Advanced Decision Support for Homeland Security

Improved counter-terrorism intelligence is helping Homeland Security authorities identify credible attack threats. However, this progress accentuates critical "downstream" problems for decision-makers:

- Modeling credible, but imprecisely defined threats
- Formulating alternative plans to prevent, recover from and respond to terrorist attacks
- Validating plans by assessing and comparing their likely impacts, both short- and long-term
- Selecting and adapting plan templates on-the-fly, as situations evolve
- Building and exploiting an institutional memory of expertise and decision processes in prior crises.

Conventional decision support tools lack the horsepower required to address these needs effectively. Spreadsheets and other simulators excel at manipulating numerical data, projecting quantitative trends, and the like. However, they fall short in modeling and reasoning about qualitative factors and interactions; uncertain and rapidly changing information; and disruptive events. Capturing and leveraging expert knowledge about terrorist behavior patterns and domestic vulnerabilities is problematic.

DecisionPath developed ForeTell™ to address these urgent decision support problems. This patent-pending solution combines a methodology based on scenario planning with powerful simulation-based modeling and analysis software. ForeTell decision support models can depict and reason about the full complexity and dynamism of attack threats, with rapid turnaround "what-if" planning tailored to situational pressures.

ForeTell enables organizations to systematically explore and compare alternative decisions in a low-risk virtual environment, much as consumers test-drive cars before buying them. A ForeTell "test drive" for a critical decision consists of modeling the situational context; projecting the likely outcomes of candidate decisions under alternative assumptions about the future; and assessing and comparing projected outcomes to select the most promising course of action.

ForeTell Decision Support for Counter-Terrorism

A ForeTell *decision model* depicts an *Environment* and a set of *Actors* operating within that context. For example, a Homeland Security model might define an Environment that consists of the World and a primary Country – the United States. Actors might include: Terrorist Groups; National and Local Authorities and Resources; Infrastructure Targets; Affected Communities; and the Media. Terrorist Groups can launch Attacks on Targets by various Attack Means (bombs delivered by car, airplanes, etc).

Each type of Actor contains descriptive attributes, relationships, and behaviors. A Community might be modeled in terms of a geographical location, a population with specific demographics, preparedness and security ratings, and relationships to Local Authorities and Infrastructure Targets. Actor *behaviors* capture expert knowledge about how these entities are likely to act in response to various conditions. For instance, a Community's Authorities may provide emergency instructions for the Media to broadcast, causing the local population to stockpile supplies, seek medical attention, or evacuate via designated routes, as directed. A population also has the potential to panic, which Authorities might attempt to control using measures ranging from persuasion to martial law.

ForeTell simulates the likely outcomes of candidate decisions or plans. Each such simulation is based on a *Scenario.* A Scenario simply populates the decision model – an Environment and relevant Actors – with facts and assumptions relating to a particular situation or kind of situation, and one decision option.

For example, Homeland Security must prepare for terrorist attacks using biochemical agents. This task involves generalized planning rather than responding to a specific crisis, so Scenarios would depict various hypothetical attack threats, against both single and multiple targets, enabling decision-makers to explore:

- The potential effectiveness of various defensive strategies to prevent or blunt diverse attack threats
- The strengths and weaknesses of alternative plans to recover from successful attacks

A Scenario might depict a threat as an accumulation of intelligence pointing to an imminent biochemical attacks against two East Coast cities, launched by terrorists already in place in the US. Counter-terrorist experts would create such Scenarios by drawing on their own knowledge, supplemented with information from Homeland Security and Intelligence agencies and state and local Emergency Management sources. ForeTell Scenarios might also include assumptions about trends, such as the general direction of the national economy, and events, such as news about US activities in Afghanistan.

Given such a threat context, officials might define various plans to: identify and capture the terrorists; heighten security around water supplies, food delivery systems, and public sites; stockpile vaccines and antibiotics at metropolitan distribution centers; ensure healthcare and civil defense readiness to carry out quarantines, inoculations, interdictions, and so forth. Each distinct combination of plan elements would be combined with the shared backdrop of the assumed attack threat to create a new Scenario.

ForeTell incorporates an advanced simulation engine to play out Scenarios over time. At each simulated interval, Actors look at their Environment and one another, and respond based on their assumed behaviors. Simulating a Homeland Security plan alters the Environment and Actor behaviors. For example, tightening security increases the probabilities of capturing the terrorists and deterring their attack. In short, ForeTell projects the likely outcomes of decisions "bottom-up," as emerging from the *collective behaviors* of Actors.

Users can monitor simulations through a graphical "dashboard," pausing the action on demand to inspect situational metrics and the current state of particular Actors or the Environment at that point. Also, as a simulation progresses, all actions taking place in the model, including changes brought about by trends, events or Actor behaviors, are logged to a database.

ForeTell integrates an analytics engine to help decision-makers and their staffs explore and assess projected Scenario outcomes. A simple "point-and-click" graphical interface enables users to query the log database about any or all Environment or Actor changes, at one instant or over time. The requested data is then retrieved and displayed in tabular reports, time series charts, histograms, and other summary formats.

For the hypothetical biochemical attack, Homeland Security experts might assess the effectiveness of a particular defensive measure by analyzing the detailed log of its corresponding Scenario. Alternatively, experts could compare that plan against other strategies by analyzing details of outcomes across the relevant Scenarios. Effectiveness might be measured in terms of the plan's success in preventing the attack and capturing the instigators. If the simulated attack did take place, effectiveness might be measured using metrics such as containment, minimized loss of life, injuries, and psychological trauma, economic cost, etc.

Bottom Line

ForeTell decision models differ from conventional approaches in their ability to capture and apply qualitative information and behavioral knowledge as well as quantitative data. A ForeTell-based counter-terrorism decision model would codify and leverage expert knowledge on counter-terrorism, public safety, economics, and so on. It would specify the factors that are directly relevant to making critical decisions, and provide a uniform modeling and analysis process to help decision makers understand the short and long term consequences of candidate decisions.

ForeTell decision models can be used interactively in team settings, facilitating collaboration, feedback, and team alignment. Simulations can be performed rapidly, supporting decision-makers in time-critical situations, as crises surface and evolve. ForeTell models can also be enhanced and improved continuously, reflecting accumulated knowledge gained from both real world experience and simulation exercises.

ForeTell can help Homeland Security authorities make critical decisions in a more consistent, thorough, and considered manner. Its simulation-based modeling and analysis capabilities can increase speed, quality and scope to the decision-making process, minimizing risk and increasing confidence.