Stadium Best Practices And BIG Ten Standards

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Lambeau Field – Mike Roemer/AP

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B1G

Emergency Management &
Special Events Conference
August 2015

Engaging with the Academic Community

- Goal is to illustrate how work with the academic community can:
  - Provide new ideas and tools to emergency managers, stadium security directors and others
  - Assist in decision making about security procedures
  - Potentially save money and time
- Will illustrate with examples from work on stadium security at Rutgers

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Can Working with Academics Lead to Useful Stadium Security Insights?

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CCICADA - Overview

The CCICADA Center

- The Command, Control, and Interoperability Center for Advanced Data Analysis (CCICADA) is a U.S. DHS University Center of Excellence based at Rutgers University.
- We work on problems involving data, modeling, simulation, and decision making.
- We work on a variety of topics in conjunction with DHS and its partners in the public and private sector
- Our work on stadium security has been strongly supported by DHS

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We Work with all Major Sport Leagues Also Minor Leagues and NCAA Venues

Homeland Security

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Special Partnerships

- Rutgers University Emergency Management
- MetLife Stadium – Giants and Jets
- Barclays Center – Nets, Islanders
- Progressive Field – Cleveland Indians
- Illitch Holdings – Detroit Lions, Detroit Red Wings
- USA Special Olympics
- Prudential Center – NJ Devils, Seton Hall basketball
- US Tennis Association
- Pocono Raceway
- New York Yankees
- New York Mets
- NJ Office of Homeland Security and Preparedness

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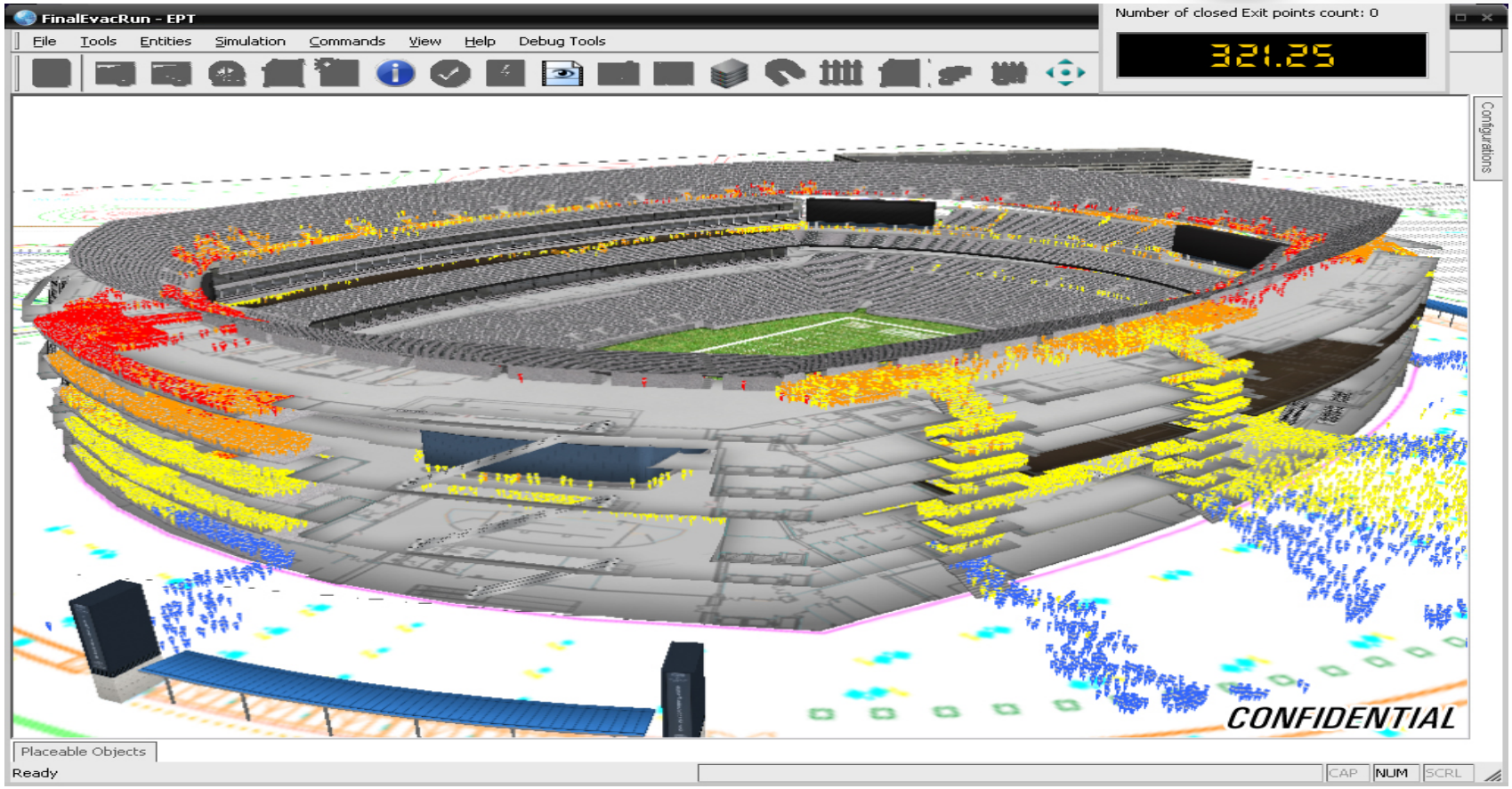
Evacuation Planning Tool



- Work with 6 NFL teams & Super Bowl
- CCICADA component of the work: behavioral aspects of stadium evacuation

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CCICADA: From Evacuation to a Large Stadium Security Program

Engagement with stadiums and Super Bowl through "sport evac" process led to connections to stadium security.

- Inspection processes at stadiums
- "Best Practices for Stadium Security" with DHS Office of SAFETY Act Implementation (OSAI)
- SAFETY Act: Metrics, Effectiveness, and Training for Inspections and Credentialing (OSAI)
- Crowd Management
- Prevention of Human Trafficking – Engagement with FBI, local agencies in connection with Super Bowls

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Other Stadium Security Work at CCICADA

- Working on all aspects of stadium security:
  - Risk Assessment
  - Staffing: Leadership, Organization, Authority
  - Information Management
  - Operations
  - Training and Evaluation

Crowd Dynamics Research

Crowd Management

- Emergency Situations
- Crowd behaviors
- Mass Panic vs. Social Comparison
- Psychological vs. Aggregate Crowd
- Past Events – including WTC
- Patterns of Movement
- Fire Engineering Studies
- Social Networking
- Leadership, Authority and Structure
- ADA Handling Disabled Persons

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Prevention of Human Trafficking

- Daily, CCICADA's web archival tool harvests thousands of online escort service ads in 66 markets around the country.
- Developed in conjunction with FBI and Microsoft Digital Crimes Unit and LAPD
- Used to support operations at 2014 Super Bowl in NJ & also applied at other Super Bowls.
- Helped officers locate likely suspects and construct cases for later prosecution.
- Tool can be used to determine which are and which are not human trafficking

SAFETY Act

- SAFETY Act designation and certification: encourages development & deployment of new and innovative terrorism technologies by providing liability protection.
- Originally aimed at small technologies
- Over 500 technologies approved thru SAFETY Act
- SAFETY Act extended to stadium liability protection
- Two large sports venues have been fully certified (Yankee Stadium, MetLife Stadium)
- Two others been partially certified (Citi Field, University of Phoenix Stadium – Arizona Cardinals)

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SAFETY Act

- Identifying the key components of anti-terrorism protection at sports stadiums is a basic step in aiding stadium operators to achieve a level of protection appropriate for SAFETY Act.
- The National Football League is currently working with its teams and venues to get each of these venues certified.
- MLB is also working on this.

SAFETY Act Project I - Overview

First SAFETY Act Project

- In July 2013, CCICADA completed a project aimed at identifying best practices for SAFETY Act Designation and Certification for sports venue security and at developing a resource guide to be used by the DHS Office of Safety Act Implementation (OSAI) for two primary purposes:

a) as a basis for application evaluation

b) guidance for applicants (venues, leagues, events) seeking SAFETY Act certification/designation

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SAFETY Act Project I - Overview

First SAFETY Act Project

- CCICADA's Guide for Best Practices in Stadium Security now on DHS OSAI website
- Downloadable from:

https://www.safetyact.gov/pages/homepages/SamsStaticPages.do?path=sams\pages\BPATS.html

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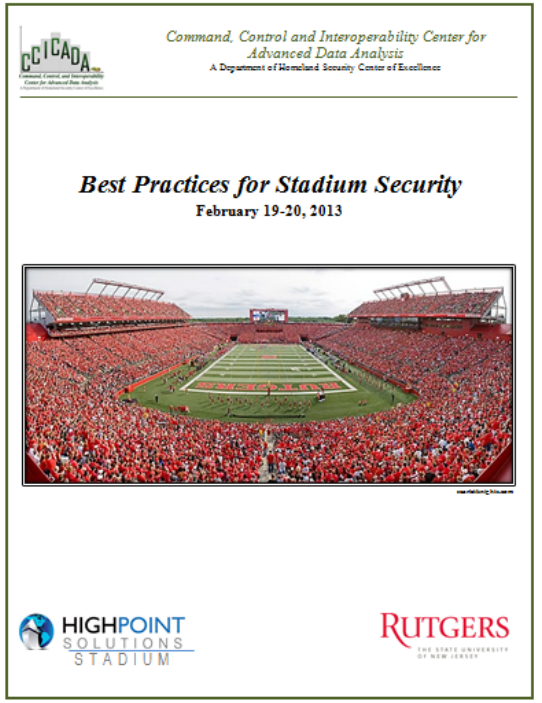
SAFETY Act Project I - Overview

Literature Review

Venue Visits

observational site-visits

Interviews [stadium security directors, league security directors, other sport security experts]



Workshop at Rutgers [venues, leagues, private firms, academia, government]

Testing Ideas [MetLife Stadium has been a testbed for us; involvement with other venues as well]

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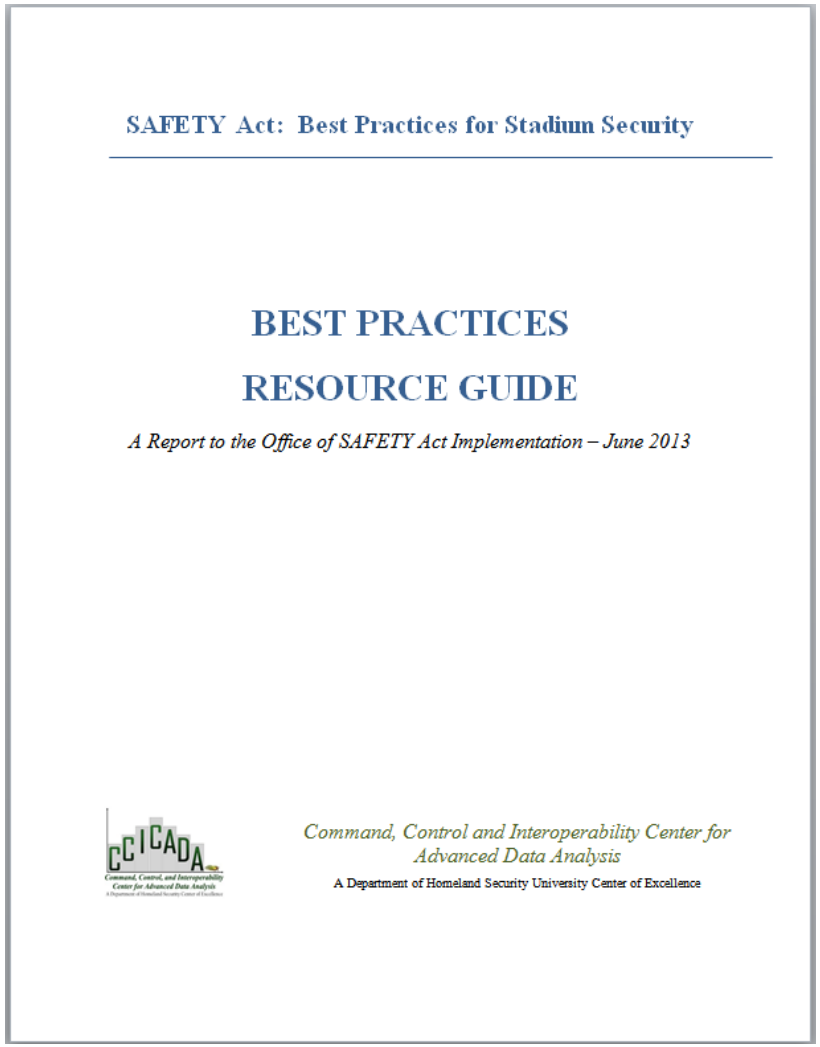
SAFETY Act: Best Practices for Stadium Security

BEST PRACTICES

RESOURCE GUIDE

A Report to the Office of SAFETY Act Implementation – June 2013

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<u>Best Practices Resource Guide</u>

FINAL Submitted to OSAI on July 31, 2013

522 pages

Final version benefitted from review from range of subject matter experts (venues, leagues, government, legal).

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SAFETY Act Project I - Overview

Best Practices Guide:

- ✓ Executive Summary &
- ✓ Introduction
- ✓ Chapters 2-6 = **KEY** aspects of stadium security

2 – Risk Assessment

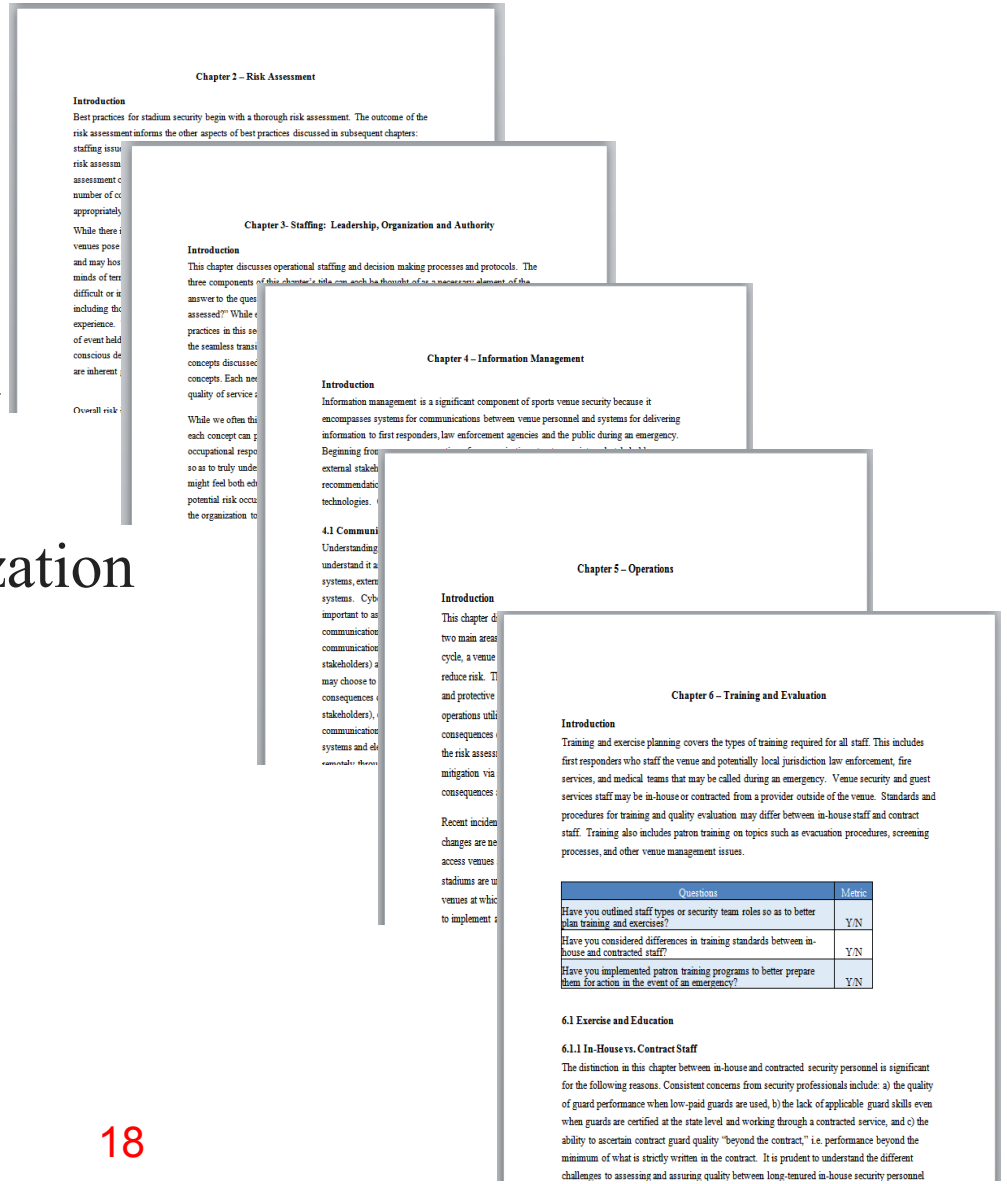
3 – Staffing: Leadership, Organization and Authority

4 – Information Management

5 – Operations

6 – Training and Evaluation

- ✓ Overlap of key components within/among chapters



Chapter 2 – Risk Assessment

Introduction

Chapter 3- Staffing: Leadership, Organization and Authority

Introduction

Chapter 4 – Information Management

Introduction

Chapter 5 – Operations

Introduction

Chapter 6 – Training and Evaluation

Introduction

Training and exercise planning covers the types of training required for all staff. This includes first responders who staff the venue and potentially local jurisdiction law enforcement, fire services, and medical teams that may be called during an emergency. Venue security and guest services staff may be in-house or contracted from a provider outside of the venue. Standards and procedures for training and quality evaluation may differ between in-house staff and contract staff. Training also includes patron training on topics such as evacuation procedures, screening processes, and other venue management issues.

Questions	Metric
Have you outlined staff types or security team roles so as to better plan training and exercises?	Y/N
Have you considered differences in training standards between in-house and contracted staff?	Y/N
Have you implemented patron training programs to better prepare them for action in the event of an emergency?	Y/N

6.1 Exercise and Education

6.1.1 In-House vs. Contract Staff

The distinction in this chapter between in-house and contracted security personnel is significant for the following reasons. Consistent concerns from security professionals include: a) the quality of guard performance when low-paid guards are used, b) the lack of applicable guard skills even when guards are certified at the state level and working through a contracted service, and c) the ability to ascertain contract guard quality "beyond the contract," i.e. performance beyond the minimum of what is strictly written in the contract. It is prudent to understand the different challenges to assessing and assuring quality between long-tenured in-house security personnel

SAFETY Act Project I - Overview

Best Practices Guide

✓ Levels of recommendation of important components:

strongly recommended

recommended

suggested

4.1.3.4 Posted Signage

Posted signage may contain information on expectations of patron behavior. It is ***strongly recommended*** that venues employ the use of temporary or permanent signage to assist in crowd management in and around the venue. It is ***recommended*** that permanent signage provide emergency contact information, incident or suspicious item reporting telephone numbers, evacuation routes and exits, and the location of emergency equipment. It is ***recommended*** that posted signage be used at the entrances for queuing and patron screening procedures, e.g. to identify objects that are restricted or prohibited from the venue. It is ***suggested*** that pictorial depictions be used on signs to help patrons understand and remember what items are permissible. Quick and easy comprehension and memory retention . . .

SAFETY Act Project I - Overview

Open Ended Questions	Anticipated Response
Describe how the threats identified impact/relate to the facility's vulnerability for each event type.	Detailed vulnerability assessment.
How were the threats prioritized in the risk assessment?	Description of risk assessment valuation of threats including estimated probabilities and consequences.
How were the consequences compared across the threats analyzed (e.g. how were human consequences compared to economic consequences)?	Description of comparison analysis conducted between consequences to support threat prioritization and risk management decisions.
How were the economic consequences calculated and what do they represent (venue loss, local economic loss, league loss, regional loss, etc.)?	Description on the criteria and formulas used to calculate the economic consequences.
What criteria were used for assigning consequence values?	Description of inputs used to assign values.
What do the consequence values represent?	Definition of what the value means.
What criteria were used for assigning vulnerability values?	Description of inputs used to assign values.
What do the vulnerability values represent?	Definition of what the value means.

Best Practices Guide

- ✓ The **body** talks generally about best practices, introduces **metrics**, and includes the recommendations
- ✓ **Tables of metrics –** quantifiable, yes-no, open ended questions

Questions	Metric
List the consequences of each threat by event type in terms of deaths and injuries.	#
List the consequences of each threat by event type in terms of economic loss.	$
List the consequence of each threat by event type in the time it will take the venue to recover to full operation.	t
Does the risk assessment identify environmental consequences?	Y/N
Does the risk assessment identify public health consequences?	Y/N
Was a fire safety assessment completed as part of the overall risk assessment?	Y/N
Was a medical response assessment completed as part of the overall risk assessment?	Y/N

SAFETY Act Project I - Overview

Chapter 6 – Training & Evaluation	
Strongly Recommended	Section
The venue security director establish a set of minimum competency standards for security practices.	6.1.2
Minimum competency standards be applicable to all employees at a venue.	6.1.2
All venue staff, including security staff, both contracted and in–house, guest services staff, maintenance staff, custodial personnel, parking staff, and food vendors receive some level of training designed by the venue security director.	6.1.3
Training include both an educational component and a testing component.	6.1.3
The results of training examinations be recorded and maintained as part of employee files.	6.1.3
Refresher training sessions be held regularly.	6.1.3
Pre-season training occur and at minimum include customer service training but ideally also include higher level incident response training for all levels of employees.	6.1.4
Patrons of a venue be educated on emergency procedures prior to the start of each event.	6.1.5
Recommended	
Security managers at sports venues know or be able to access their state's guard certification requirements, especially when hiring contracted security vendors.	6.1.1
Various levels of higher proficiency [beyond minimum competency] in security procedures be instituted.	6.1.2
The positions be clearly defined as to which positions this tiered set of [minimum to higher-level] practices applies.	6.1.2
Venues establish an introductory tour and assessment for contract guards so as to increase contract guards' familiarity with the venue and its unique features as part of a comprehensive training program.	6.1.2
Training be thought of as a constant activity that helps keep venue staff alert, informed, and engaged through the acquisition of new	6.1.3

Table of Recommendations: Final version of Best Practices Guide includes tables of recommendations.

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SAFETY Act Project II: Metrics/ Effectiveness

- More in-depth metrics for Best Practices for Stadium Security
- Project Winding Down: Best Practices Recommendations Report Ready for Review
- Focus on threats from “outsiders” and “insiders”
- Focus on inspection processes for outsiders
- Focus on credential checking for insiders
- Both broad and cover many topics from Project I

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SAFETY ACT II: Metrics/ Effectiveness

Inspection processes include:

- Patron access (hand-held metal detection wands, pat-down, walkthrough metal detectors, bag check)
- Monitoring parking structures
- Inspecting vendors, service providers, media
- Accessing loading docks
- Use of cameras and sweeps

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SAFETY ACT II: Metrics/ Effectiveness

Credentialing processes include:

- Ways to limit patron and employee access to areas
- Background checks
- Temporary and permanent badges and ID cards
- Smart card technology
- Computer and network authentication
- Protocols for returning credentials

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SAFETY ACT II: Metrics/ Effectiveness

Task 1: Metrics:

- Focus on metrics for inspection and credentialing
- Move to quantitative metrics beyond Yes/No
- Ways to develop quantitative metrics, how to weight metrics and combine them
- Define metrics easily interpretable and implementable by venue operators
  - Interviews, focus groups
- Report on metrics, scoring, weighting

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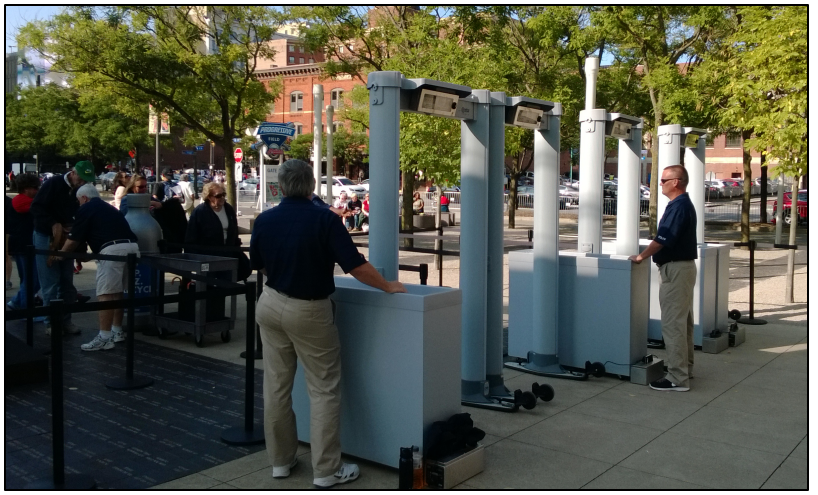
SAFETY ACT II: Metrics/ Effectiveness

Task 2: Effectiveness:

- How to tell if a security plan is effective?
- Ways to measure effectiveness
- Lessons from inspection and credentialing in applications other than stadiums –TSA, CBP, private sector security, TWIC cards.
- Report with recommendations for best practices for determining effectiveness of a sport venue security plan



SAFETY ACT II: Metrics/ Effectiveness

Task 3: Testing of Security Training:

- Testing after training can be real weakness
- Develop protocols for testing effectiveness of training in inspection and credentialing processes
- Compare current training protocols at agencies such as TSA, agencies protecting government buildings, security firms providing services to private industry, and how they test effectiveness
- Apply ideas to sports venues and develop sample metrics for testing training
- Develop guide for best practices of testing security training

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SAFETY ACT II: Metrics/ Effectiveness

Task 4: Comparing Test Results:

- Comparing test results across two different venues can be problem
- Want evaluations to be comparable
- Goal: develop an objective, mathematically-justified method for comparing scores across venues
- Best practices guide for comparing tests across venues

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SAFETY ACT II: Metrics/ Effectiveness

- ***Reviewers Wanted***: If anyone wants to get an early preview of our second SAFETY Act report, the best way is to offer to review it before submission to DHS.
- Please let me know if you would like to review the report – in early August.

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Early Work to Analyze Security Screening at Stadiums

- Work with MetLife Stadium
- Gathered data, tested ideas, developed and tested tools
- Tools built being applied to other stadiums in other leagues

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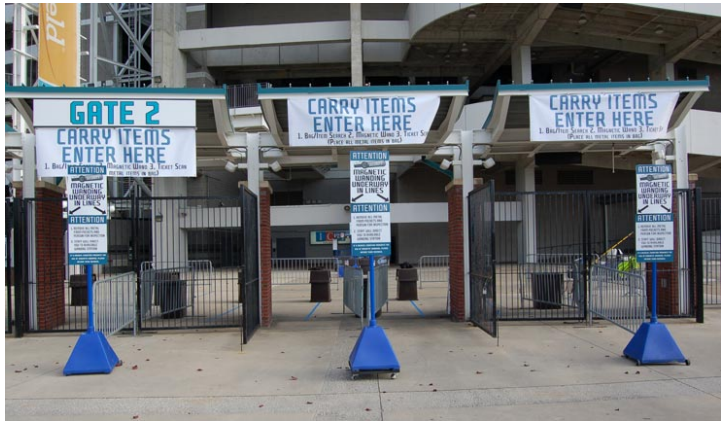
Stadium Security Inspection

- Recall that during Fall 2011, NFL asked all stadium security operators to perform 100% wanding of patrons.
- This didn't always work. Close to kickoff time, lines got too long.
- Began analysis of security procedures at MetLife Stadium
- MetLife used wands until queue got too long, then switched to pat-downs.
- Discussed ideas with NFL Security

MetLife Project Goals

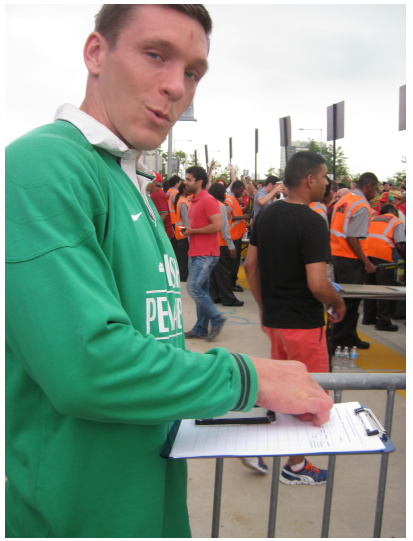
Improve: Effectiveness, Efficiency & Satisfaction

- Maintain and improve the ***effectiveness*** of patron inspection procedures and processes
- Improve **efficiency**: reduce resource costs (financial, time, staffing, etc.) associated with the procedures/ processes; and speed up throughput
- Maintain and improve patron ***satisfaction*** as enhanced procedures are applied to individuals attending MetLife events.



CCICADA-MetLife: Stage I

- Data Collection, Examination, and Analysis of:
  - Inspection times
  - Comparison of pat-down, wanding, and bag check
  - Anonymous comparison of different inspectors
  - Comparison of different gates
  - Physical design of pods
  - Ticket scanning process and related data
  - Arrival patterns of patrons over time



Data Collection

- Data were initially collected using two different methods: Observation and Video Analysis
- ***Initial Observation*** on site at 2011 football games plus four 2012 events:
  - 5/27: International Soccer – Mexico vs. Wales
  - 6/3: Hot 97 Summer Jam
  - 6/9: International Soccer: Argentina vs. Brazil
  - 6/16: Advance Auto Parts Monster Jam
- ***Video analysis*** from NFL event
- Required new Java application to facilitate the recording of inspection times from video provided by MetLife.

Data Analysis - SUMMARY

We evaluated the ***effect of several important factors on the inspection times***:

- **Inspection method** (pat-down, wanding, or bag check)
- **Location** (gate, pod, lane ~ inspector)
- **Time before event** (early wave vs. late wave)
  - Early wave = from time of gate opening until waiting line is cleared
  - Late wave = from time of crowd accumulation until event start
- **Type of event/crowd demographics** (soccer match, monster truck)

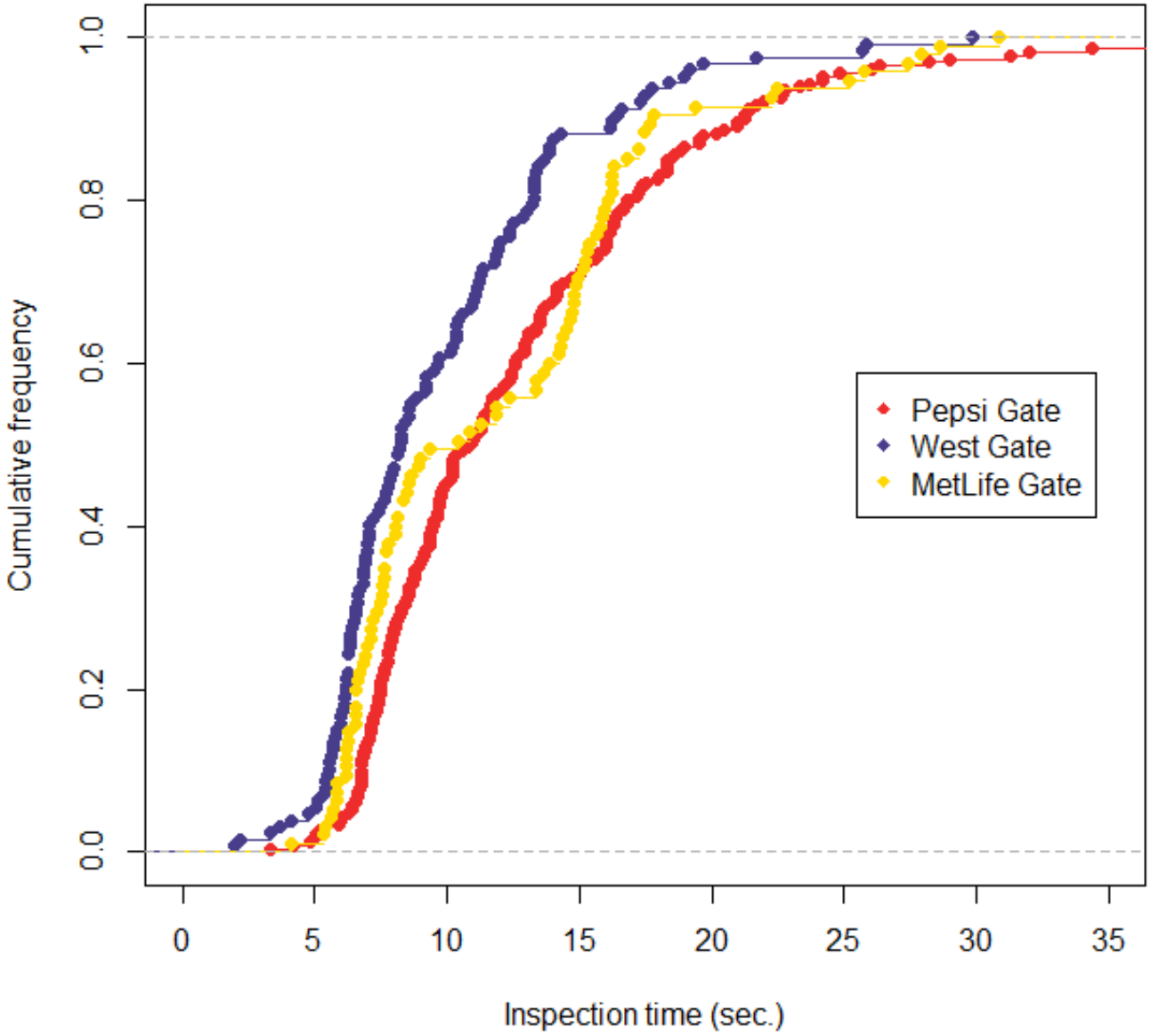
Data Analysis

- Since there is a lot of (random) variation, we analyzed the results using statistical methods.

CONCLUSIONS

- Inspection time distributions differ significantly according to:
  - Inspection methods
  - Gates
  - Times
  - Events
  - Inspectors
- ***Statistical analysis shows that the differences are much greater than can be explained by random chance.***

Wanding at Late Entrance at Pepsi, West & MetLife Gates



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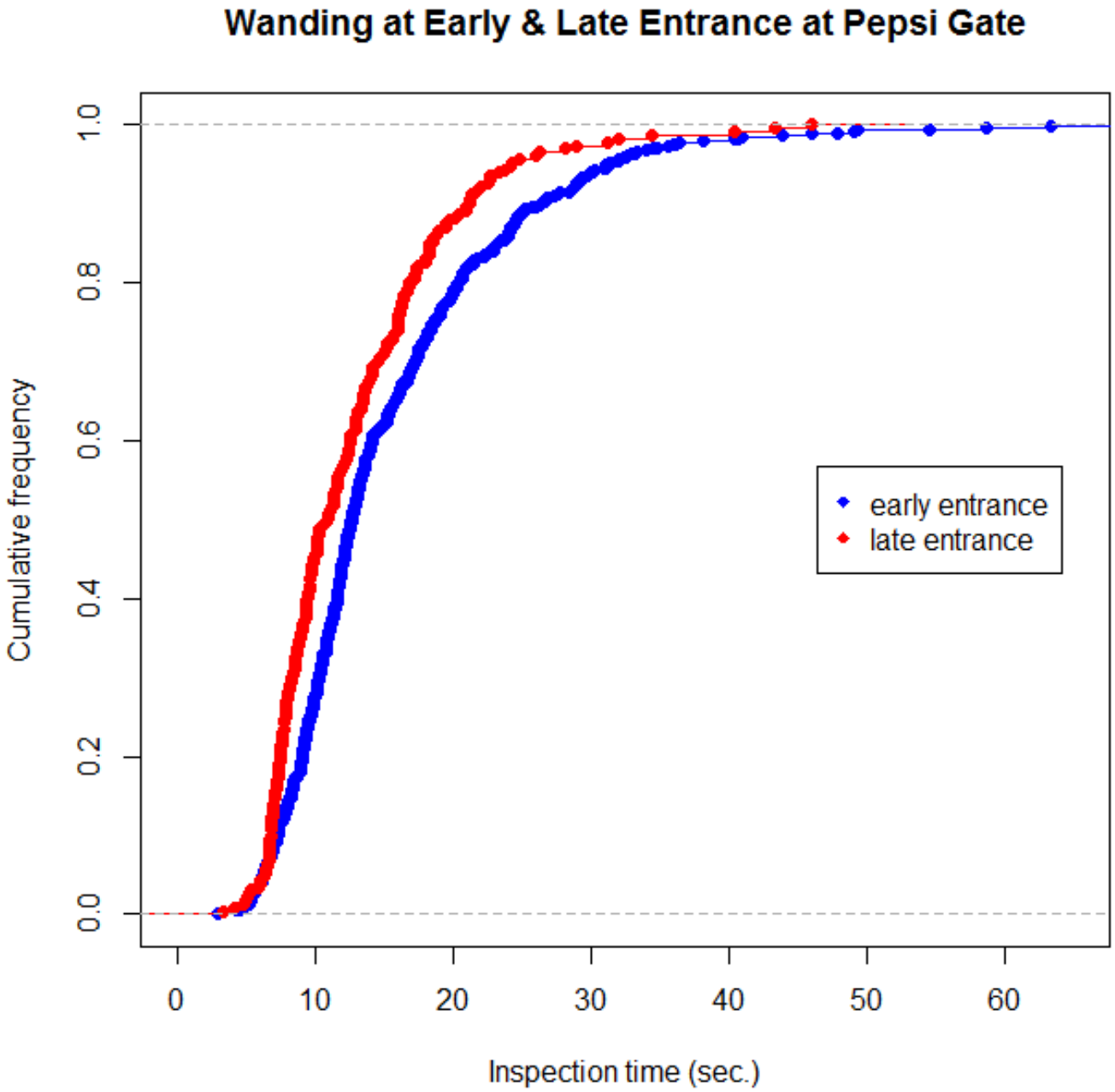

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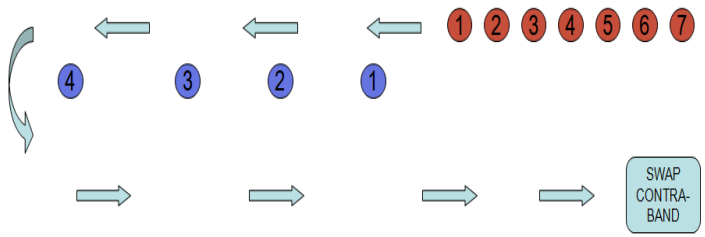
Data Analysis: Training

- We designed protocol for evaluating effectiveness of training wanders at MetLife
- We observed training of wanders and outcomes of our testing plan
- Findings led to more emphasis on training and changes in training and ***testing of training***



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CCICACA-MetLife Stage I: Conclusion

- Data Analysis and SAFETY Act work briefed to CEO of MetLife Stadium and other high ranking officials of the Giants and Jets.
- Also in Attendance: DHS Deputy Undersecretary Dan Gerstein and Director of DHS Office of University Programs Matt Clark
- High-level buy-in from both sides essential to success of our work

CCICADA-MetLife Stage II

- Because of issues with wanding, NFL started moving to walk-through metal detectors (WTMDs)
- Raised questions for stadiums, in particular MetLife:
  - Large capital expense
  - Require more space
  - How will they perform in bad weather?

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CCICADA-MetLife Stage II

- WTMD Issues:
  - How many WTMDs needed?
  - How many screeners needed?
  - What is the "throughput"?
  - Performance in bad weather?
  - Training

- Observed experimental WTMD use at MetLife in December 2012
- Repeated same type of analysis we did for wanding
- ***Preliminary conclusion: Small # of WTMDs unlikely to get everyone through quickly enough.***

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CCICADA-MetLife Stage II:

- Designed research project to ***develop a patron screening tool:***
  - Variety of inspection methods
  - Know for each the "throughput," the arrival rates at different times, the error rates, etc.
  - Have goals such as:
    - Getting everyone in by certain time
    - Not letting queues get too long – this produces vulnerabilities (and patron dissatisfaction)
    - Keeping maximum wait time low
  - Can you model which inspection process to use when and for how long?

CCICADA's Patron Screening Tool

- CCICADA developed a simulation model to evaluate the effectiveness of various patron screening strategies at MetLife stadium
- ***Usable at many different venues***
- The model can help answer many questions. For example:
  - How many WTMDs would be needed to ensure the queue clears by 5 minutes after game time?
  - If we have 60 lanes of wanding at a gate, how long will the queue get?
  - What would happen if 20 WTMDs were used, not 30?
  - What would happen if there were 40 lines using only wanding?

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Information from MetLife

- Ticket scan ("throughput") data for 14 home games (Jets + Giants)
  - Time at which each ticket was scanned (and which gate)
  - Note: No data on patron arrival rates
- Estimated average screening times per patron
  - Analysis of ticket data
  - Observations using stopwatches and clipboards – following up on Stage I work
- Discussions with stadium security personnel
  - Confirming assumptions and estimates
  - Feedback on the model and its output

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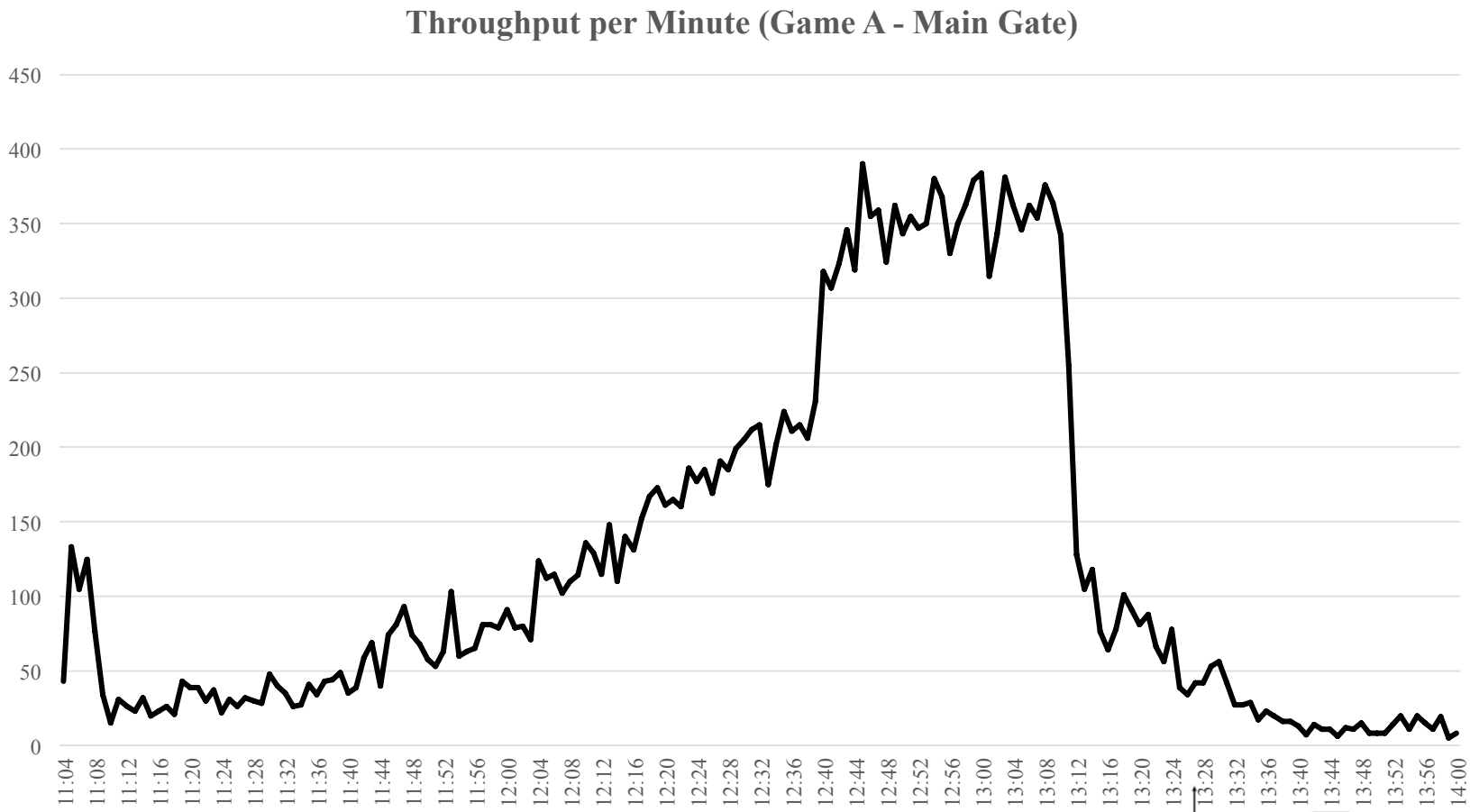
Sample (Ticket) Throughput Data



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Using CCICADA's Patron Screening Tool

- The parameters inputted into the model:
  - Arrival rates (which could differ for each game)
  - Number of lanes
  - Wanding times (these and other times could depend on type of clothing worn, e.g., function of weather)
  - Pat-down times
  - WTMD times
  - Number of patrons in line before switching screening processes
- Model allows you to use any numbers that make sense for your arena.
- The user can specify which screening method (or combination of methods) to use.

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Screening Tool Output

- The screening tool output file includes the following; each can be used to make decisions about screening policy:
  - Total arrivals
  - Total arrivals at kick-off
  - Max number of patrons in line
  - **Number of patrons in line at kick-off**
  - **Line "clearance" time**
  - Screening switch time
  - Number of patrons inspected by each method
  - **Max waiting time per patron**

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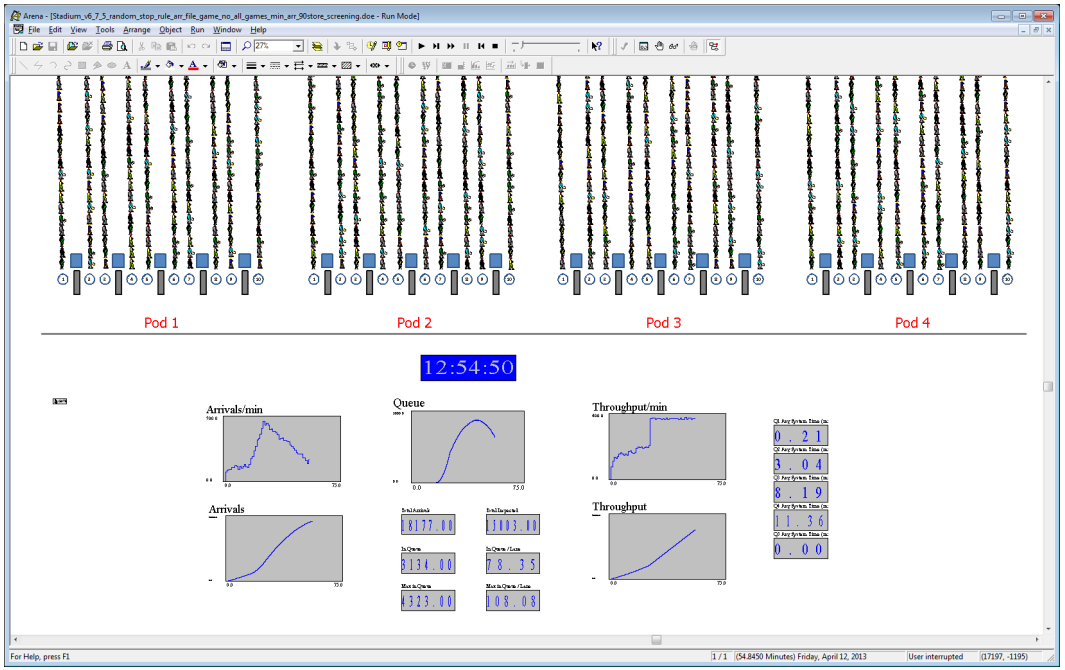
The Simulation Model

Most of the parameters can be obtained by ***choosing a representative game***

- Parameters
  - Arrival rates
  - Number of lanes
  - Wanding times
  - Pat-down times
  - WTMD times
- Screening Strategy
  - Switching inspection type (Y/N)
    - Number of patrons in queue to switch the process, or
    - Time of switch
  - Does phase 2 include randomization? (Y/N)
    - Ratio of patrons in each type of inspection in the randomization



The model output file includes

- **In Queue @ kickoff**
- **Queue clearance time**
- **Max Waiting Time per patron**

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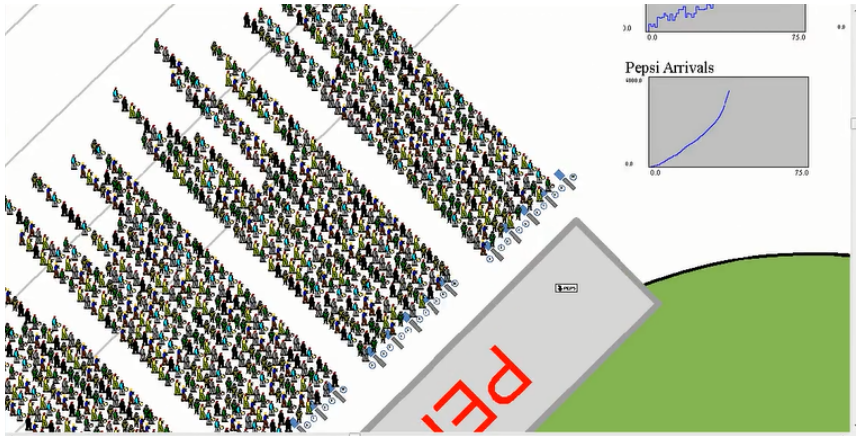
CCICADA's Patron Screening Tool

Simulation of Patron Screening

Visual of the SIMULATION MODELS

Multiple Gates

alper-AllGatesVideoMetLife5-2-13.avi



alper-SingleGateVideoMetLife5-2-13.avi

Single Gate

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CCICADA-MetLife Stage II Cont'd

Simulation Results

- The model was first used in 2013 to determine if MetLife stadium could switch to WTMDs for screening patrons.
- A switch to WTMDs would involve a serious investment, so it was important to make the determination BEFORE purchasing the walkthroughs.

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CCICADA-MetLife Stage II

Simulation Results

- Goal: get patrons in by 5 minutes after kickoff; other goals can be modeled
- Compared new procedures to the "***base case***": wand patrons until queue gets too long, then switch to pat-downs.
- We compared queue clearance times with various numbers of WTMDs to the base case.
- Model clock starts at 0 at 60 minutes before kickoff, so ***goal is to clear queue by 65 minutes***

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WTMD Scenarios (Queue Clearance)

No	Game Time	Queue Clearance Times as function of Number of Lanes					
		Base Case (*Wanding & switch to Patdown*)	Magnetometer Scenarios (Number of Lanes)				
		40	20	25	30	35	40
1	9/16/12 1:00 PM	64.65	97.76	83.57	72.18	63.19	56.57
2	10/7/12 1:00 PM	72.79	113.38	95.87	81.07	72.39	64.66
3	10/21/12 1:00 PM	68.67	108.49	92.53	82.13	71.48	65.03
4	11/4/12 4:25 PM	66.80	114.18	94.48	79.75	71.21	61.03
5	11/25/12 8:20 PM	72.40	111.95	94.56	82.52	74.22	65.96
6	12/9/12 4:25 PM	75.40	118.88	99.42	85.81	76.06	67.32
7	12/30/12 1:00 PM	82.67	128.82	108.36	95.27	85.81	76.99
8	9/9/12 1:00 PM	65.46	108.92	89.23	77.64	67.33	58.04
9	9/30/12 1:00 PM	71.33	111.08	94.26	83.39	74.11	65.91
10	10/8/12 8:30 PM	60.80	94.76	76.65	58.19	55.00	55.00
11	10/14/12 1:00 PM	66.50	109.20	91.91	79.01	65.45	55.00
12	10/28/12 1:00 PM	70.82	112.12	93.47	81.09	69.53	61.86
13	11/22/12 8:20 PM	65.94	93.41	79.52	55.12	55.00	55.00
14	12/2/12 1:00 PM	64.45	105.51	91.92	77.06	55.00	55.00

Worse than the Base and does not meet the goal

Similar to Base or better, but does not meet the goal

Meets the goal

Goal: Queue clears by 65 minutes

CCICADA's Patron Screening Tool

Wanding Only?

- After determining that a switch to WTMDs would not be feasible unless very large investment, it was asked if screening could be done with wanding only.

- (This in contrast to the base case of wanding + switch to pat-downs when queue gets too long)

Wanding Scenarios (Queue Clearance)

No	Game Time	Queue Clearance Times as function of Number of Lanes						
		Base Case (*Wanding & switch to Patdown*)	Wanding Scenarios (Number of Lanes)					
		40	40	45	50	60	65	70
1	9/16/12 1:00 PM	64.65	91.83	85.46	78.72	67.61	63.43	59.56
2	10/7/12 1:00 PM	72.79	104.55	96.69	86.55	73.98	69.97	65.82
3	10/21/12 1:00 PM	68.67	103.11	94.35	88.52	77.30	71.98	68.17
4	11/4/12 4:25 PM	66.80	111.94	102.07	92.64	78.95	73.86	69.69
5	11/25/12 8:20 PM	72.40	102.94	95.45	88.15	77.39	72.30	67.48
6	12/9/12 4:25 PM	75.40	111.56	103.53	94.26	80.69	76.09	71.61
7	12/30/12 1:00 PM	82.67	119.38	109.03	100.35	88.71	83.35	79.42
8	9/9/12 1:00 PM	65.46	93.13	84.28	77.64	64.91	59.51	55.49
9	9/30/12 1:00 PM	71.33	101.42	93.34	87.16	75.60	70.17	67.80
10	10/8/12 8:30 PM	60.80	90.41	81.26	71.97	55.00	55.00	55.00
11	10/14/12 1:00 PM	66.50	101.49	94.04	86.43	72.00	64.73	58.91
12	10/28/12 1:00 PM	70.82	97.41	89.63	81.85	69.08	62.82	59.68
13	11/22/12 8:20 PM	65.94	90.16	82.40	74.39	55.10	55.00	55.00
14	12/2/12 1:00 PM	64.45	89.57	78.49	71.87	55.00	55.00	55.00

Worse than the Base and does not meet the goal

Similar to Base or better, but does not meet the goal

Meets the goal

Goal: Queue clears by 65 minutes

Flexibility of the CCICADA Tool

- The process for doing analysis at other venues is straightforward.
- For the specific venue, one needs to determine the appropriate fixed parameters and construct an arrival function for specific events for which they have data.
- By considering different screening protocols and varying the number of screening lines, one can do what-if experiments for the specific venue.

Randomization

What if you Cannot Get Everyone through with WTMDs (or Wanding)?

- Randomization is a possible policy.
- Various ideas:
  - Select some patrons for WTMDs and others for pat-down – at random
  - At some point, randomly select lanes to shut down WTMDs and start pat-downs
- CCICADA's inspection tool allows us to test any of these policies too

Other Features of the CCICADA Simulation Tool

- Some of the new features being worked on:
  - Additional WTMDs can be rolled out during inspection if lines get too long
  - Additional WTMDs can be rolled out at prescribed time based on planning for arrival rates and minimizing staff time
  - Reversing inspection and ticket scanning to gain information about patrons
  - Extra perimeter for bag-check
- Plans for beta testing with Cleveland Indians

CCICADA-MetLife Stage III

Continuing Work on WTMDs

- MetLife decides to invest in WTMDs
- New experiment with WTMDs in Spring 2014
- CCICADA met with MetLife to help design the protocol – how many screeners per WTMD, roles of the screeners, physical arrangement of the screening
- CCICADA observed physical set up a few days before experimental use
- June 10, 2014: experimental use of WTMDs at main gate during soccer match Portugal vs. Ireland

CCICADA-MetLife Stage III

Continuing Work on WTMDs

- Game Day Observations at Soccer Match, Concert, Football Games, etc.:
  - Observe training and implementation of training: Supposedly easier to train than wanding
  - Calculate throughput
  - Observe and comment on problems observed
  - Calculate throughput at other gates that used wanding followed by pat-downs
  - Compare throughput from both methods
  - Data analyzed and results shared
  - Leads to plans for new tests
- WTMDs have been rolled out, but protocols for their use still being developed – with our help

Standards for WTMDs

- Standards go back to NILECJ 0601.00 (1974)

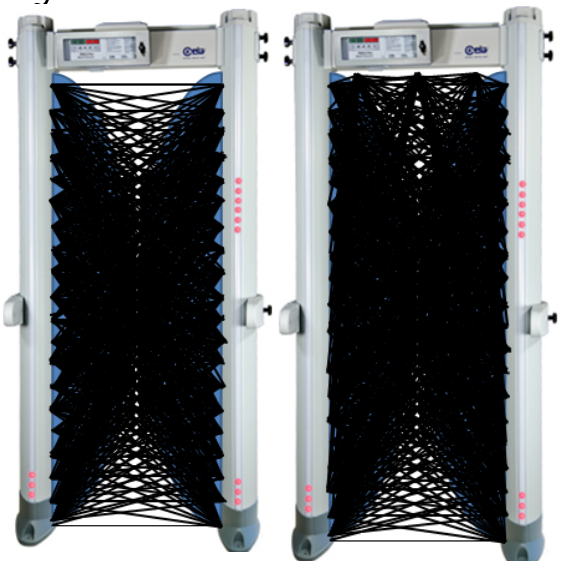
Test kit with standard test items

Visit to CEIA USA Headquarters

Learned about features of CEIA WTMDs:

- Security levels (1 to 5), sensitivity levels for each security level (0 to 99)
- Default sensitivity level for each security level

- Each NILECJ Security Level has additional sensitivity settings ranging from 0 to 99 on the CEIA machines.
  - Level 1: Sensitivity default setting 15
  - Level 2: Sensitivity default setting 32
  - Level 3: Sensitivity default setting 40



Visit to CEIA USA Headquarters

Learned about features of CEIA WTMDs:

- Weatherproofing
- Chip cards for changing security levels and other functions; 20 different functions can be changed
- User and SuperUser programming levels
- Up to 128 “coils” or “channels” for point-to-point readings that are fed to detection algorithms
- Calibration for wind
- Tamper-proof covers over control panel an option
- Random alarming feature
- Photocells for pacing patrons and counting
- Networking for fast changes and data gathering
- Advanced technology: stored profiles

Visit to CEIA USA Headquarters

Some opinions and recommendations offered by CEIA:

- Training is more important than the equipment
- Zone alarms on WTMDs are used less than 10% of the time to guide secondary wanding
- Security staff on the ground should only be changing alarm tone and volume, not more sophisticated functions
- Recommends that 3-4 people at each venue have SuperUser status, including 1 IT person

CEIA Robotic Tester

Invitation to Use it for Testing

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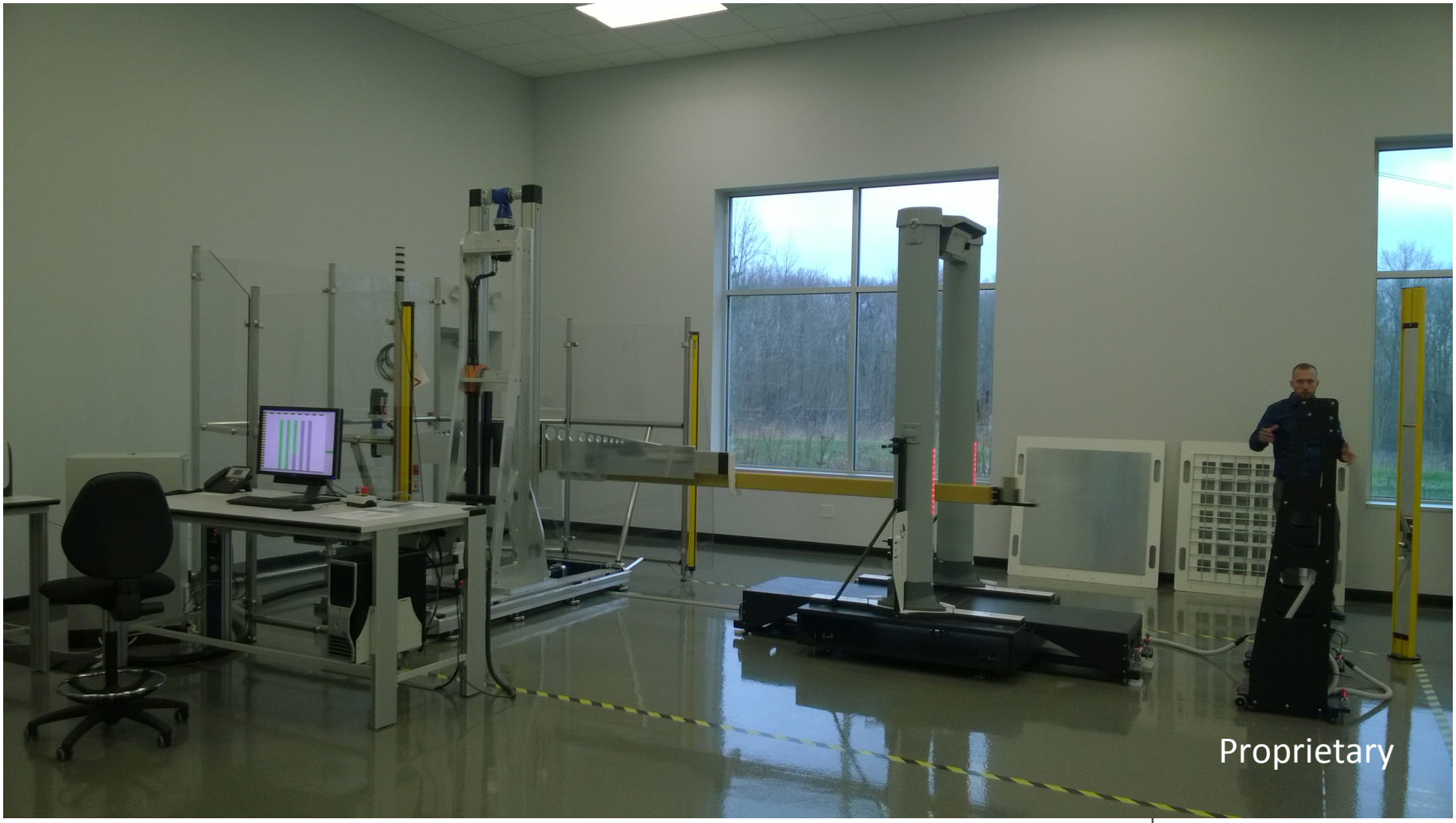
CEIA Robotic Tester



Invitation to Use it for Testing

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CCICADA WTMD Experiments: Purpose

- Understand how test conditions contained in WTMD standards can affect detection ***in practical use situations***
- Conditions include:
  - Test objects of different sizes and shapes
  - Different test object orientations
  - Different test heights
  - Different transit speeds
- Understand effects of different security levels and sensitivity settings
- Check differences between individual machines

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Experiments With WTMDs

- ***Goal is to understand performance of WTMDs in real settings, especially outdoors, as opposed to in idealized lab situations.***
- What is walkthrough performance at different settings?
- How consistent is this performance across settings, machines, venues?
- What is the tradeoff between the competing objectives of accurate patron screening and rapid patron throughput?
- How might the different features of brands of WTMDs affect what we propose as metrics and best practices?

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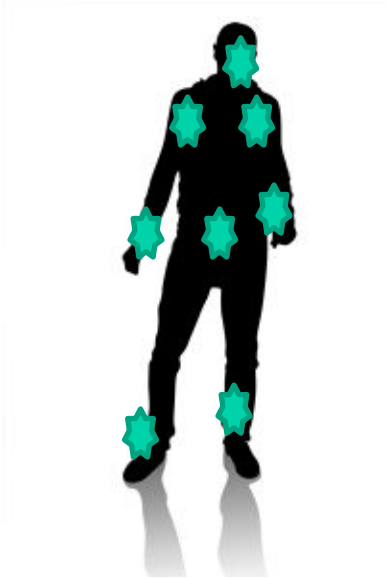
Experiments with WTMDs

- Does the security setting of 1 (or 2 or 3) give same detection/discrimination on each machine?
- How much change is there if we increase or decrease the sensitivity level?
- Is the performance consistent across machines at different venues?
- How does position or orientation of an object affect ability to detect it?
- How well do WTMDs do on standard test objects? On everyday test objects?
- How well do the WTMDs perform if they are not tested regularly, especially after being exposed to the elements?

Experiments with WTMDs

Test Factors and Values

- There is a large number of factors to be considered: type of item, location, orientation, security setting, sensitivity setting, etc.
- Test Object:
  - Knife
  - Gun
  - Keys
- Speed of person walking through metal detector:
  - 1m/s
  - 0.2m/s
- Object location:
  - Hat
  - Shirt sleeve (left or right)
  - Hand (left or right)
  - Behind belt
  - Inside sock (left or right)
- Object orientation



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Experiments with WTMDs

- Designing experiments is not easy.
- There is a large number of factors to be considered: type of item, location, orientation, security setting, sensitivity setting, etc.
- There are too many combinations to allow us to experiment with all combinations and finish in a reasonable amount of time.
- NIST/NIJ standard requires detection of threat object at least 19 times out of 20 trials; so many repetitions needed
- How many venues could afford time needed to repeat this for 40 or more devices (or 211 as in 49ers new park) for 3 or 4 threats and for different settings?

Experiments with WTMDs

- Designing the experiments has required use of a sophisticated design tool called *combinatorial experimental design* – originally developed by our partners at Bellcore/Telcordia Technologies/Applied Communications Sciences and adapted for use in a project we have done for DNDO.
- There is now a NIST ACTS code for this tool.
- One goal: develop guidelines for such experimental tests, best practices for tests, that would inform OSAI and venue operators.

Experiments by Rutgers Summer Undergraduate Students

Fisher

Indoors- CCICADA
Provided by RUPD

Garrett

Indoors – CCICADA
Provided by RUPD

CEIA

Outdoors
MetLife

Many thanks to Steve Keleman + RU PD!

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Experiments by Rutgers Summer Undergraduate Students

- Found difference in WTMD performance under different conditions.
- Varies per
  - Brand
  - Height & Orientation
  - Proximity of outside sources
  - Human gait
  - Speed

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Height and Orientation Results

- Summary of Medium test objects and Small A

Medium A

WTMD Brand 3

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	100.0%	100.0%	100.0%
B	100.0%	100.0%	100.0%
C	100.0%	100.0%	100.0%

WTMD Brand 2

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	100.0%	100.0%	100.0%
B	100.0%	100.0%	100.0%
C	100.0%	100.0%	100.0%

WTMD Brand 1

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	25.0%	100.0%	95.0%
B	30.0%	100.0%	100.0%
C	85.0%	100.0%	100.0%

Medium B

WTMD Brand 3

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	0.0%	5.0%	90.0%
B	0.0%	0.0%	0.0%
C	5.0%	5.0%	60.0%

WTMD Brand 2

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	100.0%	100.0%	75.0%
B	40.0%	60.0%	50.0%
C	100.0%	100.0%	75.0%

WTMD Brand 1

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	100.0%	100.0%	35.0%
B	10.0%	100.0%	25.0%
C	100.0%	100.0%	0.0%

Small A

WTMD Brand 3

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	35.0%	95.0%	100.0%
B	100.0%	100.0%	100.0%
C	50.0%	100.0%	100.0%

WTMD Brand 2

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A	100.0%	100.0%	100.0%
B	100.0%	100.0%	100.0%
C	100.0%	100.0%	100.0%

WTMD Brand 1

Orientation	Height E Trials Passed	Height F Trials Passed	Height G Trials Passed
A			
B			
C			

Red = failure

Speed Results

WTMD - Brand 1, Height E

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	70%	90%	60%
B	Medium B	100%	70%	50%
B	Medium A	80%	100%	100%
C	Medium B	100%	90%	80%

WTMD - Brand 1, Height G

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	50%	0%	80%
A	Medium A	10%	50%	50%
B	Medium A	70%	50%	70%
C	Medium A	0%	60%	80%

WTMD - Brand 2, Height E

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	100%	100%	100%
B	Medium B	100%	100%	100%
B	Medium A	100%	100%	100%
C	Medium B	100%	100%	100%

WTMD - Brand 2, Height G

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	100%	100%	100%
A	Medium A	100%	100%	100%
B	Medium A	0%	100%	100%
C	Medium A	90%	100%	100%

WTMD - Brand 3, Height E

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	100%	100%	100%
B	Medium B	100%	100%	100%
B	Medium A	0%	0%	0%
C	Medium B	100%	100%	100%

WTMD - Brand 3, at Height G

Orientation	Test Object	Speed 1 Pass	Speed 2 Pass	Speed 3 Pass
A	Medium B	100%	100%	100%
A	Medium A	50%	40%	20%
B	Medium A	0%	0%	0%
C	Medium A	50%	30%	20%

Red = failure

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WTMD Experiments: Discussion

- If these results hold, they may have implications for:
  - New WTMD procedures
  - How WTMD standards are written
  - How WTMD testing is done, e.g., new kinds of "testing robots"
  - New ways to design WTMDs
- ***Basic conclusion: present WTMD standards were not written for way walkthroughs are coming to be used in new settings***

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Observations on Use of WTMDs in the Field

- We have gathered data on use of WTMDs by observing them in use during real events.
  - Some stadiums use the default sensitivity setting, but change the security setting. Some didn't even know you could change the security or sensitivity settings
  - Some don't use all their WTMDs, but only number sufficient to deal with projected attendance
  - Some test the WTMDs daily, others hardly test
  - Some move the WTMDs daily
  - Some bolt the WTMDs down, others put them on wheels (some use wheels below, others fold wheels up)
  - Some (most) use battery power, others plug them in
  - Some network WTMDs

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Observations on Use of WTMDs in the Field

- Data gathered includes:
  - Fraction of people setting off WTMDs at different settings – used to compare settings/assess the device
  - Fraction setting off WTMDs who are not noticed and hence not wanded by screeners – used to assess performance of screeners or more effective ways to position screeners, to minimize missed alarms
  - Fraction of bags not opened or inspected – used to assess performance of screeners

Patron Screening: Observations Summary

Venue/Event	Date	WTMD/ Security Level	Alarm Rate	Alarm Miss Rate	Patrons Screened Per Minute
Soccer	6-10-14	CEIA/Lv 1	3%	50%	11.3/min
MLB	9-25-14	CEIA/Lv 2	9.8%	26.9%	10.7/min
NBA	10-20-14	Garrett/CH	31.9%	3.8%	5.9/min
NFL	11-3-14	CEIA/Lv 2	13.5%	7.1%	9.3/min

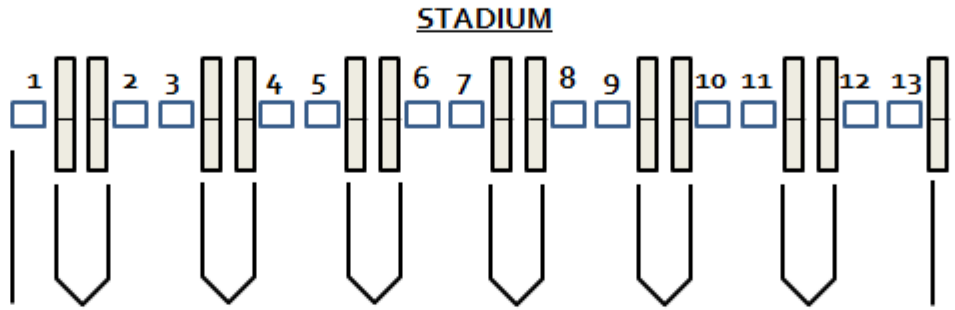
- WTMD settings matter greatly
- Greatly varying alarm rates
- Missed WTMD alerts not uncommon
- Screening rates vary

Some Comments on Field Observation Data

- Observations form a picture of current practice across venues
- Issue: Rate of Missed Alarms:
  - Inversely proportional to Overall Alarm Rate?
  - Possibly improved when throughput is slower
  - Could be subject of improved training
- Issue: Failed WTMDs
  - Different responses at different venues
  - Need for plans/instructions/training

WTMD Staffing and Placement

- Another area of interest – staffing, placement, etc.
- How many staffers are assigned per unit?
- Where should they stand?
- What should their responsibilities be?
- How many secondary screeners are needed? Is it one per WTMD? One per four WTMDs?



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Observations on Staffing, Placement

- Placement of person who views the alarm on a WTMD can actually interfere with throughput.
- Placement of ticket takers can interfere with throughput – saw examples where they were too close
- Some venues tried three staffers per WTMD, including one person whose job was to wand those who set off an alarm. Others had one wander per four WTMDs.
- Some screeners forgot to check bags
- Best design for a table for passing cell phones, keys, etc. is an issue – especially out of doors.
- Some stadiums use red-teaming to test staff

Effectiveness: Best Practices for WTMDs

- ***While WTMDs are thought of as the "Cadillac" of inspection tools, it is not sufficient to invest in one kind of defense.***
- ***A comprehensive access control counter-measure should not be limited to one technology. It should also not rely on an expensive price tag that forms a single line of defense.***
- Excessive capital investment costs may prohibit stadium operators from implementing additional control measures because of budgetary constraints.
- A total security plan will be optimal when there is a holistic balance among technology, process (e.g. policies), and people (e.g. training), and not solely a dependence on expensive technology

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Effectiveness: Best Practices for WTMDs

- Security settings for an event should be adjusted depending on threat assessment, dynamic ongoing risk assessments
- Use outdoors may require adjustment of settings depending upon weather/environmental conditions; test after recalibrating settings
- Testing of at least some of the devices is recommended before each event; randomization could be used
- Devices need to be on flat surfaces
- Wheels may raise issues with regard to SAFETY Act certification for users, but can make it easier to move out of the way in case of an evacuation

Effectiveness: Best Practices for WTMDs

- If battery powered, batteries need to be recharged and tested regularly and changed every few years
- Small number of people should be given SuperUser credentials (to change many settings); one person should be from IT staff
- For ordinary employees, limit changes to small things like volume of alarm.
- Use photo cells to change walkthrough lights from red to green.
- Use modeling and simulation to determine number of WTMDs needed
- If networked, cyber security needs to be taken into account

Effectiveness: Best Practices for Patron Inspection – not just WTMDs

- The security program must include a layered defense for access control and incorporate other security measures to detect, delay, deter, prevent, and mitigate contraband from entering the premises that may be used to perpetrate a potential destructive act.
- ***It's not just WTMDs.***
- What type of technology is being used (visual inspection, pat-down, wand, walkthrough, randomization, hybrid)?
- Has the technology used been certified (SAFETY Act certified, NCS4 or SMA awarded)?

Effectiveness: Best Practices for Patron Inspection – not Just WTMDs

- What are some of the technical aspects of the current WTMD technology setup (fixed vs. mobile, direct AC power vs. battery, networked vs. stand-alone, unit failure alarms go to whom, programming and calibration)?
- How are environmental and threat conditions taken into account?
- How often is the technology tested, the batteries charged?
- What kind of secondary screening is done?

Effectiveness: Best Practices for Patron Inspection – Not Just WTMDs

- How is evacuation planning affected by new inspection processes?
- What is the staff assignment per unit, including supervision?
- What training is given (classroom, video, performance metrics)?

Selection of Observations Surprising to Some

- **Cyber-physical systems**: Physical systems increasingly run by cyber systems. Dangers of hacking into those systems.
- We can already hack into a Prius (or Jeep) and make them do things the driver can't control. Nightmare scenario: Hacking into a car in the parking lot

Credit: ctvnews.ca

Selection of Observations Surprising to Some

Car Hacking in the Parking Lot

- 2013: Miller (Twitter) and Valasek (IOActive) demonstrated take control of Toyota Prius and Ford Escape from a laptop.
- They were able to remotely control:
  - Smart steering
  - Braking
  - Displays
  - Acceleration
  - Engines
  - Horns
  - Lights

Credit: npr.org

Selection of Observations Surprising to Some

- Having a venue invite a **security expert from another venue to visit and observe** security procedures could help your venue avoid carelessness or suggest new concepts.
- Issues in implementation of **WTMDs:**
  - Mobility: placing on wheels and the impact on effectiveness and certifiability;
  - Power source – battery or wire;
  - Future development of "wider" WTMDs allowing several people side by side might help throughput and take advantage of theoretical tools such as "combinatorial group testing"

Selection of Observations Surprising to Some

- **Innovative uses of social media**: Surprisingly, some of the stadium security officers interviewed were not aware of the extensive use of social media by their own stadiums, e.g., in **developing "apps" that would benefit patrons and increase communication with them**.
- **Sharing with Nearby Venues**: Right now, venues generally do not share software or hardware. Could they? Could they share WTMDs? Could there be multi-venue CCTV monitoring centers? It could save them funds. However, are there vulnerabilities resulting from this?

Selection of Observations Surprising to Some

- **Rotation of screening jobs** to maintain effectiveness. The use, and therefore the effectiveness, of some security procedures, such as wands for metal detection, is very inconsistent, varying from screener to screener. It can also **degrade for individuals, as they get tired or bored.**
- **Food security** is an issue addressed with widely varying degrees of effectiveness and thoroughness. Effective measures can be as simple as putting out **condiments in packets**, rather than large dispensers that make targets of opportunity for chemical or biological agents.

Selection of Observations Surprising to Some

- **Information** about the physical facilities at a stadium is often **available to the public**, e.g., when new building plans are filed. This could be a serious vulnerability.
- Background checks for employees are a key component of a stadium security plan. But it is very difficult to find out about **changes in background after an employee has been hired**. How does one find out about new problems with the law, for example? Could repeat of background checks in a randomized way be useful?

Selection of Observations Surprising to Some

- Domestic violence/workplace violence: **Disgruntled spouses** and others can be a problem. Does the stadium obtain information about restraining orders that employees are served?
- Do employees **receive a copy of an emergency plan**? Are they **required to return it** when they leave employment? Do they receive it electronically and, if so, how can we be sure they do not make and/or maintain a copy?

Selection of Observations Surprising to Some

- Does the venue have a cyber security plan in place to support the **protection of a technology-based access control system?**
- **Unusual nearby facilities offer threats** that need to be considered. An obvious one is a transportation hub, but less obvious ones are nearby hotels where unusual behavior by guests that might be observed by hotel security is something that should be shared with the stadium.

Selection of Observations Surprising to Some

- **Large crowds exiting a stadium present a vulnerability**. Monitoring and sweeping outside areas where large numbers of fans are likely to congregate or pass through after an event is recommended.

- **An incident inside a venue might be intended to lure people out** en masse, to an area where it is easier to inflict mass casualties in an unscreened, open area outside the venue.

Selection of Observations Surprising to Some

- **A metal fence surrounding stadium with large slots can present vulnerability**. At some stadiums, we heard about umbrellas passed through from outside. Could there be more dangerous things?
- One venue reported that a patron was found walking around with a shirt that said "security." He reported having found it lying around. **Secure your "uniform" and ID.**

Selection of Observations Surprising to Some

- **Training for the credentialing program is important**. The employee holding the credential as well as access control personnel should be trained in credential recognition, areas of access control, and the resolution of access control issues

Our Conclusions Given Widespread Visibility

- In addition to CCICADA Best Practices Manual on DHS OSAI website
- We briefed many of our conclusions to:
  - NFL Security Summit June 2014.
  - Congressional Subcommittee on Emergency Preparedness, Response and Communication of the House Committee on Homeland Security
    - Theme: "Mass Gathering Security: A Look at the Coordinated Approach to Super Bowl XLVIII in Newark, New Jersey and Other Large Scale Events."
    - Director of Security at MetLife also testified there; talked about impact of CCICADA's work

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Engaging with the Academic Community

- Engaging with the academic community can lead to some "outside the box" ideas
- A fresh set of ideas
- A fresh set of eyes

Source: Improvingpolice.wordpress.com

Components of Successful Relationships with Venues

- Openness to having academic folks around
- High-level buy-in from the team/venue/university
- Willingness to educate university researchers (faculty and students) as to processes and problems
- Each venue is different: sharing venue information
- Sharing of data
  - Videos of inspection processes
  - Ticket scan data
- Access to facility
- Non-disclosure agreements
- Patience: Relationships take time to develop

Toward BIG10 Standards

Source: live4sportnetwork.com

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What is the PAC-12 Conference Doing?

- November 2014 visit to HQ of PAC-12 Conference in San Francisco
- Goal: Understand extent to which NCAA conferences are providing guidance to their teams on stadium security
- ***Findings from PAC-12 review – how do these apply to the BIG10?***

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What is the PAC-12 Conference Doing?

- General conclusions:
  - Leave most of stadium security to individual schools
  - Face challenge of different schools having different budgets and traditions
  - Plan to provide stadium security guidance in general terms
- Some teams still allow coolers; clear bag policy up to school
- Conference does not review individual schools' security policies
- ***What should/does BIG10 do?***

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What is the PAC-12 Conference Doing?

- No league-wide stadium security meetings; are considering them
- Little sharing with other conferences, though some between individual schools
- PAC-12 stadiums tend to be smaller than biggest ones like Michigan, Ohio State
- Don't have big problem with rowdy-ism, drunkenness
- Have family atmosphere and want to keep it that way
- ***What should/does BIG10 do?***

What is the PAC-12 Conference Doing?

- Conference championship game at neutral site: Levi Stadium (49ers)
  - To follow stadium protocols, most likely NFL protocols
  - Venue takes the lead on security
- Credentialing
  - Staff is credentialed
  - Vendors often non-profit organizations and little or no credentialing/access control
- ***What should/does BIG10 do?***

What is the PAC-12 Conference Doing?

- Drones an exception: have adopted conference-wide drone policy
  - No drones within 3 nautical miles from 1 hour before to 1 hour after game
  - Stoppage of play, safety of players/coaches/refs
  - Isolate area where drone lands in stands
- ***What should/does BIG10 do?***

Security and The Future for Conferences

- ***The Future: What will it be like for conferences 5 years from now?***
- Comments from PAC-12 VP for Operations:
  - More corporate
  - Conferences more involved in security matters and risk assessment
  - Expect at least minimum standards
  - Budgets still a major consideration

- ***<u>What is the view from this group?</u>***

Other Security Areas for BIG10 to Consider

- Event re-admittance policies
- Training protocols
- Aircraft flyover, flight path restrictions
- Inspection exemptions for big donors
- Others . . .

Further Information

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CCICADA's Best Practices for Stadium Security – Manual on DHS Office of SAFETY Act Implementation website at:

https://www.safetyact.gov/pages/homepages/SamsStaticPages.do?path=sams\pages\BPATS.html

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