



## **Minutes of the 25 September 2008 Meeting of the North American SIMMOD Users Group**

### **1. Welcome**

The meeting convened at 9:00am at the Virginia Tech – Northern Virginia Center in Falls Church, Virginia. Toni Trani welcomed everyone to the meeting, and each participant introduced her- or himself.

### **2. Agenda**

The agenda was reviewed and approved.

### **3. Minutes of the Previous Meeting**

The minutes of the September 2008 NASUG meeting were approved.

### **4. FAA Development Activities**

John Zinna presented the current status of FAA Tech Center's work on their SIMMOD engine. The current version is 3.1 — available for both the Windows and Linux platforms. There have been nine requests for the engine since the last release. Changes have been forwarded to ATAC Corporation.

The changes are as follows:

- A new field in the AIRLINES inputs was implemented to specify a gate service time distribution by airline as well as aircraft ground group.
  - Aircraft were staging even though departure queue was not full. It is no longer necessary to use the TAXICHKPT record for staging to work.
  - History codes SW and SF were not written to the SIMU26 file, which was causing an animation error.
- The airline type and airport fields of the AIRLINES inputs are now optional.
- New RUNWAY\_TAKEOFF\_OCCUPANCY input to allow the user to define departure runway occupancy times using probability distributions.
- The AFLINKBLOCKING logic was corrected to fix cases in which not all aircraft combinations were blocked properly on specified links.
- The AFLINKBLOCKING logic was corrected to properly activate reverse blocking.
- Runway exit selection logic changed so that aircraft will avoid choosing an exit link that is filled to capacity or is blocked due to link blocking.
- A new method of departure staging was implemented to eliminate the need for a departure to first taxi to a checkpoint. The new logic simply allows a departure to taxi directly from the gate to a staging area when the departure queue is full. This new behavior is optional with the original behavior as default.

- The SIMU10 file has been updated to provide output for each iteration as well as statistics on staging time.
- The gate logic was fixed to solved the following problems:
  - Aircraft were not seeking an alternate gate when the assigned gate was unavailable and alternate gate selection was permitted.
  - Aircraft selected unavailable gates when searching for an alternate gate.
  - Aircraft we being destroyed because no gate was available. Flights will now selected an occupied gate and wait for it to become available.
  - Gate selection login was crashing when used by towed aircraft.
  - Towed aircraft were not properly releasing a gate after passenger unloading.
  - Arrival aircraft that had been towed to a remote location would be assigned to gate thus preventing that gate from being used by other aircraft.
- The re-routing logic was fixed to work with multiple departure queues to the same runway.
- The departure queue logic was fixed to properly use the add\_dq\_lower\_limit global input.
- The lack of a gate in a RUNWAY\_EXITS\_LINKS or RUNWAY\_EXITS\_PROHIBITED\_LINKS entry now implies that the entry applies to all gates.
- The engine now longer requires any ground data in cases where airports are modeled as a single airspace node (degenerate airport).
- An infinite loop due to holding for zero time was eliminated.
- The missed approach logic was fixed to eliminate an engine crash.
- The touch-and-go logic was fixed to eliminate an engine crash.
- Two new methods were added to specify towing speeds:
  - A new field has been added to the TOWING inputs. This field specifies a probability distribution from which a towing speed is drawn.
  - New TOWING\_SPEED inputs have been created with which each ground link can have a towing speed that is drawn from a probability distribution.
- There have been several changes related to the TAXICHKPT inputs:
  - The NUM\_AHEAD field of the TAXICHKPT is now being read and used properly.
  - TAXICHKPTs now may be used to select a new taxipath when aircraft leave a departure staging area for a departure queue.
  - A new taxiplan can be determined if the occupancy of a departure queue, air link, air node, or ground link exceeds a threshold value.
  - The new taxiplan can be dependent on the aircraft ground group.
  - Backward compatibility has been maintained.

## 5. ATAC SIMMOD Status

Eric Boyajian presented the current status of ATAC's SIMMOD-related activities. Version 7.3.2 of Simmod *PLUS!//PRO!* was released in March 2008. Release of version 7.4 is planned before the end of 2008. Changes include:

- Modifications to the database to accommodate new features.
- Improvements to the look-and-feel.
- Animator icon headings are now read from the SIMU26 output file.

Changes to the ATAC engine since the last NASUG meeting include the following:

- Re-routing logic changes:
  - An arrival will now properly re-route if the next node downstream of a post node is a meter node.
  - Messages associated with arrival re-routing have been assigned to trace 293 and 299 while departure re-routing messages remain assigned to trace 60 and 67, respectively.
- The airspace logic was corrected to ensure that will vector rather than hold at airspace nodes when vectoring is an option.
- Procedure logic changes:
  - The engine no longer erroneously reports that there were no valid procedures for a given flight.
  - Departing aircraft now leave the departure queue when the arrival/departure blocking time has expired even when the arrival aircraft is still completing its landing roll. This is only true if the “hold until runway clear” flag is false.
  - Previous engines would crash if no aircraft groups were assigned to a procedure. Now a warning message is written to SIMU02.
- Departure flights now properly consider the priority level of de-icing and staging areas when choosing one.
- Runway logic changes:
  - The priority of departure queues over runway crossings is now being properly reset in simulations of more than one iteration.
  - An arrival now checks to see if the planned exit link is filled to capacity. If so, it tries to choose another exit link.
- DSDPath logic changes:
  - Taxiing aircraft that were performing a spool-up delay are now entered into the DSDPaths of the next link as soon as they begin the spool-up activity rather than until they begin moving.
  - Takeoff or landing aircraft are now entered into the DSDPath to which each runway link is assigned even if this violates the capacity of the DSDPath.
- Gate logic changes:
  - It is now possible to define both a gate and a concourse for a flight. The flight will be assigned to the specified gate, but if that gate is unavailable (upon landing for an arrival or upon injection for a departure), the flight will examine other gates in the concourse if a concourse is specified. If still no gate is found, the flight will then examine all other feasible gates.
  - Improvements were made to the way in which flights choose their gates. This minimizes the likelihood of a flight from being assigned to an occupied gate.
  - New GATE\_PUSHBACK inputs and logic allow the user to define a multi-link pushback or forward routing from a gate. This routing can be specific to taxi destinations and aircraft models. In addition to the routing, the user specifies the speed during the movement and the dwell time at the end of the pushback.
  - Departures no longer power back from a gate even though the gate type is defined as “push back only”.
- The inputs specified in the GATE\_RUNWAY\_TAXIPATH table are now properly considered when a plan other than the baseplan was in effect.

- Departures would continue waiting in the departure queue after other procedures have terminated blocking because an aircraft was still on the runway even in cases where the HOLD\_FOR\_RWY\_CLEAR\_FLAG was set to “F”. Now such departures are free to taxi to the runway.
- Aircraft heading information is now written to SIMU26 to allow animators to properly orient aircraft icons.
- The engine has been compiled with a newer version of the compiler, and various debugging functions have been deactivated. Simulation execution is noticeably faster.
- FAA version 3.0 changes have been incorporated to the ATAC engine.

## 6. Modeling Shanghai Hongqiao Airport

Qianlin Li discussed some of the modeling work undertaken by Landrum & Brown for Shanghai Hongqiao Airport (SHA). This airport currently has one runway with two terminals.

In 2005, the government decided to move all international flights to Shanghai Pudong International Airport (PVG). Landrum & Brown worked with the airport to develop a masterplan that included a new west terminal with all domestic traffic. In 2007, a new decision allowed flights to/from Japan to use SHA. This may also eventually extend to other Asian carriers from Korea, Hong Kong, and Macau.

The current expansion project involves the construction of a new, closely spaced (386m) parallel runway. This is a first for China. This expansion is to meet a goal of 30 million annual passengers. The modeling assumed 706 daily flights using 58 parking positions.

Part of the modeling was to evaluate the efficiency of aircraft movement in the ramp area of the new terminal. At SHA there is no ramp control, but rather aircraft call the tower for pushback clearance. The tower guides aircraft all the way to/from the gates. Three different options were considered for managing the taxi traffic:

- A. Dedicated flows — aircraft maintain strict directionality at all times on any taxiway
- B. Semi-dedicated — three lanes of traffic
- C. Flexible — directionality can be flexible (this was not simulated as the operators did not like the concept)

Other assumptions made were that all operations were IFR with no visual (reduced separation) operations. This is partly due to very poor visibility due to pollution. The Civil Aviation Authority of China (CAAC) implements flow management at airports so schedule peaks do not normally occur. Because of this options A and B generated very similar results. There were not too many peaks and valleys in the daily operations.

## 7. Data Pre- and Post-Processing Using Google Earth

Samir Patel demonstrated capabilities developed by Landrum & Brown to bring radar data into Google Earth to visualize flight tracks. This can be used as a graphic in Simmod.

Simmod output was also exported to Microsoft Excel spreadsheets which were then used to look up related data such as the latitude/longitude positions of events and a variety of computed statistics such as stage lengths and delays. Further, this data could then be exported into the KML file format for display in Google Earth. With this format, it is possible to color-code air

and ground links in such a way as to highlight areas of interest such as locations of high delay. All of this information can be viewed in the context of Google Earth.

## 8. Database of Modeling and Simulation Tools

Toni Trani presented an overview of a project to identify and catalog the various tools that are available for performing analysis work related to NextGen. This effort is a collaboration with the LMI Research Institute in response to a NASA Research Announcement (NRA). Further, the goal is to identify gaps in the tool capabilities.

Tools can be classified in several ways such as:

- Purpose
- Execution style
- Parameters
- Level of detail
- Methodology
- Use/Scope

The research wants to:

- Study the CONOPS plans of NextGen
- Identify the models
- Identify the gaps in capabilities
- Provide recommendations

The data is stored in a Filemaker Pro 9.0 database that will, ideally, be published to the internet. This will allow easy access and queries to obtain information about the models. Toni is aware that the data needs to be reviewed in an objective way, and he welcomes comments from everyone to improve the quality.

## 9. Simmod Modeling at Dulles Airport

Erik Wilkins made a presentation on some work conducted by Ricondo & Associates for Dulles International Airport. This work represented an update of a baseline model to reflect the summer of 2008. Dulles currently has three active runways; however, a fourth parallel is nearing completion — to be a new 1L/19R. Taxiway W2 does not currently provide access from the new runway to the central terminal area as a portion is not surfaced. With this connection, aircraft would have an option to taxi between the terminal and new runway by crossing runway 1C/19C.

The question to be answered was: Is the taxiway W2 connection needed?

Four flows were examined:

Taxi times (in minutes)	Without W2	With W2
North flow	7.7	7.6
South flow	9.7	9.4
Mixed	9.3	9.0
North flow (runway 1L arrivals only)	14.3	12.9

This effort illustrated the way that Simmod can be used to quickly answer well defined questions with special-case metrics.

In the ensuing discussion, several participants described the types of metrics that have been used such as taxi times, throughput, and runway crossing times as well as the way in which historical data was acquired through surveys. It was agreed that it is often very useful to perform as much calibration as possible.

## 10. Simmod Defaults: Discussion

Belinda Hargrove led a discussion to review the default data in Simmod. Some default values are coded into the engine when values are missing; however, most are provided by the user interface and can be changed by the user. Much of this information applies to Simmod *PLUS!//PRO!*

Route separation. The default value for this 0.0 NM; however, in previous versions, the value was 5.0 NM so users should be careful.

Air node arrival strategy. The default behavior for this was to separate all aircraft pairs with a common link either entering or exiting the node. The group agreed that the default should be that all aircraft be separated.

Air node control strategy. The default value for this was “SPEED\_FIT”. The group agreed that the default should be “MULTI\_FIT”.

Air node holding strategy. The default behavior is for aircraft to hold if an aircraft is holding at the next node. The group agreed that this is too restrictive and that the default should be that aircraft hold if the number of aircraft approaching the next node meet or exceed that node’s capacity.

Air node separation. The default value air node intrail separation is 5.0 NM. The group agreed that the default should be 3.0 NM.

Procedures. The Simmod *PLUS!//PRO!* interface uses 45 seconds and 2.0 NM as default values for departure/departure separations. There was no consensus on whether this should be changed.

## 11. New York Metroplex Modeling

Dave Holl presented work that ATAC Corporation is currently performing as part of a team for a NASA NRA to study the future effects of advanced air vehicles in the New York metroplex. ATAC’s portion of this investigation includes analyzing the operation using.

The vehicles under investigation are:

- Cruise Efficient Short Takeoff and Landing (CESTOL) — approximately 100 passengers
- Supersonic Transport — approximately 100 passengers
- Unmanned Aerial Systems
- Very Light Jets — in the same class as the Eclipse 500
- Rotorcraft/Tiltrotor

The Simmod model includes the following airports: Newark, Farmingdale, White Plains, Islip, New York JFK, New York LaGuardia, Newburgh/Stewart, and Teterboro. The model also includes all the airspace routings to, from, and among these airports.

The analysis will assume the current best VMC configuration with minimum separations; and following a calibration, the simulations will be run with three demand levels assuming the years 2025, 2040, and a 3x level (perhaps 2086).

ATAC obtained radar data from the FAA with which to analyze the flight tracks to construct the Simmod nodes and links. Dave gave a short demonstration of Simmod animation of work completed thus far as well as a demonstration of the Performance Data Acquisition and Reporting System (PDARS) tool used by the FAA to analyze radar data.

## **12. Date and Location of the Next Meeting**

Metropolitan Washington Airports Authority offered to look into hosting the next meeting in March 2009. Toni Trani offered the Virginia Tech – Northern Virginia Center as a backup option.

Eric Boyajian  
Secretary, North American SIMMOD Users Group





**List of Attendance at the 25 September 2008 Meeting  
of the North American SIMMOD Users Group**

Mr. Kalyan Bala	Mitra Aviation Consulting	
Mr. Geoff Baskir	Parsons Brinckerhoff	
Mr. Eric Boyajian	ATAC Corporation	Secretary
Mr. Don Guffey	FAA – ATO-P, NextGen I&I, AJP-A	
Ms. Belinda Hargrove	TransSolutions	
Ms. Esther Hernandez	FAA – APO	
Mr. Mike Hines	Metropolitan Washington Airports Authority	
Mr. David Holl	ATAC Corporation	
Ms. Akira Kondo	FAA – APO	
Mr. Vivek Kumar	George Mason University	
Ms. Qianlin Li	Landrum & Brown	
Mr. Sutesh Malhan	FAA Tech Center	
Mr. Samir Patel	Landrum & Brown	
Mr. Fariborz Shahzamani	HNTB Corporation	
Mr. Tim Swing	Ricondo & Associates	
Prof. Toni Trani	Virginia Tech	Chairman
Mr. Erik Wilkins	Ricondo & Associates	
Mr. John Zinna	FAA Tech Center	