1.4 THE AVIATION DIGITIAL DATA SYSTEM (ADDS)
PROOF OF CONCEPT DEMONSTRATION

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1. INTRODUCTION

The Aviation Digital Data Service (ADDS) is an Internet-based system that provides digital and graphical analyses, forecasts and observations of meteorological variables to the aviation community (Sherretz, 2000). ADDS is a joint development effort of the National Oceanic and Atmospheric Administration (NOAA) Forecast Systems Laboratory (FSL), the National Center for Atmospheric Research (NCAR), and the National Centers for Environmental Prediction (NCEP) Aviation Weather Center (AWC). ADDS is funded by the Federal Aviation Administration (FAA) Aviation Weather Research Program (AWRP).

In an effort to aid and improve the transfer of weather information from a FAA Automated Flight Service Station (AFSS) to general aviation pilots, the FAA explored the utility of ADDS for AFSS use. To this end, a proof of concept demonstration of ADDS as part of an AFSS briefing was conducted. The FAA William J. Hughes Technical Center (WJHTC) Weather Branch (ACT-320) planned and conducted this demonstration. The demonstration took place at the AFSS in Princeton, MN and the WJHTC laboratories in Atlantic City, NJ. AFSS Air Traffic Control Specialists (ATCSs) provided briefings to pilots using their current weather information systems and ADDS. Feedback was solicited from both pilots and AFSS ATCSs.

The primary goals of the demonstration were to 1) assess the utility of ADDS as part of an AFSS briefing, 2) assess the ease of use of ADDS as part of an AFSS briefing, and 3) assess the value-added benefit of having ADDS as a component of an AFSS briefing.

2. SYSTEM DESCRIPTION

ADDS is an Internet-based system that provides graphical and textual information of forecasted and current weather. ADDS receives data from a wide range of sources including AWC, the National Weather Service (NWS), NCEP, FSL, and NCAR. Table 1 lists the weather products and tools available on ADDS.

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Table 1. ADDS Components.

Pilot Reports (PIREPs)
AIRMETs/SIGMETs Graphic Text
Aviation Routine Weather Reports (METARs) Graphic Text
Terminal Aerodrome Forecasts (TAFs) Graphic Text
Winds/Temperatures
Icing Freezing level graphics PIREPs Integrated Icing Diagnostic Algorithm (IIDA) AIRMETs and SIGMETs
Turbulence PIREPs Integrated Turbulence Forecasting Algorithm (ITFA) AIRMETs and SIGMETs
Convection National Convective Weather Forecast (NCWF) SIGMETs
Satellite Images Images with flight category overlays Cloud forecast graphics
Radar
Prog Charts
Java Tools Flight Path Tool NCWF PIREP AIRMET/SIGMET TAF METAR

Many of the ADDS products are routinely available to the aviation community, such as text METARs and TAFs. However, some of the products and tools are unique to ADDS and the AWRP. For example, the IIDA is a graphical representation of the potential for in-flight icing (McDonough, 1999). The ITFA is a graphical representation of the potential and intensity of clear-air turbulence for upper levels of the atmosphere (Sharman, 2000). Both IIDA and ITFA are currently

experimental products being considered for operational use. In addition, the Java Tools allow interaction with various data types. A user has the option of zooming into regions of interest; choosing various map overlays; displaying only relevant or data of interest; or creating customized vertical cross sections with the Flight Path Tool.

ADDS can be viewed using either Netscape or Microsoft Internet Explorer as the Internet browser at http://adds.aviationweather.noaa.gov (see Figure 1).

Figure 1. ADDS Main Web Page.

3. USERS

FAA AFSSs provide briefings containing aviation related meteorological information to pilots. These briefings include standard preflight, outlook, in-flight, and abbreviated briefings. All of these briefings have their own format, but for the purpose of the demonstration standard and outlook briefings were used. Standard briefings are issued in a tightly formatted manner. The components of a standard briefing include: adverse conditions, a weather synopsis, current departure, enroute, and destination conditions, enroute and destination forecasts, and a winds aloft forecast. The elements in the forecast are relayed in the specified order above. Two weather information systems exist for ATCS utilization. The Model 1 Full Capacity (M1FC) is a text-based system that gathers all pertinent information for each briefing component and provides various weather data. The second system is vendor-provided weather graphics which display a wide variety of graphical products, such as prognosis charts, radar images, and upper air data.

Outlook briefings are similar to standard briefings, but are usually for 12-24 hours in advance of a flight. More general information is conveyed rather than the specific information given in a standard briefing.

The demonstration involved the AFSS in Princeton, MN. Three ATCSs from the Princeton facility participated in the evaluation. The participating ATCSs had varying briefing styles and manner of utilizing available weather products.

Pilots were recruited for the demonstration through the FAA WJHTC local Flying Club and through the Aircraft Owners and Pilots Association. A total of 7 pilots participated. Pilots possessed ample variance in experience levels and ratings. All were Visual Flight Rules (VFR) qualified with a range from 100 to 2500 VFR flying hours, four were Instrument Flight Rules (IFR) qualified and possessed from 0.5 to 2000 hours IFR flying experience.

4. ASSESSMENT PROCEDURES

Test duration was four days at the AFSS site and three days at WJHTC. The first day at the AFSS focused on training the ATCSs. Training lasted several hours with each specialist and commenced when ACT-320 felt satisfied that all the information, products, and functions on ADDS were adequately covered. The second through fourth days at the AFSS were for test conduct utilizing one ATCS per day to complete the test scenarios. ATCSs had access to their current operational systems as well as ADDS.

Two to three pilots participated for each day of test conduct at the WJHTC. Pilots were trained in a classroom style format at the WJHTC on the day they participated. In addition, a minimum of one test administrator was assigned to each pilot for additional one-on-one instruction through the training exercises. Training lasted 1.5 hours on average. Pilots had access to ADDS, other Internet sites, Direct User Access Terminal (DUAT), and the Weather Channel in order to replicate a pilot's personal preferences for obtaining weather information.

The demonstration focused upon interactive briefings between pilots and ATCSs. Prior to the actual interactive briefings, the ATCSs performed a self-brief on general weather conditions using ADDS and their current systems in a fashion similar to that of the start of a normal work shift. Simultaneously, at the WJHTC, the participating pilots were given information necessary to file a flight plan. Flight route scenarios were used by pilots to obtain standard and outlook briefings. While no flying was actually performed, each flight scenario contained sufficient information necessary for filing a flight plan.

Flight scenarios consisted of both short and long routes to ensure adequate use of ADDS. Each pilot was given two flight scenarios. Sectional aeronautical

charts and enroute low altitude charts were available for all flight routes. The pilot was asked to perform the process by which they retrieve weather information before calling an AFSS for a standard briefing. As with the ATCSs, the pilot was asked to incorporate ADDS into their pre-brief repertoire. Once the pilot and the ATCSs completed their self-brief process, the pilot called the AFSS to obtain a standard briefing for the specified route of flight. Upon receiving the call from the pilot, the ATCS provided a standard briefing for the proposed route of flight, limited to weather information. In providing the briefing, the ATCS was asked to use ADDS as well as current systems. While the briefing was in progress, both the ATCS and the pilot were observed. During the observation, the following were noted: 1) weather information systems and products used, 2) concerns with systems and products, 3) type and/or level of pilot/briefer interaction, 4) type and number of questions asked by pilot, and 5) any other pertinent information. While briefings were conducted using simulated flights, live weather was used.

Following each briefing, ATCSs and pilots were asked to answer or clarify any impromptu questions posed by the evaluators regarding the observed briefings. Following the standard briefings, the pilots were told that the proposed departure time of the flights were postponed between 12 and 24 hours (depending on the scenario) and asked to call for an outlook briefing. The outlook briefing procedures were the same as those used for the standard briefing. Each pilot received two flight routes meaning that each pilot received two standard briefings and two outlook briefings. At the end of the interactive briefings, pilots and ATCSs were asked to complete a questionnaire, which assessed the utility, ease of use, and value-added benefit of specific ADDS products and features as part of the briefing process.

Each ADDS product and function was included in the questionnaire for evaluation. Pilots were asked to rate all products. ATCSs were asked to complete a variation of the same questionnaire; two products (IIDA and ITFA) were removed at the request of FAA Air Traffic Procedures due to the fact that they were experimental.

Interviews aided in obtaining feedback, captured user comments, obtained clarification and addressed any other pertinent information. Soliciting product information in this manner provided valuable information that could not be obtained via questionnaires and observations.

Feedback obtained from respondents in the form of interview and open-ended questions was perused for outstanding and recurrent themes. While pilot and ATCS data were analyzed in the same manner, they were analyzed separately and will be discussed separately.

5. RESULTS

5.1 ATCS Results

ATCS questionnaire results gave positive ratings mostly for products that were already available through the M1FC or vendor-weather graphics. The highest rated products on all dimensions were 1) text TAFs, 2) text METARs, and 3) Prog charts. All of these are already available to ATCSs. The various Java Tools were rated the lowest of all ADDS products for all dimensions.

Products with positive utility ratings were 1) AIRMET/SIGMET plots, 2) satellite images, 3) satellite images with flight category overlays, 4) radar, and 5) icing PIREP plots. Of these only 3) and 5) are not currently available to the ATCSs. However, all of the five products still received lower ratings on other dimensions, requests for changes, or had other disqualifying statements.

Generally, all products were rated as easy to use with the exception of 1) most of the Java Tools, 2) winds aloft, 3) METAR graphics, 4) AIRMET/SIGMET graphics, and 5) the semi-custom PIREP form.

Generally, all products received positive readability ratings with the exception of 1) some of the Java Tools, 2) METAR graphics, 3) icing PIREP graphics, and 4) winds aloft.

Observation and interview information identified that ADDS was not designed for AFSS use. It was not organized according to briefing formats nor suitable for the heavily text-based tasks currently conducted by ATCSs. Because of this design deficiency, ATCSs experienced severe delays accessing products which led to critical time problems.

Despite extensive training, ATCSs expressed discomfort with their level of familiarity with ADDS. They stated that ADDS required a steep learning curve and that more training would be beneficial.

System confidence in ADDS was low due to the frequency of ADDS locking up, especially with the Java Tools. In addition, navigational issues decreased confidence.

In regards to interactive briefings, the ATCSs felt that ADDS impaired understanding of the briefing information. They felt that pilots were distracted while waiting for products to download. The use of ADDS dramatically increased briefing times and greatly increased workload.

Comments and enhancements included that the winds aloft, despite readability issues, provided useful information due to the increased vertical resolution of the data over what is currently available. In addition, it was recommended that ATCS and pilot screens be linked so the ATCS could control what was being viewed during a briefing. Other enhancements included 1) having partial screen graphics with a text component,

2) enhancements to the radar displays, 3) customize the zoom capability to user dimensions, and 4) enable users to retain preferences and configurations of products.

5.2 Pilot Results

Pilots were considerably different from the ATCSs in their ratings of ADDS. Pilot questionnaire ratings tended to be positive for all products. Only two exceptions were noted, those being 1) download times on the Java Tools, and 2) the utility of ITFA since it was only for altitudes above 15,000 feet (4,573 meters). The difference between the pilot and ATCS ratings is due to the use of ADDS. Pilots utilized ADDS extensively as a self-briefing tool, prior to the call to the ATCS. In this context, which is more unstructured and dictated by the pilot's personal preferences, ADDS was viewed as highly useful and valuable.

Observation and interview information from the pilots identified the need for a ADDS training package to be developed. Many of the pilots believed themselves to be familiar with ADDS prior to the demonstration, using ADDS whenever they fly. However, during training they expressed surprise at many options and functions which they did not know existed.

Although the pilots had positive ratings for ADDS, like their ATCS counterparts, they felt ADDS was not suitable for interactive briefings. There were long pauses waiting for products to download and the pilots themselves stated they became distracted. The effect was a decrease in the meaning of the briefing. While pilots liked the concept of an interactive briefing, current ADDS capability was not suitable.

Comments and enhancements from the pilots that were different from the ATCSs included 1) the need for lower ITFA flight levels, 2) difficulty in discriminating some of the paler colors used in the graphics, 3) forecast times greater than 12 hours were not useful, 4) the need for a UTC time converter, and 5) adding wind direction to the Flight Path Tool vertical cross section.

6. CONCLUSIONS AND RECOMMENDATIONS

Results from the ATCSs indicated that ADDS is not suitable as part of an AFSS briefing. ADDS was not designed according to the AFSS briefing format. As a result, ATCSs struggled to utilize ADDS effectively. The most highly rate products were those that already exist on current AFSS weather information systems. ADDS-unique products that were rated positive in some aspect still were identified as needing changes in order to be beneficial for AFSS use. In addition, despite fairly intensive training, participants were not comfortable with ADDS, suggesting changes should be made or an extensive training package should be developed.

Pilots responded positively to ADDS but reported that it is not particularly useful for interactive briefings. Although it was anticipated that the shared interaction might have increased understanding, it actually impaired it by increasing workload and briefing times. Briefings were long and tedious, ultimately degrading their value. All products were rated positively by pilots, who reported that ADDS was an excellent tool for personal, self-briefs, but in its current state is not a suitable tool for AFSS briefings.

Recommendations from the demonstration were two-fold: 1) ADDS not be considered for implementation into an AFSS environment without significant changes and tailoring to AFSS tasks, and 2) that a training package should be developed and made available for users.

A full report on the ADDS proof of concept demonstration documenting procedures, results, conclusions, and recommendations is available from ACT-320.

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