

USAWC STRATEGY RESEARCH PROJECT

**MODELING A STRATEGY FOR THE WAR ON TERRORISM**

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## ABSTRACT

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By declaring a war against terrorists and governments who support terrorists in his address to the joint session of Congress on 21 September 2001, President Bush erased the distinction between terrorists, terrorist organizations, and state sponsored terrorism. The President also issued a warning order to the American people that the primary focus of his administration would be combating terrorism. This paper discusses a strategy for conducting the war on terrorism in terms of a system and how that strategy must be adjusted over the long-term to compensate for fluctuating components of the war on terrorism. A system to model terrorism and a system to model the civilized states that oppose terrorism are introduced. By approaching terrorism and the civilized states that will fight the war on terrorism as systems, a strategy for combating terrorism can be created and analyzed.



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## PREFACE

America is faced with conducting a global war on terrorism. Many say that the United States is facing an asymmetric foe and that this conflict will be the model for all future war.

“We need to identify and think hard about threats to which we lack obvious responses...We have to learn to respond differently, but effectively, to threats which cannot be answered in kind. The United States has to ask imaginatively what it is that its asymmetric foes value highly, and devise ways and prepare means to hurt those values severely.” – Colin S. Gray.

The United States has a history of successfully fighting global wars with a proven track record for developing effective strategy. In the aftermath of the tragedies of September 11, 2001, the United States needs to remain calm and approach the global war on terrorism objectively; creating a strategy based on a long-term commitment to a lasting peace.



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## MODELING A STRATEGY FOR THE WAR ON TERRORISM

On 21 September 2001, President Bush declared a war on terrorism in a speech to a joint session of the Congress of the United States.<sup>1</sup> The President made a list of demands<sup>2</sup> to the ruling Taliban party in Afghanistan and stated that,

“These demands are not open for negotiation or discussion. The Taliban must act and act immediately. They will hand over the terrorists or they will share in their fate...From this day forward, any nation that continues to harbor or support terrorism will be regarded by the United States as a hostile regime.”<sup>3</sup>

By making these bold statements, President Bush declared a war against terrorists and governments who support terrorists.

Acts of war and crimes against the state are usually easy to recognize and address. An act of war can be addressed with the diplomatic, informational, military, and economic elements of national power. Crimes can be prosecuted based on national and international laws that can be applied in court; however, terrorists and acts of terror fall somewhere between war and crime and must be addressed or combated in a different manner. Defining terrorism as a criminal problem restricts the response of civilized governments in terms of policy and resources, particularly when dealing with international terrorism<sup>4</sup>. When terrorism crosses national borders, which nation's laws apply and what precedents are applicable? How does a civilized state address terrorists who declare themselves as soldiers in a civil war?

By declaring a war against terrorists and governments who support terrorists in his address to the joint session of Congress, President Bush erased the distinction between terrorists, terrorist organizations, and state sponsored terrorism. The President also issued a warning order to the American people that the primary focus of his administration is homeland defense and combating terrorism. This paper will discuss a strategy for the United States and its coalition partners for conducting a war on terrorism in terms of a system<sup>5</sup> and how that strategy must be adjusted over the long-term to compensate for fluctuating components of the war on terrorism. Two systems to model terrorism will be introduced. One system is based on the Warden model for air power<sup>6</sup> and the other system is modeled using systems dynamics<sup>7</sup>. Both systems are simplistic, but may be modified to reflect individual terrorists as well as terrorist organizations and state sponsored terrorism. An enhanced systems dynamics model will be proposed using components introduced in several recent theories for addressing terrorism. Ideally, this enhanced systems dynamics model will provide strategic leaders with a framework for creating a strategy for combating terrorism.

## **BACKGROUND**

A terrorist is an individual who deliberately and systematically attacks innocents as a means of coercion to achieve a political end. Terrorists may act alone or with support from an organization or state, however, non-state terrorist organizations are a new breed of terrorist<sup>8</sup> with little or no ties to individual governments. These organizations are funded through individual fortunes, drug trafficking, private businesses, charities, and local support. These funding sources are either formally or informally linked together as a financial network designed to support the export of terror across national borders.

Terrorism is an attractive option used by many weak states, sub-state actors, or individuals to lessen the influence of major powers and increase popular support for the terrorist cause.<sup>9</sup> Hence, terrorists thrive on public psychology and feed off of its power. Without public support most terrorists and terrorist organizations only have the combat capability of a well organized gang. Asymmetric approaches such as large scale acts of terrorism are used to increase the terrorist's perceived power<sup>10</sup> and enhance recruiting efforts.

Asymmetry has become a popular term in strategic planning circles in recent years, however Colin S. Gray<sup>11</sup> states that

“In the history of strategic ideas, the contemporary American fascination with asymmetry comprises rediscovery of the stunningly obvious. To behave in ways different from those expected by an enemy can be simply good tactics, operational art, and strategy. Since Asymmetrical merely means different, it is a little hard to understand quite why the notion has been elevated as the latest fashionable Big Idea...all of America's wars have been asymmetrical contests.”

The notion that terrorists are able to attack the United States with asymmetric means is valuable in the information campaign to garner popular support for the United States and its coalition partner's global war on terrorism, but it shouldn't paralyze strategic leaders as they develop a strategy for combating terrorism.

“We need to learn to respond differently, but effectively, to threats which cannot be answered in kind. The United States has to ask imaginatively what it is that its asymmetric foes value highly, and devise ways and prepare means to hurt those values severely.”<sup>12</sup>

The Hart-Rudman Commission<sup>13</sup> addressed terrorism as part of an overall strategy for homeland defense. The commission made a compelling argument for creation of an independent National Homeland Security Agency with responsibility for planning, coordinating, and integrating various United States government activities involved in homeland security.<sup>14</sup> President Bush, in his September 21, 2001 address to Congress, announced the creation of a cabinet-level position reporting directly to the President and named Pennsylvania Governor,

Tom Ridge, as the Director of Homeland Security.<sup>15</sup> Ideally, the new Director of Homeland Security will be able to effectively coordinate an inter-agency approach to combating international and domestic terrorism.

The Quadrennial Defense Review (QDR) and the accompanying report submitted to Congress by the Secretary of Defense was largely complete prior to the September 11, 2001 terrorist attacks on the United States.<sup>16</sup> Many of the issues of homeland defense and asymmetric threats were addressed in the QDR, however, the recent terrorist attacks in New York City and Washington D.C. necessitate an accelerated effort in these areas to address acts of terrorism. The President's address to Congress on September 21, 2001, the QDR, and the Hard-Rudman Commission recommendations are the most current and relevant government documents available to help strategic planners develop a strategy for combating terrorism.<sup>17</sup> However, these documents fall short in recommending a systematic approach to developing a strategy for homeland defense and combating terrorism.

To develop a comprehensive strategy for combating terrorism, it may be helpful to recall memories from Junior High science classes. Mercury is often used to demonstrate the different states an element may assume based on external forces of nature. When a blob of Mercury is poked in the middle, it immediately scatters into many smaller blobs of mercury that must be rounded up. Terrorist organizations have properties similar to the blob of mercury. When attacked, terrorist organizations tend to disperse and go underground until pressure is removed or another opportunity for violence appears. If the United States and its coalition partners can accurately predict how the terrorist organization will temporarily decompose itself, they may be able to develop an effective strategy for combating terrorism. To make such predictions, strategic leaders need to break terrorists and terrorist organizations into component parts and understand how each part relates to the whole. This will assist planners in developing a comprehensive strategy for the war on terrorism.

Historically,

“As a tool for the weak, terrorism rarely succeeds in achieving its political goals. Terrorists rarely have the resources to succeed in a fight against an aroused state, but their reprehensible methods frequently inspire resolve within the target state. Those same methods also separate terrorists from crucial popular support.”<sup>18</sup>

History suggests several key ideas that should be incorporated into any strategy for combating terrorism. In particular, laws must be established to facilitate intelligence collection and distribution so that prompt action can be initiated against terrorists (based on such information) without sacrificing civil liberties. They also suggest that coalitions have historically fared better

than unilateral actions in long term conflicts and that every effort must be taken to separate the terrorists from their popular support base while maintaining the American and coalition partner's will to continue the conflict<sup>19</sup>.

A popular approach to combating terrorism is the "drain the swamp theory".<sup>20</sup> Draining the swamp increases the visibility of terrorist leaders and states that sponsor terrorism. Additionally, the draining the swamp approach reduces the number of resources available to terrorists and terrorist organizations. The draining the swamp theory can be applied to many facets of terrorist activity to include: popular support for the terrorist, infrastructure that supports the terrorist, military support available to the terrorist, organic essentials that support terrorism and the leadership of the terrorist organization. State sponsored support for terrorism can be divided into three categories.<sup>21</sup>

- Direct support (Type 1): protection, logistics, training, intelligence, or equipment
- Toleration (Type 2): not backing terrorism as a national policy, but tolerating it
- Hospitality (Type 3): legal protections on privacy and freedom of movement

Understanding how a country contributes to the terrorist effort (either directly or indirectly) helps strategic leaders identify hostile regimes (i.e., Type 1 countries who directly support terrorism) as well as vulnerabilities that coalition partners may have in the global war on terrorism (i.e., identify coalition partners that place them in the Type 3 category). Identifying a country as a Type 2 sponsor allows the United States and its coalition partners to apply appropriate elements of national power persuade the sponsor to modify its behavior. Similarly, identifying Type 3 sponsors highlights potential areas where international laws may be applied to close legal loop-holes available in Type 3 countries that are part of the coalition against terrorism.

Andrew Smith proposes a framework to evaluate the completeness of any strategy for combating terrorist attacks.<sup>22</sup> He approaches terrorist acts in phases; preparatory, crisis, and the consequence phase.

"A typical global terrorist attack consists of a years-long preparatory phase, a very brief crisis phase, and a long consequence phase. The same timeline could apply to a terrorist campaign in which a number of attacks are made using a range of tactics. In such a case, the crisis phase could be drawn out, with attacks and their consequences overlapping."<sup>23</sup>

He proposes potential terrorist and friendly activities during each phase that should be considered in any strategy for combating terrorism. See Table 1.

Clarence Chinn identifies potential strategic, operational, and tactical terrorist centers of gravity as the will of terrorist organizations to use violence to achieve their political agenda, the

terrorist leadership, and loyal subordinates respectively<sup>24</sup>. Similarly, Biddle suggests that, “Our enemy is not terrorism, it is Al Qaeda’s radical ideology.”<sup>25</sup> and that the hearts and minds of politically uncommitted Muslims are the strategic center of gravity. Chinn proposes applying the elements of national power; diplomatic, informational, military, and economic to the enemy’s center of gravity and outlines several appropriate components of each element of national power. He proposes using the informational element of national power to set the conditions for successfully employing the other elements of national power. In particular, education and information sharing are key components to winning public and international support for the global war on terrorism. Education and information sharing work together to promote the coalition against terrorism and engage the media; setting the conditions for cutting off the supply of future terrorist recruits. Information combined with diplomatic efforts can be used to shape world opinion and paint the picture of the war on terrorism as a war between good and evil versus the United States against Islam.

Terrorist Activities	Friendly Activities
Capability Development	Intelligence gathering
Recruitment	Surveillance
Training	Strategic Shaping
Fundraising	Humanitarian Operations
Research and Development	Economic Incentives
Material Acquisition	Diplomatic Action
Intelligence Gathering	Coalition Building
Planning	Compliance Verification
Strategic Deployment/Basing	Consequence Management Preparations
Network Development	Law Enforcement Response
Reconnaissance	Preemptive Strike
Counterintelligence	Information Operations
Information Operations	

TABLE 1: FRIENDLY AND TERRORIST ACTIVITIES IN THE PREPARATORY PHASE<sup>26</sup>

Diplomatic efforts must also be directed at the global war on terrorism through the United Nations. “The U.N. is to play a strong and helpful role in the fight against terrorism as well as in the stabilization of failing or failed states”<sup>27</sup>. In addition to a strengthened role of the United Nations, McCallie<sup>28</sup> proposes that the recipe for long term success in the global war on terrorism must include addressing global flashpoints through diplomacy, laying the groundwork for

stability in failed or failing states, and strengthening our human resource base. The United States must build credibility with the Muslim world to maintain the coalition in the global war against terrorism. One concrete step in this direction would be to act as a truly neutral party in the Arab Israeli conflict. Although the Arab Israeli conflict cannot be blamed for or used to justify acts of terror, a neutral stance on the issue by the United States would defuse a major propaganda tool directed at Muslim states by terrorists and terrorist organizations. Renewed efforts by the United States to provide aid to failed or failing states also pays large dividends in terms of credibility of the United State's desire to be a compassionate country looking beyond its own borders for security and economic stability. A secondary effect of a perceived kinder, gentler United States is a reduction in the terrorist recruiting base among dissatisfied youth in failed or failing states. Additionally, a renewed effort to engage countries through diplomacy creates good will between the United States and other countries and provides a valuable human presence. This presence is critical to achieving a better cultural exchange as well as effective intelligence.

Modeling terrorists as systems allows strategic leaders to explore different strategies for combating terrorism and how each strategy influences the terrorist organization's ability to conduct terrorist acts (e.g., An effective approach to combating terrorism is to drain terrorists and states that sponsor terrorism of popular support. This reduction in popular support for terrorism decreases the terrorist's effectiveness while increasing popular support for the war on terrorism). By approaching terrorism and the civilized states that will fight the war on terrorism as systems, a strategy for combating terrorism can be created and analyzed. Ideally, the systems approach will reveal relationships that may not be readily apparent.

## **MODELING TERRORISM USING THE WARDEN MODEL**

Complicated processes and organizations are often modeled as systems.<sup>29</sup> Define a terrorist system as a system that describes terrorists, state sponsored terrorists and non-state terrorists. Further define a civilized state system as a system that describes an individual government or coalition of governments formed to wage war on terrorism.

Warden introduces a five-ring model to conceptualize an enemy system (See Figure 1: warden's five-ring model).<sup>30</sup> This five-ring model can be applied to terrorist organizations (the terrorist system) or the organization of the United States and its coalition partner's response to the war on terrorism (the civilized state system). This five-ring model is general enough to apply to most systems and can be modified to provide more detail by expanding individual components of the over all model.

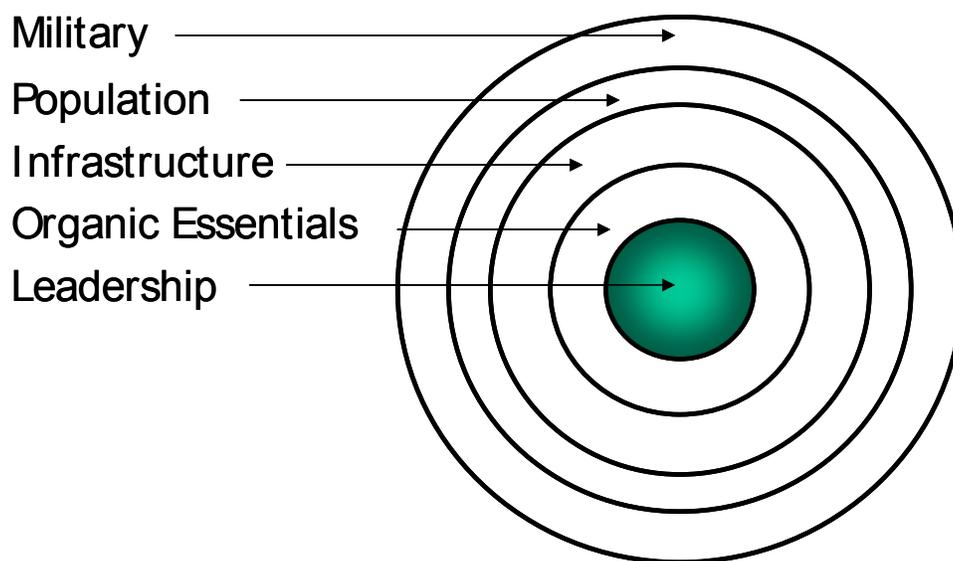


FIGURE 1: WARDEN'S FIVE-RING MODEL

Any strategic entity has an individual or group of individuals that gives direction and meaning to the organization. This individual or group of individuals is defined as the leadership element in the Warden five-ring model. In the war on terrorism, this leadership element may be the leader of a terrorist organization or an individual terrorist and should be the target of a civilized state's elements of national power (i.e., the terrorist organization's center of gravity). Neutralizing the effectiveness of the leadership element renders the other elements of the model ineffective since they take direction from the leadership element; however, the leadership element need not be targeted directly.

Surrounding the leadership element in the Warden model are concentric circles representing organic essentials, infrastructure, population and the military. Each of these concentric circles or rings may be larger or smaller depending on the effectiveness of the element represented by the ring and its overall contribution to the system. Some of these elements are static, but some are subject to change over time. Most terrorist organizations operate outside the bounds of an ordinary military organization, operating with limited organic essentials and infrastructure, hence, the leader element and the population element (i.e., popular support for the leader or his cause) are the most important aspects of the terrorist model. See Table 2 for a comparison of the elements in different systems.

Conceptualizing the terrorist system using the Warden five-ring model allows strategic leaders to identify the terrorist system's center of gravity as well as critical vulnerabilities. The

critical vulnerabilities can then be addressed in parallel using all the elements of national power available to the United States and its coalition partners to render the center of gravity ineffective.

The civilized state system used to model coalition forces combating terrorism consist of the same five elements. However, the civilized state system has access to elements of national power not available to terrorists. The existence of organic essentials, infrastructure and an organized military provide more flexibility to the civilized state system compared to the terrorist system. Understanding the interdependencies between each element of the civilized state model allows strategic leaders to increase the effectiveness of the interagency process as applied to the war on terrorism in addition to developing a grand strategy of combating terrorism in terms of shape, respond and forward presence. Additionally, the Warden five-ring model allows strategic leaders to identify key components of the civilized state system that may not otherwise be apparent.

	<b>Body</b>	<b>Drug Cartel</b>	<b>State</b>	<b>Terrorist</b>
<b>Leadership</b>	Brain	Leader	Government	Leader
<b>Organic Essentials</b>	Food, Oxygen	Raw Materials	Energy, Money	Money
<b>Infrastructure</b>	Bones, Muscles	Roads, Airways	Roads, Airways	Loose Network
<b>Population</b>	Cells	Growers, Processors	People	People
<b>Fighting Mechanism</b>	Leukocytes	Street Soldiers	Military, Police	Terrorists

TABLE 2: APPROACHING TERRORISM AS A SYSTEM

One of the key components of the civilized state system model is the population component. Maintaining the will of the people to support the war on terrorism allows civilized states to apply all the elements of national power. As the will of the people to support the war on terrorism erodes, civilized states may find that they have fewer options at their disposal and the leadership more vulnerable to the terrorists (i.e., Leaders may be forced to go on the defensive versus the offensive necessitating a shift in strategy.). Successfully engaging terrorism requires civilized states to maintain popular support for the war on terrorism while minimizing popular support for terrorists (i.e., maximizing the size of the population ring of the civilized state system model while minimizing the population ring of the terrorist state system model).

By defining the struggle against terrorism as a war on terrorism, strategic leaders can broaden the model and apply additional national assets to combat terrorism. These national assets can be applied directly to the individual terrorist, to the states that support terrorism or to individual institutions that support terrorist activities (i.e., banks that manage financial assets that belong to terrorists). This parallel approach to combating terrorism increased the likelihood that the strategy for conducting the war on terrorism will succeed.

## **MODELING TERRORISM USING SYSTEMS DYNAMICS**

Warden's five-ring model is effective for conceptualizing the terrorist and civilized state systems in terms of their center of gravity and critical vulnerabilities, but is simplistic and fails to provide a map of the causal relationships between components of the system. Even though it captures some key ideas in modeling terrorism as a system it falls short in describing how to actually drain the swamp of terrorism, hence reduce the number of acts of global terrorism.

Systems dynamics provides a more rigorous approach to modeling a terrorist organization as a system. Systems dynamics is widely used in business and industry to help managers visualize systems ranging from corporate strategy to the human immune system.<sup>31</sup> Systems dynamics uses several tools such as model boundary diagrams, subsystem diagrams, causal loop diagrams and stock and flow maps to describe a model and map the causal relationships between components of the model. This approach allows the modeler to focus on a broad model, capturing important feedback relationships rather than focusing on specifics of each component of the model. Before describing a model of the terrorist system, several definitions must be given. Each definition will be followed by an example using the components described in the Warden model.

The model boundary chart is used to summarize the scope of the model in terms of its components. Each component is categorized as either internal to the system (endogenous), external to the system (exogenous) or not included in the system (excluded). Categorizing components as endogenous or exogenous forces modelers and decision makers to narrow the focus of the system model. Endogenous and exogenous components both provide feedback to the model, but the level of feedback determines which category the components fall into (i.e., components that provide small amounts of feedback tend to be exogenous). Excluded components may not provide feedback to the model, but should be considered by decision makers because they may provide warnings of potential exogenous components. In military terms, endogenous components can be thought of components in the commander's area of

operations, exogenous components in the area of influence, and excluded components in the commander's area of interest.

The boundary chart is a useful tool for modelers and decision makers during the initial phases of creating a model to describe a system. An example of a boundary chart for the terrorist system is depicted in Table 3. As the boundary chart is created, strategic leaders gain a better appreciation for the magnitude of the system being investigated. The system can be expanded or relaxed to include the appropriate components needed to describe or conceptualize the system. By categorizing the components of the system, modelers outline assumptions and map key components of the model, hence provide credibility and rigor to the modeling process.

Endogenous	Exogenous	Excluded
Leadership	Opponent's Leadership	Coalition Support
Popular Support	Opponent's Popular Support	Political Considerations
Organic Essentials	Economic Power	
Military Power	Financial Network	
Infrastructure		
Terrorist Acts		

TABLE 3: BOUNDARY CHART FOR TERRORIST SYSTEM

Subsystem diagrams show the overall architecture of a model.<sup>32</sup> Components of the system defined in the boundary chart are grouped into subsystems and the flow of information and resources between subsystems is mapped. Subsystem diagrams are general in nature and provide minimal detail; however, they provide strategic leaders with an initial visual concept of the system that can be formalized using causal loop diagrams. This “back of the envelope” analysis allows strategic leaders the opportunity to informally map components described in the boundary chart. They also help identify missing or redundant components in the boundary chart. Figure 2 depicts the subsystem diagram for the terrorist system.

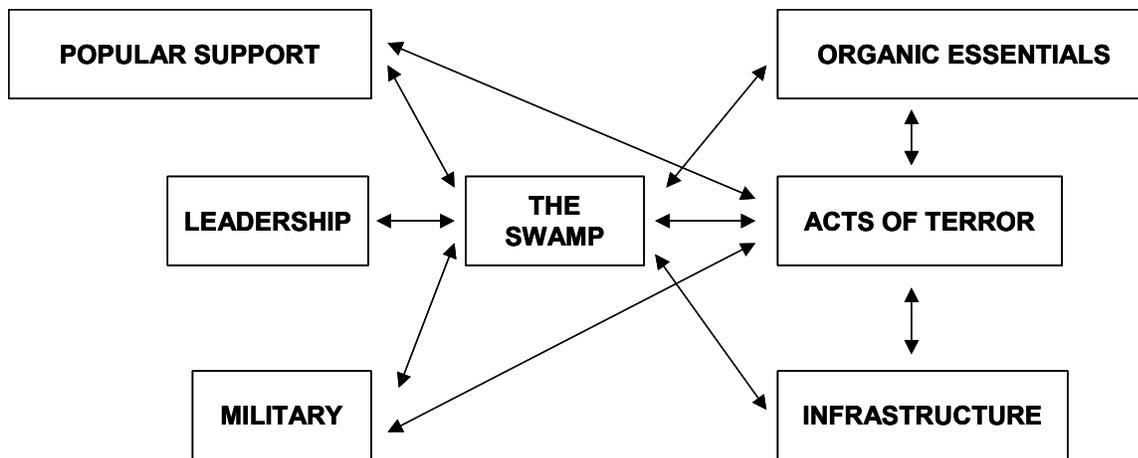


FIGURE 2: SUBSYSTEM DIAGRAM FOR THE TERRORIST MODEL

Causal loop diagrams are used to map the cause and effect of the components of the system being modeled. They build on the model architecture described in the subsystem diagrams and illustrate cause and effect links between components. Causal loop diagrams consist of variables connected by arrows denoting the causal influences among the variables (i.e., positive or negative influence between individual components of the system). These causal loop diagrams give strategic leaders an idea of the relationships between components in terms of feed back loops. Feed back loops allow strategic leaders to evaluate the effect of subsystems or components of the system on each other. This series of feed back loops helps strategic leaders determine which critical vulnerabilities should be targeted to most effectively win the war of terrorism (i.e., where to concentrate the appropriate elements of national power). Figure 3 depicts a causal loop diagram of the terrorist system.

The components in the system are tied together by causal links (depicted by one way arrows). Arrows are also used in the causal diagram to depict feedback loops in the system. A positive link is indicated by an arrow with a (+) sign and a negative link is indicated by an arrow with a (-) sign. A positive link indicates that an action by one component increases another component's capacity above what it might otherwise have been and a negative link indicates that a component decreases another component below what it would otherwise have been. These diagrams provide strategic leaders increased visibility into the cause and effect relationships between components of the terrorist system.

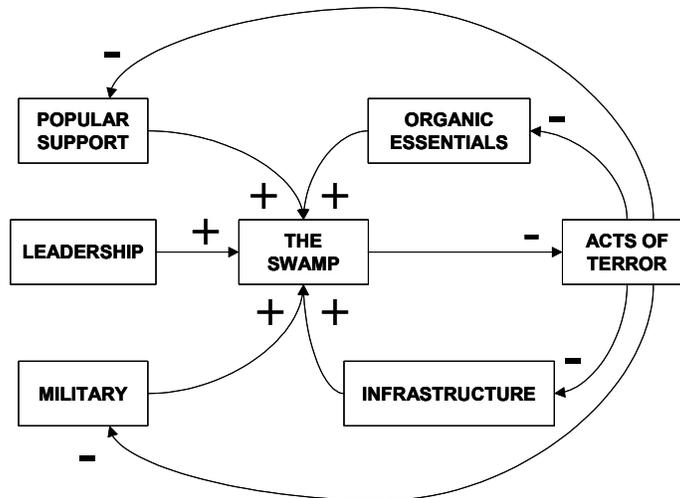


FIGURE 3: CAUSAL LOOP DIAGRAM

Although causal diagrams are useful in depicting interdependencies and feedback mechanisms, they do not capture the stock and flow characteristics of components in the system (i.e., provide no metrics for evaluating the cause and effect). Stock and flow diagrams track accumulations of material, money, and information as they move through a system.<sup>33</sup> Stocks can be thought of as a bathtub (i.e., the swamp) and flows as the spigot and drain filling and emptying the bathtub respectively (See Figure 4).



FIGURE 4: STOCKS AND FLOWS IN TERMS OF A BATH TUB

The flow into and out of the Stock is the rate of change for the individual Stock. Based on this rate of change, the amount of material in any given Stock can be represented by the equation:

$$Stock(t) = \int_{t_0}^t (Inflow - Outflow) + Stock(t_0)$$

with the corresponding differential equation:

$$dS / dt = \Delta(S) = Inflow(t) - Outflow(t)$$

Stocks provide a picture of the state of a component in the system at any given time. The flows (depicted by the double lined arrows in Figure 5) in and out of the Stock represent the material, money, and information flowing into each component. The amount of material, money, and information accumulating in each component depends on the flow in and out of the component (i.e., the Net Change in Stock). The decision function (depicted by the hourglass in Figure 5) can be thought of as valve that determines the actual rate of flow into and out of the Stock. The Stock and flow relationships provide strategic leaders with a means for measuring the effect of one components actions on another component. These diagrams allow strategic leaders to evaluate the effectiveness of targeting single or multiple components of the terrorist system. Additionally they identify which components affect the flow in and out of any given Stock. Figure 5 depicts the Stock and flow diagram for the terrorist system.

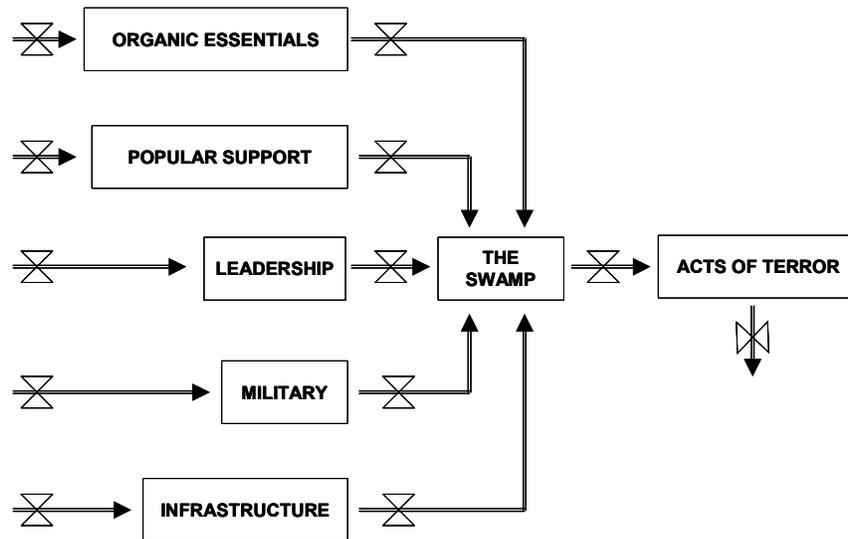


FIGURE 5: STOCK AND FLOW DIAGRAM FOR THE TERRORIST SYSTEM

Recall that the rate of flow in and out of the stock determines the amount of material, money, and information accumulated in each component of the model. The decision function (depicted by the hourglass in Figure 5) is dynamic and can change based on feedback loops inside the model and information sources from inside and outside of the model. Exogenous variables found in the boundary chart often become information sources and Stock levels are

frequently used to provide feedback to the decision function. Figure 6 depicts the external information and feedback loops that influence decision function.

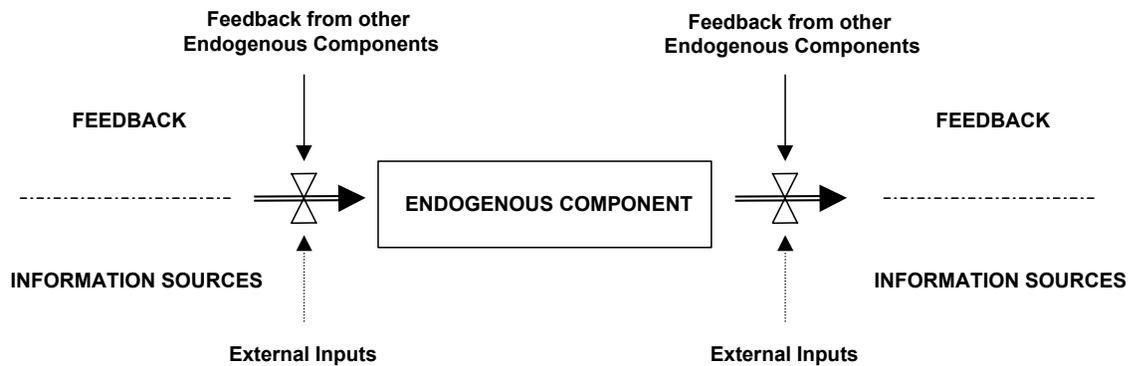


FIGURE 6: INPUTS TO THE DECISION FUNCTION (FEEDBACK AND EXTERNAL)

### IMPLEMENTING THE MODELS

The Warden model depicted in Figure 1 is simplistic, but provides strategic leaders a means for conceptualizing the war on terrorism. A similar approach can be used to construct a model that allows strategic leaders to conceptualize the civilized state system representing the United States and its coalition partners. The model of the civilized state system can be used to identify the civilized state system's center of gravity and critical vulnerabilities. This approach allows strategic leaders to match the civilized state system's strengths against the terrorist system's vulnerabilities. This asymmetric approach to combating terrorism insulates the leadership of the civilized state system, allowing them to dictate the terms of the conflict.

As an improvement to the Warden model, terrorist system can be modeled using the systems dynamics approach. The boundary charts, subsystem diagrams, causal loop diagrams, and stocks and flows diagrams discussed above provide strategic leaders with a means for conceptualizing and evaluating the terrorist and civilized state systems. By treating the endogenous components of the terrorist's system as a stock (i.e., the organic essentials, popular support, leadership, military, and infrastructure), strategic leaders can use systems dynamics to gain insights into potential strategies for combating terrorism (i.e., draining the swamp). This concept provides more detail than the Warden model and allows strategic leaders to visualize the complex relationships between each component of the terrorist system.

By approaching the endogenous components of the terrorist system as stocks, strategic leaders can explore different strategies for combating terrorism using the systems dynamics approach. The model depicted in Figure 2 adds robustness to the Warden model in that it

addresses popular support for terrorism as well as the components that have an effect on popular support. The causal loop diagram in Figure 3 indicates that acts of terror may actually decrease popular support for terrorists (e.g., Osama Bin-Laden did not anticipate the American and international outrage that followed the attacks on the World Trade Center and the Pentagon on 11 September 2001). The causal loop diagram also depicts the relationship between acts of terror and the infrastructure and military components of the terrorist system.

Using systems dynamics to model the terrorist system improves the concepts presented in the Warden model by including the other components of the terrorist system and their effect on the each other. The stock and flow diagram depicted in Figure 5 provides a snapshot of the terrorist system (i.e., freezes the system), allowing strategic leaders to measure the effect of each component on the terrorist's ability to conduct terrorist activities. In addition to exploring the influence of popular support of terrorism on the terrorist leadership, strategic leaders can use the stock and flow diagram to measure the influence of the military, infrastructure, and organic support components of the terrorist system. This approach allows strategic leaders to explore the effects of attacking components of the terrorist system individually or in parallel. Similarly, the systems dynamics approach can be used to develop stock and flow diagrams depicting the civilized state system.

The model described in the previous section is a good starting point for addressing the war on terrorism using systems dynamics. The model is simple and easy to understand, however it leaves room for modifications and enhancements. Although the simplistic variables presented in the Warden model are useful in describing the systems dynamics approach to modeling a system, they fall short of truly describing the terrorist system in enough detail to model a strategy for the war on terrorism. A more robust model can be created using additional variables discussed in the introduction section of this paper. This improved model employs the same techniques described in previous sections, however, only the boundary charts and stock and flow diagrams are necessary to draw conclusions from the new model.<sup>34</sup>

Two improved models are proposed which represent the terrorist and civilized states in the war on terrorism. The framework to evaluate completeness of any strategy for combating terrorist attacks proposed by Andrew Smith<sup>35</sup> is used to represent endogenous components of the enhanced terrorist and civilized state systems. These endogenous components are presented in the boundary charts for both systems (See Table 4 and Table 5). Although most of the endogenous components found in Table 4 and Table 5 are self explanatory, some require clarification. Strategic deployment refers to terrorist organization's ability to achieve global reach through forward basing or strategic mobility assets. Strategic deployment is tied to

network development in that forward basing of terrorists and terrorist assets depends on terrorists cells and sympathizers that make up global terrorist networks. Compliance verification refers to efforts by civilized states to ensure that nations of concern adhere to existing laws and treating concerning chemical, nuclear, and biological weapons production.

Table 4 represents the boundary chart for the enhanced terrorist system. The exogenous and excluded components of the boundary chart are a compilation of factors extracted from recent literature on terrorism (See the background section of this paper). Similarly, Table 5 depicts a proposed boundary chart for the components of the system used to describe the civilized state (i.e., the coalition conducting the global war on terrorism).

Endogenous	Exogenous	Excluded
Terrorist Leadership	Coalition Leadership	International Cooperation
Capability Development	Coalition Popular Support	Internal Coalition Support
Recruitment	Economic Power	Coalition Political Solidarity
Training	Financial Network	Number of Coalition Targets
Fundraising	Secrecy	Educate Coalition Population
Research/Development	Information campaign	Educate Terrorist Population Base
Material Acquisition	Support From Muslim Nations	International Support for Coalition
Intelligence Gathering	Media Engagement	Coalition Basing Rights
Planning	International Opinion	International Over-flight Cooperation
Strategic Deployment	International Sanctions	International Treaties and Resolutions
Network Development		Enforcement of Existing Resolutions
Reconnaissance		Coalition Intelligence Sharing
Counterintelligence		Coalition Foreign Internal Defense
Information Operations		Validity of Terrorist Jihad
Popular Support		Legitimacy of Radical Islam
Terrorist Acts		Arab/Israeli Conflict
		Criminalize Terrorism
		Nation Building - Non Hostile

TABLE 4: BOUNDARY CHART FOR THE ENHANCED TERRORIST SYSTEM<sup>36</sup>

Subsystem diagrams and causal loop diagrams can be formally or informally created for the terrorist and civilized state systems depicted in Table 4 and Table 5, however, it is more instructive to analyze the stock and flow diagram for the terrorist system based on relationships derived from the subsystem and causal loop diagrams.

Figure 7 represents the stock and flow diagram for the terrorist system using the additional endogenous components of the terrorist system presented in Table 4. Endogenous

and Exogenous components of the civilized state system (See Table 5) are mapped onto the Endogenous components of the terrorist system. Mapping civilized state components onto terrorist system components provides strategic leaders with a glimpse of the magnitude and complexity of orchestrating an effective strategy for the global war on terrorism.

Endogenous	Exogenous	Excluded
Coalition Leadership	Terrorist Leadership	International Cooperation
Intelligence Gathering	Terrorist Popular Support	Internal Coalition Support
Surveillance	Economic Power	Coalition Political Solidarity
Strategic Shaping	Information campaign	Number of Coalition Targets
Humanitarian Operations	Support From Muslim Nations	Educate Coalition Population
Economic Incentives	Media Engagement	Educate Terrorist Population Base
Diplomatic Action	International Opinion	International Support for Coalition
Coalition Building	International Sanctions	Coalition Basing Rights
Compliance Verification	Negotiation	International Over-flight Cooperation
Consequence Management	Technical Countermeasures	International Treaties and Resolutions
Law Enforcement Response	Access Control	Enforcement of Existing Resolutions
Preemptive Strike		Coalition Intelligence Sharing
Information Operations		Coalition Foreign Internal Defense
Retaliation		Discredit Terrorist Jihad
		Legitimacy of Radical Islam
		Arab/Israeli Conflict
		Criminalize Terrorism
		Nation Building - Non Hostile

TABLE 5: BOUNDARY CHART FOR CIVILIZED STATE SYSTEM<sup>37</sup>

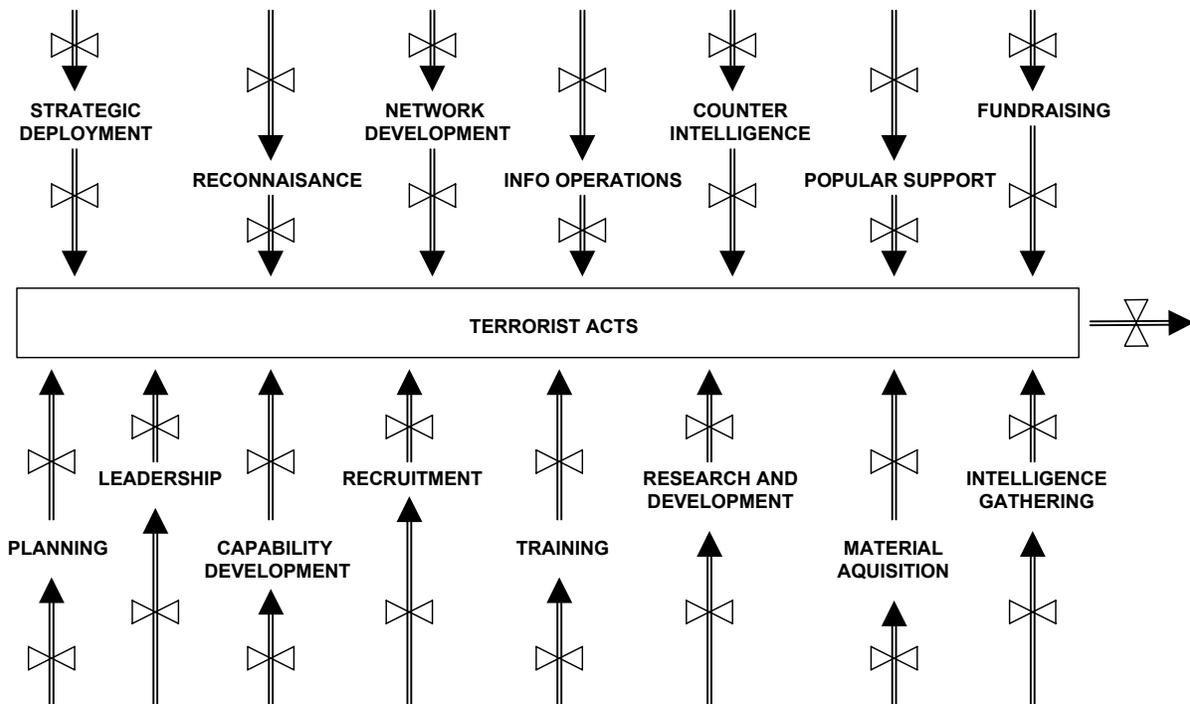


FIGURE 7: STOCK AND FLOW DIAGRAM FOR TERRORIST SYSTEM

Most systems dynamics models rely on a single system and the components that influence that system to gain insights into how the system behaves. However the system representing the United States and its coalition partners in the global war on terrorism (i.e., the civilized state system) may influence the components of the terrorist system in the stock and flow diagrams on the following pages. Components from the civilized state system are superimposed on the terrorist system to provide additional input into the decision function (flow rate) and feedback loops (Components of the civilized state system are highlighted by an asterisk\* in Figure 8 through Figure 22). This mapping of external influences onto the terrorist system provides insights into the behavior of the terrorist system when it is exposed to outside pressure from the United States and its coalition partners.

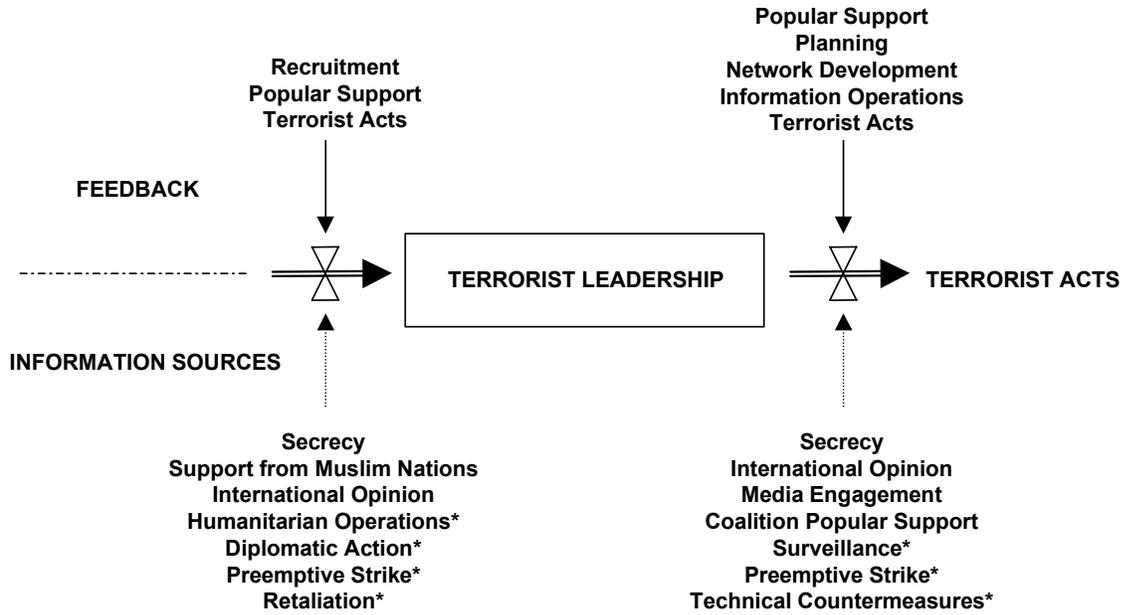


FIGURE 8: FEEDBACK AND INFORMATION SOURCES FOR TERRORIST LEADERSHIP

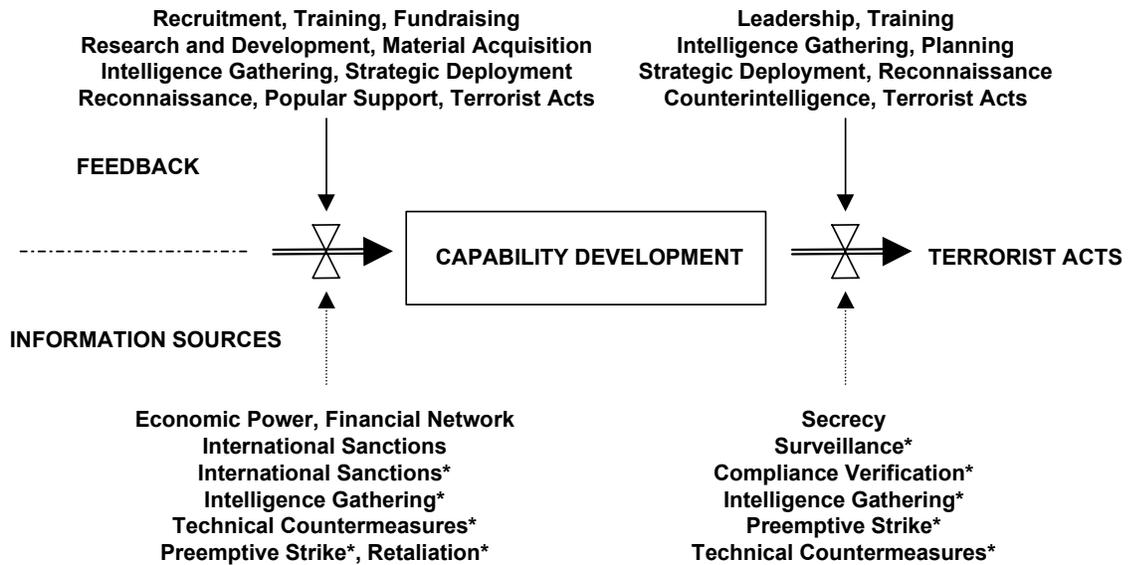


FIGURE 9: FEEDBACK AND INFORMATION SOURCES FOR CAPABILITY DEVELOPMENT

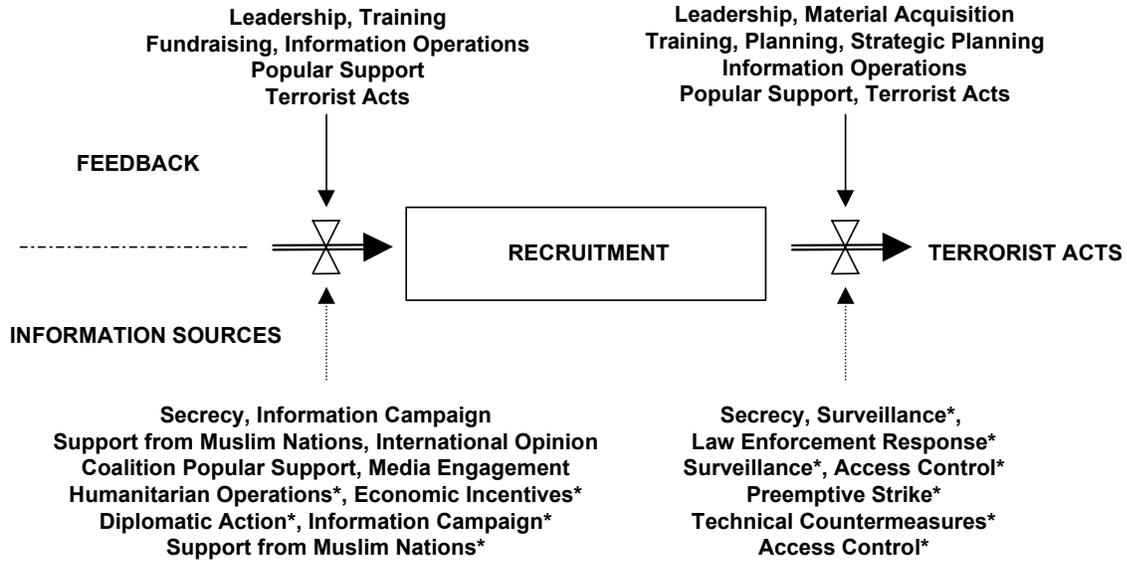


FIGURE 10: FEEDBACK AND INFORMATION SOURCES FOR RECRUITMENT

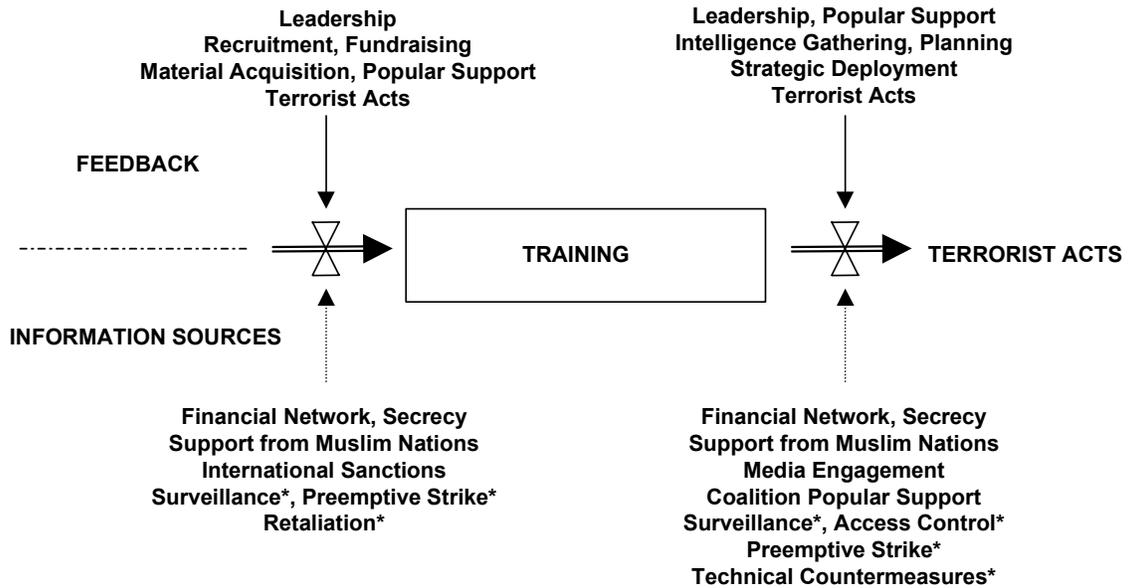


FIGURE 11: FEEDBACK AND INFORMATION SOURCES FOR TRAINING

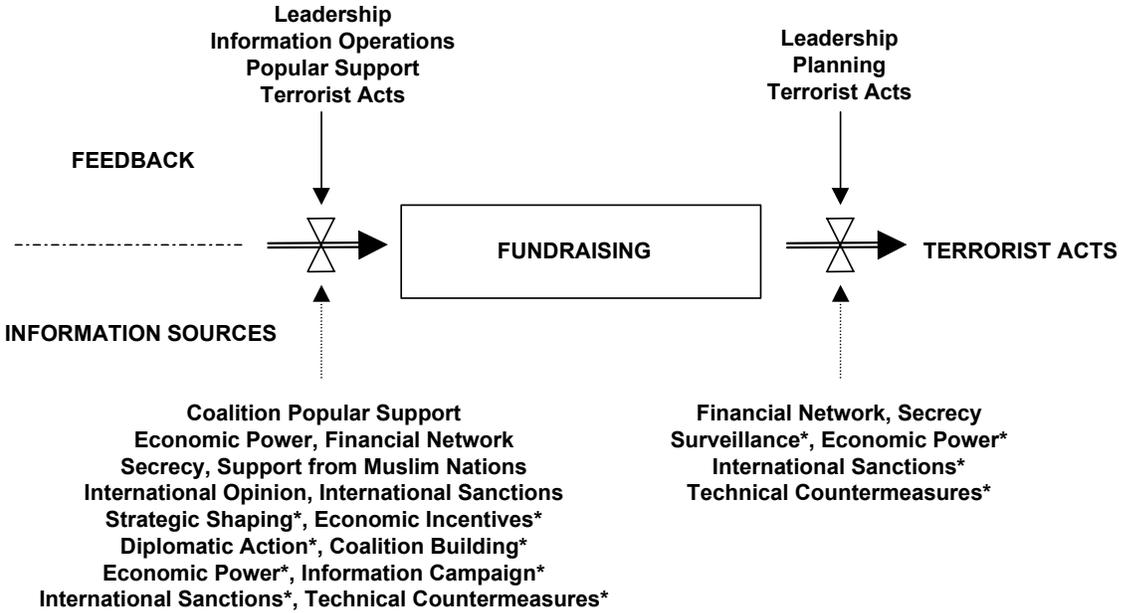


FIGURE 12: FEEDBACK AND INFORMATION SOURCES FOR FUNDRAISING

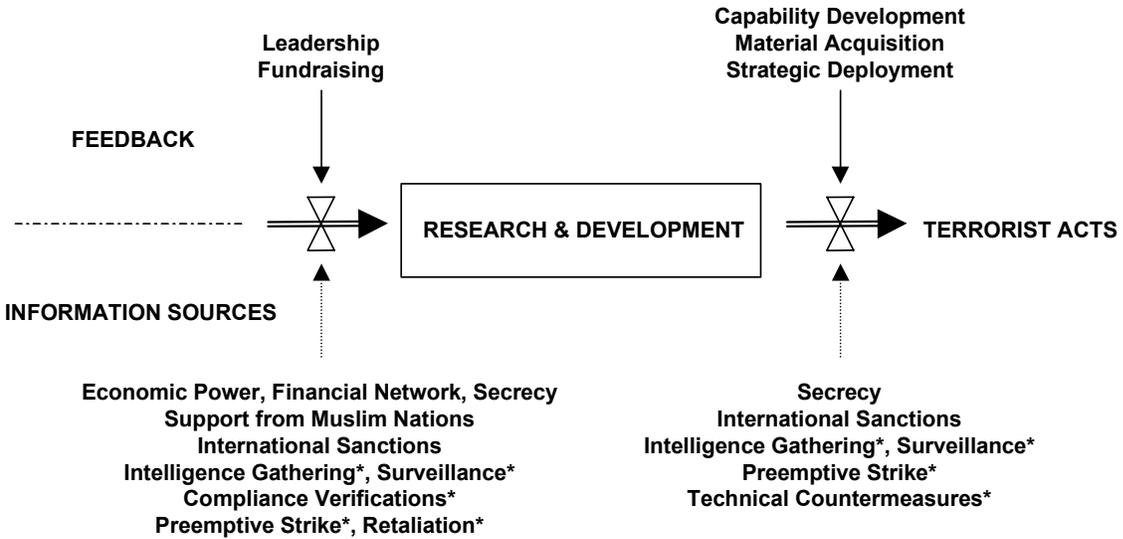


FIGURE 13: FEEDBACK AND INFORMATION SOURCES FOR RESEARCH AND DEVELOPMENT

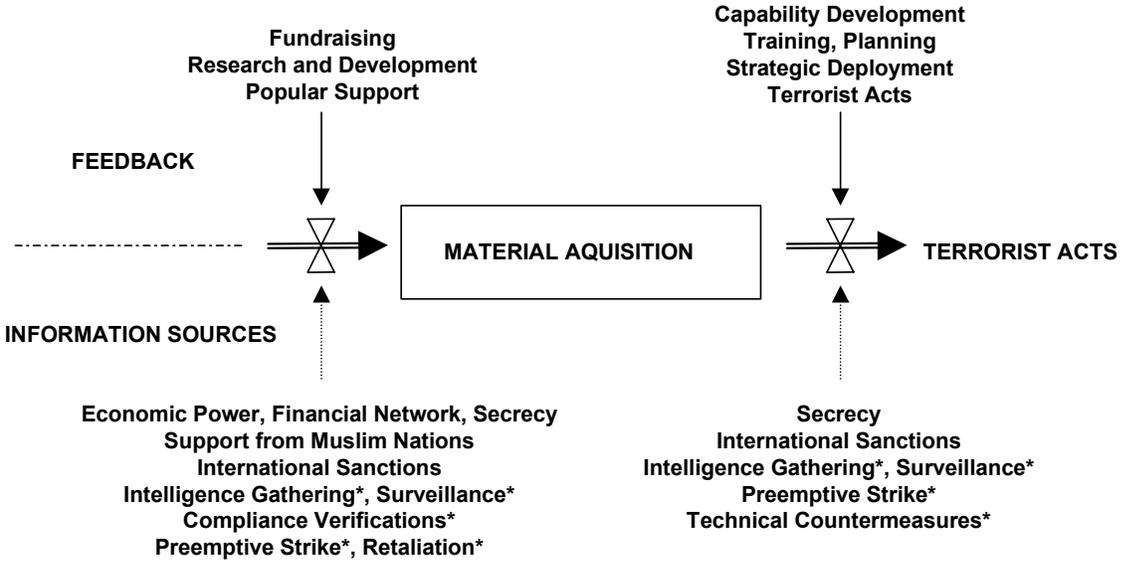


FIGURE 14: FEEDBACK AND INFORMATION SOURCES FOR MATERIAL ACQUISITION

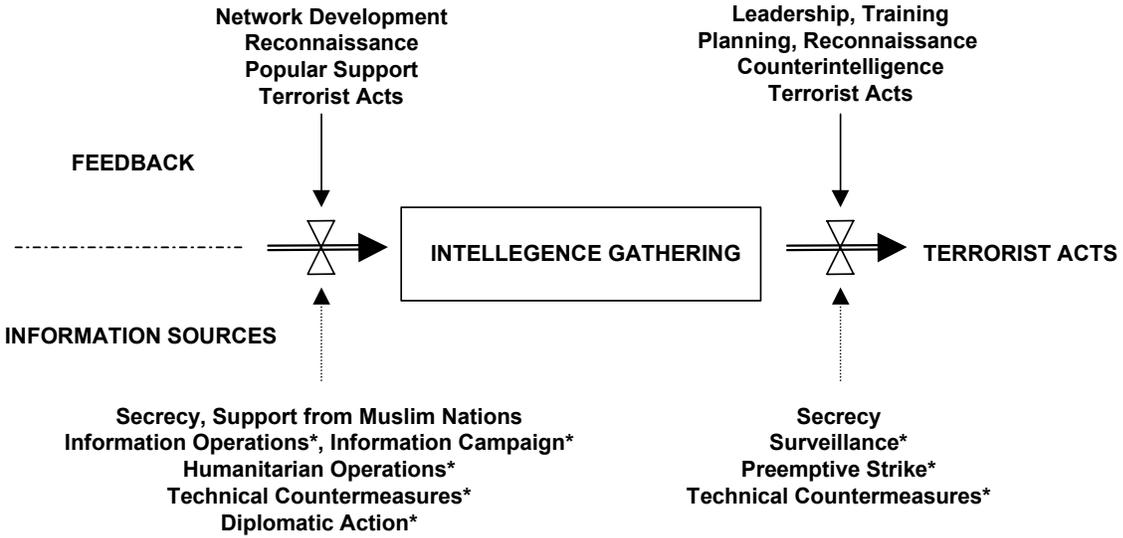


FIGURE 15: FEEDBACK AND INFORMATION SOURCES FOR INTELLEGECE GATHERING

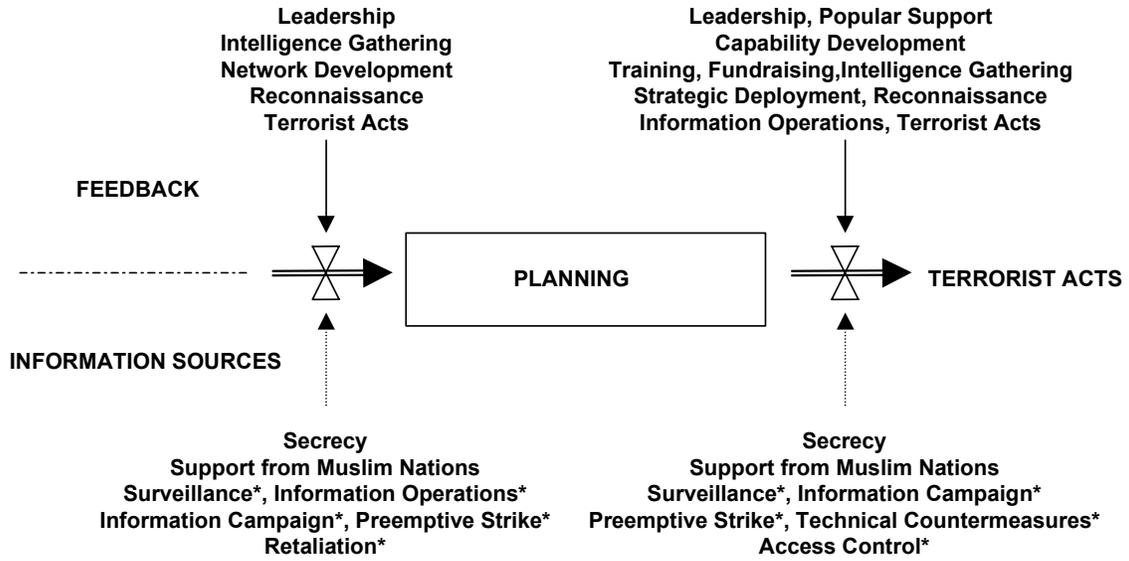


FIGURE 16: FEEDBACK AND INFORMATION SOURCES FOR PLANNING

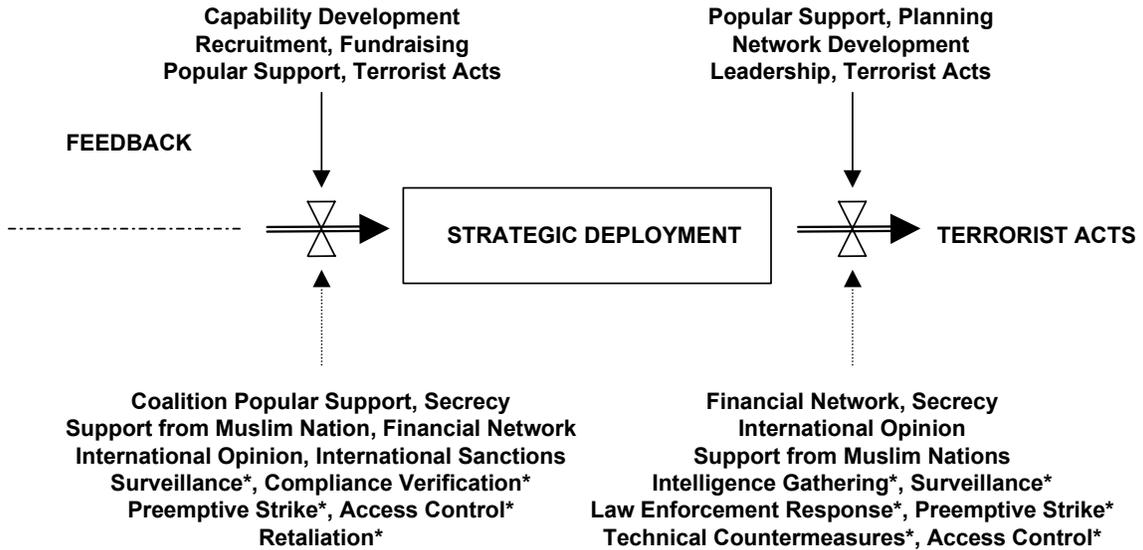


FIGURE 17: FEEDBACK AND INFORMATION SOURCES FOR STRATEGIC DEPLOYMENT

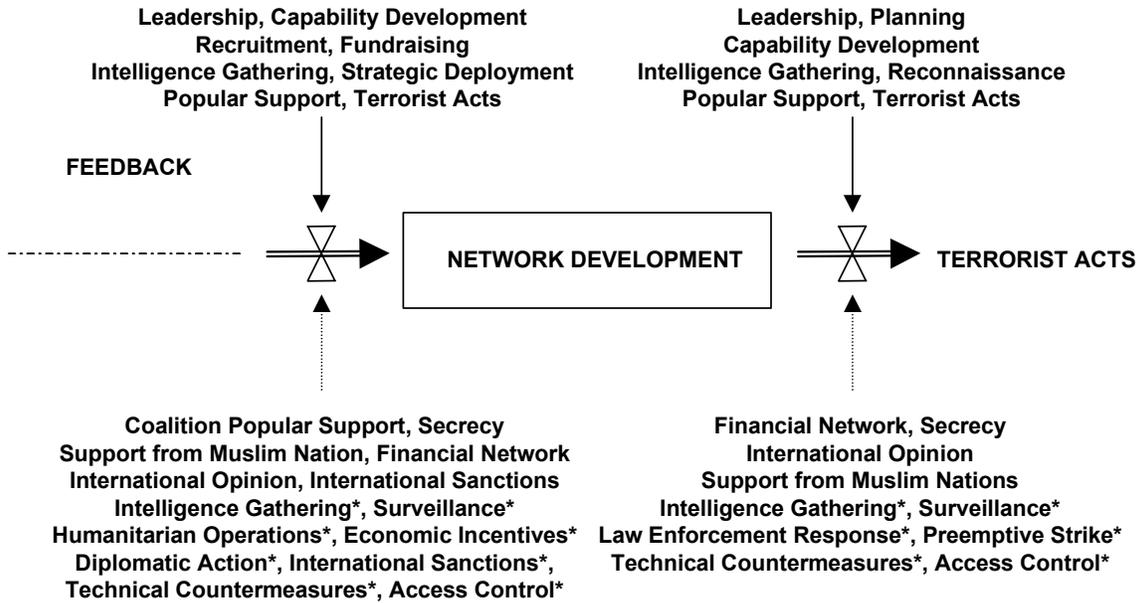


FIGURE 18: FEEDBACK AND INFORMATION SOURCES FOR NETWORK DEVELOPMENT

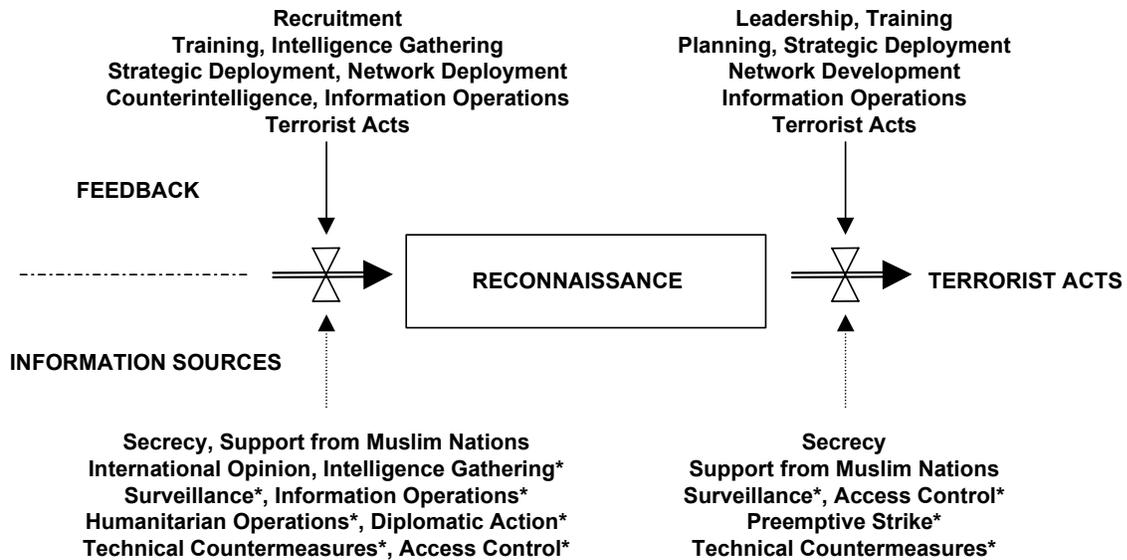


FIGURE 19: FEEDBACK AND INFORMATION SOURCES FOR RECONNAISSANCE

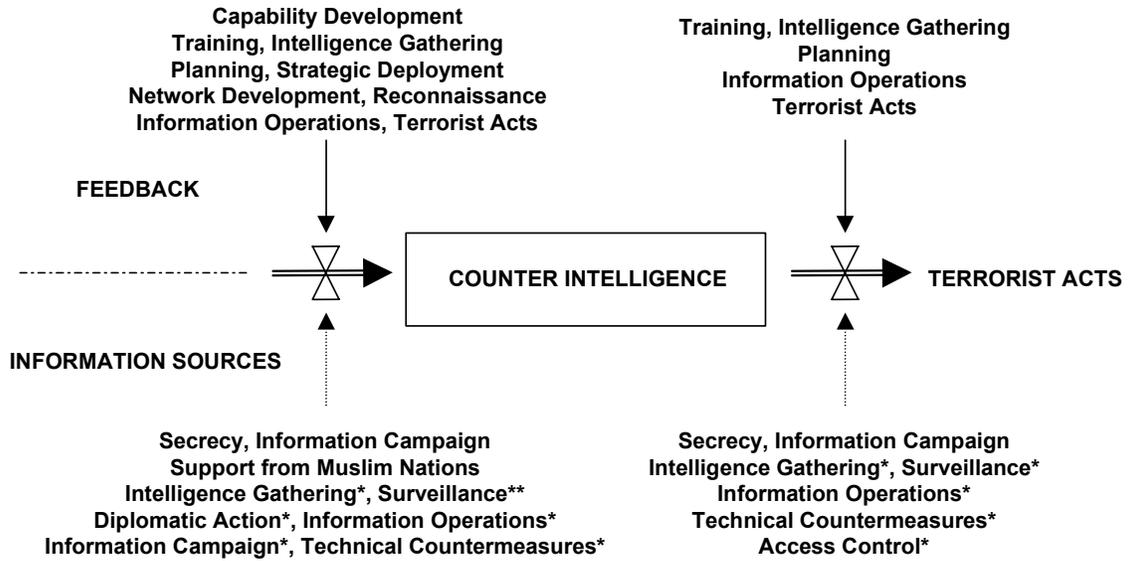


FIGURE 20: FEEDBACK AND INFORMATION SOURCES FOR COUNTERINTELLIGENCE

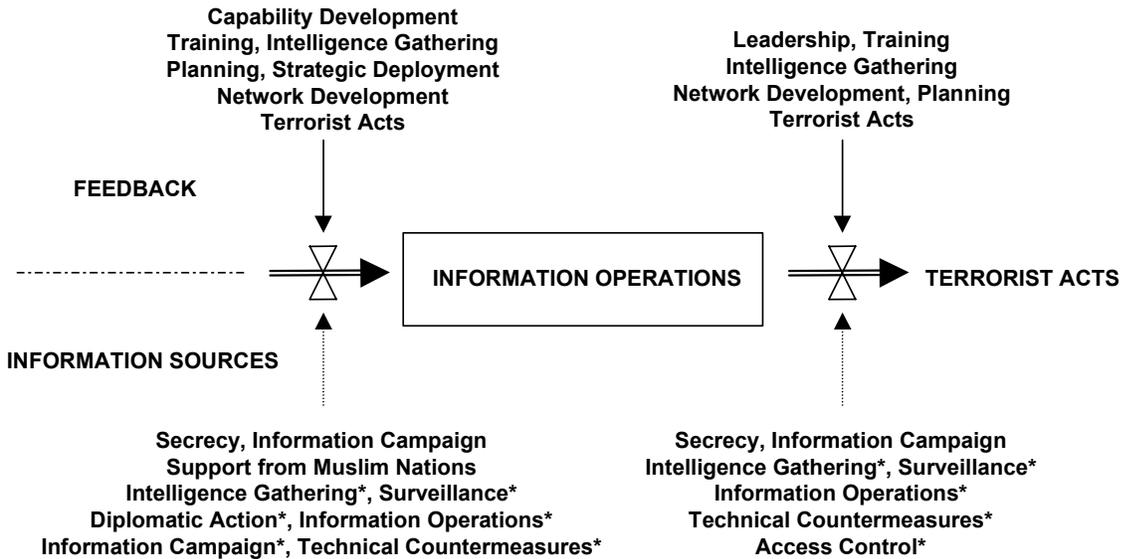


FIGURE 21: FEEDBACK AND INFORMATION SOURCES FOR INFORMATION OPERATIONS

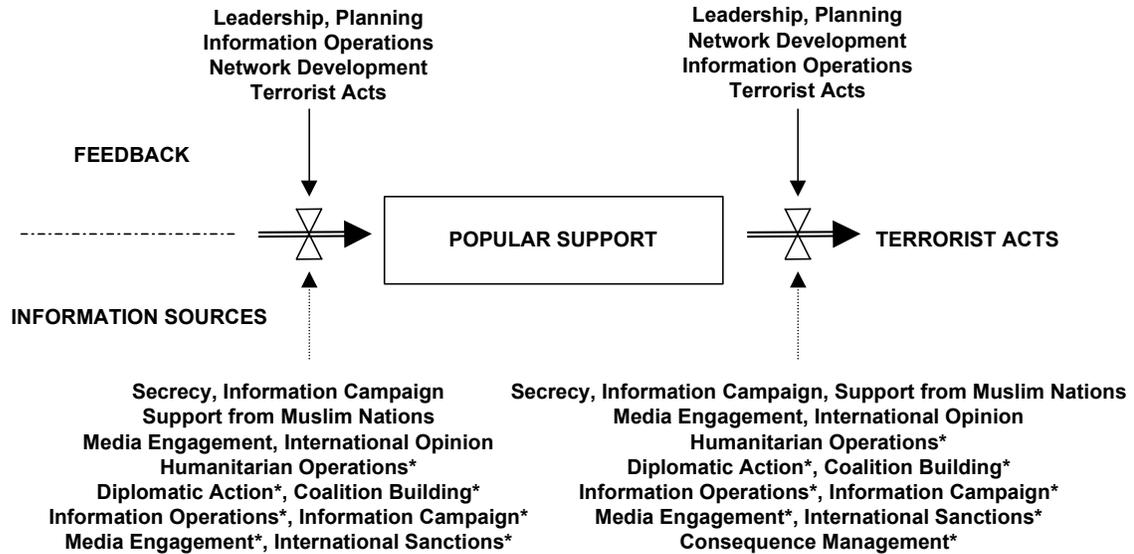


FIGURE 22: FEEDBACK AND INFORMATION SOURCES FOR POPULAR SUPPORT

The mapping of feedback and informational sources onto the decision functions for each of the endogenous components of the terrorist system depicted in Figure 8 through Figure 22 provides insight into which terrorist system components are most critical to a successful global terrorism campaign. The frequency of use for each endogenous component of the terrorist system is calculated by summing the number of times that each endogenous component provides feedback to the other endogenous components and dividing by the total number of interactions between endogenous components. For example: 174 instances of feedback between endogenous components of the terrorist model occur in the stock and flow diagrams depicted in Figure 8 through Figure 22. Popular support provided feedback to other endogenous components 15 times, therefore popular support has a frequency of 8.62% of all instances of feedback between endogenous components of the terrorist model. See Table 6 for a complete listing of endogenous component frequencies in the terrorist system.

Similarly, the frequency of use for each of the exogenous components of the terrorist model is calculated (i.e., how often the exogenous components provide information to the decision variable for each endogenous component). There are 101 instances of exogenous components providing information to the endogenous components of the terrorist system. The frequency of use for each exogenous component provides strategic leaders with insights into which components of the terrorist system are more frequently engaged, hence, provide potential high value targets. See Table 6 for a complete listing of exogenous component frequencies in the terrorist system

Endogenous	Frequency	Exogenous	Frequency
Terrorist Leadership	10.34	Coalition Leadership	0.00
Capability Development	4.60	Coalition Popular Support	5.94
Recruitment	3.45	Economic Power	3.96
Training	7.47	Financial Network	10.89
Fundraising	4.60	Secrecy	27.72
Research/Development	1.15	Information campaign	6.93
Material Acquisition	2.30	Support From Muslim Nations	19.80
Intelligence Gathering	6.90	Media Engagement	4.95
Planning	9.20	International Opinion	10.89
Strategic Deployment	6.90	International Sanctions	8.91
Network Development	6.32		
Reconnaissance	4.02		
Counterintelligence	1.72		
Information Operations	6.32		
Popular Support	8.62		
Terrorist Acts	15.52		

TABLE 6: STATISTICS FOR TERRORIST SYSTEM COMPONENTS

The same stock and flow diagrams paint a picture of which terrorist system components are most vulnerable to outside influences (i.e., rely on other components of the terrorist system or are influenced by components of the civilized state system) and which components of the civilized state system have the most influence on the terrorist system. There are 156 instances of endogenous and exogenous components of the civilized state system providing information to the endogenous components of the terrorist system. The frequency of use for each component provides strategic leaders with insights into which components of the civilized state system have the most effect on the terrorist system, hence, provide potential areas for increased funding or awareness. See Table 7 for a complete listing of component frequencies in the civilized state system

Endogenous	Frequency	Exogenous	Frequency
Coalition Leadership	0.00	Terrorist Leadership	0.00
Intelligence Gathering	8.97	Terrorist Popular Support	0.00
Surveillance	14.74	Economic Power	1.28
Strategic Shaping	0.64	Information campaign	5.77
Humanitarian Operations	4.49	Support From Muslim Nations	0.64
Economic Incentives	1.92	Media Engagement	1.28
Diplomatic Action	6.41	International Opinion	0.00
Coalition Building	1.92	International Sanctions	3.85
Compliance Verification	2.56	Negotiation	0.00
Consequence Management	0.64	Technical Countermeasures	13.46
Law Enforcement Response	1.92	Access Control	7.69
Preemptive Strike	11.54		
Information Operations	5.77		
Retaliation	4.49		

TABLE 7: STATISTICS FOR CIVILIZED STATE SYSTEM COMPONENTS

## CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

The results of analyzing the stock and flow diagrams depicted in Figure 8 through Figure 22 provide strategic leaders with a clearer picture of the terrorist threat to the United States and its coalition partners as well as insights into which components of the global war on terrorism will be most effective against individual components of the terrorist system. Even though some of the results reveal blinding flashes of the obvious (i.e., Terrorist acts account for 15.52 percent of the feedback to other components of the terrorist system which indicates that much of terrorist activity is affected by actual acts of terror and that reducing opportunities for terrorist acts has consequences to the terrorist network), however, some results are less obvious.

Terrorists are most vulnerable in terms of their lack of numbers and resources. Their strengths lie in secrecy, ruthlessness, surprise, and a virtually unlimited number of targets in vulnerable societies. Secrecy accounts for 27.72 percent of information input to the endogenous components of the terrorist system. This asymmetric approach provides terrorist organizations an opportunity to hamper the freedoms enjoyed by most civilized states. The United States and its coalition partners may attempt to minimize targets, but a more effective approach may be to strip terrorists of secrecy and resources. Surveillance provided 14.74 percent of civilized state system input into the terrorist system and technical counter measures accounted for 13.46 percent of the input. Terrorist leadership provided 10.34 percent of feedback to the terrorist system followed closely by popular support at 8.62 percent of the

feedback. By removing secrecy and popular support from the terrorist, the United States and its coalition partners expose terrorists as vulnerable and weak. By making the cost of secrecy high, civilized states expose the terrorist leadership to all elements of national power, resulting in their destruction or ineffectiveness.

Terrorists are also vulnerable in the political arena. Support from Muslim nations accounts for 19.80 percent of information flow back into components of the terrorist system and international opinion had a frequency of 10.89 percent. By seeking moderate Muslim states as allies in the war on terrorism, civilized states can reduce the sphere of popular support for terrorists and increase the vulnerability of the terrorist leadership.

Maximizing the popular support for the war on terrorism is a more delicate matter. Civilized nations must maintain the confidence of the people in order to insulate the inner rings of the civilized state system model from the effects of terrorism (See Figure 1 depicting Warden's five-ring model). This allows the civilized state to engage the inner rings of the terrorist system more effectively. By scoring a "home run"<sup>38</sup> on occasion in terms of intelligence and publicizing this success, civilized states restore the confidence of the people, hence increase popular opinion and support. Surprisingly, preemptive strikes had a frequency of 11.54 percent on the terrorist system, indicating that the potential best defense is and offense. The information element of national power should be used to minimize the impact of failures and maximize dissemination of success stories.

One implication of the simplistic model presented in Figure 5 (stock and flow diagram) is that the United States and its coalition partners must maintain a state on state war on terrorism versus targeting an individual. The war on terrorism must be prosecuted carefully. By attacking critical vulnerabilities of the terrorist system, the United States and its coalition partners can strip the leadership element of the terrorist system of power (i.e., drain the swamp and render them ineffective) without directly hunting down and attacking individual leaders. Successfully tracking down terrorists requires the civilized state to walk a fine line between security and civil liberties. We must ask ourselves if we want what is best for America or what is best for individual Americans.

International cooperation in terms of coalition support of the war of terrorism not only increases the infrastructure supporting the civilized state system, it increases the popular support. This increase in the popular support element of the civilized state system model decreases the popular support element of the terrorist system model. This cooperation can be formal (i.e., NATO's enactment of article V), or informal, but has the same net effect on infrastructure and popular support.

This paper introduces a simplified approach to modeling terrorist and civilized state systems. The models presented are simple in nature and limited in scope in order to introduce a novel approach to modeling a strategy for the war on terrorism. The models are flexible and can be expanded to capture more elements of the terrorist and civilized state systems; hence, provide more useful insights for strategic leaders as they create a strategy for the war on terrorism. More research should be conducted in this area. In particular more attention should be given to the components of the systems and the frequency of feedback and information flow into each component to validate the results presented in this paper.

Despite recent terrorist attacks sponsored by foreign states, the United States should not ignore potential domestic terrorist attacks<sup>39</sup>. Extremist organizations capable of devastating terrorist activities exist within the United States and cannot be ignored and similar systems analysis should be applied to these potential sources of terrorism.

WORD COUNT =7352

## ENDNOTES

<sup>1</sup> George W. Bush, "Transcript of President Bush's address to Congress," New York Times, 21 September 2001.

<sup>2</sup> Ibid, 3. President Bush demanded that the Taliban government in Afghanistan: Deliver to the United States authorities all the leaders of Al Qaeda who hide in your land., Release all foreign nationals, including American citizens, you have unjustly imprisoned. Protect foreign journalists, diplomats and aid workers in your country., Close immediately and permanently every terrorist training camp in Afghanistan and hand over every terrorist and every person in their support structure to appropriate authorities., Give the United States full access to terrorist training camps so we can make sure they are no longer operating.

<sup>3</sup> Ibid, 3.

<sup>4</sup> The military can be used as an instrument of national power in the counter-terrorism strategy even though terrorism is a crime.

<sup>5</sup> Peter M. Senge, The Fifth Discipline, (New York, New York: Currency Doubleday, 1990), Appendix 2, 378-390. Senge presents a compelling argument that any organization or process can be modeled as a system. These models or systems can be used to create learning organizations using feed-back loops.

<sup>6</sup> John A. Warden, "The Enemy as a System," Airpower Journal (Spring 1995).

<sup>7</sup> John D. Sterman, Business Dynamics: Systems Thinking and Modeling for a Complex World (Boston, MA: Irwin, McGraw-Hill, 2000).

<sup>8</sup> Non-state terrorist include organizations like the al-Qaida network. Michael A. Sheehan, "Post-Millennium Terrorism Review," Speech at the Brooking Institute, Washington, D.C., February 10, 2000: 4

<sup>9</sup> The ideas in this paragraph are based on remarks made by a speaker participating in the Commandant's Lecture Series at the United States Army War College, 2001.

<sup>10</sup> Ibid.

<sup>11</sup> Colin S. Gray, "Thinking Asymmetrically in Times of Terror," Parameters (Spring, 2002): 13.

<sup>12</sup> Ibid, 13.

<sup>13</sup> United States Commission On National Security/21<sup>st</sup> Century, Road Map for National Security: Imperative for Change (Washington, D.C.: Government Printing Office, 2001). The U.S. Commission on National Security/21<sup>st</sup> Century produced a series of reports on national security is more popularly known as the Hart-Rudman Commission.

<sup>14</sup> Ibid, xiii.

<sup>15</sup> Bush, 5.

<sup>16</sup> Department of Defense, Quadrennial Defense Review Report (Washington, D.C.: Government Printing Office, 2001).

<sup>17</sup> Even though strategic planners typically refer to the National Security Strategy, the National Military Strategy and Joint Vision 2020 as a basis for strategic planning, these documents were developed under the Clinton Administration and do not necessarily reflect the current administration's priorities. The terrorist attacks on the United States on September 11, 2001 necessitate an unorthodox approach to developing strategy to address homeland defense.

<sup>18</sup> Douglas V. Johnson and John R. Martin, "Terrorism Viewed historically," in Defeating Terrorism: Strategic Issue Analyses, ed. John R. Martin (Carlisle Barracks: Strategic Studies Institute, January, 2002), 1-5.

<sup>19</sup> Studies suggest that Americans appear to be ready for a protracted use of military power and are willing to endure negative consequences from in the global war on terrorism. Leonard Wong, "Maintaining Public Support for Military Operations in Defeating Terrorism: Strategic Issue Analyses, ed. John R. Martin (Carlisle Barracks: Strategic Studies Institute, January, 2002), 65-69.

<sup>20</sup> Michael A. Sheehan, "Post-Millennium Terrorism Review," Speech at the Brookings Institute, Washington, D.C., 10 February 2000.

<sup>21</sup> Steven Metz, "State Support for Terrorism," in Defeating Terrorism: Strategic Issue Analyses, ed. John R. Martin (Carlisle Barracks: Strategic Studies Institute, January, 2002), 21-25.

<sup>22</sup> Andrew J. Smith, "Combating Terrorism," Military Review (January-February, 2002): 11-21.

<sup>23</sup> Ibid, 14.

<sup>24</sup> Clarence Chinn, Combating International Terrorism, Strategy Research Project (Carlisle Barracks: United States Army War College, 9 April 2002).

<sup>25</sup> Stephen Biddle, "War Aims and War Termination," in Defeating Terrorism: Strategic Issue Analyses, ed. John R. Martin (Carlisle Barracks: Strategic Studies Institute, January, 2002), 7-12.

<sup>26</sup> Ibid, 14-15.

<sup>27</sup> Marshall F. McCallie, "The Campaign against Terrorism: Finding the Right mix of Foreign Policy Instruments," in Defeating Terrorism: Strategic Issue Analyses, ed. John R. Martin (Carlisle Barracks: Strategic Studies Institute, January, 2002), 47-51.

<sup>28</sup> Ibid, 48-50.

<sup>29</sup> Senge, 378-390

<sup>30</sup> Warden, 41-55. Warden proposes a five-ring model to represent a system. Each ring of the model represents a critical component of the system being modeled. The Leadership component is the brain of the system and controls all other components of the system. When modeling a state, the leadership component includes a government or an individual. The Organic Essentials component of the model can be thought of as the elements required by the leadership component to carry out its function as the brain. Organic essentials for a state system model may include energy and money. The infrastructure component of the five-ring model used to represent a state system may include roads, airfields and factories which provide the support needed for the system to survive. People represent the population component and the military represents the fighting mechanism of the state system model.

<sup>31</sup> Stermann, 41.

<sup>32</sup> Ibid, 99.

<sup>33</sup> Ibid, 102.

<sup>34</sup> Unclassified data is not available so conclusions must be drawn using comparison techniques and frequency analysis. When unclassified data is available, the actual flows into and out of endogenous components can be measured and conclusions drawn about effect on each of the components of the terrorist model.

<sup>35</sup> Smith, 14.

<sup>36</sup> Ibid, 14. Endogenous variables for the terrorist system are based on the preparatory phase of the generic terrorist activities time line proposed by Smith.

<sup>37</sup> Ibid, 15. Endogenous variables for the coalition system are based on the preparatory phase of the generic terrorist countermeasures activities time line proposed by Smith.

<sup>38</sup> The ideas in this paragraph are based on remarks made by a speaker participating in the Commandant's Lecture Series at the United States Army War College, 2001.

<sup>39</sup> The Hart-Rudman Commission focuses on foreign states as the greatest threat of terrorism versus individual terrorists, foreign non-state actors and domestic terrorists. Ian Roxborough, The Hart-Rudman Commission and the Homeland Defense (Carlisle Barracks: Strategic Studies Institute, United States Army War College, 2001), 27.



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