

SYColeman/L-3 Communications

Systems Engineering & Modeling Approach for Mass Transit Security

Mark Falkey
001 703 412 5250 mark.falkey@sycoleman.com
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First Principles

Mass Transit (Rail and Subway) Security can be assessed and improved through the application of computer Modeling and Simulation and Systems Engineering Disciplines.

Properly applied, these disciplines yield a process that will recommend specific systems to improve the security of mass transportation with quantifiable results (analytical rigor).

This process is exportable to many venues.

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"Old School" Design

- Expert design **OPINION**
 - Relies on the expertise and opinions of one or more persons recognized as experts in the field
 - The result of this process can be biased or unbalanced depending on the expert's knowledge
- Standardized design **CHECKLIST**
 - New security systems are designed to resemble old security systems based on a series of standards developed through extensive peer review
 - These standards meet the legal requirements of "Due Care," but features are included in the system without particular regard to changing conditions
 - Compliance with regulations is easily verified and can be implemented by non-experts
 - This design permits refinement of the system over time through trial and error, and a change in one system dictates the same change be made to all like systems governed by the given set of standardizations

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And here's what happens...

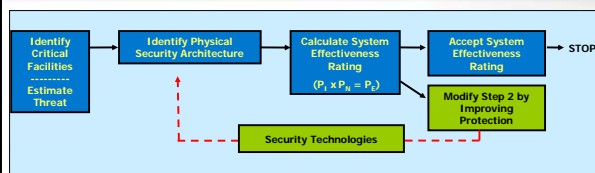
On 12 January 1981, shortly after midnight, Muniz Air National Guard Base, located at the International Airport at San Juan, Puerto Rico, incurred approximately \$45,000,000 damage to ten A-7D aircraft and a single F-104 by eleven terrorists of the Popular Army of Puerto Rico.



The unit had received exemplary results on their physical security inspection.

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"New School"; Sandia ASSESS Model



•Computer model designed by Sandia National Laboratory to evaluate Department of Energy nuclear facilities and then adopted by the Department of Defense for security assessments

•New security systems are designed based on performance characteristics of the system's DETECT-DELAY-RESPOND components

•The Probability of Interruption (P_i) is a combination of factors that allows us to find the terrorist and disrupt him enough for the security force to get there before damage is done to a critical asset (Detect & Delay).

•The Probability of Neutralization (P_o) is defined as the security force's probability of success against the threat. (Respond).

•Best used for those security systems where trial and error is not acceptable

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Systems Engineering Approach

Any complex structure such as a mass transit system can be viewed as a "System of Systems."

This complex structure can be parsed into simpler building blocks for modeling purposes.

The Mass Transport systems studied were broken into four subsystems, or building blocks, which were exhaustive and exclusive.

These subsystems can be used to represent any mass transit system in the country.

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Assessment Blocks

Rail and Subways were divided into Four subsystems: Closed Station, Open Station, Controlled Track, and Uncontrolled Track. With these Four components, any rail system in the country can be modeled.



Closed Station (Underground)



Open Station (Above ground)



Controlled Track (Tunnel)

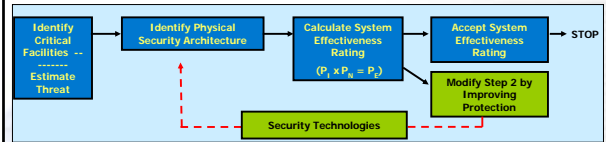


Uncontrolled Track

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What is The Systems Effectiveness Assessment?

ANSWER: A systems engineering approach to security assessment that uses modeling to measure the ability of a physical security system to protect critical facilities against a postulated threat.



WHY USE IT?

- Models physical security effectiveness
- Optimizes dollars spent on physical security resources
- Can analyze alternatives – effective for “What-If” drills
- Inexpensive to conduct – potential big return on investment

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Identify Critical Facilities

Define your asset to be protected. In our Anti-Terrorism scenarios, the humans in the mass transit system are the protected assets. Prevention of the loss of human lives is the goal.

- In the Station subsystems, we prevent the terrorist from detonating a bomb in a crowd of people.
- In the Track subsystems, we prevent a train from being de-railed by a terrorist bomb.



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Estimate Threat

Essential Input to run the model

Used multiple, but dispersed, single individuals carrying 10-pounds of explosives (TNT equivalent) and attacking separate locations. (Chem/Bio considered)

Same as seen in Chechnya, Madrid, and London

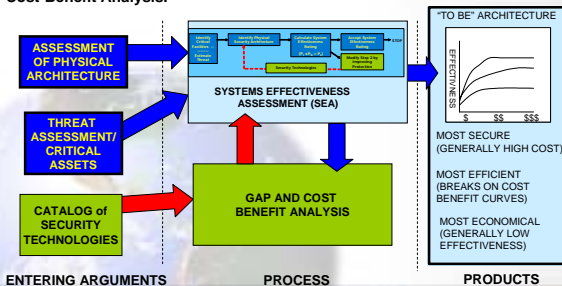
As per the Transportation Resource Board of the National Academy of Sciences (NAS)



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Methodology

Using an Assessment of the existing architecture, Threat, and Available or Hypothesized Technologies, the modeling produces Systems Effectiveness Ratings. The Ratings change as systems are added, allowing Gap and Cost-Benefit Analysis.



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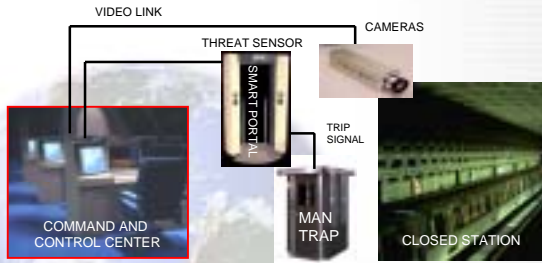
Sample Results

CONTROLLED TRACK (Subway)			
Model	Cost/Mile/Yr	P _E	Cost/P _E
Baseline		0%	
Posted Guard, 1 end	\$550,000	3%	\$183,333
Posted Guard, both ends	\$1,050,000	5%	\$210,000
Video Motion Detection w/ C2	\$9,500	73%	\$130
Passive Infra Red	\$5,418	68%	\$80
Posted Guards, both ends plus Video Motion Detection	\$1,059,500	73%	\$14,514

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CLOSED STATION (SUBWAY) SOLUTION

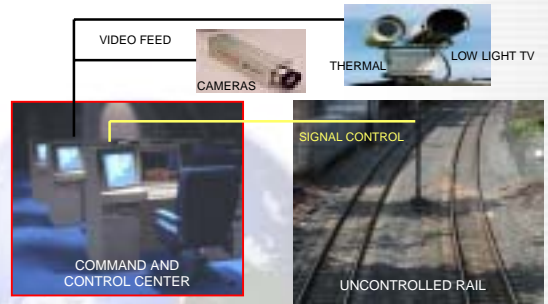
SOLUTION FOR CLOSED STATION IS ADD SMART PORTALS AND MAN TRAPS AT EGRESS POINTS. USE VIDEO MOTION DETECTORS. P_e IS 90% AT ANNUAL COST OF \$241,500. (BASED ON 20 DIFFERENT INGRESS POINTS)



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UNCONTROLLED RAIL (RAIL) SOLUTION OPEN TRACK

THE SOLUTION FOR UNCONTROLLED RAIL IS VIDEO MOTION DETECTION WITH A P_e OF 76% AND AN ANNUAL COST OF \$6,165 PER MILE



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What we learned...during our study

- The best detection system in the world is useless if it can't prevent the terrorist from detonating the bomb.
 - Historically, terrorists will detonate when they are detected or apprehended.
 - Portals and Video Detection Systems (Detect) are excellent assets but the Mantrap (Delay-Respond) with blast mitigating capabilities is also necessary for public safety.
- Fences cost a lot for the marginal amount of added security.
- Adding manpower is usually expensive and not effective.
- Smart video will improve effectiveness while reducing the manpower costs and is highly recommended.

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