Protecting Soldiers from Ambushes and IEDs

Using Rapid Prototyping to Make and Field a Portable Radio Detection Finder System

To protect foot soldiers in Afghanistan, the US Army needed a solution to detect enemy communications with push-to-talk radios, which are used for insurgents’ command and control and for triggering improvised explosive devices, or IEDs. In response, Booz Allen Hamilton provided key integration and rapid prototyping services for the “Wolfhound” radio detection finder system. Commanders now consider Wolfhound one of the most critical programs in-theater, and it has earned an Army Greatest Invention of the Year award.

The Client’s Challenge: Every day in Afghanistan, US soldiers in reconnaissance patrols, forward operating bases, and combat outposts face deadly ambushes by enemy combatants using improvised explosive devices (IED). To address this threat, the US Army issued an Urgent Operational Needs Statement for a solution to detect enemy communications with push-to-talk radios, which are used for insurgents’ command and control and for triggering IEDs.

What Booz Allen Did: In response, Booz Allen, in partnership with the US Army and a key subcontractor, helped design, test, produce, field, and sustain the Wolfhound radio detection finder system. It helps foot soldiers to quickly locate the enemy and neutralize the threat of associated IEDs. Unlike traditional equipment, the solution is lightweight, handheld, and easy to use. Booz Allen developed this technology with an agile process called rapid prototyping.

Rapid Prototyping for Urgent Solutions

Rapid prototyping allows warfighters and operators in defense and intelligence agencies to obtain functional solutions faster by using rapidly engineered and produced field prototypes with readily available electronics—commercial off-the-shelf (COTS) components. This enables results in weeks or months, as opposed to years, and addresses an efficient way of solving short-term, constantly evolving mission requirements.

The Wolfhound system provides actionable and releasable data for near-real-time force protection, situational awareness, and targeting. Wolfhound units were designed for standalone and collaborative direction finding, and geo-location on targeted ultra-high frequency (UHF) emissions from the enemy’s push-to-talk radios. The system uses a wireless network to share lines of bearing (LOB) and geo-location information to provide real-time handheld indications and warning—crucial for situational awareness by force protection units. These data help inform warfighters and operators where enemy combatants are located, and by implication, the likely proximity of IEDs.

Primary Technology Subsystems

Wolfhound has three primary technology subsystems: the antenna array for collecting UHF signals, the radio frequency (RF) system that processes UHF data, and networking functionality to enable geo-location.

Antenna Array. A well-engineered antenna array allows interception of a wide range of frequencies. Wolfhound uses the Remote Antenna-X and 8, BNC whip antennas to provide optimized signal reception in the extended 2-meter band (130–180 megahertz [MHz]). The antenna base also contains a digital compass and Global Positioning System (GPS) receiver. By contrast, the Remote Antenna and 8, BNC whip
antennas provide signal reception for the lower UHF frequency band (300–400 MHz). The antenna base also contains a digital compass and GPS receiver. The antenna array is positioned on top of a backpack and extends about 2 feet above the soldier for optimum signal reception.

**RF System and Processor.** Wolfhound includes a remote Host Component to provide signal detection, processing, and wireless networking—all powered by a battery. The physical unit contains the RF receiver, signal processing components, wireless link, and battery compartment. The unit performs the signal detection and direction finding, communications with the wireless router through the wireless local area network (WLAN), and a general-purpose computer for supporting the graphical operator interface. The interface allows the operator to set mission preferences, view signal information, view LOBs and those of networked operators, monitor GPS location, control earphone audio, adjust display, and monitor other networked operators’ locations.

**Networking.** A wireless router allows multiple operators to network with one another and share information over a WLAN. Data from at least three Wolfhound units are required for accurate geo-location. Each operator’s signal detection and associated LOB is shared with the other networked operators. The networking subsystem communicates with the Host Component through the WLAN.

**Using Trade Studies to Select Subsystems**

Our technical approach to rapid prototyping is to divide a proposed system into manageable subsystems, and use a standardized process to design and develop these subsystems. Because a majority of rapid prototyping programs use COTS components, the initial effort by Booz Allen Engineering Services usually entails a trade study analysis of what is readily available. Size, weight, and power are often key considerations. At the end of this effort, the team develops a Technical Data Package, which is a “blueprint” that specifies dimensions, electrical, mechanical, and other requirements for producing the prototype. Examples of our related trade studies for Wolfhound include:

**Batteries.** Power density and size of a battery are key issues for mobile devices. The Wolfhound device requires a battery that is small and light enough for man-portable use—often in a backpack. The trade study therefore analyzed the size, weight, and power capacity of the batteries.

**Software Defined Radio (SDR).** An SDR radio system consists of an RF front end, analog-to-digital converter, and a processor backend that can be reprogrammed for a wide variety of signals. Software-based signal processing enables the radio system to receive and transmit widely varying waveforms or radio protocols. For Wolfhound, the SDR must be capable of processing signal detection and direction-finding data for thousands of distinct RF channels located over tens of MHz of bandwidth. The trade analysis thus focused on available processing power, along with size, weight, power, environment, and complexity of algorithms for detecting radio signals.

**Fielding and Operational Results**

Over an 8-month period, Booz Allen fielded 385 units on time and without a single recall—and at 18 percent under budget. Today, commanders at every level have touted Wolfhound as one of the most critical programs in-theater. Wolfhound is now fully incorporated into newly formed tactics to help squads, platoons, and base camps gather intelligence on high-value targets. This reliable, cost-effective, life-saving device is rated as one of the top-10 required systems in Operation Enduring Freedom and has earned an Army Greatest Invention of the Year award.

**Ready to Help You**

Our work with the Army is just one example of how Booz Allen’s rapid prototyping expertise can help government and industry organizations improve processes and achieve mission goals.

See our ideas in action at [www.boozallen.com](http://www.boozallen.com)

**About Booz Allen**

Booz Allen Hamilton is a leading provider of management and technology consulting services to the US government in defense, intelligence, and civil markets, and to major corporations, institutions, and not-for-profit organizations. Booz Allen is headquartered in McLean, Virginia, employs approximately 25,000 people, and had revenue of $5.86 billion for the 12 months ended March 31, 2012 (NYSE: BAH)