IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

THOMAS C. AND
PAMELA MCINTOSH **PLAINTIFFS**

VS. **CASE NO.: 1:06cv1080-LTS-RHW**

STATE FARM FIRE AND
CASUALTY COMPANY; and
FORENSIC ANALYSIS & ENGINEERING
CORP; and E.A. RENFROE & CO., INC. **DEFENDANTS**

***DAUBERT* HEARING REQUESTED**

MOTION AND MEMORANDUM BRIEF
TO EXCLUDE EXPERT TESTIMONY OF RICHARD G. HENNING

COMES NOW, Defendant STATE FARM FIRE AND CASUALTY COMPANY ("State Farm") and files this its Motion and Memorandum to Exclude the Expert Testimony of Richard Henning, expert witness for Plaintiffs in the above-numbered cause and would show unto the Court the following, to-wit:

FACTUAL BACKGROUND

A. The Loss and Insurance Claim

On August 29, 2005, Hurricane Katrina made landfall on the Mississippi Gulf Coast and damaged Plaintiffs' home, which was located near the Gulf Coast in Biloxi. Plaintiffs submitted a claim under their State Farm homeowners policy. State Farm's investigation revealed that Plaintiffs' loss was caused primarily by storm surge.[1] State Farm paid Plaintiffs $36,228.37 for covered wind damage and denied the remainder of the claim.[2]

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[1] Plaintiffs' homeowners policy contains a Water Damage exclusion that excludes loss that "would

On October 23, 2006, Plaintiffs filed their complaint against State Farm and Forensic Analysis and Engineering Corp., the engineering firm retained by State Farm to determine causation. On May 31, 2007, Plaintiffs filed an amended complaint [194] against State Farm and Forensic and also added E.F. Renfroe, an independent claim adjusting firm used by State Farm to assist with Plaintiffs' claim, as a defendant. Plaintiffs contend that wind, including tornadoes, caused the damage to their home hours before peak storm surge. (FAC, ¶ 20) Accordingly, Plaintiffs contend they are entitled to coverage for the entire loss under their homeowners policy.[3]

B. Designation of Richard Henning

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not have occurred in the absence of . . . Water Damage," defined to include "flood" and "tidal water," "whether or not driven by wind." This Court has already ruled that this exclusion unambiguously excludes damage from flood waters and storm surge accompanying Hurricane Katrina. *Tuepker v. State Farm Fire & Cas. Co.*, 2006 WL 1442489 (S.D. Miss. May 4, 2006), appeal pending, 5th Cir. Docket No. 6-61075.

2 State Farm also paid plaintiffs $6,073 for additional living expenses and $750 for loss of rental income.

3 The Fifth Circuit has recently ruled that where a loss is caused by the combined perils of wind and water in any sequence, the loss is excluded under a homeowners policy with anti-concurrent cause lead-in language to its water damage exclusion, similar to that contained in State Farm's policy. *Nationwide v. Leonard*, __ F.3d. __, 2007 WL 2446794 (5th Cir. (Miss.)). State Farm acknowledges that unresolved issues exist in this Court regarding the burden of proof. For the purposes of this motion, it is unnecessary to resolve these issues.

On March 30, 2007, Plaintiffs served their designation of experts, naming five purported experts, including three in the field of meteorology.[4] On April 4, Plaintiffs served an amended expert designation, adding a fourth meteorologist, Richard Henning, to their arsenal. Henning has written about 140 reports related to Hurricane Katrina, all but a few were written for homeowners suing their insurance companies. (Ex. B, p. 6) Henning prepares his reports generically by neighborhood (essentially by street map and zip code), without considering topological features specific to the neighborhood or the property site. (Hurricane Katrina Timeline of Events attached to Exhibit A; Ex. B, p. 45)

Although Henning's resume is impressive - he is currently a civil service meteorologist at Eglin Air Force Base, flies with a weather reconnaissance squadron as an air force reservist, and is a private consulting meteorologist - his duties in these capacities deal primarily with forecasting, as opposed to hindcasting. (Ex. B, pp. 13, 14, 16, 18)

C. Henning's Opinions and Their Bases

Plaintiffs intend to use Henning to demonstrate the timing and speed of the winds that purportedly impacted their home. Through other experts they will attempt to show the timing and height of the storm surge in an effort to demonstrate that the home was damaged by wind prior to the arrival of storm surge.

1. The Timing and Speed of Winds

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[4] The persons designated as experts in meteorology are Dr. Pat Fitzpatrick, Dr. Keith Blackwell, and Dr. Aaron (Bill) Williams. Additionally, Plaintiffs named Dr. Ralph Sinno as an engineering expert and Tim Ryles and an insurance claims practices expert.

Henning prepared a report for this litigation on March 27, 2007. The report contains a "Timeline of Events" which documents his findings. The time line provides the following information for periodic time intervals beginning on August 28, 2005 at 3:13 p.m. through August 29, 2005 at 7:00 p.m.: the sustained (one minute average) wind speed in knots, the large scale (three second average) wind gusts in knots, the wind direction, and the distance to the center of the hurricane (in miles).[5]

This time line reflects Henning's opinion that Plaintiffs' property was hit by hurricane force winds of 75 miles per hour or more for nine and a half hours between 6:00 a.m. and 3:00 p.m. on August 29. (Timeline of Events attached to Exhibit A) Henning opines that the maximum one-minute sustained winds at the location of Plaintiff's property were 120 mph and large scale three-minute gusts, occurring at or before 10 a.m., were up to 150 mph.[6] (*Id.*)

2. <u>The Method for Arriving at Wind Speed</u>

The purported "methodology" Henning employs to arrive at his wind speed estimates is convoluted to say the least. And at the end of the day, the wind speeds are nothing more than subjective guesses. For the benefit of the court and to support this motion, State Farm will explain how Henning claims to arrive at his opinions.

a. <u>Henning manipulates a software program and then purports to rely on the output.</u>

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[5] In other reports prepared for Katrina-related litigation, Mr. Henning also includes the storm surge height above mean sea level in this time line; however, he was specifically instructed not to do any work regarding the surge for this matter. (Ex. B, p. 46)

[6] Henning's time line is expressed in terms of knots. For the Court's convenience, State Farm has converted this information to "miles per hour" using a conversion factor of 1.15.

Henning first creates a "large scale wind field estimate" using HURRTRAK, a software program.[7] (Ex. B, p.47) This is the starting point for his ultimate creation of wind speeds at any given location. He also "considers" other weather information, most notably reconnaissance data and radar data, in an effort to reconstruct what the wind speeds were at the specific location in question, although ultimately the wind speed values he arrives at are just his own subjective assignment of speeds. He provides no explanation of how this process takes place, making it impossible to determine whether or not his results have any scientific validity.

As it turns out, Henning has total discretion in inputting data into HURRTRAK. (Ex. B, p. 111) Consequently, the results generated by HURRTRAK are completely dependent upon his discretion, and therefore only as reliable as the data he "chose" for the program.[8] HURRTRAK is designed to use the National Hurricane Center ("NHC") advisories as its input and the primary purpose of the HURRTRAK program is to *forecast* storms and allow decisions to be made regarding evacuations. (Ex. B, p. 118) Henning started by inputting into HURRTRAK the real-time wind speeds contained in NHC's Advisory number 27, which was generated on the day of landfall. (Exhibit B, p. 83) A few months later, NHC published a report which downgraded the real-time wind speeds in Advisory number 27.[9] (*Id.*) But Henning opted to use the speeds

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7 The HURRTRAK software was devised by PC Weather Products. (See http://www.pcwp.com/.)

8 Curiously, the hurricane Henning generated using HURRTRAK is not consistent with typical hurricane behavior. As Henning explained in another matter: "the western side of it is unrealistically high in wind speeds;" Furthermore, all of the wind speeds in the eye register at "zero through the entire [. . .] area inside of the eye, which is unrealistic." (Exhibit C, p. 61) Nonetheless, Henning maintains it provides a good model for the arrival of the most intense winds on the Mississippi shore.

9 Henning acknowledges that the NHC often considers a variety of sources when composing its initial hurricane advisories, including "reports of winds from the police or emergency management officials

from the *initial* real-time forecast because he disagrees with how the NHC personnel interpret their dropsonde[10] and reconnaissance data. (Exhibit B, pp. 83, 84) Henning disagrees with both the sustained wind speeds calculated by the NHC and, more strongly, the 3-second wind gusts. (Exh. B, p. 85) Henning contends that these "findings of the NHC report have caused a great deal of controversy in the tropical cyclone research community," but he does not identify which persons or institutions are included in the "tropical cyclone research community" to which he refers. (Exhibit A, p. 3)

Henning admits that if he had input the data from the *revised* NHC advisories, his wind speed results would have been lower. (Exh. B, p. 118, 119) But he claims he could not use the revised advisories, even had he been so inclined, because the NHC did not provide all of the necessary "quadrants and radii" when they downgraded the wind speeds from Advisory number 27. *Id.*

It is commonly understood that wind speed decreases closer to the ground; therefore, one would expect that Henning would reduce the wind speeds obtained from the already questionable Advisory number 27. Henning acknowledges that the biggest adjustment must be interpolation from flight level to surface level. (Exh. B, p. 91) For this reason, meteorologists

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or some other kind of unofficial anemometer." (Exhibit F, p. 29-32) He further admits that "[i]n real time, there isn't much time to corroborate their accuracy," and that the Hurricane Center will likely take reports into account unless they appear "totally nonsensical." (Exhibit F, p. 29-32)

[10] A dropsonde is a device designed to be measure weather data. When used to obtain data on a hurricane, the device is dropped from a plane that flies to the center of the hurricane, normally at about 10,000 feet. The dropsonde contains a GPS receiver and pressure, temperature and humidity sensors that capture atmospheric profiles and thermodynamic data which is transmitted back to the aircraft and fed into supercomputers to enable forecasters to track and predict what will happen in a hurricane. *See* www.wikipedia.com/dropsonde.

often apply a reduction factor—sometimes up to 50%, according to Henning—in order to estimate ground wind speeds from data obtained at high altitudes. (Exhibit F, pp. 86-88) But Henning disagrees with the reduction factor used by the NHC personnel to get the surface wind estimation from the 10,000 foot flight level and, in fact, does not apply *any* reduction factor to the data he uses from Advisory number 27.

In this case after the HURRTRAK model produced wind speeds, Henning looked at this other information - flight level data, dropsonde data, radar imagery, etc., and concluded that the wind speeds calculated by HURRTRAK did not need to be adjusted. (Exh. B, pp. 113, 114) Interestingly, Henning readily admits that the wind speeds produced by HURRTRAK for the time after the maximum wind reached the property are "considerably" overstated. (Exh. B, p. 114)

b. Henning considers unreliable reconnaissance data to establish wind speed.

In addition to Advisory 27, Henning looks at flight level wind speed information obtained by reconnaissance aircraft, both before Hurricane Katrina made landfall and in the time frame between 9 a.m. and 10 a.m. on August 29, when the landfall occurred. (Ex. A, p. 5) But again, this information is of limited usefulness in predicting ground wind speed because it is measured at 10,000 feet elevation. (Ex. B, p. 22) Furthermore, meteorologists disagree on which factor to use in adjusting the flight level data to estimate surface wind speeds, making this information even less reliable. (Ex. D, p. 16)

Henning also looks at wind speed data obtained from dropsondes. (Ex. A, p. 5) Henning relates:

> A dropsonde instrument released [. . .] at 9:22 AM [. . .] which [. . .] landed in Pass Christian [. . .] measured winds as high as 133 knots (153 MPH) at an altitude of only about 350 meters above the surface [i.e., the beach in Pass Christian] [. . .] The average wind measured by this instrument in the lowest 500 meters of the atmosphere was 120 knots (138 MPH). (Ex. A, p. 5)

From this, he concludes that "extreme winds were still flowing just above the surface at landfall." (Ex. A, p. 8) But, for similar reasons, this high-altitude data is also problematic. First, the dropsonde information is subjected to only very brief quality control: the reconnaissance crew has less than five minutes to review the dropsonde data before transmitting it to the NHC and will only reject it if there is an obvious problem with it. (Ex. B, p. 27)

Second, there is a real problem in converting the data obtained from the dropsondes into ground level wind speeds. In Henning's own words: "[t]he question, the million dollar question, to them [the National Hurricane Center] is how much of that [high altitude winds detected by dropsondes] gets translated down to the surface?" (Ex. C, pp. 75-76) And as Henning explains, this "translation" is guesswork performed at the discretion of meteorologists:

> They're really just percentage reduction factors [as opposed to equations]. And again, they are used at the discretion of hurricane specialists in creating their advisory products, and then by researchers later on in doing reconstruction of the wind field. And again, sometimes they use 90 percent; sometimes they use 80 percent; sometimes they use 70 percent. (Ex. F, p. 86-88)

Henning acknowledges that there is an ongoing debate in the tropical cyclone community as to how to interpret dropsonde winds and how to reduce flight level winds down to surface. (Ex. B, p. 62)

Henning also testifies that there will be a tremendous amount of variability of dropsonde readings at ground surface, in the unlikely event that they take measurements at surface level.

(Ex. B, p. 64, 65) At his deposition, Henning reviewed the profile of a particular dropsonde reading that occurred 150 miles north of Biloxi. The dropsonde measured wind up to 175 miles per hour at 421 meters above the surface of the gulf. (Ex. B, p. 70) Once the dropsonde dropped to an altitude of about 400 meters, the wind velocity started to decrease significantly, an indication that the sonde was entering the boundary layer. (Ex. B, p. 71) He also reviewed a dropsonde that landed in Pass Christian and measured wind speeds of 153 miles per hour at 350 meters, or about 1,000 feet, about ground level. (Ex. B, p. 144) This dropsonde also recorded significantly decreased wind speeds once it dropped below an altitude of 350 meters. (Ex. B, p. 146) According to Henning, the wind speeds measured by this dropsonde near Pass Christian were about 103 miles per hour at 10 meters above ground, and he concedes that atmospheric scientists would expect surface winds to be weaker to the east, in the direction of Biloxi. (Ex. B, p. 147) Nonetheless, Henning intends to testify that a significant portion of the winds measured by the dropsondes were brought down to the surface in the areas of convection over Biloxi, and in particular, to Plaintiffs' property. (See, Exhibit A, p. 8; Ex. B, pp. 145, 146)

c. <u>Henning claims radar imagery supports his escalation of wind speeds.</u>

Henning looked at Doppler radar imagery from Slidell and Mobile to support his conclusion that "some very intense bands" came across the McIntosh neighborhood, although the Doppler radars can only see winds at the 10-meter level a few miles from their site. The wind in Biloxi that was detected by the Slidell and Mobile radars was between 4,000 and 6,000 feet above the ground. (Exh. B, p. 97)

Although Henning admits that wind speeds typically decrease below the so-called boundary layer because of the surface friction of the earth, Henning contends that the amount they are reduced is greatly influenced by the stability and characteristics of the boundary layer and where, as here, there is "active convection" the wind speeds are not as influenced, i.e. reduced, by the earth's friction. (Ex. B, p. 57, 58) Henning admits that wind speeds at 500 to 1,000 feet above ground will still be stronger than at ground level even with active convection, but the drop off in wind speed will not be as dramatic. (Ex. B, p. 59)

Henning's theory is that these high-altitude winds detected by aircraft and dropsondes on the day of the storm were brought down to ground level by "mesoscale convective vortices" that were detected from the Doppler imagery:

> There are -- there is little mechanism available to transfer those winds down to the surface. And so my -- my theory is that around 9:00 a.m. that there was a mechanism to transport it down to the surface, that being the very intense convection that was occurring in the -- in the Pass Christian, Bay St. Louis, Waveland area within the inner eyewall. And that a considerable amount of those 153-mile-per-hour winds made -- made their way down to the surface. (Ex. C, p. 76)

Henning contends that the cells were strong enough to enhance the wind speeds by somewhere between 30 and 35 miles per hour, although he admits that this is based on his "meteorological judgment" and not on any actual measurements taken on the ground. (Ex. B, pp. 155, 156) And when asked whether he would expect to see damage throughout the McIntosh's neighborhood - and not simply confined to their residence - if these meteorological phenomena indeed caused wind damage on the ground, he backpedals, testifying that it depends on a lot of factors, such as the construction of the building, the terrain, trees, and surrounding houses. (Ex. B, p. 158) It is all the more problematic that he did not bother to look into these factors in an effort to confirm or refute his novel theories.[11]

In reality, neither Henning nor any other meteorologist can ever say with any certainty that a particular cell produced a tornado.[12] (Ex. B, pp. 121-123, 150; Exhibit E, pp. 55-58) As Henning admits, it is essentially impossible to tell for sure whether a tornado has occurred in a tropical cyclone situation - which includes hurricanes - because the tornados that are generated in these situations tend to be very "transient," according to Henning. (*Id.*) In other words, they form, go through their life cycle, and dissipate in a matter of a few minutes. (*Id.*) This process is made even more difficult by the temporal resolution of the Doppler radar; the radar essentially takes snapshots every five to six minutes. Because it is suspected that the entire life of these hurricane-borne tornadoes is only a few minutes, the Doppler will oftentimes miss them altogether. (*Id.*) Moreover, tornadoes that exist within tropical cyclones are generally too small to be seen on radar, so all a meteorologist can do is look for the intense reflective cells that have

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[11] Henning acknowledges that the earth's friction considerably reduces wind speed, and terrain features such as elevation, changes in elevation, and obstructions such as trees and buildings are important considerations. (Ex. B, p. 42) It is remarkable then, that Henning does not consider the terrain at the McIntosh's property, nor does he consider what is built on the property. (Ex. B, p. 45) Nor does the HURRTRAK model take into consideration particular exposure of a particular property, such as topography or location from the coast. (Ex. B, p. 117) As Henning's deposition testimony indicates, he has never visited Plaintiffs' property and thus has no appreciation for how the house was constructed. (Ex. B, p. 175)

[12] The Doppler radar was designed to identify classic tornadoes, such as those that occur in the Midwestern plains and often last for a half hour to an hour at a time and cover several dozen miles: "not the kind of tornadoes that we see in a hurricane," Henning explains. (Exhibit B, pp. 123) They do so by generating a computer algorithm that can be identified as a tornado vortex signature (TVS). A tornado that exists within a tropical cyclone will not have that kind of signature, in part because the entire circulation of the storm is rotating.

the potential to generate them. (*Id*.) And even if these structures are detected, there is no way for any meteorologist to confirm whether they actually created a tornado that possibly impacted a ground-level property, since the radar beam used to detect them is unable to see below 3,000 to 8,000 feet from the earth's surface due to the curvature of the earth. (Ex. B, pp. 80-81, 121-123) Out of a thousand mesovortices identified on radar, only a very small percentage would actually produce tornadoes. (Ex. B, p. 151)

Consequently, as Henning admits, he has no objective evidence to support his tornado theory. (Ex. B, p. 152; Ex. E, p. 226) The National Weather Service did not confirm the existence of *any* tornadoes along the Mississippi Gulf Coast during Hurricane Katrina. (Ex. B, pp. 153, 154) Moreover, Henning will be unable to identify *any other meteorologists* that apply the same methodology he uses to determine the relative increase in gust velocity based upon small-scale convective events.[13]

3. <u>The Information Henning Ignores</u>

Equally interesting is the information that Henning chooses to ignore. For instance, he acknowledges that at least three universities have programs which have well maintained and calibrated anemometers set up on towers specifically to measure hurricane winds. An obvious way in which Henning could test his novel and completely subjective method of assigning wind speed values would be to employ his "methodology" at the sites of these towers and see if his wind speed predictions are similar to those recorded by the anemometers at those locations. At

[13] Although Henning identifies a few individuals whom he says agree with the general notion that "there isn't enough emphasis placed on the importance of the convection within the storm" (Exh. B, p. 86), there is no published materials supporting his claims.

his deposition, Henning did not accept an invitation to explain why he did not do so. (Ex. B, pp. 37-40)

Henning also chose to ignore wind gust measurements from the Florida Coast Monitoring Program ("FCMP"), which had set up a wind tower at the Trent Lott airport in Pascagoula. (Ex. B, p. 137-139) The wind tower at that location recorded a maximum 3-second gust of 92.91 miles per hour, significantly less than the maximum gust speed created by Henning. (Ex. B, p. 138) With the information Henning input into it, the HURRTRAK model would have generated a significantly higher wind gust "estimate" than recorded by FCMP. (Ex. B, p. 139)

ARGUMENT

HENNING'S PROFFERED TESTIMONY IS NOT RELIABLE AND SHOULD BE EXCLUDED

A. The Legal Standard

In *Daubert v. Merrell Dow Pharmaceuticals,* 509 U.S. 579, 592 (1993), the United States Supreme Court held that Rule 702 of the Federal Rules of Evidence,[14] which governs the admissibility of expert witness testimony, requires that the trial court act as a "gatekeeper" by determining at the outset "whether the reasoning or methodology underlying the [expert's]

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[14] In 2000, Federal Rule of Evidence 702 was amended consistent with *Daubert*:

> If scientific, technical, or other specialized knowledge will assist a trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Thus, courts must exclude expert evidence that is not "based on sufficient facts or data," that is not "the product of reliable principles and methods," or whose methods are not applied "reliably to the facts of the case." *Id.*

testimony is scientifically valid and . . . whether that reasoning or methodology properly can be applied to the facts in issue."[15] *Id.* at 592-593. The Court set forth several factors that a trial court might consider in performing this gatekeeping function, including whether a "theory or technique . . . can be (and has been) tested"; whether it "has been subjected to peer review and publication";[16] whether the particular technique involved has a "known or potential rate of error"; whether there are "standards controlling the technique's operation"; and whether the theory or technique enjoys "'general acceptance'" within a "'relevant scientific community.'" *Id.* at 592-594. These factors do not constitute a "definitive checklist or test" and the inquiry must be "'tied to the facts'" of a particular "case." *Id.* at 591. The focus of the inquiry "must be solely on the principles and methodology, not on the conclusions that they generate." *Id.* at 595. "The proponent of expert testimony . . . has the burden of showing that the testimony is reliable." *See Moore v. Ashland Chem. Inc.*, 151 F.3d 269, 276 (5th Cir.1998) (en banc).

The purpose of the *Daubert* inquiry is to ensure that an expert "employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 152 (1999). In performing its screening function, the court must meaningfully scrutinize an expert's testimony, or its "factual basis, data, principles, methods, or their application." 526 U.S. at 149. Thus in *Kumho*, the district court

[15] In *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 147 (1999), the Court clarified that this "gatekeeping" duty applies not only to "scientific" expert testimony, but to all expert testimony. *Id* at 147. (holding that trial court did not abuse its discretion in excluding testimony of engineer).

[16] In *Daubert,* the Court recognized that when a theory or technique is submitted to the scrutiny of other experts within the field, "it increases the likelihood that substantive flaws in the methodology will be detected," and thus enhances the reliability of the information. 509 U.S. at 593. Henning's reports and findings have never been peer reviewed by anyone.

excluded a qualified engineer's testimony regarding the cause of a tire failure because the court "found unreliable 'the methodology employed by the expert in analyzing the data obtained in the visual inspection, and the scientific basis, if any, for such an analysis.'" *Id.* at 153. Noting that the relevant issue was whether the expert could reliably determine the cause of the failure of the *particular tire at issue*, the court questioned both the reasonableness of the expert's approach and the "method of analyzing the data thereby obtained, to draw a conclusion regarding *the particular matter to which the expert testimony was directly relevant*." *Id.* at 154 (emphasis in original).

B. <u>Henning's Opinions Are Based on Data of Questionable Relevance and Reliability.</u>

As part of its role as gatekeeper, the district court must ensure that the underlying facts and/or data upon which a proffered expert's opinion are based are in and of themselves reliable. If an expert's opinion is based on unreliable facts, the opinion must be excluded. *See In re TMI Litigation*, 193 F.3d 613, 697 (3d Cir. 1999); *Montgomery county v. Microvote Corp.*, 320 F.3d 440, 448 (3d Cir. 2003).

The data used by Henning has a number of problems. As noted above, much of the information was obtained from HURRTRAK, a software program which requires that data input from the user. Henning had total discretion in inputting data into HURRTRAK, and the results generated by HURRTRAK are only as reliable as the data entered into the program.

Henning's ultimate calculation of wind speeds that came in contact with Plaintiffs' residence begins with data from a hurricane advisory that was later criticized and revised downward by its very source, the National Hurricane Center.

Henning's conclusions about wind speed are also dependent upon his unsupported conclusion that convective events such MCVs or wet microbursts occurred at the property, although he admits that the Doppler imagery he looks to in support of this does not necessarily indicate such was the case. A failure to test one's own premise results in a conclusion that is no better than a guess. *Joiner, supra,* 522 U.S. at 146, citing *Turpin v. Merrell Dow Pharms., Inc.* 959 F.2d 1349 (C.A. 6 1992). Here, Henning could easily test his theories employing his so-called methodology to a location where accurate wind speeds were recorded, such as the site of the towers set up by the three university programs noted above. He chose not to do so.

Henning did not consider other readily available information, such as the FEMA wind maps or the information generated by the Florida Coast Monitoring Program. He also did not look at the condition of nearby homes and trees. There is no indication that Henning looked at the wind speeds generated in the area by past hurricanes, nor did he inquire how Plaintiffs' home withstood wind forces from those hurricanes.

C. Henning's Methods Are Deficient and Thus the Conclusions He Reaches Are Unreliable.

For every conclusion contained in an expert's proposed testimony, the court must determine if the methodology leading to that conclusion is sound. *Allen v. Pennsylvania Eng'g Corp.*, 102 F.3d 194, 196 (5th Cir. 1996). A court may appropriately exclude expert testimony when it finds that an expert has extrapolated data, and there is "too great an analytical gap between the data and the opinion proffered." *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997); *Moore v. Ashland Chem., Inc.*, 151 F.3d 269, 279 (5th Cir. 1998). Such testimony should also be excluded when it is speculative or not amenable to scientific verification. *Moore*, 151 F.3d at 273.

Application of the *Daubert* factors is equally warranted in cases where the expert's testimony is based solely on experience or training. *Watkins v. Telsmith, Inc.*, 121 F.3d 984 (5th Cir. 1997). In fact, the Supreme Court has rejected validation based solely upon an expert's say so. *General Elec. Co. v. Joiner*, 522 U.S. at 146 ("[N]othing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert.").

In this case, Henning's methodology - by his own admission - is at odds with others in his field.[17] For instance, he was unable to identify any meteorologists who apply the same methodology to determine the relative increase in gust velocity based upon small-scale convective events. *United States v. Downing*, 753 F.2d 1224, 1238 (3d Cir. 1985) (Widespread acceptance is significant factor in determining whether expert opinion evidence is admissible).

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[17] After preparing his first report for this matter, Henning came across other research data that he believes support his findings, and amended his report to include it. One is a paper written by Mark Powell and Tim Reinhold that discusses "integrated kinetic energy" and the importance of taking into account the size of the storm. (See excerpts from Mr. Henning's deposition in *Candiotto v. State Farm*, attached hereto as Exhibit H, p. 9) There are also two papers written by Keith Blackwell that discuss the double eyewall structure of Katrina and about the cells that were embedded within the eyewall and feeder bands that may have enhanced the wind field. (Exhibit H, pp. 9-10) He also obtained a PowerPoint presentation that uses Blackwell's data. (Exhibit H, pp. 10-11) He also notes two papers written by individuals from Texas Tech University (Exhibit H, pp. 15-16), and a paper from the U.S. Department of Commerce which is a service assessment of the National Weather Service. (Exhibit H, pp. 16-17) This information did not change Henning's findings regarding wind and surge estimates, and there is no indication that these writings support Henning's novel methodology. (Exhibit H, p. 14)

Henning did not take into consideration the frictional effect of topographical features in determining the wind gust speeds at Plaintiffs' property despite common knowledge that the presence of numerous trees or elevation differences on a property will reduce gust velocity.

Not only are there apparent holes in Henning's methodology, there is no evidence that his novel theories and calculations have been (or even can be) tested. Whether an expert's theory has been tested is considered by many to be the most important factor in assessing reliability. Stewart Lee, *Evidence – Expert Witnesses –* Daubert *Applies to All Expert Testimony,* 69 Miss. L.J. 979, 986 (1999), citing Margaret A. Burger, *Does the Search for Truth in Our Scholarship Continue In Our Classrooms?,* 49 Hastings L.J. 1179, 1180 (1998); Michael D. Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of Agent Orange and Bendectin Litigation*, 86 NW U.L. Rev. 643, 645 (1992) (contending scientific methodology is predicated on developing and testing hypothesis).

When applying *Daubert* to meteorologists, courts have insisted that the equations upon which meteorologists rely—as well as the factors entered into those equations—be supported by peer-reviewed literature. *Holder v. Gold Fields Mining Corp*. 2007 WL 188130, *3 (N.D. Ok 1997) (excluding a meteorologist's expert testimony because a factor he chose for input into an equation had not been independently validated. In that case, the court recognized that it "would not be fulfilling its duty as gatekeeper if it permitted the introduction of novel scientific methodology [the discretionary factor] based solely on the assurances of the expert himself.") Here, even if the weather data Henning relied upon was correct, even if the hurricane was as Henning reconstructed it, even if the necessary convective features were high above Plaintiffs' house, Henning could never show that the "100% reduction factor" he chose to apply (meaning zero reduction in wind speeds from upper to lower atmosphere)—or any reduction factor for the air above the property on that day for that matter—is based upon anything more than his subjective belief. Under *Daubert*, any step which renders the expert's analysis unreliable renders the expert's testimony inadmissible. Henning's bridge from high altitude to rooftop cannot rest on discretion alone.

D. <u>The Deficiencies in Henning's Methodology Go to not to the Weight, but to the Admissibility of his Testimony.</u>

Where there is too great an analytical gap between an expert's unreliable methodology and untested theories and the conclusions he reaches, the testimony should be excluded. *See Kass v. West Bend Co.*, 2004 WL 2475606, at * 6, *10 (E.D.N.Y.) (excluding as unreliable under Daubert plaintiffs' expert's testimony concerning alternative feasible designs for allegedly defective product where expert did not adequately test prototypes or subject them to peer review and his methods were generally "incomplete, cursory and undisciplined"). In such a case, the flaws do not simply go to the weight of the testimony. *Id. See also Bland v. HC Beck*, 2007 WL 748461, at * 4-5 (E.D. Mo.) (rejecting plaintiff's argument that any "gaps" in his expert's opinion about design defect caused by expert's lack of testing and lack of experience with particular product went to weight, not admissibility). Given the likelihood of confusion and the weight generally given to expert testimony by jurors, the opponent of blatantly unreliable testimony should not have to resort to vigorous cross-examination as its only recourse. *See also Werede v. Allright Holdings Inc.*, 2005 WL 2124553, at *2, * 5 (D. Colo.) (court excluded discrimination plaintiff's expert's statistical regression analysis based on pay differentials where expert's failure to include non-discriminatory variables such as skill, education and experience rendered otherwise recognized methodology flawed, and rejected plaintiff's argument that court should "let [the jury] decide what weight, if any, should be given" to expert's conclusions).

CONCLUSION

Henning's conclusions regarding the relative time and speeds of the winds that reached Plaintiffs' property is not based on reliable scientific evidence. His conclusions rests upon unsupported premises and unreliable data. As such, his opinions and conclusions, including his report, should be excluded.

RESPECTFULLY SUBMITTED, this the 9th day of November, 2007.

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CERTIFICATE OF SERVICE

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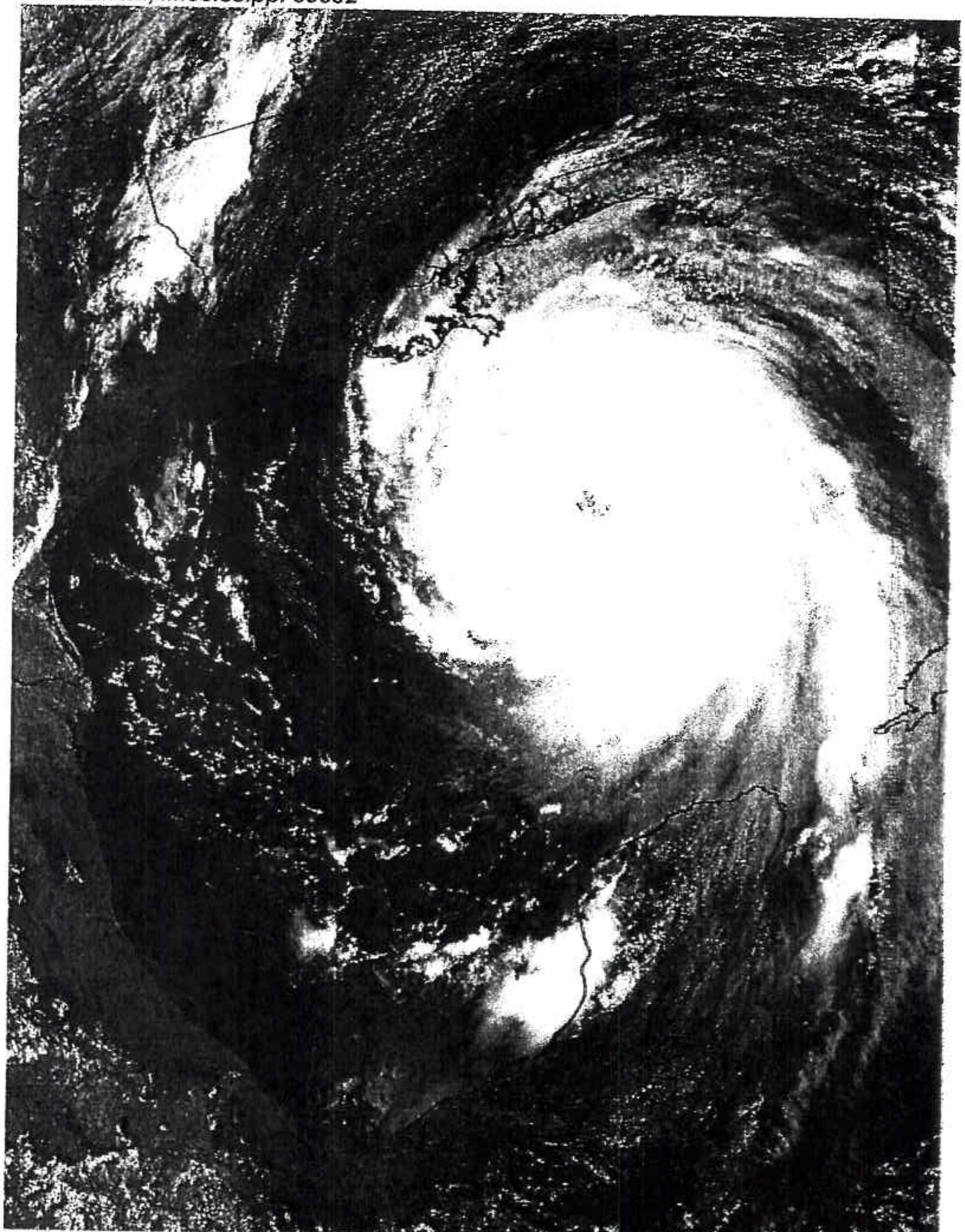


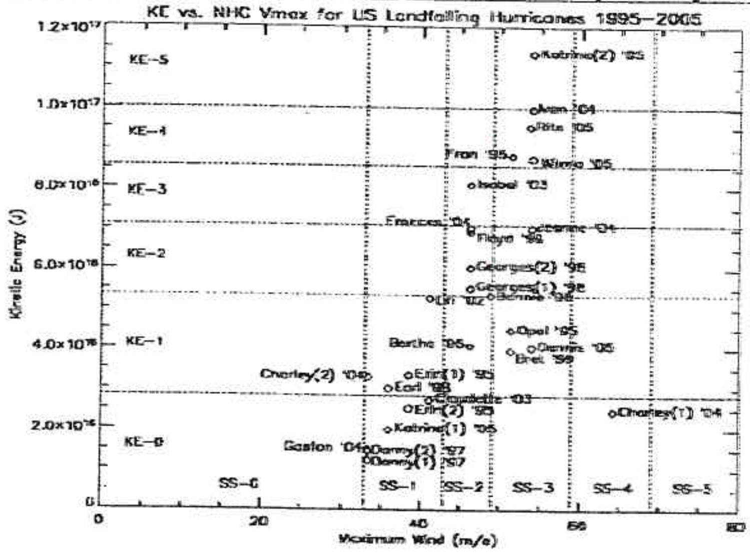
By any of several measures, Hurricane Katrina was the most destructive tropical cyclone ever to hit the United States. In May of 2006, the official death toll was raised to 1836 (making it the deadliest storm since the 1926 Lake Okeechobee, FL Hurricane), including 238 lives lost on the Mississippi Coast where over 68,000 homes were destroyed and another 65,000 heavily damaged (see Table 1). In terms of property damage inflicted (over $75 billion), as well as overall economic impact (over $125 billion), it far exceeded Camille of 1969, the storm that had previously been considered the benchmark for natural disasters in Mississippi.

While Camille came ashore as an extraordinarily intense Category 5 storm, in terms of its diameter, it was very compact compared to Katrina. See Figures A, B, and C, satellite images of Camille as it moved in August of 1969 from the northwestern tip of Cuba, across the Gulf of Mexico toward the center of the eye making landfall near Waveland, MS (sweeping the worst wind and surge underneath the northeast eyewall over coastal Mississippi).

EXHIBIT "A"

Figure D is an image of Katrina as it approached the coast on August 28th 2005 (encompassing most of the Gulf of Mexico) and Figure E is a side-by-side comparison of the two storms at landfall, showing how much larger Katrina was in terms of the number of square miles it covered.

In a study being conducted at Colorado State University by Dr Mark DeMaria and Kate Maclay, presented in April 2006 at the 27th American Meteorological Society Conference on Hurricanes and Tropical Meteorology in Monterey, CA, of all tropical cyclones that have struck the U.S. since 1995, Katrina contained far more kinetic energy (KE) at landfall than any other storm. In fact, it contained ***six times*** as much kinetic energy as Hurricane Charley, a Category Four storm which devastated Charlotte County Florida, north of Fort Meyers, in August of 2004. The study calculated KE by integrating the total wind energy multiplied over the area encompassed by those winds. The study reinforces the notion that the total number of square miles covered by winds in excess of 100 knots (not just the maximum winds nearest the center) is crucial in determining the overall destructive potential of a storm. The total energy of Katrina, as compared to other landfalling storms over the past ten years, is plotted below:



Plot of the approximate inner core KE versus the NHC intensity at land fall for all U.S. land falling hurricanes from 1995-2005

Katrina was born as Tropical Depression #12 over the Bahamas on the 23rd of August. For the first 48 hours of its life cycle, it was a very ordinary tropical system, showing no indication that it would become such a historic event. On August 25th, as it approached the Miami area, it strengthened into a Category One hurricane and came ashore over south Florida with sustained winds of 80 MPH. Katrina then crossed the Everglades and entered the Gulf of Mexico on the morning of Friday the 26th.

On Saturday morning, the 27th of August, Katrina became a major (Category Three) hurricane. The first Hurricane Watch for the Gulf states was issued at 10:00 AM for the Louisiana coast from Morgan City to the mouth of the Pearl River (see Figure 1). A later 4:00 PM afternoon advisory included a Hurricane Watch for the Mississippi coast. A Hurricane Warning was issued for the Mississippi coast later that evening at 10:00 PM CDT (see Figure 2, Advisory #19 issued 36 hours prior to the Hancock County landfall and 32 hours prior to the first landfall in the Louisiana Delta). About six hours later, a USAF Reserve reconnaissance aircraft measured a central pressure of 915 millibars in the eye of Katrina and winds of over 166 knots (191 MPH) in the eyewall, a little over 300 miles south of Biloxi. This prompted NHC to upgrade Katrina to a Category Five storm at 08:00 AM CDT on Sunday morning the 28th of August (see the forecast discussion Figure 3 approximately 22 hours prior to the initial landfall).

That reconnaissance flight by the USAF Reserve's 53rd Weather Reconnaissance Squadron *Hurricane Hunters*, and a subsequent flight later that morning by a National Oceanic and Atmospheric Administration (NOAA) WP-3 aircraft, found the central pressure of Katrina continued to drop to a value as low as 902 millibars. This is three millibars lower than the lowest pressure measured in Camille. Using a dropsonde (an instrument released from the aircraft that falls with a parachute and measures winds, pressure, temperature and other meteorological parameters) winds in the lowest 150 meters, just above the Gulf waters, averaged as high as 158 knots (182 MPH). At 09:21 AM CDT, a dropsonde released into the northeastern quadrant of the eyewall measured a wind gust of 234 knots (269 MPH) at approximately

600 meters above the ocean surface. These are the strongest winds ever directly measured in any tropical cyclone anywhere on Earth.

Thirteen hours later, with the eye of Katrina only 150 miles south of Biloxi, another reconnaissance flight (AF305) measured winds up to 152 knots (175 MPH) in the northeastern eyewall 421 meters above the surface of the Gulf (see Figures F1, F2, and F3 where this maximum wind value is depicted as 78.2 meters per second) less than nine hours before this portion of the eyewall swept over Hancock and Harrison Counties.

With the storm so close to landfall at such intensity, the fate of the Mississippi Coast was already sealed. Katrina was, by that point, transferring so much energy into the ocean that there was no way that any subsequent weakening of the system would have made much difference. The meteorological term *momentum flux* is used to describe how the warm seas of the tropics contain potential energy that is absorbed by hurricanes and converted into kinetic energy in the form of winds generated around the eye. These powerful winds whip up the ocean below the eyewall into a frenzy, transferring energy back into the sea in the form of wave energy. Due to its strength and size (an exceptionally large radius of hurricane force winds that extended, at the time of landfall, up to 125 miles northeast of the eye), the momentum flux was calculated to be higher for Katrina than any other storm that has ever threatened the U.S. coastline.

According to NOAA, the center of Hurricane Katrina first made landfall at 06:10 AM CDT on August 29th in the marshy Mississippi River Delta of Plaquemines Parish, LA, 90 miles southwest of Biloxi (see Figure 4). At landfall, the National Hurricane Center Public Advisory #26A (issued at 06:00AM CDT) listed Katrina as a Category Four hurricane with 145 MPH maximum sustained winds and a central pressure of 918 millibars. Over the next four hours, the center of Katrina moved NNE at 15 MPH across the Delta then back over Lake Borgne, southeast of New Orleans.

At 8:00 AM, NHC Advisory #26B placed the storm over Plaquemines Parish, 40 miles southeast of New Orleans with 135 MPH winds and a central pressure of 923 millibars. Katrina came ashore for a final time just east of the Mississippi-Louisiana state line (near Buccaneer State Park) into Hancock County (see a satellite loop of this in Figure 5).

Advisory #27, issued at 10:00 AM as the center of the eye was making its final landfall between Ansley and Pearlington, MS, 39 miles southwest of South Shore Drive, listed sustained winds of 125 MPH, with gusts to 155 MPH and a central pressure of 927 millibars. The McIntosh property never experienced the eye itself, with the calm center eventually passing 36 miles to the west just before 11:00 AM. Instead, Biloxi once again (as in Camille) saw some of the worst the storm had to offer as sustained winds of 100 knots or more blew for at least a 90 minute period.

The track of Katrina from birth in the Bahamas to its dissipation as a depression over Clarksville, Tennessee, along with its intensity at each point, is seen as Figure 6 (or an animated version can be seen as Figure 7). A listing of all the advisories issued by NHC on Katrina is shown as Figure 8. An animation of all the advisory graphics is at Figure 9.

On December 20th, 2005, The National Hurricane Center published its official tropical cyclone report on Katrina (which can be viewed as NHC Katrina Report). The NHC report went back and re-defined the intensity of Katrina at both the Louisiana and the Mississippi landfalls, with lower wind estimates than what they had used in their operational bulletins listed above (issued in real-time as the storm came ashore). The findings of the NHC report have caused a great deal of controversy in the tropical cyclone research community. Many scientists disagree with the revised wind assessments made, especially since they are contrary to considerable evidence that Category Four winds impacted the Louisiana coast and that these extreme winds may even have persisted as far north as the second landfall in Hancock County.

Automated Surface Observing Station (ASOS) stations all across southeastern Louisiana and southern Mississippi were either rendered inoperative due to power failures, or destroyed by winds before they could capture anything close to the strongest winds. Animation A is a loop of several hours of station plots prior to, during, and after landfall, showing more and more wind sensors on the coast and at offshore buoys dropping offline (disappearing from the plot) as Katrina struck.

The wind values in this report are based on a combination of all available data (including both the original NHC advisories and their revised December estimates) but are weighted heavily toward aircraft reconnaissance and ground based radar data sets since these continued to be recorded after conventional anemometers at nearly all weather stations along the coast were destroyed.

WIND SUMMARY

At the McIntosh property in the Ancient Oaks neighborhood of Lopez Point (see Figure 9a, Figure 9b, and Figure 9c) tropical storm force winds (in excess of 34 knots or 39 MPH) began at 8:00 PM CDT on Sunday August 28th and ended just before 7:00 PM on Monday August 29th, a duration of 23 hours. Winds exceeding 50 knots (or 58 MPH) began at 4:00 AM early Monday morning and ended just after 4:00 PM Monday afternoon, a duration of 12 hours. Sustained hurricane force winds of 64 knots (75 MPH) or more lasted for 8.5 hours, beginning at 6:00 AM Monday morning and lasting until 2:30 PM Monday afternoon.

The maximum one minute sustained winds estimated for the Ancient Oaks neighborhood, just west of the Sunkist Golf Course, about two miles south of Interstate 10 near the confluence of the Biloxi and Tchoutacabouffa Rivers and the Big Lake (the western end of the Back Bay of Biloxi, were approximately 105 knots or 121 MPH around 10:00 AM on Monday August 29th. The strongest large-scale three second gusts associated with the hurricane wind field here in this westernmost portion of Biloxi were 131 knots (151 MPH) (not including localized phenomena, that will be discussed shortly, that may have momentarily produced even higher gusts). These values are based on interpolation of the best available wind measurements using the Hurrtrak RM Pro 2005 software.

Figure 10 shows the distribution of maximum wind gusts across Mississippi and surrounding states as compiled by Clark Love of Forest One Inc., an information technology company specializing in Geographic Information Systems (GIS) and Remote Sensing (RS) solutions that is performing post-Katrina analysis of the damage. This chart clearly shows the "buzz saw" of extreme winds that raked the state of Mississippi from the southwest to the northeast corners as the storm continued to move inland (with 100 MPH gusts reaching almost all the way up to Starkville and Columbus).

The National Weather Service Office in Jackson, MS (the forecasters responsible for most of inland Mississippi) posted their report on September 7th, 2005 that described results of a field study (including aerial surveys) of the swath from Purvis to Collins to Newton to Meridian, MS. They reported seeing widespread damage equivalent to that caused by Fujita Scale F-2 tornadoes (winds of 110-135 MPH) as much as 100 miles inland with isolated areas approaching F-3 damage (as is seen with tornadoes containing winds of 136 to 165 MPH). They described F-1 type damage (winds of 86 to 110 MPH) as far inland as between 150 and 200 miles from the coast. The Jackson office measured their all-time lowest barometric pressure with 28.74 inches of mercury (breaking the old record that had been established in 1969 during Camille).

Another plot of winds at landfall can be seen as Figure 11 (showing maximum sustained winds in knots around 10:30 AM). An animated .gif file shows several hourly plots prior to, and immediately following, landfall (see Figure 12).

Figure 13 (a .jpg image) and Figure 14 (an HTML file) show tables of hour-by-hour winds for Eagle Point. A graphical plot of winds for the two days in this area is shown as Figure 15. A look at the overall distribution of maximum winds recorded during Katrina's landfall, and how the western end of North Biloxi fared in relation to the rest of the Gulf Coast, is shown as Figure 15a, Figure 15b (a breakdown of how Harrison County's winds compared to other counties on the coast), and Figure 15c (a breakdown of how Zip Code 39532 winds compared to other zip codes on the coast).

The closest official wind measurement sites all failed prior to landfall, therefore, there were no official National Weather Service reporting stations operating nearby during what would have been the maximum wind event. The Automated Surface Observing Station (ASOS) located at Gulfport Airport, failed early Monday morning at 5:25 AM and transmitted no data that would be useful in reconstructing actual observed maximum winds. At Keesler AFB, (four miles southeast of South Shore Drive) the maximum winds measured prior to the instrument failing before landfall were 85 knots (98 MPH).

The highest wind speeds recorded by an anemometer prior to failure anywhere to the west of Biloxi along the Mississippi Coast was 117 knots (135 MPH) at the Pearl River City Emergency Operations Center in Poplarville (40 miles inland). This sort of instrument failure is common during severe landfalling hurricanes, creating a data void and making efforts at reconstructing the exact intensity of winds at a particular location more of a challenge. Unofficial reports from emergency management personnel observing the readouts of remote wind instruments at NASA's Stennis Space Center, north of Bay St Louis, quote several workers seeing gusts well in excess of 140 MPH.

To the east, the ASOS station at the Jackson County Airport, east of downtown Pascagoula, failed at 4:53 AM. The Jackson County Emergency Operations Center (EOC) at 600 Convent Avenue in Pascagoula recorded what was reported by the National Weather Service as a 108 knot (124 MPH) wind gust prior to the winds tearing the roof off the facility. Later the Director of the EOC, Butch Loper, testified in court that the maximum winds had actually reached 137 MPH (119 knots) during a gust as the roof began to peel off between 8:00 and 8:30 AM. An anemometer at the Ingalls Shipyard recorded gusts to 117 knots (135 MPH) on two occasions, first, between 7:40 and 7:50 AM and a second time between 9:10 and 9:20 AM.

This sort of instrument failure is common during severe landfalling hurricanes, creating a data void and making efforts at reconstructing the exact intensity of winds at a particular location more of a challenge. If there are aircraft flying reconnaissance missions as a storm is coming ashore, this provides an excellent source of continuous information and fortunately, that morning, there were not only one but three such missions. Aircraft reconnaissance data measured from AF300 and AF306, two Air Force Reserve WC-130J aircraft, and NOAA 43, a WP-3 (all three flying simultaneous missions into Katrina as it was making landfall) supports the assertion that hurricane force winds extended up to 125 miles northeast of the center of the eye with major hurricane force winds (in excess of 100 knots or 115 MPH) spreading over an extensive area of the shoreline up to and immediately after landfall.

A dropsonde instrument released from USAF aircraft 300 (Katrina mission # 2212A) at 9:22 AM at 30.31N 89.27W, (which was then carried northward in the eyewall and actually landed on land in Pass Christian northeast of Henderson Point in the Timber Ridge neighborhood) measured winds as high as 133 knots (153 MPH) at an altitude of only 350 meters above the surface. The average wind measured by this instrument in the lowest 500 meters of the atmosphere was 120 knots (138 MPH). This dropsonde data is included in Figure 16 and a plot of this wind profile over Pass Christian is shown as Figure 16a.

Overall, winds continuously measured at flight level during the AF300 WC-130J mission (see Figure 17) were consistently over 115 knots and as high as 127 knots (146 MPH) at 10:06 AM. Figure 17b shows a plot of the aircraft track and wind speed measured as it flew across the Mississippi Sound toward marking the center of the eye just southwest of the Pearl River at 9:29 AM (where you see the wind value drop down to two knots). As AF300 flew through the eastern eyewall you can see wind values of 117 knots southeast of Biloxi, upwind from the McIntosh neighborhood.

A second aircraft, the other USAF Reserve WC-130J from the 53rd Weather Reconnaissance Squadron (AF306), measured peak flight level winds of 130 knots (149 MPH) from an altitude of 2000 meters over the beach, at 10:46AM (about 45 minutes *after* landfall) from an altitude of 2000 meters over portions of Hancock and Harrison County well inland (see Figure 17c and Figure 17d).

The eyewall of a hurricane is also prone to spawning large numbers of small, short-lived, tornadoes. The National Hurricane Center, working with the Storm Prediction Center in Oklahoma City, is examining evidence of between 33 and 39 such tornadoes that were spawned by Katrina. These tornadoes, commonly seen in the front-right quadrant of landfalling tropical cyclones, are highly transient in nature but often are responsible for locally worsening the wind damage underneath the eyewall. The Biloxi area was under a Tornado Watch for 26 consecutive hours from 4:40 PM on August 28th, until 6:40 PM on the 29th (see Figures G, H, and I). The NWS Office in Jackson published tracks of tornadoes spawned by Katrina farther inland in central Mississippi (see Figure I2 and Figure I3). The convective bands associated with these tornadoes act to mix some of the strongest winds, seen in aircraft reconnaissance data above, down to the surface for brief intervals.

Western Biloxi experienced multiple feeder bands rotating around and into the storm center which were likely to be tornadic. Since few of these isolated tornadoes happen to occur at exact locations where winds are measured with instrumentation, usually their intensity can only be estimated based on the resulting damage and the assumption (based on studies of other landfalling tropical cyclones) that these funnels, and the mesoscale convective vortices (MCVs) that create them, can locally increase wind speeds at a given spot well above the ambient, larger scale, prevailing hurricane wind field.

Damage along the Mississippi coast was not a continuum that steadily increased in severity from east to west (as you drew closer to the eye). Instead, it occurred in bands, similar to what was seen in Alabama and Northwest Florida from Hurricane Ivan. As with Ivan, much of the banded damage strips attributable to winds corresponds to where feeder bands moved onshore with embedded MCVs.

Three second wind gusts may approach values twice that of the one-minute sustained wind (Mark Powell et al., "Reduced drag coefficient for high wind speeds in tropical cyclones" 2003). The University of Chicago's noted tornado researcher, Dr Theodore Fujita, suggested in several papers written in the 1980s and 1990s that many of the most extreme convective winds in hurricanes are associated with thunderstorm downdrafts. Also, Powell and Sam Houston ("Hurricane Andrew's Landfall in South Florida. Part II: Surface Wind Fields and Potential Real-time Applications". *Weather and Forecasting*, American Meteorological Society,1996) indicate that strong horizontal shear along the lateral edge of these thunderstorm downdrafts as they spread along the ground may develop small vortices and extreme winds.

Research into what happens when dry air from the continental U.S. is ingested into the circulation of a landfalling hurricane along the northern Gulf Coast has been conducted by Dr. Keith Blackwell and others at the University of South Alabama. Their work supports the notion that while dry air ingestion weakens the overall intensity of a storm, and contributes to weakening of a hurricane prior to landfall on a large scale (as was the case with Katrina), pockets of this dry air (which is heavier than moist air and tends to cool more quickly, making it more dense and likely to descend more rapidly (therefore, with more kinetic energy)), when entrained into individual thunderstorms embedded within feeder bands and fragments of inner and outer eyewall structures, greatly enhances the potential for stronger downdrafts that, upon reaching the ground, spread out as very strong wind gusts. The enhancement of gusts by this episode of dry air entrainment into Katrina's convective bands over localized areas for brief intervals was clearly evident on the eastern semicircle of the storm as it came ashore.

Therefore, the superimposition of a feeder band, onto Katrina's sustained wind field, would have resulted in winds being locally increased from prevailing larger-scale values of around 120 MPH, with gusts over 150 MPH. Any MCVs and their accompanying funnel clouds, embedded within a feeder band, or within the main eyewall, would have produced momentary wind gusts significantly exceeding these values.

Computer model simulations of Katrina performed by Canadian hurricane researcher Chris Fogarty (see Movie File A , Movie File B, and Movie File C) show evidence of these vortices swirling around the eyewall

National Weather Service (NWS) Doppler radar, operating from Slidell, Louisiana, can identify the time when the strongest feeder bands and the eyewall came over Sunkist and Ancient Oaks during the morning of August 29th (until the radar was destroyed by high winds at 9:01 AM). It can used to identify some of the MCVs that may have produced tornadoes embedded within the convective bands. These are chronicled in the following radar animation loop: Movie File 1 (8 megabytes) and Movie File Two (22 megabytes). Several very strong feeder bands moved onshore from the Gulf prior to the eyewall (containing potentially tornadic MCVs).

The first thunderstorms associated with the periphery of Katrina's circulation developed along the Biloxi beachfront at 3:13 PM on the afternoon prior to landfall. By 4:19 PM, the first of several outlying feeder bands, rotating around the edge of the storm, moved across the coast with wind gusts to tropical storm force (over 35 knots or 40 MPH). More moved overhead at 4:52 PM and 6:25 PM that evening. Then at 11:15 PM that night, the main rain shield associated with the storm moved in as it then rained continuously over Biloxi for the next 14 hours until well after Katrina made landfall.

From midnight of August 29th until after 4:00 AM, Lopez Point was pounded by several rounds of powerful thunderstorms (with particularly intense cells coming over at 2:09, 2:31, and 3:26 AM) associated with outer feeder bands and winds began to gust to hurricane force (in excess of 64 knots or 75 MPH). While these large scale winds are not generally recognized to have been sufficiently strong to have caused significant damage, the cumulative toll of this wind stress for four hours undoubtedly weakened structures in the area. The force pressing upon each square foot of a structure exposed to the wind increases by the square of the wind velocity. Therefore, instead of the pressure being doubled as winds increase from 50 MPH to 100 MPH, the force increases by a factor of more than five, from 5.5 pounds per square foot to over 30 pounds per square foot. Also of note is that these early feeder bands began to generate MCVs and several tornado warnings were issued for the three coastal Mississippi counties during the night.

The first intense feeder bands associated with the core of Katrina moved onshore at 5:28 AM, with a second round hitting at 5:49 AM. It was during this second period when large scale gusts over 100 MPH first occurred and several more tornadic MCVs may have produced significant localized damage. Another intense band with a tornadic MCV moved over the McIntosh neighborhood at 6:21 AM.

Then at 7:11 AM, a fragment of the outer eyewall of Katrina reached Lopez Point with another eyewall fragment moving overhead at 7:27 AM. The eyewall itself come overhead at 8:05 with the strongest cells embedded within this portion of the eyewall, likely containing tornadic MCVs, moving overhead at 8:21 and 8:49 AM. In the final radar image available prior to the Slidell radar being destroyed, at 8:59 AM (see Figure J), the main inner eyewall of Katrina had rotated onshore and covered the southern end of Hancock County and the southwest corner of Harrison County.

Figure J4A and Figure J4B (from a report published by Pat Fitzpatrick and Yee Lau at Mississippi State University) are plots of 123 potentially tornadic MCVs tracked by both the Mobile (from 3:30 AM through 12:45 PM) and Slidell (from 3:30 AM through 9:00 AM) Doppler radars that rotated onto the Mississippi coast from the Gulf of Mexico as the feeder bands and outer/inner eyewalls of Katrina came ashore.

After 9:00 AM, there is radar imagery available from the NWS Doppler radar in Mobile, Alabama. Figure J2 (from 09:31AM) shows the eyewall working its way into central Hancock County and the southern portion of the county emerging into the eye. A distinctive hook echo, the signature of a potentially large tornado embedded within the inner edge of the eyewall, appears to be moving northwestward out of the area around western St Louis Bay and across Interstate 10 towards the Stennis Space Center and the town of Picayune. This would be just after the maximum wind event over southern Hancock County and extreme western Harrison County.

Doppler radar can also track the velocities of rain droplets (measuring how fast they are moving either toward the radar or away from it). This provides yet another method of estimating maximum winds. These velocities, coming from the Mobile site (rather than the more optimal location at Slidell), are distorted to appear displaced further away from the site and somewhat degraded. However, they do show maximum Doppler-derived wind velocities measured in Katrina just prior to landfall were at least 127-132 MPH (see Figure J3 and Movie File J4 (6.5 megabytes)).

Advanced MIMIC microwave satellite imagery of Katrina from The University of Wisconsin CIMSS (Morphed Integrated Microwave Imagery from CIMSS) reveals details of the storm's structure that is hidden using ordinary satellite imagery underneath the overlying cloud shield canopy capping the top of the storm. Evident in a movie animation (see Movie File D) of microwave data from Katrina over a three day period is the evolution of a very warm, well-defined eye (the classic signature of an intense tropical cyclone shown as the very dark blue color in the center) along with very cold cloud tops of the surrounding thunderstorms that comprise the eyewall (shown as bright red bands of convection). As Katrina approached landfall on the morning of 29 August, the western semicircle of convection was clearly eroded by the intrusion of dry air mentioned above. However, it is to be noted that the eye continued to be clearly evident as seen in the dark blue color at the center that perisisted, and actually became slightly ***better defined*** upon landfall briefly while inland over Hancock County. Figure J3 shows a burst of convection in the eastern eyewall (the spot of red that appears) at landfall that was likely accompanied by a very strong surge in wind gusts along the shoreline as it passed overhead. It also helps support the notion that Katrina was in the process of an eyewall replacement cycle when it made landfall (trying to rebuild a new inner core eyewall structure).

Lightning data also supports the assertion that the inner core of Katrina was experiencing a burst of convection immediately subsequent to landfall in Hancock County. The core of a mature hurricane typically contains little lightning because lightning is caused by the interaction of supercooled water droplets and ice particles above the freezing level within the storm clouds that form the eyewall. However, hurricanes contain so much warm air within their core, that the freezing level is elevated to great heights, limiting the opportunity for these water droplets to interact with ice crystals to create a build-up of static charge. Only in the most vigorous and violent updrafts in an eyewall, is the supercooled water carried high enough to rub against the ice particles and create enough charge to generate significant lightning. Figure JA shows a burst of lightning strikes immediately after landfall around 10:00 AM in what appears to be the innermost eyewall that moved across Hancock and western Harrison County. Figure JB is from 11:00 AM, showing the lightning continuing inland into southern Mississippi. These two images are in sharp contrast to Figure JC, from 7:00 AM, that shows no lightning in the core region of Katrina (with all the lightning confined instead to the outlying feeder bands). An animation of several hours of lightning data (from 5:00 AM to 11:00AM) is shown in Movie File JD depicting the sudden appearance of lightning near the center of the storm as it passed over the Mississippi Coast.

Video shot from the Hancock Bank Parking Garage on 14th Avenue in downtown Gulfport (see Figures J5 and Figure J6), by amateur storm chasers Scott McPartland and David Lewison, provide further evidence of the fury of the winds in the eyewall (see Movie File J7 and Movie File J8).

Applied Research Associates (ARA) developed a wind model for FEMA to estimate the maximum 3 second wind gusts associated with the landfall of Katrina. The Hazards U.S. – Multi-Hazard (HAZUS-MH) plot is shown below. It is a conservative, large-scale estimate that does not include the localized mesoscale features embedded within feeder bands and the eyewall that produced briefly higher gusts.

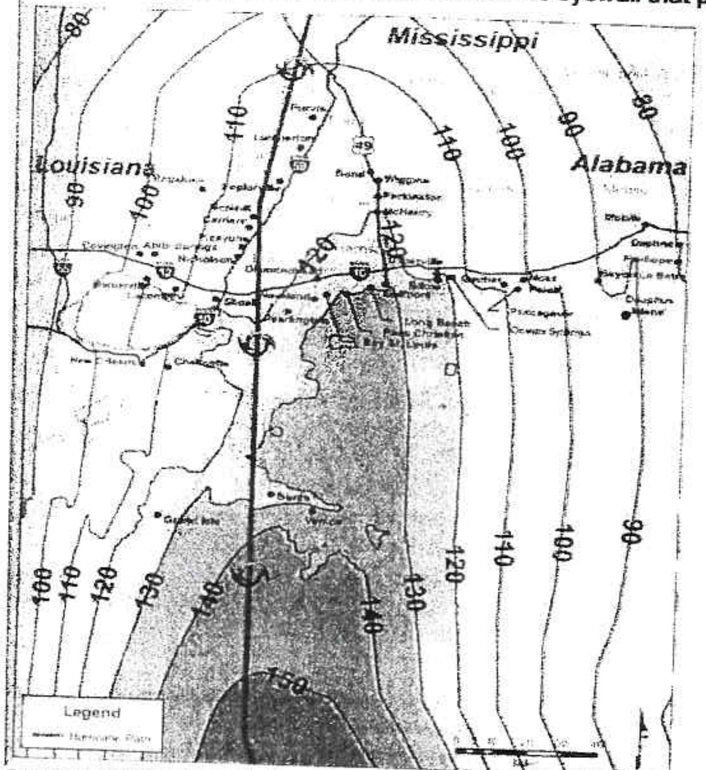


Figure 2-11.
Wind swath contour plot of 3-second gust wind speeds in mph at a height of 10 meters above ground (open exposure) based on HAZUS-MH wind field methodology
SOURCE: ARA

SUMMARY OF EVENTS

The Mississippi Gulf coast was overwhelmed by an unprecedented weather event that turned out to be even worse than what had been encountered with Camille 36 years earlier. Figure 22 is an aerial photograph taken by NOAA three days after Katrina struck showing extensive damage in the Sunkist, Ancient Oaks and Beau Chene Estates neighborhoods of Lopez Point. The combination of wind and surge created by Katrina produced an even higher degree of devastation this time around (destroying many structures that had survived Camille).

Extraordinarily high winds, both within feeder bands and underneath the outer eyewall make it is a meteorological certainty that devastating winds along the waterfront of Big Lake and the Back Bay of Biloxi (with 120 MPH sustained winds and gusts over 150 MPH) pounded South Shore Drive for several hours. Feeder bands and elements of outer eyewalls included at least a half-dozen cells containing tornadic MCVs.

The Sunkist Country Club Road area sits immediately adjacent to the expanse of the Back Bay of Biloxi and Big Lake. This allowed winds to flow with reduced friction across the water and directly onto waterfront structures, adding greatly to the wind's destructive potential. In many landfalling hurricanes there exists a sharp gradient of wind velocity both horizontally and vertically along the immediate shoreline. Dropsondes show extreme winds were still flowing just above the surface at landfall. The intense convection occurring within the re-developing inner eyewall of Katrina at landfall provided a conduit for these winds to reach the surface in the form of localized gusts much stronger than the prevailing large scale sustained wind field of the main hurricane circulation.

Richard G. Henning
Consulting Meteorologist
Report prepared March 27th, 2007

Hurricane KATRINA: Timeline of Events for 30.43N 88.99W 2558 South Shore Drive Biloxi, MS 39532

Sunday: 08/28/2005 20:00 CDT - Monday: 08/29/2005 19:00 CDT

Date / Time	Sustained (One minute average) Wind Speed (knots)	Large Scale (Three second average) Wind Gusts (knots)	Wind Direction (degrees)	Distance to center (miles)
Sunday 08/28/2005: 3:13 PM **First thunderstorms associated with Katrina develop along beachfront of Biloxi with gusts to tropical storm force**				
4:19 PM **First outlying feeder bands from Katrina reach the coast**				
4:52 PM **Second outlying feeder band moves overhead**				
6:25 PM **Third outer feeder band moves overhead with tropical storm force wind gusts**				
Sunday: 08/28/2005 20:00 CDT Sustained Winds Reach Tropical Storm Force	036	044	070	0214
Sunday: 08/28/2005 20:30 CDT	036	045	070	0210
Sunday: 08/28/2005 21:00 CDT	037	046	070	0205
Sunday: 08/28/2005 21:30 CDT	037	046	070	0202
Sunday: 08/28/2005 22:00 CDT	038	048	070	0197
Sunday: 08/28/2005 22:30 CDT	039	049	075	0192
Sunday: 08/28/2005 23:00 CDT	040	050	075	0188
Sunday: 08/28/2005 23:30 CDT	040	050	075	0182
Monday: 08/29/2005 Midnight CDT **Strong feeder bands begin rotating off the Gulf, across the beach and onto Lopez Point for the next four hours. Isolated wind gusts associated with strongest cells (at 2:09, 2:31, and 3:26 AM) briefly reach hurricane force**	041	051	075	0177
Monday: 08/29/2005 00:30 CDT	042	052	075	0173
Monday: 08/29/2005 01:00 CDT	043	054	075	0168
Monday: 08/29/2005 01:30 CDT	043	054	075	0164
Monday: 08/29/2005 02:00 CDT	044	055	080	0158
Monday: 08/29/2005 02:30 CDT	046	058	080	0149
Monday: 08/29/2005 03:00 CDT	048	060	080	0138
Monday: 08/29/2005 03:30 CDT	049	061	080	0128
Monday: 08/29/2005 04:00 CDT Sustained Winds Reach 50 knots (58 MPH)	054	068	085	0119
Monday: 08/29/2005 04:30 CDT	056	070	085	0114
Monday: 08/29/2005 05:00 CDT	059	074	085	0108
5:28 AM: **First intense feeder band associated with the core of Katrina moves inland over the McIntosh neighborhood**				
Monday: 08/29/2005 05:30 CDT	062	078	085	0104

5:49 AM: **Second intense feeder band with localized gusts to 100 MPH**				
Monday: 08/29/2005 06:00 CDT **Sustained Winds Reach Hurricane Force**	064	080	085	0099
6:21 AM: Potentially tornadic MCV moves overhead embedded within another intense core feeder band				
Monday: 08/29/2005 06:30 CDT	066	082	090	0090
Monday: 08/29/2005 07:00 CDT	070	088	090	0079
7:11: **Fragment of outer eyewall moves across Lopez Point**				
7:27: **Another fragment of outer eyewall moves overhead**				
Monday: 08/29/2005 07:30 CDT	075	094	095	0071
Monday: 08/29/2005 08:00 CDT	082	102	100	0062
8:05: **Outer eyewall moves overhead with localized gusts over 130 MPH**				
8:21: Tornadic MCV moves overhead embedded within eyewall				
Monday: 08/29/2005 08:30 CDT	090	112	106	0058
Monday: 08/29/2005 09:00 CDT	097	121	115	0050
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Monday: 08/29/2005 10:00 CDT MAXIMUM LARGE SCALE WINDS AND GUSTS	**105**	**131**	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
Monday: 08/29/2005 11:00 CDT	098	122	160	0037
Monday: 08/29/2005 11:30 CDT	092	115	180	0039
Monday: 08/29/2005 12:00 CDT	085	106	190	0045
Monday: 08/29/2005 12:30 CDT	080	100	200	0051
Monday: 08/29/2005 13:00 CDT	075	094	205	0059
Monday: 08/29/2005 13:30 CDT	071	089	210	0067
Monday: 08/29/2005 14:00 CDT	068	085	215	0076
Monday: 08/29/2005 14:30 CDT	065	081	220	0084
Monday: 08/29/2005 15:00 CDT Sustained winds drop below hurricane force	061	076	220	0092
Monday: 08/29/2005 15:30 CDT	055	069	225	0100
Monday: 08/29/2005 16:00 CDT	050	062	225	0108
Monday: 08/29/2005 16:30 CDT Sustained winds drop below 50 knots	048	060	230	0116
Monday: 08/29/2005 17:00 CDT Surge event ends as water levels on the Back Bay of Biloxi and Big Lake return to normal	045	056	235	0127
Monday: 08/29/2005 17:30 CDT	042	052	240	0137
Monday: 08/29/2005 18:00 CDT	039	049	240	0147
Monday: 08/29/2005 18:30 CDT	035	044	245	0159
Monday: 08/29/2005 19:00 CDT Sustained winds drop below tropical storm force	031	039	245	

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[signature] 27 March 2007

Richard G. Henning, Lieutenant Colonel, USAF Reserve
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Education

M.S. Meteorology, Florida State University, 1997
Thesis: *Mesoscale Convective Processes and their Link to Enhanced Tropical Cyclogenesis* Master's course work specializing in atmospheric numerical modeling, tropical meteorology, oceanography, time series data analysis, remote sensing. Thesis dealt with forecasting the development of rapidly intensifying hurricanes.

B.S. Meteorology, Florida State University, 1994
Minor in Physics, Mathematics

M.S. Management, Troy State University (NW Florida satellite campus), 1991

B.S. Geology, Southern Illinois University, 1983

Experience

AERIAL RECONNAISSANCE WEATHER OFFICER: 53rd Weather Reconnaissance Squadron, *The Hurricane Hunters*, Keesler AFB, MS. March 1995 - present. Mission Director responsible for all meteorological data collection during hurricane and winter storm penetration flights. Liaison with National Hurricane Center for all aspects of mission planning, execution, and data transmission via satellite communications link. Over 145 eyewall penetrations flown into hurricanes including Opal, Fran, Bonnie, Georges, Erin (including landfalling mission over Pensacola Beach in August, 1995), Category Five Hurricane Isabel in 2003, the major 2004 Florida storms: Charley, Frances and Ivan, as well as Hurricanes Emily, Katrina, Ophelia, and Wilma in 2005.

Directed four missions into Ivan, including three as a Category Five system. Directed historic mission on the early morning of 28 August 2005 into Hurricane Katrina, transmitting data that prompted the National Hurricane Center to upgrade Katrina to Category Five status. Flew 20 October 2005 mission into Category Five Hurricane Wilma as the storm approached landfall along the Yucatan Peninsula of Mexico.

Authored and presented papers at the American Meteorological Society (AMS) Conference on Hurricanes and Tropical Meteorology in 1997, 1999, 2000, 2002, and 2004. Chairman of the 2004 AMS conference session dealing with landfalling storms. Chairman of the 1999 Interdepartmental Hurricane Conference held in Biloxi. MS. Awarded seven Aerial Achievement Medals and the USAF Meritorious Service Medal. Over 1650 hours flown in the WC-130H & WC-130J aircraft with the *Hurricane Hunters*; over 2600 total hours of military flight time. Top Secret security clearance based on Special Background Investigation conducted in 1987, updated 1997.

PRIVATE CONSULTING METEOROLOGIST: Consultant to Levin, Papantonio, Thomas, Mitchell, Echsner & Proctor P.A., Pensacola, FL. February 2005 through present. Clark, Partington and Hart, Pensacola FL; McDonald, Fleming and Moorehead, Pensacola, FL.; Merlin Law Group, Tampa, FL; Balch and Bingham LLP, Gulfport, MS. October 2005 through Present.; Maples and Kirwan, New Orleans, LA. June 2006 through Present. Several private individuals and consulting engineering firms; Researched and authored over 85 meteorological reports regarding wind and storm surge conditions for residential and commercial properties damaged by Hurricanes Ivan, Frances, Jeanne, Wilma and Katrina on behalf of individual clients involved in litigation including experience providing sworn testimony as an expert witness at depositions.

METEOROLOGIST: Civilian employee of the Department of Defense (GS-12 Step 5), 46th Test Wing, Eglin

AFB, FL. July 1998 through present. Staff meteorologist to the Air Armament Center and the Air Force Research Lab Munitions Directorate. Responsible for ensuring that all advances in the field of atmospheric science are applied to weapons research and development of precision guided munitions and missile targeting systems. Squadron climatologist and web master, created and maintains one of the most extensive web sites in the USAF for the collection and archiving of weather data at: http://www.eglin.af.mil/weather/ Hurricane expert for Eglin AFB. Responsible for daily briefings to the base leadership during hurricane season. Primary advisor to the 96th Air Base Wing Commander responsible for the decision to evacuate a base covering 724 square miles and employing over 22,000 military and civilian workers and their dependents. Researched and drafted reports to the commander detailing the impact of Hurricanes Ivan, Dennis and Katrina on various locations across the Eglin AFB Reservation.

METEOROLOGIST INSTRUCTOR: Civilian employee of the Department of Defense (GS-11), Joint Weather Training Complex, Forecaster Course, Keesler AFB, MS. January 1997 through July 1998. Instructed coursework including atmospheric dynamics, physics, satellite analysis and synoptic laboratory. Responsible for curriculum development and quality assurance in 12 courses.

RADAR OFFICER / COMBAT INFORMATION CENTER - AIR CONTROL OFFICER: E-2C Hawkeye, US Navy active duty Naval Flight Officer, Carrier Airborne Early Warning Squadron 116, Miramar Naval Air Station, San Diego, CA. April 1986 through September 1992. 204 carrier landings and 831 flight hours aboard the *USS Ranger*. Mission Commander responsible for all aspects of mission success (planning, coordination with carrier Combat Information Center, and execution leading a crew of 5 officers). Participated in three extended deployments to the western Pacific, and Middle East, including Operation Nimble Archer in 1987, combat operations in the Persian Gulf / Straits of Hormuz. Served final assignment on active duty as an Aerodynamics Instructor at Naval Aviation Schools Command, NAS Pensacola, FL.

Flight Training, T-34C, T-2B, T-47A aircraft, Training Squadron Ten (VT-10), Naval Air Station Pensacola, FL. February 1985 through April 1986. Graduated number 1 of 19 in academics from Aviation Officer Candidate School (AOCS) Class 19-85, and 4 of 16 from basic and intermediate Naval Flight Officer training at VT-10.

Expert Witness Rate Schedule
Richard Henning

$100 per hour for research and writing of reports

$120 per hour for depositions

$140.00 per hour for trial testimony

IN THE UNITED STATES DISTRICT COURT

FOR SOUTHERN DISTRICT OF MISSISSIPPI

SOUTHERN DIVISION

THOMAS C. and PAMELA MCINTOSH,

Plaintiffs,

vs. CASE NO. 1:06-cv-1080-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY;
and FORENSIC ANALYSIS & ENGINEERING CORP;
and E.A. RENFROE & CO, INC.

Defendants.

_______________________________________/

The Deposition of RICHARD G. HENNING, taken by the attorney for the Defendants, pursuant to Notice, before Lisa D. Jeter, Registered Professional Reporter and Notary Public, State of Florida on the 8th day of October 2007, commencing at 9:37 a.m., at Destin Reporting & Technology Group, 910 Airport Road, Suite 3A, Destin, Florida.

EXHIBIT
tabbies
B

you'd probably win it.

Let me start off by asking a little bit about your background. And when we start doing that, let's introduce Exhibit 1, which I would ask you to tell us whether that is a -- let's let the reporter mark it first. Then I will ask you to tell me if that's a copy of your CV.

(Defendant's Exhibit 1 marked for identification.)

THE WITNESS: It's a copy of a CV that -- a CV that was produced last year. It's about a year old, at least a year old. The only significant difference is, is that the number of different firms that I've worked for in the section Private Consulting Meteorologist has grown considerably since then. And the number of reports that I've written regarding all the different hurricanes that are listed has grown now to in excess of 200.

So it says, Researched and authored over 85 meteorological reports, and then it lists a bunch of storms, I've done approximately 140 reports on Hurricane Katrina and about 220 total.

BY MR. BONDS:

Q. Rather than my asking you to update that, listed on this list of publications that would be pertinent.

And then depositions, the number has grown pretty dramatically. What you see are three depositions listed. I've done about 22 now up to this point. So that number has gone up quite a bit, along with the sworn affidavits. I've probably done about a dozen of those now instead of the two that are listed.

So I would be able to provide, as we did earlier with the CV, an updated version of the list of depositions, publications and affidavits.

Q. That would be good, if you would do that.

A. Yes, sir.

Q. Okay. Let's go back to your resume. And let me just ask you to tell us now, what is your employment at the present time?

A. Well, basically, I have three jobs as a meteorologist. Right now, I -- my regular Monday-through-Friday full-time job is as a meteorologist at Eglin Air Force Base. I'm a civilian GS-12 civil service employee of the Department of the Air Force. I work for the 46th Test Wing at Eglin.

In addition to my job there at Eglin Air

Force Base, I also fly in the reserves part time. I'm a lieutenant colonel with the 53rd Weather Reconnaissance Squadron based at Keesler Air Force Base in Mississippi. I've been doing that for 12 years now, since the spring of 1995.

And in addition to those two jobs, since 2005, I've been working as a private consulting meteorologist dealing with these type of cases, hurricane litigation primarily, where in the fall of -- I'm sorry. In the spring of 2005, I was contacted by Levin Papantonio, which is a law firm in Pensacola, Florida, and asked if I would be interested in writing reports for Hurricane Ivan. And I began doing that.

And since then, what at first was a relatively small portion of my time, has gotten larger, and now it's -- it takes up a considerable amount of my time, the consulting aspect. It's grown quite a bit over the last couple of years.

Q. Is that primarily as a result of Hurricane Katrina cases?

A. That's correct. I've done, in total, probably about 60 to 80 reports on storms that were not Katrina. Again, originally I worked on strictly Hurricane Ivan cases. And then I began working on

And then I've been recently retained to help with Dole and Chiquita in the same regard, where a lot of their containers ended up after Katrina in the front lawns of property owners.

So that's -- that has been a -- that, along with Hurricane Rita, I've done a report for Locke, Liddell & Sapp, a rig that was located out in the Gulf of Mexico that was destroyed by Hurricane Rita, the rig was submerged, and subsequently an oil tanker collided with it, and there was an oil spill that resulted. And Targa Corporation, which is the corporation that was retained by Locke, Liddell & Sapp, the company that I'm working with, was the defendant in that case.

Q. In the container cases, what was the issue?

A. The issue is that there was damage caused to the properties by these containers. And the case is, on the defendants' side, that these homes would have been destroyed anyway, even if the -- whether or not the container was there or not, because of the extreme nature of the storm.

Q. Was there any issue in those cases about whether it was wind that blew the containers or water that carried the containers to those landfall situations. I'm the primary adviser to the squadron commander who makes the recommendation whether or not to evacuate the base, based on the arrival of 50-knot winds and whether or not the personnel -- there's about 22,000 people that work at Eglin Air Force Base, whether or not to evacuate those personnel, that sort of thing. And then after the storm, I write reports regarding the impact to the reservation.

Eglin Air Force Base is a large complex. It's about 724 square miles. It covers a big portion of Walton and Okaloosa County and Santa Rosa County, Florida. I write reports dealing with the impact of the wind and the surge at different facilities across the base.

Q. The first part of your duties that you described, would it be fair to say, deal with forecasting as opposed to hindcasting; is that correct?

A. Yes, sir.

MR. SCRUGGS: Object to form.

BY MR. BONDS:

Q. All right. Any other duties at the 46th Test Wing that involve estimating hurricane winds at particular locations?

the ocean and falls to the bottom of the sea. They're disposable.

Q. Are these GPS sondes?

A. Yes, sir.

Q. Thank you for showing that to us.

Do you have like a button that you press when you release the sonde?

A. I work with the load master on board our aircraft, who is the one who actually releases the sonde. He is the one who loads it in the tube. And then at my command, he presses a button. And it's spring-loaded. And the spring and the suction of the winds, we're flying at about 180 knots, sucks the sonde out of the tube into the air.

Q. At what altitude do you normally fly these missions?

A. It all depends on what the Hurricane Center is looking for as far as data. They can be anywhere from 500 feet above the water, up to somewhere between 8 and 10 thousand feet in the stronger storms.

Normally, for a storm like Katrina, we're flying between 8 and 10 thousand feet above the water.

Q. I've seen some references in publications interpretation of that?

A. What we do there is, we make sure that there aren't any obviously garbled lines of data. The dropsondes tend to be quite reliable, in that if they are getting a good GPS signal from four or more satellites, the wind information tends to be very reliable. We're making sure that the -- nothing that looks obviously erroneous gets through. But that's a relatively rare situation most of the time. If we're getting good wind data, the winds all look scientifically reasonable.

We look to make sure that the temperature data looks reasonable because that's going to have an impact on the pressure data. Basically what we do, we do a quick quality check of the data. We only have a few minutes in which to do that because the Hurricane Center is eager to get the data. So, generally, we only have about less than five minutes to quality control the dropsonde message before we transmit it to the Hurricane Center.

Q. Could you give us an example of a wind reading from a dropsonde that might cause you to question its reliability?

MR. SCRUGGS: Object to the form.

THE WITNESS: For example, if the wind

BY MR. BONDS:

Q. But back to the National Hurricane Center. Among the data that the center would have available to consider, in addition to the dropsonde information, the ASOS information that we talked about, would be information from anemometers on the towers that university programs have specifically set up to measure the hurricane winds, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Yes.

BY MR. BONDS:

Q. And those would include the program known as FCMP and a Texas Tech program.

Do you know whether or not that also includes a University of South Alabama program?

MR. SCRUGGS: Object to the form.

THE WITNESS: The -- all three of those organizations set up towers in an effort to sample the winds of Katrina at landfall. The FCMP, Texas Tech and University of South Alabama all set up towers to that end.

BY MR. BONDS:

Q. Okay. Do you know whether or not the wind instruments that are maintained on those towers are specifically tested and calibrated to measure severe weather, including hurricane winds?

A. Yes.

Q. And they are?

A. Yes.

Q. Okay. Would you agree that one way of testing the accuracy of an estimated wind or specifically an estimated hurricane wind would be to compare an estimate made at a location occupied, for example, by one of those towers so that you could compare the estimated wind velocity with the actual measured wind velocity?

MR. SCRUGGS: Object to the form.

THE WITNESS: Well, part of the problem with that is it sometimes turns into an apples and oranges type of proposition, because I've actually personally been involved in an effort by FCMP prior to Hurricane Dennis to place one of those towers at Eglin Air Force Base, and it's -- the people who try to conduct these field experiments, the FCMP, Texas Tech people, run up against some obstacles. Not the smallest of which being that they're trying to set up their instruments on somebody else's property.

And when it -- whether it's a government organization where there's a lot of red tape involved or it's a private organization and there are liability concerns, sometimes there are factors that have nothing to do with meteorology that go into the placement of these towers.

The example that I know firsthand is that they wanted to set one up at what would have been an optimal location near the beach front at Eglin Air Force Base. But because of all of the rules and regulations, we couldn't, over about a 36-hour period, get all the approval that was necessary. So as a result, their plan was to take that station and move it about four miles inland to the -- what we refer to in Niceville as the Mullet Festival grounds. There's an area of civic property owned by the City of Niceville. It's a large field. But it's an area ringed with trees and several miles inland, and that turned out to be the location for their tower in landfall of Katrina.

I suspect that they may have had similar problems, in that their -- the locations that they chose to place their towers, both the FCMP and Texas Tech, were all far inland. And part of that consideration, I know they must have been thinking of was surge, the fact that Katrina was going to bring a tremendous amount of surge with it, and that they didn't want to have their towers inundated by surge.

But by making that decision to bring them from the immediate beach front or from areas immediately adjacent to inland waterways such as the back bay of Biloxi or St. Louis Bay, that instead of sampling the winds right along those waterfront properties, they're going to sample winds that are considerably inland.

And that -- there are lots of studies that are out there, some authored by individuals at Texas Tech, that show that there are quite a few dynamics that occur that are important in that difference between the immediate shoreline and further inland that the earth's -- the friction of the earth's surface that plays a considerable role in the reduction of the winds as you go inland.

BY MR. BONDS:

Q. Do you happen to recall any of those studies specifically?

BY MR. BONDS:

Q. And the terrain would be one of the constraints that you were talking about?

A. Yes, sir.

Q. Any others that come to mind?

A. Well, the -- again, the differences in the -- the distribution of terrain features in terms of elevation, changes in elevation with horizontal distance would be important. And, again, the type of obstructions that were present around the tower would be important; trees, buildings, anything like that, that would impede the wind.

Again, this tends to create a large difference between sustained winds and gusts, in that the air is still going to reach the instrument, but it tends to reach the instrument in a more pulsating fashion. So the result is a lowering of the sustained wind speed, which is winds measured across a 1-minute interval, a lowering of the sustained winds and an increase in the gust factor. That is the difference between the sustained winds and the maximum gusts.

Q. So would it be true that the anemometer on the tower would automatically take those constraints into consideration by measuring the wind as it has

BY MR. BONDS:

Q. All right. Let me switch gears a little bit. I didn't see anything in your report, I'd just represent to you, that I took to be opinions about damage on the ground from Hurricane Katrina. But I want to make sure that I ask you. Do you consider, as part of your report and your opinions in this case, to be opinions about damage on the ground from Hurricane Katrina?

A. No. In fact, I specifically point out -- or I would specifically point out that this -- at this time, that that is not part of my effort, is a forensic reconstruction of what happened based on damage. I typically do not go out to the location of these homes where I write reports for. I treat them as a latitude and a longitude, and that whatever is built on the -- at that location is not necessarily relevant to what I'm trying to do, which is to report the -- in this case, what the wind conditions were at that location during the landfall of the storm.

I leave it up to engineers to try to determine what happened as a result of the winds that I report and how a particular structure was taken apart by winds or water or any combination of the two.

So I specifically stay away from references to the damage at a particular house.

Q. Okay. I know you said that you typically don't go to the individual property. Was this a typical case?

A. Yes, sir, it was. I was not -- every once in a while, the attorney that I'm working for asks me to go out and visit a property. And sometimes I will go out with that attorney to a property. I'll be provided pictures and things like that. And I -- in this case, I was not asked to go out and make an examination of the property.

Q. Okay. Same kind of question. I did -- I will represent to you I didn't see in your report anything I interpreted as an opinion about storm surge conditions at this property. I just want to make sure. Do you consider that your report and your opinions in this case include opinions about the storm surge?

A. No, I was not instructed to do any work regarding the surge. I -- most of my reports do contain a discussion of both wind and surge, and I've done many of such reports in the back bay of Biloxi area. But this particular report I was not asked to do that. I was specifically asked to focus on the wind conditions, and that other members of their team would take a look at the surge.

Q. We will get to this area in more detail. But when you said you treat the property location for purposes of your report as a latitude and a longitude, do I correctly understand that you do that because you have the capability of creating a wind field that will show your estimate of wind conditions at that point?

A. Yes, sir.

Q. Would it be the case that you have constructed a wind field for Hurricane Katrina that you're able to use in all of these cases?

A. I have a large scale wind field estimate that I build using a Hurrtrak, which is a piece of commercial software. It's H-U-R-R-T-R-A-K. But primarily what I do with that is I just use it as a starting point. When I create timelines for a specific location, I look at the reconnaissance data and the radar data to try to reconstruct on a more small scale at a specific location what the winds were as they were affected by these smaller scale what I refer to as convective scale episodes, as each band of thunderstorms pass through the area and

falling at a rate of about 10 to 12 meters a second?
A. It works out to -- I have to do the math in my head, but it works out to about 3,000 feet per minute. In other words, from 10,000 feet we're going to expect the sonde to hit the water in a little over 3 minutes, between 3 and 3 and a half minutes.
Q. I think I will have to have a calculator to make that calculation.
Okay. As the dropsondes are falling, at some point they enter what is called the boundary layer, correct?
A. Yes, sir.
Q. Would I be correct in understanding that's an area of the atmosphere above the ground in which the speed of the winds is influenced by the surface friction or the drag force exerted by the surface on the winds?
A. Yes, that is correct.
Q. Would it be fair to say that as the dropsonde falls through the boundary layer, one would expect the winds to be increasingly slowed by the surface friction of the earth?
MR. SCRUGGS: Object to the form.
THE WITNESS: The -- the bottom of the

boundary layer is how much that friction is able to reduce wind speeds. For the most part, statistically, if you were to drop a thousand sondes at a given location, the majority of them would be -- would show a reduction in winds just above the surface due to this friction that you just spoke of. The amount to which the winds are reduced is greatly dependent upon the stability of the boundary layer. That is the characteristics of the boundary layer, including, especially, essentially what type of weather you're dropping the sonde into, whether or not there's an active convection going on with strong thunderstorm activity or if it's what we refer to as stratiform rain.

If you drop a sonde into stratiform rain, what you're going to get is -- the boundary layer just above the earth's surface tends to be rather stable and highly prone to friction from the earth's surface, and you're going to see a -- something close to a logarithmic drop in winds as they approach -- as the sonde approaches the earth's surface.

If you drop it into an area of strong

convection in a highly unstable boundary layer, much less of the -- there is much less of a reduction in winds from a few hundred feet above the surface down to the surface. The winds at 1,000 to 500 feet above the surface tend to be somewhat stronger than the winds that you record all the way down to the surface, but not dramatically so.

So it's very dependent upon the characteristics of the boundary layer. The stability characteristics of the boundary layer.

BY MR. BONDS:

Q. Would it be fair to say that depending on the stability characteristics of the boundary layer, it would nonetheless be required in order to make an accurate estimate from a dropsonde reading at some distance above the surface of the earth to take the retarding effect into consideration in some way?

MR. SCRUGGS: Object to the form. Incomplete hypothetical.

THE WITNESS: Well, we're basically just passing along the data that is measured. I mean, we don't make any -- now, later on -- when I say "we," I'm talking about a crew

Mischaracterizes his prior testimony.

THE WITNESS: You have to use as a -- for example, a forecaster at the Hurricane Center has to use whatever they have available to them. And for many years, we've -- in the tropical cyclone community, have used flight level winds. Until the advent of GPS dropsondes in 1997, that is all that the National Hurricane Center had to use was flight level winds. And so there were different strategies employed for decades as to how to interpolate those winds down to the surface, using different reduction values.

Now, the advent of GPS sondes has sort of thrown that argument kind of on its ear. There's been a lot of -- there's been a lot of debate in the tropical cyclone community as to how to interpret dropsonde winds and whether or not the kind of conventions that had been accepted for many decades, how appropriate they are in terms of how to reduce flight level winds down to the surface. So it's become an issue of ongoing debate now in the community.

MR. BONDS: Okay. Let me have marked what I believe will be Exhibit 4 to your deposition.

the surface wind speed to the 700 -- whatever that is, hPa pressure altitude wind speed from any individual sounding is of little value.

Do you agree with that?

MR. SCRUGGS: Object to form. Lack of foundation.

THE WITNESS: Again, what Mr. Franklin is doing here is a scientifically prudent way of characterizing hundreds of sondes and drawing conclusions based on multiple sondes, and because of the variability in the wind profile, the point that he's trying to make is that it's difficult to reach scientific conclusions for something like a paper that you're going to publish in a peer-reviewed environment based on individual sondes. What he's looking at here are, again, hundreds of sondes and trying to draw conclusions.

So I carry on to what he says after that, that the surface wind report from a dropsonde in a turbulent environment should not be considered necessarily to be representative of a sustained wind, and that the -- again, there's going to be a tremendous amount of variability in the readings that a sonde makes for the actual surface, if it reaches the surface. A lot of times these sondes do not pick up enough satellites to make measurements all the way down to the earth's surface. They terminate at 10 meters or 50 meters or 200 meters. There's some level below which there are no reliable wind measurements made, and that the -- a lot of the variability that Mr. Franklin talks about in here has to do with the stability of the boundary layer into which you're dropping the sonde, and whether or not you're dropping it into an active thunderstorm band with intense convection or a few miles away from that.

So I agree with what he's saying, in that you can't take the wind measurements made right near the ground level and use them without reference to any other -- without reference to any other tool.

In other words, you have to know what kind of atmosphere you're dropping it into and make conclusions from that. Using just the sonde itself, it's difficult to make definitive statements regarding the characteristics of the wind structure, of the wind field at the station, but it won't be as smooth as balloon data that's staying at the same pressure altitude either.

Q. Now, you note on -- going back to your report. You might want to just keep an eye on that because we will be coming back to it, your report that is. You note on page 3 up at the top a dropsonde reading 150 miles south of Biloxi, where flight 305 measured winds up to 152 knots or 175 miles an hour, 421 meters above the surface of the gulf.

A. Yes.

Q. Do you see that?

A. Yes.

Q. Okay. Just to try and incorporate some of the things that we've just been talking about. Am I correct in understanding that was basically a .5 second average wind speed at about 1,300 feet or thereabouts above the water?

A. Yes, sir.

Q. Okay. And if we look at Exhibit -- what we will mark as Exhibit 5, which I think we will find is a profile of that dropsonde.

(Defendant's Exhibit 5 marked for identification.)

BY MR. BONDS:

Q. Would I be correct in interpreting the profile shown by Exhibit 5 as saying that at about an altitude of 400 meters, the dropsonde wind velocity started to decrease significantly, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Yes. Yes.

BY MR. BONDS:

Q. And would you interpret that, as a meteorologist, as an indication it was entering the boundary layer and slowing because of the surface friction of the earth?

A. Yes.

Q. And at least as this individual dropsonde readout would indicate when it stopped transmitting, it was somewhere in the vicinity of the surface and reading of about 59 or thereabouts feet per second?

A. No. That's actually meters, meters per second. So it's somewhere in the neighborhood of 60 meters per second, which is about 120 knots or 140 miles per hour, would be the speed.

Q. Okay. If I represented to you that I attempted to calculate that and came up with 132, would that be -- miles an hour, would that be about accurate?

A. It depends on the number that you were using. But 60 is the -- 60 is -- meters per second find that on the 315-degree radial, if that's the right --

A. Yes, that's correct.

Q. -- that the radius to max winds would be closer and the max winds might be lower?

A. That's correct. The max winds -- I can't remember what they were in that quadrant, but they were -- in the advisory, they were lower. And they were lower still in the southwest quadrant, which was the weakest quadrant of the storm.

Q. Again, in the southwest quadrant, you would expect then that the radius to the maximum winds would be shorter and the max wind itself would be lower?

A. Yes, sir.

Q. Okay. And in the forecaster advisory, the next piece of information that would appear would be a radius to hurricane speed winds?

A. Yes. Hurricane -- the envelope of hurricane force winds.

Q. Okay. And then there would be another radius in each quadrant to tropical storm wind?

A. Well, first to 50-knot winds, which is used by emergency management people and the military for evacuation decisions.

For example, our decision whether or not to evacuate aircraft from Eglin is based on the onset of 50-knot sustained winds, not on the onset of hurricane force winds.

So the Hurricane Center, knowing that, provides a radius of 50-knot winds; and after that, they provide a radius of tropical storm force winds, which are 34 knots or about 40 miles per hour winds.

Q. And that is the information that you entered into the Hurrtrak model that --

A. Yes, sir.

Q. -- that you used. Okay.

Does the public -- I'm sorry. Does the forecaster advisory reflect any winds other than sustained winds?

A. Yeah, they -- I'm sorry. Yes, sir. They refer to -- they refer to gusts just as the -- just as the public advisory does. There should be a gust -- I know that the forecast advisory shows maximum sustained winds and then gusts as well. I'm not finding it in the public advisory.

Q. I can represent to you I didn't find it either.

A. But it is in the forecast advisory gust.

Q. And did you enter that gust information in winds in Hurricane Katrina as it made landfall on the Gulf Coast for the second time near the Louisiana/Mississippi border?

A. Yes.

Q. Okay. And am I also correct in understanding that that is a downward revision from the wind speed that the National Hurricane Center estimated at the time it issued the advisory that we were talking about?

MR. SCRUGGS: Object to the form.

THE WITNESS: It represents a 5-knot change from the advisory number 27, which used 110 knots to using 105 knots for the Mississippi landfall.

BY MR. BONDS:

Q. Okay. You point out, I believe, in your report -- I can find it if you give me a second. But you disagree with the downward revision that the NHC made?

A. I disagree with it as a -- as something of a mischaracterization of what was going on in terms of the destructive potential of the storm. I believe that the convective scale features that I emphasize in my report create wind gusts that are the kind of wind gusts that you would see associated with a category four storm, which is the intensity that they carried originally and the advisories back on August 29th as it was making landfall in Mississippi -- I'm sorry. As it was making landfall in Louisiana down around Buras, Louisiana.

So I have disagreed and I -- the Hurricane Center personnel understands my disagreement with them. I voiced it, as have others, as to the decision to recategorize the storm in this Hurricane Katrina report that they issued in December of 2005 and that they updated in 2006.

I -- we agree -- I agree with a lot of the science that went into it. These are excellent meteorologists. We just come to a disagreement when it comes to the emphasis that I place on the convective scale features that are -- excuse me, that are superimposed on the larger hurricane wind field, which I think were responsible for winds at localized settings being stronger than what this report indicates.

Q. To make sure that I understand what you're saying, would I be correct that your disagreement with the National Hurricane Center is not so much with their estimate of the 1-minute sustained winds of Hurricane Katrina, but rather with the implications that might be drawn from that in terms of the gustiness of the winds?

MR. SCRUGGS: Object to the form.

THE WITNESS: I think that there is a small disagreement still between myself and the Hurricane Center report in terms of the sustained winds, but I think the most important aspect is the -- is the gusts, the 3-second gusts and the capacity to generate very high 3-second gusts in the convection that occurred over the Mississippi coast.

So I don't believe that that was emphasized enough in the report and that it paints a somewhat misleading picture of a weakening storm at landfall that isn't necessarily true when it comes to its capacity to generate wind damage.

BY MR. BONDS:

Q. Okay. And you note on page 3 of your report that many scientists disagree, which I take to mean you're sharing your feelings about that?

A. That's correct.

Q. Do you know of any studies or at least articles in refereed journals that reflect that -- those scientific differences?

A. Well, I have read lots of the work that Dr. Blackwell at the University of South Alabama has done, and this is -- this was prior to me joining the team in which Dr. Blackwell is also now a part of. This was -- for years he's worked on identifying these convective scale features that cause wind damage potential at specified locations in storms. I know he disagrees with it. The -- a lot of people that look at the convection within a storm would tend to disagree with it.

In particular, individuals that work at the NASA-Marshall Spaceflight Center in Huntsville, Alabama that I've had personal conversations with agree with me that there isn't enough emphasis placed on the importance of the convection within the storm.

Dr. Chris Veldon up at the University of Wisconsin, I understand that he's also a consultant in this matter. But his group has produced a lot of products that would tend to cast some doubt on the -- this being a weakening storm in terms of its destructive potential, its wind destructive potential.

There are -- as I said, there's lots of others that I could point to that share this

Center in a paper that he published several years ago, where the forecasters at the Hurricane Center use our 10-second winds as a sustained wind. They would consider our 1-second winds to be analogous to 3-second gusts on the ground and our 10-second winds to be analogous to 1-minute ground-based winds.

Q. And does that analysis take into account that the wind measurement at flight level is at least in part a Lagrangian measurement?

A. To some degree. The biggest adjustment has to be for the fact that it's not at the ground level, that it -- that it would require some interpretation and interpolation from the flight level down to the surface.

Q. Okay. And would the same be true for 3-second gusts, even if -- if a 1-minute segment of flight level information would be considered equivalent to a 3-second gust, you would still need to make a translation of that to the surface?

MR. SCRUGGS: Object to the form. Incomplete hypothetical.

THE WITNESS: Well, the -- actually, the winds that we measure at flight level over any interval greater than one second are not analogous to 3-second gusts. They're more

Slidell, in both cases, you're somewhere between 4,000 and 6,000 feet, limited by curvature of the earth.

Q. So what the radar is seeing is the wind somewhere between 4,000 and 6,000 feet above Biloxi?

MR. SCRUGGS: Object to the form.

THE WITNESS: Yes.

BY MR. BONDS:

Q. Okay. And in fact, what the radar is seeing, is it not, is returns based on the speed of water droplets moving towards or away from the antenna?

A. That is the radar velocity -- the radial velocity component of the radar data. There are two different types of data that people look at. There's reflectivity, which simply shows how much of the energy is being reflected back to the radar site; and then there's radial velocity which does what you just described, try to measure the rate at which particles are moving either towards the radar site or away from the radar site.

Q. So if what you're measuring or seeking to measure is wind velocity in a horizontal direction, you would be looking at the radial velocity product as opposed to the intensity product?

BY MR. BONDS:

Q. Another wind map and the same question. Is this generated by Hurrtrak based on the information you input from advisory 27?

A. Yes, sir. It's broken down by ZIP code as opposed to county.

Q. Okay. And that's all according to algorithms that are built into the Hurrtrak program?

A. Yes, sir.

Q. Okay. Let's look at another exhibit. We're moving right along.

MR. SCRUGGS: I think that was Exhibit 13.

MR. BONDS: It was figure 14, but Exhibit 13.

(Defendant's Exhibit 14 marked for identification.)

BY MR. BONDS:

Q. Let me ask you if Exhibit 14 is a display of the timeline of wind velocities that you generated using the Hurrtrak program for the location of the McIntosh residence?

A. That's correct. Basically, I just plug in the latitude and the longitude of the McIntosh residence, which was 30.43 north, 88.99 west, and Hurrtrak objectively generates this chart for me.

Q. Okay. Now, let's talk a little bit about as you move further to the northeast and scale -- well, scale down in increments in either direction?

A. That's exactly what they do. They start out with maximum value, which was 110 knots in the northeast eye wall. And then based on the radius of maximum winds and the radius of hurricane force wind information in the Hurricane Center forecaster advisory, it will create a number. In this case, it was 105 knots. So it decreased the intensity 5 knots, moving from southwest to northeast, from Hancock County into this portion of Central Harrison County.

Q. And am I correct in understanding that's simply a mathematical interpretation that doesn't depend upon meteorological conditions along the way?

A. That's correct.

Q. Now, do I correctly recall from your original description of what you did that when the model produced these numbers, you then looked at all the other information that was available to you and made a judgment about whether those numbers produced by the model using that methodology were sufficiently accurate for your purposes?

A. Yes.

Q. And in this case, your decision was that the numbers produced by the model using these algorithms were numbers that you would incorporate into your opinion?

A. Yes. There was no reason for me to deviate significantly from 105 knots for a maximum sustained wind and approximately 130 knots for a maximum gust. Based on the reconnaissance data and the radar data, those are very representative numbers.

Now, what I have done in the months after I wrote this report is that my time lines -- I never thought it was very important to make too much of an effort to show what the winds were after the maximum event, but I have realized in the months since then that that -- you know, in my efforts to make the most complete and accurate statement that I can, I've gone back and after the most intense convection in the Northeast eye wall, I have gone back and reduced my numbers considerably below what the Hurrtrak numbers are for winds after the maximum wind event in my timelines after -- after this spring.

I believe at this point in March, I was still depicting winds in my timeline that were very similar to what these winds are. And it's my or another.

BY MR. BONDS:

Q. Okay.

A. Again, I have made an effort to more realistically decrease the winds after the maximum wind event to more -- to match the lack of convection.

So in my reports that I've written since March, you'll see that there isn't nearly the gradual decrease in winds that we have reflected here, that it's more of a sharp decrease after the maximum wind event.

Q. Okay. I think you probably answered this question. But am I correct in understanding that the Hurrtrak model does not purport to make adjustments to wind velocities to reflect the particular exposure of an individual property?

A. Not at all.

Q. And the same thing would be true, to the extent that it is a meteorological phenomenon for what's sometime called inland decay? There would be no attempt to account for this particular hurricane's winds slowing down as the hurricane moved inland in any way other than these mathematical relationships that you've just described?

A. That's correct.

Q. Just as a mechanical matter, is the Hurrtrak software set up to use the information that comes from these forecaster hurricane advisories or would it accept a variety of different kinds of input?

A. No. It's designed to use the NHC advisories as its input. Its primary purpose is for emergency management officials to plot out the wind fields in preparation for a storm and to provide graphics to warn decisionmakers as to the danger and whether or not they should evacuate a particular part of the coastline, that sort of thing.

Q. Am I correct in understanding that if you had input information analogous to that of the hurricane advisories, taken from the December 2005/updated August 2006 NHC report, you would have gotten at least slightly different results?

A. Yes. One of the problems with that report, though, is that they didn't go back and recreate a new set of forecast advisory numbers. There was the -- there was a reduction in the maximum sustained winds at the second landfall in

Mississippi from 110 knots to 105 knots. But there was no reissuance or editing of the forecast advisory number 27 product field with all the different quadrants and radii. There was no -- there was nothing like that included with the report.

Q. Now --

A. So there wouldn't have been enough -- in other words, there wasn't enough information for me to take the December report and plug it into Hurrtrak instead of the advisory 27.

Q. There is a table attached to the report called BestTrack?

A. Yes.

Q. Was that updated; do you know?

A. Yes. The BestTrack data is as its name would suggest. It's the best effort by the Hurricane Center to characterize the intensity of the storm at each of those times and longitudes and latitudes. So the BestTrack data was changed from 110 knots to 105 knots.

Q. Okay. Do I correctly understand that you're telling me that information such as this quadrant by quadrant maximum wind and radius to maximum wind was not part of the revision?

BY MR. BONDS:

Q. Okay. Let me -- let's look at -- let's mark as Exhibit 15 what I will represent to you is a satellite photograph showing the relationship between Keesler Air Force base and the area that includes the McIntosh property. Let me ask you if you can verify that that's indeed what it shows?

A. Yes.

Q. Do you know from your experience with Hurricane Hunters where the ASOS station is located on the Keesler reservation?

A. Well, the FMQ19 system that was in place the morning of landfall at Keesler Air Force base has sensors that are located at several places on the air field. There are sensors that are located near the runway, sensors that are located near the base operations building, which is about approximately midway through the runway.

And I'm not sure. I'd have to go back and look at the detailed logs of the FMQ19 output to see what combination of sensors were being used at that time. But that's typical of what we see with FMQ19. It has more than one anemometer associated with it.

Q. Okay. Now, if we look back at Exhibit 14, which is your estimates, and look at 9:00 local

THE WITNESS: It's a considerable difference between 52 knots and 97 knots. Yes. It's a meteorologically significant amount.

BY MR. BONDS:

Q. Okay. And the 97 knot amount is an estimate made by you based on information from -- at least based initially on information from the advisory -- forecast advisory number 47, right?

A. Yes.

MR. SCRUGGS: Object to the form.

BY MR. BONDS:

Q. And the 52 knots comes from actual measurement by an official weather station, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: It is -- as it's referred to on the national Hurricane Center report and the table that you site, there's a -- there's a denotation "I" next to the value of 52, along with the value of 85 knots indicating that it's an incomplete data set.

BY MR. BONDS:

Q. And am I correct in understanding that means that at some point after 09:00 local, the ASOS station at Keesler went off the air, so to speak?

MR. SCRUGGS: Object to the form.

digital or an analog readout. I don't know.

Q. Okay. You are aware, we know, I think, that the Florida Coast Monitoring Program had an instrumented wind tower at the Trent Lott airport in Pascagoula, right?

A. Yes, sir.

Q. About the same distance from the McIntosh property as the Jackson County EOC and the Ingalls Shipyard?

MR. SCRUGGS: Object to form.

THE WITNESS: Slightly -- the Trent Lott airport is slightly farther to the east than the downtown EOC location or Ingalls.

(Defendant's Exhibit 16 marked for identification.)

BY MR. BONDS:

Q. Okay. Let's look at Exhibit 16, which I will represent to you is a graph downloaded from the FCMP website of gust measurements at that wind tower.

A. I'm familiar with this diagram. I include it in all of my reports now. I didn't back in March, but I include it now in my reports. I address the FCMP measurements.

Q. Okay.

A. So I am familiar with it.

Q. And the FCMP website indicates that the maximum 3-second gust measured at that wind tower was 92.91 miles an hour recorded at about 1641 UTC, correct?

MR. SCRUGGS: Object to the form of the question and this exhibit, given that it's incomplete and there are several malfunctions on it as noted on Exhibit 16. So subject to those objections to the accuracy of anything on this piece of paper, if you're familiar with it and can answer his questions, you're welcome to do so.

THE WITNESS: Yes, sir.

BY MR. BONDS:

Q. The first question is: It says that the maximum 3-second gust recorded at that time was 92.91 miles an hour, correct?

MR. SCRUGGS: Same objection and assumes facts not in evidence.

THE WITNESS: Yes.

BY MR. BONDS:

Q. Okay. Let me ask you this and then we will get to what you think about that. If we looked back at your estimates, this would be a considerably lower gust speed than the maximum that you estimated for the McIntosh property, correct?

MR. SCRUGGS: Same objection.

THE WITNESS: Yes.

BY MR. BONDS:

Q. And would I be -- would it be accurate for me to conclude that if you had programmed into the Hurrtrak model the latitude and longitude of the tower location at the Trent Lott airport, the estimated maximum wind gust that that program would have produced would have been significantly higher than the wind gust information shown on Exhibit 16?

A. Yes.

Q. And do you have, I ask, any reason to believe that the instrumentation on this tower was not capable of lively recording the wind that the tower experienced during Hurricane Katrina?

MR. SCRUGGS: Objection to form. Asked and answered.

BY MR. BONDS:

Q. Wind velocity.

A. Two things I want to point out. We can talk a lot about this data. One is that I do plan on including in my disk to Mr. Scruggs to pass along to you a listing of all of the dropsonde data, which includes a dropsonde which was made just south of

THE WITNESS: The -- well, first of all, Hurrtrak is only the beginning of what I do. Later on, I look at all of my reports and look at the reconnaissance and radar data. So I have not -- I haven't done that for this particular location. I have done reports in Pascagoula. Several of them for Mr. Scruggs' group and for other plaintiffs in Jackson County. The winds that I've reported in those reports are significantly higher than what I see at this particular location.

Again, I've not done any reports for property that are directly adjacent to this airport. But based on what I've seen for other reports in Jackson County, my numbers are considerably higher than these numbers.

BY MR. BONDS:

Q. Okay. In the third paragraph on page 5 of your report, you address a dropsonde instrument released from USAF aircraft 300 over the gulf that landed in Pass Christian and measured wind speeds of 153 miles an hour of what you characterize is only 350 meters above the surface, right?

A. Yes.

Q. Am I correct in understanding that that

153-mile-per-hour figure is basically an instantaneous wind measured about within the neighborhood of 1,100 feet over the ocean?

A. Yes.

Q. And that would be somewhere in the neighborhood of 20 miles from the McIntosh residence?

MR. SCRUGGS: Object to the form.

THE WITNESS: It's approximately a little less than 20 miles west/southwest of the McIntosh home.

BY MR. BONDS:

Q. Okay.

A. Probably closer to 15 miles.

Q. Okay. Would you agree with me that winds at that altitude were considerably stronger than the winds immediately below the dropsonde at that altitude at the surface?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: In areas of stratiform precipitation, I would agree with that statement. In areas of intense convective precipitation with a highly unstable boundary layer, I believe that a significant portion of the 133-knot winds shown in that dropsonde are translated down to the surface, especially in the form of 3-second gusts.

(Defendant's Exhibit 17 marked for identification.)

BY MR. BONDS:

Q. Let's look at the next exhibit, Exhibit 17.

First let me ask you. Does Exhibit 17 reflect a profile of the winds measured by that particular dropsonde?

A. Yes, sir.

Q. And am I correct in seeing this that after an altitude of about 350 meters, the dropsonde recorded significantly decreased wind speeds, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Yes.

BY MR. BONDS:

Q. And the last information reported by the dropsonde here as it approached, it appears to me to be about 100 meters, would have been about 47 meters per second?

A. Yes. Again, I can give you the exact number of meters above the surface. It will only take me a moment to do.

But, yes, the basic of what you're saying is true, that the -- approximately -- I believe the number is something closer to 10 meters above the surface. The winds were 47 meters per second, which is approximately 90 knots, about 103, 104 miles per hour.

Q. Okay. Now, that was in the vicinity of Pass Christian, right?

A. Yes. That was in the Timber Ridge neighborhood of Pass Christian. These are one of the sondes that actually floated over the beach and landed inland.

Q. Okay. And would I be correct in understanding that atmospheric scientists generally would expect the winds -- surface winds to decrease as one moved eastward from that location?

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: Yes. I just found -- the last winds measured by that sonde was at 77 meters above the surface.

BY MR. BONDS:

Q. Okay. And that was, again, a -- as we've talked about it before, that was basically an instantaneous reading, correct?

locally increased wind speeds, correct?

A. Yes.

Q. Let me see if I can ask a question that will short-circuit this. These are meteorological conditions that, in your view, are consistent with the development of either tornados in the one instance or with extreme convection in the other, correct?

A. I'm not sure I understand the question.

Q. Okay. What you're talking about, when you look at radar images for example, or satellite images of these meteorological phenomena, you're talking about identifying conditions that are consistent with the existence of tornados in one case or, B, if not a tornado, an intense convective activity at the surface, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: What I'm doing is, I'm identifying very intense convective cells that were embedded with the feeder bands and the eye wall of Katrina that certainly increased the local wind field above the larger scale -- ambient wind field of the larger scale hurricane feature. And that they may or may not have created funnel clouds. They may or may not have generated funnel clouds. But the generation of funnel clouds and tornados wasn't necessary to increase the wind field. Just having these mesovortices created was enough to enhance the wind field by a certain amount.

BY MR. BONDS:

Q. Okay. Now, on the tornado side, am I correct in believing that studies mesovorti-- of radar images of mesovortices says in the Midwest have established that the observation of a radar I am page like this would be associated with the actual confirmation of a tornado on the ground and only a small portion of the cases, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: There's -- again, that's a statistical inference that if you take a thousand mesovortices identified on radar and then go back and try to confirm how many of them actually produced tornadoes, it would be a small percentage.

BY MR. BONDS:

Q. Okay.

A. But, again, a lot of that depends upon the atmospheric conditions in which the mesovortex formed as to how likely it's going to be to produce a tornado. There's a quantity in the atmosphere that metrologists refer to helicity, which is very important in determining whether or not one of these supercells is going to actually produce a tornado or not.

Q. But am I right in understanding that you can't look at any of the radar images that are included in the data on which you based your report and say this radar image shows the existence of a tornado at the McIntosh residence, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: It's not possible to definitively tell that by radar one way or the other. Either to positively confirm or to positively rule out the existence of that feature at the McIntosh place.

BY MR. BONDS:

Q. Okay. And is it also true that you cannot point to any specific radar image and say this image shows severe convective activity at the McIntosh residence, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Actually, that is not true. We did have several cells that moved over the McIntosh neighborhood that contained very intense convection.

MR. SCRUGGS: Can we take a five-minute break?

(A recess was taken.)

BY MR. BONDS:

Q. Before we broke, I was asking you some questions about radar and satellite images of meteorological phenomena and how they might relate to what took place on the ground.

Let me ask you with respect to tornados. Am I correct in understanding that the National Weather Service did not confirm the existence of any tornados along the Mississippi Gulf Coast during Hurricane Katrina, correct?

MR. SCRUGGS: Object to the form. Assumes facts not in evidence.

THE WITNESS: The typical protocol for a National Weather Service office -- and in this case the office in Slidell is responsible for the Mississippi coast -- is to go out and do a survey afterwards and look for the kind of damage that would be expected from a tornado. And that kind of forensic analysis was really not practical or possible after Katrina because of the subsequent surge event.

So a lot of the Mississippi coast in my opinion -- again, this is strictly my opinion, but it's consistent with meteorological reasoning -- is that there may or may not have been the kind of tornados that you typically see spawned by landfalling tropical cyclones along the Mississippi coast. But any evidence of them was later washed away by the extreme surge event that followed.

So such an effort by the National Weather Service office wasn't possible after Katrina.

BY MR. BONDS:

Q. Now, regarding convective activity, I understood your testimony before we broke to be that you can see supercell paths that crossed in the vicinity of the McIntosh residence, right?

A. Yes, sir.

Q. I guess my question to you is: As a scientist, can you say that such images prove that there was any severe wind damage on the ground beneath that meteorological radar or satellite picture?

MR. SCRUGGS: Object to the form.

THE WITNESS: Again, I typically don't get involved in the forensic aspect of it where I talk about damage to a property because part of the -- part of what I'm dealing with then is how the property is constructed. But what I can say is that there were -- there were thunderstorms that were imbedded within feeder bands and the outer eye wall that moved over the McIntosh property that certainly, with 100 percent certainty increased the wind speeds at the surface above the large scale ambient hurricane wind field in north Biloxi at that time. In other words, these cells were strong enough to have locally increased the winds.

Typically what I estimate is that these kind of cells to the intensity that I saw, the ones greater than 50 decibels of radar reflectivity enhanced the wind field by somewhere between 30 and 35 miles per hour above the ambient hurricane wind field. That's primarily in the form of 3-second gusts. But if you have enough 3-second gusts strung together, they can increase the sustained winds by some also.

But what I contend is that I believe that the cells were strong enough to have enhanced the winds by somewhere between 30 and 35 miles per hour in the form of gusts.

BY MR. BONDS:

Q. Okay. And am I right in understanding that that 35 -- 30, 35 percent estimate on your part is based on your meteorological judgment, as opposed to being based upon any actual measurements that were taken on the ground?

MR. SCRUGGS: Object to the form.

THE WITNESS: That's correct. There were no measurements taken on the ground in that neighborhood.

BY MR. BONDS:

Q. Now, you say on page 5 -- page 6 of your -- I'm looking at my notes to make sure. In the next to the last paragraph on page 6, you note that large scale winds that you were describing in the first part of that paragraph, while not generally recognized to have been sufficiently stronger to cause significant damage, the cumulative toll of this wind stress for four hours undoubtedly weakened the structures in the area.

Do you see that?

A. Yes, sir.

Q. My question to you is: First of all, you're not an engineer, correct?

the meteorological phenomena that you observed that formed the basis -- let's withdraw that question and start again.

The radar returns or other images of meteorological phenomena that you observed as part of expressing the opinions about tornados and convective activity that we've talked about are meteorological conditions that would not be confined, in all likelihood, to the McIntosh property itself, correct?

A. That's correct. You would expect them elsewhere.

Q. And if those meteorological phenomena caused wind damage on the ground, you would expect to see that damage through the neighborhood generally as opposed to confined to the McIntosh residence itself, correct?

MR. SCRUGGS: Object to the form.

THE WITNESS: Again, I -- that's not what I specialize in and I would be speculating at this point. Different properties respond differently to the same winds. A lot of it depends upon the construction of the building and the microscale factors involved regarding the terrain, trees, the surrounding houses,

CROSS-EXAMINATION

BY MS. PLATT:

Q. Mr. Henning, my name is Kathryn Breard Platt. I'm one of the attorneys who represents Forensic Analysis and Engineering Corporation. I apologize if I ask something that has been already asked to you. I could hear most of what was being said, but I didn't necessarily catch every single question and answer set forth today.

Did you actually visit the McIntosh property?

A. No.

MR. SCRUGGS: Object to the form. Asked and answered.

THE WITNESS: No, I did not.

BY MS. PLATT:

Q. Can you say whether or not their home did in fact receive storm surge?

MR. SCRUGGS: Same objection.

THE WITNESS: I have not visited the location. But based on -- based on the elevation and its location, scientifically, I would argue that even though I was not asked to make any statements regarding the surge, that the answer is yes, that it did receive surge.

CERTIFICATE OF REPORTER

STATE OF FLORIDA)

COUNTY OF BAY)

I, Lisa Jeter, Registered Professional Reporter, certify that I was authorized to and did stenographically report the foregoing deposition; and that the transcript is a true record of the testimony given by the witness; that the witness did not waive reading and signing.

I further certify that I am not a relative, employee, attorney, or counsel of any of the parties, nor am I a relative or employee of any of the parties' attorney or counsel connected with the action, nor am I financially interested in this action.

LISA JETER, RPR
Registered Professional Reporter

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

LYDIA D. SCHULTZ PLAINTIFF

VS. CAUSE NO. 1:06CV449-LTS-RHW

STATE FARM FIRE & CASUALTY COMPANY DEFENDANT

DEPOSITION OF RICHARD HENNING

Taken at the instance of the Defendant at the offices of Merlin Law Group, 368 Courthouse Road, Suite C, Gulfport, Mississippi, on May 4, 2007, beginning at 10:40 a.m.

APPEARANCES:

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And then the -- the increase in surge depth was not as gradual as what's depicted in the -- the ADCIRC charts from both Mississippi State and from Stennis Space Center.

Q. And what you're gesturing at again is Figure 23?

A. Yes. What I'm showing is the -- I'm trying to represent the -- the gradual nature of the -- of the rise in surge as depicted by -- by most of the ADCIRC model outputs --

Q. And when --

A. -- which --

Q. -- was -- I'm sorry.

A. -- I'm sorry -- which I consider to be somewhat unrealistic as to how -- how they compare to what actually happened in nature. What we had was a -- was a -- a much quicker rise in water than what's depicted in these outputs.

Q. Could the Flick Scripps Oceanographic Institute's ADCIRC version that provides higher resolution have the potential for altering your opinions concerning the timing of the max surge and max wind at the Schultz residence?

A. Not significantly, because even before I had looked at Dr. Flick's work, I adjusted these values in

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the surge column to reflect what I believe was the more sudden rise in water. These values do not adhere strictly to the ADCIRC model. I follow what I believe is a more realistic depiction of -- of a very gradual rise in surge through approximately 8:00 o'clock in the morning, and then a more rapid increase in surge from approximately 8:00 o'clock in the morning to 9:30 in the morning, and then an extremely rapid rise in surge at approximately 10:00 o'clock.

Q. And, again, you're referring -- I'm sorry to interrupt -- to the Hurricane Katrina wind and surge profile --

A. Yes, sir.

Q. -- for the Schultz residence? Okay. Well, are you saying now that you didn't get that data, which you've manually inputted into that column styled "Storm Surge Above MSL," from the ADCIRC?

A. The -- I -- I used the ADCIRC for -- to help reinforce my confidence in the final surge height, and in -- somewhat in the -- the characterization of -- of the -- the rate at which the surge increased. But -- but I adjusted the numbers to -- to flatten out the rise in surge early and to accelerate the rise in surge late to take away some of the smoothness in the ADCIRC representation of the surge rise. I did that manually.

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the storm in Breeden Place and to have experienced the eye and to have identified that period of time as being dead calm?

A. I -- yes. That -- that would -- that would change some of my opinions. The -- the problem I have sometimes with eyewitness accounts -- the biggest problem I've noted -- and I've -- I've read many of them from Hurricane Ivan in particular -- is that the timing is often wrong -- is that they -- sometimes people's -- either don't have a watch or their power is out, and their -- their descriptions are -- are estimates. And the time estimates can be deceiving a lot of times especially since people -- sometimes if a storm strikes late at night, they haven't slept for over 24 hours as they've been preparing for their -- for the storm event. They're tired. And later on their recollection of the facts is -- is blurry in terms of the timing.

As far as what they're observing, I -- I -- I can't question that because they -- they were there, obviously, and they saw what they -- what they saw. The biggest problem I have, again, is in the -- the timing, some of their recollections of the -- the chronology.

Q. With regard to the HURRTRAK program, would you agree with me that the H*Wind product would produce both sustained as well as gust values lower than what you is just a schematic --

Q. Is it --

A. --really.

Q. -- proportionate to scale?

A. It's -- it's proportionate to scale, and the wind directions on it, I think, are very useful because the wind directions are -- are -- are accurate. They're a good depiction of the -- the wind field swirling into the storm. I don't want to -- people to focus too much on this big doughnut red ring in that everything on the western side of it is unrealistically high in wind speeds.

Q. And you've discussed that?

A. Yeah. So it really should be a -- a half circle --

Q. Oh, sure.

A. -- or -- or -- or the southwestern quadrant of it should be removed. But other than that, it -- it provides a good reference for the arrival of the most intense winds, the arrival of the eye itself. And, again, inside the eye, HURRTRAK just has all the winds as zero through the entire -- all of the area inside the eye, which is unrealistic. That does -- that's not what occurs.

Q. Why would HURRTRAK not take into account the

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Q. And you're not saying that's not defensible? That's just not how you approached it.
A. That's right.
Q. And we talked, I think, on another occasion about how specifically with regard to the Timber Ridge dropsonde -- how the dropsonde itself leaving the aircraft and on its five to eight minute track --
A. Actually it's about three minutes.
Q. Three?
A. It --
Q. Minutes?
A. -- takes about three minutes to fall from 10,000 feet down to the surface.
Q. Down from flight level winds to the surface it's passing through features or structures or weather conditions which should be accounted for in terms of arriving at a final velocity?
A. It's -- I -- I am aware of the -- the type of conditions that it fell into. It fell into what I refer to as stratiform rain, which are the -- for example, if we look at this 9:31 Mobile radar site, the -- the most intense precipitation had already moved through. And this was the -- what's supposedly represented on the screen as -- as greens that you can see on my computer. It has areas -- areas of green and blue. That's the type

of -- of rainfall that it fell into, not an area of yellow, orange and red.

So taking that into account, what I -- what I interpret that to mean is that the -- the large scale hurricane wind field had winds as much as 150 miles per hour at 350 meters above the surface. It's -- it's very common for intense hurricanes to retain a lot of those winds in those layers above the surface between 300 meters and 1,000 meters for a long period of time after the storm begins to weaken. They -- the winds take a long time to spin down at that level because there's no friction. There's very little friction.

What's -- what is the case is that the winds at the actual surface spin down much more rapidly. That those -- that those 150 mile per hour winds still existed. I don't think anybody at the Hurricane Center would doubt that those winds still existed as they see it in the dropsonde data, not only in -- at -- in the 9:22 Pass Christian dropsonde, but dropsondes off of the coast of Pascagoula and -- and Stennis Space Center and all the other dropsondes that we've looked at. They see that stronger wind field that -- that is persistent with the -- with the storm.

The question, the million dollar question, to them is how much of that gets translated down to the

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surface? And you can see in that dropsonde that the winds had already dropped off considerably in Pass Christian because the -- the maximum winds at that point were -- were less than 100 knots at the surface. And, again, I believe that with stratiform light rain without the convection, there's -- there's little mechanism to transfer those winds down to the surface.

Q. There's what?

A. There are -- there is little mechanism available to transfer those winds down to the surface. And so my -- my theory is that around 9:00 a.m. that there was a mechanism to transport it down to the surface, that being the very intense convection that was occurring in the -- in the Pass Christian, Bay St. Louis, Waveland area within the inner eyewall. And that a considerable amount of those 153-mile-per-hour winds made -- made their way down to the surface.

Q. Why do they have to adjust anyway? Why do they have to extrapolate? Is it a matter of technology that they're not getting the readings consistently all the way down?

A. That's correct. The -- the -- the winds in the sonde are -- are -- are -- we're going to stop receiving the data at a certain point above the surface. We never have data go all the way down to the surface.

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It -- sometimes we're lucky enough to get it down to 10 meters or to 15 or 20 meters. But typically if -- if you get winds down to 30 or 40 meters above the surface, you're doing -- you're doing really well with the dropsonde.

Q. If you've got that convective structure that it's passing through, that in turn, I take it, would tend to maintain the higher velocities that you see at flight level; is that fair to say?

A. Well, not necessarily at flight level, but in that -- that boundary just above the surface, that 300 meters to 1,000 meters. That's well below our flight level.

Q. Sure. Absolutely. And I didn't mean to misrepresent that. But isn't there another contravening factor that could reduce the winds, such as blockage from buildings or --

A. Yes.

Q. -- terrain?

A. Absolutely. That's why -- that's why typically surface winds are -- there -- there is a -- if -- if you don't have -- if you don't have anemometer readings, you have to assume that there is a -- a certain amount of reduction in the surface winds because of that, because of the terrain and -- and things blocking it,

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and -- and mainly friction from the earth's surface.

Q. So in a sense, that's why there is an adjustment factor?

A. Yes.

Q. All right. I'm just about done. I don't think we asked it in this deposition. So just for purposes of completeness, we've got Figures J4A, J4B -- we don't need to go to those, Colonel -- which consist of the plots of the 123 potentially tornadic MCVs -- unless to answer this question you need to -- did any of those that are represented in those files pass over or in reasonable proximity to impact the Schultz residence, pass over close enough to impact, in your opinion, the Schultz residence?

A. Actually -- actually the answer is, yes, because we -- we discussed yesterday a pattern of -- of points that was south of Pass Christian that moves right over Bay St. Louis, so the southern end of Bay St. Louis and the northern end of Waveland in the -- in the -- in the area around Breeden Place.

Q. Okay. And apart from that, do you have any other meteorological evidence to indicate that these are indeed MCVs?

A. Well, we looked at the -- the radar reflectivity products, and I described the -- the fact

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that some of the radial velocities associated with those products contained some rotation in a couple of them.

Q. And however that may be, you're not here to testify that any of them created a tornado that impacted the Schultz residence?

A. That's right. There's no way to tell that.

MR. SHANLEY: All right. I thank you so much, Colonel Henning. I tender the witness.

MS. TROTTER: I have no follow-up questions.

(Off the record.)

THE WITNESS: I burned that disk, so this the -- the double eye -- this is the double -- what I'm presenting is the double eyewall paper by Blackwell, Fitzpatrick and Velden at the interdepartmental hurricane conference in New Orleans in March of 2007. This is a copy I'm providing to the Merlin group.

MS. TROTTER: That's the double eyewall presentation?

THE WITNESS: Yes.

(Time Noted: 1:46 p.m.)

(Exhibits 4-5 marked for identification.)

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

HELEN DAVIS PLAINTIFF

VS. CAUSE NO. 1:06CV574-LTS-RHW

STATE FARM FIRE & CASUALTY COMPANY DEFENDANT

DEPOSITION OF RICHARD HENNING
VOLUME II OF II

Taken at the instance of the Defendant at the offices of Merlin Law Group, 368 Courthouse Road, Suite C, Gulfport, Mississippi, on May 4, 2007, beginning at 8:47 a.m.

APPEARANCES:

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REPORTED BY: Sherry L. Purvis, CSR #1566
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Exhibit 'D'

exhibit to the Carbine deposition -- was that the same conference? Oh, that was a 2006 conference?

A. Yes, sir.

Q. Okay. All right. And I know we had talked about it in a previous deposition. For purposes of this record, it's true that you have authored approximately 170 reports since 2005?

A. Yes.

Q. Okay. And approximately 100 specific to Katrina?

A. Yeah, something over 100, and I don't know the exact number.

Q. Okay. And all of those, is it safe to say, we're prepared on behalf of a homeowner?

A. No. There are a few outliers that aren't the -- what I would consider the -- the vast majority of them are in cases where homeowners were acting as plaintiffs versus an insurance company, and where I was contacted by a -- a law firm representing those plaintiffs. Those are the vast majority. There are a few outliers. One of them is for Balch & Bingham, their Crowley container case. They are acting -- Crowley, Chiquita and Dole are acting as defendants in a suit brought by homeowners in the Gulfport, Long Beach, Pass Christian areas where approximately 150 containers washed

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aircraft this year. It'll be the first season that we fly them into -- into hurricanes. The NOAA P-3 aircraft that are flown by the -- the NOAA hurricane research division have been flying with the SFMR for the three years on their aircraft.

Q. And understanding that there is some disagreement within the field concerning the proper adjustment from flight level wind to surface wind in interpreting or in extrapolating what the surface winds would be, that's a disagreement among and between meteorologists, would you agree?

A. Yes.

Q. I mean you're not contending that the Hurricane Research Center had any agenda?

A. Oh, absolutely not. I -- I know most of the folks that work at the hurricane center and the hurricane research division, and I've known them since I began going to conferences in 1997, and had a lot of -- a lot of discussions with them both officially and unofficially, and I -- they're -- they're outstanding scientists. Ultimately what they're -- they're doing what -- what every scientists should do, and that's just search for the truth. And -- and I don't -- I don't think they have any -- any sort of reason to -- to fudge their data one way or another.

Sherry Purvis, CSR - (601) 605-0229

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

REBA J. ECHEZABAL,

PLAINTIFF,

vs. CIVIL ACTION NO.: 1:06-CV-005220-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY,

DEFENDANTS.

______________________________/

DEPOSITION OF RICHARD G. HENNING
JUNE 27TH, 2007
VOLUME 1 of 2
(Pages 1-198)

The deposition of RICHARD G. HENNING was taken in the above-styled cause by the attorney for DEFENDANT, on Wednesday, June 27th, 2007, commencing at 3:00 p.m., at the offices of Destin Reporting, 910 Airport Road, Suite 3A, Destin, Florida, pursuant to Notice.

REPORTED BY: TRACY LEFEBVRE, COURT REPORTER
& NOTARY PUBLIC, STATE OF FLORIDA

particular location. Is it my understanding that your methodology would be to first look at the reflectivity reflected on these radar screens, but then also as a separate method also look at radial velocity, which we haven't gotten into yet?

A. That's correct.

Q. Okay. So you use those two things and combine them to determine in your mind or formulate an opinion in your mind as to whether or not a tornado occurred at a certain location?

A. Actually, that's not -- that's not -- I can't take it that far. What I'm looking for are cells that are candidates to potentially have been tornadic. There's no way to tell for sure in most land-falling tropical cyclone situations that a tornado occurred because the tornados that are generated by land-falling hurricanes and tropical storms and depressions, which I lump together as tropical cyclones --

Q. Uh-huh (indicating affirmatively).

A. -- those types of funnel clouds and tornados tend to be very transient features. They tend to form, go through their life cycle and dissipate within a period of just a few minutes. And the temporal resolution of the radar, that is the time step of the radar, is every five to six minutes. What we're looking at are snapshots. Each of these radar frames that we're looking at are somewhere either five or six minutes apart.

There are tornados that go through their whole life cycle in between a couple of these frames that are never seen. They're also generally, in a land-falling tropical cyclone, too small to be actually seen on radar. So what you're looking for is the parent cells that could potentially generate them.

Q. Okay. So as a meteorologist, when you are looking at this reflectivity and the radial velocity, which we haven't gotten into yet, and you're looking at those things and you're combining them to formulate opinions, you're saying that it's never going to be your opinion to a reasonable degree of meteorological certainty that a tornado actually touched down without some additional information; is that right?

A. That's correct. Using radar for, again, for the types of tornados that occur within feeder bands and the eye walls of a land-falling tropical cyclone, it's difficult to tell in most cases -- in the vast majority of cases, you cannot definitively say whether a cell either did produce a tornado or did not produce a tornado based strictly on radar data. You can say that this is a candidate. This is, you know, a good candidate to have been a tornadic MCV, but you can't say for certain that it produced a tornado unless you have some sort of other way to determine that, either by looking at the damage or eye witness testimony or something like that.

Q. Okay. So to elaborate on that, when you're talking about you can't ever say to a reasonable degree of meteorological certainty that a tornado touched down at a specific location just by looking at radar data -- that's what you said, right?

A. Yes.

Q. Okay. By radar data, you mean the reflectivity information and the radial velocity information?

A. That's correct.

Q. Okay. I'm sorry. Go ahead.

A. Yeah. If you want to talk more about the radial velocity product, part of the problem with the, what people refer to as Doppler radar, which is the NEXRAD WSR-88D radar system, is that it was designed in the 1970's and the early 1980's to look for classic Midwestern tornados, the ones that occur in Oklahoma and Kansas that are the most deadly that occur for a half hour or 45 minutes, an hour at a time, that sometimes cover several dozen miles in a long track similar to what was seen in Enterprise, Alabama and places like that. That is what the WSR-88D was designed to detect.

You will not have that kind of a signature, that kind of a definitive signature with either reflectivity or with radial velocity products with a land-falling tropical cyclone. There's lots of reasons why that is the case, but one of the primary reasons is that the entire circulation of the storm is rotating.

Q. That's right.

A. And what that tends to do is it tends to confuse the computer algorithm that is built into the WSR-88 that tries to pick out what we call TVS's, tornado vortex signatures. Most people that are trained in looking at Doppler radar outputs looked for those TVS signatures that are automatically generated by the WSR-88 system. And, typically, you will not get those in a

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

REBA J. ECHEZABAL,

PLAINTIFF,

vs. CIVIL ACTION NO.: 1:06-CV-005220-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY,

DEFENDANTS.

_______________________________/

DEPOSITION OF RICHARD G. HENNING

JUNE 27TH, 2007

VOLUME 2 of 2
(Pages 199-248)

The deposition of RICHARD G. HENNING was taken in the above-styled cause by the attorney for DEFENDANT, on Wednesday, June 27th, 2007, commencing at 3:00 p.m., at the offices of Destin Reporting, 910 Airport Road, Suite 3A, Destin, Florida, pursuant to Notice.

REPORTED BY: TRACY LEFEBVRE, COURT REPORTER
& NOTARY PUBLIC, STATE OF FLORIDA

to the storm surge part summary, which is the last three pages?

A. Uh-huh (indicating affirmatively).

Q. On the -- let me look here. On the second paragraph you state: "As it is often seen with extremely high surge events, the water rose very rapidly and then receded back into the gulf quickly." And then you go into some calculations about the time frames by which the storm surge came upon the Pass Christian, Henderson Point area and then receded. Where did you get those times from?

A. What I rely on quite a bit is the ADCIRC model runs that were done after the storm. ADCIRC stands for Advanced Circulation Models and the SLOSH models. SLOSH is an acronym, S-L-O-S-H, which is -- I have both the standalone SLOSH model and the SLOSH model variant that's embedded within HURRTRAK. And --

Q. Okay. Let me stop you just one second --

A. Sure.

Q. -- just so we don't have to go into another hour explaining the differences between the two.

A. Sure.

Q. Let's make sure we can all agree. I want to calculation as to storm surge as it comes inland from the ocean. But what happens is, is that it bases its calculations as if the earth were flat and there was no topography, no terrain, no other bodies of water to slow it down or speed it up; isn't that right?

A. No. It does use terrain, but it uses a -- it's limited by the resolution of the model.

Q. Okay.

A. In other words, it's a very pixilated depiction of the topography.

Q. Okay. And so what you're saying is the numbers that you put here with regard to time frames are not exactly extrapolated from the ADCIRC models, but you use those in coming up with your figures, right?

A. Yes.

Q. Okay. So how do you get from the figures that are on the ADCIRC model to what you put in your report?

A. What I do is I take the ADCIRC curve, and I alter it to account for the fact that the acceleration of the surge depth occurred more rapidly than what's depicted in the ADCIRC model. The ADCIRC model gently and gradually increases winds to be brought down to the surface. None of those were captured by the dropsondes.

Q. Okay. So that was going to be my question. It's your opinion -- I guess my question is, is it your opinion that if that same exact dropsonde had have been released from the aircraft at the exact same place perhaps 10 or 15 minutes earlier, you would have gotten a very different reading from the dropsonde?

A. It's very likely that we would have seen stronger winds at the surface.

Q. Closer to the ground?

A. Yes.

Q. But you don't have any objective evidence to support that theory, correct?

A. No.

Q. Let me just do a few housekeeping and a few follow-up questions, and I think we're going to be done. I just want to make sure that I clarify for my purposes that, again, that you didn't do any independent site specific evaluation of the Echezabal property in particular, did you?

A. No.

Q. And so you don't know from your own observation, you don't know if there was anything

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

BARBARA A. CANDIOTTO,

Plaintiff,

vs. Civil Action No.: 1:06CV518

STATE FARM FIRE &
CASUALTY COMPANY,

Defendant.

_______________________________/

The deposition of RICHARD G. HENNING was taken by the attorney for Defendant, pursuant to Notice before Tracy A. Lefebvre, Court Reporter and Notary Public, State of Florida, on Monday, July 2nd, 2007, commencing at 3:30 p.m., at the offices of Destin Reporting & Technology Group, 910 Airport Road, Suite 3A, Destin, Florida.

papers that have been published by meteorologists that have studied Katrina, research papers. And none of those have changed the findings that I had in the report, though. Generally, what this new material has done is served to further illustrate some of the points that I make in the reports.

Q. Okay. Have you produced those additional reports in any of this litigation?

A. Yes. It's been part of the disk for each of the updated reports. If I'm asked about an updated report in a deposition, the disk will include all of the new papers. If it's an older report where I have obviously had an opportunity to look at new material since then and the report itself has not been updated and I refer to any of the new material, I do provide any of the new papers that I've looked at since then on disk. I've done that routinely in several depositions recently.

Q. Okay. But the report for the Candiotto residence, which is located at 426 North Central Avenue in Waveland, Mississippi, this is not a report which you have any plans of updating; is that correct?

A. At this point, no. I have not been asked to update this report.

MR. WEATHERLY: Jeff, let me say this. Let me interject something, that it may well be that we'll get you a supplemental report that includes this additional information. I don't believe it's going to change his ultimate opinions.

MR. PIERCE: Okay.

MR. WEATHERLY: But if we do send it to you, obviously, you have a right to reopen the deposition and question him about whatever these supplemental materials might bring out.

MR. PIERCE: Okay.

MR. WEATHERLY: I would suggest we handle it that way, that I anticipate you will get a supplemental report. Obviously, you don't have the most recent version of what's going out now, and we would not object to you re-deposing Colonel Henning in the event you wanted to on those supplemental matters.

MR. PIERCE: Great. Thank you.

MR. WEATHERLY: Okay.

BY MR. PIERCE:

Q. What additional information is out there? What additional reports are out there?

A. There have been several papers written recently.

Q. Do you know specifically what they are?

A. Yes. There's a very important paper that was published in the April 2007 bulletin of the American Meteorological Society by Mark Powell and Tim Reinhold that discussed the overall destructive potential of Katrina expressed as, what they refer to as integrated kinetic energy. It takes into account the size of the storm, the fact that Katrina was an abnormally large hurricane in terms of aerial coverage. And that's a very important factor to consider above and beyond the Saffir-Simpson scale, Category One through Five.

And I consider that to be a good piece of substantiating data that helps to support some of my -- some of the assertions in my earlier reports. So all of the reports that I write now include references to the Powell paper.

The same is true for a couple of papers written recently by Dr. Keith Blackwell at the University of South Alabama Coastal Studies also make -- it's obvious to me that you haven't had the benefit of these in advance so, you know, if you wanted to question him about them, you should have the right to look them over in advance so you can be prepared to question him. And I would suggest that if you feel like you need to go back over these additional materials, that you just let us know, and we'll set the deposition -- you know, re-notice the deposition.

MR. PIERCE: Yeah. We might have to do that. You know, I dont' know --

MR. WEATHERLY: You may find out after you review them and get the supplemental report from us, you may choose not to re-depose him, but that will be your call.

MR. PIERCE: Okay. Are there any plans right now to do a supplemental report?

MR. WEATHERLY: I think so probably.

BY MR. PIERCE:

Q. Have you been asked to do one?

MR. WEATHERLY: We typically do that in these cases. We just haven't got around to it in Candiotto.

A. That's exactly right. Their office -- both their offices in Gulfport and Bay St. Louis have been asking me to do a lot of updates to reports recently. And part of the problem for me is I've been doing a lot of depositions lately and doing a lot of traveling.

Q. And you can't be two places at once --

A. I can't be --

Q. -- and doing two things at once?

A. Exactly. So it's basically come down to a matter of time management. I'm getting to them as fast as I can. For example, I just found out about the Candiotto deposition last week, that we would be having it today so I did not have enough time to prepare an update.

One thing that I can offer is that all of the papers that I've just mentioned from Dr. Blackwell and the paper by Dr. Powell have been discussed extensively in recent depositions --

Q. Okay.

A. -- taken by State Farm attorneys.

Q. Okay.

A. So they are available in transcripts of other depositions, a discussion of these materials.

Q. And how you're relying on them in supplementing certain reports that you've already supplemented?

A. Yes, sir.

Q. All right. And is there anything that you can think of right now, and I know that you haven't really put pen to paper to supplement this report, but how is it that you would use this information to supplement a report just generally speaking?

A. What I've been doing is I've been inserting new paragraphs into an old report with this new information. Some of the verbiage in the existing paragraphs has been altered to some degree, but primarily it's a matter of just pasting in new paragraphs that deal with these new papers and this new information.

In this case, nor in any of the other cases recently, in this case I don't see where any of the new information would change my findings as far as wind and surge. And generally they haven't.

Q. Okay.

A. They haven't changed my estimations for maximum sustained winds or maximum gusts or when those gusts occurred or the magnitude of the surge and the timing of the surge. It's, again, primarily been a matter of the new material being added to the reports to help substantiate some of my findings as further evidence.

Q. All right. Now, other than the three additional sources that you've listed today -- and that's Dr. Powell's article, Dr. Keith Blackwell's written extensive double eyewall study and then Dr. Blackwell's Power Point presentation, is there any additional information that you've got which I would not have today in the Candiotto matter?

A. Yes. And, again, none of this is incorporated into any new Candiotto report yet, but it's material that has been incorporated into new reports. And that is papers written by members of the laboratory at Texas Tech University.

Several individuals from Texas Tech set up towers at Stennis Space Center and at Slidell. And I have written about the results of those towers that were set up and referenced at least two of their papers. I have -- again, I have both of those, I believe. Let me find the exact copy -- or the exact title. It will take me a

IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF MISSISSIPPI

SOUTHERN DIVISION

LYNN H. LOTT and CAMILLE W. LOTT,

Plaintiffs,

vs. CASE NO. 1:06cv315LTS-JR

STATE FARM FIRE AND CASUALTY

COMPANY and HANCOCK BANK,

Defendants.

_______________________________________/

The Deposition of RICHARD HENNING, taken by the attorney for the Defendants, commencing at 1:30 p.m., on the 10th day of May 2007, at 348 Miracle Strip Parkway, Suite 11, Ft. Walton Beach, Florida, before Patricia C. Stephens, Certified Shorthand Reporter in and for the State of California and Florida Notary Public.

Hunters, along with any surviving wind anemometer readings that may be present along the coast, buoy data, satellite data, radar imagery, and then computer models, and they then come up with these values manually. They use their experience and create the advisories by hand.

Q So they take the different data sources and evaluate them basically on a case-by-case basis to arrive at the values that they put into the system to arrive at the wind speed at a particular point?

MR. MYERS: Wait a minute. Are you talking about the federal agency, or are you talking about Hurrtrak employees?

MR. CORLEW: The federal agency.

MR. MYERS: Okay.

BY MR. CORLEW:

Q That's who creates the advisories?

A Yes, the federal -- yes, the specialists at the National Hurricane Center in Miami create the advisories based on all those different types of information. Again, they generate a package of products as a storm is making landfall, and the Hurrtrak program ingests those products and then creates a wind field based on those products.

Q Is there a method -- this may or may not be an appropriate question. But with respect to the

Hurricane Center in Miami, is there a method they use to convert, for example, a dropsond reading to a ground-level wind speed, or do they even attempt to do that?

A They attempt to do that. They use both dropsond data and our flight level data, which is -- for Hurricane Katrina, that morning and then the morning I was flying, is anywhere between 10,000 feet above the surface and 8,000 feet above the surface, depending on where you are in the storm. We actually descend in relation to the water going through the eye.

So they, again, use both flight level and dropsond data. And again, it's a case-by-case basis how each forecaster interprets the data. They use -- they do use reduction factors, but it depends on how they're interpreting the strength of the convection as to what kind of reduction factor to use.

Q What about with respect to some of the data -- to some of the data gathered at individual sites? For example, you referred to the Emergency Operations Center in Pascagoula.

A Yes.

Q How do they evaluate a particular reading from a site like that; do they have height or information that's that detailed?

A Normally, those kind of reports are used later to reconstruct the wind field. They tend to be sketchy at the time of landfall. And they may or may not get those kinds of reports that are referred to as unofficial reports, because there are only a handful of official national weather service or military reporting sites along the Mississippi coast, and they all were rendered offline at some point during the landfall of the storm.

So they rely on these to get these reports, sometimes by ham radio, sometimes by telephone line, however they get the information, and incorporate them into the advisories. You see that a lot of times in the verbiage of a landfalling storm, where they'll refer to reports of winds from the police or emergency management officials or some other kind of unofficial anemometer.

Q How do they confirm that, or is an attempt made to validate those results, for lack of a better word?

A In real time, there isn't much opportunity to corroborate their accuracy. They look at it to see if it's in context with the storm, with the -- what part of the storm the reports are coming from, to make sure that it isn't something that's totally nonsensical, either too strong or too weak of a value, and -- but again, they look at it and do their best to take the information that's coming in and make an estimate of the wind field. They don't rely a lot on those kinds of reports in their advisories.

Q And the advisories -- I probably should have asked you this earlier -- does the Hurrtrak rely on advisories that are generated during the storm, or is there some attempt to go back and look at the advisories to see if the data that they're getting is consistent with other data they may be receiving?

A This is the advisories that were issued during the landfall of the storm. This Hurrtrak used advisory number 27. That was issued the morning of the 29th of August.

Q What time was it issued?

A That was at ten o'clock a.m.

Q Okay. And then it's extrapolated. We talked about this a little bit early on about the Hurrtrak, but they take that data and extrapolate it across the coast; is that accurate?

A Well, extrapolate and interpolate. Probably interpolate is a more accurate word, because what interpolation does is it seeks to assign a value in between a couple of points rather than take a value and speculate on its -- take a point and speculate on its this: Did -- y'all didn't generate it, though, Rob.

MR. MYERS: I don't have to generate it for it to be work product.

MR. CORLEW: I just wanted to make sure I understood the objection.

BY MR. CORLEW:

Q Do you have any notes that you have done that aren't reflected in the reports?

A No.

Q What about data that you have generated that is not in the report, or that you relied on that's not in the report?

A No, I haven't -- that report specifically on the Lott property was completed on April 30th, and I've had the benefit of using all of the information that I have up until this point in that report. There are things in that report that aren't contained in earlier reports that I've done, because I've had the benefit of time, and so it's very comprehensive.

Q Other than meeting with Mr. Myers, did you do anything to prepare for your deposition today?

A I read over the report last night and the timeline, familiarized myself with some of the exhibits.

Q Are you familiar -- I know we discussed them to some extent -- with formulas or equations used -- and it may be just a factor, but used to convert wind speed readings at elevated levels, say, 1,300 feet to ground level?

A Yes.

Q And what are those equations?

A They're not necessarily -- they're not equations. They're really just percentage reduction factors. And again, they are used at the discretion of hurricane specialists in creating their advisory products, and then by researchers later on in doing reconstruction of the wind field. And again, sometimes they use 90 percent; sometimes they use 80 percent; sometimes they use 70 percent.

It -- I have found in writing 170-plus of these reports that -- and I have expressed this opinion in conferences, and I have done this with personal communication with a lot of these people -- that the more work I do in this, the more it shows me that applying a broad-brush reduction factor like that is inappropriate; that it's an oversimplification of the wind field, and that it's important to look at the convection that's occurring at a particular location at a particular time to determine how much of the winds aloft are translated down to the surface.

Q Are there -- you've told me basically three reduction factors, but is there scientifically accepted methods of using the reduction factors as opposed to, one researcher would use 90 percent?

A Well, it has to do with the stability of the boundary layer. The more unstable the air mass is below the eyewall of a storm or below feeder bands of a storm, the higher the percentage of winds aloft that are translated to the surface. I would agree with that premise. What I would not do, though, is apply a simple number. Like, I would agree that the number would be higher, but that number may be close to 100 percent in some cases. It may be 80 percent in other cases.

In a very stable, what we refer to as, laminar flow, with very stable air under the eyewall in a decaying storm, that number may be somewhere near 50 or 60 percent. It all depends on the stability of the air mass and the amount of convection that's occurring.

MR. CORLEW: Take a break for a second.

(Brief break.)

MR. CORLEW: I don't have any additional questions.

CROSS-EXAMINATION

BY MR. MYERS:

Q Mr. Henning, I do want to ask you some questions following up on Mr. Corlew's questions. In particular, I want to focus on the methodology and the principles you utilized in formulating your opinions in this case, and in Katrina in general.

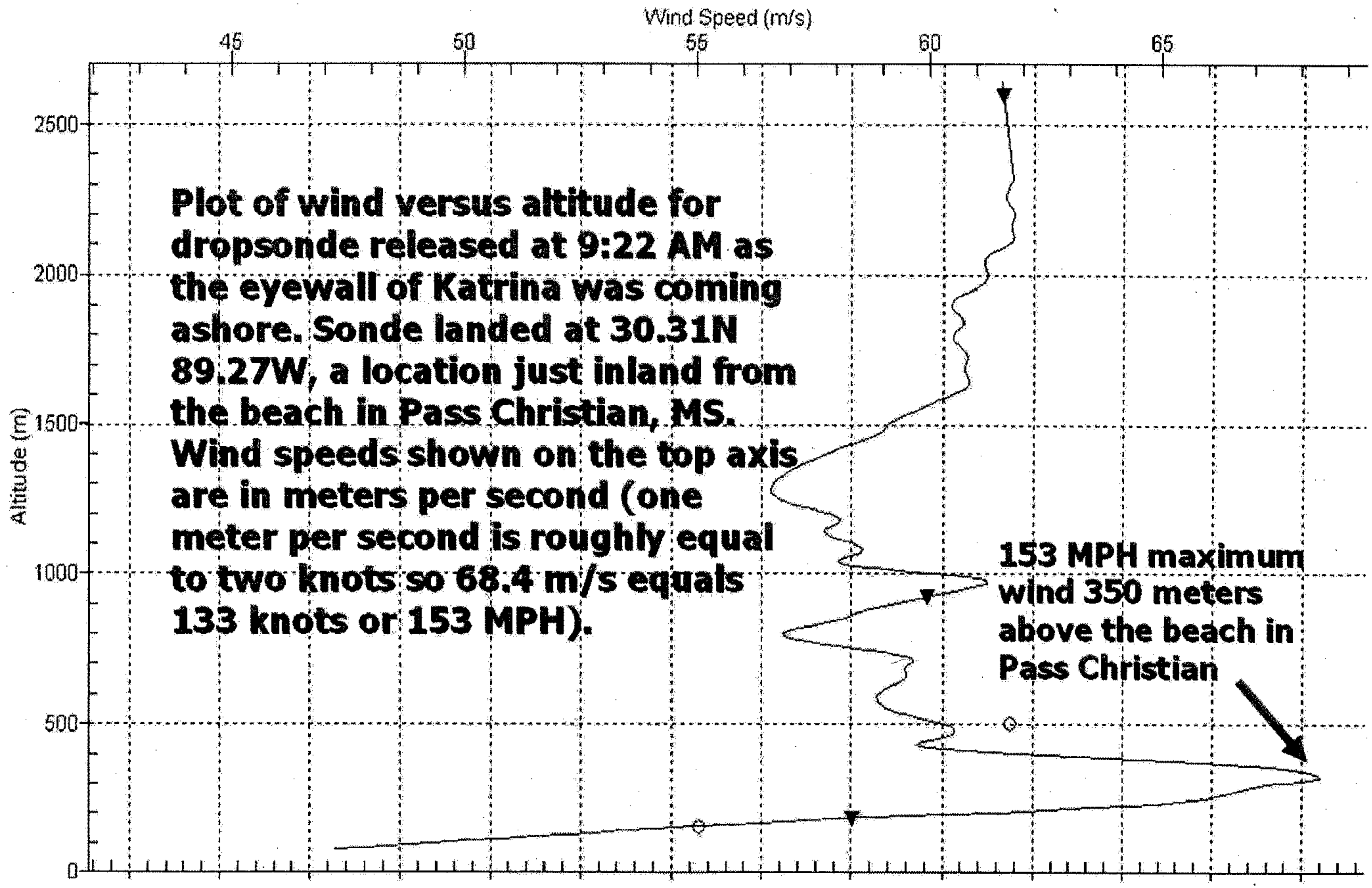
Have you applied any novel theories, approaches or methodologies? And by that, by novel, I mean that are not generally accepted in your field of expertise.

A No.

Q And as part of your job duties and responsibilities in working for the United States Government, do you not forecast the weather conditions that are -- that may approach the military base or installation, and that have approached the military base and installation in a hindcast-type analysis?

A Yes, we're -- yes, we're -- we have gone back, and in particular, Hurricanes Ivan and Dennis, how they impacted the Eglin Air Force Base. It's 724 square miles of property, and we've received a considerable amount of damage. So we went back and looked at what happened in particular parts of the base, similar to the kind of work that I've done here for this case and other cases where I've worked as a private consultant.

Q In the type of forecasting that you're


Wind Speed (m/s)
45
50
55
60
65
Altitude (m)
2500
2000
1500
1000
500
0
Plot of wind versus altitude for dropsonde released at 9:22 AM as the eyewall of Katrina was coming ashore. Sonde landed at 30.31N 89.27W, a location just inland from the beach in Pass Christian, MS. Wind speeds shown on the top axis are in meters per second (one meter per second is roughly equal to two knots so 68.4 m/s equals 133 knots or 153 MPH).
153 MPH maximum wind 350 meters above the beach in Pass Christian