Have a Human Factors Engineering request or need more information about our team: HF iShare
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Attachment B
**PLEASE RETURN ALL FOLDERS TO JENNA HAYFIELD AT E11-347N**

**Explanation, Special Instructions, Comments:**

**Purpose:** The purpose of this memorandum is to provide overview of the Blended Lanes initiative and approve the transition from Operations Support (OS) to Security Operations (SO).

**Action Requested:**

DUE DATE: 23, APR 2019
Memorandum

MEMORANDUM FOR:  
Assistant Administrator  
Security Operations

FROM:  
Assistant Administrator  
Requirements and Capabilities Analysis

SUBJECT:  
Blended Lanes

Purpose

The purpose of this memorandum is to provide an overview of the Blended Lanes initiative and approve the transition from Operations Support (OS) to Security Operations (SO).

Background

The Transportation Security Administration (TSA) Requirements and Capabilities Analysis (RCA) developed Blended Lanes, which supports effective collaboration among checkpoint operators, to ensure that all TSA Pre✓® passengers receive TSA Pre✓® screening regardless of what time of day or checkpoint they fly out of. The pilot was executed in Jackson-Medgar Wiley Evers International Airport (JAN) on Nov 26, 2018. Upon successful improvement to 100% TSA Pre✓® screening experience for TSA Pre✓® Passengers at JAN, the pilot was expanded to Southwest Florida International Airport (RSW) starting on Feb 11, 2019 and Dallas/Fort Worth International Airport (DFW) starting on Feb 26, 2019. Based on the pilot, Blended Lanes has been recommended for a soft rollout by Security Operations.

Based on data analysis collected at these three Blended Lane airports:

- **Efficiency:** Blended Lanes permits TSA Pre✓® passengers to leave compliant 3-1-1 and laptops in their bag. Additionally, shoes, belts, and light outer jackets are not required to be divested.
- **Customer Satisfaction:** All TSA Pre✓® passengers receive full TSA Pre✓® screening, regardless of what time of day or checkpoint they fly out of.
Objective

The objective of this transition is to formally enable stakeholders to sustain the rollout of Blended Lanes. RCA will support Security Operations and local TSA at airports in implementing the Blended Lanes process.

The Blended Lanes initiative engages stakeholders across TSA Headquarters and local airports. Daily operations of Blended Lanes will be owned by Security Operations local TSA. Should any circumstances at airports involve substantial efforts or major decisions, RCA will provide support and advise stakeholders as needed.

The various roles and corresponding responsibilities include:

- RCA has provided project management support to include:
  - Determination of the appropriate time(s) to conduct Blended Lane screening.
  - Development and coordination of Blended Lane documentation; Senior Leadership briefings, Operational Directive, and leadership guidance.
  - Establishing Blanket Purchase Agreement (BPA) for purchase of indicators.
  - Communications planning to include Federal Security Director (FSD) memo and national shift brief.
  - Coordination with Training and Development (T&D) for on-the-job training and Online Learning Center (OLC) tracking codes.
  - Human Performance Assessment – recommendation to assess TSO cognitive burden and threat detection in the next 3-6 months to ensure security effectiveness remains at an acceptable level.
  - List of answers to Frequently Asked Questions (FAQ).

- Security Operations is responsible for daily operations to include:
  - Monitor BPA contract administration to ensure the ceiling of the contract is not breached by assigning a responsible COR.
  - Implement based on guidance provided.
  - Disseminate ongoing communications and routine shift briefs to the field.
  - Report any questions to appropriate parties (RCA/Continuous Process Improvement Team) for resolution.

Recommendation

RCA recommends approval of this memorandum to transfer Blended Lanes from an initiative to a sustainment activity in Security Operations.

Approve ________________ \_________ Disapprove ________________ \_________
Date Date
Modify ________________ \_________ Needs more discussion ________________ \_________
Date Date
EXHIBIT

#8
MEMORANDUM OF INTERVIEW OR ACTIVITY

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<td>January 23, 2020</td>
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<td>Requirements &amp; Capabilities Analysis</td>
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<td>TSA Headquarters</td>
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<td>West Building 9th Floor</td>
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Subject Matter/Remarks

**Interview or Activity:** Transportation Security Specialist (TSS) [Redacted] was personally interviewed regarding her knowledge of the TSA operation of blended lanes. TSS [Redacted] was cooperative and provided the following information:

- The Human Performance Branch (HPB) conducted a Human Factors Qualitative Evaluation which consisted of observations, questionnaires and leadership interviews. (Written Statement Page 1; Question 5 and Audio 26:52)
- The purpose of the HPB evaluation was to 1) Understand how this new procedure effects human performance; 2) Identify pain points and bright spots in the procedure; 3) Identify error rates and 4) Determine if additional data collection is needed regarding the impact of these procedural changes on effectiveness, efficiency, cognitive load or security effectiveness.
- This initiative was meant for small airports where there is no dedicated Pre-Check lane. (Audio 10:33)
- The whistleblower's concerns regarding blended lanes are valid because of the cognitive overload added to the officers. (Audio 41:06)

Case Number: 119 0386

Case Title: OSC Disclosure


(Revised 12-15-08)
MEMORANDUM OF INTERVIEW OR ACTIVITY (continuation sheet)

- The evaluation included 18 recommendations categorized by topic area to include 1) minimize security risks 2) streamline process to improve effectiveness and efficiency at achieving stated goals, and 3) enhancing officer performance. (Written statement Attachment A)
- Some recommendations included were 1) perform testing to assess and identify security risks and gaps 2) examine effectiveness, efficiency and officer performance 3) perform a cognitive task analysis 4) Refine airport identifiers on the vetting indicators and Pre-Check cards to eliminate potential misuse and mitigate indicators being taken from checkpoints. (Written statement Attachment A)
- No action was taken on the 18 recommendations from the assessment report. (Audio 47:55)
- There were a number of drafts because it "read very negative" and they knew that LSS was "the apple of senior leadership's eye". If this report had been delivered to another agency it "would have shut down the program." (Audio 48:50)
- She became aware of 2 reported breaches. One involved passengers being screened incorrectly and one involved the wrong bag being pulled for search. The officers stated they weren't sure if the incidents were reported because "leadership at the airport wanted the pilot to be a success." (Page 3; Question 15 of the Written Statement)
- At one airport, they discovered that a passenger had taken one of the bricks from another airport. "They have lost a couple." The HPB Blended Lane Evaluation stated that 3 blocks had been lost as of 3/27/2019 (2 Pre-Check and 1 standard) (Audio 51:53)
- HPB Blended Lane Evaluation reported observations were made of a mother attempting to give her PreCheck™ card to her daughter, who was not PreCheck™. (Attachment A)
- HPB Blended Lane Evaluation include focus group interviews. A Transportation Security Manager stated "I think blended lanes is going very well here, TSOs were receptive and learned quickly. There were complaints from TSOs at first, then they adjusted, accepted and made it work. It took about 3 weeks for TSOs to adjust."
- In the draft action memo from Requirements Capabilities Analysis to Security Operations, it states "The impetus behind this effort was concerns by Congress that Pre-Check Passengers were not afforded a Pre-Check lane at all airports." The draft memo also mentioned that the HPB Blended Lane Evaluation would be attached to the memo. (Written Statement Attachment B)

**TSS Note:** This memo was never signed/finalized. Instead the memo was downgraded from the Executive Assistant Administrators to the Assistant Administrators, and the final memo that

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**Case Number:**
119 0386

**Case Title:**
OSC Disclosure

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(Revised 12-15-08)
was signed did not include the HPB Blended Lane Evaluation report, but instead just mentioned the report.

**TSS Note:** Provided copies of the Human Performance Data Collection Plan, Blended Lane Pilot-DFW and emails regarding Blended Lanes. These documents did not provide relevant information regarding the allegations being investigated, however the documents will be maintained with the case file and are available upon request.

See the attached signed statement of TSS and audio for more specific information. Audio recording will be maintained in the case file.

Attachments:
- Signed Statement by and attachments
  - Blended Lane Evaluation dated April 16, 2019
  - Action Memo (draft) for the Implementation of the Blended Lanes Initiative
Non-Disclosure Agreement

A representative from TSA Investigations has briefed me relative to an internal investigation.

I will not disclose or release any information provided to me, pursuant to the interview, without proper authority or authorization. Should situations arise that warrant the disclosure or release of such information, I will do so only and in accordance with the law, regulations, or directives applicable to the specific categories of information. I will honor and comply with any and all dissemination restrictions cited or verbally relayed to me by proper authority.

I further understand that any unauthorized release may result in civil penalty or other disciplinary action.

These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive Order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive Orders and statutory provisions are incorporated into this agreement and are controlling.

Print name: [Redacted]

Signature: [Redacted]

Issued by: [Redacted]

Witnessed: [Redacted]

Date: 4/23/2020

Date: 11/23/2020

Date: 1/23/2020

TSA Non-Disclosure Agreement (Revised 5/1/2018)
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<td>Investigator(s): [Redacted]</td>
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I hereby make the following statement to Investigator [Redacted], who has identified herself to me as an Investigator with the TSA Investigations Division.

(Below print your Statement of facts including: WHO, WHAT, WHEN, WHERE, HOW, and WHY.)

Q1. What is your current position and job duties with TSA?
A1. I am a TSS on the Human Performance team. I currently manage high risk government contracts with select vendors as well as serve as a SME with regards to field operations. I am the main Focus Group Facilitator on the team, I also perform Usability testing and my tasked capability encompasses all things User Experience & Communications related.

Q2. How long have you had this position?
A2. I have been in this position with the HPB since 2015.

Q3. Who is your current supervisor?
A3. [Redacted]

Q4. Did you have any involvement with the pilot for blended lanes?
A4. Yes I served as an HFB SME (Human Performance Branch Subject Matter Expert) and facilitate Focus Groups/Interviews with Officers at DFW airport as well as conducted checkpoint observations of the process.

Q5. Did your office conduct an assessment of the blended lanes operation?
A5. Yes it was a Human Factors qualitative assessment consisting of officer focus groups with questionnaires and Leadership interviews as well as airport observations. The task was requested by [Redacted] RCA and [Redacted] from the Lean Six Sigma group.
Q6. What airports did the assessment review?
A6. DFW and JAN

Q7. What was the purpose/goal of the assessment?
A7. To determine Cognitive burden with Task Switching, understanding potential sources of human error, the impacts on the passenger experience and to Validate the pilot - Provide Senior Leadership with data informing them of implementation challenges/gaps and path forward recommendations.

Q8. What did the assessment include?
A8. The assessment included Checkpoint and Lane observations (Officer-Passenger interactions and Officer Leadership Interactions), Focus groups and Interviews with officers that met a specific criterion (Checkpoint Certified, PreCheck Certified officers all with at least 1-year experience with TSA; focus groups were conducted with TSO's and Interviews with Leadership roles were separate i.e. LTO's and STSO's) – **please see attached Data Collection Plan**

Q9. What was the summary/result of the assessment? (i.e. what was the issues identified and what were the recommendations?)
A9. Staffing levels were inadequate for optimal success of the protocol. The X-Ray operator as well as the DO positions were the most challenging with regards to constant switching of screening protocols which impacted screening effectiveness. Performance decrements. Yet this concept worked more efficiently at the smaller category 2 airports performing it in specific time blocks. Our recommendations - we had 18- included Developing a purposeful, effective training program for this initiative and ensure all Officers are trained, Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency, Refine airport identifiers on the vetting indicators and PreCheck cards – **please see final report**

Q10. What was the timeframe of the assessment?
A10. We had approximately a month (during which there was a travel restriction in place due to Travel Card contract changes)

Q11. Who received the final assessment report? (List everyone who your office sent the report to)
A11. From my knowledge: [redacted], Lean Six Sigma Branch Manager, [redacted] DAA, RCA, [redacted], RCA, [redacted], OTD, [redacted], DAA of OS and [redacted]; EAA

Q12. What, if any, actions were taken on the recommendations from the assessment?
A12. None – to my knowledge

**FOR OFFICIAL USE ONLY**
Q13. Do you personally have concerns over the blended lanes operation or the pilot program? A13. I do... the switch cost – performance decrement in task switching is great with this procedure as well as vigilance decrement. There is greater risk for passengers to "circumvent" the security process meant for them and an even greater risk for security breaches. That's just based off our short observations to which I would’ve hopes a longer assessment/study would have been requested so we could do a full Cognitive Task Analysis and/or Usability Study for refined metrics.

Q14. Are you aware of any others who are also concerned about the security of Blended Lanes? A14. No it was just myself and my team (7 ppl total) – everyone else involved were highly enthusiastic to a nauseating extent.

Q15. Are you aware of any reported breaches, incidents or errors that have occurred because of the Blended Lane operation? A15. While we were at DFW the officers alerted us that 2 breaches (security incidents) had occurred a week prior to our arrival. One incident was a case where a passenger and their baggage were screened incorrectly and they were already on the sterile side and one was where the wrong bag was pulled for search and the suspect bag made it to air-side (sterile area). The officers told us that they weren't sure if the incidents were actually reported to Leadership at Headquarters because Leadership at the airport wanted the pilot to be a success.

Q16. The whistleblower alleges that the "screening procedures for blended lanes include multiple steps that increase opportunities for human error and introduce exploitable gaps? How would you respond to that allegation? A16. The opportunity for human error is greatly increased and does introduce new gaps but some of our leadership seem to think the job of a TSO is easy...While on one of the conference calls about the Blended Lane Effort I heard an individual say "how hard is it to memorize an SOP and push a button and pick up a bin?" and I was infuriated, shocked and horrified because it's remembering about 15 SOP's and multiple MD's and operating a Graphical User Interface with multiple buttons and switches by an individual who has minimal trust in automation and even less in the SOP correlated to the procedure. I agree with what the whistleblower stated.

Q17. What other reviews or assessments do you recommend occur on the blended lanes operation? A17. Conducting a follow up assessment to measure the effects of the procedure since implementation, a cognitive task analysis to determine associative tasks and cognitive task and their weight on the officer, even a usability study of the protocol and its effects.

----------------------------------------------------------------------------------

Initials: [Redacted]  Page 3  1/23/2020

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SENSITIVE SECURITY INFORMATION

I have read this entire statement consisting of 4 pages. I have been given the opportunity to make corrections. I declare under penalty of perjury that the foregoing is true and correct.

Signature: [Redacted]

Executed on this the 23rd (Day) of January (Month), 2020.

Signature of Investigator: [Redacted]  Date: 1/27/2020

Initials: [Redacted]

Confidential

Page 4  1/23/2020

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SENSITIVE SECURITY INFORMATION

Attachment A
BLENDED LANE EVALUATION

Human Performance Branch

April, 16 2019
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Executive Summary

The Transportation Security Administration's (TSA) Human Performance Branch (HPB) in the office of Requirements and Capabilities Analysis (RCA) aims to improve human performance within the aviation environment and other transportation venues. This report details the HPB's assessment of the Blended Lane procedure and provides actionable recommendations and next steps for successful implementation. The current analysis is the first study of this concept intended to inform decisions about the future of the Blended Lane effort focusing on operational processes, officer performance, and passenger experience. This type of assessment is critical for understanding its impact on detection.

The purpose for this assessment was to gain understanding of officers' and passengers' ability to adhere to the Blended Lane procedure and to identify both positives and negatives that may result from this process. Ultimately, the main objective was to gather data that would inform TSA on how to move forward with such a procedure in a manner that does not impact detection standards or impede the security process.

The four main objectives of this evaluation were to:

1. Understand how this new procedure affects human performance;
2. Identify pain points and bright spots in the procedure;
3. Identify error rates; and
4. Determine if additional data collection is needed regarding the impact of these procedural changes on effectiveness, efficiency, cognitive load or security effectiveness.

The Blended Lane proof of concept is currently being used in three airport locations. The HPB research team observed Blended Lane operations at two of these locations, a CATX and a CAT II airport. The scope of this effort included observational data collection, focus groups and a short questionnaire to generate data points for analysis in order to answer the four main objectives and to provide recommendations for moving forward with this procedure.

The consistent themes identified across all forms of data collected for both airport locations are listed below:

- The DO and X-Ray take on the majority of the additional responsibilities introduced by the Blended Lane process and were identified as the most challenging positions. This is in part due to the critical nature of these positions and the pressures associated with that.
- Certain aspects of the Blended Lane process need clarification and/or refinement as the SOP is finalized, including staffing requirements, vetting indicator standard procedures for tracking and returning to appropriate station, and property identification for the Property Search Officer (PSO). An SOP or an addendum to the current precheck and/or standard SOP is needed to ensure standardization and consistency.
- A formal training method is necessary to ensure every officer receives the same information and in the same way. This will help with consistency and understanding. Currently, each airport and checkpoint had varying methods of relaying the necessary information and there is currently no procedure in place for Officers coming into a checkpoint with no prior training or briefing.
- Staffing levels are inadequate for operating a successful Blended Lane. On average, both airports indicated they typically have approximately six to eight Officers available, and
both indicated that approximately 10 Officers would be ideal. This would eliminate instances where Officers are having to perform multiple duties at once because of a lack of resources (e.g., WTMD Officer having to also conduct the DO position). Overall, additional staff would help the Blended Lane process run smoothly.

- Communication between Officers working together at each position, especially the DO and X-Ray Officer is critical to the success of the Blended Lane procedure. This also includes communication with the passengers beginning at the TDC and continuing throughout the process.
- Currently, there are several items required in this procedure that have no tracking mechanism in place. These moving pieces may create a security risk if in the wrong hands or stolen, lost, or accidentally misplaced and not returned (i.e., vetting indicator blocks, Precheck cards). Procedures to track these items are necessary.

Specific overall recommendations were generated based on this effort and are categorized by topic area: 1) minimize security risks, 2) streamline process to improve effectiveness and efficiency at achieving stated goals, and 3) enhance officer performance. The 18 recommendations are listed below.

**Minimize Security Risks**

1. Perform testing in the Blended Lane to assess and identify possible security risks and gaps in the process. As part of the recommendation, assess threat detection and Officer compliance.
2. Examine how this process affects Officer TIP scores as well as other assessments and consider alternative options during Blended Lane operations.
3. Consider alternate solution to physical indicators of vetting status at the checkpoint such as automation at the X-Ray screening. At a minimum, develop tracking and reporting mechanisms for the vetting indicators and precheck cards.
4. Refine airport identifiers on the vetting indicators and precheck cards to eliminate potential misuse and mitigate indicators being taken from checkpoints.

**Streamline Process to Improve Effectiveness and Efficiency at Achieving Stated Goals**

5. Establish distinct parameters for this procedure such as when and where it should be implemented and ensure airport leadership adheres to these parameters.
   a. At CAT X airports or airports with a full modest and/or multiple checkpoints, Blended Lane should only be operational when dedicated Pre✓ lanes are closed and should not be combined with dedicated Pre✓ lanes or Standard lanes in order avoid confusion and potential increase in security risks.
   b. Blended Lane may operate continuously at smaller airports where there is a single-lane checkpoint.
   c. When volume is high, it is recommended to open a dedicated Pre✓ lane with a standard lane at larger airports where this is feasible given the checkpoint configuration.
6. Develop a purposeful, effective training program for this initiative and ensure all Officers are trained.
7. Ensure that all officers rotate through the blended lanes at a minimum of once per week to keep their performance at an acceptable level.
8. Examine effectiveness (decrease or increase in detection), efficiency and Officer performance.
9. Examine and define the adequacy of staffing levels for Blended Lane given the checkpoint size and passenger volumes. Identify the specific number of TSOs required to effectively implement this initiative and staff accordingly.
   a. A Blended Lane should operate with at least 10 officers at a given time.
   b. Ideal staffing is suggested as: 2 TDC, 2 DO, 1 Exit, 1 X-ray, 1 WTMT, 1 AIT, 1 PSO, 1 Dynamic.
10. Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency. Identify which positions should not be "combined" (i.e., DO and WTMD)
   a. TDC should segment passengers from the queue and communicate instructions to Pre✓ passengers when handing over blue card.
   b. Dynamic and PSO officer return blocks and blue cards to DO/TDC.
11. Develop and implement an internal communication plan to facilitate standard practices and communication across Officers and locations. Build in protocols for training and monitoring Officers new to the procedure (e.g., substitute from another checkpoint; Level I (D1) Officers in rotation).
   a. The "burn-in" time should be 1 month to allow for comprehension and practice of the Blended Lane.
12. Determine and provide airports with an adequate amount of vetting indicators and Pre✓ cards based on the size of the checkpoint. This will help eliminate the issue of running out of indicators and halting operations to retrieve the indicators.
13. Determine the best method for keeping track of and determining status of property when awaiting bag checks (e.g., vetting indicator specifically for the property).
14. Determine a way to automate the X-Ray notifications for when screening Pre✓ property versus Standard property to help eliminate the burden placed on the DO and X-Ray Officer. This automation could be a simple X-Ray screen color change or line at the bottom indicating which type of bag is currently being examined using some kind of RFID indicator on the bin, for example.
   a. Until automation is feasible at the X-Ray, examine and gather feedback on best practices to refine the "switch indicator" for the X-Ray position and ensure officers understand that the switch is optional; it may work well for some, but not for others.
15. Filter through all signage and dispose of or relocate to a monitor in the checkpoint. Provide effective directional signage to passengers to help with passenger segmentation to ease the burden on the TDC Officer. Provide a brief explanation on the Pre✓ card explaining that Pre✓ passengers are intermingled with non-Pre✓ passengers and there may be a slight wait period.
16. Pre✓ cards should be large enough to reduce the possibility of passengers accidentally losing the card when they are divesting (e.g., inadvertently placing the card in a bin or in their property) and should include the information necessary in as few words as possible in a bulleted list.

**Enhance Officer Performance**

17. Due to proactive interference of changing from one mental model (Pre✓ procedure) immediately to another (standard procedure), perform a cognitive task analysis (CTA) to examine the cognitive workflows of TSOs and identify specific areas in the cognitive process
that are most effortful, most error-prone, and most difficult. As part of this effort, examine the
cognitive requirements associated with each job rotation and identify mitigation strategies.
18. Conduct research to measure the effects of high volume operations on the performance of
TSOs. Examine the ability of TSOs to maintain situational awareness and vigilance in order
to understand the impact on detection rates.
1. Introduction

The Transportation Security Administration’s (TSA) Human Performance Branch (HPB) in the office of Requirements and Capabilities Analysis (RCA) aims to improve human performance within the aviation environment and other transportation venues. This aim is achieved through research on the physical, behavioral, cognitive, and social characteristics of end-users in the aviation security domain, and how such users interact with systems, processes, and technologies. While the HPB and other internal TSA groups frequently study human performance outcomes as they relate to threat detection, security effectiveness and compliance with Standard Operating Procedures (SOPs), the HPB maintains an additional focus on understanding the drivers of human performance and underlying influences that affect Transportation Security Officers’ (TSOs) behavior and performance.

This report details the HPB’s assessment of the Blended Lane procedure and provides actionable recommendations and next steps for successful implementation. The current analysis is the first study of this concept intended to inform decisions about the future of the Blended Lane effort focusing on operational processes, officer performance, and passenger experience. This type of assessment is critical for understanding its impact on detection.

1.1 Background

The Lean Six Sigma Branch developed a procedure to combine Pre✓ passengers and standard passengers in a single lane checkpoint in order to provide a way for smaller airports to incorporate the full Pre✓ experience. The intent was to provide this experience for Pre✓ passengers when an airport was unable to have a dedicated Pre✓ lane.

The impetus behind this effort was concerns by Congress that Pre✓ passengers were not afforded a Pre✓ lane at all airports. Within the procedure, the Blended Lane operates continuously, processing Pre✓ and standard passengers through the same checkpoint. Each position within the checkpoint is required to know the passenger status is in order to conduct the appropriate level of screening as they traverse through the security process. Vetting indicators were provided to help Officers switch between protocols and consisted of Pre✓ cards given to Pre✓ passengers at the TDC and blocks inserted into the X-Ray that alerts the X-Ray officer which property they are screening.

Three locations are currently operating the Blended Lane concept, two CAT II airports and one CAT X, with the desire to expand to other locations in Fiscal Year 2019. The HPB was brought in to assess human factors and get an initial understanding of opinions and experiences with the Officers participating. This report details the HPB effort and provides preliminary results from two data collection efforts.

1.2 Purpose, Objectives and Scope

The purpose for this assessment was to gain understanding of officers’ and passengers’ ability to adhere to the Blended Lane procedure and to identify both positives and negatives that may result from this process. Ultimately, the main objective was to gather data that would inform TSA on how to move forward with such a procedure in a manner that does not impact detection standards or impede the security process. Because this effort is considered a proof of concept, examining the impacts to officer performance and detection rates will provide information necessary for future data collection efforts of this procedure prior to implementation.
The four main objectives of this evaluation were to:

5. Understand how this new procedure affects human performance;
6. Identify pain points and bright spots in the procedure;
7. Identify error rates; and
8. Determine if additional data collection is needed regarding the impact of these procedural changes on effectiveness, efficiency, cognitive load or security effectiveness.

The Blended Lane proof of concept is currently being used in three airport locations. The HPB research team observed Blended Lane operations at two of these locations, a CATX and a CAT II airport. The scope of this effort included observational data collection, focus groups and a short questionnaire to generate data points for analysis in order to answer the four main objectives and to provide recommendations for moving forward with this procedure.

This HPB assessment is not meant to provide conclusions on whether this procedure should be implemented nationwide. Rather, it is meant to inform TSA leadership on what is working and what needs improvement in order to design a successful process and to provide recommended parameters when developing an execution plan. This report describes the methodology and results of HPB’s study and will assist TSA in determining the risk factors associated with using Blended Lanes and can assist in helping to mitigate the risks to performance in order to make informed decisions.

1.3 Process Overview

The Blended Lane operation provides Officers with a means to screen passengers and their property by Risk Based Security (RBS) procedures, while screening standard passengers and their property on the same lane. Blended Lanes are meant to replace the practice of expediting Pre✓ passengers during Standard lane operations and is intended for periods of low Pre✓ volume or times when one lane exists to meet total passenger volume.

A Blended Lane can screen both Pre✓ and Standard passengers on the same lane by following the steps listed below (see Appendix A for a detailed process description):

1. Establish a separate queue for Pre✓ passengers.
2. Identify Pre✓ passengers at the TDC and provide these passengers with a Pre✓ card. (Expedites passengers will be provided an Expedited card).
3. Divest Officer (DO) identifies and segregates Pre✓ passenger accessible property during divesture. DO places a Pre✓ vetting indicator in front of Pre✓ property.
4. Following the last Pre✓ passenger’s property, DO places a Standard vetting indicator in front of the Standard passenger’s property.
5. DO directs Pre✓ passengers to the WTMD. The WTMD USP will be set at All quotes on Pre✓ passengers are resolved through the AIT Screening, if eligible.
6. The X-Ray Operator utilizes the "Pre✓ / Standard" switch to track the type of screening being conducted at the X-Ray. In Blended Lanes the algorithm and TIPs will remain on. The X-Ray Operator will screen all accessible property following the Pre✓ indicator as instructed by the
RBS SOP. Screen all property following the Standard indicator as Standard passenger property.

7. The Property Search Officer (PSO) collects the vetting indicators from the recomposition belt and returns to DO position.

8. The PSO collects Pre✓ cards from WTMD and returns to TDC.

2. Methodology

In this section, HPB describes the process used to collect and analyze the data. The process consisted of four main steps, as illustrated in Exhibit 1.

Exhibit 1. Process for Acquiring Data

2.1 Data Collection Process

The HPB research team collected human performance data at the CAT X airport (March 25th – 27th 2019) and the CAT II airport (April 8th – 10th 2019). Two HPB team members and one Deloitte contractor attended each location as data collectors. Data was collected by conducting observations of each job rotation in the checkpoint where Blended Lane was being used in 30 minutes to one hour intervals at each job position. Data was captured for the Blended Lane process as a whole at each airport and checkpoint.

Focus groups were used to collect general impressions from TSOs of Blended Lane procedures, their opinions and attitudes based on their experience, and pain points and bright spots. Focus groups provide an opportunity to collect data from a number of individuals simultaneously and capitalize on the interactive dialogue among participants. Therefore, HPB designed a focus group protocol with topics pertaining to the Blended Lane and Officer experience. This semi-structured discussion included questions and follow-up prompts designed to elicit information about the following topics:

- Aspects of the Blended Lane procedure that benefitted the Officers and those that were challenging
- The Blended Lane training process and the level of confidence in the checkpoint
- Aspects of the Blended Lane procedure that affected cognitive load, security risks, efficiency and effectiveness
- Aspects of the passenger experience from the point of view of the TSO

The semi-structured questions were written to ensure that the facilitator asked them in an objective manner and allowed the researchers to ask follow-up questions not explicitly in the protocol and respond naturally to the flow of responses. The focus group sessions were 60 minutes in duration so as not to negatively impact operations and were held consecutively to be able to utilize the data collectors most effectively (one main facilitator, one assistant facilitator, one scribe).

A short questionnaire was included to gather quantitative data points regarding TSO beliefs and opinions of this new process. These were given out to the focus group participants and were
optional. For a detailed description of each data collection activity and the instruments used, please refer to Appendix B, the HPB Data Collection Plan.

2.2 Data Analysis
Once the data was gathered from each airport, the HPB team codified all responses, removing any type of identifying information in order to aggregate data across Officers.

Checkpoint Observations
HPB conducted checkpoint observations where the Blended Lane was operational at both airport locations. Data collection observation sheets were used to gather the data and to provide the data collectors with a standardized form. The data were categorized by four main topics: (1) effectiveness, (2) efficiency, (3) cognitive load, and (4) security risk. The team specifically observed instances where officers deviated from the process outline, instances where passengers did not or were unable to follow the process, as well as instances where procedures went well. It is important to note that the Blended Lanes use a Standard algorithm which include bounding boxes and TIPS. This is also a change for TSOs, as there are normally no TIPs or Bounding boxes on a Pre✓ lane. Section 4 provides more detailed findings.

Focus Groups
HPB conducted a qualitative analysis to explore the overall responses to the focus group questions and topic areas, which aligned to the main objectives for this effort. The team identified consistent themes from the focus group sessions and were categorized by topic. The analysis process of triangulation was used, which is a method used to verify that the themes capture the predominate views expressed during the data collection as a whole. This is a method of verifying the information obtained by comparing themes across different sources (i.e., responses across focus group sessions and interviews, questionnaire data, and observational data). Using varying methods of data collection for triangulation has the added benefit of minimizing the impact of any inherent bias associated with a particular method.

Survey Responses
At the conclusion of each focus group, HPB asked officers in attendance to voluntarily fill out a questionnaire regarding their experiences operating in a Blended Lane. The questions included Likert-scale items on the impact of the Blended Lane, passenger interactions and training, as well as an opportunity to provide any open ended feedback. The survey question responses were collected along with demographic information on each respondent. The numerical responses to the Likert-scale questions were collected and analyzed for key trends.

3. Limitations
3.1 General
- Data collection was conducted during the spring break period at a CAT X and CAT II airport. These data may not generalize to all airports and/or could differ based on the specific qualities of the checkpoint(s) being observed. Additional data collection at participating airports may be necessary to draw any conclusions on whether this procedure can and should be implemented nationwide.
- Observations were conducted at each location over a three-day period at 30 minute – 1 hour intervals. During this time period the Pre✓ to Standard passenger ratio varied, as did the
overall passenger volume. As a result, the effectiveness and efficiency of lane operation may differ.

- The behaviors and responses of TSOs during operations and of various participants in focus groups may have been impacted by the knowledge that they were being observed by TSA Headquarters personnel. Similar to the Hawthorne effect, the knowledge that their behaviors and responses were being recorded could impact the type and quantity of data that participants provided. To minimize this risk, the HPB team coded all observation and focus group data sheets with generic participant codes that cannot be matched back to the individual who provided the data.

- Direct passenger feedback of their experience transiting through the Blended Lane was not collected for this initial effort. This may hinder the ability to understand how the Pre✓ and Standard passengers perceive their experience. In subsequent data collections, direct feedback from passengers should be included. The HPB team did record observations of passengers transiting through the lanes as well as feedback from the Officers’ opinions of the passengers’ experience.

3.2 Checkpoint Observations

- The HPB team was limited in terms of asking questions of TSOs during the checkpoint observations so as not to impact operations. The inability to ask questions about specific observed interactions may limit the types of data collected.

3.3 Focus Groups and Questionnaires

- Scheduling and availability of Officers are dependent upon the airport and a range of demographics, experience and/or ability could vary and not be generalizable to the field. Additionally, the number of Officers in the focus groups was small, which may not be generalizable to the field and only represent a small subset.

- Focus group topics and discussions are limited to Officer perceptions and their experience with the Blended Lane procedure and most data collected within these groups are self-reported information, and therefore subjective in nature. Responses may be biased in some way and is common among self-reported data. For example, the respondent answers how they think the interviewer or facilitator wants them to, and may not accurately capture reality.

- The data collection differed slightly from the CAT X and CAT II locations. Specifically, for the CAT II effort, seven additional questionnaire items were added and three individual interviews with Leads and Supervisors were completed. The CAT X location was the first effort, and what the team learned from that visit was captured for the CAT II visit. There is an additional airport operating the Blended Lane concept and would be beneficial to collect the same data points there to gather a larger sample.

3.4 Data Analysis

- The data collected for this effort only represents a small subset of Officers, airports, and types of checkpoints. This may hinder the generalizability of the results and is not a representative sample of the field. The total sample size of participants is relatively small compared to the number of Officers this may impact. Additional data collection and monitoring of the Blended Lane will mitigate this limitation and provide additional points for possible expansion.

- There was a limited time frame for this data collection effort and not all required metrics were able to be collected given the short duration. Exact error rates from any position was not
attainable at this time, so additional assessment is necessary to fully understand the impact on
detection.

4. Results

The data gathered consisted of three main types: checkpoint observations, TSO focus groups
and TSO written questionnaires resulting in both quantitative and qualitative data. The following
sections highlight findings across all data collection mechanisms for each airport. For a
comprehensive view of the triangulation methodology used that links the data to each of the
recommended actions, please see Appendix C. The consistent themes identified across all forms
of data collected for both airport locations are listed below:

- The DO and X-Ray take on the majority of the additional responsibilities introduced by
  the Blended Lane process and were identified as the most challenging positions. This is
  in part due to the critical nature of these positions and the pressures associated with that.
- Certain aspects of the Blended Lane process needs clarification and/or refinement as the
  SOP is finalized, including staffing requirements, vetting indicator standard procedures
  for tracking and returning to appropriate station, and property identification for the
  Property Search Officer (PSO). An SOP or an addendum to the current Pre✓ and/or
  standard SOP is needed to ensure standardization and consistency.
- A formal training method is necessary to ensure every officer receives the same
  information in the same way. This will help with consistency and understanding.
  Currently, each airport and checkpoint had varying methods of relaying the necessary
  information and there is currently no procedure in place for Officers coming into a
  checkpoint with no prior training or briefing. Every officer should be certified in Standard,
  PreCheck and Blended Lane procedures.
- Staffing levels are inadequate for operating a successful Blended Lane. On average, both
  airports indicated they typically have approximately six to eight Officers available, and
  both indicated that approximately 10 Officers would be ideal. This would eliminate
  instances where Officers are having to perform multiple duties at once because of a lack
  of resources (e.g., WTMD Officer having to also conduct the DO position). Overall,
  additional staff would help the Blended Lane process run smoothly.
- Communication between Officers working together at each position, especially the DO
  and X-Ray Officer is critical to the success of the Blended Lane procedure. This also
  includes communication with the passengers beginning at the TDC and continuing
  throughout the process.
- Currently, there are several items required in this procedure that have no tracking
  mechanism in place. These moving pieces may create a security risk if in the wrong
  hands or stolen, lost, or accidentally misplaced and not returned (i.e., vetting indicator
  blocks, Pre✓ cards). Procedures to track these items are necessary.

Adversaries of varying levels of training and experience will conduct reconnaissance missions
and/or participation in the security process to educate themselves on the newest procedures. It is
in TSA’s best interest to try and eliminate any opportunities to game the system and identify gaps
in the process. Having these floating tangible items may create an opening for an adversary to
gain access to a reduced screening protocol (e.g., a vetted passenger giving their Pre✓ card to
someone else who may penetrate the system).
In the following sections, data is reported by airport to illuminate the differences in how larger, multiple lane checkpoints operate as compared to smaller, single-lane checkpoints.

4.1 CAT X Airport

The team visited the CAT X Airport from March 25 through March 27 to collect data on the Blended Lane process. The process was operational at three distinct checkpoints ("A", "B" and "C"). At each checkpoint, two lanes (one modset) were available for use. In all instances at the CAT X airport, the Blended Lane process was run continuously with the second lane available to be opened as a Standard Lane when volume necessitated. Each of the checkpoints had been running the Blended Lane process for approximately one month at the time of observation. The instruction period for the new process varied at each of the three checkpoints:

- Checkpoint A received instruction via an airport leadership brief and immediately started conducting Blended Lane process within one hour.
- Checkpoint B received a one-day notice via an airport leadership brief. The checkpoint began conducting the Blended Lane process the following day.
- Checkpoint C received one-week notice via an airport leadership update. The Officers spent approximately one hour with TSA HQ personnel who explained the procedure and then those HQ personnel observed the officers conduct the process at each position in the checkpoint providing feedback when necessary.

Observations conducted by the HPB team in all three checkpoints revealed that in most cases, when passenger volume increased, the chances for error also increased. The team witnessed several errors that included a standard passenger being screened as Pre✓ due to miscommunication between Officers, Pre✓ passengers being screened as standard due to Pre✓ cards being misplaced during divestiture and even when Pre✓ passengers were behind a standard passenger and divested everything, and X-Ray Officers missing TIP images because it was a Pre✓ bag. While some of these would not necessarily result in a breach of any kind, some may, which need to be addressed and monitored in order to mitigate such instances. Another potential security risk that was observed occurred at the WTMD. According to the Blended Lane procedure, the WTMD is set at for USP quotes and these are intended for Pre✓ passengers only. It was observed that in some cases, if the WTMD quoted on a passenger, the Officer would have them go back through until it stopped the alerting. It was unclear why this was happening, but this could be considered a security risk.

During the focus group sessions, the majority of Officers indicated that if given the choice, they would prefer not to conduct Blended Lane operations. They expressed that it creates a chaotic environment, more so than a typical standard or Pre✓ process and they were concerned about the mission. Some Officers were concerned that due to the new process, they have become more focused on identifying Pre✓ bags and electronics than identifying actual threats. While most agreed that a positive outcome from this was that it seemed to speed up processing time for property, they got bogged down trying to decipher Pre✓ contents, but only focusing on laptops. They said that because of the extra clutter in the Pre✓ property, it sometimes slowed them down for those images, but once they identified the laptop, they moved on and cleared the bag to keep the process going. An interesting finding in the Trust in Automation study conducted by HPB as well as other research external to TSA is that X-Ray operators are less likely to find a second item of interest once they identify the first. This has implications for the Blended Lane because Officers may be more prone to stop searching for a threat once they identify an accepted electronic in a Pre✓ bag.
TSOs were asked to voluntarily respond to a questionnaire regarding their experience with the Blended Lane process. Exhibit 2 shows the responses for the items included. Each bar indicates an individual officer's response and are grouped by topic area (as divided on the survey itself) and each given question. A response of 5 indicates an officer “Strongly Agrees” with the question whereas a response of 1 indicates an officer “Strongly Disagrees” with the question.

**Exhibit 2: CAT X TSO Questionnaire Average Responses**

<table>
<thead>
<tr>
<th>CAT X Airport TSO Questionnaire Average Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSOs would need substantial training before they could start operating a Blended Lane.</td>
</tr>
<tr>
<td>I know how to help passengers when they have issues navigating the Blended Lane.</td>
</tr>
<tr>
<td>The Blended Lane training I received was sufficient.</td>
</tr>
<tr>
<td>I spend considerable time explaining how to navigate the Blended Lane.</td>
</tr>
<tr>
<td>Passengers frequently asked questions about the Blended Lane.</td>
</tr>
<tr>
<td>Overall, Standard passengers are able to be screened without difficulty.</td>
</tr>
<tr>
<td>Overall, PreCheck passengers are able to be screened without difficulty.</td>
</tr>
<tr>
<td>Overall, it is easy for passengers to understand what was expected of them.</td>
</tr>
<tr>
<td>I think Blended Lanes should be used at all airports.</td>
</tr>
<tr>
<td>I prefer the Blended Lane system over using Standard/PreCheck only lanes.</td>
</tr>
<tr>
<td>Traveler wait times seemed to decrease while using Blended Lanes.</td>
</tr>
<tr>
<td>Displaying the Blended Lane concept enhances security.</td>
</tr>
<tr>
<td>Overall, deploying the Blended Lane concept is straightforward.</td>
</tr>
<tr>
<td>Overall, the Blended Lane Concept is efficient for screening passengers.</td>
</tr>
<tr>
<td>Overall, the Blended Lane concept is effective for screening passengers.</td>
</tr>
</tbody>
</table>

Major takeaways from the questionnaire responses include the following:

- The majority of officers do not prefer the Blended Lane process to Standard/PreCheck only lanes.
- The majority of officers believe the Blended Lane process is straightforward.
- The majority of officers disagree that the Blended Lane process enhances security.
- Passengers ask questions and require explanation regarding the Blended Lane.
- The majority of officers felt they knew how to help passengers navigate the Blended Lane.

**4.2 CAT II Airport**

The team visited the CAT II Airport from April 8 through April 10 to collect data on the Blended Lane process. The Airport was set up with two checkpoints, one for each wing (East and West) of the airport. Each checkpoint contained a single lane that ran Blended Lanes process at all times. Passengers were separated (with varying success) into standard and PreCheck lanes before they all merged into one divest line.

This CAT II started offering PreCheck at specific times in October 2017, and the self-reported successes they had with this resulted in the first version of Blended Lane concept with empty bowls as vetting indicators in early 2018. The airport officially began the Lean Six Sigma Blended Lane procedure in November 2018. TSA HQ worked with the Airport to learn about their process and develop a more formal process. Officers received 3-4 day official training in January 2019 at
which time they transitioned to using blocks as the vetting indicators and Pre✓ cards instead of bowls. It is worth noting that the Pre✓ cards at the CAT X airport differed from those at the CAT II airport. It would be beneficial to understand which versions work better for the passengers.

During observations in both checkpoints, it was noted that the signage at the entrance of the checkpoint was confusing for the passengers. One of the major takeaways from this effort is that proper batching, or grouping of passengers is critical in reducing the cognitive burden on Officers by lessening the task switching aspect of Blended Lanes. When passengers are unsure which lane to proceed through, the TDC has a difficult time segmenting passengers. This process begins prior to the TDC and with appropriate straightforward signage, the passengers should be able to segment themselves creating a natural separation of Pre✓ and standard. The Officers also indicated that the signage was inconsistent and confusing (see Appendix D for examples).

The majority of observations were positive at the CAT II airport and could have been due to the typical low volume of passengers. Officers are aware when the volume is set to increase and they prepare themselves accordingly by making sure they have their rotations filled with capable TSOs. This preparation helps get the Officers mentally ready for the rush, whereas in a larger airport, this constant high volume does not allow for the same type of preparation. It was also noted that at some times during the observations, the checkpoints were staffed adequately to handle the volume. However, this could have been due to HQ personnel being present as some Officers indicated. According to the Officers, having six TSOs is typical and eight is a good day, but they prefer 10.

During the focus groups, the overall sentiments were positive regarding their experiences in the Blended Lane. Most of the concerns centered around the passengers and how they still complain when they have to wait in the divest line for standard passengers to complete the process. Staffing was another concern they expressed because they explained that they usually are working more than one position at time, which is difficult.

TSOs were asked to voluntarily respond to a questionnaire regarding their experience with the Blended Lane process. The questionnaire included an additional seven items that were not in the CAT X questionnaire. These were added based on what the team learned from the first visit and felt it was important to include. Exhibit 3 shows the responses for the items included. Each bar indicates an individual officer’s response and are grouped by topic area (as divided on the survey itself) and each given question. A response of 5 indicates an officer “Strongly Agrees” with the question whereas a response of 1 indicates an officer “Strongly Disagrees” with the question. For all items, please refer to Appendix E.
Major takeaways from the responses include the following:

- The majority of officers do not prefer the Blended Lane process to Standard/Pre✓ only lanes.
- The majority of officers disagree that the Blended Lane process enhances security.
- Passengers ask questions and require explanation regarding the Blended Lane.
- The majority of officers felt they knew how to help passengers navigate the Blended Lane.
- The majority of officers felt that officers should receive significant training before operating the Blended Lane.

### 4.3 Airport Comparison

While the overarching recommendations highlighted findings at both the CAT X and the CAT II airport, a comparison of the data reveals several significant differences in operational success and acceptance across the two airports that should be highlighted.

- **Effectiveness:** A higher percentage of officers at the CAT II airport believed the process is effective and efficient for screening passengers, as well as a decrease in wait times overall. During the focus groups, more positive sentiments were heard regarding the ability of the process to achieve its stated goals.
- **Bag Checks:** At both the CAT X and CAT II airports, multiple officers expressed that identifying the vetting status of a pulled bag was a pain point without a clearly outlined solution. Despite being a large discussion topic during CAT X focus groups, this issue was not as prevalent at the CAT II airport.
- **Staffing:** At the CAT II airport, staffing was a larger topic of discussion. Due to lower staffing, officers at this checkpoint frequently operate multiple duty positions at a given time, so the added responsibility of Blended Lane is compounded on these officers. However, the CAT II demonstrated a tighter team concept than the CAT X and they all
expressed that having confidence and trust in their peers helped them with the Blended Lane operations. They were able to count on each other and increase communication between team members. This differed from the CAT X airport and is likely due in part to the size and the fact that not everyone is trained in the Blended Lane procedure.

- **Training**: At both airports, the training process for each Checkpoint varied. At the CAT II airport, officers expressed to a higher degree that they felt additional training would be beneficial to help the operation run smoothly and prevent breaches.

Exhibit 4 below highlights the variation in average responses across the CAT X and CAT II airport on the TSO Blended Lane questionnaire.

**Exhibit 4. CAT X/CAT II TSO Survey Question Average Responses Comparison**

*Please see Appendix E for individual responses to the TSO questionnaire.

### 5. Conclusions

#### 5.1 Discussion

Officers working in the Blended Lane have to continuously switch between screening protocols for Pre✓ and standard. This task switching may impact performance and ultimately screening effectiveness. For the purposes of this report, task switching is defined as what occurs when an individual’s attentive resources from one task are interrupted and reallocated to a different task. This ability of allocating attentive resources to several tasks and sequentially and smoothly reallocating attentive resources from one task to another comes with a “switch cost” (Draheim, Hicks, and Engle 2015). The more demanding, critical and stressful tasks are, task switching becomes more difficult. Research has indicated that there are measurable mental costs
associated with frequent task switching. According to Draheim, et al., (2015) in their study of task switching and the relationship to working memory, these costs are a degradation in overall performance and an increase in the amount of time to complete each task.

One major contributing factor that is related to successful task performance and which affects an individual’s ability to switch between tasks is a phenomenon known as attention residue. Attention residue occurs when an individual cannot fully extinguish his or her thoughts from a previous task when moving to another one (Leroy, 2009). This is especially important when a TSO has to switch from screening a PreV passenger’s property to a standard passenger’s property at the X-Ray. When task switching is more frequent, as opposed to large batches of each type of passenger being processed, the officer may have a difficult transition due to attention residue remaining from the previous protocol and could take longer to change mental models. This attention residue may have a direct impact on threat detection and vigilance.

Vigilance in this context applies to situations in which an observer must maintain focus of attention on an external source of information for a prolonged period of time while monitoring for rare, but critical events. Having and maintaining vigilance is critical in sustaining focus on the task at hand as well as the ability to switch effectively from one protocol to another. Because of this, it is recommended to batch passengers as much as possible given the volume in the checkpoint to reduce the amount of attention residue present and to alleviate the mental demand on the X-Ray position. This applies to all positions, but the X-Ray is especially prone to detrimental mistakes.

Research suggests a way to alleviate vigilance decrement is to take rest breaks. These breaks could also be another cognitive task (Ralph et al., 2016). This is important for this discussion since switching between screening protocols may be beneficial to some degree in remaining vigilant throughout checkpoint rotations. Breaking up the monotony of one task by switching to another similar task, may have the same effect as taking a break. However, additional research is needed to understand this concept in an airport checkpoint environment and the stresses that accompany each job role. Overall, this research does indicate that rest breaks are critical in ensuring that vigilance doesn’t decline. Some of the findings from this data collection revealed that Officers are not receiving their breaks in the usual timely manner and are not given their normal lunch time due to the resources available to operate the Blended Lane. Therefore, ensuring and monitoring that Officers are getting adequate breaks and mental rest periods will help alleviate some vigilance decline.

Working Memory Capacity (WMC) is another contributing factor that impacts whether someone is more prone to errors when switching between tasks. Shijing et al., (2016) conducted a study on the effects of WMC and task switching and found that WMC is an integral part of successful task switching. Working memory is the ability to maintain, process, and manipulate chunks of information and is a critical aspect of cognitive control, but it does have its limitations. It is estimated that only three to five chunks of information can be maintained at any given time (Cowan, 2001). Research has shown that individuals with larger working memories have the ability to multitask easier and have better attentional control (Hambrick, et al., 2010; Kane et al., 2001). However, working in a stressful environment, such as an airport checkpoint, can decrease WMC affecting performance (Draheim et al., 2016).

Task switching performance decrement is referred to in the literature as switch cost. There are ways to mitigate this cost, though some of these may not be feasible given TSA’s environment and the Blended Lane procedure. Three main principles associated with alleviating switch costs include:
1. Increase time in between tasks. Cognitive load may dissipate with a reasonable amount of time in between tasks.
2. Increased preparation for the tasks. The more someone performs certain tasks, the better they become at them.
3. Residual effects, or attention residue as described previously. Cognitive processes from a previous task may inhibit success in the task following.

The Blended Lane process does have some positives to counteract some of the negative effects of task switching. Foreknowledge has been shown to reduce the switch cost; knowing what is to come allows individuals to prepare for potential missteps. This can be further improved by incorporating monitoring and support from management by continuously checking in with TSOs and providing consistent training. Additionally, it has been shown that task similarity lowers switch cost. In this context, the tasks of screening for Pre✓ and standard are similar in nature, which could play a role in lessening errors that may occur due to task switching.

While the research on task switching is general in nature, there are implications that may affect the success of the Blended Lane procedure that may outweigh the benefits. Higher volume of passengers can create additional stressors on the Officers when they have to switch tasks and on some occasions, perform multiple jobs at once (e.g., DO and WTMD). There will be some inherent risks that accompany new procedures in which the benefits outweigh those risks. TSA needs to balance these benefits with the associated risks known and make determinations on how procedures should be implemented. An overall recommendation is to test threat detection prior to deploying any new procedure. Changing equipment or procedures can have collateral impact that was not anticipated.

For the Blended Lane procedure, the overall consensus is that it works more efficiently at smaller, single-lane checkpoint airport locations. One factor for this finding could be due to the fact that this particular CAT II airport has been performing this procedure considerably longer than the CAT X airport visited and has had longer to get accustomed to the new procedure and build confidence. According to Meiran, Chorév, and Sapir (DATE), increased practice can overcome any negative residual component of switch cost. Simply put, more practice leads to less negative overlap between tasks. It would be most prudent to conduct an additional site visit to the CAT X airport after a longer period of time to reassess operations and attitudes of the Officers. This also provides a framework for what is an appropriate amount of time for "burn-in" so that Officers can become familiar with the procedure before being expected to perform at high levels.

All of these factors should be taken into consideration when planning for additional Blended Lane operations in other airports. The below recommendations depict the research literature and the data gathered for this effort.

5.2 Recommendations
Eighteen actionable recommendations are listed below. These are categorized by topic area and were developed based on the data gathered from the two airport locations visited (CAT X and CAT II locations). The topic areas include: 1) minimize security risks, 2) streamline process to improve effectiveness and efficiency at achieving stated goals, and 3) enhance officer performance. It would be beneficial to also collect data from the third airport operating the Blended Lane to acquire additional data points and increase the sample size in order to gain a complete picture of how this procedure is being conducted on a comprehensive level and to help identify best practices.
Minimize Security Risks

1. Perform testing in the Blended Lane to assess and identify possible security risks and gaps in the process. As part of the recommendation, assess threat detection and Officer compliance.
2. Examine how this process affects Officer TIP scores as well as other assessments and consider alternative options during Blended Lane operations.
3. Consider alternate solution to physical indicators of vetting status at the checkpoint such as automation at the X-Ray screening. At a minimum, develop tracking and reporting mechanisms for the vetting indicators and precheck cards.
4. Refine airport identifiers on the vetting indicators and precheck cards to eliminate potential misuse and mitigate indicators being taken from checkpoints.

Streamline Process to Improve Effectiveness and Efficiency at Achieving Stated Goals

5. Establish distinct parameters for this procedure such as time and location for implementation and ensure airport leadership adheres to these parameters.
   a. At CAT X airports or airports with a full modest and/or multiple checkpoints, Blended Lane should only be operational when dedicated Pre✓ lanes are closed and should not be combined with dedicated Pre✓ lanes or Standard lanes in order avoid confusion and potential increase in security risks.
   b. Blended Lane may operate continuously at smaller airports where there is a single-lane checkpoint.
   c. When volume is high, it is recommended to open a dedicated Pre✓ lane with a standard lane at larger airports where this is feasible given the checkpoint configuration.
6. Develop a purposeful, effective training program for this initiative and ensure all Officers are trained.
7. Ensure that all officers rotate through the blended lanes at a minimum of once per week to keep their performance at an acceptable level.
8. Examine effectiveness (decrease or increase in detection), efficiency and Officer performance.
9. Examine and define the adequacy of staffing levels for Blended Lane given the checkpoint size and passenger volumes. Identify the specific number of TSOs required to effectively implement this initiative and staff accordingly.
   a. A Blended Lane should operate with at least 10 officers at a given time.
   b. Ideal staffing is suggested as: 2 TDC, 2 DO, 1 Exit, 1 X-ray, 1 WTMT, 1 AIT, 1 PSO, 1 Dynamic.
10. Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency. Identify which positions should not be "combined" (i.e., DO and WTMD)
    a. TDC should segment passengers from the queue and communicate instructions to Pre✓ passengers when handing over blue card.
    b. Dynamic and PSO officer return blocks and blue cards to DO/TDC.
11. Develop and implement an internal communication plan to facilitate standard practices and communication across Officers and locations. Build in protocols for training and monitoring Officers new to the procedure (e.g., substitute from another checkpoint; Level I (D1) Officers in rotation).
b. The "burn-in" time should be 1 month to allow for comprehension and practice of the Blended Lane.

12. Determine and provide airports with an adequate amount of vetting indicators and Pre✓ cards based on the size of the checkpoint. This will help eliminate the issue of running out of indicators and halting operations to retrieve the indicators.

13. Determine the best method for keeping track of and determining status of property when awaiting bag checks (e.g., vetting indicator specifically for the property).

14. Determine a way to automate the X-Ray notifications for when screening Pre✓ property versus Standard property to help eliminate the burden placed on the DO and X-Ray Officer. This automation could be a simple X-Ray screen color change or line at the bottom indicating which type of bag is currently being examined using some kind of RFID indicator on the bin, for example.
   a. Until automation is feasible at the X-Ray, examine and gather feedback on best practices to refine the "switch indicator" for the X-Ray position and ensure officers understand that the switch is optional; it may work well for some, but not for others.

15. Filter through all signage and dispose of or relocate to a monitor in the checkpoint. Provide effective directional signage to passengers to help with passenger segmentation to ease the burden on the TDC Officer. Provide a brief explanation on the Pre✓ card explaining that Pre✓ passengers are intermingled with non-Pre✓ passengers and there may be a slight wait period.

16. Pre✓ cards should be large enough to reduce the possibility of passengers accidentally losing the card when they are divesting (e.g., inadvertently placing the card in a bin or in their property) and should include the information necessary in as few words as possible in a bulleted list.

Enhance Officer Performance

17. Due to proactive interference of changing from one mental model (Pre✓ procedure) immediately to another (standard procedure), perform a cognitive task analysis (CTA) to examine the cognitive workflows of TSOs and identify specific areas in the cognitive process that are most effortful, most error-prone, and most difficult. As part of this effort, examine the cognitive requirements associated with each job rotation and identify mitigation strategies.

18. Conduct research to measure the effects of high volume operations on the performance of TSOs. Examine the ability of TSOs to maintain situational awareness and vigilance in order to understand the impact on detection rates.
References
APPENDICES
Appendix A: Detailed Process Description of Blended Lane

A. TDC:
1. TDC Officer scans boarding pass and checks identification in accordance with the Screening Checkpoint SOP (Rev.13).
2. If passenger is Pre✓ TDC Officer provides passenger with Pre✓ card and instructions to keep it in hand.

B. Divesture:
3. Identify passenger vetting status (Pre✓ card, Expedited Card, No Card)
4. Place the appropriate vetting indicator in front of property. The blue vetting indicator is for Pre✓, the Standard indicator is white, and the Crew indicator is yellow. Orient horizontally so that the indicator can be read.
5. Insert the next vetting indicator in front of next passenger of a different status or during a rotation.
   a. The DO can always insert the appropriate indicator in front of accessible property if there is a delay between passengers. Frequently, there may be gaps between passengers (very low volume) that justify placing a new indicator down regardless of the previous passenger status.
6. Vetting indicators stored on top of the mouth of the X-Ray tunnel or in designated location.
7. Provide divest instruction to passengers based on their status in accordance with Screening SOP. The table below highlights the major differences in divest instructions between Pre✓ and Standard passengers.

<table>
<thead>
<tr>
<th>DO Divest Instructions</th>
<th>Pre✓</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics larger than a cell phone</td>
<td>Not Required</td>
<td>Required</td>
</tr>
<tr>
<td>Shoes</td>
<td>Not Required</td>
<td>Required</td>
</tr>
<tr>
<td>Complaint 3-1-1</td>
<td>Not Required</td>
<td>Required</td>
</tr>
<tr>
<td>Outwear / light jackets</td>
<td>Not Required</td>
<td>Required</td>
</tr>
</tbody>
</table>

C. WTMD
8. Collect Pre✓ cards from Pre✓ passengers
9. Return Pre✓ cards to TDC as needed
10. Conduct USP on only Pre✓ passengers (identified by card) that quote. Expedited passengers are exempt from USP quotes (not part of the screening requirements for Standard Lane Expedited passengers)
11. If USP quotes on exempt passenger (includes expedited), take next eligible Pre✓ passenger. (Decision: only need to USP if quote alerts on Pre✓ Passenger)
12. USP follows the Pre✓ half-hour sequence (AIT then electronics). (Decision: only conduct AIT Screening, in line with CES OD)

D. X-Ray
13. Conduct RBS screening protocol for all property following the Pre✓ vetting indicator.
14. Conduct standard screening protocol for all property following the Standard vetting indicator.
15. Standard vetting indicators appears orange with blue dot and reads "Standard". Pre- vetting indicator appears blue/green and reads "Pre-". The Crew vetting indicator appears orange and reads "Crew". 
16. Utilize the manual "Pre- / Standard" switch at x-ray to help track screening mode. 
17. The table below outlines the primary differences between screening Pre- and Standard accessible property.

<table>
<thead>
<tr>
<th>X-Ray Screening / Search Requirements</th>
<th>Pre-</th>
<th>Standard</th>
</tr>
</thead>
</table>

E. Property Search / SO
18. Collect vetting indicators from the Recomposition belt as needed. Return vetting indicators to the DO position.
19. The PSO will conduct property search of accessible property in the same manner as any Standard or Pre- lane, following the procedures in the Screening Checkpoint SOP (Rev. 13).
Appendix B: HPB Data Collection Plan

Summary
The Transportation Security Administration’s (TSA) Human Performance Branch (HPB) in the office of Requirements and Capabilities Analysis (RCA) aims to improve human performance within the aviation environment and other transportation venues. This aim is achieved through research on the physical, behavioral, cognitive, and social characteristics of end-users in the aviation security domain, and how such users interact with systems, processes, and technologies. While the HPB and other internal TSA groups frequently study human performance outcomes as they relate to threat detection, security effectiveness and compliance with Standard Operating Procedures (SOPs), the HPB maintains an additional focus on understanding the drivers of human performance and underlying influences that affect Transportation Security Officers’ (TSOs) behavior and performance.

The current data collection plan and analysis seeks to evaluate the impact of a new *Blended Lane* procedure on operational processes, officer performance, and passenger experience. This is the first study of the Blended Lane concept intended to inform decisions about the future of this effort. It is imperative to collect various types of data at various points in time in order to assess the impact on detection. The purpose of this document is to communicate the details of the HPB data collection plan. This document includes an overview of the Blended Lane procedure, the data collection methods that will be used, and the instruments and procedures that will be included in this effort.

Introduction
The HPB research team will hold several focus groups with TSOs to include Lead TSOs and Supervisory TSOs at a CAT II Airport April 8-10, 2019. Additionally, the HPB team will conduct observations of the Blended Lanes processes and positions.

The Blended Lane operation provides Officers with a means to screen passengers and their property by Risk Based Security (RBS) procedures, while screening standard passengers and their property on the same lane. Blended Lanes are meant to replace the practice of expediting Pre✓ passengers during Standard lane operations and is intended for periods of low Pre✓ volume or times that only one lane is required to meet total passenger volume.

A Blended lane can screen both Pre✓ and Standard passengers on the same lane by following the steps listed below (see Appendix I for a detailed process description):

9. Establish a separate queue for Pre✓ passengers.
10. Identify Pre✓ passengers at the TDC and provide these passengers with a Pre✓ card. (Expedited passengers will be provided an Expedited card).
11. Divest Officer (DO) identifies and segregates Pre✓ passenger accessible property during divesture. DO places a Pre✓ vetting indicator in front of Pre✓ property.
12. Following the last Pre✓ passenger's property, DO places a Standard vetting indicator in front of the Standard passenger's property.
13. DO directs Pre✓ passengers to the WTMD. The WTMD USP will be set at All quotes on Pre✓ passengers are resolved through the AIT Screening, if eligible.
14. The X-Ray Operator utilizes the "Pre✓ / Standard" switch to track the type of screening being conducted at the X-Ray. In Blended lanes the algorithm and TIPS will remain on. The X-Ray Operator will screen all accessible property following the Pre✓ indicator as instructed by the
RBS SOP. Screen all property following the Standard indicator as Standard passenger property.

15. The Property Search Officer (PSO) collects the vetting indicators from the recomposition belt and returns to DO position.

16. The PSO collects Pre✓ cards from WTMD and returns to TDC.

The purpose for this data collection effort is to gain understanding of officers’ and passengers’ attitudes toward the Blended Lane concept and to record both positives and negatives that may result from this new procedure. Additionally, the HPB will collect error rate data on the various tasks and screening procedures that are required. The two main errors of interest are: (1) the frequency of Standard passengers incorrectly receiving Pre✓ screening and (2) the frequency of Pre✓ passengers incorrectly receiving Standard screening. This first data collection effort will provide a preliminary review of the procedure and will inform future data collection initiatives.

Rationale and Objectives

The rationale for conducting focus groups and observational data collection efforts is to understand how the Blended Lane procedure affects human performance, which subsequently will impact detection ability. The HPB team will identify pain points and bright spots in the Blended Lane process and record errors that may occur that could potentially affect efficiency, effectiveness, and overall security risk. This effort will gain insights into officer SOP adherence, divergence, and task switching ability, to name a few. Additionally, the data collected will provide insights into how the process could be improved, if at all. The HPB team will provide recommendations based on the analyses and information gathered.

There are four main goals of this effort:

9. Understand how this new procedure affects human performance;
10. Identify pain points and bright spots in the procedure;
11. Identify error rates; and
12. Determine if additional data collection is needed regarding the impact of these procedural changes on effectiveness, efficiency, cognitive load or security effectiveness.

TSA will receive valuable feedback prior to full implementation in order to provide justification when needed and to improve upon the process, training, communication, and maintenance.

Limitations

General

- Data collection is being conducted for three days during the spring break period at the Airport. These data may not generalize to smaller airports and/or could differ based on the specific qualities of the checkpoint(s) being observed. Additional data collection at smaller airports may be necessary.
- Observations will be conducted over a three-day period at 30 minute – 1 hour intervals. During this time period the Pre✓ to Standard passenger ratio may vary, as will the overall passenger volume. As a result, the effectiveness and efficiency of lane operation may differ. To account for this variety, the data collectors will record the number of each type of passenger observed as well as overall passenger volume during each observation period.
- The behaviors and responses of TSOs during operations and of various participants in focus groups may be impacted by the knowledge that they are being observed by TSA Headquarters personnel. Similar to the Hawthorne effect, the knowledge that their behaviors and responses are being recorded could impact the type and quantity of data that participants provide. To minimize this risk, the HPB team will code all observation and focus group data sheets with generic
participant codes (e.g., TSO 0001) that cannot be matched back to the individual who provided the data.

- Passenger feedback of their experience transiting through the Blended Lane will not be collected for the effort at the airport. This will hinder the ability to understand how the Pre✓ passengers perceive their experience. In subsequent data collections, this should be included.

**Checkpoint Observations**

- The HPB team may be limited as to where they are permitted to stand and observe throughout the checkpoint depending on airport preference. The observation locations may limit the quality of data collected. Additionally, the data collectors may not have full information on every passenger’s status, i.e., whether they are Pre✓, Standard, or Selectee. As a result, it may not be possible to determine whether the passenger was screened properly according to the Blended Lane process outline.
- The HPB team may be unable to ask questions of TSOs during the checkpoint observations in the event of high passenger volume that require all TSOs to be dedicated to passenger screening. The inability to ask questions about specific observed interactions may limit the quality of data collected.

**Focus Groups and Questionnaires**

- Scheduling and availability of the Officers may limit the amount of data collected.
- Scheduling and availability of the Officers may limit the ability to include individuals from different demographics in order to ensure that the sample is representative of the entire Officer population.
- The willingness of Officers to participate and share opinions during the interviews and focus groups may limit the quality of the data collected.
- Focus group questions will be limited to officer perception and experience with the Blended Lane concept to understand the challenges faced while operating the lane.
- Both focus group and questionnaire data are considered self-report data, which is inherently limited. Responses may be biased in some way. For example, the respondent answers how they think the interviewer(s) or facilitator(s) want them to, which may not accurately capture reality.

**Methodology**

**Checkpoint Observation**

The HPB team will observe the Blended Lane procedures to include observation of TSOs in the various positions required and TSO-passerger interactions at the checkpoint at the airport. There will be three (3) data collectors total and all will conduct stand-off observations. Data collectors will only interact with the officers when it does not interfere with screening. Data collectors will use clipboards with data collection sheets, a data observation guide, and will be stationed throughout the checkpoint area where the Blended Lane is operational.

There are specific data points being observed as well as general note taking. Each job rotation will be observed as well as general procedures. Data collectors will observe TSOs conduct the outlined process for each position at the Blended Lane and note deviations, errors, or challenges observed throughout the process. The data collectors will take observational notes focusing on efficiency, effectiveness, cognitive load and security risk. The data collectors will also look to answer specific outlined questions applicable across the Blended Lane on topics such as passenger volume, queuing, and task switching, among others (See Reference for complete Observation Data Collection Forms). The goal of this checkpoint observation is to gain an initial understanding of process challenges and determine whether a more objective study is needed to recommend the Blended Lane concept.
Focus Groups
TSOs at the airport will be asked by their leadership to participate in a focus group session regarding their experience using the Blended Lane concept. Additionally, demographic information will be collected to allow data analysts to characterize the sample of responses and determine applicability to the general TSO population.

Two (2) TSA Headquarters personnel from HPB and one (1) Deloitte contractor will be conducting and recording the information from the focus groups. Each member of the HPB team has been trained in conducting focus groups and will adhere to a semi-structured format to encourage discussion surrounding topics of interest.

Each focus group session will be held in a private conference or meeting room in order to limit distractions and keep the conversations as anonymous as possible. The focus groups will include 4-8 participants and the HPB team will coordinate with the airport to schedule time as appropriate so as not to negatively impact operations (e.g., removing resources from the checkpoint for an undue amount of time). All participants must have been trained and working in the Blended Lane checkpoint in order to attend a focus group session.

Each focus group session will last 60 minutes and will include the following (see Reference 2 for the focus group guide):

1. Overview of HPB and Project
2. Ground Rules
3. TSO Introductions
4. Discussions (e.g., Blended Lane pros and cons, challenges, experiences, recommendations, general feedback)
5. Wrap Up

During the wrap-up, a short questionnaire will be given to the Officers to fill out. This questionnaire will include demographic questions and Likert-style items (strongly agree to strongly disagree) to allow for quantitative data to be collected regarding Officer attitudes and beliefs around this procedure (Appendix IV).

Anticipated Analyses
Observation Analysis
After HPB has conducted observations at the checkpoint, they will analyze the deviations noted at each position within the Blended Lane to determine key areas where officers appear to have difficulty or where errors frequently occur. A percentage of deviations will be calculated for each position and for each Blended Lane process step associated with each position. HPB will use the general notes taken on topics such as throughput and ratio of Pre+ to Standard passengers to draw further linkages between variables at the checkpoint and successful operation of the Blended Lane.

Focus Group Analysis
After HPB has conducted all focus groups, they will perform a content analysis on the data to identify trends and themes. In particular, the HPB will identify the most critical topics covered during the focus groups, identify topics and themes that are common areas of discussion, and develop recommendations related to these key findings.
**TSO Questionnaire Analysis**

The HPB team will analyze quantitative data collected via the TSO questionnaire to identify key trends and themes, as well as potential challenges associated with the Blended Lane concept. Insights gained from the TSO questionnaire data will inform HPB recommendations for future implementations of the Blended Lane concept as well as additional objective studies.
### Appendix III:
Blended Lane Concept
*Observation Collection Sheets*

**Sensitive Security Information**

DFW Airport
March 2019

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#### Blended Lane Observation of TDC

<table>
<thead>
<tr>
<th>Process</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td>2</td>
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<td>13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

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#### Process Outline
- TDC Officer scans boarding pass and checks identification in accordance with the Screening Checkpoint SOP (Rev 1.3).
- If passenger is PreCheck, TDC Officer provides passenger with PreCheck card and instructs passenger to keep it in hand.

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#### Observation of Behavior

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

---

#### Additional Observations
- How many times did the TDC fail PreCheck cards if a PreCheck passenger had a PreCheck card?
- How many times did the TDC fail PreCheck cards if a PreCheck passenger had a PreCheck card and a given reason?
- How did the TDC handle batch? Number of PreCheck per number of standards?
### Blended Lane Observation of DO (1 of 2)

**Process Outline**
- Passengers are identified by a screening indicator in front of the body. The screening indicator is white, and the pass indicator is yellow. A horizontal indicator may be read.
- The indicator displays the name and status of the passenger.
- In case of more than one passenger, the indicator displays the name and status of the passenger who has the highest priority.
- The indicator displays the name and status of the passenger who has the highest priority.
- The indicator displays the name and status of the passenger who has the highest priority.
- The indicator displays the name and status of the passenger who has the highest priority.
- The indicator displays the name and status of the passenger who has the highest priority.

#### Observations of Behavior

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Process correctly generated checking indicator on front of passenger?</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>2</td>
<td>Process correctly identified passenger priority on front of passenger?</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
</tbody>
</table>

### Blended Lane Observation of DO (2 of 2)

**Observations of Behavior**

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Process correctly issued a pass indicator in front of the passenger?</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>4</td>
<td>Process correctly identified passenger priority on front of passenger?</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>5</td>
<td>Did the DO screen passengers directly to the X-Ray?</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
</tbody>
</table>

**Additional Questions**
- How many passengers were seen to the AT? How many were ProCheck? How many were Standard?
- How often was the AT used? How often was the ProCheck used?
- How did DO place the pass indicator on the belt (positioning)?
- How many passengers were screened for the AT initially, with no other alarms?

**Reports**
- ProCheck: Standard:
- Dec: Yes;
- ProCheck: Standard:

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34
### Blended Lane Observation of WTMD

#### Process Outline
- Collect PreCheck cards from PreCheck passengers.
- Return PreCheck cards to TSC as needed.
- Conduct USP only on PreCheck passengers (Identified by card). Expedited passengers are exempt from USP when not part of the screening requirements for Standard Lane Expedited passengers.
- If USP quotes an expedited passenger (includes expedited), take next eligible PreCheck passenger.
- USP follows the PreCheck half-hour sequence (55th minute). (Decide; only conduct AIT Screening, as line with CES-OG).

#### Occurrence of Behavior

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Write passenger name, status card to the WTMD office.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
<td>Efficiency:</td>
</tr>
<tr>
<td>2</td>
<td>Write WTMD office name, status card to the WTMD office.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
<td>Detection/Effectiveness:</td>
</tr>
<tr>
<td>3</td>
<td>Submit WTMD office name, status card to the TSC office.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
<td>Cognitive Load:</td>
</tr>
<tr>
<td>4</td>
<td>Submit PreCheck cards identified for AIT, inventory directed to AIT function.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
<td>Security Risk:</td>
</tr>
</tbody>
</table>

### Blended Lane Observation of X-RAY

#### Process Outline
- Conduct AIT screening protocol for all passengers following the PreCheck entry indicator.
- Conduct standard screening protocol for all passengers following the Standard setting indicator.
- Standard setting indicates orange with blue dot and reads "Standard." PreCheck setting indicator appears blue/green and reads "PreCheck." The Green setting indicator appears orange and reads "Know." Utilize the manual "PreCheck / Standard" switch at x-ray to help track screening inside.
- The table below outlines the primary differences between screening PreCheck and Standard susceptibility.

#### Occurrence of Behavior

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did the X-ray office correctly communicate to the CSO when suspicious property requires secondary, topical inspection?</td>
<td>1 2 3 4 5 6 7 8 9 10 11</td>
<td>Efficiency:</td>
</tr>
<tr>
<td>2</td>
<td>Did the X-ray office correctly communicate to the CSO when suspicious property requires secondary, topical inspection?</td>
<td>1 2 3 4 5 6 7 8 9 10 11</td>
<td>Detection/Effectiveness:</td>
</tr>
<tr>
<td>3</td>
<td>Did the X-ray office correctly communicate to the CSO when suspicious property requires secondary, topical inspection?</td>
<td>1 2 3 4 5 6 7 8 9 10 11</td>
<td>Security Risk:</td>
</tr>
</tbody>
</table>

#### Additional Questions
- How many bag searches were conducted and for which type of passengers? (PreCheck: Standard)
- Did TSC occur during the screening? (PreCheck: Standard)
- How often did the X-ray office miss the setting indicator? (PreCheck: Standard)
- How often were prohibited items found during screening for each type of passenger? (PreCheck: Standard)
### Process Outline
- Collect vetting indicators from the Recomposition belt, as needed. Return vetting indicators to the DO position.
- The PSO will conduct property search of accessible property in the same manner as any Standard or PreCheck lane, following the procedures in the Screening Checkpoint SOP (Rev. 15).

### Blended Lane Observation of PSO

#### Occurrence of Behaviors

<table>
<thead>
<tr>
<th>#</th>
<th>Process</th>
<th>Observation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If the PSO searched the property?</td>
<td>1 2 3 4 5 6 7</td>
<td>Efficiency</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>8 9 10 11 12 13 14</td>
<td>Detection/Efficiency</td>
</tr>
</tbody>
</table>

#### Additional Questions

| How often were prohibited items found during screening for each type of passenger? | PreCheck: Standard |
| How many bag checks handled for each type of passenger? | PreCheck: Standard |

### Blended Lane Observation – Overarching Questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a separate queue for PreCheck passengers?</td>
<td>established</td>
</tr>
<tr>
<td>How many passengers are batted as PreCheck on average?</td>
<td></td>
</tr>
<tr>
<td>Were the vetting indicators returned to the DO officer from the Recomposition belt? By whom?</td>
<td></td>
</tr>
<tr>
<td>How many ID cards were not scanned?</td>
<td></td>
</tr>
<tr>
<td>How many pat-downs were conducted and on which type of passenger?</td>
<td></td>
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<tr>
<td>Average time for screening for each type of passenger?</td>
<td></td>
</tr>
<tr>
<td>Did screening appear to be slowed down by the X-Ray?</td>
<td></td>
</tr>
<tr>
<td>Total # of passenger throughout pre observation period?</td>
<td></td>
</tr>
<tr>
<td>Total # of PreCheck passenger per observation period?</td>
<td></td>
</tr>
<tr>
<td>Total # of standard passengers per observation period?</td>
<td></td>
</tr>
<tr>
<td>Total # of expedited passengers per observation period?</td>
<td></td>
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<tr>
<td>Total # of selected passengers per observation period?</td>
<td></td>
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<tr>
<td>How often was there miscommunication between officers (e.g., DO and X-Ray/X-Ray and PSO)?</td>
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<tr>
<td>How often did task switching occur for the officers on average?</td>
<td></td>
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<tr>
<td>How often were passenger ID cards lost/not returned to TDC?</td>
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<tr>
<td>How often were vetting indicators lost or not returned to the DO?</td>
<td></td>
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</tbody>
</table>
### Blended Lane Observation – Data Analysis Sheet

<table>
<thead>
<tr>
<th>Position</th>
<th>Total Observations</th>
<th>Total Yes</th>
<th>Total No</th>
<th>Percent Deviation (Total No/Total Observation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDC</td>
<td></td>
<td></td>
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<td>DD</td>
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<td>Process 5</td>
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<tr>
<td>WTMD</td>
<td>Process 1</td>
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<td>Process 2</td>
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<tr>
<td></td>
<td>Process 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSG</td>
<td>Process 1</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Blended Lane Focus Group Guide

Instructions

Name Card Distribution
- Pass out name cards
- Ask participants to write their first names only on the cards

Welcome & Introduction
- Welcome the participants to the focus group and thank them for their time and participation. Be sure to emphasize the points below, either by reading verbatim or using your own words:

We are conducting focus groups that are designed to inform an understanding of the Blended Lane procedure and operations. This information will be used to identify bright spots and pain points and opportunities to improve the process.

We will aggregate all of the data we collect throughout all field research before sharing the information with Headquarters. Nothing you say will be attributed to you and we will use a specific coding system for all notes to prevent accidental determination of any individuals' identity.

All of the feedback you provide will be used in the identification of improvement areas so please share your candid feedback and any things that you think are going well or not so well.

Purpose: To understand human performance impacts of the Blended Lane concept.
Objectives:
- To understand TSO experiences working in the Blended Lane
- To understand TSO challenges working in the Blended Lane
- To understand the pros and cons of working in the Blended Lane
- To gain recommendations and feedback for improving the process

HQ Introductions and Rules
- Provide a brief introduction of the HPB team members in the room

- Review the "Rules of the Road"
  1. No cell phones
  2. Contributions are anonymous
  3. Ask questions
  4. Be polite to others

Participant Introductions
- Ask participants to go around the room and introduce themselves stating their:
  1. First Name
  2. Years of Experience at TSA

Group Discussion – General Topics and Questions Below
- Host a group discussion to find out the opinions of the group. Casually lead the group through the discussion to address the questions in the table below.
- Topic area questions are listed in bold and should be used to begin discussion. Probing questions are bulleted below the topic area question and should be used if needed to prompt additional conversation.

Wrap up
- Is there anything else that we have not yet discussed that you think is relevant to our understanding of the Blended Lane process?
- Thank you for your time, we appreciate you sharing your feedback!
- Provide contact information for additional information they may care to share

<table>
<thead>
<tr>
<th>Q #</th>
<th>Focus Group Topic Areas/Questions</th>
<th>Objective of Question (For Data Collector Awareness Only)</th>
</tr>
</thead>
</table>
| 1   | What are the benefits you have experienced working in a Blended Lane?  
- Is there a particular duty cycle position you feel benefits from the Blended Lane? Why?  
- Do you find the Blended Lane more or less cognitively taxing than a Standard lane? Than a Pre✓ lane? | Understand perceived pros of Blended Lane from Officer perspective. |
| 2   | What are the challenges you have encountered working in a Blended Lane?  
- Is there a particular duty cycle position you feel suffers with the Blended Lane? Why?  
- Do you find the Blended Lane more or less cognitively taxing than a traditional lane? Than a Pre✓ lane? | Understand perceived cons of Blended Lane from Officer perspective. |
| 3   | How were you introduced to or instructed on the Blended Lane Process?  
- Do you feel you received sufficient training/instruction on the Blended Lane process?  
- Is there any part of the Blended Lane process that is unclear or confusing? Why?  
- Do you feel comfortable operating at a Blended Lane? | Understand if officers feel comfortable with the instruction received on Blended Lanes.  
Gain information on the instruction process itself. |
| 4   | What improvements or changes would you make to the blended lane process?  
- Why would you make those suggested changes? | Understand opportunities for improvement from officer perspective. |
| 5   | In what checkpoint environment do you think the Blended Lane concept would work best? Worst? Why?  
- Do you think it works better in a small terminal or large?  
- Do you think it works better in a small airport or large?  
- Do you think it works better when throughput high vs. low, and when the ratios of pre-check are high vs. low? | Understand where and under what circumstances it makes the most sense to use a blended lane. |
| 6   | How do you think passengers like/are responding to the Blended Lane concept?  
- What do you think they like about it? Dislike?  
- Do you think passengers are confused? If yes, are Standard Passengers confused more frequently or Pre✓ passengers?  
- Does reaction/acceptance vary between type of passenger (Standard or Pre✓)? | Understand officer interpretation of passenger acceptance. |
TSO Questionnaire
Blended Lane Officer Questionnaire

Instructions: We would like your feedback regarding your experience with the Blended Lane Concept. Please provide responses for the first three demographic questions. For all others, please circle the best response or your level of agreement based on the scale provided. Please answer each question to the best of your ability. All responses to this questionnaire will be kept anonymous. Thank you!

Demographics

1. What is your age?
   - Under 18
   - Between 18 and 30
   - Between 31 and 40
   - Between 41 and 50
   - Between 51 and 60
   - Between 61 and 70
   - Between 71 and 80
   - Over 80

2. Years as a TSO:

3. Level/Job Title:

Experience

<table>
<thead>
<tr>
<th></th>
<th>TDC</th>
<th>DO</th>
<th>X-Ray</th>
<th>WTMD</th>
<th>AIT</th>
<th>PSO</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I feel that the ___ position is the easiest to perform in the Blended Lane.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>I feel that the ___ position is the most difficult to perform while in the Blended Lane.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>I feel that the ___ position is the least mentally demanding while working in the Blended Lane.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>I feel that the ___ position is the most mentally demanding while working in the Blended Lane.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>I feel most confident in which position?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>I feel least confident in which position?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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</tr>
<tr>
<td><strong>Overall Impact</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I have confidence in my fellow TSOs that they will conduct Blended Lane procedures correctly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Overall, the Blended Lane concept is effective for screening passengers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Overall, the Blended Lane Concept is efficient for screening passengers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>Overall, deploying the Blended Lane concept is straightforward.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Deploying the Blended Lane concept enhances security.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Traveler wait times seemed to decrease while using Blended Lanes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>I prefer the Blended Lane system over using Standard/PreCheck only lanes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>I think Blended Lanes should be used at all airports.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<p>|<strong>Passenger Interactions</strong>| | | | | | | | |
|15 | Overall, it is easy for passengers to understand what was expected of them with Blended Lanes. | 1 | 2 | 3 | 4 | 5 | 6 | N/A |
|16 | Overall, PreCheck passengers are able to be screened without difficulty. | 1 | 2 | 3 | 4 | 5 | 6 | N/A |
|17 | Overall, Standard passengers are able to be screened without difficulty. | 1 | 2 | 3 | 4 | 5 | 6 | N/A |
|18 | Passengers frequently asked questions about the Blended Lane. | 1 | 2 | 3 | 4 | 5 | 6 | N/A |</p>
<table>
<thead>
<tr>
<th></th>
<th>I spend considerable time explaining to passengers how to navigate through the Blended Lane.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td></td>
<td>1 2 3 4 5 N/A</td>
</tr>
</tbody>
</table>

**Training**

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>The Blended Lane training I received was sufficient.</td>
<td>1 2 3 4 5 N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I knew how to help passengers when they had issues navigating the Blended Lane.</td>
<td>1 2 3 4 5 N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>TSOs would need substantial training before they could start operating a Blended Lane</td>
<td>1 2 3 4 5 N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments**

23 In the space below, please provide any additional comments and/or suggestions regarding your experience with the Blended Lane concept and/or your perception of the passenger experience with the Blended Lane concept.
### Appendix C: Data Tables (Triangulation) for CAT X and CAT II Airport

#### CAT X Airport

**Table 1: Recommendations Derived from CAT X Data**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Focus Group Data Points</th>
<th>TSO Survey Data Points</th>
<th>Observation Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish distinct parameters for this procedure such as when and where it should be implemented and ensure airport leadership adheres to these parameters.</td>
<td>&quot;Need a designated PreCheck queue for all lanes&quot; – TSO PreCheck queue converges with standard. PreCheck passengers end up behind standard and have to wait. &quot;It’s a bait and switch&quot; – TSO.</td>
<td></td>
<td>Checkpoint 89 operates with a second lane as either Standard or PreCheck during Blended Lane. USP process confusion observed when Standard passengers were quoted</td>
</tr>
<tr>
<td>Develop a purposeful, effective training program for this initiative and ensure all Officers are trained.</td>
<td>&quot;If this is going to stay, need a training class.&quot; – TSO &quot;Blended Lane only works if you have correct training&quot; – TSO</td>
<td>6/14 officers indicated they believe TSOs need substantial training to operate a blended lane.</td>
<td></td>
</tr>
<tr>
<td>Ensure that all officers rotate through the blended lanes at a minimum of once per week to keep their performance at an acceptable level</td>
<td>&quot;For veterans it is easy to learn but newer people are having a harder time&quot; – TSO</td>
<td></td>
<td>Officer observed as brand new with no prior training on Blended Lane. She was being instructed by peer on the fly.</td>
</tr>
<tr>
<td>Examine effectiveness (decrease or increase in detection), efficiency and Officer performance.</td>
<td>&quot;We screen 250 bags during half hour rotation regularly but probably only 200 with blended. It slows the process down.&quot; – TSO</td>
<td></td>
<td>2 TDCs staffed when no passengers in queue present, but passengers waiting and backed up for divestiture. Second DO would have been better placed to help manage the passengers and help divest before getting to the X-Ray.</td>
</tr>
<tr>
<td>Examine and define the adequacy of staffing levels for Blended Lane given the checkpoint size and passenger volumes. Identify the specific number of TSOs required to effectively implement this initiative and staff accordingly.</td>
<td>&quot;The process works if you have enough staff!&quot; – TSO &quot;The 2/4 batching ratio is nearly impossible to follow&quot; – TSO</td>
<td>&quot;To be effective, a checkpoint needs to be well staffed.&quot; &quot;Blended Lane only works if you have correct staffing.&quot;</td>
<td></td>
</tr>
<tr>
<td>Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency. Identify which positions should not be &quot;combined&quot; (i.e., DO and WTMD)</td>
<td>The DO physically cannot move in their position because they have to place the blocks on the belt by the X-Ray. Reaching for the blocks can be a safety issue when operating the X-Ray. Need SOP for how to place blocks on the belt&quot; – TSO</td>
<td></td>
<td>PSO, X-Ray, Supervisor all observed returning blocks and PreCheck cards at various points. WTMO observed shouting advisements to passengers while DO feeding X-Ray. TDC observed providing advisements when handling card to PreCheck passenger. Some officers use claw to remove bricks from the X-Ray. Others use their hands. Others let roll to end of belt.</td>
</tr>
<tr>
<td>Develop and implement an internal communication plan to facilitate standard practices and</td>
<td>D1 officers cannot run the X-Ray; Airport has many D1 officers. &quot;Officers subbing in from other checkpoints don’t know the</td>
<td>When asked agreement with statement &quot;I know how to help passengers when navigating the Blended Lane&quot;, average</td>
<td></td>
</tr>
<tr>
<td>Minimize Security</td>
<td>Perform testing in the Blended Lane to assess and identify possible security risks and gaps in the process. As part of the recommendation, assess threat detection and Off compliance.</td>
<td>A delayed resolution happened on the first day of Blended Lane (security breach). “You end up focusing more on what bag you are looking at vs what is in the bag”, – TSO</td>
<td>Observed non-PreCheck passenger screened as PreCheck with coat and shoes on through WTMD. “When you engage with passengers you can forget”</td>
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</tr>
<tr>
<td>Communication and locations. Build in protocols for training and monitoring Officers new to the procedure (e.g., substitute from another checkpoint; Level I (D1) Officers in rotation). The “burn-in” time should be 1 month to allow for comprehension and practice of the Blended Lane.</td>
<td>“Need way more bricks. We run out and have to stop the belt to run them up front.” – TSO Need more than one yellow crew indicator. After 7pm KCM lane closes and many crew come through.</td>
<td>“Why can’t a PreCheck lane be opened instead of a Blended Lane? We are losing site of the reason why we are here. KEEP PEOPLE SAFE. Not catering to precheck.”</td>
<td></td>
</tr>
<tr>
<td>Determine and provide airports with an adequate amount of vetting indicators and precheck cards based on the size of the checkpoint. This will help eliminate the issue of running out of indicators during operations.</td>
<td>“It was not made clear how PSO was supposed to determine the status of a pulled bag.” – TSO One manager brought in clothes pins to pin PreCheck bag checks, but it did not work well. The PSOs do not have a way to decipher the bags.</td>
<td>X-Ray observed communicating status of pulled bags to PSO. X-Ray observed confirming with DO status of bags being re-run and pulled for search.</td>
<td></td>
</tr>
<tr>
<td>Determine the best method for keeping track of and determining status of property when awaiting bag checks (e.g., vetting indicator specifically for the property).</td>
<td>“The X-Ray [switch] indicator is too much to think about.” – TSO “The [switch] indicator is useless” – TSO “I never use the X-Ray switch” – TSO</td>
<td>Observations showed a mix in the use of the switch indicator. Some officers expressed that this is an unnecessary step.</td>
<td></td>
</tr>
<tr>
<td>Determine a way to automate the X-Ray notifications for when screening PreCheck property versus Standard property to help eliminate the burden placed on the DO and X-Ray Officer. This automation could be a simple X-Ray screen color change or line at the bottom indicating which type of bag is currently being examined using some kind of RFID indicator on the bin, for example.</td>
<td>“No passengers read the PreCheck card” – TSO</td>
<td>Observed passenger place her PreCheck card in a bin and then become upset once she then needed to be screened as Standard.”</td>
<td></td>
</tr>
<tr>
<td>Precheck cards should be large enough to reduce the possibility of passengers accidentally losing the card when they are divesting (e.g., inadvertently placing the card in a bin or in their property) and should include the information necessary in as few words as possible in a bulleted list.</td>
<td></td>
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<tr>
<td>Enhance Officer Performance</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-----------------------------</td>
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<td></td>
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</tr>
<tr>
<td><strong>Examine how this process affects Officer TIP scores as well as other assessments and consider alternative options during Blended Lane operations.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Largest concern is DO putting down incorrect brick for type of bag and standard bags being screened as precheck.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When asked agreement with statement &quot;Deploying the Blended Lane concept enhances security&quot; average answer was 1.53, strongly disagree.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>what block you put on the belt.&quot; – DO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A passenger sent PreCheck card through X-Ray but still screened as PreCheck.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Consider alternate solution to physical indicators of vetting status at the checkpoint such as automation at the X-Ray screening. At a minimum, develop tracking and reporting mechanisms for the vetting indicators and precheck cards.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officers have missed a lot more TIPs in the past month since beginning Blended Lane.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TIP and bounding boxes remain on during PreCheck screening.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3 blocks total have been lost as of 3/27 (2 precheck, 1 standard). There is currently no process for keeping track of PreCheck cards. Need a dedicated location for the blocks at the checkpoint.</td>
<td></td>
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</tr>
<tr>
<td>A block was lost at EB during observation.</td>
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</tr>
<tr>
<td><strong>Refine airport identifiers on the vetting indicators and precheck cards to eliminate potential misuse and mitigate indicators being taken from checkpoints</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passengers have attempted to give precheck cards to other passengers.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Observed mother attempting to give her PreCheck card to daughter, who was not precheck or in the low-risk category.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Due to proactive interference of changing from one mental model (PreCheck procedure) immediately to another (standard procedure), perform a cognitive task analysis (CTA) to examine the cognitive workflows of TSOs and identify specific areas in the cognitive process that are most effortful, most error-prone, and most difficult. As part of this effort, examine the cognitive requirements associated with each job rotation and identify mitigation strategies.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;The learning process is not hard but applying it in the checkpoint environment is hard.&quot; – TSO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;DO is getting a hard time by doing this Blended Lane. X-ray officer is getting too much distraction. PSD is doing too much work while doing bag check. I do recommend to discard this Blended Lane.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officers appear well versed in the process. DO observed more successfully divesting passengers when volume is low vs. high.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;USP should be removed from Blended Lane process.&quot; – TSO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;I prefer the Blended Lane system over using Standard/PreCheck only lanes&quot;, average answer was 1.64, strongly disagree.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Conduct research to measure the effects of high volume operations on the performance of TSOs. Examine the ability of TSOs to maintain situational awareness and vigilance in order to understand the impact on detection rates.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;This would be chaotic on a busy lane.&quot; – TSO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;At the DO position I find it difficult to get away from the start of the X-Ray to place bricks instead of helping everyone divest properly so it takes longer when they get to the front of the line and haven't divested correctly.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDC halted passengers at podium at one point to slow the line. It was backed up at devastated table, but not line in queue.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;We screen 250 bags during half hour rotation regularly but probably only 200 with Blended Lane.&quot; – TSO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officer observed pulling PreCheck-compliant bags, which slowed down the operation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Breaks can't be scheduled.&quot; – TSO.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## CAT II Airport

### Table 2: Recommendations Derived from CAT II Data

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Focus Group Data Points</th>
<th>TSO Survey Data Points</th>
<th>Observation Data Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Streamline Process to Improve Effectiveness and Efficiency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Establish distinct parameters for when this procedure should be implemented and ensure airport leadership adheres to these parameters. | “Determine when two TDC lines will be helpful during peak times. Other times you only need one.” – TSM  
“It is much easier to do PreCheck all day long” – TSM | | During slow times, there were not enough passengers to batch, leading to constant switching of status at DO and x-ray. |
| Develop a purposeful, effective training program for this initiative and ensure all Officers are trained. | “There were no written rules or policy for us to follow [when we started Blended Lane]. Blended Lane is not an SOP. TSA HQ formalized what we were already doing – we trained each other.” – TSM  
“It took some time to get used to what is in a precheck bag vs a standard bag” – TSO | The majority of officers (13/20) agreed that TSOs require substantial training before they can start operating a blended lane.  
11/20 officer believe the training they received on the Blended Lane was sufficient. | |
| Examine effectiveness (decrease or increase in detection), efficiency and Officer performance. | “More streamlined way of batching passengers is critical” - TSO | | Some DOs stood across the diverst tables next to passengers, while others were behind by tunnel. DO would often batch precheck passengers at dovestiture. |
| Examine and define the adequacy of staffing levels for Blended Lane given the checkpoint size and passenger volumes. Identify the specific number of TSOs required to effectively implement this initiative and staff accordingly. | “If we didn’t do [multiple positions at once], the checkpoint would shut down. It is the result of scheduling and part time positions” – TSO  
“An additional FTE needs to be allotted to the Blended Lane.” – TSM  
“There should be at least 10 personnel for Blended Lane. We have 8 TSOs on a good day and typically 6” - TSM | | Sometimes only 6 TSOs staffing checkpoint. |
| Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency. Identify which positions should not be “combined” (i.e., DO and WTMD) | “I feel that the Blended Lane concept is an excellent idea, however it needs a bit more structure.” – TSO Open Response | | At one point observed no dedicated DO; one officer filled the role of DO and WTMD.  
PSO and AIT both observed returning indicators to DO and TDC. |
| Develop and implement an internal communication plan to facilitate standard practices and communication across Officers and locations. Build in protocols for briefing and monitoring Officers new to the procedure (e.g., substitute from another checkpoint; Level I (D1) Officers in rotation). The “burn-in” time should be 1 month to allow for | “It is hard for Phase 1 (D1) officers to keep up with Blended Lane” – TSM  
“I think Blended Lane is going very well here, TSOs were receptive and learned quickly (1-month burn in). There were complaints from TSOs at first, then they adjusted, accepted, and made it work. It took about 3 weeks for TSOs adjust.” – TSM  
“It is important to have someone shadow new TSO to ensure they learn the process. “It would help if TSOs and TSOs who have been doing this went to introduce to other airports.”” – LTSM | The majority of officers (14/20) responded that Officers need substantial training before being able to operate Blended Lanes.  
A D1 officer was struggling to maintain control of blocks at the diverstiture. | |
<table>
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<th>Comprehension and Practice of the Blended Lane.</th>
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<td><strong>Determine and provide airports with an adequate amount of vetting indicators and precheck cards based on the size of the checkpoint. This will help eliminate the issue of running out of indicators during operations.</strong></td>
<td>&quot;It is more challenging to return blocks during peak times. Blocks either returned by property search or AIT to DO&quot;—TSM</td>
<td>Observed the blocks were taped up.</td>
</tr>
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</table>
| **Determine a way to automate the X-Ray notifications for when screening PreCheck property versus Standard property to help eliminate the burden placed on the DO and X-Ray Officer. This automation could be a simple X-Ray screen color change or line at the bottom indicating which type of bag is currently being examined using some kind of RFID indicator on the bin, for example.** | "I tend to use the switch so I don’t have to scroll back to check for a brick."  
"I’ve used [the indicator] only once."  
"I only use [the indicator] when it’s really busy."  
"I put [the indicator] dead center" | In ~15 minutes, the switch was not updated 3 times. The x-ray operator would go to change the status and then realize that they didn’t need to move it since they never changed it the last time. |
| **Filter through all signage and dispose of or relocate to a monitor in the checkpoint. Provide effective directional signage to passengers to help with passenger segmentation to ease the burden on the TDC Officer. Provide a brief explanation on the Precheck card explaining that precheck passengers are intermingled with non-precheck passengers and there may be a slight wait period (if addition to what is already included on the card** | "The blended lane concept can run smoothly, but operation has to have effective DO and TDC officers. I do believe having a sign that guides the precheck to stand in one line will help also for us to operate the Blended Lane concept."—TSO Open Response  
"People don’t read signs. We’ve tried every combination of signs and it doesn’t work". | Observed confusing signage at the queue and multiple instances of passengers ended up in the wrong line ahead of the TDC (see Appendix D for images of signage). |
| **Perform testing in the Blended Lane to assess and identify possible security risks and gaps in the process. As part of the recommendation, assess threat detection and Officer compliance.** | "It puts us in a risky position. When its busy, we are wondering what we’re running and need to roll back image to check for a board or ask the DO. A lot of times we get used to just saying “Still standard” instead of putting another block down." | 50% of officers (10/20) disagree that the Blended Lane concept enhances security. |
| **Examine how this process affects Officer TIP scores as well as other assessments and consider alternative options during Blended Lane operations.** | "My TIP score has dropped quite a bit lately."—TSO  
"If we could turn it [TIPS] off for precheck [in blended lanes] that would be good"—TSO  
"I don’t think Blended Lane affects TIP scores or threat detection. We have officers who look back and check missed items."—TSM | When the next standard passenger came through after a batch of precheck the DO did not announce the status or place a block. |
<p>| <strong>Minimize Security Risks</strong> | | |
| | | One officer said that it is annoying when TIPS run during precheck, though it doesn’t happen often |</p>
<table>
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<tr>
<td><strong>Enhance Officer Performance</strong></td>
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| Conduct research to measure the effects of high volume operations on the performance of TSOs. Examine the ability of TSOs to maintain situational awareness and vigilance in order to understand the impact on detection rates. | “Blended Lane requires more flexibility from officers.” – TSM  
“TSOs need to be able to move between positions to adjust to the needs of the checkpoint and the type of passengers who come through.”  
Verbal communication is often substituted for the block – i.e. DO tells x-ray operator status without placing new block.  
During peak times, it was necessary to have 2 DOs for one TDC to maintain passenger flow. During one rush, there were 3 DOs. |
| Provide adequate staffing within the checkpoint to avoid Officers having to perform multiple jobs at once. This may decrease an officer’s ability to be successful. | “Sometimes a TSO will have to do WTMT, AIT, and DO due to callouts, which makes communication with passengers difficult and leads to burnout. We are doing the job of 3 people while expected to prevent breaches.” – TSO  
When staffing is low, one TSO may have to do WTMD, AIT, and pat downs |
Appendix D: Checkpoint Signage Photographs

The following photographs were taken at the CAT II airport during data collection April 8-10.
Appendix E: TSO Blended Lane Questionnaire Individual Survey Responses
CAT X Airport

Graph 1: CAT X TSO Questionnaire Responses – Overall Impact Questions

Graph 2: CAT X TSO Questionnaire Responses – Passenger Interaction Questions
Graph 3: CAT X TSO Questionnaire Responses – Training Questions

**CAT X TSO Questionnaire Responses – Training Questions**

- **TSOs would need substantial training before they could start operating a Blended Lane.**
  - Avg: 2.93

- **I know how to help passengers when they have issues navigating the Blended Lane.**
  - Avg: 3.93

- **The Blended Lane training I received was sufficient.**
  - Avg: 2.71

Scale: 0 (Strongly Disagree) to 4 (Strongly Agree)
CAT II Airport

Graph 4: CAT II TSO Questionnaire Responses – Overall Impact Questions

Graph 5: CAT II TSO Questionnaire Responses – Passenger Interaction Questions
Graph 6: CAT II TSO Questionnaire Responses – Training Questions

- TSOs will need substantial training before they could start operating a blended lane.
  Avg: 4.07

- I knew how to help passengers when they had issues navigating the blended lane.
  Avg: 3.14

- The blended lane training I received was adequate.
  Avg: 3.5
Graphs 7-12: CAT II Airport Experience Questions

**CAT II Airport Experience Questions**

7. I feel the ___ position is the easiest to perform in the BL.

8. I feel that the ___ position is the most difficult to perform in the BL.

9. I feel that the ___ position is the least mentally demanding while working in the BL.

10. I feel that the ___ position is the most mentally demanding while working in the BL.

11. I feel the most confident in which position?

12. I feel least confident in which position?
Attachment B
ACTION

MEMORANDUM FOR:  
Assistant Administrator  
Security Operations

FROM:  
Executive Assistant Administrator  
Requirements and Capabilities Analysis

SUBJECT:  
Request for the Implementation of Human Performance  
Recommendations Regarding the Blended Lanes Initiative

Purpose

The purpose of this memorandum is to provide Security Operations (SO) with recommendations provided by the Human Performance Branch (HPB) from Requirements and Capabilities Analysis (RCA) on the Blended Lanes initiative prior to execution at additional airports. These recommendations will improve upon the procedure for the Transportation Security Officers (TSOs) and the passenger experience. Additionally, TSA must ensure that the Blended Lane procedure, at a minimum, maintains security effectiveness and efficiency.

Background

The Lean Six Sigma Branch developed a procedure to combine precheck passengers and standard passengers in a single lane checkpoint in order to provide a way for smaller airports to incorporate the full precheck experience. The intent was to provide this experience for precheck passengers when an airport was unable to have a dedicated precheck lane.

The impetus behind this effort was concerns by Congress that Precheck Passengers were not afforded a Precheck lane at all airports. Within the procedure, the Blended Lane operates continuously, processing precheck and standard passengers through the same checkpoint. Each position within the checkpoint is required to know the passenger status in order to conduct the appropriate level of screening as they traverse through the security process. Vetting indicators were provided to help Officers switch between protocols and consisted of precheck cards given to precheck passengers at the TDC and blocks inserted into the X-Ray that alerts the X-Ray officer which property they are screening.
Three locations are currently operating the Blended Lane concept, two CAT II airports and one CAT X, with the desire to expand to other locations in Fiscal Year 2019. The HPB was brought in to assess the human factors aspects of this procedure change. This report details the HPB effort and provides results and recommendations from two data collection efforts.

The purpose of this assessment was to gain understanding of officers’ and passengers’ ability to adhere to the Blended Lane procedure and to identify both positives and negatives that may result from this process. Ultimately, the main objective was to provide TSA with information to make data-driven decisions on how to move forward with such a procedure in a manner that does not impact detection standards or impede the security process. Because this effort is considered a proof of concept, examining the impacts to officer performance and detection rates will provide information necessary for additional analysis of this procedure prior to implementation.

The four main objectives of this evaluation were to:
1. Understand how this new procedure affects human performance;
2. Identify pain points and bright spots in the procedure;
3. Identify error rates; and
4. Determine if additional data collection is needed regarding the impact of these procedural changes on effectiveness, efficiency, Officer performance or security effectiveness.

Discussion

The HPB collected three types of data: observations of the procedure including any passenger interactions, focus groups and interview data, and TSO questionnaires. Triangulation, a data analysis method that pulls together consistent themes across these data types, was used to identify pain points and bright spots in the procedure.

Based on these results at two of the three airports operating the Blended Lanes procedure, the HPB identified 17 recommendations that will improve the process and potentially lesson the possibility of errors occurring, thus positively impacting detection rates. The recommendations are categorized by topic area: 1) minimize security risks, 2) streamline process to improve effectiveness and efficiency at achieving stated goals, and 3) enhance officer performance.

Minimize Security Risks

1. Perform testing in the Blended Lane to assess and identify possible security risks and gaps in the process. As part of the recommendation, assess threat detection and Officer compliance.
2. Examine how this process affects Officer TIP scores as well as other assessments and consider alternative options during Blended Lane operations.
3. Consider alternate solution to physical indicators of vetting status at the checkpoint. At a minimum, develop tracking and reporting mechanisms for the vetting indicators and precheck cards.
4. Refine airport identifiers on the vetting indicators and precheck cards to eliminate potential misuse and mitigate indicators being taken from checkpoints.
Streamline Process to Improve Effectiveness and Efficiency at Achieving Stated Goals

5. Establish distinct parameters for this procedure such as when and where it should be implemented and ensure airport leadership adheres to these parameters.
   a. At CAT X airports or airports with a full modest and/or multiple checkpoints, Blended Lane should only be operational when dedicated Pre✓ lanes are closed and should not be combined with dedicated Pre✓ lanes or Standard lanes in order avoid confusion and potential increase in security risks.
   b. Blended Lane may operate continuously at smaller airports where there is a single-lane checkpoint.
   c. When volume is high, it is recommended to open a dedicated Pre✓ lane with a standard lane at larger airports where this is feasible given the checkpoint configuration.

6. Develop a purposeful, effective training program for this initiative and ensure all Officers are trained.

7. Ensure that all officers rotate through the blended lanes at a minimum of once per week to keep their performance at an acceptable level.

8. Examine effectiveness (decrease or increase in detection), efficiency and Officer performance.

9. Examine and define the adequacy of staffing levels for Blended Lane given the checkpoint size and passenger volumes. Identify the specific number of TSOs required to effectively implement this initiative and staff accordingly.
   a. A Blended Lane should operate with at least 10 officers at a given time.
   b. Ideal staffing is suggested as: 2 TDC, 2 DO, 1 Exit, 1 X-ray, 1 WTMT, 1 AIT, 1 PSO, 1 Dynamic.

10. Revise the protocol to assign specific duties for each Officer to eliminate confusion and increase efficiency. Identify which positions should not be “combined” (i.e., DO and WTMD)
    a. TDC should segment passengers from the queue and communicate instructions to Pre✓ passengers when handing over blue card.
    b. Dynamic and PSO officer return blocks and blue cards to DO/TDC.

11. Develop and implement an internal communication plan to facilitate standard practices and communication across Officers and locations. Build in protocols for training and monitoring Officers new to the procedure (e.g., substitute from another checkpoint; Level 1 (D1) Officers in rotation).
    a. The “burn-in” time should be 1 month to allow for comprehension and practice of the Blended Lane.

12. Determine and provide airports with an adequate amount of vetting indicators and Pre✓ cards based on the size of the checkpoint. This will help eliminate the issue of running out of indicators and halting operations to retrieve the indicators.

13. Determine the best method for keeping track of and determining status of property when awaiting bag checks (e.g., vetting indicator specifically for the property).
14. Filter through all signage and dispose of or relocate to a monitor in the checkpoint. Provide effective directional signage to passengers to help with passenger segmentation to ease the burden on the TDC Officer. Provide a brief explanation on the Pre✓ card explaining that Pre✓ck passengers are intermingled with non-Pre✓ passengers and there may be a slight wait period.

15. Pre✓ cards should be large enough to reduce the possibility of passengers accidentally losing the card when they are divesting (e.g., inadvertently placing the card in a bin or in their property) and should include the information necessary in as few words as possible in a bulleted list.

Enhance Officer Performance

16. Due to proactive interference of changing from one mental model (Pre✓ procedure) immediately to another (standard procedure), perform a cognitive task analysis (CTA) to examine the cognitive workflows of TSOs and identify specific areas in the cognitive process that are most effortful, most error-prone, and most difficult. As part of this effort, examine the cognitive requirements associated with each job rotation and identify mitigation strategies.

17. Conduct research to measure the effects of high volume operations on the performance of TSOs. Examine the ability of TSOs to maintain situational awareness and vigilance in order to understand the impact on detection rates.

Recommendation

HPB is requesting that SO implement the 17 recommendations for the Blended Lane procedure as described above.

Approve ________________/________________________ Date

Disapprove ________________/________________________ Date

Modify ________________/________________________ Date

Needs more discussion ________________/________________________ Date
MEMORANDUM OF INTERVIEW OR ACTIVITY

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Subject Matter/Remarks

**Interview or Activity:** Former Branch Manager [redacted] was telephonically interviewed regarding her knowledge of the TSA operation of blended lanes. [redacted] retired from TSA in October 2019, but was the Branch Manager of the Human Performance Branch (HPB) within Requirements & Capabilities Analysis (RCA). [redacted] was cooperative and provided the following information:

- During her observations at the pilot airports, her main concern, was there was no attempt to gather metrics or testing regarding how the new procedure may impact detection rates. The analysis conducted by HPB recommended TSA check for any changes in detection capabilities. Also there were new tasks being added to the officer and they were not being done properly. (Audio 9:50)
- It was "made clear" to her by her leadership (Assistant Administrator (AA) [redacted], Deputy AA (DAA) [redacted], and Executive Advisor (EA) [redacted]) that "the report was not what they expected" and that she wasn't being a team-player. Her leadership wanted to push the program forward, but she had advised them that "things were not going well in the field." (Audio 14:19)
- She wrote her own memo regarding her concerns, but was told in a meeting with Lean Six Sigma Manager [redacted] and EA [redacted] that her information would not be included.
They agreed to have a copy of the HPB Assessment attached to the memo from Executive Assistant Administrator (EAA) [REDACTED] to EAA [REDACTED]. (Audio 16:00)

- AA [REDACTED], DAA [REDACTED] and EA [REDACTED] were not happy about the report. She spoke with DAA [REDACTED] and told him she was "losing sleep over" the blended lane initiative, and asked why nobody was testing the detection. He responded that they would look into it. (Audio 19:13)
- Detection should have been tested before implementing the program. (Audio 20:10)

Audio recording will be maintained in the case file.
MEMORANDUM OF INTERVIEW
OR ACTIVITY

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**Subject Matter/Remarks**

**Interview or Activity:** Assistant Administrator (AA) was personally interviewed regarding his knowledge of the TSA operation of blended lanes. AA was cooperative and provided the following information:

- Security Operations (SO) Executive Assistant Administrator requested Requirements and Capabilities Analysis (RCA) to develop a procedure to do Pre-Check screening at a checkpoint with a single lane. RCA tasked this to the Lean Six Sigma (LSS) team. (Audio 1:11)
- The vast majority of the Human Performance Branch (HPB) recommendations from their evaluation, were incorporated in the training documents, the SOP, the Operations Directive or guidance documents provided by RCA. (Audio 6:10)
- In his interview he stated he did not know whether threat detection in a blended lane has been assessed or tested by Red Team. It has not been raised to him as an issue and he has not heard anything negative from the Red Team regarding blended lanes. (Audio 7:23)
MEMORANDUM OF INTERVIEW OR ACTIVITY (continuation sheet)

- In his written statement he states that the Red Team testing focused on blended lanes has been discussed with SO and Inspections and will be executed moving forward. (Attachment A)
- RCA has done a cursory review of officer performance. RCA is always concerned about the cognitive load of the officers. (Audio 8:50)
- HPB is presently doing a study on cognitive load associated with blended lanes screening, which started in the fall of 2019. The “Test Report for Risked-Based Screening” is the first set of data collection. The second set of data will be collected the week of March 9, 2020 with a final report delivered in May 2020. (Audio 2:38 and Attachment A)
- In the blended lane transition memo to SO AA [redacted], it mentioned the need for a follow-up assessment, which the team is currently conducting. (Audio 9:29)
- The transition memo mentioned the HPB assessment, but the report was an internal RCA report and was not sure whether SO ever saw the report. He was confident that LSS and HPB had worked out the issues identified. (Audio 13:07)
- The possibility of passing a Pre-Check card to a non-Pre-Check passenger was assessed by RCA as a “minimal vulnerability” and would fall on SO to address if they deemed necessary. (Audio 10:24)
- [redacted] stated “in the unlikely event that the adversary were attempting to exploit specifically the small possibility that a TSO would make this error, the adversary would still face a large probability – outside of the adversary’s ability to control or even influence – of experiencing full screening. This would likely be unattractive to an adversary, again emphasizing the limited vulnerability associated with the potential error.” (Attachment B)
- During the pilot screening effectiveness was defined as Pre-Check passenger receiving Pre-Check screening. (Attachment B)
- RCA provided an inventory method and inventory template to ensure that the vetting indicators are routinely accounted for. The Blended Lane Guidance states “Each checkpoint must establish an inventory of vetting indicators and Pre-Check cards. Current level of inventory should be recorded by TSMs/STSOs prior to and immediately at the conclusion of executing blended lanes. (Attachment B)
- In reference to the HPB recommendation for signage changes, [redacted] stated that blended lanes were intended for single lane checkpoints or at airports where the PreCheck lanes were closed due to low volume. He stated that both PreCheck and standard passengers enter the queue at the same location, and therefore no different signage is required. PreCheck passengers are not identified until they reach the TDC. (Attachment B)
- RCA did not take any action regarding the information that a mother attempted to give her PreCheck™ card to her daughter who was not PreCheck™ because it was an observed “attempt” and that she did not end of actually giving the card to her.
TSS Note: Lean Six Sigma (LSS) was commonly called Performance Improvement Branch prior to the recent TSA reorganization. They are now referred to as Continuous Improvement Branch/LSS.

See the attached signed statement of AA [REDACTED] for more specific information. Audio recording will be maintained in the case file. AA [REDACTED] referred to the Blended Lane Guidance which was provided previously under Exhibit 5 and therefore was not included with AA [REDACTED] statement.

Attachments:
A. Signed Statement by AA [REDACTED] dated March 2, 2020
B. Signed Statement by AA [REDACTED] dated May 1, 2020
Attachment A
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I, hereby make the following statement to Investigator, who has identified herself to me as an Investigator with the TSA Investigations Division. (Below print your Statement of facts including; WHO, WHAT, WHEN, WHERE, HOW, and WHY.)

Q1. What was your involvement with the development of blended lanes?

A1. I am the Assistant Administrator for RCA. As such, both the Human Performance Branch and Performance Improvement Branch report to me. Security Operations requested that RCA look into developing a process whereby paying Pre Check passengers could receive their Pre Check screening experience at airports without dedicated Pre Check lanes or at small airports with single checkpoints.

This assignment was tasked out to the Performance Improvement Branch. This branch had great success with the Enhanced Accessible Property Screening program. The team went to the Jackson MI airport to do data collection and develop the Blended Lane CONOPS. They returned with a very promising solution. Security Operations wanted to implement the solution immediately; we specifically held off until we did data collection at two additional locations: Fort Myers Beach and Dallas Fort Worth.

Before or shortly after this second round of data collection began, I was approached by the Human Performance Branch with concerns that the Blended Lane Solution could potentially increase the cognitive load on TSO's. I held a meeting with both the Performance Improvement Branch ( and Human Performance Branch) as well as my senior staff. At the meeting Ms. indicated that there were Human Performance concerns that should be addressed in the final product.
I specifically directed [REDACTED] and [REDACTED] to work together to ensure that the final procedure included mitigation efforts for the Human Factors concerns. After the second round of data collection the group came to me with a modified procedure and concept of operations. I asked both [REDACTED] if all the rollout materials (training, Operations Directive, shift brief, etc) incorporated Human Factors concerns identified in the below referenced report. They both replied in the affirmative.

I then signed out the transition memo from RCA to Security Operations. The Report titled "Blended Lane Evaluation" was not included in this memo, as its contents were largely incorporated into the Blended Lanes training/briefing materials, etc. The intent of this report was as an internal RCA assessment, the contents of which were used to inform the final Blended Lane solution. Most of the recommendations in the report were included in the final field guidance.

Please note that much of the field guidance on blended lanes is contained on the TSA Frontline IShare page, and this will be referenced throughout this response. The Procedures Team, working in RCA, is in the process of coalescing all the information that has been provided to the field into a single, easy to read Standard Operating Procedure for officer use. This is an entirely normal sequence of events where an Operations Directive will be rolled into a subsequent SOP.

Q2. What was the intended limitations of using the blended lanes operation? Was this documented anywhere when the program transitioned to Security Operations?

A2. The RCA team collaborated on the Operations Directive that Security Operations provided to the field that "promulgated" Blended Lanes. RCA also collaborated on Leader Rollout Guidance that was also provided. Both state that "Once a Checkpoint drops to a single lane, a Blended lane can provide an option.... " Both also state that "When the forecasted Pre Check volume at a checkpoint drops below 20%, the checkpoint may transition one lane to a blended lane". The Operations Directive further states that a Blended Lane can be used at an airport with no dedicated Pre Check lane. This is in keeping with the original intent of the Blended Lane Initiative.

Q3. What is your role with regards to the blended lanes operation today?

A3. I currently have no specific role with Blended Lanes as they have transitioned to Security Operations. As an office RCA will continue to monitor the efficacy of blended lane solutions and will make procedural change recommendations as needed. We are also studying the effects of task switching by Transportation Security Officers which include Blended Lane scenarios (among others). Please see answers A6 and A7 below.

Q4. The Human Performance Branch (HPB) within Requirements and Capabilities Analysis (RCA) conducted an evaluation on blended lanes during the pilot phase. There are 18 actionable recommendations listed in the report. Please outline how each of the 18 recommendations were addressed and/or evaluated.

Initials: [REDACTED]

Confidential

FOR OFFICIAL USE ONLY
Introduction: This report is titled Blended Lane Evaluation, and is dated 26 April 2019. This report was developed by the Human Performance Branch to provide input into the development and execution of the Blended Lanes project. Please note that the intent of this report was to provide Human Factors considerations into the Blended Lane concept; most of the recommendations annotated below were fully implemented in the program in either the training or Security Operations guidance provided to the field. Some of these recommendations were not technically feasible and are being held in abeyance for consideration in the future. Some (like the recommendation for 10 TSOs to staff a Blended Lane) were not feasible as the entire shift at a smaller, single lane airport is less than 10 personnel. Others, to include TIP assessment and covert testing, have not been acted on yet. The recommendation to assess the cognitive load on officers posed by task switching was initiated in November 2019, and a report should be available in May 2020. This data collection includes Blended Lanes as a subset of a larger analysis.

1. Perform testing in the blended lane. The blended lane CONOPS was tested at three airports and was modified accordingly as the process was developed. The Red Team has encountered Blended Lanes during covert testing, but tries to avoid them as they focus on Standard screening. Red Team testing focused on Blended Lanes has been discussed with Security Operations and Inspections and will be executed moving forward.

2. Examine how this process affects TIP scores. TIP scores have not been specifically assessed in the Blended Lane. This has been discussed with Security Operations and will be assessed in the future.

3. Consider automation of the x-ray screening system as opposed to physical vetting status indicators. This recommendation was considered technically unfeasible, but may be incorporated in the future. This recommendation further included a recommendation to inventory the vetting indicators. A Vetting Indicator Inventory tool is provided on the TSA Frontline Ishare Page.

4. Refine airport indicators on vetting indicators and Pre Check cards to eliminate misuse. This recommendation was implemented in the vetting status placard design to include airport-specific identification. Blended Lanes use the Pre Check cards that were previously developed for TSA use.

5. Establish distinct parameters for this procedure... See Answer A2 above. OD-400-50-1-30 defined parameters for the Blended Lane initiative that are consistent with this recommendation. National Shift Briefs further define low times of Pre Check volume and that Blended Lanes should not be used during peak times.
6. Develop a purposeful, effective training program...Completed. Developed Process in Action training videos available on TSA Frontline. The Blended Lane Checklist available on the TSA Frontline page defines roles and responsibilities for each position required by a blended lane. The Blended Lane Observation Reference Document available on the TSA Frontline Ishare page provides On the Job Training recommendation for TSOs working Blended Lanes and is a reference tool to ensure that procedures are properly implemented.

7. Ensure that all officers rotate through the blended lanes at least once per week...Blended Lane Guidance available on TSA Frontline requires that officers rotate through Blended Lanes for proficiency and consistency. The "once per week" recommendation was not adopted.

8. Examine effectiveness (decrease or increase in detection), efficiency, and Officer performance. See Answer A.4.1 and A.4.2 on the intent to do focused Blended Lane testing moving forward.

9. Examine and define the adequacy of staffing levels (10 officers were recommended). The Blended Lane National Shift Brief outlines the duties for each position; the recommendation of 10 Officers was not adopted; this exceeds the staffing available at most locations where Blended Lanes have been implemented.

10. Refine protocol and assign specific duties...Blended Lane Guidance and the Blended Lanes Job Aid available on the TSA Frontline Page contain this information.

11. Develop and implement an internal communications plan. Blended Lane National Shift Brief and Blended Lane Break Room documents available on the TSA Frontline Ishare page contain this information.

12. Determine and provide airports with an adequate number of indicators and Pre Check cards. Completed.


14. Determine the best way to automate the x-ray notifications when screening Pre Check property versus standard property. This is not technically feasible at this time, but may be incorporated in the future.

a. Until automation is feasible, gather and refine data on the "switch indicator". TSO input on the utility of the Switch Indicator was considered during the Blended Lane development.

15. Provide effective signage...provide a brief explanation on Pre Check cards. There is no specific signage required for the Blended Lane. Pre Check cards used for the Blended

Initials:

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Lane program are the same as those used for other TSA screening procedures.

16. Pre Check cards should be large enough to prevent accidental loss. The Pre Check cards used for the Blended Lane program are the same as those used for other TSA applications.

17. Perform Cognitive Task Analysis on TSO’s. See A7 below. This initiative began in November 2019.

18. Conduct research on the effects of high volume operations on TSO’s. High Volume operations are not unique to the Blended Lanes procedure. The intent of the program is that it is used at lower-volume airports or airports where the volume does not require a dedicated Pre Check lane. See answer A.2 above. The data collection underway now will inform potential recommendations on “batching” passengers in either a standard or Pre Check lane to mitigate some of the task switching.

Q5. Who received the HBP Evaluation report regarding blended lanes? Was the HPB Evaluation report shared with anyone in Security Operations?

A5. The HPB report was delivered to the Performance Improvement Branch as recommendations to consider while moving forward with Blended Lanes. I am unaware of this report being shared with Security Operations, although there would have been no prohibition of doing so. As stated it was an RCA internal effort intended to inform the Performance Improvement Branch Blended Lane solution.

Q6. The transition memo handing the program from RCA to Security Operations, and signed by you, recommends “to assess cognitive burden and threat detection in the next 3-6 months.” Have any assessments been conducted or planned as recommended by this memo?

A6. Field data collection for this requirement is ongoing. The first set of data collection occurred at BWI and was delivered in November. The second set of data will be collected the week of 9 March in Indianapolis. This data on officer cognitive load will be compiled into a report to be delivered in OOA May. See Answer 7 below.

Q7. A Report titled “Test Report for Risked-Based Screening” dated November 25, 2019 was written by RCA. The purpose of this report was to determine the consequences of task switching. What is the status of this report?

A7. The referenced report contains data collected from Baltimore Washington International Airport on the effects of cognitive burden at the checkpoint. This cognitive burden can be increased by officers having to switch frequently between tasks. This analysis was initiated as referenced in my memo (undated...believe it was 8 May 2019) to wit: "Human Performance Assessment-recommendation to assess TSO cognitive burden and threat detection in the next 3-6 months to ensure security effectiveness remains at an acceptable level."
The referenced report represents Phase I of the data collection. The team has elected to perform additional analysis in Indianapolis International Airport. This data collection will occur the week of 9 March. This latest data will be combined with the data from BWI and coalesced into a consolidated report, which will be ready in OOA May 2020. I will receive a briefing on the results once the final report is completed.

Q8. The report states "The result of that test replicate some of the predictions from cognitive psychology suggesting a decrease in performance when frequently switching tasks." What actions has RCA taken based on this report?

A8. No actions have been taken to date with respect to this specific report as it is not complete. Please note that this report exceeds the Blended Lane CONOPS; the team is looking at a variety of scenarios where switching between tasks can potentially induce a cognitive load. Please see A7 above: no actions have been tasked because data collection is ongoing and will result in a consolidated report in OOA May 2020.

Q9. The whistleblower alleges that the "screening procedures for blended lanes include multiple steps that increase opportunities for human error and introduce exploitable gaps? How would you respond to that allegation?

A9. The results of the "Test Report for Risk Based Screening" will be used to determine if modifications to Blended Lane screening should be considered. Further adjustments may be made as future TIP scores and Red Team results are assessed.

Q10. The whistleblower alleges that there are no controls in place to prevent an individual from passing his or her Pre-Check or crew card to a standard passenger. This concern was also mentioned in the HPB Evaluation of blended lanes. How would you respond to that allegation?

A10. Pre Check cards used for the Blended Lane program are the same as those used for other TSA screening procedures.

I have read this entire statement consisting of 6 pages. I have been given the opportunity to make corrections. I declare under penalty of perjury that the foregoing is true and correct to the best of my recollection.

Signature:

Initials:
SENSITIVE SECURITY INFORMATION

Executed on this the ___ (Day) of _____ (Month), 2020.

Signature of Investigator: ___________________________ Date: 3/9/2020

Initials:

Confidential

Page 7

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SENSITIVE SECURITY INFORMATION

Attachment B
Name: [Redacted]  Date: 28 April 2020

Duty Assignment: Requirements and Capability Analysis

Current Position: Assistant Administrator

Pay Band: SES

Telephone Number: [Redacted]

Investigator(s): [Redacted]

I, [Redacted], hereby make the following statement to Investigator [Redacted], who has identified herself to me as an Investigator with the TSA Investigations Division.

(Below print your Statement of facts including; WHO, WHAT, WHEN, WHERE, HOW, and WHY.)

Q1. Lean Six Sigma conducted a pilot for blended lanes at 3 airports. Please provide the purpose of the pilot, the dates and location of the pilot, and what metrics were obtained.

A1. The three pilots were conducted at Jackson-Medgar Wiley Evers International Airport (JAN) in Mississippi, Southwest Florida International Airport (RSW), and Dallas/Fort Worth International Airport (DFW) in Texas.

JAN:
- Baselining (November 9, 2018): Initial data collection to identify challenges and root causes
- Rapid Improvement Event (November 26-30, 2018): Pilot solution; data collection on pilot implementation and stakeholder feedback
- Post Event Activities (December 2-19, 2018): Monitor process metrics; discuss successes and modifications; develop CONOPs

RSW: February 11-14, 2019
- Baseline data collection, which included process metrics (throughput, bag search rate, Pre-check vs non-Pre-check volume)
- Stakeholder (to include Officer and Leads) and customer feedback
- Feedback on Indicator Block process and prototypes

DFW: February 26-March 1, 2019

Initials: [Redacted]

Confidential
SENSITIVE SECURITY INFORMATION

- Baseline data collection, which included process metrics (throughput, bag search rate, Pre-check vs non-Pre-check volume)
- Stakeholder (to Include Officer and Leaders) and customer feedback
- Feedback on Indicator Block process and prototypes

Q2. What was the outcome of the pilot? What decisions were made based on the results of the pilot?

A2. The pilots resulted in an indicator prototype, training, procedural CONOPs, and benefit metrics. At the conclusion of the three pilots, the recommended path forward, which included transitioning Blended Lanes to Security Operations for sustainment and Implementation at FSD discretion and integration of Blended Lanes security effectiveness testing into subsequent initiatives, was agreed upon by Operations Support and Security Operations leadership.

Q3. The "Community of Practice Blended Lane Brief" claimed the pilot demonstrated effective screening of TSA PreCheck™ passengers (person and property), while maintaining throughput efficiency. Please provide data or evidence that supports this statement.

A3.

During the pilots, screening effectiveness was defined as Precheck passengers receiving Precheck screening. The below table captures data for this performance metrics from the JAN pilot.

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<tr>
<td>29-Nov</td>
<td>454</td>
<td>176</td>
<td>100%</td>
</tr>
</tbody>
</table>

_Q4. The "FSD Blended Lane Briefs dated March 28, 2019" claimed the blended lanes pilot resulted in significant improvement in efficiency, higher PreCheck™ passenger satisfaction, higher officer satisfaction, and limited screening error risk. Please provide data or evidence that supports this statement._

A4.

The below data provides satisfaction comparisons between the procedures that included use of Pre-check bins and those using start/stop indicators.
Q5. In the "Single Lane Pre-Check Briefing Administrator", it states that observations made during the pilot revealed the vetting indicators made the process smoother, with less errors by officers and passengers. Please provide data or evidence that supports this statement.

A5. These observations were anecdotal. The vetting indicators, when combined with batching of passengers as necessary, were observed to provide smoother integration of Pre Check in the standard lane as opposed to using different bins.

Q6. In the Human Performance Branch Evaluation on Blended lanes, recommendation #13 recommended determining the best method for keeping track and determining status of property. In your statement dated March 6, 2020, you responded that "standard procedures for tracking personal property through the checkpoint apply." What are the standard procedures for tracking personal property?

A6. When an individual is referred for additional screening, the Officer is required to maintain "Positive Control" of the person and/or property, depending on the circumstance. For this scenario, the Officer would maintain positive control by keeping the individual and their property physically separated. This physical separation prevents individuals from passing items to another person. If physical separation is not possible, an Officer would be assigned to watch and control the individual's access to cleared individuals and accessible property. When an individual's accessible property is required to receive additional screening, the X-ray Operator must ensure all items with confirmed System-Generated or annotated bounding boxes are removed from the x-ray conveyor belt and the property matches the x-ray image. The X-Ray Operator will manually transfer the item to the manual diverter roller (MDR) for additional screening and place it in the same orientation as it appears on the x-ray image.

The Property Search Officer will then retrieve the property from the MDR and maintain positive control of that property/item until the additional screening procedures have been completed.

Q7. In the Human Performance Branch Evaluation on blended lanes, recommendation #15 recommended that RCA filter through all signage and dispose of or relocate to a monitor in
the checkpoint to ease the burden on the TDC Officer. Also recommended was to provide a brief explanation of the PreCheck™ expedited card explaining that PreCheck™ passengers are intermingled with non-PreCheck™ passengers and there may be a slight wait period. In your written statement you responded that "no specific signage required for blended lanes." Explain what RCA did or explain the rationale behind why this recommendation was not addressed.

A7. Blended Lanes were intended for single lane checkpoints or at airports where the Precheck lanes were closed due to low volume. In these scenarios, both Pre Check and standard passengers enter the queue at the same location; there is no differentiation that blended lanes are in use, and no different signage is required. Pre Check passengers are not identified until they reach the TDC. Their status as Pre Check is on their boarding pass, and the TDC Officer processes them accordingly.

Q8. The HPB Blended Lane Evaluation stated that one TSO reported that 3 “blocks” had been lost as of 3/27/2019 (2 Pre-Check and 1 standard). One was lost during the observations made by the HPB team. What actions did RCA take regarding this information of lost indicators?

A8. RCA provided this recommendation to SO. SO published an inventory method to ensure that the Vetting Indicators are routinely accounted for. This requirement is contained in the “Leader Rollout” published by Security Operations, and the inventory template is posted on the TSA Frontline 1-Share site.

Q9. The whistleblower alleges that the “screening procedures for blended lanes include multiple steps that increase opportunities for human error. He provides the 4 examples below.

a. Inadequate measures in place to control the vetting indicators after screening is complete
b. Requiring employees to screen Pre-Check and standard passengers at random intervals via the same X-ray machine increases the likelihood that errors will occur.
c. Divestiture Officer’s (DO) ability to differentiate classifications and determine appropriate level of screening.
d. Complications created for the X-ray operator and bag search officer to perform functions consistent with SOPs

How will the current Cognitive Burden Study on task switching, currently being conducted by Human Performance Branch, address each of these identified vulnerabilities? Please explain in detail for each item.

A9.

The study that HPB is currently conducting examines how task switching (switching between two or three SOPs) effects performance in a general baggage screening task (decision to search or clear a bag). In this initial phase, the studies have only focused on the X-Ray task;
no other positions were examined. Additional research is needed to investigate other positions such as the DO, so A(c) will not be specifically addressed with this study, but if significant errors induced by task switching are identified, A (c) will be further assessed.

A(a) is another aspect of Blended Lanes that was not included in this current study.

A(b) In the HPB Task Switching study, examination and analysis of performance immediately after a task switch (procedure change at X-Ray) was examined as well as mitigation strategies to lessen the potential negative effects. In study 1, TSOs were asked to adjudicate (decision to search or clear) 216 X-ray images using one or three procedures. In the three conditions TSOs switched to a different procedures every eight bags allowing the investigation of performance over time and after each task switch. In study 2, the frequency of task switching was examined by having TSOs switch every six bags or every twelve bags. Mitigation strategies such as showing the specific procedure rules prior to each trial or for every bag image was also examined. This was included to better understand if certain mitigation strategies would improve performance or lessen the risk of potential errors.

A(d) This study specifically examined X-ray Officers and did not look at the Property Search Officer position or task. The study did look at potential complications with X-ray operators and their performance as it relates to switching between standard and Pre✓® screening procedures. Memory, time on task, fatigue, and performance were examined. Recommendations from these studies as it relates to task switching will be included in the final report.

Q10. In your interview with Investigations on March 2, 2020, you stated the whistleblower's concern about the possibility of passing a pre-check card to a non-pre-check passenger was assessed by RCA to be a "minimal vulnerability." Please provide data or evidence that supports that assessment.

A10. This answer will address the vulnerability associated with a TSO inadvertently giving a PreCheck card to a non-PreCheck passenger in error. In the hypothetical case of a TSO as an "insider threat", intentionally desiring to assist the passage of prohibited items into the sterile area, the TSO would have many other options, with or without Blended Lanes.

As with any error, it is within the realm of possibility that a TSO could provide a Precheck card to a non-PreCheck passenger. However, the vulnerability associated with this likely-infrequent error is very limited, because it would be very difficult for an adversary to exploit it (to plan on being at the just the right place at just the right time).

Alternatively, in the unlikely event that an adversary were attempting to exploit specifically the small possibility that a TSO would make this error, the adversary would still face a large probability - outside of the adversary's ability to control or even influence - of experiencing full screening. This would likely to be unattractive to an adversary, again emphasizing the limited vulnerability associated with the potential error.
To mitigate the possible loss of Pre Check cards, an inventory requirement was established in the Blended Lanes guidance posted on TSA Frontline.

Q11. In the HPB Evaluation on Blended Lanes it was mentioned that the team observed a mother passing her PreCheck expedited card to her daughter who was not PreCheck. What actions did RCA take regarding this information?

A11. There is no record of specific RCA action in this instance. During the data collection, it was observed that the Mother attempted to give the precheck card to her daughter, but did not end up actually giving the card to her. It is unclear as to why, but it was noted as an observation. There was no action to take.

Q12. Will the current Coronavirus crisis have an impact on the completion of the Cognitive Task Analysis final report expected May of 2020? If so, what is the new anticipated completion date?

A12. The current crisis will not have an impact on these initial task switching studies as data collection has already been completed. Data analysis and report writing are underway. Additional research that is warranted may be impacted due to travel restrictions. However, the HPB is looking into ways to collect data remotely without having to physically be at an airport location if additional research is warranted or requested.

I have read this entire statement consisting of 6 pages. I have been given the opportunity to make corrections. I declare under penalty of perjury that the foregoing is true and correct to the best of my recollection.

Signature: ____________________________
Date: 2020.05.01 15:04:48 -04'00'

Executed on this the 1 (D) of ___, 2020.

Signature of Investigator: ____________________________
Date: 5/1/2020
EXHIBIT

#11
MEMORANDUM OF INTERVIEW
OR ACTIVITY

Type of Activity:  
☐ Personal Interview  
☐ Telephone Interview  
☒ Records Review  
☐ Other

Date and Time:  
August 17, 2020  
1300 Hours

Activity or Interview of:  

Conducted by:  
Transportation Security Specialist [Redacted]

Location of Interview/Activity:  
Residence (due to COVID)

Subject Matter/Remarks

Interview or Activity: On August 13, 2020, Phoenix International Airport (PHX) Federal Security Director (FSD) [Redacted] emailed a copy of Threat Image Projection (TIP) Detection Analysis and Assessment (PHX 2019-2020). On August 17, 2020, a review of TIP Detection Analysis and Assessment was conducted. The following information was obtained from that review:

- The TIP review included 15 months’ worth of TIP data reflecting over 2 million TIP events. Blended Lanes tip performance was taken for April 2020.
- Blended lane data was reviewed for May and June as well, however due to high volume which required designated standard and pre-check lanes, there was minimal use of blended lanes.
- Prior to blended lanes the weighted average of TIPS detection (both standard and pre-check lanes) was [Redacted]% The blended lane average for April 2020 was [Redacted]% The weighted average (both standard and pre-check) in May/June 2020 was [Redacted]%.
- The weighted average for April 2019 for both standard and pre-check lanes was [Redacted]%. The blended lane average for April 2020 was [Redacted]%.
- Variation between standard lanes, pre-check lanes and blended lanes was statistically insignificant.

Attachment:
Threat Image Projection (TIP) Detection Analysis and Assessment

Case Number:  I19 0386
Case Title:  OSC Disclosure

SENSITIVE SECURITY INFORMATION/FOR OFFICIAL USE ONLY


(Revised 12-15-08)
Hi [Name],

Attached (current password to open) is our TIP Detection Analysis for Blended lanes at PHX.

Highlights include the following:

- We included 15 months of TIP's data which is broken out by month and protocol (Standard/PreCheck)
- Baseline was established using 12 months of Standard and PreCheck TIP results, as well as using volume percentages to weight the average.
- Blended TIP's performance was taken directly from Blended lanes only in April 2020.
- Post Blended lanes were established for May and June as volumes (high) for PHX required designated Standard and PreCheck.
- TIP comparisons are listed as Pre-COVID, Blended, and Post Blended.
- We included a slide to reflect same month comparisons for April in 2019 and 2020.
- As reported in May 2020 and today, variation was statistically insignificant and we stand by our claim that TIP’s detection rate may actually be higher for PreCheck passengers in a Blended Lanes.

We can provide the raw data of over 2 million assessments and the file is 37mb.

Please let us know if you require any additional information.

Regards,

[Name]
Subject: RE: Blended Lanes

We are requesting an additional 10 days to complete the analysis report for detection comparison between Standard, Pre check and Blended lanes.

Below is a list of attributing factors for the extension request:

- The detection measurement used by TSA is currently STIP reported TIP data and is not separated by screening protocols
- It is necessary for us to separate pre check detection rates from Standard detection rates to complete this analysis
- The reports that are required to obtain the information come from raw data that is extracted from each x-ray lane, the original formatting is in script and requires it to be exported into excel sheets, sorted by TIP Event and manually remove all non-essential events prior to calculating
- There are 48 x-rays at PHX, we will need to sort out the raw TIP Event report for each x-ray by serial numbers for standard in order to weigh out the projected blended percentage to create the comparison report. We completed this part of the project for Pre check but because the data used by the agency doesn't break out Standard from Pre check detection in TIP we will need to do the same breakdown to determine the detection rate for Standard lanes. (approx. another 600 reports will need to be generated, sorted and calculated.
- At this time the agency does not have a breakdown that can be used and the reports will need to be prepared by us first.
- We set up a folder on the L drive and are having Training provide us access to the raw data for the last 14 months
- This will allow actual separation and calculation of detection scores for all pre check lanes and standard lanes at PHX from 4/2019-6/2020
- We recommend that the agency take into consideration in the future to separate the protocols in STIP. It will provide a better understanding of our true detection rates and provide the field with Pre check detection rates to measure and possible use as baseline.

Please advise if this is an issue or if you need it immediately.

Regards,
The presentation you are about to receive contains Sensitive Security Information (SSI). As a covered person receiving this information, you are required to protect it from unauthorized disclosure in the interest of transportation security of the United States.

Handling, storage, reproduction, verbal repetition, and disposition of the information shown during this presentation must be in accordance with applicable statutes, implementing regulations, and TSA policies and procedures.
Data Collection

Baseline
- April 2019 through March 2020. This is also referred to as the Pre-COVID period.

Blended
- Phoenix ran exclusive Blended protocol during April 2020 and in a very limited capacity during May and June.

Post Blended
- Phoenix led the nation for throughput during May and June of 2020 which required dedicated lanes for Standard and PreCheck at three checkpoints. Minimal use of blended lanes during this period.

Weighted Average
- This calculation takes into account the total number of passengers for the period as well as the percentage of PreCheck to standard passengers. These equations allow you to compare a Blended lane to the combined detection of Standard and PreCheck lanes.

STIP (Security Technology Integrated Program)
- TSA's current TIP reporting system
- Scores are calculated by combining all of the officers TIPs (Precheck, Standard and Blended)
- Score does not take into account:
  - Screening protocol breakdown on Rapiscan AT's.
  - Detection expectations of screening protocols

Supplemental Data
- All data for this assessment comes from PHX airport
- Detection scores were assessed using a Microsoft Access Database built to assess TIP scores for the Expanded TIPs Capabilities (ETC) program. This is a more in depth calculator for assessing detection deficiencies than is provided by the STIP reports the field leadership is able to access.

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## Pre-COVID Baseline

### PRE-COVID

- **Standard**
- **Precheck**
- **Weighted Average**

|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

Precheck Throughput % and number of TIP Trials Assessed by Month

- Baseline period saw a fluctuation of **3.46** points on STANDARD lanes
- Baseline period saw a fluctuation of **11.09** points on PRECHECK lanes

**WARNING:** This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know", as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration or the Secretary of Transportation. Unauthorized release may result in civil penalty or other action. For U.S. Government agencies, public disclosure is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.
Blended Performance

Blending Protocol

PreCheck passengers use lanes with STANDARD lane configuration:

- Lanes operate with operator assisting technology to automatically identify possible explosives
- Due to operator assist, no continuous belt is utilized
- Officers operate with higher TIP assessment frequency on Blended lanes than dedicated precheck lanes
- During the blending period PRECHECK passenger volume drops from an average of 39% to 21%

WARNING: This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know", as defined in 49 CFR parts 15 and 1520 except with the written permission of the Administrator of the Transportation Security Administration or the Secretary of Transportation. Unauthorized release may result in civil penalty or other action. For U.S. Government agencies, public disclosure is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.
Post-Blended Performance

- Post-Blended period saw a fluctuation of .19 points on STANDARD lanes to baseline
- Baseline period saw a fluctuation of 1.68 points on PRECHECK lanes to baseline

WARNING: This record contains sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know", as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration or the Secretary of Transportation. Unauthorized release may result in civil penalty or other action. For U.S. Government agencies, public disclosure is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.
The comparison of Standard Pre-COVID Average and Posted-Blended Averages showed a [ ] point difference in TIP detection.

The comparison of the Precheck Pre-COVID Average and Post-Blended Averages showed a [ ] point difference in TIP detection.

The comparison of the Weighted Average of the Pre-COVID and Post-Blended months showed a [ ] point difference in detection.

The comparison of April 2020’s Blended detection rates against the pre and post COVID Weighted Average rates show a difference of [ ] points (Pre-COVID) and [ ] points (Post-COVID).

Overall comparison shows the deviation of Pre-COVID scores from Post-Blended scores are within the fluctuation norms of the baseline data.

**WARNING:** This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know", as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration or the Secretary of Transportation. Unauthorized release may result in civil penalty or other action. For U.S. Government agencies, public disclosure is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.
April YOY (2019 to 2020) Comparison

- TIP trials for April 2019 was [value] and [value] for April 2020.
- April 2019 TIP's weighted average was slightly lower than the Blended rate protocol used in 2020.
TIP's Detection Comparison Graph sent on 5/6/20 with TUS included

Graph above with 130,023 TIP's events are identical to the 2 million plus TIP's events captured in the deck.

Statistically, the above graph does not reflect any degradation for blended lanes at PHX and TUS.
EXHIBIT

#12
MEMORANDUM OF INTERVIEW OR ACTIVITY

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<th>Activity or Interview of:</th>
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<tr>
<td>Review of Human Performance Branch Research</td>
<td>Transportation Security Specialist [Redacted]</td>
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<tr>
<td>- Combined Test Report for Risked-Based Screening Experiments 1 and 2</td>
<td>Location of Interview/Activity:</td>
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<td>Residence (Due to COVID)</td>
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**Interview or Activity:** A review of Human Performance Branch (HPB) report titled "Combined Test Report for Risked-Based Screening Experiments 1 and 2" dated May 29, 2020 was conducted on July 21, 2020. The following information was obtained from that review:

- HPB conducted a study to determine the effects on Transportation Security Officer (TSO) performance from switching tasks. This study ran from January to March 2020, and assessed how frequent task switching affects TSO performance in a baggage screening task. Specifically, the study explored:
  1) How TSO performance compares when TSOs have to switch procedures versus when they have to repeat the same procedure; and
  2) Which mitigation strategies most effectively impact the negative effects of task switching (Attachment 1)
- The study was conducted by contractor Global Systems Technologies, Inc. (Attachment 1)
- TSA aims to continue the evolution of risk based screening (RBS) with Future Lane Experience (FLEX) screening. FLEX aims to improve operational efficiency and security effectiveness by further differentiating passengers by risk and offering modified screening tailored to these new risk designations. The first phase of this effort will be to further differentiate the TSA Pre-✓® population and reassess the level of risk and the appropriate level of screening required for entry into the sterile area. (Attachment 1)
The current concept of operations for FLEX defines three main Standard Operating Procedures (SOPs) for the large majority of passengers, namely Standard, LRRB (Low-Risk Rules Based), and TSA Pre✓®. When entering the checkpoint, a passenger’s risk classification will determine the SOP that will be applied to their person and property. A passenger will be directed to a line at the checkpoint where they will be screened using the Standard, LRRB, or TSA Pre✓® SOP. (Attachment 1)

Another evolution of RBS is known as a Blended lane. In a Blended lane, TSOs will switch between two or more SOPs depending on the passenger being screened. The Blended lane concept is commonly considered applicable to smaller airports where there is insufficient staffing to open a dedicated TSA Pre✓® lane.

HPB administered a test to measure performance from TSOs when they were asked to adjudicate bag images using one SOP or dynamically switching between three SOPs. The goal of this test was to determine if task switching reduced performance in a highly motivated population of participants (e.g., TSOs) using an ecological task. The scope of this study included both qualitative and quantitative assessments of task switching. (Experiment 1)

Interviews with TSOs revealed the following comments:

- The Divesture Officer would be greatly affected because he or she would have to know exactly who gets what SOP rule applied to them. The walkthrough metal detector officer would have a great deal of confusion to deal with as far as who is allowed to keep shoes and light jackets on. The Ticket and Documenting officer would have to now direct each individual passenger on what lane to go to. The bag checker in the back of each lane would be confused with each bag check and would have to then speak to the X-ray operator even more to figure out what type of screening each person and their bag received to make sure they’re conducting the proper additional screening on the pulled bag.
- No, we don’t need more SOPs, we need clearer non-contradictory SOP. The thought of bringing another set of rules into the mix is exhausting. People are tired of working triple as hard and no real monetary incentive. It would also be truly hard to switch back and forth between modes. I only see disaster if that was implemented. The one positive I see is that people would be aware and not so much in auto-pilot.
- TSOs stated that the implementation of either FLEX or Blended lanes must include a higher staffing count and high-quality training.

- Experiment 1 demonstrated that TSOs who dynamically switched instructions performed worse than TSOs who used the same instruction. The decrease in performance was the result of functional decay within a run of bag images suggesting that changes in performance are based on remembering the correct SOP to apply.

<table>
<thead>
<tr>
<th>Case Number:</th>
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<tr>
<td>119 0386</td>
<td>OSC Disclosure</td>
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(Revised 12-15-08)
SENSITIVE SECURITY INFORMATION

MEMORANDUM OF INTERVIEW OR ACTIVITY (continuation sheet)

- Experiment 2 considered two methods of mitigating the negative effects of task switching. The first method was to decrease the number of task switches by increasing the number of bags that were adjudicated in a run prior to a switch. The second method was to provide memory support by showing the current SOP for every bag in a run. The scope of this study included a quantitative assessment of task switching such as response time, accuracy in applying the correct SOP, and workload.
- In Experiment 2 we investigated whether TSOs tend to respond in a manner consistent with the Standard SOP. Defaulting to the Standard SOP would mitigate the risk of a prohibited item being released into the sterile area of the Checkpoint. Therefore, we filtered our results to only consider responses when the Standard SOP was active.
- Overall, Experiment 1 demonstrated that switching SOPs reduces detection sensitivity and increases response times compared to repeating the same SOP. By analyzing performance within a run of bag images, functional decay of memory was identified as the cognitive process responsible for reducing performance.
- In Experiment 2, methods to mitigate functional decay were examined. The results showed that less frequent switching reduced functional decay of memory within a run.
- According to Experiment 2, the likely result of notifying an X-ray operator of a switch for only the first bag would be a decrease in performance as the X-ray operator forgets the current SOP. A persistent intervention, like the SOP presented for every bag image seen here and the slider implemented on current Blended lanes would be more robust. However, it is not clear how often X-ray operators remember to change the slider or look at the slider when it is changed.
- Task switching is difficult regardless of training or practice and should be avoided. In both Experiments 1 and 2, TSOs improved performance on a coarser temporal grain (across the entire task) at the expense of performance on a finer temporal grain (within a run of bag images).
- Widespread implementation of a program like the Blended lane, where TSOs are expected to switch the SOP dynamically, may substantially increase the frequency of bags entering the sterile area where the wrong SOP was applied in addition to reducing throughput at the checkpoint.
- If TSA implements a program based on task switching, expect TSOs to forget which SOP is currently being used and provide a way for TSOs to recover the current SOP when they do forget. In Experiment 2 the SOP was added to the top-middle of the screen for every bag image. This cue was large and invasive with an onset effect which increased the likelihood that it would be noticed and used. One consequence of such an effective cue is that it may have drawn the TSOs' attention away from the bag image whether they needed the reminder or not.

Case Number: 119 0386
Case Title: OSC Disclosure

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(Revised 12-15-08)
Subtler cues may be sufficient which do not demand the TSOs’ attention such as smaller text, text to one side, less contrast between the text and the background, or keeping the SOP reminder static from image to image versus a quick onset.

- Per the cover letter by RCA, AA [redacted] states "It is important to highlight that there is no intent at this time to incorporate LRRB screening into Blended Lanes. Furthermore, LRRB screening will not be added to the Blended Lane CONOPS without additional Human Factors and Security Effectiveness assessments. As such, the study’s results and recommendations will be extrapolated to inform TSA’s ongoing efforts to improve and refine Blended Lanes, but should not be read as a direct assessment of Blended Lanes operations."

- AA [redacted] adds "this is but one part of TSA’s ongoing efforts to improve and refine Blended Lanes. RCA, in consultation with Security Operations and the Office of Inspections, is finalizing an Action Plan that outlines the efforts these offices will pursue through FY21 to more accurately assess the security effectiveness of Blended Lanes and make recommendations moving forward. These lines of effort include: Procedures Standardization, Process Review/Refinement, and Security Effectiveness Testing. As part of the Process Review/Refinement line of effort, RCA will address the recommendations included in the enclosed report. More specifically, based on the results of this study, RCA will conduct an additional assessment to determine Blended Lane utilization across airports and to explore procedural changes to reduce the amount of task switching for the Officers (e.g., passenger batching protocols, throughput parameters for operations)."

- RCA will look into the feasibility of incorporating automated methods to display the required screening procedure (i.e. Standard or TSA Pre-Check) on current and future carry-on screening systems. Based on the results of this study, the HPB recommends to "Minimize the use of Blended Lanes, if at all". Per current Blended Lanes guidance, Blended Lane usage should be based on specific Checkpoint and TSA Pre-Check Volume criteria, which is in alignment with this recommendation. The outputs of the Blended Lane Action Plan will support further decisions to the approach should there be a need to reassess and adjust.

Attachments:
A. Combined Test Report for Risked-Based Screening Experiments 1 and 2 May 29, 2020 (with cover letter from RCA)
B. RBS Task Switching Summary Slides
Attachment A
TRANSMITTAL MEMORANDUM

MEMORANDUM FOR: 
Investigator 
Inspections 

FROM: 
Assistant Administrator 
Requirements and Capabilities Analysis 

SUBJECT: 
Combined Test Report for Risked-Based Screening Experiments 1 and 2: Task Switching 

This MEMO is in response to your ongoing inquiry into the Whistleblower Complaint regarding TSA’s use of Blended Lanes in the checkpoint. 

As I indicated in my prior statements, the Human Performance Branch (HPB) of Requirements and Capabilities Analysis (RCA) conducted a study to determine the effects on Transportation Security Officer (TSO) performance from switching tasks. This study ran from January to March 2020, and assessed how frequent task switching affects TSO performance in a baggage screening task. Specifically, the study explored:

1) How TSO performance compares when TSOs have to switch procedures versus when they have to repeat the same procedure; and
2) Which mitigation strategies most effectively impact the negative effects of task switching.

Please find enclosed the final report and slide deck, which provides greater detail on the study’s methodology, results and associated recommendations.

As you review this study, I would like to emphasize some key caveats and provide additional context. First, this is an assessment of tasking switching, which is related to Blended Lanes but was not a specific assessment of the Blended Lane in operation. The study did not assess the effect of task switching in the exact Blended Lanes Concept of Operations (CONOPS). For example, Blended Lanes switch between two CONOPS (Standard Screening and TSA Pre✓®) whereas the study assessed the effects of task switching between three CONOPS (Standard
Screening, TSA Pre✓®, and Low Risk Rules Based (LRRB) screening). It is important to highlight that there is no intent at this time to incorporate LRRB screening into Blended Lanes. Furthermore, LRRB screening will not be added to the Blended Lane CONOPS without additional Human Factors and Security Effectiveness assessments. As such, the study’s results and recommendations will be extrapolated to inform TSA’s ongoing efforts to improve and refine Blended Lanes, but should not be read as a direct assessment of Blended Lanes operations.

Second, this is but one part of TSA’s ongoing efforts to improve and refine Blended Lanes. RCA, in consultation with Security Operations and the Office of Inspections, is finalizing an Action Plan that outlines the efforts these offices will pursue through FY21 to more accurately assess the security effectiveness of Blended Lanes and make recommendations moving forward. These lines of effort include: Procedures Standardization, Process Review/Refinement, and Security Effectiveness Testing. As part of the Process Review/Refinement line of effort, RCA will address the recommendations included in the enclosed report. More specifically, based on the results of this study, RCA will conduct an additional assessment to determine Blended Lane utilization across airports and to explore procedural changes to reduce the amount of task switching for the Officers (e.g., passenger batching protocols, throughput parameters for operations). Additionally, the Accessible Property Screening Capability Manager will assess the feasibility of incorporating automated methods to display the required screening procedure (i.e. Standard or TSA Pre✓®) on current and future carry-on screening systems.

Based on the results of this study, the HPB recommends to “Minimize the use of Blended Lanes, if at all” (attached slide deck). Per current Blended Lanes guidance, Blended Lane usage should be based on specific Checkpoint and TSA Pre✓® Volume criteria, which is in alignment with this recommendation. The outputs of the Blended Lane Action Plan will support further decisions to the approach should there be a need to reassess and adjust.

This concludes RCA’s current Human Performance assessment into key components of the Blended Lanes operational concept. Please do not hesitate to contact me if you require additional information.

CC:

TSA Office of Chief Counsel
TRANSPORTATION SECURITY ADMINISTRATION (TSA)

REQUIREMENTS AND CAPABILITIES (RCA)

REQUIREMENTS HUMAN PERFORMANCE AND ENGINEERING DIVISION (RHPED)

Research Report

Combined Test Report for Risked-Based Screening Experiments 1 and 2

U.S. Department of Homeland Security
TSA Headquarters
701 South 12th Street
Arlington, VA 22202-4220

May 29, 2020

Version 1.0

U.S. Department of Homeland Security
Transportation Security Administration

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Combined Test Report for Riskeled-Based Screening Experiments 1 and 2

Global Systems Technologies, Inc.
Airport Plaza II Suite 9050
2611 South Clark Street Arlington, VA 22202

Department of Homeland Security, Transportation Security Administration
Requirements and Capabilities, Technical Acquisitions/Analysis and Requirements Human Performance and Engineering Support, Human Performance Branch
701 South 12th Street Arlington, VA 22202

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This research report details the results of two experiments in human performance. TSOs dynamically applied multiple SOPs to a series of X-ray bag images at a simulated Checkpoint. Experiment 1 showed a decrease in the ability to apply the correct SOP at the correct time when switching between multiple SOPs. Experiment 2 tested two methods of mitigating the negative effects of switching between multiple SOPs, namely, reducing the switch frequency between SOPs and providing a visual reminder of the current SOP.

Risk-Based Screening, Blended Lanes, FLEX Lanes, Task Switching, Human Performance

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Executive Summary

TSA is interested in broadening its Risk-Based Screening (RBS) program to create more nuanced screening protocols based on a passenger's level of risk. Current RBS programs include Blended lane and Future Lane Experience (FLEx) programs, which require Transportation Security Officers (TSOs) to be trained on and implement a greater number of Standard Operating Procedures (SOPs) within the same passenger lane at a Checkpoint or during their shift. The consequences of task switching have been extensively researched in cognitive psychology and provides a number of predictions about what types of performance changes TSA should expect when implementing RBS programs. In this effort, two experiments investigated how switching between multiple SOPs effects performance in a baggage screening task.

In Experiment 1, 31 TSOs at one domestic airport were asked to adjudicate 216 top-down X-ray images using one simplified SOP or three simplified SOPs. SOPs were simplified to the point that TSOs were trying to discriminate the presence or absence of liquids and laptops and whether liquids and laptops were allowed in the bag. Although TSOs were told that there could be prohibited items in the bags, there were none.

This experiment asked: How does performance compare when TSOs have to switch SOPs versus when they have to repeat the same SOP? In the three SOP condition, TSOs applied an SOP to a run of bags. A run is a series of bag images in a row where the same SOP should be used (e.g., Bag 1: Standard, Bag 2: Standard, Bag 3: Standard, etc.). Each run contained eight bag images. After applying the same SOP eight times in a row, TSOs were asked to apply another SOP. Having the SOP switch every eight bags allowed for an examination of performance over time and after each SOP switch. Between runs, TSOs screened bag images faster and used the correct SOP more often when applying one SOP versus switching between three SOPs.

In addition, we analyzed performance within the run after the SOP had switched. Intuitively, one would expect that TSOs may initially perform poorly immediately after a change in SOP and then get better with practice for the rest of the run. However, an analysis of within-run performance showed that when the SOP switched, TSOs became worse at applying the correct SOP for the rest of the run of bags until presented with another SOP.

Previous research in cognitive psychology has investigated this same effect, where within-run performance continues to decrease after a task switch. The results of several studies suggest that within-run performance decreases after a task switch because of memory decay. This process is an uncontrolled and automatic feature of how people perform rapid task switching. When the memory for which SOP that needs to be applied gets updated too frequently, retrieving the correct SOP from memory becomes difficult. TSOs know that a switch has occurred, but they are unsure if the SOP they remember is from a recent switch or a switch in the distant past. The only way to correct for this is to forget the current SOP as fast as possible to get ready for the next switch in SOP. This process is known in cognitive psychology as functional decay of memory. Functional decay of memory allows TSOs to rapidly switch between SOPs by forgetting which SOP to currently apply in preparation for the next task switch. However, one consequence of the functional decay of

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memory is that TSOs will forget which SOP they are supposed to be using while they are still using it. A post-test interview with TSOs about the consequences of switching between SOPs (good or bad), revealed extremely negative perceptions about task switching. TSOs disliked the idea immensely because they expected a dramatic rise in access events (e.g., a bag with a prohibited item that enters the sterile area) which would result in them being remediated even though the task was very difficult. In addition, and contrary to best-practices, 33% of TSOs (N = 5) who switched between three SOPs said that they would apply a more liberal SOP such as LRRB or TSA Pre✓® when they were unsure of the current SOP versus the more conservative Standard SOP. Another 27% of TSOs (N = 4) in the three SOP condition said that they had no default SOP. Finally, 40% of TSOs (N = 6) said that they would use the Standard SOP when they were unsure.

Experiment 2 considered two ways to mitigate the negative effects of task switching with 166 TSOs between two domestic airports. The first method investigated was to reduce the frequency of switching between SOPs. Similar to Experiment 1, participants applied an SOP to a run of bags. For some TSOs, the SOP switched every six bags (shorter runs) while other TSOs had the SOP switch every twelve bags (longer runs).

The second method investigated was to provide a way to recover when TSOs inevitably forgot which SOP to apply. Some participants were shown the SOP for only the first bag of a run after a switch. A notification of an SOP switch for only the first bag in a run is similar to the divider placed between bags of different SOP types in the Blended lane program. Other TSOs in Experiment 2 were shown the SOP on every bag image. Showing the current SOP on every bag image is an automated version of the slider TSOs must manually switch in the Blended lane program when the SOP changes. The prediction for Experiment 2 was that TSOs would perform better when switching less frequently (longer runs compared to shorter runs) and when provided with a reminder of the current SOP on every bag (compared to just the first bag after a change in SOP).

Each TSO viewed the top and side of 216 X-ray images. TSOs categorized the bag images as Clear or Search while in one of four conditions: bags were presented in shorter runs (e.g., the SOP switched every 6 bags) or longer runs (e.g., the SOP switched every 12 bags) and the SOP was presented for the first bag after the SOP changed or on every bag. A brief summary of each SOP was supplied on a single sheet of paper that TSOs could review them at any time.

Overall, there were no differences in the ability to correctly apply the SOP between the four interventions. However, there was a difference in response time between interventions. TSOs took longer when they were shown the SOP on every bag image. We expect that this increase in response time was an artifact of the aggressive cue we provided which was large, in the middle of the screen, and flashed at onset. Furthermore, because TSOs are highly motivated in baggage-screening tasks to correctly adjudicate the bag image, some TSOs reviewed the written SOP more frequently when reminded of the SOP on every image than when the SOP appeared only for the first bag following a switch.

In addition to an analysis of performance overall, we also analyzed performance within a run following a switch in SOP. A within-run analysis started with the first bag after a switch in SOP.

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until the next switch in SOP. The within-run analysis showed that TSOs were more likely to apply the wrong SOP when they were only shown the SOP following a switch compared to when the SOP was shown for every bag image. Accuracy in applying the SOP decreased faster within a run when TSOs switched more frequently (e.g., shorter runs) compared to when they switched less frequently (e.g., longer runs). In contrast, when participants were given the SOP for every bag image, TSOs applied the correct SOP more often.

It is important to note that presentation of the SOP only when the SOP switches is similar to the current best-practice outlined for Blended lanes. The best-practice for Blended Lanes suggests that the Divesting Officer (DO) places a divider between bag images when the SOP switches. This divider is read by the X-ray operator and informs the officer that a switch has taken place. The best-practice allows the DO and the primary X-ray operator to communicate that the SOP has changed. However, the likely result of notifying an X-ray operator of a task switch, according to the current best-practice, would be a decrease in performance as the X-ray operator forgets which SOP to apply. A persistent intervention, like the SOP presented for every bag image or slider implemented on current Blended lanes would be more robust. However, it is not clear how often X-ray operators remember to change the slider or look at the slider when it is changed.

Therefore, several recommendations based on the data are presented here:

1. Task switching is difficult regardless of the amount of training or practice and should be avoided. Performance increased across the entirety of Experiments 1 and 2 at the expense of performance within a run of bag images just after a task switch.

2. TSOs feel that adding another SOP, like Low Risk Rules Based (LRRB) screening, would result in “chaos” at the Checkpoint and there would be a “significantly higher chance of passengers getting screened incorrectly.” Fewer SOPs, even if not being used all of the time, are preferred.

3. Widespread implementation of a program like the Blended lane, where TSOs are expected to switch the SOP dynamically, is likely to substantially increase the frequency of bags entering the sterile area where the wrong SOP was applied in addition to reducing throughput at the checkpoint.

4. TSA should validate these empirical findings in a field test.

5. If TSA implements a program based on task switching, reducing the frequency of the task switch will result in fewer negative effects on human performance after a task switch.

6. If TSA implements a program based on task switching, expect TSOs to forget which SOP is currently being used and provide a way for TSOs to recover the current SOP when they do forget. In Experiment 2 the SOP was added to the top-middle of the screen for every bag image. This cue was large and invasive with an onset effect which increased the likelihood that it would be noticed and used. One consequence of such an effective cue is that it may have drawn attention away from the bag image whether TSOs needed the reminder or not. Subtler cues may be sufficient which do not demand so much attention such as smaller text, text to one side, less contrast between the text and the background, or keeping the SOP

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reminder static from image to image versus a quick onset. We recognize the technical limitations of inserting the SOP onto the primary screen. Other methods of providing a similar cue could be putting a sign or lighted message board on top of the X-ray/CT machine that notifies TSOs on the lane which SOP is being used.

Finally, it is important to note that the decrease in performance shown here with task switching was obtained when participants operated in a best-case scenario:

1.) TSOs completed the study in a quiet room.

2.) TSOs had no expectation of being disrupted during their task.

3.) TSOs completed a simplified version of the task and only had the option to Clear or Search without the use of additional filters.

4.) TSOs switched SOPs applicable to a single environment, a simulated Checkpoint. TSOs did not have to switch between relevant SOPs at the Checkpoint and relevant SOPs in Checked Baggage which can be the experience of dual-certified TSOs.

5.) TSOs switched SOPs at regular intervals (i.e., Experiment 1: every 8 bags; Experiment 2: every 6 or 12 bags), versus a number that varied.

6.) For Experiment 2, the item most affected by an SOP switch, laptops, is one of the easiest items to recognize in an X-ray image because laptops are large, generally consistent in shape, and highlighted in blue (i.e., metal).

These best-case features would likely not occur at a Checkpoint in the field. The negative effects of task switching without memory support seen here would only increase especially for more difficult to find items such as guns, knives, or explosives, while simultaneously trying to task switch.

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Figure 1 The left panel shows an example of the divider used to notify the AT operator that a Blended lane is switching to TSA Pre✓®. The right panel shows an example of what the divider looks like in an X-ray machine and the slider that the AT operator must switch to TSA Pre✓®

Figure 2 Example of a common switch cost result taken from Experiment 1 of Wylie & Allport (2000).

Figure 3 Time course of the randomized-runs procedure taken from Altmann & Gray (2008).

Figure 4 Subset of results from within a run taken from Altmann & Gray (2008). Empirical data is in the left panel. Simulated data from the CCM is on the right panel. Response times are in milliseconds and are the median response for over 500,000 trials.

Figure 5 Time course and stimuli progression for the repeated instructions condition (left) and switched instructions condition (right).

Figure 6 Example of stimuli progression.

Figure 7 Example of the GTQ.

Figure 8 Equations to calculate $d'$ (top) and $d_b$ (bottom) where $H$ is the hit rate and $F$ is the false alarm rate.

Figure 9 Log-linear transformation for the hit rate (top) and false alarm rate (bottom).

Figure 10 Within run $d_b$ for each SOP instruction condition. Dotted lines are the average best-fit regression created for each TSO. The mean slope and intercept are located above the graph as well as fit statistics.

Figure 11 Median response time for each SOP instruction condition when there was the possibility of a hit. Error bars are 95% confidence intervals.

Figure 12 Median response time for each SOP instruction condition when there was the possibility of a false alarm. Error bars are 95% confidence intervals.

Figure 13 Median response time for hit trials for each run. Error bars are 95% confidence intervals.

Figure 14 Median response time for false alarm trials for each run. Error bars are 95% confidence intervals.

Figure 15 A comparison of short and long runs for response time (top) and error (bottom) taken from Altmann & Gray (2002).

Figure 16 Time course and stimuli progression for a run of 12 and first bag SOP condition.

Figure 17 Example of the stimuli progression when the SOP was available for every bag (top) or the first bag of a run (bottom). Note that the SOP is displayed for every bag image in the top panel.

Figure 18 Within run $d_b$ for each SOP instruction condition. Dotted lines are the average best-fit regression created for each TSO. The mean slope and intercept are located above the graph as well as fit statistics.

Figure 19 Within run hit rate for the Standard SOP by condition. Dotted lines are the average best-fit regression created for each TSO. The mean slope and intercept are located above the graph as well as fit statistics.

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Figure 20 Within run hit rate for the Standard SOP by condition split by negative slopes (decrease in performance) and positive slopes (increase in performance). The top panel is when the run length was a length of 6 (e.g. shorter runs). The bottom panel is when the run length was a length of 12 (e.g. longer runs). Dotted lines are the average best-fit regression created for each TSO. The mean slope and intercept are located above the graph as well as fit statistics.

Error bars are 95% confidence intervals.

Figure 21 Median response time for each SOP instruction condition when there was the possibility of a hit. Error bars are 95% confidence intervals.

Figure 22 Median response time for each SOP instruction condition when there was the possibility of a false alarm. Error bars are 95% confidence intervals.

Figure 23 Gas Tank Questionnaire by condition. Error bars are 95% confidence intervals.

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1 Background of Risk-Based Security

In 2011, the Transportation Security Administration (TSA) initiated Risk Based Security (RBS) through the deployment of TSA Pre✓\(^\circ\). The general premise of which was to end TSA’s “one-size fits all” screening approach and to apply an appropriate level of physical screening to individuals and their property based on their risk status determination. The intended result of which was to spend less time and resources screening low-risk passengers while redistributing saved resources on unknown and high-risk individuals.

Eligibility criteria for TSA Pre✓\(^\circ\) has evolved over the years since its initial implementation in 2011 and rapid expansion in 2014; populations currently included in TSA Pre✓\(^\circ\) are: Known and Vetted populations (e.g., TSA Pre✓\(^\circ\) enrolled individuals, Customs and Border Protection (CBP) Trusted Travelers, Department of Defense (DoD) military personnel, Federal Judges, Members of Congress, etc.) and Low-Risk Rules Based (LRRB) individuals (e.g., age, gender, itinerary, travel history, co-travelers of TSA Pre✓\(^\circ\)). Together these low-risk populations currently represent approximately 40% of the daily passenger volume system wide.

In conjunction with TSA Pre✓\(^\circ\), TSA has initiated several real-time threat assessment initiatives (Managed Inclusion-1 (MI-I)\(^1\), MI-II\(^2\), and Canine Enhanced Screening (CES)\(^3\) to increase and maintain the total expedited screening percentage to 50%\(^4\) to offset increasing passenger volumes and year-over-year reductions in funding for Transportation Security Officer (TSO) resources. Currently CES is the only remaining option for Federal Security Directors (FSD) to implement during peak operating hours to mitigate shortfalls in capacity and represents 6-8% of the daily passenger volume system wide, due to limitations on deployed locations and quantities of available Passenger Screening Canines (PSC).

In 2015, TSA implemented significant process and procedural modifications for screening high-risk Selectee (SSSS) passengers aimed at increasing the level of scrutiny and resources utilized for the screening of these individuals. These modifications resulted in a significant increase in the probability of detection of prohibited items for this population.

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\(^1\) MI-I represented TSA’s initial attempt at utilizing Passenger Screening Canines (PSC) to provide an additional layer of security at the checkpoint allowing a greater population to be eligible for TSA Pre✓\(^\circ\) screening by utilizing the PSCs to increase the probability of detection for Improvised Explosive Devices (IED), reducing the risk in real-time of an individual receiving TSA Pre✓\(^\circ\) screening.

\(^2\) MI-II similar to MI-I, but utilized Explosive Trace Detection (ETD) in place of PSCs at a random rate for a targeted percentage of passengers. MI-II was eliminated as a screening option in 2015 as a result of the 2015 DHS OIG Tiger Team effort in response to DHS OIG covert testing.

\(^3\) CES has replaced MI-I and has been modified several times since its initial deployment to include Real-Time Threat Assessment (RTTA).

\(^4\) 50% expedited screening was determined to be the minimum threshold for maintaining a sufficient balance between passenger demands and available resources.

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TSA aims to continue the evolution of RBS with Future Lane Experience (FLEx) screening. FLEx aims to improve operational efficiency and security effectiveness by further differentiating passengers by risk and offering modified screening tailored to these new risk designations. The first phase of this effort will be to further differentiate the TSA Pre✓® population and reassess the level of risk and the appropriate level of screening required for entry into the sterile area.

FLEx Screening will build on the existing TSA model of pre-screening, identity verification, and checkpoint screening and add further differentiation that results in new efficiencies in the airport environment. Secure Flight vetting will be modified to return an increased number of vetting results, including a new Low Risk status which will be transmitted to airlines in the form of new Boarding Pass Printing Results (BPRR).

The current CONOPS for FLEx defines three main Standard Operating Procedures (SOPs) for the large majority of passengers, namely Standard, LRRB (Low-Risk Rules Based), and TSA Pre✓®. When entering the checkpoint, a passenger’s risk classification will determine the SOP that will be applied to their person and property. A passenger will be directed to a line at the checkpoint where they will be screened using the Standard, LRRB, or TSA Pre✓® SOP. Overall, SOPs differ in how much screening and what types of items are allowed in a passenger’s property. For example, at the primary AT viewing station, Standard passengers must remove laptops and liquids, LRRB may keep laptops in their bags but not liquids, and TSA Pre✓® passengers may keep laptops and legal 3-1-1 (i.e., liquids, gels, and aerosols under 3.4 oz.) in their bags. In one conceptualization of FLEx lanes, the primary AT operator will apply only one SOP at a time. If a TSO is at TSA Pre✓® lane, they will search for explosives, shields, and prohibited items in the passenger’s property but allow laptops and legal 3-1-1s to remain in the bag.

Another evolution of RBS is known as a Blended lane. In a Blended lane, TSOs will switch between two or more SOPs depending on the passenger being screened. The Blended lane concept is commonly considered applicable to smaller airports where there is insufficient staffing to open a dedicated TSA Pre✓® lane. When a passenger enters a Blended lane that requires a change from the current SOP, the primary AT operator is notified by the DO of a change in SOP via a divider that is placed on the belt. The divider shows the name of the new SOP and is clearly visible within the X-ray machine. The AT operator uses the presence of the divider as a cue for what SOP to apply for all bags following the divider. After collecting the divider off of the belt, the AT operator is tasked with updating a slider that is located at their station. The slider contains the name of different SOPs that they can switch between. If the divider taken off the belt says “Standard”, then AT operators are asked to change the slider in front of them to “Standard.” The slider acts as a persistent reminder for the correct SOP to apply. When a passenger of a different risk classification enters the checkpoint, TSOs adapt by switching to a different SOP. Figure 1 provides an example of the divider and slider used in Blended lanes.

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Figure 1 The left panel shows an example of the divider used to notify the AT operator that a Blended lane is switching to TSA Pre✓®. The right panel shows an example of what the divider looks like in an X-ray machine and the slider that the AT operator must switch to TSA Pre✓®.

2 Experiment 1: Introduction

Implementing RBS requires TSOs to be trained in and execute multiple SOPs between or within the same shift. Depending on the SOP active for a particular lane or passenger, the same contents of a bag at the Checkpoint may require different responses. For example, if a Standard SOP is being used, a single laptop in a passenger’s bag would need to be searched at the Checkpoint. However, that same bag would be cleared if a TSA Pre✓® SOP was used. The consequences of using a more conservative SOP, such as Standard on a TSA Pre✓® bag, may inconvenience passengers and reduce throughput. Alternatively, using a more liberal SOP, such as TSA Pre✓® on the bag of a Standard passenger, may lead to errors where an item not suitable for a passenger of a particular risk class receives less screening.

Determining how people apply the right rules to a task at the right time has been an active area of research in cognitive psychology. Task switching theories from cognitive psychology result in several predictions that can help TSA understand and mitigate the effects of task switching. Theories for how people maintain cognitive control and effectively switch between tasks falls into one of three groups: task-set inertia (TSI: Allport, Styles, & Hsieh, 1994; Allport & Wylie, 1999, 2000; Wylie & Allport, 2000), task reconfiguration (Monsell, 2003; Rogers & Monsell, 1995; Steinhauer & Hübner, 2006), and combinations of TSI and reconfiguration (Meiran, 1996).

A general finding across task switching studies shows that when people are forced to switch between two or more tasks, performance decreases after the switch in what is known as a switch cost. The switch cost is measured as an increase in error rates but more often as an increase in

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response time (Allport et al., 1994; Meiran, 1996, 2000; Rogers & Monsell, 1995). Figure 2 shows an example of a classic switch cost effect from Wylie & Allport (2000). Switching an instruction for a task (Sw) significantly increases response time compared to repeating an instruction for a task (R). Switch cost is such a robust finding that even when people think there might be a switch, response times are slower (Allport & Wylie, 2000; De Jong, 2000; Los, 1996). In some studies, even when a switch does occur, the negative impact from the increase in time continues to persist 30 trials after the switch (Allport & Wylie, 2000).

![Figure 2](image.png)

**Figure 2** Example of a common switch cost result taken from Experiment 1 of Wylie & Allport (2000)

This test report focuses on the explanatory power of task-set inertia (TSI) theories which provides a robust set of predictions for the effects of task switching on performance.

2.1 Task-Set Inertia

TSI was first introduced by Allport et al. (1994). In their work, participants were presented with eight numbers (1-9, excluding 5). When a number was presented, participants were given the instruction to respond whether the number was even/odd or lower than/greater than five. By switching and repeating instructions (e.g., Even/Odd, Even/Odd, Lower/Higher, Lower/Higher), the authors found that response time to classify a number after a switch in instruction was significantly higher than if the same instructions were repeated. The explanation for this effect was that instructions for each task are encoded as they are presented. That encoded instruction is active in memory and drives the correct task instruction being implemented. However, when a switch occurs, proactive interference from an old code initially makes it difficult to retrieve the correct procedure for the new instruction.

Early studies of task switching, including Allport et al. (1994), used an *explicit-cuing* or *alternating runs* paradigm which changed the instruction frequently (e.g., task pattern: ABAB, AABBA). Investigating task switching was thus limited to the one or two trials after a switch which is not how task switching can present in the real-world. As an alternative, Altmann & Gray (2002) and Altmann (2002) introduced the *randomized-runs* procedure (see Altmann & Gray, 2008 for more details). The *randomized-runs* procedure presented trials where participants apply the same rule.

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over time before switching (e.g., $I_AAAAAA I_BB BBBBB$, where $I$ is an instruction). Applying the same rule several times in a row is called a run.

The randomized-runs procedure is most similar to operational task switching at the Checkpoint where TSOs apply the same SOP in a row before switching to a new SOP. The randomized-runs procedure forces participants to maintain the current instruction in memory and allows for an investigation of memory within a run. Altmann (2002) discusses three possibilities for performance over time within the run: First, practice with the new instruction could improve performance within the run (Newell et al., 1981); Second, only the first trial in the run is effected by the switch as the task changes to a new representation (Rogers & Monsell, 1995); Third, performance decreases within a run as memory for the current task instruction decays.

Surprisingly, Altmann (2002) showed the third hypothesis was correct, performance decreased within the run demonstrating that the memory of the current task instruction had decayed. Expanding on the results of Altmann (2002), Altmann & Gray (2002) investigated the functional role of decay by determining if memory decay adapts to the rate of task switching. In their study, Altmann & Gray (2002) manipulated the length of runs in a repeated-measures design. Switches occurred more often on short runs with fewer trials and less often on long runs with more trials.

Overall, participants demonstrated a practice effect. Response time decreased throughout the experiment which shows that people were improving over time. However, within each run, participants showed a decrease in performance where response time increased and accuracy decreased across the run of trials. This within-run decrease in performance was steeper when participants switched more frequently.

The results from Altmann (2002) and Altmann & Gray (2002) were a major contribution to theories of task switching. Although performance between runs showed that participants improved over time, one consequence of frequent task switching is decay for the current goal of the task. Altmann & Gray (2002) suggest that frequent task switching results in a buildup of memories for prior instruction switches. The sheer number of memories for task switches makes discriminating the current instruction from instructions in the more distant past increasingly impossible. Altmann & Gray (2002) argue that the only way to overcome proactive interference generated from frequent task switches is for activation of the current instruction to rapidly decay. Rapid decay increases the chance that activation from a new instruction will be higher than the previous instruction when the new instruction appears. A consequence of this strategy is that as decay accumulates during a run of trials, the task becomes more difficult to complete and retrieving the current instruction becomes less likely. In practice, people find that they can remember that a switch has occurred, but they become increasingly unsure if they are remembering the most recent switch or a switch in the more distant past.

To formalize this process, Altmann & Gray, (2008) produced the Cognitive Control Model (CCM). The CCM makes several claims about task switching behavior that can help the TSA reduce the negative effects that should occur from scanning bags while switching between multiple SOPs.
1. First, a change in task instruction (e.g., Standard or TSA Pre✓) results in a task code created in memory. When a task switch occurs, a cognitive system must try and retrieve the new task code that is in competition with older task codes.

2. Second, task codes that have been used more recently/frequently will be more active than task codes used in the distant past or less frequently. Whichever task code is most active in memory gets retrieved.

3. Third, task codes interfere with each other. More task codes in memory creates a greater chance that people will retrieve the wrong task code. The number of task codes can be increased by giving people more than 1 type of instruction to remember or by switching the instruction more frequently (e.g., switch between Standard and TSA Pre✓ every ten seconds versus every ten minutes).

4. Fourth, all task codes decay and will be forgotten over time. Decay can cause task codes to have similar activation in memory. When activation between task codes in memory is similar, errors and response time increase as the cognitive system struggles to retrieve the correct task code.

5. Fifth, frequent task switching results in a buildup of task codes. Abundant memories of task codes from the recent past interfere with each other and make the retrieval of the current task code increasingly impossible. To decrease the chance that the current task code will interfere with the next task code, the current task code decays quickly. This decay occurs while the current task code is still being used resulting in poor performance at the end of a run just before a switch.

In their study, Altmann & Gray (2008) used the randomized-runs procedure to collect data on task switching and compared it to theoretical data produced by the CCM. An example of the randomized-runs procedure can be seen in Figure 3. Identical to Allport et al. (1994), participants were asked to categorize a number from 1-9 (except 5) as either Even/Odd or Lower/Higher than five. In a repeated-measures design (i.e., all participants received all manipulations) participants were given the following manipulations: time to prepare after the Even/Odd or Higher/Lower instruction (i.e., 100, 200, 300, 400, 500, 600, 700, or 800 ms), number of trials in a row before switching (i.e., mean 6 or mean 12), switching instruction (i.e., switch, repeat), congruency (i.e., switched instruction has the same response or a different response), position of a trial in a run (i.e., 1st trial after a new instruction, 2nd, 3rd, 4th, etc.), and task (i.e., Even/Odd, Lower/Higher).

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Figure 3 Time course of the randomized-runs procedure taken from Altmann & Gray (2008)

Figure 4 shows a subset of data from Altmann & Gray (2008) which shows several basic effects found throughout task switching literature. Most importantly the right panel of Figure 4 shows that the model was able to successfully predict several findings within the empirical data which can be found in Table 1.

Figure 4 Subset of results from within a run taken from Altmann & Gray (2008). Empirical data is in the left panel. Simulated data from the CCM is on the right panel. Response times are in milliseconds and are the median response for over 500,000 trials.

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Table 1 Main points and theoretical explanation for the results of Altmann & Gray (2008)

<table>
<thead>
<tr>
<th>Result</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first trial after a switched instruction (e.g., Even/Odd → Lower/Higher) is longer</td>
<td>The existence of multiple codes decreases the likelihood that the correct code will be</td>
</tr>
<tr>
<td>than the first trial after a repeated instruction (e.g., Even/Odd → Even/Odd).</td>
<td>retrieved.</td>
</tr>
<tr>
<td>The more time people have to prepare for a switch (e.g., longer time between Even/Odd</td>
<td>Time to prepare allows activation of the old task code to dissipate.</td>
</tr>
<tr>
<td>instruction and number presentation) the lower the switch cost.</td>
<td></td>
</tr>
<tr>
<td>There is a gradual increase in response times and errors as the longer people perform a</td>
<td>The existence of multiple task codes increases the likelihood that people will forget</td>
</tr>
<tr>
<td>task with the same instruction.</td>
<td>what code they are supposed to be using without reminders.</td>
</tr>
<tr>
<td>More frequent switches results in a greater increase in response times and errors as</td>
<td>An increase in switch frequency increases the number of task codes active in memory.</td>
</tr>
<tr>
<td>people perform a task with the same instruction compared with less frequent switches.</td>
<td>The more task codes in memory increases competition for the correct code to be retrieved.</td>
</tr>
<tr>
<td>Response times and error rates are lower if the previous and new instruction require the</td>
<td>Responses require the completion of at least two different tasks. Based on the instruction</td>
</tr>
<tr>
<td>same response. Consider the following instruction: Hit the left arrow key when the number</td>
<td>given, the first task requires that the correct rule be applied to the stimuli. The</td>
</tr>
<tr>
<td>is Lower than 5 or Even and the right arrow key when the number is Higher than 5 or Odd.</td>
<td>second task requires the correct rule be applied and the correct output (i.e., left</td>
</tr>
<tr>
<td>The number 3 requires hitting the left arrow key for one instruction (Lower than 5) and</td>
<td>key or right key) be executed. If a task switch requires a change in rule and output then</td>
</tr>
<tr>
<td>the right arrow key for another instruction (Odd). Alternatively, the number 4 requires</td>
<td>two items need to compete in memory to be retrieved versus one when the output is the</td>
</tr>
<tr>
<td>the same response, left arrow key, for both instructions.</td>
<td>same.</td>
</tr>
</tbody>
</table>

3 Experiment 1: Purpose

The TSA Human Performance Branch (HPB) administered a test to measure performance from TSOs when they were asked to adjudicate bag images using one SOP or dynamically switching between three SOPs. The goal of this test was to determine if task switching reduced performance in a highly motivated population of participants (e.g., TSOs) using an ecological task. The scope of this study included both qualitative and quantitative assessments of task switching. Findings from this research may be used to inform best practices in the development of an RBS program.

4 Experiment 1: Methods

4.1 Setup

TSOs used PsychoPy that was loaded onto 5 laptops. PsychoPy is an experimental design builder powered by Python (Peirce et al., 2019).

4.2 Test Location

One domestic airport was used as a test site.

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4.3 Test Environment – Conference Room

The test environment was an available conference room at the airport.

4.4 Design

This study had a between-subjects design (SOP Switching: instruction repeats v. instruction switches).

4.5 Participants

This experiment consisted of 31 TSOs (SOP Switching: instruction repeats N = 16 v. instruction switches N = 15). Up to five TSOs were tested concurrently during 1 day of testing.

4.6 Procedure

A testing schedule can be found in Table 6.

TSOs were briefed on the purpose of the test (4.6.1). Following the briefing, TSOs were trained on all 3 SOPs regardless of the condition and adjudicated 5 practice bags per SOP (4.6.2). TSOs were not told what condition they were in or that there were multiple conditions. Afterwards, participants labeled 216 bags as either Clear or Search using the SOP that was presented to them. A task switch is defined as a change in SOP (4.6.3). Following this test period, participants were given the Gas Tank Questionnaire (4.6.4) to assess mental resources associated with different conditions of task switching (Monfort et al., 2018), finally comments in a structured interview were collected regarding TSOs experience of the experiment and their comments on how RBS programs should be implemented (4.6.5).

There was one test administrator assigned to each group of 2 TSOs.

<table>
<thead>
<tr>
<th>Step</th>
<th>Time (minutes)</th>
<th>Bags</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td></td>
<td>Intro: Briefing of purpose and intent, description of SOP, sign informed consent, and complete demographics</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>5 bags per SOP</td>
<td>Training of the bag decision responses for each SOP in PsychPy.</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>216</td>
<td>Test</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
<td>Gas Tank Questionnaire</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
<td>Structured Interview: General Comments followed by Interview Questions</td>
</tr>
<tr>
<td>TOTAL</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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4.6.1 Briefing of Purpose

The Test Manager briefed TSOs on the purpose, intent, schedule, and scope of the test. TSOs were provided with an informed consent, demographics, and a bulleted copy of simplified SOPs used for screening (Appendix B).

4.6.2 Training

Training consisted of adjudicating 5 bags per SOP using a simplified SOP (Appendix B). SOPs were simplified in such a way that the primary goal of the baggage-screening task was to determine the presence or absence of liquids and laptops. Although TSOs were told there could be explosives, guns, knives, or PI, none were actually present in the bag set. TSOs were asked to adhere to the most conservative interpretation of an SOP. For example, in the simplified version of the LRRB SOP used here, any liquid that was detected when using an LRRB SOP must result in a bag search. The goal of adhering to such a strict SOP was to create a scenario where we could compare TSO performance based on visually salient criteria (i.e., presence/absence of an item) versus personal judgment (e.g. I feel this is suspicious/I feel this is clear). The instructions can be found in Appendix B.

4.6.3 Test

TSOs in the repeated instructions condition applied only the LRRB SOP to bag images. TSOs in the switched instructions condition used 3 SOPs (i.e., Standard, LRRB, and TSA Pre✓®). The LRRB SOP was chosen for the repeated instructions condition versus Standard or TSA Pre✓® because it provided the greatest balance between Clear and Search responses. Table 3 shows the expected rate of a Clear or Search responses based on the bag contents presented to TSOs during the experiment. For example, the LRRB SOP requires that liquids be removed from baggage prior to screening and untampered laptops can stay in the bag. In the bag set used here, 50% of bags had a liquid in them, all of which should be searched and 50% had untampered laptops in them. Bag images did not contain explosives, shields, or PI. Therefore, the expected search rate should be 50%.

<table>
<thead>
<tr>
<th>SOP</th>
<th>Liquid</th>
<th>Laptop</th>
<th>Clear Rate</th>
<th>Search Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Search</td>
<td>Search</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>LRRB</td>
<td>Search</td>
<td>Clear</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>TSA Pre✓®</td>
<td>Clear</td>
<td>Clear</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

TSOs were presented the name of an SOP (i.e., "STANDARD", "LRRB", or "PRECHECK") on the screen regardless of whether the SOP was the same as the previous run. After 1 second, the name of the SOP disappeared. TSOs applied that SOP to a series of static top-down bag images for a run of 8 images in a row. There were 27 runs of bags. In the switched instructions condition each of the 3 SOPs were repeated 9 times in a block-randomized order (i.e., participants saw each SOP once before an SOP would repeat). In the repeated instructions condition the LRRB SOP was repeated 27 times.

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The time course of the study can be seen in Figure 5 and an example of the stimuli can be seen in Figure 6.

Overall, participants adjudicated 216 bag images during the test. Bag images were randomized between TSOs such that no two participants received bag images in the same order. The images were equally divided between bags with no laptops and no liquids, bags with laptops but no liquids, bags with liquids but no laptops, and bags with laptops and liquids. Any liquids in a bag were 3-1-1 compliant. TSOs adjudicated the bag images using the cued SOP until another instruction was given. TSOs were given an instruction to answer as quickly and as accurately as possible.

Accuracy (i.e., pHit/pFA) and response time were collected. To calculate accuracy, one TSO at TSA HQ validated the presence of SOP relevant contents for each bag (i.e., had a laptop or a liquid that was 3-1-1 compliant). If a bag had a laptop in it and the SOP was Standard, the correct answer was defined as a bag search. The correct answer for the same bag when the SOP was LRRB or TSA Pre✓® would be to clear the bag.

Figure 5 Time course and stimuli progression for the repeated instructions condition (left) and switched instructions condition (right)

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4.6.4 Gas Tank Questionnaire

To measure the cognitive load associated with task switching, TSOs were given the Gas-Tank Questionnaire (GTQ: Monfort et al., 2018: Appendix D). The GTQ is a single-item measure of cognitive load used as an alternative to the NASA-TLX. TSOs will be asked to "think about [their] brain as an engine," and to indicate inside a rectangle "how much gas [they] have left right now" as shown in Figure 7.

4.6.5 General Comments and Structured Interviews

After the test, participants then provided general comments about the experiment. After general comments, the Test Administrator prompted TSOs to consider several of the RBS programs and how they would impact their work at the Checkpoint. The interview questions can be found in Appendix D.

5 Experiment 1: Results

All the data explained here can be found in Appendix E. Each of 31 TSOs adjudicated 216 bag images for a total of 6,554 images. We filtered the switched instructions condition to only include data from the LRRB SOP so a direct comparison could be made with the repeated instructions condition which featured LRRB only. Similar to Altmann & Gray (2002) we removed the first 5 runs of responses given that some task switching effects can take time to stabilize. In addition, we calculated the mean and standard deviation for overall accuracy for each participant and removed any participants that performed more than 2 standard deviations below the mean (i.e., accuracy <

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We also calculated the mean and standard deviation response time for each type of bag image, at each position of the run, for each condition, for bags with (hits trials) and without (false alarm trials) targets. We removed any bag images whose response time was greater than 2 standard deviations from the mean. Finally, we removed the 8 images per participant that were shown twice due to a coding error that affected the same bag images for each TSO. A total of 3,150 trials were available for analysis or 48.06% of the initial data. A total of 15 participants remained in the repeated instructions condition and 13 in the switched instructions condition. In the following sections we report the descriptive statistics for accuracy and response time as well as an analysis of within-run decreases in performance.

5.1 Accuracy Results

To investigate performance, we calculated $d_a$ (sub a) for each TSO. We chose to use $d_a$ instead of a more common metric of sensitivity, $d'$, because previous work investigating $d'$ for visual search of X-ray images has demonstrated unequal variances for hits and false alarms based on response tendency (Verde et al., 2006). A $d_a$ with a slope of .6 is more valid and accounts for the unequal variance found in baggage screening tasks. The difference in the equations to calculate $d'$ and $d_a$ can be seen in Figure 8.

$$d' = z(H) - z(F)$$

$$d_a = \left( \frac{2}{1 + s^2} \right)^{\frac{1}{2}} \left( z(H) - sz(F) \right)$$

Figure 8 Equations to calculate $d'$ (top) and $d_a$ (bottom) where $H$ is the hit rate and $F$ is the false alarm rate.

In addition, we used the log-linear transformation for extreme values of the hit rate and false alarm rate (e.g., 0 or 1) to avoid an infinite result for $d_a$. The log-linear transformation can be seen in Figure 9.

$$\tilde{N}_h = (\tilde{N}_h + 0.5)/(N + 1)$$

$$\tilde{N}_f = (\tilde{N}_f + 0.5)/(N + 1)$$

Figure 9 Log-linear transformation for the hit rate (top) and false alarm rate (bottom).
Overall, an unbalanced ANOVA \(^5\) revealed that TSOs were much better at correctly adjudicating bag images when repeating instructions \((d_a = 1.56)\) versus switching instructions \((d_a = 1.03)\), \(F(1,26) = 10.52, \text{MSE} = 1.93, p = .003, \eta^2_p = .29\).

We took our analyses of repeating and switching task instructions one step further by investigating why performance was worse when switching instructions. TSOs in the switching instructions condition might perform worse because they had a third of the practice using each SOP (i.e., 9 runs of practice) than TSOs in the repeating instructions condition (i.e., 27 runs of practice). However, previous work suggests that task switching is difficult because memories from past task switches interfere with each other. Functional decay of the current SOP makes it less likely that the current SOP will interfere with the next task switch. Therefore, we should find that within a run, memory activation for the current SOP rapidly decays resulting in a decrease in the ability to apply the correct SOP as TSOs adjudicate bags farther from the task switch instruction. In contrast, if TSOs in the switch instruction condition are worse because they have less practice with each SOP, their performance should be consistently worse across a run, versus increasingly worse.

To test whether TSOs ability to apply the correct SOP was increasing or decreasing within the run, a regression model was created for each TSO (Figure 10). Each regression was created by calculating the \(d_a\) for all positions within a run (i.e., one through eight). The slope of each regression was compared in an ANOVA which showed \(d_a\) decreased faster when switching instructions \((M = -0.09)\) than when repeating instructions \((M = 0.00)\), \(F(1,26) = 4.42, \text{MSE} = .06, p = .045, \eta^2_p = .15\). In summary, the \(d_a\) for a TSO in the switched instructions condition decreased by .09 with each additional bag image versus no change in \(d_a\) for TSOs in the repeated instructions condition.

\(^5\) All ANOVAs reported in this study are unbalanced because of the difference in the number of participants per condition. To account for this unbalance, the Anova function in the car package (v. 3.0-7) in R was used. The ANOVA used type III sums of squares with a contr.sum contrast.

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5.2 Response Time Results

To investigate response time, we calculated the median response time when there was a possibility of a hit or the possibility of a false alarm. The median response time was chosen over using the mean because the median is a zero-parameter method of filtering that is less susceptible to extreme outliers. Reporting the median response time is also a common practice within the task switching literature. Overall, TSOs were faster at adjudicating a bag image when repeating the instruction (Median = 2.05) versus switching the instruction (Median = 2.62) when there was a target (i.e., something to find). $F(1,26) = 6.00$, $MSE = 2.29$, $p = .021$, $\eta^2_p = .19$. There was no significant difference when repeating the instruction (Median = 2.53) and switching the instruction (Median = 2.81) when there was no target (i.e., nothing to find). $F(1,26) = < 1$. 

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We explored within-run response times in a way comparable to the investigation of accuracy in applying the correct SOP. To test whether participants were speeding up or slowing down within the run, a regression model was created for each TSO. The first position of the run was not included because previous work has shown that the first trial following a switch is part of a preparatory process and not functional decay (De Jong et al., 1999; Gopher et al., 2000; Rogers & Monsell, 1995). Only the first trial in a run is burdened by the preparatory process as people reorient to a new task instruction. The cognitive burden of switching results in a large difference in response time between the first and second trial but not the second and third trial. Therefore, each regression was created by calculating the median response time for positions two through eight within a run. Both ANOVAs did not show a significant difference in the slope of response times for bag with (hit trials) or without targets (false alarm trials) within a run. However, the bag images used here are more complicated than what has been used in prior studies investigating task preparation which often utilize letters and numbers as stimuli. A consideration of Figure 11 suggests that preparatory processes with bag images takes longer and is completed by the third position in a run and not the second. By creating a regression of the third to the eighth position in the run, an ANOVA shows that response time increased faster when switching instructions \((M = 0.16)\) than repeating instructions \((M = -0.04)\) for bags with a target, \(F(1,26) = 5.73, MSE = 0.27, p = .024, \eta^2_p = .18\). No significant differences were detected for bags without a target (Figure 12).
Figure 11 Median response time for each SOP instruction condition when there was the possibility of a hit. Error bars are 95% confidence intervals.

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Figure 12 Median response time for each SOP instruction condition when there was the possibility of a false alarm. Error bars are 95% confidence intervals.

5.3 Gas Tank Questionnaire.

There was no significant difference in responses to the Gas Tank Questionnaire. The source paper for the GTQ gave the GTQ before and after the study and analyzed the differences across conditions (Monfort et al., 2018). In this study we gave the GTQ only at the end of the study and so are unable to make comparisons about the overall drain that each task may have had on workload. We do not discuss the GTQ for Experiment 1 further.

5.4 Structured Interviews

Overall, TSOs had a negative view of TSA implementing another SOP (e.g., LRRB) especially if implemented into a single lane. Low-staffing and high turnover are a persistent problem at the airport used for testing and both a dedicated lane such as FLEX or mixed SOP lane such as Blended would require additional staffing. Officers felt that adding another SOP would increase access

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events because it would exploit the inability for TSOs to efficiently communicate at the Checkpoint and would require extensive training that would take away from time at the Checkpoint.

Below are some comments from TSOs on the addition of another SOP and the concept of a FLEX or Blended lane coming to their airport:

"The Divestiture Officer would be greatly affected because he or she would have to know exactly who gets what SOP rule applied to them. The walkthrough metal detector officer would have a great deal of confusion to deal with as far as who is allowed to keep shoes and light jackets on. The Ticket and Documenting officer would have to now direct each individual passenger on what lane to go to. The bag checker in the back of each lane would be confused with each bag check and would have to then speak to the X-ray operator even more to figure out what type of screening each person and their bag received to make sure they’re conducting the proper additional screening on the pulled bag."

"I believe adding an additional SOP would be very strenuous on the officers because we get a lot of changes to SOP already and some officers may get confused. Especially dual function officers who already have three SOPs that they have to remember. I think a [another] SOP may cause access events or improper screenings especially when the Checkpoints are busy and officers have to switch between lanes."

"No, we don’t need more SOPs, we need clearer non-contradictory SOP. The thought of bringing another set of rules into the mix is exhausting. People are tired of working triple as hard and no real monetary incentive. It would also be truly hard to switch back and forth between modes. I only see disaster if that was implemented. The one positive I see is that people would be aware and not so much in auto-pilot."

"I think a dedicated lane at least at first would help everyone including the passengers adjust to the changes."

"Blended lanes will be confusing. That’s an access event waiting to happen. Keep them separate for an organized and smooth screening process."

"The quality of the employees who apply for the TSO position are not vetted for their ability to process information. I would think that it would be a disaster to assume that the majority of the workforce can effectively change between multiple SOPs. Although not officially recorded in any legitimate capacity, we have access events regularly, sometimes multiple on the same checkpoint in the same day. This would likely become a larger issue among the whole workforce if we were changing the variables for which we pull bags on a minute by minute basis. I have worked where the LRBB was a pilot program. Although it seems to demean the screening process and in turn replace security with efficiency, it worked well for increasing throughput."

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"If we had the staffing, ‘IF’, it would be better to create a whole lane dedicated just for these LRRB passengers, BUT that is not the case, having a Blended lane would create too much confusion, find more personnel then add LRRB. If not enough personnel is added the [addition of] LRRB will be a failure."

"If we had to implement [an additional] SOP we at [airport name] would need more staffing to execute the screening of passengers. To do a Blended method would just create madness. Passengers aren’t fond of TSA so having to spend more time in line with new rules would further annoy most. Change is good but this idea may be for a larger airport.”

"The Blended lane would further exploit a current issue in the entire organization, which is communication."

"I have experienced on a Blended lane that communication is often a lacking factor and its usually because after so many times switching from EAPS to Pre-Check, the person just forgets and we usually find out that a lane was switched once we see a laptop in a bin or a laptop inside of the bag still. I can see confusion happening if the officer is notified of a change in the lane by the X-ray screen, this might result in an access event once the officer realizes they didn’t follow the correct procedure for a certain bag."

In addition, and contrary to best-practices, 33% of TSOs (N = 5) who switched between three SOPs said that they would apply a more liberal SOP such as LRRB or TSA Pre✓ when they were unsure of the current SOP versus the more conservative Standard SOP. Another 27% of TSOs (N = 4) in the three SOP condition said that they had no default SOP. Finally, 40% of TSOs (N = 6) said that they would use the Standard SOP when they were unsure because the Standard SOP is safest.

6 Experiment 1: Discussion

In this study 31 TSOs were run in a between-subjects test to investigate the consequences of switching SOPs on performance. An analysis of the performance for the 28 participants above the accuracy cutoff showed a decrease in $d_c$ and an increase in response times when TSOs dynamically switched between SOPs versus using the same SOP. Critical to this investigation, we replicated theoretical work found in the task switching literature which demonstrated that a decrease in performance comes from a cognitive process best explained by learning, interference, and decay in memory as described by Altmann & Gray (2008).

When switching tasks, the instruction to follow a new SOP activates a new task code. The buildup of memories for the SOP after just a short time of task switching makes retrieval of the correct SOP nearly impossible. To overcome the interference from the previous SOP, TSOs experienced functional decay of memory which reduces the activation for the current SOP quickly to prepare for the next SOP.

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Across the task, TSOs demonstrated a practice-effect and became faster at adjudicating bag images regardless of whether they were in the repeat or the switch instructions condition (Figure 13 and Figure 14). As shown by Altmann & Gray (2002), a practice-effect appears across the coarser temporal grain of the entire task (across minutes).

![Graph showing response times](image)

Figure 13 Median response time for hit trials for each run. Error bars are 95% confidence intervals.

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Figure 14 Median response time for false alarm trials for each run. Error bars are 95% confidence intervals.

However, functional decay of memory may appear within the run (across 10s of seconds). Functional decay of memory is the process that makes the task possible for TSOs who are trying to discriminate between memories of current and past SOPs. Investigating performance within the run was important because it revealed the cognitive process, functional decay, that caused a decrease in performance when TSOs were switching versus repeating the SOP. A major consequence of functional decay was that TSOs forgot which SOP they were supposed to use while they were in the process of applying that SOP.

Furthermore, TSOs that were interviewed for this study were very critical of the addition of another SOP (i.e., LRRB) especially for Blended lanes. They identified several areas of concern that suggest that the implementation of something like a Blended lane would lead to confusion and an increase in access events. In particular, TSOs stated that the implementation of either FLEX or Blended lanes must include a higher staffing count and high-quality training.

In summary, quantitative data suggests that TSOs would perform worse when frequently switching tasks in something like a Blended lane versus a FLEX lane which was dedicated to only one SOP. Additionally, qualitative data shows that TSOs are highly resistant to the idea of adding an additional SOP given that both passengers and TSA staff have difficulty remembering two SOPs.

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