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Optimizing Airport Management Using Passenger Analytics

By Eliot Lees, Vice President, ICF International

Airport managers increasingly face operational challenges in the form of steady passenger growth, terminal congestion, rising costs and difficulty in funding infrastructure. These factors are an open recipe to deficient facilities, poor service and unhappy passengers. However, the emerging technology of "Big Data" passenger analytics is beginning to be applied to terminal operation with highly encouraging results in optimizing airport performance. Passenger analytics offers new tools and processes to help airport managers make more effective decisions, which can improve airport performance, make better use of terminals, reduce costs, and revamp the passenger experience from curb to gate. Because of a lack of data sharing with other key stakeholders (airlines, governmental entities, concessionaires, etc.), airport managers have never had a complete view of what goes on at their own airports. Passenger analytics changes this dynamic using technology, predictive modeling and new management practices and collaborative

stakeholder coordination. Using this innovative combination of information, planning and coordination airport management can optimize airport performance. This paper discusses the challenges that major U.S. airports face and how passenger analytics technologies and processes can help to meet many of their ongoing needs.

Airport Efficiencies: Historic (and Ongoing) Challenges

The current realities of major airports around the world are no surprise to passengers who have experienced the frustration of long lines, crowded terminals, and long delays involved at many airports in getting from the curb, through security, and to their gate. The primary ongoing challenges are three-fold:

- Steady growth in the number of passengers leads to longer lines, more foot traffic, and a more crowded navigation experience throughout the terminal

- The long time horizon required for the necessary terminal expansion to accommodate passenger growth, more flights, and the space for customer amenities
- Funding challenges to pay for the cost of terminal expansion

Historically, airport managers have had access to very limited information about how passengers, meters and greeters, and other constituency use their airport. For both real and perceived concerns about proprietary, competition and turf issues, airlines are reluctant to share all but the highest level of passenger information. The information they do have is often very limited and generic. The result? Airport management often have only the most general insight into terminal passenger flows or bottlenecks within the terminal, with no detailed understanding of the underlying dynamics of how passengers move through their airport – either by time of day or by season, or how to make the process more efficient.

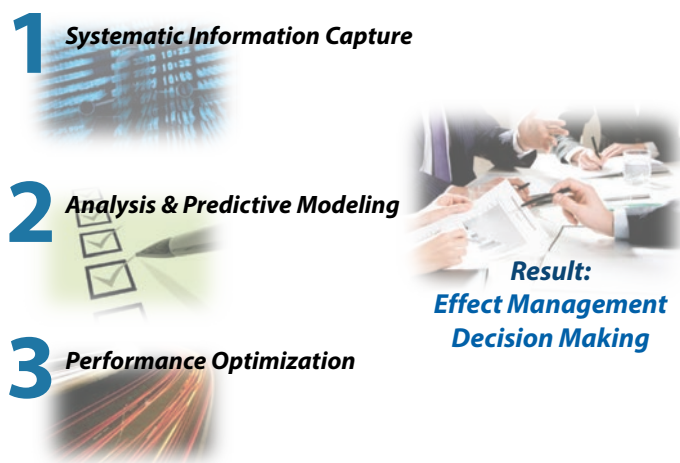
How significant is this problem? For airport managers tasked with improving efficiencies, keeping passengers happy, and keeping costs down, this lack of insight has reached a critical stage. Because passenger terminal flow patterns can vary significantly based on season, day, and hour, specific times may see serious congestion within particular zones: the curb, the airline check-in area, security checkpoints, through commercial areas, within holdrooms, at the gate, passport control and customs, arrival areas, and ground transportation access points. And of course this congestion, confusion, and delay can contribute negatively to the overall passenger experience.

Anecdotal evidence of congestion and bottlenecks from day-to-day observations and passenger complaints have resulted in rough rule-of-thumb planning metrics to address problems. But these solutions typically involve building more space--something many major airports are not in a financial position to do.

But a new solution--passenger analytics and performance optimization--is emerging as a promising tool to help airport managers face these challenges. A solution that makes use of cost-effective technologies to optimize the space airports already have and make more strategic decisions based on highly detailed, trusted information.

Understanding Passenger Analytics: A Three-Step Process Toward Airport Optimization

Passenger analytics involves three interconnected elements involving capture of passenger movement information within the airport terminal and using this data to make more informed and effective decisions about management and layout.



1. Systematic data capture

Wi-Fi. Bluetooth. Closed-circuit television. Radio Frequency Identification, Infrared tracking. These technologies have made a name for themselves in myriad personal and business electronics for years--but now, they are beginning to be being integrated into new sensor technologies that enable airport managers to track passenger movement in real time and change the way managers think, react, and plan.

Sensor technologies can systematically capture data about passenger movement, and that data can then be linked to other information sources such as airline passenger data, FIDS, OAG schedules, etc. But choosing the best solution is an individual and important consideration. Because of the variations in individual airport terminal layouts, there is no one-size-fits-all solution. A better approach is likely a customized solution ascertained on an airport-by-airport basis. Airport managers will want to consider key points when making strategic sensor technology decisions. These include clarifying current airport data analytic capabilities, and understanding airport goals on how to use current and future data sources.



2. *Analysis and predictive modeling*

The data that airports capture is only as useful as their ability to measure and analyze that information in an organized manner. Thus, analysis and predictive modeling are critical components of any airport optimization solution—enabling managers to understand passenger behavior and activity as well as the root causes of congestion and bottlenecks. Managers can designate specific zones within the airport and then build a model to predict detailed passenger flow within those zones. This step of the process also includes establishing key operational performance measures (“KPI’s”) and identifying optimization potential, and cost benefit analysis.

Key to this step is not only understanding where and how current congestion occurs, but in also predicting where future bottlenecks may emerge so that managers can take steps to mitigate or eliminate them. As operational and physical improvements are considered, managers can analyze the impact of potential changes before putting them in place. The

results include more efficient use of current capacity, more informed decisions to add capacity if needed—enabling managers to ensure proper allocation of funds as well as the right amount of additional capacity and the best timing for build out.

3. *Performance optimization*

The final step of airport optimization involves performance transformation within the terminal. This step involves improving capacity performance through discrete and focused process re-engineering of facility space and refocusing user behavior (both passengers, airline personnel and other airport stakeholders).

In this step, creation of a closed loop “Plan-Do-Act-Check” culture enables proactive and data-supported resource allocation, as well as collaborative work with stakeholders to improve performance, and reorient airport management objectives to that goal.

Airport Optimization Results: From Frustration to Efficiency

Taking a streamlined and systematic approach toward airport optimization can make for a cost-effective, customized, impactful approach that yields tremendous benefits to major airports:

- Markedly more efficient use of airport assets, freeing up resources for strategic expansion in the right place, at the right time
- Increasing utilization of capacity to do more with less
- Keeping airline costs per enplaned passenger lower
- Enhancing the overall passenger experience from curb to gate



Eliot Lees
Vice President, ICF International

Eliot Lees is a specialist in airport infrastructure development and airport commercialization/ privatization involving airports and aviation-related projects such as cargo, aircraft maintenance logistics, and multimodal tradeports. He directs global airport finance, public private partnerships (PPP), and airport strategic planning services. Mr. Lees has experience in airport privatization, financial due diligence, strategic planning, and airport finance, and he has worked on a wide range of feasibility engagements and acted as a financial advisor to investor groups and bid consortiums. He has also advised a range of

airports, governments, investment banking firms, developers, and cargo operators regarding strategic and financial issues.

Prior to joining ICF, Mr. Lees was an investment banker specializing in municipal and tax-exempt financing. He spent more than 10 years in various finance positions with leading New England financial institutions, including vice president at the Bank of New England in Boston, Massachusetts.

Mr. Lees has an M.B.A. from Boston University and a B.A. in Economics from the University of Massachusetts.



Costa Rica's Aviation Market is Feeling "Pura Vida!" about 2016

By Carlos Ozores, Principal — Eric Toler, Associate, ICF International

Country profile: Costa Rica

Costa Rica's aviation market has been growing, reaching a record 4.3 million O&D passengers in 2014, of which 80% are inbound visitors. Traffic is heavily concentrated in the country's largest international gateway, Juan Santamaria International Airport (SJO), which handled over 80% of the country's total air traffic.

From an air service perspective, Costa Rica has undergone significant transformation in recent years since Avianca closed its hub at SJO in 2013. At the time, Costa Rican authorities and tourism stakeholders were concerned by the adverse impact of lost connectivity. However, Avianca's downsizing has not been felt, as other players have filled the void, and now several carriers are planning to set up bases in SJO.

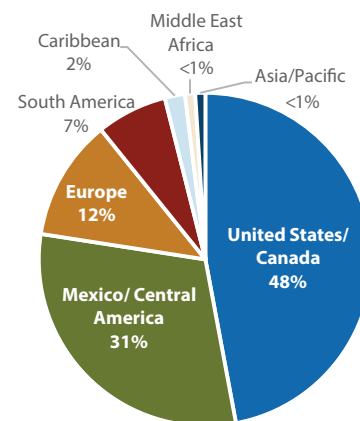
Limited connectivity and high fares within Central America and to South America, coupled with strong market fundamentals, create an opportunity for a new entrant. While it remains unclear at this point which carriers will successfully launch and how large their operation will be, 2016 is poised to be a year of change for Costa Rica's aviation market.

Strong Market Fundamentals

Costa Rica's popularity as a destination is on the rise; tourist arrivals (by air) have grown at an average annual rate of 5% over the last decade to 1.7 million in 2014. The country's air travel demand is oriented toward North and Central

America, which account for a combined 79% of total. Costa Rica has thus far not tapped into the growing demand between South America and leisure destinations in the Caribbean, as evidenced by the recent additions of service from Brazil to the Dominican Republic or Peru to Cuba, to cite two examples.

Exhibit 1: Costa Rica O&D Traffic by Region (YE June 2015)



Source: IATA Paxis

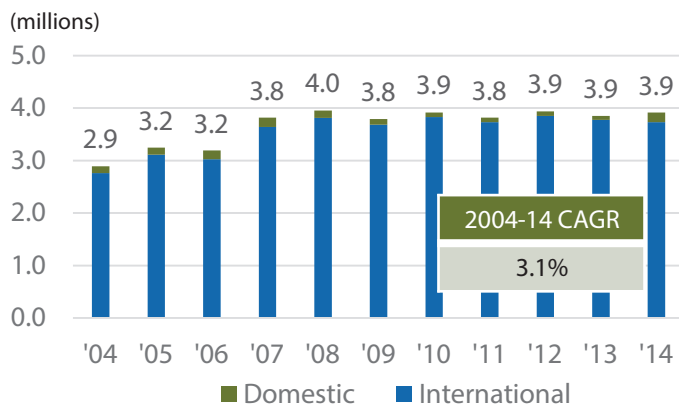
The country's economy and political stability provide a solid foundation for traffic. Costa Rica achieved annual GDP growth of 4.6% in the last decade, above the regional (3.7%) and global (4.0%) average. Costa Rica is the third most competitive economy in Latin America after Chile and Panama, according to the World Economic Forum, and the country enjoys the second highest GDP per capita in Central America (US \$14,918, PPP) and the seventh highest in all of Latin America.



Avianca's Absence Opens the Door for New Carriers

Despite the strong growth of tourist arrivals, traffic at SJO has remained around 3.9 million annual passengers for nearly a decade. This is largely due to Avianca's network strategy, which never saw SJO as a key hub, culminating with the decision to downsize operations as part of the carrier's network rationalization.

Exhibit 2: SJO Passenger Traffic



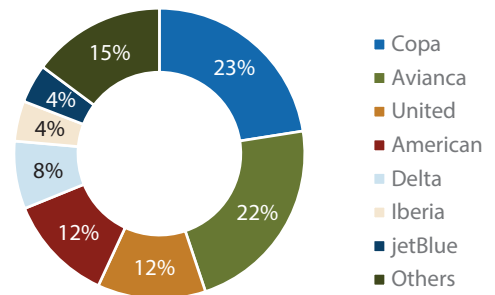
Source: SJO Airport

Avianca's operations at SJO peaked in 2008, at which time it served 20 destinations and held a 39% share of seat capacity. By 2015, its share had dropped to 22%, after the carrier cut seats by nearly half. However, thanks to SJO's large airline customer base, the airport has managed to overcome Avianca's cuts, maintaining traffic levels and actually increasing the number of destinations served.

Taking advantage of Avianca's cuts, Copa has expanded its share of international capacity at SJO from 10% in 2004 to 23% in 2015, replacing Avianca as the largest international carrier. SJO has also seen the addition of six U.S. and Mexican low-cost carriers since 2004, including Frontier,

Interjet, JetBlue, Southwest, Spirit, and Volaris, which together account for 12% of international capacity.

Exhibit 3: International Seats by Carrier at SJO (YE September 2015)



Source: Innovata

New Entrants Planning to Launch in 2016

Volaris, VivaCam, and Air Costa Rica have all announced plans to establish a base at SJO in 2016.

Volaris, a Mexican low-cost carrier, recently began flights to SJO in September 2015 from Cancun and Guadalajara (2x weekly in each). Volaris has stated that Costa Rica is a key part of its international growth plans and intends to set up a base (hub) as early as 2016. Of all the candidates to set up a base in SJO, Volaris appears to have gotten off to the fastest start.

VivaCam also intends to launch in 2016, bringing the ultra-Low Cost model to Central America. Grupo Viva previously launched VivaAerobus in Mexico (2006) and VivaColombia in Colombia (2012). VivaCam must still acquire operating permits from the Costa Rica DGAC.

Finally, Air Costa Rica, a start-up airline subsidiary of Air Panama, also plans to commence operations from SJO. Air Costa Rica has filed authorization requests with authorities



in Panama, Nicaragua, Guatemala, and Colombia, which provide some indication as to the carrier's initial routes. Although Air Costa Rica will not be a low-cost carrier per se, it plans to offer fares cheaper than the current offer. Air Costa Rica received an Air Operating Permit from Costa Rica's DGAC in September of 2015.

While there is certainly room to stimulate traffic at SJO, particularly given the limited competition and high fares on routes particularly to Central and South America, Costa Rica's relatively small market size is only likely to have room for one of these new entrants in the long run. The race is on.

Costa Rica: A Bright Spot for Aviation in Latin America in 2016

A new SJO-based carrier operating flights within Central America will be a boon not just to Costa Rica but to

Central America as a region, opening up opportunities for increased business and tourism in the region.

The Central American market has been historically underserved and ripe for entry by low cost carriers. Avianca's downsizing, together with Costa Rica's stable economic and political environment, make it a logical choice as the base of operations for a Central America-focused carrier.

While economic challenges and weak currencies are causing trouble in many of Latin America's aviation markets, ***Costa Rica remains a bright spot for the development of aviation in the region in 2016.***



Eric Toler
Associate, ICF International

Eric Toler has experience in aviation-related market analysis and research, forecasting (both airport-wide and route level), and other supporting data analysis. Mr. Toler has conducted air traffic forecasts and air service analysis for numerous studies and assists with the preparation of project deliverables.

Mr. Toler has an M.A. in Latin American Studies/International Trade and Economic Development from Georgetown University and a B.A. in Latin American Studies/Business Administration from the University of North Carolina–Chapel Hill.



Carlos Ozores
Principal, ICF International

Carlos Ozores has more than a decade of aviation industry experience and has advised dozens of airlines and airports on the development of their commercial and network strategies. He also has considerable expertise in revenue management, pricing, sales, and distribution, and he is an expert user of *NetWorks*®, a scheduling and route analysis software. His focus is on network and schedule development and optimization, airline commercial strategy, and air service marketing.

Prior to joining ICF, Mr. Ozores was a pricing analyst for Air France where he was responsible for off-tariff U.S. market pricing, evaluating competitive trends, and recommending pricing strategies to increase revenue and market share on North Atlantic routes. During the course of his work, he gained expertise in marketing information data tapes (MIDT) analysis, distribution, and the challenges of commercial policy harmonization within the scope of a global alliance. Mr. Ozores also was a revenue management analyst at American Airlines.

Mr. Ozores has a B.A. in Economics from Northwestern University.



Air Service Changes During a Volatile Time in the Latin America/ Caribbean Region

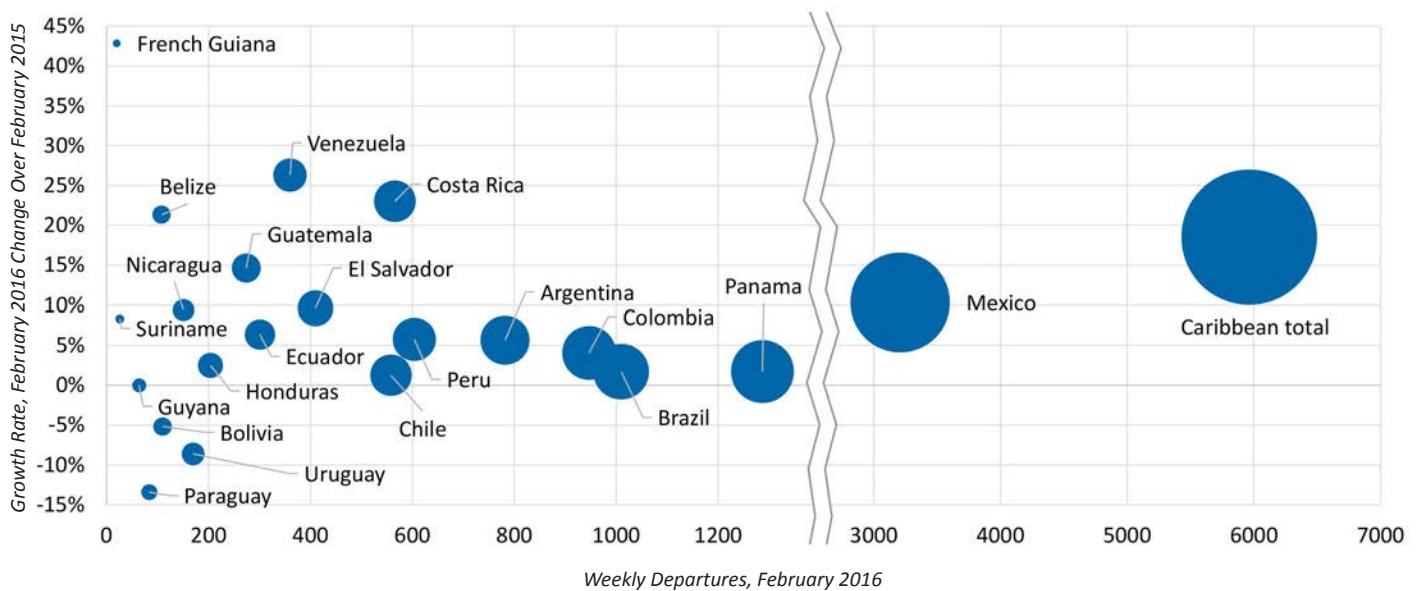
By Jared Harckham, Vice President, ICF International

The Latin America-Caribbean region is experiencing widely-reported economic distress in Brazil and Venezuela, yet the region is seeing increases in air service in many markets. The ongoing growth of low cost carriers (LCCs) and ultra-low cost carriers (ULCCs) in the region, and to the region from North America, remains a facilitator of service growth.

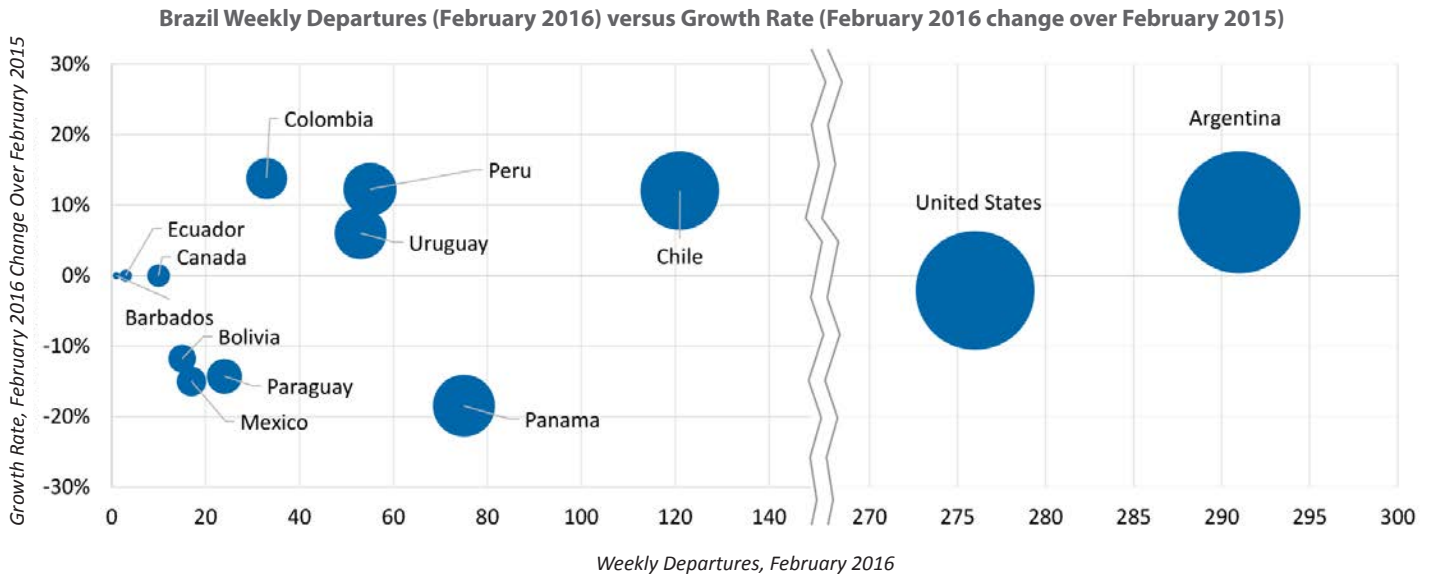
The exhibits that follow analyze the year over international frequencies for the region, by country in total and by country-pair, for the most relevant countries in the region. Europe and Asia are not included.

Questions about the data, or requests for more detail, are welcome by the authors.

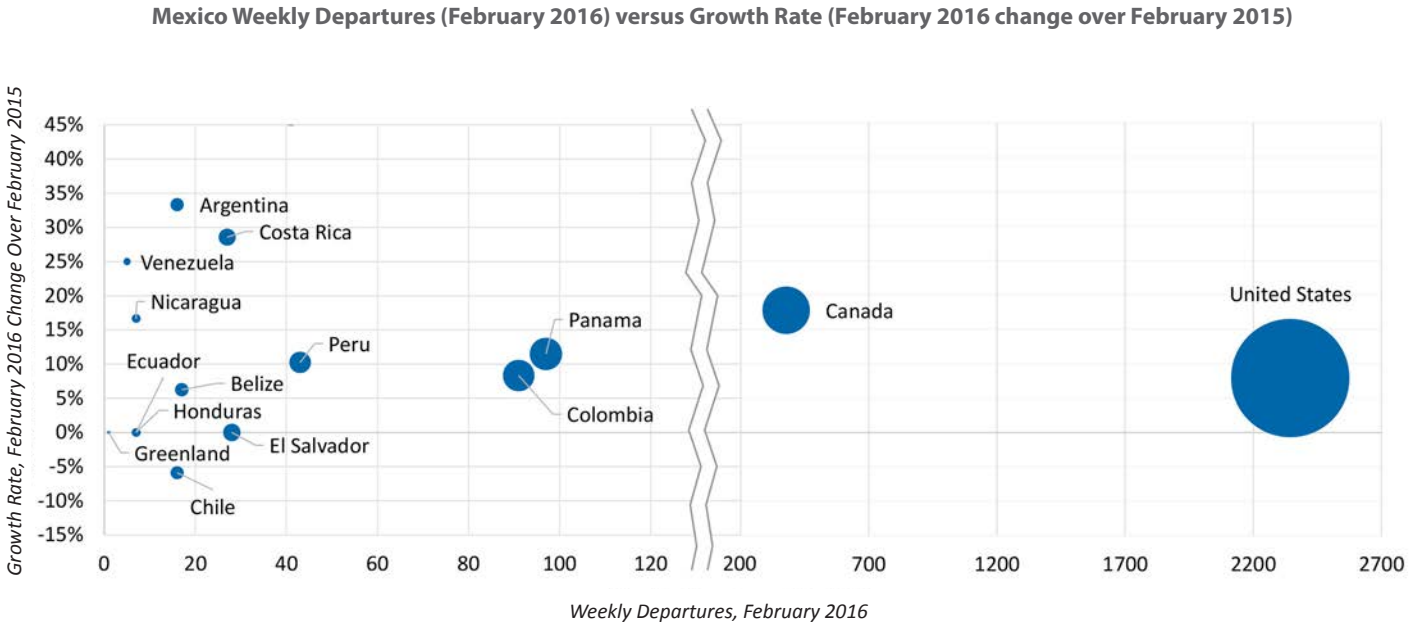
Latin America Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



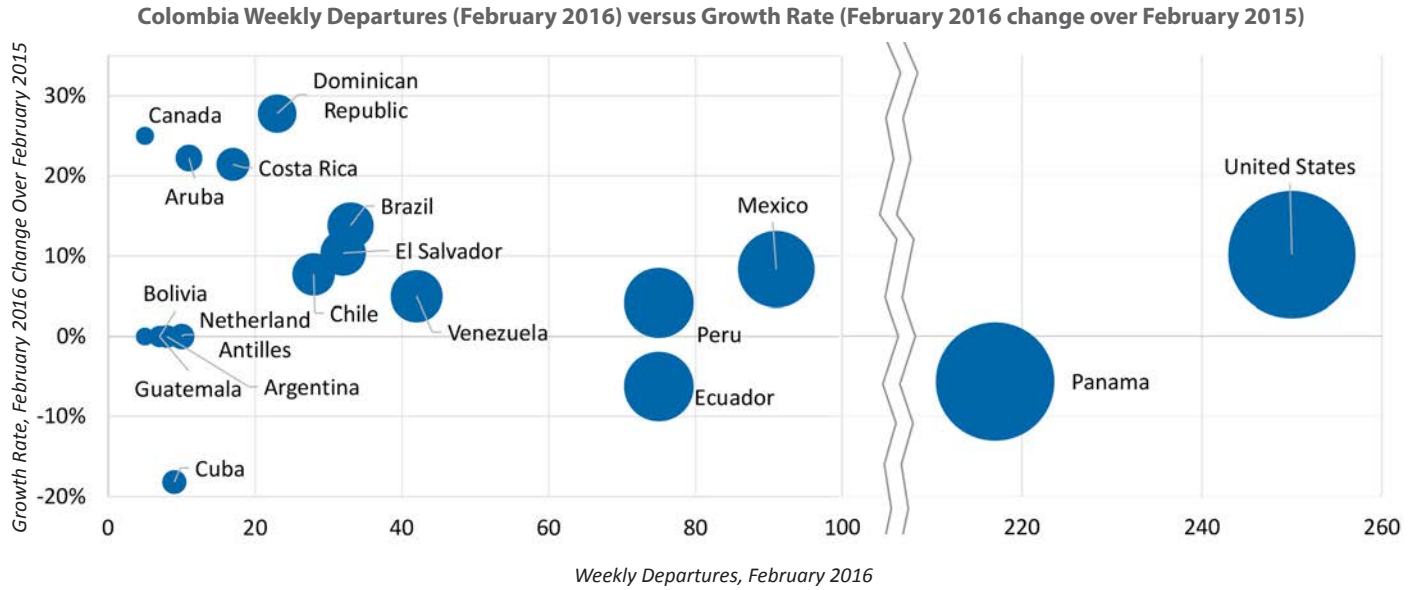
Despite Brazil's fragile economic state, frequencies are only down slightly in the US market and up in many South American markets. Panama is down due to Copa hub reductions.



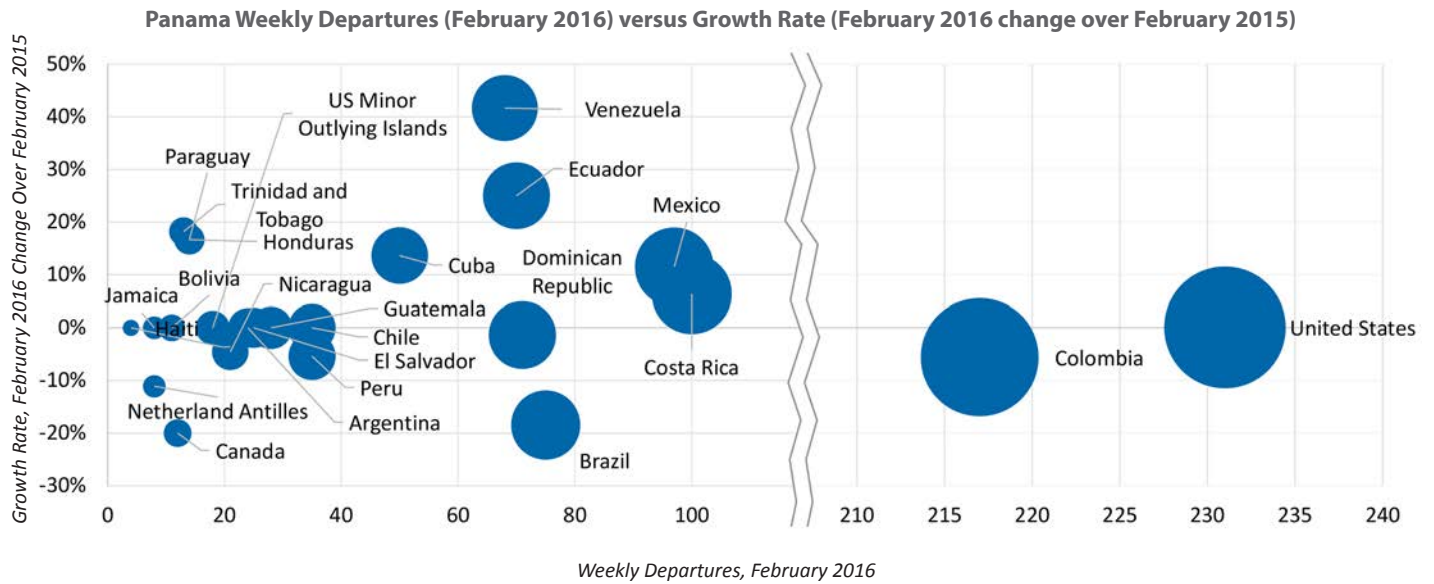
Mexico's air service is growing strongly, despite a currency devaluation. Low cost carriers in the US, Canada and Mexico are much of the story, including Southwest's new Houston gateway.



Colombia's international traffic reflects growth at Bogota and new routes from the US and Mexico to Medellin, Cartagena and other destinations.

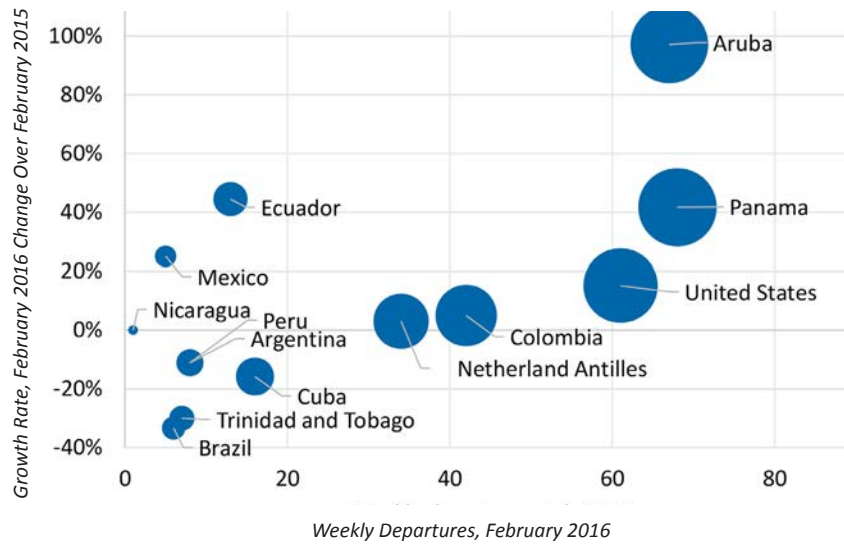


The Copa hub at Panama is a microcosm of the region, with a drop in service to Brazil, stable to the US, Chile, Argentina and growing to Mexico, Venezuela, Ecuador and Cuba.



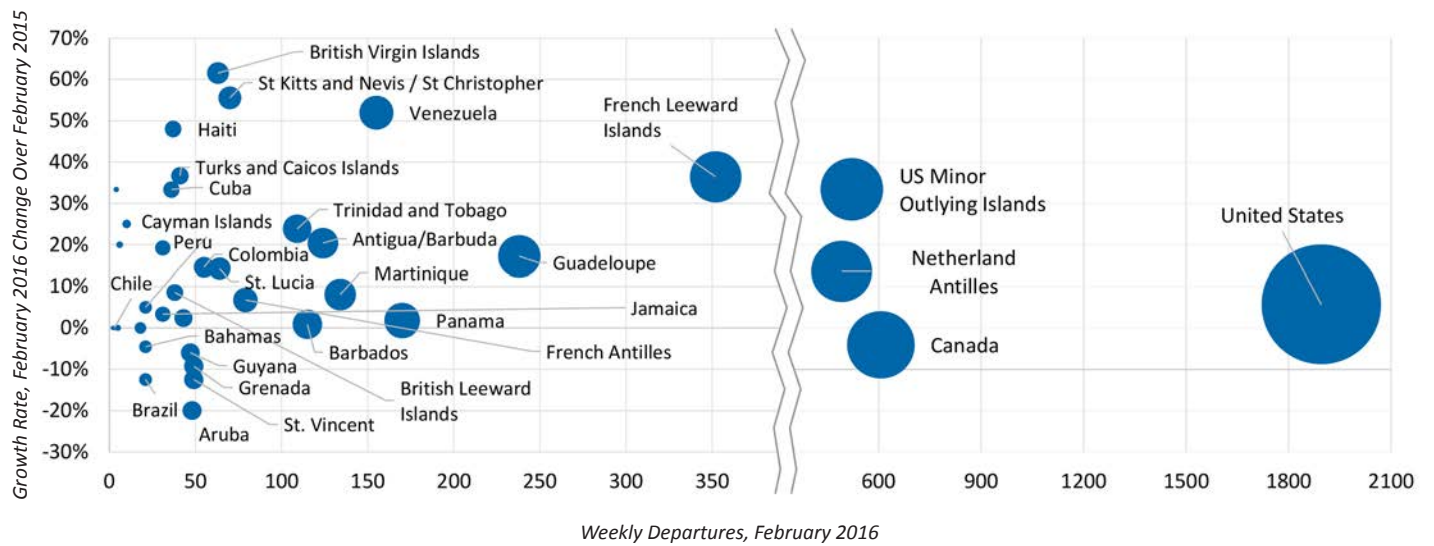
Despite Venezuela's ongoing economic malaise, air service has grown year over year, due to airlines restoring service levels that dropped dramatically due to the currency repatriation crisis that is more controlled now than in 2015.

Venezuela Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



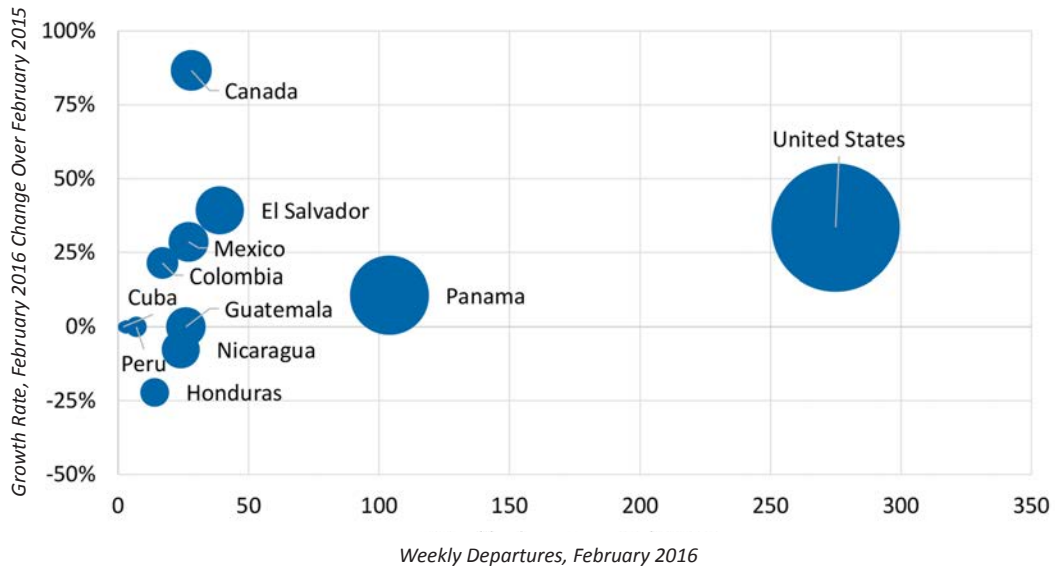
The Caribbean is doing well with growth in the large markets to the US and Canada (largely LCC), more service to Panama and increases within the region.

Caribbean Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



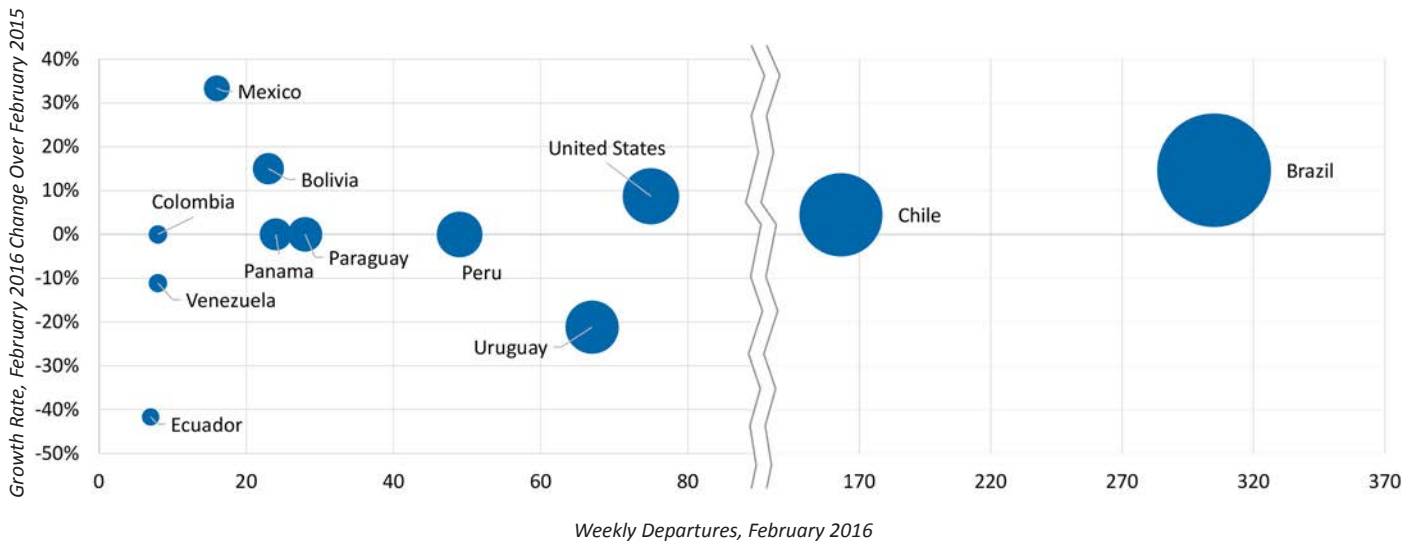
Costa Rica is experiencing growth in almost all markets, linked to its booming tourism sector. U.S. and Canadian airlines in particular have added service to Liberia, Costa Rica, which is close to major beaches and eco-tourism offerings.

Costa Rica Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



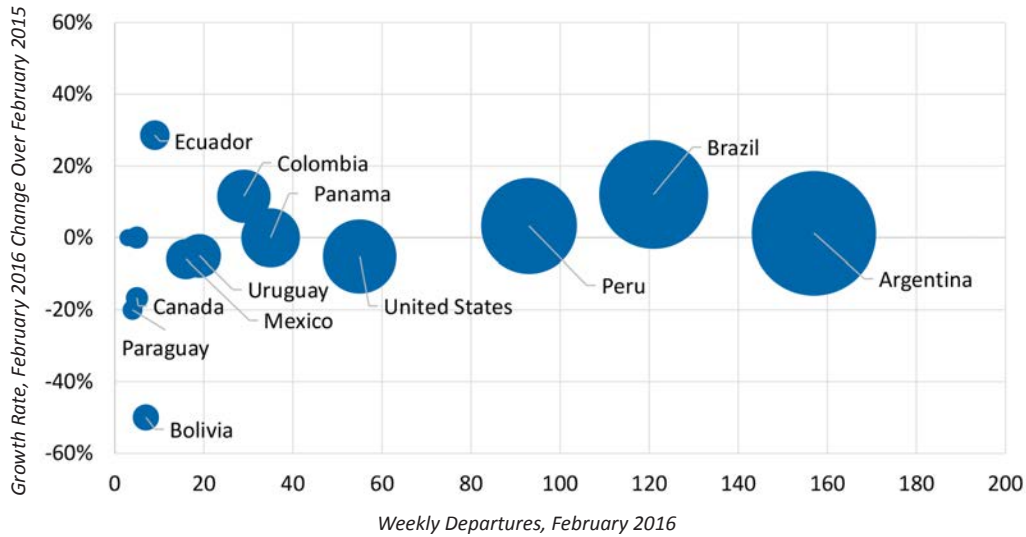
Argentina shows stability in most aviation markets and an increase in Brazil, where service has grown to secondary cities.

Argentina Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



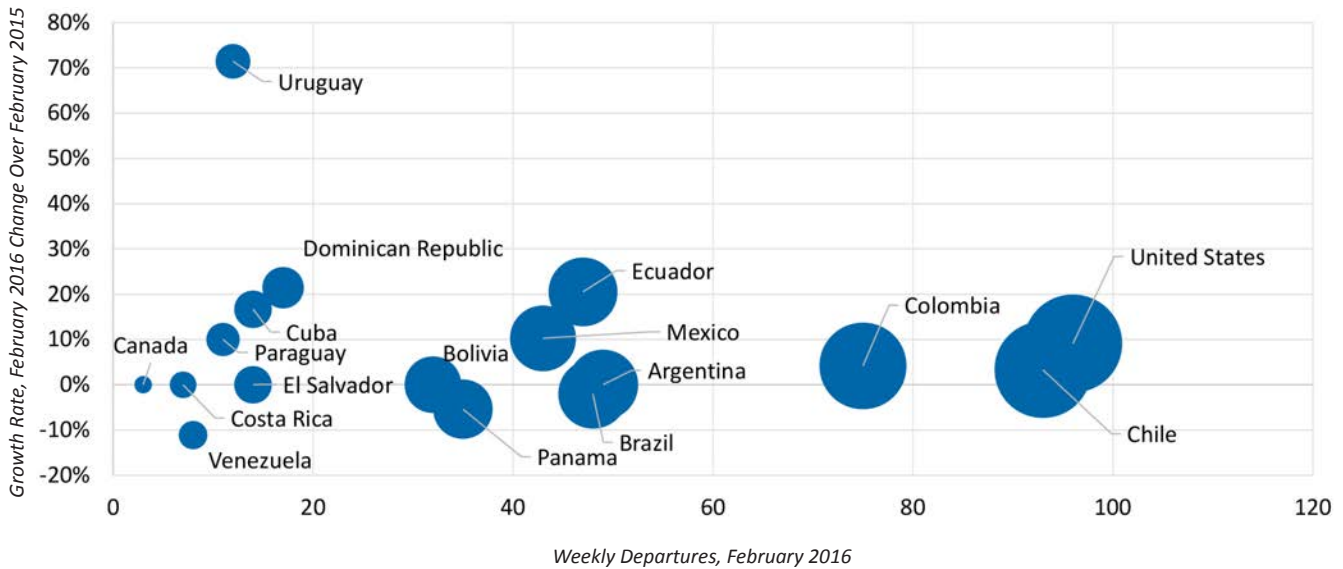
Chile's air service in the region is largely stable due to a solid economy. Frequencies to neighboring Peru and Argentina have not changed.

Chile Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



Peru's aviation market is also stable year over year, with little movement among the largest markets, including Chile, Colombia and the U.S.

Peru Weekly Departures (February 2016) versus Growth Rate (February 2016 change over February 2015)



Jared Harckham, Vice President, ICF International

Jared Harckham joined ICF in 2002 after 22 years of experience with major airlines in the United States and Mexico. He has experience in the areas of airline strategy, network and fleet planning, alliances, and marketing as well as air service development and forecasting for airports. Mr. Harckham previously worked in commercial aviation; he held a series of planning positions at TWA, and he was the

senior vice president of commercial planning at Aeromexico where he directed strategy, scheduling, planning, forecasting, pricing, revenue management, distribution, government affairs, and alliance efforts for Mexico's largest airline. He also participated in the founding and design of the Skyteam alliance.

Mr. Harckham has an M.B.A. with an emphasis in Marketing from Columbia University and a B.A. in History from Emory University.



U.S. Airport Privatization 2.0 Is U.S. Airport Privatization Finally Ready to Take Off?

By Eliot Lees, Vice President, ICF International

Airport privatization in the U.S. has never really launched. In 1997, following the success of airport privatization in other parts of the world, the U.S. Congress established the Pilot Privatization Program to open a limited test to see how it would work in this country. It has not. Over the past 18 years, only two U.S. airports successfully navigated the privatization program and entered into long-term concessions with private airport operators: Stewart International Airport (SWF) and Jose Munoz International Airport in San Juan, Puerto Rico (SJU). Stewart went private in 1997 but reverted to the public sector in 2003 when it was purchased by the Port Authority of New York and New Jersey. San Juan was privatized in 2013 after a successful tender process. Currently Oaktree Capital and ASUR, a Mexican airport operator, are investing US\$1.4bn in the airport and managing it under a 40-year concession.

However, San Juan was a rather unique situation, one not likely reproducible on the U.S. mainland. The City of Chicago tried twice to privatize Midway Airport (MDW) and failed both times. A few other airports have entertained the idea but never moved forward. The general consensus is that the privatization program airline approval requirements make this an unworkable option. So what is the outlook for private sector involvement (“3P” or “PPP”) going forward?

The U.S. airport business model and funding of infrastructure is unlike that used by the rest of the world. The building blocks of this structure, Airline Use Agreements, FAA Airport Improvement Program (AIP) grants, Passenger Facility Charges (PFCs), and tax-exempt bond financing define how U.S. airport development has proceeded over the past four decades. However, decades of AIP underfunding have resulted in aging airport infrastructure and a mounting bill to make needed investments. At this moment, Congress is reconsidering the U.S. airport business model through a possible revamping of the 2015 AIP Reauthorization bill. The proposed new bill would strip Air Traffic Control out of AIP and drastically reduce the AIP funding pool – possibly by more than a third of present levels. If this sort of restructuring happens, U.S. airports will need to consider new approaches to funding and paying for infrastructure — “U.S. Airport Privatization 2.0.”

If the U.S. Airport Improvement Program is eviscerated... U.S. airports will increasingly be squeezed, lack funding and be unable to replace aging infrastructure.

U.S. Airport Privatization 2.0 may represent part of the solution.



Given the realities of the U.S. market, is there another avenue for private sector participation at U.S. airports? We believe there is. While current U.S. FAA funding restrictions make it extremely difficult to cede control of entire airports, there are growing examples of private sector participation in airports — in the form of partial concessions. Individual terminals have been privately developed and operated. The unit terminal concept applied at New York JFK, Los Angeles and Boston airports saw airlines successfully develop, finance, construct and operate a number of terminals in each of those markets. This has been extended to non-airline tenants at both JFK (T4) and LaGuardia. The LaGuardia Central Terminal redevelopment project, awarded to the Vantage Consortium in June of this year, will result in a US\$3.6bn 3P initiative that is a true Public Private Partnership: partially funded by the private sector (with the balance being funded by the Port Authority), privately constructed and privately operated. Another example of a partial concession is Sanford Orlando Airport (SFB), which has been controlled by a private airport operator under a 40-year terminal management lease with investment

responsibilities. This may well be the future of U.S. Airport Privatization 2.0.

New 3P structures, for example concessioning diverse pieces of airports to the private sector, are starting to emerge. Denver is currently engaging in a tender process to select a private operator with the responsibility to redevelop and operate the Jeppesen Terminal under a long-term lease - with investment responsibilities. The City of Chicago has just issued a Request for Proposals (RfP) for a concession of the retail areas at Midway Airport, under a broad scope that includes a major terminal renovation. And Des Moines International Airport is currently exploring a terminal privatization option.

If U.S. AIP is eviscerated in the manner currently being discussed in Congress — U.S. airports will increasingly be squeezed, lack funding and be unable to replace aging infrastructure needed to meet expected aviation growth. Faced with this challenge, U.S. Airport Privatization 2.0 may represent part of the solution.



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Vice President, ICF International

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