IDA

Deterrence and the 9-11 Terrorists

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PREFACE

This document was prepared to support the IDA Central Research Project (CRP), "A Calibrated Model of Deterring Terrorist Attacks." The objective of the CRP was to explore the feasibility of extending our prior work on deterring drug smugglers to support various national efforts to prevent terrorist attacks. My appreciation goes to Dr. Barry Crane for originally proposing that we do this analysis, to Dr. Arthur Fries and Dr. Steve Warner for many helpful suggestions, and to Mr. Robert R. Soule for technical review.

DETERRENCE AND THE 9-11 TERRORISTS

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SUMMARY

Terrorists are engaged in a high-risk venture and must constantly exercise caution. Even suicide terrorists, who generally hope to conduct significant attacks, would most likely not carelessly or recklessly squander their lives on an attack that had little chance of success. Therefore, deterrence effects should be able to delay and complicate even suicidal terrorist efforts. At a more strategic level, we should be able to deter by undermining the terrorists' motivation. For example, they probably would not wish to appear as powerless or inept, embarrass their cause, reveal larger plans, or bring shame on their families and supporters.

This qualitative and quantitative analysis builds on what is now known publicly about the September 11th terrorist attacks to explore the missed opportunities for deterrence and assess whether the behavior of the 9-11 terrorists suggested, even if momentarily, indicators of deterrence in their final decision to proceed. The qualitative assessment describes nine sequential decision steps at each of which we might have deterred the progress of the plot and eventual attack. Although the United States missed opportunities to discover and thwart the 9-11 plot, our subsequent defensive and retaliatory actions should contribute to deterrence in the future. An important question then remains. Can we know how much defensive and offensive effort is needed to deter nearly all terrorist attacks?

A quantitative analysis of the 9-11 attacks would address the terrorist leaders' willingness to proceed given their perceived chances of boarding the aircraft for the attack unchallenged. Such an analysis is feasible if IDA's mathematical model of the psychology of deterrence, which has been validated and calibrated for operations against drug smugglers, also applies to the terrorists' willingness to risk their attack. Smugglers are known to have ignored risks, even lethal ones, up to a point determined by the severity of consequences and the odds of being interdicted.

As in IDA's counter drug work, the 9-11 perpetrators' decisions appear to have been based on objectively derived estimates of the probabilities of interdiction by

opposing forces. The total number of their unchallenged preparatory test flights (test boardings) leads to an estimate of the terrorists leaders' perceived odds of boarding a flight with box cutters. This in turn leads to the odds of one cell of hijackers successfully boarding an individual flight, as well as the odds of all four cells boarding their respective aircraft.

IDA's analysis shows that the 20 flights necessary to assemble the cells in place for attack (i.e., the 20 flights necessary for everyone to reach the United States) leaves the terrorists' perceived risk so high as to deter them from attacking. However, between one and two team practice trips, that is, twenty to forty additional flights, without being challenged, reduces the estimated failure rate well below the deterrence threshold. Thus, our deterrence model shows promise in quantifying the risks of terrorism and the contribution of deterrence to our safety. If proven to apply, a 6 percent chance of interdiction would deter 80 percent of suicide attacks, and deterrence would save resources as a powerful force multiplier. Also, the detention of just one more plot member would have increased the number of practice flights necessary to reach the threshold of confidence from 36 to 92, a 156 percent increase. Such a seemingly small event – detaining only one plot member – should have seriously challenged the plot leaders' confidence to proceed.

A. DETERRENCE AFTER THE 9-11 ATTACKS

The 11 September 2001 attacks on the World Trade Center and the Pentagon using hijacked commercial aircraft as weapons provide a chilling example of a failure to thwart committed suicide terrorists. This paper argues that it should be possible to deter even suicide terrorists, and analyzes why our security protections failed to achieve the conditions necessary to deter the 9-11 attacks. Based on our current understanding and mathematical model of the psychology of deterrence, analysis of the 9-11 attacks shows that the terrorists were cautious and risk averse, yet we as a nation failed to challenge them at the threshold levels necessary to deter their attack. While publicly available empirical data is insufficient to support a complete analysis, both qualitative and quantitative techniques indicate wide gaps between where we were on September 10th and where we need to be to deter such terrorists.

B. BACKGROUND: DETERRENCE AND AVIATION SECURITY

One would expect that as the chances of being caught, imprisoned, killed, or humiliated increase, many terrorists would quit, put off their attack, or chose different,

less protected targets. Even suicide terrorists do not want to waste their lives on a futile attack and exhibit extreme caution in all of their preparations. In addition, they probably do not wish to appear as powerless or inept, embarrass their cause, reveal larger plans, or bring shame on their families and supporters.

If deterrence can be quantified, at least approximately, the information might be used to assess system performance in denying an attack attempt.[1] In a successful aviation security system, actual terrorist attempts would be rare, so available data might not support statistical analysis. Therefore, quantitative and qualitative analyses of deterrence would have to rest in part on evidence derived from a wide range of related examples drawn from criminal and high-risk activities.

Two key questions must be answered as part of this process:

1. What types of consequences and chances of failure are necessary to deter most terrorists?

2. If most terrorists can be deterred, can we predict the probability of attack by modeling terrorists as a class of perpetrators?

We can address these questions in several ways: directly, by examining related operations where there are sufficient data to quantify different levels of risk and expected behavior; indirectly, by examining the literature on risk taking; or subjectively, by interviewing captured terrorists. Extensive data exist on drug smuggling operations and risk-taking in general.[2] Although the literature provides some clues about the mathematical form for a model of the psychology of deterrence, interviews with drug smugglers and the results of counterdrug operations[2] led to simple functional expression with calibrated parameters. Other law enforcement data[3] confirmed the results in entirely different compliance contexts. Because the mathematical form of the deterrence model applies to a range of criminal and risk-taking behavior, it is likely to generalize to include the psychology of terrorists as individuals and possibly as small groups or cells.

Interviews with imprisoned drug smugglers provide a large enough data set to derive a mathematical form for the model – a form that can be validated by other more

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[1] *Deterrence Effects of Operation Frontier Shield*, IDA Paper P-3460, March 1999. This paper shows that the threat of lethal interdiction was necessary to cause collapse of the cocaine smuggling air bridge traffic from Peru to Colombia.

[2] *Deterrence Effects and Peru's Force-Down/Shoot-Down Policy: Lessons Learned for Counter-Cocaine Interdiction Operations*, IDA Paper P-3472, April 2000.

[3] *Fisheries Law Enforcement – Assessment of Deterrence*, IDA Document D-2381, December 1999.

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narrowly focused data sets from real operations. Although interviews seem liable to bias, prisoners serving long prison terms apparently want to share their knowledge – bragging rights, if you will – given that they can do so without self-incrimination or adding to their prison time. While interview data[4] represent only the opinions of these smugglers (i.e., the perceived risk versus reward), such opinions are the ultimate basis of criminal deterrence. Because the interviewees came from a wide range of backgrounds and degrees of involvement, the emergence of a common mathematical pattern indicates that the result arises from a general property of human perception, not simply a specific criminal activity. The interview data also address other factors influencing a criminal's behavior, such as how compensation offsets perceived risk. The essence of the model is the function representing the willingness to commit a crime given the probability of being apprehended.

The general deterrence relationship as described by our mathematical model is shown in Figure 1. In the more general counter terror case, apprehension corresponds to what is referred to as interdiction in counter drug operations; hence P_I is the probability of apprehension.

$$P_t = 1 - (1 - P_I) \cdot W(P_I^*)$$

Probability of thwarting crime

Probability of *not* being apprehended

Willingness to do the crime

Actual probability of being apprehended

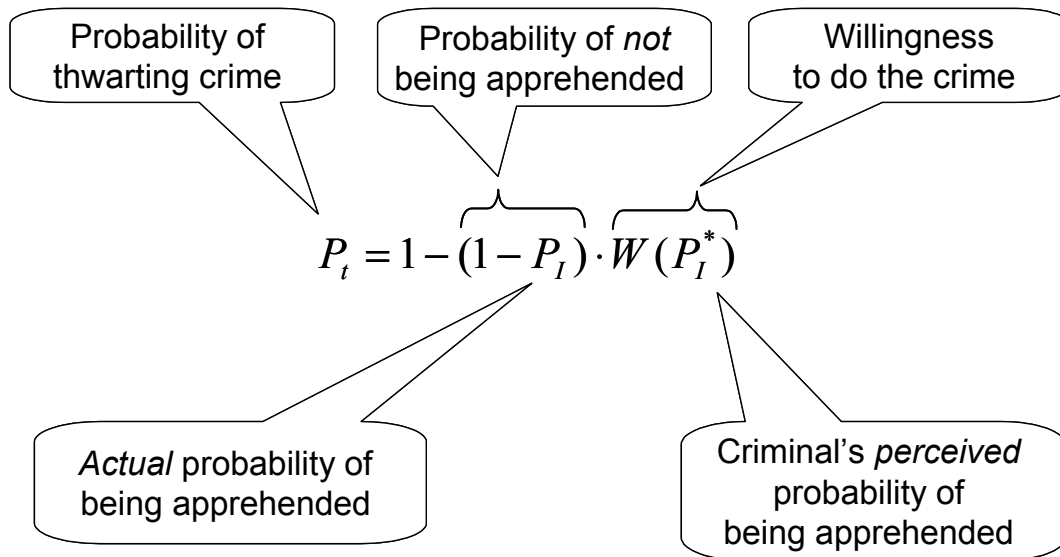Criminal's *perceived* probability of being apprehended

Figure 1. General Model of Deterrence

$W(P_I^*)$ is an empirically derived function representing the willingness to commit a crime as a function of P_I^* for a specified consequence. To simplify the general model, we

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[4]   Appendices A and B, *Deterrence Effects and Peru's Force-Down/Shoot-Down Policy: Lessons Learned*, IDA Paper P-3472, April 2000.

assume that the perceived probability of apprehension, P_I^*, is the same as the actual probability of apprehension, P_I. This assumption can be checked or modified as needed for specific situations. From the survey data, we found that the willingness function $W(P_I^*)$, described in Figure 2, is an inverse power function that relates three general characteristics of the psychology of deterrence:

- For the low probabilities of apprehension, there is a minimum threshold below which perpetrators ignore the risks, but beyond which many are deterred.

- The initial threshold for deterrence is determined by the perpetrators' perceptions of the consequences of getting caught, and those consequences are set by interdictors' *rules of engagement* (ROE).

- There is also a residual fraction of perpetrators who are never deterred by the given consequence, and it equals the deterrence threshold probability.
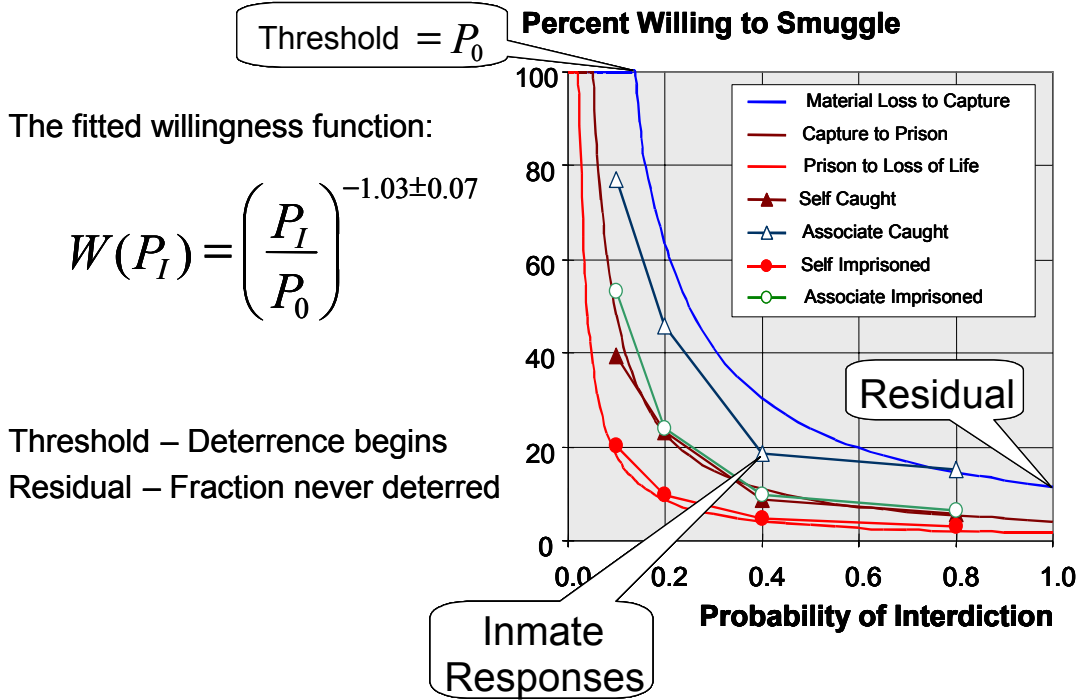
Threshold $= P_0$

Percent Willing to Smuggle

The fitted willingness function:

$$W(P_I) = \left(\frac{P_I}{P_0} \right)^{-1.03 \pm 0.07}$$

Threshold – Deterrence begins
Residual – Fraction never deterred

Residual

Inmate Responses

Material Loss to Capture
Capture to Prison
Prison to Loss of Life
Self Caught
Associate Caught
Self Imprisoned
Associate Imprisoned

Probability of Interdiction

Figure 2. The Mathematical Function Representing the Willingness to Smuggle

Combining this willingness function with the analytical definition of deterrence given in Figure 1, we obtain a complete deterrence model as shown in Figure 3. We assume that the curve marked *"prison to loss of life"* represents the upper limit for perceptions for terrorists (including fanatically determined al Qaeda terrorists) considering a suicide attack against, or with, the aviation system. This assumption is partially justified by recognizing that even suicide terrorists would not casually forfeit

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their lives on a failed mission. Failure almost certainly would have severe consequences for fellow terrorists in the attack and likely bring retaliation on their supporters. Failure might also bring ridicule and shame upon their memory, their families, and their cause.

In the full deterrence model shown in Figure 3, the range of consequences is bounded to the right by a curve representing the transition of "*capture to prison*" and to the left by a curve representing the transition "*prison to loss of life.*" The region between these boundaries represent the conditions for deterring non-suicide terrorists from hijacking or bombing an aircraft. Its boundary curves have deterrence thresholds in the range between two percent on the left up to five percent on the right. By analogy with smugglers, we believe that some terrorists will abort their attacks if they perceive their chance of failure is more than 1.2 ± 0.2 percent[5] and nearly all will abort as the chance of failure increases to ten percent and beyond. According to intelligence reports, an interviewed terrorist said an attack was aborted because they believed that the chance of failure was a value in this range. Note that for certain interdiction, $P_I = 1.0$, all of the residual, i.e., "undeterrable," terrorists are arrested.

Probability of Thwarting Crime

Residuals are all arrested

Capture to Prison

Prison to Loss of Life

Threshold

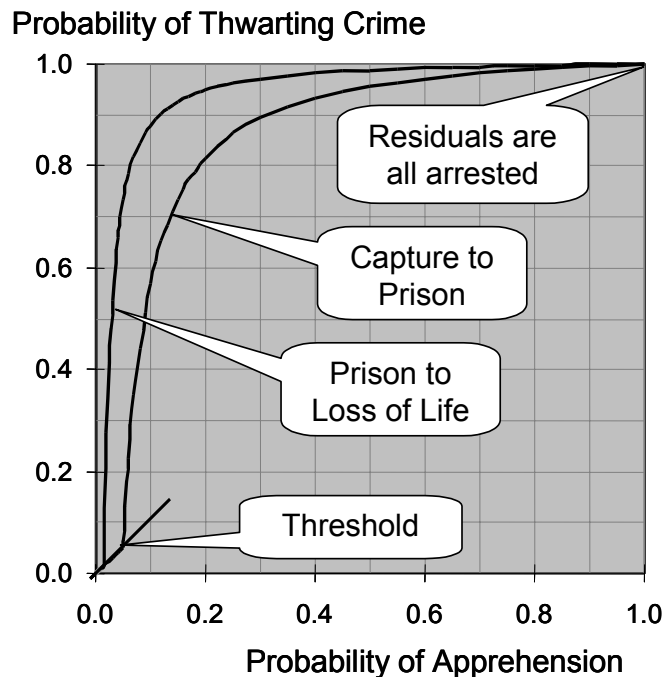**Probability of Apprehension**

Figure 3. Deterrence Model Assumed to Apply to Aircraft Terrorists

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5   For operational purposes in our counter drug work, we chose a threshold of 2 percent as a conservative deterrence threshold to dissuade smugglers accustomed to success.

Based on our deterrence model, let us qualitatively and quantitatively assess the missed opportunities for deterrence, which failed to prevent the 9-11 attacks. This assessment implicitly indicates requirements for improving aviation security.

C. QUALITATIVE ASSESSMENT OF DETERRENCE: THE 9-11 EXAMPLE

From published reports and logical necessity, we can sketch many of the steps that al Qaeda and their terrorist cells in the United States had to accomplish for their attack to be successful.[6] These are laid out down the center of Figure 4. If only a few percent chance of failure could deter the terrorists at any one of these steps, then how could four coordinated attacks involving at least 19 terrorists have succeeded?

1. Missed Opportunities to Detect and Thwart the Attack

At many of the decision steps, the United States had the opportunity to uncover the plot and react to thwart the attacks. These actual opportunities are listed to the left of Figure 4 for each step. In France, there was an aborted attempt to employ a commercial airliner for a suicide attack against the Eiffel Tower. Later in the United States, Zacarias Moussaoui was detained after he asked to be trained to fly a commercial airliner in level flight but did not want to bother with learning how to take off or land. (The terrorists thereafter had to consider the risk that Moussaoui might at some point reveal the entire plot.) Our security system missed these opportunities to uncover the intent of the coming attack. Moreover, the terrorists tested the likelihood of being stopped during the boarding process by repeatedly flying the proposed route in order to minimize the chance that passengers or agents could thwart the final attack. Finally, after the failures of State, Central Intelligence, and Defense intelligence, the Federal Aviation Administration (FAA) security was also unable to uncover and thwart the terrorist plan.

During the attack, it appears that three planeloads of passengers went to their deaths not recognizing the suicidal intentions of the hijackers. The passengers on the fourth aircraft, United Airlines Flight 93, learned of their likely fate because of a delayed takeoff and cell phone communication to relatives during the hijacking. Knowledge of the hijackers' intent came in time for the passengers of Flight 93 to take desperate action and thwart the terrorist plans, even if they did not save their own lives. Their actions also

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[6] *Joint Inquiry Staff Statement, Part I.* Eleanor Hill, Staff Director, Joint Inquiry Staff, September 18, 2002.

prevented a U.S. Air Force pilot from having to engage and destroy the flight as it approached Washington D.C.
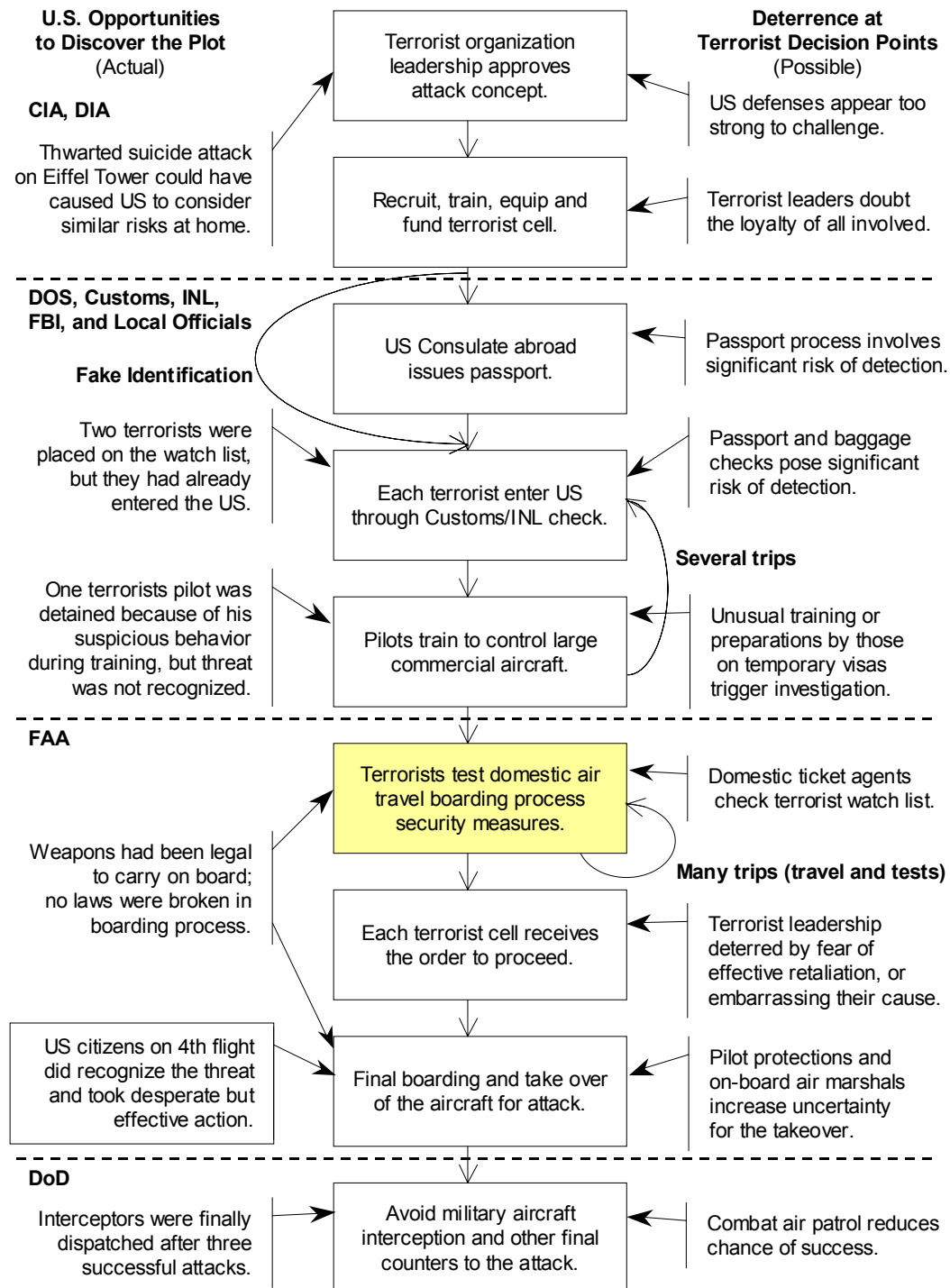

Figure 4. Factors in Assessing Deterrence for 9-11 Event

2. Possible Future Opportunities to Deter Similar Attacks

According to the deterrence model, successfully stopping a suicide attack would require either challenging the terrorists' underlying motivations for the attack or undermining their confidence in its expected success. Each decision point encountered by the terrorists offers another opportunity to deter them. The right-hand column of Figure 4 lists possible security enhancements that might cause terrorists to hesitate or abort a similar attack. For brevity in Figure 4, the far right-hand column gives possible enhancement(s), with the understanding that its deterrence value applies to decisions made by either the terrorist organization leaders or by the cell members.

3. Qualitative Evidence for Deterrence

From the terrorists' perspective, theirs was a world filled with threats and many possible ways to fail. This necessary caution appears to have deterred quick and simple action. First, the planners exercised great care in developing their course of action, since we have subsequently learned that al Qaeda is reported to have considered many other schemes involving aircraft used as weapons. Second, the hijackers practiced their boarding process with repeated trips to the West Coast. While such caution seems prudent, it illustrates that even suicide terrorists are willing to delay their attack until they are convinced that they have a "good" chance of success. The next section quantitatively analyzes the 9-11 terrorists' preparations and shows that their actions conform to the deterrence model predictions.

D. QUANTITATIVE ASSESSMENT OF DETERRENCE

Although there are no precise data on the terrorists' thinking leading up to the attack or calibration data for suicide terrorist cells, one can employ available information to assess the applicability of the deterrence model and explore the range of plausible conditions necessary to deter future attacks. The following background facts and assumptions pertinent to the 9-11 terrorists' perceptions of risk are by now either common knowledge or very plausible:

- Four teams of approximately five terrorists each planned to hijack four airliners for a coordinated suicide attack.
- Each team had at least two pilots, and could successfully complete their mission without one of their members. Conversely, challenges against two potential terrorists on one flight would very likely raise suspicions and uncover the plot to hijack that flight.

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- Each terrorist flew into the United States, and Ziad Jarrah was detained and questioned at length in the Dubai airport.[7]

- Zacarias Moussaoui was detained on immigration violations charges after being reported by a Minneapolis flight school.[6]

- Many practice flights (boardings) were conducted, probably, among other things to convince the cell leaders they could pass through security.[8]

We do not believe terrorists compute risks in making decisions. However, the real-world cases underlying the deterrence model indicate that subjective risk-taking by extremists exhibits a regular statistical pattern. It is this pattern that we examine next.

1. Odds for Individual Terrorists Being Challenged when Boarding Aircraft

From the 9-11 terrorists' perspective, the chances of getting on a plane without being challenged or arrested depends on how they view the situation. If either Ziad Jarrah's or Mr. Moussaoui's detentions were considered evidence for risk, then the terrorists might have estimated those risks as one failure out of 20 trials, that is, the 20 flights necessary for everyone to reach the United States. If, on the other hand, these detentions were considered irrelevant, then 20 trials were conducted without challenge. What statistical level of confidence (*LOC*) would these twenty flights without challenge provide if the actual probability of individual failure were 1:20?

$$(1 - \frac{1}{20})^{20} = 0.36 = 1 - LOC$$

This means the terrorists have only a 64 percent confidence[9] that the risk is as low as 1:20. Since 64 percent is not a high level of confidence, it would not be safe for the terrorists to assume their odds of boarding on 9-11 were much better than 1:20.

We now investigate the possible deterrence effect on the 9-11 terrorists based on news reports of their experience with successful air travel in preparation for the hijackings and subsequent attacks. To do this, we assume that the terrorists' subjective perception of their odds of failing to be able to board a plane equals one versus the

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[7] CNN report had link to timeline:
http://www.cnn.com/2002/WORLD/americas/11/07/terror.triborder/index.html

[8] Found in the timeline at http://www.time.com/time/nation/article/0,8599,333835,00.html

[9] In general, if *N* individual flights are conducted with an estimate of *1/N* probability of failure, the *LOC* will always be approximately *1/e* = 64 percent, where *e* is the base of the natural logarithms as long as *N* is large (ten or more).

number of successful trips completed before the attack. From this, we estimate the odds for a failing in an individual hijacking attempt and of failing in one or more of the four hijackings during the actual attack. Given these estimated probabilities of failure, we use the willingness function for a potentially lethal interdiction to estimate the percentage of terrorists who would attempt the attack with those odds of failure. We understand that boarding the aircraft with box cutters is only a step in the process of hijacking and taking control of the plane; hence the practice flights reflect their degree of caution rather than being equivalent to their subjective estimate of total risk. Nevertheless, this simple exercise shows that the practice flights would be necessary to raise confidence levels to the point of being willing to attack given the consequences of failure.

2. Odds of Failure for Hijacking a Plane

The background facts and assumptions imply that a single hijacking would be successful if four of five hijackers got on board. Thus, the probability of successfully boarding to hijack the plane given only 20 prior flights would be:

$$(1-\frac{1}{20})^5 + 5 \cdot (1-\frac{1}{20})^4 (\frac{1}{20}) = 0.977 .$$

This corresponds to a failure probability of 0.023 or odds of 1:43, more than double the estimated risk of being challenged while boarding.

Now suppose that the suicide terrorists plot leaders judged success to be all four hijacked planes reaching their targets. The estimated probability of all four hijackings succeeding would be only $(0.977)^4 = 0.913$. This corresponds to a significant 8.7 percent chance of failure or odds of 1:11.

3. Deterrence Impact on Terrorists' Decision to Attack

The best-fit threshold probability of failure for smugglers facing a lethal threat might reasonably gauge the value a suicide terrorist's places on their own life. All of the discipline, planning, and commitment necessary for the 9-11 terrorists to successfully hijack four planes and gain control of them in the air indicates that even these suicidal terrorists would not accept chances of failure greater than an individual smuggler pilot.

From our analysis of smuggling operations, the best-fit deterrence threshold for potentially lethal consequences is 0.012 ± 0.002, corresponding to odds of 1:83. For hijacking an individual airplane, the willingness function predicts that only 53 percent of terrorists would make the attempt.

$$P_0 / P_I = 0.012 / 0.023 = 0.53.$$

Similarly, if the terrorists' expectation was for all four cells to successfully hijack airplanes and attack, then the willingness equation gives 0.012/0.087 = 0.14, or only 14 percent of such teams of four cells would proceed.

These middling to low willingness values suggest that mere entry into the country or a few flights by cell leaders would not be sufficient confirmation for the terrorist plot strategists to be willing to proceed.

4. Terrorists Undermining Deterrence with Practice Flights

We now considered the impact of multi-cell practice flights on reducing the deterrence effect and increasing willingness to attack. Each time the cell leaders practiced coast-to-coast flights, they added another ten or so successful trials and correspondingly reduced the estimated probability of failure for individuals boarding. If the entire team of four cells were to practice, they would add twenty trials. For various numbers of practice flights, Table 1 shows the estimated probabilities of failure for individual flights, their corresponding odds, and the willingness for individuals in a cell to proceed with hijacking plans. The table also shows the estimated probability of failure for one or more of the four cells, the corresponding odds, and the plot leaders' willingness given the desire for total "success."

Table 1. Estimated Probabilities of Failure and Willingness to Attack for Various Numbers of Practice Trials

Person Trips	Individual Hijackings			All Four Hijackings		
Number	Failure Rate		Willing	Failure Rate		Willing
(N)	Probability	Odds	Percent	Probability	Odds	Percent
10	0.081	1:12	15%	0.288	1:3	4%
20	0.023	1:44	53%	0.087	1:11	14%
30	0.010	1:96	100%	0.041	1:24	29%
40	0.006	1:168	100%	0.024	1:42	51%
60	0.003	1:372	100%	0.011	1:92	100%

From Table 1, we observe the following about the willingness of the 9-11 terrorists to attack:

- Ten Person-Trips: If risk perceptions were based entirely on the cell leaders' trips to the U.S., they would have little confidence in their scheme and very low willingness to proceed.

- Twenty Person-Trips: This is the baseline case above – one trip per terrorist.

- Thirty Person-Trips: The 50 percent *LOC* with no detentions during the 20 person-trips to the U.S. yields a failure rate equivalent to 29 person-trips. While all individual cells would be willing at 1:30 odds, only 29 percent of the plot leaders would be. Considering the additional risks, actually taking the passengers hostage and taking control of the aircraft, terrorists would probably estimate overall odds against them as higher than simply the boarding risk and want a greater margin of error.

- Forty Person-Trips: This corresponds to the entire four-cell team practicing once. Here, the individual cell willingness has a factor of two safety margin, 1:168 is half the threshold odds of 1:83. However, the overall plot leaders willingness is only in the mid-range of 51 percent.

- Sixty Person-Trips: If the entire team practiced twice, both the individual cells and the plot leaders' perceived risks would be below the deterrence threshold.

Thus, Table 1 presents risk conditions that span insufficient experience to avoid deterrence effects upward to sufficient experience to be willing to attack, whether judging decision as individual cell choices or plot leader choice.

As teams practice without anyone suffering a detention, the reduced estimates of risk from cumulative experience also reduce their concern with further practicing. Unless in the future we can detect the patterns involved in developing plans, placing teams, and practicing attacks, terrorists will be able to convince themselves their attacks will be successful – that is, overcome whatever inhibitions there are from deterrence.

Overall, our simple estimate of the terrorists' expected odds of failure indicates that the flights into the United States would not be enough to reduce their perceived uncertainty to an acceptable level. The level is predicted by our willingness function obtained from drug operations against drug traffickers. Doubling the number of flights with coast-to-coast practice runs would reduce the terrorists' uncertainties to only a modest deterrence effect. And tripling the flights without having been challenged or detained would probably eliminate any deterrence effect for boarding.

Suppose, however, that we had detained one additional member of the plot during their practice phase. For the plot leaders to achieve comparable levels of willingness for all four hijackings, the number of practice flights would have to have been doubled. Thus, the 56 flights necessary to achieve 100 percent willingness would increase to 112 flights, or 92 practice flights after reaching the U.S. The increase from 36 before, to 92 after the additional detention would be 56 more practice flights – a 156 percent increase.

If this additional detection had occurred early in the practice process, it might well have caused serious modification of the scheme, worry that the entire plot was compromised, and possibly abandonment of the scheme. However, if the detection occurred late in the practice process, it might have caused the plot leaders to hasten their attack before the U.S. authorities could determine the scope and details of the full plot. Of course, it is speculation to consider what might have been under other circumstances; however, this speculation illustrates how the deterrence model, if fully validated, would forecast significant impacts from even incremental improvements in our detection and interdiction capabilities.

E. CONCLUSIONS AND OBSERVATIONS

Our quantitative model of the psychology of deterrence, which was derived and calibrated for drug smuggling, provides reasonable guidance for thinking about the qualitative aspects of the 9-11 attacks. It also offers a plausible quantitative representation of the decisions made by the leaders of 9-11 terrorist cells.

Deterrence arises from the fear of unacceptable consequences. The behavior of the 9-11 suicide terrorists reveals they were cautious and deliberate, and clearly not in a hurry to sacrifice their lives in a failed attack. Thus, in searching for consequences that would deter, we need to focus on their underlying fears – for example, feelings of being powerless, embarrassing one's cause, or revealing broader unfolding plans, or bringing retaliation upon their supporters.

A qualitative review of all the sequential decision points in the 9-11 attack reveals many missed opportunities for us to deter their evolving scheme. Worse, we failed to uncover their intent even with many opportunities to do so. In the future, we must provide a more comprehensive filter against suspected terrorists, and more subtly, synthesize information gleaned from our network of contacts with terrorist groups into patterns to reveal underlying motivation, plans, and operations. For example, the post-9-11 identity checks at domestic airports might cause terrorists to shy away from frequent practice flights (creating doubt from lack of practice). Conversely, they risk revealing plans if their practice flights show patterns of association. These alternatives pose a dilemma for terrorist planners.

A quantitative assessment using the deterrence model offers an interpretation of terrorist motives for conducting training flights – to increase confidence in success to an acceptable level. We have estimated that, by the time of the attack, their chances of

failure were below those necessary to deter most drug smugglers from facing potentially lethal consequences. Long before the 9-11 attacks, a captured terrorist estimated the probability of failure necessary to abort an attack as comparable to our deterrence model threshold.

While this application of our deterrence model to the 9-11 terrorist attacks only demonstrates the plausibility of our model as representing terrorists psychology, it does illuminate essential features of those attacks and provides a logical point of departure for quantitative analysis of future terrorist threats.

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14. ABSTRACT

Terrorists must exercise extreme caution to survive in hostile environments. Forcing them to enhance their caution might be interpreted as a form of deterrence. This paper examines the openly published events leading up to the 9-11 attacks to identify qualitative failures to deter and quantitative evidence for a deterrence delay. Practice flights in the U.S. appear just sufficient to satisfy the willingness conditions from our deterrence model.

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