327 THE WEATHER AND AIR TRAFFIC MANAGEMENT INTEGRATION COURSE IN THE GRADUATE AERONAUTICS PROGRAM AT EMBRY-RIDDLE

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1. INTRODUCTION

In Fall Semester 2009, Embry-Riddle Aeronautical University added a new Area of Concentration (AOC) in Aviation Meteorology to the Master of Science in Aeronautics (MSA) program at the Daytona Beach, Florida campus (Lanicci and Roberts, 2010). As part of this new program, a graduate seminar in Weather and Air Traffic Management Integration is being taught this semester (Spring 2011). This course originated as an experimental seminar in Summer Term 2009 and attracted graduate students with backgrounds in commercial and private aviation, applied meteorology, and engineering physics. The course received good reviews from the students, so it is being offered again in the Aviation Meteorology AOC.

The purpose of the course is to introduce the students to the concept of weather and air traffic management integration as it exists today, and as it is being planned for the Next Generation Air Transportation System (NextGen). The course goals are outlined below:

1. Explain the concept of weather and air traffic management integration.

2. Summarize the primary objectives of weather and air traffic management integration in the NextGen program.

3. Summarize the objectives of key research and development projects currently being carried out to support the objectives of weather and air traffic management integration in NextGen.

4. Summarize the main issues surrounding weather and air traffic management integration in the NextGen program.

5. Complete a term paper on a topic relating to weather and air traffic management integration and present its results to the class.

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2. OUTLINE OF THE COURSE

By its interdisciplinary nature, the Aviation Meteorology AOC draws students with diverse backgrounds ranging from Embry-Riddle flight instructors and dispatchers to traditional graduate students with various undergraduate degrees. This course is the last in the AOC sequence, so by this point the students have already been exposed to a graduate-level aviation meteorology course. However, due to the diverse student backgrounds, I begin the course with a traditional lecture-based review of important aviation meteorology concepts. The review includes surface and upper-level analysis, Meteorological Reports (METARs), radar and satellite products, aviation weather hazards (Instrument Meteorological Conditions, turbulence, icing, and convective weather), and forecast products such as Airmen's Meteorological Information (AIRMETs), Significant Meteorological Information (SIGMETs), Terminal Aerodrome Forecasts (TAFs), and numerical weather prediction (NWP) model forecasts. This review is completed within 6 classroom hours, and is followed by a lecture- and video-based introduction to air traffic control, air traffic management, and weather and air traffic management integration as it is currently being accomplished in the National Airspace System (NAS). The last portion of this segment uses materials from the COMET® module entitled "The Impact of Weather on Air Traffic Management" (available on-line at http://www.meted.ucar.edu/nas/). This segment takes a little longer to complete (about 6-8 classroom hours) because most of the students in this class are not as familiar with air traffic control and management as they are with aviation meteorology. Since my intent is to teach this course in seminar format, the students must be comfortable enough with the various concepts in weather and air traffic management integration to be able to research pertinent topics and lead the class in discussing them.

At approximately one-third of the way through the semester, the students, having a common level of understanding of today's weather and air traffic management integration environment, are introduced to NextGen through a lecture and several Federal Aviation Administration-produced videos. During the introductory portion of the course, the students were told that they must choose one or more NextGen topics to lead a class seminar, and produce a final project term paper and present it to the class. A list of candidate topics is shown in Table 1 below.

Table 1. NextGen topics for student-led seminars.

1.	Collaborative Decision Making and
2.	Trajectory Based Operations
3.	En Route Automated Modernization and
4.	NextGen Data Communications
5.	NAS Voice Switch and
6.	System Wide Information Management
7.	Area Navigation and
8.	Required Navigation Performance
9.	Automatic Dependent Surveillance-Broadcast
10.	NextGen Network Enabled Weather and
11.	Route Availability Planning Tool
12.	Integrated Terminal Weather System and
13.	Corridor Integrated Weather System

There are several points to note about these topics. First, the topic sequence was generated as a result of student feedback from the Summer 2009 experimental course. Second, the topics are paired up by similar areas (again based on student feedback). Third, only three of the 13 topics are meteorology-related. This last point is important because the NextGen program is being executed by people from a number of disciplines, such as pilots, dispatchers, air traffic controllers and managers, meteorologists, human factors specialists, engineers, computer programmers, and a host of other specializations. Given the diverse specialties involved in NextGen, the course needs to give the students as broad an exposure to the issues and problems as exist in the multiple disciplines participating in the program. The students are told that they can pick different topics for the seminar and the final project, but if they use the same topic, the final project must go into additional detail beyond the seminar.

At this point, the course transitions to a student-led seminar discussion format, during which time the class reads and discusses papers on the NextGen topics covered in Table 1. The students are told to share their sources for the seminar with their classmates as soon as possible so that the rest of class has adequate time to review them prior to the class. They are also required to develop seminar discussion questions and share them with the class ahead of time, so that the class can be thinking about them beforehand. The students' class participation grades are based primarily on their participation in seminar discussions and quality of the seminar they lead. Students are given the opportunity to present additional seminars to bolster their grade if they are not as active in the seminar discussions as they should be.

A list of the final project student topics from the experimental version of the course is shown in Table 2.

Table 2. Final project topics from Summer Term 2009

History of the Center Weather Service Unit (CWSU) and Proposed Consolidation
Trajectory Based Operations
Corridor Integrated Weather System
Operation of the Air Traffic Control System Command Center's National Playbook
En Route Automation Modernization and Enhanced Vision Systems

Notice that several of the Summer 2009 final project topics in Table 2 (italicized) are seminar topics in the Spring 2011 version of the course (Table 1). In 2009, topics that were not chosen by students for seminar were made available as final project topics. This time, the topics will either be presented by students in seminar or by me. As stated earlier, a student can choose to use a seminar topic for a final project topic as long as he/she expands the topic significantly from the seminar to the final project. My goal in having the all of the topics in Table 1 presented during the seminar portion of the course is to ensure that we engender a class discussion on these topics due to their overall importance to the NextGen program. Time constraints during the final project presentations do not allow such discussions to take place. Recall that the 3rd and 4th goals of the course are to summarize the objectives of key NextGen research and development projects and identify the main issues surrounding weather and air traffic management integration in the NextGen program. These two goals cannot be accomplished unless the class spends sufficient time in seminar discussion on all of the NextGen topics in Table 1.

As outlined by Lanicci and Roberts (2010), the student-led seminar discussions in the experimental version of the course were perceptive and showed good understanding of the topics. In 2009 the class was also able to take a field trip to the Jacksonville, Florida Air Route Traffic Control Center. Given the constraints on the course this semester (i.e., larger class, evening meeting time), it does not appear that such a trip will be possible. An alternative being considered is a tour of the Florida NextGen Test Bed facility at Daytona Beach International Airport. This tour is dependent on the progress being made on current renovations to the physical facility.

3. CONCLUSIONS

The creation of a weather and air traffic management integration course in Embry-Riddle's Aviation Meteorology AOC adds a critical topic to this unique program, and may perhaps be the only academic course on this topic in the country at present. Given the importance of weather and air traffic management integration in the current NAS and its role in defining the success of the NextGen program (e.g., JPDO 2010), it is critical that a M.S.-level graduate desiring to work in aviation have the

necessary cross-disciplinary background to be conversant with the myriad communities participating in NextGen development and project management. The Weather and Air Traffic Integration seminar was successful in 2009; if this semester's edition is as successful we will recommend changing it to a required course for the Aviation Meteorology AOC, allowing it to be taught every year.

4. REFRENCES

Joint Planning and Development Office, 2010. *Next Generation Air Transportation System (NextGen) ATM-Weather Integration Plan Version 2.0.* September 24, 2010. JPDO, Washington, DC. (Available on-line under "Technical Documents" at http://www.jpdo.gov/knowledge_center.asp)

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