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THESIS

**RISK-BASED AVIATION SECURITY:
DIFFUSION AND ACCEPTANCE**

by

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March 2012

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RISK-BASED AVIATION SECURITY: DIFFUSION AND ACCEPTANCE

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ABSTRACT

The Transportation Security Administration (TSA) is continually under public pressure to improve aviation security screening for air passengers while simultaneously protecting the public from all perceived threats to commercial aviation.

Applying acceptance models to predict passengers' intentions to use voluntary security programs could lead to more efficient deployment of technology and procedures or the termination of a security program before significant government resources are dedicated to the program. Accelerated adoption rates of voluntary programs could save the taxpayers millions of dollars and ensure higher levels of security for aviation passengers. Application of acceptance models and diffusion of innovation in government security programs presents a relatively untapped perspective in homeland security and, more specifically, aviation security.

This research provides options for modification of the communication plan for TSA's risk-based security policy during its initial implementation stages in 2012. Through application of social behavior prediction models such as the theory of planned behavior, technology acceptance models, and diffusion of innovations, TSA could drastically influence the adoption rate of risk-based security policy, potentially increasing the security effectiveness of aviation security while allowing for faster passenger screening necessary to adjust for expected increased flight loads over the next decade.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACLU	American Civil Liberties Union
AFGE	American Federation of Government Employees
AIT	Advanced Imaging Technology
ALPA	Air Line Pilots Association, International
APA	Allied Pilots Association
ATR	Automated Target Recognition
BDO	Behavior Detection Officer
BIB	Budget-In-Brief
CBP	Customs and Border Protection
CDRH	Center for Devices and Radiological Health
DHS	Department of Homeland Security
EPIC	Electronic Privacy Information Center
FAMS	Federal Air Marshal Service; Written FAMs when identifying Air Marshals within the service.
FDA	Food and Drug Administration
GAO	Government Accountability Office
IED	Improvised Explosive Device
JHU/APL	Johns Hopkins University Applied Physics Laboratory
KCM	Known Crew Member
NIST	National Institute for Standards and Technology
RBS	Risk-based Security
TDC	Ticket Document Checker
TSA	Transportation Security Administration
TSO	Transportation Security Officer
USTA	U.S. Travel Association
WTMD	Walk-through Metal Detector

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I. INTRODUCTION

A. BACKGROUND

The year 2011 marks the tenth anniversary of arguably the most devastating terrorist attack the world has ever known, measured through loss of life and economic damage. Since 9/11, the United States has hardened its defenses regarding aviation security through a system of layered defensive measures designed at each level to thwart various attacks through both overt and unpredictable screening. This layered system continues to evolve through constantly improving technology, techniques, and procedures designed to defeat emerging threats. In addition to these layers of security, the Transportation Security Agency (TSA) has for many years screened 100 percent of the passengers at security checkpoints prior to boarding an aircraft originating from the United States. The goal of all of these measures was to ensure the security of the traveling public and the nation's transportation system.

TSA has achieved some success in its mission to keep commercial aviation free from acts of terrorism. Despite several attempts by terrorist groups and individuals to bring down commercial airliners, none have been successful. This relative success has come at a significant cost to the American taxpayer. TSA's FY2011 multi-modal budget was approximately \$8.2 billion, of which \$5.6 billion was dedicated to aviation security (Department of Homeland Security [DHS], 2011). As this budget continues to increase, questions regarding the effective use of funding naturally arise. The balance between cost and security weighs especially heavy when there has not been a successful terrorist attack against aviation assets since 9-11.

B. PROBLEM STATEMENT

TSA's regulatory efforts to enhance airport security post-9/11 had the unintended consequence of reducing the convenience of air travel, which in turn caused a five percent decline in the demand for air travel in 2002 (Blalock, Kadiyali, & Simon, 2005). In order to reduce wait times that increased due to the new security regulations, TSA

increased the number of screeners from the pre-9/11 level of 16,200 private security screeners to 56,000 passenger and baggage screeners by the end of 2002 (Blalock et al., 2005). Passenger waits time initially increased despite the significant increase in the workforce. While screening was noticeably enhanced from pre-9/11 levels, the 9-11 Commission recommended a number of aviation specific enhancements to security policy (National Commission on the Terrorist Attacks upon the United States [9/11 Commission], 2004). Noting inadequate aviation screening and access controls, the 9/11 Commission recommended enhanced passenger pre-screening using risk-based prioritization for limited resources. TSA has received mounting criticism for overemphasizing aviation passenger screening to the detriment of air cargo, airport access controls, protecting airliners from shoulder-fired missiles, and the security of general aviation aircraft (Elias & Frittelli, 2011). Without attempted attacks against other modes of transportation to validate the criticism, TSA has continued to leverage the vast majority of its security resources in aviation.

The 9/11 Commission recommended setting risk-based priorities for defending transportation assets, noting that hard choices were required to allocate limited resources and that perfection was unattainable (Kean & Hamilton, 2004). TSA set priorities placing the vast majority of its budget to protect aviation assets averaging 79 percent from 2004–2010 according to the DHS Budget-In-Brief (BIB) reports shown in table 1, below. The assertion that former TSA Administrators David Stone and Edmund “Kip” Hawley utilized risk-based security (RBS) within TSA is supported by their budgets, which placed a vast majority of TSA funding towards protecting aviation assets.

Table 1. TSA Budget, 2004–2011

Fiscal Year	TSA Budget (billions)	Aviation Budget (billions)	Aviation as a Percentage of TSA Budget
2010	\$7.7	\$6.1	79% ^a
2009	\$8.0	\$5.6	70% ^b
2008	\$6.8	\$5.5	81% ^c
2007	\$6.7	\$5.8	87% ^d
2006	\$6.2	\$5.4	87% ^e
2005	\$6.0	\$4.3	72% ^f
2004	\$4.6	\$3.7	80% ^g
Average	\$6.6	\$5.2	79%

Table 1 Legend

a. DHS, 2011, p. 89

b. DHS, 2010, p. 72

c. DHS, 2009, p. 77

d. DHS, 2008, p. 45

e. DHS, 2007, p. 45, FAMS included from this year forward

f. DHS, 2006, p. 40, FAMS not included

g. DHS, 2005a, p. 40

In 2005, Secretary Michael Chertoff announced sweeping changes within the Department of Homeland Security and an apparent alignment with a more risk-based approach to security (DHS, 2005b). Then newly appointed TSA Administrator Kip Hawley reiterated the Secretary’s sentiments by writing to the Senate Homeland Security and Governmental Affairs Committee that “the federal government must focus resources on the basis of consequence, threat and vulnerability assessments and the prioritization of risks” (Keane, 2005). However, throughout Hawley’s tenure as the head of TSA, there was very little evidence of risk-based policy change (Poole, 2008). The U.S. Government Accountability Office (GAO) (2007) noted that DHS lacked a comprehensive strategy and integrated management systems, which limited the department’s ability to carry out its homeland security responsibilities in an effective, risk-based way while simultaneously rating TSA’s progress as moderate.

While the GAO criticized DHS and TSA, the U.S. Travel Association (2011) criticized Congress for “wild swings” in public policy as they respond to attempted attacks and public criticism. The U.S. Travel Association (USTA) report notes that dramatic policy shifts undermined America’s ability to create a secure and efficient aviation system while failing to develop a long-term vision for aviation security. Examples of responding to the last threat included policies to remove shoes for screening, after Richard Reid attempted to ignite explosive stored in the soles of his shoe in 2001; the banning of liquids after British police foiled a plot to destroy U.S.-bound transatlantic aircraft using explosive disguised as sport drinks; and the rapid deployment of advanced imaging technology (AIT) after an attempt to destroy a Detroit-bound flight in December of 2009 using non-metallic explosive components. Much of the actual policy change since 2001 appears to have been driven by political imperatives to reassure frightened populations that air travel was still safe (Poole, 2008), rather than designing and implementing a true risk-based passenger security system.

Despite claims by former TSA Administrators Stone (Korade, 2009) and Hawley (Hawley, 2007) that TSA conducted risk-based transportation security; passengers since 9/11 have been treated to a one-size-fits-all method of passenger screening (U.S. Travel Association [USTA], 2011). Hawley (2007) characterized risk-based security as a paradigm where the nature of the threats to aviation is managed consistently with what we understand of those threats, our vulnerabilities, and the potential consequences. According to Hawley, risk-based security is a way of sharing resources across all risks, both high and low, in strategic proportions. Previous administrators, including Hawley and Stone, dedicated the vast majority of the TSA budget to aviation security, allowing budgets for surface and cargo transportation to lag far behind (DHS, 2009, 2010). TSA was using risk-based security throughout the entire multi-modal transportation arena, but was not using risk-based security within aviation passenger screening.

Initially, TSA’s new Administrator, John S. Pistole, made no significant changes to TSA’s budget (DHS, 2011) or policy, but he continued down a similar path of treating all passengers equally after he was sworn in as TSA’s Administrator in June, 2010.

Pistole immediately came under fire for his decision to rapidly deploy AIT and introduced new enhanced pat-downs that Pistole himself characterized as “invasive” and “uncomfortable,” but necessary to thwart attacks on civil aviation (Abrams, 2010). The rapid deployment resulted in a lawsuit for review by the United States Court of Appeals for the District of Columbia in *Electronic Privacy Information Center (EPIC) et al. v. Department of Homeland Security et al.*, (2011) where EPIC claimed TSA’s use of the AIT violated the Fourth Amendment and should have been the subject of notice-and comment rulemaking before adoption. The court found that though there was no violation of the Fourth Amendment, TSA failed to issue notice and solicit comments prior to using AIT as a primary screening tool and ordered TSA to promptly proceed to seek comments (*Electronic Privacy Information Center [EPIC] et al. v. United States Department of Homeland Security [DHS] et al.*, 2011).

In June of 2011, TSA continued to press forward without public comment when Administrator Pistole addressed Congress and introduced a plan to utilize risk-based security within passenger security screening where TSA distinguishes between passengers who are likely to pose little risk and those about whom little is known using identity-based screening (Pistole, 2011). The concept of risk-based security gathered momentum on July 14, 2011 when TSA publically announced a program that will allow pre-qualified passengers to pass through airport security checkpoints more swiftly using an expedited process (Transportation Security Administration [TSA], 2011b). TSA began promoting this risk-based, intelligence-driven approach where eligible passengers voluntarily provide personal background information as a part of a pre-screening process for the purpose of making risk assessments on passengers prior to their arrival at the airport checkpoint. Passengers validate their identity at the airport and then may be referred to a lane where they will undergo expedited screening under this new risk-based program called PreCheck. TSA Administrator Pistole has now allowed some variants that show progress towards a risk-based approach and has been credited for making positive changes to the agency based in common sense (Postcrescent, 2011).

Expedited screening seems prudent under current passenger loads and even more practical given the projected increase in passenger loads over the next several years. According to the Joint Planning and Development Office (JPDO), a government organization created to plan and coordinate the development of the Next Generation Air Transportation System (NextGen), the number of commercial airline travelers is expected to show a two to three-fold increase by the year 2025 (Joint Planning and Development Office [JPDO], 2006). Noting that the current system for screening passengers is barely sufficient to process the approximately 50,000 flights per day in the United States, it follows that an increase in the number of flights to 100,000 or 150,000 would render current processes inadequate (Jensen, 2008). In order to process the estimated increase in passengers per day, TSA will have to make dramatic changes in its security paradigm and risk-based aviation security may well fill that need.

Former Secretary of Homeland Security Tom Ridge stated in his U.S. Travel Association report that TSA has historically deployed new screening technology because of a recent event or attempted attacks on aviation rather than thoughtful, long-term development strategy that is based on risk and driven by intelligence (USTA, 2011). The resulting quick deployment of advanced imaging technology (AIT) in November of 2010 resulted in public backlash (Gast, 2010) and a suit by the Electronic Privacy and Information Center (EPIC et al. v. DHS et al., 2011).

TSA continues to invest in technology that is intended to stop prohibited items from getting aboard commercial aircraft. This focus on stopping prohibited items rather than dangerous people from boarding an aircraft may be inefficient in terms of dedicating resources to stop acts of terrorism. The concept of a risk-based approach to aviation security offers a paradigm shift that allows TSA to concentrate its efforts on passengers whom little is known and less on those whom much is known and are considered a lesser threat to aviation.

After nearly a decade of prompting by public officials to support a risk-based approach to aviation screening, the question becomes, why has the United States not implemented such a program? The American public may be reluctant to accept new

programs or technology that are perceived as more difficult to use or lacks usefulness compared to the current system. Within perceived ease of use or usefulness exists a reluctance on the part of the American public to adopt new policies or technology that may invade their privacy (EPIC et al. v. DHS et al., 2011). Failing to heed public concern may result in further litigation that is not only costly for the taxpayer, but delays deployment of technology and implementation of security procedures that are designed to keep air travel safe. Furthermore, risk-based security presents a cultural shift in how TSA implements security at airports, dividing the public into broad categories of who is well known to the government and who is not. As evidenced by public outcry with changes to security procedures following the shoe bomber, the liquids plot, and the Christmas Day bomber, TSA's methods of implementing drastically new procedures are not well received. However, the consequences of not managing increased flight loads through a risk-based screening process will mean either a significantly increased budget for aviation screening or longer wait times at the airport as TSA utilizes the same procedures for more passengers.

C. RESEARCH QUESTIONS

What factors can influence the diffusion and acceptance of risk-based aviation security programs by the public?

What strategies can be used to influence the diffusion and acceptance of a risk-based aviation security program?

D. ARGUMENT

The Transportation Security Administration (TSA) is continually under public pressure to improve aviation security screening for air passengers while simultaneously protecting the public from all perceived threats to commercial aviation. A recent example relates to the rapid deployment of advanced imaging technology (AIT) that the American Civil Liberties Union (ACLU) called a virtual strip search (American Civil Liberties Union [ACLU], 2010). Administrator Pistole has stated that the AIT was the best technology available that could have stopped the Christmas Day bomber (McCarter,

2011), who hid non-metallic explosives in his underwear. AIT originally had monitors next to the machine that showed a chalk image of the passengers' body showing any anomalies or items under their clothing. Privacy groups complained that Transportation Security Officers could see both the image and the passenger. The immediate result was the use of viewing rooms where the officer screening the passenger communicated with another officer that could view the image, but not the passenger. This was satisfactory for a short time before public complaints about the image itself became prevalent. TSA responded by releasing automated target recognition (ATR) software to the Rapiscan AIT machines. The debate between the public, privacy groups, and TSA could have been done in advance saving the cost of litigation with EPIC and time and resources changing procedures three times for the same technology within one year.

Balancing aviation security with public perception of threats has been fraught with controversy. The courts agree, as evidenced by a recent United States Court of Appeals grant of a petition for review, stating that TSA was not justified in its failure to initiate a notice-and-comment rulemaking prior to announcing rapid deployment of AIT scanners for primary aviation screening at commercial airports (EPIC et al. v. DHS et al., 2011). The paradox is that TSA intimates that it must deploy new technology quickly to engage emerging threats to aviation (Napolitano, 2010), but the public wants to ensure privacy laws are upheld through notice-and-comment, which slows the timeline of deploying new equipment and implementing new procedures.

There are advantages to a risk-based security system in which TSA focuses more attention on passengers that potentially pose a greater risk because the government knows little or nothing about them. Administrator Pistole introduced a pilot for the PreCheck program where certain individuals may be eligible for expedited screening and forego some of the banalities of checkpoint searches (Ahlers, 2011). According to Pistole, passengers who voluntarily release certain information about themselves may be eligible for the program, but are still subject to random and unpredictable screening (Ahlers, 2011). The risk-based approach has been hailed by representatives from the Monument Policy Group, the U.S. Travel Association (Ahlers, 2011), and the Air Line Pilots

Association (ALPA) (Stellin, 2011), citing concerns about increased flight loads and budgetary pressures as reasons to implement PreCheck.

Plans to pilot Administrator Pistole's risk-based security approach are largely internal to TSA with limited interaction with the public or organizations that historically raise issue with such tactics in the courts or the media. Technology acceptance models or diffusion of innovation has not been applied to aviation security programs. Applying acceptance models to predict passengers' intentions to use a voluntary security programs could lead to more efficient deployment of technology and procedures or the termination of a security program before significant government resources are dedicated to the program. Regarding diffusion of new security programs, application of Rogers' diffusion of innovations (DOI) may lead to accelerated adoption rates cutting costs associated with piloting new programs, marketing, mass deployment, and avoiding indirect and less tangible costs associated with thwarting terrorist acts and avoiding litigation. Accelerated adoption rates of voluntary programs could save the taxpayers millions of dollars and ensure higher levels of security for aviation passengers. The application of acceptance models and diffusion of innovation in government security programs presents a relatively untapped perspective in homeland security and, more specifically, aviation security.

Furthermore, the effort is designed to build capacity within RBS which will continue to change as a complex adaptive system; that is, a self-organizing system with many autonomous parts that responds to external changes through internal feedback (Lucas, n.d.). How quickly the system responds can be influenced by better understanding influential factors.

E. SIGNIFICANCE OF RESEARCH

The significance of this research is that it provides options for modification of the communication plan for TSA's risk-based security policy during its initial implementation stages in 2012. Through application of social behavior prediction models, such as the theory of planned behavior, technology acceptance models, and diffusion of innovations, TSA could drastically influence the adoption rate of risk-based

security policy potentially increasing the security effectiveness of aviation security while allowing for faster passenger screening necessary to adjust for expected increased flight loads over the next decade. The current ability for TSA to screen aviation passengers will come under continual strain, according to the Joint Planning and Development Office (2006), who estimates that the number of commercial airline travelers is expected to show a two to three-fold increase by the year 2025. This increase would render current processes inadequate (Jensen, 2008), requiring either a massive increase in the TSA workforce or the implementation of a drastically different screening process that is quickly accepted by the public. TSA announced the adoption of the new policy without applying an apparent communication plan that accounts for factors that influence the level of public acceptance. TSA has historically implemented new policy without proper public notice-and-comment rulemaking prior to adoption. This thesis proposes the application of three behavior models to improve the rate of passenger acceptance of a vastly improved risk-based security policy.

F. METHODOLOGY

1. Appreciative Inquiry

The goal of this research is to better understand the factors that influence the adoption of a risk-based security (RBS) system and its programs through the application of diffusion and acceptance model components. The goal is to recommend changes so that RBS programs are widely and rapidly adopted by the public, improving security, and reducing inefficiencies in implementing security policy. This will be accomplished through a comprehensive review and synthesis of existing theoretical models used to better understand the diffusion and acceptance of innovations and technologies. Analysis will focus on strengths of models or frameworks as they relate to specific RBS programs within TSA. The synthesis of the literature guided the development of an idealized model that may be used to better understand factors influencing the diffusion and acceptance of a risk-based approach to airport screening and enabling technologies.

The method used for this research is appreciative inquiry. Barrett and Fry (2008) describe appreciative inquiry as an approach to capacity building through asking questions that illicit a shared image of the most positive potential of an organization. Appreciative inquiry is a strength-based approach that focuses on key features of a system regarding health and wellbeing rather than identifying and correcting needs, gaps, and problems.

The appreciative inquiry approach is explicitly intended to search for strengths within a system to discover, imagine, design, and deliver latent and untapped capacity to pursue a shared image of a preferred future (Barrett & Fry, 2008). TSA's risk-based approach to security has many positive aspects, such as expedited screening for pilots, which were achieved through meaningful dialogue with airlines and airline employee associations—signifying some elements of appreciative inquiry. Conversely, TSA has attempted to implement some programs, such as the accelerated deployment of the advanced imaging technology that experienced limited user acceptance and the resolution pat-down program, which has experienced a very low rate of diffusion and understanding in the aviation security environment (Canning, 2010). This research focuses on a synthesis of acceptance models and the literature on DOI to show what factors can influence the diffusion and acceptance of RBS programs and what strategies can be used to increase the rate of adoption and influence the public's intent to use future RBS programs.

2. Sample

Data for this research was compiled from four primary types of sources. The first is U.S. government reports, studies, and press releases citing actions taken. The second is sources of public perception primarily drawn from open-source news media. News media can be biased and special care is taken to note biases, especially when not backed by validated studies or data. The third source of data comes from third-party organizations that have both political influence and an affected constituency. These organizations have the ability to persuade their members, the public, and government officials through information sharing, press releases, and lobbyists. The fourth source of

data comes from scholarly work primarily by social scientists where parallels of data can be drawn regarding DOI or social behavior prediction models.

The Transportation Security Administration provides a wealth of information on its own programs through its own Website at TSA.gov. Additionally, TSA public affairs and the Department of Homeland Security post testimony of officials to Congress and speeches by senior officials. These documents serve as irrefutable evidence of the direction and intent of risk-based security from the perspective of the U.S. government. Documents are a matter of public record and are often backed by independent studies providing a level of validity that is difficult to repudiate.

The Congressional Research Service (CRS) provides policy and legal analysis at the behest of members of Congress. CRS is widely regarded as a source of authoritative, comprehensive, and nonpartisan research. CRS has published a number of papers regarding the Transportation Security Administration's path forward and elements of risk-based security. The nature of CRS reporting provides evidence of the strengths of policy within TSA and regarding RBS. This balanced approach to research presents valuable data useful for appreciative inquiry.

The Government Accountability Office (GAO) is another independent, nonpartisan resource for Congress. According to its Website, their mission is to provide "Congress with timely information that is objective, fact-based, nonpartisan, nonideological, fair, and balanced" (Government Accountability Office [GAO], n.d.). GAO reports often form the basis for Congressional investigative action and are intended to make government more efficient, effective, ethical, equitable, and responsive. GAO reporting often leads to laws and acts that improve government operations.

The news media provides more than ample sampling of perceptions regarding TSA's decision concerning RBS. More difficult to manage is the validity of mass news media as it often lends itself to opinion without data. However, this study is about public perception and acceptance of new technology and procedures of risk-based security, which lends itself to gauging public opinion. News media is a prevalent source of information regarding public opinion and perceptions and is tempered through the

analysis of the samples in frequency and veracity of data. Despite the preponderance of news articles questioning the wisdom of accelerating the deployment of advanced imaging technology to airports around the country in the fall of 2010 (Gast, 2010), a survey from Gallup showed that in January, 2011 showed that 78 percent of travelers actually approved of the use of the new technology (Jones, 2011). Other surveys by CBS, Trip Advisor, and Travel Leader showed even higher acceptance rates from 79 percent to 81 percent (TSA, n.d. a). News media provides requisite sampling, but does not always present the legitimacy of other samples provided in this research.

Interest groups such as the U.S. Travel Association, Electronic Privacy Information Center (EPIC), and the Air Line Pilots Association, International (ALPA) have exhibited influence on their constituency, the public, and Congress. The U.S. Travel Association's 2011 document *A Better Way: Building a World Class System for Aviation Security* laid out clear recommendation for Congress to improve the air travel experience. The Blue Ribbon Panel that wrote the document was led by former Secretary of Homeland Security Tom Ridge and garnered the support of air travelers through opinion surveys and recommendations from bloggers on its Website. EPIC's lawsuit against DHS highlights the need for public comment prior to adoption of new policies or technology that has a major impact on the traveling public. While lawsuits can be costly in time and resources, they ensure the balance of privacy concerns and applicability of law regarding government programs. The Air Line Pilots Association and other associations have been influential in providing TSA with feedback regarding the Known Crewmember (KCM) program. ALPA's involvement shows that TSA recognizes the value of associations whose constituency is impacted by policy.

Interest groups inherently harbor some bias in their actions. The U.S. Travel Association's interests lie in political influence they exert as a collection of businesses and individuals vested in the growth of travel within the United States. USTA's objectives to advance policies to grow the travel business may, in some cases, counter security efforts. EPIC is a public interest research center focusing public attention on emerging civil liberties issues and protecting privacy, the First Amendment, and

constitutional values. They are supported by donations and a trust and self-report revenue and expenses of approximately one million dollars per year (EPIC, 2008). ALPA's primary interest as the largest airline pilot union in the world is the support of over 53,000 members. Their critical services include political advocacy as well as the safety and security of pilots and the airline industry (Airline Pilots Association, International, n.d.). Interest group input to government security programs is important to ensure public and private interests that will likely affect RBS program adoption rates and acceptance. While interest group input is important for public and private support of RBS programs, biases are noted when appropriate as the primary goals of these groups are not necessarily aligned with aviation security.

Comparative data are drawn from scholarly work by social scientists with parallel fields of study to aspects of RBS. A sampling of this work is detailed in the literature review and includes work by a number of social scientists on 1) government employees intentions to modify internal controls when implementing e-services; 2) determining public acceptance of e-government services; 3) factors affecting the adoption of new tax-filing technology; 4) citizens' willingness to adopt new policies related to e-government services, and others. Each of these comparative data samples includes one or more references to diffusion and acceptance of a program that has parallels to RBS.

3. Data Analysis

The research is conducted in four steps:

1. Review and synthesize the literature to identify factors from the theory of planned behavior (TpB), technology acceptance model (TAM), and diffusion of innovations (DOI) literature that may be used to better understand the diffusion and acceptance of RBS programs.
2. Apply the identified factors from each model to three RBS programs to better understand how the factors might explain public diffusion and acceptance of RBS programs in aviation security.
3. Describe the findings from the examination of the selected factors from the models regarding the RBS programs.
4. Develop a set of recommendation for existing and future programs based on the findings.

II. BACKGROUND

A. INTRODUCTION

Risk-based security (RBS) is meant to focus TSA resources and improve the passenger experience at security checkpoints by applying new risk-based, intelligence-driven screening procedures and enhancing its use of technology.¹ RBS is an overarching concept and encompasses multiple programs that are distinct, yet mutually reliant or supporting. These programs are continually evolving and some have changed names along with sometimes subtle changes in procedure. This research focuses on three of the programs considered integral to RBS: Advanced Imaging Technology (AIT), Known Crewmember (KCM), and PreCheck. AIT, KCM, and PreCheck are used for their ease of applicability to theory of planned behavior, technology acceptance model, and diffusion of innovations. Other RBS programs, such as Screening for Passengers 12 and Under and the Expanded Behavior Detection program were not chosen due to their pilot programs' lack of data at the time of publishing. RBS is described below in general followed by a more detailed description of the three focal programs analyzed.

B. RISK-BASED AVIATION SECURITY

Risk-based aviation security is the future of TSA's approach to protecting the Nation's transportation systems to ensure freedom of movement for people and commerce. RBS is based on the following premises:

- The majority of airline passengers are low risk.
- By having passengers voluntarily provide more information about themselves, TSA can better segment the population in terms of risk.
- Behavior detection and interviewing techniques should be strengthened in the screening process.

¹Information regarding details of TSA's risk-based aviation security program through the Background section was retrieved from TSA's official Website at http://www.tsa.gov/what_we_do/rbs.shtm and its associated official links. Information retrieved from any source outside of TSA's Website is specifically cited.

- TSA must accelerate its efforts to optimize screening processes and use of technology to gain system-wide efficiencies.
- Increase security by focusing on unknowns; expedite known and trusted travelers.

RBS is a complimentary approach to the evolution of layered security that TSA has embraced for several years. Layered security includes portions of RBS in the form of intelligence, behavior detection, crew vetting, advanced checkpoint technology, and random screening programs.

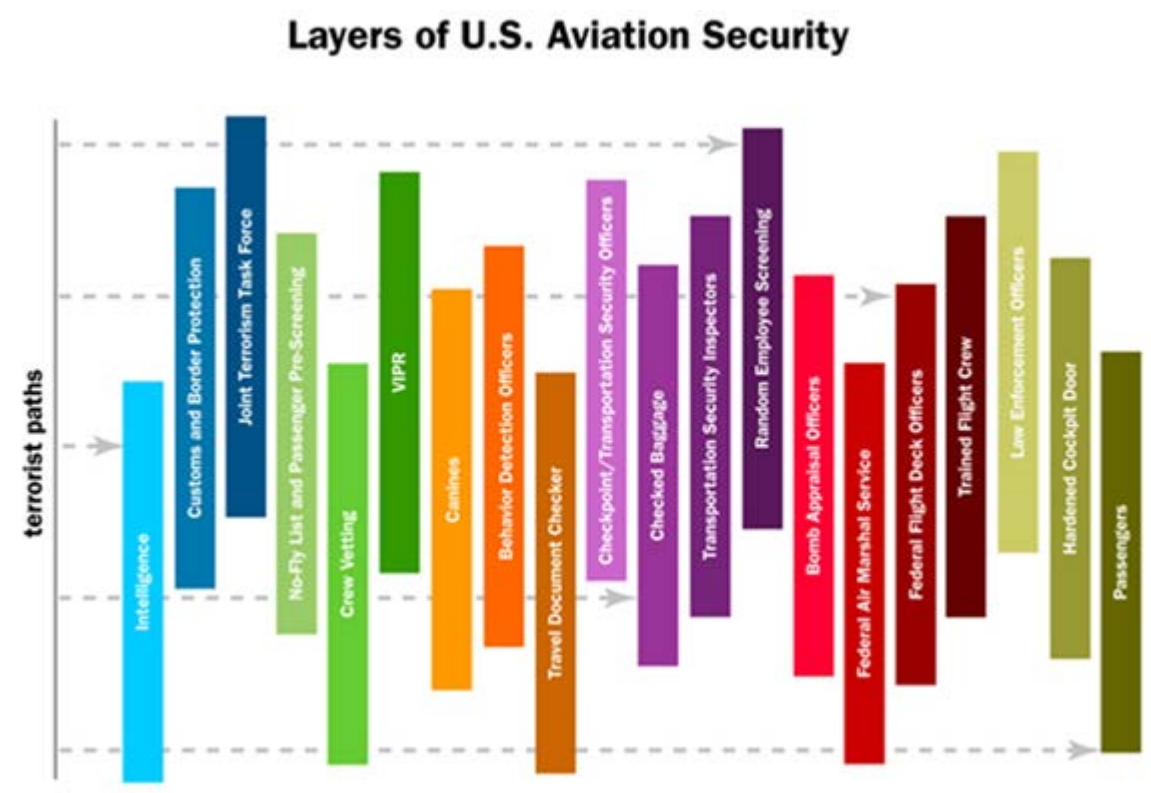


Figure 1. Layers of U.S. Aviation Security (From TSA, n.d. c)

Each layer of security is capable of stopping a terrorist attack alone. Together, the system of layers creates an unattractive and hardened target for terrorists. Strengthening the layered approach to security, TSA includes an element of unpredictability to prevent terrorists from identifying gaps in security created by the risk-based approach.

TSA began earnestly piloting RBS programs in the summer of 2011 with Known Crewmember, Screening for Passengers 12 Years and Under, PreCheck (expedited screening), and Enhanced Behavior Detection. These programs are intended to enhance security while improving the travel experience for passengers. If the pilot programs prove successful, RBS programs will allow TSA to better focus its attention on passengers who are less well known and are more likely to pose a risk to transportation.

Detractors of the risk-based expedited screening program believe the program could be exploited by the drug cartels and allow previously unknown criminals through a security checkpoint with limited screening (Winter, 2010). Some security experts have expressed concern about so-called “clean skins” that are described as potential terrorists that enroll in the expedited screening program to avoid scrutiny when they later attempt a terrorist attack. Joshua Schank, the president of the EnoTransportation Foundation, which focuses on transportation policy, voiced his concern over a program that presumes to treat anyone who is not a trusted traveler like a potential criminal (Sharkey, 2011). However, the program only offers expediting screening for passengers enrolled in the PreCheck program and does not include additional enhanced screening for those who do not. For those opting to not participate, aviation passenger screening remains status quo.

C. ADVANCED IMAGING TECHNOLOGY (AIT)

TSA began deploying Advanced Imaging Technology (AIT) in 2007. AIT has been known as full-body scanners, whole-body imagers, millimeter wave, and backscatter machines. AIT refers to all of these technologies and continues to evolve in software and hardware upgrades as they become available and as privacy concerns and technology advances force changes. The technology is designed to detect potentially dangerous items under a passenger’s clothing. TSA uses two different types of imaging technology, millimeter wave, and backscatter. Several independent studies have shown that both types of technology meet national health and safety standards and are safe for all passengers, including pregnant women, children, and people with medical implants.

1. Millimeter Wave

Millimeter wave technology bounces electromagnetic waves off the body and creates a black and white image on a remote monitor for TSOs to evaluate. An algorithm blurs the face of the passenger for an added measure of privacy. Millimeter wave imaging technology used by TSA meets all known national and international health and safety standards. In fact, the energy emitted by millimeter wave technology is 1000 times less than the international limits and guidelines.

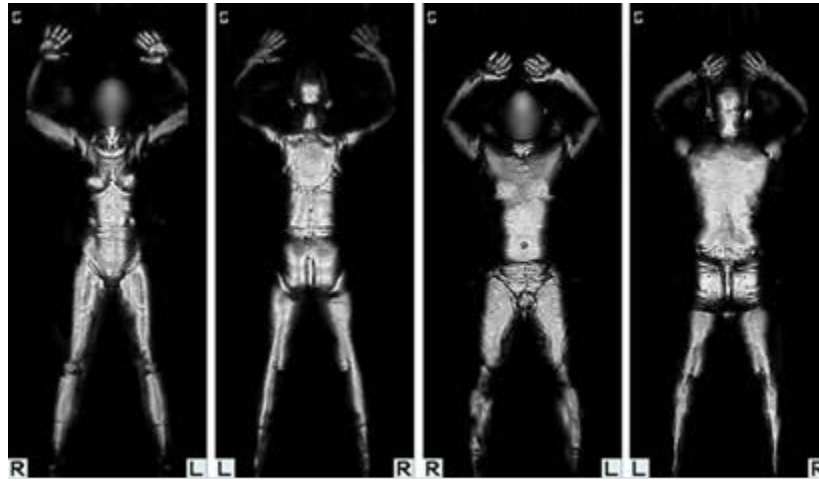


Figure 2. Millimeter Wave Image (From TSA, n.d. a)

2. Backscatter

Backscatter technology projects low level X-ray beams over the body to create a reflection of the body displayed on the monitor. Backscatter technology was evaluated by the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH) (Cerra, 2006), the National Institute for Standards and Technology (NIST) (TSA, n.d. g), and the Johns Hopkins University Applied Physics Laboratory (JHU/APL) (2009). Results showed that the radiation doses for the individuals being screened, operators, and bystanders were well below the dose limits specified by the American National Standards Institute (ANSI).

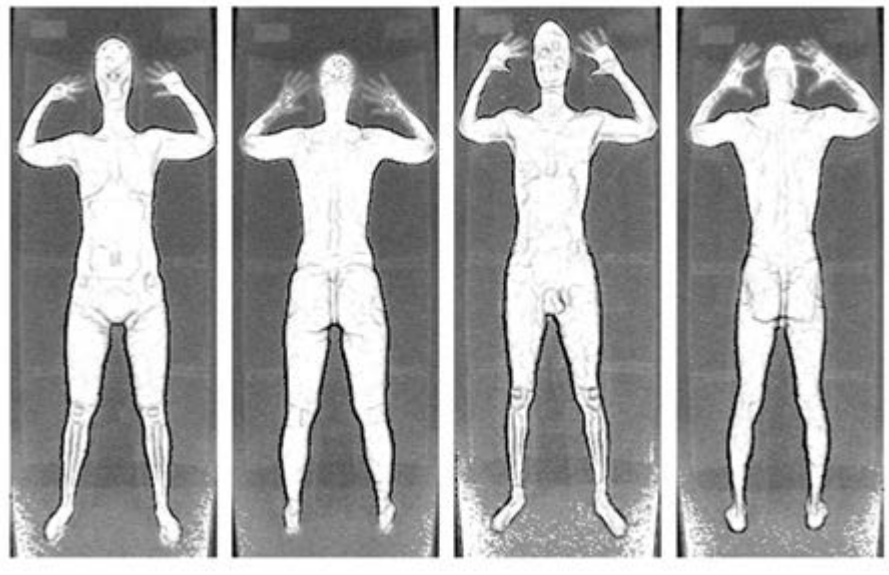


Figure 3. Backscatter AIT Image (From TSA, n.d. a)

3. Privacy

Largely in response to public pressure, TSA has implemented ever increasingly strict measures to protect passenger privacy. TSA located AIT monitors in a private booth away from the passenger so the TSO viewing the image could not see the passenger being scanned. Software blurred the passenger's face in millimeter wave images further protecting passengers' privacy. TSA implemented policy that forbade employees from taking photographs of images or even entering the image booth with technology that could take a photo. The equipment and software is designed to purge the image when the next passenger enters the AIT and is not capable of storing images.

Recently, TSA augmented millimeter wave technology with new software that further increases privacy by virtually eliminating the image of the passenger and replacing it with a chalk outline of a human shape. Automated Target Recognition (ATR) software identifies potential prohibited items on the passenger and notes the location on the chalk image. If the software does not detect a possible prohibited item, the monitor simply shows a green screen with the letters "OK," noting that the passenger is clear.



Any potential threat items that are detected are indicated on a generic outline of a person.



If no potential threat items are detected, an “OK” appears on the monitor with no outline.

Figure 4. Privacy Compliant Millimeter Wave Images (From TSA, n.d. e)

These privacy measures seem to have appeased news media and public perception of the AIT. Kashmir Hill (2011) of *Forbes* commented that ATR brought a new level of transparency to the process, noting that the new image is viewable by the passenger and the TSO monitoring the AIT. While a CBS poll reported that four out of five passengers support the use of AIT at airports (Condon, 2010), TSA indicated that over 99 percent of passengers actually choose AIT screening over alternative screening procedures (TSA, n.d. d).

Administrator Pistole remarked that while safety of the traveling public remains TSA’s top priority, ATR and other technology upgrades enables the agency to provide a high level of security for air travelers while improving the passenger experience at airports (TSA, 2011c).

D. KNOWN CREWMEMBER (KCM)

The Air Line Pilots Association, International, and the Air Transport Association (ATA) published an on-line resource regarding a new program called Known Crewmember (KCM) (Known Crewmember [KCM], 2011). KCM has also seen a number of name changes or been associated with like-programs since its conception in 2007. Crew Personnel Advanced Screening System (CrewPASS) is one version that is

has been used successfully at three east coast airports for approximately three years. The program has undergone several changes and has also been known as Enhanced Airline Pilot Security Screening. Regardless of the name, the overall goal of the program is to allow TSOs to readily and positively identify airline crewmembers that TSA has deemed a low-risk to aviation security. The intent is to spend less time screening crewmembers about whom much is known so TSOs can more time on those who may pose a greater risk to air travel. The TSA program is initially only available to pilots, with the hopes that it will expand to flight attendants in the future. ATA and ALPA contend that the program will expedite pilot access to sterile areas of airports and reduce passenger-screening line congestion.

The program, which is jointly sponsored by ALPA and ATA, ties airline employee databases together to enable TSA security officers to positively verify identity and employment status of crewmembers. KCM is intended to leverage current technology with new processes that provide an effective and cost efficient solution (TSA, 2011a). KCM acknowledges that airline pilots are partners in aviation security rather than a potential threat to it (KCM, n.d.).

TSA Administrator Pistole noted that the KCM program for pilots in uniform where TSA verifies crewmembers' employment and identity is a step in the right direction (TSA, 2011a). Pistole reinforced previous statements regarding RBS where this program allows TSA to focus limited resources on screening other passengers who may pose more of a risk to aviation while trimming the time most passengers spend at the security checkpoint (TSA, 2011a).

E. PRECHECK

Center to TSA's risk-based security approach is positively identifying passengers who are deemed a higher risk, those whom little is known, and those that pose very low risk to aviation. TSA is piloting an identity-based concept that would help the agency positively identify passengers so that screening resources may be focused on higher-risk and unknown passengers, while expediting the screening process for lower-risk and

known passengers. Passengers who voluntarily provide additional information will be eligible for expedited screening through a RBS program called PreCheck. This program will serve to enhance the passenger experience for known travelers and potentially for other passengers as well who will share the security line with fewer passengers requiring additional screening. Like other RBS programs, PreCheck has been referred to by other titles or associated with other programs such as Trusted Traveler², Known Traveler, and Registered Traveler.

U.S. Customs and Border Protection (CBP) Trusted Traveler program provides the template for a future TSA expedited screening program. Select U.S. citizens who are frequent fliers and certain members of CBP's Trusted Traveler programs, including Global Entry, SENTRI, and NEXUS, are eligible to participate in a pilot program where participants will experience expedited screening at select checkpoints at certain airports.

Conceptually, passengers will be cleared through the pre-screening process and, after presenting a boarding pass with a special embedded barcode, they will be directed to a designated lane at the airport where they will experience expedited screening. The PreCheck pilot program for expedited screening intends to use pre-screening capabilities to make intelligence-based risk assessments on volunteers. The benefits for participants of PreCheck include not having to remove shoes, light outerwear/jackets, belts, liquids from compliant 3-1-1 bags and laptops from carry-on bags. The pilot program will allow selected frequent fliers to voluntarily provide additional personal information through their airline's system to participate in TSA's program. Volunteer passengers who opt-in to the program will be pre-screened each time they fly. Though frequent fliers may prefer to keep their status as a trusted traveler throughout the year, the real-time checks on passengers allow TSA to ensure a passenger's status has not recently changed. A random element is maintained in the system, which is necessary to narrow any security gaps created by the system. TSA notes that even passengers that voluntarily participate in the PreCheck pilot are not guaranteed expedited screening.

² Trusted Traveler is a Customs and Border Protection program that has often been confused with TSA's program with similar objectives. For more information, see http://www.cbp.gov/xp/cgov/travel/trusted_traveler/

III. REVIEW OF THE LITERATURE

A. INTRODUCTION

Models that seek to predict or explain factors influencing the adoption or diffusion of a particular technology artifact have been developed and supported by numerous studies. Models applied to government change have seen less extensive study and application. Developing models and providing supporting evidence that further the advancement of our understanding and ability to predict public acceptance and the diffusion of a risk-based airport security program is possible by extending existing research on technology acceptance and the diffusion of innovations. A risk-based security (RBS) approach requires both a change in method and a change in technology usage. This literature review addresses both aspects whose diffusion and acceptance by the public is distinct, yet mutually reliant or supporting.

A risk-based aviation security approach, using the PreCheck program, is meant to be voluntary for passengers. Given that passengers have a choice in utilizing the PreCheck program, the acceptance and intent to use the program and the rate of adoption for which travelers readily accept it may be predicted using a combination of three theoretical models. By applying these social behavior prediction models, TSA may better adjust the factors that influence the diffusion of this innovation and fine tune strategies that will lead to a higher rate of adoption by the public.

Application of the theory of planned behavior as shown in previous studies by McSwain, Gladdeon, & Gladdon (2008) and Ramayah, Yusoff, Jamaludin, and Ibrahlim (2009) shows the importance of properly framing the concept of risk-based security to the public so that their behavioral beliefs are set in fact. These studies have some parallels to risk-based security for the U.S. government's benefit that can show the benefits of PreCheck for passengers personally and for aviation security generally. By reducing the number of requirements for a PreCheck passenger entering a security checkpoint, such as removing light jackets, belts and shoes, the passenger experience is enhanced. With proper framing, the enhanced checkpoint experience narrative is facilitated by both public

and private entities, making passengers more likely to exhibit the desired behavior of support and participation. Social influence plays a particularly powerful role in TpB and a passenger's intent to use PreCheck.

The technology acceptance model (TAM) may have helped guide TSA implementers of AIT in better understanding whether users perceived the program as useful or easy to use and how those factors influenced the passengers' decision to accept the program without media uproar in November, 2010. The diffusion rate for that program might have been much faster had TSA analyzed the causal relationships between AIT and passengers' perceptions of the technology and their attitude toward using it. AIT continues to evolve with increased features of privacy, allowing TSA to predict future passenger intentions to use this technology by applying TAM. Given that the passenger is convinced of the technology's perceived usefulness and perceived ease of use, they are more likely to intend to trust and use the technology as show in studies by Jaefer and Mettersson (2009), Grandon & Pearson (2004), and Cheng et al. (2005).

Lastly, Rogers' (2003) research on the diffusion of innovations has shown that innovative and sometimes life-saving ideas fail or the rate of adoption is so slow that the advantage of the innovation is lost or diminished. In the case of risk-based screening programs, the advantages to the safety of the traveling public and other perceived benefits may be lost or diminished if the innovations are not effectively communicated through appropriate channels in a timely fashion. Rogers (2003) describes five perceived attributes or factors to help explain different rates of adoption: relative advantage, compatibility, complexity, trialability, and observability. Each of these factors play varied roles in explaining diffusion of RBS programs. Studies by Singhal and Quinlan (2006) and Folorunso, Vincent, Adekoya, and Ogunde (2010) show that the literature on the DOI can be used to guide innovators to use a timely message through a preferred medium to the affected audience.

When examining the theory of planned behavior, the technology acceptance model, and Roger's (2003) work on the diffusion of innovations in the context of risk-based aviation security in the U.S., one can identify the factors that influence public

acceptance. These factors include behavior of interest toward an expected outcome, perceived behavioral expectations of persons close to the subject, perceptions of ability, perceived ease of use, perceived ease of usefulness, channels of communication, time, and the context of a given social system.

Research using these models illustrates some parallels to TSA's risk-based approach to aviation security. Presently, there is no research supporting U.S. government aviation security programs where the public has a choice to utilize a program. Typical U.S. government programs are mandatory for citizens using the given program. The PreCheck program offers American air travelers an option to participate and thereby drive the rate of adoption, which is more akin to private industry. The strategies used by TSA and the U.S. government to implement a risk-based security system are more likely to look like private industry than government regulation and procedures.

The risk-based aviation security approach posed by TSA, private corporations, independent think tanks, and Congress have a heavy reliance on technology to determine if a person or object poses a threat to commercial aviation. The assumption with a risk-based approach is that the public will accept new technologies and/or policies with regard for various factors that influence the level of acceptance of diffusion of such approaches. This assumption is fraught with exception as shown through myriad examples in this paper. The U.S. government has repeatedly presented new technology to aviation passengers without first determining if the public will accept its use, causing public outcry and lawsuits. This section of the literature review examines some of the most well supported models that explain and predict levels of user acceptance of particular technologies and innovations and their potential application to technologies used in a risk-based security approach.

User acceptance of technology has been an important field of study since the 1980s with the introduction of the theory of planned behavior (TpB) (Ajzen, 1985) and the technology acceptance model (TAM) (Davis, 1989). Building on these theories,

TAM and its successors have captured the most attention in the information systems community (Chuttur, 2009) while TpB has been most applied to advertising, public relations, and healthcare.

B. THEORY OF PLANNED BEHAVIOR

The theory of planned behavior (TpB) seeks to link attitudes and behaviors through intentions. TpB is an extension of Fishbein's and Ajzen's (1975) earlier predictive persuasion work entitled *Theory of Reasoned Action* (TRA). This extension involves the addition of one major predictor, perceived behavioral control where behaviors were deemed not entirely voluntary. This addition was made to "account for times when people have the intention of carrying out a behavior, but the actual behavior is thwarted because they lack confidence or control over behavior" (Miller, 2005). TpB has been used to predict behaviors in a wide variety of fields, including health communication, interpersonal communication and relations, public relations, advertising, commerce, marketing, and consumer behavior.

TpB has three key predictors that lead to intention and then behavior (Ajzen, n.d.). First, behavioral beliefs link the behavior of interest to expected outcomes. A behavioral belief is the subjective probability that the behavior will produce a given outcome. Behavior beliefs are linked to attitude toward a behavior, which is the degree to which performance of the behavior is positively or negatively valued. Second, normative beliefs refer to the perceived behavioral expectations of such important referent individuals or groups as the person's family, friends, associates, and coworkers. Normative beliefs then determine the prevailing subjective norm, which is the perceived social pressure to engage or not to engage in a behavior. Third, control beliefs have to do with the perceived presence of factors that may facilitate or impede performance of a behavior. It is assumed that these control beliefs determine the prevailing perceived behavioral control, which refers to people's perceptions of their ability to perform a given behavior. Each of the three predictors is weighted relative to their importance to the behavior population of interest. These predictors drive intention, which is an indication of a person's readiness to perform a given behavior. Once intention is established, the

model seeks to drive behavior, which is the manifest, observable response in a given situation with respect to a given target. See Figure 5.

TpB has been used in government studies to a limited extent, though none in the area of aviation security. McSwain et al. (2008) utilized TpB to examine governmental financial managers' intentions to modify internal controls for e-services and found that the model was useful in predicting intentions of managers' effect on internal control modifications. The authors cited limitations in their research unrelated to the TpB model and suggested future research to account for actual behaviors, which was not captured (McSwain et al., 2008).

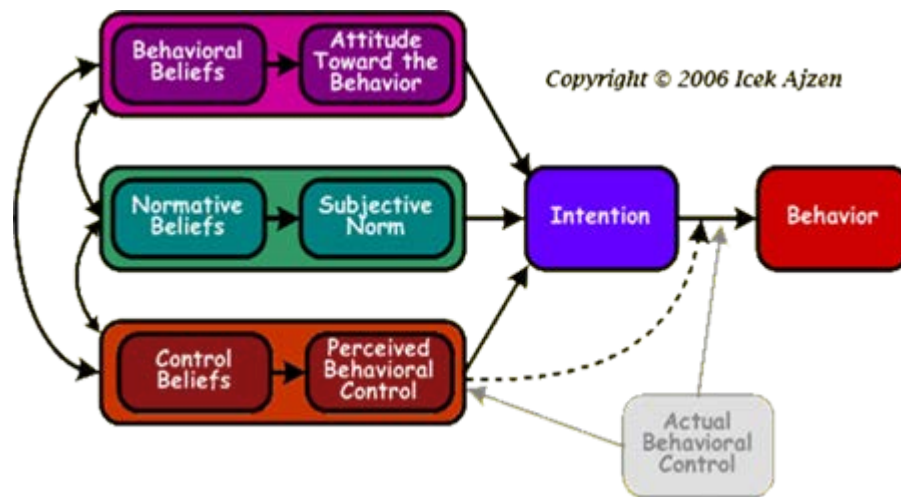


Figure 5. Theory of Planned Behavior (From Ajzen, n.d.)³

Ramayah et al. (2009) applied TpB to determine Internet tax filing intentions from Malaysian citizens. The study used the TpB model to determine the behavioral intentions of taxpayers, hypothesized to be influenced by their attitudes, subjective norms and perceived behavioral controls. The research found that attitude, perceived behavioral control, and subjective norm positively influence the behavioral intention of taxpayers to choose e-filing and lead to their intention to use the technology. The research suggested

³ The Website noted, "You may copy and use this diagram for non-commercial purposes. Other uses require permission and payment of a fee." For more information, see <http://people.umass.edu/ajzen/tpb.diag.html#null-link>.

that the government of Malaysia step up efforts to promote e-filing through social advertisement, depicting the use as socially desirable. The research further offered that such efforts would enhance the image of the system leading to more usage (Ramayah et al., 2009).

Advantages to TpB include the vast array of data gathered by application of the theory to diverse research over that last 20 years. TpB-based research has shown predictability of intention in a wide variety of disciplines. Its limitations as it relates to this research are that data in U.S. government homeland security issues is virtually non-existent. There are applicable data sets using TpB as it relates to government policy towards its citizens, and these will be examined more closely. Dutta-Bergman (2005) found that TpB was not as effective in some health-related studies because it overlooked emotional variables such as threat, fear, mood, and negative feelings. This could be a drawback when considering emotional variable regarding terrorism in studying aviation security.

C. TECHNOLOGY ACCEPTANCE MODEL

Davis (1985) developed his technology acceptance model (TAM) as an information systems theory that depicts how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it. Perceived usefulness (PU) was defined by Davis (1989) as “the degree to which a person believes that using a particular system would enhance his or her job performance.” Davis (1989) defined perceived ease-of-use (PEOU) as “the degree to which a person believes that using a particular system would be free from effort”

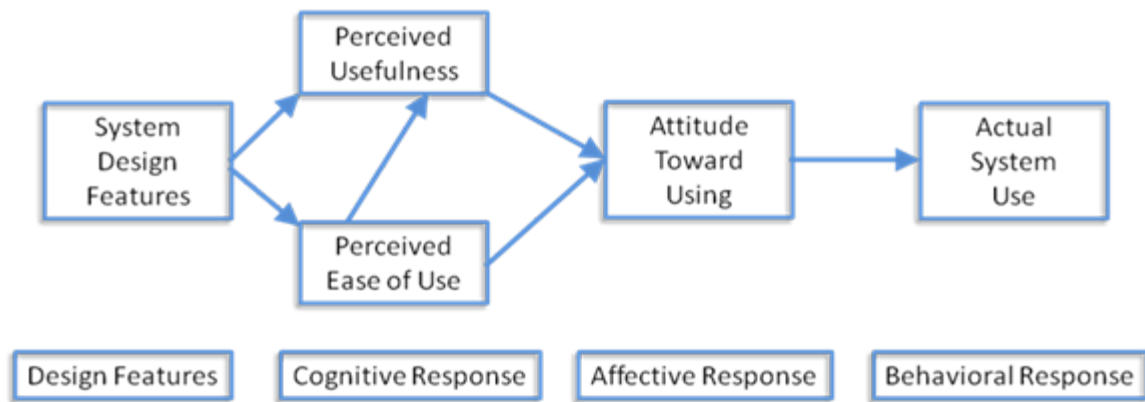


Figure 6. Technology Acceptance Model (From Davis, 1991)

Though TAM was originally meant as a model to determine behavioral intention to use for a single user of technology, extensions of TAM have been used to explore decisions by organizations comprised of groups of users and whether they would adopt new technologies (Jaeger & Matteson, 2009). Various studies have examined TAM in relation to organizational adoptions of new technologies including telemedicine, police investigations, and e-commerce (Chau & Hu, 2002; Colvin & Goh, 2005; Grandon & Pearson, 2004).

Jaeger & Matteson (2009) studied the implementation e-government Websites through a number of data collection techniques and in terms of the technology acceptance. They sought to better understand the processes by which government agencies adopt e-Government requirements and the actions that government managers can take to improve the implementation of such adoption in support of Section 508 of the Rehabilitation Act (29 U.S.C. § 794d). The authors found TAM suggested further study for TAM studies that might also be useful to help determine the best methods to improve understanding of the ways residents and public servants use e-government technologies (Chang, Li, Hung, & Hwang, 2005).

TAM is found almost ubiquitously in modeling technology acceptance. Despite, or perhaps because of, this frequent use, it has been widely criticized leading Davis and his contemporaries to redefine it several times (Venkatesh & Davis, 2000; Venkatesh &

Bala, 2008). Chuttur, (2009) approaches TAM with skepticism, noting that some researchers are not confident in the application and theoretical accuracy of the model. TAM studies have primarily been used to predict voluntary use of systems despite the fact that most organizations require use of a particular system with little choice for alternatives (Lee, Kozar, and Larsen, 2003). The current design of risk-based security as proposed by TSA allows for the voluntary use of the system (TSA, n.d. f).

TAM provides a useful theoretical platform for studying public acceptance of technology associated with risk-based aviation security. Passengers will have the opportunity to determine how useful and how relatively easy it is to use advanced technology relative to the current 100 percent screening methods in wide use today.

D. DIFFUSION OF INNOVATIONS

Everett Rogers (2003) found that innovative and life-saving ideas sometimes fail, are not readily adopted, or the rate of adoption is so slow that much of the advantage of the innovation is lost. He defined diffusion as the process “by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 11). The innovation-decision process an individual goes through from first hearing of the innovation to adopting or rejecting it involves progression through five stages: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003, p. 169). Figure 7 shows how innovations are accepted over time depending on how the perceived attributes, such as relative advantage and compatibility can affect the rate of adoption.

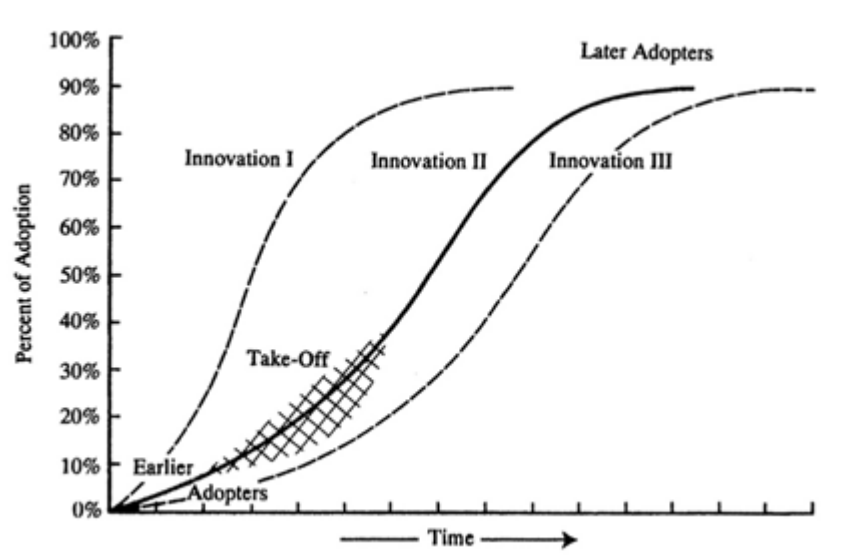


Figure 7. The Diffusion Process (From Rogers, 2003)

Rogers began his research in the 1950s relating to agricultural innovations in rural communities. In the 1960s, he continued his research continued and generalized as he grounded his theory in communication theory. The theoretical framework has been adopted by professionals in the fields of health, mathematics, information technology, service organizations, education, economics, and sociology. Members of the health behavior and education field have called Rogers' a "luminary" in their broad field calling his work inspirational (Glanz, Rimer, & Vinswanath, 2005). Support for the theory abounds while criticism represents a small fraction of scholarly papers written on the subject. Though the information systems field has leveraged Rogers' theory on diffusion, there are some detractors who state that the concept "falls short of some theoretical constructs that help address how complex networked technologies can and will diffuse" (Lyytinen & Damsgaard, 2001, p. 13).

Folorunso et al. (2010) used diffusion of innovations (DOI) theory to analyze issues surrounding the adoption of social networking sites and identified key issues that influence users' attitude towards intention to use social networking. The authors

recommended use of DOI for builders of social networking sites to examine the attributes of the model to see how they could improve on the use of these sites (Folorunso et al., 2010).

Singhal and Quinlan (2006) highlighted the effectiveness of DOI in political communication by showing the practical importance of governments utilizing the media to increase the rate of adoption of policy noting slowed adoption of countermeasures regarding the Tylenol tragedy of 1982 and the communication of the AIDS epidemic in 1985. The authors support DOI research based on its practical importance and applicability to a wide range of fields including communications, marketing, and political science (Singhal & Quinlan, 2006).

The application of DOI for risk-based aviation security seems tangible given the similarities in studies regarding governments and the need for effectively communication policy changes to citizens. Increasing the rate of adoption for programs within a risk-based security system through the application of DIO for TSA would pay dividends to the taxpayers in terms of cost, convenience, and an increased level of protection from threats to commercial aviation.

E. SUMMARY

The theory of planned behavior as portrayed by Icek Ajzen (1991) seeks to link attitudes and behaviors through intentions and is guided by three factors that influence behavioral intention:

1. Behavioral beliefs that produce a favorable or unfavorable attitude toward the behavior.
2. Normative beliefs that result in perceived social pressure or subjective norm.
3. Control beliefs that lead to perceived behavioral control.

The technology acceptance model as portrayed by Fred Davis (1989) specifies causal relationships between system design and features through two factors that influence attitudes toward using a system and behaviors intention to use the system:

1. Perceived usefulness, which is the degree to which a person believes that a particular system will enhance job performance.
2. Perceived ease of use, which is the degree to which a person believes that using a particular system would be free from effort.

Diffusion of innovations as portrayed by Everett Rogers (2003) is a “process by which an innovation is communicated through certain channels over time among the members of a social system” and is characterized by five factors that describe the degree to which an innovation is perceived by the individual:

1. Relative advantage, which is the degree to which an innovation is perceived as better than the idea it supersedes.
2. Compatibility, which is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs.
3. Complexity, which is the degree to which an innovation is perceived as difficult to understand and use.
4. Trialability, which is the degree to which an innovation may be experimented with on a trial basis.
5. Observability, which is the degree to which the results of an innovation are visible to others.

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IV. ANALYSIS

A. APPRECIATIVE INQUIRY

Using studies with parallel or similar characteristics to TSA's risk-based security approach to aviation security, this paper shows which factors serve as the most influential behavior intention attributes that influence the acceptance and / or diffusion of RBS programs. Data drawn from U.S. government documents, news media, third-party interest groups, and scholarly work by social scientists are used to model the factors outlined in TpB, TAM, and DOI. Cumulatively, they will influence a recommended strategy for influencing the diffusion and acceptance of future RBS programs which may better predict successful implementation.

The analysis provides a holistic view of how TSA can best implement risk-based security policy through the influence of diffusion and acceptance models.

B. ANALYSIS OF MODELS IN THE CONTEXT OF RBS

1. Theory of Planned Behavior

The theory of planned behavior seeks to link attitudes and behaviors through intentions and is guided by three factors that influence behavioral intention (Ajzen, 1991):

1. Behavioral beliefs, which produce a favorable or unfavorable attitude toward the behavior.
2. Normative beliefs, which result in perceived social pressure or subjective norm.
3. Control beliefs, which lead to perceived behavioral control.

a. Advanced Imaging Technology

AIT was first deployed in U.S. airports in 2007, but received a well-publicized criticism in November of 2010 when newly appointed TSA Administrator John Pistole pressed for accelerated deployment in advance of the Thanksgiving weekend. This accelerated deployment, combined with the policy that passengers

traveling through AIT-capable airports were directed to use the AIT as a primary means of security screening, created a backlash of public outcry.

Applying TpB to AIT involves assigning factors to more tangible beliefs of airline passengers. Behavioral beliefs may include an individual's belief about the consequences of a particular behavior related to AIT. The individual weighs the subjective probability that a particular behavior will produce a possible outcome. Given a passenger entering an airport checkpoint equipped with AIT equipment and directed to enter AIT screening, the passenger may decide to not comply with the TSO's direction to enter the AIT. Non-compliance may result in delayed screening, causing the passenger to miss their scheduled flight. The passenger may be subjected to a relatively invasive pat-down as an alternative screening method. They may experience some public embarrassment if they perceive others at the checkpoint are disparaging because of the delay the screening process. Conversely, some may seek attention by publically confronting TSOs and gaining viral notoriety on the Internet (Levine, 2010). Compliance may feel like privacy invasion as passengers place their feet should-width apart and raise their arms as if surrendering while TSOs view a digital facsimile of their bodies. Compliance has potential positive consequences as passengers speedily pass through security and board their aircraft on time. Others may feel that the process protects travelers from terrorism (Condon, 2010). Those travelers that are sensitive about their personal space may appreciate the touch-free aspects of AIT, noting that any anomaly is resolved through a targeted pat down of just the area where an item is identified on the body. Some travelers may feel that use of the AIT is necessary part of screening and see compliance as a part of the new normal process.



Figure 8. Passenger Stance During AIT Imaging (From Gooden, 2011).

Normative beliefs may include the expressed opinions of close friends and family. A close friend or family member's positive or negative experience with AIT during travel may influence everyone whom they relate the experience to. With the prevalence of social networking, a novice traveler could be influenced by a person whom they hold in high regard. News media can have an initial effect on opinions, though long-term beliefs are more likely based on factual data. Despite a deluge of negative publicity prior to the heavy travel period surrounding Thanksgiving 2010, an Internet campaign at www.wewontfly.com/opt-out-day/ unsuccessfully attempted to get travelers to opt-out of the use of AIT equipment, thereby delaying travel for millions. Rather, the campaign was a "bust" according to ABC news (Alfonsi & Metz, 2010). Travelers chose to comply with TSA procedures in order to get to their destinations. LAX reported 113 people opted-out of AIT screening, accounting for less than one percent of the travelers. (Alfonsi & Metz, 2010). Some travelers may simply follow the actions of those around them or feel compelled to comply with government authority. Normative beliefs may also include the influence of government marketing in the form of public appearances by the TSA Administrator on news programs, TSA's Website, and the TSA Blog, which won a Bronze Anvil Award from the Public Relations Society of America in 2010.

Control beliefs may include a passenger's choice to use alternate methods of screening. Passengers who do not want to submit to AIT screening may choose alternate travel methods such as rail, bus, or car to get to their destinations as suggested by DHS Secretary Janet Napolitano (Levine, 2010). Control beliefs may also include a passenger's knowledge of AIT, which they may have received from a variety of sources, including news, social networks, signage at the airport, or the TSA Website. What a passenger knows about health safety related to AIT may have come from the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH), the National Institute for Standards and Technology (NIST), and the Johns Hopkins University Applied Physics Laboratory (APL). Barriers or an absence of barriers play a role in perceived behavior control as passengers find that AIT screening is faster or slower than metal detectors and alternative pat-downs.

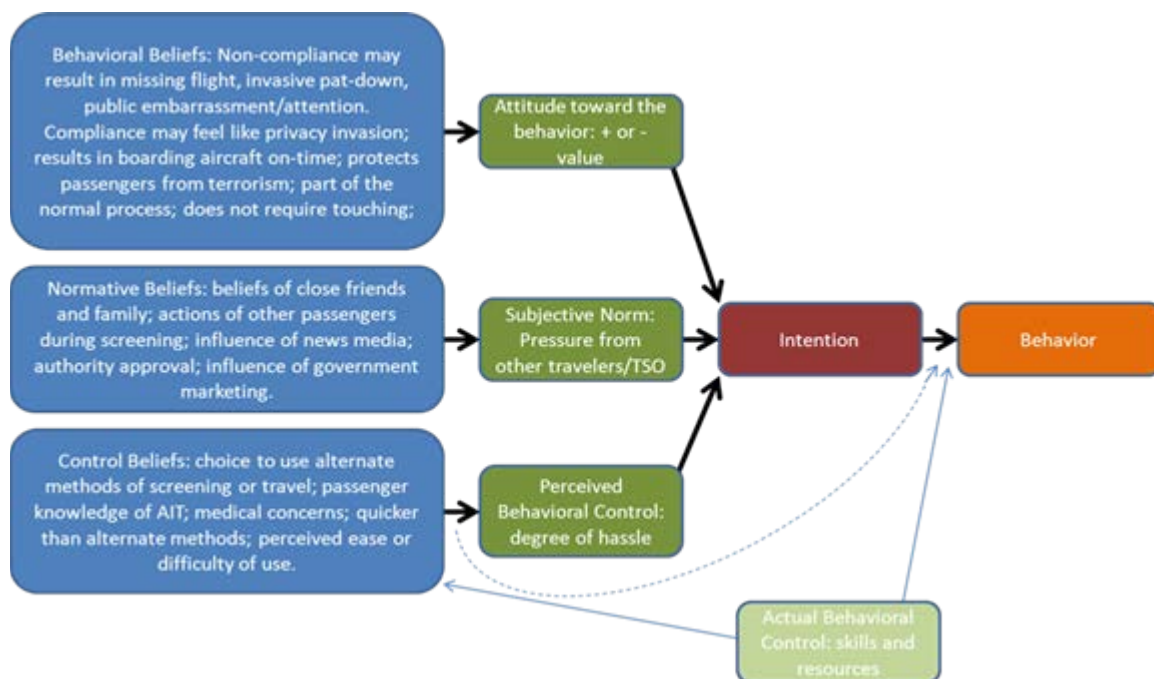


Figure 9. TpB for Advanced Imaging Technology

TSA (n.d. d) reports that since AIT deployed to national airports, more than 99 percent of passengers choose the advanced technology over alternative screening procedures.

b. Known Crewmember

The Known Crewmember (KCM) program seeks to increase security efficiency by spending less time screening crewmembers about whom much is known so TSOs can more time on those who may pose a greater risk to air travel.

Behavioral beliefs associated with KCM are a passenger's belief about the consequences of particular behavior. Non-compliance with KCM results in status quo, where the pilots are screened the same as passengers. The behavior is encouraged by the joint efforts of TSA, ATA, and ALPA in developing a program that enhances screening process by validating the existing background checks pilots receive through their employer and acknowledging the role pilots play in the safety and security of their aircraft every time they fly (ALPA, 2011). Non-compliance also counters pilot union decisions for which consequences are not known. Compliance requires background checks, which already are conducted by the employer to a level that currently satisfies TSA. Pilots using the program may notice quicker processing through security lines and fewer requirements for screening, the details of which are not currently publically available.

Normative beliefs may encompass the beliefs of business associates eligible for KCM, at this point that group includes other pilots but may include flight attendants in the future. Both ALPA's President, Captain Lee Moak, and ATA's President and CEO Nicholas Calio, support the program, noting improved security and efficiency for government, industry and labor, as well as reduced wait times for passengers and crewmembers (KCM, n.d.). TSA reiterates ATA's and ALPA's new releases on its Web Media Room where Administrator Pistole advocates KCM, which allows TSA to verify pilot's employment and identity while speeding and enhancing the checkpoint experience for everyone (TSA, 2011a). Aviation Week criticized the lack of public discussion about costs for the program citing the absence of the agreement between ATA-ALPA and TSA (Ott, 2011).

Control beliefs relate to a pilot's choice to not participate. Though KCM is a voluntary program from TSA's point of view, it seems that the arrangement with

ATA-ALPA represents the collective desire of union members. There is no indication in the literature that pilots wish to opt-out of the program or disagree with the intent of the program. Also related to control beliefs are the pilots' knowledge of KCM provided by airlines, unions, and TSA. The information is readily available on each organization's Website and placards are visible at participating airport checkpoints. Alaska Airline pilot Sean Cassidy found the KCM procedures a "very pleasurable experience" (Hilkevitch, 2011), supporting claims by pilot unions and TSA that the process is much improved and easy to use. The Chicago Tribune reported that the process was possibly too easy, noting that program is flawed because it does not include a biometric match to verify pilots' identity positively, which could be exploited by terrorists posing as pilots (Hilkevitch, 2011). The article did not clearly articulate how a terrorist would overcome the multiple layers of personnel security that make up the system. Identification is just one of several security protocols in the Known Crewmember program.

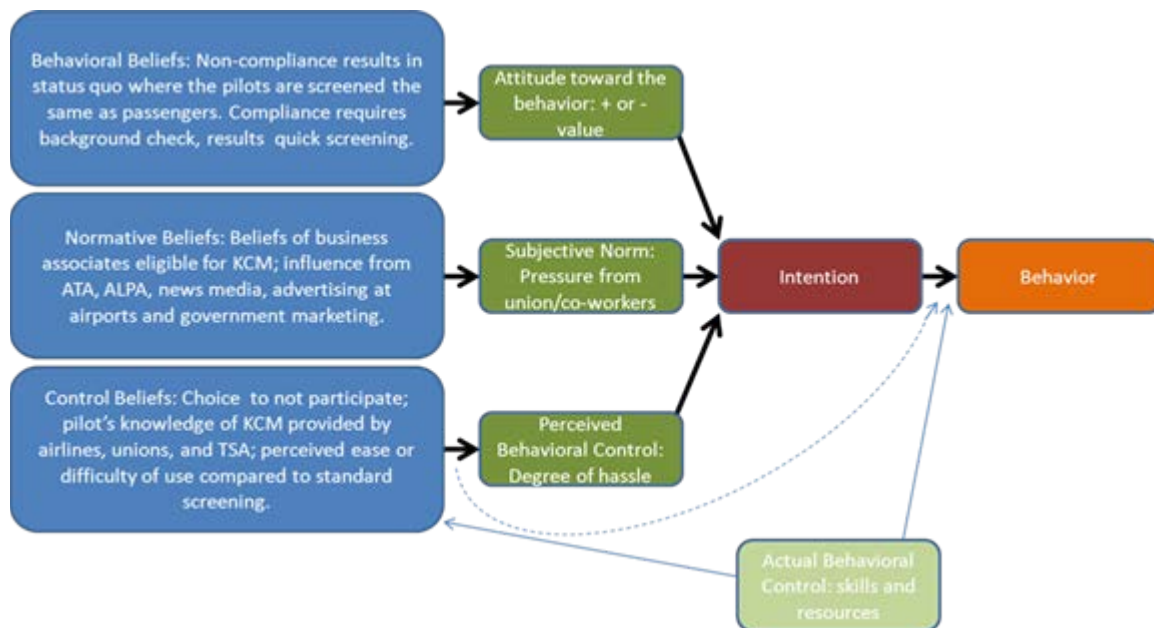


Figure 10. TpB for Known Crewmember

c. PreCheck

PreCheck is a an pre-screening process and identity-based program that helps the agency positively identify passengers so that screening resources may be focused on higher-risk and unknown passengers, while expediting the screening process for lower-risk and known passengers.

PreCheck behavioral beliefs refer to the subjective probability that a particular behavior will result in a given outcome. Passengers who choose not to participate in PreCheck maintain aviation security status quo and are subjected to traditional screening. Compliance requires a background check, which may be viewed by the passenger as either privacy invasive or necessary to screen out higher-risk passengers. Compliance also results in fewer and less invasive security checks and faster security lines for participants.

Normative beliefs may refer to the passenger's perception about PreCheck when influenced by business associates that are eligible for PreCheck, family and friends that are not eligible for PreCheck, and marketing by either the airline sponsoring the passenger or the government program promoting the program. Passengers may be influenced by participating government and industry partners, news media, advertising at airports and government marketing. Sponsors currently include American and Delta Air Lines whose frequent flyers use participating airports. Government programs promoting the PreCheck include CBP's Trusted Traveler programs including Global Entry, NEXUS, and SENTRI. While TSA is promoting the program on its Website and Delta and American are quietly promoting the program to their elite passengers, a small minority are saying the program is destined to fail as its predecessor, Registered Traveler, failed (Brancatelli, 2011).

One online journal reported that TSA strangled earlier attempts by entrepreneurs to launch trusted traveler-type programs by imposing constrictive rules that eventually made the program most costly than the benefits could overcome (Brancatelli, 2011). Other news media shows the spectrum of opinion in which one online journal called for kudos to Administrator Pistole (Verdery, 2011), and the Associated Press

called PreCheck a “basic trade-off” where passengers must give personal information in order to receive an opportunity for expedited and abbreviated screening (Henry, 2011).

Control beliefs in relation to PreCheck might include the passenger’s choice to maintain a familiar, albeit intrusive, status quo (Omri, 2011). Passenger knowledge of PreCheck is most likely delivered by participating airlines or sponsoring government programs like CBP’s Trusted Traveler. News media provides additional information as well as advertisements from participating airports. Though there has been some negative publicity regarding efficacy of the program, most news coverage includes passengers’ comments about how much easier, smoother and quicker PreCheck screening is compared to standard screening.

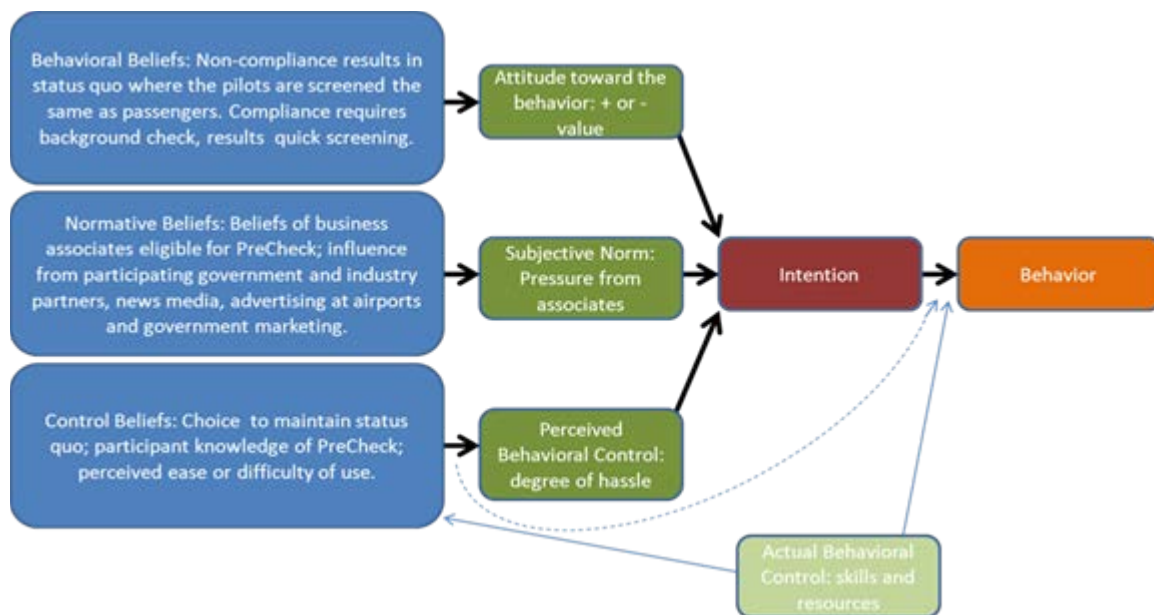


Figure 11. TpB for PreCheck

2. Technology Acceptance Model

The technology acceptance model specifies causal relationships between system design and features through two factors that influence attitudes toward using a system and behaviors intention to use the system (Davis, 1991):

1. Perceived usefulness is the degree to which a person believes that a particular system will enhance job performance.
2. Perceived ease of use is the degree to which a person believes that using a particular system would be free from effort.

a. Advanced Imaging Technology

AIT controversy primarily revolves around the issues of privacy and safety. Using TAM to explain why 98 percent of passengers chose AIT over alternate screening methods (TSA, 2010) may identify why passengers choose AIT, despite what might seem to be significant reservations. EPIC's 2011 legal case against DHS notwithstanding, a CBS poll found that 81 percent of Americans agree that TSA should use AIT to screen passengers electronically in airport security lines (Condon, 2010). The poll found that the majority opinion covered all ages, genders, and political affiliation. A Gallup poll found that 78 percent of U.S. air travelers approved of AIT (Jones, 2010). The abundance of negative attention the AIT received regarding safety and privacy in late 2010 and early 2011 did not have as significant effect on travelers' perceived usefulness of the equipment as one might expect.

AIT may be perceived as useful because it finds non-metallic explosive components that other equipment or procedures have not been able to do well in the past. The attempted attack by Umar Farouk Abdulmutallab in December of 2009 to bring down a Detroit-bound aircraft with non-metallic explosive components reinforced the need for screening passengers for more than handguns and metal improvised explosive device component parts. Until the deployment of the AIT, there was no technology that could effectively screen passengers for plastic explosives hidden under clothing. Explosive trace portals, or puffers, are still in use at some airports, but TSA halted deployment in 2007 and has no plans to purchase more because of problems detecting explosives and maintenance issues (Frank, 2007). Some passengers were occasionally screened using other explosive trace detection equipment (ETD), but only after the passenger's behavior or luggage necessitated further screening. The Gallup poll showed that passengers believe that AIT scans are more effective at preventing terrorists from smuggling explosives or other dangerous objects onto airplanes (Jones, 2010).

Passengers' perception concerning the AIT's ease of use may include awareness of the speed in which a passenger can navigate the security checkpoint. TSA has not released statistics on the time it takes for a passenger to go through AIT, but one report claims that the AIT takes approximately five seconds compared to approximately five minutes for the alternative pat-down (Bennett, 2011). The walk through metal detector (WTMD) took less time, but often required multiple scans due to forgotten items in pockets and metal implants. Metal implants will not alarm the AIT since the equipment scans the outside of the body and does not detect any implants below the skin (CNN Travel, 2010). Many passengers that have metal implants below the surface of the skin are subjected to a pat-down after alarming the walk-through metal detector. According to Ed Meyers, Esq. (2011), Arizona Center for Disability Law Director, approximately 25 million American have medical implants, most of which contain metal that could alarm the WTMD. AIT virtually eliminates passengers with metal implant due to a medical procedure from alarming unnecessarily. This change in passenger experience is likely to influence millions of travelers' perception of ease of use as the AIT will not alarm on a below-the-skin metal implant.

Although TSA continues to implement unpredictable screening and may require passengers to undergo a pat-down even if they use the AIT, passengers are less likely to get a pat-down when opting for the AIT (CNN Travel, 2010). TSA's Website notes that pat-downs are used to resolve alarms as long as the passenger removes all extraneous items from their body and clothing prior to enter the AIT, they should not require a pat-down (TSA, n.d. b). Some passenger may find that the AIT is not as easy to use as the metal detector because they must remove all items from their pockets, even if the item is not metal. For example, lip balm, paper money, and food items would not have alarmed the metal detector, but are likely to alarm the AIT.

Figure 12 shows how TAM can be used to portray design features that have influence over a passenger's attitude toward using the AIT.

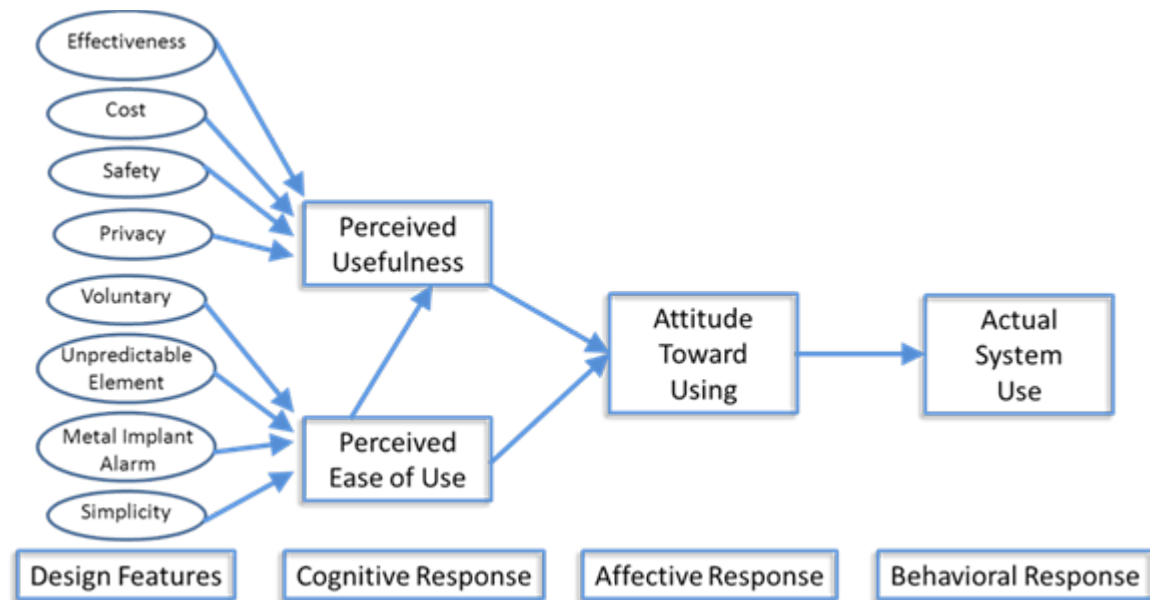


Figure 12. TAM for AIT

b. Known Crewmember

KCM perceived usefulness may be influenced by both public and pilot perception that security lines are shorter and therefore quicker. With thousands of pilots going through expedited screening as a result of comprehensive background checks and up-to-the-minute status of pilots in the system, passenger lines where pilot's used to pass through security are shorter and quicker. The Allied Pilots Association (APA) President, Captain Dave Bates, stated that KCM was a common-sense solution to crewmember security concerns and that it demonstrated the government's confidence in pilots as trusted members of the airline security community (Allied Pilots Association [APA], 2011).

Perceived ease of use may be influenced by pilots' perceptions of going through expedited screening without removing certain clothing articles and forgoing some of the more traditional security protocols. The program is still being piloted so TSA has not released exact details of what pilots can expect regarding expedited screening, except that a random element is built into the program so occasionally pilots

will have to undergo traditional screening. For the fraction of pilots that must submit to random screening, the process may not seem easy to use.

ALPA President, Captain Lee Moak, noted that pilots undergo employment checks, criminal background checks, and have been fingerprinted and as pilots, they are empowered to protect the industry (TSA, 2011a). Leveraging these advanced checks, combined with TSO verification of the pilot's identity, allows for quicker access to the sterile area of the airport for pilots, influencing their perception of ease of use.

Figure 13 shows how TAM can be used to portray design features that have influence over a crewmembers' attitude toward using the KCM.

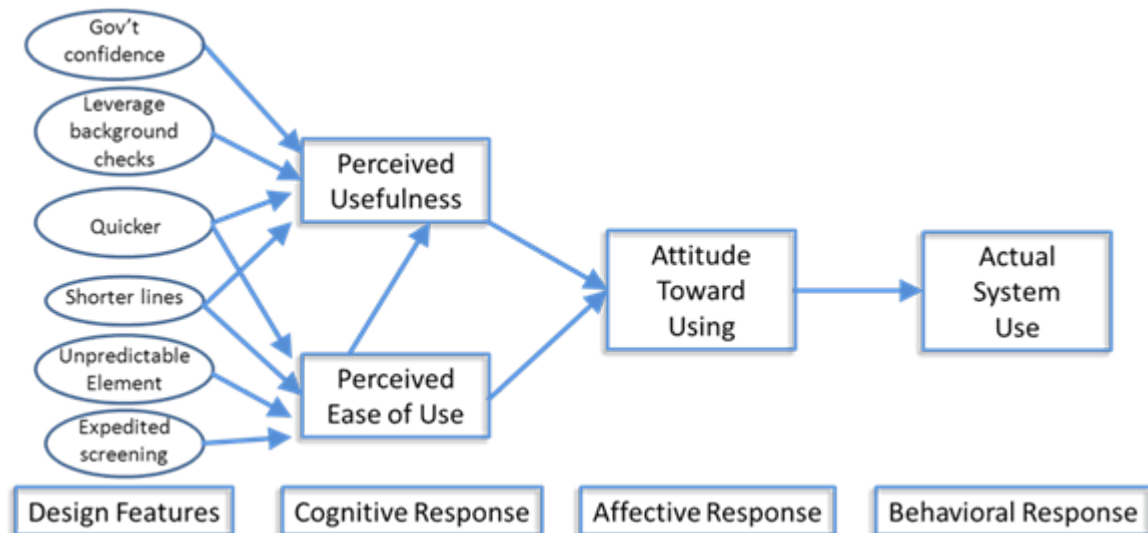


Figure 13. TAM for KCM

c. *PreCheck*

PreCheck perceived usefulness may be influenced by the notion that most air travelers pose virtually no threat to commercial aviation. A program such as PreCheck acknowledges that most passengers pose a low threat and must verify their identity as a person who poses a low threat to aviation. Because the program is voluntary, enrollment will show if the travelling public finds the program useful. Though

no studies showing participant perception has been published yet, passengers interviewed by news media were encouraged by the program. One passenger who regularly flies out of Miami not only thought the PreCheck was a terrific idea, but that the policy of random checks added legitimacy to the program (Miami Int'l Airport, 2011).

Ease of use may be influenced by passenger perception of how much more convenient and quicker checkpoint screening is when passengers are not required to remove their shoes, belts, light outerwear or jackets, and may keep 3-1-1 compliant clear plastic bags and laptops in their carryon luggage. The program is currently no cost to the passenger. A previous similar program, called Registered Traveler, ultimately failed after 250,000 customers paid \$200 for what was marketed as faster screening (Frank, 2009). Instead, it allowed participating passengers to go a dedicated security line, but it still subjected them to one-size-fits-all security screening.

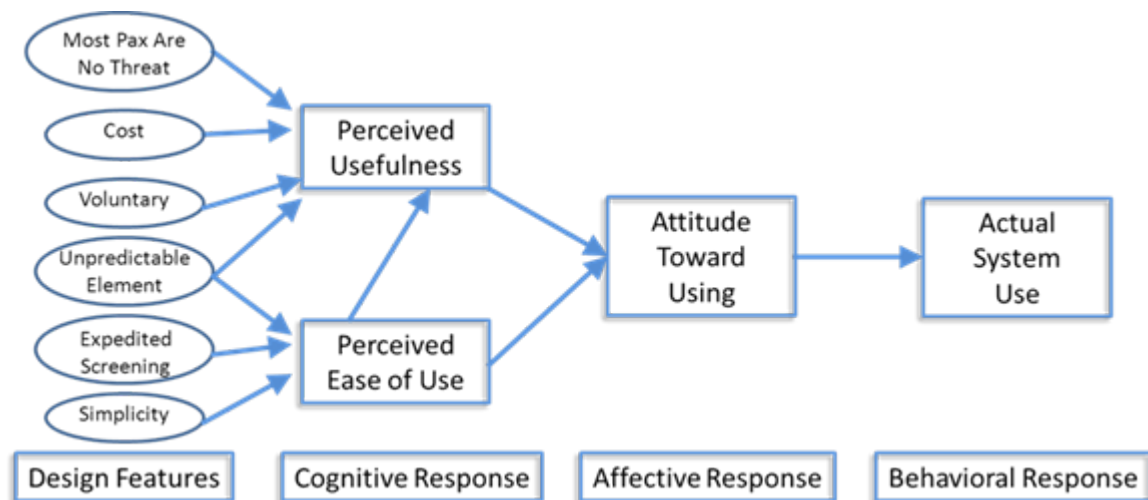


Figure 14. TAM for PreCheck

3. Diffusion of Innovations

Diffusion of Innovations is a “process by which an innovation is communicated through certain channels over time among the members of a social system” and is characterized by five factors that describe the degree to which an innovation is perceived by the individual (Rogers, 2003):

1. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes.
2. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs.
3. Complexity is the degree to which an innovation is perceived as difficult to understand and use.
4. Trialability is the degree to which an innovation may be experimented with on a trial basis.
5. Observability is the degree to which the results of an innovation are visible to others.

Each of the above factors influences, to varying extent, the rate of adoption by air travelers. The greater degree to which each factor is accounted for in the diffusion of risk-based security, the steeper the S-curve and higher the rate of adoption by potential participants in each of the volunteer RBS programs. Rogers (2003) categorizes adopters of innovation as:

- *innovators* that initially adopt the innovation and tend to be venturesome;
- *early adopters* are generally socially forward opinion leaders and tend to have the respect of peers;
- *early majority* provides interconnectedness in the social system and tends to be more deliberate in their decision making;
- *late majority* adopts new ideas out of economic or social necessity and tends to be more skeptical; and
- *laggards* appreciate traditional values and tend to have limited resources. Figure 15 shows the relationship between market share of a successful innovation and the categories of adopters.

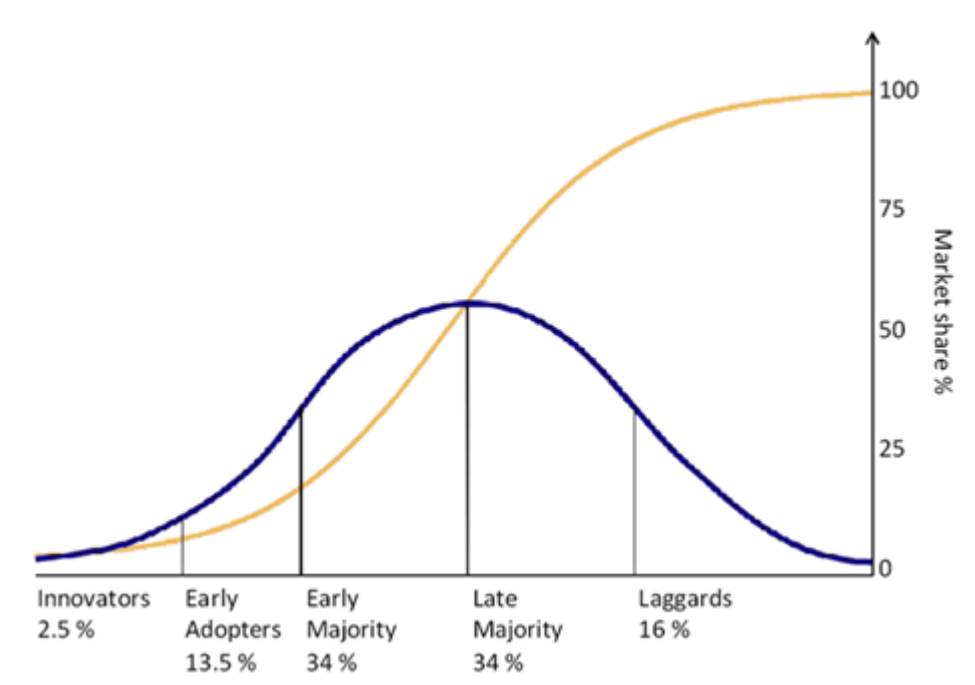


Figure 15. Adopter Categories and Rate of Adoption (From Rogers, 2003)

a. Advanced Imaging Technology

1.) Relative Advantage. AIT's relative advantage may be evaluated in terms of how it is perceived compared to the ubiquitous walk-through metal detector (WTMD). It may also be compared to previous or alternate versions of the AIT. The WTMD has been standard checkpoint equipment for aviation security at airports since 1973, and the American public is generally understanding for the need to keep accessible weapons off commercial aircraft. Non-metallic threats in the form of plastic and liquid explosives had been less well known until several notable terrorist attack attempts, such as the attempt by Richard "the shoe bomber" Reid in 2001, the suspected al-Qaida group planning the 2006 liquids plot, and Umar Farouk "the underwear bomber" Abdulmutallab in 2009. The attack attempts identified gaps in security that could not be resolved by a metal detector and prompted TSA to adopt new policies and accelerate the development and deployment of AIT.

The rapid deployment of AIT prior to Thanksgiving 2010 caused a media backlash and resistance by privacy groups in an event, and the relative advantage

may not have been as effectively communicated by TSA as it could have been. Rather than focusing on this new equipment as the only physical security measure at the airport that could detect plastic explosives under clothing, the media and privacy groups called for an end to the use of what was deemed by EPIC as a violation of the Fourth Amendment, or search and seizure protections. One group launched a national opt-out day for what they called naked-body scanners. The relative advantage seemed to have been lost during the accelerated deployment of AIT. The rate of adoption may have been slowed by TSA's inability to show the security advantages of AIT while addressing privacy and safety concerns.

The rate of adoption increased from 81 percent supporting the use of AIT in November 2010 (Condon, 2010) to 99 percent choosing AIT over alternative screening methods in 2011 (TSA, n.d. d). Some of the increase may be due to several independent surveys in late 2010 and early 2011, showing that approximately four out of five passengers supported the use of AIT (Condon, 2010; Jones, 2010; TripAdvisor, 2011; and Dooley, 2010). The failed lawsuit by EPIC claiming TSA violated passengers' Fourth Amendment rights by using the AIT and the implementation of automated target recognition (ATR) software may have also assisted in speeding up the rate of adoption. ATR, which is currently only available on millimeter wave AIT equipment, virtually eliminated the privacy concerns of most passengers by replacing the black and white image of a passenger's body with a generic outline of a human and a small box that shows the location of any potential threat item.

In July 2011, government intelligence officials warned that terrorists may be planning to use surgically implanted explosives in order to bypass airport security measures (Homeland Security News Wire, 2011a). Since AIT cannot detect threats below the skin, other security measures, such as unpredictable screening and explosive trace detection are used to complement the AIT, according to TSA (Homeland Security News Wire, 2011a).

The relative advantage of AIT is summarized in Table 2 with how the different technologies over the past few years might be viewed in comparison. New

threats involving improvised explosive devices under the skin may be detected by metal detectors, if components contain enough metal to alarm the WTMD. The AIT is much more advanced in detecting potentially dangerous items hidden under clothing and with the advances in privacy software, such as ATR, the public is more likely to adopt AIT given the choice.

Table 2. Relative Advantage of AIT

	WTMD	Millimeter Wave AIT	Backscatter AIT	ATR AIT
Detects metal	Yes	Yes	Yes	Yes
Detects non-metallic threats	No	Yes	Yes	Yes
Metal objects under the skin	Yes	No	No	No
Privacy concerns	No	Yes	Yes	No

2.) Compatibility. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs. The accelerated deployment of AIT equipment in the fall of 2010 seemed to violate existing values of Americans as evidenced by the number, frequency, and ferocity of news media reports against the deployment. Opinion polls in 2010 and 2011 did not support the news media claims that travelers were in opposition to the use of AIT (Condon, 2010; Jones 2010; TripAdvisor, 2011; Dooley, 2010). Counter to news reports, travelers largely felt that the relatively new technology was needed, especially so soon after the underwear bombing attempt, which could not have been detected by a WTMD and was unlikely to have been detected by existing pat-down procedures.

Safety concerns continue to gain publicity despite several independent studies to assuage the anxiety of travelers. While the radio waves used in millimeter wave AIT has not raised concerns of safety advocacy groups, backscatter machines that emit small doses of ionizing radiation have been the focus of attention. Reports by CNN (Hunter, 2010), *USA Today* (Young & Morrison, 2011), and CBS (CBS 5, 2011) all raise concerns about radiation exposure from backscatter AIT. The American Federation of Government Employees (AFGE) expressed concern for the

45,000 TSOs who work near the equipment (Young, 2010). Allied Pilots Association President Dave Bates called for his constituency to opt-out of AIT during Thanksgiving, 2010, out of radiation safety concerns (Adams, 2010). News agencies and employee unions often frame issues in terms of values and needs of their customer or constituency base. Few of the news agencies or employee unions gave credence to the health studies provided by independent organizations that should have persuaded travelers that AIT was safe.

Despite assurances by the FDA, the CDRH, NIST, and Johns Hopkins University APL that the equipment was safer than the flight itself with regard to radiation (TSA, n.d. g), news media and employee unions continued to raise doubts. Although there was a great deal of negative publicity regarding the safety of AIT, passengers continued to choose AIT over alternate screening methods at 99 percent (TSA, n.d. d). Though no survey has determined exactly why passengers and employees chose to largely ignore safety warnings from news media and unions, it is possible that facts by independent agencies weighed more heavily than anecdotal claims of safety concerns for passengers and employees alike.

3.) Complexity. Complexity is the degree to which an innovation is perceived as difficult to understand and use. AIT equipment is not much more complex to use for the passenger than the WTMD. Passengers are instructed verbally and with signage in the checkpoint cue to remove items from their bodies and clothing and then stand in the AIT for a few seconds and follow the instructions of the officers. Examples of signage are shown in Figure 16 and present relatively clear guidance to passengers whether they are expert or novice travelers. Foot outlines on the floor of the equipment show the passengers where to place their feet and officers demonstrate by example how passengers should position their bodies and arms for the scan.



Figure 16. AIT Signage (From TSA, n.d. b)

4.) Trialability. Trialability is the degree to which an innovation may be experimented with on a trial basis. AIT has been used in industry since the 1960s when researchers at Pacific Northwest National Laboratory pioneered the development of optical and acoustic holography, which is considered the foundation of the millimeter-wave technology (TSA, 2010). AIT has had a decade's long history of commercial use, including the manufacturing of custom-made jeans. London's Heathrow airport first deployed AIT for passenger screening in 2004 and expanded deployment to London's Paddington Station in 2006 to screen rail passengers. Amsterdam piloted AIT at Schiphol airport in 2006 (Kohl, 2010), and test trials were conducted in Canada and Australia in 2008 (TSA, 2010) with positive results and increased use by the respective airports. TSA first deployed AIT in 2007 after the FDA's Center for Devices and Radiological Health conducted safety tests on the equipment (Cerra, 2006). Safety testing by the FDA, Johns Hopkins APL, and NIST in the application of passenger screening shows consistent reproducible data that falls within guidelines set by the American National Safety Institute (ANSI) (Cerra, 2006; JHU/APL, 2010).

5.) Observability. Observability is the degree to which the results of an innovation are visible to others. Despite AITs relatively long history in both commercial industry and passenger aviation trials in England, Canada, Australia, and the U.S. as noted above, commercial aviation passengers in the U.S. seemed largely unaware of the technology until the rapid deployment in the fall of 2010 at U.S. airports. TSA had been testing AIT for use in aviation passenger screening since 2004 (TSA, 2010) in contravention to media reports that the deployment was in response to the Christmas Day Bomber attack in 2009 (Buckley, 2011). The rapid and accelerated deployment of AIT prior to Thanksgiving 2010 was the result of the non-metallic explosive device used by the Christmas Day Bomber and the belief of TSA's new Administrator, John Pistole, that emerging threats must be managed with a risk-based approach, which included advanced imaging technology (Pistole, 2010). Though TSA had been testing the equipment for some time, the public was largely unaware of its presence until the new TSA administrator made known its necessity in identifying emerging threats to aviation security.

The United States Court of Appeals for the District of Columbia Circuit found that TSA did not conduct a notice-and-comment rulemaking, which is a procedure for a proposed rule that is published in the Federal Register and is open to comment by the general public. EPIC, who brought the petition, had not been satisfied by TSA's efforts to protect passenger privacy and health related to AIT (EPIC et al. v. DHS et al., 2011). EPIC's suit was upheld in part as the court found that TSA should have conducted a notice-and-comment rulemaking, which could have served to highlight the positive aspects of AIT in public forum. The actual result was that TSA appeared to be hiding details of the technology, raising concerns with EPIC and the media about health and privacy of passengers.

b. Known Crewmember

1.) Relative Advantage. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Pilots and crew were, and in some cases still are, required to submit to the same security screening procedures at

airports as passengers. Known Crewmember uses existing technology to positively identify employment status of crewmembers by allowing them to use a technologically modern and efficient alternative to the traditional screening process (TSA, 2011a). The process is seen a significant development for crewmembers and a modest improvement for passengers. For crew, the process allows them to very quickly establish their identity to TSA officers and undergo alternate screening, yet to be defined. While crew members go through a special and expedited lane, regular security lines have fewer travelers making the lines move quicker. The program acknowledges crewmembers, pilots especially, as stakeholders in aviation security. The logic implies that if pilots can be trusted to fly an aircraft full of passengers, they are likely trusted to enter the sterile area of the airport with expedited screening.

The program has been embraced by airline related associations such as ALPA, APA, and ATA. Gaining stakeholder support for the program has allowed TSA to pilot and implement the program quickly and with support of associated groups. A natural byproduct of this support is generally positive media coverage. The support of the program, by proxy, represents approximately 65,000 union crewmembers whose livelihood is dependent upon a safe, secure, and efficient screening system (ALPA, 2011 and APA, 2011).

2.) Compatibility. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs. The previous procedures for crewmember screening by TSA were distinctly incompatible with values and expectation by crewmembers. Dave Bates, the President of APA, who in 2010 called for his pilots to opt out of AIT use at airports, potentially causing security line congestion and missed flights (Adams, 2010), later endorsed the Known Crewmember program calling it a common sense approach to aviation security (Mayer & Overman, 2011). Pilots, who manage the safety of the aircraft they fly, want to be seen by their government as trusted agents in aviation security, Bates stated (Mayer & Overman, 2011). Similar sentiment was delivered by ATA President Nicholas Calio when he noted that airline pilots are highly skilled and trusted partners in aviation

security and Known Crewmember improves the screening system for flight crews while improving the travel experience for passengers (TSA, 2011a).

3.) Complexity. Complexity is the degree to which an innovation is perceived as difficult to understand and use. ALPA President Captain Lee Moak acknowledged that pilots have undergone employment checks, criminal background checks, and have been fingerprinted, making them some of the most highly screened employees in the aviation industry (TSA, 2011a). These are measures that the airlines have already taken to ensure they hire pilots who are more likely to be trustworthy representatives of their company and trusted agents of aviation security. Known Crewmember simply links the information that has already been collected by the airline and matches it with credentials presented when entering the security checkpoint. In terms of complexity, the identity verification process is the same for the crewmembers. Regarding the process for accessing the sterile area of the airport, crewmembers are expecting a more efficient alternative to traditional screening methods (TSA, 2011a).

4.) Trialability. Trialability is the degree to which an innovation may be experimented with on a trial basis. In one form or another, the program that is called Known Crewmember has been used on a limited basis since 2007 when ARINC, a third-party vendor, developed the Crew Personnel Advanced Screening System, or CrewPASS, in three east coast airports (ARINC, n.d.). ALPA promoted CrewPASS to TSA as the first alternate screening method for crewmembers. ALPA and ATA have been partnering with TSA to pilot Known Crewmember with admitted success by each of the three partners (TSA, 2011a). TSA has been piloting Known Crewmember since early 2011, despite nearly three years of testing CrewPASS, because it needed to evaluate the program, which is maintained jointly by the three partners instead of a third-party vendor, based on its own merits (Known Crewmember, n.d.).

5.) Observability. Observability is the degree to which the results of an innovation are visible to others. The partnership between TSA and two large unions, ALPA and ATA, increases the opportunity for program exposure to pilots throughout the industry. With the close proximity that pilots and flight attendants work

together, the program is likely to gain visibility with an untapped group that is targeted for future Known Crewmember status. ALPA and ATA are both urging TSA to include flight attendants in the KCM program (Known Crewmember, n.d.). Flight attendants are not included in the Known Crewmember program because TSA is not currently able to access the databases where flight attendant information is kept (Homeland Security News Wire, 2011b). In order for flight attendants to participate, they will need to adhere to the same strict background checks and identity verification that pilots enrolled in the program provide. Association of Flight Attendants spokeswoman Corey Caldwell hopes that her constituency will be included in KCM in the near future (Homeland Security News Wire, 2011b). Pilots and flight attendants are exposed to the benefits and requirements of KCM from news media, their colleagues, and their employee unions.

c. PreCheck

1.) Relative Advantage. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Many diffusion scholars have found relative advantage one of the most significant predictors of an innovation's rate of adoption (Rogers, 2003). Aspects of relative advantage include social prestige, low initial cost, a decrease in discomfort, and saving of time and effort (Rogers, 2003).

For early adopters of PreCheck there may be a certain amount of prestige that goes with membership in a relatively elite group of travelers that bypass much of the screening process. Not only will some of these travelers receive status as frequent flyers with their airlines, they now get special treatment at the security line. Gabriel Tarde's (1903) second law of imitation noted that the influence of prestige or alleged superiority tended to drive the adoption of innovations. Given the early adoption by air travel's most elite customers, the frequent flyer, the rate of adoption is likely to increase as other traveler witness the expedited screening.

The cost of the PreCheck program is currently absolved by TSA or the sponsoring airline. If low cost influences rate of adoption, then no-cost may dramatically affect the adoption rate. Registered Traveler captured 250,000 participants

in two years at a cost of \$200 a year (Frank, 2009). The program failed not because of its cost but because of its lack of relative advantage in convenience. If PreCheck maintains its no annual fee feature, the more significant benefit is likely to be in the increased rate of adoption and secondarily in the total number of adopters.

PreCheck allows participant travelers to forego traditional screening by validating their identity and proceeding to the special line that allows them to keep certain clothing items on and previously suspect items in their carry-on baggage. Air travelers most negatively rated the act of removing their shoes while going through checkpoint screening in a 2010 survey (Consensus Research Group, Inc., 2010). PreCheck eliminates three of the top five most dissatisfying elements of air travel with shoe removal at 37 percent of travelers, the time it takes to get through security screening at 28 percent and having to remove a belt at 26 percent (Consensus Research Group, Inc., 2010).⁴ PreCheck participants are likely to notice the relative advantage and so will the travelers that look on from full-screening lines.

2.) Compatibility. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs. The checkpoint screening process, where passengers are required to remove clothing and possibly receive a pat-down that invades a passenger's intimate space, violates American social norms that finds touching psychologically disturbing and uncomfortable (Hall, 1966). The perceived need for airport security tempers passengers' discomfort with pat-downs but does not eliminate it. PreCheck allows participating passengers to decrease the likelihood of a pat-down and allows them to keep certain clothing item on making the concept more desirable.

3.) Complexity. Complexity is the degree to which an innovation is perceived as difficult to understand and use. PreCheck, like many of the other RBS programs, retains a certain element of unpredictability. Passengers will not know until

⁴ The Consensus Research Group, Inc. (2010) survey differentiated between travelers that had flown in the past 30 days from an aggregate of those that had flown in 2009 and 2010. These percentages relate to passengers that had flown in the past 30 days (survey period was November 29 through December 10, 2010) and were more likely to become early adopters of PreCheck.

they arrive at the airport and have their boarding pass scanned if they will continue to expedited screening or go through standard screening. The unpredictable element, claims TSA, keeps terrorists from gaming the system and exploiting a weakness created by expedited screenings practice of allowing passengers to keep electronics and liquids in their carry-on bags. TSA will not reveal the frequency of unpredictable screenings or the ratio of PreCheck passengers that will not have the advantage of expedited screening. Since the complexity of PreCheck, as perceived by participants, is negatively related to its rate of adoption (Rogers, 2003), shifting requirements are likely to negatively influence PreCheck's rate of adoption. Clearly articulated requirements are necessary to make the adoption of the program attractive to future participants.

4.) Trialability. Trialability is the degree to which an innovation may be experimented with on a trial basis. PreCheck's pilot program increases the likelihood that the innovation is adopted more rapidly (Rogers, 2003). Re-invention may occur during the pilot, and is even expected by early adopters, to improve the program. However, changes that are too significant may negatively impact adoption as a result of creating complexity.

5.) Observability. Observability is the degree to which the results of an innovation are visible to others. PreCheck participants that use their established channels of communication to communicate the positive or negative perceptions of the program will influence future participants. Closely related to relative advantage, non-participants observe advantages of PreCheck participants when security checkpoint lanes are in close proximity. News media tend to cover early PreCheck programs as they enter the local market. During this critical time in early adoption, positive or negative comments related to PreCheck will affect the rate of adoption in the local area. National news coverage will naturally have a more wide-ranging affect on adoption rates of later adopters.

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V. FINDINGS

A. SYNTHESIS

The theory of planned behavior, technology acceptance model, and diffusion of innovations all provide a framework from which TSA can identify factors that can influence the diffusion and acceptance of risk-based security programs by the public. Depending on the specific program, some factors are more influential than others and it is unlikely that any one model, or combination of models, could perfectly match a specific set of parameters established by an RBS program. Nevertheless, a synthesis of TpB, TAM, and DOI assists in developing strategies that can be used to more effectively influence passenger and crewmember behavior regarding risk-based aviation security programs. In each RBS program, it may be useful to attempt to measure all factors in order to determine which are most influential.

A combined diffusion and acceptance model, shown in Figure 17, presents a synthesis of TpB, TAM and DOI. While TpB and TAM are theories that seek to understand and potentially predict behavior based on certain factors that influence an individual's intention, DOI is a theory that seeks to define the process that an innovation is communicated through certain channels over time among the members of a social system. The synthesis of these three theories shows overlapping factors that are, in some cases, mutually supporting. Perceived attributes of an innovation, as shown in the diffusion and acceptance model, relate to the design of the artifact itself. Depending on how the attributes of a particular innovation are perceived and later communicated across various channels, the effect can move in either direction.

The theory of planned behavior factors behavioral beliefs, normative beliefs, and control beliefs are underlined in black font in the diffusion and acceptance model. The technology acceptance model factors of perceived usefulness and perceived ease of use are depicted in italics in light blue font. The diffusion of innovations factors of relative advantage, compatibility, complexity, trialability, and observability are shown in green standard font.

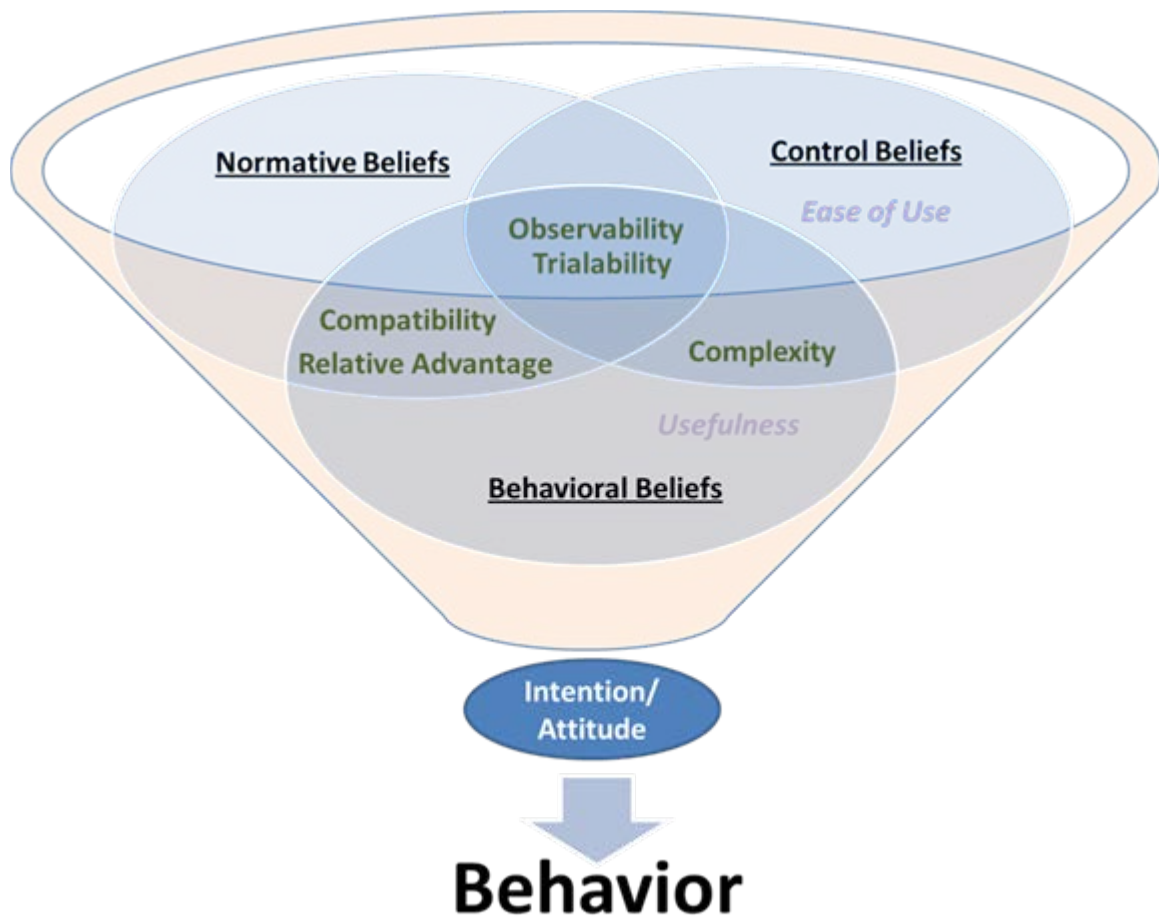


Figure 17. The Diffusion and Acceptance Model

The TpB factors of behavioral beliefs, normative beliefs and controls beliefs are three distinct components. The overlap shown in the model (Figure 17) represents the intersection of factors in TAM and DOI as they relate to TpB rather than an overlap of TpB factors. The three TpB factors should be considered independent lenses through which to view the TAM and DOI factors.

1. Behavioral Beliefs

Perceived usefulness from TAM can be viewed through the lens of TpB's behavioral beliefs. A study by Pommeranz, Wiggers, Brinkman, & Jonker (2010) linked the two factors when investigating attitudes toward new technology in social networking.

The relationship is well founded as both TAM and TpB have aspects that trace back to the theory of reasoned action by Ajzen and Fishbein (1980). TAM's perceived usefulness may be defined as the degree to which a person believes that using a particular RBS program will enhance their experience at airport security. TpB's behavioral belief is closely related and may be defined as a passenger's belief that using a particular RBS program will have positive or negative consequences.

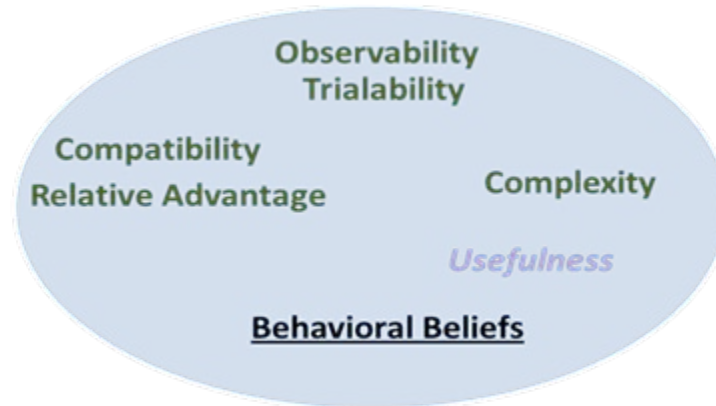


Figure 18. Behavioral Belief Lens

All of the DOI factors may generally be viewed through the behavioral belief lens. Relative advantage may be examined where the use of an RBS program results in a consequence of convenience at the airport checkpoint, such as those identified in PreCheck. PreCheck also offers potential social status where participants are elite members of a group of passengers that navigates through the expedited screening lane saving time and hassle. Compatibility may be viewed as the degree to which a program, such as AIT, shifts from existing privacy values and norms with negative consequences for passengers. Early versions of millimeter wave and current versions of backscatter AIT pressed passengers to choose between an invasive pat-down and a machine that presented a virtual strip search of the passenger. The DOI factor of complexity may influence a passenger's value of a program and their intention to use it. Naturally, the more simple the program, the more likely passengers will see it as having a positive value. Depending on how passengers view the consequences of a pilot program, the rate of adoption is positively or negatively affected as described in the DOI factor of

trialability. Observability affects a passenger's belief about the consequences of a program as they view other passengers experiencing pat-downs, entering AIT machines, or taking advantage of expedited screening.

2. Normative Beliefs

There are four factors from DOI that may be viewed through the lens of TpB's normative beliefs. Relative advantage, which can be expressed in social prestige, is easily linked to normative beliefs formed through the influence of those close to the individual. A passenger's perception of a program is likely influenced by the expectations of those closest to them. Compatibility, where the perception of an RBS program is viewed as being consistent with existing values and experiences, may be influenced by social pressure from friends, colleagues, family, and the media. Crewmembers apparently see the KCM program as more consistent with the expectation that flight crews are partners in aviation security and should be treated as such. Trialability is linked to normative beliefs through the observation and judgment of members of a social system. As programs are piloted, passengers and crew relay their opinions to other passengers and crew, setting the expectation that the particular program holds value or not. Closely related is the DOI factor of observability where passengers or crewmembers see the program in use at airports or on new media. Depending on the social influence of the media source or the social circle, the passenger may form an opinion prior to ever experiencing the program first hand.

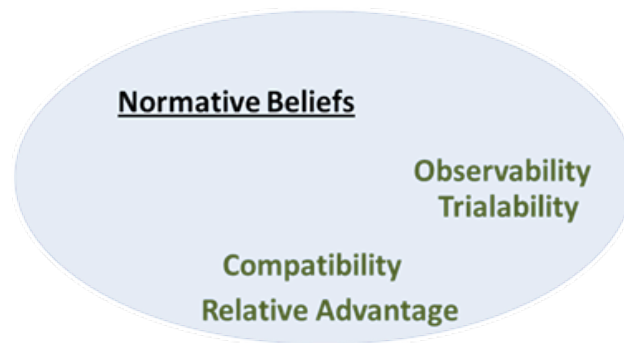


Figure 19. Normative Belief Lens

3. Control Beliefs

Perceived ease of use from TAM can be viewed through the lens of TpB's control beliefs. Control beliefs are related to an individual's understanding of the factors that facilitate or impede their performance of utilizing an RBS program. How a passenger or crewmember perceives the program as being easy or difficult to use influences their perceived behavioral control. If they view the AIT as relatively simple program to use because it does not detect metal implants in their bodies, they are more likely to feel like they have relative control and will use the technology. If they find it difficult to use because they repeatedly forget to remove items from their pockets prior to entering the machine resulting in a pat-down, they are more likely to feel like they have less relative control and may tend not to use the technology.

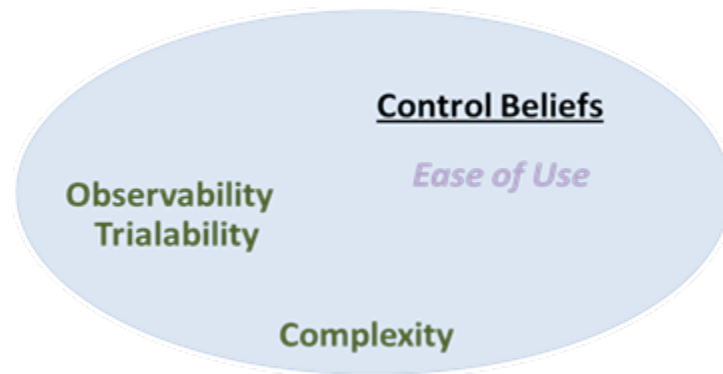


Figure 20. Control Belief Lens

Control beliefs have three DOI factors that may be viewed through its lens. Complexity, which is the degree to which an RBS program is perceived as difficult to understand, directly relates to factors that facilitate or impede performance. Minimizing the complexity of any RBS program is likely to result in travelers using the program by choice and increasing its rate of adoption. More complex innovations require more skill and effort and are generally associated with slower adoption (Premkumar, Ramamurthy & Nilakanta, 1994). Trialability allows for some experimentation of the program and allows travelers to become used to the features and increases their perceived control. The DOI factor of observability increases travelers' perceptions of control by watching others

perform a given action at the airport, through news media, or online demonstrations at TSA.gov. The more travelers see the activity, understand how and why it is used, and believe they have control over their behavior, the more likely they will utilize the program freely.

B. GENERALIZABILITY/APPLICATION: THE RBS MODEL OF DIFFUSION AND ACCEPTANCE

Determining the most significant factors of a particular program requires some dissection of the program itself through examination of diffusion and acceptance factors of RBS programs. This dissection is accomplished by taking an RBS program at the macro level and breaking it down into sub-processes through the application of diffusion and acceptance factors. While the diffusion and acceptance model includes the most impactful factors that may influence the diffusion and acceptance of an RBS program, not all factors will be applicable for all programs.

As an example, the AIT program received wide media attention in November, 2010. Though the program had been in a pilot phase since 2007, the rapid deployment and designation that it was a primary screening method caused media backlash. On the surface, DOI factors of observability and compatibility, as well as the TpB factor of normative beliefs, may lead an observer to assume that the acceptance rate of this technology would be low and the diffusion rate slow. However, independent surveys and data obtained by TSA showed that passengers overwhelmingly approved of the AIT and the diffusion rate at participating airports was rapid. In this case, it appears that the TAM factors of ease of use and usefulness, TpB factors of behavioral and control beliefs, and DOI factors of relative advantage and complexity more readily influenced passengers' intentions and attitudes than did normative beliefs, observability, and compatibility. The result was approximately 80 percent favoring the AIT initially in late 2010 and 99 percent of passengers choosing to utilize the technology in early 2011. In this particular case, normative beliefs and social pressures did not influence passenger behavior as the group that organized wewontfly.com and EPIC had anticipated.

Another example is that KCM has a limited pool of participants, largely represented by pilot and crewmember unions. The normative beliefs are likely influenced by union opinion. Media reports on KCM quote union leaders, and the literature reveals a distinct lack of individual opinions from participants. From the literature, it appears that the most predictive and explanatory factors for KCM are TpB's normative beliefs resulting from the perceived social pressure by union representatives. The DOI factor of compatibility may be useful in predicting participants' behavior because of the view that KCM is more closely aligned with the perception that flight crews are trusted agents in aviation security. KCM is likely seen as being more consistent with crewmembers' values and needs. This value of crewmembers as trusted agents has been articulated by union representatives and acknowledged by TSA officials. Where the influence of others in AIT appeared minimized, the KCM case shows that those factors seen through the behavioral beliefs lens are likely the most influential.

Literature supporting PreCheck diffusion and acceptance shows initial approval by the traveling public and also indicates that the diffusion rate after the pilot program will be moderate to high. Ahlers (2011), Miami Int'l Airport (2011), and Verdery (2011), show strong passenger acceptance and indications that TSA is making improvements in its risk-based security through the PreCheck program. PreCheck tends to rate positively on several factors. The TAM factor of perceived ease of use will be a likely predictor of support from participants as travelers pass through security with fewer requirements to remove clothing or items from carry-on baggage. DOI factors of relative advantage, complexity, and trialability are showing indications of support by early adopters during the pilot stage of this RBS program because of PreCheck's improvement in expedited screening over traditional screening, fewer requirements, and participant support during piloting.

The diffusion and acceptance model allows implementers of any new RBS program to quickly identify and synthesize factors that are most likely to influence diffusion and acceptance of the new program. A wealth of literature supports the use of

TpB, TAM, and DOI in predicting and guiding new technologies, procedures, and programs to achieve higher rates of diffusion and adoption.

Upon development of a new RBS program, implementers may apply attributes of the new program to each of the factors in the diffusion and acceptance model. The combined list of factors creates versatility in the diffusion and acceptance model that does not exist with TpB, TAM, or DOI independently.

VI. RECOMMENDATION/CONCLUSION

A. SUMMARY OF RESEARCH

The Transportation Security Administration has implemented successive risk-based aviation security programs with increasing acceptance by participants. In order to continue influencing the acceptance of new programs and increasing the rate of diffusion, TSA should examine all the factors that could potentially influence participants' intentions and behaviors using the diffusion and acceptance model. Through the behavioral, normative, and control belief lenses provided by the theory of planned behavior, RBS program implementers can see how mutually supporting diffusion of innovations and technology acceptance model factors strengthen a synthesized model of diffusion and acceptance.

The collective identification of factors that may help predict participant intentions and attitudes that ultimately leads to a desired behavior will assist in building a communication framework for TSA. Without properly identifying these diffusion and acceptance model factors and specifically addressing them prior to, during, and after an RBS program pilot, TSA may find participants litigating, refusing to use the programs, or causing damage to the image of the agency. Conversely, using a behavior predictive model to predict participant behavior may allow TSA to better expend resources on the program itself by communicating features that will enhance travelers' experience at the airport through established channels more quickly. TSA will be able to more efficiently deploy new technologies by applying factors that result in accelerated adoption rates, which will decrease costs associated with longer pilot programs or terminating the program altogether because an important factor was not well considered.

This paper provided multiple examples of current RBS programs that could either have benefited from the use the diffusion and acceptance model, such as AIT, or highlighted portions of existing programs, such as KCM and PreCheck, where the strengths of the programs should be promoted and applied to related RBS programs. Using a strengths based approach to develop RBS programs allows TSA to focus on

positive aspects of a system that may lead to other design features that are difficult to see when the agency is so focused on correcting mistakes and image control. If the diffusion and acceptance model is applied in the planning stages of a new RBS program, mistakes are mitigated before the public has a chance to critique the new program and TSA may then focus on positive potential through appreciative inquiry.

TSA should solicit input from stakeholders who are both supporters and detractors of RBS programs. This research shows that an absence of input from organizations like EPIC can be a distracter for a strengths-based approach to program improvement. Conversely, partnerships with supporters, like the U.S. Travel Association and crewmember unions, has shown to pay dividends in rate of adoption, acceptance by participants, and creating a positive image of TSA. Airline pilot unions were strong advocates of Known Crewmember, while showing resistance to AIT. TSA should identify the key stakeholders in each program and partner with organizations that represent the particular constituency. Large advocacy groups are likely to increase the adoption rate of an RBS program. TSA should quickly identify key stakeholder groups that may impede or enhance the diffusion and adoption of a program and, using the factors of the diffusion and acceptance model, identify methods for promoting collaboration or mitigating detracting arguments from opponents.

B. LIMITATIONS OF RESEARCH

This research is theoretical and requires specific surveys of RBS program participants to validate the diffusion and acceptance model. There is ample literature to show that TpB, TAM, and DOI are predictive theories that work well independently. There is currently no data to date to show that these theories are useful in risk-based security or that they can be synthesized to build a stronger model for prediction of behavior.

TpB, TAM, and DOI have many mutually supporting features and are well suited to complement each other in a synthesized model. TSA may still apply the diffusion and acceptance model to currently piloted programs to ensure corrections in passenger

perception have been adequately addressed. New programs will require careful consideration of RBS program participant surveys that seek to find factors that are most influential in enhancing public perception of the program and increase the rate of adoption. Future research should focus on surveys designed to predict acceptance and diffusion of specific RBS programs. This data may then be used to identify which factors TSA should expend the greatest amount of resources to influence travelers' perceptions. In many cases, third-party organizations may partner with TSA in the formulation of questions.

This research does not create a solution template for RBS implementers but rather a framework for a strengths-based approach to behavior prediction. It asks the implementer to consider, for example, the relative advantage of an RBS program and why it may be important to travelers. Since each program is unique, how the implementer communicates each factor to the traveler is also unique.

C. CONTRIBUTIONS TO PRACTITIONERS AND THE FIELD OF HOMELAND SECURITY

Risk-based aviation security implementers will benefit from the use of the diffusion and acceptance model as they break from the common government technique of compelling citizens to adopt new programs without adequate input from those most affected. RBS programs at TSA are necessary to protect the traveling public and gain efficiencies to mitigate predicted growth in the passenger aviation industry. Improvements in acceptance and adoption rates of new programs through application of the diffusion and acceptance model are likely to contribute to improving TSA by:

1. Saving financial resources through more efficient piloting of new RBS programs.
2. Increasing the adoption rate of new RBS programs thereby getting critical technology or procedures to airports faster in order to protect the lives of travelers.
3. Improving the image of TSA through partnerships with influential third-party organizations.

USTA (2011) and the Consensus Research Study (2010) on air traveler perception of aviation security show that the public and air travel industry stakeholders desire a better system to screen passengers. Much of USTA's recommendations for improved air passenger experience and security are captured in TSA's risk-based security approach. The application of the diffusion and acceptance model will help TSA protect the nation's transportation systems through participant support and gained efficiencies.

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