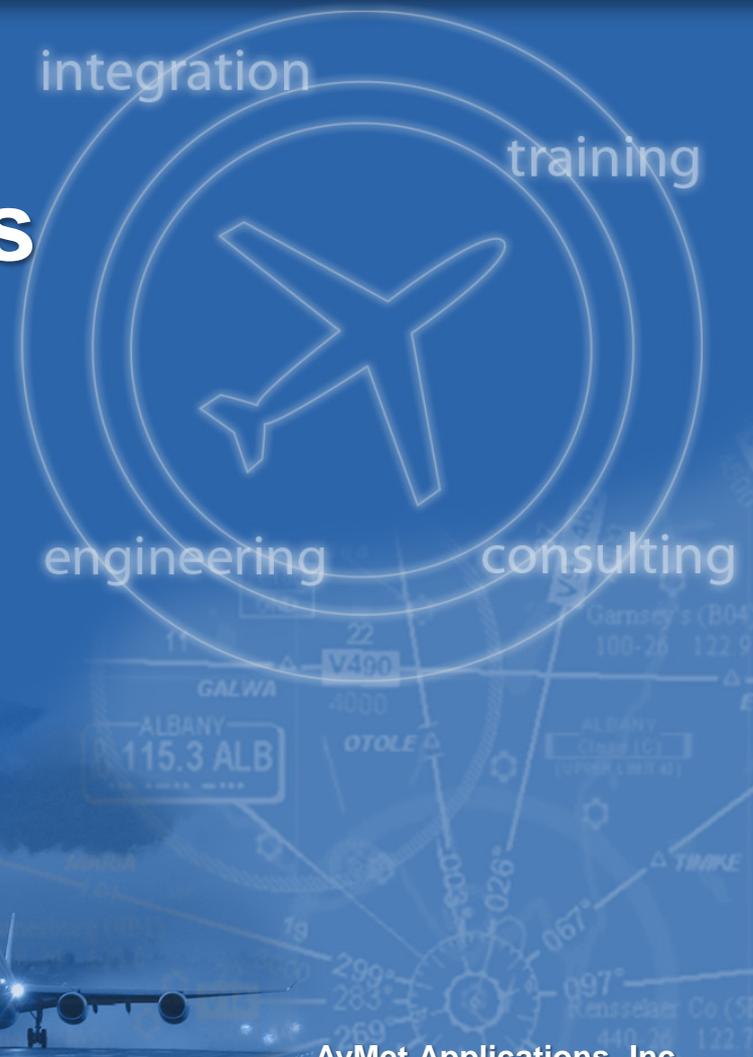




Quantification of Benefits of Aviation Weather

Mike Robinson
AvMet Applications, Inc

*Friends and Partners in Aviation Weather
Fall Meeting 2013 – Las Vegas (NBAA)*



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Discussing “Operational Benefits” at FPAW (2011 – 2013)

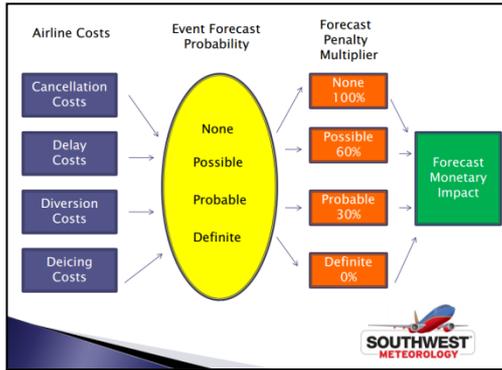
- Five (5) Consecutive FPAW panel discussions since 2011 (summer session)
- Participants have included NWS, FAA (SysOps, IP&A), ESRL, Airlines (SWA, UPS, DAL, JBU), Business Aircraft and GA, and Private Companies (SpectraSensors, AvMet)
- Discussions have sought to demonstrate
 - Importance of understanding *operational value* of aviation weather info / forecasts
 - Can be “knife-point edges” and challenging risk management considerations when seeking to favorably balance “cost” vs. “benefits”
 - True for scalable domains (flight, fleet, airport, system) and for different stakeholders (NWS, Airline, ANSP)
 - Significant challenge for all parties to “course-correct” from meteorological verification to defensible, ops-based impact mitigation savings; presented some tools, data, methodologies to assist
 - Effect on “bottom line” (value-added forecasts (NWS), industry revenue (Airlines), ANSP efficiency FAA)) is what should matter most (for utility assessment; likely even development)
 - Tool / data sponsors, Investment Planning / Program Acquisitions paying closer and closer attention to this “bottom line”; increased scrutiny during period of shrinking budgets
- Has been very good to have continued focus on benefits quantification and associated paradigm shifts



Discussing “Operational Benefits” at FPAW

Some Highlights

Methodologies / Initial Paths Forward
Rick Curtis (SWA), 2011



Cost of Delay – User Reality; “Frost Ex.”
Randy Baker (UPS), 2011

How Arrival Delays at SDF Hub Affect Costs

- Cost Per Minute Late Arrival into SDF Hub = \$711.96
(Cost is for Hub Workers Only does not include Power Consumption, Support Staff, Downstream Impact)

\$711.96 Per Minute Late Per Flight
1 Flight 15 Minutes Late = \$10,679.40

NWS Activities in Benefits Quantification
Kevin Stone (NWS), 2012 (‘Fcster-Over-Loop’ Benefits Case)

Recent Attempts – Case 2

- National Aviation Meteorologists at ATCSCC
 - GDP request based on CIWS/CoSPA forecasts
 - NAM recognized CoSPA forecast discrepancies
 - NAM input to decision not to implement GDP
 - NTMO noted “GDP would have unnecessarily delayed numerous flights and drawn out the schedule”
- How do we know what would have happened?
- Simulated what would have been incurred by the system given a conservative GDP implementation (21z-00z):
 - 322 flights delayed – 232 actual flights delayed = 90 flight delays saved
 - 7565 minutes of delay – 5136 minutes actual delay = 2429 minutes saved
 - 23.5 average delay per aircraft (actual 22.2 minutes for all arrivals)
 - Assuming \$40 cost/minute of delay, this one instance of an avoided TMI would have saved roughly \$100,000

FAA Investment Planning Challenges
Dan Citrenbaum (FAA), 2013

NAS Acquisition Programs

Flight Efficiency/Delay Savings Claims during Adverse Weather

Surface, Terminal		En Route		Terminal, Surface	
ASDE-X	CATMT	AIMM	CATMT	CATMT	CSS-WX
CSS-WX	DATA COMM	CSS-WX	DATA COMM	DATA COMM	ERAM
ELVO	NWP	ERAM	ERAM Future	ERAM Future	ITWS
AIMM	ADS-B	NWP	NVS	NWP	Future Facilities
TBFM	TDFM	ADS-B	TBFM	PRM-R	ADS-B
		TBFM	WAAS	TBFM	WAAS

Quantifying Aviation Weather Forecast Benefits
FAA Investment Analysis Perspective

Federal Aviation Administration

Some “Grades” that Matter for WX Guidance
Steve McMahon (FAA), 2013

Key Performance Indicators

- Operation counts
- Cancellations
- Diversions
- Holding
- Go-arounds
- Taxi-backs
- Completion rate
- Delays

Combine to tell a story...

Tools / Approaches for Assessing Ops Benefits
Mike Robinson (AvMet), 2012, 2013

Impact Management Decisions With/Without Fcst Aid

DART Simulations of NAS Response & Outcomes

With Forecast-derived Decision: Airway J29 open to relieve traffic on VUZ playbook reroute; reduced MIT, less delay

Without Forecast-derived Decision: VUZ playbook reroute traffic uses standard route; J29 closed; heavier MIT, longer delays

Only the traffic using NAS Playbook reroutes is shown. Color-coding by delay: 0-15, 15-20, 30-60, 60-120, >120 min arrival delay



Our Operational Benefits Discussion Continues

Maintaining Momentum, Building on What We've Learned

- Revisiting our broader challenges
(Robinson – next slide)
- FAA Weather Acquisitions – historical summary pertaining to benefits
(Nick Stoer – 10 min)
- Aviation Weather Benefits from Industry Perspective (winter weather scenario);
Possible, additional step forward?
(Rick Curtis – 20 min)
- Aviation Weather Benefits from FAA Ops Perspective – understanding contributing
elements to an efficient NAS and role of wx guidance in complicated relationship
(Leo Prusak – 20 min)
- Wrap-up and Discussion (ALL – 10 min)



Seeking to Quantify Aviation Weather Benefits

You Think THAT is Tough....Some Broader Challenges (1 of 2)

- **Significant aviation weather benefits unlikely without accounting for human factors**
 - Human factors is extremely important element
 - How to best visualize, disseminate, evaluate, share, and integrate weather information, all with proper training, to affect positive change and overcome current “muscle memory” are fundamental to achieving benefits
 - From this, for example, seemingly ancillary weather / info dissemination improvements may result in significant operational benefits (ex: forecast scoring, RAPT “PIG” timer)
- **In some instances, we may be afraid of the benefits answer**
 - Achieving significant operational benefits from weather guidance may require fundamental shift to *weather translation* research and (ex: “penetrable” weather, capacity degradation forecast, not storm forecast)
- **In many instances, we should NOT be afraid of the benefits answer**
 - Weather forecasts, decisions based on forecasts, will always come with errors
 - Need to recognize this, account for this, and use it to improve risk management and best practices

Seeking to Quantify Aviation Weather Benefits

You Think THAT is Tough....Some Broader Challenges (2 of 2)

- **Without close collaboration with operational community, aviation weather products will not be developed optimally for operational use**
 - “Embedded” partners; more than surveys and “spot-checks”
 - More than Subject Matter Experts, need operations advocates
 - FPAW has helped to make met research community more aware of how operators evaluate and “score” effective weather forecast utility
- **Unfair benefits expectations for technology under development?**
 - Requirements / acquisition often scrutinized based on how today’s system operates, but new technology not deployed for years
 - Aviation weather operational benefits achieved when accompanying training is relentless; expectations without this level of training are unrealistic
 - Takes multiple years to modify decision-making model and optimize new tool / approach usage

Seeking to Quantify Aviation Weather Benefits

It IS Challenging....but We Are Assembling Needed Tools/Know-how

- Focus being placed on weather-aware, post-operations analysis
- Weather event normalization becoming a functional reality
- Evaluation of forecast performance / needs from air traffic impact perspective gaining traction
- Agile, weather-aware, superfast-time NAS / airport / TMI simulator now in existence and in use for benefits analysis
 - Employed successfully for FAA Investment Analysis Decision for NextGen Weather Processor (NWP)
- Progress on several other fronts as well, and it continues....

