

Mine Detection Using Radar Bullets

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Abstract: The mines which are implanted during the war time may remain undetected for several decades and may suddenly be activated after that. There are several methods for detection of land mines, such as metal detection and explosive detection. These ways of detection are dangerous because they are done very close to the mines. A safe method for detecting land mines is “mine detection using radar bullets”.

Keywords: Radar bullets, Magnetic flux compression.

1. Introduction

The mines that are implanted during the wartime may remain undetected for several decades and may suddenly be activated after that. Also during wartime mines implanted by our enemy countries are to be detected and diffused properly in order to save the lives of our soldiers. Radar bullet is a relatively a new discovery used specially for the detection of land mines. And this was very important invention because around 85 countries having problems with land mine and approximately 20,000 peoples injured and kill every year by land mine accidents. So we should say that detecting land mines is important for every country today.

2. Basic categorization of land mines

A. Anti-personnel mines

Anti-personnel landmines are designed specifically to reroute or push back foot soldiers from a given geographic area. These mines can kill or disable their victims, and are activated by pressure, tripwire or remote detonation. There are also smart mines, which automatically deactivate themselves after a certain amount of time. These are the most common types of mines currently used by the U.S. military.

B. Anti-tank mines

The basic function of both of these types of landmines is the same, but there are a couple of key differences between them. Anti-tank mines are typically larger and contain several times more explosive material than anti-personnel mines. There is enough explosive in an anti-tank mine to destroy a tank or truck, as well as kill people in or around the vehicle. Additionally, more pressure is usually required for an anti-tank mine to detonate. Most of these mines are found on roads, bridges and large clearances where tanks may travel.

3. Radar bullets

The radar bullet is a special type of bullet. The main use of

radar bullet is to find landmines without setting foot on the ground. This consists of firing a special bullet in to the ground from a helicopter, which could pin point buried land mines.

The bullet units a radar pulse as it grounds to a halt. This pulse strikes the mine and its image gets available on the computer in the helicopter, offering a safe and efficient way of finding land mines.

Radar makes use of radio waves to detect and locate objects. The purpose is to provide estimates of certain characteristics of its surroundings most commonly the presence, position and motion of aircrafts, ships and other vehicles.

Radar operates by transmitting electromagnetic energy into the surroundings and detecting energy reflected by object. If a narrow beam of this energy is transmitted by the directive antenna, the direction from which reflections come and hence the bearing of object may be estimated. The distance to the reflecting object in estimated by measuring the period between the transmission of radar pulse and reception of echo.

4. Magnetic flux compression

Inside the bullet is a metal cylinder, surrounded by a tightly wounded coil of wire. As the bullet leaves the gun, there is a battery generating a magnetic field in the cylinder. When the bullet smashes into the ground, the sudden deceleration forces the cylinder out from inside the coil. The sudden movement of the metal cylinder through the magnetic field induces a large pulse of current in the coil. The coil thus acts like an antenna converting the pulse into a short burst of high frequency radiation.

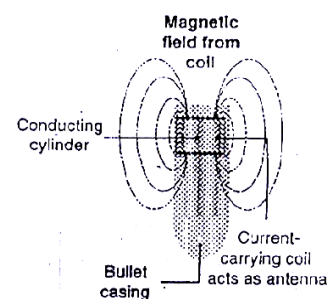


Fig. 1. Magnetic flux compression

5. Advantages

- The light weight system can be fitted to any helicopter i.e., gun, computer controls etc.
- Extremely small bullets can be used for detection A 30 mm

bullet gives out a 4 kW radar pulse. Almost 10 times more power than a standard ground penetrating radar from 20cm down.

- Also since the bullet is beneath the surface of the ground, it transmits more radio wave into the ground. For ordinary penetrating radar, little radiation penetrates the soil, most is reflected by the ground because of the sudden change in density between the air and the soil. Here the radiation has to change the medium twice. First from air to ground, and then after reflection, from ground into air. Therefore, weak signals are obtained. But in radar bullet principle the radiation has to change the medium only once i.e.; from the ground into the air and hence stronger signals are obtained.

6. Disadvantages

- It cannot detect plastic land mines, but researches are working hard to overcome this.
- Since the equipment is to be mounted on a helicopter, the cost of operation is higher. But considering its future prospects and the static's released by red –Cross, cost can never be considered as a disadvantage.

7. Applications

- It can be used for detecting land mines.
- It can be used for detecting buried pipelines. For example: Recently an illegal pipeline carrying drugs between Afghanistan and Turkmenistan has been discovered. Such type of illegal pipelines can be detected out by using radar bullet.

8. Conclusion

Mines are major cause of concern in many countries. Detection and removal of mines is very important as it is hazardous to both man and animals alike.

The conventional methods that are being used right now for mine detection involves working in close proximity for the mines. So overall mine detection using radar bullets is a cutting edge technology that is safe and effective.

With all its advantages it may be hoped that mine detection using radar bullets will be more used in detection of mine there

by making the world safer place to live in.

9. Future prospects

As the UN has already implemented a worldwide ban on anti-personal mines. The invention of radar bullet helps to speed up the destruction of mines.

Ten thousand of anti - personal mines lied buried in the hilly regions of Cambodia/North-Korea/Afghanistan etc. And according to UN it would take more than 100 years to detect and destroy these, if worked out manually. Mine clearance or demining is normally broken into three stages. Detection, Removal and Disposal. Current detection methods range from high tech electronic ground penetrating radar infrared, magnetic resonance imaging to biological detection schemes (dog sniffers and insect or bacteria) to simple brute forces detection methods (Rails, Rollers and plows) and use of hand-held mechanical plodders. Most of these methods are very slow and/or expensive and suffer from a high false alarm rate. So with helicopter and radar bullet, the mines can be cleared easily.

Mass graveyards which result from internal civil wars as in Cambodia, Kosoro and in some African nations can be detected using radar bullets.

This can be applied is future space travels, when we go to a different planet, in that case we can shoot this bullet in to the ground and detect mineral deposits and other deposits.

References

- [1] A. M. Zoubir, I. J. Chant, C. L. Brown, B. Barkat and C. Abeynayake, "Signal processing techniques for landmine detection using impulse ground penetrating radar," in *IEEE Sensors Journal*, vol. 2, no. 1, pp. 41-51, Feb. 2002.
- [2] R. Siegel, "Land mine detection," in *IEEE Instrumentation & Measurement Magazine*, vol. 5, no. 4, pp. 22-28, Dec. 2002.
- [3] L. Collins, P. Gao, S. Tatum, J. Moulton, L. Makowsky, D. Reidy, and R. Weaver, "A comparison of statistical signal processing algorithms for detection and identification of low metal mines," presented at the UXO/Countermine Forum, Anaheim, CA, May 2000.
- [4] D. Hibb, G. A. Barrall, P. V. Czipott, D. K. Lathrop, Y. K. Lee, E. E. Magnuson, R. Matthews, and S. A. Vierkotter, "Landmine detection by nuclear quadrupole resonance," in *SPIE Conf. Detection Remediation Technologies Mines, Mine like Targets III*, Orlando, FL, Apr. 1998, pp. 522-532.