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Prioritizing Like Nuclear Smugglers

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Abstract:

An individual or group attempting to smuggle nuclear material out of a country has a choice of what border crossing to use and how to do it. If it is possible to think like a smuggler and determine what preferences one would have, then we could protect those smuggler-preferred border crossings first. Thinking like a smuggler requires that one understand a host of things: who is likely to smuggle and what might they have obtained, where they might have gotten it, and where they would like to deliver or sell it, how they will attempt to pass customs, how they might travel on both sides of the border, and what influences they might have on customs officials. After collecting data on criminology, geography, and much else, it is necessary to paste the data together into scenarios to ensure that self-consistent smuggling plans are created. These lead to counter-smuggling opportunities. Smuggling by amateurs turns out to be of a different class than professional smuggling, and needs to be countered differently. This work also assists in formulating key policy questions useful to guide counter-smuggling efforts. This methodology was developed for DOE/NN-43 for assistance with prioritization within the Second Line of Defense program.

Introduction

Last year, DOE's Nuclear Transfer and Supplier Policy Division (NN-43) was given responsibility for establishing a new program, the Second Line of Defense (SLD). The goal of the program was to reduce the possibility of nuclear proliferation by cooperating with the Russian Customs Service to improve controls on nuclear smuggling from Russia. At the outset, NN-43 sought to establish a sustainable long-term plan for the program. One key element of the plan was the determination of how to most effectively use available funds to accomplish program goals. This paper describes the methodology that was determined at LLNL to determine the best use of equipment funding.

The SLD program is responsible for procuring nuclear detection equipment, such as portal monitors, for Russian Customs for installation at their international border posts. The methodology in this paper was developed by LLNL to set a firm theoretical basis for deciding where to install monitors. The methodology has been applied by NN-43 to establish priorities for new portal monitors among Russia's 300 border sites.

Countering nuclear smuggling is similar to countering smuggling in general, with one exception: a single shipment can be very significant. The amount of nuclear material that has to be smuggled to produce a single weapon can be as little as a few tens of kilograms. Given the

difficulty of stopping other forms of smuggling, e.g., drugs, arms, precious metals, or people, this is a daunting task. The standard worldwide customs procedure of only checking a fraction of the goods passing out of a country is clearly an inadequate means of blocking such a single shipment. Instead, technology, in the form of portal monitors and other detection equipment, needs to be used so that a screening rate for nuclear materials as close to 100% as possible can be maintained.

Formulation of Goals

For the SLD start-up problem, the situation is more related to a project planning task than to usual types of optimization. It is impossible, in the start-up phase of a multi-year program, to do complete coverage of all avenues of smuggling. It would be possible to wait until enough resources have been accumulated to install equipment everywhere needed, but since the need to solve the problem of nuclear smuggling is immediate, this is not a desirable solution. Instead, a subset of locations has to be chosen. Prioritization is needed to decide where should the first, second and later rounds of equipment installations take place.

There are several interesting aspects to the problem of prioritization of paths to equip with detectors. Consider what the goal should be in two different situations. The first situation is where the smugglers are unaware of the location of the equipment. In this instance, the goal would be to determine the most probable locations for smugglers of nuclear material to cross the border. After these locations were equipped, any smugglers using them would receive a surprise. But there is a second possibility. Assume that the smugglers are able to observe where the detectors are located. Portal monitors are quite large and visible. If the smugglers do this investigation, they can then avoid the covered locations, because full coverage is not initially possible. In this situation, the goal should therefore be to force the smugglers to develop substitute routes that will be as risky for them as possible. There are many other ways other than portal monitors that may lead to the interception of nuclear smuggling, such as informants or accidental discovery. The goal, in the situation where the smugglers avoid the border crossings with detection equipment, is to make this alternate risk as high as possible. Thus the two goals for the prioritization of start-up installations should be to cover the highest probability border crossings and also to cover the border crossings associated with lowest risk to the smugglers.

Compare these two different goals, where smugglers do not or do observe the detectors. In the first situation, smugglers will make decisions to minimize their capture risk by these alternate means. This means that the most likely border crossings for them are those connected with the smuggling plans that have lowest risk by alternate means. So the two criteria for choosing border crossings for equipment installation, 1) picking crossings that smugglers will prefer and 2) picking crossings that raise their risk of capture by alternate means, are very similar if not identical, provided that the smugglers choose their smuggling routes to minimize their risks. As will be discussed below, this is the case for professional smugglers. Putting detectors at border crossings that have the lowest risk for smugglers (in the non-detector-equipped situation) will address both criteria. There is no conflict between these two goal formulations.

It might be considered that smugglers do not only seek to minimize their risk of capture, but they also seek to minimize their costs. Thus, if one smuggling route has a high risk, but is cheaper to follow, it might be chosen in lieu of another with lower risk. This is true theoretically, but it is not significant for a practical reason. The expense differences between one route of smuggling and

another are small compared to the costs that are involved with capture of the nuclear materials by law enforcement. Route expenses need not be considered.

Thus we are faced with a need to determine how smugglers analyze their risks and how they minimize them. We need to do project planning for the smugglers. When this is done, we can then take the next step and determine how to best deploy the detection equipment to raise these smuggling risks as high as possible with available equipment.

Categories of smugglers

Before delving into the task of project planning for nuclear smuggling, it would be useful to examine what nuclear smuggling data is available. There have been many interceptions of radioactive and nuclear materials over the last eight years. Fortunately, all the intercepts of nuclear material have been either of very small quantities or of material not useful for a weapon, usually both. These cases are examples of what we call "amateur smuggling". The perpetrators typically were opportunistic thieves, who found some radioactive source unguarded, and pilfered it. Then, at some convenient time, they traveled abroad with the material and attempted to find a buyer. All the cases have involved individuals or small groups. There have not been any significant criminal gangs involved in such smuggling.

It is important not to use this data to determine how to deploy the detection equipment for the SLD program. If this was done, amateur smuggling would be thwarted. But there are additional possibilities. A study of law enforcement literature and other sources indicate that smuggling is conducted by two separate and distinct groups of people. One group is the amateurs, who, in nuclear smuggling, are represented by those apprehended already. They do not have a customer before they steal. They are not stealing and smuggling to order. They are stealing because the opportunity presents itself, and then they seek a market for the stolen material. These perpetrators are typically caught when they seek a buyer for the material, and someone reports their offer of stolen nuclear material to law enforcement, leading to arrest. Alternatively, a sting is set up by law enforcement. This type of capture would not occur if the smugglers had a market for their goods already set up. So there is a strong selection effect. Those caught are not the professionals.

According to criminology literature, the second group of people who smuggle are the professional smuggling gangs. These are bands of people whose livelihood is crime and whose specialties include smuggling. They are organized into a structure, ranging from informal unions to hierarchical systems resembling a modern corporation. There may be a system of rewards corresponding to rank in the hierarchy. All in all, a smuggling gang can closely resemble a corporation, except that the product it delivers is illegal.

Professional smuggling gangs are the organizations most capable of smuggling nuclear material at the request of a recipient. This is comparable to arms smuggling. In arms smuggling, a nation or an insurgent group might want some type of arms. They will not contact smugglers directly. There are many arms merchants around the world who can be contacted by those desiring illegal arms. The merchants act as brokers, and will involve smuggling gangs known to them to transport the arms from their source to the chosen destination. We should expect that nuclear smuggling would follow the same method.

Preventing Amateur Smuggling of Nuclear Materials

The first allocation decision to be made is how much equipment should be devoted to stopping amateur smuggling, which are the known cases, and how much to stopping professional smuggling, which, by analogy to arms smuggling, represents the greatest potential threat for proliferation and nuclear terrorism. It is not reasonable to ignore amateur smuggling. Any broker of stolen nuclear materials might want to deliver a sample of the material to the prospective customer before attempting the delivery of the main block of material. This sample delivery might take place through the same routes as amateur smuggling, as samples are typically small and easily carried by, for example, an airline passenger. The capture of the sample delivery person might lead to enough information to break the case and prevent any further possibility of those involved from fulfilling their goal.

A second reason that amateur smuggling needs to be checked is that smuggling can take place using couriers. In the drug smuggling literature, these individuals are known as "mules". They are non-professional individuals who are recruited by smuggling gangs to transport drugs across international borders. This mode of transportation has been popular for many years and continues to be used. If routes of amateur smuggling were not equipped to detect nuclear materials, then, for example, the nuclear components of a weapon could be divided up among multiple couriers, and then all delivered to a handler near the final destination. This is an easy method of smuggling, with the advantages of deniability and untraceability, and needs to be clamped down on.

Courier smuggling uses ordinary people taking ordinary trips. This means that, in the absence of any other information, a good indicator of smuggling likelihood is trip numbers. Putting detectors where they will screen the highest level of traffic will make most efficient use of them. Thus, for the allocation of equipment versus amateur smuggling, a traffic volume analysis is needed for ordinary passengers. This means that a tabulation of the number of person-trips going through different border crossings is needed.

Countering Professional Smuggling Gangs

Other modes of nuclear smuggling by professional gangs do not involve mules but instead have gang members following smuggling routes believed by them to be reliable. It would be strange for a smuggling gang to devise a new route for their initial attempt at nuclear smuggling. Development of a new route for smuggling is a risky undertaking as it may involve new people, one of whom may be an informant, new sensors, new law enforcement people and tactics, and much else. There would be little smuggling of nuclear material under any circumstances, as so little material is needed for a proliferation program, compared to the smuggling of other items. Gradual route development would therefore be unlikely. It would be expected that smugglers would use smuggling routes and connections already established for other smuggling, for example, arms smuggling or precious metal smuggling.

Thus, to determine the most likely smuggling routes, it would be possible to determine smuggling routes for these surrogate items. This can be done by combining information from two sources, one, crime reports related to this type of smuggling, and two, an evaluation of potential smuggling routes based on known preferences by smugglers. The first one of these is not available in large number or in great detail, but still a compendium of known similar smuggling attempts can

lead to checks on any routes developed theoretically. The second will be the basis for the prioritization.

To determine routes for smuggling from smugglers' preferences, those preferences need to be laid out clearly. There is a good amount of literature on professional smuggling of various sorts, and the choices related to how they choose their modes of smuggling can be distilled to a few rules. These are:

1) Maintain personal control of the smuggled item as much as possible.
2) Minimize the number of events that may go wrong, such as border crossings, contact with unknown officials, or stops at new locations.
3) Minimize the time involved in delivering the item.
4) Avoid low traffic regions and especially low traffic border crossings unless the officials there can be compromised.
5) Maintain the ability to react to new information and intelligence.
6) Maintain communications discreetly.
7) Minimize the number of different modes of transport required reloading, e.g., truck to airplane to boat, that could lead to exposure of the item.

The first conclusions relating to routes, or more properly, the transport mode choice related to routes, can be deduced at this point. Moving items on land leaves open the possibility of contact with law enforcement, so, if distances and destinations permit it, sea transport would be preferred, everything else being equal. Air transport is, of course, subject to intense scrutiny of cargo and luggage for bombs. Sea transport can be arranged for in several ways. Crew members could bring the material aboard as part of their luggage. Port employees could hide the material aboard a ship and port employees at the destination could retrieve it. The material can be hidden in a container and shipped out on a container ship. The material could be hidden on a truck and driven onto a Ro/Ro (roll-on/roll-off) ship.

There are typically few crew members, and examination of their luggage could be routinely done. Port employees are escorted when on shipboard, and in Russia, the escort is the Federal Border Service. However, containers or Ro/Ro trucks can be lost in the large numbers of them at busy ports. Thus, this is the preferred mode for longer distance smuggling. Control is maintained while on land if the container is shipped by truck from source to seaport, and the same is true for Ro/Ro trucking. There is no law enforcement presence at sea, and communications can be maintained easily. A truck can be redirected enroute to the port if something is learned by the smuggling gang immediately after the material is picked up. Similarly, the ports of choice would be those ports with the highest container traffic rate.

For shorter distances, trucks are the preferred mode for the same reasons. A truck can be stopped before it reaches the border post if a compromised customs official at that post is suddenly taken off the job and a new official is put in place. A truck does not have to be reloaded during the travel, and can be driven anywhere to deliver the item. Thus, the border sites that need to be protected as a first order of business are those high-traffic crossings that provide the shortest routes from source site to destination.

Other groups have made analyses of professional smugglers' preferences. These preferences have been deduced by the US Customs Service based on their own analysis of their historical records, and have also been determined on theoretical grounds by a customs anti-smuggling research group for the EU.

Developing Self-Consistent Scenarios

Besides the collection of preferred modes of transport, a few more sets of data have to be collected before scenarios can be put together. One of these is likely location for theft of nuclear materials. It is fairly well known where in Russia, and in other countries for that matter, nuclear material of interest to proliferators and terrorists is stored. While these sites all have some manner of protection, the Second Line of Defense program was created to back up these site security systems. It is a very difficult manner to rank these storage sites as to the likelihood of theft occurring. Many different factors play a role, and clear information on some of them is not readily available. Nuclear storage sites might be treated all equally as possible theft locations. They are not distributed uniformly, however, and the distribution of these sites gives a set of starting points for the scenarios.

Another set of information is likely destinations. The literature on proliferation is rich, and the same set of possible destination nations has not changed markedly for years. Thus, destinations can be denoted, and also prioritized by their likelihood to be seeking nuclear material. Further information can be developed on the type of nuclear material that might be sought by different potential proliferators. This information is used in the setting of standards for the detection equipment, so that the equipment provided by the program will be able to detect appropriate quantities of different types of nuclear material.

Thus, information on likely perpetrators and their mode of operation, preferred modes of transportation, sources, destinations and target materials can be collected. From this, some representative scenarios can be put together. The reason that scenarios are useful is that separate collections of data can be misleading. Some disconnects can arise and putting together scenarios allows a check for consistency to be performed. It also allows ancillary information to be brought in. For example, some regions are unstable due to armed insurgent activity. A smuggling gang would avoid these regions to reduce the risk of loss of their cargo, unless they originated in that region and had connections there. With a scenario, transport routes can be checked for such factors. Another check would be for available logistics. Russia has not had much time to improve their highway system and truck transport for long distances some through remote areas would not be preferred. A secondary choice of containers on railcars might be used instead.

After a scenario is constructed, it can be examined to see what changes might be made in it to further reduce the risks that a smuggler would encounter. The scenario can also be examined to see what changes might be made that do little to affect the risks. These changes provide information on what sites should be regarded as equivalent in priority.

Following the development of a set of scenarios, they would be prioritized on the basis of the priority of the destination. This leads immediately to a set of priorities for border crossing sites. The priority border crossings that emerge in some scenarios are individual border posts. In others, a set of equivalent sites will emerge. An example of this would be an area where there were a

number of roads crossing the border, all linking an important source site with a high priority destination, and all with comparable traffic. Since there is no clue that is available to further refine the ranking of these highway crossings, they have to be treated as equivalent at this stage in the analysis.

The scenario analysis allows information that is collected later to be integrated into the methodology rapidly and the priority of sites adjusted based on it. For example, learning of changes in traffic amounts, perhaps from changes in the economy, can be put into either the amateur smuggling priority list or integrated into the professional smuggling scenarios. Temporary fluctuations, of course, need to be avoided, but changes resulting from major economic developments can be incorporated easily. Opening of new border crossings, new ferry crossings, new capabilities at seaports, and so on can be similarly taken into account.

Other Factors for Prioritizing Border Posts

The methodology that has been outlined here is not the only consideration that has to be used in determining the final list of locations for border crossing equipment installation. Infrastructure considerations have to be evaluated. Some ports, airports, highway or rail crossings may not have the organizational infrastructure or the physical infrastructure to be able to use this type of equipment. Physical security can be lacking at a site, which makes the installation of detection equipment less useful. This type of information is not likely to be available in the literature, but would require a visit to the site to survey the physical condition and other factors. The methodology would be useful in setting up a list of potential sites for site surveys, and then the site surveys would filter out those sites that would not immediately benefit from the equipment. Hopefully, these sites would be the subject of renovations and other needed changes by the responsible agency, as they represent potential high priority smuggling routes, whether or not some type of infrastructure is in place.

There are, of course, site and budget considerations to take into account. It is not feasible to do half a site, and then later do the other half, as funds become available. A site takes considerable amount of work on installation, on the development of infrastructure, and the training and preparation of personnel to use the equipment. It makes better economic sense to allocate funds so a number of sites can be completely done, rather than partial completion of more. However, the priorities for the selection of sites in generated, for amateur smuggling by traffic surveys and for professional smuggling by scenario analysis, and then this selection needs to be tweaked for cost-effectiveness.

Equipment Selection

There are a number of considerations to be taken into account for an equipment selection for a chosen prioritized site. One is the need for standardization, so the customs service can train all its inspectors on one type of equipment and can minimize the supply of spare parts needed. Another is the need for reliability and nation-wide service availability, so that the equipment will have little down-time. There also has to be adequate sensitivity to detect a threshold level of nuclear materials. This threshold is set by national authorities.

Summary

A new methodology was developed by LLNL for use of the Second Line of Defense program under NN-43. The Second Line of Defense program has the difficult task of deciding where to place its initial purchases of nuclear detection equipment among the 300 border crossing sites in Russia. The methodology generates a priority list of border crossing sites. It is based on an understanding of the history and criminology of smuggling. The methodology takes into account that there are two generic types of smugglers, amateurs such as an individual who steals nuclear material from his workplace and tries to market it, and professional smuggling gangs, such as the ones engaged in arms smuggling. It develops a means for assessing preferred transportation modes, routes of travel and source and destination lists, which are used to construct representative nuclear smuggling scenarios. These scenarios allow for consistency checks. The scenarios in turn lead to the generation of the priority list of sites. The methodology has been applied to Russia, but could be applied to any nation.

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