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Mobile Technology in Mine Action: The Fulcrum Application

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FEATURE

MOBILE TECHNOLOGY IN MINE ACTION: THE FULCRUM APPLICATION

by Camille Wallen and Nick Torbet [The HALO Trust]

HALO staff in Cambodia receive training in Fulcrum.
All photos courtesy of The HALO Trust.

In 2014, The HALO Trust (HALO) began trialing Fulcrum, a mobile data collection application for survey developed by Fulcrum Mobile Solutions. Due to the success of the trial, the subscription-based commercial product, designed specifically for mobile data collection, was used in eight HALO programs. Using Fulcrum, HALO has created 35 applications that collect data for a variety of outputs, including rapid contamination assessments, socioeconomic and impact surveys, minefield quality assurance checks, vehicle and logistics checks, and a number of reports including technical and non-technical surveys, explosive ordnance disposal (EOD), mine risk education (MRE), and daily minefield stats reports.

Enhancing Data Collection and Analysis

The principal benefit of Fulcrum is more efficient and accurate data collection. Prior to using the app, HALO's Cambodia program alone generated over 3,000 pages of paper reports every month, all of which were entered manually into an internal operations database and the national International Management System for Mine Action (IMSMA) database.

Since HALO introduced Fulcrum in its Cambodia program, the data entry workload has reduced by over 70 percent. Survey teams, MRE teams and supervisors now all carry Android tablets and use dual-language apps in Khmer and English created in Fulcrum. Each tablet has access to multiple applications for teams that require several different types of forms. In the field, data entered directly into the tablet can be exported to HALO's in-country database and converted into Extensible Markup Language (XML) format for submission to the national IMSMA database. The huge reduction in manual data entry means that the program information management team can spend more time checking the quality of data and providing analysis. The system is also cost-effective, the increasing availability of high-quality mobile devices and low subscription costs are met by increases in efficiency and the ability to scale up the system without putting significant strain on resources.

Using mobile technologies such as Fulcrum also enables the real-time management of teams in the field. Issues on the ground can be resolved immediately without the need to return to headquarters for problems to be identified and handled at a later time. This has particular pertinence in insecure environments such as Syria and remote locations such as Laos.

Personnel do not need to be IT experts to use the application. New applications such as survey forms can be created online in a matter of minutes, with little to no training required. To prevent data corruption or user errors, each device has a unique username. All input data is associated with specific devices and different levels of access are granted to administrators and users. The simplicity of setting up apps, exporting data and analyzing the results also means that one-off studies can be conducted, assessments are rolled out rapidly and survey forms can be edited remotely when required, taking the burden off resource-intensive and time-consuming tasks. Moreover, the Fulcrum software developers are very responsive to adding new functions to the system in response to

requests from users such as HALO, enabling more advanced applications to be developed using the same simple tools.

Notably, the use of mobile technology has increased the efficiency of socio-economic surveys conducted pre- and post-clearance. The detail of these surveys in paper form can create problems with time-consuming data entry, more opportunities for data entry errors and complex databases that are difficult to manage and analyze. Fulcrum has significantly enhanced the capacity of HALO's community liaison and survey teams conducting this work, reducing the time required to conduct interviews, removing the requirement for separate data entry and enabling data to be exported and results to be analyzed remotely in HALO's global headquarters.

A HALO team leader and operations officer in Laos enter data in the field during technical survey.

Challenges of Mobile Technology

While mobile technologies bring many benefits and present multiple opportunities, they still present challenges, particularly in less developed countries. Tablets and smartphones require accessible data networks in order to upload reports. As teams can spend weeks at a time out in the field without access to a mobile data network or Wi-Fi, they are often unable to upload their collected data. While mobile devices are able to store and collect data offline, Fulcrum can only back up to its cloud-based database, which requires internet access. If devices are unable to connect to a network, teams run the risk of losing any data that has not been uploaded were anything to happen to the device. Therefore, while HALO is exploring alternative solutions to backup data from Fulcrum in countries where data networks are poor or non-existent, pen and paper remains the primary collection method to avoid any large loss of data, time and work. While pen and paper and Fulcrum are sometimes used in conjunction with one another, the former is preferred for minefield survey reports whereas the latter is currently used for socio-economic survey. This remains the largest restriction to the use of mobile technology in HALO programs.

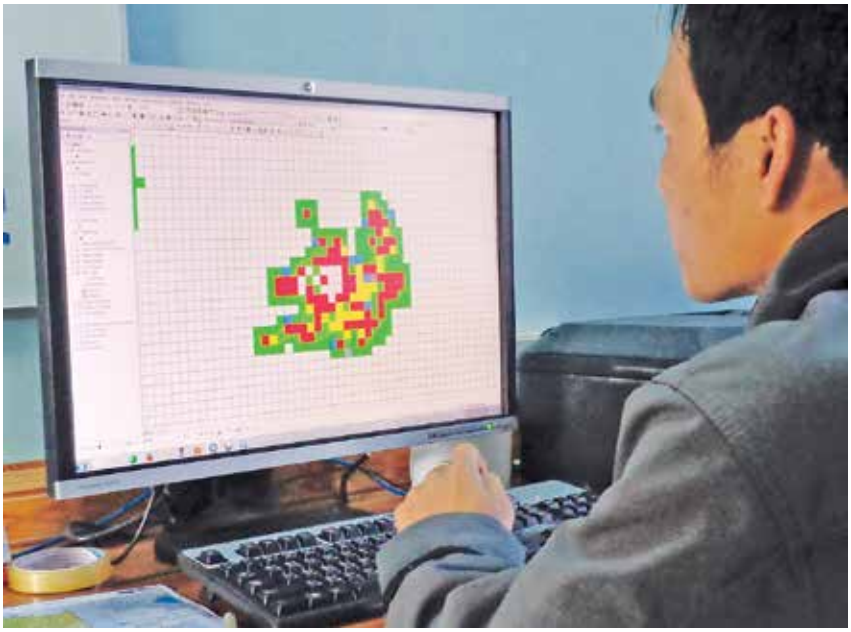
Exporting data from Fulcrum is easy; however, integrating the Fulcrum data into existing program databases can be more challenging, requiring time and attention from database and GIS managers to ensure the data synchronizes correctly. Although not all Fulcrum users (teams, supervisors, etc.) require advanced IT skills or knowledge of HALO's program databases, using remote technology can be challenging for those who have very little IT experience. Using smartphones can help to familiarize staff members with the technology, but additional training may be required for those who have no prior experience with the technology before they feel comfortable and are proficient at using it in their daily work.

Similarly, communities who are unfamiliar with smartphones or tablets may at first be suspicious of the technology during survey or interviews and may be unwilling to participate. It is therefore important to recognize where such an issue may occur and to mitigate any negative effects through community demonstrations or by using alternative methods that are familiar to the community.

Potential of Mobile Technology

Despite these challenges, mobile technologies can significantly enhance the efficiency, effectiveness and accuracy of data collection. Applications such as Fulcrum can also be used to manage emergency situations remotely. By including photos and videos in reports on new item types that were recently found, field personnel can relay information to specialists in real-time, who can provide technical recommendations to the field team remotely.

Mobile technology has a role to play in mine action operations, and the ongoing development of systems such as Fulcrum enhances the capacity of operators in their everyday



A HALO Laos geographic information system specialist uses data sent from the field to map areas contaminated with submunitions.

activities. HALO's most advanced use of Fulcrum is in Laos, where it is used to assist with efforts to survey and clear UXO (unexploded ordnance) contamination.

Case Study: HALO's Use of Fulcrum in Laos

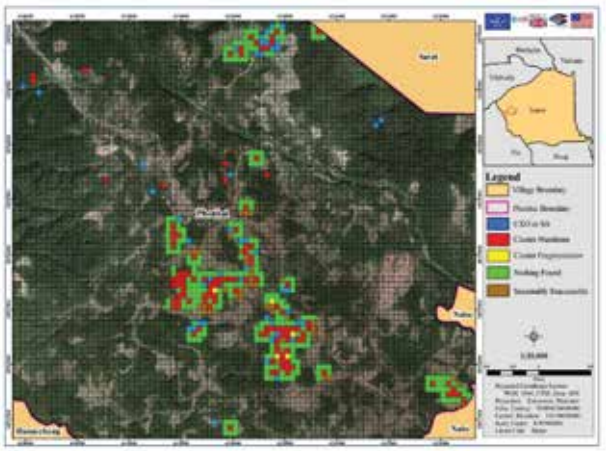
Laos remains heavily contaminated with UXO (particularly air-dropped submunitions) from the Indochina wars. Even 40 years after the conflict, UXO continues to impact some of the most impoverished and isolated communities. Estimating the scale of the problem and mapping the extent of contamination has proven to be particularly challenging. HALO is working alongside other operators to both define and survey the extent of the submunition contamination as well as clear it.

Much of the challenge can be attributed to the technical nature of air-dropped cluster munitions, which distinguishes Laos from other demining programs. Submunitions were dispersed from aircraft and, in the vast majority of cases, were intended to function upon impact with the ground. The residual submunitions are those that failed to function as intended, which present unique survey challenges; the dispersal pattern of submunition strikes is far more varied and widespread than minefields, and records of their locations are far less precise. Even with local knowledge of contaminated areas, assessing and mapping submunition strikes for clearance is hugely challenging. Conversely, it also presents opportunities. Submunitions enable survey teams to enter a contaminated area physically and use hand-held metal detectors to confirm the extent of the contamination. This enables operational management to very accurately target follow-on clearance operations.

This technical survey process is fast-paced and data heavy. Any locally reported submunition is known as an evidence point, and HALO's GIS department overlays the surrounding area with a universal transverse Mercator (UTM) grid, divided into 2,500 square meter boxes (50 x 50 m), a method introduced by Norwegian People's Aid (NPA) in Laos as described in an article in *The Journal of ERW and Mine Action*, issue 17.2.[1] Using MBTiles (mapping software that allows users to load map layers onto mobile devices for offline use), each box is assigned a unique ID, and survey teams search the boxes surrounding each evidence point, recording the locations of any identified submunitions. The intent of the survey team is not to identify all submunitions within a single 50 x 50 m box, but only to determine if there is further evidence of contamination. In practice this usually means marking and destroying the first identified submunitions in a box before moving on to surrounding boxes.

Given the extent of the bombing campaign, each box contains a large amount of information (UXO identified, UTM locations, date searched, etc.), which needs to be centrally stored and monitored. Transferring this data by paper is time consuming and prone to human error. Data must be recorded by hand, called into the GIS department by phone or hand delivered and then manually entered into the operational database. This is at best hugely inefficient and at worse unsustainable, given the scale of the task faced by in-country clearance operators. The problem is compounded when multiple strikes overlap one another, creating added complexities as survey officers have to contend with different strikes in close proximity that may require the survey of additional boxes. The use of the Fulcrum system means that teams can now reconcile all issues with a single visit rather than needing to revisit a single area multiple times in order to clarify outstanding queries.

Consequently, HALO has equipped all of its Laos survey teams with Samsung Tab4 tablets loaded with the Fulcrum app and connected to the country's effective 3G network. HALO selected the Tab4 for its availability, price, and durability, although any mobile devices running Android or iOS



An example of contamination mapping in Phonhai village, Laos, showing results of the technical survey.

are suitable. Using Fulcrum, HALO's operational management team created several different forms, enabling the easy and accurate collection of data—ranging from socioeconomic information about impacted communities to EOD reports detailing the location of destroyed UXO. The app is user friendly, and the team can design and edit forms without requiring any significant technical knowledge. This flexibility allows HALO to ensure accurate and comprehensive data reporting.

The Tab4 has proven to be remarkably durable during field operations, surviving months of rain during wet season operations and constant use in jungle terrain. While there are occasional 3G coverage limitations, each team is able to synchronize their data with headquarters daily, and in many cases, they are able to live stream data. All data gathered during the survey process is downloaded as a Microsoft Excel file format and automatically entered into HALO's Microsoft Access operational database. Links with the program's GIS software (ArcGIS Desktop) then enables a visual representation of this data and by assigning a color code to each box (e.g., green for no cluster munitions found, red for found cluster munitions), operations management can then identify confirmed hazardous areas (CHA) that can be entered into HALO's work plan and national database.

Aside from the requirement for 3G coverage, some key lessons have been identified. First, when designing digital forms, it is important to minimize the amount of free-text data entry as possible, usually through the use of drop down menus. This hugely reduces problems associated with maintaining consistent database records that are also symptomatic of paper reports, such as changes in spaces, numbers or capital letters (e.g., variations on 105 millimeter artillery shells can include: 105, 105 MM, 105 millimeter, and 105 mm). Second, the GPS technology within mobile devices is often not accurate enough for UXO survey purposes. Currently, separate data is manually entered into forms from more accurate Garmin GPS, but in the future HALO will look to GPS linked directly to the Tab4 via Bluetooth.

Cluster munition technical survey is intensely data driven, and GIS is a crucial component of the whole system. This mobile technology has revolutionized HALO's approach to UXO surveying in Laos, switching from paper maps and forms to integrated software that enables straight-forward data entry and visual representation. HALO is investigating what other support and management systems could be streamlined through the use of mobile data collection. In the near future, HALO Laos hopes to use apps such as Fulcrum to eliminate all paper reporting completely, enabling operational teams to record all of their daily statistics and synchronize immediately with headquarters.

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Camille Wallen is HALO's global monitoring and evaluation manager. She oversees monitoring and evaluation (M&E) across all HALO programs, including the design and implementation of M&E systems, socioeconomic surveys and impact studies, through which she has helped to develop HALO's use of mobile technology in M&E. She is based in Washington D.C., though frequently travels around HALO's programs.

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Nick Torbet arrived in Laos in January 2015 having worked with HALO in Cambodia, Colombia and Ivory Coast. He is the in-country lead for over 250 staff and is ultimately responsible for the operational and administrative management of the program. He previously served as a British Army officer for over ten years, specializing in explosive ordnance disposal.