The Actuator: Demining Innovations

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This approach to humanitarian demining differs from generally accepted methodology. It has not yet been tried, and the purpose of this article is to ensure that the general concept is placed in the public domain, where it may be debated and modified without considerations of intellectual property. Intention Research Corporation, where this idea originated, is not in the business of mine clearance, or of manufacturing mine clearance systems, so the idea is being passed along to the community best capable of analyzing it.

Mines are built to destroy themselves when triggered by an external event. If we can simulate the triggering event adequately, we can clear an area of mines by detonating them on site. For anti-personnel mines this means simulating the tread of humans to the necessary degree of impact and repetition. During this process the system used must not be seriously damaged by the detonation of mines, and operating personnel must be kept safe.

In accordance with John Walker's concept of "Moore's Law in the Minefield," http://www.fourmilab.ch/minerats, our system is intended for local manufacture and assembly using one or more high-technology components produced in high volume at low cost. Our concept differs from Walker's concept of the actuator on the horizontal plane at all times, probably through electronic sensing of cable extensions as processed through simple trigonometry. The control module would contain dedicated microprocessors controlling operation of inputs from sensors located on the suspension poles. The poles then control the electrical actuation of clutches, which apply prime motive power to the positioning cables.

The "closed loop" is formed by the path from cable extension sensors through the microprocessor and its software, to the clutches and to the extension of the positioning cables. Reference monuments would be necessary to allow the system to recalibrate itself, given the inevitable shifting of the poles. The software controlling operation would be built into a processor control module in the form of read-only memories (ROM). The control module would be built to move the actuator successively over every element of the surface below it, and to remember the last position at which the actuator probed. The operators would have a few command states: resume, recalibrate, and stop. The operators may choose to run the system through as many complete passes over the mined land as they desire.

Prime motive power for the system need not be electrical. A shaft would be provided which may be turned by whatever power source is available. The operation of the shaft would generate sufficient electrical power to operate the control module and its clutches, in addition to mechanically performing the shift, drop and lift functions of the actuator. Persons involved in the operation on site must, of course, be protected from the fragments generated by mine detonations by beams or similar obstacles.

This system is intended to take advantage of economies of scale and the low cost of local labor. It should be distributed by a multi-tiered system involving training of local personnel in the process of installation and maintenance, and in the training of on-site operators. Control modules and other high-tech components would be constructed and distributed by organizations having an interest in promoting mine clearance. Lower-technology items would best be manufactured locally, and tools and training must constitute the imported items in this case.

The manufacture of the control modules would be best carried out in the area of the control module, which will better serve those who live with the effects of mines. We also acknowledge that our proposed system contains many items (which will be partially subsidized) should, we believe, include an agreement to resell at controlled prices, perhaps through the agency handling distribution and training in the local country. In this way the allocation of the components goes first to the locality that can raise the initial price, which is then refunded (less depreciation) by the next purchaser and so forth until the components wear out. This would, we hope, be a long time, given that each user sees the components as valuable property to be protected from depreciation and sold off as soon as its local use is complete.

Some might object that we are postulating a billyard-table environment whereas the real world is much more complicated. We acknowledge, of course, that paths will have to be cleared manually to allow the erection of this system on mined land. It is less difficult to demine manually a linear path than a whole field. The presence of brush overgrowing the mine field is an obstacle that can be addressed by fitting brush-clearing attachments to the actuator so as to allow for safe removal. Manual control of the actuator movement may be necessary for this phase.

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