

Product Operational Exercise

Patriot One Technologies' Threat Detection and Patron Screening Solutions (System Versions 1.1 and 1.4)



NCS⁴TM



Foreword

The National Center for Spectator Sports Safety and Security (NCS⁴) at The University of Southern Mississippi established the Operational Exercise Program to assist practitioners and industry experts in identifying operational use cases for safety and security solutions. By design, the demonstration and exercise allow sporting and venue experts to observe solution-provider-stated product capabilities in a real-world or simulated environment.

The NCS⁴ provides a mechanism to aggregate specific safety and security requirements for the spectator sports domain. The exercise process and focus areas were developed in cooperation with the NCS⁴ National Advisory Board, including representatives from professional sports leagues, select collegiate institutions, major events, and public assembly sites. The NCS⁴, using industry requirements and operational needs, partners with industry and technical experts to observe and exercise products or solutions with the intent to:

- Enable venue operators and security personnel to make informed decisions related to the selection and procurement of solutions.
- Observe and report a product's ability to perform vendor-stated capabilities in a spectator sporting or special event environment.
- Ensure that technical promise translates to operational feasibility.
- Understand deployment and maintenance requirements.

The exercise program follows principles currently espoused by standing U.S. Department of Homeland Security (DHS) validation programs to assist end operators with objective and quantitative reviews of available commercial systems and solutions (e.g., Department of Homeland Security SAVER program)¹.

¹ System Assessment and Validation for Emergency Responders (SAVER) Program. The SAVER Program conducts assessments and validations on commercial equipment and systems, and provides those results along with other relevant equipment information to the emergency responder community.

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1. Introduction

The Introduction describes the needs analysis forming the basis for the evaluation and provides an overview of Patriot One Technologies' Threat Detection and Patron Screening Solution.

1.1. Needs Analysis

In December 2018, the NCS⁴ National Advisory Board and Technology Alliance identified effective and efficient venue security checkpoints as a major priority for sports safety and security. The Patriot One technology is designed to quickly detect potential weapons on ingressing fans, including those holding bags, thus decreasing the time required to search individuals and their belongings. Prior to conducting the Patriot One Operational Exercise, the NCS⁴ National Advisory Board and sports league representatives provided input on industry standards and operational considerations pertaining to their league requirements for patron screening.

This report summarizes the exercise and demonstration of the Patriot One Threat Detection and Patron Screening Solution. The platform was observed for functionality and overall performance capabilities.

1.2. Patriot One Overview

Patriot One Technologies is a provider of touchless threat detection and patron screening solutions for community safety. The integrated solutions, powered by artificial intelligence (AI), are intended to allow a wide variety of threats to be detected quickly and easily - from guns and weapons to crowd disturbance and perimeter security.

The Patriot One Platform combines physical Multi-Sensor Gateway towers (to replace walk-through metal detectors) and a Video Recognition Software that can be integrated with existing video management systems. Utilizing AI, Patriot One's solution allows the identification, analysis, and alerting of safety staff to security and health risks.

The goal of the solution is to provide unobtrusive sensors and invisible screening to provide a seamless experience, without patrons or staff divesting their personal assets or being searched while enhancing the safety of people and assets.

This overview was provided by Patriot One. While all statements were not evaluated during the exercise, several statements serve as the basis for exercise criteria.

1.3. Patriot One Technology Overview

Patriot One develops and produces the Multi-Sensor Threat Detection Solution (the

“Technology”). The Technology integrates the power of AI with multiple advanced sensors to assist security personnel in screening for non-conforming threat objects such as guns and knives while providing proactive threat monitoring through its user interface (the “Client”). The Technology consists of a combination of (1) Patriot One’s Platform and one or more pairs of (2) Multi-Sensor Gateway (MSG) systems. The Gateway system consists of sensor components (hardware) that are used to observe its environments. The Platform is the central integration point for curating and classifying threat object information collected from the Gateway sensors. The Platform enables the collection, aggregation, analysis, and sharing of security information to provide security personnel with real-time situational awareness. The Technology may be deployed covertly or overtly and is used to protect locations including, but not limited to, casinos, stadiums, concert halls, shopping centers, schools, and other entryways into private or public spaces. The Technology can also be integrated with various sensor types as new security requirements emerge. The Technology encompasses the following five (5) components:

1. Multi-Sensor Gateway hardware consisting of pillars (two or more), interconnecting cables, acquisition boards, and optical cameras in support of the Gateway system’s detection and threat object localization.

The system configuration can be uniquely designed to scale and conform with end-user needs by deploying singular or multiple pairs of MSGs to suit the environment in which it is deployed.

2. Multi-Sensor Gateway software comprised of device drivers, programs, and AI classification analytics which, when combined and integrated, enable data collection and classification of objects.

In addition, the system can be tuned to correspond to the throughput needs of a given facility entrance based on traffic patterns and anticipated on-person clutter (pocket clutter, backpacks, suitcases, etc.). The system can also be configured to use multiple auxiliary sensor types in concert to provide diversified detection coverage.

3. A networked Platform Server is used to host and aggregate data collected from the Gateway hardware, any video cameras, and software above (1 and 2). The server houses data from one or more Gateways along with additional auxiliary sensor types such as optical or thermal cameras (optional). The Platform Server can be deployed on a local server or to the cloud to meet end-user requirements.
4. Platform Client connects end-users to threat data collected by the Gateway Hardware (1) and processed and served by Gateway software (2) and

Platform Server (3) via a user interface, enabling them to actively and securely screen patrons for threat objects as they pass through the Gateways.

5. (Optional) Mobile Alert Center is a remote-access solution that enables security alert delivery to a mobile application. The Alert Center extends the functionality and flexibility of the Platform, providing a broad set of options for security operations teams to design security processes to match their business models and detection monitoring and interception preferences.

The Technology does not embody and is independent of any third-party technologies. Enhancements can be made by integrating third-party technologies and enabling data sharing across a unified security network.

This overview was provided by Patriot One. While all statements were not evaluated during the exercise, several statements serve as the basis for exercise criteria.

2. White Paper Objectives

The objectives of this report are as follows:

- Describe the exercise methodology, scoring system, and the role of exercise evaluators.
- Outline solution functional capabilities as identified by Patriot One.
- Publish the product operational exercise scoring results, comments, and additional information provided by the exercise evaluators and Patriot One.

The purpose of this exercise is to observe and report the demonstrated capabilities and functionalities of the Patriot One Threat Detection and Patron Screening Solution as indicated by Patriot One.

This evaluation and/or report does not constitute NCS⁴'s endorsement of Patriot One solutions, nor is it intended to be used for comparison purposes with similar solutions.

3. Methodology

The NCS⁴ uses a scalable methodology to guide its product operational exercises. The methodology is designed to ensure that the exercise occurs in a realistic environment so that industry experts can observe whether the solution delivers the capabilities under the use case conditions (i.e., normal and/or emergency) within the ecosystem (i.e., sports, entertainment, and special event venue). The methodology includes: (1) a general overview of the steps used to perform an exercise, (2) the selection and training of exercise evaluators, and (3) how the aforementioned Steps 1 and 2 were applied to the exercise of Patriot One Technologies' Threat Detection and Patron Screening Solution.

3.1. Overview

A repeatable and scalable product operational exercise methodology was developed to evaluate and assess numerous solutions. The methodology steps are as follows:

1. The NCS⁴ and the solution provider seeking an operational exercise discuss the capabilities and functional requirements of the company's solution and the professional backgrounds of three industry experts (e.g., law enforcement; fire/rescue emergency management; emergency medical; venue director of security, operations, or guest services) to participate as an exercise evaluator on the exercise team.
2. The NCS⁴ ensures that the solution provider has access to the facilities and the means to create conditions for effectively demonstrating the capabilities and functional requirements of the solution and access to exercise evaluators with the requisite experience for observing the solution.
3. The NCS⁴ and solution provider work together to create a matrix of operational capabilities and functional requirement items that the exercise team will quantitatively rate (described below in Section 3.2).
 - a. The company develops the items, and the NCS⁴ ensures that each item addresses only one capability or functional requirement.
 - b. Each item is written so that the exercise team, who may not be familiar with the solution, will understand the solution and the operational capability being observed in each item.
 - c. The NCS⁴ does not dictate what items they must include on the matrix but will share industry best practices, standards, and needs to ensure exercise criteria are developed with consideration to operational settings and capability gaps.
4. The NCS⁴ and the company select a date(s), location(s), and use case(s) that will provide an appropriate ecosystem and the desired use case conditions for the product exercise.
5. The NCS⁴ staff, company representatives, and the exercise evaluators meet at the date(s), location(s), and use case(s) as determined in Step 4. The NCS⁴ staff facilitates the

exercise, ensuring that it adheres to an approved agenda. After all personnel introduces themselves, the company provides an overview of their organization and solution. To rate each matrix item, the exercise team either interacts with the solution themselves or closely observes company representatives, practitioners, or exercise role players interacting with the solution.

6. After concluding the exercise, the NCS⁴ staff compiles evaluation forms and individual feedback from each exercise team member. The NCS⁴ staff uses quantitative feedback to create a cumulative matrix, calculating score averages for final scoring. The NCS⁴ staff uses qualitative feedback to provide score justifications and exercise team member comments.

Throughout the exercise, the exercise evaluators may ask the company representatives clarification questions about the operation and capabilities of the solution. The exercise evaluators may provide comments and/or answer questions from the company representative (e.g., potential use cases, cost, pricing plans, future capabilities that would be beneficial to add to the solution) and make recommendations and/or suggestions based on their professional experiences. Similarly, the company representatives may ask the exercise evaluators questions that may or may not be related to the matrix items. This open dialogue often yields valuable information beyond the matrix ratings.

3.2. Exercise Team Selection and Training

To maintain the impartiality of the exercise, the company may not request specific industry experts to serve on the exercise evaluation team. Per Step 1 in Section 3.1, the company may identify desired skills and experiences that observers should have for the exercise. The company may request discrete skills or general competencies relevant to the solution. The company may also identify the caliber of exercise team members based on experience, roles, or responsibilities. Per the information provided by the company, the NCS⁴ canvasses its sports safety and security industry network and its exercise database to identify potential exercise team members with the requisite professional backgrounds. The NCS⁴ will then invite qualified candidates to participate in the exercise until the NCS⁴ has secured a minimum of three exercise evaluators with the requisite expertise to serve as exercise team members.

As part of its due diligence, the NCS⁴ informs the exercise team members about the company and solution undergoing an operational exercise during the team solicitation process so that potential exercise team members can assess their suitability and comfort level with the solution and identify any potential conflicts of interest. In some cases, individuals may decline due to a conflict of interest. If this occurs, the NCS⁴ will invite another qualified candidate to serve. Once exercise team members are confirmed, the NCS⁴ notifies the company who the team members are for the exercise.

Prior to the start of the exercise, the NCS⁴ facilitators train the exercise team members on the exercise process and review the item rating scale (Table 1). The NCS⁴ facilitators emphasize that each exercise team member will receive a copy of the matrix and rate each item individually

using this scale; team members must each provide their own score and may not collaborate to develop a group rating for each item or the overall exercise. Team members are also encouraged to ask the company representatives questions and provide comments beyond the matrix rating feedback.

The company representatives are encouraged to ask the exercise team members questions related to, or outside the scope of, the matrix items. This dialogue, coupled with the matrix item ratings, provides complete exercise information. The matrix ratings show that the solution has been impartially rated by exercise team members against company-defined specifications, and the conversation allows for feedback beyond the scope of the matrix (i.e., for aspects of the solution that cannot be evaluated via a matrix, such as plans for future development or how to price and market the solution).

Table 1. Item Rating Scale

Score	Description
0	Does not meet the stated requirement
1	Partially meets the stated requirement
2	Meets the stated requirement with recommendations
3	Meets the stated requirement

3.3. Patriot One Technology Exercise Methodology

When applying the previously outlined methodology to Patriot One Technologies’ Threat Detection and Patron Screening Solutions, the industry experts were: (1) a Security Representative for professional baseball, soccer, and hockey, (2) a Director of Security at a professional American football stadium in the United States, (3) a U.S. Secret Service Special Agent in Charge (Retired), (4) a Senior Director of Business Development and Operations at a company that focuses on a safe and secure guest experience, (5) a Director of Safety and Security Operations at a professional American football stadium in the United States, and (6) a consultant for professional sports venues. Exercise team members will be referenced by the aforementioned numbers throughout the rest of this document.

The Threat Detection and Patron Screening Solution was exercised twice. The first exercise was conducted on System Version 1.1 and observed by Exercise Evaluators 1 through 5. The second exercise was conducted on System Version 1.4 and observed by Exercise Evaluators 4 through 6. System Version 1.1 exercise criteria are outlined in section 4.1. System Version 1.4 exercise criteria are outlined in section 6.1.

3.3.1. System Version 1.1. Location

The first operational exercise of the Patriot One Technologies’ Threat Detection and Patron Screening Solution (System Version 1.1) occurred on October 19, 2021, from 12:30 pm to 7:30 pm CDT at Climate Pledge Arena in Seattle, WA, USA for a Foo Fighters concert. The exercise took place indoors, at the Alaska Airlines Atrium ingress gate, as shown in Figure 1. The temperature in the facility was 72 °F for the duration of the exercise and event. During this

exercise, five evaluators (Exercise Evaluator 1-5) assessed detection performance, user interface usability, threat localization, video/image integration, administrative tools, and monitoring capabilities.



Figure 1. System Version 1.1 Exercise: Climate Pledge Arena and the Alaskan Airlines Atrium Gate

Prior to the gates opening, the exercise evaluation team conducted a performance test to determine detection rates of the items used during this exercise.

Once gates were opened for ingress, three (3) individuals staffed each screening portal: pacer, tablet operator, and secondary screener. The patron journey through ingress consisted of the following:

1. Patrons were processed through ticketing.
2. The pacer directed patrons to walk at a normal walking pace through the system.
3. In the absence of an alarm, the tablet operator would guide patrons into the venue. If the system alarmed, the tablet operator directed patrons to secondary screening.
4. If secondary screening was required, patrons would divest items at the secondary screening table and be directed to repeat steps 2 and 3.

Figure 2 illustrates this process.

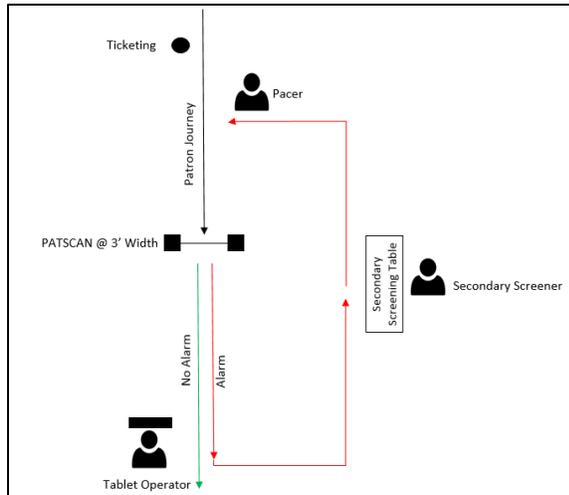


Figure 2. Ingress process.

During this observation, ticketing operations took place prior to patrons entering the system. Patrons scanned tickets at one of four kiosks prior to entering the screening lane being used for the Operational Exercise. During this exercise, ticketing operations were unable to keep pace with screening, preventing the observation of the systems advertised 1,800-3,600 throughput capacity. Capabilities observed during this exercise can be found in section 4.2.

3.3.2. System Version 1.4. Location

The second operational exercise of Patriot One Technologies’ Threat Detection and Patron Screening Solution (System Version 1.4) occurred on November 8th, 2021, from 5:00 pm to 8:30 pm MST at the Cambria Hotel in Phoenix, AZ, USA. Additional observations occurred at the same site on November 10th from 8:30 to 10:00 am MST. The exercise took place indoors, in a conference room, as shown in Figure 3. The temperature in the facility was 65°F for the duration of the exercise. During this exercise, three evaluators (Exercise Evaluator 4-6) assessed the detection performance of the system (System Version 1.4).



Figure 3. System Version 1.4 Exercise: Cambria Hotel Conference Room

3.3.3. Sensitivity Settings

Prior to conducting operational exercises, the NCS⁴ facilitators confirmed the system sensitivity settings were set to the level Patriot One Technologies currently recommends for sports and entertainment venues. Per Patriot One Technologies, the setting selected (sensitivity level 3) is the solution's equivalent to Security Level 2, as defined by NILECJ-STD-0601.00. This level of screening is common for sports and entertainment venues and allows patrons to carry normal pocket items through screening. The goal of Security Level 2 is to have high throughput with low false alarm rates.

3.3.4. Test Objects

Test objects consisted of the following:

- Steel (UNS G41400) simulated handguns, following the dimension criteria outlined in the American Society for Testing and Materials (ASTM) test document. A diagram of the simulated handgun can be seen in Figure 4.
- Handguns of various sizes.
- Knives ranging from smaller than 4" to greater than 6" in blade length.
- Miscellaneous innocuous items, as defined by NILECJ-STD-0601.00 and NIJ Standard – 0601.02.

Test objects were selected based on the stated and advertised capabilities of Patriot One Technologies. Test objects were made of stainless steel, steel, or iron alloys.

A performance test was conducted for each system version, where test objects were positioned on clean test subjects and processed through System Version 1.1 and System Version 1.4 225 times each, evenly distributed amongst the nine (9) test locations identified in NIJ 0601.02. Clean test subjects were processed through both systems at a walking pace of 1.0 – 1.5 meters per second (m/s). Figure 5 illustrates the nine test locations.

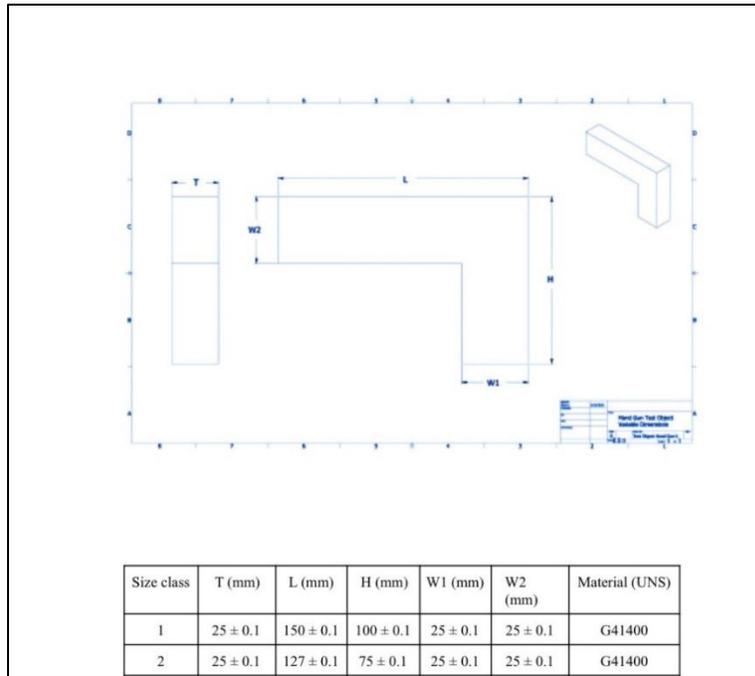


Figure 4. ASTM test material diagram

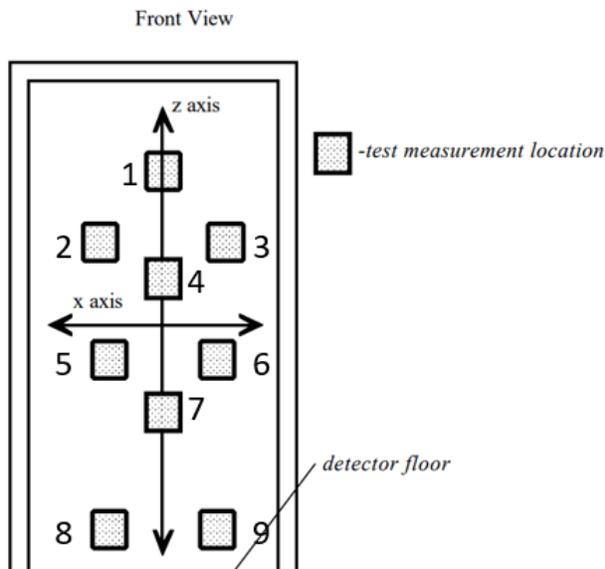


Figure 5. Diagram illustrating the nine test measurement locations

3.3.5. Detection Rate Observation (Knives)

Following the performance tests using the approved test object, knife detection rates were evaluated by processing a variety of knives through the system. Knives were positioned at randomized locations on the body, incorporating the nine test locations and loosely carried configurations. Knives were broken into categories of less than 4”, 4” to 6” and greater than 6”

as shown in Figure 6. Knives used in testing were made of stainless steel or iron alloys. Exercise outcomes are captured in sections 4.2 and 6.2 for System Version 1.1 and 1.4, respectively.

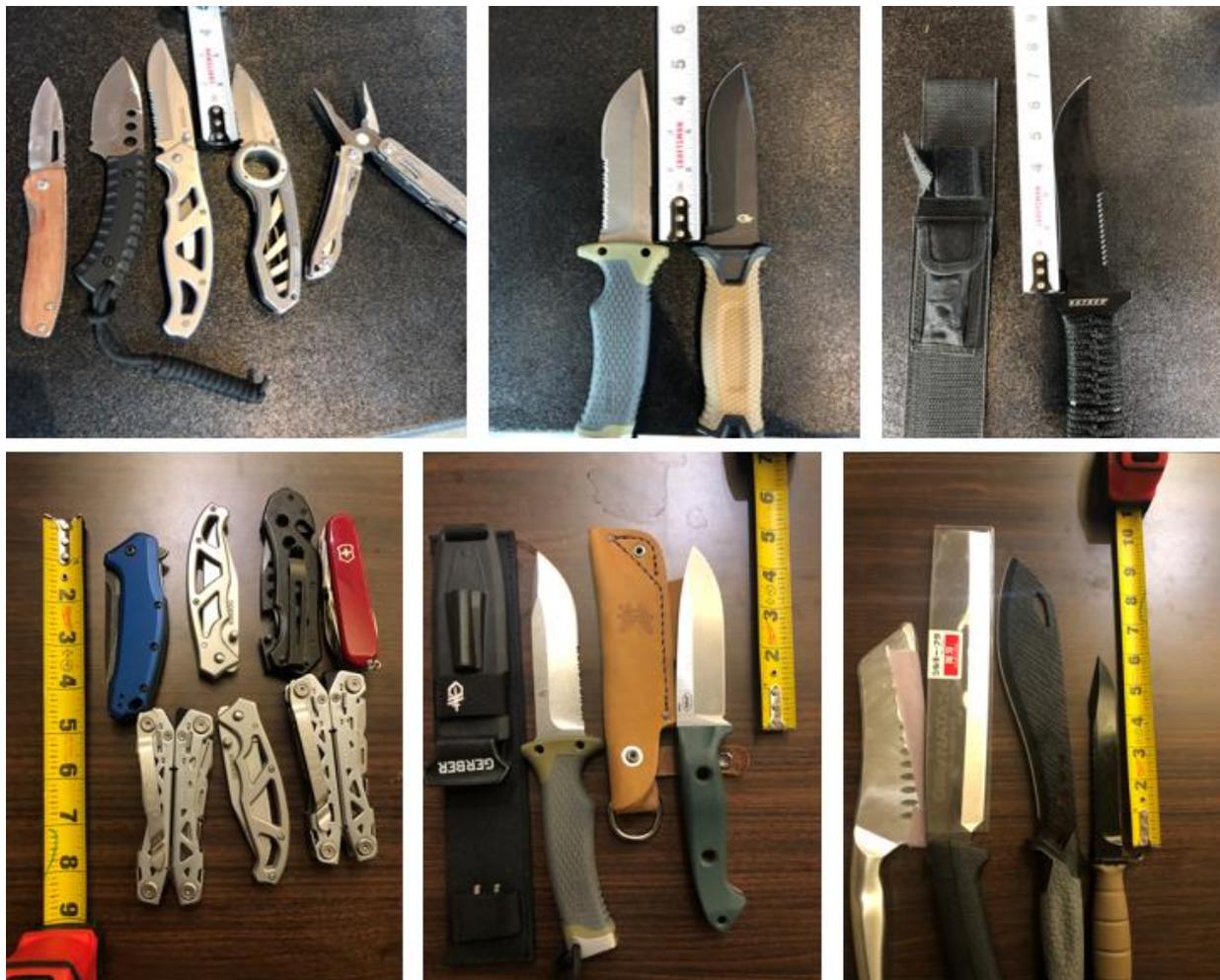


Figure 6. Knives

3.3.6. Detection Rate Observation (Handguns)

To demonstrate the ability of the Patriot One Technologies’ Threat Detection and Patron Screening Solution to detect guns, the following handguns were used for the exercise of System Version 1.4:

- Sig Sauer P245 (compact)
- Sig Sauer P245 (slide and barrel only)
- Kimber .380 ACP Micro Raptor (micro-compact)
- North American Arms Pug .22 Magnum Mini Revolver (pocket pistol)

Handguns were positioned at randomized locations on the body, incorporating the nine test locations and loosely carried configurations. Handguns were processed through the system a

total of 82 times. Images of the tested handguns can be seen in Figure 7. Exercise outcomes are captured in section 6.2.



Figure 7. Handguns

3.3.7. Detection Rate Observation (Innocuous Items)

The exercise evaluation team observed common items carried in pockets to determine the alarm rate of innocuous items, as shown in Figure 8. Clean testers processed each item through the systems individually to determine individual detection rates. Items were then carried through together to determine collective detection rates.

Note: Although ungraded for the purposes of this exercise, items equipped with neodymium magnets (Apple Watch, Air Pods, etc.) produced false alerts at a high rate on System Version 1.1. Neodymium magnets in Apple Watches were considered “innocuous” and evaluated during the exercise of System Version 1.4.

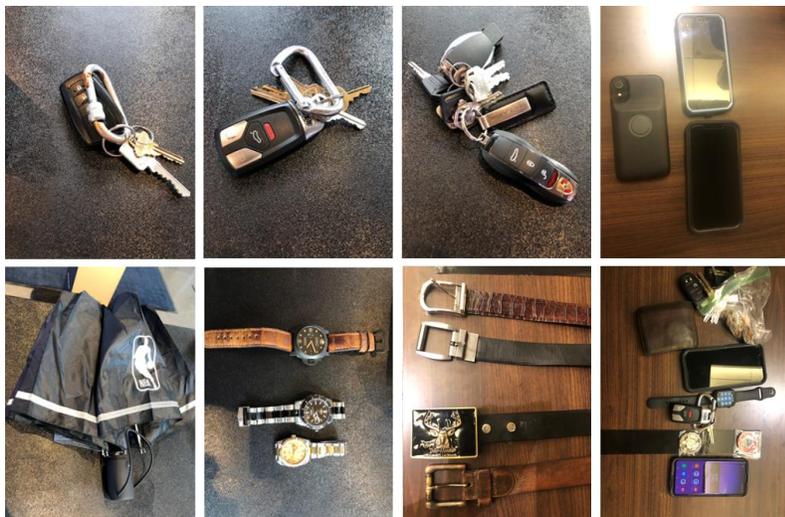


Figure 8. Innocuous test objects.

3.3.8. Exercise Evaluator Ratings (System Version 1.1)

The average exercise evaluator rating for each matrix item was calculated using Equation 1:

$$\text{Equation 1} \quad R = (r_1 + r_2 + r_3 + r_4 + r_5) \div 5$$

where:

- R = average exercise rating for a given matrix item
- r_1 = Evaluator 1 rating for that matrix item
- r_2 = Evaluator 2 rating for that matrix item
- r_3 = Evaluator 3 rating for that matrix item
- r_4 = Evaluator 4 rating for that matrix item
- r_5 = Evaluator 5 rating for that matrix item

Equation 1 was applied to each matrix item separately (e.g., the average evaluator rating was calculated for item 1.1, 1.2, 1.3, etc.).

The average evaluator score for each matrix section for each evaluator was calculated using Equation 2:

$$\text{Equation 2} \quad S = \left(\sum_{i=1}^n r_i \right) \div n$$

where:

- S = average score per evaluator for a given matrix section
- n = number of items in that matrix section
- r = each evaluator's rating for each matrix item in that matrix section

The average evaluator score for all of the matrix items for each evaluator was calculated using Equation 3:

$$\text{Equation 3} \quad E = \left(\sum_{i=1}^n r_i \right) \div n$$

where:

- E = average score for each evaluator for all matrix items
- n = total number of items in the matrix
- r = each evaluator's rating for each matrix item

The overall average matrix rating (i.e., the average of all of the item scores from all five evaluators) was calculated using Equation 4:

$$\text{Equation 4} \quad A = \left(\sum_{i=1}^n r_{1i} + r_{2i} + r_{3i} + r_{4i} + r_{5i} \right) \div (n * e)$$

where:

- A = overall average matrix rating
- n = number of matrix items
- r_1 = Evaluator 1 rating for each matrix item
- r_2 = Evaluator 2 rating for each matrix item

r_3 = Evaluator 3 rating for each matrix item
 r_4 = Evaluator 4 rating for each matrix item
 r_5 = Evaluator 5 rating for each matrix item
 e = number of evaluators

3.3.9. Exercise Evaluator Ratings (System Version 1.4)

The average exercise evaluator rating for each matrix item was calculated using Equation 1:

$$\text{Equation 1} \quad R = (r_4 + r_5 + r_6) \div 3$$

where:

R = average exercise rating for a given matrix item
 r_4 = Evaluator 4 rating for that matrix item
 r_5 = Evaluator 5 rating for that matrix item
 r_6 = Evaluator 6 rating for that matrix item

Equation 1 was applied to each matrix item separately (e.g., the average evaluator rating was calculated for item 1.1, 1.2, 1.3, etc.).

The average evaluator score for each matrix section for each evaluator was calculated using Equation 2:

$$\text{Equation 2} \quad S = \left(\sum_{i=1}^n r_i \right) \div n$$

where:

S = average score per evaluator for a given matrix section
 n = number of items in that matrix section
 r = each evaluator's rating for each matrix item in that matrix section

The average evaluator score for all of the matrix items for each evaluator was calculated using Equation 3:

$$\text{Equation 3} \quad E = \left(\sum_{i=1}^n r_i \right) \div n$$

where:

E = average score for each evaluator for all matrix items
 n = total number of items in the matrix
 r = each evaluator's rating for each matrix item

The overall average matrix rating (i.e., the average of all of the item scores from all three evaluators) was calculated using Equation 4:

$$\text{Equation 4} \quad A = \left(\sum_{i=1}^n r_{4i} + r_{5i} + r_{6i} \right) \div (n * e)$$

where:

A = overall average matrix rating

n = number of matrix items

r_4 = Evaluator 4 rating for each matrix item

r_5 = Evaluator 5 rating for each matrix item

r_6 = Evaluator 6 rating for each matrix item

e = number of evaluators

4. Results and Recommendations: System Version 1.1

This section covers the following matrix-related results: (1) the average individual matrix item rating from all of the exercise evaluators, (2) the average matrix section score for each exercise team member, (3) the average overall matrix score for each exercise evaluator, and (4) the average overall matrix rating. It also summarizes the comments from the exercise evaluators.

4.1. Matrix Results: System Version 1.1

Table 2 shows the average exercise evaluator rating for each matrix item. The ratings ranged from 0.8 to 3.0. The raw scores and comments from each evaluator are in Appendix A.

Table 2. Matrix Item Average Exercise Evaluator Rating for System Version 1.1

Function #	Functional Area	Function/Specification to Score	Score
1	Ferrous Metal Detection	The system will detect ferrous metals (firearms and knives) at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:	
1.1	Handgun (classified as Large item per NIJ 0601.02)	Requirement: The system will detect a handgun (NIJ large test object) at a rate greater than 98%. Outcome: Total rate at 9 test locations was 89% Evaluator Feedback: While 7 test locations had nearly a 100% detection rate, 2 test locations were slightly above 50%.	1.2
1.2	Knife (blade greater than 6")	Requirement: The system will detect knives larger than 6" at a rate of 80% or greater. Outcome: Total rate at 9 test locations was 96% for knives of this size used during exercise. Evaluator Feedback: Although the system exceeded percentage threshold, misses were observed in the same 2 test locations experiencing lower detection rates outlined in Functional Area 1.1.	2.4
1.3	Knife (blade greater 4", but less than 6")	Requirement: The system will detect knives between 4" and 6" at a rate of 70% or greater. Outcome: Total rate at 9 test locations was 88% for knives of this size used during exercise. Evaluator Feedback: Although the system exceeded the detection threshold, detection did not always align with the displayed detection areas on the tablet. Monitoring freezes were also observed during high traffic, which impacted alert times. Additionally, misses were most commonly observed in the same 2 test locations experiencing	2.2

		lower detection rates outlined in Functional Area 1.1.	
1.4	Knife (blade less than 4")	<p>Requirement: The system will detect knives smaller than 4” in blade length. For the purposes of this exercise, this function was observed but not rated.</p> <p>Outcome: The total detection rate at randomized test locations was 73% for knives less than 4” in length.</p>	N/A
2	Innocuous Item Test Objects	The system will not alarm (less than 10%) on commonly carried, permitted items at 3’ portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:	
2.1	Keys	<p>Requirement: The system will alert to keys at a rate of 10% or less.</p> <p>Outcome: Total rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.2	Cell Phone(s)	<p>Requirement: The system will alert to cell phones at a rate of 10% or less.</p> <p>Outcome: Total rate was 8% for items used during this exercise.</p> <p>Evaluator Feedback: Although the detection rate was below the identified threshold, larger phones caused the largest percentage of detection.</p>	2.6
2.3	Wristwatch	<p>Requirement: The system will alert to wristwatches at a rate of 10% or less.</p> <p>Outcome: Total rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.4	Belt Buckle	<p>Requirement: The system will alert to belt buckles at a rate of 10% or less.</p> <p>Outcome: Total rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.5	Coins	<p>Requirement: The system will alert to coins at a rate of 10% or less.</p> <p>Outcome: Total rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.6	Combined	<p>Requirement: The system will alert to a combination of common items carried in pockets at a rate of 10% or less.</p>	3.0

		<p>Outcome: Total rate was 8% when items used during this exercise were combined.</p> <p>Evaluator Feedback: No additional feedback.</p>	
3	False Alerts	<p>Requirement: The system has a false alert rate of less than 10%. (20% is the NIJ standard.)</p> <p>Outcome: False alert rate was 1.8%.</p> <p>Evaluator Feedback: This number excludes umbrellas and apple watches, which both result in a high false alert rate.</p>	2.4
4	Detection Rate	<p>Requirement: The system has a detection rate of greater than 98% for large objects, as defined in NIJ 0601.02.</p> <p>Outcome: Total detection rate for items screened (test objects and knives) during this exercise was 92%.</p> <p>Evaluator Feedback: The total detection rate did not meet the 98% requirement defined in NIJ 0601.02. Low detection rates in the 2 test locations observed in Functional Area 1.1 reduced the detection rate below the threshold.</p>	1.0
5	Lane Throughput	<p>Requirement: The system is capable of processing 1,800 (or greater) people per hour.</p> <p>Outcome: Patrons processed through ticketing prior to entering the system. This item was not assessed due to increased service rates at ticketing locations and limited queuing at the exercise location.</p> <p>Evaluator Feedback: No additional feedback.</p>	N/A
6	Walk-through Speed	The system will screen subjects walking through at a range of speeds.	
6.1	Slow	<p>Requirement: The system will screen subjects walking through the portal at a slow pace, while continuously walking (0.5 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a slow pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
6.2	Normal	<p>Requirement: The system will screen subjects walking through the portal at a normal pace (1.0 m/s as per NIJ 0601.02).</p> <p>Outcome: There was no consensus between evaluators on impacts to detection rates when</p>	2.6

		patrons moved at a medium pace through the portal. Evaluator Feedback: Patrons walking at medium paces would come in close proximity to table operators, making recognition of the alert and the directing of patrons to secondary screening more difficult. Recommend venues accounting for space required to conduct screening operations with this system.	
6.3	Fast	Requirement: The system will screen subjects walking through the portal at a fast pace - not running (1.5 m/s as per NIJ 0601.02). Outcome: Some impacts on detection rates and operations were observed when patrons moved at a fast pace through the portal. Evaluator Feedback: Several positive alarms moving through the portal at close proximity resulted in freezing and buffering of the tablet at times. Additionally, sources located at certain test locations were less likely to be detected when moving at a fast pace.	2.0
7	User Interface	The system is equipped with a user interface enabling users to view alert events. Alerts consist of a notification in the left side menu of the alerts screen. An alert consists of sensor name, relative date/time, jpeg, and mpeg captures of the individual scanned.	
7.1	Assessments	Requirement: Users can review output assessments and classification details. Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: Observation was limited to a laptop. Seeing this functional area demonstrated in real-time and on multiple devices (iPad, desktop, etc.) would have been helpful.	2.8
7.2	Alerts	Requirement: Users are provided with an alert notification and an image and video of an alert event. Outcome: Evaluators observed this capability throughout the exercise. Evaluator Feedback: Alerts were visual and limited to the tablet. There appears to be a need for additional visual/audible alerts.	2.4
7.3	Localization (X-Axis)	Requirement: Users can view the position of the object alerting on the X plane (left to right). A red circle will indicate the location on-body within	1.2

		<p>the X plane. This is present in both the photo and the video of the alert. Outcome: Video and a photo of the alert was available. Evaluator Feedback: The red circle was often not located on or near the alarming object.</p>	
7.4	Localization (Y-Axis)	<p>Requirement: Users can view the position of the object alerting on the Y plane (up and down). A red circle will indicate the location on-body within the Y plane. This is present in both the photo and the video of the alert. Outcome: Video and a photo of the alert was available. Evaluator Feedback: The red circle was often not located on or near the alarming object.</p>	1.3
7.5	Multiple Objects	<p>Requirement: If there are multiple objects on-body, the red circle will point to the center location between the objects. Outcome: Due to the inconsistency of red circle placement, this capability could not be confirmed. Evaluator Feedback: The red circle did not consistently point to the center of multiple objects placed at test locations.</p>	0.8
7.6	Alert History	<p>Requirement: The most recent alerts are logged and accessible via the user interface. There is no specified retention period. It is customer configurable. Outcome: The most recent 25 alerts were available on the tablet. The most recent 200 alerts were available on the desktop application. Evaluator Feedback: Anything beyond 200 alerts is stored on the server.</p>	3.0
8	Video/Images	<p>The system is equipped with video cameras to capture a video and a photo corresponding to the alert events.</p>	
8.1	Live Video View	<p>Requirement: Activity can be monitored using the live video feature on the sensor management page Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.</p>	3.0
8.2	Image Overlay	<p>Requirement: Outputs of the detection assessment are overlaid onto an image to show the location of the object on the person. This is indicated with a red circle</p>	2.2

		<p>Outcome: Patriot One staff demonstrated this capability to the evaluation team. A red circle was overlaid onto the image.</p> <p>Evaluator Feedback: See items 1.7.3, 1.7.4, and 1.7.5 for accuracy.</p>	
8.3	Alert Output	<p>Requirement: All video and images generation for alerts are automated and require no interaction from the operator.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
9	User Mode	<p>Requirement: User Mode allows the operator to view alerts and alert evidence. User Mode does not allow the modification of sensors in the system. It does allow the user to view the list of sensors and any available live feeds. This is accessed by logging in with the “user” account.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: While operating in this mode during the exercise, the system lagged when multiple items were detected during high throughput. As a result, alerts were not always available in time to effectively stop patrons and direct them to secondary screening.</p>	2.6
10	System Configuration	<p>Requirement: System configuration is limited to Administrator Mode (admin account)</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
11	Local Monitoring	<p>Requirement: A local user interface can be used to setup and operate the system. The system health can be monitored using the sensor health, which can be checked on the sensor health page. Support should be contacted whenever the system is not functioning nominally.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
12	Remote Monitoring	<p>The system can be monitored both locally and remotely by accessing the web interface. A user interface can be used to setup and operate the system. The system health can be monitored using the sensor health, which can be checked on the sensor health page. Support should be contacted whenever the system is not functioning nominally. The</p>	

		interface is web-based and can be accessed remotely with proper network configuration	
12.1	Tablet	Requirement: The system can be accessed remotely by tablet using the web interface. Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.	3.0
12.2	Cellphone (iPhone/Android)	Requirement: The system can be accessed remotely by cellphone using the Patriot One Alert Center mobile app on iOS or android Outcome: The venue was experiencing network issues during this exercise. Therefore, this item was not demonstrated.	N/A
12.3	Desktop	Requirement: The system can be accessed remotely by desktop using the web interface. Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.	3.0
12.4	Simultaneous Monitoring	Requirement: A local and remote interface can be used simultaneously. Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.	3.0
13	Adjustable Portal Width	Requirement: The portal is adjustable between widths of 3' and 4'. Portal width information can be adjusted in the user interface. Outcome: Demonstration of this capability would require a 20-minute cycling time and negatively impact ingress operations. Therefore, this item was not demonstrated during this exercise.	N/A
14	System Memory	Requirement: Powering off the system does not remove or alter the configuration or system logs. However, they are deleted in a first in, first out manner as space is required by the system. We do not have any stated retention period for either alerts or logs. Outcome: Demonstration of this capability would require a 20-minute cycling time and negatively impact ingress operations. Therefore, this item was not demonstrated during this exercise.	N/A
15	Diagnostics	Requirement: Sensor health is available on the sensor management page. The sensors are pinged on a regular basis to make sure the connection is	3.0

		established. If it cannot be established, the sensor health shows an alert. Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.	
Average Score			2.5

Table 3 and Figure 9 show the average exercise evaluator score for the entire matrix (e.g., Function/Specification).

Table 3. Each Exercise Evaluator’s Average Matrix Section Score

Exercise Evaluator	Function/Specification
Evaluator 1	2.5
Evaluator 2	2.4
Evaluator 3	2.4
Evaluator 4	2.6
Evaluator 5	2.4

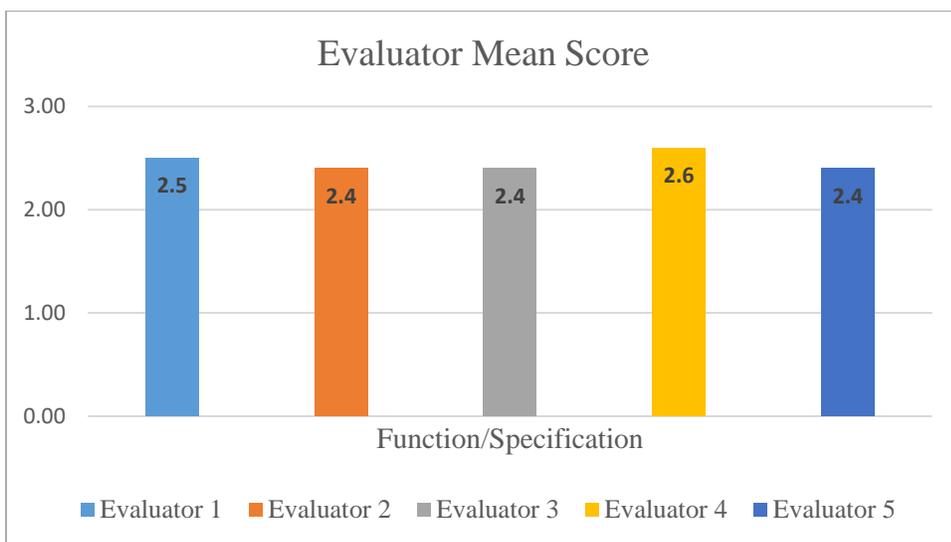


Figure 9. Average evaluator score for each matrix section

The overall average matrix score (i.e., the average of all item scores for all evaluators) was 2.5.

4.2. Evaluator Comments and Recommendations: System Version 1.1

As noted in Sections 1.3 and 4.1 of this document, the Product Operational Exercise showed that all capabilities evaluated (Appendix A) were successfully demonstrated.

Exercise evaluator scores and comments for each matrix item, as well as comments on the technology as a whole, can be found in Appendix A.

5. Exercise Evaluator Overall Comments: System Version 1.1

The NCS⁴ asked each exercise team member to provide overall feedback on the solution following the operational exercise. Each exercise evaluator was given the time to record the details of each demonstrated requirement. After reviewing their notes, team members were asked to provide a qualitative statement summarizing their thoughts on the product, which are provided below. The statements were edited for grammar, punctuation, and clarity; their meanings were not altered.

5.1. Evaluator 1

Venues adopting systems such as this should prioritize staffing and training to avoid performance issues. The system has several key components (Operating, Divesting, Pacing) that need to be in concert for a smooth operation. If one or more of these key components are not in sync, you can expect detection failures. The human element plays a key role in each of these key components. I observed several human errors during the functional operations, which led to failures and/or missed detection.

The system's visual alert on the monitor (red circle) was a bit confusing. If there was a questionable item on an individual above their shoulder, then the red circle alert would be shown on the lower torso of that individual. If there was a questionable item below the individual's waist, that alert would alert anywhere below that individual's knees. The system's alert should be simple and intuitive.

This system's functionality appeared to have some unique qualities that, if revisited, retooled, and refined, could make it a featured weapon's detection system. Observed concerns include:

- The system's visual alert were delayed/untimely (happening or done at an unsuitable time).
- The system's visual alert on the monitor of ferrous metals above the height of the portal towers were misleading.
- The system had difficulties in detecting ferrous metals located on or around the ankles.
- The system showed signs of buffering when it was taxed with multiple alerts, which led to missed and/or undetected alerts.

5.2. Evaluator 2

Overall, the system performed as advertised, with a couple of exceptions. Per the vendor, those issues should be corrected in the latest version (System Version 1.4) of the technology. My thought was that they should have demonstrated the later version. Specific issues were as follows:

- The red circle rarely identified area alerted. It would have been better served to light up the whole screen in a red image when alerted.

- Another issue was when the simulated gun was on the ankle. When the ankle was swung through the system, it rarely alerted.
- The review screens need to have to be 12' to 15' beyond the system to give enough time for recognition of alert. Most facilities will not have that space; this caused the monitors to hold people up to one person at a time. The tight space and ticketing system service rates caused flow rates to resemble those of a traditional walk-through metal detector.

5.3. Evaluator 3

The Patriot One Technologies' Multi-Sensor Gateway (MSG), Video Recognition System and Threat Detection Platform is an emerging technology system with the potential for improving and/or enhancing current standard magnetometer screening protocols. Among the strengths of the system is that it has the capability to detect ferrous metals, including those used to manufacture firearms and some knives. The visual outlay of patrons during the screening process is impressive. Screeners are able to view each patron on a monitor in real-time as they pass through the Patriot One MSG kiosks. Ideally, the system detects threats (e.g., weapons/potential weapons) by displaying a red circle (i.e., visual alert) at the general anatomical location where the weapon is being carried. A warning/alert also appears on the monitor that reads "Threat Detected."

The technology/system did appear to have some notable shortfalls. A number of items were missed (e.g., not detected) during the screening exercise, most significantly the simulated handguns. Multiple simulated handguns carried on the ankles of patrons were not detected during the screening exercise. There were also several iterations of what Patriot One representatives described as "catch-up glitches," in which the video monitor froze after a "threat was detected", and then, as the video monitor remained frozen, multiple patrons (for purposes of the exercise) carrying weapons walked through the kiosks without triggering any type of alarm. This is problematic.

An additional concern is the Patriot One MSG alarm automatically keys on Apple watches and other Apple devices (reportedly due to these items' magnetized and electromagnetic components). This factor is potentially troublesome, as screeners may be conditioned to waive individuals wearing Apple devices through MSG kiosks while failing to key on other potential threats, such as concealed knives and firearms. If not already implemented, training and standard operating procedures should be put in place for screeners to be cognizant of Apple products triggering false positives while steadfastly focusing on actual threats (e.g., weapons possibly being carried by patrons, irrespective of them wearing or carrying Apple products).

5.4 Evaluator 4

The system demonstrated a higher throughput than traditional metal detectors with similar sensitivity settings. The Patriot One technology states it can detect smaller knives, which has been a challenge for current metal detector technology. Patriot One 1.1 technology scored well in detecting small knives that may not alert in standard metal detectors with similar sensitivity settings. Reviewing the Patriot One 1.1 units, the technology did not perform as expected in

detecting simulated guns in the lower leg area. The 1.1 units also gave false positives detecting Apple watches and cell phones. An associated tablet displayed the alert approximately 1.5 – 2 seconds after an individual walked through the screening process. The timing often made the alert to be displayed while the individual being screened was in the process of walking away.

5.5 Evaluator 5

There is some concern that the system did not consistently detect test objects located on the ankles. Additional sensors or the adjustment of existing sensors might be necessary when system sensitivity settings are set for events.

The amount of space between the security officer with the iPad (operator tablet) needs to be further back than what was observed during the exercise. The amount of time before an alert took too long, and in some cases, the subject had passed the screener or multiple alerts were making it difficult for the screener to stop the subject. The exit area near the screener also needs to be tighter so that the subject cannot walk around another person.

There is also some concern that if the item is not made of ferrous metal, it may not be detected.

6. Results and Recommendations: System Version 1.4

This section covers the following matrix-related results: (1) the average individual matrix item rating from all of the exercise evaluators, (2) the average matrix section score for each exercise team member, (3) the average overall matrix score for each exercise evaluator, and (4) the average overall matrix rating. It also summarizes the comments from the exercise evaluators.

6.1. Matrix Results: System Version 1.4

Table 4 shows the average exercise evaluator rating for each matrix item. The ratings ranged from 0.3 to 3.0. The raw scores and comments from each evaluator are in Appendix B.

Table 4. Matrix Item Average Exercise Evaluator Rating for System Version 1.4

Function #	Functional Area	Function/Specification to Score	Score
1	Ferrous Metal Detection	The system will detect ferrous metals (firearms and knives) at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:	
1.1	Handgun (classified as Large item per NIJ 0601.02)	Requirement: The system will detect a handgun (NIJ large test object) at a rate greater than 98%. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0
1.2	Compact Pistol (Sig Sauer P245)	Requirement: The system will detect a compact pistol. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0
1.3	Micro-compact Pistol (Kimber .380 ACP Micro Raptor)	Requirement: The system will detect a micro-compact pistol. Outcome: Total detection rate at 9 test locations was 88% Evaluator Feedback: No additional feedback.	2.0
1.4	Pocket Pistol (North American Arms Pug .22 Magnum Mini Revolver)	Requirement: The system will detect a pocket pistol. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0
1.5	Knife (blade greater than 6")	Requirement: The system will detect knives larger than 6" at a rate of 80% or greater. Outcome: Total detection rate at randomized test locations was 100% for knives of this size used during exercise. Evaluator Feedback: No additional feedback.	3.0

1.6	Knife (blade greater than 4", but less than 6")	<p>Requirement: The system will detect knives between 4" and 6" at a rate of 70% or greater.</p> <p>Outcome: Total rate at randomized test locations was 60% for knives of this size used during exercise.</p> <p>Evaluator Feedback: This performance test was performed using two knives measuring greater than 4" but less than 6" in length. While one knife had a high detection rate, the other had a low detection rate. The system did not meet the solution provider established standard of 70% for knives during this observation.</p>	0.3
1.7	Knife (blade less than 4")	<p>Requirement: The system will detect knives smaller than 4" in blade length.</p> <p>Outcome: The total detection rate at randomized test locations was 77% for knives less than 4" in length.</p> <p>Evaluator Feedback: The solution provider did not provide a minimum detection rate for knives of this size.</p>	2.5
2	Innocuous Item Test Objects	The system will not alarm (less than 10%) on commonly carried, permitted items at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:	
2.1	Keys	<p>Requirement: The system will alert to keys at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.2	Cell Phone(s)	<p>Requirement: The system will alert to cell phones at a rate of 10% or less.</p> <p>Outcome: Total detection rate exceeded 10% for items used during this exercise.</p> <p>Evaluator Feedback: Certain phone cases and newer phones caused the largest percentage of detection.</p>	1.0
2.3	Wristwatch (Apple Watch)	<p>Requirement: The system will alert to wristwatches (Apple Watch) at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0

2.4	Belt Buckle	<p>Requirement: The system will alert to belt buckles at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.5	Coins	<p>Requirement: The system will alert to coins at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
2.6	Combined	<p>Requirement: The system will alert to a combination of common items carried in pockets at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 27% when items used during this exercise were combined.</p> <p>Evaluator Feedback: The total detection rate did not meet the solution provider's established standard of 10% or less. Newer, larger phones (i.e., iPhone 12 Pro Max) caused the greatest number of false positives.</p>	0.7
3	False Alerts	<p>Requirement: The system has a false alert rate of less than 10%. (20% is the NIJ standard.)</p> <p>Outcome: The total false alert rate for items used during this exercise did not exceed 10%.</p> <p>Evaluator Feedback: Note that this exercise did not include items not defined as “innocuous” in NIJ standards.</p>	3.0
4	Detection Rate	<p>Requirement: The system has a detection rate of greater than 98% for large objects, as defined in NIJ 0601.02.</p> <p>Outcome: Total detection rate for large objects screened (test objects and handguns) during this exercise was 99%.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
5	Walk-through Speed	The system will screen subjects walking through at a range of speeds.	
5.1	Slow	<p>Requirement: The system will screen subjects walking through the portal at a slow pace, while continuously walking (0.5 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a slow pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0

5.2	Normal	<p>Requirement: The system will screen subjects walking through the portal at a normal pace (1.0 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a medium pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
5.3	Fast	<p>Requirement: The system will screen subjects walking through the portal at a fast pace - not running (1.5 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a fast pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0
Average Score			2.5

Table 4 and Figure 10 show the average exercise evaluator score for the entire matrix (e.g., Function/Specification).

Table 3. Each Exercise Evaluator’s Average Matrix Section Score

Exercise Evaluator	Function/Specification
Evaluator 4	2.6
Evaluator 5	2.4
Evaluator 6	2.5

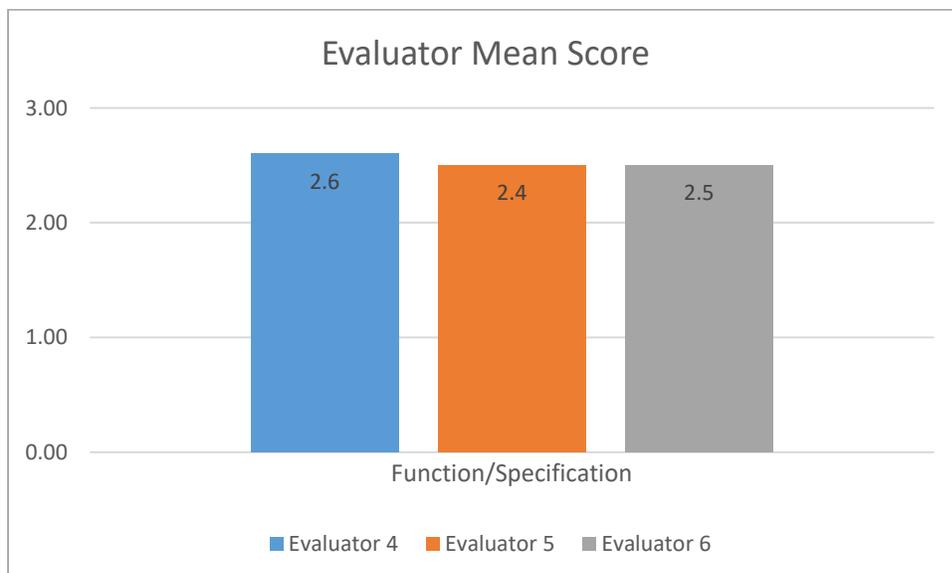


Figure 10. Average evaluator score for each matrix section

The overall average matrix score (i.e., the average of all item scores for all evaluators) was 2.5.

6.2. Evaluator Comments and Recommendations: System Version 1.4

As noted in Sections 1.3 and 6.1 of this document, the Product Operational Exercise showed that all capabilities evaluated (Appendix B) were successfully demonstrated.

Exercise evaluator scores and comments for each matrix item, as well as comments on the technology as a whole, can be found in Appendix B.

7. Exercise Evaluator Overall Comments: System Version 1.4

The NCS⁴ asked each exercise team member to provide overall feedback on the solution following the operational exercise. Each exercise evaluator was given the time to record the details of each demonstrated requirement. After reviewing their notes, team members were asked to provide a qualitative statement summarizing their thoughts on the product, which are provided below. The statements were edited for grammar, punctuation, and clarity; their meanings were not altered.

7.1. Evaluator 4

In reviewing Patriot One technology, I observed a greater throughput than that of a traditional walk-through metal detector. During the exercise, the Patriot One technology was very successful in detecting firearms. Firearms were placed at various areas on a person, including the ankle area, torso, and shoulder areas. The system also excelled at detecting knives, large and small. While medium-sized knife detection rates did not meet testing parameters, one knife, in particular, seemed to present the largest challenge and negatively impacted the overall percentage.

Additional observations include:

- Items that were carried above the height of the detection towers had a lower alarm rate.
- Overall, innocuous items had a very low alarm rate. However, one specific type of cell phone used during performance tests resulted in a higher alarm rate.

Patriot One representatives stated that a system option with higher towers is currently in development. Additionally, Patriot One staff mentioned that they plan to do further testing on the cell phone type with a higher alarm rate to reduce false alarms in order to add this to their AI detection engine. Having seen the solution in the earlier stages of development and their changes based on industry feedback, I am pleased with Patriot One's willingness to continuously look for ways to improve their technology.

7.2. Evaluator 5

During this evaluation, the technology detected 100% of all large, compact, and pocket handguns. However, the detection rate for the micro-compact handgun used for this exercise was 88%. This weapon had an aluminum frame and stainless steel slide and barrel.

While knives over 6" blade were detected at a rate of 100%, the detection rate for blades between 4" and 6" decreased to 60%. This does not meet the Patriot One standard of 70%.

In testing of innocuous items, it was determined that newer or larger cell phones and custom cases may increase false alert rates. However, the system did not alert on other innocuous items (watches, belt buckles, and coins). Overall, the provider established a 10% alert rate.

Venues may want to increase sensitivity levels to account for weapons with a lower composition of ferrous metals. However, increased sensitivity will likely cause slower throughput and longer lines due to an increase in alerts and secondary screening. Further research should be conducted to determine if the settings and/or screening area range needs to be adjusted to alert on the placement of the weapon on the subject's body or the amount of actual metal used in this particular weapon.

7.3. Evaluator 6

I was VERY impressed with the vetting process of the Patriot One Technologies product. The evaluation was very detailed, and I am comfortable with providing my opinions.

Most of the areas evaluated during the vetting process received the highest grade of “meets the requirements” (13 out of 17). Those areas that did not receive the highest grade (4 out of 17) were not significant concerns for me. I have been involved in the sports and entertainment facilities and event management industry since 1987, so I believe I have my finger on the pulse of what is important.

I believe in this technology but encourage venues to make sure that it meets the safety services needs of the venue and event (screening and staffing).

8. Operational Exercise Summary

8.1. System Version 1.1. Exercise Summary

The specific functions and features of this product were observed and rated by a team of industry experts as outlined in Section 3.2. The NCS⁴ staff facilitated the product operational exercise and compiled the results listed in Section 4.1 of this report. The NCS⁴ staff did not have any input into the scoring of the evaluation criteria or evaluator comments.

The overall composite score of 2.5 from a possible 3.0 indicates that this product, on average, met the criteria used for this matrix. However, five functions were rated below 2.0, indicating those functions did not meet or partially met the criteria used for this matrix. A summary of exercise evaluator ratings for the thirty functions evaluated during this exercise is as follows:

- One function did not meet the criteria established for this exercise
- Four functions partially met the criteria established for this exercise
- Ten functions met the criteria established for this exercise, with recommendations
- Fifteen functions met the criteria established

Please note that exercise evaluator ratings are not intended to serve as a guide for procurement. Ratings are based on how well each evaluator determined the product performed its advertised capabilities. Customers should consider risk tolerance, venue-specific needs, best practices, and policy when evaluating the appropriateness of this solution. Additional observation information is available for each functional area in Section 4.1 of this report. Recommendations and raw scores can be found in Appendix A of this report.

8.2. System Version 1.4. Exercise Summary

The specific functions and features of this product were observed and rated by a team of industry experts as outlined in Section 3.2. The NCS⁴ staff facilitated the product operational exercise and compiled the results listed in Section 6.1 of this report. The NCS⁴ staff did not have any input into the scoring of the evaluation criteria or evaluator comments.

The overall composite score of 2.5 from a possible 3.0, indicates that this product, on average, met the criteria used for this matrix. However, three functions were rated below 2.0, indicating those functions did not meet or partially met criteria used for this matrix. A summary of exercise evaluator ratings for the eighteen functions evaluated during this exercise is as follows:

- Two functions did not meet the criteria established for this exercise
- One function partially met the criteria established for this exercise
- Two function met the criteria established for this exercise, with recommendations
- Thirteen functions met the criteria established

Please note that exercise evaluator ratings are not intended to serve as a guide for procurement. Ratings are based on how well each evaluator determined the product performed its advertised

capabilities. Customers should consider risk tolerance, venue-specific needs, best practices, and policy when evaluating the appropriateness of this solution. Additional observation information is available for each functional area in Section 6.1 of this report. Recommendations and raw scores can be found in Appendix B of this report.

The NCS⁴ would like to thank the industry experts and the Patriot One team for their participation in this operational exercise and commitment to creating a safer, more secure environment for spectators attending sporting and special events.

Appendix A: System Version 1.1 Exercise Evaluator Raw Scores and Comments

Exercise evaluator comments in this appendix have been edited only for grammar and punctuation.

Function #	Functional Area	Function/Specification to Score	Evaluator 1	Evaluator 2	Evaluator 3	Evaluator 4	Evaluator 5
1	Ferrous Metal Detection	The system will detect ferrous metals (firearms and knives) at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The items below were used for this exercise:					
1.1	Handgun (classified as large item per NIJ 0601.02)	<p>Requirement: The system will detect a handgun (NIJ large test object) at a rate greater than 98%.</p> <p>Outcome: Total rate at 9 test locations was 89%</p> <p>Evaluator Feedback: While 7 test locations had nearly a 100% detection rate, 2 test locations were slightly above 50%.</p>	2.0	1.0	1.0	1.0	1.0
1.2	Knife (blade greater than 6")	<p>Requirement: The system will detect knives larger than 6" at a rate of 80% or greater.</p> <p>Outcome: Total rate at 9 test locations was 96% for knives of this size used during exercise.</p> <p>Evaluator Feedback: Although the system exceeded the percentage threshold, misses were most commonly observed in the same 2 test locations experiencing lower detection rates outlined in Functional Area 1.1.</p>	2.0	3.0	2.0	2.0	3.0

1.3	Knife (blade greater than 4", but less than 6")	<p>Requirement: The system will detect knives between 4" and 6" at a rate of 70% or greater.</p> <p>Outcome: Total rate at 9 test locations was 88% for knives of this size used during exercise.</p> <p>Evaluator Feedback: Although the system exceeded the detection threshold, detection did not always align with the displayed detection areas on the tablet. Monitoring freezes were also observed during high traffic, which impacted alert times. Additionally, misses were most commonly observed in the same 2 test locations experiencing lower detection rates outlined in Functional Area 1.1.</p>	2.0	3.0	1.0	3.0	2.0
1.4	Knife (blade less than 4")	<p>Requirement: The system will detect knives smaller than 4" in blade length. For the purposes of this exercise, this function was observed but not rated.</p> <p>Outcome: The total detection rate at randomized test locations was 73% for knives less than 4" in length.</p>	N/A	N/A	N/A	N/A	N/A
2	Innocuous Item Test Objects	The system will not alarm (less than 10%) on commonly carried, permitted items at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The items below were used for this exercise:					
2.1	Keys	<p>Requirement: The system will alert to keys at a rate of 10% or less.</p>	3.0	3.0	3.0	3.0	3.0

		<p>Outcome: Total rate was 0% for items used during this exercise. Evaluator Feedback: No additional feedback.</p>					
2.2	Cell Phone(s)	<p>Requirement: The system will alert to keys at a rate of 10% or less. Outcome: Total rate was 8% for items used during this exercise. Evaluator Feedback: Although the detection rate was below the identified threshold, larger phones caused the largest percentage of detection.</p>	2.0	3.0	2.0	3.0	3.0
2.3	Wristwatch	<p>Requirement: The system will alert to keys at a rate of 10% or less. Outcome: Total rate was 0% for items used during this exercise. Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
2.4	Belt Buckle	<p>Requirement: The system will alert to keys at a rate of 10% or less. Outcome: Total rate was 0% for items used during this exercise. Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
2.5	Coins	<p>Requirement: The system will alert to keys at a rate of 10% or less. Outcome: Total rate was 0% for items used during this exercise. Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0

2.6	Combined	<p>Requirement: The system will alert to a combination of common items carried in pockets at a rate of 10% or less.</p> <p>Outcome: Total rate was 8% when items used during this exercise were combined.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
3	False Alerts	<p>Requirement: The system has a false alert rate of less than 10%. (20% is the NIJ standard.)</p> <p>Outcome: False alert rate was 1.8%.</p> <p>Evaluator Feedback: This number excludes umbrellas and apple watches, which both result in a high false alert rate.</p>	3.0	3.0	2.0	3.0	1.0
4	Detection Rate	<p>Requirement: The system has a detection rate of greater than 98% for large objects, as defined in NIJ 0601.02.</p> <p>Outcome: Total detection rate for items screened (test objects and knives) during this exercise was 92%.</p> <p>Evaluator Feedback: The total detection rate did not meet the 98% requirement defined in NIJ 0601.02. Low detection rates in the 2 test locations observed in Functional Area 1.1 reduced the detection rate below the threshold.</p>	3.0	1.0	1.0	0.0	0.0

5	Lane Throughput	<p>Requirement: The system is capable of processing 1,800 (or greater) people per hour.</p> <p>Outcome: Patrons processed through ticketing prior to entering the system. This item was not assessed due to increased service rates at ticketing locations and limited queuing at the exercise location.</p> <p>Evaluator Feedback: No additional feedback.</p>	N/A	N/A	N/A	N/A	N/A
6	Walkthrough Speed	The system will screen subjects walking through at a range of speeds.					
6.1	Slow	<p>Requirement: The system will screen subjects walking through the portal at a slow pace, while continuously walking (0.5 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a slow pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
6.2	Normal	<p>Requirement: The system will screen subjects walking through the portal at a normal pace (1.0 m/s as per NIJ 0601.02).</p> <p>Outcome: There was no consensus between evaluators on impacts to detection rates when patrons moved at a medium pace through the portal.</p>	3.0	1.0	3.0	3.0	3.0

		Evaluator Feedback: Patrons walking at medium paces would come in close proximity to table operators, making recognition of the alert and the directing of patrons to secondary screening more difficult. Recommend venues account for space required to conduct screening operations with this system.					
6.3	Fast	Requirement: The system will screen subjects walking through the portal at a fast pace - not running (1.5 m/s as per NIJ 0601.02). Outcome: There were some impacts on detection rates and operations when patrons moved at a fast pace through the portal. Evaluator Feedback: Several positive alarms moving through the portal at close proximity resulted in freezing and buffering of the tablet at times. Additionally, sources located at certain test locations were less likely to be detected when moving at a fast pace.	2.0	1.0	2.0	3.0	2.0
7	User Interface	The system is equipped with a user interface enabling users to view alert events. Alerts consist of a notification in the left side menu of the alerts screen. An alert consists of sensor name, relative date/time, jpeg, and mpeg captures of the individual scanned.					
7.1	Assessments	Requirement: Users can review output assessments and classification details.	3.0	3.0	2.0	3.0	3.0

		<p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: Observation was limited to a laptop. Seeing this functional area demonstrated in real-time and on multiple devices (iPad, desktop, etc.) would have been helpful.</p>					
7.2	Alerts	<p>Requirement: Users are provided with an alert notification and an image and video of an alert event.</p> <p>Outcome: Evaluators observed this capability throughout the exercise.</p> <p>Evaluator Feedback: Alerts were visual and limited to the tablet. There appears to be a need for additional visual/audible alerts.</p>	2.0	2.0	3.0	3.0	2.0
7.3	Localization (X-Axis)	<p>Requirement: Users can view the position of the object alerting on the X plane (left to right). A red circle will indicate the location on-body within the X plane. This is present in both the photo and the video of the alert</p> <p>Outcome: Video and a photo of the alert was available.</p> <p>Evaluator Feedback: The red circle was often not located on or near the alarming object.</p>	0.0	2.0	2.0	1.0	1.0
7.4	Localization (Y-Axis)	<p>Requirement: Users can view the position of the object alerting on the</p>	0.0	2.0	2.5	1.0	1.0

		<p>Y plane (up and down). A red circle will indicate the location on-body within the Y plane. This is present in both the photo and the video of the alert.</p> <p>Outcome: Video and a photo of the alert was available.</p> <p>Evaluator Feedback: The red circle was often not located on or near the alarming object.</p>					
7.5	Multiple Objects	<p>Requirement: If there are multiple objects on-body, the red circle will point to the center location between the objects.</p> <p>Outcome: Due to the inconsistency of red circle placement, this capability could not be confirmed.</p> <p>Evaluator Feedback: The red circle did not consistently point to the center of multiple objects placed at test locations.</p>	0.0	1.0	1.0	2.0	0.0
7.6	Alert History	<p>Requirement: The most recent alerts are logged and accessible via the user interface. There is no specified retention period. It is customer configurable.</p> <p>Outcome: The most recent 25 alerts were available on the tablet. The most recent 200 alerts were available on the desktop application.</p>	3.0	3.0	3.0	3.0	3.0

		Evaluator Feedback: Anything beyond 200 alerts is stored on the server.					
8	Video/Images	The system is equipped with video cameras to capture a video and a photo corresponding to the alert events.					
8.1	Live Video View	Requirement: Activity can be monitored using the live video feature on the sensor management page Outcome: Patriot One staff demonstrated this capability to the evaluation team. Evaluator Feedback: No additional feedback.	3.0	3.0	3.0	3.0	3.0
8.2	Image Overlay	Requirement: Outputs of the detection assessment are overlaid onto an image to show the location of the object on the person. This is indicated with a red circle Outcome: Patriot One staff demonstrated this capability to the evaluation team. A red circle was overlaid onto the image. Evaluator Feedback: See items 1.7.3, 1.7.4, and 1.7.5 for accuracy.	3.0	1.0	3.0	3.0	1.0
8.3	Alert Output	Requirement: All video and images generation for alerts are automated and require no interaction from the operator.	3.0				
				3.0	3.0	3.0	3.0

		<p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>					
9	User Mode	<p>Requirement: User Mode allows the operator to view alerts and alert evidence. User Mode does not allow the modification of sensors in the system. It does allow the user to view the list of sensors and any available live feeds. This is accessed by logging in with the “user” account.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: While operating in this mode during the exercise, the system lagged when multiple items were detected during high throughput. As a result, alerts were not always available in time to effectively stop patrons and direct them to secondary screening.</p>	2.0	3.0	2.0	3.0	3.0
10	System Configuration	<p>Requirement: System configuration is limited to Administrator Mode (admin account)</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0

11	Local Monitoring	<p>Requirement: A local user interface can be used to setup and operate the system. The system health can be monitored using the sensor health, which can be checked on the sensor health page. Support should be contacted whenever the system is not functioning nominally.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
12	Remote Monitoring	<p>The system can be monitored both locally and remotely by accessing the web interface. A user interface can be used to setup and operate the system. The system health can be monitored using the sensor health, which can be checked on the sensor health page. Support should be contacted whenever the system is not functioning nominally. Our interface is web-based and can be accessed remotely with proper network configuration</p>					
12.1	Tablet	<p>Requirement: The system can be accessed remotely by tablet using the web interface.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
12.2	Cellphone (iPhone/Android)	<p>Requirement: The system can be accessed remotely by cellphone using the Patriot One Alert Center mobile app on iOS or android</p> <p>Outcome: The venue was experiencing network issues during</p>	N/A	N/A	N/A	N/A	N/A

		this exercise. Therefore, this item was not demonstrated.					
12.3	Desktop	<p>Requirement: The system can be accessed remotely by desktop using the web interface.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
12.4	Simultaneous Monitoring	<p>Requirement: A local and remote interface can be used simultaneously.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
13	Adjustable Portal Width	<p>Requirement: The portal is adjustable between widths of 3' and 4'. Portal width information can be adjusted in the user interface.</p> <p>Outcome: Demonstration of this capability would require a 20-minute cycling time and negatively impact ingress operations. Therefore, this item was not demonstrated during this exercise.</p>	N/A	N/A	N/A	N/A	N/A
14	System Memory	<p>Requirement: Powering off the system does not remove or alter the configuration or system logs. However, they are deleted in a first in, first out manner as space is</p>	N/A	N/A	N/A	N/A	N/A

		<p>required by the system. We do not have any stated retention period for either alerts or logs.</p> <p>Outcome: Demonstration of this capability would require a 20-minute cycling time and negatively impact ingress operations. Therefore, this item was not demonstrated during this exercise.</p>					
15	Diagnostics	<p>Requirement: Sensor health is available on the sensor management page. The sensors are pinged on a regular basis to make sure the connection is established. If it cannot be established, the sensor health shows an alert.</p> <p>Outcome: Patriot One staff demonstrated this capability to the evaluation team.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0	3.0	3.0
Average Score			2.5	2.4	2.4	2.6	2.4

Appendix B: System Version 1.4 Exercise Evaluator Raw Scores and Comments

Exercise evaluator comments in this appendix have been edited only for grammar and punctuation.

Function #	Functional Area	Function/Specification to Score	Evaluator 4	Evaluator 5	Evaluator 6
1	Ferrous Metal Detection	The system will detect ferrous metals (firearms and knives) at 3' portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:			
1.1	Handgun (classified as Large item per NIJ 0601.02)	Requirement: The system will detect a handgun (NIJ large test object) at a rate greater than 98%. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0	3.0	3.0
1.2	Compact Pistol (Sig Sauer P245)	Requirement: The system will detect a compact pistol. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0	3.0	3.0
1.3	Micro-compact Pistol (Kimber .380 ACP Micro Raptor)	Requirement: The system will detect a micro-compact pistol. Outcome: Total detection rate at 9 test locations was 88% Evaluator Feedback: No additional feedback.	2.0	2.0	2.0
1.4	Pocket Pistol (North American Arms Pug .22 Magnum Mini Revolver)	Requirement: The system will detect a pocket pistol. Outcome: Total detection rate at 9 test locations was 100% Evaluator Feedback: No additional feedback.	3.0	3.0	3.0
1.5	Knife (blade greater than 6")	Requirement: The system will detect knives larger than 6" at a rate of 80% or greater.	3.0	3.0	3.0

		<p>Outcome: Total detection rate at randomized test locations was 100% for knives of this size used during exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>			
1.6	Knife (blade greater than 4”, but less than 6”)	<p>Requirement: The system will detect knives between 4” and 6” at a rate of 70% or greater.</p> <p>Outcome: Total rate at randomized test locations was 60% for knives of this size used during exercise.</p> <p>Evaluator Feedback: This performance test was performed using two knives measuring greater than 4” but less than 6” in length. While one knife had a high detection rate, the other had a low detection rate. The system did not meet the solution provider established standard of 70% for knives during this observation.</p>	1.0	0.0	0.0
1.7	Knife (blade less than 4”)	<p>Requirement: The system will detect knives smaller than 4” in blade length.</p> <p>Outcome: The total detection rate at randomized test locations was 77% for knives less than 4” in length.</p> <p>Evaluator Feedback: The solution provider did not provide a minimum detection rate for knives of this size.</p>	3.0	2.0	N/A
2	Innocuous Item Test Objects	<p>The system will not alarm (less than 10%) on commonly carried, permitted items at 3’ portal width and a sensitivity equivalency of Security Level 2, as defined by NILECJ-STD-0601.00. The below items were used for this exercise:</p>			
2.1	Keys	<p>Requirement: The system will alert to keys at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0

2.2	Cell Phone(s)	<p>Requirement: The system will alert to cell phones at a rate of 10% or less.</p> <p>Outcome: Total detection rate exceeded 10% for items used during this exercise.</p> <p>Evaluator Feedback: Certain phone cases and newer phones caused the largest percentage of false positives.</p>	1.0	1.0	1.0
2.3	Wristwatch (Apple Watch)	<p>Requirement: The system will alert to wristwatches (Apple Watch) at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
2.4	Belt Buckle	<p>Requirement: The system will alert to belt buckles at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
2.5	Coins	<p>Requirement: The system will alert to coins at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 0% for items used during this exercise.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
2.6	Combined	<p>Requirement: The system will alert to a combination of common items carried in pockets at a rate of 10% or less.</p> <p>Outcome: Total detection rate was 27% when items used during this exercise were combined.</p> <p>Evaluator Feedback: The total detection rate did not meet the solution provider's established standard of 10% or less. Specifically, newer,</p>	1.0	0.0	1.0

		larger phones (i.e., iPhone 12 Pro Max) caused a significant number of false positives.			
3	False Alerts	<p>Requirement: The system has a false alert rate of less than 10%. (20% is the NIJ standard).</p> <p>Outcome: The total false alert rate for innocuous items used during this exercise did not exceed 10%.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
4	Detection Rate	<p>Requirement: The system has a detection rate of greater than 98% for large objects, as defined in NIJ 0601.02.</p> <p>Outcome: Total detection rate for large objects screened (test objects and handguns) during this exercise was 99%.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
6	Walkthrough Speed	The system will screen subjects walking through at a range of speeds.			
6.1	Slow	<p>Requirement: The system will screen subjects walking through the portal at a slow pace, while continuously walking (0.5 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a slow pace through the portal.</p> <p>Evaluator Feedback: No additional feedback.</p>	3.0	3.0	3.0
6.2	Normal	<p>Requirement: The system will screen subjects walking through the portal at a normal pace (1.0 m/s as per NIJ 0601.02).</p> <p>Outcome: There were no impacts on detection rates when patrons moved at a medium pace through the portal.</p>	3.0	3.0	3.0

		Evaluator Feedback: No additional feedback.			
6.3	Fast	Requirement: The system will screen subjects walking through the portal at a fast pace - not running (1.5 m/s as per NIJ 0601.02). Outcome: There were no impacts on detection rates when patrons moved at a fast pace through the portal. Evaluator Feedback: No additional feedback.	3.0	3.0	3.0
Average Score			2.6	2.4	2.5