used the product
9% always used the product

COMMENT(S): Helped to see what ZJX was looking at and sometimes MCO could offer suggestions to ZJX.

Move ATAs/DTAs.

The 200 mile range has only been available for a short period. I see big potential for MCO and ZJX to use it.

Not in use long enough to properly evaluate.

9% thought the product not to be useful.
18% thought the product to be somewhat useful.
18% thought the product to be more than moderately useful.
55% thought the product to be very useful.

16. 82% never used the product to coordinate operations with Delta flights.
18% seldom used the product.

COMMENT(S): Don't normally coordinate with individual airlines.

I don't talk to Delta.

Don't coordinate with airlines.

Never differentiated.

56% thought the product not to be useful.
22% thought the product to be somewhat useful.
22% did not know.

17. 82% never used the product to coordinate with Northwest Airlines.
18% seldom used the product.

COMMENT(S): Don't normally coordinate with individual airlines.

Never differentiated.

Don't coordinate with airlines.

I don't talk to Northwest.

56% thought the product not to be useful.
22% thought the product to be somewhat useful.
22% did not know.

18. 100% thought that the weather situation, as indicated by the Long Range Precipitation product, agreed with their perception (based on pilot reports) of weather impacted areas.

19. 73% thought that the Long Range Precipitation product update rate was adequate.
27% thought that it was too slow.

COMMENT(S): Movement prediction is hampered by the slow update rate.

Make quicker update.

20. 36% observed anomalous propagation (AP).
45% did not observe AP.
18% did not know.

AP echoes were determined to be present by:

COMMENT(S): Pilot reports.

21. 91% did not believe that during clear weather conditions, AP induced clutter regions resulted in operational problems.

9% did not know.

22. 55% did not believe that AP induced clutter regions observed behind thunderstorms resulted in operational problems.
45% did not know.

23. 9% had suggestions to improve the product.
73% did not have suggestions.
18% did not know.

COMMENT(S): Add 100 mile range.

D. STORM CELL INFORMATION:

1. 25% never used the product to access severity of a storm and plan re-routing.
42% seldom used the product.
8% often used the product.
16% always used the product.

COMMENT(S): NWS level 1-6 is sufficient.

The intensity of the storm level is a good indication of the strength, growth and decay of the storm.

Although these products are "nice to have," their value is limited.

Base reports would make this product very useful.

I played with it quite a bit. Tops information is probably more useful to enroute centers because of their high strata airspace.

Aircraft won't fly in level 3 or above anyway.

Extremely useful and keeps the "real" picture.

33% thought the product not to be useful.
42% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
16% thought the product to be very useful.

2. 33% never used the product to anticipate storm growth and the need for flight-path deviations.
42% seldom used the product.
8% sometimes used the product.
16% always used the product.

COMMENT(S): Airline crews will normally deviate around level 2 and above. More useful for ZJX.

Extremely useful and keeps the "real" picture. Invaluable.

I played with it quite a bit. Tops information is probably more useful to enroute centers because of their high strata airspace.

42% thought the product not to be useful.
42% thought the product to be somewhat useful.
17% thought the product to be very useful.

3. 33% never used the product to anticipate storm decay and the resumption of normal operations.
56% seldom used the product.
11% always used the product.

COMMENT(S): Does provide some useful information but NWS levels display adequate information.

I played with it quite a bit. Tops information is probably more useful to enroute centers because of their high strata airspace.

Aircraft won't fly in level 3 or above anyway.

Extremely useful and keeps the "real" picture.

42% thought the product not to be useful.
33% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
16% thought the product to be very useful.

4. 50% never used the product to determine whether aircraft could fly over a storm.
42% seldom used the product.
8% always used the product.

COMMENT(S): Not useful in terminal environment because most convective weather is at or above 12,000 (ceiling of our airspace).

But they won't!!

No use in terminal. Give us bottoms.

I played with it quite a bit. Tops information is probably more useful to enroute centers because of their high strata airspace.

This doesn't really apply in a terminal environment.

The top of terminal airspace is usually lower than any storm top.

50% thought the product not to be useful.
40% thought the product to be somewhat useful.
8% thought the product to be very useful.

5. 100% did not know if the echo top estimate, as indicated by the Storm Cell Information product, agreed with pilot reports.

COMMENT(S): Too high usually.

6. 42% thought the Storm Cell Information Product update rate was adequate.
58% did not know.

7. 18% had suggestions for improving the product.
64% did not have suggestions.
18% did not know.

COMMENT(S): Bottoms.

Base reports.

E. STORM MOTION PRODUCT:

1. 27% sometimes used the product to anticipate weather-induced restrictions on terminal routes and plan traffic flows.
27% often used the product.
56% always used the product.

COMMENT(S): Very useful tool for planning arrival/departure flows, gate holds and ground stops.

This is an excellent tool for planning traffic flows.

If you know where the storm is going then you know where to go.

Best feature.

8% thought the product to be somewhat useful.
25% thought the product to be moderately useful.
67% thought the product to be very useful.

2. 25% sometimes used the product to anticipate when terminal routes would be clear and plan traffic flow.
33% often used the product.
42% always used the product.

COMMENT(S): Storm motion provides necessary information.

If you know where the storms going then you know where to go.

17% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
67% thought the product to be very useful.

3. 58% never used the product to anticipate changes in airspace of approaching flights.
33% seldom used the product.
8% always used the product.

COMMENTS(S): Not normally used for this purpose.

Not useful for this in terminal environment.

"Keep the speed up" to beat the storm.

70% thought the product not to be useful.
20% thought the product to be somewhat useful.
10% thought the product to be very useful.

4. 8% never used the product to anticipate airborne holds.
8% seldom used the product.
16% sometimes used the product.
42% often used the product.
25% always used the product.

5. 17% never used the product to anticipate need for in trail spacing.
8% seldom used the product.
25% sometimes used the product.
17% often used the product.
33% always used the product.

COMMENT(S): Provided very good information to predict arrival spacing requirements.

If you know activity you know how to regulate.

17% thought the product not to be useful.
17% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
50% thought the product to be very useful.

6. 17% never used the product to anticipate gate holds.
8% seldom used the product.
25% sometimes used the product.
42% often used the product.
8% always used the product.

COMMENT(S): Provides necessary and accurate information to plan gate hold.

If you know activity you know how to regulate.

17% thought the product not to be useful.
17% thought the product to be somewhat useful.

8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
50% thought the product to be very useful.

7. 17% never used the product to anticipate changes in Airport Acceptance Rate (AAR).
8% seldom used the product.
33% sometimes used the product.
17% often used the product.
25% always used the product.

COMMENT(S): AAR is not greatly affected.

With ITWS traffic is either landing or holding. Weather in area may affect the number of aircraft a sector can work but very little effect on AAR.

If you know activity you know how to regulate.

17% thought the product not to be useful.
25% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
25% thought the product to be more than moderately useful.
25% thought the product to be very useful.

8. 17% never used the product to change the AAR.
33% seldom used the product.
17% sometimes used the product.
8% often used the product.
25% always used the product.

COMMENTS(S): AAR is not greatly affected.

With TSTMS traffic is either landing or holding. Weather in area may affect the number of aircraft a sector can work but very little effect on AAR.

If you know activity you know how to regulate.

17% thought the product not to be useful.
33% thought the product to be somewhat useful.
17% thought the product to be moderately useful.
33% thought the product to be very useful.

9. Other task.

COMMENT(S): Provide good information to relay to SFB Tower so they can plan better.

10. Other task. None

11. 100% thought that based on their perceptions, the storm

motion speed estimate was accurate.

12. 100% thought that based on their perceptions, the storm motion direction estimate was accurate.

13. 75% thought that the Storm Motion product update rate was adequate.
17% thought it was too slow.
8% did not know.

COMMENT(S): Seemed adequate.

Speed it up.

14. 92% thought that the number of storm motion vectors presented on the display was adequate.
8% did not know.

COMMENT(S): Good as displayed.

I would like the ability to click "on" or "off" each cell to see speed and direction then shut it off if I want to.

15. 91% thought that the number of storm motion vectors displayed within 10 nm of the airport is adequate.
9% thought there were too few.

COMMENT(S): Storm motion vectors should default to the closest storm to the airport. I have seen weather (about to impact my airport) with no vector allocated. Bull!

16. 92% thought the number of storm motion vectors displayed between 10 nm and 30 nm of the airport was adequate.
8% thought there were too few.

17. 92% thought that the number of storm motion vectors displayed outside 30 nm of the airport was adequate.
8% did not know.

18. 8% noticed, in the terms of performance a difference in the storm motion based on the Short-Range Precipitation and the Long Range Precipitation products.
75% did not notice any difference.
17% did not know.

COMMENT(S): More accurate of course and information quicker update.

19. 83% did not notice in the terms of utility, any differences in the Storm Motion product based on the Short-Range precipitation products.

17% did not know.

20. 100% did not have any suggestions for product improvement.

COMMENT(S): It is one of the most useful if not the most useful of all ITWS products.

F. STORM EXTRAPOLATED POSITION PRODUCT:

1. 25% never used the product to anticipate weather-induced restrictions on terminal routes and plan traffic flow.
17% seldom used the product.
17% sometimes used the product.
17% often used the product.
25% always used the product.

COMMENT(S): Storm Motion sufficient.

Excellent for planning purposes.

This is something you can quickly determine without touching the keyboard or computer.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

33% thought the product not to be useful.
8% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
8% thought the product to be more than moderately useful.
42% thought the product to be very useful.

2. 25% never used the product to anticipate when terminal routes would be clear and plan traffic flow.
17% seldom used the product.
17% sometimes used the product.
8% often used the product.
33% always used the product.

COMMENT(S): Storm Motion sufficient.

Excellent for planning purposes.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

33% thought the product not to be useful.
8% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
50% thought the product to be very useful.

3. 75% never used the product to anticipate changes in airspeeds

of approaching flights.
17% seldom used the product.
8% always used the product.

COMMENT(S): Not a factor.

Excellent for planning purposes.

Not useful in terminal environment.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

73% thought the product not to be useful.
18% thought the product to be somewhat useful.
9% thought the product to be very useful.

4. 50% never used the product to anticipate airborne holds.
17% seldom used the product.
8% sometimes used the product.
25% always used the product.

COMMENT(S): Storm Motion is sufficient.

Excellent for planning purposes.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

5. 42% never used the product to anticipate need for in-trail spacing.
17% seldom used the product.
8% sometimes used the product.
8% often used the product.
25% always used the product.

COMMENT(S): Storm Motion provides necessary information - S.E.P. caused too much clutter on GSD.

Self explanatory.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

42% thought that the product was not useful.
8% thought the product to be somewhat useful.
8% thought the product to be moderately useful.
17% thought the product to be more than moderately useful.
25% thought the product to be very useful.

6. 42% never used the product to anticipate gate holds.
25% seldom used the product.

8% sometimes used the product.
17% often used the product.
8% always used the product.

COMMENT(S): Storm Motion provides necessary information -S.E.P. caused too much clutter on GSD.

Was able to predicate my plan on real time knowledge.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

7. 50% never used the product to anticipate changes in Airport Acceptance Rate (AAR).
17% seldom used the product.
8% sometimes used the product.
25% always used the product.

COMMENT(S): Storm Motion provides necessary information - S.E.P. caused too much clutter on GSD.

Was able to predicate my plan on real time knowledge.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

55% thought that the product was not useful.
9% thought that the product was moderately useful.
9% thought that the product was more than moderately useful.
27% thought that the product was very useful.

8. 50% never used the product to change the AAR.
17% seldom used the product.
8% sometimes used the product.
25% always used the product.

COMMENT(S): Storm Motion provides necessary information - S.E.P. caused too much clutter on GSD.

Was able to predicate my plan on real time knowledge.

The lines added too much clutter. The same results can be achieved by the Storm Motion product.

55% thought that the product was not useful.
9% thought the product to be moderately useful.
9% thought the product to be more than moderately useful.
27% thought the product to be very useful.

9. Other task. Some responses indicated that the product was used for other tasks. (No comments were furnished).

10. Other task. (Same as No. 9)

11. 88% thought that based on their perception, the Storm Extrapolated Position product was accurate.
12% thought that it was not, or did not know.

COMMENT(S): None

12. 83% thought that the Storm Extrapolated Position product update rate was adequate.
8% thought it was too slow.
8% did not know.

13. 58% thought that the total number of Storm Extrapolated Position lines presented on the display was adequate.
42% thought there were too many.

COMMENT(S): Too much clutter.

Something extra, not needed, causes clutter.

It added too much clutter.

14. 58% thought that the number of Storm Extrapolated position lines displayed within 10 nm of the airport was adequate.
33% thought there were too many.
8% did not know.

COMMENT(S): Too much clutter.

It added too much clutter.

15. 58% thought that the number of Storm Extrapolated lines between 10 nm and 30 nm was adequate.
33% thought there were too many.
8% did not know.

COMMENT(S): It added too much clutter.

16. 55% thought that the number of Storm Extrapolated lines displayed outside 30 nm of the airport was adequate.
36% thought there was too many.
9% did not know.

COMMENT(S): It added too much clutter.

17. 33% thought that compared to Storm Motion vectors, the Storm Extrapolated Position product was much less useful.
50% thought it was less useful.
8% thought it was equally useful.
8% thought it was much more useful.

COMMENT(S): Too much clutter, prefer Storm Motion vectors.

Storm Motion vectors are quicker and easier to read.

This is something you can quickly determine without touching the keyboard or computer.

The Storm Motion does basically the same thing without the clutter.

18. 36% had suggestions for improving the product.
36% did not.
27% did not know.

COMMENT(S): Eliminate!

Get rid of Storm Extrapolated Position product.

Storm Motion worked better in this local area. Elsewhere it may be helpful on fast moving lines.

Lose it. This is not a useful tool. If the storm remained the same intensity and if it kept moving the same way... what a joke. Absolutely no positive benefit here.

G. LIGHTNING PRODUCT:

1. 73% never used the product to anticipate need to switch to generator power.
18% seldom used the product.
9% always used the product.

COMMENT(S): Lightning product was redundant. Level 2 weather and above may have lightning.

Self explanatory.

Never saw it.

Not available.

This is something you don't need a computer to tell you.

This product does not give enough information. I know when the lightning is close to the airport. I need to know how far it is.

Whenever we have significant weather building within 20 miles of the airport, we turn on the generators.

2. Other task. One person said they used it for other task.

COMMENT(S): None

3. 25% thought that the location of the lightning, as indicated by the Lightning product, agreed with their perception of the location of lightning activity.
8% thought that it did not.
67% did not know.

COMMENT(S): We very seldom paid much attention to the product, whenever we get convective weather starting to build.

4. 17% had suggestion for improving the product.
83% did not or did not know.

COMMENT(S): I don't use this product in either the Tower or Radar room to assist me. If I see lightning, I react. Lightning announces itself.

More detailed information on how many strikes in a given cell might help.

Give us a product that gives us distance and degrees from the airport.

H. TERMINAL WEATHER DATA LINK PRODUCT:

1. 75% never used the product to provide summary weather information to pilots.
25% seldom used the product.

COMMENT(S): Most useful to pilots.

It isn't my job.

Not accurate enough to be helpful.

Pilots have not commented on it and I believe the update is slow.

45% thought the product not to be useful.
27% thought the product to be somewhat useful.
9% thought the product to be moderately useful.
18% did not know.

2. 33% never used the product to keep abreast of information being provided to pilots.
50% seldom used the product.
17% often used the product.

COMMENT(S): None

27% thought the product not to be useful.

36% thought the product to be somewhat useful.
18% thought the product to be moderately useful.
9% thought the product to be more than moderately useful.
9% thought the product to be more than moderately useful.

3. 67% never used the product to improve the safety of flight.
25% seldom used the product to improve the safety of flight.
8% sometimes used the product.

COMMENT(S): Weather radar is very indicative of weather conditions, data link just confirms information.

Ask the pilot.

All the times we provide weather information to aircraft it comes from a display, never have they used data link.

It is impossible to answer this question accurately.

4. 50% never used the product to improve pilot situational awareness of severe weather in the terminal area.
25% seldom used it.
25% sometimes used it.

COMMENT(S): Weather radar is very indicative of weather conditions, data link just confirms information.

Ask pilot.

45% thought the product was not useful.
18% thought the product to be somewhat useful.
9% thought the product to be moderately useful.
27% did not know.

5. 80% never used the product to assist pilots in making operational decisions.
10% seldom used the product.
10% sometimes used the product.

COMMENT(S): Don't know, it seems it would be. May relieve us of some aircrew inquiries.

Put them at odds with ATC since their information is dated.

If they use it.

Ask pilot.

50% thought that the product was not useful.
10% thought it to be moderately useful.
40% did not know.

6. 42% thought that the Terminal Weather Data Link product update rate was adequate.
17% thought it was too slow.
42% did not know.

COMMENT(S): None

7. 75% thought that as a result of Terminal Weather Data Link messages, requests from approaching pilots for terminal weather briefings remained the same.
25% did not know.

8. 83% thought that as a result of Terminal Weather Data Link messages, requests from departing pilots for terminal weather briefings remained the same.
17% did not know.

9. 8% had suggestions to improve the product.
58% did not.
33% did not know.

COMMENT(S): Increase aircrews awareness of product availability.

ARINC is really just trying to make a buck here. Come on folks.

I. PRESENTATION OF INFORMATION:

1. 33% thought the ease of turning products on/off was fair.
50% thought it was good.
17% thought it was very good.

COMMENT(S): "Hot keys" would be useful.

There must be a way of making a "one step" on/off entry instead of "selecting, turning on/off, accepting, etc.".

2. 8% thought that the ease of interpreting whether a product was on/off was fair.
58% thought it to be good.
33% thought it to be very good.

COMMENT(S): None

3. 8% thought that the ease of interpreting whether a product is available was poor.
8% thought it to be fair.
67% thought it to be good.
17% thought it to be very good.

COMMENT(S): Too small and insignificant legend.

4. 17% thought the ease of accessing storm cell information was

fair.
50% thought it to be good.
33% thought it to be very good.

COMMENT(S): None

5. 8% thought that the ability to select a series of storm cell information reports and then scroll through the previously selected reports was poor.
17% thought it to be fair.
33% thought it to be good.
8% thought it to be very good.
33% did not know.

COMMENT(S): Didn't use very much.

6. 25% thought the ability to receive storm cell information report on the cell closest to the cell you are currently viewing (next) was fair.
33% thought that it was good.
25% thought that it was very good.
17% did not know.

COMMENT(S): None

7. 17% thought that visual presentation of Storm Extrapolated Position product (blue lines) was very poor.
17% thought it to be poor.
8% thought it to be fair.
25% thought it to be fair.
33% thought it to be very good.

COMMENT(S): Too much clutter.

This is just clutter.

This adds too much clutter to an already crowded display.

J. TRAINING:

1. 67% thought the training was sufficient.
25% thought it was not sufficient.
8% did not know.

COMMENT(S): Have sufficient number of displays for "hands on", not just lecture.

CBI training would be very useful.

Needed more.

2. 33% thought the "ITWS GSD Users Manual" was useful.

8% did not.
58% did not know.

COMMENT(S): Didn't see it.

Never saw it.

Never saw it.

It was not always available in proper location.

Never got one.

3. 33% thought that ITWS playback data was useful.
17% did not.
50% did not know.

COMMENT(S): For demonstration purposes.

Never used it.

Never saw it.

For training or orientation the GSD display was impressive.

4. 58% thought that ITWS playback data was representative of actual weather observed at this location.
42% did not know.

COMMENT(S): Never used it.

K. ADDITIONAL COMMENTS AND OBSERVATIONS:

Many of the ITWS Products would be nice but expensive. Storm Motion is the most valuable of all the products at this time.

If ITWS products could be "plugged in" site specific like a program on a PC, many more of these products would be useful. If they have to be added at all sites then cost would be a major factor.

TDWR is great. WSP is great. Long Range Precipitation is good informationally, but not especially useful in the terminal environment. Storm Cell Information Product - useless in terminal area. Storm Motion needs work but even with work it would only be marginally useful. Storm Extrapolated Position Product - useless.
Lightning Product - lose it. Data Link Product - lose it.

We must remember that these are tools that are supposed to make the supervisor/CIC job easier and more efficient. Too many products or too much time at the keyboard will render this

objective impossible. The products should be easy to see, decipher and use. Emphasis should be placed in these areas, especially in ease of use.

Although some of the products that were added this year were of limited use, the overall value of TDWR is immeasurable. The ability to clearly see the weather and to plan traffic around it, helped to make traffic flow much smoother. If only two products were available, I would chose Gust Front Projection and Storm Motion. We have learned to rely heavily on the TDWR and feel somewhat "blind" when it is off. Orlando had been the test site for many new pieces of equipment and we pride ourselves in giving the equipment a thorough and honest evaluation. Without a doubt, the TDWR has been the most useful piece of new equipment that we have seen. I will be sad to see it go.