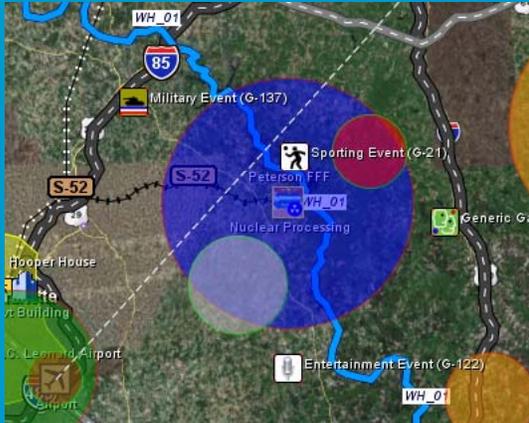
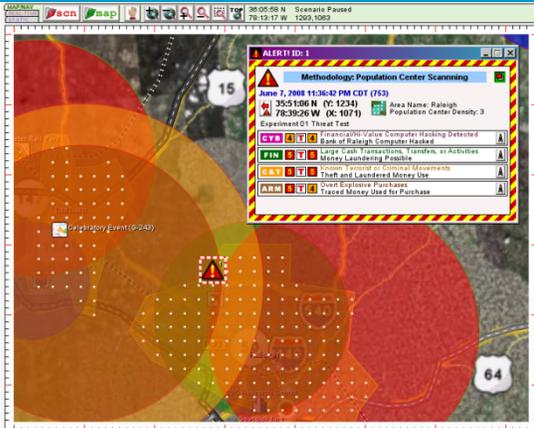


Investigation of Data Fusion for Threat Assessment

Project Number: 20.R9723
Sponsor: SwRI® Advisory Committee for Research
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Inclusive Dates: 7/2007 to 7/2008



Section of the Hydra Map Window showing standardized intelligence data (colored circles), static operational data (facility location, roads, railways, and waterways), and several hypothetical dynamic events.



Section of Hydra Map Window showing hypothetical threat alert (triangle) triggered by four intelligence data types at a population center. Inset is the alert popup window with details of the alert.

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Project Brief

Statement of Problem: To address current domestic security concerns, many national studies have called for research on technologies for integrated information management. A recent National Research Council study found that large volumes of data from diverse sources must be acquired, integrated, and interpreted to support counterterrorism efforts. The study recommended advancing the practical utility of data fusion for intelligence analysis. Data fusion combines multisource, multiformat data to support timely interpretation and efficient use of information. Every year, about three million packages of radioactive materials are shipped across the country by road, rail, air, and waterways. A large proportion of these packages are transported between nuclear facilities. In other sectors of business and commerce, millions of shipments of hazardous materials and critical goods, including food supplies, traverse the nation by various modes of transportation. From a security standpoint, these shipments are exposed to threats of theft, misdirection, or malevolent use.

Approach and Accomplishments: Staff investigated simulation-based data fusion methods for detecting security threats to potentially vulnerable assets. The methods convert multisource intelligence data items into standardized data objects and combine these objects with static and dynamic operational data. Once the data are combined in this way, analysts can define and apply various criteria for detecting potential threats. Interfaces with geographical information systems were examined to support data acquisition, transport simulations, and threat visualization. Various intelligence and operational data sources were investigated and linked to scenarios depicting intercity shipment of nuclear materials. Simulation experiments were conducted to test the data fusion methods. Experiments with hundreds of shipments and thousands of intelligence data items achieved more than 95 percent threat detection accuracy. This successful proof of concept led to developing a prototype analysis platform (Hydra) for threat detection and assessment. Hydra incorporates five innovative data fusion methods, a supporting system architecture and data processing stream. These features are included in a pending United States patent application.

Client Benefits: Hydra provides real-time analysis and early warning capabilities that support timely decisionmaking to safeguard critical assets. Potential applications involve security for nuclear materials and facilities, municipal water supplies, oil and gas distribution systems, agricultural and food supplies, public events, and customs and border protection.