Modeling the Combined Terrorist-Narcotics Trafficker Threat to National Security

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MODELING THE COMBINED TERRORIST-NARCOTICS TRAFFICKER THREAT TO NATIONAL SECURITY

The relationship between terrorism, drug trafficking, and policymaking is examined through the development, implementation, and use of a series of systems dynamics-based models. These activities are intended to provide the basis for future development of a decision aid to support policymakers in combating the narco-terror threat. The models developed for this purpose are: a narcotics, counter-narcotics, and trafficker double agent model; a policy cycle model to manage the trafficker double agent conversion policies; a prototype societal deprivation, affection, disaffection, and advanced terrorist recruitment, training, and narco-terrorist support model; entity security and terrorist activity models; a violence generation model; and policy cycle models to represent the management of social violence and entity security policies. These models illustrate the relationships between deprivation of key resources to individuals and disaffection and ultimate terrorist activity; attack of notional targets by teams of terrorists; deprivation of individuals leading to violence, which can lead to an increase in the level of perceived deprivation; dynamics of policymaking in response to perceived needs; and the impact of corruption on policymaking.

The U.S. Federal Government has well documented the strong ties between terrorist organizations and drug-trafficking organizations. A number of indictments are further proof of this relationship. In some cases, both organizations need the same facilitators: improve financial gains, expand geographical domains, provide common personnel protection, and utilize common logistical support. The U.S. administration has released two important national strategies to counter each of these threats separately, although their linkage is recognized. Some policy considerations must be taken into account when both elements operate in the same theater, including the amount of funds dedicated to combat these operations, the personnel resources required, and the level of intelligence gathering and dissemination necessary to produce meaningful results. Strategic and tactical considerations also must be acknowledged. On the strategic side, allocating resources to interrogation and “flipping” of traffickers after their arrest can be productive in learning more about the entire network. On the tactical side, it may be more productive to devote resources to monitoring and detection. In the case of terrorism, more resources directed toward radicalization, disaffection, and deprivation of individuals may be just as productive as intelligence gathering and kinetic means of action.

This modeling study demonstrated that model-generated data closely resembled actual reports about tons of disrupted narcotics substances in three consecutive years. The policy cycle model showed that increased rates of policy cycle activity increased the amount of narcotics disruption, while increased levels of corruption reduced those levels. Model-generated results show that policymaking can lead to a reduction in the level of deprivation, disaffection, and violence and that policy-related effects can be inhibited by corruption. The study also showed that availability of trained terrorists can be a rate-limiting factor and that targets of opportunity may not be attacked because trained terrorists are lacking. Many more results can be generated depending on the assumptions used in the parameters of the models. These assumptions have to be validated by actual field data. These models can be enhanced to provide guidance to the policymaker and decisionmaker in selecting options for the allocation of limited resources to support future counter-terror and counter-narcotics actions.

INTRODUCTION

Interest in examining the relationship between drug cartels and terrorist organizations is increasing, as has been reflected in the recent congressional testimonies by leading authorities on the subject on July 7, 2011.1 In particular, the Hezbollah group has been alleged to be working with the Mexican drug cartels to use existing drug pipelines to penetrate the U.S. homeland. In fact, research conducted by the American Enterprise Institute for Public Policy Research has concluded that at least two parallel terrorist networks are growing in Latin America. One is operated by Hezbollah, and another is managed by Qods operatives. These networks cooperate to carry out various criminal activities, including narcotics smuggling. The study concluded there are more than 80 operatives in at least 12 countries throughout the region, and the regions of Brazil, Venezuela, and the Southern Cone are of the greatest concern.2 Several reports address Hezbollah's financial ties to the contraband center of the Tri-Border region of Paraguay, Argentina, and Brazil, and the contributions of the Lebanese diaspora on Isle Margarita and other locations.3 More recently, a new case, called Operation Red Coalition, began in May 2011 when an Iranian-American from Corpus Christi, Texas, approached a U.S. Drug Enforcement Administration (DEA) informant. He was seeking the help of a Mexican drug cartel to assassinate the Saudi ambassador, according to counter-terrorism officials. The Iranian-American thought he was dealing with a member of the feared Zetas Mexican drug organization, according to agents; instead, the suspect was arrested on October 11, 2011.

Terrorist organizations are working with narcotics traffickers to increase the magnitude and extent of terrorist actions. Drug-trafficking organizations (DTO) in Colombia and Venezuela and the terrorist organization FARC, of Colombia, were indicted for moving cocaine through Liberia to Europe.[4] Considerable evidence indicates that FARC, operating on the Ecuadorian border, has developed ties to the Sinaloa cartel, which operates inside the Ecuadorian border.[5] Also well known is that West African criminal syndicates cooperate in illicit smuggling operations with Al Qaeda operatives in Islamic Maghreb (AQIM). DEA has confirmed that 19 foreign terrorist organizations have ties with DTOs. Furthermore, Taliban ties to Latin American DTOs and Hezbollah have been well established. These are a few of the drug terrorism alliances that have been reported in the literature.

The case of Hezbollah's ties to the drug cartels in Mexico is somewhat controversial even with the mounting evidence from leading officials. Some experts think it is pure speculation that Hezbollah intends to launch terrorist operations against U.S. interests in the western hemisphere. One expert believes that Hezbollah is involved in mainstream Lebanese politics and has become more pragmatic and is less likely to confront the United States.[6] A closer examination of the Mexican DTOs suggests they are loosely organized with drug production based on demand and distribution through independent providers after point of entry to the United States. DTOs are

1 US Congressional Subcommittee on Counterterrorism and Intelligence, House Committee on Homeland Security, United States Congress, Hezbollah in Latin America: Implications for U.S. Security, July 7, 2011.
2 Testimony by Ambassador Roger Noriega before the Subcommittee.
3 Testimony of Douglas Farah before the House Committee on Foreign Relations, Subcommittee on Oversight and Investigations, October 12, 2011.
4 Douglas Farah, Terrorist-Criminal Pipelines and Criminalized States: Emerging Alliances for the 21st Century, *Prism*, Center for Complex Operations, Vol. 2, No. 3, June 2011.
5 Ibid reference 3.
6 Melani Cammett, Testimony before the Subcommittee on Counterterrorism and Intelligence, July 7, 2011.

family-based with ties to the land and community. Their strong religious affiliations and lack of interest in promoting terrorism differentiates their culture from that of Hezbollah. They certainly do not want to add visibility to their operations by being involved in terrorist acts. The main priority for such groups is making money. It is well known that the Lebanese communities in Mexico are wealthy but do not have any known ties to DTOs. The above evidence of partnerships between the cartels and terrorist organizations makes it clear that the goal is to generate profits for later use in recruiting, training, purchasing weapons, and carrying out terrorist attacks in selected regions. The groups use the same pipelines, exploit the same structures, and capitalize on the vulnerabilities of the population and legal system for mutual benefit.

Because of the growing importance of this threat, the U.S. administration has released two significant documents: the *National Strategy for Counterterrorism*, published in June 2011, and the *Strategy to Combat Transnational Organized Crime* (TCO), published in July 2011. Both of these publications address the terrorist and TCO threats separately, although linkage between the two is recognized. The latter document focuses on breaking the economic power of TCOs and protecting strategic markets and the U.S. financial system. It also seeks to build international consensus, multilateral cooperation, and public-private partnerships to defeat TCOs. The new capabilities created for this effort include a new executive order that establishes a sanctions program to block property and prohibit transactions. Another is a Presidential proclamation that denies transnational criminal aliens entry into the United States. A rewards program was also established to obtain TCO information, and the Interagency Threat Mitigation Working Group was initiated to identify threat and coordinate the means to combat TCOs.

This paper examines how terrorist activities might be supported by resources and facilities provided by narcotics traffickers. Of particular interest is determining how terrorist activities supported by narcotics traffickers might influence government policies and actions aimed at reducing threats and providing protection to the general population.

Trafficker-supported terrorist activities can corrupt the actions of the government by delaying the development and implementation of counter-terrorist policies and reducing their effect. This work builds on earlier research that described processes in which deprivation creates disaffection and creates the potential for violence. Disaffected individuals can be recruited into terrorist networks and trained to carry out terrorist actions within the wider society (Davis et al. 2003, Woodcock, 2003; also Woodcock and Cobb, 1994, and Woodcock and Dockery, 1989). Terrorist organizations can facilitate those activities and increase the scope and magnitude of their actions by working with narcotics trafficker entities. One of the main concerns is that terrorist organizations such as Hezbollah are providing technology for the highly sophisticated narco-tunnels being discovered along the U.S.-Mexican border. These tunnels resemble the ones along the Lebanese border and the Ghaza strip that Hezbollah used. The tunnels start inside the homes of recruited and disaffected families and end inside the homes of other disaffected families across the border. Detecting such tunnels by conventional means is very difficult. Extensive modeling efforts are needed to assess the impact of narcotic trafficker support to terrorist operations.

The estimated value of drug-trafficking operations is on the rise. The value of cocaine from South America to North America was estimated to be $38 billion in 2008[7] and from South America to Europe, it was estimated to be $34 billion. Heroin traffic from West Asia to Europe was valued at $20 billion and from West Asia to Russia at $13 billion.[8] FARC in Colombia is the world's main cocaine producing organization. A highly decentralized narco-terrorist organization with extensive linkages to Hezbollah, FARC has more than 7,000 armed combatants operating out of the jungles on the borders with Ecuador and Venezuela. FARC has a strong relationship with high-ranking Venezuelan officials, including the president. The ties between Venezuela and Iran are becoming stronger and are designed to facilitate the funding of terrorist organizations. As for Mexico, the narcotics industry provides from $25 billion to $40 billion in profits from illicit drug sales. According to the U.S. Department of State, cartels and gangs employed 450,000 people in the cultivation, processing, and sale of illegal drugs, with one-third involved in processing and selling.[9]

It appears that both terrorist and drug-trafficking organizations need the same facilitators and leverage the relationship to mutual benefit. Other benefits of these partnerships include financial gains, geographic growth, personnel protection, and logistical support, but partnership-produced vulnerabilities include increased attention from law enforcement, potential compromise of internal security, risk of infiltration, and capture of leadership. A recent study [10] provided 10 case studies on the variations in the crime-terrorism nexus. These ranged from the full convergence/fusion of crime and terrorist organizations in the Dawood Ibrahim's 500-member D-Company operating in Pakistan, India, and the United Arab Emirates, to the terrorist organizations with in-house criminal structures such as FARC-based groups in Colombia, to the terrorist organization with criminal sympathizers such as Hezbollah. Other examples include the 2004 Madrid bombers, with decentralized terrorist cells having in-house criminal capabilities, and the Taliban with coalitions between terrorist groups and criminal organizations. The judicial system is almost nonexistent in West Africa, and the drug trade enjoys open sponsorship in Venezuela. As a result, the alliances between terrorist groups and criminal organizations will continue to grow.[11]

Some policy considerations may be relevant to the terrorism-crime/drug trafficking nexus. For example, how to prioritize the counter policies when both elements are present, as in the case in Afghanistan; the sharing of foreign aid funds to combat terrorism and crime; the role of the U.S. Department of Defense (DOD) in what has been considered a criminal justice and law enforcement responsibility; and following the crime-terrorism money trail.[12]

The above discussion makes it clear that narcotics traffickers and terrorists have distinct domains in which they operate. The narcotics domain consists of production and general assembly, primary and secondary transit systems, staging areas, disassembly, wholesale functions, and distribution for consumption. In each of these elements, the value of the drugs changes

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7 Robert Killebrew, Criminal Insurgencies in the Americas and Beyond, *Prism*, Center for Complex Operations, Vol. 2, No. 3, June 2011.

8 Ibid, Reference 7.

9 Ibid, Reference 7.

10 John Rollins and Liana Sun Wyler, International Terrorism and Transnational Crime: Security Threats, U.S. Policy, and Considerations for Congress, Congressional Research Service, March 2010.

11 Ibid, Reference 4.

12 Ibid, Reference 7.

depending on the size, shipment, and location of the distribution centers. The value is highest during the transit stage because of the size of the shipment. From a detection and monitoring perspective, this stage becomes the most significant. The terrorist domain is somewhat different. Certain precipitants can start the process, and these include dissatisfaction, discrimination, ideological beliefs, and so forth. This leads to internalizing values, possible indoctrination, following a charismatic leader, contact with a group, possible ideological seeking, and then committing an act of terror. This process of radicalization was discussed in a previous paper.[13] A definite profile for an individual ready to commit terrorist acts no longer exists. Furthermore, the availability of the Internet is changing the process of radicalization. The potential interaction of the narcotics trafficker and the terrorist results from the need for the same facilitators, financial gains, logistical support, and personnel protection as mentioned previously. Models that characterize the nature and degree of interaction in the different domains is a useful consideration.

The role of law enforcement and policymakers in countering the drug traffickers and terrorists requires a more in-depth analysis. In some cases, allocating resources to address the issues that lead to radicalization and terrorist acts can be productive. In others, providing resources to intelligence gathering and dissemination to the appropriate authorities can be more productive. The same can be said for the role of the policymaker in the counter-drug-trafficking area. More attention to dealing with the strategic aspects of allocating resources to interrogation and the flipping of traffickers after their arrest can be quite productive in learning more about the entire network. In other cases, it can be productive to focus on detection and monitoring for tactical reasons. It is then useful to consider policy cycle models to characterize the role of the policymakers in countering these threats, taking into account the number of factors that influence this process, including corruption of policymaking and policy-implementation activities.

MODEL-BASED ANALYSES OF COUNTER-NARCOTICS ACTIVITIES

In order to address a number of the issues raised in the introduction, the narcotics, counter-narcotics process through the production and use of several models is examined in more detail. These models will provide insight on the operations of the drug traffickers and means to counter their actions. Figure 1 outlines the models that were developed; implemented in STELLA™ (a commercially available systems dynamics-based software system) by Woodcock;[14] and used to study the counter-narcotics and terrorist problem. Two main activities were undertaken: (1) a study of counter-narcotics activities and the impact of converting traffickers into double agents to disrupt narcotics shipments, and (2) an examination of the possible synergy of terrorist and trafficker activities, the impact of public policy aimed at reducing violence and increasing counter-terrorist security levels, as well as the corruption of those processes by traffickers and other actions. Descriptions of the construction and use of the models are presented below. Implementation of the models is discussed in more detail in the appendices.

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[13] Samuel Musa and Samuel Bendett, Islamic Radicalization in the United States: New Trends and a Proposed Methodology for Disruption, Defense and Technology Paper 77, CTNSP, September 2010.

[14] The models developed for the study described in this paper were developed by Woodcock using STELLA™, a commercially available software system (http://www.iseesystems.com). Details of the implemented software are presented in the appendices. Interested parties are invited to communicate with the authors for further information.

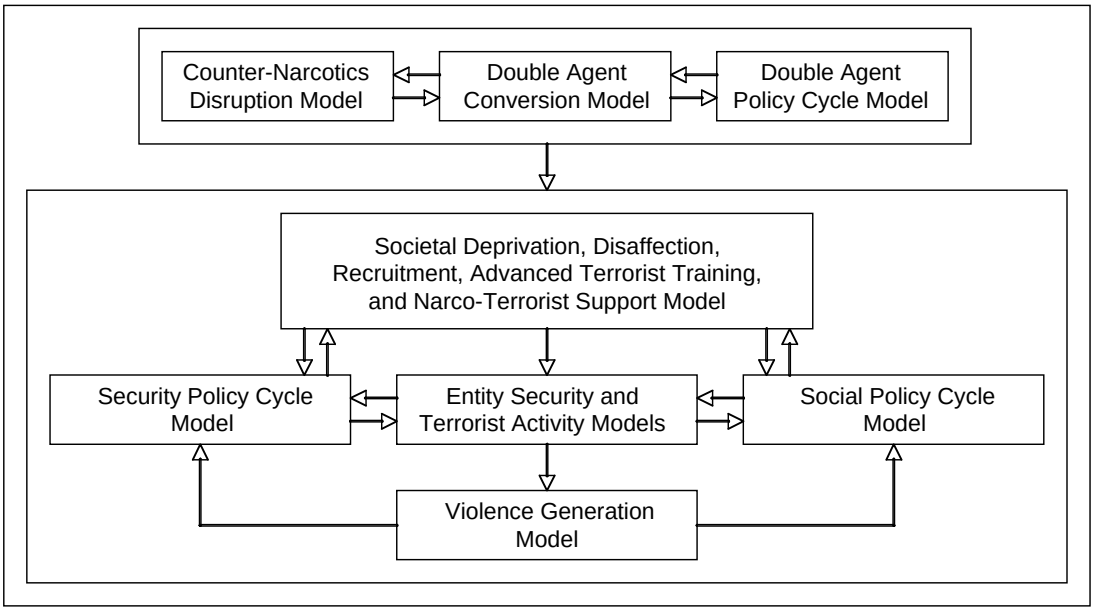

Figure 1. Model-based analyses of counter-narcotics activities involved studies of the impact of creating double agents and of the possible synergy of terrorist and trafficker activities.

- Counter-narcotics actions and the creation of double agents: This paper describes results of an investigation of counter-narcotics activities and the impact of efforts aimed at converting traffickers into double agents. Model-generated data closely resembled actual reports of tons of disrupted narcotics substances detected in 2008, 2009, and 2010. Success in counter-narcotics and trafficker conversion activities can have important public policy implications. To examine those possibilities, a policy cycle model was developed and used to study the potential impact of increased levels of policymaking support as well as corruption of the policy process on the ability to form double agents and to disrupt trafficker activities. Increased rates of policy cycle activity increased the amount of narcotics disruption while increased levels of corruption reduced such disruption.
- Examination of the possible synergy between narco-traffickers and terrorists and the impact of policy-related actions. In this paper, model-generated data show that policymaking can lead to a reduction in the level of deprivation, disaffection, and violence and that policy-related effects can be inhibited by corruption, which can change the overall political dynamics of societies of interest. Modeling the combined terrorist-narcotics trafficker threat to national security has involved the production of several component models, including the following: (1) a *Societal Deprivation, Disaffection, Recruitment, Advanced Terrorist Training, and Narco-Terrorist Support Model* that illustrates how notional individuals deprived of key resources can become disaffected and recruited and trained to become advanced terrorists, (2) an *Entity Security and Terrorist Activity Model* that illustrates teams of trained terrorists attacking notional targets, (3) *Entity Security and Violence Generation Models* that describe how deprived and disaffected individuals may become violent and how such violence can increase the level of perceived deprivation and disaffection, and (4) *Social and Security Policy Cycle Models* that describe the processes of identifying a

problem and formulating, implementing, evaluating, changing, and/or terminating a policy in response to perceived need, as well as the impact of corruption in preventing successful policy-related outcomes.

Building and Using a Prototype Narcotics, Counter-Narcotics, and Trafficker Double Agent Model[15]

A significant counter-narcotics strategy involves capturing narcotics trafficker operatives and forcing them to "flip" or to give up information regarding their organization that could be used to reduce future trafficker activities. Such information could be used to create double agents whose activities might reduce the trafficking of narcotics and reduce the ability of the traffickers to provide supplies to their clients. A prototype model has been developed and implemented by Woodcock in STELLA™, a commercially available systems dynamics software system, to study the impact of those actions on trafficker capabilities. Model-based studies show that increasing the effort to create double agents can lead to a corresponding increase in the amount of seized narcotics substances. The model could serve as a basis for a more advanced model that captures additional components of the actions of counter-narcotics forces.

A Narcotics, Counter-Narcotics, and Trafficker Double Agent Model[16]

The major components of the prototype *Narcotics, Counter-narcotics, and Trafficker Double Agent Model* are shown in Figure 2. Introductory systems dynamics-based modeling activities are presented in Appendix 1. Selected details of the implementation of the model in systems dynamics software are presented in Appendix 1 to increase the initial accessibility of the materials for the reader. In the model, a notional effort is assumed to take place that results in the transformation of narcotics traffickers into individuals that provide information on trafficker activities. Traffickers that provide such information can support counter-narcotics efforts to detect, capture, remove from the marketplace, or otherwise disrupt the supply of narcotics substances.

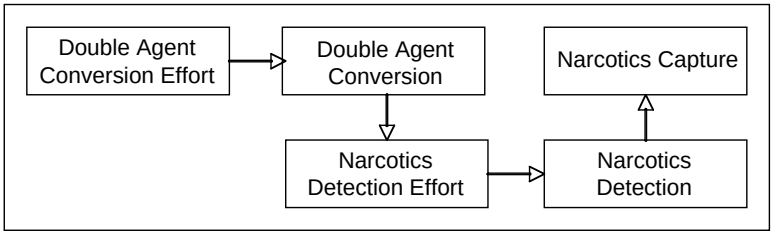

Figure 2. A prototype model illustrates the processes involved in the conversion of traffickers to double agents and use of the information they provide to identify and capture or disrupt illicit narcotics products.

The model was used to examine the effect of converting narcotics traffickers into double agents on the disruption of narcotics shipments. Results of those activities are presented below. In each case, the initial threshold for detecting narcotics substances (represented by the parameter: *NarcoThresh* in the model [Appendix 1]) was assumed to be 95 percent. This represented an

[15] The models developed for the study described in this paper were developed by Woodcock using STELLA™, a commercially available software system (http://www.iseesystems.com). Details of the implemented software are presented in the Appendix.

[16] Details of the implementation of this model are presented in Appendix 1.

assumed likelihood of detecting 5 percent of the actual supply of narcotics substances. The model included a random number generator and a threshold device. Random numbers greater than the threshold were considered to represent events in which narcotics substances were captured or disrupted by counter-narcotics activities. Thus, a threshold of 95 percent would lead to the capture or disruption of 5 percent of the total supply of narcotics. Each detected or disturbed narcotics event served as input to a second random number process that determined the size of individual shipments. A notional maximum seizure size, represented by (*MaxEvntSize*), of 100 tons was assumed. In this case, disturbed or captured shipments were assumed to range from 0 to 100 tons of narcotics. A level of counter-narcotics effectiveness of using trafficker-provided information to increase the likelihood of detecting or disrupting narcotics shipments, represented by (*CN Efft*) of 0.1 (or a 10-percent effectiveness of using trafficker-provided information) was also assumed.

Conv Effrt	Total (tons)	Narcot Evnts	Doubl Agnts	Thresh Dep
0	3376	68	0	0
5	6448	129	70	7
10	8881	173	142	14.2
15	10936	214	205	20.5
20	13263	260	275	27.5
25	16332	319	357	35.7
30	18990	373	427	42.7

Figure 3. Impact of narcotics trafficker conversion efforts on the creation of trafficker double agents, represented by (*Conv Effrt)* and (*Doubl Agnts*), the disruption of narcotics shipments (*Narcot Evnts*), and the capture of illicit narcotic substances during a notional period of 360 days. Conversion of traffickers into double agents was assumed to reduce or depress the threshold for detection (*Thresh Dep*) and increase the likelihood of detecting or disrupting shipments of narcotics substances.

The results of a series of preliminary studies of the impact of different levels of effort aimed at converting traffickers into double agents, with trafficker conversion effort-related results ranging from 0 percent to 30 percent, are shown in Figure 3. Typical model-generated outputs are shown in Figure 4, which shows the control panel created for the model, and Figure 5, which shows the number and size of narcotics seizures in the absence of counter-narcotics intelligence efforts. Figures 4 and 5 and similar figures are screenshots taken directly from the STELLA™ output from the model.

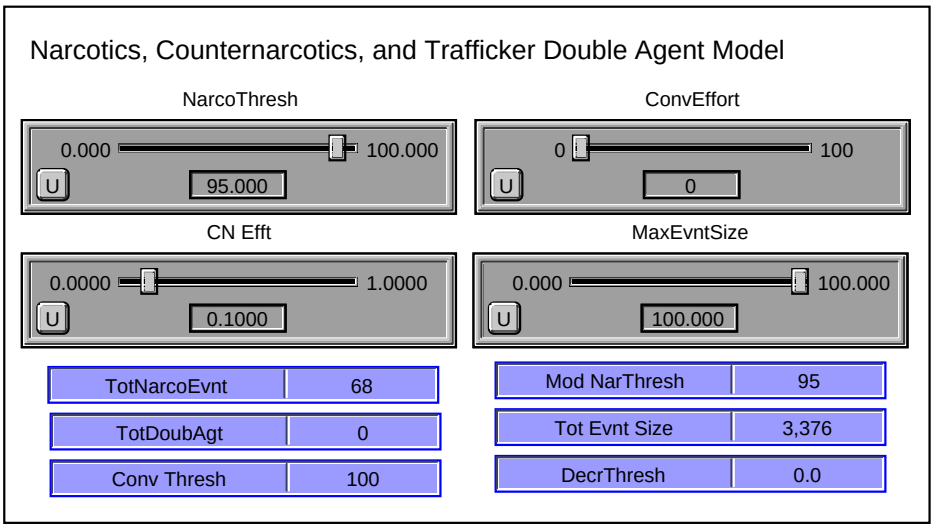

Figure 4. Software slider entities permit user selection of model parameters and their use in studies and experiments. The model control panel shows that an initial threshold for detecting narcotics products of 95 percent and 0 percent trafficker conversion effort leads to 68 counter-narcotics events and the disturbance of 3,376 tons of narcotic shipments (*Tot Evnt Size*).

In this case, the conversion of traffickers into double agents is assumed to increase the likelihood of detecting and disrupting narcotics shipments. This increased likelihood of detection is reflected in a reduction or depression of the detection threshold in the model (*Thresh Dep*). Such a reduction would lead to the increased detection or disruption of narcotics substances. As an example, some 3,376 notional tons are seized in 68 counter-narcotics events without the conversion of double agents, while 6,448 tons might be seized or disrupted with a 5-percent conversion effort involving 70 double agents and a maximum shipment size of 100 tons. A conversion effort of 10 percent generated 142 double agents and 173 narcotics events that resulted in the disruption of 8,881 tons of narcotics. A double agent conversion effort of 30 percent generated 427 notional double agents and led to the disruption of 18,990 tons of narcotics in 373 events (Figure 3).

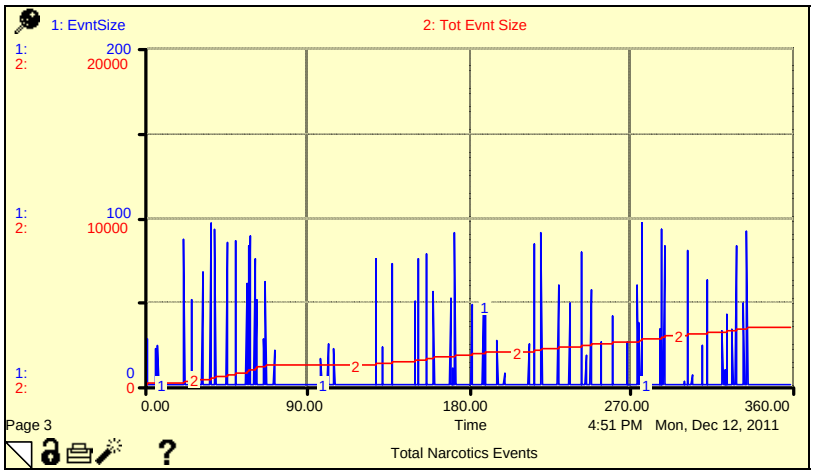

Figure 5. Number and size of narcotics disruptions without counter-narcotics intelligence efforts. Some 3,376 tons are seized in 68 events during a notional 360-day time period.

To summarize: Model-based studies show that increasing the effort to create double agents can lead to a corresponding increase in the amount of seized narcotics substances. The model represents the likelihood that a trafficker would be converted into a double agent and that narcotics substances might be detected, seized, or otherwise disrupted by a random process and associated threshold. Details of the implementation of the model are presented in Appendix 1. Events are assumed to take place when a generated random number exceeds the threshold. The model could serve as the basis for a more advanced version that would capture additional components of the actions of counter-narcotics forces, including details of the process of obtaining and using trafficker-related information to increase the likelihood of detecting and seizing or otherwise disrupting the supply of narcotics substances.

Developing a more advanced model could involve validating the overall model-based processes and modifications that generate output data equivalent to actual field-generated data. A preliminary comparison of model-generated and actual data of the disruption of counter-narcotics supplies is presented below.

Modeling Actual Narcotics Capture Activities

An estimated 1,200 to 1,500 tons of cocaine are shipped from South America to Central and North America on an annual basis.[17] Of that amount, it is reported that the movement of some 264 tons were disrupted in 2008, 274 tons were disrupted in 2009, and 194 tons were disrupted in 2010 (Figure 6). Those data can be used to determine model thresholds and to modify the model described in Figure 3 and Appendix 1 to calculate actual amounts of narcotics seizure or disruption.

[17] Private communication with Allen McKee, Joint Interagency Task Force-South (JIATF-S).

Year	Narco Seized	%	Threshold	Total (2.0)	Total (1.9)	Total (1.8)
2008	264 tons	19.6	80.4	277 tons	263 tons	249 tons
2009	274 tons	20.3	79.7	291 tons	276 tons	262 tons
2010	194 tons	14.4	85.6	206 tons	196 tons	185 tons

Figure 6. Estimated cocaine shipments and actual cocaine seizures or disruptions (*Narco Seized*) can be used to set parameters for the random process model.

With an estimated 1,200 to 1,500 tons of cocaine shipments from South America, it is assumed that the mean annual shipment of cocaine was 1,350 tons. Of this total amount, 264 tons represent 19.6 percent, 274 tons represent 20.3 percent, and 194 tons represent 14.4 percent. These percentages can be translated into thresholds for the random process model. Thus it is assumed that model thresholds should be set at 80.4 percent for 2008, 79.7 percent for 2009, and 85.6 percent for 2010. Such thresholds reflect the effectiveness of counter-narcotics operational efforts.

The actual amount of seizures or disruptions generated by the random process model depends on the assumed maximum size of the individual shipments. Reportedly, shipments by airplane may range from 1 to 10 tons; shipments by "gofast" boat may be a maximum of 1 ton; shipments by fishing boat may be some 1.5 tons; and shipments by submersible may be up to 3 to 4 tons.[18] These values can be used with the model described in Appendix 1 to estimate the maximum size of narcotics shipments disrupted or seized by counter-narcotics forces.

Calculation of the amount of disrupted narcotics shipments is essentially a two-stage process. The first stage calculates whether or not a disruption has taken place. The second stage calculates the size of the individual disruptions. Addition of the individual disrupted shipments generates the total amount of the disruptions. Threshold values were set at 80.4 percent for 2008, 79.7 percent for 2009, and 85.6 percent for 2010. At the outset, the model-based maximum shipment size was set at 2.0 tons and without double agent-related activities. Model-generated data with that setting were 277, 291, and 206 tons for 2008, 2009, and 2010, respectively. With the maximum amount set at 1.9 tons, some 263, 276, and 196 tons were generated by the model for 2008, 2009, and 2010, respectively. Lower total amounts were generated when the maximum amount was set at 1.8 (Figure 6). It is evident that the random process model with maximum shipment size of 1.9 tons can generate model seizure or disruption amounts that are almost equal to the actual amounts of those substances that are disrupted. This success in replicating the amounts of seized or disrupted narcotics provides at least a measure of verification for the model. Additional research could be aimed at providing additional model verification.

Policy Cycle Models Can Manage Trafficker Double Agent Conversion Policies[19]

The role of U.S. counter-narcotics policy on the "flipping" procedure varies from increased allocation of agents involved in the interrogation process, to advanced training, to increased funds to pay the informants, and more. Modeling of some of these activities can be useful in identifying the major impact on the policymaking and the policy cycle. Processes involved in the development, implementation, use, and modification of policies associated with a wide range of activities can be represented by an entity called the policy cycle (Lester and Stewart, 2000; Woodcock and Falconer, 2012; and Woodcock, Christensson, and Dockery; 2006, for example).

[18] Ibid, reference 13.

[19] Details of the implementation of this model are presented in Appendix 2.

Major features of the policy cycle are shown in Figure 7. Policy cycle actions can begin when problems arise in society and impact existing government policies and activities. Thus, terrorist and drug-trafficking actions can create demands for more protective measures for the general population as these actions are reported in the media and discussed within the society.

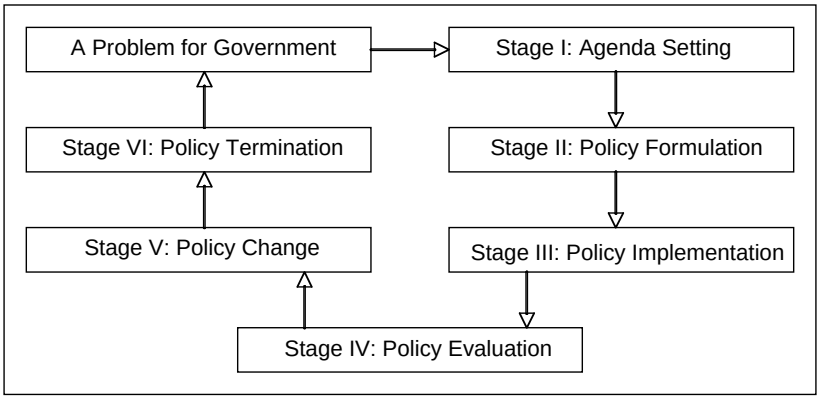

Figure 7. Policy cycle actions identify a problem for a government; set an agenda; and formulate, implement, evaluate, change and/or terminate a policy to address identified problems (Modified after Lester and Stewart, 2000).

Stage I of the policy cycle sets an agenda to address problems and could involve discussions of the causes and effects of the problems created by terrorist attacks and narcotics trafficking and related actions. In Stage II, policies are formulated and legislation aimed at addressing identified terrorist and narcotics trafficker-related problems is developed and passed. Such legislation might increase penalties for trafficker-and terrorist-related activities.

In Stage III, policy implementation occurs and can involve the definition and promulgation of new anti-terrorist or counter-narcotics laws and regulations. In Stage IV, policy is evaluated and can involve assessing the effectiveness of anti-terrorist or counter-narcotics legislation in reducing access to drugs. The results of such evaluations can lead to policy changes in Stage V or to termination of parts or all existing policies in Stage VI. These activities can create new problems that could lead to setting new agendas and undertaking further actions to manage terrorist or drug-trafficking problems.

A policy cycle model of policies aimed at increasing the effort to convert traffickers into double agents has been developed and implemented in systems dynamics software (Appendix 2). A key feature of this model is the inclusion of properties that reflect the impact of corruption on undermining the counter-narcotics policy-related actions of a government. Corruption can inhibit the double agent recruitment process and reduce the amount of narcotics substances disturbed by counter-narcotics actions, for example.

Selected results obtained from the use of the double agent-related policy cycle model are shown in Figures 8, 9, and 10 and described below. Those studies used different settings of the policy cycle parameters: Input to double agent policy evaluation (*DAgt Eval Inpt*), policy change (*DAgt Chnge Inpt*), and policy termination (*DAgt Term Inpt*); new policy formation (*DAgt New Inpt*); and the corruption of notional new policy (*DAgt CorrRte NewPol)* and formulation and implementation activities *(DAgt F&I Corrupt*). Those settings can reflect different rates of policymaking and the effect of different levels of corruption on the development of new counter-

narcotics policies involving the creation of double agents. Additional information is provided in Appendix 2.

- Establishing a performance baseline: Increased conversion efforts increase the amount of disturbed substances (Figure 8): A first study established a performance baseline for the combined Narcotics, Counter-narcotics, Trafficker Double Agent (Appendix 1, Figure A1.5) and policy cycle models (Appendix 2, Figure A2.1) without policy cycle input. The (*DAgt PolSens*) parameter was set at zero to prevent policy cycle input. The maximum size of the narcotics shipments was set at 1.9 tons and the (*CN Efft*) parameter was set arbitrarily at 0.1. Model-generated results show that 263 tons were disturbed in the absence of actions that created double agents (Figure 10). Increasing the level of effort of trafficker conversion to 5 percent, 10 percent, and 15 percent creates 70, 142, and 205 double agents and increases the amount of disturbed substances from 263 to 320, 371, and 410 tons, respectively. Levels of effort of 20 percent, 25 percent, and 30 percent result in the creation of 275, 357, and 427 double agents, and the disturbance of 445, 498, and 550 tons, respectively.

Conv Effrt	Total (tons)	Doubl Agnts	CN Efft	Thresh Dep
0	263	0	0.1	0
5	320	70	0.1	7
10	371	142	0.1	14.2
15	410	205	0.1	20.5
20	445	275	0.1	27.5
25	498	357	0.1	35.7
30	550	427	0.1	42.7

Figure 8. Increased efforts (*Conv Effrt*) targeted at the creation of double agents (*Doubl Agnts*) with a counter-narcotics effort (*CN Efft*) of 0.1 increases the amount of disturbed notional narcotics substances due to a reduction of the threshold level for triggering disturbances (*Thresh Dep*).

- Increased policy cycle-related information transfer rates without corruption can increase the amount of disturbed substances (Figure 9): An established performance baseline (Figure 8) provides a basis for a study of the impact of different rates of transfer of notional information within the policy cycle model in the absence of notional corruption (Appendix 2, Figure A2.1). The influence of corruption was prevented by setting the corruption of new policy (*DAgt CorrRte NewPol*) and the corruption of formulation and implementation process (*DAgt F&I Corrupt)* parameters equal to zero. Increasing the policy cycle parameters of policy evaluation (*DAgt Eval Inpt*), policy change (*DAgt Chnge Inpt*), policy termination (*DAgt Term Inpt*), and new policy (*DAgt New Inpt*) from 0 to 0.1 (10 percent per time step) increased the amount of disturbed narcotics substances from 320 tons to 369 tons; the number of double agent conversions increased from 70 to 180.

PCM Param	Total (Tons)	Doubl Agnts	Thresh Dep
0	320	70	7
0.02	341	133	13.3
0.04	354	160	16
0.06	358	169	16.9
0.08	368	177	17.7
0.1	369	180	18

Figure 9. Increased rates of policy cycle parameter (*PCM Param*) information transfer from 0 to 0.1 (0 to 10 percent per time step) increase the amount of disturbed narcotics shipments and number of converted double agents (*Doubl Agnts*) caused by depression of the threshold for detection (*Thresh Dep*).

- Policy cycle-related corruption decreases the amount of disturbed substances (Figure 10): A third study demonstrated that increased levels of corruption can offset the impact of increased policy cycle information transfer rates, reducing the amount of disturbed narcotics shipments and the number of double agents. Thus some 369 tons of narcotics substances can be disturbed and 180 double agents can be created without corruption. By contrast, 327 tons can be disturbed and 78 agents created with a corruption level of 0.05 (5 percent per time step).

Corrupt Lvl	Total (Tons)	Doubl Agnts	Thresh Dep
0	369	180	18
0.01	339	111	11.1
0.02	331	91	9.1
0.03	330	84	8.4
0.04	327	78	7.8
0.05	327	78	7.8

Figure 10. Increased levels of corruption (*Corrupt Lvl*) can offset the impact of increased policy information transfer rates, reducing the amount of disturbed narcotics shipments and the number of double agents (*Doubl Agnts*).

The studies reported above have shown that notional increased efforts involving creation of double agents can increase the amount of disturbed notional narcotics substances. Additional studies have illustrated the notional impact of policymaking on counter-narcotics efforts involving the creation of double agents. Increased rates of policy information transfer increase the amount of disturbed narcotics shipments and the number of converted double agents. A third study demonstrated that increased levels of corruption can offset the impact of increased policy information transfer rates and reduce the amount of disturbed narcotics shipments and the number of converted double agents. These results suggest that further investigation of the process of double agent formation and the role of policymaking might be pursued with benefit.

The studies were continued to investigate the possible impact of a synergy between narcotics traffickers on the one hand and terrorist and insurgent entities on the other.

Building and Using Combined Terrorist-Narcotics Trafficker Models

Modeling the combined terrorist-narcotics trafficker threat to national security has involved the development and implementation in systems dynamics software of several component models (Figure 11). Production and use of those models in a series of studies are described. The overall model consists of the following major functional components.

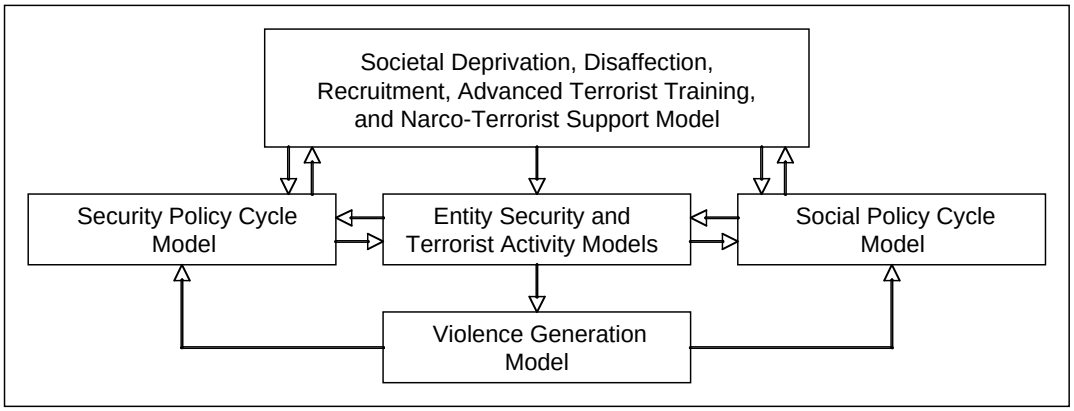

Figure 11. Insights gained from modeling the combined terrorist-narcotics trafficker threat to national security can provide guidance to policymakers and decisionmakers.

- A Societal Deprivation, Disaffection, Recruitment, Advanced Terrorist Training, and Narco-Terrorist Support Model illustrates how notional individuals deprived of key resources can become disaffected, recruited, and trained to become advanced terrorists. Terrorist activities can be supported by narcotics trafficker personnel and resources and can lead to increased violence and casualties within an overall society.
- An Entity Security and Terrorist Activity Model illustrates teams of trained terrorists attacking notional targets. Attacks take place when targets are sufficiently vulnerable and sufficient trained terrorists are available. Model-generated data provide estimates of the number of casualties caused by terrorist attacks as well as terrorist losses from those activities.
- A Violence Generation Model describes how deprived and disaffected individuals may become violent and how such violence can increase the level of perceived deprivation and disaffection. Policy-related actions by notional government entities can act to reduce the level of disaffection and the corresponding level of violence.
- Security and Social Policy Cycle Models describe the processes of identifying a problem and formulating, implementing, evaluating, changing, and/or terminating a policy in response to perceived need. Policy Cycle models have been developed to permit changes in policies that increase security and reduce deprivation by increasing satisfaction and reducing violence levels, respectively. A novel feature added to the Policy Cycle models is the impact of corruption on the policymaking processes that can reduce overall policymaking effectiveness and prevent lowering of violence levels, for example.

A Societal Deprivation, Affection, Disaffection, Advanced Terrorist Recruitment, Training, and Narco-Terrorist Support Model[20]

A prototype *Societal Deprivation, Affection, Disaffection, Advanced Terrorist Recruitment Training, and Narco-Terrorist Support Model* has been developed and implemented in systems dynamics software (Figure 12 and Appendix 3). The model represents the action of two basic processes assumed to be involved in the production and fielding of terrorist assets. One process

[20] Details of the implementation of this model are presented in Appendix 3.

involves the recruitment and training of disaffected individuals from the wider society to provide terrorist operatives. The second process involves the recruitment and advanced training of individuals provided by narcotics trafficker organizations. Those trafficker organizations are also assumed to provide resources that could support training and other operationally related actions. They are also assumed to provide resources to corrupt and reduce the effectiveness of government policymaking and other activities aimed at reducing disaffection and violence levels and stabilizing an overall society.

Major features of the Affection, Disaffection Terrorist Recruitment, Training, and Narco-Terrorist Support Model are shown in Figure 12. The implemented model is shown in Appendix 3, Figure A3.1, and the model control panel is shown in Appendix 3, Figure A3.2. The violence, casualties, and other deprivations caused by terrorist actions are assumed to disaffect individuals who were previously affected toward a government entity. Government actions aimed at satisfying deprivations can transform disaffected into affected individuals. Disaffected individuals can be recruited by terrorist organizations and may undergo some form of basic terrorist-related training. Basic training could be followed by more advanced training aimed at providing operationally competent terrorists. The model has facilities representing the recruitment of narcotics trafficker personnel into the advanced training activities. Following advanced training, the individuals would be available to undertake terrorist operations. Such operations have been modeled as described in the Entity Security and Terrorist Activity Models section of this paper.

Selected output levels of basically trained and advanced terrorists are shown in Figure 13 and Appendix 3, Figure A3.2. An initial population of 100,000 individuals and 200 personnel provided by narcotics traffickers was assumed. Levels of deprivation and satisfaction for a particular setting of model parameters created 84,798 affected and 13,208 disaffected individuals. After the passage of a notional 300-day period, some 574 basic terrorists and 37 advanced terrorists were generated by the modeled training and terrorist event processes (Figure 13). The “stair-step” nature of the output of trained terrorist personnel reflects the assumed size of the trainee terrorist cohorts and training duration in the model. Training throughput can be increased by increasing capacity and reducing the time needed for training. It was envisioned that trafficker resources might support increased advanced terrorist training capacity, and this might be examined in future model-based studies.

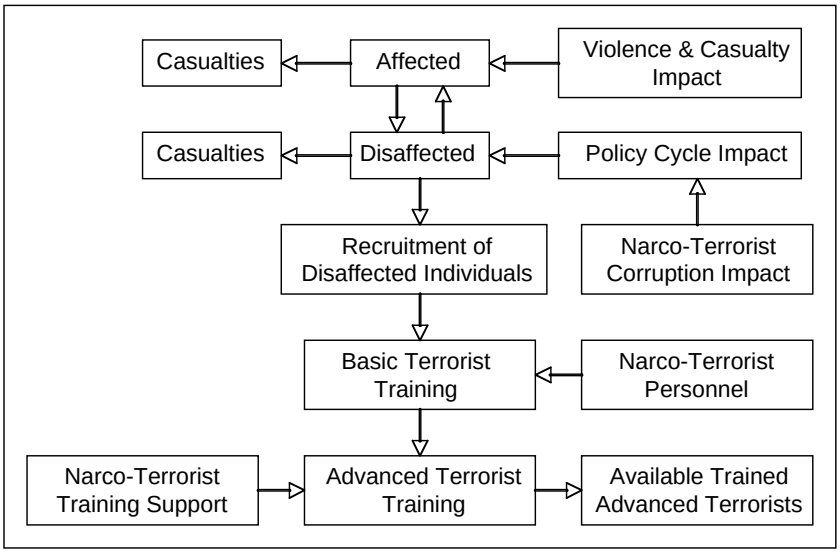

Figure 12. Key activities of the Societal Deprivation, Affection, Disaffection, Advanced Terrorist Recruitment, Training, and Narco-Terrorist Support Model generate notional trained terrorists who are available to undertake terrorist activities.

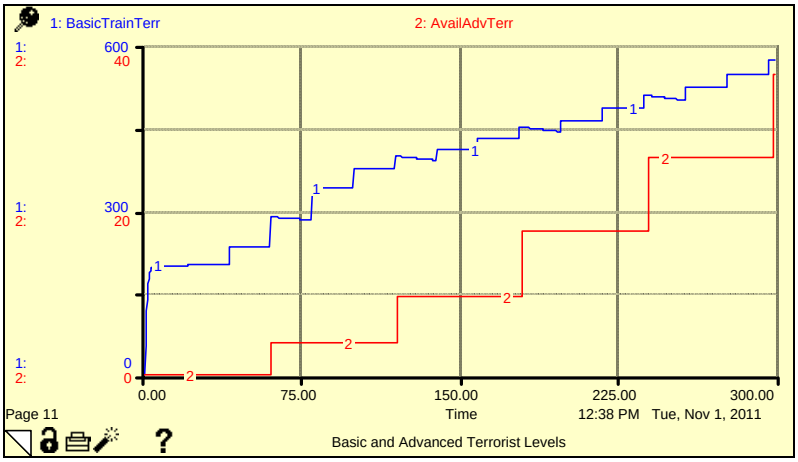

Figure 13. Model-generated numbers of notional basic and advanced terrorists. In this particular case some 574 basic terrorists and 37 advanced terrorists were produced.

An additional study investigated the impact of different numbers of trafficker-provided basically trained terrorists on the availability for operations of terrorists with advanced training. Selected results are presented in Figure 14. With a recruitment rate for advanced terrorist training of 0.001 (0.01 percent per time step) some 200 trafficker recruits can provide 181 basically trained terrorists and 19 terrorists with advanced training after a notional period of 300 time steps. A combination of trafficker-supplied personnel and disaffected individuals recruited at a rate of 0.0001 (0.01 percent of available personnel per time step) can provide 326 basic and 28 advanced terrorists after 300 notional days, for example.

Traff Staff	Basic Terr	Adv Terr
50	45	5
100	90	9
150	136	14
200	181	19

Recrt Rte	Basic Terr	Adv Terr
0	181	19
0.0001	326	28
0.0005	883	62
0.001	1579	77

Figure 14. (a) Trafficker-supplied (*Traff Staff*) personnel can train to become terrorists with basic (*Basic Terr*) and advanced (*Adv Terr*) training and (b) Trafficker supplied personnel can be combined with disaffected individuals recruited from the general population (*Recrt Rte*) to provide terrorists with basic and advanced training.

Entity Security and Terrorist Activity Models[21]

Prototype Entity Security and Terrorist Activity Models have been produced to represent the impact of model-generated numbers of basic and advanced terrorists and the level of security of notional target entities on terrorist activity outcomes. Major functional features of the models are shown in Figure 15. Implementation of the models is illustrated in Appendix 4, Figure A4.1. Reduced security and increased recruitment rates can increase the number of terrorist events.

The *Entity Security Model* component represents the level of security associated with notional target entities. Security investments can increase the level of security and security losses can reduce the level of security from user-selected initial conditions. Security levels can also be increased as a result of the implementation of new security policy actions triggered by losses caused by policy cycle-related terrorist actions, as described below. The level of new policy activity is calculated by the security policy cycle model components.

The *Terrorist Activity Model* component generates notional terrorist events. Those events, referred to as potential terrorist events, are possible when the notional security level falls below a number that has been randomly generated by the model. However, such events may not take place if sufficient terrorists with advanced training are not available. Actual terrorist events take place when sufficient terrorists with advanced training are available and the level of security falls below the generated random number. Security assessments are generated by the model and represent the likelihood that notional entities might be subject to a terrorist attack.

[21] Details of the implementation of these models are presented in Appendix 4.

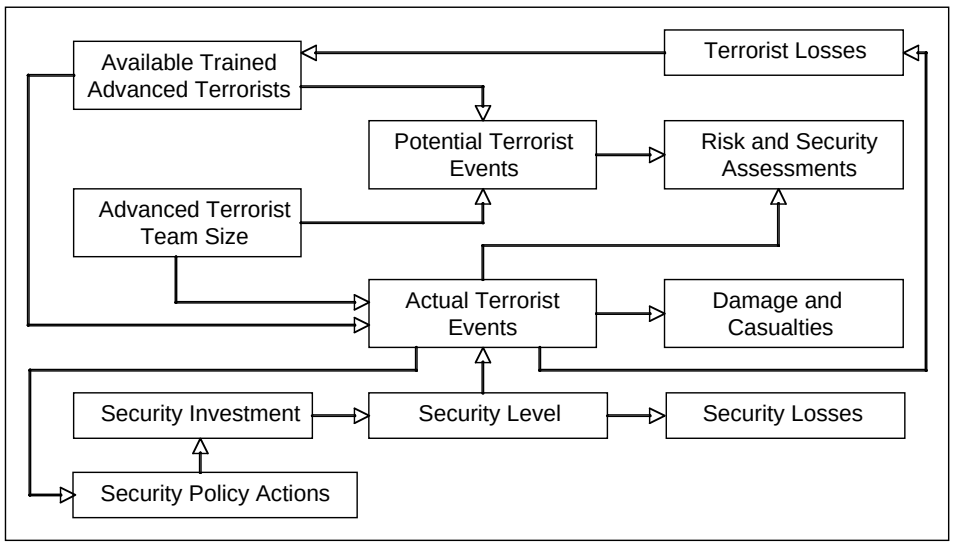

Figure 15. Entity Security and Terrorist Activity models calculate the level of security based on security investment and losses. Security investment levels can be increased as a result of government policy actions. Terrorist events can take place when adequate advanced trained terrorists are available and the security level is sufficiently low.

Team Size	Terr Evnts	Tot Casults	Terrst Loss
1	26	1396	26
2	13	727	26
3	9	418	27
4	7	342	28
5	6	290	30
6	5	281	30

Figure 16. Increasing the terrorist team size (*Team Size*) reduces the total number of actual terrorist events (*Terr Evnts*) because of staffing considerations. Smaller teams can become involved in a larger number of events and may generate more total casualties (*Tot Casults*) and fewer terrorist losses (*Terrst Loss*). Selected output from the Entity Security and Terrorist Activity Models with a security investment of 0 percent per time step, an initial security level of 100, and security loss rate of 0.0004 (0.04 percent) are shown.

The Control Panel for the Entity Security and Terrorist Activity Models is presented in Appendix 4, Figure A4.2. Selected model output data involving teams formed from one to six members are presented in Figure 16. Inspection of the model-generated output suggests that terrorist actions may not take place under some circumstances because suitably trained individuals to fulfill team size requirements may not be available, for example. As a result, care should be exercised when attempting to identify cause-and-effect relationships. Model-generated data for particular settings show that terrorist teams consisting of a single individual create conditions in which more terrorist events can be undertaken compared with situations involving larger teams because personnel are available. In a particular use of the model, the initial security level was set at 100 units and declined to 88.7 after 300 time units due to losses of security, perhaps because of terrorist actions and lack of concern of security personnel. Model-generated data show that terrorist teams consisting of one member might undertake 26 terrorist events and create 1,396

notional casualties with an assumed loss of 26 terrorists. Teams of six terrorists could be involved in five events and create some 281 casualties with the assumed loss in action of 30 terrorists, for example (Figure 16).

A Violence Generation Model[22]

The prototype *Violence Generation Model* calculates the notional level of violence generated in response to societal deprivation, disaffection, and other factors. The major features of the Violence Generation Model are illustrated in Figure 17. Implementation of the model in systems dynamics software is shown in Appendix 5, Figure A5.1. The model control panel is presented in Appendix 5, Figure A5.2. Deprivation is assumed to transform affected individuals into disaffected individuals. Satisfaction of needs, perhaps due to government and other entity actions, is assumed to transform disaffected into affected individuals. Deprivation and satisfaction are assumed to take place at user-selected rates. Relatively high rates of deprivation can create increased levels of disaffection.

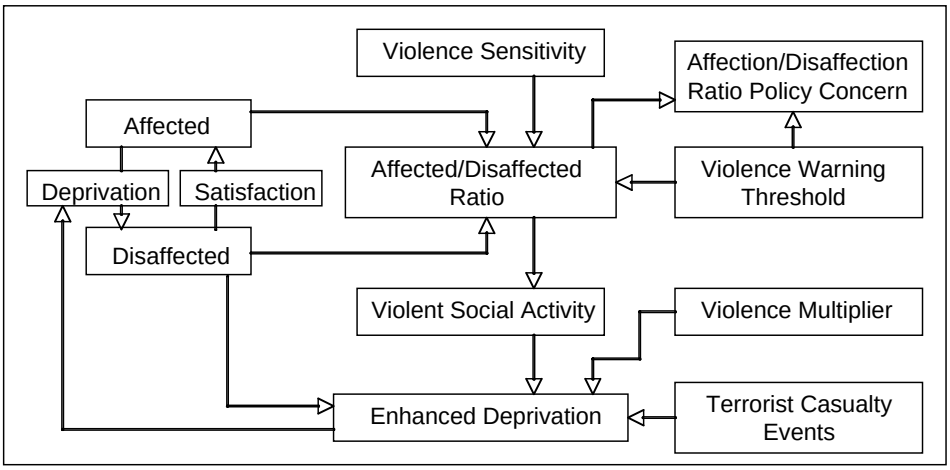

Figure 17. The Violence Generation Model calculates the level of violence based on notional levels of disaffection and affection caused by deprivation and satisfaction, respectively, and social violence sensitivity, reflected in the violence warning threshold parameter. Feelings of insecurity and threat as a result of violence and terrorist-related casualties, for example, can cause enhanced deprivation.

Sample model-generated output is presented in Figure 18. In this case, randomly generated violent activity (*Violence*) and *AD Concern* outputs are produced when the ratio (*Disaffected*/(*Affected* + *Disaffected*)) rises above the *AD POL Warn* threshold. That threshold was assumed to represent the historical experience of a country of interest. Violence in countries with a history of violence is more likely to occur at relatively lower disaffection levels, for example. The *AD Concern* model-generated output triggers activities that generate instructions for creating a new policy (*Soc New Pol*), as described below and in Appendix 6.

[22] Details of the implementation of this model are presented in Appendix 5.

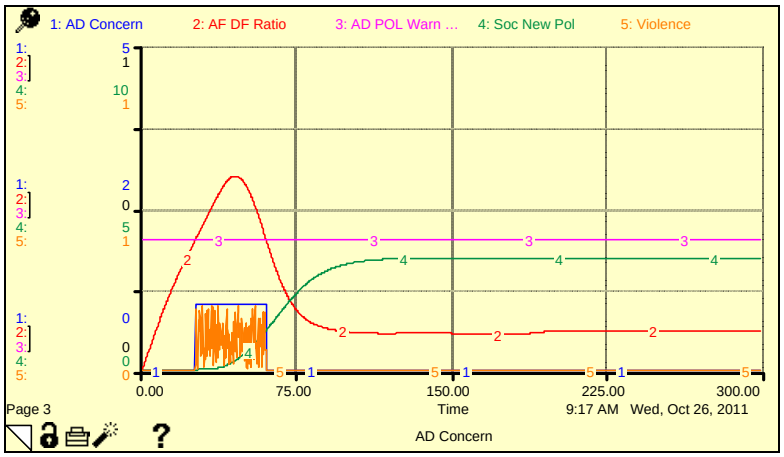

Figure 18. Model-generated output shows the production of violent activity (*Violence*) and (*AD Concern)* output when the ratio of affected to disaffected individuals rises above the (*AD POL Warn)* threshold. The (*AD Concern)* output triggers policy cycle-based activities that generate instructions for creating a new policy (*Soc New Pol*).

POLICY CYCLE MODELS CAN REPRESENT THE MANAGEMENT OF SOCIETAL VIOLENCE LEVELS AND ENTITY SECURITY POLICIES[23]

Policy cycle models for the *Management of Societal Violence Levels and Entity Security* have been developed and implemented in systems dynamics software (Appendix 6). A key new feature of these and the other policy cycle models in this paper is the inclusion of properties that are assumed to reflect the impact of corruption in undermining the policy-related actions of a government entity. In the following studies, policy cycle-related corruption reduced the impact of policies aimed at reducing violence and increasing security. Corruption increased violence levels and prevented increased security-related processes from being implemented.

A Social Policy Cycle Model for the Management of Violence

A Social Policy Cycle Model for the Management of Violence has been developed. Increasing rates of policy-related information transfer in the absence of corruption can reduce the level of societal violence caused by disaffection. Figure 19 presents the key features of the model. Details of model implementation are described in Appendix 6, Figure A6.1. Input to the model represents policy concerns related to the levels of disaffection and violence. Those concerns trigger actions assumed to represent the formulation and implementation of social policy aimed at reducing disaffection and violence. Those actions are followed by actions assumed to represent the evaluation and change of an existing policy involving either new policy creation and/or termination. Corruption is assumed to act by reducing the input to policy formulation and implementation and new policy generation actions. New policy actions would be aimed at reducing violence levels by increasing satisfaction levels within a notional population.

[23] Details of the implementation of this model are presented in Appendix 6.

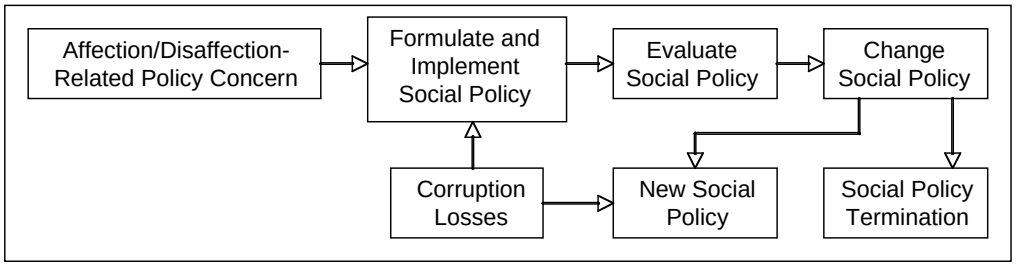

Figure 19. Key features of the Social Policy Cycle Model with policy-related corruption.

Selected results obtained from the use of the Social Policy Cycle model with different settings of the policy cycle parameters are shown in Figures 20, 21, 22, 23, and 24 (also Appendix 6). The (*Soc Pol Sensitiv)* parameter was set at 0.2 and the (*Sec PolSens)* parameter was set at zero, thereby preventing contributions from Security Policy Cycle activities. Studies were undertaken in which the Policy Cycle parameters were set at 0.8 (an 80 percent transfer of information per time step) or 0.1 (10 percent per time step) and either with or without the influence of corruption.

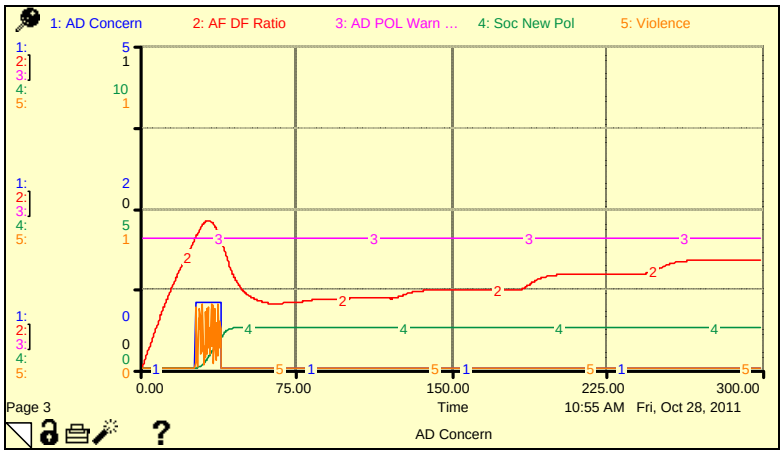

Figure 20. Social Policy Cycle parameters set at 0.8 and corruption 0.0 generates a single burst of violent activity (*Violence*) when (*AF DF Ratio)* exceeds the (*AD POL Warn)* threshold.

- Social Policy Cycle parameter values of 0.8 and corruption levels of 0.0 reduce violence levels (Figure 20): Cycle parameters social policy evaluation (*Soc Eval Inpt*), social policy change (*Soc Chnge Inpt*), social policy termination (*Soc Term Inpt*), and new social policy (*Soc New Inpt*) set at 0.8 represent an 80-percent transfer rate per time step between entities. Without corruption, the corruption of new policy (*Soc CorrRte NewPol*) and formulate and implementation activities (*Soc F&I Corrupt*) were set at 0. These settings generate a single short period of violent activity. That period stops when policy-based actions reduce the level of disaffection below the warning threshold. In this case, relatively rapid migration takes place through these entities: social policy formulate and implement (*Soc F&I Tot*), social policy evaluation (*Soc Eval Tot*), social policy change (*Soc Chnge Tot I*), social policy termination (*Soc Term*), and new social policy (*Soc New Pol*). New policy actions increase the level of satisfaction and reduce the level of disaffection in a relatively rapid manner in the absence of corruption. Those inputs create a single

period of violence (*Violence*), which is terminated as the new policy leads to an increase in satisfaction and a corresponding reduction in disaffection (Figure 20).

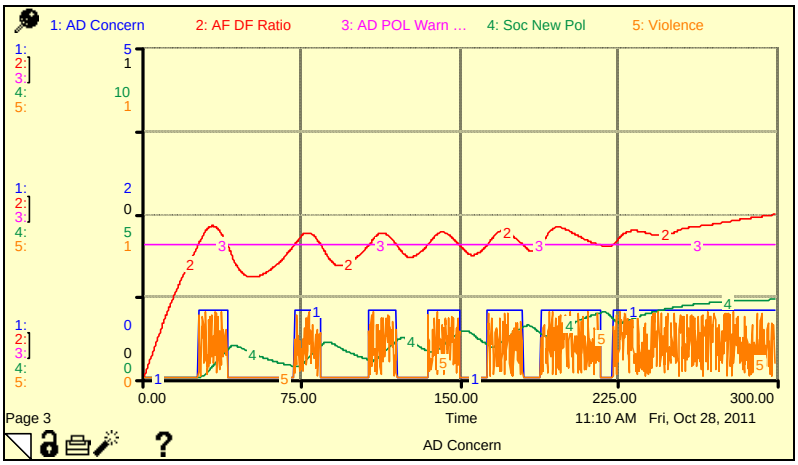

Figure 21. Setting the Social Policy Cycle parameters at 0.8 and corruption parameters at 0.04 generated bursts of violent activity followed by continuous violence because of an inability caused by corruption of a government entity to reduce disaffection to sufficiently low levels where violence does not occur.

- Social Policy Cycle parameter values of 0.8 and corruption levels of 0.04 can increase the duration of violence (Figure 21): Those inputs create conditions in which multiple bursts of violent activity are followed by a period of continued violence as government policies impacted by corruption are unable to reduce disaffection to sufficiently low levels in order to prevent violence. Corruption could be caused by use of trafficker-generated resources that interfere with those government-related actions aimed at increasing the level of satisfaction and decreasing the level of societal violence. Multiple bursts of violence reflect an inability to create a permanent reduction in the level of disaffection. Corruption could be funded by narcotics trafficker resources and lead to increased levels of violence. Violent events could destabilize government entities and lead to an increase in trafficker and terrorist influence within the society, for example.
- Social Policy Cycle parameter values of 0.1 and corruption levels of 0.0 can increase the duration of violence (Figure 22) and create conditions that produce a single period of violent activity of longer duration than that generated with policy cycle parameter values set at 0.8 (Figure 20). Violence occurs when the level of disaffection exceeds threshold levels. Slower policy cycle-related actions reduce the rate of policy-related actions aimed at reducing disaffection. Policy cycle parameter values of 0.1 represent a transmission of 10 percent of notional information per time step, significantly less than the 80-percent rate mentioned above (Figures 20 and 21). The slower rate might represent normal practice and the higher rate an emergency fast-track response to increased levels of societal violence, for example.

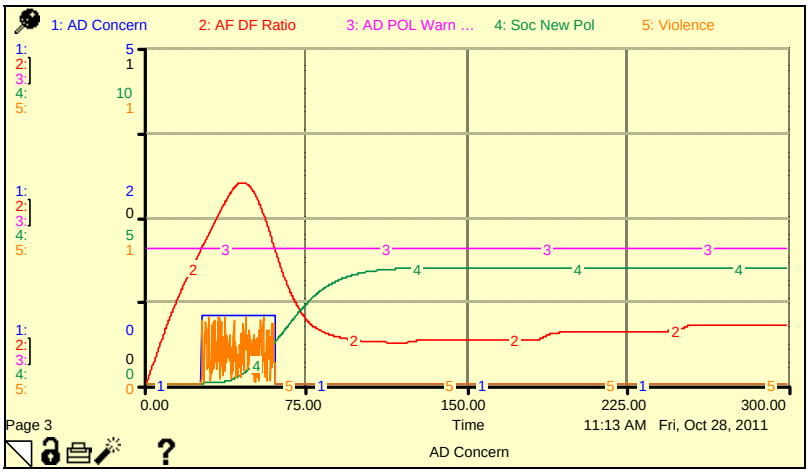

Figure 22. Social Policy Cycle parameters set at 0.1 and corruption levels of 0.0 generate a longer period of violence compared with the situation involving parameter values of 0.8 (Figure 20) when the (*AF DF Ratio)* exceeds the (*AD POL Warn)* threshold.

- Social Policy Cycle parameter values of 0.1 and corruption levels of 0.04 can increase the duration of violence (Figure 23). Slower notional information transmission rates coupled with corruption create conditions that produce a single period of violence followed by continuous violent activity. Activities in the (*Soc F&I Tot*), (*Soc Eval Tot*), (*Soc Chnge Tot*), (*Soc Term*), and (*Soc New Pol*) entities are slower than with the Policy Cycle parameters set at 0.8. This represents the inability of the government entity to generate policies that are adequate to reduce disaffection-related violence.

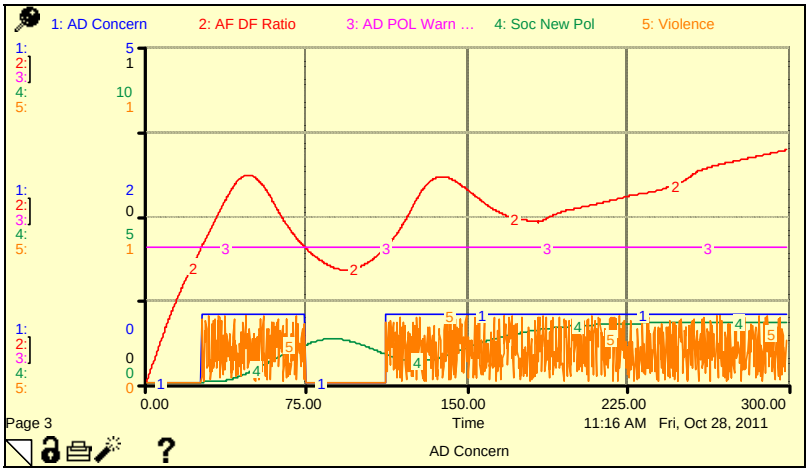

Figure 23. Social Policy Cycle parameter values of 0.1 and corruption levels of 0.04 generated a period of violent activity followed by continuous violence. Compare Figure 23 with Figure 21, which reflects the impact of Social Policy Cycle parameters set at 0.8.

These preliminary experiments have demonstrated that modeled policy cycle-related intervention can act to reduce the level of disaffection in a notional population by increasing the level of satisfaction. Reduced levels of disaffection can reduce the level and duration of violence within a society. Corruption of the policy cycle process can reduce or even stop the disaffection-reducing

actions, including implementation of new government policy cycle-generated policies. The level of societal violence is assumed to be determined by the ratio of disaffected to the total number of affected and disaffected individuals. Violence could occur when that ratio exceeds a value that reflects the historical behavior of a society of interest. Higher levels of violence can be created by increasing the overall level of disaffection; lower violence levels can occur with relatively lower levels of disaffection caused by increased policy-based societal satisfaction.

Policy cycle-generated events that reduce the level of disaffection can act to reduce overall violence levels. Even relatively modest levels of corruption can cause a reduction in policy effectiveness. It is assumed that corruption could be mediated by the infusion of trafficker-generated resources into the policymaking processes of a national government or other policymaking entities. Higher levels of violence can act to reduce the legitimacy of a government so that trafficker-generated corruption can provide a basis for facilitating terrorist actions. Increased terrorist effectiveness could also facilitate trafficker actions by reducing the number and extent of government-led counter-narcotics actions.

A Security Policy Cycle Model for Entity Security Management

A *Security Policy Cycle Model* for the management of entity security has been developed and implemented in systems dynamics software. Figure 24 presents the key features of the model. Details of implementation of the model are shown in Appendix 6, Figure A6.3. Input to the policy cycle model represents policy concerns related to the impact of casualty levels generated by notional terrorist activities. Terrorist actions can occur when targets are vulnerable and trained terrorists are available. In the model, terrorist actions trigger policy cycle-based actions assumed to represent the formulation and implementation of a security policy. That policy is responsive to existing conditions and involves evaluation and change of an existing policy, creation of a new policy, and/or termination of the existing policy. Corruption is assumed to act by reducing the input to the policy formulation- and implementation-related activities. Corruption could also reduce the input responsible for generating a new security-related policy, thereby increasing the likelihood that terrorist events might occur because of an inability to increase security policy.

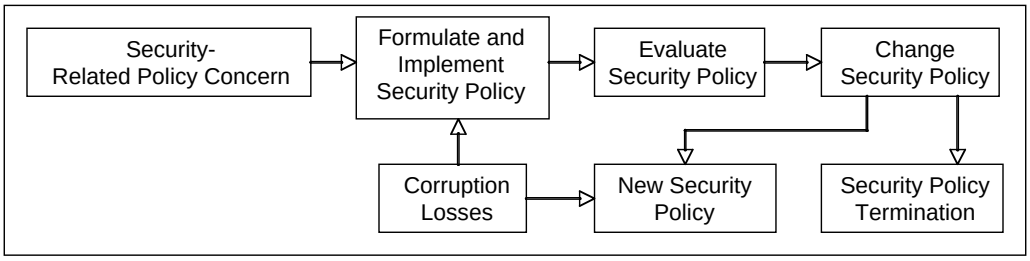

Figure 24. Key features of the Security Policy Cycle Model with policy-related corruption.

Activities within the implemented model are triggered when the number of actual terrorist events (*TotATActEvents*) is greater than zero (Appendix 6, Figure A6.3). The magnitude of policy-related responses is also determined by the level of security-policy-related sensitivity (*Sec Pol Sensitiv*). Policy-related changes are intended to raise the threshold above which terrorist actions would be triggered when the randomly generated number (which can vary between 0 and 100) exceeds the threshold. Under some circumstances, excessive policy cycle output levels cause the threshold to increase above 100, representing some form of excess security level for triggering

terrorist actions. Corruption-related activities, by contrast, can reduce the threshold and increase the likelihood that notional terrorist actions would be triggered when the generated random number exceeds the threshold value.

Two studies were undertaken to examine the impact of (1) increasing the speed of notional policy-related information transfer within the security-related policy cycle model by increasing the value of the policy cycle parameters in the absence of corruption, and (2) increasing the level of corruption within the policy cycle model at fixed information transfer rates. Those studies demonstrate that higher rates of notional information transfer within the cycle can generate instructions that cause a relatively rapid increase in the security threshold, thereby reducing the likelihood of terrorist actions from taking place. Higher corruption levels reduce the level of policy-related changes in security levels and can lead to increased numbers of terrorist events and casualties. Results are presented in Figures 25 and 26.

PCM parms	Fin Sec Lvl	Tot Evnts	Act Evnts	Sec New Pol	Tot Casult
0	88.7	70	27	0	1496
0.02	95.8	57	25	10.5	1358
0.04	102	39	21	16	1114
0.06	105	32	16	18	846
0.08	106.8	29	15	19	840
0.1	108	26	13	20	727

Figure 25. Increased rate of policy-related information transfer can reduce total terrorist-generated casualties. Impact of policy cycle parameter values (*PCM parms*) on security level (*Fin Sec Lvl*), potential (*Tot Events*) and actual (*Act Evnts*) terrorist events, and total casualties (*Tot Casult*) with security political sensitivity (*Sec Pol Sens*) set at 0.2; security investment (*Sec Invest*) was set at 0.01; and corruption was set at zero.

- The impact of policy cycle information transfer rate on security levels and terrorist-related casualties: Increased rate of policy-related information transfer can reduce total terrorist-generated casualties (Figure 25). The first study investigated the impact of increasing the speed of notional information transfer within the security-related policy cycle model from 0 to 0.1 (10-percent transfer per time step) on the potential and actual number of terrorist events and the production of notional casualties. Increasing the rate of policy cycle-related information transfer reduces the number of events and the number of casualties. (1) Baseline conditions were established by setting the policy cycle parameters at zero and preventing policy cycle involvement and policy cycle-mediated security investments. Notional security losses perhaps because of increased vulnerability, of 0.0004 (0.04 percent) per time step caused the security threshold to decline from 100 to a final security level (*Fin Sec Lvl*) of 88.7 during a notional period of 300 days. The reduced security threshold permitted generation of 70 possible terrorist events (*Tot Evnts*) of which only 27 (*Act Evnts*) actually took place because of the lack of trained terrorist personnel. Those events created some 1,496 notional casualties (*Tot Casult*)). (2) Policy cycle parameters set at 0.1 provide an increased investment in security that can offset the impact of security losses. Under these conditions, the security threshold initially decreased and then increased to 108, which is above the initial value of 100, and represents conditions in which entities are not vulnerable to terrorist attack. Model-generated

data suggest that under policy-related security conditions of transient vulnerability, 13 of 26 actual terrorist events with 727 casualties occurred (Figure 25).

- The impact of corruption on security levels and total terrorist-related casualties: Increased levels of corruption can lead to increased numbers of terrorist-generated casualties. (Figure 26). The second security study investigated the impact of corruption on security level, number of terrorist events, and the level of casualties. The policy cycle parameters were held at 0.1 and the corruption parameters varied from 0 to 0.1. Studies show that with zero corruption, the policy cycle process results in a final security level of 108, some 13 actual terrorist events that create 727 total casualties take place. Increasing the level of corruption to 0.1 prevents policy cycle-related increases in security levels from taking place. This creates a final security level of 89.6, which results in 27 actual terrorist events with 1,496 total casualties taking place.

Corrruption	Fin Sec Lvl	Tot Evnts	Act Evnts	Sec New Pol	Tot Casult
0	108	26	13	20	727
0.02	94.8	50	26	4	1396
0.04	91.7	64	27	1.8	1496
0.06	90.6	65	27	1	1496
0.08	90	66	27	0.7	1496
0.1	89.6	66	27	0.5	1496

Figure 26. Increased levels of corruption can lead to increased numbers of terrorist-generated casualties. Impact of policy cycle corruption (*Corruption*) on security level (*Fin Sec Lvl*), potential (*Tot Events*) and actual (*Act Evnts*) events, and total casualties (*Tot Casult*) with security political sensitivity (*Sec Pol Sens*) set at 0.2, the security investment (*Sec Invest*) set at 0.01, and the policy cycle parameters set at 0.1.

It could be assumed that synergetic interactions involving narcotics traffickers and terrorists could involve use of trafficker resources to corrupt the counter-narcotics policymaking processes. Such actions could block attempts to increase security and lead to an increased number and scope of terrorist events with higher casualty levels. This could create an increased perception of a government that was unable to protect the citizenry and lead to increased levels of disaffection and create further violence. Those changes could act to undermine a government and facilitate future trafficker and terrorist actions, to the benefit of both traffickers and terrorists.

Higher security thresholds can have the effect of preventing terrorist events from taking place as the result of a notional increase in security or reduction in entity vulnerability. Such changes could reflect an increase in the alert status and responsiveness of entities involved in setting and implementing security policy. Increased responsiveness can reduce vulnerabilities and the number of terrorist events and associated casualties that could occur. Studies have examined the impact of corruption on the ability of policy-related changes in alert status and responsiveness and the production of notional casualties. Corruption can prevent policy-related security increases from taking place, thereby increasing vulnerability and fostering the perception of an inability of a government to protect its people.

SUMMARY, DISCUSSION, AND A WAY FORWARD

This paper has provided a review of the drug trafficking and terrorist domains as well as means to counter their activities. This was accomplished through the development of models for drug trafficking, terrorist activities, and the role of the policymaker in countering their activities. More specifically, the conclusions of the overall study are as follows:

- The study included an investigation of the counter-narcotics activities and the role of efforts aimed at converting traffickers into double agents. Model-generated data closely resembled actual reports of tons of disrupted narcotics substances detected in 2008, 2009, and 2010. A policy cycle model was developed and used to study the potential impact of increased levels of policymaking support as well as corruption of the policy process on the ability to form double agents and to disrupt trafficker activities. Increased rates of policy cycle activity increased the amount of narcotics disruption. However, increased levels of corruption reduced those levels.
- Model-generated results show that policymaking can lead to a reduction in the level of deprivation, disaffection, and violence and that policy-related effects can be inhibited by corruption, which can change the overall political dynamics of societies of interest. The policies may range from providing social services, employment, medical and housing assistance, and so forth. This is similar to what Hezbollah provides to poor communities in Lebanon and other Diaspora locations. The goal is to win the hearts and minds of the people. The prevention of actions taken by the government tend to increase the duration of disaffection-related violence, and they also increase the number of disaffected individuals available for recruitment into terrorist training programs. In order to accurately assess this impact, it is necessary to have data that provide the range of possible actions taken by terrorist organizations and their impact on the population. A leading counter-terrorism expert conducted an extensive interview process of prisoners in Israel that reveals the rationale for undertaking terrorist acts such as planting improvised explosive devices (IED) in public places. The level of disaffection ranges from ideological concerns to personal grievances and family tragedies as a result of the occupation.
- Modeling the combined terrorist-narcotics trafficker threat to national security has involved production of several component models, including the following:
    - *A Societal Deprivation, Disaffection, Recruitment, Advanced Terrorist Training, and Narco-Terrorist Support Model* that illustrates how notional individuals deprived of key resources can become disaffected and recruited and trained to become advanced terrorists.
    - *An Entity Security and Terrorist Activity Model* that illustrates the attack of notional targets by teams of trained terrorists.
    - *Entity Security and Violence Generation Models* describe how deprived and disaffected individuals may become violent and how such violence can increase the level of perceived deprivation and disaffection.
    - *Social and Security Policy Cycle Models* that represent the processes of identifying a problem and formulating, implementing, evaluating, changing, and/or terminating a policy in response to perceived need, as

well as the impact of corruption in preventing successful policy-related outcomes.

- Model-based studies also show that the availability of trained terrorists needed for operations is a rate-limiting factor and that vulnerable targets of opportunity may not be attacked because trained terrorist operatives are lacking. This suggests that the narcotics trafficker networks could perform important intelligence functions by identifying vulnerable targets and alerting terrorist organizations to pre-position operatives in order to take advantage of opportunities. Trafficker networks could also increase target vulnerability by creating climates of fear and reduced social activity in target areas. These potential actions by the cartel networks could be of great value to the terrorists and may be worth the financial investment they would make in such cartel organizations. In order to assess the value, a detailed examination of specific indictments and the contribution of intelligence are required. However, most of the unsealed cases focus on the tactics used by the cartels in moving shipments of narcotics and the actions of facilitators in this process. A distinct connectivity between criminal and terrorist groups is well known. Their interaction is based on the ability of each group to provide a critical service to another and profiting from the transaction. The accomplishment here is beyond the academic exercise of model development but is focused on the interaction and the benefits/gains that are achieved.

Looking forward, additional model-based studies are needed to assess the effect of narcotics trafficker and terrorist involvement in at least the following activities:

- Support to terrorist training capacity and the increased rate of recruitment of disaffected individuals as terrorists
- The supply of trained terrorist personnel, resources, and facilities to support advanced terrorist training and operational activities
- The effect of narcotics trafficker and terrorist involvement in and the impact of corruption on security-related protective policy-based measures
- The effect of corruption on implementation of government policies aimed at preventing social deprivation, disaffection, and violence
- The effect of terrorist and narcotics trafficker personnel deployment on entity vulnerability and intelligence collection actions.

The authors believe that modeling these activities can provide a deeper understanding of the relationship between drug trafficking and terrorist activities as well as the role of the policymaker in countering these threats. Additional insight can be generated by studies that identify values for the assumed model parameters, potentially leading to the development of enhanced and more realistic models. Those models could support production of new facilities for counter-terrorist and counter-narcotics policymaking and decisionmaking.

APPENDICIES 1 TO 6: IMPLEMENTATION OF THE MODELS IN SYSTEMS DYNAMICS SOFTWARE

Details of the models developed and used in the studies reported in this paper are presented below.

APPENDIX 1: A NARCOTICS, COUNTER-NARCOTICS, AND TRAFFICKER DOUBLE AGENT MODEL

Preliminary Model-Building Considerations

The models described in this paper were developed and implemented in STELLA™, a commercially available systems dynamics-based software system (http://www.iseesystems. com) by Woodcock. Figure A1.1 and other figures are screenshots taken from the models developed and used as described in this paper. Programming in STELLA™ involves dragging icons representing different properties and capabilities onto a workspace provided by the system and forming functional links between appropriate entities. Key components include, but are not limited to, stocks, flows, converters, and action converters. Figure A1.1 represents a sample model of the Flow *Input* to a *Process* entity (represented by the rectangular stock construct) at a rate determined by the *Input Rate* parameter. Output from the *Process* entity to a *Product* entity takes place at a rate determined by multiplication of the value of the *Process* and *Output Rate* parameters. Once the model is assembled, the system asks the user for information and data.

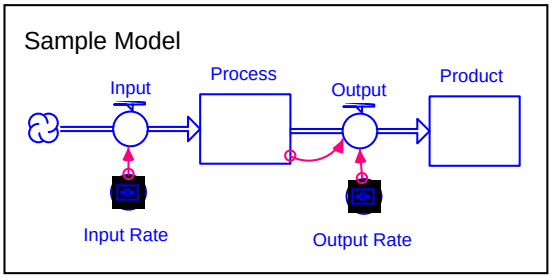

Figure A1.1. The Sample Model structure involves stocks, flows, converters, and action converters provided by the STELLA™ system.

```
Process(t) = Process(t - dt) + (Input - Output) * dt
INIT Process = 0

INFLOWS:
Input = Input_Rate
OUTFLOWS:
Output = Output_Rate*Process
Product(t) = Product(t - dt) + (Output) * dt
INIT Product = 0

INFLOWS:
Output = Output_Rate*Process
Input_Rate = 0.1
Output_Rate = 0.05
```

Figure A1.2. Sample Model source code is generated automatically by STELLA™.

User development of the model structure, model relationships, and parameter values (Figure A1.1) sets the scene for automatic source code generation for the model (Figure A1.2). The rectangular icons inside the *Input* and *Output Rate* converter icons (Figure A1.1) represent the fact that sliders have been implemented to permit user selection of specific *Process* and *Output Rate* parameter values. Those sliders are shown in the model control panel in Figure A1.3. Sliders permit rapid user selection of parameter values during experimental studies with the model. The control panel can be constructed to provide numerical data displays and other information. In this case *Input* and *Output Rates* set at 0.1 generate *Process* and *Product* values of 1 and 9, respectively. STELLA™ also provides a graphical display facility that has been used to display the increase with time of the *Process* and *Product* parameters (Figure A1.4). The system permits user selection of Run Specifications that define the duration and other properties of the runtime of the model. In this case the runtime has been set at a notional 100 days.

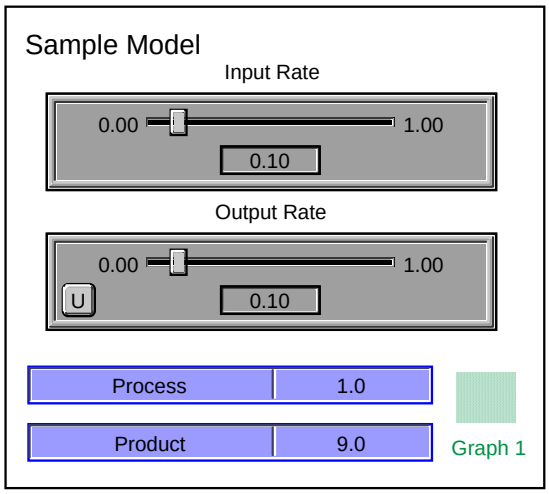

Figure A1.3. Sample Model control panel showing sliders and numerical data displays.

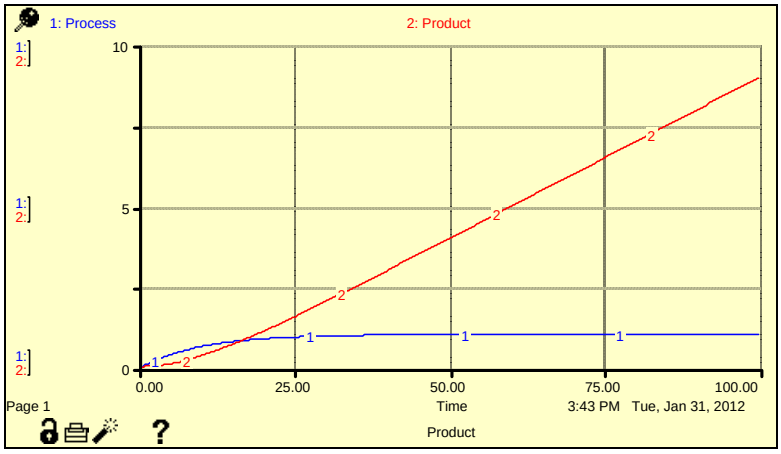

Figure A1.4. Sample Model graphical output showing calculated *Process* and *Product* values for a notional 100 days.

It is hoped that this brief introduction to the use of STELLA™ has provided an adequate foundation to permit the reader to access the following descriptions of the development, implementation, and use of the models described below. Additional information can be obtained from the http://www.iseesystems.com website.

Implementation of the Narcotics, Counter-narcotics, and Trafficker Double Agent Model

Implementation of the *Narcotics, Counter-narcotics, and Trafficker Double Agent* model in STELLA™ (http://www.iseesystems.com) is shown in Figure A1.5. The model provides a notional representation of the process of converting traffickers into double agents and using the information they might provide to disrupt additional shipments of narcotics. Details of these activities are presented below.

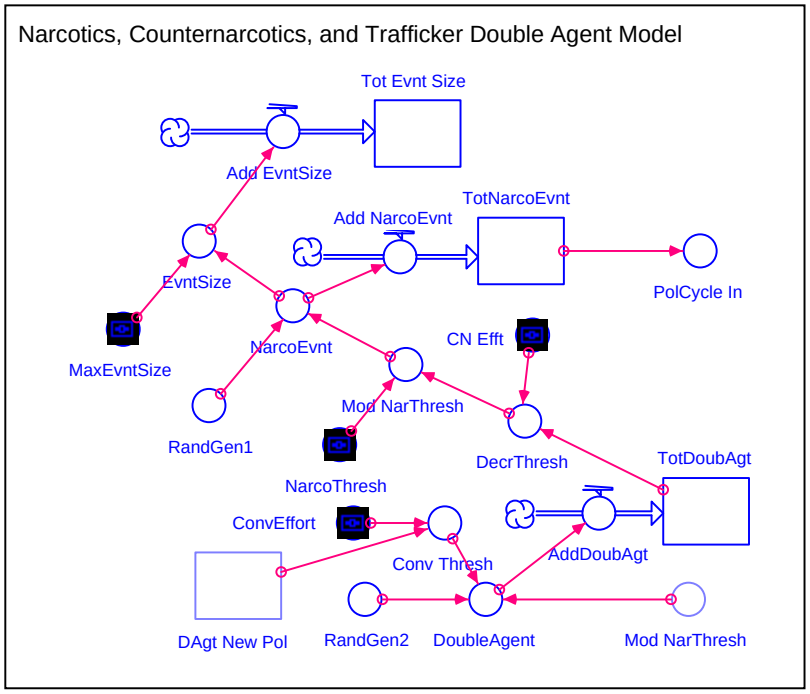

Figure A1.5. Counter-narcotics model that represents the impact of creating trafficker double agents on the number and size of narcotics seizure activities. The model also provides output to (*PolCycle In*) and input from a policy cycle-based management model (*DAgt New Pol*) described in the text.

Narcotics substance seizures or disruptions are assumed to take place when a randomly generated number (*RandGen1*) is greater than a user-selected threshold value (*NarcoThresh*) (Figure A1.5). The threshold for detection or disruption of narcotics substances can be modified by the effect of the generation of double agents, (*Mod Nar Thresh*) as described below. Disruption events are represented by the (*NarcoEvnt*) parameter which has value 1 for a model-generated event and 0 otherwise. Non-zero (*NarcoEvnt*) data trigger another random number generator (*EvntSize*), the output of which ranges from 0 to the user-selected (*MaxEvntSize*) parameter representing the maximum size of disrupted narcotics shipments. The total event size (*Tot Evnt Size*) is formed from the addition of all events; the total number of counter-narcotics

events is represented in the model as the (*TotNarcoEvnt*) parameter. Model facilities were also created that provide input to a policy cycle management model (*PolCycle In*), and output from the policy cycle model can change the policy on double agent recruitment (*DAgt NewPol*). The policy cycle model is described below (Appendix 2). Use of that model enabled consideration of the impact of the rate at which policymaking could take place and how policymaking might be influenced by corruption. Data on the total number of narcotics seizures and the total size of those seizures was collected and displayed both numerically and graphically.

The conversion of narcotics traffickers into double agents is represented by a process in which conversion is assumed to take place when a random number generated by a random number generator (*RandGen2*) is greater than a user-selected threshold determined by the value of the user-selected *ConvEffort* and *Conv Thresh* parameters (Figure A1.5). Higher thresholds represent conditions where such conversion is relatively unlikely to take place. Increased conversion efforts are assumed to reflect a lowering of the threshold (*Mod Nar Thresh*) representing conditions where a greater likelihood exists for the generated random number (*RandGen1*) to exceed the threshold and represent disruption of narcotics shipments.

The trafficker double agents (*TotDoubAgt*) generated by the conversion process are assumed to provide information that could be used to decrease the threshold for detection of narcotics trafficker activities (*DecrThresh*). Actual narcotics detection was assumed to depend on the level of effort involved in converting trafficker-provided intelligence into operational counter-narcotics activities represented by the (*CN Efft*) parameter. Higher levels of such efficiency are assumed to generate a greater likelihood for narcotics detection, seizure, or other types of disruption.

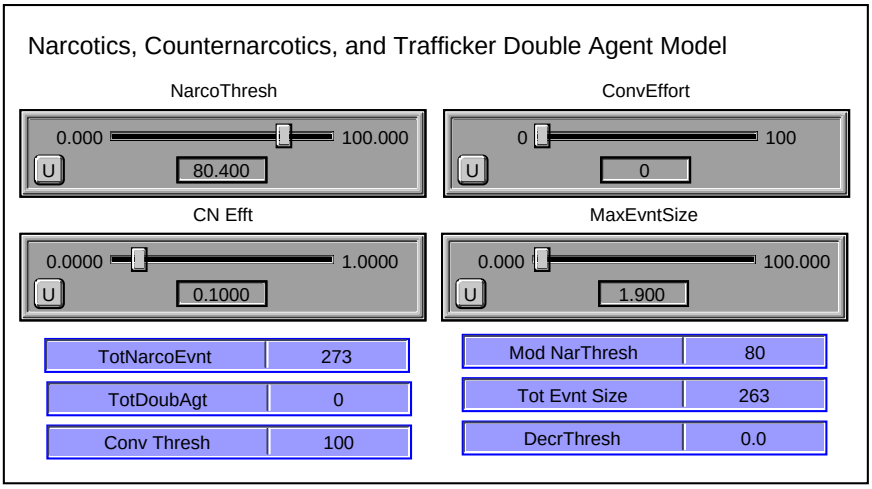

Figure A1.6. Control panel for the Narcotics, Counter-narcotics, and Trafficker Double Agent Model permits the display of selected model outputs.

The control panel for the Narcotics, Counter-narcotics, and Trafficker Double Agent Model is shown in Figure A1.6. The panel permits user selection of the narcotics detection threshold (*NarcoThresh*; set at 80.4), counter-narcotics effectiveness (*CN Efft*; 0.1), double agent conversion effort (*ConvEffort*; 0), and maximum size of disturbed shipments (*MaxEvntSize*; 1.9) and their use in model-based studies, for example.

APPENDIX 2: POLICY CYCLE MODELS CAN MANAGE TRAFFICKER DOUBLE AGENT CONVERSION POLICIES

A policy cycle model of policy aimed at increasing the level of effort to convert traffickers into double agents has been developed and implemented in systems dynamics software (Figure A2.1) The model has facilities that detect actions aimed at producing double agents. Notional policies are developed to enhance the rate of creation of those agents. A key feature of this model is the inclusion of properties that reflect the notional impact of corruption in undermining the counter-narcotics policy-related actions of a government. Corruption inhibits the double agent recruitment process and reduces the amount of narcotics substances disrupted or disturbed by counter-narcotics actions.

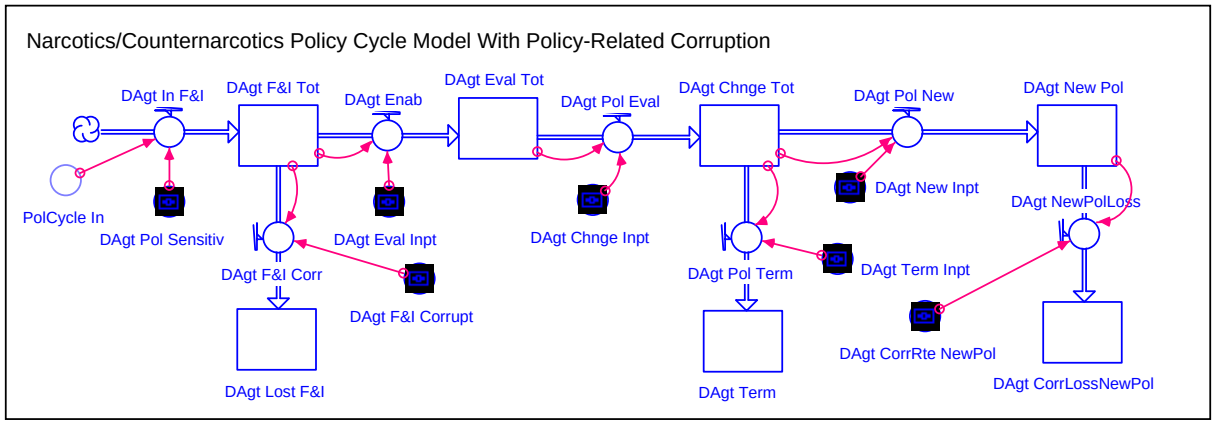

Figure A2.1. Policy Cycle Model describing the creation of double agent generating policies. Policies supporting the creation of double agents can result in an increase the amount of narcotics substances disturbed by counter-narcotics actions; corruption of the policymaking process can reduce that amount. Double agent new policy (*DAgt New Pol*) provides input to the Narcotics, Counter-narcotics, and Trafficker Double Agent Model.

Activities within the implemented policy cycle model are triggered when the *TotNarcoEvnt* parameter is equal to 1 and the (*PolCycle In*) parameter is then set to 1 (Figures A1.5 and A2.1). Policy-related responses are also determined by the level of sensitivity to double agent-related actions (*DAgt Pol Sensitiv*). Double agent policy cycle-related activities involve double agent policy formulation and implementation (*DAgt F&I Tot*), double agent policy evaluation (*DAgt Eval Tot*), double agent policy change (*DAgt Change Tot*), new double agent policy creation (*DAgt New Pol*), and double agent policy termination (*DAgt Pol Term*). These activities take place at user-selected rates: policy evaluation (*DAgt Eval Inpt*), policy change (*DAgt Chnge Inpt*), new policy (*DAgt New Inpt*), and policy termination (*DAgt Term Inpt*), respectively. Corruption of the double agent policy formulation and implementation processes takes place at a rate determined by the (*DAgt F&I Corrupt*) parameter and corruption of the new double agent policy takes place at a rate determined by the (*DAgt CorrRte NewPol*)parameter. Output from the counter-narcotics model (Figure A1.5) (*PolCycle In*) triggers events in the policy cycle aimed at increasing the number of converted trafficker double agents. The ability to increase the number of conversions can be affected by corruption of the policymaking processes since that reduces

the value of the (*DAgt New Pol*)parameter as well as the efforts involved in agent recruitment (Figure A1.5).

The control panel for the Double Agent Policy Cycle Model is shown in Figure A2.2. The control panel permits user selection of the following parameters: double agent policy sensitivity (*DAgt Pol Sensitiv*; set at 0.0), input rate to double agent policy evaluation (*DAgt Eval Input*; 0.1), input rate to double agent policy change (*DAgt Chnge Input*; 0.1), input rate to double agent policy termination (*DAgt Term Input*; 0.1), input rate to new double agent policy (*DAgt New Input*; 0.1), new double agent policy corruption rate (*DAgt CorrRte NewPol*; 0), and corruption of double agent policy formulation and implementation (*DAgt F&I Corrupt*; 0).

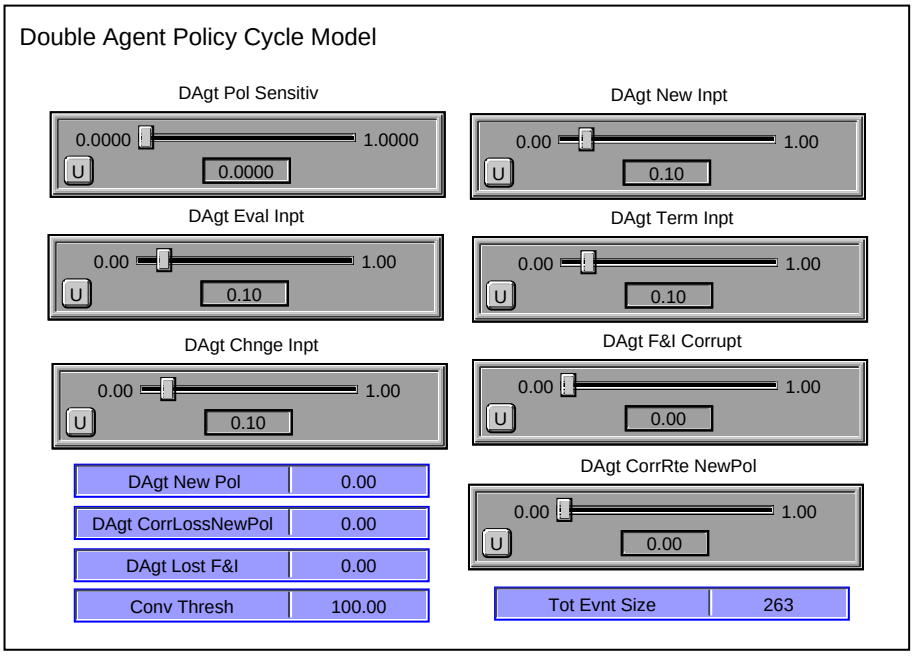

Figure A2.2. Control panel for the Double Agent Policy Cycle Model shows slider value inputs and numerical output values of selected parameters.

APPENDIX 3: PROTOTYPE SOCIETAL DEPRIVATION, AFFECTION, DISAFFECTION, ADVANCED TERRORIST RECRUITMENT, TRAINING, AND NARCO-TERRORIST SUPPORT MODEL

Implementation of the Societal Deprivation, Affection, Disaffection, Advanced Terrorist Recruitment, Training, and Narco-Terrorist Support Model is shown in Figure A3.1. In the model, affected individuals (*Affect*) are transformed into disaffected (*Disaffected*) individuals at rates determined by the level of deprivation (*DepLvl* and *Dep Enh*). Disaffected individuals can become affected by actions aimed at increasing the level of satisfaction either by existing government policies (*SatLvl*) or by new government policies (determined by the values of the (*Soc New Pol*) and policy multiplier (*PolMult*) entities). Both affected and disaffected individuals may be lost as casualties as a result of terrorist actions (represented by the model-generated *Damage* parameter) and reduce the overall size of the populations of interest.

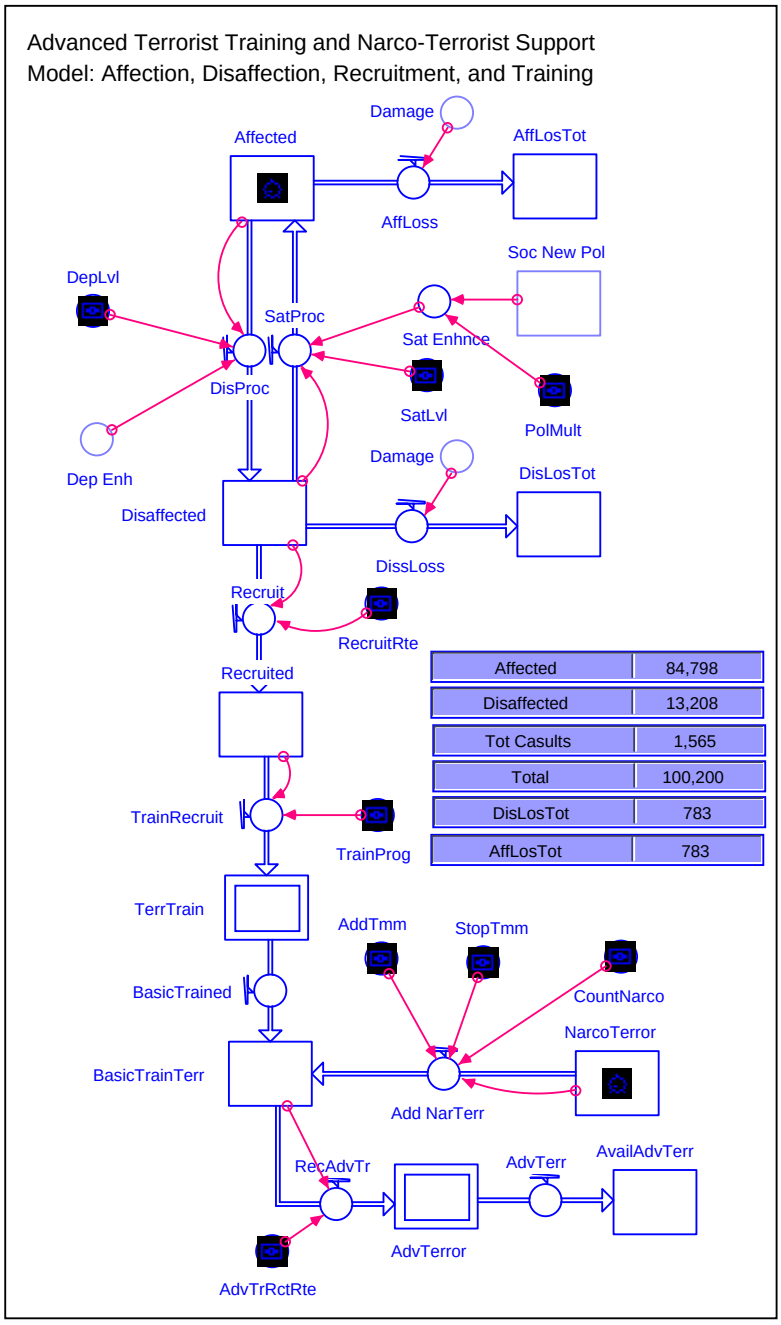

Figure A3.1. Advanced Terrorist Recruitment, Training, and Narco-Terrorist Support Model represents the processes of affection, disaffection, recruitment, and production of basically trained and advanced terrorists. Those activities can be supported by the use of trafficker personnel and training facilities that create additional terrorists.

Terrorists can be recruited from among disaffected individuals at a rate determined by the *RecruitRte* parameter. Recruited terrorists can undergo notional basic training (*TerrTrain*) and be recruited into advanced training (*AdvTerror*) at a rate determined by the (*AdvTrRctRte*) parameter generating available advanced terrorists (*AvailAdvTerr*). Training can be stopped by

setting the (*TrainProg*) parameter to zero. Additional individuals can be supplied by drug trafficker organizations (*NarcoTerror*) between times (*AddTmm*) and (*StopTmm*). The level of notional government actions against that process is represented by the (*CountNarco*) process. In addition, narcotics trafficker resources could be used to increase the overall model-based capacities and throughput rates of the notional basic and advanced terrorist training facilities.

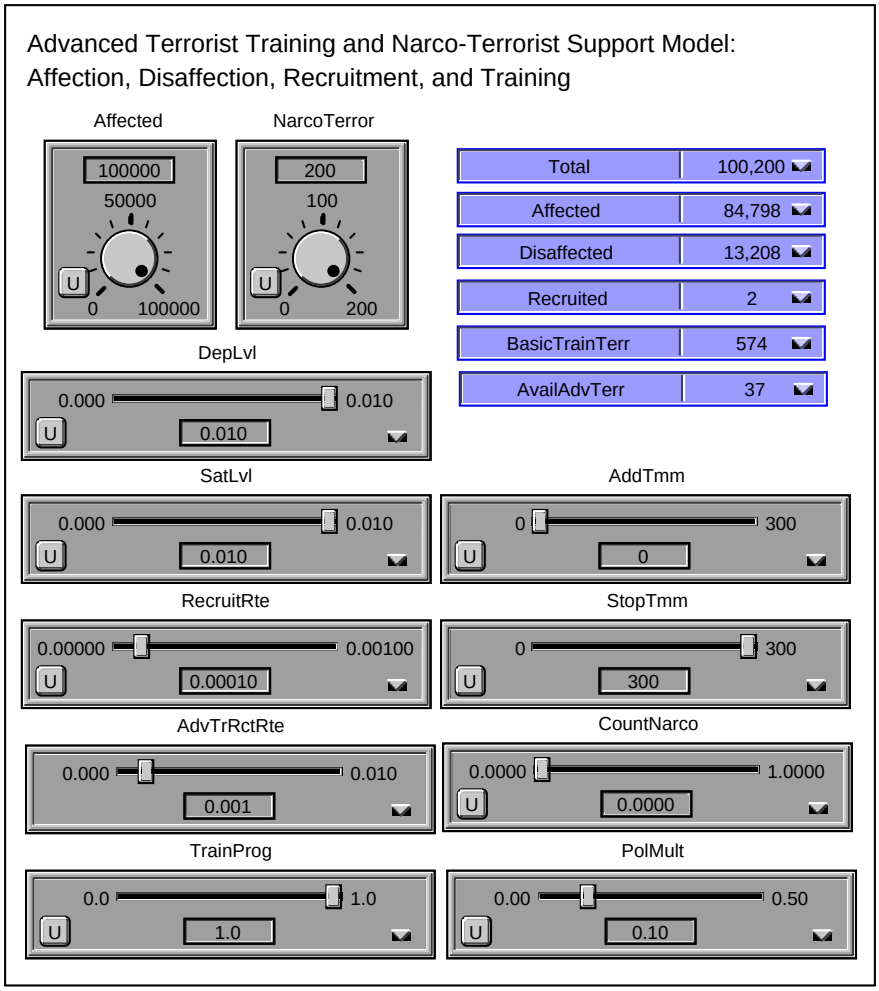

Figure A3.2. The Advanced Terrorist Recruitment, Training, and Narco-Terrorist Support Model control panel provides capabilities for selecting model parameters and undertaking parameter impact analysis and assessment studies.

The control panel for the Advanced Terrorist Training and Narco-Terrorist Support Model is presented in Figure A3.2. User selection of model parameter values with the use of software sliders can provide an environment for undertaking studies of the impact of model parameter values on model-generated outcomes. User-selected parameter values can include the following: initial affected population (*Affected*; set at 100,000); terrorists supplied by narcotics traffickers (*Narcoterror*; 200); deprivation rate (*DepLvl*; 0.01); satisfaction rate (*SatLvl*; 0.01); recruitment rate for disaffected individuals (*RecruitRte*; 0.0001); advanced terrorist recruiting rate (*AdvTrRctRte*; 0.001); training program in place (*TrainProg*; 1); start time for adding trafficker

personnel (*AddTmm*; 0); end time (*StopTmm*; 300); counter-narcotics effort (*CountNarco*; 0); and political multiplier (*PolMult*; 0.1).

Figure A3.3 provides a numerical cross-check to determine the involvement of all participants. Thus the total number of notional participants (*Total*) = 100,200 = (*Affected*) + (*Disaffected*) + (*Recruited*) + (*AffLosTot*) + (*DisLosTot*) + (*TerrTrain*) + (*AvailAdvTerr*) + (*BasicTrainTerr*) + (*AdvTerror*) + (*NarcoTerror*).

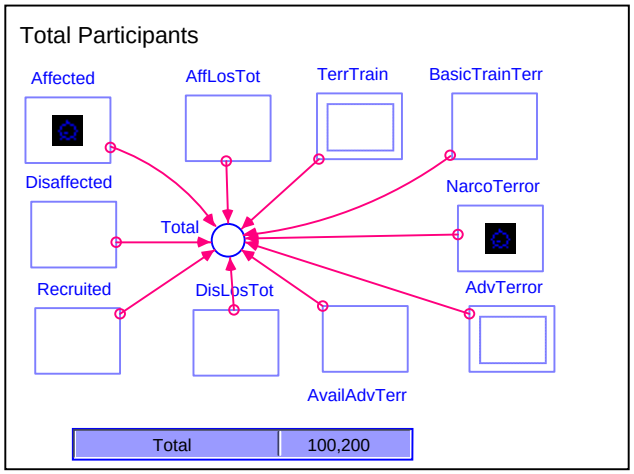

Figure A3.3. Numerical cross-check to verify involvement of all notional participants in Figure A3.1.

APPENDIX 4: ENTITY SECURITY AND TERRORIST ACTIVITY MODELS

Implementation of the Entity Security and Terrorist Activity Models in systems dynamics software is shown in Figure A4.1. The key feature of the model is the representation of the level of entity security. The initial level of security (*SecLevel*), which can range from 100 (most secure) to 0 (least secure), can be selected by the user at the outset with the aid of the control panel (Figure A4.2). The security level (*SecLevel*) is increased by investment (*SecInvestRte*) and policy cycle-generated actions (*Sec New Pol*). The level of security can be reduced by losses caused by lack of maintenance and attention and by hostile terrorist actions (*SecLosRte*), for example.

Actual terrorist events (*ActAdvTerr*) can take place when adequate numbers of advanced terrorists (determined by the terrorist team size [*AdvTerTeamSize*] and numbers of advanced terrorists [*AvailAdvTerr*]) are available and security levels are appropriately low. Terrorist numbers are reduced by operationally generated casualties (*Losses*). Terrorist losses are calculated based on the size of the team and number of terrorist events, assuming that total terrorist casualties occur during each event.

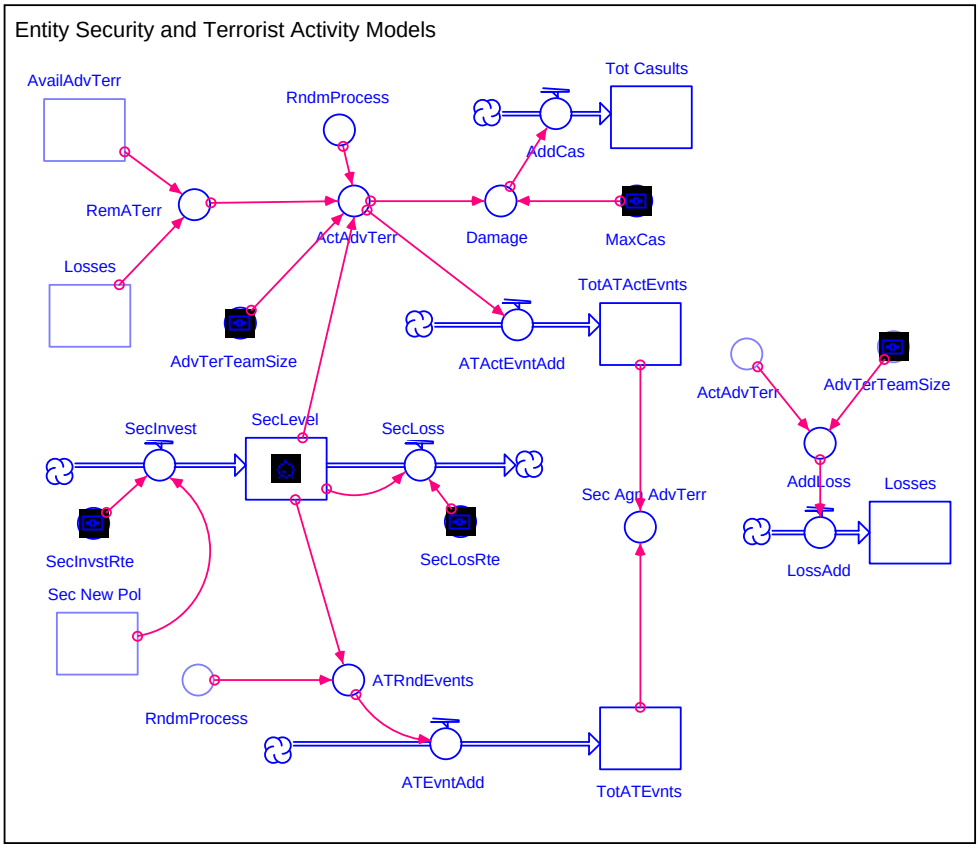

Figure A4.1. Implementation of the Entity Security and Terrorist Activity Models provides a basis for undertaking studies of the impact of the number of trained terrorists and the vulnerability of targets on casualty levels. The key feature of the model is the level of security (*SecLevel*) that can be increased by investment in security and decreased by lack of maintenance and/or hostile actions.

Potential events represent situations when the model-generated security level is below the value of the model-generated random number (*RandomProcess*) but insufficient trained terrorists are available to take action. The ratio (*Sec Agn AdvTerr*) of total actual (*TotATActEvents*) and total potential (*TotATEvents*) number of terrorist events provides an indication of the relative availability of trained terrorists for operational purposes.

The Control Panel for the Entity Security and Terrorist Activity Models is presented in Figure A4.2. The Panel permits user selection of the investment rate in maintaining security (*SecInvstRte*; set at 0), the rate of loss of security (*SecLosRte*; 0.0004), the maximum number of casualties per incident (*MaxCas*; 100), the terrorist group size (*AdvTerTeamSize*; 1), and initial security level (*SecLevl*; 100) of the of the modeled security environment.

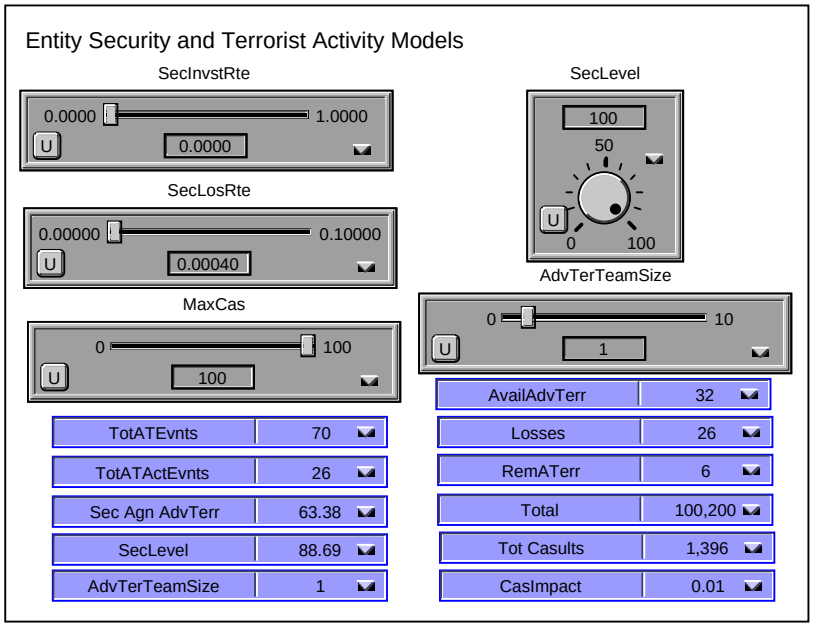

Figure A4.2. The Control Panel for the Entity Security and Terrorist Activity Models shows selected parameter inputs and model-generated output. Settings indicate a maximum initial security level of 100, a security investment rate (*SecInvsRte*) of 0.0 and loss rate (*SecLosRte*) of 0.0004 (0 percent and 0.04 percent per time step, respectively), a maximum of 100 casualties (*MaxCas*) per incident and terrorist team size (*AdvTerTeamSize*) of 1. This creates 1,396 notional casualties (*Tot Casults*) in 26 incidents (*TotActEvnts*) that cause the loss of 26 terrorists (*Losses*).

APPENDIX 5: A VIOLENCE GENERATION MODEL

Implementation of the Violence Generation Model in systems dynamics software is shown in Figure A5.1. The model calculates the level of violence (*Violence*) per incident and total violence (*Total Viol*) assumed to correspond to the ratio (*Disaffected*/(*Affected* + *Disaffected*)) of affected (*Affected*) and disaffected (*Disaffected*) individuals (*AF DF Ratio*), the affection-disaffection Political Warning threshold (*AD POL Warn Thresh*), and violence sensitivity (*Viol Sens*). The model also generates enhanced deprivation (*Dep Enh*) levels based on the values of a violence multiplier (*Viol Mult*), the level of violence (*Tot Viol*), and total casualties (*Tot Casults*) caused by terrorist events calculated by the Entity Security and Terrorist Activity Models (Appendix 4).

The control panel for the Violence Generation Model is shown in Figure A5.2. The Control panel permits user selection of the violence sensitivity (*Viol Sens*; set at 0.1) and multiplier (*Viol Mult*; 0.0008) and the (*AD POL Warn Thresh*; 0.2) parameters.

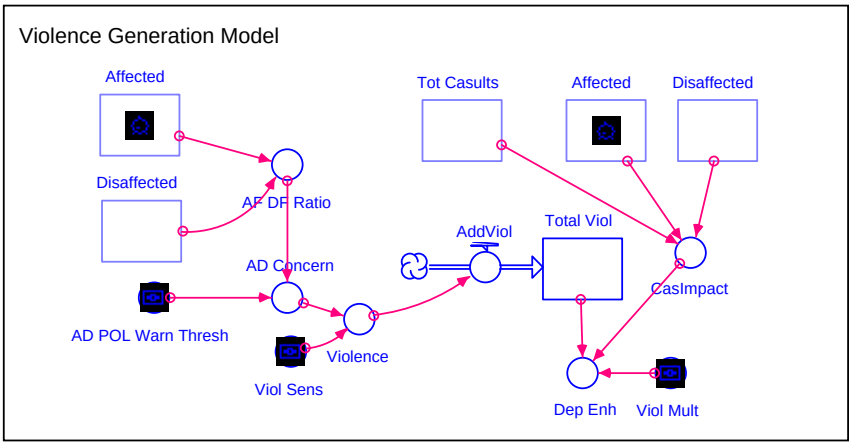

Figure A5.1. Implementation of the Violence Generation Model. The model calculates the level of violence assumed to correspond to the ratio of (*Disaffected*/(*Affected* + *Disaffected*)) of disaffected and total affected and disaffected individuals and violence sensitivity as described in the text. The model also generates enhanced deprivation (*Dep Enh*) based on the level of violence and total casualties caused by terrorist events.

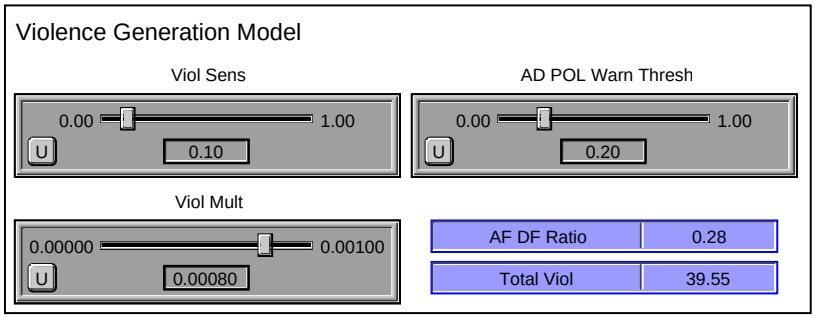

Figure A5.2. The Violence Generation Model control panel permits user selection of the violence sensitivity (*Viol Sens*; set at 0.1), violence multiplier (*Viol Mult*; 0.0008), and the (*AD POL Warn Thresh*; 0.2) parameters.

APPENDIX 6: POLICY CYCLE MODELS CAN REPRESENT THE MANAGEMENT OF SOCIAL VIOLENCE AND ENTITY SECURITY POLICIES

A Social Policy Cycle Model for the management of societal violence levels and a Security Policy Cycle Model for the management of entity security have been developed. Those models have been implemented in systems dynamics software and used in a series of preliminary studies. Details of the software implementation are presented below. Results of the studies are presented above.

A Social Policy Cycle Model

A Social Policy Cycle Model for the management of societal violence has been developed. Figure A6.1 presents implementation of the model in systems dynamics software. Input to the model represents policy concerns related to the impact of levels of affection and disaffection and related levels of violence. Those concerns trigger notional actions assumed to represent the formulation and implementation of social policy responsive to existing model-related conditions. These actions are followed by actions assumed to represent the evaluation and change of existing policy involving either the creation of a new policy and/or termination of an existing policy. Corruption is assumed to act by reducing the input to policy formulation and implementation-related activities and to reduce the input responsible for generating a new policy aimed at increasing the overall level of satisfaction within the notional population.

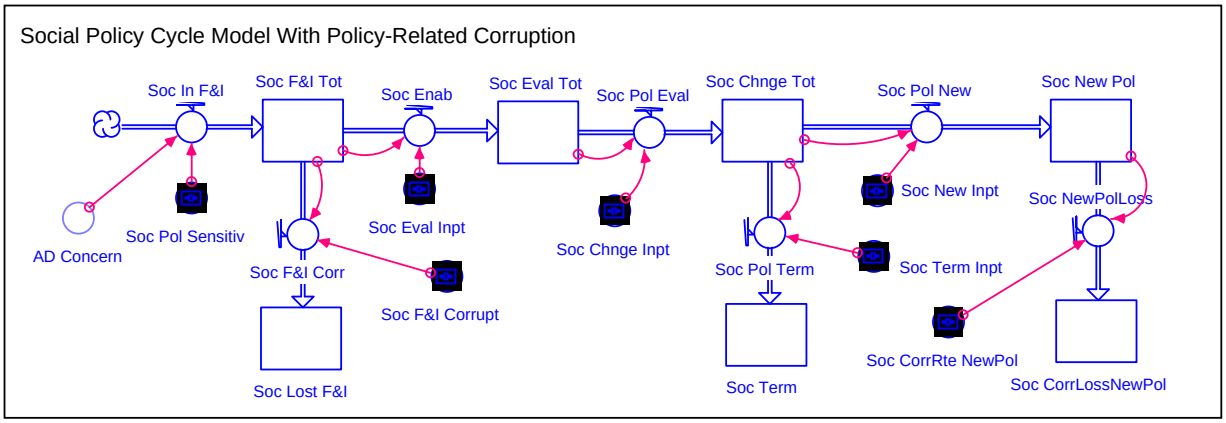

Figure A6.1. Implementation of the Social Policy Cycle Model provides an environment for assessing the impact of Policy-Related Corruption on the production of new policies.

Activities within the implemented model are triggered when the ratio of disaffected individuals compared with the total of affected and disaffected individuals (*AD Concern*) exceeds a user-selected threshold (*AD POL Warn*) (Figure A6.1). Policy-related responses are also determined by the level of social-policy-related sensitivity (*Soc Pol Sensitiv*). Activities involve social policy formulation and implementation (*Soc F&I Tot*), evaluation (*Soc Eval Tot*), change (*Soc Change Tot*), new policy creation (*Soc New Pol*), and policy termination (*Soc Term*). These activities take place at user-selected rates: policy evaluation (*Soc Eval Inpt*), policy change (*Soc Chnge Inpt*), new policy (*Soc New Inpt*), and policy termination (*Soc Term Inpt*), respectively.

Corruption of the policy formulation and implementation processes takes place at a rate determined by the *Soc F&I Corrupt* parameter and corruption of the new policy takes place at a rate determined by the *Soc CorrRte NewPol* parameter.

The control panel for the Social Policy Cycle Model, shown in Figure A6.2, permits the user-selection of specific model parameter values, including social policy sensitivity (*Soc Pol Sensitiv*; set at 0.2), input rate to social policy evaluation (*Soc Eval Input*; 0.1), input rate to social policy change (*Soc Chnge Input*; 0.1), input rate to social policy termination (*Soc Term Input*; 0.1), input rate to new social policy (*Soc New Input*; 0.1), new social policy corruption rate (*Soc CorrRte NewPol*; 0.04), and corruption rate of social policy formulation and implementation (*Soc F&I Corrupt*; 0.04), for example.

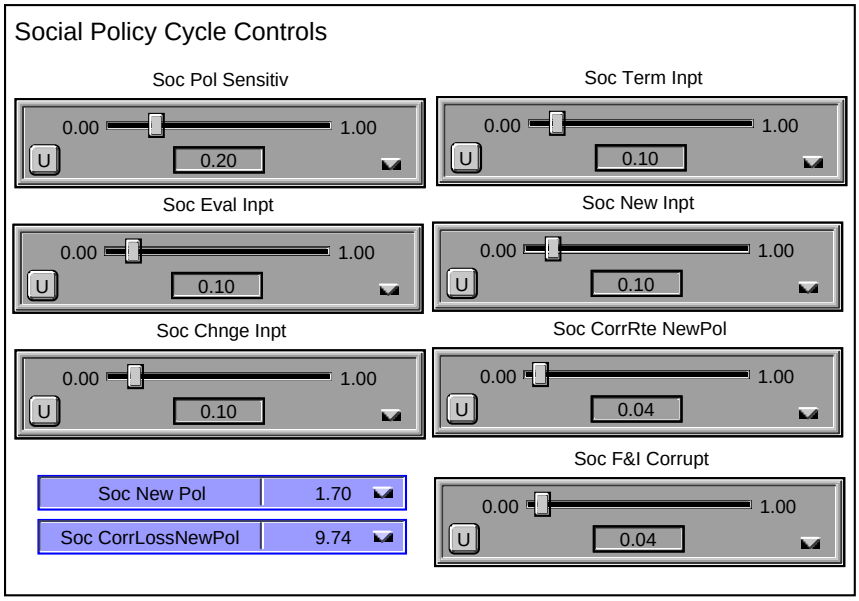

Figure A6.2. Control panel for the Social Policy Cycle Model With Policy-Related Corruption.

A Security Policy Cycle Model

A *Security Policy Cycle Model* for the management of entity security has been developed and implemented in systems dynamics software. Figure 24 presents the key features of the model and Figure A6.3 shows implementation of the model in systems dynamics software. Input to the policy cycle model represents policy concerns related to the effect of casualty levels generated by notional terrorist actions that are made possible by lowered security threshold conditions and availability of trained terrorists. In the model terrorist actions trigger policy cycle-based actions assumed to represent the formulation and implementation of security policy that are aimed at increasing the level of entity security. Increased security can prevent terrorist events from taking place. Corruption within the security policy cycle is assumed to reduce the ability of a government entity to increase security in response to increased amounts of terrorist activity.

Security-related policy cycle model activities involve the formulation and implementation (*Sec F&I Tot*), evaluation (*Sec Eval Tot*), change (*Sec Change Tot*), new policy creation (*Sec New Pol*), and policy termination (*Soc Term*) (Figure A6.3). These activities take place at user-

selected rates determined by user-selected security policy evaluation (*Sec Eval Inpt*), security policy change (*Sec Chnge Inpt*), new security policy (*Sec New Inpt*), and security policy termination (*Sec Term Inpt*) values, respectively.

Corruption of the policy formulation and implementation processes takes place at a rate determined by the (*Sec F&I Corrupt*) parameter and corruption of the new policy takes place at a rate determined by the (*Sec CorrRte NewPol*) parameter. Typical settings of the user-selectable parameters for the Security Policy Cycle Model control panel are shown in Figure A6.4.

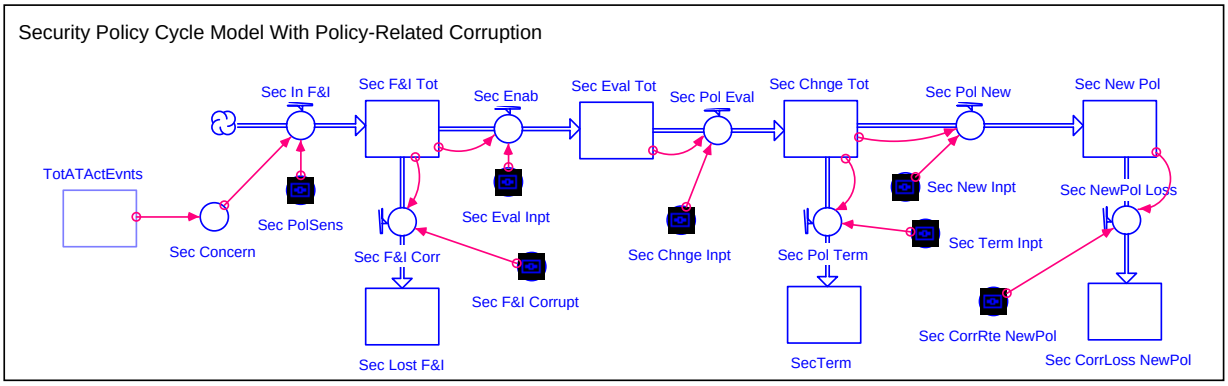

Figure A6.3. Implementation of the Security Policy Cycle Model provides an environment for assessing the impact of the speed of policy cycle actions and the effect of policy-related corruption on the production of new policies and their effect on changing security levels and on the number of terrorist-related events and casualties.

The control panel permits the user selection of specific model parameter values, including security policy sensitivity (*Sec Pol Sensitiv*; set at 0.2*)*, input rate to security policy evaluation (*Sec Eval Input*; 0.1), input rate to security policy change (*Sec Chnge Input*; 0.1), input rate to security policy termination (*Sec Term Input*; 0.1), input rate to new security policy (*Soc New Input*; 0.1), new security policy corruption rate (*Sec CorrRte NewPol*; 0.1), and corruption rate of security policy formulation and implementation (*Sec F&I Corrupt*; 0.1).

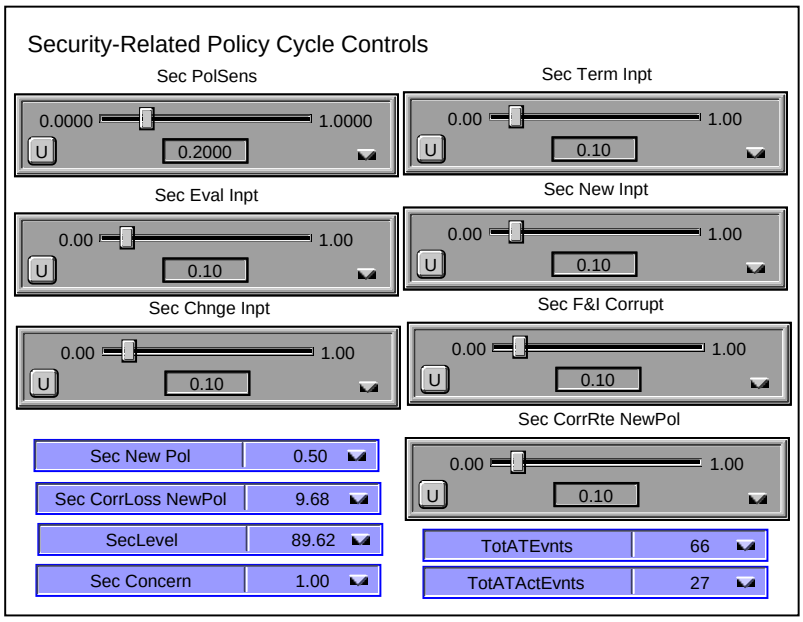

Figure A6.4. Security Policy Cycle Model with policy-related corruption control panel. Settings indicate a sensitivity of 0.2 and policy cycle and corruption parameters of 0.1 (10 percent per time step).

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