1.7 TECHNOLOGY TRANSFER AT THE AVIATION WEATHER CENTER: DEVELOPING, TESTING, AND IMPLEMENTING NEW FORECAST TOOLS

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1. INTRODUCTION

Forecasters at the Aviation Weather Center (AWC) are responsible for predicting inflight meteorological conditions for the contiguous United States as well as for much of the rest of the world. Forecasters and support meteorologists are constantly seeking new analysis and forecast techniques that can potentially be used in the forecast process to improve the accuracy of AWC products. Sources of these new techniques include the Federal Aviation Administration (FAA) funded Aviation Weather Research Program (AWRP) Product Development Teams, Department of Defense aviation forecast and affiliated research agencies, academia, foreign centers of aviation weather forecasting, and the meteorologists and computer scientists at the AWC.

Two programs guide the technology transfer process at the AWC: The Aviation Weather Technology Transfer (AWTT) process, a joint FAA/National Weather Service (NWS) effort, and the AWC's Technique and Product Implementation Directive (TPID). Both processes take advantage of scientific and technical advances focused on improving the quality of aviation analyses and forecasts from any of the sources listed above by transitioning new methods and techniques through a detailed review process. This paper describes the AWTT and TPID processes and some of the products transitioning through both.

2. THE AVIATION WEATHER TECHNOLOGY TRANSFER PROCESS

The AWTT process, a joint partnership between the FAA Aviation Weather Directorate and the National Weather Service, was implemented during 2001. This process guides the development, testing, and transition of new aviation weather hazards detection and forecast products into operational use for dissemination to the user community from the AWC. Many of these products are developed for transmission to end users such as pilots, dispatchers, and flight service station weather briefers. The AWC also plans to incorporate the output from these new techniques into daily operations by making them available on the meteorologists' integrated workstations.

A flowchart outlining the major steps of the AWTT process is shown in Fig. 1. There are five stages to the product transition process shown, with corresponding decision points (D1 to D5) associated with each stage. The tasks to be accomplished before each decision point are outlined below. The board reviews progress at each point, determines whether the product should be advanced to the next step, or if more work is needed before reconsidering for advancement at a later date.

D1: An initial Concept of Use (CONUSE) for a new product or technique is developed based user needs. This information is presented for approval by an AWTT board. Once approval is granted, actions which follow include gaining sponsorship of the user's needs for development of the new technology.

D2: Refined user needs and CONUSE are presented to the AWTT board, along with an estimated risk assessment detailing the chances for successful development and operational implementation of the proposed technology. After AWTT approval is granted, initial funding, research, development, and testing of the new technology commences which supports stated operational requirements.

D3: The CONUSE is refined, risks are quantified, an initial scientific/technical review is completed, and an operations and maintenance (O&M) budget is proposed for review by the AWTT board. After AWTT approval, the technology is released for testing under a FAA test plan, is made available via the Internet (on the Aviation Digital Data Service (ADDS) and/or other display vehicle) for experimental application, and is hosted at the AWC on experimental FAA Testbed servers.

D4: The final CONUSE and a final scientific/technical review are completed, any/all operational approvals for implementing the technology are in place, an O & M budget is in place, and final work on operational requirements is complete so the technology is ready for D4 approval. When the approval occurs, the technology is deemed ready for use by meteorologists and is supported by the AWC 24 hours/day. It is made available through NWS and FAA communications systems. Products approved at the D4 stage are not "stand-alone" products. They are provided as guidance for

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aviation meteorologists and aviation weather data users as one of many products which are routinely available to assist in producing final operational forecasts (AIRMETs, SIGMETs, Area Forecasts, etc.) and in pre-flight and in-flight decision-making. Products approved at the D4 level do not supersede or replace any official National Weather Service aviation weather forecasts produced by the AWC.

D5: Technology can transition from the D3 stage directly to the D5 stage, or they can pass through the D4 stage in the process. For D5 approval, the same documentation and actions associated with D4 implementation are required. The difference is that a D5 product is approved for all aviation end-users (not just meteorologists). Thus, they are declared as official NWS aviation weather products for operational use and are to be considered complementary to other official products provided by the AWC.

There have been two products thus far that have passed through the D4 or D5 process and are now implemented at the AWC. The National Convective Weather Forecast (NCWF) product was implemented as a D5 product in September 2001 (Kulesa, et. al., 2002). The Current Icing Potential (CIP, formerly IIDA) product was approved for implementation in December 2001 and should be available as a D4 product by May 2002. Both of these products can be viewed at www.aviationweather.noaa.gov.

Work is underway at the AWC to integrate both the NCWF and CIP into the daily forecast process by making these product displays available on the National Centers AWIPS (N-AWIPS) workstations. Other experimental products in the AWTT process include the Integrated Turbulence Forecast Algorithm (ITFA), the Forecast Icing Potential (FIP, formerly IIFA), and a national ceiling and visibility forecast product. AWRP-sponsored experimental products may be viewed at: www.adds.aviationweather.noaa.gov.

3. THE TECHNIQUE AND PRODUCT IMPLEMENTATION DIRECTIVE (TPID)

At the Aviation Weather Center, the TPID program was recently implemented for internal AWC use. It encourages and guides AWC meteorologists and computer scientists during the development of new forecast techniques and products and in the transfer of potentially useful scientific results from sources outside the AWC for test, evaluation, and eventual operational implementation. Approval for developing, testing, and verifying new science and technology is based on documented AWC forecaster need and is designed to complement the work being done through the AWTT process, not to compete with it. Thus, new technologies transitioned into AWC daily operations may be suitable for submission to the AWTT process for potential approval and operational implementation by end users (other than aviation meteorologists) outside the AWC and NWS.

A TPID flowchart similar to the AWTT process depicted in Fig. 1 can be seen in Fig. 2. There are five stages to the TPID process, however, the requirements for advancing through each stage and the approval process for implementation on operational AWC servers differ somewhat from the AWTT process:

Experimental Stage: One or more AWC personnel (the "developer") develops or adapts a new technique, product, or forecaster display for AWC use and performs initial limited case study tests to prove it will be a viable candidate for advancing through the TPID process. If results are favorable, advancement to Stage 1 status follows.

Stage 1: The developer submits a proposal which includes the following: product description, initial CONUSE, list of required AWC databases needed to produce the new technology, description of software/hardware changes needed, verification/assessment plan, and a risk assessment. The proposal is sent to a Technical Review Board (TRB) made up of selected AWC personnel with the charter to act as the scientific authority for the approval of transitioning new products into AWC operations. When the TRB approves the proposal, the developer moves to Stage 2.

Stage 2: This is an experimental implementation stage which includes hosting the product on an AWC Testbed server and making the product available to forecasters, scientific staff, and (optionally) the AWC web page for comment and evaluation. Subjective feedback on product performance is provided to the developer and an initial statistical assessment is completed. The developer works with support staff to complete a detailed project plan outlining all the steps required for eventual operational product implementation. The software is documented and reviewed, and a technical report is written. When the developer's Stage 2 actions are complete, the project plan, software documentation, technical report, a final CONUSE, assessment and forecaster feedback summaries, and a list of expected hardware and software changes needed are reviewed by the TRB. If acceptable, the product advances to Stage 3.

Stage 3: The product continues to be made available in an experimental status while the finishing touches and final changes are made to software and documentation. A peer-reviewed technical publication is also submitted as part of this stage. If the TRB decides the product is

ready for operational implementation, it also determines if approval by the NWS Committee on Analysis and Forecast Technique Implementation (CAFTI) is appropriate, especially if there is a desire to have the product created on NCEP's supercomputer and/or output made available for distribution outside the AWC. The TRB also determines if the product is to be inserted into the AWTT process. Any operational communications changes for distribution of the product outside the AWC, are also identified in this stage.

Stage 4: The product is implemented operationally at the AWC and, if appropriate, made available to users outside the AWC. AWC forecasters are trained on use of the product, display options are inserted into forecaster menus, and operational support is provided to ensure the product is available for forecaster use at all times.

The first two products entered into the TPID process at the AWC are the Global Convective Diagnostic algorithm (Mosher, 2002) and a new South American mid-level aviation hazards chart to be experimentally implemented during 2002. There are also quite a few experimental algorithms running at the AWC, such as VVICE, VVSTORM, NNICE, and MWAVE, which continue to be produced and displayed on the AWC web page. Procedures are under way to officially enter these into the TPID process before each algorithm can be advanced to Stage 4 and be declared officially operational.

4. SUMMARY

The AWC is able to take advantage of new technology designed to improve the quality of aviation forecasts and warnings. Both the Aviation Weather Technology Transfer and the Technique and Product Improvement Directive programs offer the opportunity to ensure new scientific breakthroughs and new forecast tools are put through a strict review process with strong oversight provided through the steps of each process. The goal of both programs is to provide aviation forecast users with advanced products which will serve to improve the safety and efficiency of flight. The AWTT and TPID processes encourage the development and technical transfer of new products and techniques, while complementing each other to ensure this goal is achieved.

5. REFERENCES

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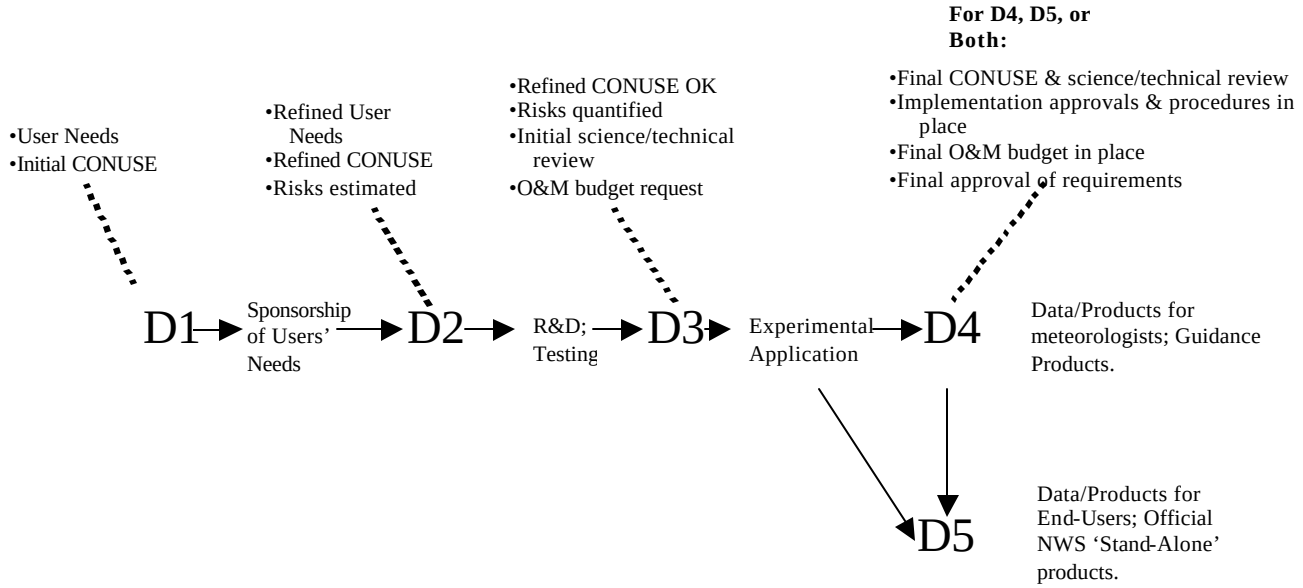

Figure 1. Flowchart of steps in the Aviation Weather Technology Transfer process.

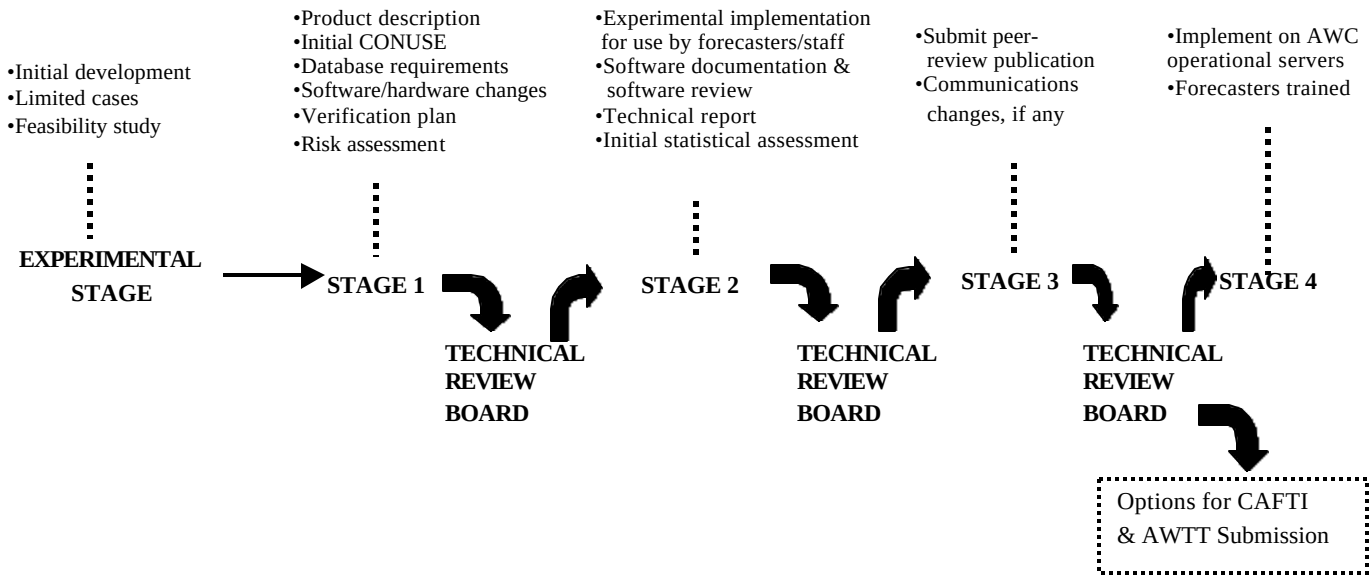

Figure 2. Flowchart of steps in the Technique and Product Implementation Directive process