Minutes of the Federal Aviation Administration (FAA) SWIM Industry Collaboration Workshop – SWIM Industry-FAA Team (SWIFT) Meeting #6 Day 2 May 22, 2019 (8:30am – 4pm)

Southwest Airlines Wings Building
2195 Research Row
Dallas, Texas 75235

1. **Doors Open & Registration: 7:30am**
   1.1 The meeting was held at Southwest Airlines Wings Building, 2195 Research Row Dallas, Texas 75235 on Wednesday, May 22, 2019 at 8:30am.
   1.2 The sixth meeting of the Federal Aviation Administration (FAA) – SWIM Industry-FAA Team (SWIFT) was called to order by David Almeida, LS Technologies, SWIM SME and Strategist.
   1.3 Representatives from FAA, American Airlines, Delta Air Lines, Southwest Airlines, United, JetBlue, NASA, Jeppesen, NBAA, MITRE, Airlines for America (A4A), ARINCDirect, SeaTec, SaabSensis, Harris Corporation, Thales, LS Technologies, Noblis, Leidos, Metron Aviation, airlines, and the public attended. See Appendix A for more information about attendees.
2. **Opening: 8:30am**
   2.1. Kickoff – Al Capps (NASA) discusses leveraging work that has been done in the NAS already.
      2.1.1. There is a certain quality that needs to be met in an operational environment.
         2.1.1.1. ATD-2 is a producer on the R&D server, making TFDM data available early.
      2.1.2. Asked to implement a surface metering system consistent with TFDM.
         2.1.2.1. Example: Implementation where you can see the data.
            2.1.2.1.1. Opportunity to be a part of TTP pilot project to stream this data and do some data mappings.
            2.1.2.1.2. Future ops want to do real time analytics, predictive analytics.
            2.1.2.1.3. Analysts will want to know where this data comes from and will answer those questions.
            2.1.2.1.4. Lots of fuel savings, cost, predictability.
            2.1.2.1.5. Flight matching across SWIM feeds is challenging, will talk to that later today.
   2.2. We will talk about challenges on the receiving end of SWIM data/documentation; it's rather complex.
      2.2.1. Merge data from multiple SWIM feeds (flight matching) is difficult.
      2.2.2. CRISP-DM: process flow that you learn to accept as someone who works in this industry.
      2.2.3. Data-mining needs iterative process.
         2.2.3.1. Moving the needle is to have a discussion with technical and business folks.

3. Agenda

3.1. Day 2: ATD-2 and TFDM Special Session

3.1.1. Arrive and Sign-in

3.1.1.1. Introduction & Session Kickoff

3.1.1.2. Learn to Swim with ATD-2

3.1.2. Break

3.1.3. Fuser:

3.1.3.1. Why Everyone Should Have One

3.1.3.2. Fuser Deeper Dive & Mediation Use Cases

3.1.3.3. Fuser Database – How ATD-2 stores all the data

3.1.4. Lunch

3.1.5. SWIM Data Analysis:

3.1.5.1. Turning SWIM Data into consistent reports for analysts and users

3.1.5.2. Use of SWIM Data for ATD-2 Analysis

3.1.6. Break

3.1.6.1. TTP – How it fits in

3.1.7. Where are we now and where are we going?

3.1.8. Q&A and Close out

3.1.9. "Extra Innings"

4. Learning to SWIM with ATD-2 (Shawn Gorman, Mosaic ATM)

4.1. SWIM has the richest set of data, SWIM is great.

4.1.1. Now the data is out there and there's a new set of challenges to make use of all the data.

4.1.2. Products available in one place with SWIM. ASDI was a five minute delay - couldn't use that for ATD-2.

4.2. TFMS is the backbone, bringing in data from multiple feeds but there are things we need from TBFM, STDDS SMES, etc.

4.2.1. Not only one system has everything we need.

4.2.1.1. We need data from TFMS, TBFM, EOBT, gate info, for the TMC display.

4.2.1.2. We need a community forum for documentation that would benefit everyone.

4.2.1.2.1. NSRR, SWIFT Operational context and use cases, FAA NAS Storyboards, SWIM page, SWIM Users Forum.

4.2.1.3. Site-to-site VPN (connecting to NESG) can take a while.

4.2.1.3.1. SCDS a couple of hours.

4.2.1.4. NEMS jumpstart kits are available after you've hooked up to SWIM.

4.2.1.4.1. Develop your own or use third party vendor.

4.2.1.5. ATD-2 connects to multiple things: solace, Weblogic, ActiveMQ, etc. Also built in performance monitoring.

4.2.1.6. Almost everyone will take it and repeat to your own broker, you won't connect application direct to SWIM.

4.2.1.7. ATD-2 is vast because we have a lot of networks and purposes. Fanning out of data is big.

4.2.1.8. Costs to manage can add up. TBFM - cancel and APREQ, it's in header, not data itself.

4.2.1.9. If operational system says there is problem with data, wonder where it lies.

4.2.1.10. Dashboard allows us opportunity to see where it is in the system. If it's whole thing, probably upstream.

4.3. What do we want from each data feed?

4.3.1. There are a lot out there. ATD-2 connected to SWIM data feeds: TFMS, ASDE-X, TBFM, ERAM.

4.3.1.1. Each system has own logic on what they're working with.

4.3.1.2. SWIM office doing good job by adding extra IDs to the feeds.

5. Fuser (Shawn Gorman, Mosaic ATM)

5.1. *Why Everyone Should Have One*

5.1.1.1. ATD-2 is built on SWIM but also has direct connections to airlines.

5.1.2. Why Fuser?

5.1.2.1. It is the one stop shop for all analysis needs; the right data at the right time.

5.1.2.1.1. It reduces troubleshooting time.

5.1.2.1.2. Flight management: built in strategy for removing flights from system.

5.1.2.1.3. Flight matching: Issues with syncing flights across information services.

5.1.2.1.3.1. Integrated with sites, can get trouble tickets from ATC and it comes in as a flight matching problem to identify the problem.

5.1.2.1.3.2. Every message that comes into the GUFI service gets assigned a GUFI to match the flight.

5.1.2.1.3.3. If airlines want to participate, they can partner/collaborate to ensure your inputs go into these algorithms (e.g., different airlines have different substitution rules).

5.1.3. We are working with Delta to put Fuser in the cloud and get them connected.

5.1.3.1. Willing to engage with others if there's interest.

5.1.3.2. Trying to figure out where we are going next.

5.1.4. Where do we go next with this?

5.1.4.1. I think the NAC/NIWG groups - surface NIWG recommended - need discussion on continuing this activity to reduce risk on TFDM and TBO, 3T integration.

5.1.5. With whichever Fuser product you use, you will go through a lot of same things we are talking about today.

5.1.5.1. There may be a way to connect you with data sooner rather than later.

5.1.6. What's Fuser doing now and what is its ability to operate at NAS scale?

5.1.6.1. Process ASDE-X for CLT/DFW.

5.1.6.2. We can handle NAS to a degree, but the database volume is big, so long-term solution, we'd need partner with a lot of processing power.

5.1.7. How adaptable is it to another airport? CLT has unique operations. How much customization?
5.1.7.1. At the data level, there's no changes needed.
5.1.7.1.1. You can feed in whatever airport you want. Available on SWIM feeds, blended into FUSER.
5.1.8. Change management: as TPP comes out, different levels of data are available by SWIM.
5.1.8.1. There are changes happening across NAS.
5.1.8.1.1. Fuser works NAS-wide.

5.2. *Deeper Dive*

5.2.1. Fuser Processing: ATD-2 had to build both sides of TFDM (FAA and Operator), what still has to be done on the FAA side?
5.2.1.1. The architecture fits both sides, TFDM will produce a new feed with your identifier and predictions, but if someone wants to correlate that to TFMS they will still have to do a fusion process.
5.2.2. You mentioned bad data, where does it come from?
5.2.2.1. Sometimes airlines make mistakes, departure runways in TBFM are not reliable and format doesn't work well with our system.
5.2.2.2. We feel we can do better detection with off/on using surveillance, so we filter out actual off/on times.
5.2.2.3. We built in a capability that if you find there is data you don't want, you have two different ways to filter it or you can put mediation rules in the architecture.
5.2.3. Mediation: Harmonize various airport codes across IATA, ICAO, FAA
5.2.3.1. Priority rules for setting airport ID data sources – will overwrite the airport id based on source (TFMS, TBFM, etc.).
5.2.3.2. Where did the source priority list come from?
5.2.3.2.1. Analysts in the field made reports and that guided these rules, mainly trial and error.
5.2.3.3. Position Coverage – timeout data source if no reports or data goes out of range.
5.2.3.4. EDCTs – ingest EDCTs from TFMS and TBFM.
5.2.3.5. How to track diversions?
5.2.3.5.1. If flight diverts it is still considered 1 flight object, we track the full flight history so we can see when it changed airports.
5.2.3.6. Operators submitting EOBT today, that would become part of the logic as well.
5.2.4. Flight matching is key to fusion.
5.2.4.1. Every flight message gets unique ID.
5.2.4.2. The goal is for every SWIM message and non-message to assign unique ID to message.
5.2.4.3. Use call sign, airport, data source, etc. FAA also unique ID process across their SWIM IDs.

5.2.4.4. Different systems have different ideas about flight starting and taxiing to gate.

5.2.5. How does GUFI comply with European naming conventions?

5.2.5.1. This is for us. We have to assign within our own system. Everyone will have to do this if you're bringing in new data.

5.2.6. If you don't have standard that's global, it creates a conundrum. It is challenging for us to have unique IDs for everyone. Traversing world, not just NAS.

5.2.6.1. We keep track of all IDs from other systems.

5.2.6.2. It's an ICAO issue. ATM RPP is looking at the definition of what's been referred to as flight object. The FIXM model is intended to address it at an international level. It needs to be standardized and resolved.

5.2.6.2.1. We can take an action to see where they are and report out at next SWIFT.

5.2.7. How do you merge GUFI?

5.2.7.1. Some basics: aircraft call signs, destination/origin, position, etc. GUFI looks across flights and if a match is found, it's returned back to the external client.

5.2.8. We want to partner with you to understand anomalies. If you're finding issues to relate information, that's means I've done something wrong up front. Want to partner to figure it out. Each carrier does something different.

5.2.8.1. We run a series of queries every night to look for issues.

5.2.9. Would the application of Fuser for the airline involve scenarios where we have Departure Metering, Stream restriction?

5.2.9.1. I would put that in TTP. We can put it in fuser, but we won't implement that logic.

5.2.9.2. Your operational needs and focus dictates what data you use at different times. Your logic might look different than ours.

5.2.9.3. Illustrate the differences between airport names: IATA, ICAO, FAA.

5.2.9.3.1. Ex: Hilton Head Airport (HHH, KHXD, HXD).

5.2.9.4. Given the data source, the Fuser tries to incorporate all three (IATA, ICAO, FAA).

5.2.9.4.1. Fuser will look for data anomalies and special cases.

5.2.9.4.2. We will replace what we know is the wrong airport with the right airport.

5.2.9.5. For TFM, we'll take the message and set it. Is it from Priority 1? If so, it can override priority 2. Priority 2 cannot override Priority 1.

5.3. Fuser Database

5.3.1. Fuser is not available to download; it would require a lot of help to set up.

5.3.1.1. It would have to be configured to your SWIM connection; databases initialized.

5.3.2. Turning SWIM Data into Consistent Reports for Analysts and Users

5.3.2.1. Presented descriptions of the database reports that are created based on various queries to provide information about a day's operations.

5.3.2.2. Pilot ready time – that was not in the concept originally, how is that captured?

5.3.2.2.1. It is an algorithm we developed. Gate hold clearance is the highest priority, but we don't always get that clearance. Track data or out time can also be used.

5.3.2.2.2. CFR gives best measure of departure readiness.

5.3.2.2.2.1. If you are measuring EOBT and only use out time, the pilot could have been ready, but something stopped them from pushing earlier.

5.3.2.2.3. Fused SWIM data made post-ops reports much easier.

5.3.3. Accuracy Comparison of Various Landing Time Prediction Sources

5.3.3.1. Look at sources in the Fuser to identify which landing time estimates are the most accurate.

5.3.3.2. Plots show how errors change in various estimate times throughout a flight's predictions pre/post departure.

5.3.4. Mediation Position Data

5.3.4.1. Multiple data sources trying to provide us with the latitude/longitude of flights. We want to be able to mediate that so when you look at a flight track, it's as smooth as possible.

5.3.4.2. We have a priority based on the source that's coming in which is built into how we mediate the position data.

5.3.4.3. We are fused with NASA's TFMS system which does have TRACON.

5.3.4.3.1. TAIS is a heavy data source as far as processing goes.

5.3.5. Reviewing EDCT

5.3.5.1. Went to TFMS and TBFM to get the data. EDCT also published to ERAM.

5.3.5.1.1. The EDCTs are filtered and not every update goes through to ERAM; later published through SWIM data so we get EDCTs from both sides.

5.3.5.2. TBFM EDCT should match the TFMS EDCT.

5.3.5.2.1. To do that we need to make sure the TBFM SYNC messages are handled correctly.

5.3.5.2.2. Ex: A single flight has multiple flight plans. It is tracked individually and updated based on which flight plan came in most recently.

5.3.6. Overview of Fuser Flight Model

5.3.6.1. It is useful to have a standard naming convention.

5.3.6.1.1. The goal is to get alphabetical naming that makes sense: category, resource and source type.

5.3.6.2. Flight times are all tracked separately.

5.3.6.2.1. We also track the runway used: actual versus predicted runway used. We track timestamps too.

5.3.6.3. We track departure stand prediction times: initial, proposed time, airline time, the earliest time and the actual time.

5.3.6.3.1. We need to track and map these individually and mediate them individually so we can determine the best available option at any point in time.

5.3.6.4. Need to determine which sources we trust more for the data elements.

5.3.6.5. Post all of the mappings online. (Refer to URL link on slide).

5.3.6.6. How are you handling diversions and tracking multiple diversions for a single flight?

5.3.6.6.1. If the flight diverts, we still consider one flight object. We tend to do other flight logic if available otherwise we track it individually. We store the whole flight history so we can see when it changed airports.

5.3.6.6.2. If you start with SWIM, you start with TFMS.

5.3.7. Review of Fuser Database with TFM Tables

5.3.7.1. Difficult to query when common fields are not used.

5.3.7.1.1. We really rely on Fuser databases - which originally come from TFMS.

5.3.7.2. If I download The Fuser application and install it to our environment and ran it through the input, can I see at that end what is being updated?

5.3.7.2.1. Fuser is not available for download. If it were, it would require quite a bit of knowledge. It would have to be configured and setup. Lots of worked involved in getting the architecture setup if that were the way to go.

5.3.7.3. How do we convey complexity if that's a message we received from different folks?

5.3.7.3.1. If that were available, it wouldn't simply be download and crank. It would require a good system to run on.

5.3.8. Review of Data Cancellation Messages

5.3.8.1. How refined are the databases? Can they identify issues by a specific carrier?

5.3.8.1.1. We track each issue; it just depends.

5.3.8.2. A user in the Cloud POC, what do you envision being the output of that?

5.3.8.2.1. A feed of the user-defined schema. Rather than trying to understand multiple messages, you could at least have one flat spot.

5.3.8.3. A flight summary record has everything for the flight, is the track information included or is it separate?

5.3.8.3.1. In the database you can get all of the information in all sources.

5.3.8.4. Did you find/consider any value in overlaying where the flight plan is from a lifecycle perspective…has it dropped into ERAM? Any value in layering that piece in to try to pull apart anything?

5.3.8.4.1. Getting ready to brief on this type of data - over the lifetime of a flight, the different sources of data. We'll go part of the way to answer that question fully.

5.3.9. Review of flightSummary

5.3.9.1. Deriving a lot of geometric times, do you do that as part of the Fuser or post-Fuser, what's your level of success and accuracy?

5.3.9.1.1. A layer that exists between the Fuser and the database. We are definitely looking at the accuracy of that.

5.3.9.2. Are these reports where you find a sweet spot for your EOBT? 20 minutes beforehand?

5.3.9.2.1. Yes, we determine when to figure that out.

5.3.9.2.2. Various look ahead times - 4x more often than your flight getting an EDCT. The scheduling and overhead process is really tactical.

5.3.9.3. Would this group consider a catalog/library of Use Cases that run the gamut of everything that's happened over the last two days…everything being worked on?

5.3.9.4. A library of Use Cases? And maybe those have a consistency of formatting?

5.3.9.4.1. (Writes suggestion on whiteboard) Library of Use Cases that identify various methods and algorithms (i.e., Fuser) go about solving the operational issue.

5.3.9.4.2. Much similar working with the SWIM data. Don't have to worry about translating language that the user is accustomed to.

6. SWIM Data Analysis

6.1. Review of Use Case Studies

6.1.1. Analysis of APREQ Flights at CLT

6.1.1.1. Great improvement in compliance to APREQ time in 2019 – worst day in 2019 is the same as the average compliance in the beginning of the project in 2017.

6.1.1.2. Increased predictability of pre-departure delays allows for FOC to assign shorter block times.

6.1.1.3. Pre-scheduling allows for more capacity in overhead stream.

6.1.1.4. What are the limitations of the statistical method? How to correct them?

6.1.1.4.1. APREQs – there are anomalies why an aircraft didn't take off that you can't get more information about. There are no algorithms, these are physics-based calculations, most of the limitations are based on external inputs – rain, etc.

6.1.1.5. Is this gate departure delay?

6.1.1.5.1. These are departures leaving CLT with a controlled departure time, say noon. They have rescheduled their departure for an earlier time, say 11:55am. So, a five-minute earlier departure time.

6.1.1.6. Which controllers are using this tool?

6.1.1.6.1. The TMC and the Tower. The request is being sent over to TFMU/FAA?

6.1.1.7. Looking at top graph, pilots are calling later than EOBT.

6.1.1.7.1. The negative value means early with respect to EOBT. So pilot ready minus EOBT.

6.1.1.8. Your EOBT is conservative?

6.1.1.8.1. We see a different relationship with EOBT than any other services.

6.1.1.9. What are the other limitations of predictable method used (statistical method) used? If any, how do you correct those?

6.1.1.9.1. From the analysis side - there are anomalies we don't have visibility into.

6.1.1.9.2. These are physics-based predictions being levered here.

7. TFDM Terminal Publication Service (TTP) (Stuart Wilson, Mosaic ATM)

7.1. TTP is the SWIM version of what goes in the Fuser.

7.1.1. Same schema as TFDM but this is the NASA prototype version. We can't replicate all the functionality of TFDM.

7.1.2. Algorithms are different than the ones for TFDM, but the intent is the same, so the content provided by the data elements should be similar to what will be provided by TFDM.

7.1.3. GUFI is published with each flight message in TTP, but it will not match the format of the TFDM GUFI.

7.1.4. Providing information about which flights are impacted by TMI – including reroutes?

7.1.4.1. Yes. There's the opportunity to test the swapping service, to get into surface CDM. If there are additional needs, we can see how to get early access to see if you need to test out the R/R. Will give better insight into non-movement area we can factor into the scheduling.

7.1.5. If there's no metering program in place what would be on TTP?

7.1.5.1. Restrictions, airport configurations, TMIs, Runway.

7.1.5.2. Only 27 of 89 TFDM airports will have metering. You can have access to the fused data as well as operational awareness – AEFS, surface state changes, current tactical situation at the airport. More insight into the FAA ATO.

7.2. Voice traffic between ATC and AOC was cut ~90% once ATD-2 was put in place.

7.2.1. Are you using the same algorithms as TFDM?

7.2.1.1. The algorithms are not exactly the same. In many cases, it's comparable. The intent is to have them the same as what's coming out.

7.2.2. Will that also carryover to TFDM?

7.2.2.1. It's our own generated one.

7.2.3. Would information also include flights subject to a require reroute?

7.2.3.1. No

7.2.4. If there's a not a metering program in place, what kind of data is being streamed?

8. Q&A / Closing

8.1. Concerns about providing Fuser in a downloadable format since there would need to be lots of changes with regards to user SWIM feeds, infrastructure, etc.

8.1.1. Is there a scorecard of stuff we should have implemented before the next time we meet?

8.1.1.1. Today was very technical so you could see some of the data science done so far. Did you see a linkage to value in solving a problem? To go to IT lead do you need a business case?

8.1.1.2. Provide a link of some of the use cases presented over the next few weeks to link use cases to benefits case that would lend itself to a business case.

8.1.2. When is it needed? – the value to JBU they could be getting tomorrow if they were using the data a certain way. When is it needed by TFDM so the NAS benefits? I think we can look at those dimensions and come up with a checklist. One value of EOBT is used 4 different ways. You benefit as well because you get updated data. TFDM, TTP are near term.

8.2. It's a parallel process between this and C-SIT. How to bridge that gap is an issue. Lots of work still to do. Could be good to do a dry run at SFO.

8.2.1. We are doing a dry run at PHL right now. We can do something for a broader audience – SWIFT or somewhere else.

8.2.2. SFO was going to be here today but they are on-boarding on SWIM. Great idea to look at another airport like that and it's nice that there is ARP level interest and bridge that gap. CLT benefited from a local service team before we started this automation. Airports that don't automate won't get as much benefit.

8.2.3. Engage with all the entities at the airport and form surface teams that CLT was an example for.

8.2.4. It's the first opportunity to have a carrier-rich environment with an international presence also at SFO.

8.3. What will happen in September?

8.3.1. A 2-day workshop on ATD-2 with panels and breakouts. Operational piece fits with this technology and we will walk through that. Speak about TTP again and what operators need to do to get ready for the future.

8.4. Thank you to Rick Dalton and SWA for hosting.

8.4.1. We are planning to automate the registration.

8.4.2. Targeting August for the next SWIFT meeting.

8.4.3. More information will be sent about that.

8.4.3.1. The meeting location is TBD.

Appendix A: SWIM Industry - FAA Team (SWIFT) Meeting #6 Attendees – May 22, 2019

David Almeida, LST	Michael Beck, United	Matthew Bellinger, SaabSensis
Miles Bellman	Joe Bertapelle, JetBlue	Kristen Beverly, LST
Steve Bradford, FAA	Chris Brinton, NASA	Lee Brown
David Brukman, Passur	Chris Burdick	Vicki Burford, American Airlines
Jason Burke, NASA	Stefanie Calabrese, Noblis	Al Capps, NASA
Ted Carniol	Eric Chevalley	Andrew Churchhill, NASA
Erin Cobbett, Delta Air Lines	Eli Cohen	William Coupe, NASA
Kathryn Crispin, American Airlines	Daniel Criswell	Rick Dalton, Southwest Airlines
Claudia Davidson, Palantir	Michelle Davis	Kent Duffy, FAA
Shouvik Dutta	Dave Emmons, American Airlines	Shawn Engelland
Paul Finn	Robert Flynn	Mark Galyen, American Airlines
Kenneth Gochenour, Jeppesen	Rob Goldman, Delta Air Lines	Shawn Gorman, MosaicATM
Thomas Green, Rockwell Collins	Douglas Harvey	Shawn Herron, LST
Rory Hight	John Howard	Mindy Howard
Michael Huffman, FAA	Rose Hsu	Ilhan Ince, Passur
Michael Jagmin, United	Kevin Johle	Craig Johnson
Joon Jung	Rafal Kicinger	Suzanne Koppanen
Dennis Krisczy, FAA	Connor Landy, Palantir	Dan London
Marcus Lowther, Metron Aviation	Dan Lyons	Scott Masarky
Melissa Matthews, FAA	Eric Mayne	Greg Meadows, Red Cloud Services
Teresa Mendes, Noblis	Alex Murray, Noblis	Dayal Nagasuru
Tim Niznik, American Airlines	Oriol Oliva	Susan Pfingstler, United
Venkata Ranga	Isaac Robeson, NASA	Bob Richard
Amit Sahay	John Schade	John Short
Garrison Smith, Delta Air Lines	Kwangil Sohn	Sandra Steele, American Airlines
Mark Talaga	James Tauss, HSI	Jamie Terrell, American Airlines
Dan Torres	Sarasina Tuchen, NASA	Steve Turner
Eric Van Brunt, Leidos	Robert Vandusen	Ruben Velez
Unni Vellanikaran, SeaTec	Himanshu Verma	Felisa White, FAA
David Wickes	Stuart Wilson, NASA	Tak Wong, AlaskaAir
Kevin Witzberger, NASA	Pengcheng Zhang, American Airlines	Jay Zimmer, LST