NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Washington, DC 20594

February 10, 2011

ATC GROUP CHAIRMAN'S FACTUAL REPORT

CEN10LA363

A. AIRCRAFT ACCIDENT

Location: Pioneer, Louisiana

Date: June 28, 2010

Time: 1752 Central Daylight Time / 2252 Coordinated Universal Time

Aircraft: American Eagle flight 3224 (EGF3224), Embraer 145 Regional Jet

B. AIR TRAFFIC CONTROL GROUP

Mr. Scott J. Dunham
National Transportation Safety Board
Washington, D.C.

Mr. Jeff Rich
Federal Aviation Administration
Oberlin, OH

Mr. William Shea
National Air Traffic Controllers Association
Fort Worth, TX

Mr. Nathan J. Enders
Federal Aviation Administration
Fort Worth, TX

C. SUMMARY

On June 28, 2010, approximately 1752 Central Daylight Time, N601DW, an Embraer EMB-145 operating as American Eagle flight 3224 (EGF3224), encountered severe turbulence while in cruise flight at 36,000 feet over Pioneer, Louisiana. The captain declared an emergency and landed without incident at East Texas Regional Airport

(GGG), Longview, Texas, at 1824. The airline transport rated captain and the commercial rated first officer were not injured, and the one flight attendant was seriously injured. Of the 42 passengers on board, one was seriously injured and three sustained minor injuries. The airplane was not damaged. The airplane was registered to and operated by American Eagle Airlines, Incorporated, Fort Worth, Texas. An instrument flight rules (IFR) flight plan was filed for the flight that departed Piedmont Triad International Airport (GSO), Greensboro, North Carolina, at 1605 and was destined for Dallas/Fort Worth International Airport (DFW), Dallas-Fort Worth, Texas. Instrument meteorological conditions prevailed for the scheduled passenger flight conducted under 14 Code of Federal Regulations Part 121.

D. DETAILS OF THE INVESTIGATION

The air traffic control group met at Fort Worth Air Route Traffic Control Center (ZFW) on August 11, 2010. The group reviewed a replay of the incident and weather data extracted from the Weather and Radar Processor (WARP) system that supplies displayed precipitation information to ZFW controllers. The group interviewed the Operations Manager (OM) on duty at the time of the accident, a front-line manager (FLM) involved in the post-accident response, the ZFW controller in contact with EGF3224 during the turbulence encounter, and another controller that next handled the flight. The group also visited the control room to configure a radar display as it was set at the time of the accident and evaluate the conspicuity of precipitation shown. The group then completed an outbriefing with facility management and concluded the visit to ZFW.

On August 16 and 17, 2010, the group met at Memphis Air Route Traffic Control Center (ZME) to interview the controllers and supervisors responsible for handling EGF3224 just before the aircraft was transferred to ZFW.

1. History of Flight

EGF3224 departed GSO at 1605 en route to Dallas-Fort Worth, Texas. According to information provided by the crew, the flight encountered some localized precipitation and turbulence in the GSO area that required deviations and caused the captain to leave the seat belt sign on until the aircraft reached its cruise altitude of 36,000 feet. The flight was subsequently uneventful, and the crew was operating under control of Memphis Center (ZME). According to information provided by the captain, as the aircraft approached the Shreveport area the crew activated the seat belt sign and advised the flight attendant to be seated in anticipation of forecast thunderstorms along the route ahead. At 1751:01, the ZME controller instructed the crew to contact ZFW. EGF3224 checked in with ZFW at 1751:14 level at flight level (FL) 360. At 1752:37, the aircraft's altitude readout indicated that it was climbing above FL360, eventually reaching FL368. At 1752:54, EGF3224 called the center. The controller acknowledged twice, and at 1753:07 EGF3224 replied, "Stand by." At 1753:17, EGF3224 advised the controller, "…we just went through some severe turbulence there, we've got a couple of problems we've got to work out, uh we're OK for now, we'll get back to you." The controller responded, "OK, are you able to descend back to 36?" EGF3224 replied, "Uh, we'll do that – yes." The controller transmitted, "OK, that's the first report of turbulence I've had - every report

I've had has been of smooth air … it was severe and uh it caused you an 800 foot updraft is that correct?" The crew responded, "That's correct we had some severe turbulence there was just hardly anything there at all and just all of a sudden some real hard bumps it was very short duration maybe 30 seconds uh but yeah we climbed up a little bit we're coming back down now." At 2258:04, the controller transmitted, "EGF3224 they're asking me if you had any injuries." The crew responded, "…we're evaluating that right now. We do have some minor injuries and we've lost some of our navigation capabilities. We're VMC [in visual meteorological conditions] at this time we're waiting for a further report from the flight attendant." The controller acknowledged the report. At 1758:49, EGF3224 stated, "…We realize we've gone a little south of course while we recovered our nav facilities here, we're now going direct to Elm Grove." The controller acknowledged and instructed EGF3224 to contact the next controller on frequency 132.27. The crew accepted the frequency change.

At 1800:53, EGF3224 contacted the Fort Worth Center Elm Grove position and reported level at flight level 360. At 1802:37, the crew advised that a passenger and a flight attendant had been injured, declared an emergency, and advised that they would be diverting to Shreveport. The controller began vectoring and descending the flight toward Shreveport. At 1808:22, the crew requested to divert to Gregg County airport because of weather between their position and Shreveport. The controller cleared the flight direct to Gregg County, and the remainder of the air traffic handling was uneventful. EGF3224 landed at Gregg County at 1822, and was met at the gate by medical personnel.

2. Radar Data

The radar track for the accident aircraft is shown in figure 1, with the approximate location of the turbulence encounter. The aircraft climbed above FL360 at the point indicated.

Figure 2 is an excerpt from the WARPPLOT data supplied by the FAA Technical Center after the accident. The aircraft position is indicated by the X. Moderate, heavy, and extreme precipitation return is indicated by L, M, and H characters respectively. Each letter represents a 1 square mile area. Complete WARPPLOT reports for the relevant portions of the flight will be included in the docket for this case.

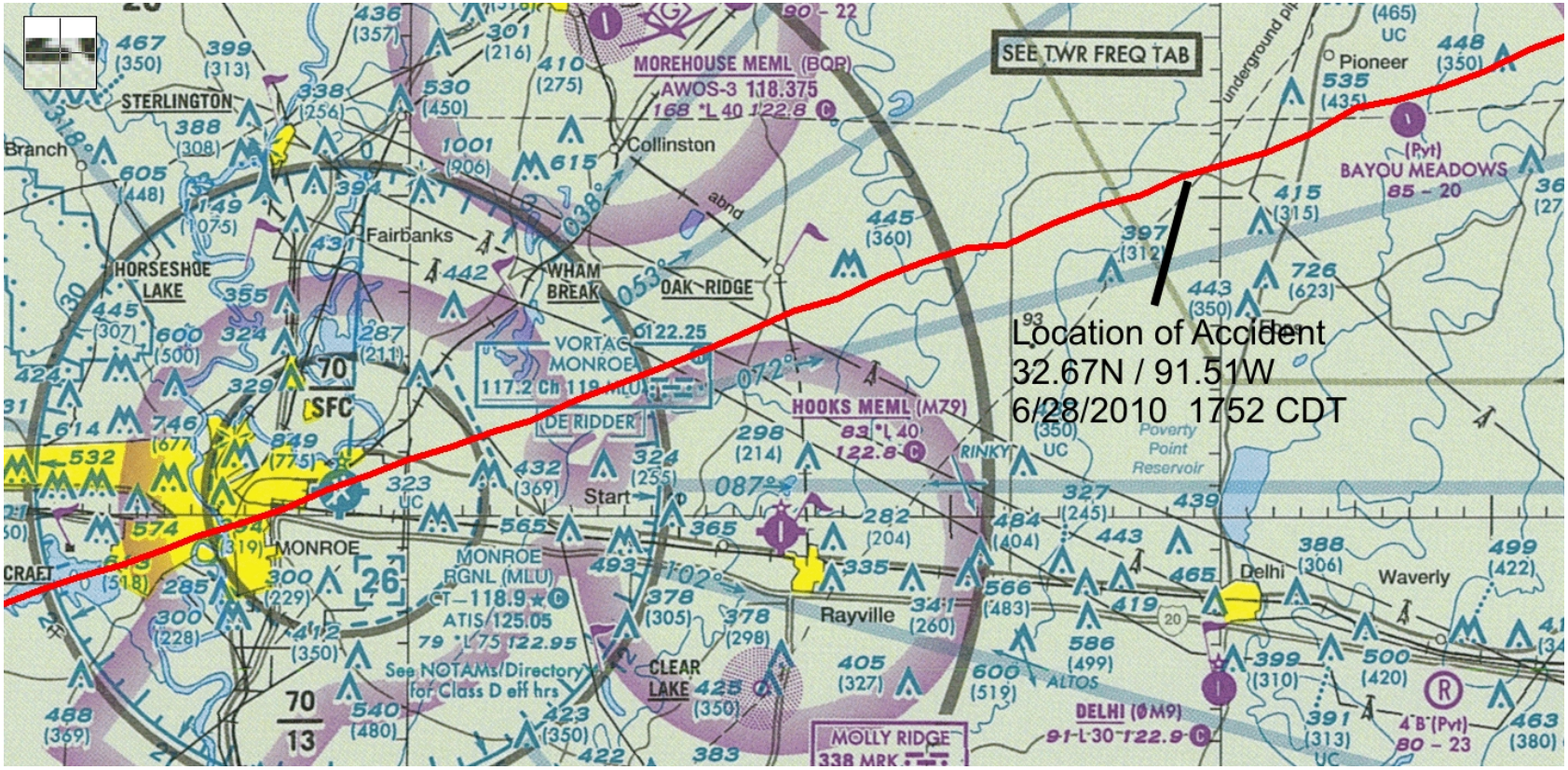


Figure 1 – Accident location (initial observed altitude deviation)

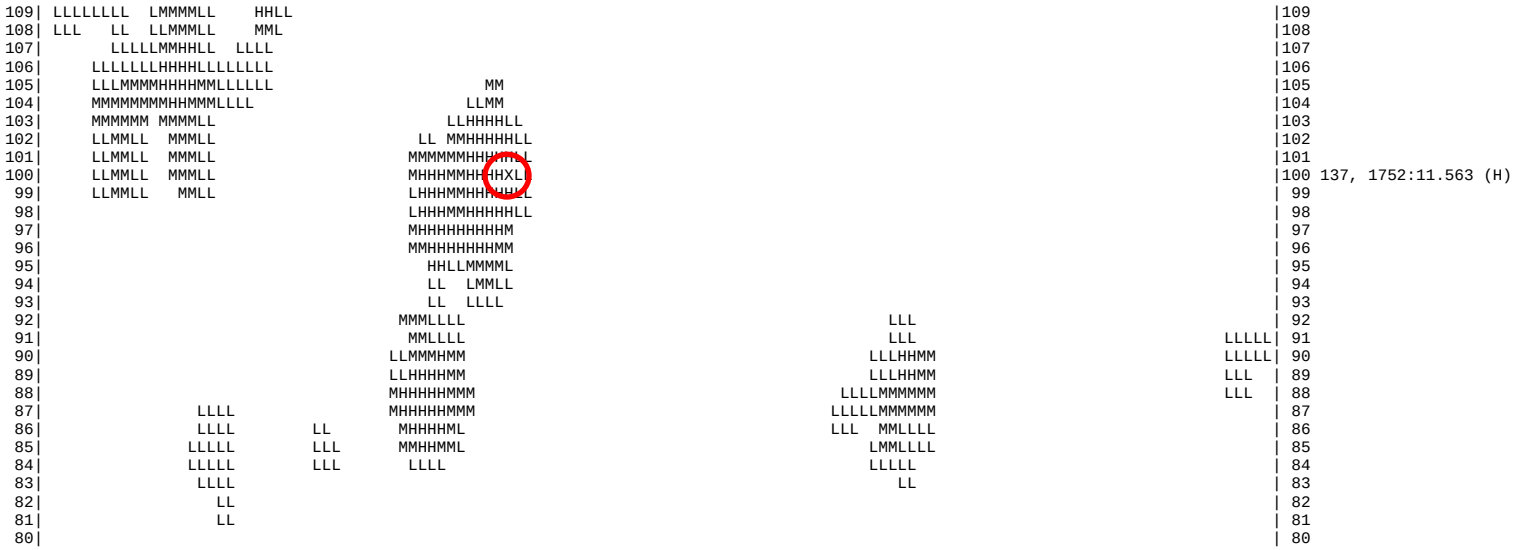
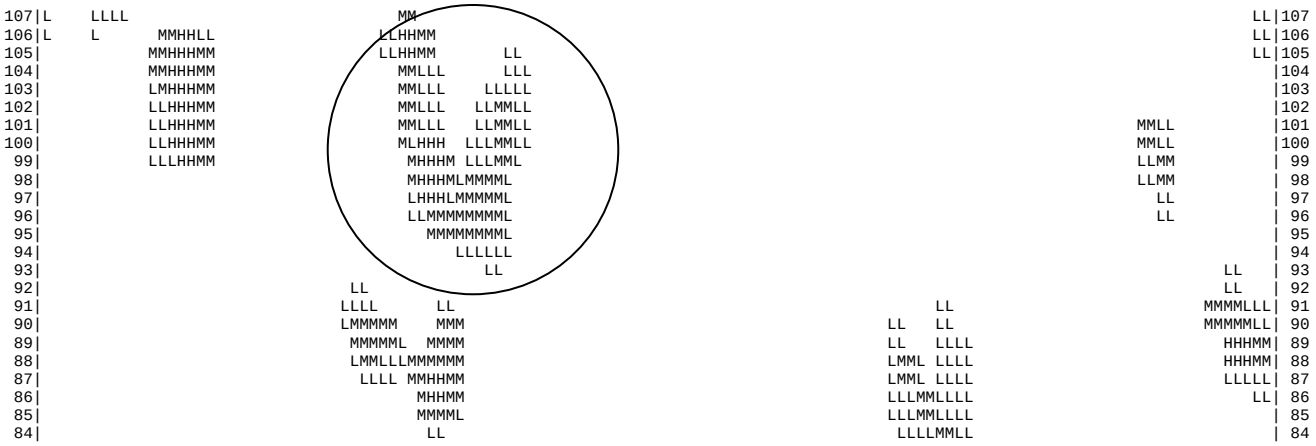


Figure 2 – WARPPLOT data for 1752 CDT showing EGF3224(X) in area of extreme level precipitation.
L = moderate intensity, M = heavy intensity, H = extreme intensity.

The WARPPLOT excerpts on the following pages show the precipitation return in the area of the accident for the 20 minute period preceding the accident. EGF3224 is not depicted because these images were developed independent of the aircraft's position.

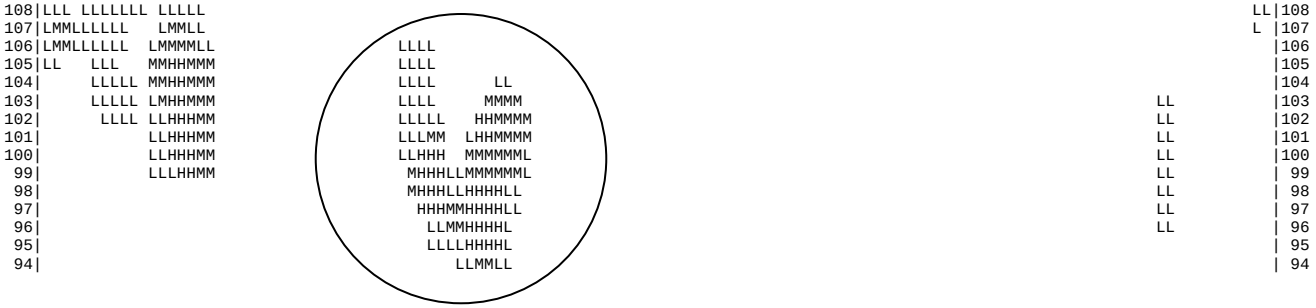
Date: 2010/06/28-1735:25.506 Area: 54 NAS Row/Y: 3 NAS Column/X: 6 Altitude: High/Ultra High (24,000-60,000) Change: TRUE

L: Low Precipitation M: Medium Precipitation H: High Precipitation



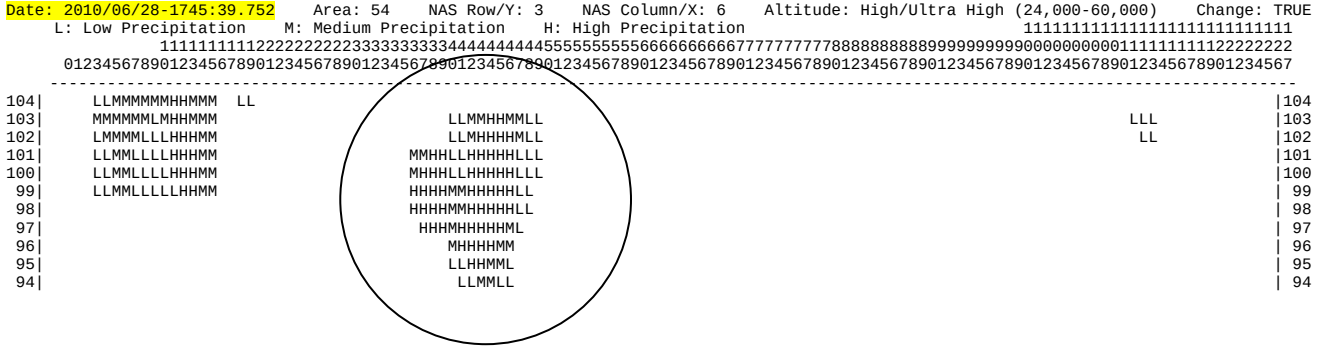
Date: 2010/06/28-1740:07.004 Area: 54 NAS Row/Y: 3 NAS Column/X: 6 Altitude: High/Ultra High (24,000-60,000) Change: TRUE

L: Low Precipitation M: Medium Precipitation H: High Precipitation



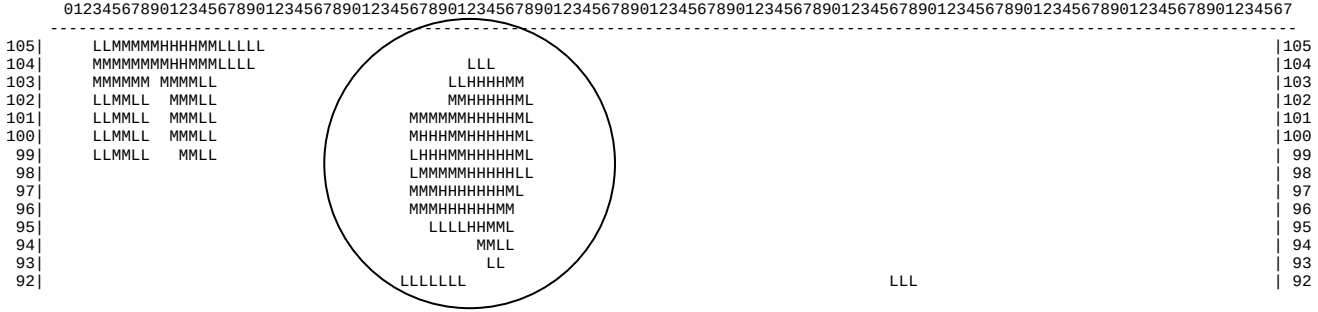
Date: 2010/06/28-1745:39.752 Area: 54 NAS Row/Y: 3 NAS Column/X: 6 Altitude: High/Ultra High (24,000-60,000) Change: TRUE

L: Low Precipitation M: Medium Precipitation H: High Precipitation



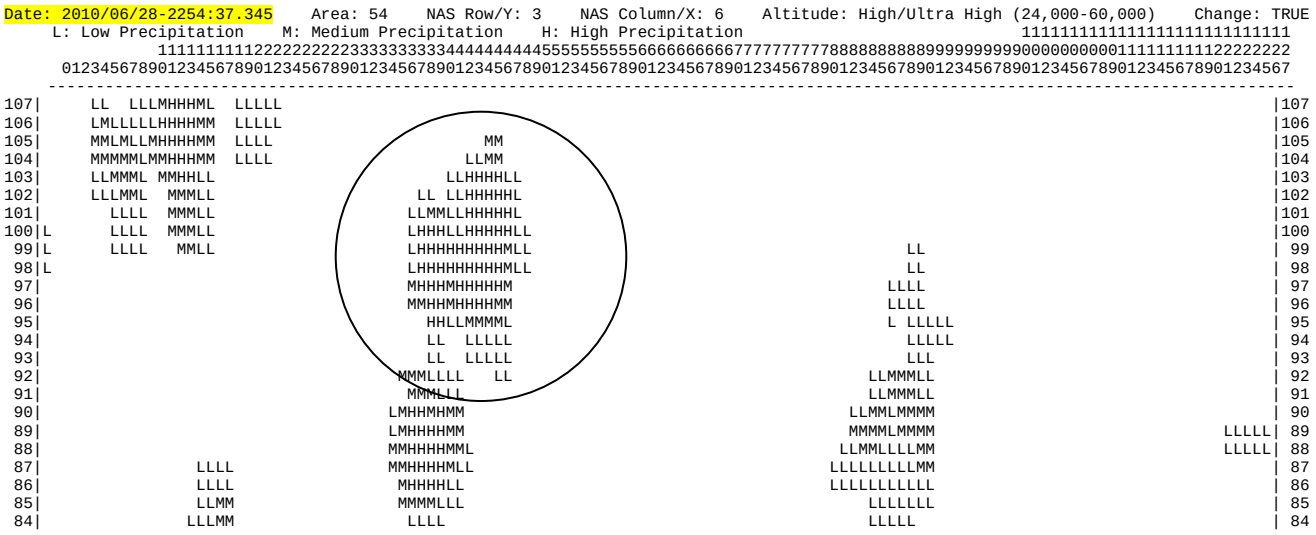
Date: 2010/06/28-1750:21.793 Area: 54 NAS Row/Y: 3 NAS Column/X: 6 Altitude: High/Ultra High (24,000-60,000) Change: TRUE

L: Low Precipitation M: Medium Precipitation H: High Precipitation



Date: 2010/06/28-2254:37.345 Area: 54 NAS Row/Y: 3 NAS Column/X: 6 Altitude: High/Ultra High (24,000-60,000) Change: TRUE

L: Low Precipitation M: Medium Precipitation H: High Precipitation



E. Personnel Statements

Jeff Stewart **ZFW Operations Manager**

Mr. Stewart entered on duty with the FAA in January 1983 at Toledo Air Traffic Control Tower (ATCT). He later worked at Miami ATCT, Chicago Terminal Radar Approach Control (TRACON), Tulsa ATCT, and Fort Worth TRACON. He came to ZFW in 2007 as an Operations Manager (OM).

Mr. Stewart was the OM in charge of the time of the accident. He became aware of the event when front-line manager Thornton called the OM desk to report that an aircraft had a turbulence encounter with injuries. Mr. Stewart went to the Center Weather Service Unit and asked the meteorologist on duty to provide a picture of the weather in the area of the turbulence encounter. When he reviewed the weather image provided, Mr. Stewart determined that the event had occurred in Memphis Center's airspace. He reviewed the audio recording of the ZFW control position involved, and determined that the aircraft had contacted Fort Worth when it was "… right on top of the weather." He notified Memphis Center that they needed to review their services because the turbulence encounter occurred in their airspace. Mr. Stewart then notified the ZFW air traffic manager and others of the encounter and completed initial paperwork on the accident. Further investigation was left to the ZFW Quality Assurance Manager.

Asked what he does as an operations manager to ensure that controllers are issuing weather information as required, Mr. Stewart stated that the facility has placed special emphasis on issuance of weather information. It was a focus item for every shift. Operations managers are required to perform at least three weather monitors on each shift. They pick random sectors, monitor the controller's performance in issuing weather, and enter the monitoring events in the facility operations log. If the services are determined to be deficient, the operations manager creates a picture of the weather and an audio replay of the circumstances, and supplies it to the controller's supervisor for a documented performance discussion. The facility then conducts a follow-up evaluation 30 days later to ensure that the deficient performance has been corrected.

Mr. Stewart stated that his initial review of the event involving EGF3224 indicated that it was an imminent issue. The pilot called just as he was entering the precipitation and there wasn't time for the controller to act.

Asked why he did not perform more investigation of the event at the time, Mr. Stewart noted that OMs are faced with multiple tasks, and on a day where there is substantial weather in the area the OM is charged with managing the operation, coordinating with the traffic management unit, working with the meteorologists and other facilities, numerous other tasks. An OM cannot really focus on one event.

Asked what feedback he received from the quality assurance office after they further investigated the event, he stated that they advised him that Memphis Center should have issued the weather and that Fort Worth did "... a good job." The response received indicated that there was no need for further action on his part.

Walter Gilbertson ZFW Cedar Creek Front Line Manager

Mr. Gilbertson entered on duty with the FAA in October 1987 at Tulsa Riverside ATCT. He then transferred to Fort Worth Meacham air traffic control tower in November 1990, and came to ZFW in November 1997. He became a supervisor in December 2008.

On the day of the accident Mr. Gilbertson was working as a front-line manager in the Cedar Creek area where the accident occurred. He overheard the sector 92 controller stating that an aircraft had encountered severe turbulence. Mr. Gilbertson was preparing to go off duty and leave the area, but when he heard the report he stayed to ensure that the PIREP was written down and properly submitted. The oncoming supervisor, Mr. Banks, went to the sector to discuss the incident with the controller. Mr. Gilbertson remained in the area to provide assistance as needed. Mr. Banks was busy coordinating the emergency, and the aircraft changed its destination at least twice. To assist him, Mr. Gilbertson went to the Bonham area, which controlled the sectors below the Cedar Creek area, to ensure that the supervisor there was aware of the emergency. He then returned to the Cedar Creek area. Mr. Gilbertson noted that there was a recorded position relief briefing completed when he turned over responsibility to Mr. Banks, and that the supervisors briefing checklist includes discussion of weather in the area.

Asked about routine monitoring of controllers, Mr. Gilbertson stated that supervisors provide general supervision at all times and that includes checking to ensure that controllers are providing weather information as required. Each shift begins with a weather briefing that includes forecast weather and related information. The content of the briefing is relayed by the supervisors to controllers in their area as appropriate. There are also weather displays in the area. Operations managers do random audits of weather services every day. Supervisors generally give more attention to sectors that are affected by weather, but they also have other functions to attend to at the same time. Mr. Gilbertson noted that ZFW heavily stresses the importance of weather services, and that it was an emphasis item in supervision and training. Mr. Gilbertson was not aware of any issues with Mr. Wyatt's provision of weather information to pilots, and does not recall any need to correct his performance in that area.

Asked if controllers are typically receptive to the need to issue weather information to pilots, Mr. Gilbertson stated that they are, and noted that American Airlines was at the facility within the last week to discuss weather services and other operational issues with the controllers. Part of the discussion included the American Airlines pilot describing the differences between the information available to pilots using aircraft onboard radar and the controller's view of weather information.

Controllers were periodically given refresher training on various issues including weather services. This training included computer-based instruction modules, mandatory crew briefings, and all hands briefings. Recent training included a specific verbal briefing on the Houston Center accident involving a King Air last year. In addition there were weekly crew briefings on various topics which periodically included weather services. Mr. Gilbertson had not had anyone on his crew fail a weather services audit by the operations managers.

Asked if he had any idea why the sector 92 controller may not have issued weather in this case, Mr. Gilbertson stated that he did not know. The supervisors try to emphasize joint responsibility with the controllers and to train them to not assume that other controllers have done what should have been done. That was the advice he gave his employees, but other supervisors may not brief the same material.

Mark Wyatt **ZFW R92 Controller**

Mr. Wyatt entered on duty with the FAA in February 1988 and was assigned to the Cedar Creek area at ZFW.

The group began the interview by reviewing the Satori replay of the incident with Mr. Wyatt and showing him the recorded WARPPLOT information on the precipitation displayed at his control position at the time of the accident.

Mr. Wyatt stated that he did not recall any precipitation being displayed on the scope of the area of aircraft at the time of the accident. He saw the aircraft's mode C change, and intended to ask the pilot of EGF3224 about it, but the pilot called first to report the turbulence encountered. Most of the precipitation in the sector was north and west of EGF3224's location. Mr. Wyatt stated that when he observed an aircraft heading into an area of precipitation, he would typically advise the pilot when the aircraft was approximately 30 miles away from it. When EGF3224 reported the turbulence encounter, Mr. Wyatt advised his supervisor, Mr. Banks of the event. Mr. Banks came to the sector and Mr. Wyatt told him what had happened. There was no discussion of weather involvement at that time. After the incident, EGF3224 was handed off to the Elm Grove sector. Mr. Wyatt understood that the aircraft had later diverted and landed short of its destination.

Asked to describe his training about provision of weather services, Mr. Wyatt stated that controllers received refresher training every year and had recently been briefed about an accident in Houston Center involving a King Air. Asked to describe the altitude filter settings available to him at the position, Mr. Wyatt stated that the altitude bands included zero up to flight level 230, flight level 240 to flight level 330, and flight level 330 to flight level 600. The weather intensities displayed included moderate, heavy, and extreme, but Mr. Wyatt was unable to explain the displayed appearance of the different levels. However, he stated that he can, "…tell what they are when he is working traffic" and that he just did not recall at the moment.

Asked what priority he puts on issuing weather, Mr. Wyatt stated that it was one of the higher priority duties after separation of traffic. He did not know how often the weather display was updated, and did not use the old "lines and H's" weather display in conjunction with NEXRAD. Asked if he had ever called another controller to ask if weather information had been issued to a pilot, Mr. Wyatt stated that he had not done so. If he was uncertain, he would ask the pilot.

Mr. Wyatt stated that he had observed aircraft deviating around areas where his radar was not detecting any precipitation, and that it "happened all the time." He had also seen aircraft go through areas of precipitation that he had previously advised them about. When a pilot advised that he was deviating around an area of precipitation, Mr. Wyatt stated that he would typically not continue to tell the pilot about that particular weather.

Mr. Wyatt was not aware of ever having been the subject of a weather audit by the operations managers. He stated that after EGF3224 reported severe turbulence, he made sure that ZME knew about it and did not send other aircraft through the area. After he was relieved from the position, he went to the OM desk to ask about what happened and about the reported injuries.

Marvin Moore **ZFW R52 Controller**

Mr. Moore entered on duty with the FAA in July of 1988 at the FAA Academy. He was then assigned to Oakland Center before transferring to ZFW in August 2000.

Mr. Moore received EGF3224 from Mr. Wyatt after the turbulence encounter occurred. The aircraft was still flying its original route, but Mr. Wyatt advised him that the pilot might soon be declaring an emergency because of the incident. After the aircraft had been on frequency for about three minutes, the pilot did declare an emergency and asked to divert to Shreveport, Louisiana. The crew reported two injured persons aboard the aircraft, and Mr. Moore advised the supervisor of that. Shortly afterward, the crew changed their destination and requested to land at Gregg County airport in Longview, Texas. Mr. Moore obtained fuel and passenger count information from the crew, and his radar associate controller coordinated the new destination with the low altitude sectors. Mr. Moore then transferred the aircraft to the next sector, where it continued to Longview.

Mr. Moore stated that weather training given to controllers at ZFW consists of computer-based instruction modules, and two annual all hands weather briefings given in the spring and the fall.

Asked to describe the altitude filters available to controllers when managing their NEXRAD displays, Mr. Moore stated that they are zero to flight level 600, zero to flight level 240, flight level 240 to flight level 330, flight level 240 to flight level 600, and off. He described three levels of intensity; moderate, heavy and extreme. Moderate precipitation was shown as a purpleish color, heavy precipitation was a checkerboard pattern, and extreme precipitation was green. The weather display was updated every six

or seven minutes, and the issuance of weather information was prioritized second to separating aircraft. Mr. Moore has been the subject of a weather monitor via the operations managers, and was advised that he did "... a good job." It was his observation that controllers normally issue weather information as required. He was not certain about whether their motivation was to provide this service because they believed it was important or simply because they were directed to do so. He personally provided pilots with detailed information about observed precipitation, and used the filtering capabilities available to him to attempt to better understand what was being displayed and what the pilots are seeing.

Debbie Walker **ZFW Quality Assurance Manager**

Ms. Walker entered on duty with the FAA in 1980, and was employed as the quality assurance (QA) manager at DFW. She previously held staff positions in the airspace and procedures office, the training department and the Central Area regional office. She has also served as a supervisor and operations manager at ZFW.

Ms. Walker found out about the accident the day after it occurred when she received the initial investigation package from Mr. Stewart. The quality assurance department created a Satori replay of the accident, listened to the voice tape and otherwise conducted their own investigation of the reported incident. They looked at weather pictures provided by the Center Weather Service Unit (CWSU), and concluded that it looked like the aircraft had skirted around the weather. The quality assurance assessment was that when the turbulence report was made, the depicted weather was behind the aircraft. They attempted to match the aircraft's position from the Satori to the weather depiction provided by the CWSU. There was no way to determine exactly where the turbulence occurred.

Ms. Walker stated that she did not talk to supervisor Jim Banks about the incident at all. Asked if it would be normal for the quality assurance department to not talk to the involved supervisor, Ms. Walker responded that the operations manager on duty does the initial investigation and provides the initial package to the quality assurance office. The quality assurance staff then talks to the supervisor if they believe it necessary. There were no specific questions directed by the quality assurance office to anyone about any precipitation that may have been displayed on the radar. Ms. Walker stated that the QA department always looks at both the things controllers did well in a given situation and things that did not go so well, and tries to obtain lessons learned for training. The QA department investigation indicated that there was nothing the ZFW controller could have done to prevent the accident.

Ms. Walker stated that she did not believe that the WARPPLOT data necessarily represented what was on the controller’s display. She stated that if she had recognized that there was anything done incorrectly by the controller, the QA department would have identified the deficiency and briefed on it. Their belief was that the aircraft was either in or past the weather at the time that the pilot reported on frequency.

Ms. Walker noted that ZFW focuses on the dissemination of depicted precipitation information to pilots all the time. The facility provides a lot of weather information and weather services to pilots. The facility puts much effort into providing the required services, and the management team has been working on it very hard, trying to stay ahead of such situations.

James Banks **ZFW Cedar Creek Supervisor**

Mr. Banks entered on duty with the FAA on August 3, 1984. He reported to ZFW on October 26, 1984, and became a supervisor in May 2003. He maintains currency on the R92 and D92 positions.

Mr. Banks found out about the accident involving EGF3224 when the R92 controller called him to the position and reported that the aircraft had encountered severe turbulence. Mr. Banks stated that at the time he looked at the radar display specifically to see whether there was any precipitation showing around the aircraft. There was none, although he did observe depicted precipitation in other parts of the sector. Mr. Banks notified the operations manager of the severe turbulence report. While he was doing that, the radar controller told the pilot to advise if he needed any further assistance. When the pilot stated that he wished to divert because of the injured people aboard the aircraft, Mr. Banks began coordinating with the Monroe Low area, other sectors, and the operations manager. The aircraft ended up landing at Longview, Texas. Mr. Banks could not remember the specific interactions he had with the operations manager, but stated that he may have asked the operations manager if there were any further actions required in the area. The operations manager did not request any further assistance.

The group described configuring a display at ZFW to use the same brightness settings as the radar controller had set at the time of the accident, and noted that the displayed weather appeared to be fairly dim. Mr. Banks responded that the Cedar Creek area was the dimmest-lit area in the center, and stated that he does not have any trouble observing controller weather displays while supervising in the area. Asked to describe the intensity levels and altitude filter settings available on NEXRAD, Mr. Banks responded that controllers may select altitudes from flight level 240-600, 000-240, 240-330, or 330-600. The intensity levels are moderate, heavy, and extreme. He stated that the moderate weather was depicted in a blue color, but was unable to describe the appearance of the other two intensities. He stated that he would recognize them if he saw them at a sector. Asked to describe the update rate of the weather display, Mr. Banks said that controllers do not actually know when updates occur, but it was common to see aircraft deviating around weather that was not being depicted by the radar. There was a delay in the display, and it was not really current.

Mr. Banks stated that pilot reports are required under conditions where visibility was less than 5 miles or ceilings are below 5000 feet, there was any icing reported at all, when turbulence of moderate intensity or greater exists, and when thunderstorms exist.

Asked what kind of direction he had received about controllers issuing observed precipitation information to pilots, he stated that supervisors continuously monitor the service, and are to ensure that pertinent weather was issued.

James Woodard **ZME R43 Controller**

Mr. Woodard entered on duty with the FAA on August 27, 1987 at the FAA Academy. He was assigned to ZME on November 16, 1987, and completed training on July 19, 1990.

Asked to describe the NEXRAD weather information available to controllers, Mr. Woodard stated that it provided three levels of intensity, including moderate, heavy, and extreme levels. Moderate level precipitation was represented by a solid blue color, the heavy level was represented by a checkerboard pattern, and extreme intensity precipitation was shown as a solid cyan color. Altitude filters available include 000-240, 240-600, 330-600, and 000-600. The normal setting for sector R43 was 330-600. However, Mr. Woodard also uses the 000-600 when necessary to see precipitation at lower altitudes.

Weather training at ZME consisted of a yearly refresher CBI that contained information on different types of weather, icing, and turbulence. When controllers receive information on such conditions via pilot reports, they are expected to inform other aircraft of the report and to pass the report along to their supervisor. Asked to specifically discuss the use of NEXRAD information, Mr. Woodard stated that he would tell a pilot about observed extreme level precipitation if another pilot had deviated around it. He was not aware of any requirement that controllers shall inform pilots about observed precipitation - it was just generally what he does. Asked to state the minimum requirement for issuance of radar displayed precipitation, Mr. Woodard stated that there was no minimum requirement, but if controllers choose to issue precipitation information, they must provide the observed intensity. Asked how he would describe to a pilot an area of extreme level precipitation surrounded by an area of heavy precipitation, Mr. Woodard stated that he would describe the area of extreme precipitation to the pilot. He does not use the altitude filtering ability of NEXRAD to attempt to depict the tops of the weather.

Mr. Woodard stated that controllers were required to obtain pilot reports when weather conditions included ceilings at or below 5000 feet, visibility of less than 5 miles, icing of light degree or greater, turbulence of moderate degree or greater, wind shear, volcanic ash, or thunderstorms. Asked what information pilots typically provide about thunderstorms, he stated that they usually just report that they see some weather and give the position. Pilots seldom provided tops information on thunderstorms. Mr. Woodard stated that he did not typically ask for tops reports on his own, but did so only when other pilots requested the information. He as not aware of any situation where the supervisors or operations managers monitored controller performance in issuing radar displayed weather.

In crew briefings, controllers and supervisors go over whatever the weekly material is. Sometimes it does include information on summer weather conditions. He does not provide weather information any differently when working a low altitude sector than he does when working a high altitude sector.

In response to another question, Mr. Woodard confirmed that he typically describes radar detected precipitation to pilots only in response to a pilot request, or if the aircraft appears to be entering an area of extreme precipitation that another pilot has already deviated around.

Paul Russenberger **ZME D43 Controller**

Mr. Russenberger entered on duty with the FAA on January 3, 2008. He was assigned to ZME in April 2008. Before coming to the FAA, Mr. Russenberger was a controller in the United States Navy for five and half years, with assignments in Iceland and Virginia Beach, Virginia. He was certified on the radar positions at sector 43 and sector 45, as well as all the radar associate positions. He was still training on the remaining radar positions.

Mr. Russenberger was able to correctly describe the degree intensity levels provided by NEXRAD, as well as the four altitude filter limits available to controllers. He was unable to describe the minimum requirement for controllers to issue radar displayed weather to pilots. However he stated that his personal practice was to provide the position and intensity of the precipitation, report what other pilots have done (deviations, etc.), and to otherwise tell pilots about everything he sees. He does obtain tops reports from pilots and passes them along if available. Mr. Russenberger said that when he was assisting other radar controllers as a radar associate controller, they did typically describe observed precipitation to pilots and also passed along information on previous weather deviations.

Asked to list the situations where pilot reports were required, Mr. Russenberger stated that reports were required in conditions where the ceiling was less than 5000 feet or visibility was less than 5 miles, thunderstorms existed, there was forecast or reported icing of light degree or greater, turbulence, volcanic activity, or wind shear. During training he did use the altitude limits on NEXRAD to observe the effect on the display of selecting different altitude filters. However he has not done that since becoming certified on radar positions. He was unaware of any particular supervisory oversight or remote monitoring related to the provision of weather services.

Asked to evaluate the accuracy of weather displayed to controllers, Mr. Russenberger stated that he believed it was fairly accurate, but noted that the displayed precipitation can be 6 to 8 minutes old. If he observed pilots deviating around weather, he tried to work with them to understand what their plan was. He noted that airborne radar has limitations but he tries to work around them.

Provided with a sketch of heavy and extreme weather ahead of aircraft, Mr. Russenberger was able to correctly describe the extent and intensity of the area shown.

James Courtney **ZME Operations Manager**

Mr. Courtney was the operations manager on duty at the time of the accident. He began working for the FAA at Fort Lauderdale ATCT in 1991, later transferring to Morristown, New Jersey, LaGuardia Airport in New York, and New York ARTCC before coming to Memphis in 2008 as an operations manager. He held supervisory positions at both LaGuardia and New York ARTCC.

Mr. Courtney stated that he first became aware of the incident involving EGF3224 about an hour after the event when he received a call from ZFW asking him to do a "services rendered" review because the aircraft had encountered severe turbulence. He first checked with the Center Weather Service Unit for active pilot reports and other weather advisories, and made sure that the weather coordinator had the turbulence information. He began monitoring sector 43 to ensure that the pilot report information was being issued, and also ensured that the supervisor in the area was aware of it. He was using the see-all function of the radar display at the operations manager desk to monitor sector 43. The see-all function also shows precipitation. Aircraft in the sector were finding their way through the precipitation, and Mr. Courtney noted that the turbulence was not unexpected given the weather situation. Most of the precipitation he saw was moderate in intensity. The severe turbulence report seemed odd, almost like a "stray report," because there were no other pilot reports of similar conditions. Mr. Courtney did not remember specifically speaking to the supervisor at the time. He noted that there should have been a quality assurance review entry in the facility log around the time of the report. His responsibility at the time of the event was to perform an initial investigation, with the remaining detailed investigation to be performed by the quality assurance office. As operations manager, his main focus needed to be on the operational activities of the shift.

Performance management for weather services was typically done through random remote monitoring by the Operational Supervisor Evaluation Team (OSET). The operations managers received trend data from the OSET, and attempted to identify any negative performance trends. The handling of SIGMETs and other weather advisories was recently identified as a performance concern, and therefore had become a focus item for the operations managers. The operations managers typically selected two issues in need of improvement to receive additional attention. In this case, the handling of weather advisories was one issue, and the other was a communications issue. The operations managers have been emphasizing the reading and recording of printed weather products. The supervisors have also been directed to provide specific attention to this area. This effort did not include monitoring and managing the delivery of information on radar displayed weather from controllers to pilots. The facility was unaware of the WARPPLOT capability to provide a retroactive view of weather on a display. Monitoring was typically performed by the OSET team in real-time, either via direct observation or through real-time monitoring using the see-all function. Direct oversight

of the day to day operations of the OSET team was provided by the quality assurance manager, Robert Gill.

Asked how much emphasis the facility puts on communicating displayed weather to pilots, Mr. Courtney responded, "average, cursory." He noted that it had not been a focus item in the same way that the reading of weather advisories had been. That did not mean that the facility was not paying attention to it, but simply that there was no evidence that the service was not being provided correctly. As an agency, the FAA had been putting more emphasis on "did you read the SIGMET?" than on issuing displayed weather.

When weather advisory strips were delivered to control positions, the person delivering the strip was required to initial and put the time on it. After delivery, there was no specific documentation of whether the advisory has been read, except by reference to the recorded audio from the position. Controllers managed the strips by moving them to a specific file after they had been read. The quality assurance office did a monthly audit on this, checking to see that the strips did have times and initials on them, and that the actual reading of the advisory could be found on the recorded position tape. Supervisors performed monitoring of weather services as part of their general supervision duties.

Asked to describe the minimum requirement for use of displayed weather by controllers, Mr. Courtney stated that they were required to display moderate, heavy, and extreme weather throughout the altitude stratum they are working. Controllers were required to issue the weather to pilots if it was on the display and they had time to do so. This was not an optional activity, and the process of ensuring compliance was part of general supervision. There always had to be a balance between safety and efficiency, and controllers may have a different assessment of their workload than that held by the supervisors or managers. Mr. Courtney stated that the priority of duties was separation first, weather services second.

Mr. Courtney stated that he has done remote monitoring of controllers from the operations manager position, and the outcome was usually discovery of "new guys being lazy." Typical errors observed during remote monitoring include phraseology errors, poor sequencing or other basic mistakes.

Asked about briefing on specific accidents and incidents, Mr. Courtney stated that he could not recall a specific briefing about the King Air accident that occurred in Houston Center, but it did sound familiar. The facility did do occasional briefings on actual events, normally operational errors, with briefings on some accidents or incidents that occur outside the facility. This was not very common.

Asked to compare New York Center and Memphis Center, Mr. Courtney stated that New York was busier and it was sometimes difficult to perform additional services beyond just maintaining separation between aircraft. Controllers at Memphis were more "technically accurate" because they had time to be.

Asked if he could describe the update cycle for NEXRAD, Mr. Courtney responded "not a clue." He stated that there was some delay between detection and display, but he was not certain how much. The evening of the accident was a “weather night” at ZME. There were lots of active weather advisories, thunderstorms throughout the area, and numerous aircraft reroutes. It was “…one of those nights.” He was dealing with operational issue after operational issue, and then the phone call from Fort Worth came reporting the need for an investigation.

Paul Junkins **ZME Area 4 Operational Supervisor**

Mr. Junkins entered on duty with the FAA on December 14, 1981, and was assigned to Birmingham ATCT on April 2, 1982. He transferred to Memphis ATCT on February 16, 1986, and to ZME on January 13, 1992. He became a supervisor in January 2009. He was current on the radar positions at sectors 45 and 43, and worked traffic approximately 8 hours a month.

Mr. Junkins first became aware of the accident when the sector 43 radar controller was informed by ZFW that EGF3224 had encountered severe turbulence. Mr. Junkins went to the sector and saw the aircraft on the display. He asked the radar controller if he was talking to the aircraft, and the radar controller responded no, the aircraft had already been transferred to ZFW. At the time the aircraft was still in ZME airspace. There was precipitation in sector 43, but Mr. Junkins stated that he did not see any directly around the Eagle Flight aircraft. He thought perhaps it was clear air turbulence. Mr. Junkins notified the operations manager of the incident, but did not file a pilot report at the time because ZME was not talking to the aircraft. The operations manager inquired about whether the weather advisories had been read, so Mr. Junkins checked the strips to determine if they had been initialed and marked with the time of delivery as required. However, there was no way to know if the advisories had actually been read on the frequency. Supervisors could not tell if the advisory had been read; they could only tell whether or not the strip was marked when it was delivered to the sector.

Asked to describe the NEXRAD display and altitude stratifications available to controllers, Mr. Junkins stated that there were NEXRAD levels one, two, and three, which were described to pilots as moderate, severe, and extreme precipitation. Moderate precipitation was depicted as a solid blue color, severe precipitation was depicted as a checkerboard pattern, and extreme precipitation was shown as a solid cyan color. There were four altitude filters available, enabling controllers to select 000-240, 240-330, 330-600, or 000-600. Asked about the update rate, Mr. Junkins noted that the displayed weather can be up to seven minutes old when displayed to controllers. He was not aware of any controller that still used the old weather display depicting lines and H characters. Mr. Junkins stated that issuing displayed weather was required. The OSET remote monitors and over the shoulder observations should detect situations in which required weather information was not provided to pilots. Mr. Junkins stated that in his experience, controllers do issue displayed weather as required. There had been no specific management focus on ensuring that displayed weather was issued except as a side effect of the various briefings on the reading and recording of printed weather advisories.

Controllers at the facility generally participated in weekly briefings, either all hands briefings on a specific topic or team briefings with their supervisor discussing whatever the issue of the week was. Mr. Junkins stated that controllers had previously expressed concerns about the accuracy and timeliness of NEXRAD weather, and they typically put more emphasis on what pilots were showing on their airborne radar rather than what the DSR display showed.

Aubrey Darrell Day **ZME R43 Controller**

Mr. Day entered on duty with the FAA on December 2, 1982. He was assigned to Memphis ARTCC on March 7, 1983, and completed training on December 16, 1985.

Mr. Day had been the radar controller at sector 43 for about five minutes before the accident occurred. ZME had been experiencing severe weather all summer, and this was another "weather day" with many deviations and other weather related issues. Mr. Day called the Fort Worth controller handling EGF3224 when he saw the aircraft's altitude report indicating a climb. He asked the Fort Worth controller if they were talking to the aircraft, and Fort Worth responded that they were. Shortly afterward the Fort Worth controller called to advise Mr. Day that the aircraft had experienced severe turbulence. Mr. Day did not recall having seen any precipitation around the aircraft at the time, but noted that the accident had occurred almost 6 weeks before his interview. At the time, he was unsure what had caused the severe turbulence. His relief briefing had not included any reports of more than light chop.

As to describe the NEXRAD weather display, Mr. Day said that it showed three levels of precipitation; moderate, heavy, and extreme. He was able to correctly describe the colors associated with each level. When asked about altitude filters, Mr. Day stated that controllers can use 000-600, 240-600, or 330-600.

Asked about minimum requirements for delivery of radar displayed weather information to pilots, Mr. Day noted that the requirement was for controllers to issue pertinent weather. When asked to elaborate on the definition of pertinent, Mr. Day stated that there were numerous variables, such as pilot reports, what other pilots had done about particular displayed weather, previous deviations, and turbulence reports. He stated that if he observed an aircraft approaching an area of extreme precipitation, the right thing to do would be to advise the pilot of it. His objective would be to make sure that the pilots know what was out there. However, he noted that the NEXRAD weather was somewhat behind real-time, and that it was “probably 50-50” that the view of the precipitation held by the pilot differed from that displayed to controllers. Pilots frequently chose to fly through areas other than what the controllers recommended based on what they saw on their cockpit displays. Controllers generally did tell pilots about observed precipitation, but with varying levels of detail. Some controllers provided more detailed information than others. Pilot reports of turbulence and the reactions of other pilots to the displayed weather were important in deciding how to deliver the information to pilots. The time lag of the NEXRAD weather display may affect its accuracy.

Mr. Day stated that he was sympathetic to pilot efforts to minimize the effect of turbulence on their aircraft, stating "... I try to keep pilots advised of what's out there. As a passenger I don't like it when it's choppy."

The recorded data from DSR showed that at the time of the accident, Mr. Day had selected altitude filters 000-600. When asked if that was normal, Mr. Day responded, "I don't know how to answer that. I would normally expect to use 330-600 at sector 43." He stated that configuring the NEXRAD display was part of his process for settling into a position. He did not necessarily check it every time he took over a position, but he did look at the settings frequently.

Mr. Day again noted that it was not at all uncommon for aircraft to go into areas where, based on what he saw on his radar display, he would have advised the pilot to avoid. The time lag in display of NEXRAD weather may result in controllers feeling unable to provide the pilot with accurate weather information with great certainty.