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# Reducing Accidents in Demining: Achievements in Afghanistan

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## Introduction

An expatriate military adviser in Bosnia inspired me to write this paper when he explained his opinion that demining accidents were "a statistical certainty." I had just arrived in Bosnia after visiting Pakistan where I had conducted extensive interviews with deminers and their advisers to learn how they had managed to reduce demining accidents. I realized that some of the techniques that the Afghan deminers had devised for themselves were widely applicable.

Two days before, I attended a meeting of demining managers in Bosnia, at which Mine Action Center Director Mr. Filipovic demanded that all demining procedures be followed rigorously. His remark was prompted by a run of fatal accidents involving the feared PROM-1 fragmentation mine in which deminers were not following the Standing Operating Procedures (SOP). His words barely faded when yet another accident occurred for the same reason.

By 1997, demining operations in Afghanistan had acquired a reputation for fatalism and risk taking. With 50 to 60 accidents each year among 2,000 deminers, the Mine Action Program of Afghanistan (MAPA) was seen by many in the industry as intrinsically dangerous and, perhaps, out of control. Bill van Ree, the program manager at the time, explained later that Afghan deminers would ask him after a run of accidents, "Mr. Bill, what are you going to do about these accidents?" Yet by 1995, he realized that the accident rate could only be reduced once the deminers accepted partial responsibility for accidents.

It is easy to accept the stereotypical view of the Afghan deminer as a fatalist: "If it is the will of Allah



An Afghan soldier watches a mine explosion in a mine field south of Kabul.

Photo c/o AP/ World Wide Photos

that today I will have an accident, then today I will have an accident." However, Bill van Ree realized that stereotypes can be incorrect and started a complete overhaul of attitudes in the demining program. His successor, Ian Bullpitt, continued this extraordinarily successful effort. In 1998, accidents were reduced

by 50 percent from 1997. In the first half of 1999, there were only 10 demining accidents in the entire program. The trend was continuing in 1999, until the third quarter when there was a significant increase in the accident rate--prompting further review of the program. In spite of this increase, the Afghanistan demining program has achieved an enviable safety improvement that could provide a useful example for other demining programs.

A comparison of accident rates between Afghanistan and Cambodia, which have similar manual demining programs, shows that the accident rate in Afghanistan, before 1997, was much greater than that for Cambodia. However, close analysis reveals

dents: extensive vegetation roots grow around buried mines in Cambodia, thus reinforcing the soil. This environment means that it is easier to detonate a PMN-1 mine by accident in Afghanistan than a PMN-2 mine in Cambodia. This hypothesis remains to be formally tested, but it could explain most of the difference in accident rates between the two programs before 1997.

Also, the construction industry in Pakistan accepts an accident rate of three percent. Only serious accidents, those requiring hospital stays or death, are included in this number. Based on this percentage, with 2,000 deminers, one could expect 60 accidents per year. While this accident rate would be entirely unacceptable in a Western country, it serves as a useful comparison.

## Western Industrial Practice

Industrial practices in the West have led to immense improvements in safety in many industries, including aviation, the chemical industry, the nuclear industry, construction, mining and offshore oil and gas production. All of these industries have devised strategies to minimize accidents. Many lessons have been learned from them.

One of the main lessons is that there is an intrinsic link between safety and quality. The practices leading to high quality work most often lead to safe working conditions. The methods of quality improvement pioneered by Deming and applied so successfully by Japanese companies can also lead to significant safety improvements. "Kaizen," the practice of continuous improvement by small changes, has been widely applied in all these industries.

Another widely applied practice is the distribution of responsibility within teams. Authoritarian models of organizations proved to be inappropriate for achieving high quality and high safety. Industries learned that high quality results could only be achieved through high quality work practices. This goal could not be achieved through rules, regulations and close supervision without the active cooperation of the workforce. By placing more responsibility in the hands of individuals, even to the extent that they could choose their tools and equipment, companies found improved quality, safety and productivity.

Many of these techniques are well documented in industrial literature. They are part of the normal curriculum for industrial engineering students in most Western universities. What surprised me most about this research was the discovery that many of these techniques had been reinvented by Afghan



An ATC team.  
Photo c/o ATC.

demining organizations in response to their safety and quality problems.

### Initial Investigations

By 1997, MAPA collected a large database on demining accidents. Each accident is investigated by an independent monitoring agency, and a detailed report is submitted to the mine action program manager. This 30 to 40 page report includes a summary report by the investigators; interviews with the deminer involved; interviews with the supervisor and team leader; report of an inspection of the accident site with photographs; medical reports from the hospital receiving injured personnel; post-recovery reports on injured personnel; details of injuries with photographs of injured personnel immediately after the accident; and recommendations for procedural changes or protective equipment.

One of the first steps toward reducing accidents was a statistical analysis to discover common factors in the majority of accidents. As a result, it was possible to describe the "typical demining accident." Such typical accidents could occur at 8:30 a.m. in summer while a deminer was prodding a PMN-1 mine or when the deminer was working in a difficult area, such as an irrigation channel, a steep slope, in thick vegetation or in ruined houses. Some factors were false leads. While one might have suspected that deminers would become fatigued in the heat of summer, most accidents occurred before the hottest part of the day.

We became involved on the periphery of this

effort, as we worked to devise cost-effective protective equipment for deminers (Trevelyan 1999). We focused on prodding accidents and produced prototypes of improved head and face protection visors and helmets, prodders with safety guards to protect hands and an apron to protect the body. We focused on the reasons why most deminers worked in the squatting position, contrary to SOPs that require that deminers lie on the ground while investigating targets. We devised effective protection to enable them to work in the squatting position. We concluded that the squatting position is far more comfortable and probably more effective from an ergonomic standpoint. We also discovered that deminers are reluctant to lie on the ground because it is so difficult to keep their uniforms looking clean. Deminers are widely regarded in Afghanistan as a high status group; they believe that wearing dirty clothes detracts from their status. However, the main priority for mine action program management was avoiding accidents.

### Demining Organizations in Afghanistan

The United Nations Office for Coordinating Humanitarian Assistance in Afghanistan (UNOCHA) operates the mine action center at its head office in Islamabad, Pakistan. The program manager, deputy manager, logistics officer and a technical adviser (expatriate staff) are based in the office with an operations manager and Afghan support staff. The main UNOCHA office provides communications. The other expatriates include a technical adviser based with META in Jalalabad and a regional manager based in Kabul. About 4,000 other Afghan staff members work for a number of independent NGOs that implement the mine action program in Afghanistan.

The Monitoring, Evaluation and Training Agency (META), based in Jalalabad, provides training courses for the entire program. As the name suggests, META is an independent agency responsible for accident investigations, monitoring demining quality standards, quality control checks and several other tasks under the general direction of the program manager. Their role in quality control is currently undergoing major restructuring.

The Mine Clearance and Planning Agency (MCPA), with its head office co-located with MAPA in Islamabad, carries out Level 1 and Level 2 surveys and maintains maps and databases for the entire program.

Afghan Technical Consultants (ATC), a UNOCHA partner, is the oldest and largest demining

NGO in Afghanistan. Present director Kefayatullah Eblagh established the organization in October 1989. ATC started demining operations in early 1990, with an initial staff of 35. Since then, it has undergone significant change and expansion. ATC has developed into a highly organized and effective NGO employing about 1,300 personnel. The head office is in Peshawar, Pakistan.

The Mine Dog Center (MDC) was formed early in the program to train and operate the mine detection dog program, which was also started in 1990. Originally based in Pakistan, MDC has now moved to Kabul.

Two other Afghan NGOs carry out demining operations: the Demining Agency for Afghanistan (DAFA) in Kandahar and the Organization for Mine Clearance and Afghan Rehabilitation (OMAR) in Heart (Maley 1998). HALO Trust is the only foreign demining NGO and operates in Kabul and the northern areas where fighting continues.

Mine clearance operations rely primarily on manual demining and use dogs on suitable tasks and mechanical support (backhoes) in residential areas and mined irrigation channels. For more details, refer to Trevelyan (2000).

### Organizational Changes

#### Work procedures

Kefayatullah Eblagh, director of ATC, explained to me that his first step toward reducing accidents was to accept responsibility. ATC is a paramilitary organization modeled in a uniquely Afghan style. The director is not only an authoritarian figure but also a caring parent to his entire workforce. He has to assume responsibility for the families of injured or killed deminers. Deminers take their personal problems to the director at any time—it is a demanding job for any person. ATC has undergone many changes in the effort to reduce accidents and improve quality and safety.

ATC deminers work in teams of 30 men. Each team has 12 breaching parties of two men each. In demining's early stages, each breaching party consisted of three men. The first man would be responsible for using the metal detector; the second man would investigate with a prodder; and the third man would monitor his colleague's actions.

In the three-man drill, and initially with the two-man drill, deminers were trained in one area. Later, the two-man drill was changed to where each deminer operated the metal detector and investigated the targets he located. This method reduced the

chance of incorrectly marked target locations—the suspected cause of several incidents. It should be noted that Afghan deminers use painted rocks to mark mine field boundaries and suspected target locations. Lane boundaries are marked with steel rods and rope. On the other hand, Cambodian deminers always operate on a 0.5m x 1m strip at the end of the lane marked by wooden poles. Though the Cambodian practice takes slightly more time, it is probably safer than the Afghan methods.

The two-man drill was initially introduced to improve efficiency and productivity. The first man used the metal detector and investigated targets with a prodder while the second man monitored. After 20 to 30 minutes, they would exchange roles. All personnel would take a rest break after a two-hour period.

Four section leaders monitor the actions of the breaching parties and record their work. A team leader monitors the entire team, coordinates transport and handles communications, record keeping and other administrative functions. Each team also has a driver and a paramedic on standby.

One of the first changes made to improve safety was to change the two-man drill. ATC suspected that the deminers needed more rest, so they decided to test a new arrangement in which one man would work for 20 minutes with a metal detector and prodder while his partner rested some distance away. The responsibility for supervision was placed with the section leader. With the deminers resting every 20 minutes and the section leaders sharing each other's supervision, the rest breaks every two hours were eliminated. The result was a reduced risk of dehydration in the summer heat and greater working efficiency.

#### Sleep

Lack of sleep was also a suspected cause of fatigue among deminers. The Afghan deminers wake as early as 3:30 a.m. in the summer for dawn prayers, yet they retire at 9:30 p.m. While there was an opportunity to rest between prayers and breakfast, ATC decided that more rest was required. The daily schedule was accordingly rearranged. The original summer time schedule is shown in Table 1. Times are approximate—prayer times depend on sunrise and sunset and other activities are scheduled around prayer times.

#### Safety Awareness

Accident investigation reports typically emphasized a failure to follow SOPs as the main contributing cause. While deminers often did not follow the correct procedures, this disregard was usually due to

**First Summer Schedule Table 1**

4:00 a.m.	Wake, prepare for prayers
4:30 a.m.	Breakfast
5:30 a.m.	Morning parade, prayer for safety, address by site manager
6:00 a.m.	Depart for work site (about one half hour transit)
6:30 a.m.	Commence work
8:30 a.m.	1 <sup>st</sup> Break
11:00 a.m.	2 <sup>nd</sup> Break
1:30 p.m.	Finish work in mine field, prayers, return to camp
2:00 p.m.	Lunch
3:30 p.m.	Afternoon prayer, equipment maintenance
6:00 p.m.	Sunset prayer
6:30 p.m.	Dinner
7:30 p.m.	Evening prayer
9:30 p.m.	Bed and lights out
10:30 p.m.	Radio shut-down

circumstances at the particular site rather than negligence. This fact does not include the widespread practice of squatting during demining. Some other variations on the SOPs are widely practiced, such as reducing the number of marking stones when marking the location of a metal detector indication. According to deminers, when they are aware of the presence of site managers, staff of higher status or visitors, they revert to SOPs.

ATC recognized that if there was to be any variation in the standard procedures, the implications had to be examined first. Therefore, they decided to implement a daily meeting among the deminers to discuss safety and the need for special procedures at the particular site. The daily safety briefing was used to review and discuss safety hazards or technical problems at the site. Deminers could voice their own opinions to their team leader and also report "near misses."

Another move to increase rest breaks and reduce fatigue was to place restrictions on weekend leave for deminers. Deminers are normally based at camps close to the work site. Three teams and a resident site manager are normally based together at the same camp called a "project site." ATC decided that deminers would not be allowed to travel home on the weekend.

Other problems prior to this decision included the following:

**Revised summer schedule to improve sleep pattern Table 2**

4:00 a.m.	Wake, prepare for prayers
4:30 a.m.	Breakfast
5:30 a.m.	Morning parade, prayer for safety, address by site manager
6:00 a.m.	Depart for work site (approx. half hour transit)
6:30 a.m.	Commence work
12:30 p.m.	Finish work at mine field, on-site safety review.
1:00 p.m.	Return to camp, prayers
1:30 p.m.	Lunch
2:00 p.m.	Compulsory sleep
4:00 p.m.	Afternoon prayer
4:15 p.m.	Training session, review of operations, daily activity reports, equipment maintenance.
6:00 p.m.	Sunset prayer
6:30 p.m.	Dinner
7:30 p.m.	Evening prayer
9:30 p.m.	Bed and lights out
10:30 p.m.	Radio shut-down

- Transport difficulties, such as traffic accidents and traveling times, caused deminers to return to camp late on Sunday night;
- A loss of sleep due to social activities with family over the weekend;
- Security problems, such as deminers who were arrested and detained by authorities for trespassing; and
- While at home, the deminers unintentionally informed their friends and families of incorrect information which then was reported to the Taliban authorities, causing problems for the mine clearance agencies.

**Leave schedule**

Deminers have 30 days of paid annual leave. Eight days are set aside for the Eid holiday, leaving 22 other days. Each team is given eight days paid leave after two months. ATC allows two days for traveling to reach family homes and two days to return. Many deminers take four extra days from their annual leave to increase these breaks to 12 days.

**Responsibility in Supervision**

ATC also recognized that when deminers failed to follow agreed procedures, supervisors had to share the responsibility. Section leaders often have a problem when a deminer persistently refuses to follow their

directions. It is not uncommon for the section leader simply to give up and let the deminer take responsibility for his own safety.

To reduce the chance of this occurrence, ATC decided to demote and decrease the pay of section and team leaders one level immediately after an accident, which could only be restored following an investigation clearing them of wrongdoing. To implement this procedure, ATC required prompt feedback on the causes of an accident. META required several weeks and even months to complete its accident report. Thus, ATC had to have its own investigation capability. ATC staff is delegated for accident investigation whenever the need arises. Typically, the site manager and two section leaders from other teams are assigned to an investigation.

**Changing the culture**

Just as experience in Western industries has shown, it is necessary to change the culture of an authoritarian organization to obtain significant safety and quality improvements. Responsibility has to be delegated and shared appropriately at different levels in the organization. Deminers need a level of discretion in deciding how to approach each task. It is not possible to devise foolproof procedures for every conceivable mine field situation.

Afghan culture tends to resent centralized authority; so, it is remarkable that organizations as large as ATC can operate with such high levels of reliability. This activity is more remarkable when one realizes that the demining organizations are practically the only sign of a large-scale, disciplined organization in the entire country. They operate in a vacuum surrounded by chaos, disintegration, extreme poverty and deprivation. The social institutions we take for granted in Western countries simply do not exist in Afghanistan. There is usually no electric power, police force, coherently organized system of justice, social security, post office nor any telephones.

Sharing responsibility could be regarded as foolhardy in these circumstances. Yet the experiences of ATC show that it is possible and has led to significant safety improvements. The other demining organizations adopted many of the changes pioneered by ATC.

**The Views of Deminers**

As part of research on the technological needs of deminers, we interviewed several deminers and staff in different organizations. Some of their opinions and quotes make interesting and informative reading.

An operations manager based in Peshawar said, "The only time I experience a bad day in my job is when I receive a report of an accident in a mine field. That is a very depressing experience. Fortunately, we are making big improvements. In the first six months of 1997, we had 17 accidents. In the same period of 1988, we had seven accidents. This year [1999], we have had only one accident in the same period. I am still concerned about July—it is the hottest month of the year and a bad time for accidents."

One deminer said, "One of the teams at our site had two accidents last month. One of the deminers had several arguments with his partner. His original partner had fallen sick and had gone home for several weeks leave. The new partner did not get on with him well at all. Then there was an accident. I do not know what the cause was, but I am sure that if they had not been arguing the accident would not have happened. In my team, if a deminer is upset or angry, he is not allowed to work that day. Even though it is harder to keep up with the schedule, we feel safer that way. Also, deminers are less likely to be angry or upset if they know that all the rest of the team has to make up for their work."

Another deminer said, "One of our problems is that we are always being asked to work faster. We have heard that teams which work too slowly may not get any work contracts. It is difficult when you work in a mine field with many fragments and you can only work slowly in this kind of mine field."

A third deminer remarked, "The safety meetings are a good idea. We discuss mistakes to make sure the work is done correctly. People forget the correct procedures, and when the problem is discussed, we remember our training. Sometimes, I mention mistakes I have made myself. Often, I only tell them to my friends in my tent, and I give thanks to God that I am safe, and I try and tell them not to do it again. Sometimes I also tell the team leader but not always. The team leader says, 'please be careful and don't do that again.'"

**Training**

The Afghanistan demining program has a highly organized system of training deminers and provides them with refresher courses every six months. META runs separate training courses for supervisors, team leaders, UXO specialists and communications. ATC also runs many internal training courses for its staff. English classes are provided both for administration and demining personnel. Nearly all of the administration staff is computer trained. Many other special-

ized training courses have been run, using both internal and external instructors. The level of training has reached the point where a significant number of ATC staff are being recruited by international demining agencies for work in other countries. ATC deminers, supervisors and administration staff are now working in Iraq, Somalia and elsewhere.

### Comparison with Western Practice

We can see several significant parallels between the changes introduced to ATC to improve safety and what would be regarded as "best practice" in western industries. ATC devotes significant resources to improving its workforce. Apart from support for deminers' families and help with personal crises, the organization provides significant training and career development opportunities for its staff.

Responsibility is delegated across the organization, rather than being concentrated at the top. Team leaders, supervisors and deminers all contribute to discussions on safety and the techniques that should be used to deal with particular mine field problems. Team leaders and supervisors carry significant responsibility and pay the penalty if an accident occurs in their team.

Safety and cautiousness are reinforced daily at the safety briefings. Deminers are not allowed to forget the need to constantly be careful to avoid accidents. The organization pays careful attention to the health and well being of deminers. While recognizing the importance of home leave, discipline is imposed to ensure that deminers are in top physical condition for the required job. In contrast to the stereotypical fatalist image of an Afghan deminer, all employees accept that accidents have human causes and can be prevented. An accident represents organizational failure as much as human failure.

### Further Improvements

There are generally three classes of accidents in demining. One class occurs while a mine is being investigated or destroyed. Another class occurs because deminers walk on a mine that has been overlooked. The third class occurs when deminers walk in areas that have not yet been cleared.

Understanding these classes leads to the close link between safety and quality in demining, as in any other industry. If a deminer steps on an overlooked mine, he is the victim of poor quality work by other deminers or possibly his own poor work. It is this link that is currently being targeted in MAPA in a major overhaul of quality assurance procedures.

Currently, deminers check their work in an informal manner. As one deminer walks forward to resume work at the end of a lane, he sweeps his detector from side-to-side to check for overlooked metal targets. From our observations of deminers working in a simulated mine field in Islamabad, Pakistan, this checking is not very thorough, but it does reveal missed targets. After completing the clearance of a significant area, deminers may check the area once again with a metal detector.

In a carefully documented test, we observed an instance of a serious error which could lead to accidents. When one deminer has finished working at the end of a lane, he usually marks the last position cleared with a painted stone or by leaving his detector lying across the lane at the end of the safe area. We observed how one deminer located a metal target forward of his position and on the left-hand side of the lane. After he had located the metal fragment, he marked the target location with a stone. His partner thought that the stone marked the end of the safe area. As the diagram shows, it did not—it marked the location of the last target removed. The area to the right of the stone had not been cleared, but the second deminer missed this area, which happened to contain two targets that could have been easily discovered with a metal detector. The targets were missed again when they carried out a final check of the area.

In an effort to overcome errors such as these examples, Afghan demining NGOs are working on a system of comprehensive quality checking. It has been proposed that each deminer thoroughly check the ground cleared by his partner in the most recent spell. The partner will commence checking at the point at which he last worked and work forward until he reaches the end of the area his partner cleared. Each section leader will also conduct a comprehensive check of the area cleared by the deminers working under him. Finally, the team leader will check 25 percent of the area cleared by the team. This procedure will add significant costs to clearance operations. It is clearly impractical for a supervisor to check ground adjacent to where deminers are currently working. Further, the supervisor cannot do the checking while he is expected to supervise deminers at the same time. Approximate calculations suggest that the extra work involved will add perhaps 10 percent to the cost of clearance. However, this reflects a significant emphasis on safety and quality and will reduce the amount of reworking required. Another important issue is the quality of work the initial deminer performs.

The comprehensive checking procedure de-

scribed above may not improve the quality of the initial demining without significant incentives. If deminers know that the area they have cleared is going to be checked again, they may think that it is okay to leave a target unchecked every now and again. On the other hand, especially if there is some degree of embarrassment or penalty associated with the discovery of a target missed by a deminer, working standards could improve.

Finally, it is necessary to remember that this proposal has been stimulated by a significant rise in the accident rate after a long period of decline. It is possible that this increase reflects a common industrial problem. Major changes to work practices that improve safety have a limited lifetime. After a while, workers develop a false sense of security and stop paying as much attention to their work practices. It is necessary to introduce further changes to avoid this risk. Constant vigilance is necessary to maintain standards, and experience in Western industries suggests that constant change is also required.

### Acknowledgements and Principal Sources

Much of the material for this paper was obtained through interviews with Eblagh between June 1997 and January 2000. Other material was gathered from interviews with deminers, senior staff of demining agencies and expatriate technical advisers and program managers of MAPA. Their assistance is gratefully acknowledged. For further details, readers are asked to contact the author or the MAPA head office in Islamabad, Pakistan.

Some additional material was obtained from interviews with staff and deminers in Bosnia-Herzegovina and Croatia in August 1999. Their assistance is also gratefully acknowledged.

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