

WHITE PAPER

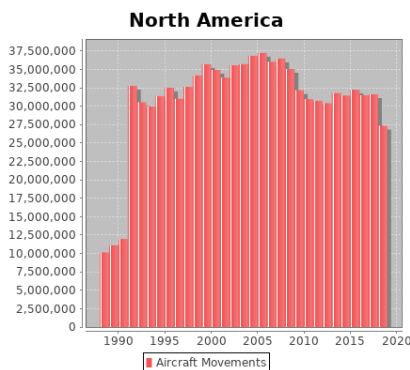
Why planes are more crowded than ever, and the impact this has on your Baggage Handling System



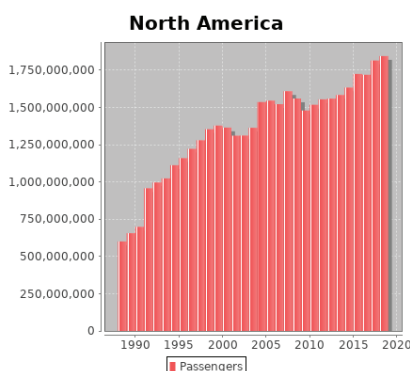
If you have been a passenger on a major airline in the last ten years, you might have noticed planes are more crowded than ever. Airlines are always looking to increase revenue and throughput in all sorts of ways. One of the ways to improve throughput and revenue is to add more flights to their schedule. However, adding more flights can also increase operating costs by requiring more planes, staff, additional gates, and more ground support. For Airlines, the key is to find ways to improve their throughput without having to invest in more flights. Based on Airplane and passenger data over the last ten years, airlines have seemingly figured out a way to improve throughput and increase revenue without adding more planes.

How to increase passenger throughput?

Data from multiple sources including U.S. Department of Transportation’s Bureau of Transportation Statistics, show a steady decrease in airplane movements in North America since 2005. However, since 2010, there has been an increase in passenger volume and movement. Perhaps, the easiest explanation for how airlines are increasing passenger throughput with fewer airplane movements is through Next-Gen aircraft. Since the early 2000s, plane manufacturers such as Boeing and Airbus have been releasing planes with higher passenger capacity and more and more airlines are putting them into circulation as they retire older aircraft. These higher capacity planes are making it possible to transport more people per flight and still meet environmental goals.



A second way of increasing passenger throughput while decreasing the number of flights is to increase the passenger load factor, which means that flights are filled more with passengers. A 2018 MIT study indicates an increase in the average passenger load factor. At the end of the 1990s, the average passenger load was around 67% in North America. So, if you booked a flight back in 1995, the plane was likely only two thirds full. The passenger load percentage increased steadily, reaching an all-time high of 85.3% in 2018. Feeling like you are on a crowded plane is more than just perception; it is a fact. Most routes for the major carriers are operating at a +95% load factor. When is the last time you were on a flight with more than 1 to 2 empty seats?



This increased passenger load has been great news for the airlines as it allows them to increase revenue, without increasing the number of flights or expanding their fleet.

The impact of increase in air traffic on the Baggage Handling System

Managing seat occupancy more efficiently certainly has helped drive profitably for the airlines, however, this presents new challenges for the airports. More passengers mean passenger waiting areas at gates are often too small for the size of aircraft. While more passengers can also mean more revenue for the airport via concessions and parking fees, longer lines and ride share services like Uber and Lyft are cutting into those revenues. This increase in air traffic often has a lurking problem that many passengers don’t realize, the impact

on the Baggage Handling System. Most fliers don't realize the criticality of the Baggage Handling System (BHS) and is often the "heart" of an airport terminal buried deep below the bones under those air conditioned, well-lit spaces to buy snacks and souvenirs.

Annual passenger throughput, the number of aircraft gates, and airline baggage policies (i.e. "Bags fly Free") are integral factors when determining the size and capacity of a BHS. However, there is not always a necessity to increase the number of gates to increase passengers, as was proven above. The increase in passenger loads and (slightly larger) planes can generate capacity for growth before investing in additional ground facilities through terminal expansions and/or additional gates.

In this case, the quantity of bags needs to be taken into account, but this is always in combination with the number of people traveling. IATA is predicting 8.2 billion people will be traveling by air in 2037, doubling the current number of air travelers in just 18 years. This translates to roughly a yearly growth of 3.5%. The North-American market is expected to grow 2.4% (on average) annually, totaling an additional 527 million travelers by the year 2037. The industry standard for domestic check-in bags has been 0.8 bags per person for the last decade, and 1.5 bags per person on international flights. Based on market trends and data, we can assume that more and more bags are being transported. Even without the increase in plane size, the increasing passenger volume is expected to lead to a 27% increase in checked luggage.

The Below table shows the increase in bags per flight based upon an increase in airplane capacity and the load factors for domestic and international flights. The first two columns compare data from 1995 and 2018. By comparing the data,

we can see a 52.5% increase in checked baggage in 2018 compared to 1995. Even if we leave out the increase in plane size, and only focus on the passenger load, there is still a 27.5% increase in bags per flight.

The factors mentioned above affect the use of the Baggage Handling Systems at airports. Many of the Baggage Handling Systems in North America were installed in the mid to late 1990s or early 2000s and therefore cannot accommodate such rapid growth and increased volume. Under increasing performance demands, these older systems are vulnerable to breakdowns. Moreover, older systems are not designed to be flexible or expandable; they are unable to adapt to dynamic flight changes and changes in baggage flow. This could create bottlenecks in various parts of the system, such as, in the makeup area.

Solutions to handle growing passenger volume

Airports can mitigate these issues by analyzing the system for possible bottlenecks, energy or operational inefficiencies, and identifying their systems growth requirements. Simpler Baggage Handling Systems of old are not sophisticated enough to deal with today's dynamic flight schedules, the increase in passenger movements, efficient dynamic bag routing, and variations in bag flows. Having an intelligent system that is proactive will decrease the chances of breakdowns, reduce mishandled bags, and improve the working environment. Finding the right solution tailored to the needs of the airport should begin with an honest systems evaluation. Stakeholders can implement solutions to growing passenger volume in two ways; Short-term and Long-term.

A short-term method of increasing the efficiency of the BHS does not require an overhaul of the existing system. Like the airlines did with the load factors, the same logic

<i>Domestic (North America)</i>	1995	2018	2018
Airplane capacity	149	179	149
Load factor	67%	85%	85%
Number of Passengers	100	152	127
Average bags check-in	0.8	0.8	0.8
Number of bags per flight	80	122	102
		+52.5%	+27.5%

<i>International</i>	1995	2018	2018
Airplane capacity	149	179	149
Load factor	67%	85%	85%
Number of Passengers	100	152	127
Average bags check-in	1.5	1.5	1.5
Number of bags per flight	150	228	191
		+52%	+27.3%



can be applied to the BHS. Software analytics, High/Low Level Controls modifications, and updated BHS managing software are crucial tools for the short term. Vanderlande offers comprehensive analytics tools that provide insights into BHS performance in the forms of their VIBES and VIDi software.

VIBES goes beyond the status screens that most Control Room Operators know and leverages High Level Controls technology to adapt to increased passenger flow and perform dynamic traffic routing. The VIBES system also provides analytic insights with reporting that will give stakeholders the tools they need to plan for future growth. Furthermore, VIBES is a stackable software suite, making it possible to pick and choose the functionalities and tailor it to each customer's needs. VIDi is event-based analytics software that searches, monitors, and analyses (machine generated) big data, via a web-style interface.

A health assessment of the Baggage Handling System

However, before the software solutions mentioned above can be used to their fullest potential, it is essential to know the health of the existing Baggage Handling System. Process engineering analysis can provide various system checks, investigations (both on and off-site), and analytics to provide a full health assessment of the system. Process engineering can play a valuable role in increasing the efficiency of a BHS. Utilizing the findings from the process engineering analysis BHS stakeholders and Vanderlande

work together to develop a maintenance and system plan that will increase the efficiency of older BHS systems. As mentioned earlier, these are less invasive solutions and will improve the performance of a BHS. Process engineering and utilizing smart HLC methodology will enable the stakeholder to invest in system improvements with having to invest in a completely new BHS.

Looking at long term solutions caused by increasing passenger volume, investing in a new BHS opens up a whole host of possibilities. One thought-provoking solution to an intelligent and flexible BHS is an Individual Carrier System (ICS), which has been used in some of Europe and Asia's largest airports for nearly 20 years. As a leading ICS solutions provider, Vanderlande's TUBTRAX is a complete solution for facilitating fast, high volume processing, transportation, and storage of baggage. In an ICS solution, every piece of baggage is transported in an individual carrier (or "tote"). This method provides complete uniformity to the baggage handling process because every bag (now in a "tote") becomes the same length and same texture, enabling a significantly more efficient operation and higher throughput (due to reduced jams), compared to a standard baggage handling. Engineered for high redundancy, reliability, low maintenance, and higher speeds (up to 1400 feet per minute, 7 m/s) an Individual Carrier System could be the right solution for a growing airport, especially if you need to connect multiple bag rooms or terminals. The unique Vanderlande Loop system design delivers the highest





system capacity in the market (4000 bph). The additional benefit of an ICS is the traceability of the bags; since every bag gets an individual carrier, pairing a bag with a unique tote reduces the chance of bag mishandling through the use of RFID technology. In 2016, recovering and returning lost bags cost the aviation industry \$2.1 billion.

In addition to reducing the mishandled bag rates (MBR) for airlines, increasing reliability, and providing increased operational efficiency an ICS solution opens the possibilities for additional operational improvements, such as Early Bag Storage (EBS). An EBS system can help distribute the peak load and provide flexible load times at piers. As the name suggests, this system will be able to hold baggage after it has been screened and sorted. This makes it possible to store early bags, help with transferring baggage, shorten make up open time on piers. An EBS system results in shorter wait times for passengers, therefore spending more time in the airport enabling customers to enjoy shopping and concessions.

Conclusion

To summarize, the technology in the baggage handling environment is changing. Even though fewer flights are being scheduled, the increase in passenger movements does not show signs of slowing down anytime soon. Therefore, thanks to the increase of passenger loads, more pressure is being put on the baggage handling infrastructure at airports which is increasing the chance of breakdowns, mishandled bags, and system bottlenecks. Vanderlande offers services that can be implemented in short time frames, such as life cycle planning, condition health assessments, and offer increased performance with our software solutions, VIBES and VID. As with every industry nowadays, data is becoming key, and the BHS world is no exception. Therefore, investments in these products will not only be able to give you an insight into your current situation, or even solve them in the short term but will continuously provide insight into your system. Other advances like EBS and ICS are long term solutions that help “future proof” baggage operations by creating, highly efficient, high capacity systems.

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