P4.4 DISTANCE LEARNING TRAINING FOR AVIATION FORECASTERS: THE IMPACT OF WEATHER ON AIR TRAFFIC MANAGEMENT

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1. INTRODUCTION

During the fall of 2004 and spring of 2005, the Cooperative Program for Operational Meteorology, Education, and Training (COMET®) and the National Weather Service (NWS) developed a Web-based course titled "The Impact of Weather on Air Traffic Management." This was to address concerns expressed by NWS Director D. L. Johnson, who identified a gap in knowledge exhibited by some NWS Center Weather Service Unit (CWSU) meteorologists about Federal Aviation Agency (FAA) operations and the National Airspace System (NAS). Considering how vastly different the NWS and FAA cultures are, it is no surprise that this gap exists. Published in May 2005, the course is available to any forecaster at no charge. It can be accessed from COMET at http://www.meted.ucar.edu/nas/index.htm.

2. BACKGROUND OF THE CWSU

Born from National Transportation and Safety Board (NTSB) recommendations that followed a weather-related aircraft accident in 1977, CWSUs were quickly planted in each of the 21 FAA Air Route Traffic Control Centers (ARTCC) across the U.S. Each unit is comprised of three journeymen meteorologists and the Meteorologist-in-Charge (MIC). These forecasters are charged with advising air traffic controllers on specific weather hazards to aviation. Since the CWSUs began, there has been no national standard for service and no formal training. This being the case, each CWSU has autonomy in the way it serves its customer and assesses this service. Feedback on performance is rare, so the assumption is that the forecaster knows enough to get the job done. This paradigm must be broken to bring positive, widespread change to the program.

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3. TRAINING OBJECTIVES

CWSU meteorologists have the unique opportunity to interact face-to-face with their customer. This is rarely the case for most other NWS programs, where a suite of products is sent out to each customer group based on pre-established requirements. However, every hour of every day, FAA personnel are faced with a different situation and need specially tailored weather information to make decisions quickly. Conversely, CWSU meteorologists must understand FAA and NAS operations thoroughly and be able to communicate effectively to meet the FAA's needs. This translates to the following training objectives:

- Describe the components of the NAS and the FAA infrastructure
- Identify how various weather events affect the NAS and its different components
- Describe the needs of the FAA for weather information
- Collaborate with your local FAA partner to identify their special needs
- Produce a briefing that meets these needs, in a language the FAA understands, and delivered at the appropriate time via the most effective medium

4. TRAINING APPROACH

Traditional training involves presentation of material and measurement of retention via quiz questions. Often associated with undergraduate level curriculums, this approach rarely causes major, long-lasting change for an individual or a program. A graduate-level approach that encourages personal discovery and application is necessary to bring significant change to a program. CWSU forecasters will change the way they do their job only if they fully understand why something is important, the benefit of applying it, and the consequence if they do not. This course uses both approaches and has three components; The Module and Quiz, Job Sheets, and Weather Impact Playbook (WIP).

5. THE MODULE

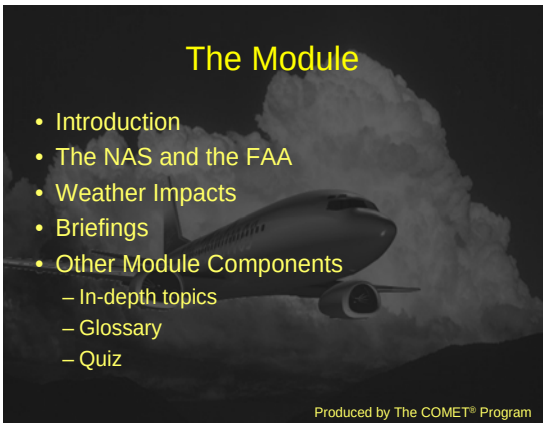


Figure 1 Module structure.

The basic module presents an overview of the NAS and the FAA, weather impacts to the NAS, and essentials of good briefings (Fig. 1). Those who would like to delve deeper may choose "In-depth topics" for additional reading materials and links. Students who are less familiar with the CWSU program are highly encouraged to view these. There is also a link to a glossary of commonly-used FAA phrases, terms, and acronyms. A quiz must be taken with a passing score at the end of the module for the student to receive a certificate of completion.

Figure 2 Module begins with introduction video from NWS Director D. L. Johnson.

At the beginning of Module Section 1, NWS Director D. L. Johnson (Fig. 2) emphasizes how important it is for CWSU meteorologists to understand how weather impacts the National Airspace System and what information FAA air traffic managers need to control the flow of air traffic. This section also presents the FAA-NWS partnership and the missions of the respective agencies. It closes with an overview of the course components.

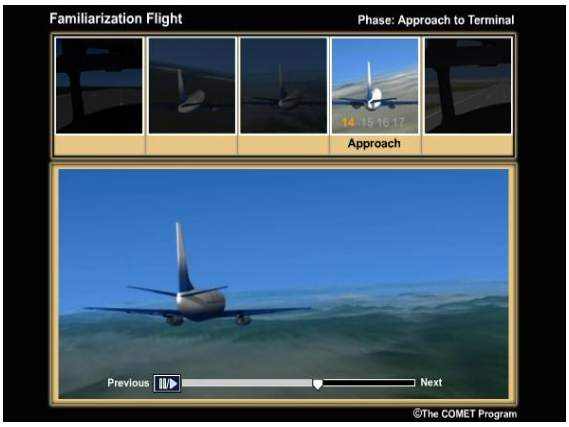


Figure 3 Familiarization flight showing pilot-controller interactions during approach.

Section 2 provides a history and infrastructure of the NAS and FAA. A simulated familiarization flight is also provided (Fig. 3) to show pilot-controller interactions during all phases of flight – terminal, departure, en-route, approach, landing, and back to the terminal again. This section also describes the unique FAA culture and background, skills, weather knowledge, and communication techniques of air traffic personnel.

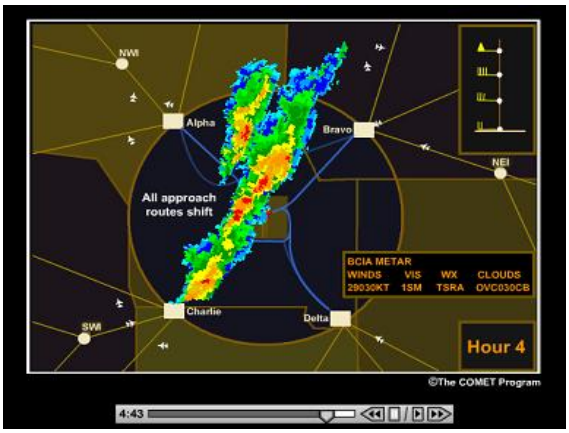


Figure 4 Scenario of squall line impacting air traffic at major airport.

Section 3 is the "meat and potatoes" of this module. An observation by Director Johnson sets the stage as an introduction to the heart of the issue; "Weather is the largest, uncontrolled user of the NAS." Air traffic flows have daily and seasonal patterns. In order to better understand how impacts vary, climatology of weather impacts to the NAS is examined. Weather can cause major problems for air traffic, especially if it hits a major airport (Fig. 4). This section looks at how weather can affect each phase of flight. Procedures used by air traffic managers to mitigate weather's impact are also examined.

Section 4 is where the "rubber meets the road." To be effective in their briefings, CWSU meteorologists must know their customer's needs. An important part of that is to open lines of communication and develop relationships. Tips are offered on delivering good briefings.

This section also recommends things to avoid. As a final exercise, students are asked to critique two briefings on the same weather situation (Fig 5.) and think about how they can polish up their own briefing skills.

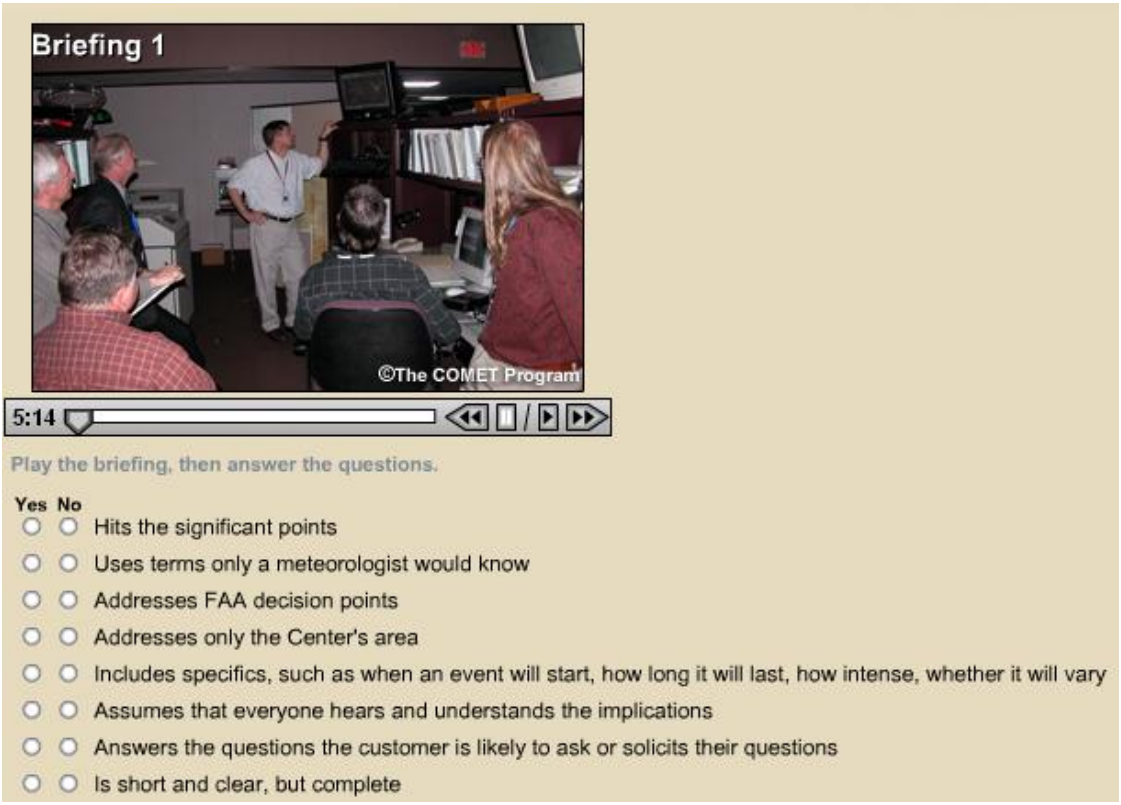


Figure 5 Interactive critique of first briefing. Student listens to audio and answers questions.

6. THE POWER OF INTERACTIVE SCENARIOS

It is difficult to teach how weather impacts operations of the FAA and NAS without using scenarios. During the familiarization flight scenario from Section 2, the student monitors air traffic communications between the flight crew and air traffic controllers during all phases of flight. These phases are terminal, departure, en-route, arrival, and back to terminal. Occasionally, questions or explanations pop up to engaged the student and make a point (Fig. 6).

An interactive animation is also used in Section 3 to simulate the impact of weather on air traffic at a major (hub) airport. It begins with air traffic arriving and departing in benign weather (Fig. 7). However, a squall line moves across the airport later and disrupts the flow of air traffic (Fig. 8). Aircraft are shown holding or deviating around the storms. Scenarios such as these are invaluable in showing the relative spacing and location of aircraft and sensitivity of the entire system to timing and location of hazardous weather.

Figure 6 Familiarization flight simulation and pop-up window for question and answer.

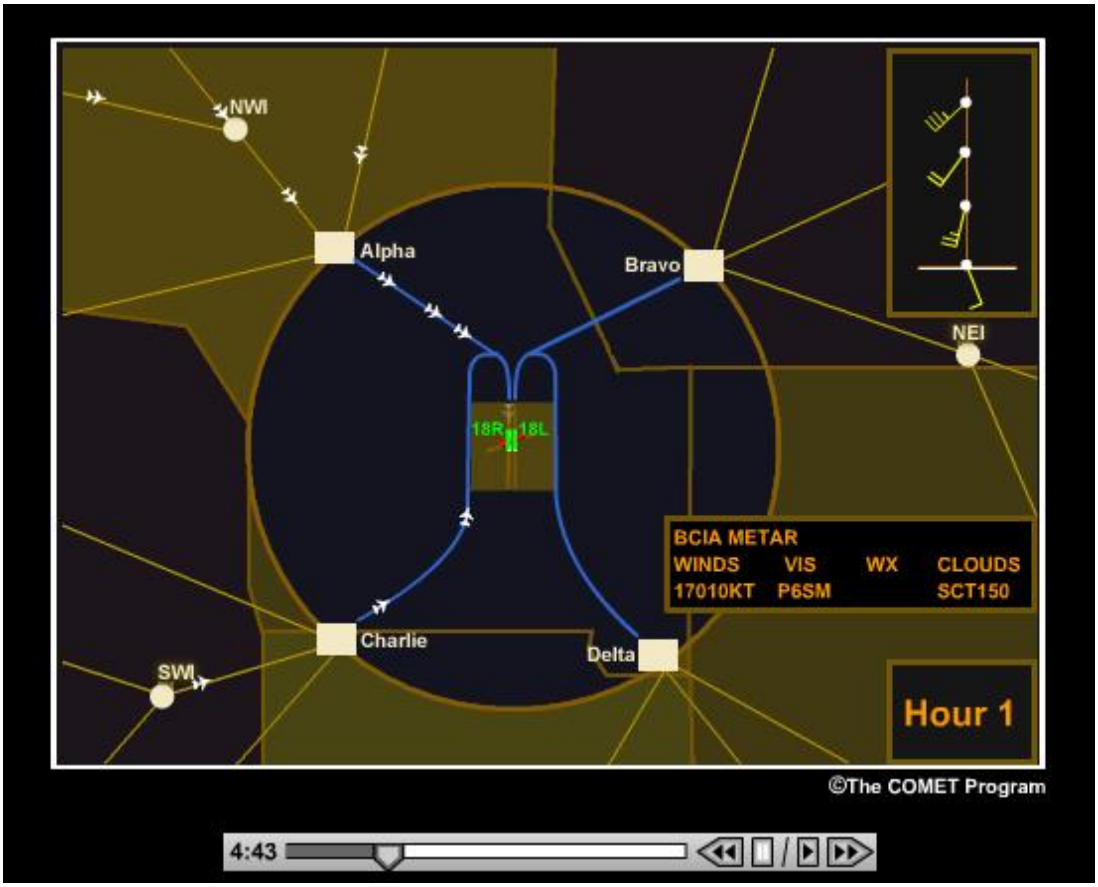


Figure 7 Major airport scenario showing air traffic during benign weather.

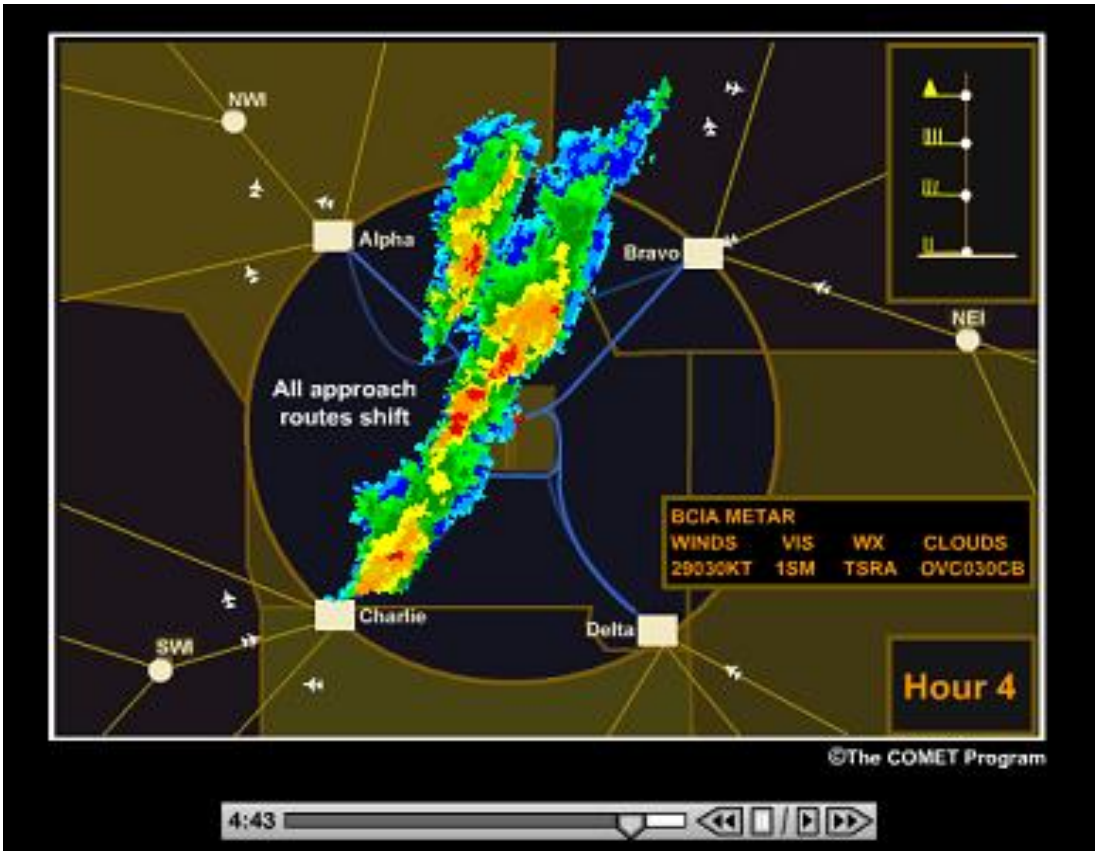


Figure 8 Major airport scenario at a later time, showing impact to traffic from squall line. Aircraft at Alpha, Bravo, Charlie, and Delta arrival gates are holding due to the weather.

7. JOB SHEETS AND THE WEATHER IMPACT PLAYBOOK

Job sheets and the Weather Impact Playbook (WIP) are used to meet the training objective to "collaborate with your local FAA partner to identify their special needs." The job sheet (Fig. 9) has tasks that direct students to find local information pertinent to the impact of weather on their customer's operations. These tasks are linked to specific topics from the module and may require reading local documents, Web searches, or interviews with key FAA personnel. The information is used to fill in a WIP worksheet (Fig. 10), which can be customized by the MIC to fit the customer's needs for that particular CWSU. Once completed by each student at a CWSU, information from the worksheets is collated to create the office's WIP (Fig. 11). This WIP can be considered a customizable tactical operations guide that augments information in the office's Station Duty Manual. This is the ultimate objective, because it is going to get the entire staff to understand what the FAA needs. The WIP will also be an invaluable training resource for new CWSU meteorologists.

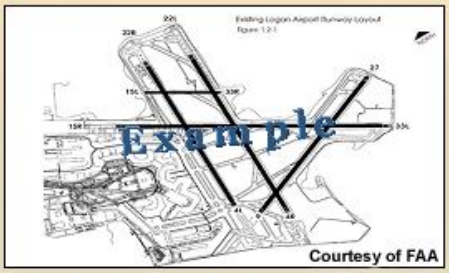
Job Sheet 10

Objectives:
Identify runway configurations for any airport within your ARTCC control space that can have an impact on your operations

WIP Section:
Hub/Pacing Airports: C1 and C2 (or however many sections are in your worksheet for this topic) – Airport diagram(s) or aerial photograph(s)

Data Sources:
Airport Diagrams Search (National Aeronautical Charting Office)
Facility cartographer
Facility homepage
Local NATCA homepage
Regional links

Discussion:
Runway configuration is an important driver for the NAS. Depending on the situation, a change in configuration can have a major impact on operations within an ARTCC area and subsequently throughout the NAS. Locate or draw the runway configuration for the pacing airport(s) within your area of responsibility. An Internet search can yield promising results, such as that for Boston's Logan Airport (see below). If not readily available via the Internet, you can construct one using the WARP, any drawing software, or even PowerPoint. Be certain to identify each runway (e.g., 34L/R). Place this graphic in your WIP worksheet upon completion.



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Close this window

Figure 9 Example of a Job Sheet. Data sources and Web links, when available, are included to assist the student in finding important local information.

C. Hub/Pacing Airports

1. _____

Add Airport diagram or aerial photograph.

i. Time of Daily Pushes (i.e., aviation "rush hour")

a. Morning _____

b. Afternoon _____

c. Evening _____

d. Other _____

ii. Runways _____

a. _____

1) Approaches _____

2) Minimums _____

3) Limiting Issues _____

b. _____

1) Approaches _____

2) Minimums _____

3) Limiting Issues _____

c. _____

1) Approaches _____

2) Minimums _____

3) Limiting Issues _____

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Figure 10 Example of a page from the WIP worksheet.

C. Hub/Pacing Airports

1. Boondocks International BDK

i. Time of Daily Pushes (i.e., aviation "rush hour")

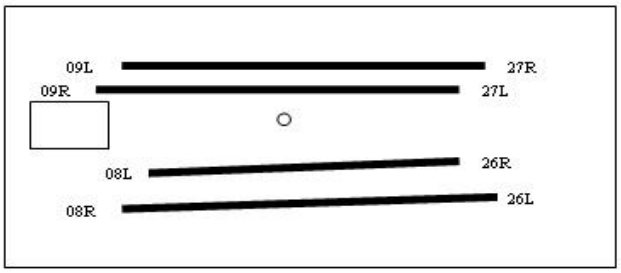
a. Morning 0800-0930 1100-1200

b. Afternoon 1400-1600

c. Evening 2000-2100

d. Other None noted

ii. Runways 4



a. 09R/27L

1) Approaches ILS/VIS

2) Minimums 100ft ¼ vis

3) Limiting Issues

b. 09L/27R

1) Approaches ILS/VIS

2) Minimums 100ft ¼ vis

3) Limiting Issues

c. 08R/26L

1) Approaches ILS/VIS

2) Minimums 100ft ¼ vis

3) Limiting Issues

d. 08L/26R

1) Approaches ILS/VIS

2) Minimums 100ft ¼ vis

3) Limiting Issues

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Figure 11 Example of completed page from the WIP.

8. SUMMARY

"The Impact of Weather on Air Traffic Management" has been developed to address a training need in the CWSUs. The course uses a combination of text, interactive graphics, job sheets, and a Weather Impact Playbook to help bring forecasters up to speed on FAA and NAS operations. Powerful scenario animations are used to portray how weather impacts these complex operations. Job sheets direct students to seek and compile pertinent local aviation information into a Weather Impact Playbook. This document becomes their customer-based station duty manual. Using what they have learned from the course and applying the playbook, CWSU meteorologists should be able to raise the level of their service. Over time, the entire program will improve.

9. ACKNOWLEDGEMENTS

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