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Applying Additional Self Service Methodologies to Commercial Aviation Baggage Handling: Is A Potential “Win-Win” Being Left on the Table?

Derrick Denny

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Applying Additional Self Service Methodologies to Commercial Aviation Baggage
Handling: Is A Potential “Win-Win” Being Left on the Table?

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An Independent Study

Submitted to the Graduate Faculty

of the

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for the degree of

Master of Science

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The Faculty Advisor under whom the work has been done and is hereby approved, has read this independent study, submitted by Derrick Denny, in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota.

(Advisor)

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Abstract

This project looks at the possibility that airlines are overlooking an opportunity to save money and at the same time provide a better service to their customers.

On certain regional-jet flights, airlines handle carry-on baggage in a way that avoids many of the pitfalls that drive mishandled baggage claims on other flights. This paper investigates the feasibility of using this very reliable carry-on bag system for all bags (checked and carry-on) on all passenger flights, thus potentially enabling commercial airlines to provide a more reliable service that customers prefer. Since the system, in this paper deemed the “pink-tag system”, involves increased customer self-service, it may result in dramatically lower costs to the airlines as well.

CHAPTER 1

INTRODUCTION

Statement of the Problem

Ensuring that airline checked baggage arrives at the passenger's destination on-time and intact is an important part of an airline's ability to compete in today's global marketplace. In fact, this importance has recently increased for two reasons. First, because most airlines now charge separately for checked baggage, increasing passenger expectations that their bag will arrive with them at their destination, on time and intact.

Second, the way that an airline handles a passenger's bag is far more visible today than previously (thanks to the media) and can potentially subject the airline to greater public ill-will. Because many people travel with a camera capable of video and have access to post videos on sites like *YouTube*, anyone's baggage nightmare can be shared with thousands of others. There are already many examples of this. Perhaps the most famous is the case of country music singer Dave Carroll whose personal baggage nightmare resulted in a music video entitled "United Breaks Guitars". It has been viewed on *YouTube* over 8.7 million times (source?). Even though it's been posted for over two years, there have been over one million views in just the last month suggesting that its popularity is not dying down at all. One wonders how much money United Airlines would pay to make it go away forever, but of course, that isn't even an option. As passengers routinely capture what they see happening out the window, it is more

important than ever for airlines to provide a baggage handling system that customers value.

As important as baggage handling is, airlines are often criticized for the poor job that they do with it. It has been a continual source of entertainment for late night comedians and on the internet. Whether the criticism is deserved or not, clearly the public believes there is room for improvement. Consequently, any opportunity to improve in the critical area of baggage handling is an opportunity for an airline to distinguish itself from its competitors. All airlines do strive continually to improve their baggage handling product, but potential solutions are often limited by the economic constraints. Today's commercial airline industry is hypercompetitive and profit margins (in those rare years when there is any profit) are extremely thin (source?). Therefore, initiatives to improve baggage handling have to be able to recoup any upfront investments very quickly. Expected success of an initiative must be very high. Thus a system already in use with a track record for viability would have a much better chance of consideration than others.

The way the pink-tag system works today, passengers bring baggage through the security checkpoint that normally would be stowed in the overhead compartments of a larger aircraft. But because the overhead compartments are much smaller on a regional jet, airlines must redirect these bags to the cargo bins in the belly of the aircraft where the checked baggage is stowed. During the boarding process, as the passenger presents their boarding pass for scanning, an agent applies a pink tag to their bag, such as the one shown on a stroller below in Figure 1.



Figure 1. Baby Stroller with Pink-Tag applied

Once in the jet-bridge, the passenger tenders their pink-tagged bag to a ramp agent. The ramp agent collects all such bags and then stows them in the cargo hold of the aircraft. Upon arrival, the bag is returned to the customer right there on the jet-bridge. If the customer is making any connections, they simply tote the bag with them to their next departure gate, and if that plane is also a regional jet, the process is repeated. If this stop is their final destination and the pink-tagged bag is their only bag, then of course they proceed out of the airport with no need to stop at the baggage claim area.

Purpose of the Study

It is in such an environment that this paper considers whether an adaptation of the “pink-tag system” might be successful if used for all bags on all flights. In its current, limited use for carry-on bags on smaller regional jets, the pink-tag system does have a track record for being extremely reliable. But would this more reliable system translate well into the realm of larger mainline jets?

Research Questions

Three areas of investigation are required to determine whether the Pink-Tag system would in fact be an improvement. First, the operational design of the traditional system must be compared to the proposed operational design of a system-wide implementation of the Pink-Tag system. Is there sufficient reason to believe that the Pink-Tag system would likely reduce mishandled baggage claims?

Secondly, would the pink-tag system reduced costs compared to the traditional system? This section looks at the primary areas of expense associated with baggage handling, as well as the revenue collected today for checked bags to determine whether there is an overall savings with the Pink-Tag system. If there are savings, would they justify any up front expenses associated with implementing the Pink-Tag system?

Third, would the flying public accept or even prefer the pink-tag system? Even if it is demonstrated that, over time, the pink-tag system is workable and will save airlines money, airlines would also need a level of confidence that the method would be accepted by the flying public. At its core, the pink-tag system is essentially a self-service system, very analogous to other self-service systems implemented in other industries, like ATMs, self-service gas stations, and self-service check-outs in retail stores. If it could be demonstrated that airline customers embrace self-service offerings in other industries at least as enthusiastically as the general public, then airlines could be fairly confident that the pink-tag system would enjoy the same kind of acceptance as these other self-service offerings.

To summarize, then, if it could be established that the pink-tag system can first - work operationally, second - save airlines substantial dollars, and third - that the public would actually prefer it, then airlines would be highly motivated to find ways to overcome any remaining obstacles.

Methodologies

The first two areas of investigation, the operational design of the systems and cost comparisons, were conducted by means of qualitative interviews of experts in various parts of commercial aviation baggage handling. Two certified industrial engineers, one material handling systems expert, one airline staffing analyst, and one official from the Transportation Security Administration were interviewed for the project. The results from these sections must be considered qualitative even though financial data is included. In the third area of investigation regarding customer preferences, a survey was taken using a standard Likert scale to determine quantitatively if frequent airline customers prefer self-service offerings in general. T-tests were run to determine if any differences were statistically significant. The details of that methodology are contained in the corresponding section below.

CHAPTER II
OPERATIONAL COMPARISON OF THE SYSTEMS

The Traditional System

Forwarding a bag to a passenger's destination may seem to the vast majority of the flying public like a fairly simple process. In actuality, under the current system, it is very complicated and has a large number of potential pitfalls. The following is the series of steps that a bag transitions through for a passenger traveling for example from Cincinnati, Ohio to San Diego, California, with a connection in Salt Lake City, Utah. Underneath is a description of the fourteen steps involved in the process. Then each step is considered for potential pitfalls.

The Fourteen-Step Process

- 1) Passenger tenders bag at the Cincinnati ticket counter to agent, agent tags the bag and places it on the conveyor.
- 2) Conveyor Belt forwards bag to TSA inline screening area
- 3) System either clears bag or redirects it for further screening
- 4) Cleared bag forwarded to re-induction point, bag tag manually scanned and re-inducted into system
- 5) Based on scan, system forwards bag to one of four bag make-up areas
- 6) Agent in bag make-up area sorts bag to cart associated with the passenger's flight
- 7) Cart is forwarded to plane-side

- 8) Bags are loaded onto plane
- 9) At destination, bags are unloaded from aircraft and sorted by agents into one of several carts designated either for transfer to another flight or local claim area.
- 10) Cart is forwarded to connecting flight
- 11) Bag is transferred to a cart at the departure gate
- 12) All bags in cart are loaded onto departure aircraft
- 13) At arrival, bags are unloaded from aircraft and sorted by agents into one of several carts designated either for transfer to another flight or local claim area
- 14) Local claim bags are transported to an unload belt which carries them to the claim area

Potential Pitfalls

(Step 1) Passenger Tenders Bag at Ticket Counter

Agent tags the wrong bag. This along with what is known as a “tag off” is perhaps the most complicated problem associated with baggage and requires some explanation. When a ticket counter lobby is teeming with people pushing forward toward the counter, and bag tags are continually spitting out from a number of different printers, it is sometimes the case that the agent places the wrong tag on a bag. Standard procedure to avoid this is for the agent to confirm with the individual in front of them who they are (“Mr. Jones?”) and what their final destination is (“Are you traveling to San Diego today?”). Nevertheless, in some cases bags get mis-tagged. This is a very difficult problem to unravel, and can involve one, two, or even more passengers. The most common situation is when the two passengers both place their bags in the bag well between counters, and the two tags are switched.

When Mr. Jones arrives in San Diego and awaits his bag at the baggage claim carousel, but his bag doesn't come down, he heads to the baggage service office. The scanning records in the agent's computer indicate that his bag did arrive, and upon investigation of the claim area, there is one bag left unclaimed. This bag has Mr. Jones' tag on it, but it is not his bag. So the agent knows that Mr. Jones' bag and at least one other – the one with Mr. Jones' tag on it - was mis-tagged. The question now becomes where is Mr. Jones' bag, and whose bag is this? Again, this can be an extremely difficult problem to solve. It helps if both Mr. Jones and the owner of the bag in front of them have a name tag, but that is certainly not always the case. It is still not known what tag was placed on Mr. Jones' bag. It could have been the tag belonging to the owner of the bag in front of them, or in the case of a three-way tag swap, it could be another tag. So Mr. Jones bag literally could be anywhere, and there is no tracking information to help locate it.

If for example Mr. Jones' bag arrived in Orlando, Florida with Ms. Smith's tag on it, the Orlando agent (after having gone through the same discovery process with Ms. Smith) would post a description of the leftover bag in front of her and its contents to a general search file that can be viewed by all stations. When the agent in San Diego searches for a bag that fits Mr. Jones' description, they hopefully recognize the bag in Orlando as his. If so, a request is sent to Orlando to have the bag forwarded to San Diego. If the San Diego agent doesn't recognize a bag description matching Mr. Jones', he may never get his bag back.

Tag-Off. In the case of a “tag-off”, occasionally an agent will place a tag on a part of a bag that renders it susceptible to coming off such as when the tag binds two straps together. If the straps are pulled apart at any point in transit, the tag can be torn off leaving no destination identification on the bag at all. If there’s no name tag on the bag, agents trying to locate it are again dependent upon finding a bag and contents description that hopefully matches what they’re looking for. Otherwise the bag might not ever be recovered.

(Step 2) Conveyor belt forwards bag to TSA in-line screening system

Conveyor belt breaks. Conveyor belts are moving parts, and moving parts eventually break down. Figure 2 shows a technician repairing a broken belt. Unfortunately, per Jim Hansen, a baggage conveyor systems manager with Linc Systems, the belts are most susceptible to break down when they are carrying the heaviest loads, i.e. the most bags. (personal communication June 15th, 2010) In larger airports, bags typically travel longer distances on conveyor belts thus increasing the likelihood of a breakdown. When conveyors break down, it is not a matter of bags being lost but rather bags being delayed. Depending on how long the belt is down and how many bags are involved, airlines will decide whether or not to hold departing flights to connect the delayed bags.



Figure 2. Technician Repairing a Conveyor Belt.

Unfortunately, the larger airport (where breaks are more likely to occur), the less airlines are able to hold flights without compromising the integrity of their connections network. Consequently, conveyor belt breakdowns often lead to misconnecting bags.

Bag falls off conveyor belt. Even if the belt does not break, occasionally bags just fall off of conveyor belts due to vibrations, turns, inclines, etc. Although these situations are usually just a single bag rather than many bags, they can be harder to detect because there is no indication that the system is malfunctioning. It is not uncommon for several hours or even a day to go by before this type of bag is discovered.

(Step 3) System either clears bag or redirects it for further screening

As with conveyor belt issues, there is also the potential that a bag could be delayed due to TSA security screening. Most large airports now have in-line screening systems such as in Figure 3 below which means that the conveyor belt that the bag is riding on travels right through the scanning device without anyone having to handle it. Both the system and a human screener review the images for potential threats. If there

are any concerns, the bag is redirected to a review bay for further screening. This typically only takes a couple of minutes, but at least two problems can occur.



Figure 3. Airport Inline Screening System

Equipment Malfunction. Due to a malfunction of the equipment that monitors the several in-line screening machines, hundreds of bags may be redirected for further screening because the monitoring system cannot determine whether there is a suspect item in the bags. The one human agent monitoring the images as well couldn't keep up with all the in-line machines. In this situation, bags will have to be stowed rather hastily on the floor while each is sent back through the system or manually searched. It is virtually impossible for screeners to keep the bags in any kind of time order. In fact, it is often the case that those bags first put on the floor, by virtue of their being on the bottom of the pile, will be the last to be manually screened and re-inducted into the system. This can lead to bags missing their outbound flights.

Questionable Item. If a given bag is sent for manual screening, and a questionable item is identified, it is sometimes the case that the passenger must be located for questioning about the item. It is not always easy to find a passenger in an airport and they don't always respond to public address announcements. If there is a delay in finding the passenger, it can lead to both the passenger and the bag missing the flight. The

emphasis here is in the problems that can occur when passengers and bags are (perhaps needlessly) separated.

(Step 4) Cleared bag forwarded to re-induction point, manually scanned and re-inducted.

This transition is done manually to better ensure that all bags get a good scan. The manual process is more reliable than the electronic scan readers but there is still the chance that a bag gets into the system without a good scan. As we'll see in the next step, this scan determines where in the system the bag will be forwarded.

(Step 5) Based on scan, system forwards bag to one of four bag make-up areas

Some larger airports utilize a tilt-tray system such as the one in Figure 4 below to drop bags off at different make-up locations. These systems are in use worldwide in many sortation operations like those for Fedex or UPS. From time to time, however, a bag can fall off of its tilt-tray prior to arrival at its destination. The companies that operate these systems at an airport employ people to look for such bags, but a bag that falls off will certainly incur a delay and will likely miss its flight. (Hansen, 2010)



Figure 4. Bags on a Tilt-tray System

(Step 6) Agent in bag make-up area sorts bag to cart associated with the passenger's flight

Once the system delivers the bag to the final sortation area, an agent manually sorts the bag into one of a dozen or so carts. Each cart is associated with an outbound flight. If a bag is inadvertently loaded into the wrong cart, it's at risk for being loaded on the wrong flight. Even if the error is discovered, the bag will certainly incur a delay and likely miss its flight.

(Step 7) Cart is forwarded to plane-side

Anyone who has spent significant time at an airport can recall seeing a bag lying on the ground out on the airport ramp. Generally, these bags have fallen out of a cart while being transported. The carts most often used are designed with closable curtains as in Figure 5 below, but the curtains take a lot of abuse and the locking mechanisms are

often inoperative. Some bags do fall out. They are of course found, and hopefully before they are run over by another cart, but they will be delayed and potentially miss their flight.



Figure 5. Airport Baggage Carts

(Step 8) Bags on cart are loaded into the plane

Just a few years ago, the only safeguard against loading the wrong bag onto the plane was the loading agent's vigilance in reading each tag to verify destination. Today, however, all major airlines use scanners like the one in Figure 6 below that read the bar codes printed on the bag tag. The scanners include features that will audibly alert the agent if the bag they are scanning does not match the flight number that they previously entered. The catch however is that airport ramps are extremely noisy and the agent will not always hear the audible alert. There are also visual alerts on the scanner's screen. If the agent doesn't catch either the audible or visual alert, then the system's reliability at that point reverts back to agent vigilance.



Figure 6. Airport baggage scanner

(Step 9) Bags unloaded from aircraft and sorted by agents into one of several carts

When bags are unloaded from an aircraft, generally several carts are staged planeside. Some of them are designated for connection bags, and others are designated for terminating bags. In our example of a bag transiting from Cincinnati to San Diego with a connection in Salt Lake City, this would be the transition from the plane arriving into Salt Lake. The bag should be sorted into a cart setup for San Diego bags. As with previous sortations into carts, there is always the risk that the bag is placed in the wrong cart. In this case, bags are not scanned into the carts, so there is no protection from alarms.

(Step 10) Cart is forwarded to connecting flight

This step includes the same risks of a bag falling out of the cart as previously described. In the next section, it will be seen that identifying the connecting flight may be tricky.

(Step 11) Bag is transferred to a cart at the departure gate

If when the cart driver arrives at the San Diego departure gate, the crew is not yet actively loading, the driver must then stage the bag somewhere that the crew can access it when they arrive. These are typically called “drop carts”. There is one drop cart staged at each gate. The risk here is significant. If the San Diego flight does not depart for an hour or more, the plane might not even be on the field yet. If so, there is the risk that its departure gate could be changed. In this case, you have a bag waiting in the drop cart at gate B-17 for example, but the outbound flight is now scheduled for gate D-22. If the crew to load the San Diego flight has just come on duty, they may not even be aware that there was a gate change or that there is potentially a bag waiting at B-17.

(Step 12) All bags in cart(s) are loaded onto departure aircraft

This is precisely the same process described for the loading of the first aircraft with precisely the same risks. Scanners are again used and, hopefully, the agent catches any alarms for misdirected bags.

(Step 13) Bags again unloaded from aircraft and sorted by agents into several carts

This is again the same unload process as with the first flight. At this point in our example, the bag has arrived in San Diego, so it will be sorted into a cart designated for terminating bags – those whose final destination is San Diego.

(Step 14) Local claim bags transported to unload belt which carries them to claim area

In this last of our fourteen steps, bags are again subjected to another ride in a baggage cart, a transfer by the agent, and one last ride on a conveyor belt before they drop onto the luggage claim carousel that most people are familiar with.

Traditional System Summary

Although this explanation of the current system in use by all major carriers is rather lengthy, its length emphasizes the point that the current system is complicated and perhaps needlessly so. In our example, the bag was subjected to three different rides on conveyor belt systems, one tilt-tray system, three different human sorts, two different airplanes, and staging in four different carts. What makes things even more challenging is that airplanes and carts are movable, so in some sense for these steps, the agent is trying to hit a moving target. Each step's potential pitfalls may occur only a fraction of a percentage point of the time, but the cumulative effect of them all is equal to the airline's current baggage performance shown in Table 1 below – 5.26 claims per thousand passengers in 2008. (DOT, 2009) To put it another way, one in every 190 passengers fails to get their bag on time. (DOT, 2009) According to Mark Zessin, a director for

baggage handling at Delta Air Lines, these failures cost over \$172 million to the airlines that year. (M. Zessin. Personal communication in March of 2010.)

2008	# of claims	# of psgrs	rate	Cost to airlines
JAN	338,932	45,866,635	7.39	\$ 18,641,260
FEB	292,032	45,547,673	6.41	\$ 16,061,760
MAR	357,646	53,697,627	6.66	\$ 19,670,530
APR	253,507	50,774,180	4.99	\$ 13,942,885
MAY	244,249	53,109,779	4.60	\$ 13,433,695
JUN	281,707	54,695,007	5.15	\$ 15,493,885
JUL	273,970	56,288,055	4.87	\$ 15,068,350
AUG	268,902	54,002,397	4.98	\$ 14,789,610
SEP	168,582	43,685,245	3.86	\$ 9,272,010
OCT	172,398	48,528,100	3.55	\$ 9,481,890
NOV	163,842	43,692,073	3.75	\$ 9,011,310
DEC	319,591	45,910,556	6.96	\$ 17,577,505
Total:	3,135,358	595,797,327	5.26	\$ 172,444,690

Table 1. 2008 Total Baggage Claims and Costs for Major US Carriers

Table 2 illustrates where the most common failure points are. (Hasan, 2007)

Clearly the area most in need of improvement is transfers through hubs. Hub transfers are the transfers most affected by the moving parts mentioned earlier.

Global percentage breakdown of the irregularity coding for delayed baggage:		
IATA Code	Category	Percent
RL 10	Tagging Error	3%
..		
RL 20	Failed to Load	14%
..		
RL 30	Loading/Offloading Error	4%
..		
RL 40	Arrival Station Mishandling	2%
..		
RL 50	Transfer Baggage Mishandling	54%
..		
RL 60	Airport/Customer/WX/Space-Weight	5%
..		
RL 70	Tckt Error/Bag Switch/Security/Other	18%

Table 2. Breakdown of Mishandled Baggage

When a broken aircraft forces a gate change for a flight, or if a particular inbound flight arrives late, a hub becomes a complicated system of moving parts. When late arrivals force agents to rebook passengers on new itineraries, the puzzle becomes even more complex. Aircraft are moving, gates are changing, and passengers are being moved as well. These new itineraries may just be a new way to get to the same final destination, but they could also end up routing a passenger to an alternative airport in the same greater metro area. In our example, Mr. Jones could get rerouted to John Wayne International in Orange County, California, 75 miles to the north of San Diego International. Throw in a thunderstorm that closes the airport ramp for 20 minutes, and the hub operation can become chaotic. Hundreds of bags are being rerouted and agents can't possibly keep up. What is more, the total cost to airlines to provide this level of service is over \$3 billion per year just for the baggage handling component as seen in Table 3. (DOT, 2010)

2009 Airline Expenses for Baggage	Column1
Northwest Airlines Inc.: NW	110,887
Southwest Airlines Co.: WN	50,629
Hawaiian Airlines Inc.: HA	13,216
Continental Air Lines Inc.: CO	360,305
Delta Air Lines Inc.: DL	439,920
American Airlines Inc.: AA	1,014,273
Alaska Airlines Inc.: AS	29,652
United Air Lines Inc.: UA	899,435
SkyWest Airlines Inc.: OO	288
US Airways Inc.	219,348
Expressjet Airlines Inc.: XE	6,206
American Eagle Airlines Inc.: MQ	4,366
Frontier Airlines Inc.: F9	2,395
AirTran Airways Corporation: FL	15,098
Total:	3,166,018

Table 3. 2010 Major US Airline Baggage Handling Costs in Thousands

It's not hard to see that if there were a simpler method that could both deliver bags more reliably and lower airline costs, it would be of great interest airline managers.

The Pink-Tag System

When applied to all flights and all baggage as proposed, the Pink-Tag system breaks down into the following fourteen steps. To maximize similarity, we will use the same customer itinerary of Cincinnati to San Diego with a connection in Salt Lake City.

The Eleven Step Pink-Tag Process

- 1) Passenger checks in at ticket counter and proceeds with all bags to TSA checkpoint
- 2) Passenger and bags are cleared through checkpoint
- 3) Passenger proceeds with bags to gate
- 4) Passenger checks bags in at gate
- 5) Bags are forwarded to ramp area below gate for loading
- 6) Upon arrival at connecting hub, bags are forwarded to gate area
- 7) Passenger collects bags and proceeds to connecting flight
- 8) Passenger checks bags in at gate
- 9) Bags are forwarded to ramp area below gate for loading
- 10) Upon arrival at destination, bags are forwarded to gate area
- 11) Passenger collects bags and exits the airport

Potential Pitfalls

(Step 1) Passenger checks in at ticket counter and proceeds with all bags to TSA checkpoint

Under the traditional system, passengers check some bags in at the ticket counter and bring other items through the security checkpoint as carry-on. Under the proposed Pink-Tag system, all bags stay with the customer, so there is no transfer to the ticket agent, no opportunity for the bag to be mis-tagged, and no ride on a conveyor belt.

(Step 2) Passenger and bags are cleared through checkpoint

Under the traditional system, two potential pitfalls were identified. First, due to equipment malfunctions, hundreds of bags could be redirected to the re-screening area for manual searches. The Pink-Tag system relies on the current checkpoint design where one agent monitors one imaging machine. While this is more labor intensive for the TSA (this financial consideration will be reviewed later), according to Kevin Bidwell of the TSA's Operations Improvement Branch in Washington D.C., it insulates the Pink-Tag system from a major meltdown. (K. Bidwell, personal communication, July 6, 2010.) If a given machine does fail, then it is but one of many and the passenger traffic can be redirected to the other lines.

The other potential pitfall at this point in the traditional system is when a suspect item is discovered in a bag, and the TSA needs to speak with the passenger. With the

Pink-Tag system, at least the passenger and bag remain together in the screening process, and any discrepancies can be cleared up without having to go search for someone. This would eliminate excessive delays that cause passengers and bags to miss flights.

(Bidwell, 2010)

(Step 3) Passenger proceeds with bags to gate

Once through the security checkpoint, the passenger proceeds with all belongings to the gate. There will be more on this step in the economic and passenger preference sections, but for our current consideration regarding system reliability, there are really no potential pitfalls.

(Step 4) Passenger checks bags in at gate

At this point, the exchange between passenger and agent is essentially the same transaction that previously occurred at the ticket counter. In the traditional system, the pitfalls identified were mis-tags and tag-offs. These are indeed serious problems, and the possibility exists that the bag could be mis-tagged (or lose its tag) even when the transaction occurs at the gate. There is however a major difference, as was made clear by Phil Burt, a certified Industrial Engineer for Delta Air Lines. In the traditional system, after tendering the bag at the ticket counter, all of the subsequent steps to the bag's journey are dependent on the information contained on that tag. So if a tag with the wrong destination is applied to the bag, the bag goes to the wrong destination. With the Pink-Tag system, that is not the case. (P. Burt, personal communication, April, 2010)

In the Pink-Tag system, neither conveyor belt systems nor baggage handling agents make decisions about where a bag is going. Quite simply, those bags checked in at the gate for a given flight go on that flight. Since they are returned to the passenger at the end of that flight, they cannot be mis-directed. It is possible that a passenger can approach the wrong gate, and they could incorrectly tender a bag there, but with the help of gate scanners, it is very rare that a passenger actually boards the wrong flight. These passenger errors would be discovered before the bag or the passenger head in the wrong direction. Even if a passenger should board a wrong flight, their bag would go with them and be returned to them at the end of the flight. Being in the wrong city might be a big problem for the passenger, but they will not have a problem with a missing bag. It will be right there with them in the wrong city.

What's more, under the Pink-Tag system, it may not be necessary to use tags that include the destination at all, as they currently do. (Burt, 2010) Rather, the actual pink valet tags that are used today for the carry-on bags that don't fit in the regional jet overhead compartments could be implemented. These tags are perforated, with a matching barcode on either side of the perforation. As the tag is applied to the bag, the stub is torn off and handed to the passenger. In the rare event that a bag gets separated from the passenger, the barcode identification serves as the back-up identification process. But of course, preventing bags from getting separated from the passenger is what the Pink-Tag system is all about.

(Step 5) Bags are forwarded to ramp area below gate for loading

The method for getting bags from the gate to the ramp area for loading onto the aircraft has both an economic and an operational component. The economic considerations will be covered in the next section, but regarding operations, two different methods are used in the pink-tag system's current application. First, some jet-bridges have baggage elevators installed on them as in Figure 7 below.



Figure 7. Baggage Elevator Mounted on Jet-bridge

While these elevators have improved in recent years and are fairly useful for the current volume of bags handled on 50-seat aircraft, per Greg Aho, a certified Industrial Engineer with Delta Air Lines, there is reason to believe they would have difficulty keeping up on larger aircraft with greater numbers of bags. (G. Aho, personal communication, June, 2010) The second method involves the use of a belt-loader such as the one in Figure 8 below positioned on the exterior stairs of the jet-bridge.



Figure 8. Baggage Belt Loader.

In this case, passengers leave their pink-tagged carryon luggage at the bottom of the jet-bridge just prior to entering the aircraft. The belt-loader is then used to move the bags over to another belt-loader that is positioned at the cargo bin. This method is equipment intensive and would also fail to accommodate the need for gate agents to be able to check bags in early, as the transfer point is only accessible to passengers after being cleared to board. (Aho, 2010)

Given that both methods are likely inadequate, a facilities modification will need to be made to accommodate a smooth process for checking in bags at the gate. This along with staffing considerations will be addressed in the economic comparison section. For now, and with regard to reliability, it is important to stress that this system would not involve sorting or decisions of any kind. The only task to be accomplished is to move the bag from gate level to ramp level, immediately below. There is virtually no opportunity for problems that could lead to delays.

(Step 6) Upon arrival at connecting hub, bags are forwarded to gate area

As with the previous step, no method currently exists to accomplish this efficiently. A system would have to be built. However, once built, the system would be able to accommodate both arriving as well as departing flights. (J. Hansen, personal communication, June, 2010) Again, the system would be simple, likely just one belt with no decision points.

(Step 7) Passenger collects bags and proceeds to connecting flight

In this step, both the greatest potential benefit as well as the greatest concern about the Pink-Tag system comes out. The challenges at a hub associated with broken aircraft, gates changes, and foul weather were previously described. Essentially, there are two different workgroups, one above-wing and one below-wing, separately trying to coordinate the movements of the passenger and their bag, and hoping that they both arrive together at a destination. In irregular operations, the customer service agents are routing and re-routing the passengers through the hub while the baggage handlers are trying to ensure that the bags follow the passengers. The more passengers with altered itineraries, the more difficult it is to keep the bags straight. As Table 2 above revealed, more than half of all baggage failures occur at this point.

The Pink-Tag system appears to eliminate all the problems associated with aircraft changes, gate changes, and new itineraries. By returning the bag to the passenger at the arriving gate, regardless of any changes, the bag goes with the passenger to the new departure gate. From an engineering standpoint, minimizing the time of separation of

customer and bag, and the events that occur during separation, minimizes failures. (P. Burt, personal communication, May 2010)

The biggest concern expressed by engineers regarding the Pink-Tag system had to do with connection times between flights. According to Greg Aho, if airlines have to increase the amount of time between connecting flights, it represents a very significant increased cost. (G. Aho, personal communication, June 2010) His concern was that rather than being able to run to a very tight connection, the passenger would be delayed waiting for their bags to be returned to the gate. This concern requires further investigation. However, when asked if a significant problem had been noted for passengers currently using the Pink-Tag system in its current application with carry-on bags on smaller regional jets (which would represent the exact same time-connection challenge), he was not aware of any. In the initial remarks of this paper, it was noted that a system that is currently in use would have a much greater chance of implementation in a new application than a brand new, untried system. Here is a great example of why. A concern is expressed about use of the Pink-Tag system in a new way, but the system is already being used in a similar way, and therefore data should be available to determine if this is a valid concern or not.

(Step 8) Passenger checks bags in at connecting flight gate

This step mirrors the check-in process at the first flight's gate with one possible exception. The bag may not need to be re-tagged. There will be more on this in the economic discussion.

(Step 9) Bags are forwarded to ramp area below gate for loading

This step is precisely the same as for the first flight leg, and again there will be need of an efficient system for moving bags from gate to aircraft and back again.

(Step 10) Upon arrival at destination, bags are forwarded to gate area

Again, this step is precisely the same as with the previous flight leg.

(Step 11) The passenger collects their bags and exits the airport

There is no need to stop at the luggage claim area.

Pink-Tag System Summary

The Pink-Tag system's greatest strength is its simplicity. The time that a bag is separated from its owner and the number of transitions that occur during that separation are minimized. Due to its simplicity, virtually all bag claims could be eliminated. There are, however, at least four areas of concern that would need to be addressed if the Pink-Tag system is going to be given serious consideration. The first is facility constraints. As discussed above, modifications will have to be made to accommodate smooth movement of bags from the gate area to the ramp, and vice-versa. Per Jim Hansen of Linc systems,

the necessary systems are not complicated and should be able to be installed at any airport. (J.Hansen, personal communication, June 15th, 2010) It is simply a matter of cost, which will be discussed below. There also may be some concern about the amount of available space in gate hold-room areas and concourse corridors. At some of America's oldest but busiest terminals, like Atlanta's Hartzfield, these areas are already very congested, and the presence of additional bags in them might cause issues. (G. Aho, personal communication, June 2010).

Secondly, moving to the Pink-Tag system would necessarily require cooperation from the TSA. There is some reason, however, to believe that the TSA may support the idea. While there would certainly be costs associated with "moving the furniture" and re-engineering operations plans, the Pink-Tag system does afford the TSA an opportunity to merge two separate "silo" operations into one – the in-line baggage screening operation and the customer check-point operation. It's possible that if airlines would cover the initial moving expenses, the TSA could potentially save money going forward by more efficient use of personnel.

Another operational procedure that airlines would have to work out with the TSA is how to handle items that are currently prohibited in carryon luggage but permitted in checked luggage. These items currently include larger quantities of liquids, gels, and powders, as well as specialty items like blades, firearms and ammunition. According to Bidwell, the current limitations on liquids and gels may soon be eliminated. (K. Bidwell, personal communication, July 2010) If that is the case, then only the specialty items are of concern. Bags containing these items represent less than one tenth of one percent of

customer check-in bags currently. If airlines acknowledge the tremendous economic benefits of the Pink-Tag system, they will find a way to accommodate this one-in-ten-thousand customer, perhaps by means of a deal with Fedex or UPS.

Third, airlines have an obligation to ensure that their services are accessible to disabled members of the community and those that need additional assistance. In order to meet this Americans with Disabilities Act requirement, airlines hire companies to provide wheelchair service. Nothing about the Pink-Tag system fundamentally changes this, but it should be noted that if passengers will be required to get their baggage to the gates on their own, airlines may have to provide additional support.

Fourth, special consideration would have to be given to large, wide-body aircraft on which the baggage is containerized in the cargo holds. This may not be any additional problem at all, but the details would have to be considered.



Figure

Finally, the Pink-Tag system may run into challenges associated with partial implementation. If for example, only one airline implements the system at a given airport, and other airlines do not, then the TSA at that airport will still have to maintain their current split operation and lose any benefits associated with the Pink-Tag system.

Also, if an airline implements the Pink-Tag system at some locations and, due to facility constraints, not at others, maintaining two different systems in their network may become confusing to passengers. These partial implementation challenges are an area for further research.

CHAPTER III

ECONOMIC COMPARISON OF THE SYSTEMS

Operations

Due to the nature of the Pink-Tag system as a self-service system where the customer does more of the work, a considerable reduction in labor expenses is assured, and as labor is the main component in baggage handling expenses, an overall operational savings is also assured. What airline managers will also have to factor in along-side the operational savings is whether the customers will accept the Pink-Tag system. This question is precisely what will be answered in the next chapter. Here however, the financial benefits are laid out with the assumption that the new system will not affect traffic positively or negatively.

In order to access the total financial benefit of the Pink-Tag system, the savings from baggage handling labor and equipment as well as baggage claims will need to be combined with expected increases in the costs for wheelchair assistance. This will identify a net ongoing operational savings. The operational saving amount will then be compared to the one-time expected facility modification construction expense to determine a time-frame for return on investment and a total ten-year savings.

Operational Comparison

According to Amalia Cerbin, a staffing analyst for Delta Air Lines, the savings in baggage handling expenses are significant, but they vary depending on the size and complexity of the operation. (personal communication, June 2010) Because larger airport operations are more heavily involved in handling passengers transferring through their city (rather than those originating or terminating in the city), these larger operations stand to save a higher percent of labor expenses than smaller ones. Table 4 below shows the expected percentage savings for Delta operations at a few select airports.

% Baggage Handling Labor Saved with Pink-Tag system				
		Traditional FTE	Pink Tag System FTE	Percent Savings
	CVG	298	225	24%
	ATL	3539	1595	55%
	IND	73	56	23%
	DTW	1090	482	56%
		4999	2358	53%

Table 4. % Baggage Handling Labor Saved with Pink-Tag system.

Delta's CVG Operation as an Example

In order to arrive at a complete operating picture for a given airline at a given location, Delta's CVG operation will serve as an example. Currently CVG spends approximately \$19 million annually on baggage handling labor, \$1.7 million in baggage claim expenses, and \$240,000 in wheelchair service. If the Pink-Tag system can eliminate 90% of claims, and passenger assistance costs double, then the operational comparison for CVG would look like Table 5 below.

DL CVG Operating Expenses	Traditional	Pink-Tag	Difference
Baggage Handling	19,000,000	14,440,000	4,560,000
Baggage Claims	1,700,000	170,000	1,530,000
Passenger Assistance	240,000	480,000	-240,000
Annual Operational Savings			5,850,000

Table 5. Delta CVG Annual Operating Savings with Pink-Tag System.

Baggage handling system expert Jim Hansen of Linc Systems estimates that the one-time cost of the facility modifications would be \$200,000 per gate or less. If we use the high estimate, then the cost to outfit CVG’s 28 gates would be \$5.6 million. That gives us a return on investment time-frame of just under one year and a total ten year savings from the plan of over \$50 million just for CVG.

Estimating Delta’s Atlanta Operation

Again per Cerbin, (personal communication, June 2010) the larger the facility is, the greater the leverage of savings. Atlanta’s baggage handling labor expense is over ten times that of CVG, estimated at \$275 million annually. Per Table 4, the Pink-Tag system can save Delta’s Atlanta operation 55 percent of labor costs, or \$124 million annually. Even with a more conservative estimate, it is conceivable that Delta’s largest facility in Atlanta could save \$100 million or more annually after a one-time facility construction cost of \$34 million. Atlanta’s return on investment may be as little as 4 months, and their ten year total savings could be as much as \$1 billion. With potential savings numbers like these, airlines may be highly motivated to find solutions to any obstacles.

Baggage Fees

One area that warrants special consideration is the fees that virtually all airlines charge for checked baggage. Airlines have already endured the public ridicule that came with charging separately for a service that most believed was poorly provided. They do not intend to go backward and give up any of that revenue. Therefore, it must be assumed that the same fees that are collected today at the ticket counter will need to be collected at the gate. There is nothing inherently difficult about this, and the resources currently dedicated to collecting fees for bags at the ticket counter can simply be moved to the gate area.

By moving this activity to the gate area with the Pink-Tag system, airlines actually have an opportunity to solve a persistent problem with bags. Since the introduction of bag fees, more and more travelers attempt to skirt around the fees by bringing bags through security and to the gate. These additional bags have caused considerable difficulty in the boarding process. Inevitably, the overhead space is all used up and there are a number of bags left over that must be stowed below in the cargo bins.

Today, gate agents are hesitant to challenge customers that are bringing too much onboard because they do not have the resources to easily process bag charges at the gate. Therefore, many passengers successfully avoid bag fees and the boarding process takes longer than it should.

With the Pink-Tag process, agents will have extra help in the gate area (redeployed from the ticket counter) and also the electronic equipment needed to quickly

process bags and fees. This will potentially enhance the amount of fees that airlines collect and also offset the concerns raised earlier about connection times between flights.

CHAPTER IV

PUBLIC ACCEPTANCE OF THE PINK-TAG SYSTEM

The Pink-Tag System as a Self-Service System

When considering whether the public would accept the pink-tag system, it is important to realize that, at its heart, the pink-tag system seeks to enlist the customer to perform more of the work involved in baggage handling. Such self-service implementations have absolutely transformed certain industries in recent years. Many people first noted this transformation in self-service gas stations and Automated Teller Machines in the 1970's, but Salomann (2009) places the beginning of the self-service era much earlier, in 1916. In that year, Clarence Saunders, founder of Piggly Wiggly grocery stores, realized that waiting customers were "an untapped resource" and could increase efficiencies for both the store and themselves if they gathered their own groceries and brought them to the clerk. This of course freed up the clerk to more expeditiously process orders at the desk. Thus began the era in which the customer was considered part of the delivery system.

Many others have recognized the role of the customer as part of the team that delivers the service. Some insisted that customer involvement must extend even farther. Lovelock (1979) says that managers of service organizations should ask the question "How can our customers become more productive inputs into the creation of the services that we produce for them?" Not all services lend themselves equally to customer participation. Mills (1986) attempted to separate various service industries into

categories of low, medium, or high customer participation. He uses as an example the relationship between physician and patient as one that requires a high degree of participation from the client. Engineering or legal services were categorized as medium, and banking services were considered low participation on the part of the client.

Lovelock (1979), however, points out that including the customer in the development of the offering is critical. He lists five instances where companies blundered in their offerings due to failing to include the customer in production design. Typically, improved productivity in an organization has been relegated to the production department, but Lovelock believes that a company's marketing department is responsible for managing demand and should be extensively involved in helping the customer perceive the value of the automated service.

Bateson (1985) perhaps provides the keenest insight into the dynamics of self-service. His research identifies a number of psychological factors involved in how customers respond to self-service offerings. These factors included:

- *Time*: Whether the self-service offering is perceived as time-saving or not.
- *Control*: Whether the self-service offering makes the customer feel more in control
- *Effort*: Whether the self-service offering is perceived as requiring more effort
- *Dependence*: Whether the self-service offering enhanced the customer independence
- *Efficiency*: Whether the self-service offering was perceived as more efficient
- *Human Contact*: Whether there was a perceived loss of human contact
- *Risk*: Whether the self-service offering exposed the customer to social or psychological risks such as the ability to perform the task while others wait for you

The results of Bateson's findings are that "some people seem to find participation (*in the service delivery*) inherently attractive" across a variety of situations, from banks to

restaurants to gas stations. Bateson established that some people, even when any external benefit to self-service is removed, such as a lower price per gallon for self-service gasoline, just prefer to provide the service themselves. He correlates this preference to the psychological factors listed above.

The question to be addressed in this study is whether, as Arnoult (2009) suggests, frequent travelers on commercial airlines find self-service offerings “inherently attractive” more often than those who don’t fly very often. If it can be established that they do, then airlines should be able to implement additional self-service measures confidently in their baggage handling systems, including the pink-tag system. The null-hypothesis then becomes:

H_0 = frequent airline travelers do not prefer self-service offerings more than infrequent flyers.

Methodology

In order to test this hypothesis, a survey was developed to divide people into five separate groups based on how many roundtrips they took on commercial airlines annually. For simplicity, these groups were collapsed into just two: those who made four or less roundtrips per year, and those who made 5 or more roundtrips per year. These two groups were then compared in terms of their preference for self-service offerings in four different settings: banks, grocery stores, home improvement stores, and airports. Preference responses were on a standard Likert scale of one to five, with five being “most inclined”. As with Bateson, an attempt was made to negate ulterior motives

and isolate a preference for the inherent benefits or disadvantages of self-service offerings.

A sample of convenience was used by emailing a link to the survey to 221 general contacts of the author of this study on April 13th, 2010. The recipients were encouraged to in turn email the survey to their associates and so on. At least two posted the link to the survey on their Facebook sites. By April 16th, a total of 326 responses had been collected and the collection window was closed. Of these, five responses were thrown out because they were incomplete.

Analysis of Results

A number of *t* tests were run to compare the means of the two groups for each of the individual self-service locations. Table 6 below displays the means of the various responses for each of the two groups and also the results of the *t* tests run.

Preference for Self-Service Offerings					
	T scores				
	Bank	Grocery	Home Imp	Airport	Ave of All
4 or Less vs 5 or more	3.348	1.644	2.823	4.878	9.807
All respondents vs 5 or more	2.900	1.424	2.445	4.224	5.314
Significant <i>T</i> at .05 two-tailed test:		2.021			

Table 6. Preference for Self-Service Offerings.

The *t* test statistics reveal that the frequent flyer group demonstrated a significantly higher preference for self-service offerings in all settings except grocery stores. This was true when frequent flyers were compared to the less frequent flyers and also when frequent flyers were compared to the sample as a whole. Raw scores in the

grocery store setting were also higher, with means of 3.744 and 3.406 respectively, but the difference was not enough to be considered statistically significant. Based on these *t* tests, the null hypothesis must be rejected. It can therefore be affirmed that frequent airline customers generally prefer self-service offerings.

One might think intuitively that either age or gender would reveal a difference in preferences for self-service offerings, but the comparative *t* tests demonstrated otherwise. In all four settings, neither gender nor age revealed any significant difference. This perhaps strengthens the hypothesis that those who fly more really do have a strong preference for self-service offerings.

Customer Preference Conclusions

T tests comparing those who fly more frequently to those who fly less and the general population confirm Arnoult's (2009) assertion. Frequent flyers prefer self-service options. There is good reason to believe that this is due to wanting more control of the process. (Bateson, 1985) As the old saying goes, "If you want something done right, do it yourself". Travelers must fend for themselves in many ways, and those who travel more often have honed the process very finely. They know what to bring with them, and they know what to leave at home. They also know the best practices for getting through all the transition points, whether it is at check-in, the TSA checkpoint, or ground transportation options.

Given this demonstrated pro-self-service attitude on the part of frequent flyers, airlines should be all the more encouraged to develop additional self-service options for

their most valuable customers. Baggage is clearly an area of service that needs to be improved. Many frequent flyers do everything they can to avoid checking baggage as it is currently handled. The Pink-Tag system appears to be ready in the waiting as a proven and reliable method of handling baggage that would help passengers (and especially frequent flyers) feel more in control of the process.

CHAPTER V

FINAL RECOMMENDATIONS

Even though this study has devoted some forty pages to exploring the details and ramifications of the Pink-Tag system, the very basic and simple premise should not be obscured. That is - the Pink-Tag system is used today by anyone who travels on regional jets with carry-on baggage only, and it is very reliable. If one adds to its reliability that airlines will likely save money and customers will likely prefer it, the Pink-Tag system seems to warrant serious consideration.

The concerns raised above in the final paragraphs of the systems comparison are real concerns. Facilities constraints, TSA cooperation, and ADA compliance issues must be addressed, but there ought to be plenty of motivation on the part of air carriers to find solutions to those challenges.

The implementation process also remains a challenge. Whether it is possible for only one carrier to implement the Pink-Tag system or whether all the carriers must work together to benefit themselves and the public is an area for further research. One possible interim step could be adding a Pink-Tag system option on all flights for carry-on baggage only while keeping intact the current methods of handling checked bags. This would allow the public to become more familiar with the process without limiting their options or causing confusion. Once the process became part of the regular workings of all flights, it is expected that more and more travelers would gravitate to it. The stage

would then be set to eliminate checking bags at the ticket counter without too much confusion.

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