

Disarming Improvised Explosive Devices (IEDs)

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The Problem



Many countries are having to deal with IEDs, (Improvised Explosive Devices) which pose a serious danger to the people living in the affected areas. The team is tasked by HALO to produce a remotely controlled way to cut the wires of various IEDs.

Requirements

- Neutralize wired explosives by cutting the wires cleanly each time
- Practical device capable of being transported easily
- Uses unregulated parts that can be shipped without difficulty and able to pass through airport security and customs
- Capability of being initiated remotely 100 –500 meters away without straight line of sight.
- Durable, waterproof, and mud-proof
- Ability to be manufactured cheaply or by the client in the area they are working

Past Work

Our project started out in 2018 with the design and construction of prototypes to try out different ways of cutting wires. Prototypes 1-3 were to test the best way of powering our cutter. They were sent for field tests to get data and feedback which lead to a 4th prototype. The final prototypes 5, 6, and 7 were created from the experiences and lessons learned from our past work.



Current Designs

- Three different designs using different types of cutting mechanisms
- An off-the-shelf linear actuator was chosen as the common power source to simplify the design and is compact, waterproof, inexpensive, and provides enough force to cut various wire sizes



Prototype 5

- Linear cutting motion against an anvil
- Retractable cutting module for protection
- Carbon hardened tool steel blade
- 2 pins to disassemble



Prototype 6

- Shear cutting motion
- 2 pins to disassemble
- Serrated ceramic blades



Prototype 7-2

- Designed with modified Knipex wire cutters
- All components made with mild steel
- Dimensioned so when the cut is made no more power is being drawn
- 1 pin to disassemble

Our Client

- Mission is to lead the effort to protect lives and restore livelihoods for those affected by war
- Engaged with humanitarian demining in 25 countries and territories around the world
- In their work to make people and places safe they embed themselves in local communities, build capacity and work closely with local and national governments as well as aid and development partners
- They create safe and secure environments, offer opportunities to rebuild lives and livelihoods, and prepare the way for development and long term



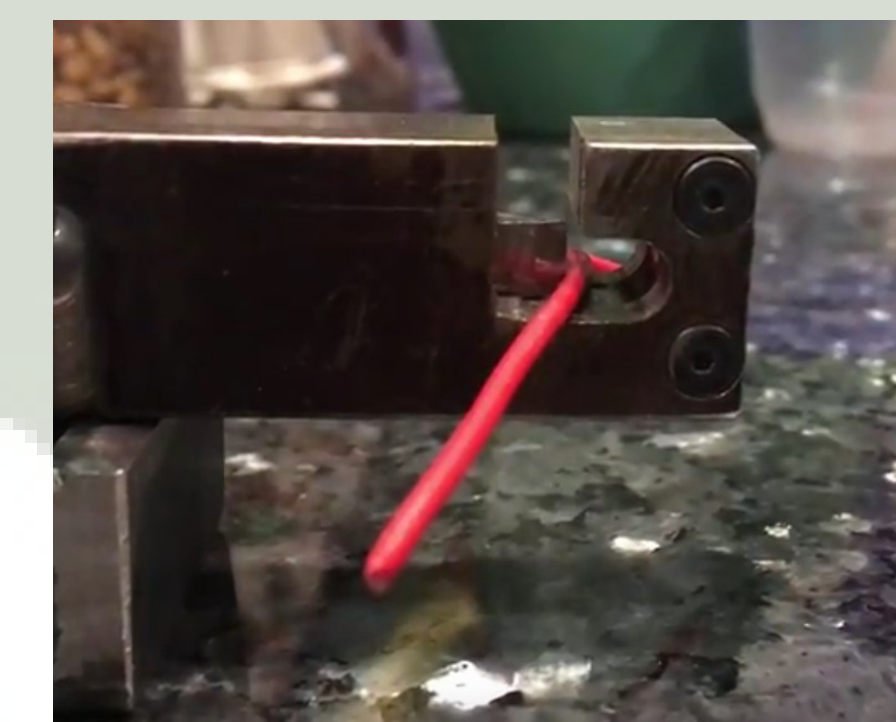
<https://www.halotrust.org/>



Results and Future Work

The project team has developed three prototypes for HALO to use in the field. The cutters will be used to cut different sized wires, leading the team to test eight different wire types and sizes to get an idea of the limit of each prototype. A sample of this data is shown below in the pictures. Prototype 5 and 6 had some difficulty cutting the larger wires, while prototype 7 was able to cut all wires. This gives HALO some options when deciding which cutter to use. For example, prototype 6 could be used for smaller wires where ceramic blades are a safer option, while prototype 7 could be used for the larger wires. The team is also looking into testing how long a 9V battery can supply the linear actuator effectively such that it will not cause an incomplete cut. Moving forward the team is finalizing one more prototype of each design to send to HALO by May to be used in their teaching seminar. This is where field trials will be conducted and the client will be able to see how the prototypes perform in the field, providing feedback for anything they may want to change.

Prototype	5			
Gauge	Type	Clean Cut	Elastic deformation	Additional Comments
30 GA	Solid	No	Small amount	Too small to clean cut
22 GA	Solid	Yes	Small amount	Almost not a clean cut (blade dull)
18 GA	Solid	Yes	Small amount	Almost not a clean cut (blade dull)
14 GA	Solid	Yes	Small amount	Blade dull
12 GA	Solid	No	Small amount	Wire too thick
22 GA	Stranded	Yes	Small amount	Blade dull
24 GA	AV Stranded	No	Small amount	Blade dull
16 GA	Stranded	Yes	Small amount	Blade dull



Acknowledgements

Advisors:

Dr. Don Pratt
Nicholas Torbet (HALO)
John Meyer
Andy Erikson
Paul Myers

Collaboratory Sector

