Cross-Cutting Issues Impacting Operational ATM and Cockpit Usability of Aviation Weather Technology[1]

Sherrie Callon[2]

and

John McCarthy,[3] Nicholas Stoer[4], Mike Robinson[5]

1. Introduction. The primary objectives of this paper are to highlight gaps in operational air traffic management (ATM) and Center Weather Service Unit (CWSU) training that should be addressed to maximize system capacity in adverse weather. While the thrust is on convection, all manner of hazardous and operationally significant weather must be subject to improved training for ATM and CWSU personnel, including cross training. Additionally, we address the question of how well determined is the accuracy and reliability of weather information presented to ATM decision-makers. By decision-makers, we mean the Supervisory Traffic Manager Coordinator (first author), specialists at adjacent ARTCCs, and at the System Command Center. Another question we address is how facile are CWSU meteorologists in terms of ATM practices, phraseology, and operational impact of weather?

Moreover the authors believe that there is a gap between flight crew, ATM, and CWSU weather interpretation of adverse weather, especially convection. As NextGen evolves toward providing increasingly sophisticated Decision Support Tools (DSTs) to ATM personnel, there remain questions about how well DST sponsors and developers are capturing the needs of the operational FAA personnel who make real-time decisions all day long. Under the assumption that near term DSTs will support near term implementations of NextGen, termed NowGen, will these systems adapt adequately to working conditions in the field? FAA, as a safety conscious organization, is very conservative about introducing new tools and concepts until they are thoroughly tested. Finally, as the planning horizon extends to more robust NextGen DSTs in 2018 and beyond, how well will future controllers be trained to provide the desired outcome -- a large increase of NAS capacity? In asking these questions, one concern relates to the idea that unless there is a major improvement in training TMCs and controllers on how to take full advantage of more sophisticated DSTs related to weather, these new tools may somehow be used to move traffic in a more conservative manner, thereby reducing system capacity. The underlying issue addresses weather impacts versus weather

---

[1] This paper is a companion to a presentation for the 92nd Annual Meeting, New Orleans, LA, January 22-26, 2012 for the session Third Aviation, Range and Aerospace Meteorology Special Symposium on Weather-Air Traffic Management Integration.

[2] Federal Aviation Administration, Washington, DC 20591.

[3] Aviation Weather Associates, Inc., Palm Desert, CA 92211.

[4] Nicholas Stoer & Associates, Chester, MD 21619.

[5] AvMet Applications Incorporated, Reston, VA 20191

opportunities, or how can more precise weather information is used to exploit permeability or safe gaps or holes in weather to facilitate capacity gain?

2. The ATM Facility Today. The lead author is a Supervisory Traffic Manager Coordinator (STMC) at Jacksonville Center (ZJX), on temporary assignment to FAA R&D at FAA Headquarters. The role of the Traffic Management Unit (TMU) is to ensure safe, orderly, expeditious traffic flow through en route airspace and underlying facilities by managing demand/capacity imbalances with Traffic Management initiatives. To do so, the TMU analyzes, develops, coordinates, communicates, executes, monitors, and adjust traffic management tactics and plans. Issues of her work provide a unique perspective of the En Route ARTCC, and focuses on the accuracy and reliability of weather information presented to ATM decision-makers. While CWSU meteorologists from the National Weather Service work hand-in-glove with the FAA TMCs, due to periodic personnel turnover at the operational level, these experts in their respective disciplines require continuing on-the-job (OJT) training to learn to speak and understand the needs of each other. In the case of ZJX, there is continuing OJT between these two disciplines to provide for successful two-way (or cross) communications. However, we think that the answer here could be much better. There does not appear to be a general, standardized training, or a best practices process, for TMCs and TMUs that is engrained in the ATM and CWSU process nationwide, in TMUs in ARTCCs, TRACONs, and possibly at the FAA national Air Traffic Control System Command Center (ATCSCC) in Virginia.

3. The Challenge of Accurately Translating Weather Conditions into ATM impacts. Improvements in weather tools such as the Corridor Integrated Weather System (CIWS), Consolidated Storm Prediction for Aviation (CoSPA), and Localized Aviation MOS Product (LAMP) are useful. However, they do not automatically provide advice in traffic management terms as to what actions the ATM system should take in the face of specific forecasts. The TMU view recognizes that rote translation of weather information may lead to overly cautious Traffic Management Initiatives (TMIs) such as miles-in-trail restrictions, route closures, ground delay programs and similar actions. Another concern is that current weather tools lack real-time operationally relevant performance validation to assure TMCs, controllers and pilots how well a given forecast is doing at a given time and location. In CIWS and CoSPA, operational evaluations were performed when the systems were initially deployed. This gives conceptual confidence to the ATM controller regarding these products. However, a real-time validation is sought to increase controller and TMC confidence that the forecasts they are using are, in fact, right on the money. Scientific evaluation in the laboratory in and by itself does not validate a weather system for ATM. Real-time verification systems need to be available. In other words, scientific laboratory validation is necessary but should be emulated in operational tools to buttress the confidence of TMCs and controllers, especially in during periods of rapidly changing weather.

4. Training ATM and CWSU personnel. Air traffic managers, controllers, and

supervisors are **NOT** meteorologists, yet they make strategic and tactical decisions for the movement of aircraft through the NAS based on the display of various weather products. Meteorologists are **NOT** air traffic controllers or TMCs, yet provide frequent advice on changing weather conditions that will impact air traffic flows. Working controllers and TMCs want DSTs associated with weather information to present data in ATM terms (e.g. probability that a given air route, altitude or runway may be blocked or constrained during specific time windows). This has not been the case in most weather systems to date. Terms and symbols must be decoded for easy use, and coding should consider airframe type (i.e., small, large, heavy, with explicit translation specifically pertinent to ATM). Training should be specific to the geographic area and unique airspace regimes. FAA and NWS should document and continually update "best practices" as used in the TMU and CWSU environment. Training should be "face-to-face" with experts in the field, supplemented with computer based training capabilities where appropriate. Translations of screen colors must be better related to flight conditions that are likely to occur. Red is too often interpreted as a "no fly" condition when upon closer inspection the weather may be sufficiently permeable to allow safe transit. ATC, ATM and pilots must be included in the development of translation assumptions, spending face time to garner mutual impressions and confidence regarding how the translations/decisions processes work. A frequent case in point about a difference in translation is when a controller suggests a route change to a pilot based on a radar depiction of weather that the pilot can actually see 30 miles ahead from the cockpit. The pilot is in a position to make either no change in course or a much smaller change in course based on his or her experience in such weather. Finally, there should be FAA facility cross training, to understand differences between weather and traffic issues at difference locations. This is especially important at facilities with adjoining airspace. Illustrative training issues include the following:

- How to find and predict "soft spots" in a line of (convective) weather
- Where the weather is permeable by different classes of aircraft
- Expected deviation on the routes
- Importance of real-time pilot information to validate decisions
- How and when to change airport runway assignment based on wind forecasts

Regarding standardized aviation training for CWSU meteorologists, specialized "aviation" training is needed include ATC phraseology, ATC practices, airspace utilization assumptions, and a thorough understanding of the operational impact of weather on the National Airspace System. Each ARTCC currently conducts "training" for newly assigned CWSU personnel. A standardized checklist or training module developed jointly by the FAA and the National Weather Service would be most helpful.

5. Conclusions and Core Issues. It is critical to recognize the need for DSTs to translate meteorological jargon (we call it "met speak") and displays directly into explicit aviation impacts:

- To further the operational validation efforts, weather and constraint guidance must be evaluated against actual flight trajectories or charted air routes.
- Adverse weather must not be considered an avoid-only issue. Instead, responses to weather includes a gamut of choices from a no-fly-zone, generalized weather avoidance fields, to developing plans to penetrate the weather in zones deemed safe. This set of possible responses is complex, but recognize the realities of actual conditions. By doing this, we can focus on weather encounter opportunities in addition to weather avoidance.
- Additional/specialized meteorological training for TMCs - scenario-based and leverage "best practices" into daily operations.
- Specialized aviation training for CWSU meteorologists makes them more valuable contributors to air traffic operations.
- With a better understanding of the flight conditions in the atmosphere, ATC/ATM can better plan for the reduction in volume to accommodate deviations.
- Address gaps in operational views of the weather between controller, traffic manager, and the cockpit, thus leveraging opportunities for improved impact/opportunity translation.

When we examine the issues above, certain larger core issues emerge related to NowGen and NextGen. There must be better incorporation of operational insights into NextGen DST tools, and to better integrate flight crew and dispatch knowledge in NextGen DST/procedure development.

- Become more effective in merging operational insights from controllers, TMCs and pilots with NextGen DST developments.
- A major national effort is required on training needs for weather for controllers, TMCs and CWSU personnel.
- Better integrate real-time flight crew and dispatch knowledge as an ATM information node in NextGen. This is the mostly overlooked element of NextGen.
- Continue to refine a common lexicon of air traffic-related weather terms to improve the meaning of operationally relevant translation of meteorological terms into the impact of weather on air traffic control conditions.
- .

GLOSSARY

ARTCC – Air Route Traffic Control Center
ATCSCC – Air Traffic Control System Command Center
ATM – Air Traffic Management
CIWS – Corridor Integrated Weather System
CoSPA – Consolidated Storm Prediction for Aviation (8-hour aviation forecast product)
CWSU – Center Weather Service Unit (NWS meteorologists assigned to each ARTCC)
DST – Decision Support Tool. A supplemental display for TMCs or controllers.
LAMP – Localized Aviation Model Output Statistics (MOS) Product. A form of magic.

NAS – National Airspace System
STMC – Supervisory Traffic Management Coordinator
TMC – Traffic Management Coordinator
TMI – Traffic Management Initiative (controls, restrictions used to meter aircraft)
TMU – Traffic Management Unit
TRACON – Terminal Radar Approach Control Facilities
ZJX – Jacksonville ARTCC. All FAA ARTCCs have a 3-letter designator beginning Z.

--END--