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Demining Programme Office in the Falkland Islands - Exploitation 2017

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FALKLANDS ORDNANCE EXPLOITATION – JANUARY 2017

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EXECUTIVE SUMMARY

In January 2017, exploitation work was carried out by Fenix Insight Ltd on mines and other ordnance recovered by the Land Release Contractor (LRC).

Examination of grenades used in booby traps revealed that one, considered to be complex and dangerous, had been rendered safe by the ageing process. The other, though more familiar, was still fully functional and highly lethal. The findings highlight the continued danger from unexploded ordnance, and the need for threat assessment to be based on technical evidence rather than intuition.

The LRC had found that a certain batch of P4B anti-personnel mines were more readily detectable than the types encountered previously. Exploitation established that an additional aluminium capsule was present within mines produced after 1980. This means that they can be located to depths of 20 cm or more, substantially increasing the rate of clearance. Inert examples were produced for the LRC and DPO.

Continued testing of fuzes contributed to the body of evidence gathered on previous phases of exploitation. Of the 100 fuzes tested during this phase, only one was capable of detonating the main charge. This suggests that the majority of P4B mines are now non-functional, and that the entire population of these mines is nearing the end of its life. In the unlikely event that somebody both encountered and actuated a P4B, the likelihood of detonation and resultant injury would be extremely low.

FALKLANDS ORDNANCE EXPLOITATION – JANUARY 2017

Introduction

Exploitation[1] work for Phase 5a was conducted by Colin King (hereafter 'CK'), technical director of Fenix Insight Ltd, from 6-12 January 2017. The ordnance set aside for exploitation by the Land Release Contractor (LRC) included the following items.

Type	Designation	Country of origin
Grenade	M5	Spain
Grenade	M67	USA
Explosive blocks	Charge, demolition, TNT, 1lb	USA
Anti-personnel (AP) mine	P4B	Spain
Anti-tank (AT) mine	C3B	Spain

Fenix was also asked to examine images taken of Argentine 'M1' anti-tank mines encountered during the previous clearance phase.

Aim

The aim of this report is to outline the findings from the exploitation work, with particular emphasis on:

- The general condition of the ordnance
- The functionality of fuzing mechanisms
- The viability of energetic materials
- Significant changes to characteristics that might affect detectability or sensitivity.

Recovery of Ordnance

Following assessments from previous exploitation work, the P4B AP and C3B AT mines were recovered by the LRC during clearance operations. The mines were defuzed and stored, with bodies and fuzes in separate ISO containers, in the holding area.

A booby trap incorporating an M5 grenade, identified and marked in SA108 by the LRC, was neutralised and lifted by CK. A further booby trap incorporating an M67 grenade was neutralised and recovered from SA020 by the LRC.

Methodology

Prior to deployment, risk assessments were carried out for each type of ordnance, together with a provisional plan for disassembly and testing. A specialist tool kit was brought from the UK, with more common hand tools being bought in the Falklands. Local contacts assisted with the provision of other equipment such as a workbench, vice, generator and lighting.

As always, the support and cooperation of the LRC was critical to the success of the mission, and included the provision of equipment, access to Suspected Hazardous Areas (SHAs) and the provision of a medic.

The work flow followed the standard Fenix process map for exploitation activity, with reviews conducted as-and-when necessary.

[1] In this context, 'exploitation' is the characterisation of an item of ordnance; this usually involves disassembly, examination and testing of components.

Ordnance disassembly was carried out in an ISO container in Pony Pass quarry, adjacent to the explosive storage and burning site used by the Land Release Contractor (LRC). Access to the area surrounding the makeshift Ammunition Processing Building (APB) was controlled during the exploitation process.

The APB was established in an ISO container, in a disused section of the quarry at Pony Pass

A simple work station was set up, with specialist tools brought from the UK and others purchased locally

Explosive testing

The explosive testing of P4B detonators was an important part of the exploitation work, building on the body of data collected during Phase 4a. No matter what the condition of the body, the fuze mechanism or the main charge, a mine is incapable of functioning as designed unless the detonator is serviceable. The testing of detonators is therefore critical to the real-world evaluation of the risk currently posed by these mines, and for the prediction of long-term residual risk.

A rig was improvised, in which a heavy steel rod could be lowered onto a mine fuze in order to actuate it. The mechanism was operated from a distance by a pulling line, meaning that the operators required only eye protection. A simple release latch held the rod in the raised position while the fuze was placed on the anvil, with the latch releasing automatically when the line was pulled. One hundred fuzes were tested using this method, with video recording used throughout.

The explosive test rig used a rope and pulley to lower a steel rod onto the mine fuze

A P4B mine fuze placed on the test rig, ready for the rod to be dropped

EXAMINATION OF ORDNANCE

M5 grenade booby trap

The booby trap consisted of a Spanish M5 grenade, which was wired to two wooden stakes at ground level. Adjacent to the grenade were two 1-pound blocks of TNT. Unlike other booby traps found to date, the anchorage of the device used purpose-made stakes made from treated wood and copper wire, both of which remained in good condition.

The M5 booby trap, prior to recovery

The stakes and wire were still in good condition

The use of treated wood and copper wire means that the grenade is held firmly, which is key to successful operation should the tripwire be pulled. Without this, the grenade might be pulled out of the ground without functioning. In this case, the tripwire was absent, having been made from steel and rusted away.

The M5 is a Spanish hand grenade made by Expal (who also manufactured the P4B and C3B mines). It is unusually complex, incorporating fuzing mechanisms for both impact and delay initiation; this makes it potentially hazardous to handle. The grenade has a plastic body that can be fitted with a steel fragmentation cup; in this example, the cup had not been fitted.

The body of the grenade appeared to be in good condition, with no discolouration, cracking or other external signs of deterioration. The fly-off lever – the primary arming device – had rusted away, revealing the two arming plungers of the fuze mechanism. These are spring-loaded and designed to move as soon as the lever is released; their exposure raised the concern that the grenade could be initiated by the slightest movement.

Before the trap was moved, a block was secured into place to prevent the plungers from moving. The grenade, and other components of the booby trap were then recovered to the APB for exploitation. Details of the findings are at ***Annex A***.

M67 Booby Trap

Another booby trap recently encountered by the LRC incorporated an American M67 grenade as the initiator. This grenade appeared to be in good condition and, being familiar to the LRC, was recovered by them prior to the Fenix visit, and stored ready for exploitation. Details of the M67 grenade examination are at ***Annex B***.

TNT demolition blocks

The TNT blocks used in the M5 grenade booby trap were also recovered for examination. Blocks of this type were routinely used by Argentine sappers in the construction of booby traps, and many more are likely to be encountered as clearance work progresses.

The blocks appeared to be in very poor condition, but this was largely due to the degradation of the cardboard sleeves and the heavily rusted end caps. Internally, the TNT was in good condition, and fully capable of detonation. The same conclusion was reached during the examination of similar TNT blocks during a previous phase of exploitation.

Findings from First World War battlefields confirm that high grade TNT can remain intact for more than 100 years. However, TNT requires substantial shock, or other energy input, in order achieve detonation – especially when it is not encased. The danger posed by these blocks is therefore wholly dependent on the viability of the primary munition in a booby trap.

The TNT blocks appeared to be heavily degraded

Internally, the explosive was still in good condition

P4B anti-personnel mines

Detectability

Until recently, all of the recovered P4B mine bodies and fuze assemblies were produced in batch number 2-5-78 (1978 being the year of production). A number of mines from this batch have been examined and tested during previous phases of exploitation. The detectability of these mines has been very poor, generally allowing location to a depth of no more than 5 cm, and frequently less. In previous clearance phases, this meant that detection was not an option, and that all mines had to be located manually by excavation.

In contrast, a high proportion of the P4B mines cleared during Phase 5a were found to be detectable at far greater depths (around 20 cm). All of these mines appeared to come from a different lot, namely 1-11-80. A large number of these mines were recovered and retained for examination during exploitation.

P4B mines from Lot 1-11-80 were found to be far more detectable than the types previously encountered. The variation in markings was also unusual for mines originating from the same batch.

Functionality

Impact testing was carried out using the explosive test rig, to establish the proportion of fuzes that remained capable of functioning. This method subjects the fuze (separated from the main charge) to an impact well above the threshold required for initiation. Only complete fuzes in reasonably good condition are used, so that the energetic material is being tested, rather than the mechanism. This testing augmented work from previous phases in order to build a significant evidence base.

Detailed findings from the exploitation of P4B mines are given in ***Annex C***.

C3B anti-tank mines

Three C3B mine bodies and 5 fuzes were made available for exploitation. One of the casings was badly cracked, but otherwise all components appeared to be in good external condition. The fuze of the C3B is the same as that of the P4B, except that the mechanism is protected by an outer plastic housing, which raises the operating pressure to a level more appropriate to an AT mine (approximately 275 kg).

The outer fuze housing provides an additional barrier against the ingress of water, which is normally the primary cause of degradation within the fuze. This means that, all other factors being equal, C3B fuzes are likely to remain functional for longer than P4B fuzes.

The protective housing of the C3B raises the operating pressure, but also helps to keep water out

If the fuze housing cracks, then the operating pressure could be substantially lowered, perhaps to a level where the mine could be actuated by a person. However, the ingress of water is also likely to accelerate the degradation of the fuze to the point where it is no longer functional.

The main charge of the C3B tends to remain in very good condition, regardless of cracks in the casing or the ingress of water. Once again, great variation in explosive composition was encountered, with some parts of the filling heavily aluminised and others where virtually no aluminium was evident. At present, the metal dust plays no part in the mine's detectability and only affects its explosive power. If, at some point, the metal were involved in a new detection technique, then the variation in content might be significant.

The central booster and main charge in C3B mines tend to remain in good condition

The distribution of aluminium within the explosive is very uneven; in some case, virtually absent

Argentinian 'M1' mine

The steel-cased Argentinian AT mine used in the Falklands has been nick-named the 'M1', due to its similarity to the US anti-tank mine of that designation; its correct nomenclature is not known.

One example of the 'M1' was seen during exploitation in March 2015. The mine had been recovered by the LRC as an unidentified type, with no fuze and a filling thought to be inert (possibly concrete). The schedule did not permit full exploitation, but a brief examination confirmed that this was an Argentinian 'M1' and that the filling was TNT.

A field of 'M1' mines was encountered during Phase 4 clearance, but no exploitation was conducted that year. Photos of some mines were taken, permitting some basic analysis; this is given at ***Annex D***.

This mine was recovered during Phase 4. A brief examination concluded that it was an 'M1' and that, what at first appeared to be an inert filling, was in fact TNT. No fuze was present

Creation of inert samples

A number of P4B and C3B mines were rendered inert, including the extraction of initiation compositions and primary explosive from the detonators. This allowed the construction of inert versions of the detectable P4B mines for the use of the LRC and DPO.

Some samples of mines, fuzes and components will be returned to the UK, to be held by Fenix for further research, training and future reference.

A number of inert training aids were produced, including sectioned P4B mines and inert mines, reconstructed with detectable detonator capsules

KEY CONCLUSIONS ON AGEING AND FUNCTIONALITY

Mines

After a certain length of time, all ordnance will eventually lose the ability to function as designed. It may still incorporate hazardous material for some considerable period, but this is unlikely to constitute a threat during the course of day-to-day activity.

The period over which an item of ordnance fails will vary, depending mainly on the vulnerability of the materials and the environment in which they exist. The failure of a large proportion of P4B mines during testing indicates that most are no longer capable of functioning as designed.

Even among the most robust mine types (the Italian SB-33 anti-personnel and SB-81 anti-tank), testing during an earlier phase of exploitation revealed that a substantial proportion were now non-functional.

The time scale on the failure distribution curve (see ***Annex C***) is difficult to predict and will differ for each type of ordnance. However, there is evidence that the degradation process accelerates once water enters the casing. Thirty five years after the conflict, the vast majority of P4B mines are already non-functional, it is therefore reasonable to predict that very few, if any, will survive the next 10 years.

Evidence collected during exploitation so far, in conjunction with extensive studies of landmine ageing in other countries, suggests that the entire population of mines in the Falklands is nearing the end of its operational life. In the unlikely event that somebody both encounters and actuates a mine at some point in the future, the risk of detonation and resultant injury is low. That risk will continue to diminish, year on year.

Unexploded ordnance (UXO)

Findings from the exploitation of the M5 and M67 grenades illustrate the fallibility of intuitive risk assessment. The M5, considered to be highly dangerous and unpredictable, turned out to be non-functional, with multiple points of failure. The M67, being more familiar and therefore considered 'safer', proved to remain highly lethal.

After many years with few serious incidents, the local population are also in danger of becoming somewhat blasé about the risks from UXO.

RECOMMENDATIONS

Exploitation should be conducted on samples of additional types of mine, and other ordnance, as they are encountered. Significant types of ordnance not yet examined include:

Designation	Type	Origin	Notes
BL-755	Dual-purpose submunition	UK	Subject to Convention on Cluster Munitions
FMK-1	Anti-personnel mine	Argentina	Plastic-cased, minimum-metal
FMK-3	Anti-tank mine	Argentina	Plastic-cased, non-metallic
M1	Anti-tank mine	Argentina	Steel-cased, vulnerable to degradation
No 4	Anti-personnel mine	Israel	Plastic-cased, resilient
No 6	Anti-tank mine	Israel	Steel-cased, resilient

Additional functionality testing should be conducted on mines recovered by the LRC during future phases of exploitation. The resultant data should be charted and analysed in order to establish trends and predict failure time scales. This may help to quantify the risk from any ordnance that evades the clearance process.

The residual risks posed by types of UXO other than landmines should be analysed and monitored. Technical findings should be made known to the LRC and EOD community as a whole.

Awareness messages and education on residual risks from UXO should be disseminated to the population of the Falklands.

Colin King

Technical Director
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January 2017

ANNEX A

EXPLOITATION OF THE M5 GRENADE

Background

The M5 is an unusually complex grenade manufactured by the same Spanish company (Explosivos Alavese 'EXPAL' SA) that produced the P4B and C3B mines. Once the safety pin has been withdrawn, release of the fly-off lever initiates a firing delay, but can also be set to arm an impact fuze. The impact fuze uses an 'all-ways acting' mechanism, so called because it functions no matter what the direction of impact. This makes it inherently dangerous, and therefore of concern during disposal.

The Spanish M5 grenade. The lower casing of the live grenade is black

Findings

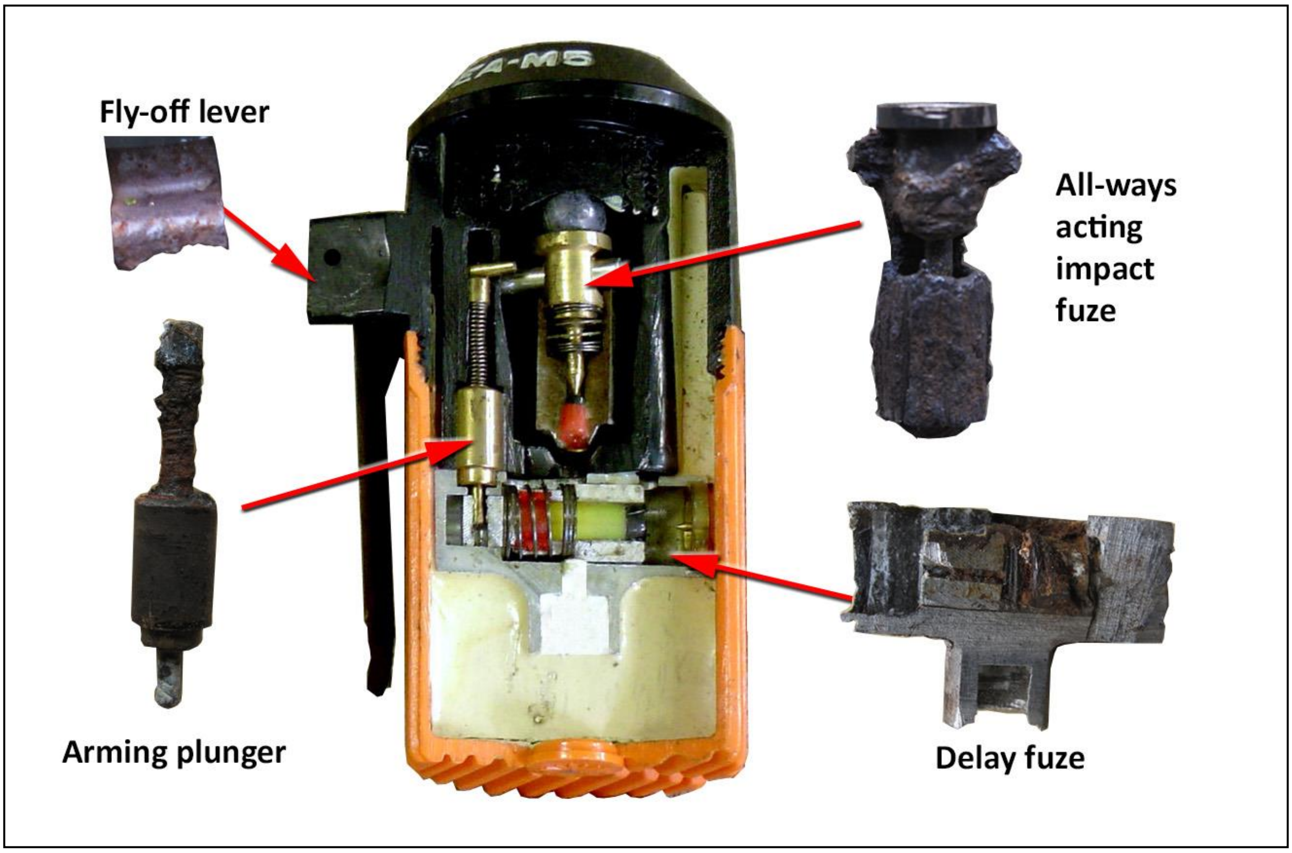
Exploitation revealed that the main charge was in good condition and appeared to consist of Composition B (RDX/TNT mixture) rather than the pure TNT mentioned in technical references. Composition B is substantially more powerful than TNT, causing greater blast and, therefore, being far more likely to initiate the adjacent TNT charges.

The main charge was moulded around every component, making disassembly difficult

Examination quickly revealed the level of deterioration within the fuze mechanisms

The fuzing mechanisms, however, were heavily corroded and it soon became apparent that neither of the actuating sequences could function. The primary and secondary arming plungers were seized into place, with their actuating springs rusted away and no longer capable of applying any force; this means that the mechanism was incapable of arming as designed.

The delay fuze relies on an arming plunger releasing a spring-loaded slide onto a firing pin; this initiates a pyrotechnic delay while also bringing a secondary detonator into line. The space into which the slide moves was filled with aluminium oxide, the slide itself was seized into place and the spring had rusted away. The delay composition was no longer viable and it is likely that the detonator was also non-functional. The same was found with the impact fuze, with all mechanical components corroded and seized, and energetic elements apparently deteriorated.



All of the major fuzing components were badly corroded and non-functional

Conclusions

The conclusion of these findings was that the M5 grenade was completely incapable of functioning as designed. Ageing of the complex fuzing mechanism has resulted in multiple points of failure, effectively rendering the grenade safe. The high explosive charge remained viable; however, there was no internal means by which it could be initiated.

ANNEX B

EXAMINATION OF M67 GRENADE

Background

The M67 is one of a series of grenades, based around similar bodies, but with different fuzing variations. Most hand grenades are straightforward in design, but some variants of the M67 used a more complex fuze incorporating an electronic delay function. The markings on the grenade were faint, so the first priority was to identify the version beyond doubt.

The grenade was in remarkably good condition, considering its age

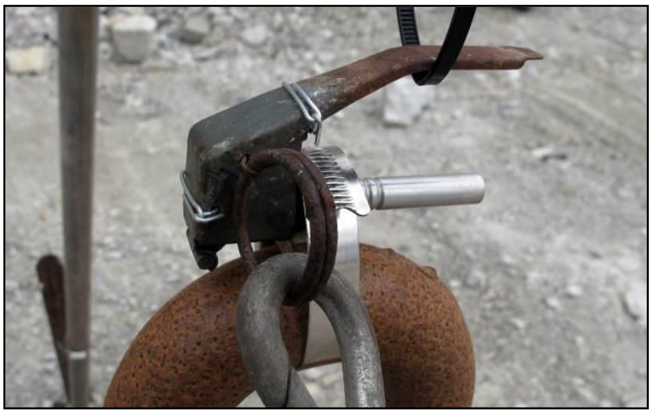
The fuze type and markings confirm that the grenade is indeed a US M67

Examination

Once cleaned, it was clear that the grenade was in surprisingly good condition, with only minimal and superficial rust in places. Markings were just about discernible and confirmed the identification as an M67. The fuze was confirmed as an M213 pyrotechnic delay of the type normally associated with the M67.

Removal of the initiation set (the assembly comprising the fuze, detonator, fly-off lever and safety pin) required a substantial amount of force, but the tight fit and presence of a sealing O-ring had prevented water from entering the grenade body. This meant that the detonator and main charge were in excellent condition.

In order to establish the functionality of the fuze, it was mounted onto the explosive test rig so that the safety pin could be pulled out, using a line, from a safe distance.



Preparing to test the M67 fuze

The result of the detonation

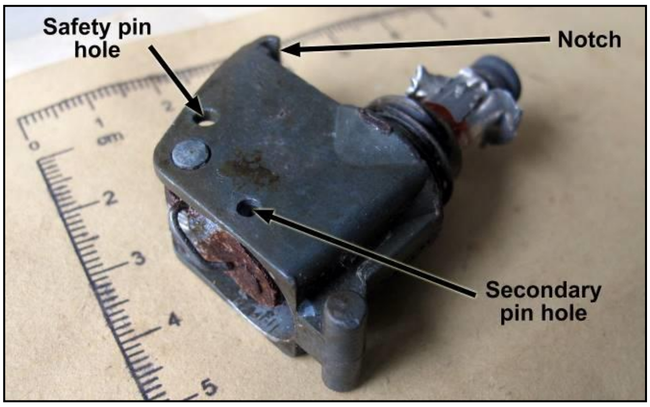
Once the pin had been pulled, there was a delay of approximately 4 seconds before the detonator exploded. This confirmed that the both the fuzing mechanism and the energetic components of the detonator assembly had been fully functional.

Had the body been fitted, there is no doubt that the grenade would have functioned as intended. Unlike the anti-personnel mines encountered during clearance work in the Falklands, this grenade has a 'coined' (pre-fragmented) steel casing with the potential to cause multiple fatalities.

Making safe

The M213 fuze has the provision for an additional safety clip, which is fitted as standard during manufacture. It is normal EOD practice to use duct tape to bind the fly-off lever into position on grenades; however, this is best used as a temporary measure. Duct tape can stretch or creep apart – especially if it is damp and under tension (as it may be if the safety pin fails for any reason).

The secondary pin hole allows a steel pin or wire to be inserted through the fuze body, directly blocking the path of the striker. The notch on the fuze body also allows the fly-off lever to be wired into place. The images below show the locations of these safety features, and how they can be used.



Safety features of the M213 fuze body

Safety wiring with the fly-off lever in place

Conclusions

The remarkably good condition of the M67 grenade was probably due to a combination of materials and build quality; this means that others may also be well-preserved and fully functional.

Of the various components liable to failure, the safety pin is among the most vulnerable. Failure of the safety pin could make movement of the grenade extremely dangerous.

Recommendations

The M67 should be considered, and treated as, a high threat item. Its continued functionality and potential to cause multiple fatalities should be clearly understood.

The render-safe procedure for the M67 should include placement of a steel pin through the secondary pin hole to positively block the impact of the striker.

ANNEX C

EXPLOITATION OF P4B MINES

Background

During the early stages of Phase 5a, a substantial number of P4B mines were located by the LRC and recovered to their storage facility, awaiting destruction. All of these mines were made available for exploitation, the aim of which was to focus on their detectability and functionality.

Detectability

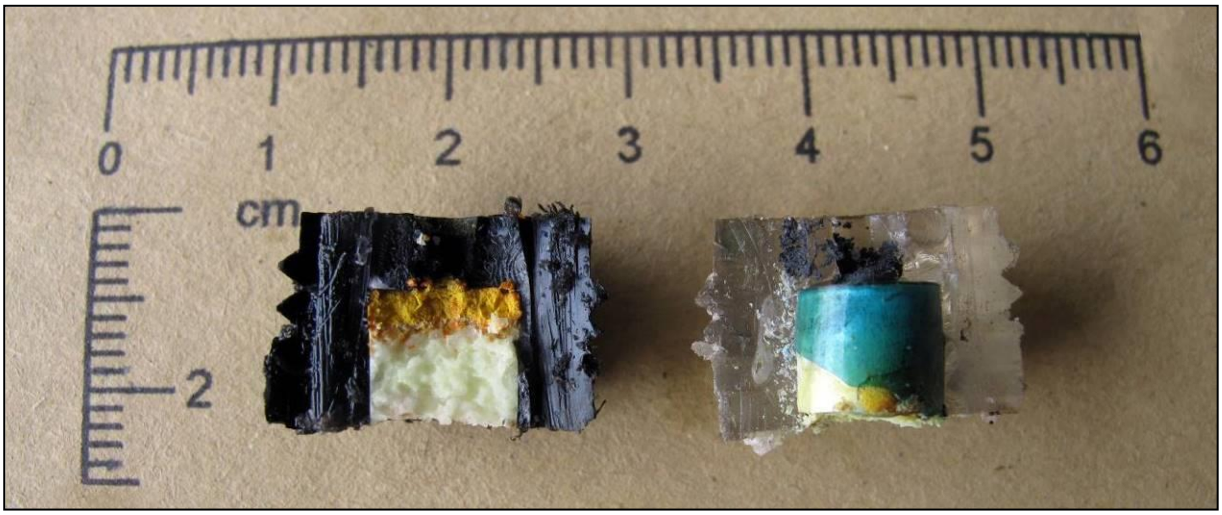
When new, the striker spring of the P4B weighs just 0.14 g is detectable to a maximum of 5 cm. Sometimes the spring cannot be detected at all, and previous exploitation work revealed that many springs have rusted away altogether. The metallic foil covering the main charge also makes little contribution to the detection signature. Until now, this minimal detection signature has meant using manual excavation to locate mines.

Early in Phase 5a, it emerged that many of the P4B mines being encountered were detectable to around 20 cm; all of these more detectable mines came from the same production batch: Lot 1-11-80.

The spring in the P4B fuze is only detectable to a maximum of 5 cm, and many have rusted away

The red metallic foil is a lead/tin/antimony alloy and is virtually undetectable

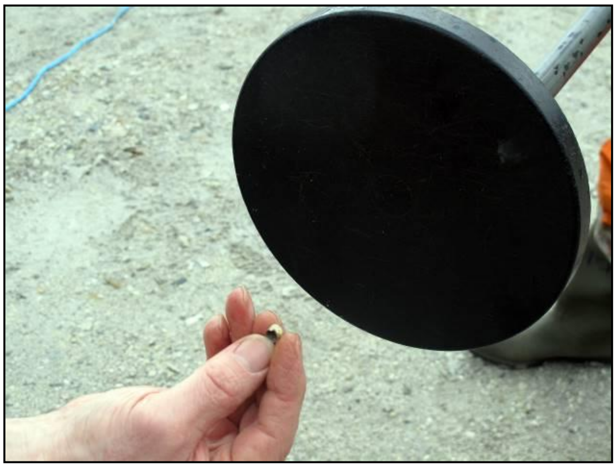
In the P4B mines recovered and examined in previous phases, the detonators were pressed directly into the plastic well of the detonator plug. Examination of the fuzes from mines of lot 1-11-80 indicated that the detonators were contained in small aluminium capsules.



The detonator compositions of mines from 1978 (left) are pressed directly into the plastic of the detonator plug, while those of the 1980 mines (right) are contained in an aluminium capsule

A number of detonator capsules were extracted from mines belonging to lot 1-11-80, and all of the energetic material removed. Each capsule is approximately 7mm in diameter and 6 mm high, made from aluminium alloy and weighing approximately 0.1 g. The capsules were then tested, with the Minelab metal detector used by the LRC, to establish the distance at which they could be detected.

The detonator capsule from a lot 1-11-80 P4B


Testing the detectability of the capsule

Despite the relatively crude test, it was possible to establish that each of these detonator capsules could be detected to around 20 cm (in air, with no other detectable material nearby).

When the additional metallic components of the mine (the remains of the spring and foil) were placed in their normal positions in relation to the capsule, the detection distance often increased. These increases ranged from 0 (no discernible difference) to 5 cm beyond the distance measured using the capsule alone.

Detonator functionality

Detonator function tests were performed, using the improvised test rig, on a number of fuzes recovered from different locations; these included fuzes both with and without aluminium detonator capsules. Only complete fuzes, in good external condition, were selected for the test.

The results were as follows:

- Of the 100 fuzes tested, only 3 produced any reaction at all.
- Of these, two produced a weak effect, indicating that only the composition in the stab receptor had been consumed; this had failed to initiate the primary and secondary explosive in the detonator.
- Only one fuze functioned fully, and would have detonated the main charge in the mine body.


In two fuzes, only the stab receptor functioned, with the detonator failing to explode

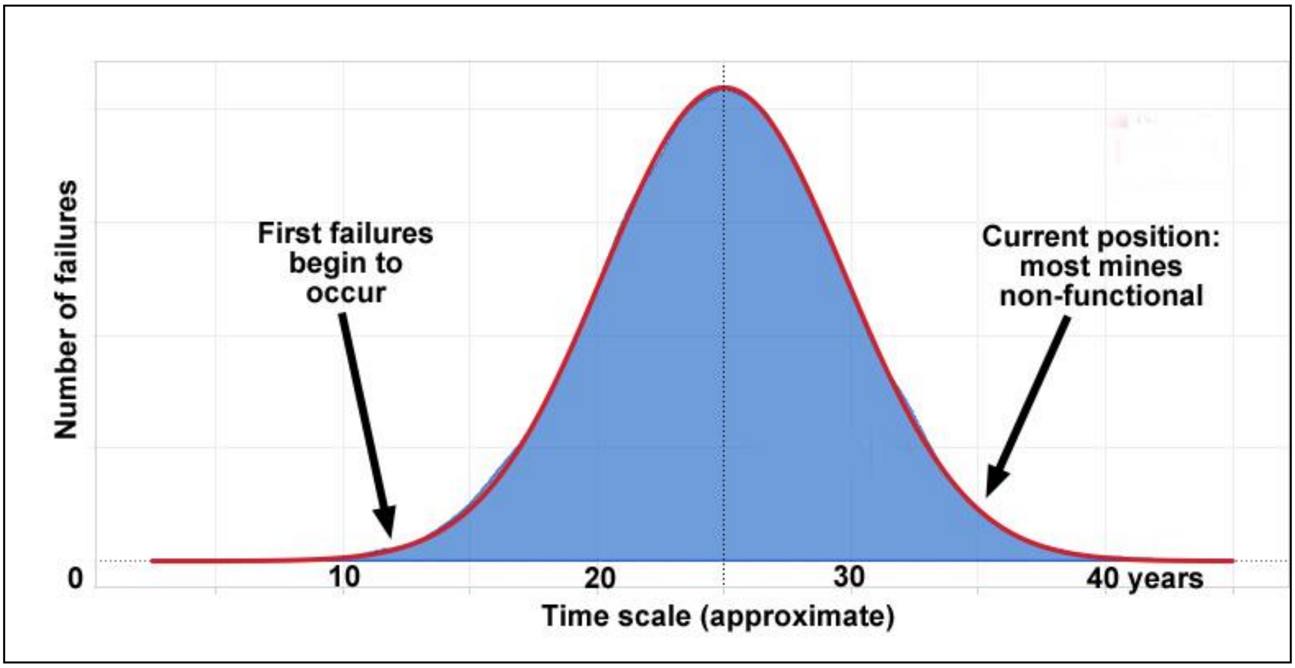

Of the 100 fuzes tested, only one detonated, and would have initiated the main charge

Conclusions

Detection. The detonator capsules in P4B mines from lot 1-11-80 allow them to be reliably detected to a depth of 20 cm or more. This has already allowed the LRC to locate mines substantially faster than they could when using excavation alone.

Functionality. The findings from the functionality testing build on the evidence of previous phases, confirming that the majority of P4B mines are no longer capable of functioning as designed. The sample sizes are too small to have real statistical significance and other factors, such as location and immediate environment, may be influential. However, exploitation and testing appears to indicate that the proportion of mines remaining functional is decreasing noticeably, year on year.

This would support the expectation that the rate of failure among mines is following a normal distribution curve, and that the current position is well towards the end of that curve, as shown in the illustration below.



The decline in mine functionality is expected to follow a normal distribution curve. Testing indicates that most P4B and C3B mines have already reach the end of their functional life
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Residual risk. It is not possible to put precise timelines on the degradation process, nor to predict the overall proportion of mines affected, although additional data may allow more accurate assessments. But it is clear that the residual risk is declining, and that – even now - an accidental encounter with a P4B is unlikely to result in detonation. In future decades, this risk is likely to approach zero.

Although they are very unlikely to be initiated by normal activities, non-functional mines should not be considered ‘safe’. The fuzes and bodies still contain high explosive with the potential to cause destruction and injury. Detonations during the burning process used for disposal by the LRC prove that the majority of the explosive components are still capable of functioning, if they are subjected to sufficient energy.

ANNEX D

ANALYSIS OF 'M1' MINE IMAGES

Background

The following photos were taken of 'M1' mines encountered by the LRC during Phase 4. No exploitation was carried out and CK did not see these mines in the field; however, some basic deductions can be made from the images.

Analysis

Observation

Most images show mines in flat, stable locations, within the bounds of expected burial depths, and with the main assemblies present.

Deduction

This suggests that they have remained largely undisturbed, and that the only significant influences will have been environmental.

Observation

Some mines are heavily degraded, to the point where even thick steel sections have rusted through.

Deduction

This generally appears to be the case with mines on, or near, the surface. In the unlikely eventuality that the fuze were functional, these heavily degraded mines may have lost the structural integrity needed in order to function.

Observation

Although many mines are heavily rusted, a number appear to be in good condition, with external painted surfaces showing only superficial corrosion.

Deduction

The extreme differences in condition are surprising, since the mines are likely to have very similar characteristics, and all mines have been subjected to similar conditions for the same duration. It appears that burial can slow the degradation process.

Observation
The casing of this mine is empty; there is a pronounced upward bend in one of the bars of the 'spider', while the other bar has been displaced.

Deduction
The main explosive charge has almost certainly burned away, blowing out the large round filling plugs in the top surface. Any remaining paint would have been burned off during the fire, rendering the casing more vulnerable to corrosion. Since this mine is on the surface, yet only lightly rusted, it appears that the fire was fairly recent. The damage to the spider bars was probably caused by explosion of the detonator. This indicates that the primary explosive was still viable at the time of the fire.

Conclusions

Energetic components. The booster and main charge of the 'M1', believed to be TNT, are likely to remain serviceable indefinitely. The evidence of detonation seen in one burned-out mine indicates that the primary explosive of the detonator may also be functional. Whether or not the initiating composition within the detonator remains viable will be dependent on how well sealed this assembly is.

Mechanical components. The type of fuze mechanism used in the 'M1' is not yet known, but the expectation is that any metallic components would have degraded to the point where the mechanism could no longer operate. The presence of casings in good condition introduces some uncertainty regarding the condition of fuzes.

Recommendations

Examples of 'M1' mines in good condition should be recovered for exploitation, the purposes of which should be to:

- Characterise the mine (external appearance, dimensions, weight, markings etc)
- Photograph external appearance and internal components
- Confirm the composition and viability of the main charge and booster
- Determine the type of operating mechanism used in the fuze
- Examine fuze components to assess functionality
- Test the functionality of detonators
- Establish whether there is a link between condition (or rate of degradation) and burial depth
- Assess likelihood of any 'M1' mines remaining functional
- Consider implications for clearance methods.