Approved by the Tactical Operations Committee July 2015

Recommendations to Improve Operations in the Caribbean

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

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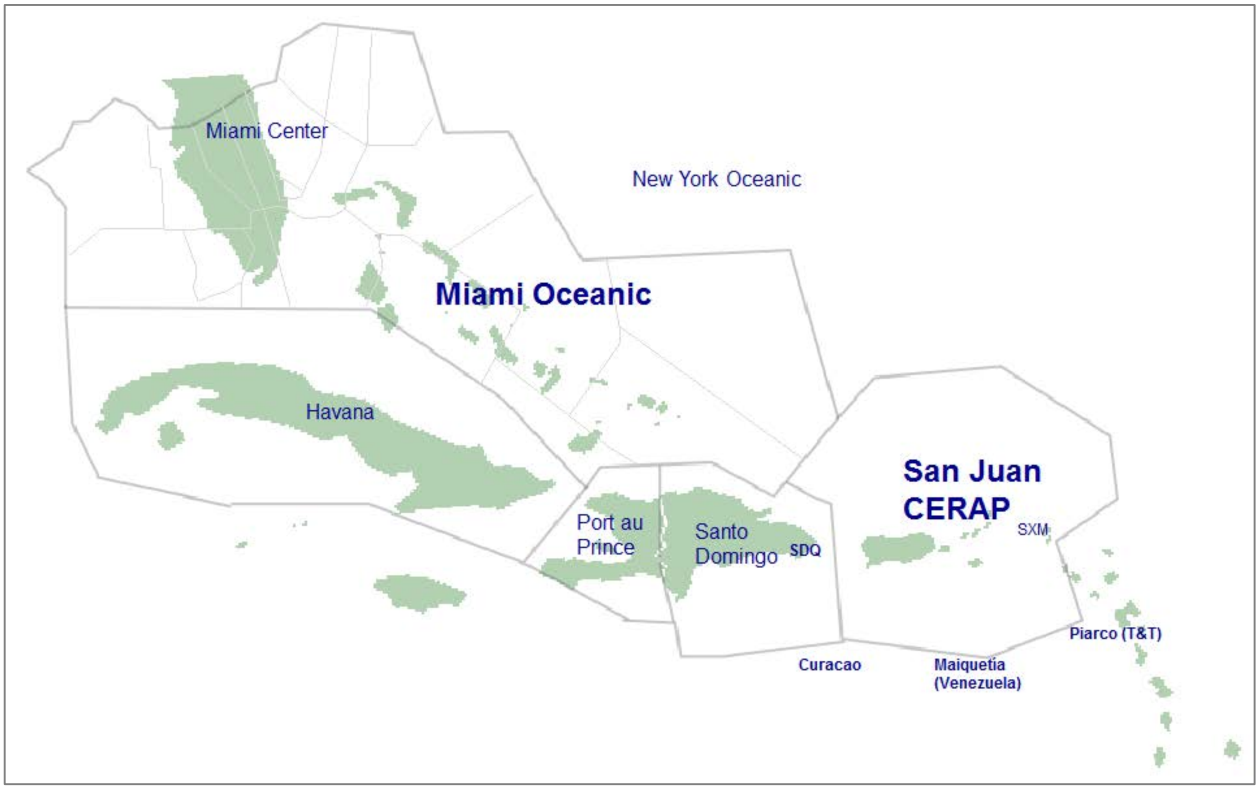
Contents

Background and Introduction

In recent years, stakeholders involved with managing and operating air traffic between the United States and the Caribbean have identified a need to address airspace capacity, operational performance and safety in the region. Within the National Airspace System (NAS), the Federal Aviation Administration (FAA) Caribbean region is defined as the combination of Miami Air Route Traffic Control Center (ARTCC) airspace over water (ZMA Oceanic[1]) and the San Juan Combined En Route Approach Control Facility (CERAP or ZSU). The diagram below highlights ZMA Oceanic and ZSU airspace:

Figure 1 Caribbean Airspace



In September of 2014, the Eastern Regional Task Group (ERTG) of the RTCA Tactical Operations Committee (TOC) met with FAA operational personnel from the Caribbean region to document existing issues and review historical trends. Both FAA and industry personnel agreed that there are infrastructure and airspace issues in the region that need to be addressed to improve operations and safety. This premise is further supported by National Transportation Safety Board (NTSB) observations and recommendations issued in August 2012 in response to a safety incident in ZMA Oceanic in July 2012.

The FAA considered the issues raised by the ERTG and made a task request to the TOC to offer recommendations to improve Air Traffic Control (ATC) services and performance in the region. The

[1] This report refers to ZMA "Oceanic," IAW ICAO doc 7030 CAR region, to describe the non-domestic airspace over the ocean. Surveillance capabilities and direct pilot controller radio communication allow the application of domestic separation standards.

Tasking Letter states: “We [the FAA] believe a tasking to the TOC to provide recommendations on a comprehensive approach to address infrastructure and airspace changes in the region would benefit the NAS as a whole. We request the TOC provide recommendations on a comprehensive strategy for infrastructure and airspace changes to improve safety, efficiency and capacity in the region. Specifically, this tasking would include recommendations in the following sub-task areas”:

- **Problem Identification**: the use of data to clearly define the problem, causes and solutions to the safety, efficiency and capacity issues in the region.
- **Infrastructure**: prioritized solutions for any infrastructure components identified as most critical to improving/enhancing operations in the region.
- **Airspace**: prioritized solutions for any airspace improvements or enhancements as needed.
- **Harmonization**: a review of existing or planned domestic or international activities in the region and a recommended method or mechanism to insure all the work is harmonized into a comprehensive and coherent master plan.

The TOC requested the Eastern Regional Task Group to provide a response to this task request from the FAA. The report that follows presents the recommendations of the TOC and ERTG in response to the questions posed by the FAA in its tasking letter.

Executive Summary

In November 2014 the Federal Aviation Administration (FAA) tasked the RTCA Tactical Operations Committee (TOC) Eastern Region Task Group (ERTG) with identifying infrastructure and airspace issues that need to be addressed to improve the safety, capacity and efficiency of operations in the Caribbean. The FAA acknowledged in its tasking letter that airspace in the region has remained largely unchanged for many years despite the growth of air traffic in the region. Though small improvements have been made to existing infrastructure and procedures, a demand-capacity imbalance continues to exist, particularly during peak seasonal periods. Demand in the region is expected to continue growing and absent significant improvements to infrastructure and airspace, delays are expected to escalate, adversely impacting the traveling public and operators in the region.

The ERTG, which consists of representatives of the airlines, business aviation, pilots, air traffic controllers and the DoD, along with subject matter experts from the FAA, held monthly meetings during the first half of 2015 to understand operations in the region. Based on this, and in direct response to the FAA tasking, the group developed a comprehensive set of infrastructure and airspace priorities that will improve the safety, capacity and efficiency of the Caribbean airspace.

A unique feature of ZMA’s Oceanic airspace is the funnel design which is created by multiple foreign Air Navigation Service Providers (ANSPs) bordering it to the south and New York’s Oceanic airspace to the north. In recent years, growing traffic volumes have been compressed through this funnel constraining throughput in the area. Additionally, between these disparate adjacent airspaces including those underlying ZMA Oceanic, multiple separation standards exist due to variations in surveillance, communication and automation, and more specifically, a lack of connectivity in each of these domains.

These infrastructure limitations result in increased complexity and the requirement to manage throughput in order to ensure the safe and orderly flow of traffic in the region.

Infrastructure options for the region were considered, prioritized and organized into four areas: Communications, Surveillance, Automation and Technology Improvements. After detailed study, it became evident that each of these areas must be addressed collectively in order to best achieve the desired outcomes. The group examined a broad range of issues including radar coverage and overlap, frequency reliability and redundancy for air to ground communications, limited or non-existent instant communications capability with adjacent ANSPs, etc. Existing communication gaps between controller and aircraft were highlighted as a priority to ensure safe management of aircraft. The group also noted a lack of automated data exchange for flight plans and boundary crossing estimates with multiple neighboring foreign facilities as a significant issue limiting capacity. This lack of automation requires extensive manual coordination involving a three or four person sector teams when normally it would take two. Additionally, many inter-facility communications and data exchanges still require use of dial-up telephone to coordinate and copy flight plans and transfer control. During periods of moderate to heavy demand, these rudimentary capabilities are an impediment to the flow of traffic and frequently require traffic management initiatives of varying magnitudes to spread out the demand. During the approximately 120 days of the peak Caribbean season in FY2015, there were 20 days with Airspace Flow Programs and 50 days with miles or minutes of trail between facilities in the Caribbean. Scheduled or unscheduled equipment outages can exacerbate the problems.

As noted above, airspace design and route structure in the Caribbean have remained unchanged in the face of increasing demand. Demand, particularly on a seasonal basis, is expected to continue to grow and will be augmented by the relaxation of travel restrictions to Cuba. The Group looked broadly at the region for opportunities to redesign airspace in both ZMA Oceanic as well as ZSU. In ZMA, Sector 40 is highly complex as this sector manages the intersection of arrival and departures to multiple airports as well as overflights. The NTSB has previously offered observations for improving Sector 40. ZMA Oceanic, unlike other Oceanic Centers, manages aircraft utilizing standard radar separation. Given these sectors are much longer than their domestic counterparts, the amount of traffic a controller has to manage can be significant. At ZSU, there have been minimal changes to the airspace or sector design since the closure of a Navy base and decommissioning of its associated Warning Area. Airspace capacity can be increased and associated TMIs reduced by jointly redesigning the airspace in ZMA and ZSU and ensuring connectivity to routes being developed by the South Florida Metroplex project team and neighboring ANSPs. This may require creation of additional physical sectors, particularly in ZMA.

A key recommendation that supports the need for better and expanded surveillance coverage in the region is to install additional ADS-B ground stations to increase surveillance coverage in the region and "make the airspace funnel wider" thus increasing routes with radar separation standards in and out of the Caribbean. It would also provide much needed surveillance redundancy that affords operational advantages to appropriately equipped aircraft in the event legacy radar surveillance is out of service, similar to the operational capabilities being developed in New York Center for the offshore radar routes. Currently, ZMA domestic and ZSU each have ADS-B ground stations, however there is a broad expanse of airspace in the corridor between them where ADS-B is unavailable and where existing surveillance sources have reliability issues.

A related recommendation is increased sharing of radar data with other ANSPs to facilitate reduced separation requirements between adjacent facilities when airport infrastructure and other flow constraints permit. In addition, the TG supports short cut opportunities identified by the FAA in the Caribbean that can be implemented fairly expeditiously.

There is a compelling need for enhanced enroute weather data for controllers to increase the safety and efficiency of the extended overwater operations and the TG is making a strong recommendation to accelerate the availability of a prototype weather information system, Offshore Precipitation Capability, (OPC), for ZMA and ZSU to cover the areas beyond the range of the existing ground based weather radar systems.

It is challenging to provide a “comprehensive approach or strategy” for improvements in the Caribbean region with the seemingly disparate needs and diverse population of ANSPs and airspace. Over time, the FAA has identified a portfolio of projects to improve safety and capacity in the region that have reached various levels of maturity, but have generally lacked funding in the constrained budget environment. In many cases, the projects require international negotiation and agreements. For infrastructure priorities, recommendations in this report are based, where possible, on impact to the highest number of operations. As the needs of the region are addressed, care must be taken to ensure new capacity imbalances or constraints are not introduced and, further, that redundant capabilities are established to accommodate equipment outages or other irregularities.

Finally, many organizations in the FAA and industry collaborated to develop these recommendations. The diversity of the recommendations and the requirement to negotiate agreements with foreign governments underscore the fact that an FAA team spanning multiple lines of business will need to work together to build the ultimate plan for implementation. The leadership of this implementation will need to maintain active coordination within the FAA, industry and internationally to ensure harmonization with other airspace and capacity improvement initiatives in the region (ICAO Aviation System Block Upgrades, PBN) and to prioritize these recommendations for the Caribbean.

The table below provides a summary of the recommendations discussed in more detail throughout this report:

Executive Summary of Prioritized Recommendations

Category		**Prioritized Recommendations**
Infrastructure Priorities	Communications	Implement a New Communications Frequency at Saint Maarten
		Implement a New Communications Frequency at Abaco Island
		Install Dedicated Shout Lines with Certain Adjacent or Underlying International Facilities
	Automation	Regional Implementation of Automation: 1. Continue implementation of ADE with Santo Domingo 2. Develop software translation for neighboring facilities with AIDC protocol 3. Ensure ERAM software upgrades associated with ADE stay on schedule
		Implement Independent Flight Data Processing in ZSU
	Surveillance	Implement ADS-B in the Caribbean
		Input St. Maarten Radar into the ZSU Radar Mosaic System
		Identify and Access a Backup Option for Grand Turk Radar
	Technology Improvements	Investigate Option to Access Weather Information from Long Range DoD/DHS Radars
		If the Offshore Precipitation Capability (OPC) shows promise, expedite Caribbean access
		Enable ZSU to Participate in Data Comm
		Make Caribbean Radar Presentations Available to ZNY
Airspace Priorities		Explore Options to Reduce Separation between ZNY and ZSU/ZMA
		Implement a Shortcut Route between CARPX and RENAH
		Conduct an Integrated Redesign of ZMA and ZSU Airspace
		Improve Short Term Cuba Access in the Giron Corridor
		Prepare for Significant Growth in Cuba Operations
Harmonization		FAA should establish one body to develop an integrated plan and lead implementation in the Caribbean
		Maintain Active Coordination with ICAO's North America, Central America and Caribbean Offices
		Ensure Active Involvement of the Office of International Affairs, Western Hemisphere Office

Methodology

The Eastern Regional Task Group held a series of meetings and teleconferences between January and June 2015 to deliberate on elements of the Caribbean task request. As the ERTG learned about the complexities and challenges of the safe and efficient movement of air traffic in the region, the FAA made appropriate Subject Matter Experts (SMEs) available to help the group understand the needs and realities more effectively. By the time recommendations were developed, the group included representatives from the following organizations (in alphabetical order):

- Air Line Pilots Association (ALPA)
- Department of Defense (DoD)
- FAA Air Traffic International Office, Americas Group
- FAA Eastern Service Center – Planning and Requirements Group (PRG) and Operations Support Group (OSG)
- FAA Management and NATCA personnel from impacted NAS facilities – New York Air Route Traffic Control Center (ZNY), Miami Air Route Traffic Control Center (ZMA) and San Juan Combined Center/Radar Approach Control (ZSU)
- FAA Manager of Tactical Operations (MTO) for the Southeast
- FAA Oceanic and Offshore Standards and Procedures Group
- FAA Office of International Affairs, Western Hemisphere Office
- FAA Surveillance and Broadcast Systems (SBS) Office
- International Air Transport Association (IATA)
- Major scheduled and cargo air carriers in the region
- National Air Traffic Controllers Association (NATCA)
- National Business Aviation Association (NBAA)

The ERTG's process was to request the FAA ATC facilities in the region to provide briefings on their operations and to identify their most pressing operational needs first. This involved discussions and briefings with Management and NATCA representatives from ZMA and ZSU, the primary enroute and terminal facilities responsible for air traffic services in the region. After identifying the operational needs with the facilities, the ERTG worked with flight operators and facilities to understand the operational and safety benefits of each operational capability or program. Additionally, the group worked with the Eastern Service Center PRG and OSG and the Air Traffic International Office, Americas Group personnel to fully understand the status and implementation realities of each requirement, including cost, equipment required, international agreements, etc.

After gathering the full background on each capability or project, the group went through a consensus-based exercise to prioritize the needs based on expected safety and capacity benefits and flights impacted. The results were then complied and translated into the recommendations in this final report.

Problem Identification

Robust Growth of Demand in ZMA Oceanic and ZSU

Operations through the FAA's Caribbean region, defined as ZMA Oceanic and ZSU airspace, has had robust growth over the last five years. Data presented below demonstrate that the combined number of aircraft handled by the ZMA Oceanic and ZSU has been growing since FY2009. Note in the second chart that this growth outpaces the growth in the entire National Airspace System (NAS). Growth has occurred in this region in an environment in which "in 2014, activity at FAA facilities declined for the seventh consecutive year."[2]

Figure 2 Growth of ZMA/ZSU Traffic

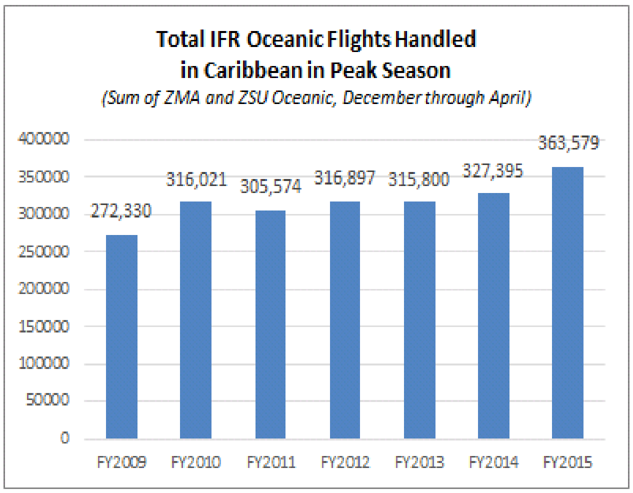
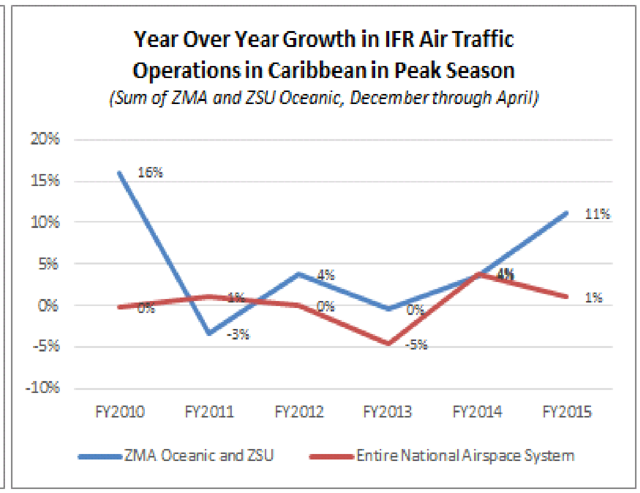


Figure 3 Comparison of ZMA/ZSU Growth to Rest of the NAS



Source: OPSENT data, Aviation System Performance Metrics (ASPM)

There are a number of different factors that may contribute to the growth of traffic in the Caribbean region and ultimately traffic through ZMA and ZSU airspace. This includes economic growth in the Caribbean, Central and South America, cruise ship activity and tourism, and Miami evolving into a financial hub for Latin America ("The Wall Street of the South").

Looking forward, both scheduled and non-scheduled operations are expected to grow in and around the region. The International Air Transport Association expects passenger growth in Latin America and the Caribbean to grow from the current level of 242 million to 385 million within 10 years, assuming certain infrastructure and other improvements by regional governments. This growth will be accelerated by the recent opening of relations between the United States and Cuba and an easing of travel restrictions[3]. Already, at least one US operator has announced scheduled charter service between New York and Havana beginning in July 2015[4]. Additionally, while FAA analysis of ARTCC activity projects an overall 4% decrease of operations in the NAS in 2019, the only Center projected to increase activity is ZMA which is estimated to grow by 1.3% by 2019. This data is drawn from the FAA's Performance Analysis Group's Five Year Projection (FYRP). The FYRP forecasts future traffic based primarily on the dynamics of

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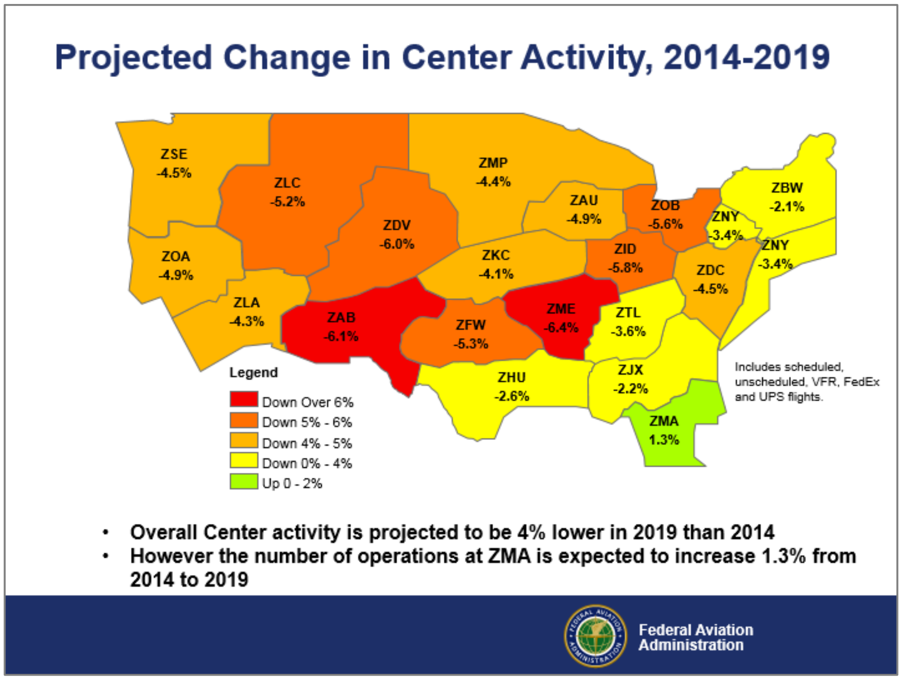
[2] Source: "FAA Aerospace Forecast, Fiscal Years 2015 – 2035"
[3] See: http://www.nytimes.com/2015/01/16/world/americas/us-eases-decades-old-rules-on-travel-to-cuba.html
[4] See: http://otp.investis.com/clients/us/jetblue_airways/usn/usnews-story.aspx?cid=981&newsid=29204

scheduled US carriers along with more generalized assumptions about traffic for foreign carriers, general aviation and cargo operations[5]:

Figure 4 FAA Projected Growth of Center Activity in the NAS: 2014-2019



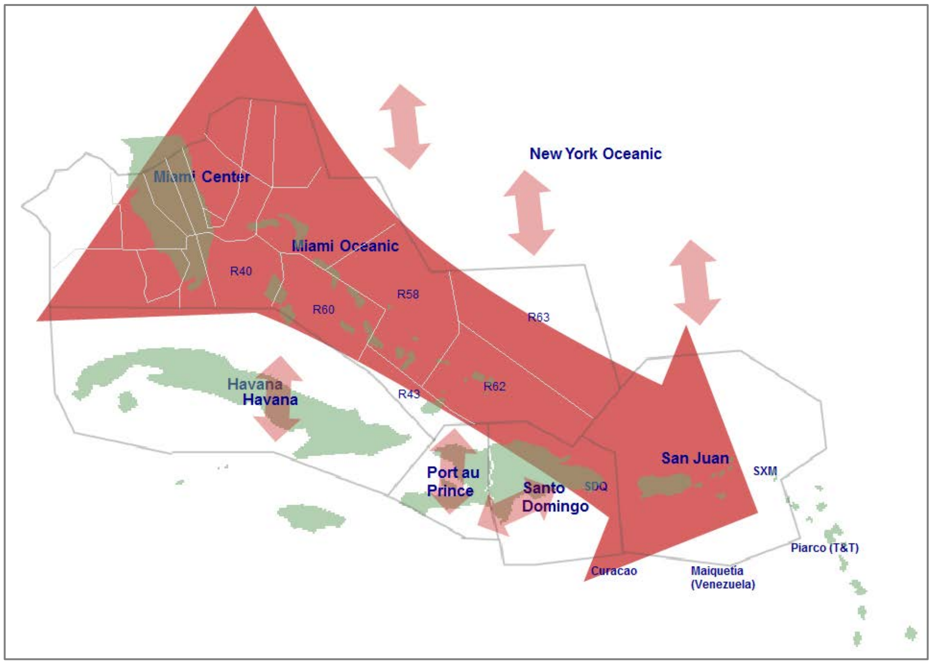
Source: FAA AJR-G Five Year Projection (FYRP) for the NAS

Funnel Effect of Caribbean Traffic

The primary operational challenge for the NAS Caribbean region is the funneling of traffic between ZMA and ZSU within a combination of radar and non-radar airspace that is bounded in several areas by foreign Air Navigation Service Providers (ANSPs). The diagram below shows how the funnel effect between the Contiguous United States (CONUS) and the Caribbean as well as the additional traffic into, out of, and through this funnel from ZNY and foreign ANSPs.

[5] Results do not include projection of traffic at ZSU. However, additional analysis does indicate that the projection of growth rate in ZSU is similar to the expected growth rate at ZMA.

Figure 5 Funneling Effect in NAS Caribbean Operation

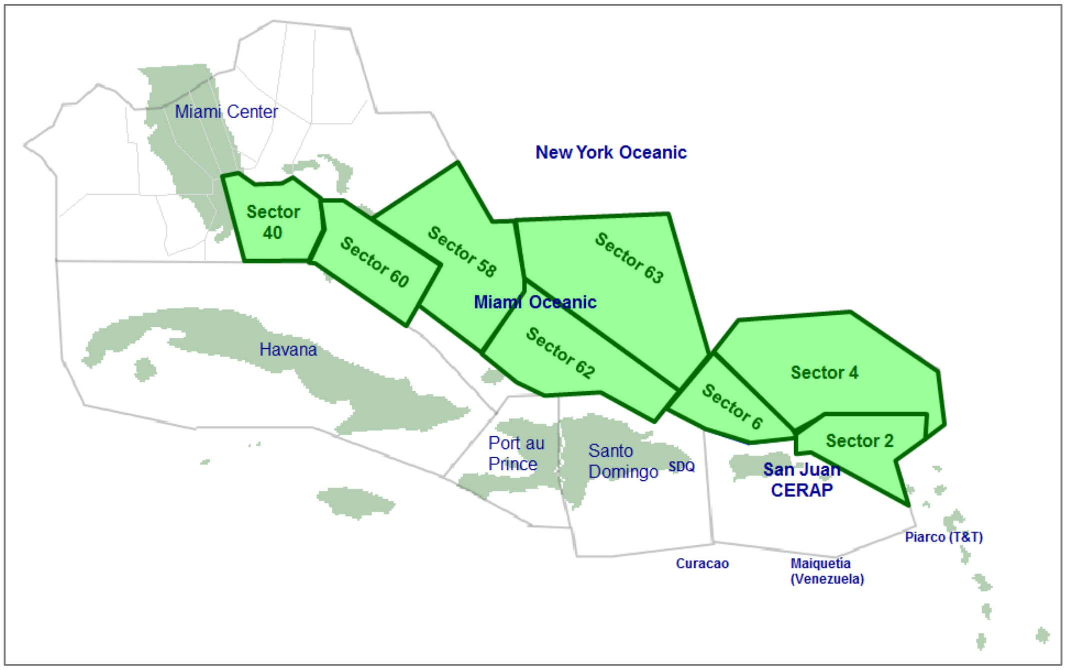


The growing traffic referenced earlier traverses this static funnel and creates additional complexity in airspace with a complex airway structure that has not been redesigned in many years. During peak traffic periods, current traffic levels are at a notional capacity for flow through this region. As a consequence, and as will be detailed later, the utilization of Traffic Management Initiatives (TMIs) to manage flow through the region on peak operational days has been a standard requirement in recent years.

Airspace Structure not Aligned to Current Traffic Demand

There are a number of areas in which the airspace structure in the Caribbean region may be improved. The current airspace structure is inconsistent with the traffic needs of the region and has not changed in many years. There is a mix of radar, non-radar and oceanic airspace and areas where communications are limited or unreliable. There is limited redundancy for communications or surveillance and manual coordination between ANSPs is the norm, thus reducing airspace capacity and increasing the likelihood of unpredictable delay. Facility outages increase risk, reduce airspace capacity, and increase controller workload. The following diagram presents key airspace sectors in the Caribbean discussed below:

Figure 6 Key Sectors of Interest in Caribbean Operations



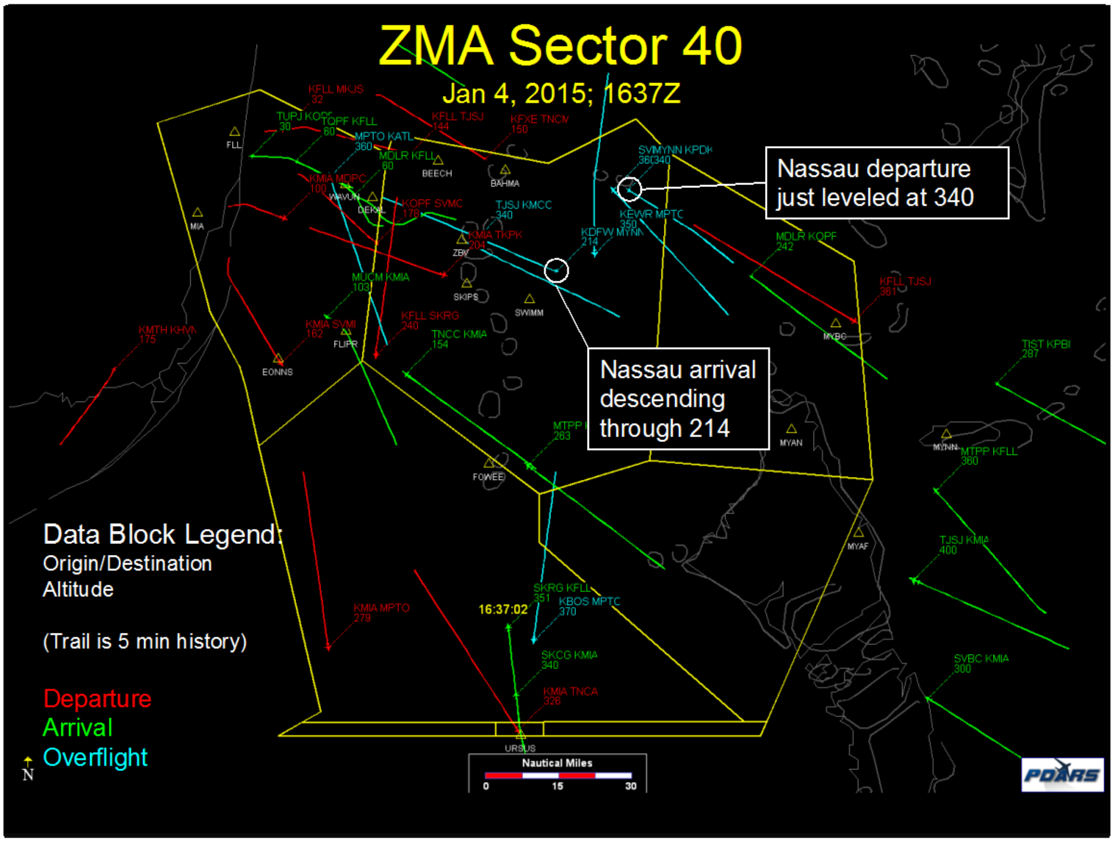
Safety Concerns in ZMA Sector 40

Sector 40 (R40) in ZMA, also known as the Bimini High sector, is located in the United States offshore airspace, east-southeast of Florida. It covers portions of the Bahamas and shares a common boundary with the Cuban Flight Information Region (FIR). Its vertical limits are flight level 240 and above. The traffic flow in R40 is not specific in terms of concise, directional, and streamlined patterns. The sector includes:

- Overflight aircraft in intersecting trajectories from north-eastern and north-western United States aerodromes, as well as east/west trajectories for flights originating in/destined to European aerodromes.
- Service to aircraft climbing and descending to/from Bahamian aerodromes.
- Sequencing arrival traffic destined to South Florida aerodromes (e.g. Miami Intl and Ft. Lauderdale Intl) from the southeast. Inbound traffic from internal adjacent sectors directly east and southeast, must blend with northbound traffic from Cuba to the south. This sector also controls south and southeast bound departure traffic from South Florida airports.

The snapshot below depicts some of these dynamics during a peak day in January 2015:

Figure 7 Sample Traffic in ZMA Sector 40



Source: Performance Data Analysis and Reporting System (PDARs)

The steady increase in traffic volume in a legacy airway structure that handles intersecting overflight traffic, as well as transition traffic descending and climbing to/from Florida, Bahamian, and Cuban aerodromes, has contributed to complexity and an increase in traffic conflicts in the Bimini High sector. These conflicts have led to an increase in operational incidents.

An incident in R40 in 2012 resulted in an NTSB inquiry into operations in the sector. The Investigator made a series of observations on Sector 40. (*Note that ZMA has addressed many of these observations already*):

Figure 8 Summary of Observations from NTSB Review of Sector 40

Observations from National Transportation Safety Board (NTSB) on Sector 40 in ZMA:

1 - **AIRSPACE DESIGN OF SECTOR 40-** review sector airspace for improvements.

2 - **STREAMLINING REROUTES:** Observation that reroutes need to reviewed to determine impact on sectors and contributory factors.

Final Comments: NTSB feels that this incident was the result of numerous contributing factors including but not limited to sector complexity and volume, lengthy reroutes and needed airspace updates.

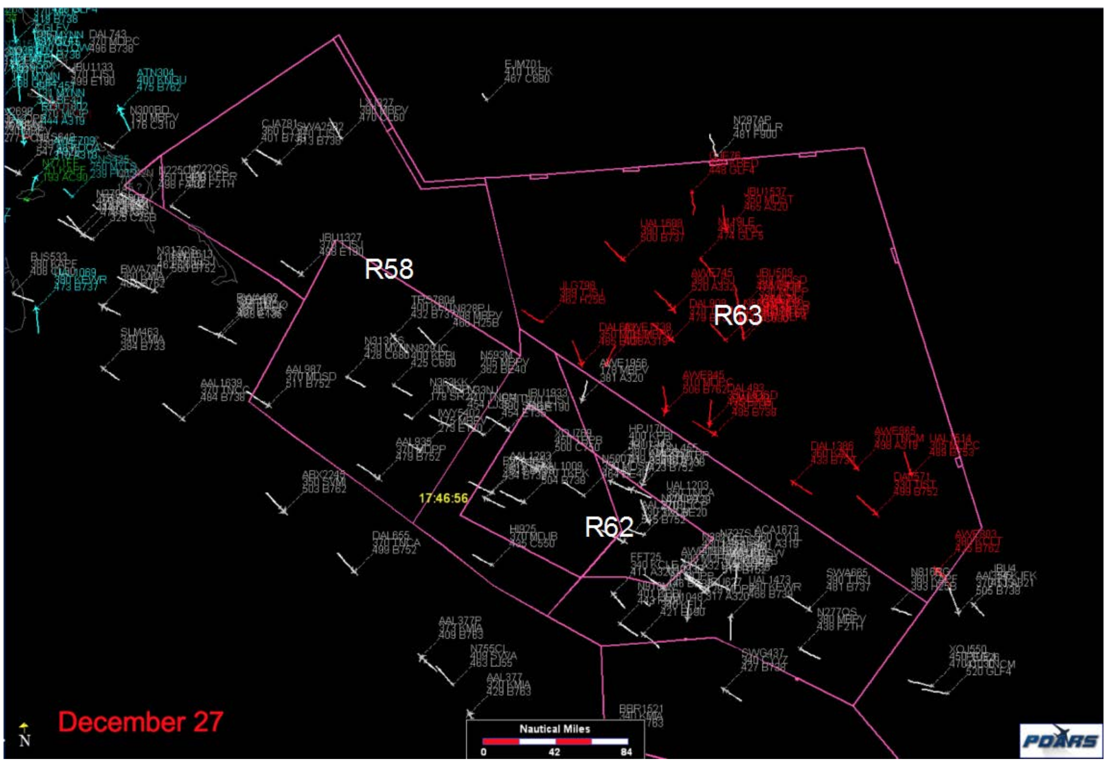
Improving safety in the Bimini Sector has also warranted discussion in the work of the ICAO North America, Central America and Caribbean Office (NACC). During Working Group meetings of the ICAO NACC, the FAA has recently presented a summary of the context of the operations in R40 as well as what is being done to mitigate the issues (Traffic Management Initiatives, probing traffic with the User Request Evaluation Tool [URET], Automated Data Exchange, supplemental training, etc.).

Finally, the expected increase in operations to Cuba will likely exacerbate the traffic demand through R40.

Volume in Large Oceanic Sectors in ZMA

Most sectors in ZMA are very large oceanic sectors, with some going from the surface to FL600. Aircraft spend long periods of time in these sectors, with the average flying time in Sectors 62 and 63, for example, being 34 minutes. The depiction below presents a snapshot of traffic in Sectors 58, 62 and 63 on December 27, 2014 at 17:46:56 Z. At this time over 30 aircraft are traversing sector 62:

Figure 9 Traffic through Large ZMA Oceanic Sector



Source: PDARs

Given the large area and flying times, the number of aircraft that may be traversing these sectors at any one time can be high and, therefore, challenging for a controller to manage. Even during optimal weather conditions, controllers may be managing up to 40 aircraft which drives workload for the controller. The following figure presents a sample of Traffic Flow Management (TFM) forecasted sector counts in key ZMA sectors on December 27, 2014, the same day depicted in the snapshot above. The numbers in red depict hours in which the number of aircraft in the sector are projected to exceed the

Monitor Alert Parameter (MAP) value. Note that for the picture above, Sector 62 was forecasted to have a peak of 38 aircraft at 1745 UTC.

Figure 10 MAP Numbers for Some ZMA Sectors on December 27, 2014

Max of Count

ZMA Sectors	MA	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00	14:15	14:30	14:45	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45
58	21	2	5	4	6	7	6	11	9	7	11	15	16	17	18	14	17	17	18	12	16	16	23	24	18
59	21	2	0	0	1	2	3	4	2	7	8	11	7	10	6	7	8	4	8	9	12	14	9	13	14
60	21	5	6	5	10	13	13	10	7	14	14	15	19	25	23	21	23	21	24	23	17	29	28	19	18
61	15	2	3	2	3	4	3	3	4	5	6	8	9	9	7	7	14	14	12	11	14	13	9	10	13
62	21	9	13	13	13	11	8	11	17	17	14	14	13	16	18	19	17	14	16	23	23	22	24	32	38
63	21	5	4	0	2	5	7	7	5	7	8	8	5	7	10	10	13	12	11	9	14	14	18	25	23

ZMA Sectors	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00	20:15	20:30	20:45	21:00	21:15	21:30	21:45	22:00	22:15	22:30	22:45	23:00	23:15	23:30	23:45
58	22	20	21	20	23	19	19	14	14	20	23	22	18	18	15	15	15	19	19	12	12	12	11	7
59	9	7	17	18	13	14	11	7	9	14	13	14	12	11	12	9	7	8	9	11	9	8	10	7
60	15	27	28	22	22	15	14	14	19	22	20	23	25	22	16	20	24	24	19	20	15	12	12	14
61	15	16	12	14	11	5	14	11	15	15	9	17	18	12	8	7	12	12	14	13	12	11	12	11
62	30	23	23	23	24	24	24	26	24	21	16	18	22	25	24	21	22	18	18	19	13	11	14	14
63	25	21	18	17	16	11	14	14	12	13	15	18	20	16	14	12	12	11	12	13	13	11	7	10

Source: Traffic Flow Management System, data pulled from PDARs

When there is any operational anomaly in the system, such as weather, equipment outages, or airport congestion, there may be a significant workload increase on controllers managing these sectors, particularly if the event is unscheduled or unpredicted. For example, when pilots request deviations around severe weather, which may or may not be visible to the controller, it may impact multiple aircraft or traffic flows, thus increasing workload and complexity significantly. When these deviation requests are expected, it may be necessary to implement traffic management initiatives to keep the traffic volume manageable. Obviously any equipment outages create a similar or more extreme situation. Another example involving ground congestion can occur a several airports: Providenciales Airport (MBPV) has limited taxiway, ramp and gate capacity and may not be able to accept arriving aircraft. In such cases, MBPV requests ZMA to hold aircraft until an aircraft can depart MBPV to free up space on the ground for the incoming aircraft. The ZMA sector controller then must hold the aircraft awaiting arrival clearance from MBPV while managing the other aircraft traversing the sector.

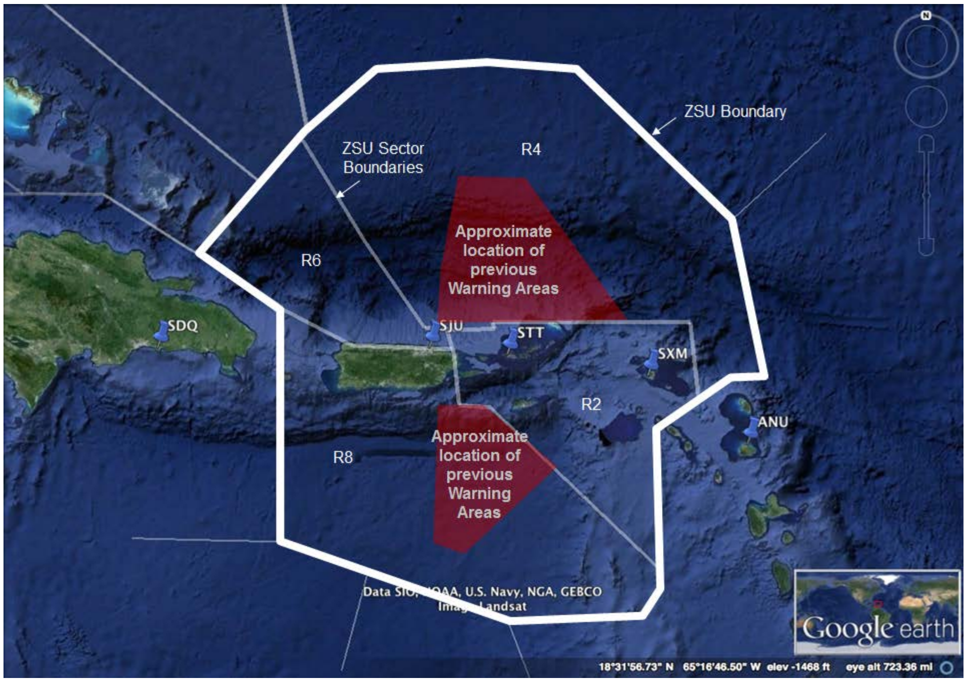
Finally, most facilities surrounding these large oceanic sectors are non-radar facilities or without automated data exchange, so time consuming manual coordination is required to transfer control.

Limited Airspace Structure in ZSU not Aligned to Current Traffic Demand

Finally, the airspace in the San Juan CERAP has not been redesigned in many years and no longer reflects the traffic flows and growth in the area. Existing ZSU sectors are based on legacy military traffic demand that no longer exists. The ZSU Approach sectors were designed around old Navy approach control airspace and the ZSU En Route sectors were designed around Warning Areas that were decommissioned as of October 22, 2007. As traffic flows evolved in the region since the Navy vacated in 2003, route structures and flows have changed to utilize the military airspace to help meet the new traffic demand but the current sector designs do not align with the route structures.

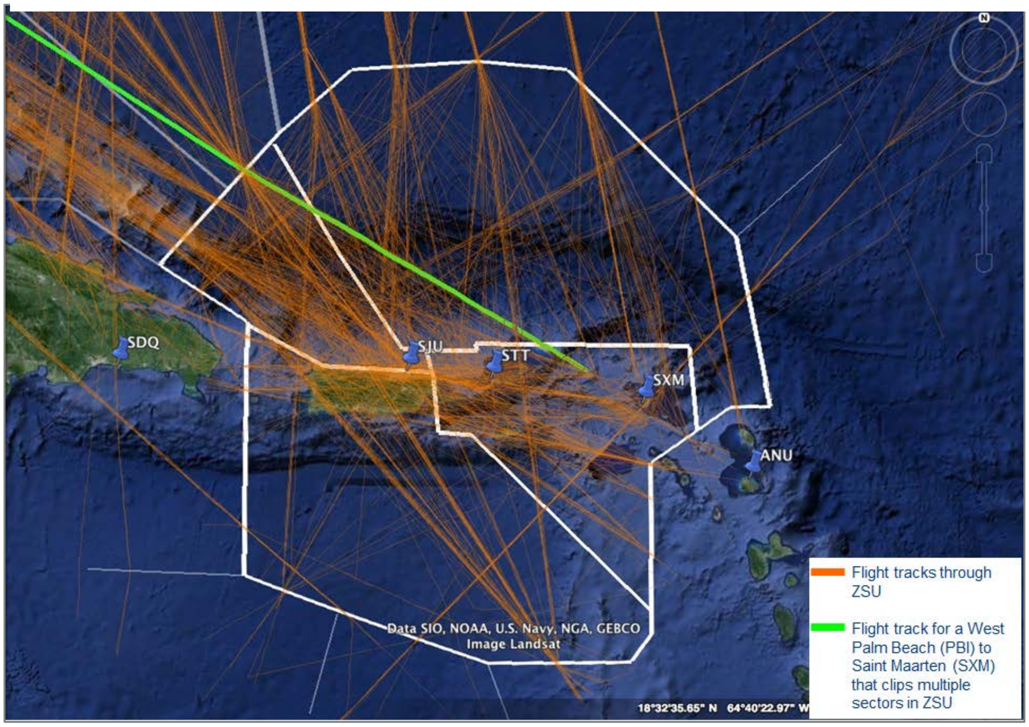
The diagram below shows that the four en route sectors were designed specifically around the warning areas associated with the Navy Base.

Figure 11 Approximate Location of Historical Warning Areas and Structure of ZSU Sectors



With the Navy base closed and most warning areas cancelled since 2007, the traffic flows in ZSU have adapted in response to the demand within the original airspace structure. The traffic flows adjusted but the sectors did not. Looking at the flows for one day in ZSU below, there is imbalance in the utilization of sectors with R6 and R2 the most utilized. R4 is also heavily utilized during certain conditions while R8 is least utilized. Additionally, the green line represents a flight from West Palm Beach (PBI) to Saint Maarten (SXM). Note that this flight is an example of one which crosses multiple sectors within ZSU, which creates unnecessary workload and complexity for the controllers.

Figure 12 Traffic Flows through ZSU on Peak Day (Jan 3, 2015)



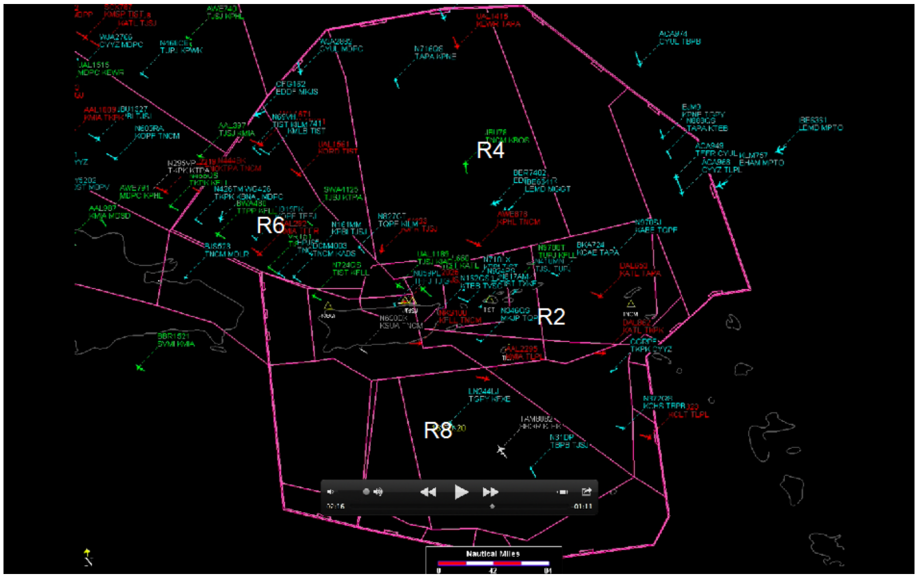
Source of flight track data: PDARs

The San Juan CERAP also has limited defined structure for its traffic flows. The diagram above shows a number of entry points into ZSU from which aircraft essentially proceed direct to their next destination within ZSU – either an airport destination or an exit point from ZSU. Although this may minimize route mileage, it creates a web pattern with increasing complexity and workload that ZSU controllers must manage. Recently, FAA has been evaluating the utility of a Traffic Management Unit (TMU) in ZSU to better organize flows and assist with managing demand capacity imbalances. However, for the longer term, there is a need to examine and possibly restructure the airspace using PBN, which not reliant on ground based NAVAIDs.

Sector 6 in ZSU, in particular, has the highest workload of the four sectors in the CERAP. R6 handles approximately 80% of arrivals into SJU in ZSU. The sector also deals with climbing and descending traffic from both Puerto Rico, the Virgin Islands and the Dominican Republic. Today, Traffic Management Initiatives are being used to manage the flow and ensure safety. In the FY2015 peak Caribbean season (December through April), ZSU requested miles or minutes in trail from ZMA on nearly 50 of the 120 days in the season. This frequency of TMI's has been approximately the same for the last three peak seasons (FY2013 through FY2015).

Sector 2 is second to Sector 6 in volume but higher in complexity. Frequency and Radar coverage limitations add to controller workload and decrease efficiency of traffic flow adversely affecting the sector's capacity. Finally, Sector 4 handles the majority of Oceanic traffic from Europe and feeds Sector 2 with traffic landing St. Maarten (TNCM) and V. C. Bird International Airport in Antigua and Barbuda (TAPA). When TNCM closes due to volume, Sector 4 has to hold the inbound traffic:

Figure 13 Snapshot of Imbalanced Volume in ZSU Sectors

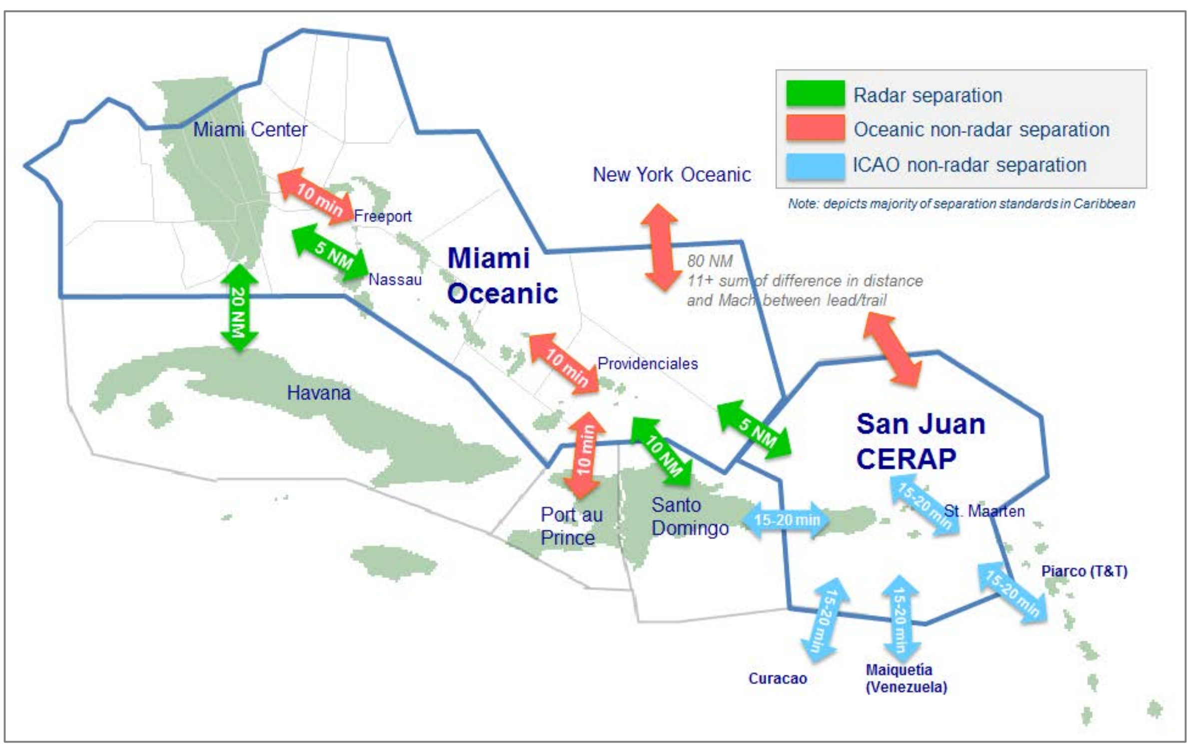


Source: PDARs

Infrastructure Issues in the Caribbean

Operations in the Caribbean are challenging for a number of reasons. One of the primary challenges for controllers at ZMA and ZSU is managing multiple separation standards which result from various levels of infrastructure in the region. The diagram below shows the different separation standards and the areas where transitions are required to accommodate traffic flows in the Caribbean operation:

Figure 14 Transitions between Different Separation Standards in the Caribbean



The separation standards used in the Caribbean are "Procedural" Separation and Radar Separation. The Procedural Separation can be further divided into two methods, Non-Radar and Oceanic. When listed by distance required for separation, Oceanic generally requires the greatest distance for separation, Non-Radar requires less distance than Oceanic but more distance than Radar, and Radar requires the least distance for separation and is therefore the most efficient.

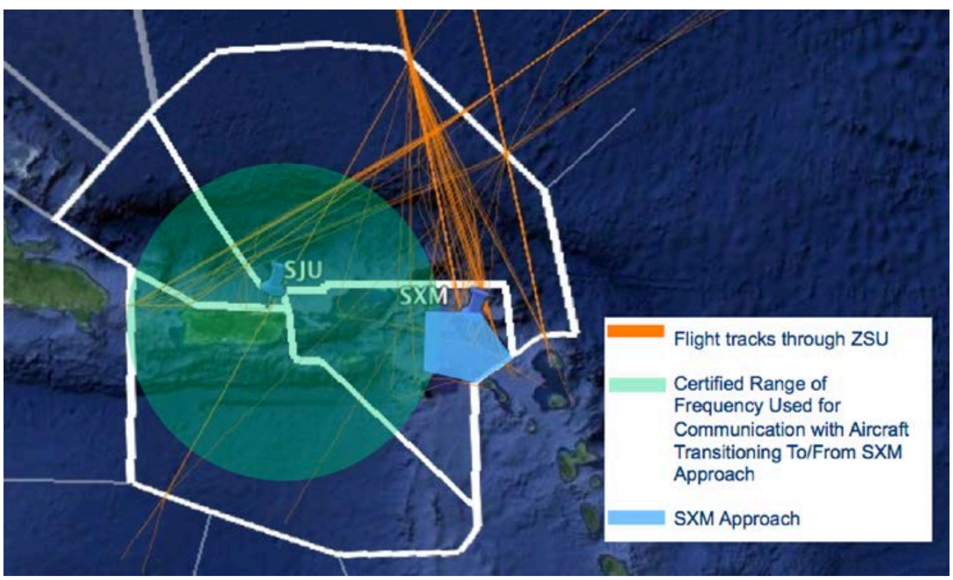
Both Non-Radar separation and Radar Separation require immediate communication with the aircraft involved. Radar Separation requires a surveillance source (primary radar, secondary radar or ADS-B/Wide Area Multilateration [WAM]). As currently configured, surveillance and communications sources must be land based. In an area with large expanses of open water, lacking ground-based communications and surveillance and served by multiple foreign ANSPs, airspace capacity and efficiency are constrained in order to ensure safety and manage controller workload.

The following is a summary of the various infrastructure limitations and the resultant challenges impacting the Caribbean airspace today:

Communications Gaps Drive Increased Separation for Contingency Management

There are blocks of airspace in the Caribbean with gaps in direct pilot-controller radio communication. For example, in the Northeast segment of ZSU, the frequency used to communicate with aircraft being transitioned to or from SXM Approach Control is only certified to the Western edge of SXM Approach. This frequency has an "official certified range" of 132 NM, and SXM is located 152 NM east of the 118.15 MHz transmitter site. Coverage beyond 132 NM is unreliable.

Figure 15 Flight Tracks Potentially Impacted by Lack of Certified Frequency Coverage in ZSU



Controllers handling traffic in ZMA and ZSU state that their first priority is to have communications with aircraft; if a controller can communicate with an aircraft, then various separation standards are available to ensure a safe and efficient operation. Currently there are gaps in the region that make communications periodically unreliable. The result is a requirement for additional separation to safely manage contingencies.

Another significant frequency coverage gap is for operations in and out of Providenciales ("Provo") Approach Control airspace in the Turks and Caicos Islands. Installation of a new frequency has been a high priority in the region for several years and it has just recently received the required funding. It is expected to be completed in Fall 2015.

Single points of failure/Lack of redundancy

There are multiple single points of failure in Caribbean operations. On March 28, 2015, for example, ZMA's Oceanic sectors experienced a communications outage. Due to high volumes of crossing traffic in that airspace, the outage caused Sectors 62 and 63 in ZMA to revert to procedural separation of 10 minutes in trail above FL200 and 20 minutes in trail below FL200. This was done in an effort to reduce the volume of traffic in the airspace. Subsequent reroutes and other Traffic Management Initiatives resulted in significant operational disruptions and diversion of 36 aircraft.

Another single point of failure in the Caribbean is the radar site at Grand Turk. This site is a critical source of surveillance for flights traversing ZMA's Sectors 62 and 63. In the diagram below, the figure on the right depicts radar coverage in the Caribbean when Grand Turk's radar is out of service. Orange lines are flight tracks that traverse ZSU:

Figure 16 Radar Coverage in the Caribbean

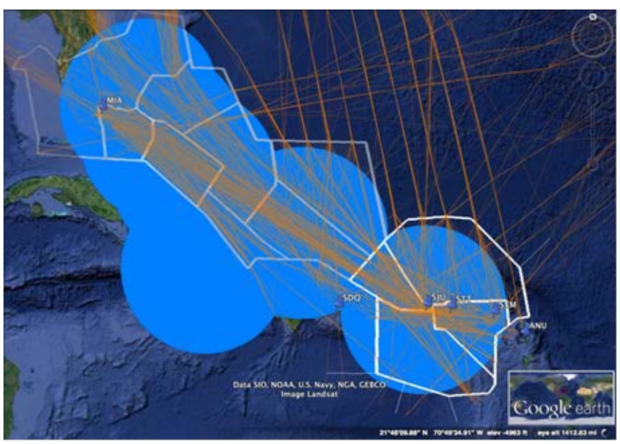
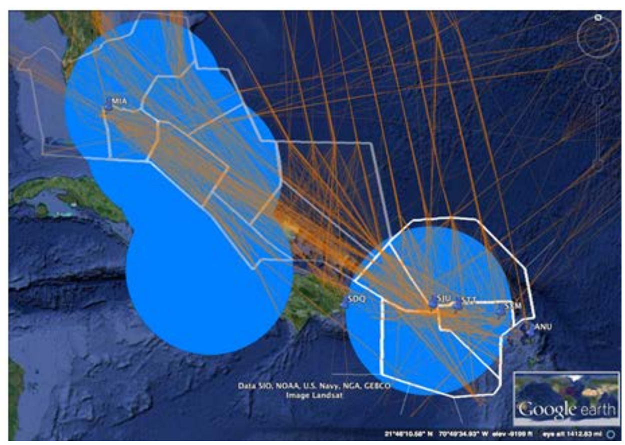


Figure 17 Radar Coverage in the Caribbean when Grand Turk radar is Out of Service



When this radar site is out of service, whether scheduled or unscheduled, it results in reroutes and volume reductions that cause delay and additional fuel burn and can impact thousands of passengers. ZMA personnel indicated that the Grand Turk radar was out of service 7 times during CY2014. An analysis of operations from a peak day in January 2015 indicated that approximately 700 flights are impacted on a peak season day. It is estimated these seven outages cost flight operators $2-3 million in extra fuel burn. Additionally, there are incremental costs associated with missed passenger connections and delays impacting crews and aircraft.

ZSU Automation Platform's Dependency on ZMA Limits Functionality and Improvement

San Juan CERAP utilizes the Micro EARTS automation platform for air traffic control. ZSU does not have its own Flight Data Processor (FDP) and relies on ZMA's ERAM system for flight data processing. Miami ARTCC serves as the automation parent facility for San Juan CERAP. All data communications to the STARS/MicroEARTS serving a TRACON/CERAP is routed to that facility via the Parent Center. It does not go directly to the ARTS/CERAP facility without first passing through the parent center. Miami provides flight data and flight strip processing for ZSU.

As a result, any change in the ZSU MEARTS automation platform requires ZMA to adapt the change into its ERAM system. For example, any changes to routes or sector boundaries in ZSU must be implemented in ZMA. While this is possible, it requires additional coordination and linkage to other systems before ZSU can benefit from improvements in its automation system. Additionally, when the ZMA FDP is offline, ZSU loses all flight plan information, including call sign, beacon code, fixes, altitudes, etc. Finally, the lack of independent flight data processing requires additional resources in the ZSU controller team. Flight plans are activated and/or amended in ZSU via Flight Data Input/Output (FDIO) Equipment.

MEARTS is not expected to be retired in the near future, particularly because it serves a critical function for the ATOP (Advanced Technologies and Oceanic Procedures) platform. However, it may be retired as a standalone automation system. Contractually, MEARTS is renewed on a year-to-year basis so making investments into new capabilities is more challenging from a programming and budget perspective. As a result, ZSU MEARTS lags behind in capability to the rest of the NAS. For example, MEARTS is not included in the Waterfall for Data Comm and requires additional software translators for Automated Data Exchange with other ANSPs in the region.

Weather Information Gaps Create a Safety Hazard

Lack of real time weather information on the controller's scope is another limitation in the Caribbean. ZMA Oceanic has limited real-time weather information available and ZMA weather radar is only available within about 150 NM of Miami. An Air Traffic Safety Action Program (ATSAP) Corrective Action Report (CAR) issued in 2011 notes that "lack of weather radar presentation, within airspace overlying the Caribbean area of Miami ARTCC (ZMA), creates a safety hazard."[6]

ZSU has NEXRAD data available but this system has a 5 to 7 minute time lag on the controllers' scopes. It has availability and coverage issues and is dependent on ground stations for information. As backup to the NEXRAD, ZSU only has weather radar with 60 NM coverage around San Juan (SJU) and Saint Thomas (STT). Additionally, blind spots in weather information exist to the east of SJU along the western and southern boundaries of SXM Approach Control due to terrain limitations.

Flight crews have reported that there are times in tropical atmospheres where there is so much water aloft that the radar attenuates and no longer paints an accurate picture. Given that Caribbean operations are in areas of significant convection and flow through "Hurricane Alley," the complete lack of weather information in multiple sectors in ZMA and unreliable information in ZSU can create operational challenges, compounded by lack of common situational awareness with flight crews. When pilots and controllers have different understandings of evolving weather, time is required for the two

[6] From: "Air Traffic Safety Action Program Corrective Action Plan, Monthly Report, April 2015"

parties to safely resolve the conflicts. This additional time and workload are particularly problematic in the large Oceanic sectors in ZMA, such as Sectors 62 or 63. Oftentimes when severe weather is present, routes must be closed or traffic dramatically reduced to allow for deviations.

The TG was shown a recent example that illustrates these issues:

An air carrier flight was in Cruise at FL360 at approximately 160 nm east of GTK. The flight crew coordinated with ATC and inquired about ride reports and deviation requests as they were painting weather ahead (approximately 150 miles). ATC had no previous aircraft through the area and therefore no ride reports. The crew also sent dispatch a message requesting a look at the radar ahead. The flight deviated to the left (South) of course (upwind) of the targets painted on the radar. Flight approached the system well over 40 miles from any painted returns while in IMC [Instrument Meteorological Conditions] conditions the entire time. Crew continued with multiple scans, changing gain and range along with tilt. The flight experienced severe turbulence and a possible lightning strike.

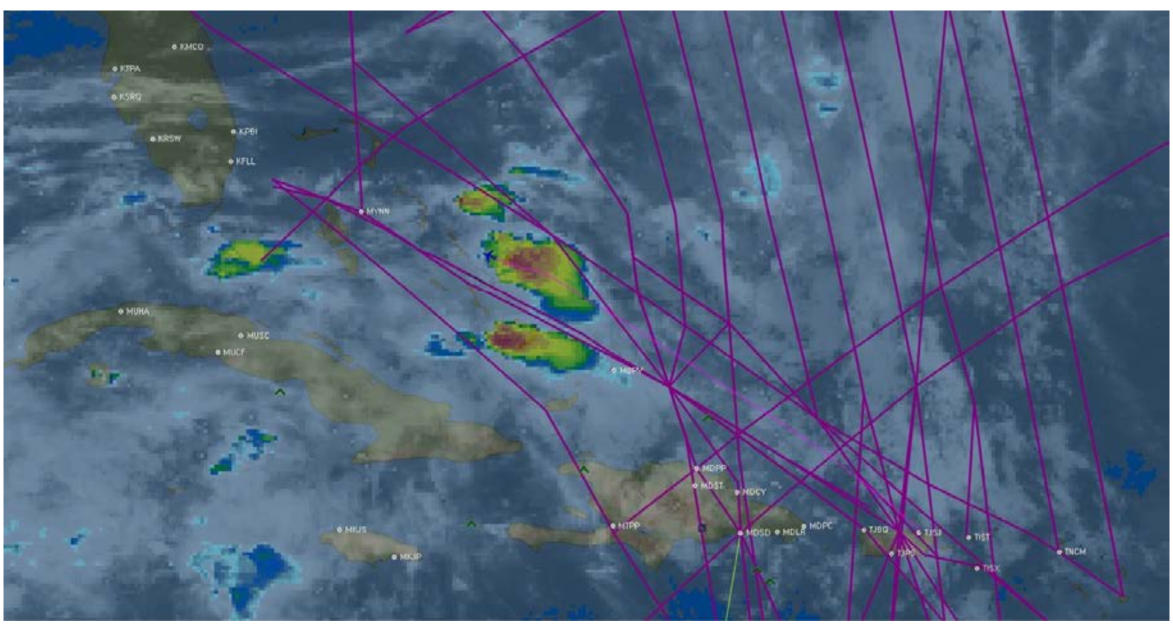
The event report was summarized in the following way:

ENCOUNTERED SEVERE TURB. @ FL 360, AT 0730Z. LOST 1000FT WITH AN DOWNDRAFT. LOCATION WAS 2405N/7438W.

ALSO HAD A LIGHTNING STRIKE ZQA147@120. NO INJURIES OR DAMAGE TO AIRCRAFT. MOR ENTERED WITH #2015/06/05-0001.

Finally, the following is a depiction of the aircraft and weather during this incident:

Figure 18 Example Weather in Caribbean on June 5, 2015



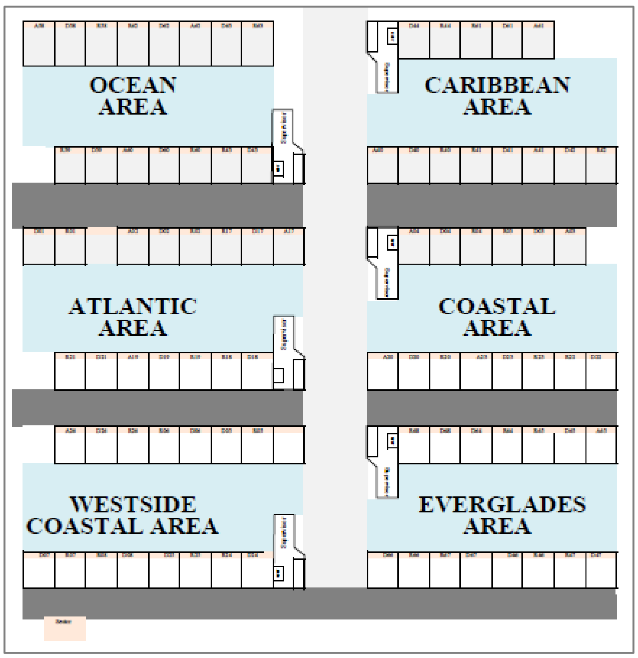
Source: WSI

When in domestic US airspace, controllers add an additional level of safety by alerting flight crews to areas of moderate or greater precipitation when it's on their route and inquiring if they would like to deviate. If real time weather information was available to ZMA and ZSU, controllers could provide critical safety of flight information and better manage traffic flows through areas of severe weather.

Space Constraints in ZMA Limit the Pace of Airspace Resectorization

The airspace challenges discussed earlier suggest that there may be a need for new physical sectors in ZMA and ZSU. However, for ZMA, there is no floor space currently available in the facility for an additional sector. The diagram below depicts the current layout of the ZMA control room. Note that there are currently no free physical sectors in this space. ZMA Management is currently researching options to free up space on the floor to accommodate a new sector.

Figure 19 ZMA Control Room Layout



Surveillance Gaps Drive Increased Separations

Finally, there are surveillance gaps in ZSU today. Aircraft transitioning between ZSU and SXM approach, for example, are not visible to ZSU until just before they enter ZSU airspace. Additionally, given the prevalence of oceanic airspace along the boundaries of Caribbean airspace, there are multiple boundary crossings with oceanic facilities that do not have radar coverage.

Regional Coordination Challenges

Manual Workload Requires Up to a Three Person Team to Operate one Sector

As noted and depicted earlier, there are numerous adjacent and underlying foreign ANSPs bordering both ZMA and ZSU with various transitions of separation standards. Most require manual coordination and handoffs between facilities, usually via telephone landlines; flight plan information is also passed manually between facilities along with altitude and crossing time estimates.

On a typical day, a sector in ZSU requires three controllers to manage the sector – an R side, a D side and an A side. The R side controller is communicating with aircraft, the D side is often on the phone transferring information to/from foreign facilities and the A side is entering, correcting and generally managing the information. This process requires two of the three controllers (D and A sides) to be involved in “heads down” work. Additionally, with language differences in the region, manual transfer of information results in frequent miscommunications that either drive additional time to clarify or the passing of incorrect information. These situations increase risk and may decrease sector capacity, and would be less prevalent with automated transfer of information (ADE).

No Regional Traffic Management Limits Facility Control of Flow and Penalizes US Operators

The high number of adjacent and underlying foreign facilities also creates challenges in managing traffic flow in the region, particularly in an increasingly congested operational environment. ZMA and ZSU have some level of informal coordination with neighboring facilities, but there are no formal agreements for an integrated air traffic management concept. While there is a strong sense of cooperation between facilities in the region, currently there are no mechanisms to levy restrictions on foreign ANSPs or aircraft to manage throughput and controller workload. As a result, when there is a need in US facilities to manage traffic, domestic flights originating from or destined to the United States get penalized to manage the overall demand. These are the flights the FAA can regulate; hence these are the ones that get controlled when it is required. With a regional Air Traffic Flow Management (ATFM) structure, all participants would be governed by traffic management which would result in a more equitable distribution of initiatives.

Summation of Current Operational Problems in Caribbean

There are a number of dynamics intersecting in the Caribbean that highlight the need to expeditiously address the airspace, infrastructure and connectivity deficiencies in the region. Air traffic demand in ZMA and ZSU airspace is currently the only region in the NAS that both has grown in recent years and is projected to grow in the future. The airspace is at capacity today, particularly during the region’s peak season when the most passengers want to travel. Structural limitations in the airspace design drive problems in both individual sector safety and efficiency and controller workload. Compounding the airspace deficiencies is a series of infrastructure limitations in the region including single points of failure, facility space limitations, lack of automation capability and gaps in communications, weather information and surveillance. Finally, interfacing with the many foreign facilities neighboring or underlying ZMA or ZSU airspace requires extensive manual coordination, increasing controller workload and limits any structured approach to regional traffic management.

As discussed earlier, there are a series of safety concerns in this region, including NTSB observations of complexity in Sector 40 and large over-water sectors that regularly have very high volumes of traffic. To manage volume and ensure the highest levels of safety, the operating facilities in the region in conjunction with the Air Traffic Control System Command Center (ATCSCC) regularly utilize Traffic Management Initiatives such as Airspace Flow Programs (AFPs) and Miles/Minutes in Trail (MITs). Of the approximately 128 days during the 2015 peak winter Caribbean travel season, the region experienced 20 AFPs and about 50 days in which ZSU and ZMA passed back MIT restrictions to other facilities.

Operational Needs in the Caribbean

This section of the report presents a series of operational priorities that, if implemented, would address the airspace and infrastructure challenges in the Caribbean and benefit the safety and operational performance issues raised. The full set of operational needs is presented in Appendix A: Detailed Assessment of Operational Needs. Each item in the package is discussed in more detail below. This section is divided into a discussion of Infrastructure Priorities and Airspace Priorities. Ultimately, the improvements should be packaged in a way that enables them to complement one another and be implemented in the shortest possible time. This may involve using existing budget line items for communications and surveillance, NextGen funding, a new comprehensive budget line item focusing on improving the infrastructure in the region, or some combination of all three.

Infrastructure Priorities

The following is a set of infrastructure improvements that should improve the safety, efficiency and capacity of the airspace corridor controlled by Miami Center and San Juan CERAP. The ERTG has categorized and prioritized these into four broad categories: Communications, Surveillance, Automated Data Exchange and Technology Improvements. The first three of these categories relate to infrastructure improvements that utilize existing technologies to address gaps and improve operations in the region. The final category (Technology Improvements) relates to improvements that leverage new technologies that are being implemented or are available in the rest of the NAS. Priorities were developed based upon the number of operations impacted as well as perceived operational benefits in terms of safety, capacity, efficiency and reductions in controller workload.

Communications

Increasing communications in areas that currently have none or in areas that have incomplete coverage will increase safety and efficiency.

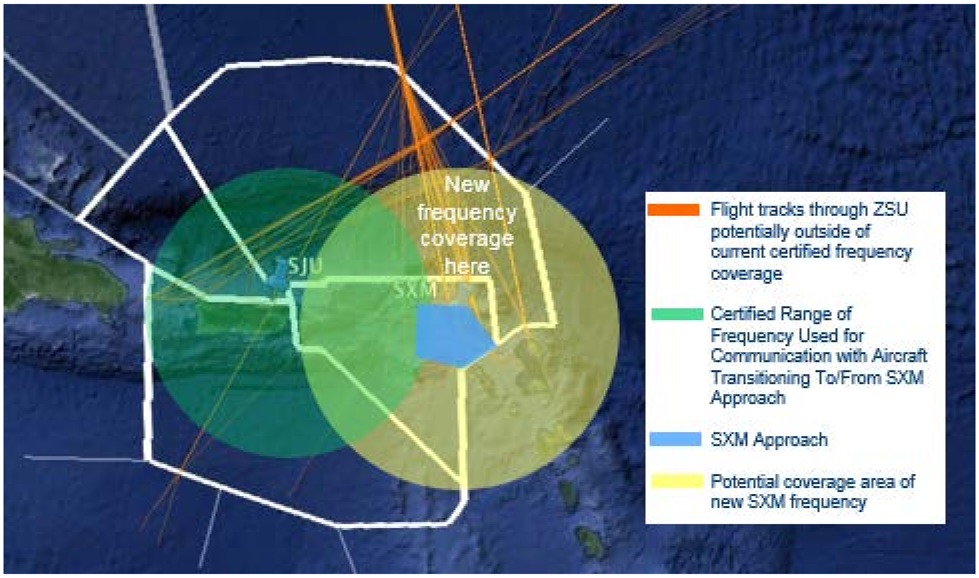
Implement a New Communications Frequency at Saint Maarten

This is a new frequency that will extend the area of communications for ZSU's northeast oceanic Quadrant. The lack of reliable communications in this area currently affects approximately 120 flights a day. This results in inability to communicate with aircraft or requires controllers to make multiple broadcasts to complete one transmission for about 15% of aircraft in this area. Additionally, this frequency is out of service approximately 4 times per year. Deployment of this frequency will ensure consistent communication with aircraft transiting this area and result in a safer, more efficient operation.

The SXM frequency requires new digital radios with communications through FAA Telecommunications Infrastructure (FTI). The frequency could utilize existing funding streams for communications. Additionally, this will require final execution of draft international agreements with St. Maarten that include an annex for establishing an FAA-owned air-to-ground radio site (RCAG) in and on the air traffic control tower in St. Maarten. This agreement would be updated after this requirement is validated and funded.

The diagram below presents an approximation of the coverage impact the new SXM frequency would provide:

Figure 20 Potential Increased Communications Coverage from SXM Frequency



Implement a New Communications Frequency at Abaco Island

This is a new frequency in the Northern Bahamas. It will improve communications with aircraft operating at lower altitudes in the Northern Bahama area. Additionally, it will improve coverage gaps that exist today along the ZNY-ZMA boundary. Filling this gap, along with a boundary change between ZNY and ZMA, will allow aircraft to consistently cut corners on existing routes resulting in time and fuel savings. This will also provide opportunities to help controllers with traffic saturation and weather deviations. The frequency would also be required to consistently take advantage of any increased surveillance afforded by ADS-B in the Caribbean. (*Both the Shortcut Route and ADS-B are discussed further below.*)

This frequency is a new requirement and no validation work has been done to date. Both countries will benefit from the safety and efficiency offered by this new frequency, particularly if complemented with new surveillance from radar or ADS-B.

Install Dedicated Shout Lines with Certain Adjacent or Underlying International Facilities

Communications with most international facilities adjacent to ZSU is presently accomplished by conventional telephones. A controller dials the number of the international facility and waits for someone to answer. Information is exchanged between the controllers on the phone, and that information is then relayed to the R-side controller working the sector. A dedicated “shout line” is a line that puts the controller directly in communication with the international facility at the sector needed. By push of a button, a controller in ZSU, for example, would have the functionality to speak directly into the headset of the controller in the international facility with which he or she is coordinating.

Shout lines eliminate the requirement for a telephone call and any corresponding delays and wait time. This will save the controller time and allow the controller to stay focused on the traffic display. It will increase efficiency and help eliminate route extensions or holding for aircraft while coordination is accomplished.

Priority for shout lines is correlated to the number of handoffs between ZSU and adjacent facilities. The table below provides a priority of shout lines based on an estimate of the number of aircraft affected daily. Shout lines to Beef Island and Piarco are the two highest priorities:

Figure 21 Number of Aircraft Impacted by Shout Line with Neighboring Facility to ZSU

Neighboring Facility	Number of Aircraft Impacted
Beef Island, USVI (TUPJ)	Significant volume of Visual Flight Rule (VFR) traffic
Piarco, Trinidad and Tobago (TTZP)	170 flights per day
Maiquetia, Venezuela (SVMI)	27 flights per day
Curacao (TNCC)	12 flights per day

Source: Analysis of PDARs flight tracks on peak operational day of January 3, 2015

Installation of a shout line is not trivial as it requires site surveys as well as connectivity to multiple international locations.

Automation

Regional Implementation of Automation
a) Continue implementation of ADE with Santo Domingo
b) Develop software translation for neighboring facilities with AIDC protocol
c) Ensure ERAM software upgrades associated with ADE stay on schedule

In the Caribbean region, there are multiple adjacent and underlying foreign facilities which require manual coordination. The transferring controller in one facility must call the receiving controller in the other facility and give an estimate of the position and altitude at a crossing point along with the beacon code. This is done approximately 10 minutes prior to crossing. If this is not accomplished before a specified, safe distance from the boundary between the two facilities, the aircraft must be turned away from the receiving controller's airspace and held until the handoff can be accomplished. This may result in the aircraft having to hold or make a wide circle before returning to its assigned route resulting in delay and additional fuel burn.

The current process is time and labor intensive as it requires making phone calls, answering phones and waiting for approval from the specific controller working the sector. Frequently, controllers are required to pass complete flight plan information. This increases controller workload and reduces airspace capacity as additional separation must be built in to accommodate the manual process.

Interfaces between automation systems in the US and foreign facilities can assist controllers by reducing the need for voice communication and manual data (flight plan) transfer between facilities. A protocol which uses North American Common Coordination Interface Control Document (NAM ICD) performs

Automated Data Exchange (ADE). This has three classes which offer increasing levels of automation between facilities with the ultimate goal being non-verbal transfer of control, i.e., automated hand-offs.

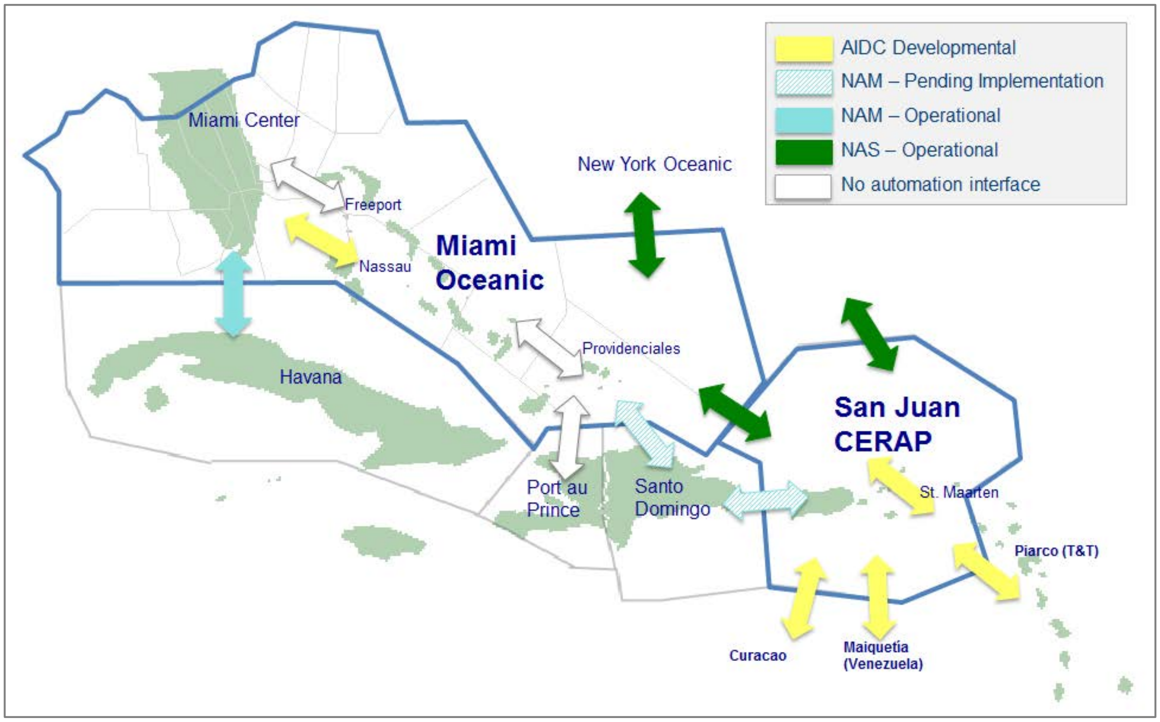
The three classes are:

1. Transfer of current flight plan information and time over given fix. Transfer of control is completed manually via a phone call to confirm handoff between neighboring facilities. All changes to a previously submitted flight plan are done manually.
2. Includes all of Class 1. Additionally, any changes to flight plan information are transferred via ADE automation. Changes include modification of flight plan, cancellation, etc.
3. Automated handoff of aircraft and optional point out capability.

Having access to this information in a more timely and automated manner allows the controller to plan for traffic entering the airspace and results in a safer and more orderly flow of traffic. Class 1 ADE has been implemented between ZMA and Havana Center. A recent analysis of automated flight plan transfers indicated that over 95% of flight plans were successfully transmitted via automation, reducing the manual effort to activate flight plans and mark up flight strips.

The diagram below indicates status of ADE in the Caribbean. Class 1 ADE is in place between ZMA and Havana and in development between Santo Domingo and ZMA and ZSU. The six facilities with arrows labeled in yellow – Curacao, Maiquetia, Piarco, St. Maarten, Nassau – all operate systems on a similar ATS Interfacility Data Coordination (AIDC) protocol that would require one automation translator between ERAM and these systems to implement ADE. There is opportunity for one software effort to enable improvement of automation interfaces with at least five foreign facilities. This is estimated to be a significant software endeavor involving development, testing and configuration with multiple facilities. The US is centrally located and the only country with the requisite expertise and resources to drive a seamless ADE solution for the region.

Figure 22 Automation Interface Protocols between/within NAS and Foreign Facilities in Caribbean



A list of key adjacent facilities is shown below with an estimate of the number of aircraft affected daily:

Figure 23 Number of Aircraft Impacted by ADE with Neighboring Facility to ZMA/ZSU

Neighboring Facility	**Number of Aircraft Impacted**
Santo Domingo FIR (MDCS)	400+ flights per day with ZMA 86 flights per day with ZSU
Piarco, Trinidad and Tobago (TTZP)	170 flights per day with ZSU
St. Maarten (TNCM)	120 flights per day with ZSU
Maiquetia, Venezuela (SVMI)	27 flights per day with ZSU
Curacao (TNCC)	12 flights per day with ZSU

Source: Analysis of PDARs flight tracks on peak operational day of January 3, 2015

Assuming that this saves just 1 minute of controller time per flight, Automated Data Exchange will save 6 hours of controller time per day for flights between ZMA-MDSD, 1.5 hours per day for flights between ZSU-MDSD, 3 hours for flights between ZSU-TTZP and 2 hours for flights between ZSU-TNCM. This is a conservative estimate when considering the savings at peak demand periods and seasonal demands.

In addition, ADE allows for improved utilization of the airspace capacity as controllers have more time to focus on separating and managing traffic and less time manually coordinating information. This drives a better use of capacity and a possible reduction in TMIs.

The ERTG recommends that the FAA actively continue pursuing ADE with Santo Domingo FIR (MDCS). Initial work suggests that Class 1 implementation should be possible within the next 12 months and this should be expedited to the extent possible.

In addition, the ERTG recommends the FAA develop the software translation required to enable ADE with the neighboring foreign ANSP facilities that operate on the AIDC protocol.

Finally, there are ERAM software upgrades underway associated with ADE. Software is planned to enable Class 3 handoffs within ERAM. This would be required to eventually reach Class 3 ADE with Cuba and the Dominican Republic. The current software effort is slated for 2018 in support of implementation with Canada. The ERTG supports this effort and recommends moving it earlier in the schedule.

The ERTG also reviewed the timeline for ERAM-ATOP interface software development that, within FAA facilities, will eventually enable full transfer of control between ERAM and ATOP. The timing for this software activity has been delayed until 2020. The ERTG believes this activity should retain its current position in the ATOP Waterfall.

Implement Independent Flight Data Processing in ZSU

Currently, the ZSU Micro EARTS platform relies on ZMA ERAM for flight data processing which requires all adaptation and data for ZSU to flow through ZMA's ERAM. This extra step hurts ZSU in its ability to access improvements to its automation. This effect is seen, for example, with ZSU not being on the Data Comm Waterfall schedule.

The ERTG recommends that ZSU acquire its own Flight Data Processor, similar to Anchorage's use of MEARTS with its own FDP. This would enable ZSU to independently pursue the automation improvements most critical to its operation. Some improvements from independent flight data processing include:

- Flight plan readout: "slew and enter on data block." When resolving air traffic and/or flight plan issues in real time, ZSU controllers may have to search for the physical strip among many. Once the strip is found, the controller must mentally consider the flight plan going forward. If any changes are required, the controller must coordinate with the A side controller to make the changes in the FDIO equipment. With independent flight data processing, the flight plan can be pulled up on the radar display and amendments can be made directly from the Radar Position without A-side coordination.
- Route readout: draws a line depicting the planned route of flight on the glass for a specified number of minutes ahead of current time. Aids in conflict detection.
- Allows for use of full four letter ICAO code. The current process only uses 3 characters. This has created confusion and incorrect depiction of aircraft location for the controller. For example, St. Thomas is identified as TIST and St. Croix is identified as TISX. When the fourth character is dropped, both locations are TIS and there may be system confusion as to which location is being referenced.
- In the event of an outage in ZMA, ZSU maintains ability to conduct normal facility operations with any facilities not impacted by the underlying event.
- With appropriate radar data sharing in place, enables radar handoffs between ZSU and ZNY in the future.

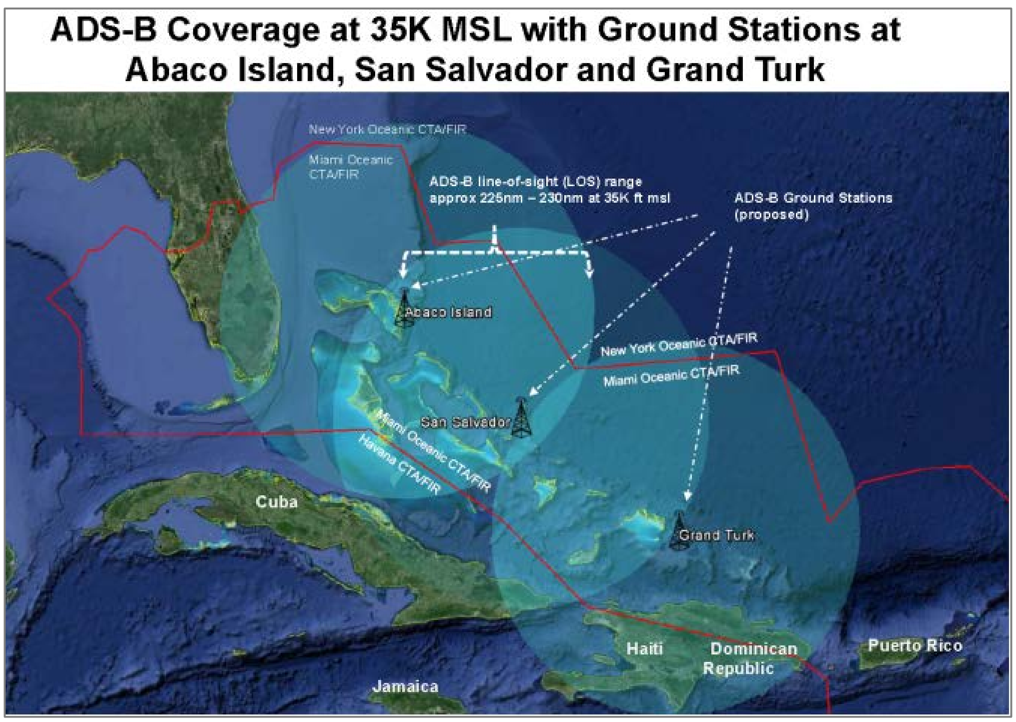
Surveillance

By improving or adding surveillance in the Caribbean, controllers can make use of more efficient separation or routes for aircraft. There are two primary challenges today with respect to surveillance. As noted above, single points of failure such as Grand Turk radar drive significant reroutes and delay when they are out of service. Hence, backup or redundancy surveillance is important to maintain efficiency. In addition, current surveillance restricts traffic between ZMA and ZSU into a funnel shaped area north(west?) of ZSU defined by the radar coverage overlap between the two facilities (also noted earlier). Expanded surveillance coverage may increase the size of the airspace where radar separation could be utilized. The widening of the funnel will allow for additional routes to be utilized through that area thus increasing capacity.

Implement ADS-B in the Caribbean

The addition of Automatic Dependent Surveillance – Broadcast (ADS-B) ground stations in this area will improve the areas of coverage and provide needed redundancy. The diagram below from the FAA Surveillance and Broadcast Services (SBS) Program Office depicts three potential ADS-B ground station sites in the Caribbean at Abaco Island, San Salvador and Grand Turk. Note the potential increased reach of the surveillance beyond the northern borders of ZMA.

Figure 24 Potential ADS-B Coverage in the Caribbean

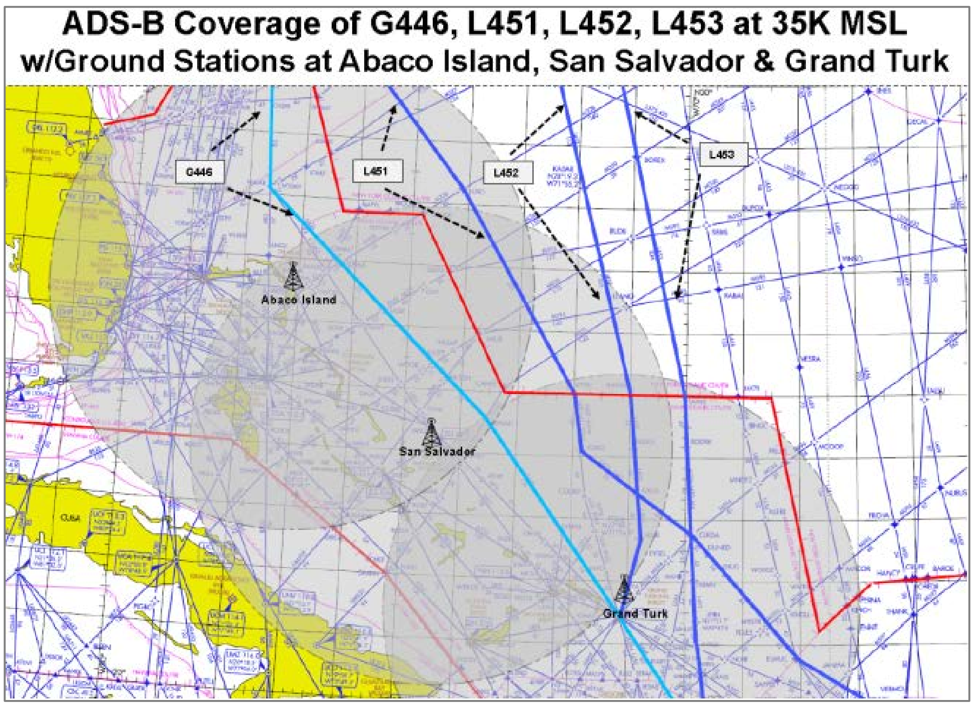


Source: FAA Surveillance and Broadcast Systems (SBS) Office

There are meaningful potential benefits from ADS-B in the Caribbean. First, when Grand Turk radar is out of service (seven times in 2014), flight operators experience $2-3 million in extra fuel costs along with increased levels of delay and cancellation. ADS-B's surveillance redundancy would allow appropriately equipped aircraft to operate on traditional routes even without Grand Turk radar in service. While the ADS-B mandate is not until 2020, some operators already have equipped aircraft and the rest expect to have equipped aircraft begin to enter their fleet in the next 2-3 years. During the 2017-2020 time frame, ADS-B capability in the Caribbean will offer operational benefits and may motivate flight operators to accelerate equipage and allocate ADS-B equipped aircraft to the region.

There will also be new opportunities for radar separated routes. The following diagram depicts some current routes in the Caribbean including Lima route 451. Note that L451 is wholly contained by potential ADS-B coverage. Additionally, L452 enters potential ADS-B covered airspace earlier than it enters ZMA's radar airspace today. There are concepts to evolve to ADS-B routes with radar-like separations and/or to implement additional parallel routes.

Figure 25 Relationship of Existing Caribbean Routes and Potential ADS-B Coverage



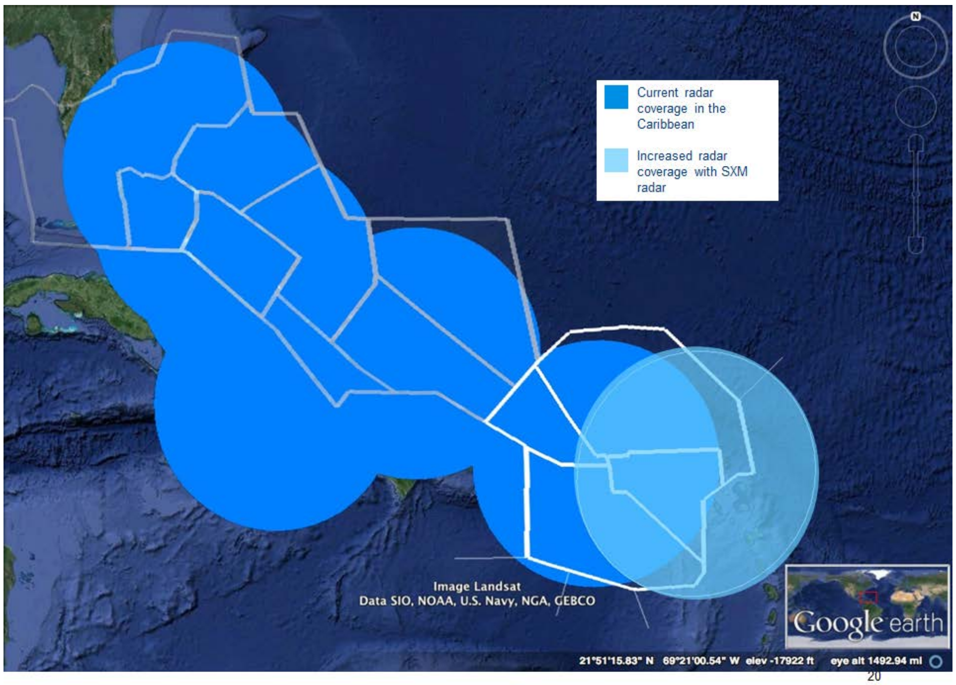
Source: FAA Surveillance and Broadcast Systems (SBS) Office

In addition to ground-based ADS-B, the ERTG considered the impact of potential space based ADS-B in the Caribbean. While space based ADS-B may have operational benefit in the future, it is an emerging technology with many technology, operational and policy questions. As such, the ERTG stands by its recommendation of implementing ground-based ADS-B in the Caribbean.

Input St. Maarten Radar Feed into the ZSU Radar Mosaic System

This option involves input of the existing SXM radar into ZSU via Fusion. The diagram below shows the additional coverage the SXM radar would offer. This will provide additional radar coverage into/out of SXM Approach as well as increasing the coverage in the Northeast portion of ZSU airspace. The SXM radar data could enable reduction of separation standards between ZSU and SXM approach to normal separation (45 NM lateral separation to 5 NM radar separation[7]). This will allow for more efficient blending of climbing and descending traffic into and out of a number of aerodromes, including Clayton J. Lloyd International Airport in Anguilla (TQPF), Princess Juliana International Airport in St. Maarten (TNCM), V.C. Bird International Airport in Antigua (TAPA), Robert L. Bradshaw International Airport in St. Kitts (TKPK), Hewanorra International Airport in St. Lucia (TLPL), Martinique Aime Cesaire International Airport (TFFF) and Pointe-a-Pitre International Airport in Guadaloupe (TFFR). This could affect approximately 150-200 flights per day.

Figure 26 Increase in Surveillance from SXM Radar



This will require completion of draft international agreements with St. Maarten developed years ago which included an annex for radar data sharing. This agreement would be updated after this requirement is validated.

Identify and Access a Backup Option for Grand Turk Radar

Gaining access to one or more radar sites from the Dominican Republic may provide a backup to Grand Turk (GDT) radar and continuity of radar service when the GDT radar fails. There is an existing radar data sharing agreement in place with the Dominican Republic, and they have at least two radars with 240 NM range that may provide some backup coverage depending upon their current location.

[7] From 6/29/04 memorandum from Acting Air Traffic Manager, San Juan CERAP to Kip Johns, Manager Requirements Branch, Eastern Enroute and Oceanic Operations, Subject: ACTION: Request for Data from St. Martin Radar Site to be submitted to the San Juan CERAP MEARTS Radar System

Technology Improvements

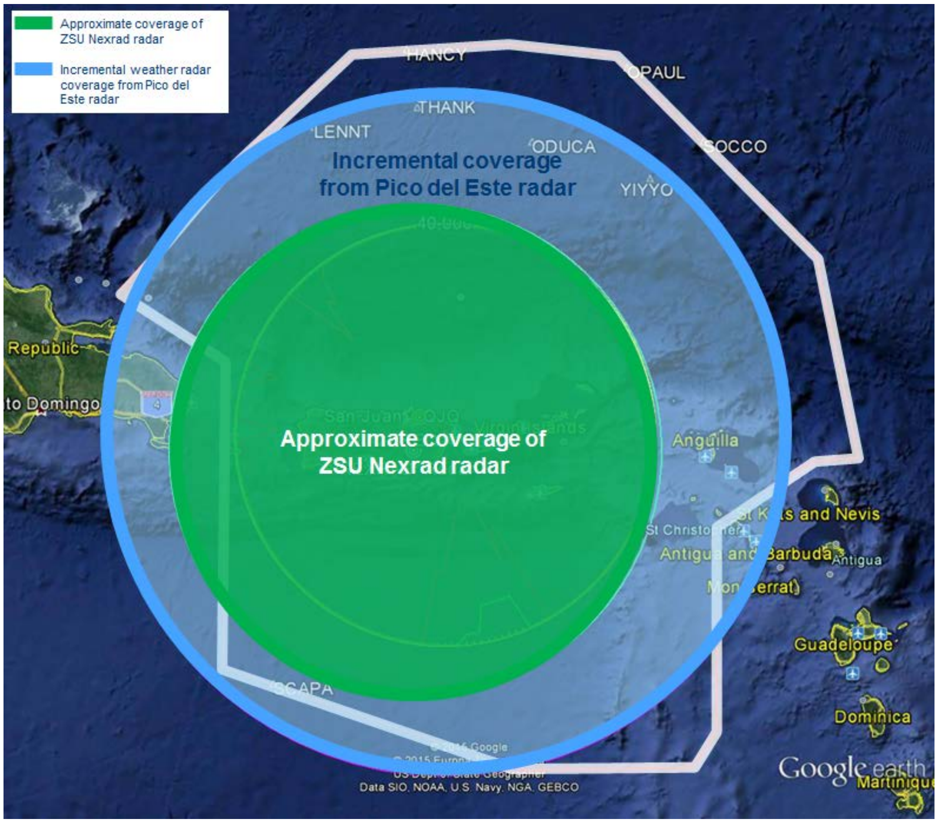
The areas and items mentioned above are the highest priority and most straight forward needs identified by the task group. They provide the greatest gains in the shortest possible timeframe. There are several other items evaluated during deliberations that also deserve serious consideration, but they are considerably more complex and will require greater resources or time. Some of these items may require their own program. They are listed below in order of priority:

Investigate Option to Access Weather Information from Long Range DoD/DHS Radars

Ultimately the objective of ATC is to provide real-time weather information “on the glass” on controller’s radar displays to the extent possible. Weather is always a consideration in flight safety and planning and ensuring safe and timely access to the available airspace. There are Long Range Radars (LRR) in the Caribbean that capture primary weather information. In 2004, the Office of Management and Budget (OMB) transitioned these LRRs from the FAA to DoD and DHS. As a result, the weather information from these radars ise no longer available to Air Traffic Services as processing of weather data can be detrimental to the high target detection capability requirement of DoD and DHS. One such LRR site (out of the 120 impacted) is Pico del Este on the Eastern side of Puerto Rico.

In the figure below, the white line represents the boundary of ZSU while the blue represents the range of the Pico del Este radar. Note that it covers nearly the entirety of ZSU and is significantly larger than the NEXRAD coverage, depicted in green. The ERTG understands there are software accommodations that may be utilized to strip off weather data for independent processing in a manner that does not impact the mission of DoD or DHS. Such data could be utilized to provide high quality weather information to air traffic controllers.

Figure 27 Weather Radar Coverage of NEXRAD and Pico del Este Radars



In 2012, the FAA decided that weather functionality on these radars would remain disabled. The ERTG recommends this be reconsidered for the Caribbean.

If the Offshore Precipitation Capability shows promise, expedite Caribbean access

In addition, a current research effort between the FAA and MIT Lincoln Labs, the Offshore Precipitation Capability (OPC), appears to have promise to offer a capability in enhancing offshore weather information. The OPC will undergo an evaluation at the Tech Center during 2015. Should the results from this testing be promising, the ERTG recommends accelerating movement of OPC out to the field. Strong consideration should be given to deploying the capability as a demonstration program in the Caribbean. Generally, speaking any research involving offshore weather should consider ZMA and ZSU as logical targets for partnering and testing new products or information.

Enable ZSU to Participate in Data Comm

As noted earlier, ZSU is not currently on the Waterfall schedule for Data Comm. With the communication gaps inherent to offshore airspace, Data Comm could serve as an important communication backup to controllers struggling to make contact with aircraft inbound to the region.

Make Caribbean Radar Presentations Available to ZNY

Through use of emerging IP protocols, there is opportunity for ZNY Oceanic sectors to ingest 1 or 2 Caribbean radars for situational awareness. Due to the IP protocol approach, such information could not be utilized for separation. However, even such situational awareness would be of value to ZNY Oceanic controllers to have the "heads up" about aircraft that are coming into the Center via manual coordination. The Tech Center has already connected this information in its research facilities, and ZNY personnel have seen what the IP-based display of Caribbean radars would look like. ZNY's first choices would be to access Freeport, Grand Turk and Saint Maarten radars.

Airspace Priorities

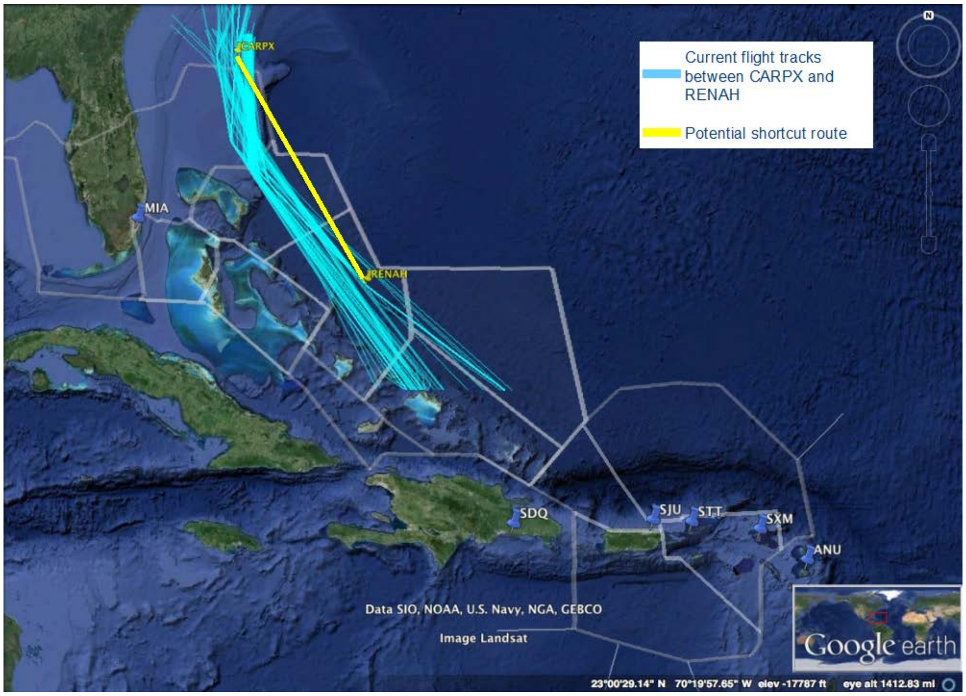
Explore Options to Reduce Separation between ZNY and ZSU/ZMA

With the existing precedent set between Oakland (ZOA), Seattle (ZSE) and Anchorage (ZAN) Centers regarding the transfer of aircraft into and out of Oceanic airspace using Oceanic reduced separation standards available to suitably equipped aircraft, we believe there are opportunities to follow this example in this region. Current Interfacility procedures require ZNY oceanic to transfer aircraft into ZMA and ZSU airspace using traditional oceanic separation of ten minutes (80NM) longitudinal separation between all aircraft at the same flight level. The advanced automation platform used by ATOP allows for ZNY to apply distance based longitudinal separation of 30NM for RNP-4 aircraft, and 50NM for RNP-10 aircraft. Since 98 percent of all aircraft that operate in the ZNY Oceanic West airspace are RNP-10 equipped, there is an opportunity to be able to transfer aircraft between facilities using the 50NM reduced standard, provided that appropriate surveillance and communications are available at the common boundary. In this way, FAA can apply best equipped/best served applications of separation, enhance the flight routings of approximately 350 flights per day based on today's volume and schedules, make available more efficient altitudes for other flights, increase capacity, and reduce the amount of holding prior to transfer due to a lack of available altitudes. There are some opportunities now available with the integration of the Freeport (ZFP) radar into ZMA that will be explored, and with future enhancements to integrate the Saint Maarten (PJM) radar and frequency into ZSU, other opportunities will become available. The three facilities have committed to continue the research, and begin aligning procedures to explore all possible options in this area, but will need the support of FAA to provide some level of funding for travel and potential overtime to expedite the process.

Implement a Shortcut Route between CARPX and RENAH

After research and analysis between the FAA and NAS users regarding routings in this area, there is benefit to both the FAA and NAS, by shortening the G446 routing by going CARPX direct to RENAH rather than the present routing required today. This shortcut is depicted below:

Figure 28 Potential Shortcut Route in ZMA



This will increase airspace capacity and efficiency by making the route shorter and more desirable to other operators. This change would affect approximately 100 flights a day based on today's flight schedule and usage. The savings in dollars is expected to be between $8-10 million dollars annually in direct operating costs to the NAS users. This would benefit the FAA by making this route more desirable and having the option for offloads and decrease in saturation of other routings. All stakeholders agree this option is a "win-win" for all involved and initial progress on this should continue.

This will require a boundary change between ZMA and ZNY as well as a test and analysis of the communications within this area of airspace and will have to go to Spectrum Engineering to be evaluated. Additionally, for this route to be offered at all altitudes, the Abaco Island frequency referenced earlier would be a requirement. Until this frequency is made available, the shortcut could be offered at higher altitudes using existing communications, if possible. There is a possibility that this task could be completed with a minimal amount of funding. The required resources for this to become a reality will be overtime and travel costs.

Conduct an Integrated Redesign of ZMA and ZSU Airspace

Airspace structure in the Caribbean received extensive attention during ERTG discussions. Both airspaces require a significant redesign effort as both have undergone changes since their original design, including extensive growth and closing of the Navy Base in Puerto Rico. To ensure safety in the current airspace structure and traffic demand, TMIs are regularly utilized to meter the flow. This sacrifices efficiency and points to the fact that capacity in the region's airspace structure as currently defined is completely utilized, particularly on peak operational days. In the FY15 winter season (128 days) approximately 50 days included TMI's of which 23 days had AFP's initiated out of a total 120 FY15 operational winter days.

Airspace issues in the Caribbean range from safety concerns to overloaded sectors to imbalance between neighboring sectors to a lack of structure. All of these issues are understood as high priority at the facility level and multiple offices within the FAA area already examining the issues.

In ZMA, continuation of work to address safety concerns in Sector 40 is required along with analysis of the large oceanic sectors to consider lateral and/or vertical development. In ZSU, a complete overhaul is required to redesign away from the current sector structure designed around warning areas that are now retired as well as to instill structure to segregate traffic streams. The route structure could include overflight routes as well as SIDs and STARs.

Redesign of ZMA and ZSU needs to be one macro effort, or, at a minimum, closely linked. Airspace at both oceanic and approach control functions would have to be redesigned to complement the new traffic flows. Additionally, a redesign would require linkage to the South Florida Metroplex and any international endeavors with neighboring or underlying foreign faciltiies. This redesign effort will increase safety, help decrease controller workload, and increase capacity and efficiency. The FAA and NAS users all benefit with the redesign.

Discussions are already taking place between ZMA, ZSU, the Eastern Service Area and FAA Headquarters to redesign Caribbean airspace. This effort will require resources for airspace study and design teams as well as implementation that may include new supporting infrastructure or establishment of new physical sectors in ZMA or ZSU. In addition to the state of the current sectors, additional ADS-B coverage would allow for this area of airspace to expand the width of this narrow corridor and consume non radar airspace thus creating more opportunities to improve through put.

Improve Short Term Cuba Access in the Giron Corridor

In current operations, there is a need to develop dual north and south airways in and out of Cuban airspace in the Giron Corridor between ZMA and Havana. The airspace available for transition between Miami ARTCC and the Havana ACC in the Giron corridor is limited. Due to this limitation, the airway structure does not allow for procedural separation of aircraft. Aircraft must transition north and southbound along the same route, creating built in conflicts between climbing and descending traffic. These conflicts are “hot spots” that require attention, increase workload and introduce unnecessary risk to the operation. There have been incidents in this area including loss of separation in recent years.

The dual route structure between ZMA and Havana ACC could be created with the addition of a minimal amount of airspace. This would have safety benefits but also improve efficiency as traffic flow restrictions should diminish and the overall ability to accommodate peak demand should improve.

This option should be further researched and analyzed. Looking at the present day flight schedule and usage, approximately 125 flights traverse this corridor on a daily basis and is only anticipated to grow with easing of US/Cuba relations. This is being reviewed in ZMA within the Metroplex design.

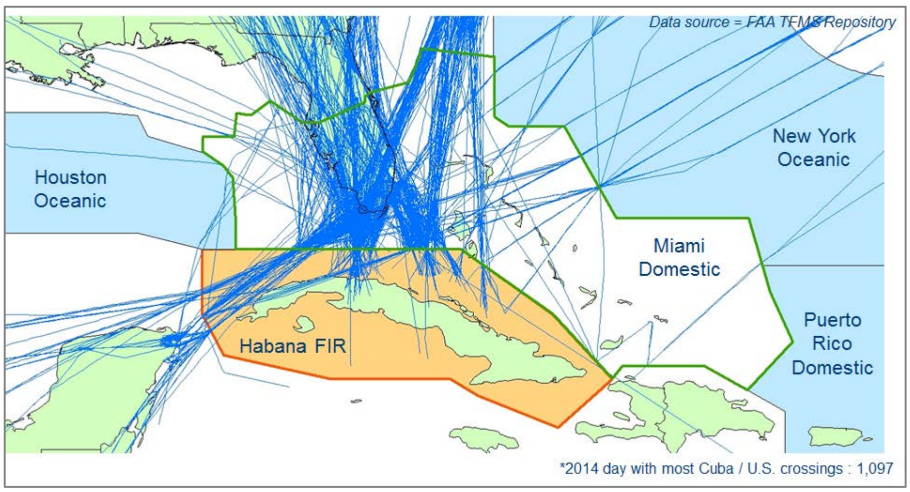
Prepare for Significant Growth in Cuba Operations

Beyond the specific Giron corridor, the easing of relations between the US and Cuba is expected to experience growth of traffic operations through ZMA Oceanic. From 2012 to 2014, there were approximately 22,500 annual operatoins between Cuba and non-US airports. A sample of non-Cuba

Caribbean airports suggests that flights from US airports typically comparise about two-thirds of Caribbean traffic. If this ratio holds in a mature US-Cuba market, operations to and from Cuba would grow to about 70,000 annual operations. This would represent an increase of 40,000 annual operations from today, most of which would traverse ZMA Oceanic airspace. This airspace handled approximately 511,000 aircarft during CY2014 implying that Cuba growth on its own could increase ZMA's traffic by 8%.

The diagram below, drawn from the FAA's April 2015 briefing to the ZMA Customer Forum, depicts current flights crossing the Cuba/US boundary. This diagram underscores the fact that Cuba growth is clearly tied to ZMA and could place further demand on Sector 40.

Figure 29 Flights Crossing Cuba/US Boundary on December 27, 2014



Source: Florida/Caribbean Customer Forum, International Office Updates – Cuba, April 29, 2015

Dialogue is ongoing between US and Cuban facilities on his topic. The ERTG stresses that flight operators are actively preparing to operate scheduled service to Cuba and preparation for this anticipated growth should be deemed a critical priority for the region.

Harmonization in the Region

Finally, the ERTG makes a series of recommendations to ensure harmonization of its recommendations with other efforts in the region. There are multiple efforts underway to improve operations and safety in the Caribbean, both within the FAA as well as with international entities. In addition to the ERTG's efforts in the Caribbean, some other activities include the South Florida Metroplex, ZMA's efforts to address R40, the ICAO North American, Central American and Caribbean Office (NACC) effort, PBN efforts by Trinidad and Tobago (Piarco), etc.

FAA should establish one body to develop an integrated plan and lead implementation in the Caribbean

Throughout the course of the Eastern Regional Task Group's work, subject matter experts from many areas of the FAA engaged with the ERTG. Experts came from the operational facilities, the Eastern Service Center, multiple organizations within headquarters and the Technical Center. The broad FAA participation on this effort underscores the fact that an FAA team across different lines of business will also need to collaborate on implementation. Leadership of this cross-functional effort will be critical. The Committee recommends the FAA establish a single point of leadership within the agency, in collaboration with Labor and Industry, to develop an integrated plan and lead implementation. The leadership of this initiative will need to maintain active coordination within the FAA to ensure harmonization with other efforts as well as priority of the solutions for the Caribbean.

When possible, the FAA should strive to utilize the same personnel across the implementation to ensure consistency. When this is not feasible, targeted face-to-face interactions between parallel teams are recommended to build appropriate relationships and coordination.

Industry should continue to be engaged in the Caribbean Air Traffic Improvement Initiative: going forward, the TOC should continue to stay abreast of the status of these recommendations, aid in collaboration and implementation of priority recommendations and ensure all parties remain aware of planned changes. The Eastern Regional Task Group (ERTG) has already convened a wide cross section of stakeholders in the Caribbean operation and would be a logical group to continue overseeing these recommendations as one aspect of its ongoing business

Maintain Active Coordination with ICAO's North America, Central America and Caribbean Office

To ensure alignment, FAA implementation leadership and the affiliated industry working group must remain synchronized with any other activities that are impacting the region. With ICAO, implementation must synchronize with the work of the ICAO NACC activities which include efforts in PBN route development, radar data sharing, exchange of flight plan data and ATFM.

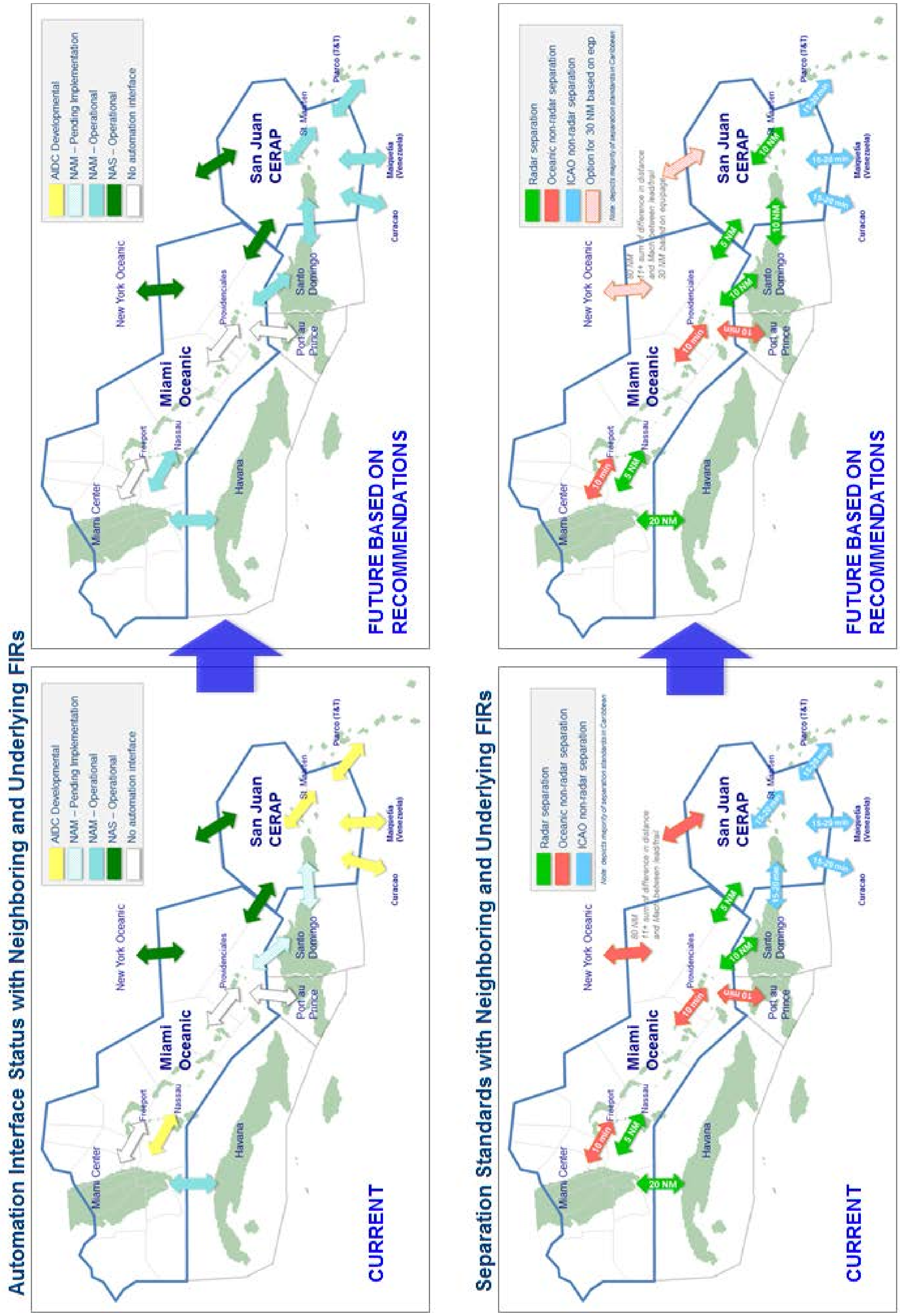
Ensure Active Involvement of the Office of International Affairs, Western Hemisphere Office

Keeping the Office of International Affairs involved in the ongoing implementation will be critical to activities that might have international implications. This applies to many of the infrastructure recommendations discussed above. IATA has also expressed a willingness to support the FAA in any international facilitation.

Summary and Impact of Recommendations

Category		Recommendation
Infrastructure Priorities	Communications	Implement a New Communications Frequency at Saint Maarten
		Implement a New Communications Frequency at Abaco Island
		Install Dedicated Shout Lines with Certain Adjacent or Underlying International Facilities
	Automation	Regional Implementation of Automation: 1. Continue implementation of ADE with Santo Domingo 2. Develop software translation for neighboring facilities with AIDC protocol 3. Ensure ERAM software upgrades associated with ADE stay on schedule
		Implement Independent Flight Data Processing in ZSU
	Surveillance	Implement ADS-B in the Caribbean
		Input St. Maarten Radar into the ZSU Radar Mosaic System
		Identify and Access a Backup Option for Grand Turk Backup
	Technology Improvements	Investigate Option to Access Weather Information from Long Range DoD/DHS Radars
		If the Offshore Precipitation Capability shows promise, expedite Caribbean access
		Enable ZSU to Participate in Data Comm
		Make Caribbean Radar Presentations Available to ZNY
Airspace Priorities		Explore Options to Reduce Separation between ZNY and ZSU/ZMA
		Implement a Shortcut Route between CARPX and RENAH
		Conduct an Integrated Redesign of ZMA and ZSU Airspace
		Improve Short Term Cuba Access in the Giron Corridor
		Prepare for Significant Growth in Cuba Operations
Harmonization		FAA should establish one body to develop an integrated plan and lead implementation in the Caribbean
		Maintain Active Coordination with ICAO's North America, Central America and Caribbean Office
		Ensure Active Involvement of the Office of International Affairs, Western Hemisphere Office

Figure 30 Impact of Recommendations on Automation Interfaces and Separation Standards



Appendix A: Detailed Assessment of Operational Needs

OPERATIONAL NEEDS TO ADDRESS CARIBBEAN OPERATIONS

Note: any cost estimates below are purely order of magnitude estimates; actual costs may differ greatly from these estimates based on a variety of variables including cost of software development, equipment, access, communication lines, etc.

Num	Option	What it is	Status	Operational Impact	Value	Timing	Cost	Risk	NAP Entry
				INFRASTRUCTURE OPTIONS					
1	SXM Frequency	A new frequency that extends ZSU's comm reach in the Northeast Oceanic quadrant of ZSU. ZSU does not have a frequency for SXM today. The frequency used not certified to reach SXM and any comm beyond certified service volume is additional benefit when available.	Existing radios will need to be upgraded to Nexcomm radios with connectivity (meva3). Have draft international agreements with St Maartin from several years ago for Air Navigation Services and an annex for radar data sharing. Also very rough draft of 2nd annex for establishing an FAA-owned air-to-ground radio site (RCAG) in/on the ATCT in St. Maarten. Agreements require updating after requirements validated and funded.	Currently, comm gaps in NE of ZSU may affect approximately 120 flights per day. Result is difficulty to communicate with aircraft and/or multiple attempts to make contact. ZSU SMEs estimate 15% of aircraft require multiple transmissions.	**Controller Workload & Safety** Frequency ensures consistent communication between pilots and controllers resulting in safer operation. **Redundancy** The current frequency is out of service approximately 6-7 times per year.	**1-3 yrs after funding in place**	**$350K ROM** Funding streams exist for comm; this equipment needs to go into this funding database; requires dedicated line		2014-1931
2	Abaco Island frequency	New frequency in Northern Bahamas	No work done to date. No existing formal international agreement for FAA-owned facilities in the Bahamas.	Improves comm with low altitude aircraft in northern Bahamas Covers gaps on ZNY-ZMA boundary Improves comm for shortcut route and potential ADS-B coverage area	**Controller Workload & Safety** Improved comm with operating aircraft **Capacity/Efficiency** Prepares for changes from shortcut or ADS-B			Negotiations between US and Bahamian governments	
3	SHOUT LINES: **TUPJ** (BI Tower, Tortola, USVI), **TTZP** (Piarco ACC, T&T), **SVZM** (Maiquetia ACC, Venezuela), & **TNCF** (Curacao ACC, Curacao, Kgdm of Neth)	A direct line between facilities for a Controller to "shout" to another facility without dialing or waiting for other end to pick up	All locations will require site surveys and identification of needs, some need NAP. Requires connectivity from ZSU and multiple locations.	Wait time to reach appropriate controller in other facility versus immediate "shout" to coordinate. TTZP affects 170 flights per day. SVMI 27 per day. TNCC 12 per day. First two priorities are MDPC and TTZP	**Controller Workload & Safety** Saves controller time and attention from dialing/waiting; may be used to look at scope instead **Capacity/Efficiency** Controllers more focused on traffic and can provide improved service	**1-3 yrs after funding in place**	**$???** Includes initial acquisition and ongoing maintenance		2015-6116, 2015-6117,2015-6115, 2013-2117, 2013-2116, 2013-2115, 2013-2122-
4	ADE with MDCS, TNCC, SVMI, TTZP and underlying facilities	ZMA/ZSU handoffs with foreign facilities are manual, except for Cuba. This takes time for controller to establish comm with adjacent facility and exchange flight plan and crossing info. ADE eventually leads to seamless transition of aircraft and comes in three phases: 1) ADE provide flight plan, position, time information 2) Provide flight plan changes 3) Automated handoffs	Pursuing Class 1 ADE with Santo Domingo. Thales/DR system vendor making some software changes. For ZSU-MDSD, preliminary adaptation done. Testing after Thales upgrades will determine compatibility. ICAO AIDC Interface GoTeams Site Assist visits only conducted for the DR and Honduras. ADE with AIDC protocol neighbors (Curacao, SXM, Piarco, Maiqueta) requires interface translator to be developed with ERAM.	<u>Daily, this affects:</u> 400+ flights ZMA-MDSD 86 flights ZSU-MDSD 170 flights ZSU-TTZP 27 flights ZSU-SVMI 12 flights ZSU-TNCC <u>Assuming 1 min saving of controller time per flight with ADE, this frees up:</u> 6 hrs for ZMA-MDSD 1.5 hrs for ZSU-MDSD 3 hrs for ZSU-TTZP	**Controller Workload & Safety** Controller time reallocated from manual coordination to time available to control, monitor, etc.	**18-24 mos** (best case)	**$TBD** Normal cost of doing business; requires personnel time and/or overtime for working interfaces (HQ) and adaptation, configuration and training (Facility)	**Software changes** None anticipated. But if any are uncovered, may required additional software development funding.	2015-3850
5	Improved Real-Time Weather Information for Controllers	Improved weather information for controllers on the glass, either through access to LRR Wx data or new Wx sources like OPC	Current NEXRAD Weather radar in ZSU is slow to update (5-13 minute refresh) and has a blind-spot bearing 280 from SJU. The lag is larger with more weather. Also, lost access to LRRs with weather info.	Consistency between what pilot and controller sees. Inconsistency increases comm to reach resolution. Also better info earlier allows for less drastic route changes.	**Controller Workload & Safety** Alignment of controller/pilot Wx info during bad weather scenarios makes for safer operation	**Extended**			

OPERATIONAL NEEDS TO ADDRESS CARIBBEAN OPERATIONS

Note: any cost estimates below are purely order of magnitude estimates; actual costs may differ greatly from these estimates based on a variety of variables including cost of software development, equipment, access, communication lines, etc.

Num	Option	What it is	Status	Operational Impact	Value	Timing	Cost	Risk	NAP Entry
6	ADS-B in Caribbean	Have approximately 3 ADS-B ground stations on foreign soil in the Caribbean to provide coverage between domestic ZMA and ZSU	ADS-B in Caribbean under consideration in the SBS Office.	Currently radar-covered airspace between ZMA and ZSU is a funnel and restricted to the North by reach of radar coverage. ADS-B extends the size of this funnel to the North.	**Capacity/Efficiency** > ~$3M extra DOC when GDT OTS; add'l costs upline delay and CX > New radar sep routes, opp'y for L451 to be covered by ADS-B > May provide routing option for eqp'd aircraft in 17-19 timeframe **Redundancy** Between now and 2020, provide surveillance backup	**2.8 yrs**	**$3.5M**		
7	Independent Flight Data processing in ZSU	FDP in ZSU and no longer reliant upon ZAM for FDP	None. No work to date on this beyond initial discussion with technical experts.	Enables ZSU to become independent of ZMA in FDP which helps enable changes to airspace, sector design, etc. Also removes risk of reliance on ZMA. Finally, enables new functionality like route readout, flight plan readout, input of amendments on the glass, etc.	**Controller Workload & Safety** Reduces work of A side controller, improving overall "heads up" time for controller team **Capacity/Efficiency** Improved management of air traffic on the glass improves service to operators		**$3-4 M**		
8	Datacomm	ZSU Participate in Datacomm Deployment	None for ZSU. Pre-departure reroutes via Datacom end of 2016. Airborne reroutes in 2018/2019. Dependent upon ERAM; right now only for 20 contiguous Centers.	Alternative mechanism to establish comm Provide airborne reroutes that adjust for weather and/or volume	**Controller Workload & Safety** Reliable method to establish comm and adjust routes for safety **Capacity/Efficiency** Improved efficiency of routing operating in the Caribbean				
9	SXM Radar	Fuse SXM radar into ZSU's surveillance data	Have draft international agreements with St Maartin from several years ago for Air Navigation Services and an annex for radar data sharing. Agreements require updating after requirements validated and funded. Will also require further investigation on how to provide connectivity between ZSU and SXM.	Provide additional radar coverage in/out of Juliana Approach as well as in NE portion of ZSU. Radar coverage provides a more efficient service for climbing and descending oceanic traffic in and out of TQPF, TNCM, TAPA, TKPK, TDPD, TLPL, TFFF, and TFFR. Estimate affects about 150-200 flights per day.	**Capacity/Efficiency** More efficient service for climbing and descending oceanic traffic in and out of Juliana approach airports		**$650K ROM**		2014-1928
10	Grand Turk Backup	Access to radar that serves as surveillance backup when Grand Turk goes out of service	Have radar sharing agreement in place with DR. Still need to identify the appropriate radar, likely in the DR.	Provides continuity of surveillance coverage even without GDT radar.	**Redundancy** Provides partial backup to GDT radar	**18 mos**	**~$1M**		
11	Make Caribbean radars available to ZNY	IP-based integration of Caribbean radars to ZNY Oceanic surveillance.	ATOP Work Package 1 bringing more data in via IP protocol. Current ATOP limit of 6 surveillance sources can be overcome with IP.	Integration into ATOP protects vs errors in timing, altitude by feeding radar to conformance monitoring system. If ADS-B ground stations available, would integrate into ATOP as well.	**Controller Workload & Safety** Improved controller Situational Awareness of oceanic traffic	**After data storage capacity increase ~2018**		**Will IP protocol be approved for controlling traffic?**	

OPERATIONAL NEEDS TO ADDRESS CARIBBEAN OPERATIONS

Note: any cost estimates below are purely order of magnitude estimates; actual costs may differ greatly from these estimates based on a variety of variables including cost of software development, equipment, access, communication lines, etc.

Num	Option	What it is	Status	Operational Impact	Value	Timing	Cost	Risk	NAP Entry
				AIRSPACE OPTIONS					
1	Reduce Separation between ZNY and ZSU	Implementation of reduced separation from current 80 nm down to 20-30 nm separations on ZNY-ZSU handoffs.	ZSU continuing to research what is required to accomplish reduced separation. Precedent exists between ZOA and ZNC.	Affects 350 flights per day transitioning between ZNY and ZSU. More efficient altitudes will become available. Some reduced holding prior to handoff.	**Capacity/Efficiency** More efficienct altitude and reduced holding. Estimate $600 per flight savings for narrow body accessing FL370 vs FL330. If 10% of daily flights improve altitude, saves $7.5 million.	**Ongoing** **~2 yr project**	**Cost Doing Business** Personnel, OT, travel	**Access to OT or Travel Funds**	
2	Shortcut route	Short cut G446 route, CARPX direct RENAH.	Still requires test on communication; will have to go through Spectrum engineering. Could be "fasttracked" with minimal amount of funds.	Approximately 60-70 flights a day may take shortcut route.	**Capacity/Efficiency** Saves $6-8 million annually in DOC	**Ongoing** **~1 yr project**	**Cost Doing Business** Personnel, OT, travel	**Access to OT or Travel Funds**	
3	ZMA/ZSU Airspace Redesign	Airspace redesign effort for the combined ZMA Oceanic and ZSU airspaces. Expect to follow an accelerated National Airspace Redesign (NAR) process.	Airspace between CONUS and SJU out of date and in need of redesign. ZMA Oceanic sectors large, laterally and vertically. ZSU design based on closed Navy base and little structure. ZMA R40 area of NTSB interest. Map values of sectors 58/60/62/63 may exceed 30. Neighboring airspace are being reworked - S Florida Metroplex and Piarco. In discussion already with ZMA, ZSU and Eastern Service Center.	During FY15 Winter season, approx. 50 days with TMIs and 23 days with AFPs out of 120 total.	**Controller Workload & Safety** Alignment of airspace and traffic demand and patterns will improve safety and workload **Capacity/Efficiency** Improving airspace design to yield improved and increased throughput in the region	**Ongoing**	**~$1M** For initial airspace analysis		
4	Giron Corridor	Develop dual north/south airways in/out of Cuban airspace.	Being worked in ZMA and Metroplex. Working through differences between US/Cuba separations on RNAV routes.	Currently about 125 flights traverse this corridor daily. Will become much higher priority if/when Cuba relations open up further.	**Controller Workload & Safety** Increase narrow airspace for controllors to manage Giron flow **Capacity/Efficiency** Allows more routes for aircraft to efficiency access Cuban airspace			**Possible resistance from DoD**	

Appendix B: Members of the Eastern Regional Task Group

Mark Cato, Air Line Pilots Association
JP Lazo, Air Line Pilots Association
Melissa McCaffrey, Aircraft Owners and Pilots Association
Brian Gonzalez, American Airlines, Inc.
Toby Miller, American Airlines, Inc.
Michael O'Brien, American Airlines, Inc.
Tim Stull, American Airlines, Inc.
Rico Short, Beacon Management Group
Rob Goldman, Delta Air Lines, Inc.
Mark Hopkins, Delta Air Lines, Inc.
David Houck, Delta Air Lines, Inc.
Bob Oberstar, Delta Air Lines, Inc.
David Vogt, Delta Air Lines, Inc.
Doug Arbuckle, Federal Aviation Administration
Mike Artist, Federal Aviation Administration
Christopher Barks, Federal Aviation Administration
Krista Berquist, Federal Aviation Administration
Charles Blackwell, Federal Aviation Administration
LaGretta Bowser, Federal Aviation Administration
Jorge Chades, Federal Aviation Administration
Raul Chong, Federal Aviation Administration
Janice Deak, Federal Aviation Administration
Dan Eaves, Federal Aviation Administration
Felipe Fraticelli, Federal Aviation Administration
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Geoffrey Lelliott, Federal Aviation Administration
Curtis Lineberry, Federal Aviation Administration
Paul Lore, Federal Aviation Administration
Robert Novia, Federal Aviation Administration
Mark Palazzo, Federal Aviation Administration
Mike Polchert, Federal Aviation Administration
Leo Prusak, Federal Aviation Administration
Joe Rather, Federal Aviation Administration
Mike Richardson, Federal Aviation Administration
Ed Rodgriguez, Federal Aviation Administration
John Vinyard, Federal Aviation Administration
Madison Walton, Federal Aviation Administration
Jim Webb, Federal Aviation Administration
Dan Allen, FedEx Express
Don Dillman, FedEx Express
Phil Santos, FedEx Express
Jeffrey Miller, International Air Transport Association
Joe Bertapelle, JetBlue Airways (Co-Chair)
Joe DeVito, JetBlue Airways
Thomas Lloyd, JetBlue Airways
Woody Camp, National Air Traffic Controllers Association
John Fox, National Air Traffic Controllers Association
William L Geoghagan, National Air Traffic Controllers Association
Greg Harris, National Air Traffic Controllers Association
Dale Wright, National Air Traffic Controllers Association
Bob Lamond Jr, National Business Aviation Association
Dean Snell, National Business Aviation Association
Tom Bock, Port Authority of New York & New Jersey
Ralph Tamburro, Port Authority of New York & New Jersey
Kalyan Bala, RTCA, Inc.
Trin Mitra, RTCA, Inc.
Brandi Teel, RTCA, Inc.
Bob Everson, Southwest Airlines
Edwin Solley, Southwest Airlines
Steve Kalbaugh, The MITRE Corporation
Jeffrey Collins, U.S. Air Force
Eric Eibe, U.S. Air Force
Bill Cranor, United Airlines, Inc.
Glenn Morse, United Airlines, Inc. (Co-Chair)
Ron Renk, United Airlines, Inc.
Allan Twigg, United Airlines, Inc.
Jim Hamilton, United Parcel Service

Appendix C: FAA Tasking Letter

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

Mission Support Services
800 Independence Avenue, SW.
Washin
gton, DC 20591

NOV 21 2014

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

Dear Ms. Jenny:

The Federal Aviation Administration (FAA) is committed to collaboratively identifying and addressing efficiency impacts to the National Airspace System (NAS). Ongoing Metroplex projects currently accomplish this with focus on the airspace and PBN procedures around the Core 30 airports in the NAS using a well-defined and understood process to address issues and make improvements. Other geographic regions may also have unmet needs since efforts to enhance the airspace and operations may be limited by national program priorities and funding. A growing area of concern is in the Caribbean. Air traffic volumes in ZMA Oceanic and ZSU have grown in recent years while the capacity of the airspace itself remains largely unchanged. Select infrastructure and procedural enhancements combined with traffic management tools like miles in trail (MIT) spacing and Airspace Flow Programs (AFPs) have squeezed as much capacity out of the existing airspace but a demand/capacity imbalance persists. Both industry and facility personnel believe no further improvements in efficiency are possible without some level of airspace and infrastructure improvements.

The Eastern Regional Task Group (RTG) of the Tactical Operations Committee (TOC) recently engaged in informational exchanges with local personnel to brainstorm the current challenges and share ideas on possible solutions. Additionally, some infrastructure improvements are already underway or planned and the Central/South Florida Metroplex project has just started the design and implementation phase as well. Also, the FAA is supporting other activities in the Caribbean such as the ICAO's project for the implementation of PBN and improved aeronautical information exchange in the region.

We believe a tasking to the TOC to provide recommendations on a comprehensive approach to address infrastructure and airspace changes in the region would benefit the NAS as a whole. We request the TOC provide recommendations on a comprehensive strategy for infrastructure and airspace changes to improve safety, efficiency, and capacity in the region. Specifically, this tasking would include recommendations in the following sub-task areas:

- The use of data to clearly define the problems, causes, and solutions to the safety, efficiency, and capacity issues in the region.
- Prioritized solutions for any infrastructure components identified as most critical to improving /enhancing operations in the region.

- Prioritized solutions for any airspace improvements or enhancements as needed.
- A review of existing or planned domestic or international activities in the region and a recommended method or mechanism to insure all the work is harmonized into a comprehensive and coherent master plan.

The FAA will still face an uphill battle in terms of funding airspace and infrastructure projects in coming years, but we believe work done to complete this tasking will provide us with much clearer information in terms of what industry sees as most valuable. This will help inform better decision-making. We will provide Subject Matter Expertise (SME) as needed. We request this task be completed by the 3rd Quarter TOC meeting in the Summer of 2015 with an interim report in February 2015.

Sincerely,

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