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Approved by the Tactical Operations Committee August 2017

Use Cases and Benefits for AIMM Segment 3

A Report of the Tactical Operations Committee in Response to Tasking from the Federal Aviation Administration

June 2017

Use Cases and Benefits for AIMM Segment 3

Contents

Executive Summary

A Task Group of the Tactical Operations Committee (TOC) reviewed use cases and benefits for the Aeronautical Information Management Modernization Segment 3 (AIMM S3) Program and provided feedback and recommendations. Stakeholders look forward to receiving the data intended for AIMM S3 – improved SAA schedules, near real-time Special Activity Airspace (SAA) status information and digitized Letters of Agreement (LOAs) and Standard Operating Procedures (SOPs). Operators have sought this robust data set for years and provision of the information is expected to drive new and innovative applications.

AIMM Segment 3 SAA information is expected to enable operators to plan and operate more efficiently, improve situational awareness and enhance collaboration around the use and management of airspace.

The Task Group reviewed the FAA's Flight Efficiency benefits study for SAA information in AIMM S3 and submits the following recommendations regarding the benefits study:

- Enhancements should be made to the FAA's AIMM S3 SAA flight efficiency benefits study to make the analysis less conservative.
- The FAA should engage and provide interim reports to the TOC on the development of the business case analysis for AIMM S3.
- The FAA should conduct further analysis of safety issues to better define the magnitude of benefits that could be realized from AIMM S3.

The Task Group also identified a series of Dependencies and Concerns to achieve benefits from the SAA schedule and status data and offered the following recommendations:

- Cold status information is most valuable if it includes information on when the SAA will be Hot next. This should be included in the data, if possible.
- Human Factors analysis must be performed to understand how different stakeholders will use and benefit from the new data from AIMM S3
- Ongoing evaluation of SWIM is critical to ensuring data integrity and, ultimately, flight safety.
- The FAA should work with stakeholders to determine requirements for the future SAA user application and consider integrating all data into a single website with other aeronautical information (i.e., TFRs, SUA, NOTAMs, etc).
- The FAA should engage with stakeholders to develop the OSS and provide updates to the TOC as the OSS matures.
- The FAA should consider tasking the appropriate Special Committee, i.e., SC-206, to reevaluate the FIS-B Minimum Operational Performance Standards (MOPS) to determine when uplinking SAA status would be beneficial.
- Local SAA adaptations or modifications should be included in SWIM.
- As more scheduling entities connect to SAMS, the FAA should reevaluate the amount of SAA that is active without being scheduled and analyze why those operations are not being scheduled.

Finally, the Task Group provided perspective on LOAs and SOPs. By understanding these, stakeholders understand constraints in the air traffic system, enabling more efficient flight planning. With over 20,000 LOAs/SOPs in the NAS today, stakeholders understand digitization of these will require time to complete.

The group made the following two recommendations regarding LOAs and SOPs:

- The Task Group recommends that the FAA consider establishing a single authoritative source for LOA/SOP information.
- The Task Group requests the FAA continue to work with the TOC to receive guidance and direction on how to sequence the digitization of LOAs and SOPs as AIMM Segment 3 moves forward.

Introduction

The Federal Aviation Administration (FAA) has established the Aeronautical Information (AI) Management Modernization (AIMM) program to mature AI into digital and standardized formats in support of FAA Next Generation Air Transportation System (NextGen) initiatives. In the third stage of the AIMM Program, Segment 3 (S3) seeks to provide operators with updated schedule and status information on Special Activity Airspace (SAA) as well as digitized and structured Letters of Agreement (LOA) and Standard Operating Procedures (SOP). Segment 3 is in an early stage of concept and requirements definition and the FAA requested the Tactical Operations Committee (TOC) to provide input into the S3 use cases and benefits assessment (see Appendix A for the tasking letter). This report serves as the TOC's response to this request. The report that follows includes both feedback to the FAA's work as well as TOC recommendations for AIMM S3. Recommendations for AIMM S3 are identified via **bold** text in the report.

Methodology

The TOC established the AIMM Segment Task Group as a working group of the full Committee to consider the task request and develop a draft recommendation report. The result of this Task Group's work is this report. The Task Group included expertise from different stakeholders in the National Airspace System (NAS), including operators (General Aviation, Business Aviation, Commercial Aviation and Military), labor groups, flight planning vendors as well as Subject Matter Experts from the FAA (see Appendix B for Task Group membership). The group held multiple briefings and discussions to consider the existing use cases and benefits from the FAA and develop and document feedback.

Use Cases and Benefits for SAA Information

This section reviews the use cases and benefits for provision of SAA schedule and status information through AIMM Segment 3.

SAA Capabilities in AIMM Segment 3

The following are understood as the new information and capabilities that must exist in AIMM Segment 3 for operators to achieve benefit:

1. More complete schedule information on SAA
2. Airspace definitions of SAAs
3. Digital (non-manual) transfer of schedule information from the Aeronautical Common Service (ACS) to Air Traffic automation systems which will provide increased accuracy of the SAA schedule, while reducing latency.
4. Near real-time, updated SAA status information will provide a means of tracking, measurement, and analysis of SAA. Analytics will enable identification of patterns of SAA use.

5. Enabling of collaboration between civilian and military operators to recognize current requirements and future emerging requirements.

Benefits from SAA Information in AIMM Segment 3

The Task Group anticipates the key benefit areas for AIMM Segment 3 are as follows. These are applicable to all operators in the NAS, including general aviation (GA), business aviation (BA), commercial airlines and military operators flying through civilian airspace:

- Flight Efficiency
  - Reduction of emissions, time and/or fuel in flight through increased utilization of cold SAAs
  - Reduction of fuel loads by utilizing available, accurate status information
  - Ability to operate a flight (go/no go decision) – applicable to GA/BA
  - May lead to operations that reduce community impact from noise
- Situational Awareness and Safety
  - Improved accuracy of data on airspace definitions
  - Accurate status information for air traffic control (ATC) and operator
- Utilization Reports will provide tracking, measurement, and analysis of SAA which will allow:
  - More dynamic scheduling and utilization of airspace
  - Greater stewardship of the airspace
  - Optimization of future airspace needs
  - Improved operator flight planning/scheduling
  - Future SAA development, design, and revisions
  - Development of cohesive policies and agreements with the Department of Defense (DoD), FAA, and other operators for improved use and management of SAA

Assumptions to Achieve AIMM Segment 3 Benefits

The Task Group worked under the following assumptions:

- SAA status in AIMM S3 will provide more accurate information than SAA schedules do today
- Both large and small SAAs at high and low altitudes can have an impact on all types of operators
- Aeronautical Information Exchange Model (AIXM)-formatted data on SAA schedule or status provided through AIMM S3 will require manipulation to become usable to derive benefits
- Flight planning and/or data vendors will have an important role to play in making the AIMM S3 AIXM-formatted data available and usable from System Wide Information Management (SWIM) for some operators to extract benefits.
- FAA will continue to make SAA data viewable through a publicly available website (as they currently do with the graphical Special Use Airspace (SUA) website today)
- Data on SAA availability/usage will only include times, altitudes and will not provide military data on missions, platform types, etc.
- Any changes to Air Traffic automation systems will be made to ingest aeronautical information from ACS

- All users of SAA will provide schedule and status information that feeds aeronautical information into ACS
- The OSS is a location where users can subscribe to data and this resource will replace any customer-facing web application

Feedback on FAA's Flight Efficiency Benefits Study

Observations

The Task Group makes the following observations on the FAA's Flight Efficiency analysis for improved SAA information (see Appendix F for the benefits study):

- The Task Group understands and agrees that, in concept, flight efficiency is improved through AIMM S3 with more complete and near real-time information and/or analytics on SAA schedule and status. This will enable operators to proactively plan better routes or initiate requests to improve current routes.
- The Task Group understands that currently some Air Traffic Controllers already offer 'shortcuts' through cold SAAs. The analysis approach to baseline which flights already receive benefits today and measure incremental benefit for flights that did not traverse a cold SAA is logical. The order of magnitude of daily benefit for each of the city pairs analyzed is reasonable.
- The analysis assumption of 287 good weather days per year is reasonable.

Input to the Study

The Task Group finds the flight efficiency benefits analysis to be conservative for the reasons listed below. **Enhancements should be made to the FAA's AIMM S3 SAA flight efficiency benefits study to make the analysis less conservative.**

- The percent of eligible flights to utilize the cold SAA is currently estimated between 25% and 50% in the study.
    - The Task Group recognizes there are reasons why an aircraft may not be able to utilize a cold SAA, including: if aircraft is landing weight limited, air traffic congestion, weather, etc. However, from an operator perspective, the 25-50% estimate is considered to be conservative.
    - Based upon the operator input and constraints, the group estimates over 90% of opportunities for shortcuts through cold SAAs would be accepted.
- The current analysis only focuses on city pairs between the Core 30 airports and does not consider impacted Business Aviation and General Aviation flights, or military aircraft operating through civilian airspace.
    - Subject matter experts involved with the original National Special Activity Airspace Program (NSAAP) study note that the DoD is the largest single operator in the NAS and therefore has the greatest potential for savings from near-real time SAA information. This is not factored into the current analysis.
    - General aviation accounts for more instrument operations in the NAS than air carriers and DoD combined and do not typically operate at only core 30 airports. Additionally, a majority

of SAAs have floor altitudes of 3000' or less, thus having a greater impact on General Aviation operators.
  - Visual Flight Rule (VFR) aircraft operations are not included in the analysis.

Future Analysis Recommendations

When the FAA conducts future iterations of its benefits analysis, the group recommends the following for consideration:

- Consider evaluating by region – i.e., Northeast, Gulf, to/from SoCal, to/from NorCal – or by routes known to be impacted by SAAs (e.g., WHITE/WAVEY departures in Northeast).
- Include GA/Business Aviation/DoD and VFR operations in the assessment
- Include metric on carbon emissions
- Provide clear explanation of approach to extrapolate benefits from case studies in the NAS
- Consider presenting results in terms of nautical miles (NM) saved and/or gallons of fuel saved to provide as objective of a metric as possible
- Consider evaluating benefits to community noise

The FAA should engage and provide interim reports to the TOC on the development of the business case analysis for AIMM S3.

Situational Awareness and Safety Benefits

The Task Group analyzed situational awareness and potential safety benefits from AIMM Segment 3, and concluded **the FAA should conduct further analysis of safety issues to better define the magnitude of benefits that could be realized from AIMM S3**.

As detailed in the FAA's case studies and safety report analysis[1], several issues have been identified that may impact safety: (a) poor LOA/SOP version control; (b) inconsistent airspace definition management; and (c) failure to properly manage SAA status and schedule. The Task Group discussed these examples and recognized the potential for increased safety benefits because of the reduction of risk associated with increased situational awareness. This is evident by reducing the opportunity for an aircraft collision. Several Aviation Safety Reporting System (ASRS) reports detail operations where aircraft incorrectly flew through active hazardous airspace due to a lack of status information resulting in the potential for collision. Access to near real time status information would help reduce these inadvertent operations into an active SAA and deconflict civilian and military traffic leading to safer operations.

AIMM S3 will provide an authoritative and universally understood definition for each piece of airspace that can be shared with NAS operators. This will enable a better awareness of SAA use that is taking place.

AIMM S3 supports an increase in situational awareness as it will provide near-real time information of SAA status. SAA is often activated without formally being scheduled which creates a hazard based on the

[1] See page 53 of Appendix F

lack of information available to pilots for planning purposes. Enabling a process that allows for schedules and status information commonly shared by controllers, schedulers, and operators will improve joint understanding of SAA status and reduce the potential for inadvertent airspace penetration when the SAA is hot.

When the users of SAA operate outside of the scheduled and published hours of operation, it affects the efficiency and safety of operators in the NAS. The operators that are already airborne have no way of knowing that the SAA is still active and may fly into an SAA that they believe is not active (i.e., MOA's, etc). With the ability to conduct an analysis of actual SAA usage, schedulers will be able to better manage SAA usage. Users of SAA could contain their training to stay within the scheduled and published times and reduce the likelihood of an operator flying into an active SAA. This would increase the efficiency and safety of operations within the NAS.

Dependencies and Concerns to Achieve Benefits

The Task Group identified concerns related to AIMM S3 data and its provision to stakeholders. These are beyond scope of the original tasking. However, they are critical and documented below:

1. The data provided by AIMM S3 needs to be timely and accurate and from an authoritative source. If it is not timely, accurate or from an authoritative source, use and benefits will not accrue.
2. There is concern regarding the completeness of the SAA data. Providing information on what percent of SAA schedule/status data is expected in the system over time would be helpful.
3. **Cold status information is most valuable if it includes information on when the SAA will be Hot next. This should be included in the data, if possible**. This is particularly relevant when an SAA is made Cold earlier than scheduled. Civilian airspace operators would like assurance that it will stay cold or know when it will become Hot again.
4. **Human Factors analysis must be performed to understand how different stakeholders will interact with the new data from AIMM S3**. This includes understanding how controllers, pilots and dispatchers will all make use of this new information to achieve benefits. HF are paramount to understanding controller workload as status information becomes more available and requests through Cold SAAs become more frequent. It is also important for developing process, procedures or training for managing Hot/Cold SAAs, etc.[2]
5. There are multiple commercial entity perspectives and concerns regarding receipt of the data from AIMM Segment 3:
    a. SWIM is emerging as a backbone for information sharing between FAA and industry and is undergoing scrutiny to evaluate whether any changes to requirements or improvements in capability are needed. This Task Group understands AIMM S3 data will be distributed over SWIM and some of the data, such as dynamic SAA status data, may have implications to flight safety. **The Task Group stresses that ongoing evaluation of SWIM is critical to ensuring data integrity and, ultimately, flight safety**.

[2] Generally, stakeholders request the process and procedures for SAAs be as standardized as possible across facilities.

b. The Task Group would like to highlight that to access, process and utilize AIMM S3 data will require significant effort and investment. The Task Group recognizes that AIMM S3 data, along with all AI data over SWIM, will be provided in AIXM format as bulk data, i.e., a "data dump". Operators or their 3rd party providers will be responsible for going through the process of connecting to SWIM, maintaining the connection, building AIXM capability, understanding and parsing the data provided over SWIM and, ultimately, deriving value from the data provided. Operators will have to make significant investments to access and utilize this data. The Task Group anticipates that different operators will take different approaches to connect to, ingest and make use of SWIM data. This challenge will have an impact on business investment decisions that operators will have to make to realize benefits.

6. There are also general aviation concerns regarding receipt of the data from AIMM Segment 3 for:
   a. There are currently multiple websites that deliver NAS information to the public today (TFR website, Notice to Airmen (NOTAM) website, SUA website, etc.). As the data provided by AIMM S3 becomes available, it is important the FAA modernize their existing websites to integrate and leverage this information. Improving the existing graphical SUA website is important for many pilots to benefit from the new data being provided. There is a benefit to consolidating existing FAA websites and merging these user-facing applications into a single resource where aeronautical information, like NOTAMs and SAA, can be sorted and filtered. **The FAA should work with stakeholders to determine the requirements for the future SAA user application and consider integrating all data into a single website with other aeronautical information (i.e., TFRs, SUA, NOTAMs, etc.)**.
   b. The FAA provided Flight Information Services Broadcast (FIS-B) service does not currently uplink all SAA data due to accuracy and completeness concerns. As AIMM S3 improves upon the information currently available, **the FAA should consider tasking the appropriate Special Committee, i.e., SC-206, to reevaluate the FIS-B Minimum Operational Performance Standards (MOPS) to determine when uplinking SAA status would be beneficial**.
   c. With the implementation of the ACS and One Stop Shop (OSS), existing FAA data portals could eventually merge into one website that provides all of the information in one location. **The FAA should engage with stakeholders to develop the OSS and provide updates to the TOC as the OSS matures.**

7. Local air traffic adaptations or modifications of SAA internal boundaries result in inconsistencies, which are barriers for operators to determine what airspace is active and impacts the safety of operators in the NAS. **The Task Group recommends local SAA adaptations or modifications be included in SWIM**. This would allow operators to have accurate boundary information, flight plan accordingly, and increase safety and efficiencies in the NAS.

8. While a full analysis has not been done on why there is a high percentage of SAA that is active, without being scheduled, the Task Group recognizes many scheduling organizations are not currently connected to Special Use Airspace Management (SAMS). These organizations plan to

automate the transfer of scheduling information in the near future. **As more scheduling entities connect to SAMS, the group recommends the FAA reevaluate the amount of SAA that is active without being scheduled and analyze why those operations are not being scheduled**.

Use Cases and Benefits for LOA/SOP Information

Today, operators are generally not aware of LOAs and SOPs in the NAS and the information is not made available to the public in a consistent manner. As a result, the impact of LOAs or SOPs on flight planning and active flights is only understood by the operators after a flight plan is filed or once the aircraft is airborne. This reactive method is inefficient, affects operator flight planning, causes reroutes, and increases workload and complexity for air traffic and operators.

There are inconsistent methods by which new LOAs/SOPs or changes are shared with operators. Each individual facility must therefore try and determine what information or documents may impact the operators. In most cases, operators learn about LOA or SOP changes through operator experience, Letters to Airmen (LTAs), System Impact Reports (SIRs), NOTAMs or emails from ATC facilities. The current process of discovery of LOAs/SOPs is cumbersome, inefficient, and inconsistent. Hence, operators place a high value on a single authoritative source of LOA/SOP distribution that has a consistent and reliable process of dissemination. **The Task Group recommends that the FAA consider establishing a single authoritative source for LOA/SOP information.**

Providing LOAs or SOPs to stakeholders will enable flight planners (pilots and vendors) to study or ingest this information and thereby plan flight trajectories that remain consistent with air traffic constraints. This group believes that if a restriction exists along a route, operators should be aware of it so they can comply. This group spoke with two flight planning vendors serving the GA, BA and airline communities that expressed keen interest in receiving this information for their flight planning products. Some flight planning vendors already ingest approximately 22,000 LOA/SOP constraints from Eurocontrol in AIXM format[3]. The vendors note that having this data in Europe enables flights to be planned in line with what ATC wants and expects, improving predictability of time and fuel.

LOA/SOP information is distinct from SAA information in its timing. While SAA schedule and status can evolve hourly, LOAs and SOPs do not change as frequently. Hence, systems ingesting LOA/SOP information require periodic updates while those utilizing SAA information require updates up to the minute.

Today, there are over 20,000 LOAs and SOPs in the NAS today in PDF format. The group appreciates that the FAA will require time to digitize the full set of LOAs and SOPs. The Task Group's input to the FAA is to prioritize those LOAs/SOPs that directly or indirectly impact flight trajectories as it sequences

[3] For more information, see: http://www.nm.eurocontrol.int/RAD/index.html for detail on the Eurocontrol Route Availability Document (ERAD) AIXM data which includes ~22,000 RAD rules. A background briefing is also available at the following link: http://www.eurocontrol.int/sites/default/files/publication/files/20140709-presentation-of-nm-18.5-to-externals.pdf

its digitization process. Those LOAs or SOPs that are unique to air traffic control process or communication and do not impact flight trajectories should be de-prioritized. Some further input on prioritization is presented below.

Finally, operators and third-party vendors indicate that AIMM S3 data could enable new, enhanced information to be provided to pilots, such as graphical renderings of Air Traffic Control Assigned Airspace (ATCAA) and Altitude Reservations (ALTRV), as well as facilitate new capabilities that exist today only in concept. For example, one vendor indicated communication frequency prediction would be enabled to a more realistic level with LOA data, which could provide greater situational awareness for pilots. This concept requires more research but it exemplifies the type of wide-ranging innovation that this data could allow.

Benefits

The Task Group makes the following assumptions in its discussion on benefits from LOA/SOP data:

- The global aviation industry is moving towards an AIXM format and anticipates that digitized LOAs/SOPs will be provided in an AIXM format as well
- LOA/SOP data provided will be based upon an authoritative source

Specific areas of benefit for the LOA/SOP information include:

- *Alignment with NextGen*: fundamental to Next Gen capabilities is sharing accurate data for purposes of creating new noise abatement procedures; improve NAS information for common situational awareness and alignment to implement new tools to assist in future time-based flow management.
- *Awareness of LOA/SOP Development*: through the Airspace Definition Origination Tool (ADOT), greater operator visibility into the development of new LOA/SOP.
- *Safety*: currently there is poor version control of SOP/LOAs that impacts the accuracy and timeliness of some LOA/SOP information. There are 15 safety reports over an 18 month period from 2015 through the first half of 2016 related to this issue. For example, inaccurate LOA information is known to have resulted in a situation where an aircraft in Alaska was too high and operating in icing conditions.
- By having consistent access to LOA/SOP information, operators have multiple benefits for their daily operation:
    - *Feasible Planned Trajectory*: flight plans factoring in air traffic constraints should be more feasible and expected by air traffic, reducing last minute changes that drive delay
    - *Flight Planning Systems*: opportunity to remove constraints in flight planning systems based on outdated assumption or understanding of LOAs and SOPs
    - *Validation*: by having access to the LOA/SOP, operators will have visibility into the constraints and an opportunity to validate the need for specific LOAs/SOPs, or whether the LOA/SOP is required 24 hours a day or every day of the week
    - *Query/Filter*: using new tools in the future, opportunity to query and filter LOA/SOP documents to search for specific air traffic constraints in specific airspace(s).
    - *Awareness of LOA/SOP to Access SAAs*: some LOA/SOP relate to special procedures to access SAAs for certain types of operations. By making the LOA/SOP information available,

operators that can benefit from these procedures will have an opportunity to search for them.

Feedback on LOA/SOP Category

The FAA provided information on LOA/SOP categories (See Appendix D). Based on input from one flight planning provider, the priorities are 1) Routes, 2) Instrument Flight Procedure Crossing Constraints and 3) Boundary Data / Constrained Airspace / ATCAA. This prioritization is based on the group's initial understanding of the categories.

The Task Group requests the FAA continue to work with the TOC to receive guidance and direction on how to sequence the digitization of LOAs and SOPs as AIMM Segment 3 moves forward.

In addition to the information noted above about each category of LOA/SOP information, the flight planner and/or operator would also need the conditions under which the LOA/SOP applies.

Finally, for the NOTIONAL SOP/LOA Attributes, the following are missing characteristics that should be included in the ultimate LOA/SOP data that is disseminated:

- Aircraft Navigation Capabilities (Requirement Navigational Performance/Performance Based Navigation)
- Departure Airport
- Departure Flight Information Region (FIR)
- Overflight FIR
- Overflight waypoint/VOR/airway/playbook route, etc.

Acronyms and Definitions

ACS	Aeronautical Common Service
ADOT	Airspace Definition Origination Tool
AI	Aeronautical Information
AIMM	Aeronautical Information Management Modernization
AIXM	Aeronautical Information Exchange Model
ALTRV	Altitude Reservation
ARTCC	Air Route Traffic Control Center
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
BA	Business aviation
DoD	Department of Defense
ERAD	Eurocontrol Route Availability Document
FAA	Federal Aviation Administration
FIR	Flight Information Region
FIS-B	Flight Information Services Broadcast
GA	General aviation
IFR	Instrument Flight Rules
LOA	Letters of Agreement
LTAs	Letters to Airmen
MOPS	Minimum Operational Performance Standards
NAS	National Airspace System
NextGen	Next Generation Air Transportation System
NM	Nautical miles
NOTAM	Notice to Airmen
NSAAP	National Special Activity Airspace Program
Operators	Entities that fly in the NAS, including general aviation, business aviation, commercial airlines and military operator
OSS	One Stop Shop
S3	Segment 3
SAA	Special Activity Airspace
SAMS	Special Use Airspace Management System
SIRs	System Impact Reports
SOP	Standard Operating Procedures
SUA	Special Use Airspace
SWIM	System Wide Information Management
TOC	Tactical Operations Committee
VFR	Visual Flight Rule

Appendix A: Tasking Letter

U.S. Department
of Transportation
**Federal Aviation
Administration**

Ms. Margaret Jenny
President
RTCA, Inc.
1150 15th Street, NW
Washington, DC 20036

Dear Ms. Jenny:

Advancements in data processing, cloud storage, standardized information exchange models, and Web-based interfaces present an opportunity for significant improvement in the interoperability and quality of Aeronautical Information (AI) Management (AIM). The FAA has established the AIM Modernization (AIMM) program to enable efficient management of AI digitally in standardized formats in support of FAA Next Generation Air Transportation System (NextGen) initiatives. AIMM Segment 3 is quantifying shortfalls, developing concepts, and defining requirements for Investment Analysis Readiness Decision (IARD) in September of 2017. Collaboration with the stakeholders is essential for the success of this segment.

To ensure successful delivery of NextGen operational improvements, the FAA requests that the Tactical Operations Committee (TOC) use their broad expertise within the air traffic management community to help refine and/or validate supporting AIMM Segment 3 use case operational scenarios and supporting information for the two tasks highlighted below.

Background:
AIMM provides capabilities in a segmented approach and progressively improves the collection, management, and maintenance of AI. AIMM harmonizes aeronautical data and products by migrating from product-centric proprietary data environment to an information-centric environment with standardized and open formats. AIMM improves availability of near real time AI between providers and consumers and helps managing airspace with timely dissemination of constraint info like NOTAMS. AIMM migrates the architecture from point-to-point to enterprise network enabled by web services.

Building upon earlier collaboration with RTCA on the National Special Activity Airspace Project (NSAAP), AIMM S3 seeks to further NextGen Segment Implementation Plan (NSIP) Operational Improvements (OI) for the On Demand NAS Information (ODNI) portfolio:

- Improve Management of Special Activity Airspace (SAA) [OI: 108212]
  - ANSP Real-Time Status for SAAs [OI: 108212-11]
  - Improved Access to SAA Information [OI: 108212-21]
- Tailored Delivery of On-Demand NAS Information [OI: 103306-01]

  - Static Airspace Constraints [OI: 103306-01]
- Manage Airspace to Flow [OI: 108207]
  - Planned Airspace Constraints [OI: 108207-21]

AIMM Segment 3 delivers the following capabilities relevant to this request.

#	Capability	Description
1	SOP/LOA Static Airspace Constraint	• Establish an authoritative data source for Standard Operating Procedure (SOP)/Letter of Agreement (LOA) static airspace constraints. • Use standardized processes for SOP/LOA constraints data capture and management. • Leverage Aeronautical Common Services (ACS) for SOP/LOA constraint notification, data access, and distribution to NAS users and ATM systems (e.g., One Stop Shop web portal, Common Support Services - Flight Data (CSS-FD), etc.).
2	SAA Integration	• Provide more robust, timely, and accurate SAA data. • Standardize SAA definitions and nomenclature. • Integrate SAA schedule and status information. • Establish digital interfaces for SAA information exchange with ATM systems (i.e., ERAM, STARS, and ATOP).

Per our discussion at the March 2, 2017 TOC Meeting, the FAA requests TOC complete the following tasks:
Task 1 – Review the SAA Integration use case operational scenarios with supporting information to describe how Hot/Cold status of SAA (in addition to SAA schedules) would support more efficient flight operations.

Task 2 – Review the SOP/LOA Static Airspace Constraints Management use case operational scenarios with supporting information to describe how airspace constraints (such as crossing restrictions) would support more efficient flight operations.

Fulfillment of this request by May 31, 2017 will provide the FAA with clearer insight into what industry values and help to inform better decision making moving forward. The FAA will provide subject matter experts as needed to support this effort.

Sincerely,

Elizabeth L. Ray
Vice President, Mission Support Services
Air Traffic Organization

Appendix B: Participants in the AIMM S3 Task Group

Darrell Pennington, Air Line Pilots Association (ALPA)

Rune Duke, Aircraft Owners and Pilots Association

Frank Oley, Airlines for America

Bhavik Bhatt, CSRA

Steve Anderson, Federal Aviation Administration (FAA)

Farzad Davarya, Federal Aviation Administration (FAA)

Tim Funari, Federal Aviation Administration (FAA)

Rob Hunt, Federal Aviation Administration (FAA)

Allen Proper, Federal Aviation Administration (FAA)

James Sizemore, Federal Aviation Administration (FAA)

Bill Murphy, International Air Transport Association

Ken Gochenour, Jeppesen

John Moore, Jeppesen

Joe Bertapelle, JetBlue Airways

Rex Jackson, National Air Traffic Controllers Association (NATCA)

James Keith, National Air Traffic Controllers Association (NATCA)

Heidi Williams, National Business Aviation Association (Co-Chair)

Trin Mitra, RTCA, Inc.

Richard Dalton, Southwest Airlines

Scott Dehart, Southwest Airlines (Co-Chair)

Ron Ooten, Southwest Airlines

Jeff Dugard, U.S. Navy

George Ingram, United Airlines, Inc.

Glenn Morse, United Airlines, Inc.

Howard Mui, US Department of Defense

Appendix C: SAA Case Study

Powder River Training Complex

Given the large size of the Powder River Training Complex and regular scheduling of the airspace, near real-time SAA status would be beneficial for increasing pilot alertness when transiting SAA during large periods of scheduled activity. In June 2016, a "near miss" was reported in this airspace between a Cessna 172 and a USAF B-1B. The civilian pilot, an instructor at a local flight school, acknowledged he knew the airspace was scheduled; however, he had become accustomed to the airspace being scheduled for many hours each weekday but not used. Providing activation status could have improved this pilot's situational awareness and prompted the need for greater vigilance for military activity. The SAA activation status provided by AIMM S3 can enable new methods of increasing awareness, such as graphical depictions of "hot" airspace.

Appendix D: Detail on LOA/SOP Information

SOP/LOA Airspace and Constraints

The Table below lists notional SOP/LOA airspaces and constraints that will be made available to authorized stakeholders through AIMM S3. It also defines the purpose of these airspace and constraints.

Aeronautical Base Feature	Base feature defined through SOP/LOA?	SOP/LOA Airspace & Constraint Definition
1. ATCAA	Yes	Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other Instrument Flight Rules (IFR) traffic. Constraints are applied on ATCAAs by ATC facilities through SOPs/ LOAs in order to better manage air traffic in accordance with local operational needs.
2. SUA	No	SUA legal definitions are defined by JO 7400.8. Constraints are applied on SUAs by ATC facilities through SOPs/ LOAs in order to better manage air traffic in accordance with local operational needs. SUAs include Restricted Areas, Prohibited Areas, Military Operations Areas (MOAs), Alert Areas, Warning Areas, and National Security Areas.
3. Routes	No	Routes are defined by FAA form 8260-x, SOPs/LOAs define constraints such as crossing restrictions on Routes in order better manage air traffic in accordance with local operational needs Routes include Jet Routes, Very High Frequency Omnidirectional Range (VOR) Airways, and Area Navigation (RNAV) Routes.
4. IFPs	No	IFPs are defined by FAA form 8260-x, SOPs/LOAs define constraints such as crossing restrictions on IFP in order better manage air traffic in accordance with local operational needs.
5. Aerial Refueling Routes (Tracks), Aerial Refueling Anchors, Military Training Routes (MTRs) (Instrument Routes (IR) and Visual Routes (VR)) Orbit Areas	No	The LOA defines operational procedures for entry and exit routes, the actual definition of the Anchor, Refueling Routes, and Military Training Routes. The LOA may or may not restrict non-participating aircraft from flying into one by applying standard separation procedures.
6. Temporary Flight Restrictions (TFRs)	No	A TFR defines an area restricted to air travel due to a geographically-limited, short-term, airspace restriction. TFR related SOPs/LOAs describe the operational procedures around TFRs such as who is qualified to go through this or not, what happens if there are violators.
7. Parachute Jump Areas	Yes	Airspace where parachute operations are conducted. These airspace constraints are applied on parachute Jumping Airspace to support efficient and safe airspace management.

Aeronautical Base Feature	Base feature defined through SOP/LOA?	SOP/LOA Airspace & Constraint Definition
8. Orbit Areas	Yes	This activity is used to occupy an expanded area used for holding or maneuvering aircraft. Orbit areas are used by DoD surveillance aircraft (e.g., E-2, E-3, and E-8) and are normally contained within ATCAAs. JO 7610.4N. Orbit Area related SOP/LOAs describe the procedures for flying through an Orbit Area, as well as the bounds of the area, and FAA guidance during flight.
9. Aircraft Manufacturers Test Airspace (e	Yes	Airspace used by aircraft manufacturers during the development and testing of aircraft. Some aircraft manufacturers' testing is conducted within already defined SAA.
10. Commercial Space Launch Airspace e.g., Aircraft Hazard Areas (AHAs); and Debris Hazard Fields (DHFs))	Yes	Airspace used by launch and reentry vehicles to transit the NAS (Title 14 CFR Part 400). Commercial Space Launch Airspace related SOP/LOAs describe the procedures before, during and after launch, as well as the bounds of the area, and FAA guidance during flight.
11. Facility Boundaries	Yes	The geographic limits, both vertical and horizontal, of a volume of airspace in which a specified ATC facility provides ATC services. Boundaries(Boundary points defined by Lat/longs) of En Route, Oceanic, and Terminal Facilities.
12. Sector Boundaries	Yes	The geographic limits, both vertical and horizontal, of a volume of airspace in which the responsibility for providing ATC services is delegated to a specific ARTCC sector. Boundaries (Boundary points defined by Lat/longs) of Sectors within En Route or Terminal Facilities.
13. Flight Information Region (FIR) Boundaries	No	A flight information region (FIR) is a specified region of airspace in which a flight information service and an alerting service (ALRS) are provided. It is the largest regular division of airspace in use in the world today. FIR related SOP/LOAs describe the boundaries and the procedures for FAA personnel.
14. National Ranges	Yes	Large ranges used for military training (i.e., Utah Test and Training Range (UTTR), Nevada Test and Training Range (NTTR), Western Training Range (WTR), and White Sands Missile Range (WSMR). National Range related SOP/LOAs describe the procedures for flying through an Orbit Area, as well as the bounds of the area, and FAA guidance during flight.
15. Flight School Training Areas	Yes	Airspace where flight training is conducted. Flight School Training Area related SOP/LOAs describe boundaries of the flight area.
16. Aerobatics Areas	Yes	Airspace where aerobatic maneuvers are conducted. Aerobatics Area related SOP/LOAs describe boundaries of the flight area.

Notional SOP/LOA Attributes

These are items in SOPs/LOAs that may be used to identify aircraft that will receive a restriction, or it is the restriction that will be assigned to the aircraft.

LOA constraint characteristics:

- Destination=Precondition-Aircraft with this destination may receive a restriction
- Altitude(s)=Restriction or precondition-Aircraft between these altitudes may receive a restriction
- Airspace Definition=Precondition-Aircraft entering this volume of airspace may receive a restriction
- Fix (Arc/Line)
- Aircraft type
- Route
- Time of day
- Coordination procedures : Controller to Controllers coordination procedure
- Airspeed Restriction
- Procedure for recurring special events
- Automation configuration
- Additional airspace configuration
- Metering Procedures
- Military Procedures
- Special procedures with other State /Local/ Federal agency
- Emergency Agency Procedures
- Contingency Procedures
- SAA activation/deactivation Procedure
- Altimeter Procedure
- Temporary Flight Restrictions (TFRs) Procedures* (not a documented procedure)
- Recreational Area Procedure/
    - Glider Operations Areas/
    - Flight School Training Areas
    - Aerobatics Areas
- Unpublished SAA subdivision

SOP constraint characteristics:

- Airspace description
- Waver Altitudes
- Unpublished Route and altitude speeds
- ATC only Routes
- Time of day
- Coordination procedures
- References to LOAs
- Destination
- Altitude(s)
- Airspace Definition

- Fix (Arc/Line)
- Aircraft type
- Route
- Time of day
- Coordination procedures
- Airspeed Restriction
- Metering Procedures
- Altimeter Procedure

Appendix E: LOA/SOP Case Studies

The following case studies provide additional perspective on how the awareness of LOA/SOP has value for operators:

Case Study: Descending Traffic Early

An operators to airport X noticed that arriving traffic were descended down to 8000 feet approximately 400 NM away from the airport. After further research, the operator learned that this was driven by LOAs established by the Air Route Traffic Control Center (ARTCC) that contained airport X. The ARTCC had LOAs that stratified the altitude of traffic arriving to the many high volume destination airports within this Center. Airport X was at the lowest strata, resulting in flights being pushed down to 8000 feet 400 NM out. Collaboration between the operator and air traffic facility resulted in some sector changes that reduced the low altitude segment by 50%. Additionally, the operator pointed out that the restriction was utilized for all flights, including its flights that operated after midnight local time. As a result, use of the LOA was no longer 24 hours a day but instead based on necessity.

This LOA had significant fuel impacts for this operator at a hub airport. Only after an individual Captain issued a complaint about being descended down too early did the company identify the issue and look further into the LOA.

Case Study: Utilizing an Existing LOA for ZLA/ABQ/Needles

Traffic departing to the east from Las Vegas typically traversed a single departure fix which could result in congestion on the group and increased taxi times. An operator with high frequency of flights learned of an existing LOA that offered a second departure path to the east from LAS. This path departed to the South of LAS over the Needles VORTAC before turning to the east. This option was longer but offered a continuous climb helped in maintaining departure throughput from LAS to the east. Maintaining flow from LAS reduced taxi out times. The operator evaluated the option and elected to utilize the Needles option along with the traditional departure fix for traffic to the east. In this case study, once the operator became aware of the LOA, they recognized utilizing it could actually improve throughput and taxi out time for LAS departures.

Case Study: Salem, OR

In August 2015, the FAA expanded the Class D airspace at McNary Field, Salem, OR, in order to ensure adequate encompassing of the instrument approach procedures. The airspace expansion resulted in thousands of acres of Christmas tree farms now being located within the Class D surface area that were previously in less restrictive Class E. Christmas tree farms rely upon dozens of helicopters to move the trees to the waiting trucks, largely in marginal weather conditions. With the new airspace, should McNary become IFR, the airspace would become one-in, one-out operations; dramatically impacting the farms and the thousands of operations they would conduct daily during the harvest. Following the review of several existing publicly available LOAs, the helicopter operators, tower controllers, ARTCC controllers, and other stakeholders were able to collaborate on an LOA that created a grid of the airspace and allowed continued operations in various weather conditions. The availability of the previous LOAs on this topic were instrumental to facilitating a successful solution and ensuring the continuation of the commerce of the farms.

Case Study: Volk Field SAA

In 2016, the WI Air National Guard reorganized and expanded the Volk Field SAA complex. The SAA complex overlies several airports with instrument approaches. In order to ensure continued access to these airports, an LOA between Minneapolis ARTCC and the military was created. According to the WI ANG, "under the LOA, airspace is recalled to 5,000 feet MSL when use of the GPS approach is requested. The Minneapolis ARTCC is able to recall airspace for the other airports in the vicinity of the Volk Field SAA using this LOA as well. The LOA is not published and is not releasable to the public." The airports impacted account for more than 70,000 operations each year, with a percentage of that being IFR operations. The lack of visibility of this LOA and the relief it provides likely results in many delayed or rescheduled flights due to SAA activity. Underlying airports and communities can be negatively affected by reduced aircraft operations and fuel sales. Increasing the transparency of these agreements will improve operational efficiency, airport access, and reduce SAA's negative economic impact on civil aviation.

Appendix F: FAA Flight Efficiency Benefits Study

AIMM S3 Benefits

May 8th, 2016

Objective

- Preview initial AIMM S3 Shortfall Quantification Metrics
- Solicit feedback on benefit claims, assumptions on SAA Status flight efficiency improvements

AIMM S3 Shortfalls – SAA Status

NSAAP Shortfall	FAA Program	Mitigating AIMM Capabilities
Airspace Definition & Representation of Airspace	AIMM S3	Establish an authoritative source for airspace definitions Correlate legal definitions with locally defined SAAs
Notification Timing for Airspace Schedule Creation, Amendment & Cancellation	AIMM S3	ATM systems (i.e., ERAM, ATOP & E-IDS) will process SAA schedule updates sent from SAMS capability already exists within TFMS
Notification of Airspace Activation and Deactivation	**AIMM S3**	**NAS Users & Air Navigation Service Providers (ANSP) will receive SAA hot/cold status updates from the Aeronautical Common Service (ACS)**
Location of Airspace Status	**AIMM S2/S3**	**ACS is the single access point to receive SAA status updates**
Dissemination of Airspace Status	**AIMM S3**	**ATM systems (i.e., ERAM, ATOP & E-IDS) will send SAA status updates to SAMS for ACS distribution to NAS systems, NAS Users & ANSPs**

Source: National Special Activity Airspace (NSAAP) Concept of Operations, Section 3.3 Shortcomings of the Current Environment (2011)

SAA Flight Path Analysis

Sample City-Pair Savings

City Pair	SFO-LAS	IAH-MCO	DFW-PHX
Average Daily Savings (NM)	152	144	103
Average Yearly Savings (NM)	38,912	36,847	26,266

Methodology

- **Key points:**
  - Use historical flight trajectories
  - Use historical SAA Schedule from SAMS
  - Use historical SAA status from ERAM messages
  - Overlay track data with SAA Schedule/Status and location
  - Find flights that unnecessarily flew around inactive SAAs
  - Calculate potential savings for sample days
  - Extrapolate sample day savings to NAS level

City Pair Selection

- **Impedance Analysis**
  - List of highest impeded city-pairs (AJR-G analysis)
- **SME input**
  - City pairs with highest flight count with either departure or arrival airport within the Center of interest
  - Visual inspection of actual trajectories and SAAs
  - Avoid transcontinental or international city pairs

General Formula

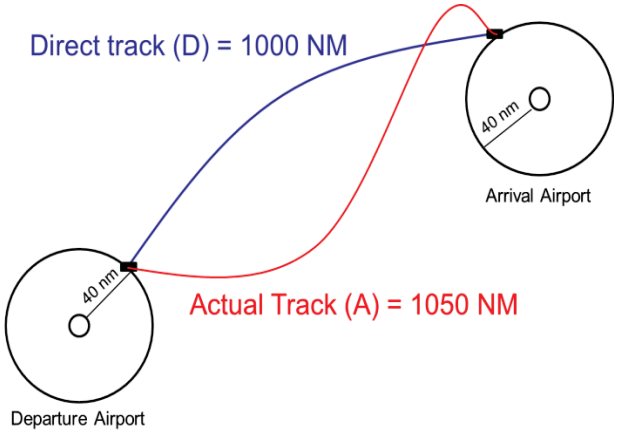
1. **Select a city-pair within an ARTCC**
2. **Select sample days (good weather)**
3. **Find SAAs impeding the city-pair**
   - Combine Schedule and Status to find active/inactive timeframes
4. **Find flights "eligible" for Saving (reroute)**
5. **Calculate potential Savings for eligible flights**
   - Calculate avg daily Savings for the city-pair
6. **Extrapolate sample city-pair Savings**

$$\left(S_{city-pair} \times A_{top\,40}\right) \times \%_{reroute} \times growth_{IFR} \times ADOC_{\$TY}$$

$S_{city\text{-}pair}$ = annual flight path savings for the three city-pairs evaluated
A_{top40} = number of similarly impeded city-pairs among top 40 CONUS airports
$\%_{reroute}$ = percentage of potential flight path savings that are feasibly claimed
$growth_{IFR}$ = growth rate of IFR traffic from 2016
$ADOC_{\$TY}$ = aircraft direct operating costs, calculated in $TY

Actual – Direct Trajectory

Actual-Direct (A-D) trajectory: the difference between the direct and actual flight trajectories (excluding terminal area)



A-D = 50 NM

Actual – Direct Trajectory

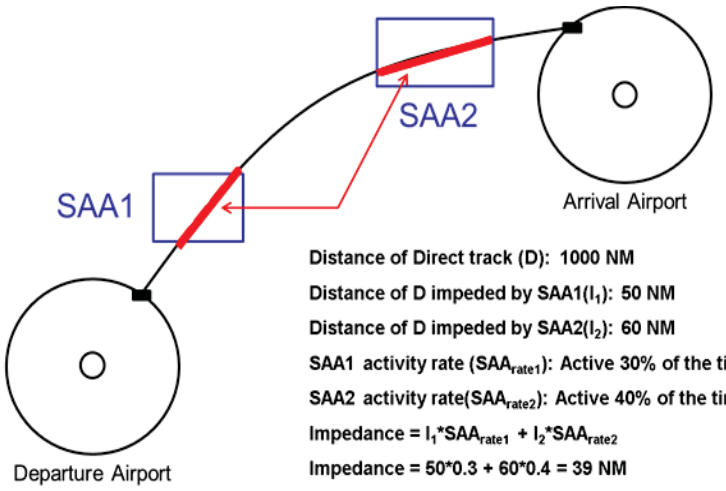
The A-D for every flight between a city-pair was summed annually (2014) for flights between the top 40 CONUS airports

Annual A-D is an absolute measure of how much additional flight mileage is flown between a city-pair versus the direct path. It does not account for:

- **SAA**
- **Instrument flight procedures**
- **Weather**
- **Traffic**
- **Etc.**

SAA Impedance

SAA Impedance is the combined effect of SAA location and schedule on direct flight paths



Distance of Direct track (D): 1000 NM

Distance of D impeded by SAA1(I_1): 50 NM

Distance of D impeded by SAA2(I_2): 60 NM

SAA1 activity rate (SAA_{rate1}): Active 30% of the time

SAA2 activity rate(SAA_{rate2}): Active 40% of the time

Impedance = I_1*SAA_{rate1} + I_2*SAA_{rate2}

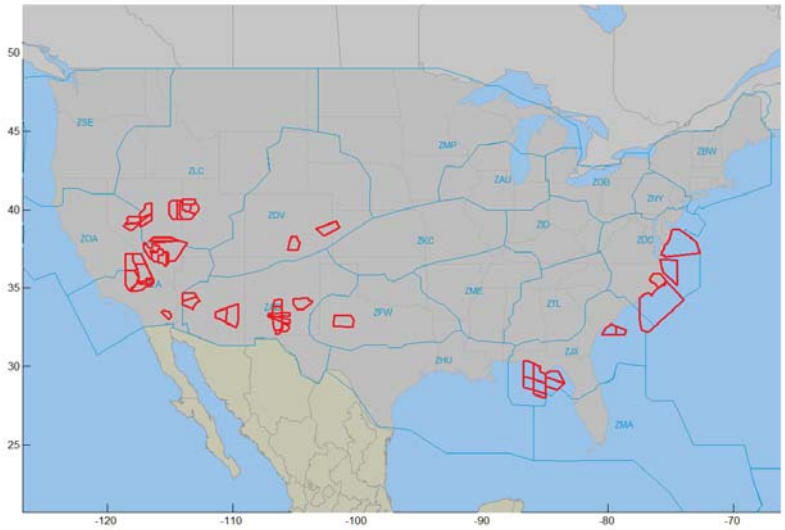
Impedance = 50*0.3 + 60*0.4 = 39 NM

City-Pair Ranking and Filtering

- **Top 40 CONUS airports**
  - 780 city pairs
  - Not all are significantly impacted by SAAs
- **Filtered out city-pairs where the "impedance" (Annual A-D) was <5% of the total direct flight trajectory**
- **Other factors**
  - Scheduled SAA Hours
  - Traffic Count between city pairs

Top 50 Impeding SAAs

Calculating average impedance of flight trajectories between top 40 CONUS airports, the top 50 impeding SAAs:



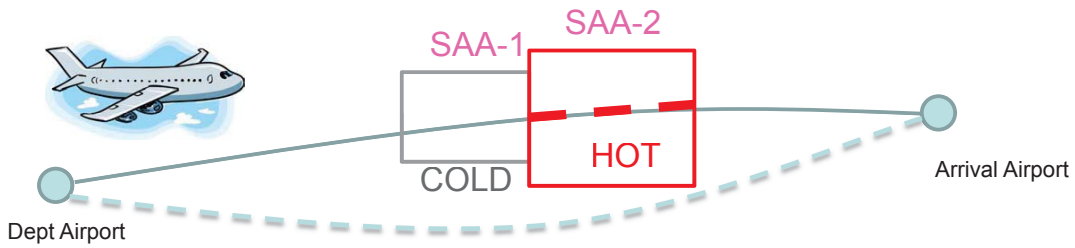
Impeded City-Pairs Ranking

After filtering, the following city-pairs remain, ranked by their annual A-D:

A-D Rank	City Pair	A-D Rank	City Pair	A-D Rank	City Pair	A-D Rank	City Pair
1	LAS-SFO	22	DFW-TPA	43	PDX-SAN	64	HOU-SAT
2	IAH-SFO	23	DFW-FLL	44	IAD-JFK	65	DAL-SFO
3	DFW-SFO	24	OAKPHX	45	LAS-SAT	66	DAL-PHX
4	JFK-MCO	25	LAX-SFO	46	BOS-JFK	67	SAT-TPA
5	DFW-LAX	26	FLL-SFO	47	IAH-TPA	68	MEM-STL
6	JFK-MIA	27	IAH-MCO	48	HOU-MCO	69	DAL-TPA
7	PHX-SEA	28	DFW-SAN	49	OAK-SLC	70	DAL-SAN
8	JFK-TPA	29	SAN-SEA	50	AUS-MCO	71	HOU-SFO
9	BOS-MIA	30	MCO-PHX	51	AUS-PHX	72	DAL-OAK
10	LAS-SEA	31	MIA-SFO	52	MCO-SAN	73	BWI-LGA
11	PHX-SFO	32	LAS-LAX	53	HOU-PHX	74	OAK-SAT
12	BOS-MCO	33	SFO-SLC	54	MEM-OAK	75	IAH-OAK
13	DFW-PHX	34	IAH-PHX	55	AUS-OAK	76	DCA-TEB
14	AUS-SFO	35	LAS-PHX	56	HOU-TPA	77	FLL-OAK
15	LAX-SLC	36	MCO-SFO	57	LAX-TPA	78	MIA-OAK
16	BOS-FLL	37	FLL-LAX	58	MIA-TPA	79	ATL-OAK
17	PDX-PHX	38	LAS-PDX	59	SAN-SLC	80	OAK-TPA
18	LAX-MIA	39	FLL-PHX	60	MCO-SAT	81	MCO-OAK
19	LAX-MCO	40	PHX-TPA	61	FLL-MCO	82	SAN-TPA
20	IAH-LAX	41	HOU-OAK	62	BWI-JFK	83	MCO-PDX
21	LAS-OAK	42	SAT-SFO	63	DFW-OAK		

Calculate SAA active/inactive timeframe

- **Process historical SAMS Schedules**
- **Process historical ERAM status messages (On/Off)**
- **Need to integrate the sched/status for neighboring SAAs:**



Find flights "eligible" for Savings (reroute)

- **Overlay 4D flight trajectory & SAA sched/status**
  - A flight is considered "eligible for Savings" if its actual trajectory **goes around** impeding SAAs that are scheduled but are **inactive** (cold) at the time the flight could traverse that SAA

Eligible for Savings

Not Eligible for Savings

City Pair Sample Data Analysis

City Pair Analysis

- **Sample Data Analysis:**
  - **LAS-SFO (A-D Rank = 1)**
  - **DFW-PHX (A-D Rank = 13)**
  - **IAH-MCO (A-D Rank = 27)**

Due to time constraints, only LAS-SFO city pair is included in this presentation. Analysis for other city pairs can be found in supporting PDF.

See Sample City Pair Analysis PDF Slides

City Pair Benefits Calculation

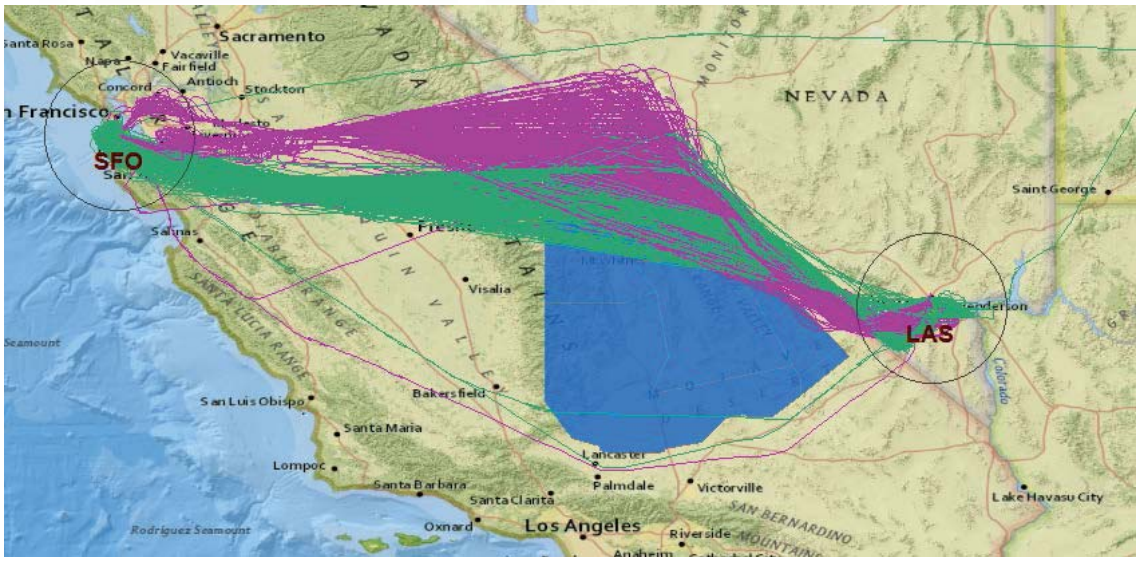
- Sample City Pairs and dates of analysis
  - SFO-LAS

    March 17th & 29th ,2016
  - IAH-MCO
    - March 5th, 25th, 31st ,2016
  - DFW-PHX
    - March 1st, 23rd ,2016

FLIGHT PATH ANALYSIS
SFO-LAS

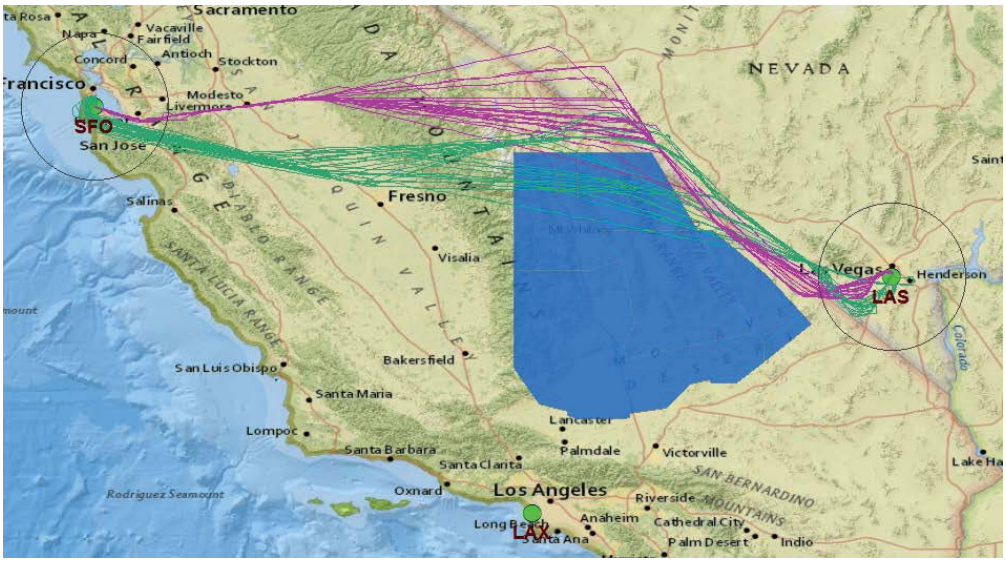
SFO – LAS

Flight Trajectories for March 2016



LAS Departure SFO Departure

SFO-LAS City Pair 03.17.2016



SFO Departures LAS Departures

SFO-LAS City Pair 03.17.2016

SAMS Schedule

AirspaceName	AirspaceType	LowAlt	HighAlt	SchedStartDateTime	SchedEndDateTime
2508	R	200	999	3/16/2016 13:00	3/17/2016 1:00
OWENS ATCAA	ATCAA	180	400	3/17/2016 0:30	3/17/2016 3:15
OWENS MOA	MOA	2	179	3/17/2016 0:30	3/17/2016 3:15
SALINE ATCAA	ATCAA	180	400	3/17/2016 0:30	3/17/2016 3:15
SALINE MOA	MOA	2	179	3/17/2016 0:30	3/17/2016 3:15
OWENS ATCAA	ATCAA	180	390	3/17/2016 3:15	3/17/2016 5:00
OWENS MOA	MOA	2	179	3/17/2016 3:15	3/17/2016 5:00
SALINE ATCAA	ATCAA	180	390	3/17/2016 3:15	3/17/2016 5:00
SALINE MOA	MOA	2	179	3/17/2016 3:15	3/17/2016 5:00
OWENS ATCAA	ATCAA	180	290	3/17/2016 5:00	3/17/2016 6:00
OWENS MOA	MOA	2	179	3/17/2016 5:00	3/17/2016 6:00
SALINE ATCAA	ATCAA	180	290	3/17/2016 5:00	3/17/2016 6:00
SALINE MOA	MOA	2	179	3/17/2016 5:00	3/17/2016 6:00
2508	R	200	999	3/17/2016 13:00	3/18/2016 1:00
OWENS ATCAA	ATCAA	180	600	3/17/2016 13:00	3/18/2016 1:00
OWENS MOA	MOA	2	180	3/17/2016 13:00	3/18/2016 1:00
SALINE ATCAA	ATCAA	180	600	3/17/2016 13:00	3/18/2016 1:00
SALINE MOA	MOA	2	180	3/17/2016 13:00	3/18/2016 1:00

Effective schedule: 0000->0600 and 1300->2399

SFO-LAS City Pair 03.17.2016

ERAM STATUS

SAAID	LowAlt	HighAlt	Activation	Deactivation
OWENS	-0.01	999	3/16/2016 22:22	3/17/2016 0:12
OWENS	-0.01	300	3/17/2016 0:12	3/17/2016 1:42
OWENS	-0.01	999	3/17/2016 1:42	3/17/2016 1:58
OWENS	-0.01	230	3/17/2016 1:58	3/17/2016 3:51
OWENS	-0.01	300	3/17/2016 15:19	3/17/2016 15:40
OWENS	-0.01	410	3/17/2016 15:40	3/17/2016 16:52
OWENS	-0.01	300	3/17/2016 16:52	3/17/2016 19:45
OWENS	-0.01	350	3/17/2016 19:45	3/17/2016 20:28
OWENS	-0.01	300	3/17/2016 20:28	3/17/2016 22:52
OWENS	-0.01	360	3/17/2016 22:52	3/18/2016 0:00
PANAMINT	-0.01	999	3/16/2016 14:45	3/17/2016 1:59
PANAMINT	-0.01	230	3/17/2016 1:59	3/17/2016 3:51
PANAMINT	-0.01	999	3/17/2016 15:19	3/18/2016 3:39
SALINE	-0.01	999	3/16/2016 22:22	3/17/2016 0:12
SALINE	-0.01	300	3/17/2016 0:12	3/17/2016 1:42
SALINE	-0.01	999	3/17/2016 1:42	3/17/2016 1:59
SALINE	-0.01	230	3/17/2016 1:59	3/17/2016 3:51
SALINE	-0.01	300	3/17/2016 15:19	3/17/2016 15:40
SALINE	-0.01	410	3/17/2016 15:40	3/17/2016 16:52
SALINE	-0.01	300	3/17/2016 16:52	3/17/2016 19:45
SALINE	-0.01	350	3/17/2016 19:45	3/17/2016 20:28
SALINE	-0.01	300	3/17/2016 20:28	3/17/2016 22:53
SALINE	-0.01	360	3/17/2016 22:53	3/18/2016 0:00
SHOSHONE	-0.01	179	3/17/2016 22:48	3/18/2016 0:01
SHOSHONE N	180	350	3/17/2016 22:48	3/18/2016 0:01
SHOSHONE S	180	350	3/17/2016 22:48	3/18/2016 0:01

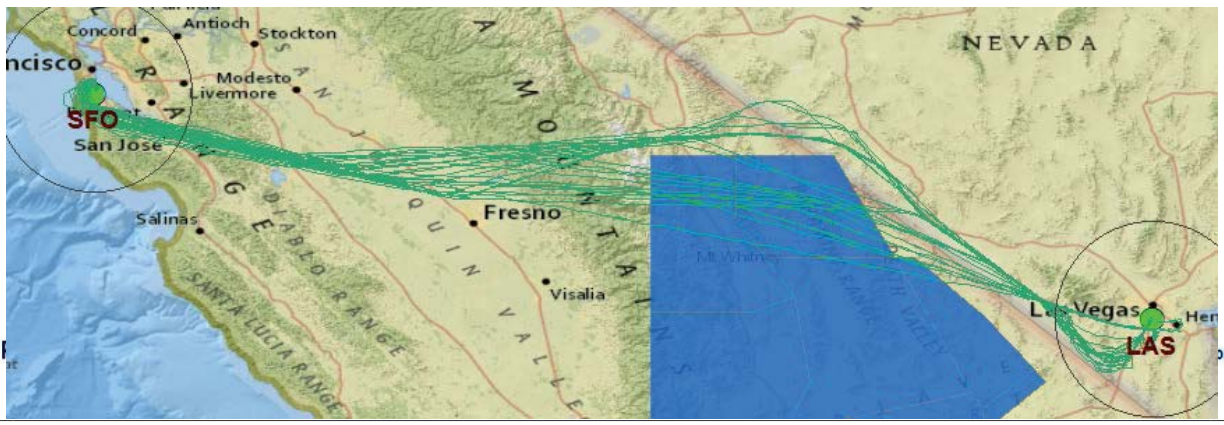
Effective Status:
Owens: 0000-0158
1515-2400
Panamint: 0000-0159
1519-2400
Saline: 0000-0159
1519-2400
Shoshone: 2248-2400

Potential Reroute timeframe:
0159-0600
1300-1519

FAA Air Traffic Organization

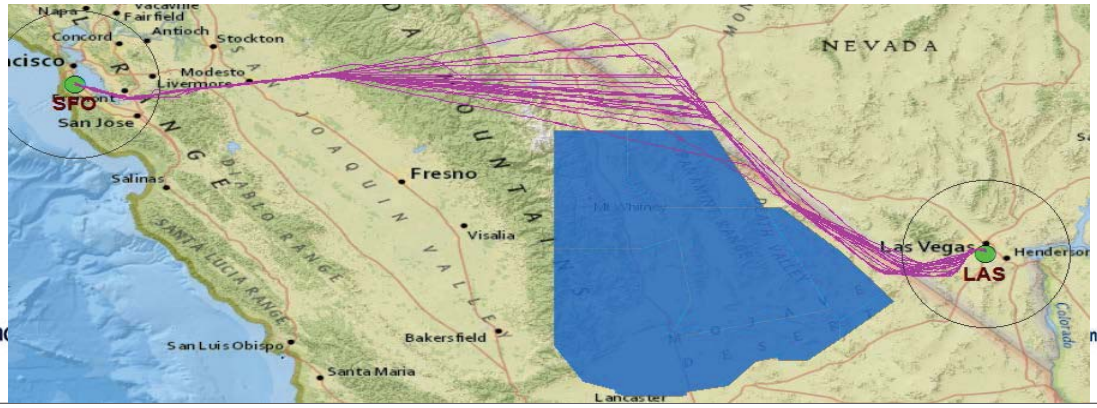
SFO->LAS Flights 03.17.2016

- 27 flights
  - 15 fly-through
    - Avg A-D = 7.2 NM
  - 12 fly around
    - Avg A-D = 26.9 NM
  - 0 Eligible for Reroute (within Scheduled but Cold hrs)



LAS->SFO Flights 03.17.2016

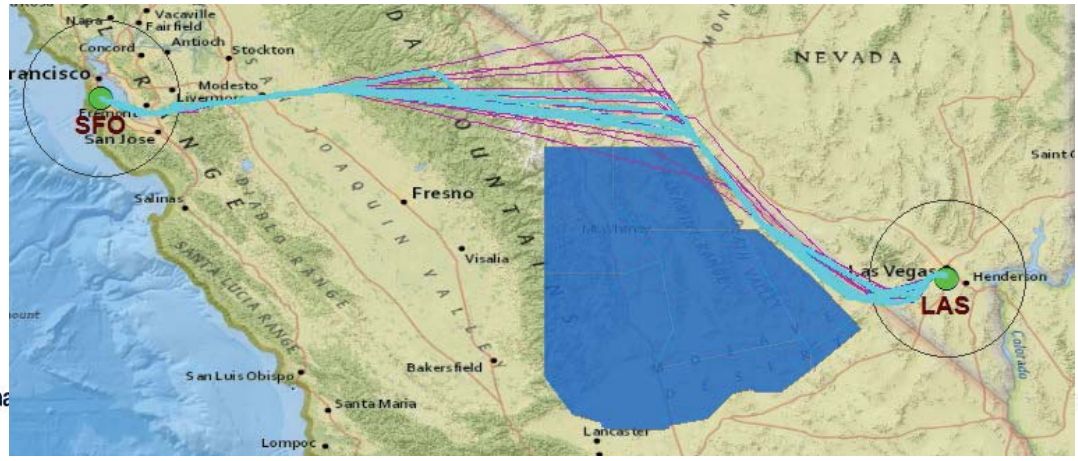
- 24 flights
  - 2 fly-through
    - Avg A-D = 15.4 NM
  - 22 fly around
    - Avg A-D = 34.0 NM
  - 7 Eligible for Reroute (within Scheduled but Cold hrs)



LAS->SFO Flights 03.17.2016

- Flights Eligible for reroute

ACID	DEPT_APRT	ARR_APRT	ACTUAL_DEP_TIME	ACTUAL_ARR_TIME	D40_A40_ACT_DIST	D40_A40_GC_DIST	A_D	FLY Around SAA	Eligible for Reroute?
UAL451T	LAS	SFO	3/17/2016 1:51	3/17/2016 2:56	316.61	278.80	37.813	1	1
FFT1125	LAS	SFO	3/17/2016 2:13	3/17/2016 3:19	306.87	278.80	28.069	1	1
JBU2689	LAS	SFO	3/17/2016 3:08	3/17/2016 4:17	309.67	278.80	30.869	1	1
SWA1601	LAS	SFO	3/17/2016 4:07	3/17/2016 5:15	309.04	278.80	30.243	1	1
SWA3398	LAS	SFO	3/17/2016 5:34	3/17/2016 6:41	318.26	278.80	39.466	1	1
UAL728	LAS	SFO	3/17/2016 13:05	3/17/2016 14:06	311.66	278.80	32.865	1	1
SWA1866	LAS	SFO	3/17/2016 14:43	3/17/2016 15:46	301.15	278.80	22.348	1	1



SFO-LAS City Pair Potential Benefits 03.17.2016

	SFO->LAS	LAS->SFO	Total
Flight Count	27	24	51
Fly-Around count	12	22	34
Fly-Around Avg. Actual distance	305.7	312.8	310.3
Fly-Thru count	12	2	14
Fly-Thru Avg. Actual distance	286.0	294.2	287.0
Reroute Eligible count	0	7	7
Eligible flight Avg. Actual Distance	n/a	310.5	310.5
Potential Savings per Elig. Flight	0	16.3	16.3
Total Potential Savings (NM)	0	114.1	**114.1***

* Total Saving for the city-pair is calculated as the sum of Total Savings for each leg

SFO-LAS City Pair 03.29.2016

SFO-LAS City Pair 03.29.2016

SAMS Schedule

AirspaceName	AirspaceType	LowAlt	HighAlt	SchedStartDateTime	SchedEndDateTime
2508	R	200	999	3/28/2016 13:00	3/29/2016 1:00
OWENS ATCAA	ATCAA	180	600	3/28/2016 13:00	3/29/2016 1:00
OWENS MOA	MOA	2	180	3/28/2016 13:00	3/29/2016 1:00
SALINE ATCAA	ATCAA	180	600	3/28/2016 13:00	3/29/2016 1:00
SALINE MOA	MOA	2	180	3/28/2016 13:00	3/29/2016 1:00
OWENS ATCAA	ATCAA	180	400	3/29/2016 1:00	3/29/2016 6:15
OWENS MOA	MOA	2	179	3/29/2016 1:00	3/29/2016 6:15
SALINE ATCAA	ATCAA	180	400	3/29/2016 1:00	3/29/2016 6:15
SALINE MOA	MOA	2	179	3/29/2016 1:00	3/29/2016 6:15
2508	R	200	999	3/29/2016 13:00	3/30/2016 1:00
OWENS ATCAA	ATCAA	180	600	3/29/2016 13:00	3/30/2016 1:00
OWENS MOA	MOA	2	180	3/29/2016 13:00	3/30/2016 1:00
SALINE ATCAA	ATCAA	180	600	3/29/2016 13:00	3/30/2016 1:00
SALINE MOA	MOA	2	180	3/29/2016 13:00	3/30/2016 1:00

Effective schedule: 0000->0615 and 1300->2399

PerformanceAnalysis ATOSysOps

FAA Air Traffic Organization

SFO-LAS City Pair 03.29.2016

ERAM STATUS

SAAID	LowAlt	HighAlt	Activation	Deactivation
OWENS	-0.01	300	3/29/2016 0:17	3/29/2016 1:51
PANAMINT	-0.01	999	3/29/2016 0:18	3/29/2016 1:51
SALINE	-0.01	300	3/29/2016 0:18	3/29/2016 1:51
OWENS	380	999	3/29/2016 15:02	3/29/2016 15:04
PANAMINT	380	999	3/29/2016 15:02	3/29/2016 15:04
SALINE	380	999	3/29/2016 15:02	3/29/2016 15:04
OWENS	-0.01	360	3/29/2016 15:04	3/29/2016 16:16
PANAMINT	-0.01	999	3/29/2016 15:04	3/30/2016 3:30
SALINE	-0.01	360	3/29/2016 15:04	3/29/2016 16:16
SHOSHONE	-0.01	179	3/29/2016 15:24	3/29/2016 15:47
SHOSHONE N	180	350	3/29/2016 15:24	3/29/2016 15:47
OWENS	-0.01	300	3/29/2016 16:16	3/29/2016 16:46
SALINE	-0.01	300	3/29/2016 16:16	3/29/2016 16:46
OWENS	-0.01	410	3/29/2016 16:46	3/29/2016 17:53
SALINE	-0.01	410	3/29/2016 16:46	3/29/2016 17:53
SHOSHONE	-0.01	179	3/29/2016 17:22	3/29/2016 18:16
SHOSHONE N	180	350	3/29/2016 17:22	3/29/2016 18:16
OWENS	-0.01	360	3/29/2016 17:53	3/29/2016 18:11
SALINE	-0.01	360	3/29/2016 17:53	3/29/2016 18:11
OWENS	-0.01	300	3/29/2016 18:11	3/29/2016 18:26
SALINE	-0.01	300	3/29/2016 18:11	3/29/2016 18:27
OWENS	-0.01	410	3/29/2016 18:26	3/29/2016 19:04
SALINE	-0.01	470	3/29/2016 18:27	3/29/2016 18:27
SALINE	-0.01	410	3/29/2016 18:27	3/29/2016 19:04
SHOSHONE	-0.01	179	3/29/2016 18:41	3/29/2016 19:03
SHOSHONE N	180	300	3/29/2016 18:41	3/29/2016 19:03
OWENS	-0.01	300	3/29/2016 19:04	3/29/2016 21:35
SALINE	-0.01	300	3/29/2016 19:04	3/29/2016 21:35
OWENS	-0.01	420	3/29/2016 21:35	3/29/2016 23:15
SALINE	-0.01	420	3/29/2016 21:35	3/29/2016 23:14
SHOSHONE	-0.01	179	3/29/2016 21:47	3/29/2016 23:09

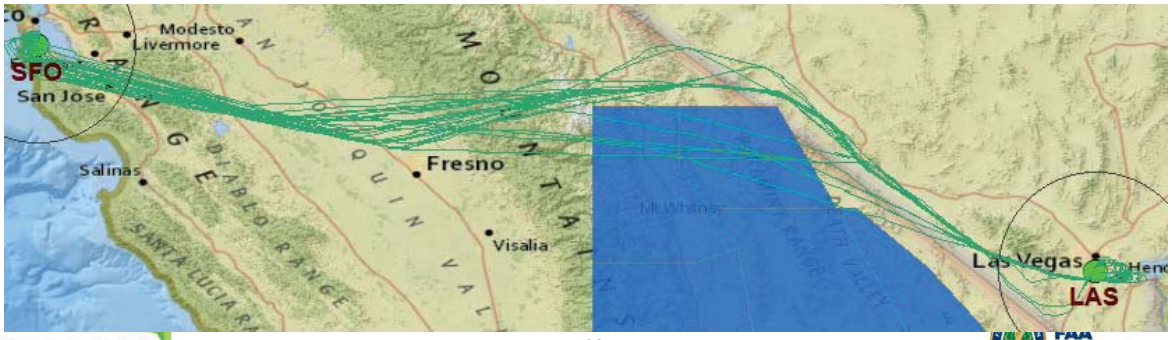
Effective Status:
Owens: 0017-0151
1502-2400
Panamint: 0018-0151
1502-2400
Saline: 0018-0151
1502-2400
Shoshone: 1524-2309

Potential Reroute timeframe:
0151-0615
1300-1502

FAA Air Traffic Organization

SFO->LAS Flights 03.29.2016

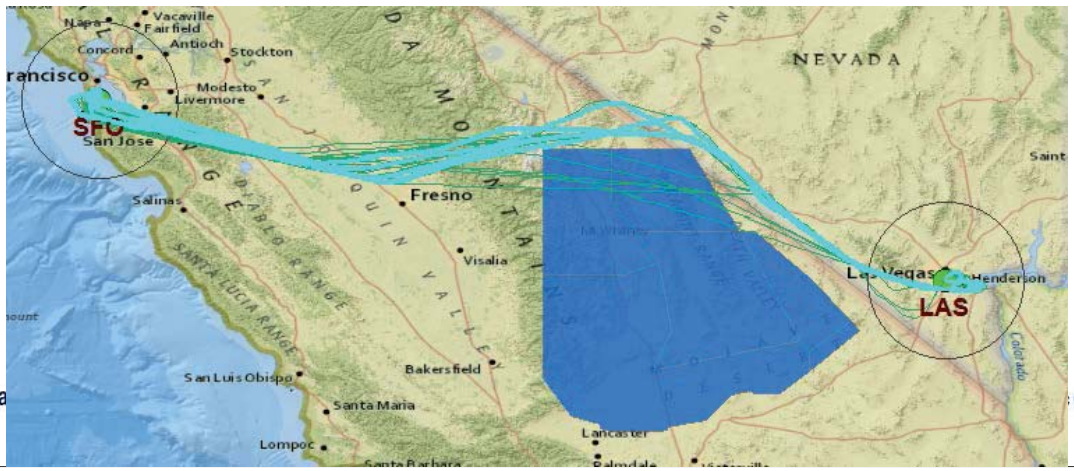
- 25 flights
  - 5 fly-through
    - Avg A-D = 7.4 NM
  - 20 fly around
    - Avg A-D = 25.2 NM
  - 7 Eligible for Reroute (within Scheduled but Cold hrs)



SFO->LAS Flights 03.29.2016

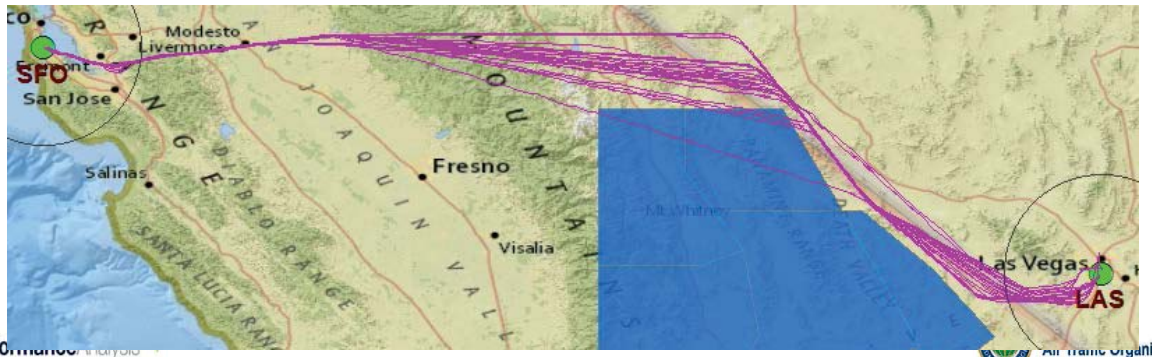
- Flights Eligible for reroute

ACID	DEPT_APRT	ARR_APRT	ACTUAL_DEP_TIME	ACTUAL_ARR_TIME	D40_A40_ACT_DIST	D40_A40_GC_DIST	A_D	FLY Around SAA	Eligible for Reroute?
VRD918	SFO	LAS	3/29/2016 1:45	3/29/2016 2:52	304.05	278.80	25.25	1	1
UAL681	SFO	LAS	3/29/2016 3:50	3/29/2016 4:59	311.16	278.80	32.36	1	1
FFT1124	SFO	LAS	3/29/2016 4:04	3/29/2016 5:13	305.22	278.80	26.43	1	1
SWA135	SFO	LAS	3/29/2016 4:13	3/29/2016 5:18	306.92	278.80	28.12	1	1
SWA2636	SFO	LAS	3/29/2016 5:41	3/29/2016 6:48	308.34	278.80	29.55	1	1
UAL1436	SFO	LAS	3/29/2016 5:50	3/29/2016 6:54	302.98	278.80	24.18	1	1



LAS->SFO Flights 03.29.2016

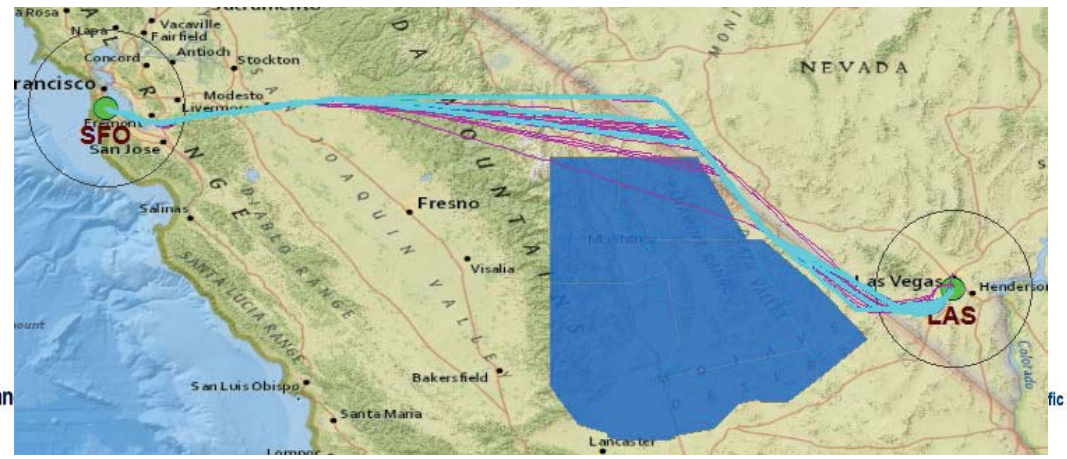
- 24 flights
  - 1 fly-through
    - Avg A-D = 19.8 NM
  - 23 fly around
    - Avg A-D = 27.9 NM
  - 6 Eligible for Reroute (within Scheduled but Cold hrs)



LAS->SFO Flights 03.29.2016

- Flights Eligible for reroute

ACID	DEPT_APRT	ARR_APRT	ACTUAL_DEP_TIME	ACTUAL_ARR_TIME	D40_A40_ACT_DIST	D40_A40_GC_DIST	A_D	FLY Around SAA	Eligible for Reroute?
UAL451	LAS	SFO	3/29/2016 3:07	3/29/2016 4:11	300.82	278.80	22.02	1	1
JBU2689	LAS	SFO	3/29/2016 3:40	3/29/2016 4:47	304.55	278.80	25.75	1	1
UAL1839	LAS	SFO	3/29/2016 4:54	3/29/2016 6:02	315.16	278.80	36.37	1	1
SWA1601	LAS	SFO	3/29/2016 5:09	3/29/2016 6:14	298.09	278.80	19.29	1	1
UAL728	LAS	SFO	3/29/2016 13:19	3/29/2016 14:25	321.93	278.80	43.14	1	1
SWA1866	LAS	SFO	3/29/2016 14:40	3/29/2016 15:48	304.37	278.80	25.57	1	1



SFO-LAS City Pair Potential Benefits 03.29.2016

	SFO->LAS	LAS->SFO	Total
Flight Count	25	24	49
Fly-Around count	20	23	43
Fly-Around Avg. Actual distance	304.0	306.7	305.4
Fly-Thru count	5	1	6
Fly-Thru Avg. Actual distance	286.2	298.6	288.3
Reroute Eligible count	7	6	13
Eligible flight Avg. Actual Distance	305.7	307.5	306.5
Potential Savings per Elig. Flight	19.5	8.9	14.6
Total Potential Savings (NM)	136.5	53.4	**189.9** *

* Total Saving for the city-pair is calculated as the sum of Total Savings for each leg

MCO-IAH and DFW-PHX

- See “Sample City Pair Analysis” PDF for sample analysis for other city pairs

SAA Status Benefits Calculations

Converting to Yearly Savings

City pair analysis resulted in reroute savings for a selection of days between a city par, which were converted into annual savings by:

- **Determining the daily average between a city-pair**
- **Converting the daily average to a yearly average, assuming 256 good weather days**

- **For SFO-LAS:**

$$Yearly\ Average\ Savings = \frac{Daily\ Savings_{3/17} + Daily\ Savings_{3/29}}{2\ days} \times good\ weather\ days$$

$$38,912\ NM = \frac{114.1\ NM\ + 189.9\ NM}{2} \times 256\ days$$

Converting to Yearly Savings

Yearly Average Savings for evaluated city pairs

City	Day 1 Average	Day 2 Average	Day 3 Average	Daily Average	Yearly Average Savings (NM)
SFO-LAS	114.1	189.9	-	152.0	38,912
MCO-IAH	97.2	325.2	9.4	143.9	36,847
DFW-PHX	86.4	118.8	-	102.6	26,266

Extrapolating

- **Across the NAS**
- **Broken down by aircraft type**
- **Over 20 years**

Used “impedance” analysis completed by AJR-G1 to identify other city-pairs flights affected by SAAs.

Total NAS Savings

NAS Savings was estimated from the following equation:

$$NAS\ Savings = Yearly\ Average\ Savings \times \%rerouted \times 83\ city\ pairs$$

Yearly Average Savings **was selected as one of the three city pair values:**

- **LAS-SFO = (Optimistic)**
- **DFW-PHX = (Pessimistic)**
- **IAH-MCO = (Neutral)**

% rerouted **was ranged from 0 to 100%**

Sensitivity Analysis

A second sensitivity variable was added to account for the percentage of eligible flights that are rerouted, which is influenced by:

- **Fuel loading**
- **Traffic**
- **Controller workload**
- **Etc.**

Request TOC Feedback on additional variables impacting re-routes

2016 Annual Flight Path Savings

Total Yearly NAS Savings (NM)

		Optimistic	Neutral	Pessimistic
Percentage of Eligible Flight that are Rerouted	100%	3,229,696	3,058,295	2,180,045
	90%	2,906,726	2,752,466	1,962,040
	80%	2,583,757	2,446,636	1,744,036
	70%	2,260,787	2,140,807	1,526,031
	60%	1,937,818	1,834,977	1,308,027
	50%	1,614,848	1,529,148	1,090,022
	40%	1,291,878	1,223,318	872,018
	30%	968,909	917,489	654,013
	20%	645,939	611,659	436,009
	10%	322,970	305,830	218,004
	0%	0	0	0

Request TOC Feedback on the overall % of eligible flights which can be claimed by AIMM S3
Recent Feedback: 60%-85%

Aircraft Type

Based on Sample analysis,

Reroute savings will be realized for Air Carriers only

Aircraft Type	Percentage of City-Pair Flights
Air Carrier: Passenger	94.29%
Air Carrier: Cargo	1.48%
Air Taxi	2.16%
General Aviation	1.88%
Military	0.03%
Other	0.15%

Next Steps:
Analyze GA and Military impacts

- Assume "Average A-D" between Air Carriers and GA/ Military is the same
- Extrapolate by NAS traffic count

20-Year Extrapolation – Air Carrier

Results were extrapolated to AIMM S3 implementation and the 20 years following (2024-2043).

- **Considers the growth in Air Carrier departures during that time frame**
- **Assumes annual reroute savings will increase linearly with an increase in flights**

Flights between the analyzed city-pairs were 94% air-carrier, so the growth rate for air carrier departures is used (2.1% per year).[1]

1. Federal Aviation Administration, FAA Aerospace Forecast Fiscal Years 2017-2037, Washington D.C.

ADOC per airborne hour, by aircraft type

2016 Annual Flight Path Savings were extrapolated to 2043 using the growth in air carrier departures. The savings from 2024-2043 were monetized using Aircraft Direct Operating Costs (ADOC):

- **Note: fuel cost of $2.88 per gallon assumed**

Aircraft Type	ADOC (FY 2016$)
Air Carrier: Passenger	$4,300
Air Carrier: Cargo	$12,652
Air Taxi	$2,163
General Aviation	$1,046
Military	$3,396
Other	$0

2024 to 2043 Monetized Savings

Total Monetized NAS Savings over 20 years (TY$)

		Optimistic	Neutral	Pessimistic
Percentage of Eligible Flight that are Rerouted	100%	$1,742,006,606	$1,649,558,010	$1,175,854,459
	90%	$1,567,805,945	$1,484,602,209	$1,058,269,013
	80%	$1,393,605,285	$1,319,646,408	$940,683,567
	70%	$1,219,404,624	$1,154,690,607	$823,098,121
	60%	$1,045,203,964	$989,734,806	$705,512,675
	50%	$871,003,303	$824,779,005	$587,927,230
	40%	$696,802,642	$659,823,204	$470,341,784
	30%	$522,601,982	$494,867,403	$352,756,338
	20%	$348,401,321	$329,911,602	$235,170,892
	10%	$174,200,661	$164,955,801	$117,585,446
	0%	$0	$0	$0

Discussion Points

Based on the provided flight path Analysis

- **Will NAS Users re-route if a scheduled SAA becomes cold? If so, how?**
  - Under what conditions (SAA type, fuel, magnitude of savings, gate allocation)
  - Potential for added controller and dispatcher workload
  - Extremely dynamic and complex air traffic environment
  - Value added for Air Carrier, Military, GA, Air Taxi, Other

AIMM S3 Safety Analysis

Safety Report Analysis

Data Source

- Searched reports filed to ASIAS (ASRS) and ATSAP databases
- ASRS
  - Searched by keyword or phrase
  - Each report contains a narrative of the safety event
- ATSAP
  - Requested by phrase and provided a batch of reports
  - Each report contains a “Report” and “Recommended” Narrative section
- Reports filed between 1/1/2015 and 6/30/2016 (18 months)
- Combined for analysis

Data Review

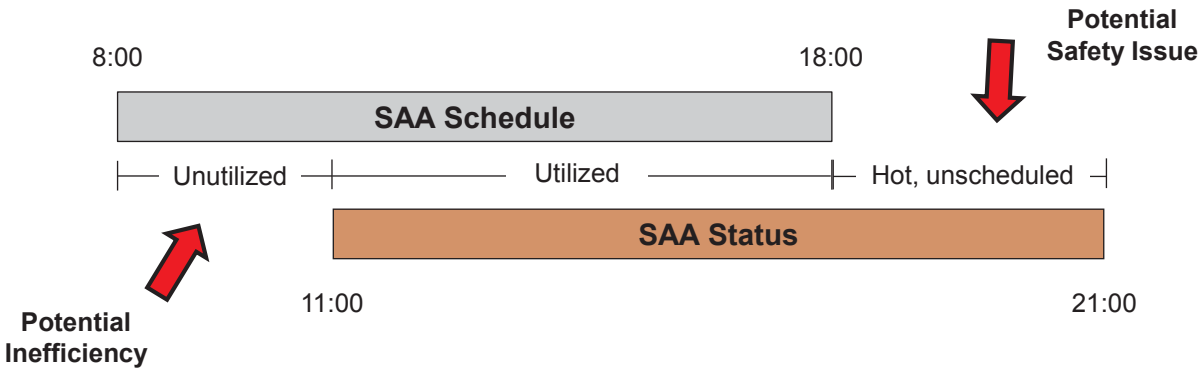
- Reports were reviewed by SMEs to confirm legitimacy of incidents and relevance of reports to AIMM S3 shortfalls

Safety Report Analysis

- **Airspace Definition Management** 2
  - Airspace definitions vary between NAS users and ATC
- **SOP/LOA Static Airspace Constraints Management** 16
  - New and updated SOP/LOA are not version-controlled and maintained, causing discrepancies between controllers and facilities
  - During origination, SOP/LOA constraints are omitted from updates or contradict existing constraints
- **Managing SAA Schedules** 6
  - SAA schedule data is manually transcribed from SAMS
  - Changes made to SAA schedules do not reach all affected ATC facilities
- **Managing SAA Status** 14
  - SAA status changes are not automatically disseminated between facilities, resulting in discrepancies in status between facilities (both hot/cold status and altitudes)
  - Verbal coordination is error-prone, again causing discrepancies

Schedule – Status Analysis

An SAA schedule is utilized when the scheduled SAA is statused as hot within the schedule



Utilization of SAA Schedules

Percentage of scheduled hours that are statused hot:

Airspace Type	ZLA	ZJX	Total Utilization
ATCAA	43%	59%	45%
MOA	42%	22%	41%
Restricted Area	77%	29%	71%
Warning Area	32%	63%	53%
ARTCC Total	**65%**	**46%**	**62%**

Hot, Unscheduled Hours

Percentage of hot hours that fall outside of a schedule:

Airspace Type	ZLA	ZJX	Total Hot, Unscheduled
ATCAA	48%	68%	52%
MOA	32%	47%	34%
Restricted Area	14%	36%	15%
Warning Area	60%	87%	85%
ARTCC Total	**21%**	**81%**	**42%**

Schedule – Status Altitudes

Impacts of differences in schedule and status altitudes

- **Statused cold altitude within schedule: inefficiently reserved airspace**
- **Statused Hot Altitude outside of schedule: potentially unsafe altitudes**

Altitude Average	ZLA	ZJX	Average Total
Cold Altitude within Schedule	4,576 ft	10,538 ft	5,731 ft
Hot Altitude outside of Schedule	8,241 ft	9,278 ft	6,825 ft