J3.6 THE NATIONAL SEVERE WEATHER WORKSHOP SCENARIO: INTERACTIVE ADULT LEARNING FOR INTEGRATED WARNING TEAM PARTNERS

Dale A. Morris^{1*}, Derek Arndt², John Burchett³, Sarah Corfidi⁴ John Ferree⁵, Dave Freeman⁶, Gayland Kitch⁷, Daphne LaDue⁸, Dan McCarthy⁹, John McLaughlin¹⁰, Elizabeth Quoetone¹¹, Paul Schlatter¹¹, Rick Smith¹², Maj. Jennifer Winslow¹³

 ¹Cooperative Institute for Mesoscale Meteorological Studies, University of Oklahoma and NOAA/NWS/Warning Decision Training Branch, Norman, OK
²Oklahoma Climatological Survey, Norman, OK
³Ada/Pontotoc County (Oklahoma) Emergency Management (Ret.), Byng, OK
⁴NOAA/NWS/Storm Prediction Center, Norman, OK
⁵NOAA/NWS/Severe Storm Service Leader, Norman, OK
⁶KSNW-TV, Wichita, KS
⁷City of Moore (Oklahoma) Emergency Management and Communications
⁸College of Education, University of Oklahoma, Norman, OK
⁹NOAA/NWS Weather Forecast Office, Indianapolis, IN
¹⁰KCCI-TV, Des Moines, IA
¹¹NOAA/NWS/Warning Decision Training Branch, Norman, OK
¹²NOAA/NWS Weather Forecast Office, Norman, OK
¹³USAF and NOAA/NWS Radar Operations Center, Norman, OK

1. INTRODUCTION

The National Severe Weather Workshop (NSWW) is an annual three-day meeting of forecasters, broadcast meteorologists, and emergency managers along with researchers, practitioners and enthusiasts from both the private and public sectors. The NOAA/National Weather Service (NWS) Storm Prediction Center hosts the NSWW in partnership with the NOAA Weather Partners in Norman, Oklahoma (http://www.norman.noaa.gov), the Oklahoma Emergency Management Association; and the Central Oklahoma Chapter of the American Meteorological Society/National Weather Association. Held in late February or early March, just prior to the severe weather season, one overarching goal of the NSWW is to facilitate enhanced communications among members of the Integrated Warning Team (IWT; Fig. 1). Here, the IWT is defined to consist of NWS forecasters, broadcast media, and local emergency management (EM) officials, which is similar to the integrated warning system of Doswell et al. (1999). All members of the IWT share the goal of protection of life and property; they should have a consistent message to promote a favorable public response (Mileti and

*Corresponding author address: Dale A. Morris, NOAA/NWS/WDTB, 120 David L. Boren Blvd, Room 2640, Norman, OK 73072; e-mail: Dale.A.Morris@noaa.gov

Sorenson 1990).

In 2006, the organizers of the NSWW desired to bring a more interactive learning environment to the workshop in addition to a standard conference format. Moreover, some NSWW partners possessed an experience base in developing preparedness exercises for emergency managers and first responders, while other partners had previously designed displaced real-time simulations for NWS forecasters using the Weather Event Simulator (WES: Magsig and Page 2002, Magsig et al 2007). Based upon these factors, the NSWW planning committee decided to include a roleplaying scenario in the workshop, designed to demonstrate the need for consistent communications among the IWT.

The scenario consisted of three separate, but synchronized, displaced real-time simulations of operations by an emergency operations center (EOC), a TV station, and the



Figure 1. The three components of the Integrated Warning Team: the NWS, local public safety/emergency management officials, and *broadcast* media (TV and radio).

NWS during an actual weather event. To develop understanding and empathy among IWT partners as well as to create a level playing field, workshop participants were assigned roles that differed from their normal professions. In addition, this job-swapping approach was based upon prior human factors research. This research indicated that (1) team performance can be enhanced when team members possess similar mental models such that team members can anticipate information needs of other members; and (2) cross-training can help to increase both shared mental models and shared situation awareness (Fig. 2; Bolstad *et al.* 2005).

The three simulations featured synchronized playback of radar and other relevant weather data along with simulated field reports. While physically separated in different rooms, the simulations were linked in that information could be shared among the rooms. A variety of mechanisms facilitated these communications, including handheld radio, creation and dissemination of NWS warning products and follow-up statements, and a closed-circuit TV broadcast. As detailed in Section 2.2, the 2007 edition included augmented communications capabilities.

This manuscript reports on the technical design of the 2006 and 2007 editions of the scenario, including learning objectives, case selection, and the application of and linkages between three separate simulation systems. The discussion includes participant feedback collected through evaluations, some aspects of adult pedagogy, and future plans.

2. TECHNICAL DESIGN

A scenario leader guided each of the three groups with assistance from several subject matter experts. The leader kept the individual simulations on schedule while the subject matter experts taught the group while keeping operations as realistic as possible.

The NSWW workshop agenda spread the scenario timeline (Fig. 3) over two consecutive afternoons. After dividing the workshop participants into their assigned roles, the first afternoon was mostly devoted to basic training on the duties and responsibilities of the three roles. For example, the media group learned how the management structure of a typical commercial TV station supported and affected the decisions about severe weather coverage. To support this basic education in job roles

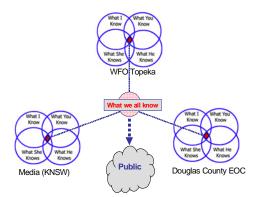


Illustration of shared situation Figure 2. awareness for distributed teams. In a single team (e.g., WFO Topeka), the shared situation awareness is the subset of knowledge shared among all team members. In a distributed team like the IWT, the concept of shared situation awareness is extended to be the knowledge shared among all components of the IWT. The better the communications among these groups, as well as a clear understanding of roles and responsibilities, the better the chance for good decision making and public service during severe weather events. Adapted from WDTB (2007) to illustrate the 2007 NSWW scenario.

and responsibilities, the first day had an "outlook/watch phase" with a compressed time format suitable for each group to analyze weather products typically viewed before full-blown operations commence.

The first day of the scenario also included a transition to displaced real-time warning operations with a specific warning decision designed to spur interest and conversation among the participants until the scenario resumed the following afternoon. The second day consisted of approximately two hours of real-time operations followed by a debriefing session. This basic design was implemented for both the 2006 and 2007 editions of the NSWW.

The scenario followed a general script. As illustrated by the 2007 version (Fig. 4), the script basically specified that certain reports delivered to specific rooms were at appropriate times. Each group then collectively decided what actions to take based on the new information including whether or not to communicate the information to the other rooms. These field reports were mostly based upon reports collected during the actual weather event.

(a) Paducah Time (May 6-7, 2003 UTC)									
	2100 - 0036	0016-0036	0036-0120	0120-0245					
Intro Day 1	Explanation of Duties Outlook & Watch Phase	Ops Day 1 Phase 1 Wrap-up	Intro Day 2	Operations Phase 2	Survey & Plenary Break Debrief				
3:30-3:45	3:45-5:20	5:20-5:40 5:40-6:00	3:30-3:45	3:45-5:10	5:10-5:40 5:40-6:00				

Norman Time (March 2-3, 2006 CST)

(b) Topeka Time (March 12, 2006 UTC)

	0600 - 1245	1245-1315		1315-1335	1335-1500		
Intro Day 1	Explanation of Duties Outlook & Watch Phase	Ops Phase 1	Day 1 Wrap-up	Intro Day 2	Operations Phase 2	Survey & Break	Plenary Debrief
3:30-3:45	3:45-5:10	5:10-5:40	5:40-6:00	3:30-3:45	3:45-5:10	5:10-5:40	5:40-6:00

Norman Time (March 1-2, 2007 CST)

Figure 3. Scenario timelines for the (a) 2006 and (b) 2007 simulations. Shaded boxes reflect times when the simulations ran in an operational displaced real-time mode.

4:19 Norman Time (1409 UTC 8:09 AM Scenario Time)

REPORT TO MEDIA via telephone (read over mic, Frantically if possible): "I'm in Lawrence just west of the campus! We just got hit by a tornado! It was terrifying! I didn't hear any warning, what's going on ?? A huge tree is down in my front vard!

4:20 Norman Time (1410 UTC 8:10 AM Scenario Time) REPORT TO MEDIA via telephone (read over mic, also frantically if possible): "I just saw a scary looking tornado move across US 59 just south of I-70 in Lawrence. There are trees down everywhere!

4:22 Norman Time (1412 UTC 8:12 AM Scenario Time)

REPORT TO NWS via telephone (read over mic): "This is KU meteorology student Matt Foster. I am calling to report significant wind-related damage on the KU campus that occurred a few minutes ago. All the windows are blown out of my dorm on the west side, two huge oak trees are down and laying on top of parked cars, and it looks like a A/C unit from a neighboring dorm landed on a car in the lot next to ours. Sounded like a tornado but I didn't see any rotating clouds'

4:25 Norman Time (1415 UTC 8:15 AM Scenario Time)

REPORT TO EM via telephone (read over mic): "Is this the Douglas County EOC? I am trying to report a tornado in Lawrence. There is catastrophic damage to the Clifton Place Apartments near 23rd and Iowa streets. A brick wall fell onto an unoccupied vehicle. It's a war zone out here, I've gotta go...I heard there is more tornado damage on the KU campus!"

4:28 Norman Time (1424 UTC 8:17 AM Scenario Time)

REPORT TO MEDIA via cell phone from station storm tracker Chase McTwister (read over mic and if possible, broadcast live): "Hi (insert name of on-camera met). Just exited I-70 in Lawrence and let me tell you there are trees down everywhere. I also saw numerous windo ws blown out of stores, and it's getting worse as I drive south. I cannot confirm a tornado caused this damage since I was trying to catch up to the storm but it was moving so fast. Damage sure looks like it was from a tornado though. I'll get back to you with some photos in just a bit. That's all for now."

4:29 Norman Time (1419 UTC 8:19 AM Scenario Time)

REPORT TO NWS via telephone (read over mic): "Trained spotter Jim Naismith III reporting golfball hall in southeast Jefferson County. I am about 8 miles southeast of Oskaloosa. The hail bet despende followed by the set 40 occession. just stopped failing in the last 60 seconds.

4:30 Norman Time (1420 UTC 8:20 AM Scenario Time)

REPORT TO EM via HAM radio: "This is Highway Patrol Officer Jake Cunningham. We've got an overturned tanker on I-70 4 miles east of Lawrence at the KS-32 interchange, roughly 1/2 mile east of the Douglas County line. The tanker is leaking an unknown hazardous material and seems to be giving off some kind of smoke, and is blocking the eastbound lanes. We are trying to close off I-70, KS-32 and US24/40 for a 2 mile radius from the accident. There is also a Union Pacific rail line less than a mile southeast of the accident but I have not been able to contact anyone about closing that off yet."

Figure 4. Excerpt from the 2007 scenario script. Note that reports were delivered to each group at specified times. The reports are based on actual reports received during the real weather event, with the exception of the overturned tanker at 1420 UTC.

2.1 The 2006 Version

The NWS group actually played two roles in sequence: (1) the Storm Prediction Center (SPC) and (2) a local Weather Forecast Office (WFO). Hence, the NWS simulation began with operations focused on long-fused watch issuance. The transmission of a severe thunderstorm watch or tornado watch to the other groups was the signal to begin the transition to full-blown short-fused, displaced real-time warning operations.

As depicted in Figure 5, the NWS simulation was driven using the Weather Event Simulator. WES consists of the NWS AWIPS (Advanced Weather Interactive Processing System) software fed by additional "data pump" software which allows AWIPS to function in a displaced real-time mode. An experienced AWIPS operator displayed radar products requested by the participants. He also used the AWIPS WarnGen software to create warning products and follow-up statements according to the group consensus. In the 2006 version, he also manually transmitted these products to a web server located at the Oklahoma Climatological Survey (OCS). To derive group consensus and to help manage large group dynamics, the NWS group used responders distributed among the group and voting software that tabulated the audience choices. The votes

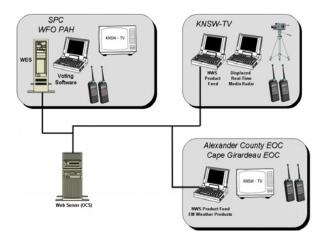


Figure 5. Schematic of the 2006 scenario.

were taken after a suitable amount of group analysis and discussion.

The TV simulation was based on FasTrac® software (Baron Services 2008) that facilitates playback of Level II radar data and generates familiar broadcast-guality radar displays. Complete with interactive scrolling and zooming capabilities, this software also provided algorithm output. This display was visualized on a projection screen. Volunteers took turns at playing the role of an on-camera meteorologist in front of the radar display; a closed-circuit TV feed ("KNSW-TV") was broadcast to the NWS and emergency management rooms. NWS products were available in the TV room using a connection to the web server.

Weather data for the EM room were fed directly from the web server. Radar data and surface maps were visualized using the WxScope Plugin (Wolfinbarger et al. 1998a,b). Custom "back-end" software provided the subset of Level III radar products typically viewed by emergency managers. This software was similar to that used by the OK-FIRST decision-support system for emergency managers (Morris et al. 2001, 2002), with one important distinction. The OK-FIRST system used the WxScope Plugin to disseminate and visualize a real-time Level III data stream, while the simulation version accessed an archive of radar products and surface data to construct the displaced real-time weather displays.

All three weather display systems were synchronized between the rooms. Some of the systems (e.g., the WES) were placed in displaced real-time mode by setting the computer clock back to the event time and allowing the computer time to move forward. Because some simulation data were delivered using an off-site web server, custom software on the web server accepted a simulation starttime as an input parameter. The server software stored the time offset between the simulation start-time and the real world time. Thus time conversion between the two time spaces could be performed at any later time to deliver the appropriate products from a timeordered archive of radar and other weather The warning and advisory products data. produced by the WES were also stored in a similar time-stamped archive on the web server but were delivered to the media and EM rooms within seconds of their production in the NWS room.

Communications between the three rooms were facilitated using two sets of handheld radios. One set was reserved for internal communications between the scenario leaders and the overall scenario director. The other set was used to communicate reports between the three rooms and to simulate any other direct communication between the offices (e.g., clarification of reports). The groups used flip-charts to log the reports and any decisions made.

2.2 The 2007 Version

Several technological enhancements were added to the 2007 edition of the scenario (Fig. 6). First, an instant messaging (IM) capability was added to facilitate information sharing among the groups. Instant messaging has been identified as a best practice by some WFOs to help share the thought processes of the warning forecaster with emergency managers and broadcast meteorologists.

Second, an onsite web server and a private computer network prevented any outside Internet outage from disrupting data transmission during the scenario. In addition, this computer setup automated the transfer of NWS warning products and follow-up statements from the WES to the web server rather than the previous manual process.

Third, feedback from the TV and EM groups of the 2006 version indicated that timely transmission of local storm reports from the NWS (both in the simulation and in reallife) was an important factor in how well the broadcasters and emergency managers could perform their jobs. Consequently, a web-

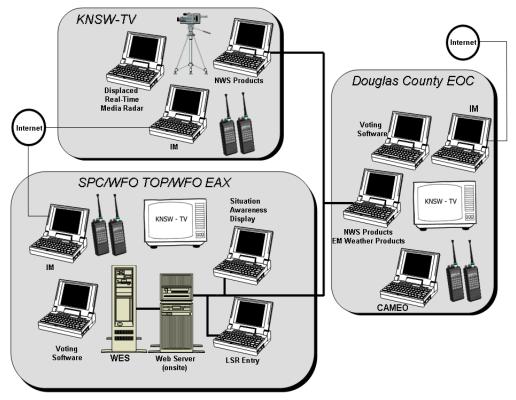


Figure 6. Schematic of the 2007 scenario. Heavy solid lines denote connectivity through an onsite private computer network.

based software interface was provided to the NWS room. A volunteer entered report details; the software formatted the report which was automatically disseminated to the other rooms as part of the NWS product feed.

Finally, the scenario planners recognized the 2007 scenario as an opportunity to provide training on the then-upcoming implementation of storm-based warnings by the NWS on 1 October 2007. Accordingly, the scenario required a method to display warning polvaons. Subsequent to its initial documentation by Quoetone et al. (2004), the Norman WFO had enhanced their situation awareness software to display polygon warnings. This web-based software was adapted for the scenario domain and to automaticallv process and display the warnings issued by the WES (Fig. 7).

The emergency management room was also augmented with a second voting system and a laptop with CAMEO software. CAMEO is a GIS-based package that uses a simple plume model to help emergency managers target evacuations during hazardous materials incidents. During the scenario, the EM group requested information about wind speed and direction from the WFO to use as input for CAMEO, as a consequence of the report of an overturned tanker truck (Fig. 4).

3. LEARNING OBJECTIVES

Because the scenario was designed to be an interactive learning experience, the simulations were constructed with several goals and objectives in mind. The overall goal of the scenario was to improve communication among the IWT members by building understanding and empathy for the other roles. The scenario planners drafted specific objectives for each group that could be covered either in the pre-briefing for the role or during the scenario itself. These objectives are listed below.

3.1 Emergency Management

- Foster support among IWT members.
- Understand limited staffing and resources of most EM operations.

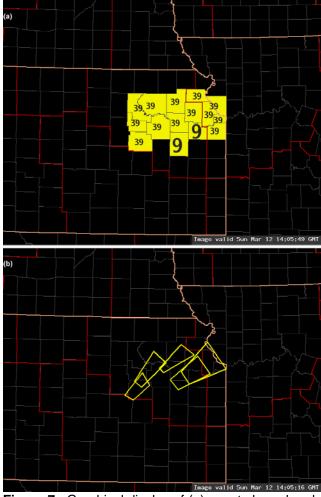


Figure 7. Graphical display of (a) county-based and (b) storm-based warnings issued by the WFO group during the 2007 scenario, valid at 1405 UTC on 12 Mar 2006. County-based image indicates the number of minutes remaining until the warnings expire.

- Understand citizen reaction to media broadcasts and the associated impact on EM and other emergency services operations
- Understand the impact of uncorrelated and "uncalibrated" spotter reports (data quality)
- Improve EM feedback to WFO and media
- Understand the jurisdictional nature of EM operations

3.2 Broadcast Media

 Understand the critical need for current information (which impacts decisions on the type and quantity of coverage)

- Understand the impact of the timeliness of WFO warning decisions upon the media
- Understand the factors that affect coverage decisions including nature of the weather threat, the number of affected viewers, time of day, and competitive issues
- Understand the balance between regular programming and weather coverage and how station management affects coverage decisions
- Understand the impact of public telephone calls on coverage and the broadcasters (complaints about the coverage, "uncalibrated" viewer reports)

3.3 NWS/Storm Prediction Center

- Understand that SPC issues watches and outlooks and WFOs issue warnings and both are part of the NWS
- Understand that coordination between the WFOs and SPC in watch issuance is time consuming and has potential conflicts
- Understand the pressures involved in issuing watches (type of watch, geographical size, duration, and lead time).
- Understand the impact of lack of reports from media and WFOs on SPC operations (especially at night)
- Understand how watches are cleared.

3.4 NWS/Weather Forecast Office

- Demonstrate challenges of warning decision-making (severe thunderstorm versus tornado warnings; how to handle warnings with no spotter reports; conflicting spotter and media reports; dealing with multiple simultaneous hazards such as tornadoes, hail, severe winds, and floods)
- Highlight the value of providing a continuous flow of information in various forms (enhanced services such as instant messaging and

graphical outlooks which are above and beyond minimum requirements)

- Demonstrate the importance of using all available data to make warning decisions, including spotter reports, media reports, and base data from multiple radars
- Demonstrate the challenges presented by communications failures (service backup operations)

4. CASE SELECTION

The scenario designers had to make several critical choices that affected the ability of the scenario to fulfill its objectives. Perhaps the most important decision was the weather event. Because the participants were in unfamiliar roles, the event could not be too difficult. In addition, the event could not be too obvious (i.e., a single isolated tornadic supercell) where the participants would not be subjected to real challenges involved with sharing information among the IWT members. The event location also affected other decisions, including the Designated Market Area (DMA) of the TV station and the jurisdiction(s) of the EOC(s).

4.1 The 2006 Version

The first version of the scenario used the 6 May 2003 severe weather episode over the Paducah, KY county warning area (CWA). This CWA covered 58 counties in southeast Missouri, southern Illinois, western Kentucky, and the southwestern tip of Indiana. Accordingly, the DMA for the TV station was chosen as Paducah/Cape Girardeau (Fig. 8). Note that by choosing only one TV DMA, the scenario oversimplified the real-world situation because CWAs and DMA boundaries do not align exactly. For example, in real-life, the Paducah WFO must deal with four media markets (Paducah-Cape Girardeau, Jonesboro, Nashville, and Evansville). Conversely, broadcast meteorologists in the Paducah-Cape Girardeau market have three separate WFOs (Paducah, St. Louis, and Memphis) which may provide somewhat different services.

To demonstrate the highly jurisdictional nature of EM operations, two EOCs with different capabilities were simulated. A municipal EOC typical of a metropolitan jurisdiction was located at Cape Girardeau, while Alexander County had a small, rural EOC with limited resources (Fig. 9). Both EOCs received the same weather information, but they had different emergency operations plans, which affected the actions they could take.

The severe weather event (Fig. 9) featured two isolated supercells and two bow echoes that produced multiple significant tornadoes, 2 in. (5 cm) diameter hail, and 80 mph (36 m/s) wind gusts. One supercell produced a 2 mi (3.2 km) long F3 tornado that damaged 200 structures in Cape Girardeau County. The other supercell spawned a long track tornado in rural areas of Pulaski, Massac, and Pope Counties. This tornado

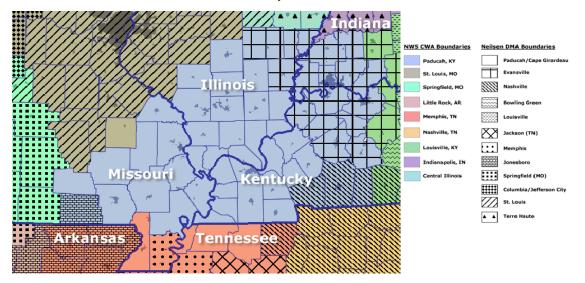


Figure 8. Real-world configuration of NWS county warning areas (solid colors) and Neilsen Designated Market Areas (stippled) for the domain of the 2006 scenario. The scenario used the Paducah CWA (blue) and the Paducah/Cape Girardeau DMA (solid shading).

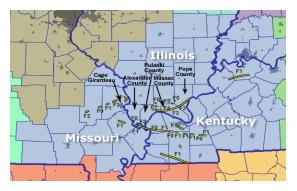


Figure 9. Approximate locations of tornado tracks and accompanying Fujita-scale ratings of the 6 May 2003 event used for the 2006 scenario. Adapted from NWS (2007).

was responsible for two fatalities and more than 30 injuries along its 33 mi (53 km) path.

4.2 The 2007 Version

The 2007 scenario focused on a severe straight line wind event in Lawrence, Kansas, during the morning hours of 12 March 2006. Halfway between Topeka, KS, and Kansas City, MO, Lawrence was located at the eastern edge of the Topeka CWA (Fig. 10). Because the thunderstorms associated with this event quickly moved out of the Topeka CWA, the scenario design included a communications failure at the Kansas City (Pleasant Hill) WFO so that the Topeka WFO assumed backup operations for the Kansas City office. The emergency management group assumed the identity of the Douglas County EOC situated in its county seat of Technically in the Kansas City Lawrence. DMA, the close proximity of Lawrence and Douglas County to Topeka (30 mi or 48 km) permitted the scenario to use a Topeka TV station (i.e., Lawrence can receive broadcast and cable TV signals from both Topeka and Kansas City stations). An additional consideration for the scenario was that the event occurred on a Sunday morning, when the TV station typically would have limited staffing.

Just after 1400 UTC on 12 March 2006, a thunderstorm moved along the west and north sides of Lawrence (Fig. 11). At 1408, the KTWX WSR-88D estimated inbound radial velocity exceeding 95 kts at approximately 4400 feet above ground level. The downburst associated with this event produced 80 to 90 mph (35 to 40 m/s) winds at the surface with

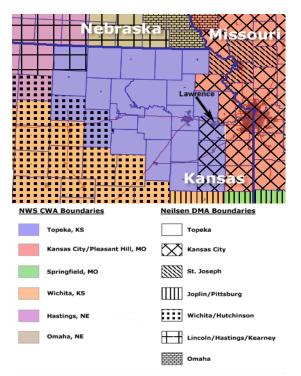


Figure 10. Configuration of NWS county warning area and Neilsen designated market area boundaries for the 2007 scenario, which used the Topeka CWA and the Topeka DMA.

widespread damage over a 3 mi (5 km) wide area in Lawrence. Some 60% of the buildings on the campus of Kansas University sustained damage. According to Storm Data, several semi-trucks were overturned during this event. As shown in Figure 4, the scenario planners decided to make one of these trucks a tanker transporting a hazardous substance along I-70 which runs through Lawrence, particularly complicating the job of the emergency managers and potentially affecting the operations of the other two rooms depending upon decisions made by the EOC.

5. PARTICIPANT FEEDBACK

During the second day of the scenario, participants were given an opportunity to complete a short, voluntary, and anonymous survey. This survey was an attempt by the scenario planners to gain some general feedback and to qualitatively learn whether perceptions of participants about the warning process and other warning team members had been affected by the scenario. Survey questions included:

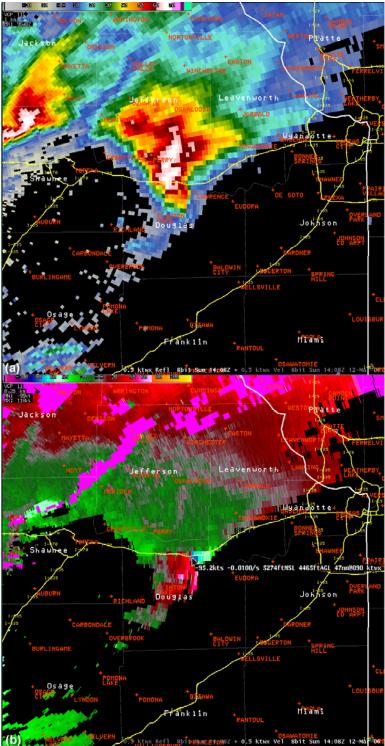


Figure 11. Base reflectivity (a) and base radial velocity (b) images from the KTWX WSR-88D from 1408 UTC on 12 March 2006.

- What did you learn about your scenario role that you didn't already know?
- What were the strengths and weaknesses of how the scenario was run?

- What changes will you make in your real-life role?
- Other comments?

5.1 TV Scenario Role

In general, those who participated in the broadcast media room seemed to gain an appreciation for difficulties inherent in doing live broadcasts. According to their responses, they appreciated the lack of time to analyze data while on the air, the challenge and pressure of keeping coverage going non-stop while receiving new information, and the staggering amount and varying quality of incoming information. They also commented about broadcast decisions based on the balance between coverage, station revenue, and ratings, and how these decisions can vary widely.

5.2 EM Scenario Role

Some of the real-life meteorologists and enthusiasts who wore an emergency manager's hat during the scenario remarked that getting a true situation awareness was difficult, based on the types of weather information received by the EOC as compared to their real profession. They also commented that the EM job is often ill-defined with too many varying responsibilities. They were also surprised at the lack of continuity of responsibilities and resources between EM jurisdictions.

5.3 NWS Scenario Role

Because the survey was distributed on the second day of the scenario, fewer comments were received about the watch phase (SPC operations) than those about WFO warning operations. Even so, some of audience members mentioned the difficulty in analyzing environmental data and outlining and issuing tornado watches.

During warning operations in the NWS room, participants seemed to learn how critical spotter reports were to their warning decisions. In some cases, they were frustrated about the lack of reports. Others remarked about the difficulty in getting reliable reports or in trusting numerous reports of varying quality. In the 2007 scenario, someone remarked about the challenge of having to produce a spot forecast for the EOC while also dealing with ongoing warning decisions.

5.4 General Feedback

Scenario participants seemed to gain some appreciation and empathy for others involved in the warning process. As a result, numerous comments were received about trying to improve the quantity and quality of spotter reports. Real-life NWS forecasters remarked about the need to provide more frequent local storm reports to help broadcasters better communicate weather threats to the public.

In general, feedback about the scenario concept itself was overwhelmingly positive. A few participants did not like being pushed outside their comfort zone, while most recognized the scenario as a unique learning opportunity.

6. SCENARIO LEARNING CONTEXT

One of the overall goals of the scenario was to develop understanding and empathy among IWT partners. Experience and observation of adult education (Knowles *et al.* 1998) and studying brain activity (Anderson 2005) have agreed that learning is highly contextual. For example, brain scans have shown that key words can activate knowledge learned during practice sessions.

The scenario planners tried to keep the simulations as realistic as practically possible, by using real tools during actual situations. The scenario was designed to reveal relationships between someone else's job and one's own job. The degree of realism in the scenario (*i.e.*, the learning context) was important because certain key words, images, or other triggers that can come up during the real warning process might trigger memories of doing the other job during the scenario.

7. FUTURE PLANS

The 2008 edition of the NSWW will include a third scenario. In the previous editions, the scenario staff assigned scenario roles based upon the participants' profession. In the 2008 version, the participants will be able to choose their preferred scenario role during the registration process. However, the scenario leaders may override some initial preferences to created balanced groups. Some workshop participants have expressed their desire to learn in a standard lecture/presentation format. Thus, the workshop also will include plenary sessions and a number of break-out sessions. These sessions will support the scenario by providing background concepts.

The 2008 scenario will include an event that exhibited multiple simultaneous weather hazards. At the same time, the simulated EOC will have to deal with issues surrounding a large outdoor event venue. Finally, the TV station will have to make weather and news coverage decisions that might make viewers unaffected by the weather event unhappy.

8. ACKNOWLEDGEMENTS

The authors would like to thank the following individuals who contributed their assistance and expertise. The scenarios would not have occurred without their support: David Barnes, Mark Bogner, Bill Bunting, Janice Bunting, David Cleaver, Linda Crank. Foster. Christine Grant. Matt Pam Heinselman, Jim LaDue, Les Lemon, Donnie McBride, Doug Rhue, Jason Ribelin, Don Rinderknecht, Joe Schaefer, Mark Sessing, Peggy Stogsdill, and Dan Threlkeld.

Funding for this manuscript was provided by NOAA/Office of Oceanic and Atmospheric Research under NOAA-University of Oklahoma Cooperative Agreement #NA17RJ1227, U.S. Department of Commerce.

9. REFERENCES

- Anderson, J.R., 2005: Cognitive psychology and its implications. 6th ed. Worth Publishers, 519 pp.
- Baron Services, Inc., cited 2008: FasTrac. [Available from http://www.baronservices.com/solutions/br oadcast/display_solutions/fastrac.php]
- Bolstad, C.A., H.M. Cuevas, A.M. Costello, and J. Rousey, 2005: Improving situation awareness through cross-training. *Proceedings of the Human Factors and Ergonomics Society 49th Annual Meeting*, Orlando, FL, 2159-2163.
- Doswell, C.A. III, A.R. Moller, and H.E. Brooks, 1999: Storm spotting and public

awareness since the first tornado forecasts of 1948. *Wea. Forecasting*, **14**, 544-557.

- Knowles, M.S., E.F. Holton, and R.A. Swanson, 1998: The Adult Learner. 5th ed. Butterworth-Heinemann, 310 pp.
- Magsig, M.A, T. Decker, and N.M. Said, 2006: Builds five and six of NOAA'S NWS Weather Event Simulator. Preprints, 22nd Intl. Conf. on Inter. Info. Proc. Sys. for Meteor., Oceano., and Hydro. Paper P7.7, Atlanta, GA, Amer. Meteor. Soc.
- Magsig M.A. and E.M. Page, 2002: Development and implementation of the NWS warning event simulator version 1.0. Preprints, 18th International Conf. on Interactive Information Processing Systems Orlando, FL. Amer. Meteor. Soc, J236–J238.
- Mileti, D.S., and J.H. Sorenson, 1990: Communication of emergency public warnings: A social science perspective and state-of-the-art assessment. Oak Ridge National Laboratory Rep. ORNL-6609, Oak Ridge, TN, 166 pp.
- Morris, D.A., K.C. Crawford, K.A. Kloesel, and J.M. Wolfinbarger, 2001: OK-FIRST: A Meteorological information system for public safety. *Bull. Amer. Meteor. Soc.*, 82, 1911-1923.
- Morris, D.A., K.C. Crawford, K.A. Kloesel, and G. Kitch, 2002: OK-FIRST: An example of successful collaboration between the meteorological and emergency response communities on 3 May 1999. *Wea. Forecasting.*, **17**, 567-576.
- National Weather Service, cited 2007: May 6, 2003 Tornado Outbreak. [Available from http://www.crh.noaa.gov/pah/storm/May.6. 2003/index.php]
- Quoetone, E.M., D.L. Andra Jr., M.P. Foster, S.E. Nelson, and E. Mahoney, 2004: Maintaining operational readiness in a warning environment: Development and use of the Situation Awareness Display System (SADS). Preprints, 22nd Conference on Severe Local Storms,

Paper 1.6, Hyannis, MA. Amer. Meteor. Soc.

- Warning Decision Training Branch, cited 2007: Situation Awareness and Decision Making in a Warning Environment, Lesson 3: Team SA. [Available from http://www.wdtb.noaa.gov/courses/awoc/a woc.html]
- Wolfinbarger, J.M., R.A. Young, and T.B. Stanley, 1998a: Interactive software for viewing NEXRAD level 3 data on the World Wide Web. Preprints, 14th International Conf. on Interactive Information Processing Systems. Phoenix, AZ. Amer. Meteor. Soc, 208-212.
- Wolfinbarger, J.M., R.A. Young, and T.B. Stanley, 1998b: Delivering real-time interactive data from the Oklahoma Mesonet via the World Wide Web. Preprints, 14th International Conf. on Interactive Information Processing Systems. Phoenix, AZ. Amer. Meteor. Soc, 213-217.