

KEEL Technology applied to the Secure Border Initiative (SBI)

Compsim White Paper

The SBI Strategic Plan has four specific performance goals, objectives for meeting these goals, and a host of performance measures to gauge progress. The following list was taken from the Washington Technology “Secure Border Initiative Program Guide”.

The highlighted list below identifies the goals and objectives that can clearly benefit from enhanced decision-making technology. This paper introduces Compsim’s Knowledge Enhanced Electronic Logic (KEEL[®]) Technology as a mechanism of augmenting the efforts of human analysts to satisfy many of the objectives of SBI.

1. Ensure that border security information and intelligence is shared among stakeholders.
 - 1.1. Provide timely strategic, operational, and tactical intelligence to operators, decision-makers and stakeholders.
 - 1.2. Enhance collaboration and connectivity among border security stakeholders to aggregate and analyze intelligence and information.
 - 1.3. Enhance capacity to identify and analyze trends, linkages, and targeting to support the full range of enforcement, to include interdiction and investigation, and adjudication.
 - 1.4. Develop and deploy a common operating picture at the tactical, operational and strategic levels.
2. Ensure compliance with immigration and customs laws.
 - 2.1. Expand partnerships and outreach to educate and foster compliance with immigration and customs laws.
 - 2.2. Enhance immigration and customs compliance programs.
 - 2.3. Build a comprehensive employer compliance system.
 - 2.4. Streamline the legal flow of people and goods into and out of the United States.
3. Ensure border security through increased enforcement of immigration and customs laws.
 - 3.1. Develop and deploy the optimal mix of personnel, infrastructure, technology and response capabilities to identify, classify and interdict cross-border violators.
 - 3.2. Anticipate, detect, respond, disrupt, dismantle and prosecute criminal organizations and target criminals involved in the illegal cross-border movement of people, goods, contraband, narcotics, money and transnational threats with an emphasis on national security and public safety.
 - 3.3. Identify and dismantle the financial networks that support transnational criminal activity.
 - 3.4. Increase DHS capacity to establish and verify the identity of aliens entering, exiting, and within the United States, while removing those aliens without the right to remain in the country.

- 3.5. Investigate and penalize employers who employ or exploit aliens unauthorized to work and increase the capability to detect, deter, and eliminate the abuse of the immigration process.
- 3.6. Identify, apprehend, and remove the criminal alien and immigration fugitive population.
- 3.7. Increase the efficiency and capacity of the detention and removal system.
4. Unify DHS efforts to resolve border security issues.
 - 4.1. Exercise responsible stewardship of public resources
 - 4.2. Develop and implement systems, policies and processes needed to facilitate the coordination and integration of DHS components and program activities.
 - 4.3. Effectively communicate the SBI mission, accomplishments, best practices and lessons learned both within the Government and to the public at large.
 - 4.4. Establish a program of cross-training and rotational assignments to ensure that Department personnel develop a useful and more comprehensive understanding of issues across border security-related components.

KEEL Technology Overview:

KEEL Technology was developed to emulate the way that humans make judgmental decisions. While humans use “rules” to define specific courses of action, they use judgment to interpret the rules at the same time that they use judgment to interpret the information on which to apply the rules. For humans, this is a balancing act as they attempt to match each situation to their interpretation of the rules. Human judgment is built upon years of experience and training. But even with this education process, human judgment may not be consistent. Humans make errors for a variety of reasons:

- Lack of attention (lack of situation awareness)
- Failure to Perceive (failure to understand a situation)
- Limited Memory (short term memory of 7 ± 2 items)
- Logical Reasoning (poor judgment)

In the complex world that is being addressed with SBI, any techniques that can accelerate the decision-making process and reduce the impact of human error can significantly enhance the value of the SBI program. The comments following the highlighted objectives of SBI and describes how KEEL Technology can add value.

Provide timely strategic, operational, and tactical intelligence to operators, decision-makers and stakeholders.

The concept of timely strategic, operational, and tactical intelligence demands that one is talking about processed data that can be interpreted by humans. KEEL is an information fusion technology. Using the KEEL dynamic graphical language, one defines in advance how information is to be interpreted; how it is to be valued; how information from a variety of sources collectively provides this intelligence. Since the SBI will be dealing with large numbers of data sources, a methodology that allows complex situations to be

addressed with relative ease will be invaluable. While it might be possible to define the rules of engagement or policies using the human written / verbal language (English), this language is not sufficient in describing non-linear systems. For example: A coordinated intrusion might be detected by looking at a broad view of the border, while a series of individual intrusions may not highlight the larger objective. Similarly, acting on each sensor as a single data point may not allow the operators to “see the forest for the trees”.

Human-like judgment, using KEEL Technology, can help filter inconsistent data from the system. Canned expert judgment can also avoid some of the human “types” of errors.

Enhance collaboration and connectivity among border security stakeholders to aggregate and analyze intelligence and information.

Here, the focus of KEEL Technology is in the analysis of intelligence and information. By packaging the judgmental interpretation of information in an automatic system, the intelligence can be more rapidly shared.

Enhance capacity to identify and analyze trends, linkages, and targeting to support the full range of enforcement, to include interdiction and investigation, and adjudication.

KEEL Engines (the embodiment of the judgmental logic in systems) can be as adaptive as necessary. Trends can be used to change how information is interpreted. Trends can change the policies or rules of engagement. Linkages can be modified by human operators or real-time sensor data. This flexibility can be applied to any component of system design.

The entire SBI system is likely to be an evolutionary system. By this we mean that those attempting to breach the borders will be constantly changing their tactics. This means that the SBI system itself will require periodic updates. KEEL Engines are easily created and updated with simple drag and drop techniques. Code (in the conventional sense) is created automatically. It is easy to “see” the logic or rules of engagement, even when the policies address dynamic, non-linear problem sets.

This said, one must consider the economics of system maintenance when designing the system. Creating these complex models is simple relative to alternative methods.

Streamline the legal flow of people and goods into and out of the United States. Develop and deploy the optimal mix of personnel, infrastructure, technology and response capabilities to identify, classify and interdict cross-border violators.

In this area we want to highlight the value in developing autonomous or semi-autonomous systems. Any time one can take a human out of a system and provide equal or better performance one can expect to have a better system. It is likely that this will be an evolutionary process. First we will put humans in the loop because of their ultimate flexibility. Eventually, however, it will become obvious where roadblocks exist and

where automation can provide the most value. KEEL provides an efficient model for automating human-like judgment into complex problems that are prone to human error.

Anticipate, detect, respond, disrupt, dismantle and prosecute criminal organizations and target criminals involved in the illegal cross-border movement of people, goods, contraband, narcotics, money and transnational threats with an emphasis on national security and public safety.

The terms “anticipate, detect, respond, disrupt, dismantle and prosecute” all have subjective components. Humans use judgment to “anticipate” problems. They use judgment as they interpret information to “detect” specific situations. They use judgment as they allocate resources to “disrupt, dismantle and prosecute”. All of these subjective actions can be modeled with KEEL and deployed as KEEL Engines.

While one might attempt to write “rules” to handle these types of problems, the result would be large volumes of text that few, if any, would ever have time to review and understand. The same could be said for the development of complex formulas.

This is the target domain for KEEL Technology, however. Developing these policies in KEEL has the added value in that the policies will be “explicit”. There will be no subjectivity in the interpretation of data. If it is determined that there is a problem with the policy, or that more information needs to be incorporated into the policy, this can easily be accomplished.

Identify and dismantle the financial networks that support transnational criminal activity.

Like the prior topic, the act of identification is commonly a judgmental decision. This information fusion process can be packaged as a KEEL Engine.

Increase DHS capacity to establish and verify the identity of aliens entering, exiting, and within the United States, while removing those aliens without the right to remain in the country.

Policies defined with the KEEL dynamic graphical language are explicit. The language allows information to be interpreted as if a mathematical formula was being used. By having an explicit interpretation of information it should be legally admissible.

Investigate and penalize employers who employ or exploit aliens unauthorized to work and increase the capability to detect, deter, and eliminate the abuse of the immigration process.

The focus here is on “increasing capability” or increasing productivity by automating as much as possible the detection process (the interpretation of information). KEEL Engines have a very simple API and can be integrated into almost any system with relative ease.

Identify, apprehend, and remove the criminal alien and immigration fugitive population.

The identification process is an information fusion process. Identification is the first step in allocating resources for apprehension and removal. Both the identification phase and the resource allocation phase are subjective functions that can be modeled and deployed with KEEL Technology.

Increase the efficiency and capacity of the detention and removal system.

KEEL Technology addresses increased efficiency and capacity by automating the integration and interpretation of information.

Develop and implement systems, policies and processes needed to facilitate the coordination and integration of DHS components and program activities.

Policies described in KEEL are explicit and can easily be used to drive HMI (human machine interface) designs that can be used to direct the application of resources. Rules of engagement, echelons of control, etc. can be explicitly defined. This explicit documentation should eliminate confusion and facilitate a common understanding between groups.

Establish a program of cross-training and rotational assignments to ensure that Department personnel develop a useful and more comprehensive understanding of issues across border security-related components.

In the early phases of SBI it is likely that humans will play the major role. Some people will develop a specific expertise in how to interpret information and how to react to different scenarios. These “experts” could be trained in the use of KEEL to document how they interpret data items in their domain. They could document in an explicit way how data items interact as they make judgmental decisions of detection and response. Using KEEL, these experts will document how they solve problems in a way that is completely auditable and explainable. Others can be used to review the KEEL logic and adapt the logic as asymmetric approaches are selected by the intruders.

Summary:

KEEL Technology provides a way to capture, test, deploy and audit human-like reasoning that can be packaged in software applications or embedded in devices. To effectively achieve the goals of SBI will require that large numbers of judgmental decisions be accelerated through the use of technology.

KEEL Technology is a proprietary technology that can be licensed from Compsim. Compsim is a technology provider, not a solution provider. Compsim needs to partner with domain experts or total system suppliers so that KEEL can be integrated into SBI. Compsim will assist these partners in developing an expertise in KEEL Technology so they can operate alone.

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