INTRODUCTION

The Border and Transportation Security Data, Sensor, and Alert–Fusion Center (BTSDSA-FC) is a DoHS pilot program and developmental test platform to demonstrate new technologies applicable to the security of our nation’s borders. The increasingly complex environment of the U.S. borders drives the requirement for the presentation and interactive control of the stream of information arriving from the various data sources and sensors deployed. The Situation Awareness picture becomes fragmented without the benefit of data fusion and correlation to present a true picture from all information sources. The system will enable capabilities currently not available and support a new Concept of Operations for border security. It will provide local, state, and federal agencies the tools necessary to deny access and use of our ports, borders, and coastal regions for transporting illegal persons, Weapons of Mass Destruction, and contraband across U.S. borders.

The BTSDSA-FC provides a shared adaptable Common Operating Picture (COP) framework for sensor fusion and a Geographic Information System (GIS) that directly addresses system characteristics for collaborative sensor fusion. The objective is a framework based on common components that can be tailored to meet unique automated border, port, and coastal security requirements. Fusion combines data from a wide array of sensors into a single, unambiguous data set to produce information of value to the user, deal with conflicting data, and produce interim results that can be revised as more data becomes available. Sources may include, but are not limited to, video, radar, and Unattended Ground Sensors (UGS) such as seismic, magnetic, and passive infrared. Since no single sensor provides the capability to find, fix, track, target, engage, and assess in all weather conditions, the ability to fuse information from various sensors enables multiple looks at each target and takes advantage of the strengths of each sensor type to increase target identification and location accuracy.

Shown in Figure 1, the BTSDSA-FC also provides field agents direct wireless access to sensor alerts, location, and relevant data to provide actionable intelligence in the form of indications, warnings, incident responses, and situation maps.
UGS are generally implemented along the vast terrain and remote areas that require coverage in securing our nations borders. The fusion of these type sensors with additional sensors, such as radar, presents a common track picture. At Ports of Entry, information system infrastructures are generally available to support port security operations. However, along the land border between the Ports of Entry, the terrain, remote location, and potential cost have been the foremost issues leading to the lack of data system infrastructure development. While securing the nations borders has been paramount with respect to homeland security, and many capabilities do exist that would streamline control of borders, no single integrated system has been developed to address the current mission needs while providing an open architecture for future requirements. While these regions require a high degree of mobility and flexibility, communications have been limited to voice communications, such as Very High Frequency (VHF) radios and cellular telephones to exchange mission critical information between the Border Patrol Station and field agents. Currently there is no display of real-time Situational Awareness; no event predictions, alerts and warning, or incident response based on fused data and sensor information; and communications are unreliable in some remote areas.¹

**OBJECTIVES**

The principal tactical objectives of the BTSDSA-FC sensor data processing and data fusion include the following:

¹ BTSDSA-FC Concept of Operations, Global Technical Systems, October 2005
- Manage correlation, association, and tracking for any sensor.
- Detect and intercept individuals attempting to enter the US illegally.
- Provide Situational Awareness and sensor information to field agents.
- Provide autonomous procedures and methods to decrease station and field agent workload.
- Fuse Blue Force Global Positioning System (GPS) track data into the COP.
- Incorporate standard hardware and operating system for maximum system stability and maintainability during long-term operation.
- Provide real-time data to an arbitrary number of authenticated users via Transmission Control Protocol/Internet Protocol (TCP/IP).

As stated previously, the strategic objective of BTSDSA-FC is a “framework based on common components that can be tailored to meet unique automated security requirements”. However, due to the intricate melding of different types of sensors, communications systems, signal processing algorithms, data fusion processes, manufacturers and end user applications, distributed multimedia surveillance systems are inherently complex and have a high level of risk associated with their acquisition. Hence a comprehensive architecture centric approach is needed in order to realize this most important tailorable framework objective.

ARCHITECTURE APPROACH

The BTSDSA-FC architecture approach is based on COTS C3I middleware\(^2\) that integrates sensors, algorithms/fusion, and common components for real-time situation awareness and operations automation. Open & reusable services support interoperation and architecture extension for evolving border patrol requirements via a fungible C\(^2\) toolkit. Core services provide most BTSDSA-FC software functions out-of-the-box (data acquisition/processing, data recording/reduction, simulation, configuration mgt, map visualization, track geo-referencing, etc.). Border Patrol adaptations consist of extending existing software patterns/templates for creation of specific sensor plug-ins, integration of fusion engine & sensor controls, and configuration of HMI for border patrol ConOps. While the C3I middleware is indeed proprietary, it is also open and significantly accelerates BTSDSA-FC time to market, which is critical to meeting project objectives. It is open in the following perspectives:

- The architecture is open because each layer of the architecture is documented via explicitly published APIs (Application Programming Interfaces) or standardized XML (extensible markup language)-based information transfers.

The architecture is modular because each specific layer of the architecture is isolatable to a specific set of modules.

The architecture is scalable since it allows for one or more levels of processing to be off-loaded / distributed to other computer systems.

The architecture is evolutionary because it allows improvements in or changes to an algorithm or component to be deployable entirely within the appropriate processing layer(s) and module(s) without requiring modification of the entire system.

Current Progress

The BTSDSA-FC is being integrated and fielded by Global Technical Systems, Inc. (GTS) under contract to DHS – Science and Technology Border and Transportation Security. GTS is being supported by Command and Control Technologies Corp. and Daniel H. Wagner Associates, Inc. providing key C² and fusion components and technical support. The initial pathfinder configuration has been successfully demonstrated in a controlled but realistic urban setting that integrated red force, blue force and multi-sensor fusion to create a common operating picture and automated tracking and interdiction system.

Perhaps the most important result of the pathfinder was the demonstration of the overall system framework of loosely coupled common assets that can grow and evolve with the expanding border patrol needs for increased situation awareness and operations automation. The pathfinder was assembled in a matter of a few months, rather than years typical for systems of this sophistication and complexity built from scratch. The effort was more a matter of integration rather than software development.

Plans for Initial Deployment

DHS has tasked GTS to install and perform operational testing of the BTSDSA-FC at Douglas Border Patrol Station in southeast Arizona. The system is currently being installed in an operational sector designated by Senior Border Patrol Investigative Agents for the initial pilot program and as a developmental test platform for emerging technologies. The system will be integrated with existing Douglas sector video surveillance systems, UGS, and other border IT systems and networks, in addition to introducing new surveillance radar and mobile blue force capabilities.

Other major activities associated with the deployment are sensor and fusion calibration for the desert terrain, and collaboration with border agents on concepts of operations and enhanced interdiction and forensic gathering automation.

3 Prime contractor, developer, and integrator of the BTSDSA-FC system. www.gtshq.com
4 Providing the C² middleware and common operating picture, www.cctcorp.com
5 Providing the fusion engine for the C² environment, www.wagner.com