

Airborne detection of minefields:

General information

AIRBORNE MINEFIELD DETECTION PILOT PROJECT

Operational period : 1997 - 1999
Country : Mozambique
Value : US \$ 4,850,000
Current status : In progress

Funding agency: European Commission, Governments of Belgium, Germany, Luxembourg, Portugal, United Kingdom and own contribution consortium members

Background

Since the Second World War, according to United Nations estimates, a total of 70 million mines have been laid worldwide in wars, civil conflicts and in campaigns of blind terrorism against civilians. Most of these landmines around the world do not have self-destruction mechanisms. In spite of great international willingness to provide aid in this area, serious accidents continue to occur in the over 60 affected countries. The International Committee of the Red Cross estimates that up to 26,000 people become mine victim each year or in other words: every 20 minutes somewhere a landmine induced accident occurs. Women and children account for a very large share of the victims. The lost labour productivity resulting from landmine injuries cripples the economy and remains a permanent impediment to the economic recovery of countries after the turmoil of war has finished.

Minefields not only affect people, they also affect national economies. They hinder transport of people and goods, limit the possibilities for agriculture, etc. Often entire villages have to be evacuated and the affected population roams around as homeless refugees. In war affected areas billions of dollars, which could be used to rebuild the economic and social infrastructure instead, have to be used to clean the debris of war.

Landmines may be the most widespread, lethal, and long-lasting form of pollution we have yet encountered (U.N. Secretary General, 1994). Up till now about 10 million anti-personnel mines per year have been produced. The production costs of an anti-personnel mine are between three to 30 dollars. To remove a mine about 300 to 1000 dollars have to be spend.

Even if all mines were to be banned immediately it would take thousand years, at today's pace of mine clearance, to remove the mines currently in place. The current demining technology is slow, expensive, dangerous, and can only cover a few hundred square metres per day. On every 5000 cleared mines a deminer is killed and two others are injured.

In order to accelerate the mine clearance process new demining methods are urgently necessary. The military has developed remote sensing techniques to detect minefields. Since the need for humanitarian demining has increased, many of these sensors and techniques are now also available to detect minefield from commercially available platforms and sensors.

In this project it is tried to detect minefields by combining the results of several airborne remote sensing sensors which are used on test fields. This Pilot Project, in order to be as useful as possible, will demonstrate the airborne remote sensing detectability of minefields in four test areas in Mozambique. Each test area represents a different type of landscape, with variations in relief, vegetation type and density, climate, soil type, etc. Also the conflict history is different. The sensors used cover the optical, infra red (thermal) or microwave (radar) region of the electromagnetic spectrum.



minefields can be found by airborne remote sensing. These minefields were constructed more than one year prior to the airborne survey and the type of minefields reflected the Angolan situation.

In order to ensure maximum likelihood of detecting anti-personnel and anti-tank minefields under diverse terrain/vegetation conditions, six core sensors were employed:

- Two optical sensors in the visible/near infrared region:
 - Two Metric Cameras with panchromatic, pan-IR, colour and colour infrared film and the VOS 80C digital camera
- Two thermal sensors in the thermal infrared region:
 - MFLIR (Forward Looking Infrared) (3-5 μm) and the CA-860 Infra Red Line Scanner (8-12 μm)
- Two sensors in the microwave region:
 - P-band and X-band radar

The test area was flown with various sensors, at various times of the day and night, at various altitudes, under various weather and daylight conditions, and with various instrument settings. A ground truth survey was carried out in the field during the airborne survey to collect relevant ancillary data. Not only did the team find most of the minefields, but also a high percentage of individual landmines, both anti-tank and anti-personnel landmines, were detected correctly.

Based upon this test the most promising sensors were mobilized to Mozambique and the selected areas were recorded. The analysis is even more challenging as the majority of the mines laid are anti-personnel mines and some the minefields have been constructed more than twenty years ago. Apart from the airborne survey also a satellite change detection analysis is performed.

Results

The data of the Mozambique airborne campaign are processed, analyzed and orthophoto maps are being prepared. During May 1999 the suspected areas were verified in the field. The minefields identified proved to be correct. Further detailed field validation is in progress. The detected minefields are plotted onto the detailed photomaps to accelerate the demining effort.



Objectives

The objectives of this ITC-coordinated landmine detection project are:

1. To carry out an Airborne Remote Sensing Pilot Project in four test areas in Mozambique, to find minefields.
2. To demonstrate feasibility of the proposed methodology.
3. To test European sensors, expertise and cooperation by means of this Pilot Project, in order to improve any weaknesses, deficiencies discovered during Pilot Project, in order to establish a European prototype minefield detection capability based on remote sensing.
4. To prove ability of remote sensing systems to detect minefields over large and varied tracts of land in a much more cost-efficient, safer and reliable manner.
5. The Pilot Project will also serve to establish if the multisensor data fusion system is efficient for processing the data and to what level of accuracy the minefields are determined.

6. To produce detailed maps showing precise location of minefields in the four test areas, selected to be representative of four different types of Mozambican terrain, with different vegetation, soil, relief, climate, etc.

Activities

This Pilot Project will demonstrate the airborne remote sensing detectability of minefields in four test areas in Mozambique (note: it had originally been planned to do this project in Angola, but due to uncertain security situation, the project diverted to Mozambique). Each of the test areas represents a different type of landscape, with variations in climate, relief, vegetation type and density, soil type, etc. to see if the approach is reliable in different parts of the country. More than 650 km² were flown during the months of October and November 1998, in Mozambique.

Prior to the project in Mozambique a "blind" test was carried out in May 1998 in Belgium to prove that

References:

Final Project Proposal:
Pilot project for airborne minefield detection (May 1997).

or

<http://www.itc.nl/ags/conference>
<http://www.itc.nl/ags/projects>

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