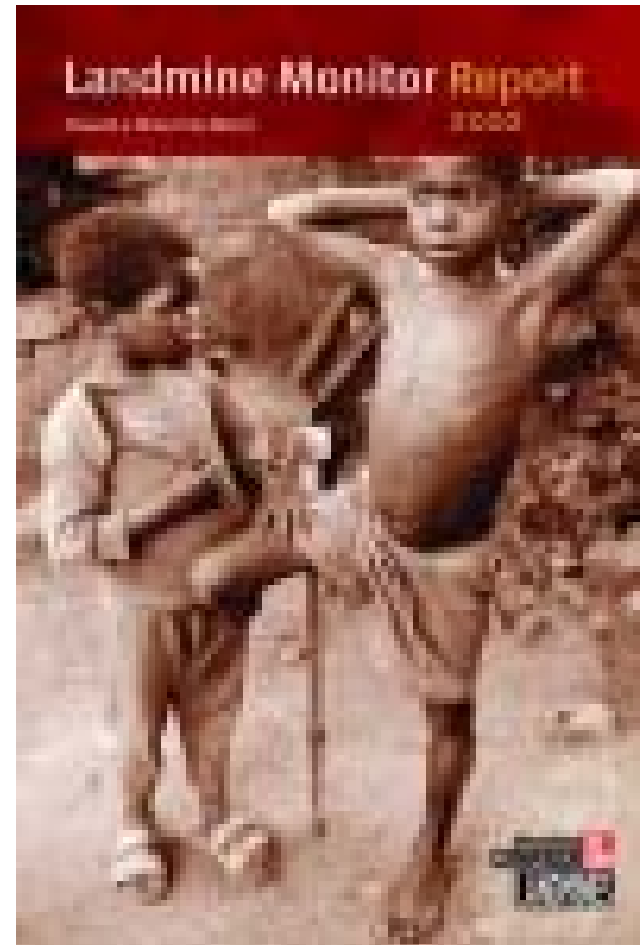

EGYPT LANDMINE PROBLEM: HISTORY, FACTS, DIFFICULTIES AND CLEARANCE EFFORTS

Said M. Megahed, Hussein E.M. Ali & Ahmed H. Hussein

Mechanical Design & Production Engineering Department
Faculty of Engineering – Cairo University

smegahed@cu.edu.eg



Outline

- **Landmine Problem Statement**
- **History of Egypt Landmine Problem**
- **Facts of Egypt Landmine Problem**
- **Egypt Socio-Economic Effects**
- **Difficulties in Humanitarian Demining**
- **Egypt Landmines Clearance Efforts**
- **Summary**

Landmine Problem Statement

- Landmines represent a serious danger in a number of regions of the whole world including Egypt
- Some landmine fields are well known, mapped and mostly even fenced-in
- When no correct information exists about landmines, they pose the greatest threat and this is the Landmine Problem

Landmine Statistical Data/Country

| Country / region | Number of Landmines | Field type |
|---------------------------|------------------------|---|
| Egypt | 22 millions | Sandy desert |
| Angola | 10-15 millions | Not known |
| Afghanistan | 9-10 millions | Dry, desert, rocky and clay ground, vegetation. Residential. |
| Cambodia | 8-10 millions | Vegetation |
| Kuwait | 5-10 millions | Sandy desert |
| Yugoslavia without Kosovo | 6 millions | Not known |
| Bosnia & Sarajevo | Not known | European environment: vegetation growing wild among ruined houses |
| Lebanon | Not known | Rocky high ground |
| Mozambique | 2 millions | Not known |
| Somalia | 1 million | Not known |
| Latin America | 0.3-1 million | Not known |
| Croatia | Not known | Vegetation, residential/industrial areas, machinery. |
| Iraq | Not known | Semi-arid region |
| Other countries | 6.7-33 million | Not known |
| Total | 70-110 millions | |

Causalities, Statistics and Cost

- **1 million** Persons killed or maimed by APL since 1975
- **100,000** Persons killed or injured by APL in the 1900s in USA
- **26,000** Persons were killed or maimed annually by Landmines
- **70** Persons were killed or injured daily by Landmines
- **33%** US casualties caused by Landmines during Vietnam War

- **250 million Stockpiled Landmines worldwide Now**
- **110 million Landmines in the ground worldwide**
- **2.5 million New Landmines laid each year**
- **350 Different types of Landmines**

- **\$33 billion** Total cost of removing the planted Landmines
- **\$1,000** Average cost of removing one Landmine
- **\$3** Average cost of planting a cheap Landmine
- **12 million km² of land** around the world

History of Egypt Landmine Problem

- West-Egypt (El-Alamain) had been contaminated with all types of Landmines from **World War II 1939-1945**

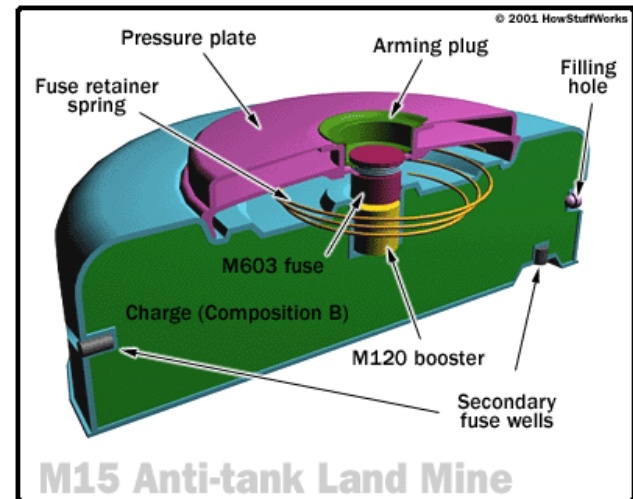
and

- East-Egypt (Sinai) is contaminated with Landmines ERW from armed conflicts between **Israel and Egypt in 1956, 1967 and 1973**

Types of Landmine in Egypt

| World War II | Israeli-Egypt Conflicts |
|---|---|
| British: MK5, MK7 German: Rieglmine 43, S mines, Tellermine 35, 42, 43 Italian: B-2, V-3. | Egyptian: M71, TM46, T79 , TS50, MOTAPM Israeli: MOTAPM |
| There is also a wide variety of ERW in the infested areas of Egypt including air dropped bombs | |

Different Types of Landmines



Facts of Egypt Landmine Problem

Egypt Landmine Monitoring Reports (2008 & 2009)

www.icbl.org

| | 2008 | 2009 |
|------------------------------------|--|---|
| Mine Ban Treaty Status | <ul style="list-style-type: none"> • Not a State Party | |
| Production, Transfer and Stockpile | <ul style="list-style-type: none"> • Unknown, but thought to be substantial | <ul style="list-style-type: none"> • Egypt has stated that it stopped production of antipersonnel mines in 1988 and export in 1984 |
| Contamination | <ul style="list-style-type: none"> • Antipersonnel and anti-vehicle mines, UXO and ERW | |
| Estimated area of Contamination | <ul style="list-style-type: none"> • 2,680 km², to be significantly reduced by technical survey | |
| Demining progress | <ul style="list-style-type: none"> • None | <ul style="list-style-type: none"> • The “Support to the North West Coast Development Plan and Mine Action Project” between Egypt and UNDP was signed in November 2006. • An extension was due to run until December 2009 |
| Mine/ERW casualties | <ul style="list-style-type: none"> • Total: 25 (2006: 22) • Mines: 10 (2006: 8) • ERW: 14 (2006: 8) • Unknown: 1 (2006: 6) | <ul style="list-style-type: none"> • Total: 40 (2007: 25) • Mines: 6 (2007: 10) • ERW: 33 (2007: 14) • Unknown: 1 (2007: 1) |

Egypt Landmine Monitoring Reports (2008 & 2009)

www.icbl.org

| | | |
|---------------------------------|---|---|
| Casualty analysis | <ul style="list-style-type: none"> • Killed: 8 (2006: 9) • Injured: 17 (2006: 13) | <ul style="list-style-type: none"> • Killed: 14 (2007: 8) • Injured: 26 (2007: 17) |
| Risk Education capacity | <ul style="list-style-type: none"> • Inadequate | <ul style="list-style-type: none"> • Risk Education was included in the joint UNDP/Egypt project signed in November 2006, yet little has been implemented. • In July 2008, the Chair of the State Information Service stated that a three-month RE campaign in Matruh, Alexandria, Suez, Al-Arish, northern and southern Sinai, and Ismailia governorates would take place, but no activities had taken place as of July 2009 |
| Availability of services | <ul style="list-style-type: none"> • Unchanged-inadequate | |
| Mine action funding | <ul style="list-style-type: none"> • \$500,000 (2006: none) | <ul style="list-style-type: none"> • \$918,244 (2007: \$500,000) |
| Key developments | <ul style="list-style-type: none"> • In mid-August 2008, it was announced that demining would begin before the end of the month. | <ul style="list-style-type: none"> • From 7 February 2009 until 31 July 2009, demining operations were reported to have cleared 210214 items of UXO and 13720 mines from 14474 acres (approximately 58.6 km²). • It has not been possible to verify these figures, which seem high given the available resources |

Egypt Official Landmine Data

- The Egyptian government cites a figure of 23 million landmines emplaced in the country.
- Official Egyptian sources estimate that:
 - 16.7 million landmines affect 248,000 hectares (2,480 million square meters) in the western desert area
 - 5.1 million landmines affect 20,000 hectares (200 million square meters) in eastern areas.
- Other Egyptian officials have stated that:
 - only 20-25% of these “landmines” are really landmines, the remainder being other types of unexploded ordnance (UXO).

Estimated and reported number of Mine/ERW casualties in Egypt

| Year | Causality Analysis | | | | | | |
|------------------------|--------------------|--------|---------|-----|-------|------|-------|
| | Total | Killed | Injured | Men | Women | Boys | Girls |
| 1945-1999 ¹ | 8313 | 696 | 7617 | NA | NA | NA | NA |
| 2000 | 12 | NA | 12 | NA | NA | NA | NA |
| 2001 | 11 | NA | 11 | NA | NA | NA | NA |
| 2002 | 18 | 5 | 13 | NA | NA | NA | NA |
| 2003 | 14 | NA | 14 | NA | NA | NA | NA |
| 2004 | 10 | NA | 10 | NA | NA | NA | NA |
| 2005 | 16 | 6 | 10 | NA | NA | NA | NA |
| 2006 | 22 | 9 | 13 | NA | NA | NA | NA |
| 2007 ² | 25 | 8 | 17 | NA | NA | NA | NA |
| 2008 ³ | 40 | 14 | 26 | 28 | 1 | 11 | 0 |
| 2009 ⁴ | 22 | 13 | 9 | 13 | 0 | 8 | 1 |
| Total | 8503 | 751 | 7752 | NA | NA | NA | NA |

Estimated and reported number of Mine/ERW casualties in Egypt

| |
|--|
| 1. Year 1999: Estimation by the Egyptian Official Authorities and Egypt Landmine Monitoring Report. |
| 2. Year 2007: 1 incident in May 2008 in Alexandria governorate, the explosion of a World War II SHELL that was being dismantled for scrap metal caused 17 casualties (4 killed and 13 injured). |
| 3. Year 2008: 40 Landmine/ERW casualties in eight governorates from 11 incidents. ERW caused 33 of casualties, landmines caused 6, and an unknown device caused 1 casualty. 3 incidents involving 4 casualties in Matruh governorate, 2 incidents in Ismailia, and 1 incident in each of Albihira, Al Suez, Alqaliobia, Alexandria, North Sinai, and Alsharqia governorates. 2 incidents causing 5 casualties occurred while people were illegally crossing Egypt-Libya border and 29 casualties in scrap metal trade. 3 casualties in each of playing with ERW, playing/recreation, and travel, and 1 casualty in each of agriculture and fishing/hunting |
| 4. Year 2009: 4 casualties in each of agriculture, fishing/hunting, 3 casualties in each of travel, playing with ERW, and playing/recreation, and 1 causality providing security; in addition to 4 unknown casualties. In May 2009, a police officer was injured when he handled a landmine while working at the Egypt-Israel border. |

According to Egypt Landmine monitoring Reports (www.icbl.org):

- the mine/ERW casualties include men, women, boys, girls, children under the age of 18, civilian and military people.
- Among 50 accidents cases:
 - (16 accidents were reported at suspected areas (32%)
and
 - 34 accidents were reported outside the infected areas (68%).



Egypt Socio-Economic Effects

Egypt Socio-Economic Effects

The impact of contamination is significant on the following activities in Egypt:

- **Irrigation projects, which represent one of the essential facets of national development projects in desert areas, have experienced delays. This prevents the establishment of new communities in the northern coast area.**

Egypt Socio-Economic Effects

- **Oil and gas extraction are delayed from reserves estimated at:**
 - **4.8 billion barrels of oil and**
 - **13.4 trillion cubic feet (379 billion m³) of natural gas in the western desert.**

Egypt Socio-Economic Effects

- **Tourist projects have been hindered on the northern coast.**
- **New kinds of tourism, such as safari and eco-tourism, can encroach on affected areas, increasing the risk of incidents.**
- **It is necessary to warn people of potential hazards, but there is a fear of discouraging travel to the country**

Difficulties in Humanitarian Demining

Demining Techniques

Military Demining

military force prepares a safe corridor for the troops to move through

Acceptable: 80%
clearance success

Flail machine can be used

Humanitarian Demining

the entire land area must be cleared free of mines to be productive.

UN-Standard: 99.6%
clearance success

Currently with manual demining method

Egypt Landmines Maps



These Maps are misleading because of their limited accuracy

Maps Data Sources

- *North Western Coast Soil Survey and Reports: FAO 1970.*
- *Land Master Pla: Euro consult-pacer Consultants (LMP1986).*
- *The Geology of Egypt. EGPC 1988.*
- *Topographic Maps 1: 100,000: Department of Survey and Mines. EGSA 1970.*
- *Landsat ETM+ of 5 scenes of year 2001 (P178 R039, P179 R038, P179 R039, P180 R038, and P180 R039) and Mosaic Landsat TM of zone 35 year, 1990*
- *Water Science Department, Alexandria University*

Complications and Description

- 1 **Landmines locations are usually unknown.**
- 2 **Landmines are often discovered by accidents.**
- 3 **Maps indicating the locations are useful in few cases.**
- 4 **Mines that have been in place for years:**
Can be corroded, waterlogged or impregnated with mud or dirt, and then behave quite unpredictably.
- 5 **Floods and heavy rains:** may cause mines to move from the original place to another or to move deeper into the ground.
- 6 **Mines placed near buildings:** may lie deep under fallen rubble with more mines laid on top
- 7 **Stakes supporting fragmentation mines**
- 8 **Tripwires may run through**



Complications and Description (cont')

9

The vegetation grown in many years after the land-mines were laid: an obstacle to demining operations.



x

border between Croatia & Republika Serbska within (present and 8 years before)

10

Type of terrain: Plenty of metal fragments represent an obstacle for the use of metal detector. Uneven rocky terrains.

Photo: MCPA, Afghanistan

x

11

Mines buried in a sandy desert: can easy move deeper.

Photo: Western Desert, near Al Alamein

x

12



Mine age implies high sensitivity of mines.

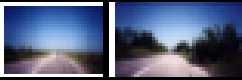


13

The climate is extremely unpleasant for deminers.

14

Mines status are not expected as well: Waiting for press , Or Already pressed and waiting for release in order to be activated.

| Complications | Description | |
|--|--|--|
| Landmines locations are usually unknown | Because landmines are very cheap and easy to build weapons, they have been largely used in different types of conflict, by military or | |
| Often discovered by accidents | Associations like the Red Cross when they have to provide support for mine victims. | |
| Maps indicating the locations is useful in few cases | Demining operations may not start until years after the minefield was laid and during this time the conditions of the affected lands can drastically change. | |
| Mines that have been in place for years | Can be corroded, waterlogged or impregnated with mud or dirt, and then behave quite unpredictably. |  Photo: J. Trevelyan |
| Floods and heavy rains | May cause mines to move from the original place to another or to move deeper into the ground. |  |
| Mines placed near buildings | may lie deep under fallen rubble, with yet more mines laid on top) | |
| Stakes supporting Fragmentation mines | May fall over and may rot, leaving the fragmentation mines half buried lying on their sides. | |
| Tripwires may run through | The branches of the scrub & may pull the pins from the fragmentation mine as the branches sway in the wind. | |

| Complications | Description |
|--|---|
| The vegetation grown in many years after the landmines were laid | <p>Border between Croatia and Republika Srpska, 8 years after mines were laid can represent a very big obstacle to demining operations.</p>  <p>Photos: J. Trevelyan</p> |
| Type of terrain itself can cause many problems to mine clearance | <p>Plenty of metal fragments represent an obstacle for the use of metal detector. Uneven rocky terrains add complications to the mine removing operation</p>  <p>Photo: MCFPA, Afghanistan, Prof. J. Trevelyan</p> |
| Mines buried in a sandy desert | <p>Can easy move deeper when the wind blows the sand</p>  <p>Photo: Western Desert, near to Al Alamein (Prof. J. Trevelyan)</p> |
| Mine age implies high sensitivity of mines. | In Western Desert and Sinai Peninsula, age of most of the explosive materials is up to 65 years. (high sensitivity) |
| In Western Desert and Sinai Peninsula, the climate is extremely unpleasant for deminers. | Temperatures up to 55°C are common. The conditions are either dusty, sandy or muddy (salty mud and swamps) along the coast: sometimes both. The muddy areas and marshes are particularly difficult to deal with as it is often impossible to stand in the mud. |
| Mines state are not expected as well. | Array of mines as those German mines in the World War II waiting for press in order to be activated. Already pressed under certain weight of contaminations and waiting for release in order to be activated. |

Associated Technical Problems

- **The use of all available knowledge to improve the efficiency and safety of landmine detection and removal techniques.**
 - Developing sensors to detect explosives and metal parts
 - Developing operating mobile platforms to carry these sensors without detonating the embedded landmines
 - Developing Control algorithms, image and signal processing
 - Creating real Maps of infested Areas



Egypt Landmines Clearance Efforts

Egypt Landmines Clearance Efforts

- All Demining work is handled by a division of the Ministry of Defense in Cairo the Egyptian Military Engineering Organization (**EMEO**).
- **Since 1946**, according to the Egyptian Official Authorities:
In the past 15 years:
- **7 million** mines have been cleared from the western desert
- **3 million** from the Sinai desert.
- That leaves at least **22 million** others.

Egypt Landmines Clearance Efforts

- In July 2002, the Government of Egypt has established the "National Committee for the Northwest Coast Development and Landmine Clearance".
- This Committee is headed by the Ministry of Planning and International Cooperation.
- Demining Programs aim to propose and implement regional developmental programs for the Northwest Coast and its desert back areas up to the year 2017

Egypt Landmines Clearance Efforts

- **The responsibilities of this National committee are:**
 - **conducting studies and establish programs and plans for landmine clearance in the designated areas,**
 - **revising financial plans for the programs related to Landmine clearance as well as available grants and assistance from countries, agencies, international organizations,**
 - **presenting allocation suggestions within the scope of the designed objective,**
 - **verifying and following-up on the implementation of the programs and plans prepared for Landmine clearance, preparing draft laws and decisions and research necessary for Landmine clearance projects.**

-
- **The Egyptian government is now pursuing a more open policy, recognizing that information is needed to help secure assistance.**
 - **Until recently, all aspects of minefields and Demining are classified.**

Summary

Landmines detection and removal needs the answers of the following questions:

1. What are the difficulties of detection and clearance of landmines?
2. What is the most efficient technique for exploration, localization, and mapping of such landmines?
3. What is the most efficient sensor (s) used in the detection process of different landmines types?

Summary

1. **Egypt National Income** is greatly affected by Landmines problem according to Egypt Landmine Monitoring Report 1999-2009
2. The **exploration, localization, mapping,** and removal of these landmines have a very positive impact on the economy of Egypt.
 - Area Reduction Techniques
 - Developing new sensors able to differentiate between explosive and non-explosive materials
3. Remotely Operated Vehicles ROV and UAV technology may play a good role in landmines detection and removal in Egypt.
4. This needs **Grants and Funds** of all related international organizations

Thank You