

# ARCHIVED REPORT

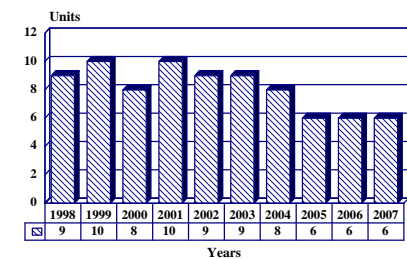
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## Kollmorgen Mk 46 EO Director - Archived 6/99

### Outlook

- Standard equipment on the latest US Navy DDG-51s
- Likely to be retrofitted on all, plus Spruance class destroyers
- Price-competitive, effective unit
- Enhances accuracy of five-inch Mk 45 gun substantially
- US Navy happy with thermal imaging technology; IR coming

10 Year Unit Production Forecast  
1998 - 2007



### Orientation

**Description.** Electro-optical fire control director system.

**Status.** Production and service

**Sponsor**

US Navy Sea Systems Command  
Washington, DC 20360  
USA

**Total Produced.** An estimated 27 sets have been built through 1997. Production continues at a rate of eight to nine units per year.

**Contractors**

Kollmorgen Corp  
Electro-Optical Division  
347 King Street  
Northampton, Massachusetts (MA) 01060  
USA  
Tel: +1 413 586 2330  
Fax: +1 413 586 1324

**Application.** Anti-surface warfare, splash spotting, damage assessment, target surveillance/identification, naval gun fire support, mine detection and automatic target tracking.

**Platform.** The system was originally designed for the DDG-51 Arleigh Burke class destroyers. It is also suitable for fitting on the CG-47 and FFG-7 class ships.

**Licensee.** No production licenses have been granted.

**Price Range.** Contract analysis indicates a unit value between US\$1.54 million and US\$2.99 million, the latter being for the first units off the production line.

### Technical Data

**Characteristics**

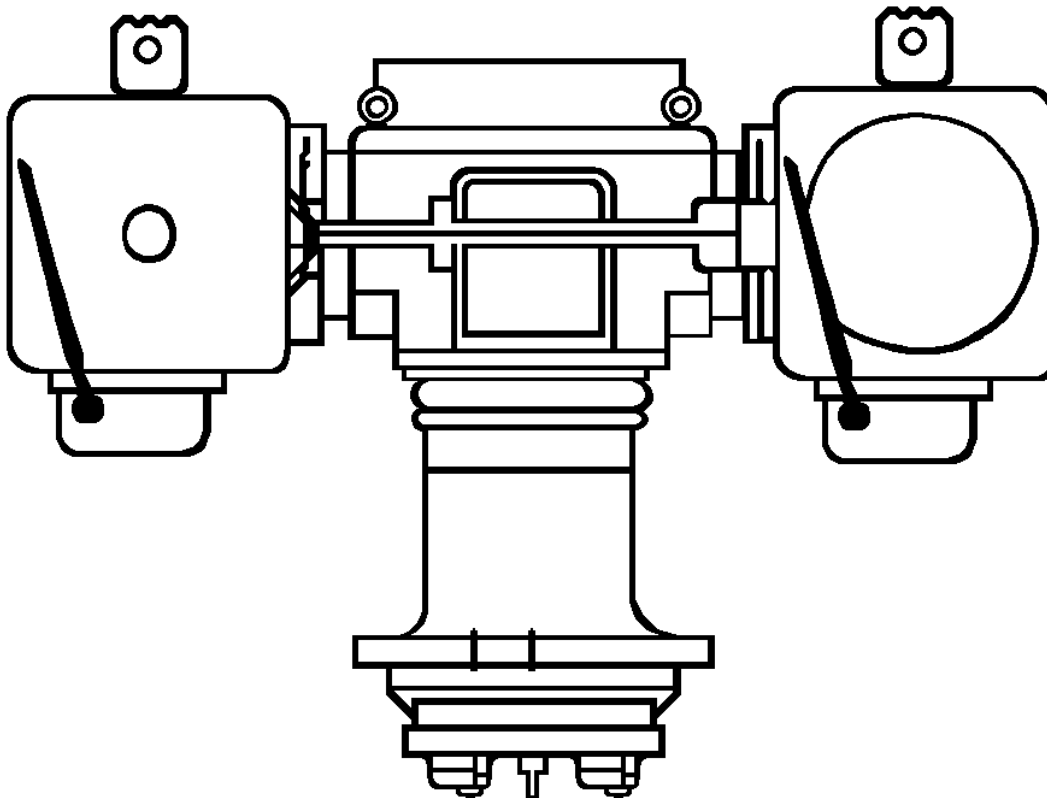
Thermal Imaging:	8 -12 $\mu\text{m}$ (3-5 $\mu\text{m}$ FPA optional)
Daylight Imaging:	Hi-RES monochr. CCD sensor
Stabilized Director:	2 axis elevation/azimuth
Automatic Video Tracking:	Correlation/Centroid

	<u>Metric</u>	<u>US</u>
<b>Dimensions</b>		
<b>Above-deck unit</b>		
Width:	762 mm	30 in
Height:	706 mm	28 in
Weight:	136.4 kg	300 lb

**Design Features.** The Mk 46 above-deck unit carries a daylight imaging TI/CCD television and a Kollmorgen hybrid-serial Micro-FLIR. The latter scans a sprite array both horizontally and vertically. Below decks, the sensor display and control systems are integrated, with the output being sent to a high-resolution monochrome monitor with graphics overlays. Automatic target tracking capability and built-in testing equipment are

included. The complete unit is stabilized in both elevation and azimuth.

**Operational Characteristics.** The Mk 46 is intended primarily for surface warfare and naval gunfire support duties. Its primary role is target surveillance and identification, followed by splash spotting and damage assessment once the engagement has been joined. An associated role is mine watching.



Mk 46 Mod 1

Source: Kollmorgen Corporation

## Variants/Upgrades

**Mk 46 Mod 0.** The original production version of the Mk 46 optical sight designed for installation on the DDG-51 class destroyers and forming part of the Mk 160 fire control system.

**Mk 46 Mod 1.** Proposed variant of the Mk 46, intended for deployment on the CG-47 Ticonderoga class cruisers. Mk 46 mod 1 differs from the mod 0 baseline in having a laser

range-finder as standard and provision for interfacing with the Mk 86 fire control system.

## Program Review

**Background.** The Mk 46 electro-optical sight has its origins in two previously abortive attempts to provide a fire control system for the five-inch L54 Mk 45 gun on the DDG-51 Arleigh Burke class destroyers. The first of these was Seafire, development of which was covered in a contract awarded in July 1979. This system was a combined daylight television, laser range-finder/designator and thermal imager deployed on a fully stabilized mount. The weight and cost of the system escalated alarmingly during development, partially in response to the laser power required to illuminate targets for the Deadeye five-inch L54 laser-guided round. The Seafire system was canceled in March 1982.

Following congressional pressure, the US Navy initiated a new competition to select an electro-optical sight for the DDG-51 class in February 1983. A three-company short-list was announced in September of that year and the development contract was awarded to Texas Instruments in November 1983. According to some reports, this also ran into weight and cost escalation problems. Whatever the reason, this contract too was canceled in 1986, leaving the DDG-51 class with only the options of using the SPY-1D radar or local control for its five-inch gun.

Experience during the Iran-Iraqi war showed that this was hardly a satisfactory solution. As a direct result, a third attempt was made in 1990 to procure an electro-optical fire control system for the DDG-51. Competitors for this program included Contraves (offering Sea Hawk II), Lockheed (tendering the CelsiusTech 9LV200), Hughes (bidding the Italian NA-18L upgraded with additional Lockheed sensors), McDonnell Douglas (a proposal based on the Mast Mounted Sight designed for the OH-58D and already installed on some ships operating in the Persian Gulf), Norden/SAGEM (offering a derivative of the TRS-906 Canopus) and Kollmorgen (offering its new EX-46 system).

The Norden/SAGEM and Kollmorgen bids were shortlisted and, in June 1990, the contract to develop the new system was awarded to Kollmorgen. The develop-

ment program included the Mk 160 gunnery fire control system (GFCS), which provided an interface between the Aegis system and the five-inch gun, and the EX-46 electro-optical target acquisition and sighting system. Work during 1991 and 1992 was undertaken as part of the US Navy budget's Program Element number 0604602N, Naval Gunnery Improvements. This saw the system being brought up to service-ready standards and fully integrated into the Mk 160 fire control system. On reaching operational status, the system was redesignated Mk 46 mod 0.

Production of the Mk 46 system is now under way, with the equipment being fitted on the DDG-51 Arleigh Burke class destroyers. In 1995, a modified version of the Mk 46, the Mk 46 mod 1, was developed for installation on the CG-47 Ticonderoga class cruisers. Other variants of the basic system will be developed for additional ship classes as the requirement is formulated.

Electro-optical imaging systems have rapidly become an essential part of a ship's sensor outfit. In a military sense, they are almost totally passive and can control gunfire with only minimal operational indiscretion. In fact, they do have a small level of exposure in that the cooled imaging infrared component can be picked up by a similar system. This effect is, however, so minimal that it can be largely ignored. Overall, the benefits of the equipment are so marked that the expense of installing the systems and integrating them with the overall ship's combat system can easily be justified, even with today's stringent financial requirements.

The value of this equipment is justified even in non-military situations. Thermal imagers have proved extraordinarily valuable in search-and-rescue operations. Ships so equipped have found that survivors in the water show up extremely well on infrared, and this significantly increases their chance of being located and rescued before succumbing to hypothermia. Other applications include maritime policing and anti-smuggling operations.

## Funding

Development and procurement of the Mk 46 electro-optical sight was funded by the US Navy under PE#0604602N Naval Gunnery Improvements. This is a wide-based catch-all for a number of munitions and fire control improvement programs, and the funding actually allocated to the Mk 46 cannot be separated.

## Recent Contracts

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Kollmorgen	8.975	November 1990 – Supply of three Mk 46 mod 0 optical sights for DDG-51 class ships
Kollmorgen	24.677	January 1993 – Supply of 16 Mk 46 mod 0 optical sights for DDG-51 class ships. Includes an option for four additional units valued at US\$6.169 million
Kollmorgen	7.605	July 1994 – Provision of Mk 46 sight system depot and initial installation plus check-out spares

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jul	1979	Seafire development contract awarded
Mar	1982	Seafire canceled
Feb	1983	New E/O system for DDG-51 competition
Nov	1983	Contract awarded to Texas Instruments
	1986	Contract canceled
Jun	1990	EX-46 development contract awarded to Kollmorgen
Jan	1993	USN contract for 16 units on the <i>Arleigh Burkes</i>

## Worldwide Distribution

US. DDG-51, CG-47

## Forecast Rationale

The Mk 46 is likely to become the standard US Navy electro-optical surveillance sensor. A version of the existing system has been designed for application to the CG-47 class, and it is reasonable to assume that other versions will be forthcoming for the FFG-7 class, a variety of amphibious assault vessels and the mine warfare ships.

are scheduled to enter service. It is likely that 22 systems will be bought to equip the vertical launch system (VLS) armed versions of the CG-47 class and approximately 20 units to fit on selected ships of the FFG-7 class. Finally, an additional 20 systems are projected for other ship classes. Production is likely to extend well beyond the forecast period.

The following forecast is based on procurement for the DDG-51 class, the dates being those on which the ships

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION													
Designation	Application	thru 97	<u>High Confidence Level</u>			<u>Good Confidence Level</u>			<u>Speculative</u>			Total 98-07	
			98	99	00	01	02	03	04	05	06		07
Mk 46	CL/DD/FF (US NAVY)	27	9	10	8	10	9	9	8	6	6	6	81