P2.2 THE ADVANCED WARNING OPERATIONS COURSE (AWOC)

John T. Ferree and Elizabeth M. Quoetone
National Weather Service / Warning Decision Training Branch

Michael A. Magsig
Cooperative Institute for Mesoscale Meteorological Studies
Warning Decision Training Branch

1. INTRODUCTION

One of the most important duties for a National Weather Service (NWS) forecaster is to deliver timely and accurate warnings during extreme weather events. Over the past several years, NOAA's National Weather Service has focused attention on the decision making process in the issuance of hazardous weather warnings. This included numerous Warning Decision Making workshops presented by NWS's Warning Decision Training Branch (WDTB). These workshops focused on the science, technology, and human factors of the warning decision making process.

Although the Warning Decision Making workshops were well received, participation was typically limited to only one person in each forecast office per year. Attendees to these workshops delivered short seminars back at their local office, but scheduling seminars in an operational environment typically limited the on-station presenter to a small subset of both the workshop materials and the forecast staff.

WDTB has converted much of this material to distance learning, added training on the latest severe weather science, and packaged it to allow all NWS forecasters (meteorologists and hydrologists) to participate in a more comprehensive experience. Although this course is for NWS forecasters, much of the web-based training is available on the Internet.

This paper presents a general description of the Advanced Warning Operations Course (AWOC).

2. STRUCTURE

The Advanced Warning Operations Course initially consists of two tracks – a Core Track and Severe Weather Track. Each track contains 12 to 14 hours of training material (including evaluation components). Both tracks use a "blended learning" approach with a combination of distance learning technologies including teletraining, web-based training, computer-based training on CD-ROM, Weather Event Simulator (WES) simulations, and printed material. Each student receives a student guide that includes slides and speaker notes from all presentations. The guides are designed for both note taking and as a resource to review for exams.

At each NWS office, an on-site facilitator (typically a Science and Operations Officer (SOO) or Development and Operations Hydrologist (DOH)) helps deliver the course, incorporating their expertise on local needs and requirements. Facilitators attended one of seven three-day workshops in August, September or October 2004. The workshops focused on developing a partnership between WDTB and the on-site facilitators, familiarization with the course materials, and training on the new NWS Learning Management System.

NOAA's National Weather Service has used this diverse blend of learning techniques successfully for several years. Examples include the WSR-88D Distance Learning Operations Course (DLOC) and the Distance Learning Aviation Course (DLAC). An extensive job impact study done in 2003 (Thomson Corporation 2003) found a structured curriculum of blended learning generated a 30 percent increase in accuracy and performance and a 41 percent increase in speed of performance over single-delivery options. This study also pinpointed necessary components for a successful blended approach and found that blended learning driven by scenario-based exercises (Kindley 2002) was the most successful approach.

3. FACILITATION

The AWOC instructional approach requires a partnership between the training developers and the on-site facilitators. The training developers designed and developed the training materials and course structure. The AWOC on-site facilitators guide the students through the course.

The task of on-site facilitator requires knowledge of the curriculum, but more importantly, facilitation skills. The agenda for the three-day AWOC Facilitator Workshop balanced the need for curriculum familiarization and training on facilitator skills.

To address facilitation skills, each workshop attendee was given a copy of *Facilitation Basics*, a very recent (McCain and Tobey 2004) addition to the *American Society for Training and Development (ASTD) Training Basics* series. Workshop presentations and exercises discussed applicable aspects presented in this "How-to Guide".

Simulations using the Weather Event Simulator (WES) (Magsig and Page 2001) are an integral part of AWOC. The on-site facilitator administers the simulations, choosing from several provided by WDTB or from locally developed simulations. Attendees at the AWOC Facilitator Workshops were able to use a newly

developed WDTB Research and Training (WRAT) laboratory (See Figure 1) for:

a) familiarization with events chosen by WDTB,
b) assessment and evaluation techniques that use the simulations, and
c) as a means to help design a local simulation.

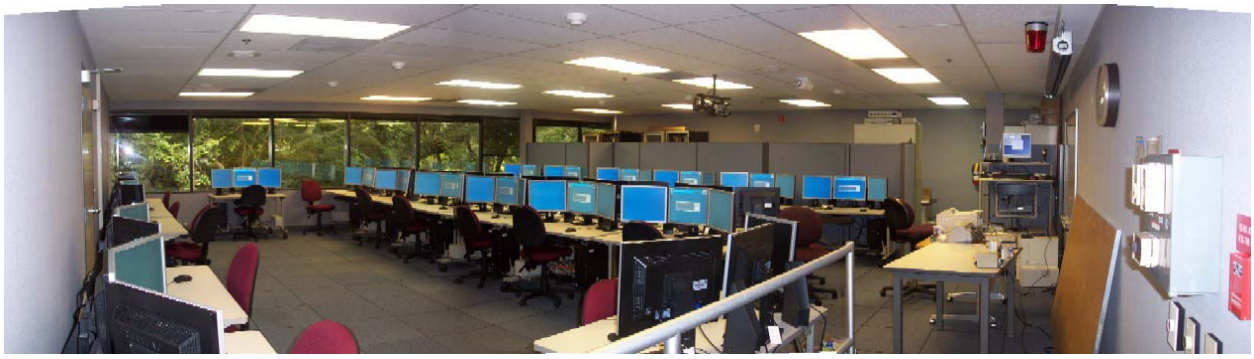

Figure 1: WDTB Research and Training Lab has 25 three-headed networked Linux workstations running Weather Event Simulator (WES) software. (Photo by Ed Mahoney)

The workshop also provided facilitators with an overview of the entire AWOC curriculum, and complete presentations of selected instructional components. These "sample" presentations varied from workshop to workshop, dependent on availability of the authoring Subject Matter Expert.

Support for the on-site facilitator includes an e-mail list to subject matter experts, resource material, and a monitored list server.

4. LEARNING MANAGEMENT SYSTEM (LMS)

Due to the scope of AWOC, the administration is a complex factor. With 10 instructional components broken down to 58 separately tracked lessons, delivered to over 1600 students, there is the potential for upwards of 90,000 learning units to be tracked. This is made possible by the use of a Learning Management System (LMS).

AWOC is the first NWS developed course to use this new LMS. Through the LMS the students, their supervisors, course facilitators, instructors, and upper-level management will be able to track progress through the course. The Facilitation Workshops included instruction on the LMS, utilizing the live system on laptops in the classroom (see Figure 2).

5. OBJECTIVES AND EVALUATION

Lessons within AWOC use consistent instructional design principles. These principles are based on a foundation of solid research and were chosen for their proven track record in improving employee performance (Rothwell and Kazanas 2004).

Each instructional component includes one or more **performance objectives**. These are objectives that can be measured either in a simulation or in actual operations.

Figure 2: WDTB Classroom includes 24 networked laptops for hands-on use by students and two data projectors/screens for instructor use. (Photo by Ed Mahoney)

Each individual lesson has one or more **learning objectives** that explain the purpose of the instruction and the intended outcomes. Exam questions relate to the learning objectives.

In recognition that some students may be very knowledgeable of certain topics, AWOC offers a test-out option for many of the online modules. This test-out option requires a 90% passing score, and students only have one chance to test out.

With the exception of the simulations that are facilitated on station, all instructional components include an exam. Successful completion (70% passing score) of the exam is required to register completion of the course. Those failing the exam are given the opportunity to review the materials and retake the exam.

Evaluation of performance is also part of the AWOC design. Course developers and stakeholders will use the performance objectives to measure performance changes using the WES (Ferree et al 2002) or in operations after completion of the training.

6. CONTENT

6.1 Welcome to AWOC

Included in the "Welcome to AWOC" web-based module is a video perspective on the NWS warning process from respected field experts, and an exercise to emphasize the importance of the warning decision making process. This introduction also includes a brief overview of AWOC contents and resources.

6.2 AWOC Core Track

The AWOC Core Track is intended to cover human factors aspect of the warning process.

6.2.1 Optimizing Learning

In order for learning to be effective, both trainer and trainee have roles and responsibilities to bring to the task. Learning is not a one-way street from trainer to trainee, but a partnership that depends on the interaction of both. This module presents learning strategies employed in AWOC, including a discussion of learning styles, the need for evaluation, and the methodology for simulations. Lastly a brief discussion of the Learning Management System used in AWOC is presented.

6.2.2 Situation Awareness and Decision Making in a Warning Environment

This web-based module focuses on various aspects of decision making in the context of the operational warning environment (Klein 1988). The topics include definitions and examples of the three levels of situation awareness (SA) (Endsley and Rodgers, 1988) and how they are integrated into the decision making process. Failures of the three levels of SA are presented with examples, as well as elements that contribute to the SA failure. Finally, roadblocks to good SA ("SA demons"), and their impact on operations are discussed.

6.2.3 Expertise and Effective Office Warning Strategies

The content focuses on putting together strategies that allow the decision maker to make the best use of their skills and those of the warning team. This includes a discussion on the value of expertise, the ways in which expertise can be developed, and what expertise looks like among NWS warning forecasters. One of the primary ways in which expertise can be developed is via post event evaluations. Ways in which these evaluations can be effectively and efficiently accomplished are presented. Examples of the uses and applications of expert strategies during significant events are also presented.

6.2.4 Data Quality

Radar, satellite, spotter reports, ground truth and a radar volume coverage pattern explorer tool are some of the topics covered in this instructional component. Emphasis is on the impacts of poor data quality, strengths and limitations of various sensors, and optimum utilization of the various sensors to improve/mitigate data quality issues.

6.2.5 Societal Impacts and Public Perception

This instructional component explores the place of weather warnings in a sociological context, identifies elements of an effective warning, and reviews some social science lessons from recent flash flood events.

6.3 AWOC Severe Weather Track

The AWOC Severe Weather Track focuses on recent findings in severe weather research.

6.3.1 Conceptual Models for Origins and Evolutions of Convective Storms and Systems

This instructional component describes conceptual models of convective storms. The emphasis is on physical processes associated with these specific storm type hazards: supercell tornadoes, squall line tornadoes, hail storms, multicell storms, and flash flooding.

6.3.2 Threat Assessment

This component identifies the operational process in a NWS Forecast Office for continuous evaluation of hazardous severe weather threats (tornadoes, damaging winds, hail, and flash floods) to support effective warning methodologies. Emphasis is on assessing mesoscale lifting mechanisms and evaluating important kinematic and thermodynamic parameters for severe storm prediction.

6.3.3 Storm Interrogation

In this section, the participant demonstrates selection of products and proper procedures for effective data analysis in completing storm interrogation strategies for tornadoes, hail, flash flooding, and severe straight-line winds. The storm interrogation instructional component contains 26 lessons covering 6 storm interrogation topics, and an overview lesson that discusses each of the 26 lessons briefly. At least 6 lessons are required.

6.3.4 Application and Review of AWOC Severe Weather Track

This instructional component uses a case or two to review and illustrate the important considerations that a warning forecaster should apply in an effective warning methodology. This review includes components of threat assessment and storm interrogation strategies.

6.3.5 Simulations

Students apply AWOC concepts in an operational context with two simulations that are run on site using the WES. Simulations are organized and proctored by the local training facilitator. Four cases, complete with simulation guides, are being released for the training facilitators to consider using in AWOC. Each simulation guide contains support materials that illustrate how simulations can be created to support AWOC performance objectives. Facilitators can use these cases and materials for the simulations in AWOC, or they may develop their own simulations using other cases.

7. FUTURE ACTIVITIES

The Training Division of the National Weather Service is expected to add additional AWOC tracks in the upcoming years. Current plans are to develop a Winter Weather AWOC Track in the upcoming year (FY05). Suggested topic areas for FY06 development and beyond include Homeland Security and Tropical Meteorology.

8. LINKS

Look for additional information on the AWOC Main Page at http://wdtb.noaa.gov/courses/awoc/index.html.

9. REFERENCES

Endsley, Mica and M. D. Rodgers, 1988: **Situation Awareness Global Assessment Technique (SAGAT):** *Proceedings of the Human Factors Society 32nd Annual Meeting,* 97-101

Ferree, John T, E.M Quoetone, E. Page, and M.A. Magsig, 2002: **Weather Event Simulator Best Practices:** *Preprints 21st Conference on Severe Local Storms,* San Antonio TX, Amer. Meteor. Soc., J55-J56

Kindley, Randall W., **Scenario-Based ELearning: A Step Beyond Traditional E-Learning**: *ASTD Learning Circuits* (May 2002), 1 pp

Klein, G., 1988: **Sources of Power: How People Make Decisions**, The MIT Press, 330pp

Magsig, Michael A and Elizabeth M. Page, **Development and Implementation of the NWS Warning Event Simulator Version 1.0:** *Preprints Interactive Symposium on AWIPS,* Orlando FL, Amer. Meteor. Soc., J236-J238

McCain, Donald and Deborah D. Tobey, 2004 **Facilitation Basics**, ASTD Press, 168pp

Rothwell, William J. and H.C. Kazanas, 2004 **Mastering the Instructional Design Process**, Pfeiffer, 473pp

Thomson Corporation, 2003 **The Next Generation of Corporate Learning** *T&D Magazine (June 2003*) p47