

Comment : Working prone?

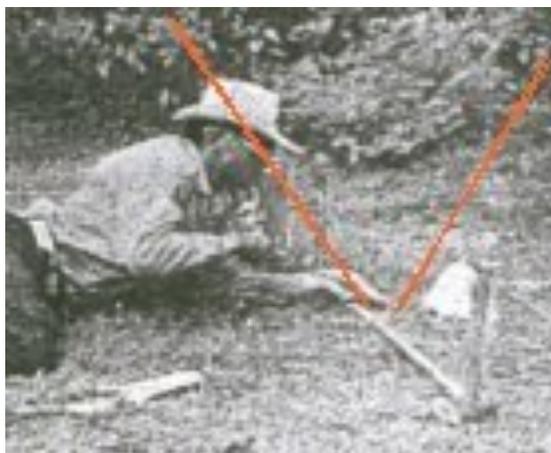
QUESTION: Isn't it safest for a deminer to work in a prone position?

ANSWER: Differences of opinion over the safest position in which to excavate a detector reading do exist. Most groups are flexible, allowing deminers to lie down if they want to - and sometimes requiring that they lie down if working on steep slopes (demining on slopes is always supposed to be done uphill). This last is to improve stability. That said, the vast majority (99.9%) of demining excavations are made from a kneeling/squatting position.

No one works "prone".

This is because working in the "prone position" is not actually possible. Try it with your chest on the ground. You will not be able to see the ground more than a few cm from your head when there is no vegetation stubble, and arm movements to probe/excavate will be cramped and clumsy. If digging to any depth, you must move over the excavation to see what you are doing. Trying to keep your head bent back to see is very uncomfortable. People working in the prone position actually work with their head raised and resting on one forearm. This makes it possible to see and to work up to around 50cm in front of them - but they usually work closer.

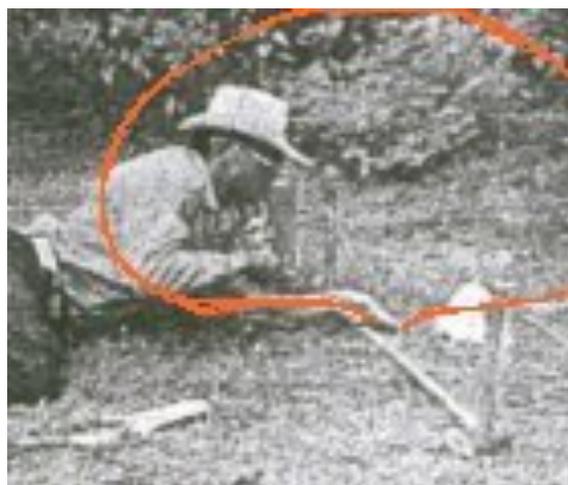
The picture below was copied from the cover of the Cambodia MAC's old SOPs. It shows how the deminer holds himself up and, if he is guiding his prodder, how the length of his forearm dictates the distance he can work away from his elbow. This is the way they were told to work by inexperienced "experts".



His face is barely 40cm from the place where his prodder enters the ground - and the top of his head is within the 60 degree line of the fragment cone (shown in red). Fragments of earth, stone, roots and mine casing are ejected from a blast mine detonation in an "ejecta-cone" that is crudely 60 degrees from the ground.

In fact, the ejecta-cone angle depends of ground-structure and mine depth. If the mine is close to the surface the spread can be far greater. A greater spread means less concentrated fragments, but a wider area of risk. The fragments are generally traveling erratically and slow down very quickly. Most who are aware of the ejecta-cone prefer to have their heads further away than they could be if they were working on one elbow. The CMAC deminer is not even wearing a visor - but in any case the CMAC deminers ignored the SOPs and actually worked kneeling whenever the experts were not there. Several who had accidents in the kneeling position still lost their eyes because of the inadequate industrial "safety" spectacles they had been issued for protection, but sometimes these spectacles worked. One of these victims was even refused compensation because he was in breach of SOPs at the time - because he was not lying down. But that has all changed in Cambodia today - where reliance on outside experts has diminished.

What people are less aware of is the "blast front". Expressed simply, when high explosive detonates, the small volume of HE tries to become a large volume of gas instantly. The interface between the gas and the world is called the "blast front". It does not have the same direction as the material objects ejected as fragments and spreads low to the ground. It is moving very rapidly indeed at first, but because it is expanding by volume, as its volume increases the "blast front" interface slows down. In practical terms, at 5cm the blast front from a [PMN mine](#) will rip all flesh from a hand and may tear whole fingers away. At 30cm it will not.



The blast front is more of a "dome" than a cone, but again its shape is partly dependant on the mine depth and ground-structure. In detonations of mines only just beneath the surface, you can see the surrounding dust being sucked under the dome to fill the low-pressure area behind the expanding blast-front.

If you work in the position shown above (some call it "semi-prone"), your head is subjected to a far greater shock-wave than if you were kneeling and your head were further away. Kneeling does not always mean that the head is further away - but does when appropriate tools are in use (at least 30cm long).

The prone position is a hangover from military training when demining may be undertaken under fire, so keeping a low profile makes sense. Humanitarian Demining is never conducted under fire, so "open-minded" people considered other positions as soon as Humanitarian Demining got going. A few groups disarm mines while lying down, but this does not reduce the risk to their hands (the most common disarming injury). Lying down at such times is probably only of psychological benefit... and if it makes a deminer feel more confident it may have some value.

From the injury data in the Database of Demining Accidents, I can find no evidence that "prone is safer". But since almost no one works prone, I cannot find evidence to show that it is less safe either. In the absence of compelling evidence, the judgment comes down to applying common sense to what is known about small blast events - and about the protective equipment in use.

If a deminer detonates a blast mine in a kneeling position when wearing a 5mm visor properly and using long tools, his head and face will usually be OK. If a deminer detonates the same mine when lying down, there is a greatly increased pressure on the head and far faster fragments hitting the visor. 5mm visors are not perfect: they are simply the thickest practical polycarbonate visor to wear. Tested at 60cm, they perform very well. At 30cm there is a far higher risk of their penetration by ejecta and their fracture by blast-front impact. This has been proven in tests against real mines many times.

Groups that wear 5mm full-face visors on a head frame and frontal apron protection are wearing armour DESIGNED to be used in a kneeling/squatting position. If they lie down, their armour and visors will often be inadequate.

If anyone wanted to work "semi-prone" - they SHOULD wear an

armoured helmet and long-visor - and should wear chest and shoulder armour designed for that position. If visors are compromised or brain injury from shock occurs - the group management that told deminers to put their heads so close to a blast would bear some responsibility for the unnecessary injuries incurred.

Professionals in humanitarian demining do not work "prone" except in very exceptional circumstances.