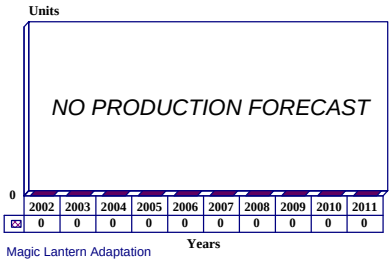
Magic Lantern Adaptation - Archived 04/2003

Outlook

- This report provides supplemental information to the "Magic Lantern" report
- Forecast International expects Kaman Aerospace Corporation to continue its Magic Lantern Adaptation research and development efforts over the next decade
- For a detailed analysis of the Magic Lantern system, see separate report titled "Magic Lantern"

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. Magic Lantern Adaptation (MLA) is an airborne mine detection system. It uses a laser mounted on an unmanned aerial vehicle to locate mines in coastal waters. MLA is an adaptation of the Magic Lantern Deployment Contingency system developed by the Kaman Aerospace Corporation.

Sponsor

US Navy
USN Sea Systems Command
Washington, DC
USA

Naval Surface Warfare Center
Coastal Systems Station
Panama City, Florida (FL)
USA

Contractors

Kaman Aerospace Corporation
Old Windsor Road
PO Box 2
Bloomfield, CT 06002-0002
USA
Tel: +1 860 242 4461
Web site: http://www.kamanaero.com
(Prime Developer and Manufacturer of Magic Lantern)

Status. The Magic Lantern Adaptation program was sponsored by the US Navy to study the problems associated with electro-optic mine detection in coastal waters. The MLA program was successfully completed in 1995. Currently, Kaman Aerospace is conducting further research and development activities of the Magic Lantern Adaptation mine detection system.

Total Produced. Two advanced development models of the Magic Lantern system were produced in 1993. The two models were used for the Magic Lantern Adaptation demonstration in 1995.

Application. To locate mines in coastal waters.

Price Range. Indeterminate

Technical Data

Characteristics. The Magic Lantern Adaptation system is a modification of the Magic Lantern Deployment Contingency system. The major alteration is in the MLA sensor. The MLA sensor adds functions to achieve high probability of detection and low probability of false alarm in coastal waters. For a detailed analysis of the Magic Lantern system, see the report titled "Magic Lantern."

Variants/Upgrades

This section is not applicable to the Magic Lantern Adaptation system.

Program Review

Background. The Magic Lantern Adaptation project was part of the Mine & Expeditionary Warfare Advanced Technology Program (previously titled Shallow Water Mine Countermeasures Demonstration Program). The MLA effort was designed to demonstrate and evaluate the ability to modify the Magic Lantern advanced development model to detect mines along an extended, hostile shoreline in support of amphibious landings.

First year activities of the MLA project focused on upgrading the analytical performance model. Other activities included tank and pier testing of the optics imaging components.

By the end of fiscal year 1993, efforts had been initiated to reorient the Magic Lantern cameras to survey a surf zone in a horizontal plane. Additional work consisted of designing and fabricating a bottom follower capability. This capacity enabled surf zone detection of minefields. During this time, Kaman Aerospace was awarded a contract to fabricate an engineering development model. The model was to be used for testing.

In Fiscal Year 1994 software algorithms were developed, enabling initial target recognition. This capability was essential to the success of the MLA system. Hardware fabrication was also finished and at-sea testing of the imaging system begun.

The major components of the Magic Lantern Adaptation demonstration were completed by year end 1995. During the last year, program work focused on completing system testing under authentic conditions. Critical environmental and technological parameters were identified as inputs for future investment. Other activity focused on the creation of more automatic target recognition capacity. Finally, plans were developed to reduce the size and weight of the existing hardware so the system could be installed on smaller platforms.

Funding

No further funding has been allocated for this program.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Kaman Aerospace	13.1	Jan 1993 – Contract award for a demonstrator system.

Timetable

Year	Major Development
1991	Shallow Water MCM Countermeasures Demo program established
1992	Design of Mark I processor completed

Year	Major Development
1993	EDM contract awarded to Kaman Aerospace
1994	At-sea test sites for validation developed and at-sea testing of the imaging system initiated
1995	Proof-of-concept testing completed. Efforts transferred to "contingency system" low-rate production

Worldwide Distribution

The Magic Lantern Adaptation program was strictly a **United States Navy** program.

Forecast Rationale

Coastal waters represent a difficult challenge for electro-optic mine detection systems. Seacoast waters contain dense clutter from vegetation, fish, and man-made objects, making it hard to locate mines. Laser mine detection is further complicated by the water-to-land transition, which has a significant impact on target signal-to-noise ratios (SNR). Moreover, wave action from the sea, as well as the sea surface itself, can distort or "geometrically warp" mine targets.

To study the problems facing laser mine detection systems, the US Navy sponsored the Magic Lantern Adaptation (MLA) program. The specific mission of the MLA project was to collect and analyze coastal water data. Analysis of the information gathered revealed a dilemma for automatic target recognition algorithms. Namely, the algorithms had a hard time distinguishing land clutter from underwater mine targets.

Land images typically have high SNR clutter, with crisp edges. Underwater images typically have lower SNR clutter, with blurred edges. To better distinguish land images from underwater images, target feature thresholds were made to vary. Thresholds varied as a function of the SNR of image features within images, and as a function of a measure of the edge crispness of the image features.

Using MLA data and a new algorithm, the ability to vary target feature thresholds to reduce false alarm rates was successfully demonstrated. Four features of the new algorithm were developed based on expected target shape and resolution:

1. A contrast difference measure between circular targets and their local backgrounds,
2. A signal-to-noise ratio,
3. A normalized correlation, and
4. A target circularity measure.

Results showed a target probability of detection and classification of 50 percent to 78 percent, with false alarms per frame equaling less than 4 percent.

Mine-free coastal waters guarantee the safe and successful landing of amphibious forces. Consequently, Forecast International expects Kaman Aerospace Corporation to continue its Magic Lantern Adaptation research and development efforts over the next decade.

Ten-Year Outlook

Due to program completion, no additional production is forecast. Consequently, the Ten-Year Outlook chart has been omitted.

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