RISK ASSESSMENT PROFILING PROCEDURE (RAPP) FOR AIR CARGO SECURITY

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ABSTRACT

This paper offers a risk assessment profiling procedure (RAPP) for air cargo based on leveraging the role of the human factor along the security process. RAPP is based on principles taken from the Israeli method of passenger profiling and suspicious signs published by the United State Department of Homeland Security. RAPP is challenged with the plot of 2010 to bomb an all-cargo airplane using explosives concealed in printers originating from Yemen. The core competence of RAPP is individually assessing the risk of each shipment by a qualified agent, who looks for suspicious signs and anomalous patterns and addressing the level of risk by adjusting appropriate technological resources for detecting the explosives. RAPP allows less screening of cargo and makes the security process of air cargo more active. The combination of the human factor and the right technological resources enhances the level of success in securing air cargo.

Keywords: risk, assessment, profiling, procedure, cargo, security

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1. INTRODUCTION

Air operators worldwide handle more than 70,000 tons of air freight on a daily basis. The low amount of explosive required in order to create a mid-air explosion makes targeting air cargo desired by terrorist. Concealing a bomb inside a cargo shipment is relatively easy due to the different types, sizes and volumes of goods (Giemulla, Rothe & Zielinski 2014).

The plot to bomb a plane over U.S. soil in 2010 using explosives concealed in printers originated from Yemen was prevented due to real-time intelligence report. The bombs had not been detected by technology along the shipment's course from Yemen to Chicago via Cologne. This proves that technology itself cannot give a whole and complete solution for securing air cargo shipments (Giemulla, Rothe & Zielinski 2014).

The concept of passenger profiling was introduced three decades ago by the Israeli Security Agency. The core concept of passenger profiling is that qualified security agents assess the level of risk from each and every passenger flying from Tel Aviv Ben-Gurion airport. Each passenger is then given an individual level of security check according to different levels of threat. The agents do not look for the explosives, but rather look for suspicious signs and anomalous patterns, which send warning signals of possible terrorist method of operation (eds Zureik, Lyon & Abu-Laban 2011).

The aim of this paper is to offer a profiling procedure for air cargo security based on assessing individual risk of every cargo shipment. The paper begins with a description of the theoretical background on aviation terrorism and air cargo security, continues with comprehensive explanation of the Israeli passenger profiling method and ends with developing a new air cargo security method of profiling air cargo shipments. All information and interpretation used in this paper are non-classified and were taken from open sources.

2. THEORETICAL BACKGROUND

2.1 Aviation terrorism

Terrorism is defined as 'the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives' (Federal Bureau of Investigation 2014). Terrorism targets non-military personnel, and differs from civil wars, guerrilla warfare and riots. The act of terrorism has the objective to influence

political behavior by maximizing media exposure and further spreading the atmosphere of fear (Baseren 2008).

The aviation industry has been facing terrorism for the past half-century. The reason for the attractiveness of carrying out an attack against civil aviation is due to the amount of deaths and media exposure that could be achieved compared to other forms of attacks (eds Zureik, Lyon & Abu-Laban 2011). Due to the international characteristics of the aviation industry, terrorism against civil aviation is used as a tool to fight globalization, or in other words, the domination of western values worldwide (Baseren 2008).

2.2 Air cargo security

Air cargo is defined by the International Civil Aviation Organisation (ICAO) as 'any property carried on an aircraft other than mail, stores and accompanied or mishandled baggage' This definition excludes, others than mail, all supplies intended for consumption during the flight by the passengers or by the crew and goods needed for the operation and maintenance of the aircraft such as fuel and lubricants. The only stores defined as cargo, are those which have the classification of dangerous goods (International Civil Aviation Organisation 2009 p. 3). Aviation security is 'the combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference' (Morrel 2011 p. 170).

The security threats deriving from air cargo are: (1) Hijacking of an all-cargo airplane in order to use it as a weapon of mass destruction by crashing it on ground, (2) Bombing a cargo shipment concealed with explosive on board an all-cargo plane or on board a passenger plane, which carries cargo (Bart 2010). According to Transportation Security Administration (TSA) experts, the improvements implemented in the field of air passenger security have caused terrorists to consider attacking air cargo instead. Cargo is transported by both all-cargo and passenger planes. Security experts claim that the efforts and focus of authorities should be mainly given to securing cargo shipments which are loaded on passenger airplanes. This is explained by the claim that targeting an all-cargo aircraft is not likely to create the same fear effect amongst the public as compared to targeting a commercial passenger aircraft and the achieved level of media exposure is relatively less as well (Bart 2007). However, the failed plot to bomb an all-cargo airplane using printers concealed with explosives originated from Yemen in 2010 suggests otherwise. In this incident, a terror group in Yemen linked to al-Qaida has sent cargo shipments to the

United States which contained bombs. The explosives were concealed in a sophisticated manner inside printers and were addressed to Jewish synagogues in Chicago. Technological screening failed to detect the explosives, and only due to reliable on-time intelligence reports, the printers were located, searched and the bombs were disarmed (Department of Homeland security 2010a). This failed plot has shown that the bombing of an all-cargo airplane is still an important threat, which should be addresses (Bart 2010).

Nevertheless, unlike targeting a commercial passenger aircraft using an attacker on board or by concealing a bomb inside a passenger's baggage, the method of operation of targeting air cargo is different and lacks the key advantage of timing of the explosion. Unless assisted by individuals with access to the aircraft or to the ground handling procedures, terrorists have no influence on the course of the shipment along the supply chain and, therefore, can neither precisely predict the specific flight the cargo is loaded to nor the location of the explosion (Bart 2009).

Figure 1: Points of exploiting the air cargo movement based on International Civil Aviation Organisation (2013)
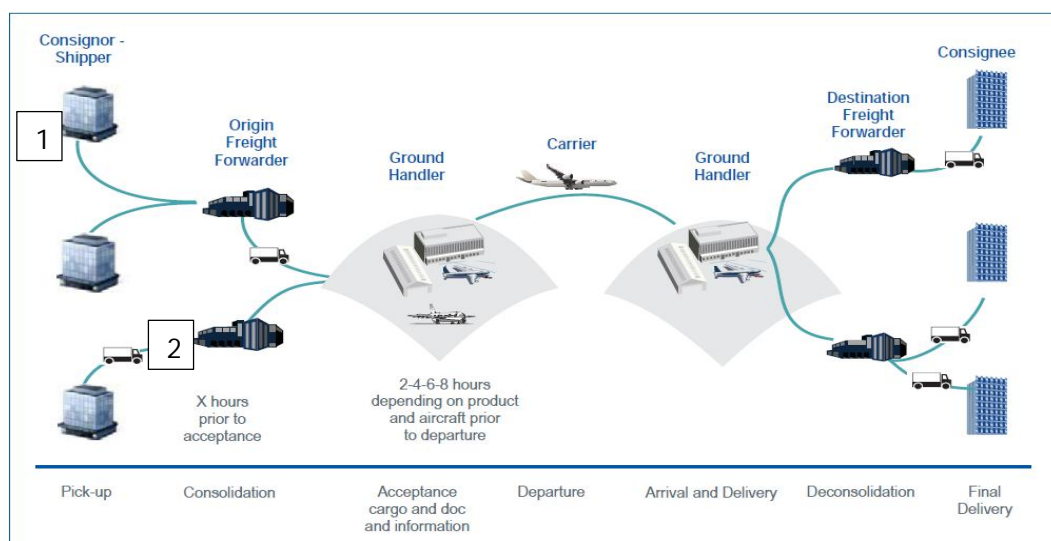

Figure 1 explains the terrorist method of operation of exploiting the air cargo platform. Terrorist execute their plans either by concealing explosives in a sophisticated manner in the beginning of the supply chain at the shipper phase (marked by 1), or by targeting the movement of the cargo along the supply chain, where terrorist can add an improvised explosive device to the cargo shipment (marked by 2) (Department of Infrastructure and Transport 2013).

2.3 Status Quo

As of August 2010, all cargo transported on commercial passenger aircrafts to and from the United States of America must be entirely 100% checked. This mandatory obligation has been decided as part of the recommendations post September 2001 attacks in order to compare the cargo's level of security checks to the security level of passengers' checked baggage (Bart 2010). The costs of implementing 100% check are tremendous. An analysis by the Congress Research Service (CRS) has concluded that the costs of implementing a 100% check of all cargo carried on commercial passenger aircrafts expected to reach the sum of $3.6 billion over a period of 10 years (Bart 2007). The consequences of this decision have made the transporting of goods by passenger aircraft less appealing economy wise (Giemulla, Rothe & Zielinski 2014). Moreover, shippers and forwarders of cargo from countries outside of the US have had to comply with the new regulation and adjust their cargo security checks to the standards issued by the American authorities, forcing them to purchase expensive technological machines (Morrel 2011).

The European Union (EU) has emphasized the importance of securing the supply chain as a tool of improving air cargo security. The European Commission (EC) mandates each EU member state to regulate the various entities of the supply chain of air cargo on condition that each entity along the process meets strict standards of controls, which includes background checks of staff, training and other legal obligation. By ensuring a secured supply chain, cargo companies can be officially validated as 'known consignor'. Once cargo is accepted from a known consignor, it can be exempted of additional screening and loaded directly onto the aircraft. If, however, cargo shipments are accepted from an unknown consignors, or if cargo has not been fully protected during its transportation prior of arriving at the airport for loading, it is mandatory to fully screen its content (European Commission 2014 a).

2.4 Technology limitations

Technology is widely used worldwide for cargo screening. The TSA certifies the X-ray and the Explosive Trace Detection (ETD) as approved technological machines for the detecting of explosives (Department of Homeland security 2010b). The EC does the same and approves the use of sniffer dogs as well (European Commission 2014). The main limitation of technology is that it requires the involvement of humans to analyze threat items produced by each machine. An unqualified screener may not recognize alerts produced by an X-ray machine, unless he is trained appropriately and has the right experience. The failure of detecting the threat items can be attributed to the

fact that the item looks different when scanned than in reality and that there are items that the screener might not know from everyday experience (Schwanninger 2006). A study about the role of the human factor in the layers of airport security suggests that airport security staff does not trust the technological security tools they use (Andriessen, Van Gulijk & Ale 2012).

The effectiveness of using technology is limited. An X-ray machine is utmost effective in screening low density cargo shipment shipments that are identical from unit to unit. ETD is effective as long as security personnel are able to take samples of shipment surface that is contaminated by explosives. If a sample is taken from a non-contaminated surface, or if taken hastily, then no alarm is produced (Crowely and Butterworth 2007).

3. PROFILING AS A RISK ASSESSMENT TOOL

3.1 Profiling of passengers in Israel

For more than four decades, Israel has been facing terror plots, attacks and threats on its commercial aviation industry both in its territory and abroad. The cornerstone of the aviation security in Israel can be dated to the year 1968, when an EL AL Boeing 707 was hijacked to Algiers on its way from Rome to Tel Aviv. Immediately after this successful hijacking, the Israeli government has formulated security regulations and created a security system with the goal of preventing attacks on Israeli carriers both domestically and internationally (Israel security Agency n.d. a).

The need for great aviation security in Israel is driven from the long-lasting Arab-Israeli conflict. Targeting Israeli airplanes is very much appealed by terrorist. Israel's tourism industry is dependent on air traffic to and from the country, and an attack would have catastrophic results on this industry. In addition, hijacking an Israeli airplane would force Israel to release terrorists that would re-enter the cycle of violence (Hasisi, Margalioth & Orgad 2012). Moreover, bombing of an Israeli airplane would force Israel to declare a war against the entity responsible for the attack (Israel security Agency n.d. b).

Profiling can be defined as 'the observation, recording and analysis of selected characteristics of individuals or groups for the purpose of predicting future behaviour (eds Zureik, Lyon & Abu-Laban 2011, p. 373). During the process of profiling, personal data is collected and cross checked with existing models of behaviour (eds Zureik, Lyon & Abu-Laban 2011). Profiling enables the authorities to dedicate efforts

and target not every single passenger, but those passengers who are more likely to fit the model behavior of a terrorist. Profiling acts as a risk based security technique, in which the individual level of risk from each passenger is assessed according to each passenger's risk category (Hasisi, Margalioth & Orgad 2012).

Israel airport security procedures are made of four security circles:

1. Detecting suspicious passengers outside of the terminal area – by matching names to checklists based on intelligence sources.
2. Information gathering from data found on the airline ticket - flight habits, method of purchasing the ticket and whether or not the passenger is flying alone.
3. Passenger profiling by a qualified security agent – each passenger is verbally screened by security agents, who determine the level of security the passenger should be granted.
4. On-board security (Orgad & Hasisi 2010).

The profiling method in the third circle of security highlights the use of the human factor. The method of passenger profiling depends on the expertise and the qualifications of the security staff. All of the security agents working at Tel Aviv's Ben Gurion airport and EL AL Israel Airlines' stations worldwide are well trained by Israel Security Agency (ISA), and have all completed mandatory military service. The agents' common sense, experience and intuition are the basic of the profiling method, and the variables in the profile process are based on empirical analysis of previous attacks and constant assessment of the threat by the authorities (Hasisi, Margalioth & Orgad 2012).

The passenger profiling method has proven to be very successful. After its implementation in 1968 all attempts to hijack an Israeli airplane have failed. In addition, the profiling has proven to thwart all attempts to bomb an Israeli airplane, except for one incident in 1971, when young European women were exploited to carry suitcases concealed with bombs (Hasisi, Margalioth & Orgad 2012). Advocates of the profiling procedure claim that the profiling is not simply based on the passenger's religion or ethnicity, but is rather behavioral. While interviewing each passenger, the agents look for anomalous pattern which flags warning signals that there is something wrong with regard to a specific passenger (eds Zureik, Lyon & Abu-Laban 2011).

The effectiveness of the profiling procedure can be illustrated by the successful preventing of two plots to bomb Israeli planes in the 80's. The first incident had occurred in Zurich in April 1980. A Christian German citizen was tricked to smuggle a suitcase of diamonds to Israel in return of money. The passenger was not aware that the suitcase did actually contain a bomb given to him by a member of the terrorist group Bader Meinhof. While being asked by the Israeli agent at Zurich airport regarding his trip to Israel, he acted nervously, was sweating and gave contradictory statements. His answers regarding his visit to Israel were not sufficient, which led him to expose his ties with the Palestinians. The Israeli agents had successfully detected the bomb after intrusive search of his suitcase (Hasisi, Margalioth & Orgad 2012).

The second terror plot in April 1986 to bomb an Israeli plane departing to Israel from London Heathrow illustrates the anomalous patterns that send warnings and assist the agent to assess the level of risk. An Irish woman named Ann-Marie Murphy was tricked to fly to Israel by her Jordanian lover, Nizar Hindawi. Murphy had carried Hindawi's unborn child and was six months pregnant at the time. Hindawi had connections with the Syrian intelligence officers, who promised him money in return of plotting to bomb an Israeli plane using Murphy's alleged visit to Israel. Hindawi bought Murphy a flight ticket to Tel Aviv, gave her a handbag with a present to his family in Israel and asked her not to mention her relationship with him. Murphy was not aware that the present she got from Hindawi did actually contain a sophisticated bomb. While being profiled, Murphy could not provide details about her visit, had no suitcase and only carried 150 dollars cash. Further questioning revealed her connection to Hindawi, and led to strict search of her bag. The bomb hidden in her handbag was not detected technologically by an X-ray machine. However, the anomalous patterns of her story made the agents to physically search the bag, when the bomb was finally revealed (Hasisi, Margalioth & Orgad 2012).

3.2 Non-classified Passenger Profiling Procedure

According to the academic and non-classified studies by Hasisi and Orgad (2010) and Hasisi, Orgad & Margalioth (2012), the Israeli airport security staff allegedly evaluates dozens of suspicious signs as shown in Table 1.

During the profile procedure, the agent identifies discretely suspicious signs and sorts each passenger into different risk groups: low risk, medium risk and high risk. Generally, the security checks of each passenger get more intrusive, in accordance to

the amount of suspicious signs detected. The screening resources are also adjusted to each risk group according to the proportion of risk level. If a passenger does not pass the process of profiling, he would be subjected to additional intensive questioning, which could lead to frisks and searches (Hasisi, Margalioth & Orgad 2012).

Table 1: Suspicious signs allegedly used by Israeli profiling agents based on Hasisi, Margalioth & Orgad (2012) and Hasisi and Orgad (2010)

Behavioural signs			
nervousness	Lack of cooperation with the airport security officer	Contradictory statements	Avoidance of answering

Passport signs		
Passengers who do not speak the language of	Passengers who do not match the passport photo or physical description entered	Passengers who have different names in the passport and the flying ticket

Ticket signs
Cash purchase of a one-way ticket prior to boarding in high-risk countries and with foreign currency

Traveling signs				
New suitcases	A large amount of cash	No alternative ID's	Previous trips to high-risk countries	No luggage for a long trip

| Nationality signs			
Country of citizenship	Country of residence	Ethnicity	Country issuing the passport

Civil rights organisations in Israel claim that the process of profiling causes discrimination against Muslims. Their claim points put that Israel conducts ethnic profiling and singles out intentionally Arab and Muslim oriented passengers from other passengers who are neither Arabs nor Muslims. The ethnic profiling results in different technological screening. Bags belonging to Arabs passengers are sent to an X-ray scanner with a higher resolution than the one that is used for bags belonging to Jewish passengers. The discrimination of passengers is visibly seen by the tagging system of stickers put on the passengers' passports, thus publicly identifying each passenger with different level of risk (eds Zureik, Lyon & Abu-Laban 2011).

3.3 Air cargo profiling
Profiling of air cargo in the United States is conducted using the programs of 'known

consignor' and 'known shipper', which ensures that these entities have been approved by the regulated authorities to have the mandatory screening processes and secured supply chain (Bart 2010). Profiling of air cargo is also conducted in the European Union. The EC has initiated new regulations regarding cargo arriving to the continent from airports outside of the EU. An air operator wishing to transport goods to the European Union from a third country airport must first obtain ACC3 validation, which ensures proper standards of cargo screening and a secured supply chain. In addition, the EC differentiates cargo arriving from high risk countries. A list of high risk countries is not publicly published, but every ACC3 air operator gets relevant information about suspicious cargo on a 'need to know' basis, and must be physically screened in accordance to different screening standards (European Commission 2014). Once a shipment is categorized as a high risk cargo, the only mandatory check of it by the air operator is to screen it according to strict standards. In other words, technology screening plays the major roll or the risk mitigation resources (Macario et al. 2012).

Figure 2: Security procedures for air cargo and mail originating in airports outside of the EU as from 2014, adopted from Macario et al. 2012)
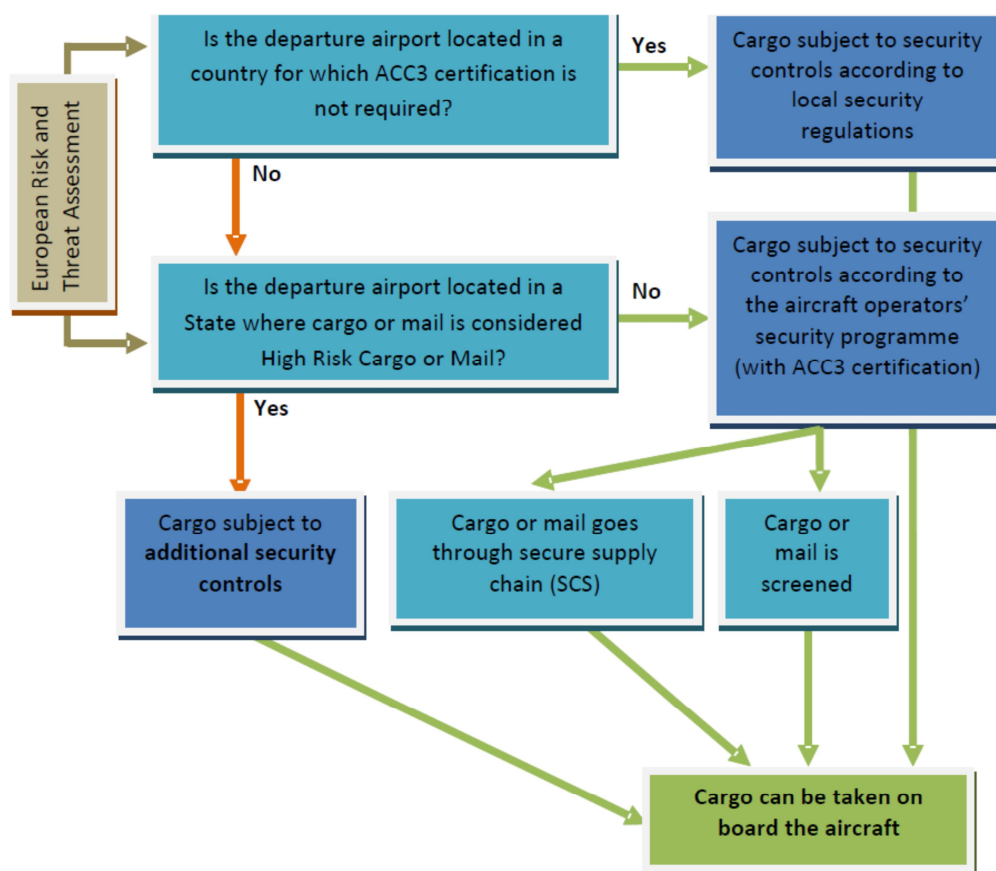
However, according to a former EL AL security expert, Amotz Brandes, air cargo profiling is conducted differently based on the Israeli approach. Brandes claims that EL AL conducts risk assessment on every single shipment with a special air cargo profiling technique. The specific air cargo profiling technique is not published due to classified security reasons. Nevertheless, Brandes indicates that for cargo profiling, the best tool for mitigating and preventing a terrorist threat is by questioning or inquiry (Airline Pilot 2007).

4. RISK ASSESSMENT PROFILING PROCEDURE FOR AIR CARGO SECURITY
4.1 Suspicious signs
This paper offers a RAPP for air cargo originating from both low risk and high risk countries. RAPP is based on the same principles and ideas from the Israeli passenger profiling procedure as explained in the previous chapter. However, the suspicious signs of RAPP ,shown in table 2, are taken from the United States Department of Homeland Security's own study regarding the failed 2010 plot to bomb a cargo plane using explosives concealed in printers.

Table 2: Suspicious signs for air cargo profiling based on Department of Homeland Security (2010a)

Signs related to the physical characteristics of the package			
Unusual odors	Sealed with excessive tape	Lopsided or uneven shape	Indications of liquids/powder leaking from the package
Signs related to dispatching mistakes			
Poorly or illegibly typed or written addresses	Use of incorrect titles	Mailed with excessive postage	Addresses misspelled or containing only titles of recipient.
No return address			
Signs related to anomalous patterns			
Unexpected packages mailed from outside the United States		Restrictive markings destined for a specific, high-profile person	

4.2 Cargo originating from low risk countries

RAPP makes full use of the 'Known Shipper' programs and validated secured supply chains. RAPP suggests that every cargo shipment should be first filtered into two groups according to its country of origin – high risk vs. low risk countries. Figure 3 illustrates the security process of a cargo shipment originating from a low risk country.

Figure 3: RAPP for cargo shipments originating from low risk countries
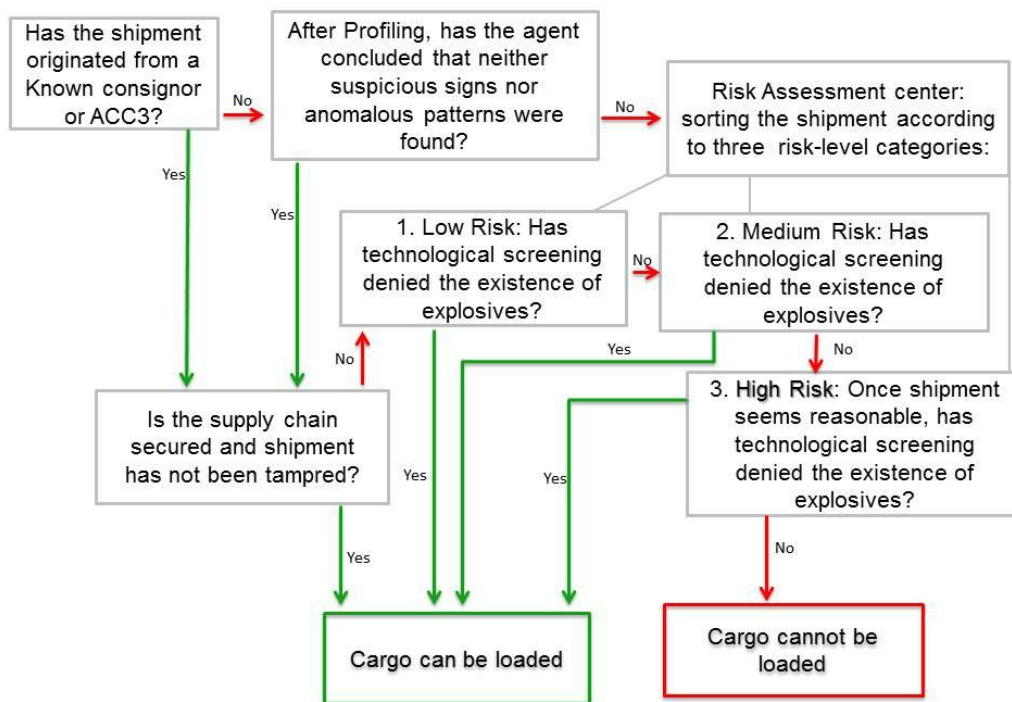
A cargo shipment can be exempted from any technological screening if it is originated from a low risk country by a known consignor or ACC3 validated air operator using a secured supply chain. If neither known consignor nor ACC3 apply, the cargo shipment must be profiled by an agent who looks for anomalous patterns and suspicious signs according to table 2. If the profiling ends successfully, the cargo can be loaded without technological screening once the course of the shipment (the supply chain) was secured. If the supply chain is not secured and / or if the profiling resulted in failure, the shipment must be further inspected according to risk assessment (by an agent) filtering the shipment into three risk categories: low risk, medium risk and high risk. For every level of risk, the technological resources intensify. A low risk shipment which was successfully screened can be loaded. If problems were detected, it becomes a medium risk category. Failure while screening the cargo shipment as a medium risk makes the shipment a high risk. Once a cargo

is categorized as high risk, an agent must determine if the shipment seems reasonable and logic. Once the agent did, the cargo must be technology screened, and if no explosives are detected, the shipment may be loaded. If problems are detected during the checks of a high risk category shipment, the shipment cannot be loaded. RAPP allows for less cargo shipments to be screened, which contributes saving time, money and manpower.

4.3 Cargo originating from high risk countries

Figure 4 illustrates the security process of a cargo shipment originating from a high risk country. This process is similar to the process above, with the obliged technology screening of every shipment even if it is originated from a known consignor or a validated ACC3 entity. In addition, risk assessment is mandatory if a cargo shipment has passed the profiling stage but its supply chain is proven not to be secured or if the shipment is tempered. However, according to RAPP, a tempered cargo is not a high risk cargo and it is checked according to the specific circumstances. High risk cargo is only attributed after a risk assessment has been completed or if the screening of a medium risk cargo fails.

Figure 4: RAPP for cargo shipments originating from high risk countries
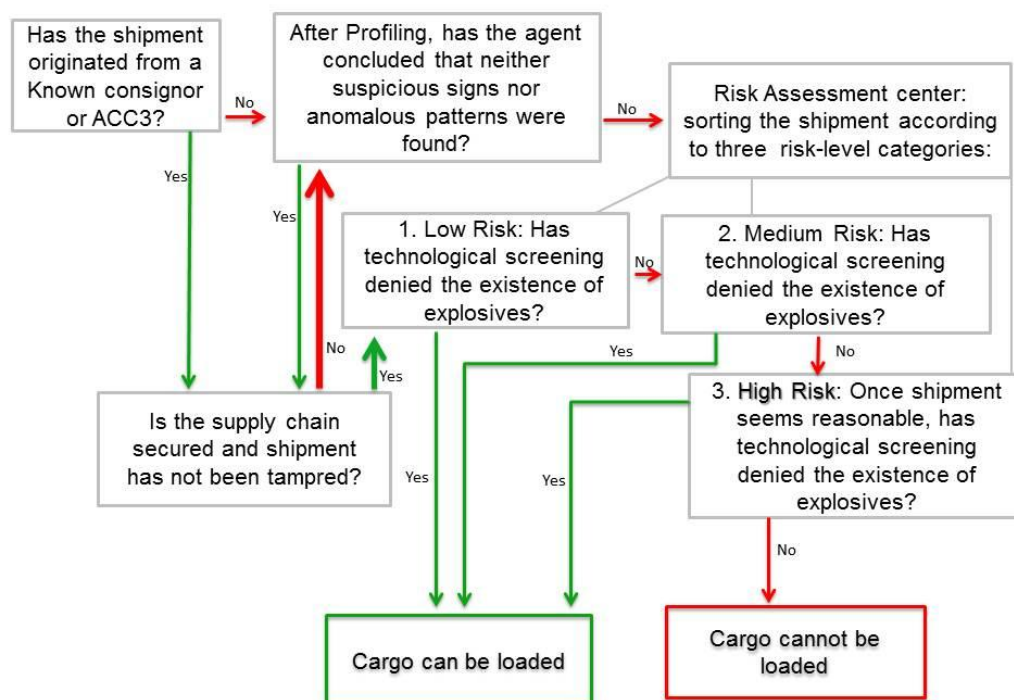
RAPP makes sure that the technology is used smartly and in accordance to the risk assessment, in which the screener is aware of the security threat and uses the

technological tools properly to the level of threat. The Air cargo shipment that raises concern during profile is subjected to an additional inquiry and suspension just as it is done with passengers, whose security checks require them to undergo an additional questioning. The agent's main objective is to look for a terrorist method of operation by analyzing anomalous patterns.

4.4 Case study

RAPP can be challenged with the 2010 concealed printer plot to check its effectiveness. Giemulla, Rothe and Zielinski (2014) suggest the following regarding this plot:

1. The shipment was of two packages originated from Sanaa, Yemen, in 26.10.2010, and each contained a Hewlett Packard laser printer, books and souvenirs.

2. The terrorists used Semtex explosives, which were sophistically concealed inside the printers' toner together with the bomb mechanism. This had made the explosive very difficult to be detected. A question rises on whether the bomb could have been identified by standard screening.

3. The bombs were detected after a real time intelligence report had been given.

Homeland Security (2010b) report on the failed plot adds that:

4. The packages were shipped to likely fictitious individuals formerly associated with Jewish synagogues in Chicago, Illinois.

Assuming Yemen is a high risk country, the printer shipment would have been checked according to figure 4. The shipment was not originated from a known consignor or from an ACC3. In retrospect, the suspicious sign of 'Unexpected packages mailed from outside the United States' might have been detected if an agent had tried to contact the addressee. This sign would have led the agent to determine a risk category. The agents would have realized that sending a printer, books and souvenirs to a Jewish synagogue is likely unexpected and follows an anomalous pattern. This finding would have categorized the unreasonable shipment as a high risk cargo shipment. The shipment might have been halted with no further screening and denied from being transported. In retrospect, RAPP could have increased the chances of stopping the plot with no technology involved, regardless of intelligence agency's real-time assistance. The combination of the human factor and

technology is the core advantage of RAPP. Technological tools are smartly used after a human agent asses the risk and determines the terrorist method of operation.

5. CONCLUSION

The vulnerability of securing air cargo shipments makes it an easy target for terrorists. Technology plays a major role in the security process of air cargo shipments worldwide and new regulations have been ruled by governments in order to address the threat facing from air cargo terrorist attacks to shipments.

The paper introduces the Risk Assessment Profiling Procedure (RAPP) for air cargo security, which is based on principles taken from the Israeli passenger profiling method. RAPP maximizes the role of the human factor in the security process of air cargo and uses the current technological resources smartly. According to RAPP, after passing the profiling stage and as long as the supply chain is secured, cargo shipments, which originated from low risk countries can be exempted from technological screening whether or not the consignor is a 'known consignor' or certified as an ACC3. Shipments originated from high risk countries, however, are subjected to technological screening only after a risk assessment has been completed. The purpose of the risk assessment is to track the terrorist method of operation and to allocate the right tools for addressing the threat. In retrospect, RAPP could have successfully stopped the plot of 2010 to bomb explosives concealed printers originated from Yemen.

The authors believe that human factor and technology complements each other. RAPP allows the authorities to focus more energy on the suspicious cargo shipments and makes the security process more efficient by less screening. In addition, by applying RAPP, the industry becomes more active against continuous threats by terrorist and acts instead or reacts to security threats.

Future studies of this topic should focus on operations and business aspects. It is important to research how likely it would be to implement RAPP on a large scale for cargo shipments of different origins, and what economic consequences RAPP would have on the industry.

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