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**The Terrorist Threat to Singapore's
Land Transportation Infrastructure:
A Preliminary Enquiry**

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ABSTRACT

The highly lethal attacks against land transportation targets in Madrid and London have sparked considerable amount of debate in Singapore about the terrorist threat to the local land transportation infrastructure. How real is this threat and what can be done to counter it? This is the central question addressed in this working paper.

While transportation targets in general have always been a terrorist favorite, in recent years there has been an increased emphasis on attacking soft transportation targets such as mass transit. There are several distinct reasons for this development, including the increasing difficulty of successfully striking other targets, the ease of producing large number of casualties, the panic-spreading universality of the city bus or metro car, economic impact on the afflicted state by crippling workforce mobility and deterring foreign investment and tourism, symbolic value, and an overall high probability of success and a low level of risk. Indeed, since 1991 more then 42 percent of terrorist strikes worldwide were directed specifically against land transportation, producing the highest casualty rates of any type of terrorist attack.

With regards to the threat to Singapore's transit system, analysis of JI's ideology and targeting patterns reveals an increasing preference for soft, Western, mass-casualty targets in Southeast Asia. But while Singapore's commuter transportation system fully encompasses all of these adjectives, the recently weakened JI currently lacks to capability to strike this type of target. Still, other adjacent threats exist including a possible attack by a home-grown terror cell, attempted suicides by deranged individuals, or the disruption of service via a wave of hoaxes by pranksters or terror group sympathizers.

Despite the relatively low level of threat, Singapore has made many preparations and preventive measures that other countries that have experienced surface transportation terrorism have identified as pillars of effective public transportation security. These essentially include prevention, effective response and timely mitigation, and psychological defence measures.

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The Terrorist Threat to Singapore's Land Transportation Infrastructure: A Preliminary Enquiry

Introduction

On 11 March, 2004, ten 5-10 kilogram bombs exploded on board four trains in three Madrid stations during the morning rush hour, killing 190 people and injuring over 1,400 more in what at the time was the ninth deadliest terrorist attack in world history. Then on 7 July 2005, three suicide bombers exploded their devices within 50 seconds of each other on three London Underground trains, with a fourth bomb exploding on a bus nearly an hour later. 52 people were killed and about 700 were injured in the most lethal terrorist attack in the history of the United Kingdom.[1]

Both Madrid and London have sparked considerable amount of debate in Singapore about the terrorist threat to the local land transportation infrastructure. How real is this threat and what can be done to counter it? This is the central question that this working paper will seek to address. First, the global trends in land transportation terrorism will be discussed, along with an analysis of the scope of reasons behind land transportation becoming an increasingly attractive terrorist target. Secondly, the paper will focus on threat assessment with regard to the possibility of an attack on transportation infrastructure in Singapore, with a particular focus on the al Qaida-linked al Jemaah al Islamiya (JI) organization, a group that had plans to attack the country's transportation infrastructure in the past. And finally, an overview of measures that could be implemented to mitigate the threat will be provided.

Trends in Transportation Terrorism

Transportation in general has been one of the most preferred terrorist targets, consisting of more then half of all terrorist attacks overall. This trend is highly disturbing, particularly in light of the fact that attacks against transportation targets have been extremely lethal when compared to other terrorist targets. Particularly in attacks against land transportation targets, terrorists have utilized the full terrorist arsenal: bombings, sabotage, arson, capture of hostages, dispersal of chemical and biological agents, roadside ambushes, and assaults with standoff weaponry.

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[1] Excluding the 1988 bombing of PanAm flight 103 over Lockerbie, Scotland

The initial terrorist attacks against transportation in the late 1960s focused primarily on commercial airliners, which represented the highly visible symbols of nations, confined "containers" of hostages, as well as mobile platforms providing the terrorists a chance of escape. Since 1968 and the PFLP hijacking of an ElAl airliner from Rome to Algiers, the favorite mode of attacking aviation targets included the hijacking of aircraft, with the goal of taking hostages for the instrumental purpose of forcing governments into political concessions. Following increased security measures at airports consisting of a mandatory installation of metal detectors and other devices for boarding gate screening of passengers and luggage, along with increased international cooperation, successful hostage rescue raids of Entebbe and Mogadishu, and the increasingly tougher stance of many governments on the issue of granting concessions to hijackers, the hijacking of an airliner became an increasingly challenging task. This resulted in a change of *modus operandi* among many terrorist groups. While some organizations simply shifted their attention form aviation targets onto land based symbolic targets such as embassies,[2] others responded by modifying their tactics thereby shifting the gravity of aviation terrorism to shooting attacks and bombings of airports and airliners in midcourse flight. Since 1980, 225 attacks on civilian aircraft or airports have occurred worldwide, with two-thirds (150) being attacks on civilian aircraft and one-third (75) being attacks on airports.[3] Governments were once again forced to modify their security measures in order to counter this new threat. As a result the emphasis was now placed on the threat of bombing of airliners in midcourse flight, as opposed to hijackings. Especially the 1988 bombing of the Pan Am 103 flight over Lockerbie, solidified the perception that hijackings as a terrorist tactic had greatly diminished.[4] These changes, while effective in some ways, again opened new opportunities for terrorists to exploit. For instance, prior to 9-11 it was perfectly feasible to *overtly* bring items such as knives and other bladed weapons on board domestic flights in the U.S., under the condition that the length of the blade did not exceed four inches. On September 11th 2001, 19 hijackers exploited our misjudged dismissal of the hijack threat, and by using a tactic that has already been

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[2] Enders W., Sandler T. and Cauley J., "U.N. Conventions Technology and Retaliation in the Fight Against Terrorism: an Econometric Evaluation", *Terrorism and Political Violence*, Vol.2 No. 2 (1990)

[3] Jenkins, Brian Michael "Improving Public Surface Transportation Security: What Do We Do Now?" The Lexington Institute, July 2003

[4] Hoffman, Bruce, "Terrorist Targeting:, Tactics, Trends, and Potentialities." *Terrorism and Political Violence*, Vol.5 Issue. 2 (1993) p. 12

overlooked as nearly obsolete, they succeeded in perpetrating the most destructive terror attack in history. This example reminds us about the amorphous nature of the terrorist threat, which should force us to constantly challenge and reevaluate the basic assumptions upon which our security framework is based. Today, aviation security has been boosted not only by improved screening measures, but also by an increased resistance to hijacking attempts on behalf of the passengers, who no longer see their chances for survival as high. Nevertheless, we still have seen highly lethal attacks on civil aviation, such as the August 2004 twin suicide bombings of passenger airliners in Russia that killed 89 people. This incident reminds us that no security system is foolproof. Besides the threat of suicide bombings or hijackings, other current high-priority threats include the possible use of surface-to-air missiles against civil airliners, as well as the potential of crude dispersal of chemical or biological on board passenger aircraft.

   With the declining prominence of aviation terrorism, the greatest current threat is constituted by attacks against surface transportation: trains, stations, depots and buses. A softer target than aviation, surface transportation offers terrorists easy access and little security to penetrate. In addition, the large crowds of strangers at surface transportation facilities guarantee anonymity for the attackers and facilitate their escape. Further, analysis of more than 22,000 terrorist incidents since 1968 indicates that attacks on land-based transportation targets have the highest casualty rates of any type of terrorist attack.[5] On average, attacks against such systems created more than two-and-a-half times the casualties per incident as attacks on aviation targets. In terms of fatalities, attacks on surface transportation are among the deadliest, ranking behind attacks on aviation and nearly equaling fatality rates of attacks on religious and tourist targets.[6]

   Despite the heightened focus on ground transportation terrorism in the wake of London and Madrid, it must be emphasized that this threat is far from new. For instance, in May 1985, Sikh terrorists killed 84 people in a wave of attacks involving booby trapped transistor radios left on buses in New Delhi and three adjacent Indian states. Between 1991 and 1999 the IRA planted no less then 81 explosive devices on British underground and railway cars, terrorizing commuters in the whole country.

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[5] Jenkins, Brian Michael "Improving Public Surface Transportation Security: What Do We Do Now?" The Lexington Institute, July 2003

[6] Jenkins, Brian Michael "Improving Public Surface Transportation Security: What Do We Do Now?" TheLexington Institute, July 2003

Then in 1995, Aum Shinkrikyo attempted to release sarin, hydrogen cyanide and botulinum toxin on subway trains or stations in Japanese cities on at least eight occasions, in one instance killing 12 and injuring 1,039. During the same year the Algerian Armed Islamic Group (GIA) spread terror in France with a wave of bombings in the Paris metro. And finally, in one of the most disturbing recent trends in global terrorism, suicide bombers have killed scores of passengers on Israeli buses and more recently the Russian metro. Overall, according to a study conducted in 1996 by the Mineta Transportation Institute (MTI), almost a third of all terrorist activity worldwide since 1920 involves transportation targets.[7] According to a more current study conducted by the Brookings Institution, between 1991 and 2001 a full 42 percent of terrorist strikes worldwide were directed against mass transit.[8] With enhanced aviation security measures further decreasing chances of successful attack on aircraft and given the high public visibility of Madrid and London, terrorists are likely to rely even more on land transportation targets in the future.

Why terrorists attack transportation targets

There are several distinct reasons behind the continual increase in the proportion of attacks against land transportation over other targets. The first reason are the trends in global terrorism, which have witnessed the increasing lethality of individual attacks, along with the reduction in the volume of targets that are considered "taboo" by most terrorist groups. Because ground transportation provides a high concentration of people in a confined space, it creates an attractive mass-casualty environment; if a bomb is detonated in such a confined space, the blast wave has great potential for destruction. This is especially true in cases where the blast occurs on board trains passing underground or through tunnels, which create another obstruction for the blast to escape, resulting in even higher casualties. A clear example of this was the February 2004 attack on a train in Moscow, where the device carried by the suicide bomber was quite small[9] but caused disproportionate damage, killing 42 and wounding 250, mainly because the blast had nowhere to escape in the

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[7] Jenkins, Brian Michael, Protecting Surface Transportation Systems and Patrons from Terrorist Activities. Case Studies of Best Security Practices and a Chronology of Attacks. Norman Y. Mineta International Institute for Surface Transportation Policy Studies, IISTPS Report 97-4, December 1997
[8] Holt, Andrew, "Al-Qaeda and the Threat to Mass Surface Transportation", Jamestown Foundation Terrorism Monitor, Volume IV,Issue 9, May 4, 2006
[9] between 2.5 - 5 kg of TNT

tunnel. The mass casualty environment of public transportation is one of the key reasons why attacks against transportation targets have been nearly twice as lethal as terror attacks overall. Secondly, another key advantage is the panic-spreading universality of the city bus or metro car, which underscores the perception among the civil population that anyone who uses public transportation could become a victim of the next terror attack. Thirdly, a terror campaign targeting commuter transportation can deter people from everyday travel, having a profound economic impact on the afflicted state by crippling the mobility of its workforce along with scaring away potential investors and tourists. Fourthly, continuous attacks against such frequently used infrastructure such as buses or trains can severely undermine government authority, as with time the populace grows increasingly frustrated, eventually blaming the government for its inability to maintain order. Fifthly, terrorists prefer transportation targets because they are essentially a feature of large population centers, which in the terrorist's mindset represent a strike against the heart of the enemy. And finally, unlike civil aviation which was the favorite terror target throughout the late 1960s and 1970s, ground transportation is essentially a soft target that provides the terrorists with almost an infinite number of options for operations with a high probability of success and a low level of risk. In short, commuter transportation is an attractive terror target, a reality that is unlikely to change any time soon. On the contrary, attacks against public transportation are becoming even more prominent then in the past, especially with the declining capability of terror organizations to successfully launch attacks against hard targets.

Threat assessment

In most basic terms, the threat assessment matrix consists of two critical factors: the intent of a potential perpetrator to attack a particular target, as well as the capability of that actor to carry out a successful attack against that target. In the absence of either component, an attack cannot take place. For the evaluation of intent one must understand the drivers in the given group's decision-making, such as ideology, overall strategy, strength, leadership structure and demonstrated targeting patterns. Several key questions must be answered, i.e.: How would the given actor benefit from an attack against the target in question? Is the target seen as legitimate and justifiable by the group's ideology? How does it fit into the overall strategy of

what the group is trying to achieve? Is the group operationally conservative or innovative? Does the given target fit the group's established targeting pattern? If not, what are the prospects of a change occurring in the group's targeting preferences? Are there any shortcomings or dangers involved in such a change? What is the authority of the leadership or autonomous cells to initiate such a change? All of these factors should be examined in the assessment of intent.

Similarly, in the assessment of capability, we need to look at a combination of several components. What types of weapons and tactics has the group used thus far? Are these usable in an assault on the target in question? How and with what prospects of success? Are there any indications of possible changes in the group's established *modus operandi*? Does the group in question have the organizational practicality to infiltrate the environment in question in order to launch its attack? How does the given target compare to other targets in terms of difficulty and probability of success? All of these questions need to be taken into consideration in the analysis of a possible threat. The next section will explore the threat posed by the JI to land transportation in Singapore.

Intent

With regards to ideology, the religious nature of the organization seems to provide the group with an enhanced level of enemy dehumanization, which ultimately leads to an escalating spiral of violence and the associated inclination toward producing am increasingly large number of casualties. This trend seems to be confirmed by the operational progression JI has undergone over the past few years. Inspired by Darul Islam and founded with the intent of creating a regional Islamic government in Southeast Asia, Jemaah Islamiyah originally focused its wrath against local targets such as the assassination attempt on the Philippine ambassador to Indonesia, who was injured in the explosion of a remotely detonated car bomb in August 2000. Three people were killed and 17 others were wounded in the attack. But the JI leadership's willingness to become a public political organization had contributed to an ideological split within the group, which effectively triggered the escalation of JI tactics on behalf of the more radical faction under the operational command of Hambali. In December 2000, JI operatives conducted 38 bomb attacks throughout Indonesia targeting Christian churches, on the one hand maintaining the

group's targeting logic but on the other introducing elements of synchronization and grandiosity on a scale previously unknown.[10] The Christmas 2000 church bombings clearly aimed for a much higher level of fatalities then JI has ever produced in the past, and despite the fact that the coordinated attack resulted in the death of "only" 19 people and injuries to 120 others, the *modus operandi* that was used in the attacks represented a significant shift. Further, when during the operation one of the cells encountered a problem with their target -- the church they selected was not having a Christmas Eve service -- it had been advised by Jabir[11] to select any location such as a discotheque or other establishment, as long as it was either *kafir* (infidel) or Chinese. This suggestion was a good indication of where the JI elements under Hambali were heading. Only six days later, JI launched its first successful attack against transportation infrastructure in the Philippines, killing 14 people on a light railway train and wounding some 70 others by a series of explosions in Metro Manila. This attack again was a sign of an increasingly daring attempt at mass casualties.

The Metro Manila bombings, however, were not the first instance where JI planned to attack transportation infrastructure. In 1999 two members of JI's Singapore cell, Mohammad Khalim bin Jaffar and Hashim bin Abbas conceived a plan to bomb a shuttle bus service conveying US personnel between Sembawang Wharf and the Yishun MRT Station. Around this time, the two men filmed several videos of the Yishun MRT area, which were then edited into a single piece and sent to Mohammad Atef, al Qaida's operations chief to Afghanistan. Interestingly, in this case the targeting was hardly indiscriminate, as the attack was specifically aimed at U.S. military personnel. Similarly, there is no indication that public transportation as such was a prime target, Jaffar simply selected the Yishun MRT station because he lived in the area,[12] and because this was the only place with visible American military presence that he was familiar with. As such the targeting for this attack was focused and discriminate, thus quite different from Madrid or London style attacks. Likewise, for Operation JIBRIL in which multiple suicide bombers were supposed to detonate truck bombs in Singapore, only Western or *kafir* targets such as embassies and government buildings were selected, targeting specifically what the terrorists called "white meat", and not the average Singaporean. This is another indication that public

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[10] Ressa, Maria A., *The Seeds of Terror*, (New York: Free Press, 2003) p. 103

[11] Jabir, whose real name is Enjang Bastaman, was the close friend of Hambali. Both were fellow Afghan veterans who had also been associates in Malaysia.

[12] Ressa (2002) p. 155

transportation might not have been an ideal target for the Singapore cell at that particular time, as the overwhelming majority of passengers who use the system are average Singaporeans, which the group was perhaps willing to sacrifice as a part of collateral damage, but did not have the intent to specifically target. And while this may be a subtle distinction, it does provide a critical insight into JI's target selection logic. At the same time, the avoidance of Singaporean casualties is likely associated with the fact that the perpetrators themselves were Singaporean, suggesting that another cell that would be sent from another country to carry out attacks in Singapore might not share such a sentiment. This again underscores the fluidity of internal logic within terrorist organizations, which forces us to approach the issue of threat assessment from a non-static frame of reference.

After the failure of Operation JIBRIL due to the swift arrests of the Singapore cell's members in December 2001, yet another important shift in JI's targeting preferences took place. Under pressure to deliver a strike that would finally succeed, at the next meeting held in January 2002 in Thailand Hambali called for a revision of targeting procedures to focus on "soft targets" associated with the West, such as night, clubs, bars and hotels.[13] The shift from hard government targets to soft tourist targets represents a significant escalatory progression – due partly to the difficulty of successfully attacking heavily protected government targets, the terrorists now started considering innocent civilians to be a guilty party in the conflict, regressing their attribution of guilt to the lowest possible common denominator: anyone but themselves and their co-conspirators. Indeed, Hambali reportedly distributed bin Laden's fatwa advocating precisely this targeting logic among the operatives of the Bali attack.[14] In the bin Laden text, anyone who supports the infidel governments by paying taxes is declared guilty of the resulting oppression of Muslims, and therefore a legitimate target. At the same time, even in the upcoming attacks the target selection still focused primarily on attaining American casualties.[15]

On October 12, 2002, a man detonated a suicide belt in the Patty's Bar in Bali. As people fled out onto the street in panic, another suicide bomber detonated a van loaded with nearly 1000 kg of explosives in the middle of the quickly forming crowd. According to one of the terrorists, the bomb weighed 1000 kilograms as a symbolic

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[13] Ibid. p. 182
[14] Associated Press: Bali bombing link to bin Laden claimed. April 3, 2004
[15] Although the majority of victims in Bali were Australians, interrogation reports reveal that the group planned to target American sailors; their ship however left earlier then expected.

payback for the one-ton bombs America dropped on Muslims in the Middle East.[16] The attack represented the first use of suicide bombers in Southeast Asia, and followed a signature al Qaida *modus operandi* of a synchronized attack against multiple targets. Only nine months after the Bali attack, suicide terror would reach the Indonesian capitol, when on August 5th, 2003, a car bomb exploded outside the J.W. Marriott Hotel in Jakarta, killing 12 people and wounding 150 others. The link between the two attacks was immediately obvious. As in the Bali bombing, the perpetrators in Jakarta used the same kind of explosives, as well as mobile phones for the purposes of remote detonation. Another thirteen months later, on September 9, 2004, a nearly identical suicide truck bombing took place at the Australian Embassy in Jakarta, killing10 people and injuring more than 180 others. The attack was a clear demonstration of the fact that despite the apprehension of Hambali in February 2004, the pro- al Qaida wing in the JI was still a potent force. Just in case there was any doubt, on October 1, 2005, three suicide bombers detonated their belts at the seaside area of Jimbaran Bay and the bar and shopping hub of Kuta, killing 23 people and wounding 102 more.

The above chronology carries several important lessons and implications. The first implication stems from the JI ideology, which at least in the interpretation of the more radical wing provides an environment that favors operations that can maximize damage and casualties. In this light, the mass casualty favorable environment of transportation systems provides a logical target for the group to attack. Secondly, JI's larger goal of establishing a Muslim state in Indonesia, Malaysia, Singapore, Brunei and southern Philippines nominates Singapore as a natural target, as demonstrated by the various disrupted plots targeting the city state. Thirdly, following the failure to launch attacks against hard targets in Singapore and the Philippines, JI's targeting pattern has witnessed the shift toward soft targets such as hotels, bars and clubs frequented by western tourists. The Bali bombing was the evidence of first such attack, followed by the J.W. Marriot bombing. Having grown increasingly confident after these two operations, key operatives of the JI radical wing, Noodrin Mohammed Top and Dr Azhari decided to once again attempt striking a hard target, choosing the Australian Embassy in Jakarta. However, the attack could hardly be considered a success by any standard, as all of the 11 casualties were Indonesian Muslims,

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[16] Wayne Miller: Bali attack delayed a day, mastermind reveals, The Age, July 5 2003

sparking a wave of popular resentment against the perpetrators. As a result, the group switched back to attacking soft targets with the second Bali bombings. This suggests that land transportation targets, which are "soft" by definition, are well within JI targeting scope. And while JI has yet to perpetrate attacks that would be completely indiscriminate in the sense that they would also deliberately target Muslims, attacking land transportation in a setting where non-Muslims provide the majority of passengers would certainly be ideologically acceptable, if not desirable. Singapore, Philippines and Thailand provide such a setting. Not coincidentally, have all three countries been targets in transportation attacks in the past.

Capability

Terrorist organizations generate various fantastical ideas and attack plans. Their ability to translate those plans into action, however, is very much constrained by the operational capability of the given group. Having established the logic for JI's selection of Singapore's land transportation system as a target, let us now focus on JI capabilities and operational skills, in order to assess the likelihood of a successful attack being launched as well as the probable *modus operandi* that such an operation is likely to employ.

JI's tactical repertoire is a relatively modest one, at least when comparing to other major contemporary terrorist organizations. Virtually all of the group's operations have involved the use explosive devices, detonated either remotely or by suicide bombers. JI has never engaged in shooting attacks, barricade hostage or kidnapping incidents, sabotage, or more exotic means of attack such as the dispersal of chemical or biological agents. Even in the area of explosive devices JI has been rather conservative, settling for the design that has worked in the past accompanied by minor incremental improvements over time.[17] These improvements were essentially the result of a "learning from failure" approach. For instance, during the 2000 Christmas church bombings the explosive devices were made out of carbon, potassium, sulfur and TNT,[18] wrapped in gift paper and rigged to mobile phones for remote detonation. In this case however, a number of the bombs malfunctioned, either failing to detonate completely or detonating at the wrong time. This has resulted in the

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[17] Baker, John C., "Jeemah Islamyia" in Jackson, Brian, et. al: Aptitude for Destruction Volume 2: Case Studies of Organizational Learning in Five Terrorist Groups. (Santa Monica: RAND 2005) p. 74
[18] Ressa (2002) p. 102

death of several JI operatives including Hambali's close friend Jabir, who forgot to change his SIM card and died in an explosion triggered by an unexpected phone call. JI bomb makers reviewed their mistakes and during the next major attack in Bali, not only were the destructive effects of the large bomb enhanced by packing the delivery vehicle with a dozen plastic filing cabinets filled with a mix of explosive materials; the device was also rigged with four separate detonation mechanisms (remote, timing, manual and anti-handling mechanism) to ensure that it would detonate as planned.[19] The 1000 kg bomb, although only 30 percent efficient,[20] produced a large enough explosion and subsequent fire to kill an overall number 202 of people, marking the deadliest attack since 9-11 and the 8th deadliest attack in the history of terrorism. According to interrogation reports, the Bali terrorists originally planned for an even greater carnage, by incorporating a third suicide bomber who was supposed to ride a motorcycle through the doors of the packed Sari Club and detonate himself. The plan was abandoned only after it was discovered the man chosen for the suicide task could not ride a motorcycle.[21]

The explosive device used in the bombing of the J.W. Marriot in Jakarta was identical to the one used in Bali, and although it was considerably smaller consisting of six plastic boxes weighing 19 kilograms each,[22] it was still clear the attack was aimed to create as many casualties as possible. In order to increase lethality, the terrorists attached dozens of bars of laundry soap to containers of inflammable liquid which were placed next to the bomb. The mixture of sodium and fatty acids in the soap helped create fireballs which engulfed some of the victims.[23] According to investigators, the bomb was personally detonated via a mobile phone by Dr. Azahari bin Husin, JI's top bomb maker who escaped from the scene on the back of a motorcycle. The explosion produced a two-meter wide crater, penetrating through 32-centimeter thick concrete into the basement, and the suicide bomber's head was catapulted all the way to the hotel's 5th floor. As earlier in Bali, also in this attack the perpetrators tried to prevent easy identification by attempting to scrape off the identification numbers on the vehicles used so they would not be easily traceable to

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[19] Ibid 186-187

[20] Australian investigators calculated that only about 30 percent of the chemical mixture exploded, the rest simply burned

[21] Cindy Wockner: Third suicide bomber planned, The Advertiser, 23. July 2003

[22] Damar Harsanto: Reenactment traces bomb assembly, *The Jakarta Post, December 10, 2003*

[23] Damar Harsanto and Fabiola Desy Unidjaja, The Jakarta Post, 12 August 2003

the original owner.[24] However, in both of these cases as well as in the case of the Australian embassy bombing, the Indonesian authorities were still able to recover and reconstruct the registration number from the debris, leading to the arrest of many of the JI members involved in the bombings.[25] This fact, along with the failure to achieve significant damage to the Australian Embassy due to anti-vehicle barriers installed in front of the building, apparently led to a change in JI's bombing approach. Instead of using trucks packed with explosives which had trouble approaching their targets, the group adopted the use suicide backpacks, which would not only be more difficult to trace, but could also be more successful in reaching the desired target. Such devices were not only used in the second Bali bombing, but were also recovered from the hideouts of Dr. Azahri during his elimination in Malang in November 2005, and even more importantly, in the safe house of Noordin Mohammed Top during the unsuccessful apprehension attempt in Wonosobo in May 2006.[26] Especially the Wonosobo discovery is significant, as it demonstrates JI's ability to construct these explosive devices even after the demise Azhari, the group's chief bomb maker.

With regards to other potential tactics that could be used by JI, we also need to mention chemical and biological agents, especially in the light of the Aum Shinrikyo experience in Japan and the October 2003 discovery of a chemical and biological weapons manual in the apartment of top JI operative Taufiq Rifqi in Cotabato City southern Mindanao.[27] This manual provides useful insights into the CBW capability of the group.[28] On the one hand, the document surveys several agents of disturbing potency and expresses considerable optimism and fascination with regard to how miniscule amounts of the respective agent are needed to kill a large number of people. On the other hand, the manual hints a complete lack of knowledge with regards to efficient delivery of the produced agents. The manual covers a number of chemical gases, pesticides and even narcotics, as well as biological toxins. All of the agents are discussed in a uniform structural manner, describing the materials and the procedures

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[24] CBS news: Jakarta Bomber: Qaeda Group Link. August 8, 2003
[25] Baker in Jackson (2005) p. 84
[26] Stratfor: "Indonesia: Missing a Chance at a 'Top' Militant." Stratfor Daily Terrorism Brief 05.01.2006
[27] Sunstar: Bio-weapons traces found in JI hideout Tuesday, October 21, 2003. Internet. Available at: http://www.sunstar.com.ph/static/net/2003/10/21/bio.weapons.traces.found.in.ji.hideout.html (accessed on 12.May 2006)
[28] Dolnik Adam and Gunaratna, Rohan, "Jemaah Islamyiah and the Threat of Chemical & Biological Weapons Terrorism."Unpublished Document, 2004

needed for the production of the given agent, expected effects, dosage, experimental results, and in some cases, delivery methods. With regards to the scope of the chemical agents listed, in is noteworthy that with the exception of phosgene, one of the gases that were developed and used for assassination purposes by the Aum Shinrikyo, none of the listed substances can be accurately described as warfare agents. The chemical substances covered in the manual include hydrogen cyanide, hydrogen sulfide, phosgene, chlorine, and arsenic, which are described in some detail. The manual also discusses various less threatening or completely unusable agents such as potassium ferrocyanide, potassium permanganate, chloroform, aniline, as well as a number of narcotics including cocaine, heroin and morphine. These agents are discussed in less detail, skipping the information on composition, manufacture and weaponization. Hydrogen cyanide, the blood agent that was used in the Nazi gas chambers under the name Cyclone-B, is the one substance that is covered in most detail. The manual also spends a considerable amount of space on describing two "firing devices" for this agent, one of which utilizes a close up release consisting of a mechanical break of a glass plate separating the binary components, triggering their mixture and immediate release. The other firing device then relies on the use of a table tennis ball as a delay mechanism. In this scenario the ball injected with sulfuric acid is placed into an open container filled with potassium or sodium cyanide, relying on the acid to eat through the plastic in order to combine with the other ingredient. Having described the production and delivery, the manual moves on to prescribing ideal targets, focusing mainly on buildings that are air-conditioned in order to "achieve a more rapid spread of the gas". Overall, the chemical weapons section of the manual discusses fairly accurately the production of several highly potent agents that theoretically could cause the death of a large number of people. At the same time, only agents the production of which is about as challenging as the mixing of a lime juice are considered in further detail – the manual completely omits the category of nerve agents, which are the most potent but also most difficult to produce.

In the category of biological agents, the JI manual focuses only on toxins (poisons produced by living organisms) such as botulinum toxin, nicotine, toxins from poisonous mushrooms and potato buds. In terms of agent selection, only substances that can be easily produced from conventional materials such as cigarettes, potatoes, castor beans, mushrooms, or meat are considered. The described production methods are fairly accurate, but the problem with JI's biological weapons knowledge is the

complete lack of mass-casualty capable delivery systems. Noteworthy in this respect is the complete absence of contagious agents that could theoretically be delivered by a human carrier via secondary transmission. The non-inclusion of contagious agents is by no means a surprise – the lack of control over the outcome of the attack makes them highly unattractive for terrorist purposes, unless of course the perpetrators desire to kill everyone including themselves, their constituency and even their own family members.

With regards to the threat to land transportation terrorism, the manual is interesting in that it references Aum Shinrikyo's tactics in targeting Tokyo trains. In the discussion about hydrogen cyanide, the manual states: "[the agent] was used in a Japanese railway several years ago killing a number of people".[29] This statement, however appears to be highly inaccurate, as it apparently refers to the Tokyo subway gassings, which employed the nerve agent sarin, and not hydrogen cyanide. Another possibility is that the citation refers to the 5 May 1995 incident in the bathroom of the Shinjuku subway station, where two plastic bags containing 1,5 liters of diluted sulfuric acid and 2 liters of powdered sodium cyanide, respectively, were found on fire. The objective of the attack that was ascribed to the Aum Shinrikyo, was the production of hydrogen cyanide with the hope that the air-conditioning system would suck in the gas, dispersing it over the platform.[30] The attack however failed to impact anyone, as have the three duplicate attempts that took place later during the same year. As a result, the vague reference in the JI manual is ultimately incorrect, which is significant given the common tendency of analysts to assume that terrorist organizations routinely learn from each other. While there are historical instances where organizations have indeed studied the operations conducted by other groups in order to learn from them, the JI manual example clearly shows the inability or unwillingness of this group to do the same. This is evident not only in the area of chemical agents, but also in the earlier discussed example of JI's explosive devices.

Analysis

JI has in recent years experienced an internal split. The principal organizers behind the main attacks in Indonesia have been two Malaysians, Dr. Azahari and

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[29] Dolnik Adam and Gunaratna, Rohan, "Jemaah Islamyiah and the Threat of Chemical & Biological Weapons Terrorism." *Terrorism and Political Violence* (forthcoming in 2007).
[30] Center for Nonproliferation Studies: *Chronology of Aum Shinrikyo's CBW Activities*, (March 2001), Internet, available at http://cns.miis.edu/pubs/reports/aum_chrn.htm. (Accessed on 12/12/02)

Noordin Mohammed Top, both members of the more radical pro-al Qaida faction within the JI, which according to a former key JI operative Nasir Abbas, who "[sees itself] as fighting a new world battle. ... They say, we can attack civilians anywhere, just as Americans attack Muslim civilians all over the world".[31] This view is in sharp contrast with the JI core, whose actions and objectives are very much local in nature. It is this faction that has shown the desire to launch attacks consistent with al Qaida targeting guidelines and using the signature *modus operandi* of multiple synchronized suicide attacks against high profile targets. An attack against the transportation system in Singapore, especially following the precedents set by Madrid and London, would certainly be consistent with the group's preferences. Further, this group has planned attacks in Singapore in the past, has a history of targeting commuter transportation, and appears to be further progressing to soft targets. As a result the motivation to attack public transportation in Singapore is not in question. At the same time, this appears be too ambitious of a plan for the group in its current state. Following the elimination of Dr. Azhari in November 2005, the immediate capability of the group has certainly decreased. Yes, it is true that given the codification of Azahari's knowledge in JI bomb making manuals and the presence of Noordin Mohammed Top, another key operative who is still at large, JI's ability to launch further suicide operations had not yet been eliminated completely. But while it may be safe to assume that we may see more suicide attacks in Indonesia, JI's reach currently does not appear to go past the borders of that country, at least as far as operations are concerned. This is especially true if we consider Singapore as a target, as the city state has more stringent border controls in place then most other countries in the region and provides many other barriers and security measures that would make a possible attack highly challenging. For instance, even if JI operatives were to overcome the immigration obstacle and succeed in infiltrating Singapore, significant obstacles in obtaining the necessary precursor materials to build explosive devices for the attack would still exist. These problems alone are likely to convince JI to focus on other, more feasible targets.

Is this a reality that could suddenly change? History tells us that terrorist organizations rarely alter their established *modus operandi*, and when they do, these

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[31] Robin McDowell: Indonesians ask why fellow Muslims are turning to suicide bombings. Associated Press, December 4, 2005

changes are driven by very specific reasons.[32] The first such reason comes in the event of an introduction of government countermeasures, such as target hardening efforts that serve as a direct obstruction to the tactics used by terrorists in the past. While most groups can be expected to yield to this pressure and substitute targets, an innovative organization will refuse go down this path of least resistance in order to increase its probability of success. Instead, such a group will work to overcome these countermeasures by means that have not been accounted for by the enemy, often placing an emphasis on projecting an image of invincibility as well as mocking the state for failing to stop the attack despite all of its resources. This is not a profile that would fit the JI in the current state. The group has responded to government countermeasures in the past precisely in a regressive fashion, by refocusing their target preferences to less challenging targets such as tourist spots, wile making only minor incremental improvements along the way. This suggests that a shift toward hardened targets such as Singaporean MRT[33] does not fit the group's operational profile. To date, JI has been able to launch only one attack per year, and all of the attacks in recent years have targeted soft targets in Indonesia where the group finds it much easier to prepare and execute.

Another scenario in which a group can be expected to alter its operational methods in a novel direction comes in the presence of an inherent ideological pre-determination toward using certain technologies or the need to innovate in order to obtain the capability to match the level of violence associated with the respective ideological and strategic preferences.[34] This is not the case of JI at this moment; Azhari whose personal technological zeal was one of he major drivers of the incremental improvements in explosive devices is no longer available, and the group is dependent on the codification of his knowledge via various manuals and past training. For this reason, it is highly unlikely that JI's *modus operandi* will change because of ideological or strategic reasons, especially given the limited resources and capability of the group.

The third relevant scenario of a trigger to terrorist adaptation of new operational methods is an incidental or unintended acquisition of a particular human or

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[32] Dolnik, Adam, *Understanding Terrorist Innovation: Technology, Tactics, and Global Trends* (Routledge, forthcoming in 2007)

[33] MRT is by definition a soft target, but given its location in Singapore, it certainly represents a much harder target then a restaurant in Indonesia.

[34] Dolnik, Adam, *Understanding Terrorist Innovation: Technology, Tactics, and Global Trends* (Routledge, forthcoming in 2007)

material resource. This is a real threat. If, for instance, a Singaporean JI cell offered to facilitate a *feasible* plot against the transportation system in Singapore, it is quite possible that JI may lend its expertise and resources toward this end. The current trends in terrorism suggest that the greatest threat is posed by homegrown groups which although inspired by al Qaida ideology, do not bear any visible links to the network. As we have seen in virtually all attacks attributed to the al Qaida after 9-11,[35] they have been carried out by either ad-hoc groups, or operatives who were at home in the country where the attack took place. This has significant implications, as launching an operation from abroad requires much more resources, planning and expertise while also exposing the conspirators to great level of risk. JI presently does not have this capability. However, the facilitation of this process by a local cell, which is familiar with the targets and the system and does not need to worry when crossing borders, would make the execution of such an attack much more feasible. Although still quite low in probability due to extensive intelligence efforts within Singapore, this homegrown group scenario is by far the greatest terrorist threat facing the country's public transportation system today.

While the terrorism threat has received the most attention, we should be aware that other scenarios exist as well, namely the possibility of an attack by individuals or small groups without a political agenda, such as financial gain or psychological idiosyncrasy. The most probable scenario in this regard is a deranged individual along the lines of Colin Ferguson, who in December 1993 began firing randomly at passengers traveling from New York on a crowded Long Island Rail Road train during rush hour. Ferguson, who was finally overpowered by passengers while reloading, killed six passengers and wounded 17 others.[36] Other examples include Edward Leary, who in December 1994 detonated two gasoline bombs on subway trains injuring 48 people,[37] or a Korean man who burned 192 persons to death during his February 2003

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[35] An exception to this are suicide bombings in active conflict zones such as Iraq, and the November 2005 bombing in Amman, which included an Iraqi husband and wife who infiltrated Jordan to blow themselves up in the Radisson Hotel.

[36] Boyd, Annabelle and Sullivan, John P. "Emergency Preparedness for Transit Terrorism", TCRP Synthesis of Transit Practice 27, Transportation Research Board, National Research Council. 1997. Available at http://nationalacademies.org/trb/publications/tcrp/tsyn27.pdf

[37] Jenkins, Brian and Gersten, Larry N., "Protecting Public Surface Transportation Against Terrorism and Serious Crime: Continuing Research on Best Security Practices," Mineta Transportation Institute, September 2001.

suicide attempt on the Seoul subway.[38] These incidents serve as a reminder that not always is the perpetrator's intent a predictable variable.

In the case of criminal motivation, such attacks are unlikely in Singapore due to the overall very low level of criminality in the country, strong punishments for criminal offenses, small number of possible escape routes and the lack of precedents for successful negotiations on behalf of attackers when it comes to achieving concessions in hostage situations such as free passage. Robbing a train or holding hostages on a bus for ransom is simply not a good proposition for any criminal in Singapore. In contrast, a deranged or suicidal individual's motivation and intent is much more difficult to predict. And while obtaining a firearm in Singapore is very difficult, we should not forget the above mentioned Seoul subway tragedy, in which easy to acquire technology requiring only about a $3 dollar investment was used to kill hundreds (a paper milk container filled with gasoline and a cigarette lighter). This example shows that an attack does not need to be particularly sophisticated to cause significant damage.

Another low-cost means to disrupt the transportation system are hoaxes, which can at a time of heightened threat level or in the aftermath of high profile attacks, cause a considerable headache. For instance, in Atlanta during the Olympic Games, the local MARTA transportation system experienced more then 140 suspicious packages in the wake of the Centennial Park incident.[39] Similarly, in the U.K. between 1991 and 1997, there were 6,569 telephone bomb threats concerning transportation targets and 9,430 suspicious objects were reported and investigated.[40] Hoaxes can be a considerable problem as they can cause the disruption of service, spread of fear and economic damage by the need to respond to them. However, they tend to work "best" in places where actual attacks have happened, and authorities thus cannot afford to ignore any type of threat. In the UK experience, no unattended bag was ever linked to an

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[38] CBS News: "Arson Attack on S. Korean Subway". Internet, available at: http://www.cbsnews.com/stories/2003/02/18/world/main540957.shtml (accessed on 26/09/03)
[39] Jenkins, Brian and Gersten, Larry N., "Protecting Public Surface Transportation Against Terrorism and Serious Crime: Continuing Research on Best Security Practices," Mineta Transportation Institute, September 2001.
[40] Jenkins, Brian and Gersten, Larry N., "Protecting Public Surface Transportation Against Terrorism and Serious Crime: Continuing Research on Best Security Practices," Mineta Transportation Institute, September 2001.

explosive device, but due to the fact that real bombing happened frequently enough every unattended bag had to be checked.[41]

Countermeasures

Contrary to popular perception, when compared to other major cites in the world, the threat to Singapore's transportation system is rather low. At the same time, the same could have also been said about the Tokyo metro system in March 1995, just before the sarin attacks. This fact underscores the dilemma faced by decision makers and security managers. If no real immediate threat exists, and yet nothing can ever be ruled out, how much security is enough? Is a specific real time terrorist threat the only way to gather together enough security, or should public agencies take action to prevent such a threat?[42] Given the fact that there are never enough resources to address all possible threats, striking the right balance is always a difficult task. Singapore is no exception, although the city's size, availability of resources and a generally high level of *perceived* threat have resulted in the implementation of more security measures then one might expect.

There are a number of reasons why terrorism has become such a high priority item on the government agenda in the last few years. Besides the now disrupted existence of JI cells with concrete attacks plans in the country, Singapore's specific circumstances result in a perception of high vulnerability. The first reason is the small size of the country and herewith associated lack of "strategic depth", as well as its economic dependence on the confidence of foreign investors, which might be disrupted in the event of a terror attack. Also important is the overall high level of security in the country, which besides its positive deterrent function also results in higher level of complacency among the general population, as well as a heightened psychological vulnerability toward the feeling of insecurity which is likely to occur in the aftermath of a possible attack. Similarly, the city-state's highly multicultural population has a questionable resilience to a terrorist campaign, and should a terror attack be perpetrated by people form within Singapore's minority communities, intercultural harmony in Singapore could be jeopardized. Combined with the perception of being a

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[41] Ibid.
[42] Jenkins, Brian Michael, "Protecting Surface Transportation Systems and Patrons from Terrorist Activities. Case Studies of Best Security Practices and a Chronology of Attacks." Norman Y. Mineta International Institute for Surface Transportation Policy Studies, IISTPS Report 97-4, December 1997

"prize" target for terrorists in Southeast Asia due to its pro Western political position and economic success, the attention and resources devoted to defensive strategy against terrorism in Singapore is unusually high.

An essential part of this strategy is the protection of Singapore's public transportation infrastructure, which includes primarily bus and rail systems. The bus service operated by two companies, SBS transit and SMRT corporation, provides a combined total of 3395 vehicles on 261 routes, totaling over 3 million passenger trips daily. The system also features 109 km of the so-called Mass Rapid Transit (MRT) with 3 lines and 67 stations, 1,3 million daily passenger trips. A new 34 km Circle Line is under construction and will be opened in phases as the various stations are ready. In addition to the MRT, the train system also features three lines of the Light Rapid Transit (LRT) system and 38.6 km of train tracks and one rail's terminal at Tanjong Pagar Railway Station which serves trains to Malaysia.[43] Given the fact that Singapore is a small city state, it has one of the most dense ground transportation networks of all *countries* in the world.

In principle, land transportation security has two objectives: not only the prevention of casualties, but also the minimization of disruption of service. The elimination of casualties relies heavily on preventing an attack in the first place via deterrent and protective measures, but also on mitigation via swift and efficient medical response. The disruption of service and herewith associated economic costs relies on good inter-agency communication a well as planning or providing alternative means of transport for commuters, as well as contingency plans for restoration of regular service. An excellent analytical study by the Mineta Institute in California in 1997 has compared the lessons learned from attacks on public transportation systems in the U.K. France, Japan, and the United States, and identified the best practices in responding to the threat of public transportation terror. [44] Many of these measures have been adopted in Singapore particularly in the immediate aftermath of the Madrid bombings.

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[43] Singapore Ministry of Transportation Website. http://www.mot.gov.sg/keys.htm

[44] Jenkins, Brian Michael, "Protecting Surface Transportation Systems and Patrons from Terrorist Activities. Case Studies of Best Security Practices and a Chronology of Attacks." Norman Y. Mineta International Institute for Surface Transportation Policy Studies, IISTPS Report 97-4, December 1997

As a part of this effort, many security measures have been implemented on trains and stations such as abundant presence of CCTV cameras at platforms. In addition a plan was announced to fit MRT trains with CCTV cameras, as well as the mounting of GPS systems on buses in order to achieve the ability to quickly pinpoint their exact location. Such measures are meant to not only serve as a tool for monitoring possible threats and incursions and to aid response teams by exactly identifying the current conditions inside impacted vehicles, but also as a deterrent function aiming to undermine the confidence of potential attackers that their attack plan will succeed. The British experience from the IRA camping in early 1990s provides a good example. In 1991, IRA terrorist attacks centered on stations in London. By 1992, following the adoption of highly visible CCTV cameras, intrusion alarms and other security measures, the attackers were pushed out to suburban stations, and by 1993, they were confined to home counties. The targets of the attackers also shifted from stations to switch boxes and rail lines away from stations.[45]

Another measure that has been identified as highly productive was the adaptation of an environmental design of transportation stations that would eliminate potential hiding places for bombs. In Singapore, this step was represented by the removal of trash bins and mail boxes from platforms and concourse levels to the main station entrances.[46] Given the fact that the platforms are well lit and monitored, this measure has virtually eliminated potential hiding places. Another step that has been used in countries experiencing terrorist campaigns has been the deployment of bomb resistant trash containers to eliminate fragmentation effects of a possible explosion, but such a measure would represent overkill in the Singapore context considering the comparatively low level of threat.

The next practice identified in the examined case studies as highly effective was the augmentation of visible security personnel in periods of immediate threat to deter potential attackers, or following major crises, in order to mitigate the psychological impact and restore a perception of security among commuters. This model was followed after Madrid by the deployment of private unarmed guards to

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[45] Jenkins, Brian and Gersten, Larry N., "Protecting Public Surface Transportation Against Terrorism and Serious Crime: Continuing Research on Best Security Practices," Mineta Transportation Institute, September 2001.

[46] Wikipedia: Security on the Mass Rapid Transit. 2006
http://en.wikipedia.org/wiki/Security_on_the_Mass_Rapid_Transit#endnote_measures

patrol the station platforms, with the authority to check the belongings of customers. In addition, following the London attacks, the Singapore police also deployed armed Police Tactical Unit officers to patrol within stations the day after the bombings occurred, while pre-existing security measures were placed on higher alert. These armed officers began visible patrols on the MRT and LRT systems, conducting random patrols in pairs in and around rail stations and within trains. Selected with their height and physique in mind to project a tougher presence, these officers are trained and authorized to utilize their firearms based on the officers' discretion, including "shoot to kill" if deemed necessary.[47] This fact was, of course, widely publicized in order to achieve maximum deterrent effect.

The next area identified among the best practices for protecting commuter transportation is the involvement of the public, particularly in the area of boosting vigilance and encouraging the prompt reporting of unattended luggage and suspicious packages, in order to increase the likelihood that a potential explosive device left behind in a train or bus is discovered and disarmed before it can be detonated. This campaign has featured periodical public announcements on platforms and trains, as well as the distribution of ever-present posters encouraging passengers to report any suspicious activity or unattended luggage.

The one area identified as all important has been training, coordination and testing of response capability though simulated exercises. Such exercises are particularly useful in uncovering flaws in the system and advancing readiness, as well as serving to reassure the public that a response capability exists. In Singapore, exercises are also designed to serve a deterrent function by trying to demonstrate to potential perpetrators that a robust response capability is present to minimize the chances of success of any potential attack. This is one of the reasons why simulation exercises in Singapore tend to respond to highly fantastic and challenging threats, as in the case of the three hour Exercise NorthStar V, which took place on 8 January 2006. This exercise, the largest of its kind in the history of Singapore, simulated near simultaneous suicide bombings followed by a chemical attack on four MRT stations and one bus interchange. Northstar V involved a total 22 agencies and 2,000 emergency personnel. Services at 13 MRT stations were temporarily disrupted and roads within the vicinity were also closed to traffic, affecting about 3,400 commuters.

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[47] Asia One.com http://www.asia1.com.sg/st/st_20050816_334786.html

Shuttle buses were used to ferry commuters affected by the exercise. Thunderflashes, smoke generators, and fire simulators were used to simulate the explosion and 500 simulated casualties were deployed to test emergency rescuers at the scene. These mock casualties carried tags to provide paramedics information on the extent of their injuries and these includes injuries related to bomb blasts, such as open wounds and burns. There were also some with injuries related to sarin, and 28 casualties underwent decontamination before being treated. Besides clinical readiness, the drill also tested how hospital operations and information were coordinated and total of 1,280 hospital workers from seven hospitals and two polyclinics were involved in the drill.[48] Further such exercises are planned for the near future.

Conclusion

Analysis of JI's targeting pattern reveals an increasing preference for soft, Western, mass-casualty targets in Southeast Asia. Singapore's commuter transportation system fully encompasses all of these adjectives, and is thus a natural target. But although a "soft" target by definition, the Singapore public transportation system appears to be too "hard" for the JI to attack at present, precisely because it is located in Singapore. So, while JI might very well be motivated to launch an attack against the system, it currently lacks the capability to do so. For the time being, the group's operations are likely to take the form of synchronized suicide bombings against soft targets in Indonesia. If the land transportation system in Singapore is in fact to be attacked in the future, this will likely involve an explosive or arson attack by a homegrown cell that will conduct the attacks either independently by acquiring necessary know how and guidance via the internet, or with the help from an ideologically affiliated group with better resources and expertise. Other scenarios include attacks by deranged individuals along the lines of the Seoul suicide, or the disruption of service a wave of hoaxes by pranksters or sympathizers.

Despite the relatively low level of threat, Singapore has made many preparations and preventive measures that other countries that have experienced surface transportation terrorism have identified as pillars of effective public

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[48] Ng, Julia: Health Minister says Exercise NorthStar a good test of hospitals' readiness. Channel News Asia, 8 January 2006. Available at
http://www.channelnewsasia.com/stories/singaporelocalnews/view/187149/1/.html

transportation security. And yet, the system still has visible holes and weaknesses that could be exploited by potential attackers. This has, particularly in the wake off the Madrid bombings, led to many suggestions on how to strengthen the security system, essentially mimicking the measures that have gradually been implemented over the past 30 years in the effort to strengthen the security of civil aviation. These have consisted mainly of the installation of metal detectors, x-rays and vapor detectors, the securing of perimeter fences around airports, the deterrent presence of armed guards, sniffer dogs, etc. After London, the debate has gone as far as suggestions to introduce remote signal jammers in metro systems in order to eliminate the possibility of remote detonation of explosives on trains. Ironically, such measures could not have been effective in preventing even Madrid, where the alarm clock function that does not require a signal was used for detonations, nor London itself, where suicide bombers were present to detonate their devices manually.

It is clear that most of the proposed measures are not an option for securing ground transportation targets such as buses and MRT lines, for several reasons. Firstly, the sheer number of bus and train stops at which potential attackers could board is incomparably higher then the number of gates at airports, making the implementation of even relatively basic screening procedures for ground transportation an extremely expensive proposition. Secondly, while compulsory airport taxes paid by each passenger can aid in financing the security of civil aviation, the low cost of a bus or metro ride make the duplication of such efforts for ground transportation just about impossible. Thirdly, the idea of everyday commute being prolonged by up to an hour due to queues forming at screening stations would hardly be acceptable for the majority of the population. And finally, even if all of the above obstacles were somehow overcome, the ease of causing massive destruction with dual use items makes the prospects of successfully averting acts of terror uncertain. Clearly, no system is perfect and no matter what measures are eventually put into place, the public will inevitably have to accept a significant level of risk. The above mentioned experiences of countries that have been affected by deadly waves of ground transportation terror provide us with useful lessons we can build upon. In this sense, it has always been a combination of several measures that has helped the authorities to cope with the threat. On the prevention side, it has been the deterrent presence of armed guards and dogs at critical interchanges, the high level of awareness and bravery of surface transportation staff, and the heightened vigilance of

the public, that had succeeded in thwarting a large number of terrorist attacks. No less important has been the role of effective response and timely mitigation once attacks actually did occur. Fast and efficient medical response saves lives, effective forensics procedures can aid to timely identification and apprehension of the perpetrators, and returning the people's lives back to normal as soon as possible helps in thwarting the effects of terror.

The one often neglected but in reality crucial aspect of effectively countering transportation terror is psychological defence. Terrorism is essentially a psychological mind game the objective of which is to create the universal perception of vulnerability that is largely disproportionate to the actual level of the threat. From a terrorist's strategic perspective, the killings itself are secondary to the spread of panic. It is thus crucial to recognize that by living in fear and uncertainty we help satisfy the terrorists' key objective. This is not to suggest that we should not take all reasonable preventive measures to improve our security, but it would be foolish to think that we can ever fully eliminate all of the weak spots of soft targets such as ground transportation. The population must understand that no system is perfect, and that no matter what steps are taken, public transportation will still remain a feasible target. Terrorists will always find ways to attack it. Reassuring the public that measures to combat the threat are in place, while also preparing it for the possibility that an attack might happen, provides the right combination of measures.