

## **Chapter 26**

### **The Terrorist Threat to Transportation Targets and Preventive Measures**

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Attacks on airliners and airports constituted a large percentage of terrorist operations in the late 1960s and early 1970s, requiring extraordinary security measures. Despite progress in reducing the number of hijackings and sabotage of airliners, terrorists continued to attack commercial aviation. The 9/11 attacks in which nearly 3,000 people died, and subsequent suicide bombing attempts aboard airliners prompted even more stringent measures to keep weapons and explosives off airplanes. By 2020, terrorist hijackings have been almost entirely eliminated although sabotage remains a concern. Meanwhile, terrorist attacks on public surface transportation steadily increased into the 2010s. The attacks in the early 1970s were aimed at causing alarm and disruption. To later generations of terrorists, trains and buses offered easily accessible crowds of people in confined environments—the goal changed to slaughter as witnessed in the bombings of commuter trains in Madrid in 2004, London in 2005, and Mumbai in 2006. The aviation security model could not be applied to surface transportation. The volume of passengers was too great—passenger screening would require an army of screeners. The delays and costs would destroy public transportation. Instead of establishing security checkpoints, transportation operators had to look at ways to mitigate casualties through station and coach design and rapid intervention, and enlist passengers themselves in detecting suspicious behavior and objects.

**Keywords:** aviation, buses, hijackings, passengers, prevention, railways, security, terrorism, transit, transportation

Terrorism can be examined from various perspectives. Analysts have studied the causes that motivate terrorist campaigns, the radicalization process by which individuals move from extreme beliefs into the realm of actually using violence, the *modus operandi* of various terrorist groups, the evolution of terrorist tactics, the unique challenges terrorists pose to security, and the legal responses and other countermeasures. In this chapter, we examine terrorist targeting of commercial aviation and surface transportation. The terrorists' focus on this set of targets tells us a great deal about their strategies.

Attacks on airliners and airports constituted a large percentage of terrorist operations in the late 1960s and early 1970s, and these targets appear to be a continuing obsession for some terrorist groups, necessitating extraordinary security measures. Terrorist attacks on passenger trains, metros, and buses also began in the early 1970s, and they increased in volume and lethality during subsequent decades.

In going after transportation targets, terrorists are not making statements against any particular mode of public transportation. Targeting airplanes or passenger trains reflects broader objectives and trends. Commercial aviation has offered accessible targets to terrorists who had little chance of operating inside the countries whose governments or policies they opposed. Like embassies and diplomats - also favorite targets of terrorists in the 1960s and 1970s - airplanes are symbols of the enemy, vulnerable outposts that can be attacked anywhere in the world. In addition, attacks on international air travel guarantee worldwide publicity.

The increase in attacks on surface transportation, which came later, reflected different trends. As terrorists sought to escalate their body counts and were willing to kill indiscriminately to do so, trains and buses became convenient killing fields. Symbolism was less important than accessible crowds of people aboard trains or subways or in stations or depots. Instead of attacking symbolic targets abroad, attacks on surface transportation targets were carried out by local operatives - homegrown terrorists - although some were inspired by the actions of known terrorist groups and some were assisted from abroad.

### **Terrorists Make Commercial Aviation Part of the Battlefield**

Commercial aviation offered terrorists mobility and targets in the 1960s. Jet air travel, which had expanded rapidly in the preceding decade, offered terrorists the opportunity to board an airplane in one country and then fly to another country, where they could hijack a second airliner and divert it to a third country.

Commercial airliners also provided terrorists with nationally labeled containers of hostages, increasing their leverage over target governments. When sabotaging airliners, terrorists could punish a country by achieving high body counts. Airlines and airports found themselves on the front line of a global conflict. This is still the case.

Terrorism in its contemporary form emerged with a series of spectacular attacks in the late 1960s. Airline hijacking entered the terrorist repertoire in July 1968, when members of the Popular Front for the Liberation of Palestine (PFLP) hijacked an El Al airliner and forced it to fly to Algiers, where they released the non-Israeli passengers but demanded the release of convicted Arab prisoners held by Israel in return for the safe release of the remaining passengers and crew.<sup>1</sup>

The episode, which lasted 40 days, was not, however, the first hijacking of a commercial airliner. After World War II, hijacking had often been employed as a means to escape from the Soviet Union and other countries behind the Iron Curtain, and during the 1960s, flights in the US were frequently hijacked by individuals wanting to fly to Cuba. But the El Al incident was the first hijacking to involve political demands beyond asylum, and it set off a wave of terrorist hijackings.

The PFLP struck again in August 1969, hijacking a plane on a flight between Rome and Tel Aviv and flying it to Damascus. In September 1970, the PFLP escalated its campaign,

hijacking three commercial airliners and flying them to an airfield in Jordan that was under Palestinian control. As part of the same operation, PFLP operatives hijacked a fourth plane and flew it to Egypt. A fifth hijacking was foiled when PFLP hijackers were shot by Israeli air marshals while trying to take control of an El Al plane. Airline hijacking became increasingly common between 1968 and 1972, when hijacking attempts occurred with an average frequency of one every six days.

Airline sabotage entered the terrorists' playbook in February 1970, when the PFLP planted a bomb aboard a Swissair jet flying from Zürich to Tel Aviv. The arrest and conviction of three Palestinians by Switzerland had made the country a target for retaliation. The explosion caused the plane to crash, killing all 47 persons on board. The same day, another bomb smuggled by the PFLP into the cargo hold of an Austrian Airlines flight from Frankfurt to Vienna exploded, blowing a hole in the side of the aircraft, but the captain managed to keep the plane under control and bring it to a safe landing.

Airports also became part of the battlefield. In May 1972, three members of the Japanese Red Army recruited by a Palestinian group arrived at Tel Aviv's airport on a flight from Rome. Taking automatic weapons and hand grenades out of their hand luggage, they opened fire on passengers and airport staff, killing 26 people and wounding 80, many of them Puerto Ricans on their way to the Holy Land. It was not merely the scale of the carnage from the event that attracted global attention, but its international complexity. How was it, people asked, that Japanese terrorists came to Israel to kill Puerto Ricans on behalf of Palestinians?

The attacks on commercial aviation fit into the broader strategy of the Palestinian groups determined to carry on an armed struggle with Israel. Tight security made it difficult for Palestinians to carry out attacks inside Israel itself, but there were ample Israeli and Jewish targets abroad. Attacking airlines flying to Israel or belonging to countries perceived to be supporting Israel's existence was, in the eyes of the Palestinian attackers, a legitimate expansion of the battlefield and had historical precedence.

The early Palestinian groups modeled their own struggle on the Algerian war for independence (1954-1962). The Algerians had carried their armed struggle beyond the colony of Algeria to the metropole - France itself. The Palestinians saw Israel as a colony imposed on them by the West. If Israel itself was too hard a target, the Palestinians would attack Israel's support structure abroad - Zionists, which in Arab eyes included Jews anywhere, nations supporting Israel (which meant nations not supporting the Palestinians), countries doing business with Israel, and travelers to Israel. All were considered "legitimate" targets. There were no innocents.

Although the Palestinian groups were innovators and the most frequent attackers, they were not alone in targeting aviation. Other groups followed their lead. The Japanese Red Army, independently of its alliance with the PFLP, hijacked airliners. Marxist guerrillas in Latin America and Europe, along with Eritrean, Croatian, Armenian, Puerto Rican, and Kashmiri separatists, Sikh extremists, and anti-Castro extremists also attacked airliners and airports in the 1970s. In addition, there were individual hijackers seeking asylum, demanding ransoms, escaping law enforcement, or calling attention to personal grievances. In some cases, their motives remain unclear. The hijacking phenomenon was widespread.

### ***Extraordinary Security and International Cooperation***

The continuing threat required extraordinary security measures. Israel decided that it could not risk the hijacking of another El Al airplane and made airline security a matter of national security. El Al implemented screening procedures that included interrogating boarding passengers. The airline's comparatively small number of international flights and the composition of its passenger load made this approach feasible. Armed air marshals provided an additional layer of security.

Other commercial airlines were reluctant to adopt such stringent measures, but by 1973, as hijackings continued, government regulatory authorities compelled the airline industry to adopt 100-percent passenger screening. More frequent flights, a greater volume of passengers, a more diverse flying population, public resistance, and privacy concerns obliged the industry to adopt less-intrusive inspection techniques than those implemented by the Israelis, however. Instead of attempting to profile passengers according to risk, airline security treated everyone equally and instead looked for weapons and explosives.

By today's standards, early aviation security was primitive. It consisted of metal detectors to keep weapons from being smuggled aboard flights and x-ray or physical inspection of carry-on luggage. Explosives detection technology was not routinely deployed until the 1990s. Body scanners were deployed after 2010, and imaging technologies have been steadily improved.

Parallel with the increased security measures adopted by different countries, the proliferation of attacks on commercial airliners in the late 1960s and early 1970s also led to efforts to increase cooperation at the international level. A single event could involve the governments of several countries, so prevention and resolution of incidents required international coordination.

The Convention on Offences and Certain Other Acts Committed on Board Aircraft, commonly called the Tokyo Convention, was introduced in 1963, when hijackings were still only occasional events. It was the first international agreement that addressed security and gave the captain of a flight authority to deal with passengers who jeopardized the safety of the flight. It also required countries where hijacked or threatened aircraft landed to restore the authority of the captain and take the offender into custody until extradition could be arranged. Ratification was slow. By 1969, only about half of the world's countries had ratified the Tokyo Convention.<sup>2</sup>

The increase in hijackings and sabotage attempts in 1969 and 1970 called for new measures. During the two-year period, there were 118 hijackings and 14 incidents of sabotage. The 1970 Hague Convention for the Suppression of Unlawful Seizure of Aircraft obligated states to either prosecute or extradite hijackers, thereby closing off safe havens such as Cuba.<sup>3</sup> The Hague Convention was widely adopted but did not cover aircraft sabotage.

This gap was filled by the 1971 Montreal Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, which extended criminal culpability to individuals not on board the aircraft.<sup>4</sup> A separate protocol in 1988 extended the convention to crimes at international airports.<sup>5</sup>

These conventions were part of a broader international effort to outlaw all international terrorist tactics. In addition to the conventions and protocols covering commercial aviation, conventions outlawed attacks on diplomats, taking hostages (already a war crime under the 1949 Geneva Convention), attacks on maritime targets and offshore platforms, and terrorist bombings (which were defined as bombing places of public use, government facilities, public transportation systems, or infrastructure facilities). By the end of the century, there were also international agreements to protect nuclear material, mark plastic explosives to aid in investigations, and prevent terrorist financing.

Ratification by individual states and compliance with the agreements varied greatly, but overall, the corpus of anti-terrorist conventions signaled that the international community did not want to see progress that had been made in regulating armed conflict reversed by terrorism, and the conventions facilitated cooperation where there was political will to cooperate. International cooperation on dealing with attacks on commercial aviation did improve, due to a combination of international agreements and diplomatic pressure on uncooperative states.

The combination of increased security (though costly and inconvenient), international cooperation (although uneven), and the suppression of some of the groups responsible for hijackings appeared to gradually reduce the number of hijackings. As pointed out in 1998 in *Aviation Terrorism and Security*, airplane hijacking dropped from an average of 50 events a

year in the late 1960s to an average of 18 in the 1970s and 1980s and an average of 14 in the 1990s.<sup>6</sup> Although the numbers differ slightly, a more recent (and excellent) analysis by Jacques Deuchesneau shows a jagged decline from a high point in 1970.<sup>7</sup> Looking at it another way, attacks on commercial aviation, which accounted for roughly a third of terrorist attacks on all targets in the late 1960s, declined to just 7 percent of terrorist attacks in the 1970s.<sup>8</sup>

However, Ariel Merari, a distinguished Israeli authority on terrorism, noted that “despite the long-accumulated experience with attacks on commercial aviation and notwithstanding the immense investment in security measures and procedures, the effectiveness of aviation security measures has not improved during the past three decades [1967–1996].”<sup>9</sup> Merari did not challenge the fact that the number of airline hijackings had declined from its peak at the beginning of the 1970s, but he pointed out that the number of successful attacks remained unacceptably high.

Moreover, the rate of thwarting hijackings had not improved. In the decade between 1967 and 1976, 31 percent of all attempted hijackings were thwarted. In the decade between 1987 and 1996, only 18 percent were thwarted - the most determined hijackers were still getting through security.<sup>10</sup> Terrorist bombers were also getting through.

### *Aircraft Sabotage*

While terrorist hijackings declined, attempts to sabotage aircraft increased. In 1974, a bomb caused the crash of a TWA flight from Tel Aviv to New York, killing all 88 on board - the bloodiest terrorist attack to that date. In 1982, an offshoot of the PFLP planted bombs aboard two Pan Am flights. One bomb exploded on a flight between Tokyo and Honolulu. The explosion killed one passenger and wounded 14 others, but the pilot was able to land the plane safely. Two weeks later, cleaners discovered an undetonated device on a Pan Am plane at the airport in Rio de Janeiro. These bombs and others detonated later in the decade were the work of a single terrorist bombmaker who, despite a multi-million-dollar reward, was never arrested.

The deadliest act of terrorism involving aviation prior to the 9/11 attacks on New York and Washington, DC, occurred in June 1985, when Sikh extremists bombed an Air India flight from Montreal to London, killing all 329 people on board. On the same day, that group also had attempted to sabotage another Air India flight scheduled to take off from Tokyo, but the device they planted exploded prematurely, killing two baggage handlers.

Further incidents of aircraft sabotage occurred in the 1980s and 1990s, including the 1987 bombing of a Korean Air flight, in which 115 people died; the 1988 bombing of Pan Am 103 over Lockerbie, which killed 270 people; and the 1989 bombing of a UTA flight to Paris, which killed 170. North Korean agents were responsible for the 1987 bombing, while Libyan agents were held responsible for the Pan Am and UTA bombings. These attacks paralleled the general escalation of terrorism in the 1980s.<sup>11</sup>

Bringing down wide-body jets can potentially give terrorists a body count of several hundred. Exceeding this ceiling required multiple coordinated attacks. The most ambitious of these was the so-called Bojinka plot uncovered by Philippine authorities in 1995. The plot involved operatives planting bombs on 12 airliners flying to the US from various airports in Asia. The bombs were intended to produce near-simultaneous explosions over the Pacific. Had the plot succeeded, it could have resulted in 4,000 fatalities.<sup>12</sup>

The Bojinka plot bombers perfected a small bomb suitable for the task, tested it on an Air Philippines flight, and were preparing to complete construction of the devices when an accidental chemical fire brought fire crews to their apartment laboratory in Manila. What the crews found aroused their suspicions and police were called in. One of the plotters was immediately arrested, and others were arrested after a manhunt. However, one of those involved in the plot escaped and later became the architect of the 9/11 attacks.<sup>13</sup>

### *The Lead up to the 9/11 Attacks*

The deadliest terrorist operation involving commercial aviation was the assault of 9/11. The audacious operation was the culmination of trends and ambitions expressed in terrorist plots and playbooks during the previous decades - airline hijackings, suicide attackers, multiple targets struck simultaneously to demonstrate organizational capacity and achieve a higher body count, an order-of-magnitude increase in the number of fatalities.

Authorities in the US said that the 9/11 scenario was a new type of attack that had not been foreseen.<sup>14</sup> Although this precise attack was not predicted, the possibility of hijacked airliners crashing into buildings was neither unimaginable, nor unimagined. There were ample precedents, although they went largely unnoticed.

In 1972, three hijackers took over a Southern Airways flight shortly after takeoff from Birmingham, Alabama, initiating the longest hijacking saga in US history. On one of the flights, the hijackers threatened to crash the plane into the nuclear facilities in Oak Ridge, Tennessee. Atomic reactors were shut down immediately upon receipt of the threat. This case led to the imposition of passenger screening in the US.

In 1973, Israeli jets shot down a Libyan Arab Airlines plane that flew over Israeli-occupied territory in the Sinai, fearing that it might be deliberately crashed into Tel Aviv. In 1979, a Serbian nationalist hijacked a flight in the US. He demanded and received another airplane, which he ordered to fly to Ireland. From there he wanted the plane flown to Yugoslavia, where he planned to crash it into headquarters of the Communist Party in Belgrade.

In 1986, members of the Abu Nidal Organization, a Palestinian group based in, and supported by, Libya, stormed aboard a Pan Am jumbo jet preparing to take off from the Karachi airport in, Pakistan. The hijackers had intended to fly the plane to Israel and crash it into Tel Aviv. However, the pilots were able to escape from the cockpit. Without pilots, the hijackers could not fly the aircraft, and Pakistani commandos stormed the plane.

In 1993, an FBI informant and an ex-Egyptian Army officer, testifying at the trial of the plotters of a series of terrorist attacks in New York that were to follow the bombing of the World Trade Center, described another terrorist plot. According to the informant, a Sudanese Air Force pilot was to hijack an airplane, bomb Egypt's presidential palace, and then crash the plane into the US embassy in Cairo. The plot never got beyond the discussion stage.<sup>15</sup>

In April 1994, an off-duty pilot riding as a passenger on a Federal Express flight attacked the flight crew and attempted to crash the plane into a company building in Nashville, Tennessee. Later that year, a suicidal pilot with a history of alcohol and drug abuse crashed his single-engine Cessna onto the South Lawn of the White House, slamming into the White House itself. Then, in December, Islamist extremists hijacked an Air France jet departing from Algiers. According to French authorities, the hijackers had discussed crashing the plane into the Eiffel Tower, although exactly how this was to be accomplished is not clear. French commandos stormed the aircraft after it landed for refueling in Marseille.

The most dramatic part of the 1995 Bojinka plot was the bombing of 12 airliners flying across the Pacific, but another part of the plot contemplated crashing a light aircraft into CIA headquarters. This idea was later proposed to Al-Qaeda leader Osama bin Laden, but he rejected it as paltry.

American intelligence services obtained information about a planned suicide attack by followers of the imprisoned instigator of the 1993 World Trade Center bombing and other terrorist plots in the US. The plotters intended to fly to the US from Afghanistan and attack the White House. Similar reports came to the attention of the intelligence community during the 1990s, including a reported plot in 1998 by Arab extremists to fly an explosives-laden plane into the World Trade Center.<sup>16</sup> Authorities dismissed the plot as unlikely, and the existence of intelligence reports does not mean that all of the plots were serious. Nonetheless, the reports indicate that at least some terrorists were talking about scenarios involving crashing hijacked airliners into buildings of iconic value.

The architect of the 9/11 attack initially planned to crash 10 hijacked airliners into both the east and west coasts of the US, but this idea was abandoned as too complicated. Instead, the planners substituted the idea of a second wave of attacks involving hijackings or sabotage of aircraft. The intense reaction of the US to the 9/11 attacks rendered this impractical.<sup>17</sup>

However, Al-Qaeda did attempt a further round of sabotage attacks later in 2001. British volunteer Richard Reid was equipped with a small bomb concealed in his shoe, which he tried to detonate aboard a US-bound flight from Paris in December 2001. The device failed to detonate. A second bomber who was to detonate his device on a flight to the US from Amsterdam, changed his mind and abandoned his device.

### *Dramatic Changes in Airline Security after 9/11*

Not surprisingly, the 9/11 attacks prompted dramatic increases in aviation security. In the US, passenger screening, which had been conducted by contract services widely seen as inadequate, was taken over by the federal government. Inspections were heightened everywhere. Cockpit doors were armored and kept locked while the plane was in flight. The airline strategy for dealing with hijackings changed from compliance with hijackers' demands to resistance if possible. Passengers became part of the response. Airline crews were empowered to enlist able-bodied assistants in dealing with threatening situations. Terrified passengers were ready to tackle and subdue hijackers themselves without waiting for an invitation or instructions by the crew. Hijackings declined.

There were 47 attempted hijackings of commercial airliners between 9/11 and March 2020. This continued the downward trajectory of hijacking attempts. About two-thirds of the attempts occurred in developing countries, some in conflict zones or theaters of ongoing terrorist campaigns. However, the hijackers were members of known terrorist groups in only a few cases. Most of them had personal motives; 25 had mental-health issues.

In 15 cases, the hijackers used knives or other sharp objects, including small wooden stakes, sharpened aluminum canes, a nail file, and a fountain pen, to threaten the crew. In only four cases were hijackers able to smuggle firearms past security, but three of them were in Sudan and Mauritania - both open conflict zones. In two more cases, the hijackers had replica guns or a toy pistol. Nine hijackers falsely claimed to have explosives. Crew and passengers overpowered the hijackers in several incidents. Apart from the hijackers themselves, no one was killed in any of these incidents.<sup>18</sup>

These figures underscore the continuing threat, but they also indicate that terrorist groups - who historically have accounted for only a fraction of the total hijackings - are playing an even smaller role. Security measures, where rigorously followed, appear to be having a measure of success in keeping guns off airplanes, but not in all cases. Cabin crew and passengers are now definitely part of aviation security.

After 9/11, governments also accelerated the deployment of explosives-detection technology, and after the attempted sabotage by the shoe bomber, passengers were required to remove their shoes during screening. Still, continuing sabotage attempts underscored the continuing threat.

In 2004, female suicide bombers simultaneously brought down two jets on domestic flights in Russia, killing all 90 persons on board. The discovery in 2006 of a plot in England to bomb airliners by using liquid explosives led to restrictions on the amount of liquids passengers could carry on board. An attempt in 2009 to blow up a US-bound airliner by a saboteur using a bomb concealed in his underwear led to the deployment of full-body scanners. In 2010, intelligence efforts in the Arab peninsula foiled terrorist plots to use bombs concealed in printer ink cartridges to sabotage airliners. Another attempt was foiled in 2012. Later intelligence reports indicated that terrorists were trying to conceal tiny but powerful bombs in laptops.

The fact that terrorist bomb makers were trying to develop tiny devices that would escape detection confirmed that despite criticism that airline security was ineffective and merely for show, terrorists took it seriously. And while terrorists were often able to smuggle their devices on board, the devices were generally unreliable.

Yet in 2015, a bomb smuggled on board a chartered Russian tourist airliner on a flight from Egypt to Russia detonated, killing 224 people. A bomb planted in the cabin of a passenger plane flying from Mogadishu, Somalia, in 2016 exploded, blowing a hole in the side of the aircraft and killing one passenger, but the pilot was able to land the plane. A month later, a soldier searching airline luggage was killed by another bomb.

Airports also remained targets. Terrorists and mentally unstable individuals carried out bombing and shooting attacks in the publicly accessible areas of airports in Los Angeles in 2002, Moscow in 2011, Brussels and Istanbul in 2016, and Fort Lauderdale, Florida, in 2017. These attacks led to a discussion of whether the security screening checkpoints should be extended to the front doors of terminals and whether outer perimeters should be added.

The idea of moving the screening checkpoints was rejected. Their purpose is to keep weapons and explosives off airplanes, not out of airports. Installing additional checkpoints to protect the publicly accessible areas of a terminal would have to cover both entrances and check-in areas, as well as baggage retrieval areas, and would risk creating crowds of people waiting to get through security who would be vulnerable to shootings or bombings.

Looking at the issue of airport security more broadly, any security measure against terrorism should provide a “net security benefit,” that is, it should not merely displace the risk from one crowded public place to another. If denied access to one venue, terrorists can target another to achieve the same results; in that case, there is not a net security benefit. An argument can be made that keeping adversaries from hijacking or bombing airplanes provides a net security benefit, while protecting the public areas of airports merely displaces the risk. The net-security-benefit argument is significant in the case of security of train stations and bus depots, discussed below.

Nonetheless, many airports have increased security at entryways, deploying more surveillance and armed guards to intervene rapidly in the event of a shooting. Rapid intervention to mitigate casualties differs strategically from prevention, which is what screening of boarding passengers and baggage aims at.

### ***The Threat Posed by Hand-held Surface-to-Air Missiles***

In the late 1970s, terrorism analysts tried to identify military weapons that terrorists might acquire and use in future attacks. One obvious concern were man-portable, precision-guided surface-to-air missiles, which were then being deployed in large numbers to armies around the world. As second- and third-generation weapons were distributed to the military establishments of the major powers, first- and second-generation weapons were sold to armies in developing countries, in many of which there were concerns about corruption and black-market sales. Terrorists had already acquired shoulder-fired anti-tank weapons.<sup>19</sup>

Despite these concerns, the US distributed Stinger missiles to the Afghan resistance fighters in 1986, which enabled them to shoot down Soviet helicopters. This altered the course of the war and the Soviet Union withdrew from Afghanistan three years later. As terrorism concerns grew after that conflict ended, efforts were made to account for and recover any remaining missiles. Concerns about terrorism precluded the distribution of surface-to-air missiles to the rebel formations during the civil war in Syria.

Guerrilla forces and terrorist groups did acquire some missiles and used them against commercial aircraft, but almost all of those incidents took place in conflict zones such as Rhodesia/Zimbabwe, Mozambique, Lebanon, Afghanistan, Sri Lanka, and Iraq. There were several reports in the 1970s and 1980s that terrorist groups had acquired surface-to-air missiles,

and for brief periods, airliners flying into certain airports adopted approach and takeoff procedures aimed at reducing their vulnerability footprint.

When TWA Flight 800 exploded in midair off the East Coast of the US in 1995, some speculated that it had been brought down by a missile. Anomalies in some of the physical wreckage lent weight to the assertion. Ultimately, however, investigators concluded that the plane had been brought down by an accidental explosion in the plane's center fuel tank; nevertheless, the missile theory persisted. In its 1996 report, the White House Commission on Aviation Safety and Security recommended that a task force be created to assess the surface-to-air-missile threat, but the feared scenario of terrorists shooting down commercial airliners as often as they bombed planes did not come to pass.<sup>20</sup> In 2002, Al-Qaeda operatives in Mombasa, Kenya, bombed a hotel and simultaneously launched two Soviet Strela missiles at a chartered passenger plane carrying Israeli tourists, but the missiles missed their targets. The attack, however, renewed discussions of countermeasures, including fitting commercial airliners with the anti-missile technology used by combat aircrafts.

### ***The Future of Aviation Security***

Aviation security remains one of the most important components of our overall defense against terrorism. It is costly, controversial, and contentious. It dramatically demonstrates the basic tenet of terrorism - that small groups with a limited capacity for power can achieve disproportionate effects by using terrorist tactics. The threat of one terrorist bomber obliges the nation to divert vast sums to airport security. Terrorists need to recruit only one bomber; the world must protect thousands of commercial airports with more than 100,000 daily flights.<sup>21</sup>

Aviation security has improved, although performance levels, when tested, have sometimes been disappointing. There is public and political pressure to improve effectiveness, reduce inconvenience, and lower costs all at the same time—competing goals that are difficult to achieve simultaneously. Yet, overall, one can assert that the technology has become more effective as well as more efficient in reducing false alarms and inspection delays.

Future passenger screening will increasingly combine information obtained from the moment flight reservations are made to aircraft boarding. Passengers will no longer be required to remove items from their carry-on luggage. Physical screening will not be confined to checkpoints but will also combine new technologies. These gains in efficiency, however, may be offset to some degree by growing passenger loads, especially in areas of the world where resources to acquire the new technology and the training of operators may lag.

Aviation security is also a victim of its own success. As memories of the 9/11 attacks fade, and as there are fewer hijackings or bombings to remind people of the terrorist threat, public complacency will enable those in government who are determined to cut costs to reduce security budgets or to shift them from a national responsibility to a private sector concern. We already see this happening. Many officials still tend to view terrorism as they do war - as a finite undertaking - and to look for an end to the threat and a peace dividend. More than a half-century after the first terrorist hijackings and bombings, this fatigue is understandable, but it is wrong.

### **Terrorist Attacks on Surface Transportation**

Since terrorists can attack anything, anywhere, anytime, their range of targets is broad and statistically random. To focus on a specific class of targets, therefore, seems arbitrary - like examining terrorist attacks on targets that begin with the letter C. However, the targets selected by terrorist groups are not random from their perspective. Their choices reflect strategies and operational considerations.

As we have seen, terrorist attacks on commercial aviation - in particular, those carried out by Palestinian groups in the late 1960s and early 1970s - reflected the terrorists' determination to attack Israeli targets abroad because tight security made operations inside Israel difficult. Going after airliners also allowed them to leverage or punish nations that supported Israel, and it fit with their desire to obtain greater publicity and international support for their cause. It was a strategic decision.

Similarly, Al-Qaeda saw attacks on airliners or using hijacked airliners as weapons as a means of achieving the high body counts that would not only cause worldwide alarm but would also bring them publicity, recruits, and financial support. That also was a strategic decision.

The same is true of terrorist attacks on surface transportation targets. The thousands of attacks on trains and train stations, metros, buses, and bus depots since 1970 have been carried out by a diverse group of attackers, including individuals propelled by idiosyncratic causes, which are sometimes hard to discern. Their choice of transportation targets reflects their personal mindsets and operational considerations, but the attackers are also frequently imitating what they have seen in the news media. The choice of certain tactics and targets often follows a contagion pattern - one spectacular event inspires copycats.

If, however, we look at cases where *specific* terrorist groups have waged campaigns against surface transportation targets, we again see evidence of a strategic and operational logic from their point of view.

### ***A Long History of Rail Sabotage***

Targeting rail systems has been a feature of warfare since rail systems became a major mode of transporting goods and people, including troops. During the American Civil War, both sides sabotaged railroads to impede enemy logistics. World War I saw numerous attacks on rail lines and dramatic derailments - for example, attacks by Arab raiders on the Turkish rail line in the Middle East. During World War II, rail yards and rolling stock were targets of strategic bombing, but also targets of resistance fighters in German-occupied Western Europe. The most intensive sabotage campaign took place in German-occupied Russia, where poor roads made German forces heavily dependent on rail systems. As part of what was officially called "the Railway War," hundreds of attacks were carried out by thousands of Soviet saboteurs operating behind German lines. The Soviet Army trained and equipped them and coordinated their operations.

The partisans used bombs with long-term delays, pressure- or vibration-triggered bombs, and command-detonated devices to destroy gasoline-filled tank cars, as well as magnetic mines with time-delay fuses, all supplied by the Soviet Army.

By 1943, German forces were struggling to deal with more than 1,000 rail sabotage incidents a month. In just two nights in 1944, Soviet partisans cut the rails in 8,422 places. Those running the trains had to remove an additional 2,478 mines. A single night later in the war saw more than 10,000 demolition actions. Partisans also fired anti-tank weapons at locomotives and attacked German rail repair crews. In the second phase of the Railway War, during the autumn of 1943, Soviet partisans destroyed more than 10,000 trains and 72 bridges and caused 30,000 casualties.<sup>22</sup>

Sabotage of rail lines and attacks on trains have also been a component of civil wars and insurgent campaigns. Rail sabotage and attacks on trains were prominent features of the Spanish Civil War (1936-1939), the Palestinian uprising (1936-1939), the Jewish insurgency (1944-1948), the First Indochina War (1946-1954), the separatist insurgency in southern Thailand (since 1948), Colombia's Marxist insurgency (since 1962), and the Naxalite insurgency in India (since 1967). Angola's civil war (1975-2002) destroyed most of the country's rail infrastructure. Mozambique's civil war (1977-1992) similarly caused heavy

damage to the country's rail system. India's Naxalite insurgents and guerrillas in southern Thailand continue to attack rail systems and passenger trains.

### ***Terrorists Seek Disruption, Fear, and Increasingly High Body Counts***

Wartime saboteurs concerned themselves with disrupting supply lines and preventing reinforcements from reaching the front. Effective disruption required sustained campaigns, a high volume of attacks, central direction, a large supply of demolition equipment, and large numbers of operatives. Recent insurgencies, in contrast, have sought to disrupt rail traffic as a mode of economic warfare, but also to kill ordinary passengers.

Terrorists today think differently about attacking trains. They are unable to replicate the magnitude of wartime sabotage campaigns and can rarely match the sophistication of those campaigns. Instead, terrorists seek easy targets for less-frequent attacks which are aimed at attracting attention, creating alarm, and causing disruption.

The first generation of urban guerrillas and terrorists in Latin America, Western Europe, North America, and the Middle East focused their attacks on government officials, diplomats, and commercial aviation. For the most part, they did not target surface transportation. The Provisional Wing of the Irish Republican Army (IRA) and the Basque separatist group Euskadi Ta Askatasuna (ETA) were exceptions.

Beginning in the 1980s, terrorist attacks on surface transportation were increasingly intended to cause mass casualties. The terrorists targeted passenger trains and stations and rarely went after infrastructure. While derailing speeding passenger trains remains a terrorist dream - and in some cases, the terrorists have succeeded - their more frequent targets have been metro systems and commuter trains, where high volumes of passengers offer opportunities for high body counts. By the late 20th century, bombings in train stations or on trains had become one of the most common terrorist tactics.

### ***The IRA Campaign against Transport in England***

The IRA was one of the first groups to initiate a bombing campaign targeting British rail passengers. For the first few years of its armed struggle, the IRA confined its terrorist operations to Northern Ireland, but in 1973, the group "exported" its campaign to England and began carrying out bombings in London. This fit with the IRA's overall strategy to impose a high psychological and economic burden on the British public and its government as a price for remaining in Northern Ireland. "Active Service Units" - clandestine cells of IRA bombers - initially targeted government buildings but later expanded their targets to include hotels, restaurants, and tourist sites, as well as train and Tube stations.

Many of the IRA attacks caused injuries and some caused fatalities, but the IRA was cautious. It had the capability to cause mass casualties - its members knew how to make bombs. But unlike the generation of jihadist terrorists that operated in the UK decades later, the IRA operated within self-imposed constraints. Its goal was to levy an unacceptable cost on Britain until its leaders decided it was no longer worth remaining in Northern Ireland - a strategy drawn from earlier anti-colonial contests. Massacres might repel the IRA's own supporters and reduce financial contributions from sympathizers abroad.

As a precaution, the IRA often provided authorities with warnings of where and when bombs were about to go off, claiming that it did so in order to give them time to evacuate the area and avoid casualties. Providing "warnings" offered the group cover when people were killed by IRA bombs, allowing it to shift culpability to the authorities, but warnings were not always given, the information was not always precise, and sometimes it was misleading.

Warnings were timed to force the authorities to evacuate large facilities quickly, creating potential panics, giving them just enough time to respond but not enough time to search. The IRA also called in hoax warnings to increase disruption. IRA operatives might plant one bomb to establish credibility while claiming to have planted many more, none of which targets could be ignored.

As an example, the IRA set off a bomb in London's Paddington Station at dawn on 18 February 1991. The station was empty, and the explosion injured no one, but it established credibility for a subsequent IRA call, warning that bombs would explode at all 11 of the main-line train stations in London during the morning rush hour. An evacuation of this magnitude was unprecedented, and the police hesitated before halting all incoming trains and evacuating every station, which would have put thousands of people into the streets. It would be a dangerous course of action that would put crowds of people in harm's way if the streets were where the IRA actually had planted bombs - and in some cases, the terrorists did plant secondary devices aimed at killing arriving police and others who gathered at the scene of an explosion.

Before ordering a massive evacuation, the authorities tried to search the stations. As a result, passengers were still present on a crowded platform when a bomb hidden in a trash can went off in Victoria Station five minutes before the detonation time given in the warning. The explosion killed one person and injured 38. Fearing further casualties, the authorities shut down all of the other train stations for the first time in history.<sup>23</sup>

### *The ETA Campaign against Spanish Railways*

Spain's Basque separatist ETA was a contemporary of the IRA. Beginning in the late 1960s, it carried out a campaign of assassinations, armed assaults, and bombings directed against Spanish government officials, Spain's security forces, and civilian targets, including Spain's rail system. ETA claimed responsibility for, or was directly linked to, 25 attacks on transportation targets; another 77 unclaimed attacks were also attributed to it.

ETA was even more cautious than the IRA about civilian casualties. Its attacks on transportation targets were intended to demonstrate its capabilities, cause fear and disruption, and discourage tourism as part of its campaign of economic warfare. Most of its attacks targeted empty trains and stations. When ETA planted bombs where civilian bystanders were likely to be killed, it - like the IRA - provided warnings. Only two of its many attacks on rail targets resulted in fatalities: four people were killed by bombs detonated in the Atocha and Chamartin train stations in Madrid on 29 July 1979.

However, as is the case in many terrorist campaigns, there was pressure to escalate the violence. In 2003, Spanish police thwarted an ETA plot to detonate two suitcases containing bombs with more than 50 kilos of explosives on a train in Madrid's Chamartin train station on Christmas Eve.<sup>24</sup> The arrest and interrogation of the individual attempting to plant one bomb alerted police to the second bomb, which was already on its way to Madrid. Authorities halted the Madrid-bound train, evacuated its passengers, and defused the device. On 29 February 2004, police arrested two ETA members driving vans carrying 536 kilos of explosives on their way to Madrid. The arrest interrupted a terrorist plan to detonate a massive vehicle bomb there on the day of the national elections, scheduled for 14 March.

It is understandable, therefore, that ETA would be at the top of the list of suspects when ten bombs went off on four commuter trains arriving at Madrid's Atocha rail station on 11 March 2004, killing 193 people and injuring around 2000 others. However, police quickly realized that the design of the devices and the explosives used were different from devices fabricated by ETA. This and other evidence convinced police that the bombs were the work of jihadists, not Basque separatists.

Spanish police were therefore surprised when the Minister of Interior announced that ETA was responsible, a claim that Spanish political leaders persisted in making despite overwhelming evidence to the contrary. This infuriated many people, who considered the government's claim as an attempt to cover up what people saw as a terrorist attack in retaliation for Spain joining the US in the invasion of Iraq.

A detailed analysis of the March 11 bombing by Fernando Reinares makes the point that both sides were wrong: ETA was not responsible for the attack, despite continuing conspiracy theories; and the decision by jihadists to carry out a major terrorist attack in Spain was already made in December 2001. The jihadist network in Spain that carried out the attack assembled in March 2002, and Al-Qaeda's senior leadership approved the plan in October 2003, all long before Spain joined the American-led coalition to invade Iraq.<sup>25</sup>

Transportation targets were not a feature in the terrorist campaigns of Germany's Red Army Faction, Italy's Red Brigades terrorists in the 1970s and 1980s, or other groups active during the period. Neo-fascists, however, bombed an express train in Italy in 1974, killing 12 people and injuring 48, and they bombed the Bologna Central railway station in 1980, killing 80 people and injuring more than 200 others. The Sicilian Mafia was believed responsible for the bombing of a passenger train in 1984 that killed 16 and injured 256.

### *The Tokyo Sarin Attack*

The terrorist events described above were exceptions and reflected different mindsets and motives. Terrorist violence in general, however, escalated during the 1980s and 1990s, prompting fears that terrorists would eventually resort to using weapons of mass destruction - chemical, biological, radiological, or nuclear (CBRN) weapons. A survey of terrorism experts in 1985 indicated that most thought the use of nuclear weapons was highly unlikely, while some thought that terrorists might try to use some form of biological weapons. A majority thought it likely that terrorists would use chemical weapons before the end of the century.<sup>26</sup> Their guess was right.

On 20 March 1995, members of Aum Shinrikyo, an apocalyptic Japanese cult, dropped and punctured plastic bags filled with sarin, a lethal nerve agent, on five Tokyo subway trains as they reached the central part of the city, where government buildings were concentrated. As the quality of the sarin manufactured by the group was poor and the method of dispersal was primitive, only 12 persons died in the attack, although more than 1,000 people were directly exposed to the fumes, and more than 5,500 were treated for a variety of medical conditions related to the attack. Had the sarin been more potent and the dispersal more effective, the number of deaths would have been much higher.<sup>27</sup>

Weeks later, Aum Shinrikyo members still at large attempted another attack on Tokyo's subway system, this time using hydrogen cyanide. The dispersal scheme did not work as planned, although four people were injured. With these incidents, chemical weapons had become part of the threat matrix, but they did not initiate a trend, although Al-Qaeda operatives later plotted attacks involving lethal chemicals and biological substances. Old-fashioned bombings and derailments continued to account for the highest-casualty attacks.

### *Campaigns Against Railways Continue*

In July 1995, a small group of Algerian extremists, angered by France's support of the Algerian government in its war against Islamists, detonated a bomb aboard a French commuter train at the St. Michel station in Paris. Seven persons died in the explosion, and more than 80 were injured. This was the first of a series of attacks, several of which were directed against transportation targets, that continued until mid-October. In August, the terrorists

unsuccessfully attempted to derail a high-speed train between Lyon and Paris. In October, a bomb exploded on a commuter train in Paris, injuring 30 people. After a long hiatus, when the campaign appeared to have ended, another bomb exploded on a commuter train in Paris in December 1996, killing four persons and injuring more than 90 others.<sup>28</sup>

India has experienced more attacks on surface transportation than any other country and has suffered some of the deadliest incidents. Terrorist attacks on commuter and intercity passenger trains in India became increasingly common in the first years of the 21st century. In 2002, sabotage caused the derailment of a high-speed passenger train crossing a bridge, resulting in between 130 and 200 fatalities. The incident was blamed on Naxalite or Maoist guerrillas, who are responsible for many of the attacks on Indian trains. Another derailment caused by Maoists in 2010 killed more than 90 persons. In addition to Maoist rebels, separatists in northeastern India and jihadist extremists, including operatives of the Islamic State, have also attacked India's trains.

### *Attacks on Buses*

While the IRA and ETA usually targeted trains, other groups went after buses and bus depots. The choice appears to have been operationally determined. For terrorists bent upon mass casualties, train attacks offer higher body counts, since speeding passenger trains can be derailed, trains and train stations can be attacked with multiple explosive devices, and train targets include packed metros and subways. Only a limited number of people can be killed on a single bus. However, buses are the primary form of public transportation in many developing countries and also in Israel.

Terrorist attacks on buses increased during the Palestinian uprising known as the Intifada (1987–1993), but the Second Intifada (2000–2006) may have been the most intensive and lethal campaign waged in any country, with the possible exception of Sri Lanka's civil war, which lasted from 1983 to 2009. According to Israeli statistics, Palestinian organizations during the Second Intifada carried out thousands of attacks between 29 September 2000, and the end of 2005. Although many of these had negligible results, 1,084 Israelis were killed, and more than 6,000 others were injured.<sup>29]</sup>

Bombings of buses and bus depots have been common in conflict zones across much of Africa and South Asia. They also have been a feature of jihadist campaigns in the Middle East.

Only 147 of the recorded attacks on buses were suicide attacks, but they caused 49 percent of the fatalities and 56 percent of the injuries. Suicide bombings of urban buses, which are small confined environments, made ideal targets for suicide bombers and buses in Tel Aviv and Haifa and figure prominently among the high-casualty events. Buses ripped apart, with bodies strewn across the streets, created horrific images that added to the alarm.<sup>30</sup>

### *The Jihadist Threat to Surface Transport*

Fanatics inspired by Islamist ideology have posed the greatest threat to surface transportation targets in first two decades of this century. An analysis of jihadist targeting preferences in Europe between 1996 and 2016 showed that transportation (aviation and surface) was the most frequent intended target in jihadist plots, ahead of public areas in general.<sup>31</sup>

The attacks on transportation are part of a global terrorist campaign initially inspired by continuing exhortations from Al-Qaeda leader Osama bin Laden and other Al-Qaeda communicators. Al-Qaeda's rival, the Islamic State of Iraq and Syria (ISIS), which emerged during Syria's civil war, has also attacked transportation targets, including a Russian airliner sabotaged in Egypt in 2015.

In contrast to the 9/11 hijackings, the attacks on surface transportation targets have been carried out by home-grown terrorists, although some of them received instruction in training camps run by Al-Qaeda or ISIS or had learned from information posted on jihadist websites. The jihadists in all cases sought to inflict mass casualties - the objective was carnage, not disruption. Transportation venues became killing fields.

The 2004 bombing attack on Madrid's commuter trains has already been mentioned. The following year, suicide bombers attacked London's underground, and one device was detonated aboard a London bus. In total, fifty-two persons were killed, and hundreds were injured. Two weeks later, four jihadist bombers attempted to replicate the attack, but their devices were faulty.

In 2006, jihadists in India planted bombs aboard a Mumbai commuter train, killing 209 persons. In 2007, bombs hidden in the coaches of a passenger train killed another 70 persons.

The Chechen insurgency in Russia started out as an independence movement, but over time it acquired a more radical jihadist ideology. Between 2003 and 2017, Chechen rebels/Islamists carried on a deadly bombing campaign targeting passenger trains and stations and urban metros in Moscow and other cities in Russia.

In 2004, a suicide attacker detonated a device on Moscow's packed metro during the rush hour, killing 40 people and injuring more than 100 others (later that year, as noted above, two female suicide bombers brought down two Russian airliners, killing 88 persons). In 2010, two blasts in Moscow metro stations killed 40 people. On December 29 and 30 of that year, two suicide bombers carried out attacks at Volgograd's train station and on a trolleybus, killing a total of 30 persons. In all, jihadist attacks on surface transportation in Russia killed more than 240 people and wounded hundreds more.

### ***Derailments: A Terrorist Dream***

While bombings aboard packed trains or in crowded stations offered jihadists the high body counts they wanted, speeding passenger trains crashing into ravines promised the spectacular images terrorists dreamed about. After 9/11, derailing trains became an obsession. Computer files recovered during the 2011 raid on Osama bin Laden's hideout in Pakistan indicate that at the time of his death, Al-Qaeda was looking for ways to "celebrate" the tenth anniversary of 9/11 by carrying out a major terrorist attack in the US. This would show that the Al-Qaeda enterprise was still in business ten years later. Bin Laden's proposed plan was to derail a passenger train as it crossed a high bridge, plunging the coaches into a river or deep valley, killing hundreds.

The Mineta Transportation Institute database includes 17 attempts by jihadists to sabotage rails, including 10 definite attempts to derail trains. Although other categories of attackers have carried out more-frequent attacks, the jihadist operations were by far the deadliest attacks.<sup>32</sup>

Saboteurs in 2007 detonated a bomb under the tracks of the Moscow-St. Petersburg Express to derail it as it passed over a bridge. The train managed to clear the bridge before the coaches derailed, and instead of plunging down the steep slope as anticipated, the coaches slid on their sides. Scores of people were injured, some seriously, but there were no fatalities. Saboteurs struck the same line again in 2009, and this time they succeeded in causing a deadly derailment - 26 people were killed, 97 injured. In both cases, Islamist fanatics from Ingushetia in Russia's turbulent North Caucasus were identified as the perpetrators. In 2011, Russian authorities foiled another attempt to sabotage the Moscow-St. Petersburg train.

In 2016, saboteurs derailed 14 coaches of the Indore-Patna Express in India's Uttar Pradesh state, killing 148 people and injuring 125 others. Initially, the derailment was thought to have been caused by a mechanical problem, but Indian authorities later blamed an ISIS cell operating in the area.

In 2017, ISIS supporters from Tajikistan attempted to sabotage a high-speed train, causing it to derail in the path of another train traveling in the opposite direction. The trains did not crash, and there were no casualties, but the coaches sustained extensive damage.

These incidents show that derailments can be deadly but are difficult to carry out. Surface transportation offers easier, less spectacular but still deadly ways of attacking. Police uncovered several jihadist plots against French rail targets in the early 2000s, and a 2015 attempt to gun down passengers on the high-speed train between Amsterdam and Paris was foiled by passengers. Members of the same network of Belgian and French ISIS recruits carried out coordinated bombings at the Brussels airport and on the Brussels metro in 2016, killing a total of 32 people. Police shot and killed another bomber at the Brussels Central Train Station in 2017.

### ***Recent Terrorist Plots indicate a Continuing Threat***

In addition to the jihadist attacks on surface transportation that have occurred, police have uncovered numerous jihadist plots. British authorities uncovered plans to disperse poison gas and ricin on London trains in 2002 and 2003. In 2003, jihadists also planned to release cyanide gas in New York's subway system but reportedly were diverted to another project. Authorities thwarted a plot by homegrown jihadists to bomb a subway station in midtown Manhattan in 2004. In November 2005, Australian authorities uncovered a plot to carry out attacks in Sydney and Melbourne; targets included Melbourne's landmark Flinders Street Rail Station.

In 2006, homegrown jihadists planned to detonate two bombs hidden in suitcases on German commuter trains, but the devices failed to detonate. That same year, Lebanese authorities discovered another jihadist plot to bomb trains in the tunnel under the Hudson River, and Moroccan police uncovered a jihadist plot to bomb Milan's metro in Italy.

In 2008, police in Spain uncovered a jihadist plot to carry out bombings on Barcelona's metro. An American jihadist who traveled to Pakistan offered his experience as a former employee of the Long Island Railroad to help Al-Qaeda plan and execute a terrorist attack on that system. He was arrested by Pakistani authorities and returned to the US.

The following year, acting on a tip from British authorities, FBI agents uncovered the existence of a group of jihadists planning to carry out suicide bombings on New York's subways. Another individual was arrested the following year in an undercover operation. He intended to carry out a bombing on the Washington DC metro. Even if most of the plots were aspirational, they indicate that attacks on transportation targets remain in terrorist playbooks.<sup>33</sup>

### **Trends in Tactics**

Thus far, we have been looking at terrorist attacks on surface transportation historically, by group and country. In this section, we look at the broader trends in terrorist tactics regarding attacks on transportation.

Terrorist attacks on surface transportation targets have increased over the long run. Between 1970 and 1979, terrorists carried out a total of 23 surface transportation attacks that caused fatalities (only incidents with fatalities are included in this analysis to mitigate apparent increases that may be due solely to better reporting.). The number grew to 44 attacks with fatalities in the 1980s, 271 in the 1990s, 446 in the decade between 2000 and 2009, and 814 in the decade between 2010 and (15 October) 2019.<sup>34</sup> These numbers include attacks on both bus and passenger rail targets.

Most of the attacks on surface transportation involved few or no fatalities, but 11 of them since 9/11 resulted in 50 or more deaths, and three of these killed nearly or slightly more than 200 people each. The total number of fatalities in these 14 attacks would translate into the

casualties from roughly 12 or 13 commercial airline crashes.<sup>35</sup> One can imagine the fear and furor that would have resulted if 13 commercial airliners had been brought down by terrorists since 9/11.

The total number of fatalities caused by attacks on surface transportation also increased, although both the number of incidents and the number of fatalities declined sharply after 2015. Overall lethality - the average number of fatalities per attack - appears to have declined slightly over the years, but this is due to a few high-casualty events in the 1970s and 1980s combined with a lower number of total events in those years, resulting in a higher average fatality per attack and tipping the trend line downward. If these few incidents are set aside, the trend line tips slightly upward. The greater number of high-fatality events in recent years is offset by the growing volume of low-level attacks, which lowers the average lethality rate. We also cannot dismiss the possibility that some portion of the increased volume of incidents recorded in recent years may be due simply to better reporting as more local news accounts become available via the internet.

Bombings account for most of the attacks on surface transportation and most of the casualties. Improvised explosive devices (IEDs), grenades, and mines were used in about 60 percent of the attacks. Bombings are also the most lethal form of attack. Shootings and armed assaults constitute 15 percent of the attacks. Incendiary devices and other forms of arson account for nearly 13 percent of all attacks, and mechanical means of sabotage (mostly of rails) account for about three percent.<sup>36</sup>

Recently, there has been an increase in more-primitive terrorist tactics - stabbings and vehicle-ramming attacks. There have also been incidents in which people are pushed off platforms into oncoming trains. The trend reflects changes in how terrorists are recruited. In the past, terrorists usually joined small underground groups that carefully vetted them to prevent infiltrators or individuals judged to be unreliable. In contrast, much of today's terrorist recruiting is done by exhortation. Jihadist groups, in particular, have exploited the Internet and social media to inspire followers abroad to carry out attacks wherever they are, using whatever means they have available. Often operating alone, the recruited individuals have limited resources and skills. Guns, where they are easily available, may be used. Knives and vehicles are readily accessible almost everywhere.<sup>37</sup>

Remote recruiting emphasizes the violence of attacks as much as the causes for which they are carried out, and it appeals to a broader audience of potential actors that includes not only fanatics, but individuals with histories of aggression and violence, as well as mentally disturbed persons. Intense media coverage adds to the attraction. The result is an increase in random attacks by individuals untethered to organizations.

### ***An Aviation Security Model won't work for Surface Transportation Attack Prevention***

Although the immediate threat posed by Al-Qaeda and ISIS appears to have diminished, it must be presumed that the threat will continue, because individual jihadists or operatives of other groups will view surface transportation as a target if only because it offers high body counts in easily accessible venues. Security measures for surface transportation cannot replicate those in place for aviation security. To begin with, the volume of passengers using public surface transportation greatly exceeds that of airline passengers. Rigorous passenger screening would require a vast army of security personnel.

Train stations, especially metro stations, are configured to allow as many people as possible access from multiple points. They do not lend themselves to security checkpoints, which could create long lines of waiting passengers who would be vulnerable to attack. Moreover, delay times for security that may be acceptable to passengers boarding flights would be inconvenient if imposed twice daily on commuters - especially during rush hours. While the costs of security represent a small portion of an airline ticket, adding them to the cost of commuter travel could

render public surface transportation unaffordable for many. In the future, new technology may allow effective, low-cost inspection that still allows rapid, high-volume passage, but for the foreseeable future, attempts to replicate the aviation model will not work.

There is one further consideration. Security measures should offer a “net security benefit,” that is, the security measures cannot easily be obviated by merely shifting targets. The argument for a net security benefit can be made in the case of aviation, where a bomb can bring down an airliner, causing hundreds of fatalities, or hijacked airliners can be turned into missiles killing thousands. Public surface transportation offers crowds, but so do many other accessible venues. Keeping bombers and shooters off trains and out of train stations and bus depots is desirable, but the net benefit to society is less (there are some exceptions, such as preventing explosions in deep tunnels where the destructive effects are magnified and rescues are difficult).<sup>38</sup>

The argument can be made that terrorist attacks on surface transportation have a greater psychological effect than, say, terrorist attacks on night clubs or movie theaters, even though the casualties may be the same, and therefore such attacks have greater economic consequences. Higher security for surface transportation, therefore, may be justified.

Security for surface transportation differs from aviation security in one further aspect. Today’s aviation security is multilayered, beginning the moment one makes reservations for air travel and extending through security checkpoints and air marshals and armored cockpit doors, not to mention alarmed passengers who are no longer passive bystanders in threatening situations. But while it has layers of defense, aviation security is still front-loaded, that is, it concentrates resources on preventing weapons or explosives from getting on airplanes. Once a bomb goes off, there is little that can be done to mitigate the consequences.

In contrast to airline transportation, public surface transportation does not allow many opportunities for prevention. Except for longer trips by rail that require reservations, there are fewer opportunities to confirm identities or check them against terrorism databases. And, as already mentioned, with some exceptions, there are fewer opportunities for security checkpoints at boarding places. However, there are greater opportunities for immediate intervention in the event of an attack, for prompt evacuation out of harm’s way, and for rapid rescue, all of which may mitigate casualties. Public surface transportation security, therefore, can be addressed with broader strategies and along a lengthier timeline. It begins with station design and construction, which can facilitate surveillance and mitigate casualties by creating large open spaces rather than confined environments. Design and construction measures can also eliminate those things (such as glass) that can turn into shrapnel or burn with toxic fumes and can facilitate rapid evacuation and rescue. The same principles apply to bus design.

CCTV is already widely used in surface transportation systems. Software is making CCTV systems smarter and capable of learning and recognizing anomalous behavior. Although it is more controversial from a civil liberties perspective, facial recognition technology is developing rapidly and increasingly being deployed.

Behavioral detection is another controversial security measure. The science is still debated, and its application can easily turn into racial or ethnic profiling, but it is already a standard component of many airports and may be used more widely in surface transportation security.

Police presence, which anecdotal information indicates has some deterrent effect, can be increased or deployed in accordance with threat information or on a random basis. A more limited form of passenger screening is in place for some commuter systems that conduct random passenger screening. This allows the operators to design and test screening protocols and train security personnel. Based upon threat conditions, the screening can be quickly expanded if necessary and can just as quickly be reduced.<sup>39</sup> Screening can be accompanied by behavioral detection. Explosives detection - primarily by canine units - is widely used. Dogs are now trained to follow vapor trails instead of sniffing individual objects.<sup>40</sup>

Enlisting public participation in “See Something – Say Something” campaigns appears promising. While crowded stations and coaches may seem chaotic to an observer, they are familiar territory to regular commuters, who are often able to spot things that are out of order. Staff training adds eyes and ears to the security effort. According to a statistical analysis done by the Mineta Transportation Institute, transport staff and passengers play an important role in the prevention of terrorist attacks. “By discovering and reporting suspicious objects, they have prevented more than 10 percent of all terrorist attacks on public surface transportation. Detection rates are even better in the economically advanced countries where more than 14 percent of the attempts are detected - and have been improving.”<sup>41</sup>

Aviation security, like aviation safety, is government regulated, reflecting a long tradition and the necessity of applying the same rules across the entire system. A new mode of attack anywhere is viewed as a potential global threat. In most cases, surface transportation security remains the responsibility of the operators and local authorities. Attackers are mostly local. Although an individual anywhere may carry out an attack, threat levels vary by country and city.

Instead of a regulatory approach, public surface transportation operates on a “best-practices” mode. Threats are assessed by central government authorities and local police. Attacks are analyzed for lessons learned. Information is shared with local authorities and operators, who then make individual decisions about the level and nature of security appropriate to their situation rather than conforming to a regulatory regime. The central government conducts research and may add resources in the form of personnel for security duties or financial support, although in countries where authority is traditionally more centralized and the threat level is high, central government intervention and control may increase.

Security does not come cheap, and surface transportation operators are under public and political pressure to keep fares low. This places low ceilings on security expenditures and creates a need for government subsidy. Some governments have reacted by treating public transportation - both air and ground - as a matter of national security. Others offer security assistance but leave funding and decision-making to the operators. As a result, surface transportation security remains a patchwork quilt with great variations.

### **How Much Security is Enough?**

There is, of course, the fundamental question: how much security is enough? This is not easily answered in dealing with events that have low probability but potentially high consequences. The nature of the terrorist threat makes it even more difficult to answer.

As noted earlier, terrorists can attack almost anything, anywhere, anytime, while we cannot protect everything, everywhere, all the time. That gives the terrorists a tremendous advantage, enabling them to obviate security measures by merely shifting their sights. It also means that consequences must be measured in terms of psychological effects, as well as casualties and physical destruction.

Accurate statistics about terrorism are extremely difficult to compile. Differences in definitions of terrorism, criteria for collection, and limitations on collection capabilities mean that no two sets of numbers agree, and data are often incomplete. Nevertheless, combining the Mineta Transportation Institute’s database of attacks on surface transportation systems, which includes nearly 50 years of information and has been an ongoing enterprise for the past 25 years, with a proprietary database of attacks on commercial aviation being compiled by Bruce R. Butterworth gives us a fairly good estimate of the total number of events and casualties.

The aviation database includes 1,123 events with 6,196 fatalities that occurred between 1970 and the end of 2019. The events include airline hijackings, airline sabotage, and attacks on airports (for all but 15 years) and aircraft on the ground. The data exclude apparent suicides

by commercial pilots who deliberately crashed their airplanes, killing all on board; attacks on airline ticket offices, navigational aids, and other infrastructure; and military activity in war zones. Spread over 50 years, the average annual total number of deaths from attacks on commercial aviation worldwide is 124. As the database is refined, these figures will shift somewhat, but not significantly.

If the 2,977 persons who died as a result of the 9/11 attacks are excluded, this gives us a rough average of three fatalities per attack.

There were a total number of 4,182 attacks against buses, bus depots, passenger trains (including metros and subways), train stations, and passenger ferries and terminals between 1970 and the end of 2019. The attacks resulted in 12,052 fatalities, producing a rough average of three fatalities per attack and an annual average of 241 fatalities worldwide.

At the risk of sounding callous about thousands of individual tragedies, these are not huge numbers. A strict application of cost-benefit analysis of security measures in place to prevent attacks on transportation targets, especially commercial aviation, would challenge the expenditures. Taken together, the total worldwide volume of deaths is roughly equivalent to the annual homicide toll in the US alone. We know that hundreds of thousands of people are murdered in the world every year, and more than a million die annually in automobile accidents.

Including economic damage and disruption in the tally alters the calculations. Major terrorist attacks produce cascading economic consequences, but do these suffice to merit the billions of dollars spent over the years on prevention?

The problem is that terrorist attacks, which are intended to create alarm, have enormous psychological impact, which cannot be ignored. We know that single deaths, although high in volume, have less psychological effect than incidents with multiple fatalities. The psychological effect of a plane crash that kills 100 people at once is far greater than the effect of hundred individual deaths from other causes. Psychologically, its effects may be closer to an event of 10,000 fatalities, although the effects will vary greatly according to the society and the circumstances.

An event that involves deliberate mayhem has a greater psychological effect than accidental deaths. Attacks that take place closer to home have a greater effect than faraway attacks. Even the primitive terrorist stabbing attacks that have become more frequent in recent years create the impression that nowhere is one safe, thereby adding to the level of anxiety.

Fear can have insidious but real effects on the economy; it can create political crises that bring down governments; it can exacerbate other anxieties; it can provoke rage that leads to war. While cantankerous passengers may complain about taking their shoes off at airports or being selected for a random check before entering a subway station, the public demands security or head will roll when a terrorist attack is not prevented.

Societies subjected to continuing terrorist campaigns may come to accept terrorism as a fact of life, but over time, attitudes change. Suppressed fear hardens into hatred. Tolerance declines. Democracy itself is imperiled. A state of security gradually becomes a security state.

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## Endnotes

- <sup>1</sup> Green, David B. 'This Day in Jewish History/The First and Only El Al Hijacking', *Haaretz*, 23 July 2013. Available at: [haaretz.com/jewish/premium-this-day-the-first-and-only-el-al-hijacking-1.5298481](http://haaretz.com/jewish/premium-this-day-the-first-and-only-el-al-hijacking-1.5298481).
- <sup>2</sup> Convention of Offences and Certain other Acts Committed on Board Aircraft. Signed in Tokyo on 14 September 1963. Available at: <https://treaties.un.org/doc/db/Terrorism/Conv1-english.pdf>.
- <sup>3</sup> Convention for the Suppression of Unlawful Seizure of Aircraft. Signed at The Hague on 16 December 1970. Available at: <https://treaties.un.org/doc/db/Terrorism/Conv2-english.pdf>.
- <sup>4</sup> Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation (with Final Act of the International Conference on Air Law held under the auspices of the International Civil Aviation Organization at Montreal in September 1971), concluded at Montreal on 23 September 1971. Available at: <https://treaties.un.org/doc/Publication/UNTS/Volume%20974/volume-974-I-14118-English.pdf>.
- <sup>5</sup> Protocol for the Suppression of Unlawful Acts of Violence at Airports serving International Civil Aviation 1998 ('Montreal Protocol'). Available at: [https://www.unodc.org/pdf/crime/terrorism/Commonwealth\\_Chapter\\_5.pdf](https://www.unodc.org/pdf/crime/terrorism/Commonwealth_Chapter_5.pdf).
- <sup>6</sup> Wilkinson, Paul, and Brian Michael Jenkins (eds.), *Aviation Terrorism and Security*, London: Frank Cass, 1998.
- <sup>7</sup> Deuchesneau, Jacques, *Aviation Terrorism: Thwarting High-Impact, Low-Probability Attacks*, Doctoral Thesis, Royal Military College of Canada, 2015.
- <sup>8</sup> Wilkinson and Jenkins 1998.
- <sup>9</sup> Merari, Ariel, 'Attacks on Civil Aviation: Trends and Lessons', in: Wilkinson and Jenkins 1998.
- <sup>10</sup> Ibid.
- <sup>11</sup> Jenkins, Brian Michael, 'Aircraft Sabotage', in Wilkinson and Jenkins 1998.
- <sup>12</sup> The 9/11 Commission, *Final Report of the 9/11 Commission on Terrorist Attacks Upon the United States*, Washington, DC: Executive Agency Publications, 2004. Available at: <https://www.9-11commission.gov/report/>.
- <sup>13</sup> For details of the Bojinka plot, see: The 9/11 Commission, 2004; see also: Minter, Richard, *Mastermind: The Many Faces of the 9/11 Architect, Khalid Shaikh Mohammed*, New York: Sentinel, 2011.
- <sup>14</sup> *Press Briefing by Ari Fleischer*, 16 May 2002. Available at: <https://georgewbush-whitehouse.archives.gov/news/releases/2002/05/text/20020516-4.html>.
- <sup>15</sup> Although details of this plot are in public records of the World Trade Center bombing trial, both the 9/11 Congressional Inquiry and the 9/11 Commission Report fail to mention it. History Commons, 'Complete 911 Timeline: Sheikh Omar Abdul-Rahman'. Available at: [http://www.historycommons.org/timeline.jsp?timeline=complete\\_911\\_timeline&other\\_al-qaeda\\_operatives=complete\\_911\\_timeline\\_sheikh\\_omar\\_abdul\\_rahman](http://www.historycommons.org/timeline.jsp?timeline=complete_911_timeline&other_al-qaeda_operatives=complete_911_timeline_sheikh_omar_abdul_rahman).
- <sup>16</sup> The "Red Team" created to examine potential threats to the World Trade Center following the 1993 bombing postulated a plane crashing into the towers as a possible scenario. The author of this chapter directed the threat analysis.
- <sup>17</sup> The 9/11 Commission 2004.
- <sup>18</sup> These statistics derive from a database compiled by Bruce R. Butterworth, the former Director of Aviation Security Operations at the US Federal Aviation Administration.
- <sup>19</sup> Jenkins, Brian Michael, *High Technology Terrorism and Surrogate War: The Impact of New Technology on Low-Level Violence*, Santa Monica, CA: The RAND Corporation, 1975. Available at: <https://www.rand.org/pubs/papers/P5339.html>; see also: Schaffer, Marvin,

*Concerns About Terrorists with PGMs*, Santa Monica, CA: The RAND Corporation, 1992. Available at: <https://www.rand.org/pubs/papers/P7774.html>.

<sup>20</sup> *White House Commission on Aviation Safety and Security Final Report to President Clinton*, Washington, DC, 1997. Available at: <https://fas.org/irp/threat/212fin~1.html>.

<sup>21</sup> Jenkins, Brian Michael, *Aviation Security: After Four Decades, It's Time for a Fundamental Review*, Santa Monica, CA: The RAND Corporation, 2012. Available at: [https://www.rand.org/pubs/occasional\\_papers/OP390.html](https://www.rand.org/pubs/occasional_papers/OP390.html).

<sup>22</sup> The Railway War is described in detail by its principal organizer in a book. Cf. Starinov, Ilya Grigo, *Over the Abyss: My Life in Soviet Special Operations*, New York: Ballantine Books, 1995.

<sup>23</sup> For a more detailed account of the IRA campaign against British transport, see: Jenkins, Brian Michael and Larry N. Gersten, *Protecting Surface Transportation Systems and Patrons from Terrorist Activities*, San Jose, CA: Mineta Transportation Institute, 2001.

<sup>24</sup> Goodman, Al, 'Spain Police Find Railway Bomb', *CNN.com*, 26 December 2003. Available at: <https://www.cnn.com/2003/WORLD/europe/12/26/spain.bomb/index.html>; Múgica, Fernando, 'La Extrana "Caravana de la Muerte,"', *elmundo.es*, 19 May 2004, Available at: <https://www.elmundo.es/elmundo/2006/05/19/espana/1148055732.html>.

<sup>25</sup> Reinares, Fernando, *Al-Qaeda's Revenge: The 2004 Madrid Train Bombings*, Washington, DC: The Woodrow Wilson Center Press/Columbia University Press, 2017.

<sup>26</sup> The results of the survey appeared in Jenkins, Brian Michael (ed.), *TVI [Terrorism, Violence, and Insurgency] Journal*, 1985. Readers, who were mostly law enforcement, military, and others concerned with terrorism, as well as private security personnel and researchers, were asked to assess the probability that terrorists would employ chemical, biological, or nuclear weapons by the end of the century. Respondents considered only chemical weapons more likely than not to be used. The survey, of course, had no scientific value - it was merely a quantification of guesses.

<sup>27</sup> The Tokyo sarin attack is described in Jenkins and Gersten 2001. See also: Kaplan, David E., *The Cult at the End of the World: The Terrifying Story of the Aum Doomsday Cult*, New York: Crown Publishers, 1996.

<sup>28</sup> The 1995–1996 terrorist campaign in France is described in detail in: Jenkins, Brian Michael and Jean-François Clair, *The 1995 Attempted Derailing of the French TGV (High-Speed Train) and a Quantitative Analysis of 181 Rail Sabotage Attempts*, San Jose, CA: Mineta Transportation Institute, 2010. Available at: <https://transweb.sjsu.edu/research/1995-attempted-derailing-french-tgv-high-speed-train-and-quantitative-analysis-181-rail>.

<sup>29</sup> Butterworth, Bruce R. Shalom Dolev, and Brian Michael Jenkins, *Security Awareness for Public Bus Transportation: Case Studies of Attacks Against the Israeli Public Bus System*, San Jose, CA: Mineta Transportation Institute, 2012. Available at: <https://transweb.sjsu.edu/research/security-awareness-public-bus-transportation-case-studies-attacks-against-israeli-public>.

<sup>30</sup> Butterworth, Dolev, and Jenkins (2012).

<sup>31</sup> Hemmingby, Cato, "Exploring the Continuum of Lethality: Militant Islamists' Targeting Preferences in Europe," *Perspectives on Terrorism*, Vol. 11, No. 5, 2017. Available at: <http://www.terrorismanalysts.com/pt/index.php/pot/article/view/642/html>.

<sup>32</sup> Jenkins, Brian Michael, and Bruce R. Butterworth, *Train Wrecks and Track Attacks: An Analysis of Attempts by Terrorists and Other Extremists to Derail Trains or Disrupt Rail Transportation*, San Jose, CA: Mineta Transportation Institute, 2018. Available at: <https://transweb.sjsu.edu/research/1794-Train-Wreck-Train-Attacks>.

<sup>33</sup> Various terrorist plots against transportation targets are examined in: Jenkins, Brian Michael and Joseph Trella, *Carnage Interrupted: An Analysis of Fifteen Terrorist Plots Against Public Surface Transportation*, San Jose, CA: Mineta Transportation Institute, 2012.

Available at: <https://transweb.sjsu.edu/research/carnage-interrupted-analysis-fifteen-terrorist-plots-against-public-surface-transportation>.

<sup>34</sup> These statistics were provided by the Mineta Transportation Institute database.

<sup>35</sup> The average number of fatalities in the four airline crashes caused by terrorist sabotage since 9/11 is 106.5, which gives us a rough equivalent of fatalities in 13 crashes.

<sup>36</sup> Jenkins, Brian Michael and Bruce R. Butterworth, *Explosives and Incendiaries Used in Terrorist Attacks on Public Surface Transportation: A Preliminary Empirical Analysis*, San Jose, CA: Mineta Transportation Institute, 2010. Available at: <https://transweb.sjsu.edu/research/explosives-and-incendiaries-used-terrorist-attacks-public-surface-transportation>.

<sup>37</sup> Jenkins, Brian Michael, and Bruce R. Butterworth, *“Smashing into Crowds”- An Analysis of Vehicle Ramming Attacks*, San Jose, CA: Mineta Transportation Institute, 2019. Available at: <https://transweb.sjsu.edu/research/SP1119-Vehicle-Ramming-Update>; see also: Jenkins, Brian Michael, Bruce R. Butterworth, Jean-François Clair, and Joseph Trella III, *An Exploration of Transportation Terrorist Stabbing Attacks*, San Jose, CA: Mineta Transportation Institute, 2019. Available at: <https://transweb.sjsu.edu/research/SP0319-Terrorist-Stabbing-Attacks-Public-Transportation>.

<sup>38</sup> A detailed discussion of the challenges of surface transportation security can be found in: Jenkins, Brian Michael, *The Challenge of Protecting Transit and Passenger Rail: Understanding How Security Works Against Terrorism*, San Jose, CA: Mineta Transportation Institute, 2017. Available at: <https://transweb.sjsu.edu/research/challenge-protecting-transit-and-passenger-rail-understanding-how-security-works-against>.

<sup>39</sup> Jenkins, Brian Michael, and Bruce R. Butterworth, *Selective Screening of Rail Passengers*. San Jose, CA: Mineta Transportation Institute, 2007. Available at: <https://transweb.sjsu.edu/research/selective-screening-rail-passengers>; see also: Jenkins, Brian Michael, Bruce R. Butterworth, and Larry N. Gersten, *Supplement to MTI Study on Selective Passenger Screening in the Mass Transit Rail Environment*. San Jose, CA: Mineta Transportation Institute, 2010. Available at: <https://transweb.sjsu.edu/research/supplement-mti-study-selective-passenger-screening-mass-transit-rail-environment>.

<sup>40</sup> Butterworth, Bruce R., ‘The Use of Canines’, in: Jenkins, Butterworth, and Gersten 2010)

<sup>41</sup> Jenkins, Brian Michael, and Bruce R. Butterworth, *Does “See Something, Say Something” Work?* San Jose, CA: Mineta Transportation Institute, 2018. Available at: <https://transweb.sjsu.edu/research/SP1118-See-Something-Say-Something> .

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### **Web-based Resources**

Mineta Transportation Institute, Available at: <https://transweb.sjsu.edu/>

International Air Transport Association (IATA). Available at: <https://www.iata.org/>

International Union of Railways (UIC). Available at: <https://uic.org/>