



EXPENDABLE DECOY CARTRIDGES



THE NEED FOR SHIP SELF PROTECTION

The nature of warfare never changes; a more capable weapon is developed and a more sophisticated countermeasure is then required and designed to meet this increased threat. Such is the ongoing evolution in naval weapons, as anti-ship cruise missiles (ASCM) are put into service by large, modern navies as well as smaller, defense-oriented national forces. These ASCM's may have several different modes of operation as they track the target and often more than one sensor for final homing and attack. As these missiles become more difficult to detect and destroy, hard kill presents more and more of a problem. The other option, Electronic Warfare (EW) soft kill, has been used for decades and has been effective in countering less capable ASCM's. But these too have evolved, incorporating newer technologies and requiring more integrated tactics.

With the explosive growth in the cost of modern weapon systems, cost effectiveness remains the key advantage of off-board countermeasures. Moreover, as future tactics change, off-board countermeasures may easily be upgraded and adapted to keep pace with inevitable improvements in offensive weapon systems. This includes the integration of all off-board and on-board EW countermeasures to avoid mutual interference/interaction among existing soft and hard kill systems.

OFF-BOARD COUNTERMEASURE SYSTEMS

The objective of all off-board EW countermeasures is to deny or delay acquisition of targets of opportunity by missiles until they are no longer capable of

impacting their designated termination point.

Sippican's Passive Decoy Systems Group (PDSG) develops and manufactures basic and advanced off-board expendable countermeasure decoys and decoy launching systems to protect ships from radar (RF) and infrared (IR) guided missile threats. Chaff and IR decoys are used by most navies in several different tactical situations, ranging from confusion to distraction to seduction.

For confusion, chaff is deployed at some distance from the ship, usually 5 kilometers or greater. Several chaff clouds, strategically seeded around the ship's own position, at varying distances, prior to the launch of hostile anti-ship missiles, present multiple targets to offer the enemy surveillance platform alternative targets to the ship.

After launch, and as the ASCM nears the target, distraction cartridges are fired at ranges up to 4.5 km to disturb the range and accuracy of the missile's guidance system. However, should the missile have already locked on to the ship in its final attack phase, seduction chaff is deployed to provide point defense and a means, sometimes in coordination with other on-board EW equipment, to "pull" the seeker away from the ship to the chaff cloud.

When the ASCM emitter illuminates the chaff cloud, the dipoles resonate at the emitter frequency and create a false radar echo. This echo represents a radar cross-section (RCS) greater than the target, thereby pulling the ASCM away from the ship to the chaff bloom.

EW COUNTERMEASURES: CHAFF AND INFRARED DECOY CARTRIDGES

Sippican is a world leader in the design, development, and production of off-board chaff and infrared (IR) decoy cartridges. The original NATO standard SEA GNAT chaff cartridges for distraction and seduction were designed by the Hycor Group, which was acquired by Sippican in 1998. Over 70,000 of the SEA GNAT MK 214 (RF Seduction) and MK 216 (RF Distraction) cartridges have been manufactured for US and foreign navies. These advanced cartridges are used with the Hycor-developed MK 36 Decoy Launching System (DLS) currently deployed on all US Navy combatants, ships of many NATO countries, as well as those of other foreign navies.

The Passive Decoy Systems (PDS) Group also has developed and is producing the 112 mm and the 130 mm families of proprietary decoy cartridges for export. Each family includes an RF Seduction decoy (CHAFFSTAR), RF Distraction decoy (LOROC), IR Seduction decoy (HIRAM), and dual RF/IR Seduction decoy (GEMINI).

Chaff and IR cartridges may be deployed from two sizes of launchers:

- 112 mm RBOC (or RBOC II) launcher
- 130 mm SRBOC launcher

The 112 mm launcher is designed for use with smaller naval platforms; the 130 mm for larger ships requiring a larger RCS, thus a larger cartridge to handle a greater chaff or IR payload.

The deployment of decoy cartridges is controlled by a decoy launching system. The PDS Group was instrumental in the development of early semi-automatic systems which have evolved into ALEX (Automatic Launching of EXpendables), a state-of-the-art, fully automated system complete with launchers and controls interfaced to the ship's combat system.

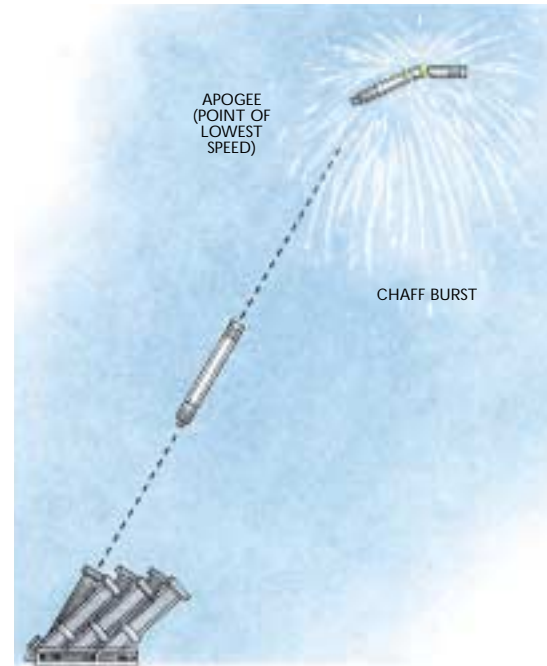
CHAFF DECOYS

Chaff Decoys are a cost-effective countermeasure to anti-ship cruise missiles (ASCM's) and form a part of layered ship self-defense. Chaff consists of millions of aluminized individual glass elements, cut to match the frequency of the anticipated threat radar to be countered. The chaff dipoles are packaged into mortar or rocket propelled cartridges which, when fired, bloom very rapidly into a large cloud, hence the term Rapid Bloom Off-board Chaff (RBOC).

SEDUCTION

The Hycor-developed NATO standard MK214 is used by the US and other NATO navies for defense against ASCMs with radar (RF) emitters. The Sippican export equivalent is the SUPER CHAFFSTAR (130 mm) and the CHAFFSTAR II (112 mm). These are the most advanced chaff

decoys available today. The chaff cloud is large enough to be effective without any special maneuvering of the ship.



PHYSICAL DATA	CHAFFSTAR II	SUPER CHAFFSTAR
Diameter	112 mm (4.4 in)	130 mm (5.125 in)
Overall length	1067 mm (42 in)	1220 mm (48.1 in)
Weight	15.5 kg (34 lb)	22.2 kg (48.9 lb)
Muzzle velocity	60 m/s (200 ft/s)	65 m/s (213 ft/s)
PAYLOAD DATA		
Chaff	Aluminized glass, rapid blooming	
Frequency coverage	Any single frequency, multiple frequencies, or band coverage within the limits of 8 to 18 GHz	
Radar Cross Section (RCS) (Single Frequency)	Up to 12,000 m ²	Up to 16,000 m ²
Radar Cross Section (RCS) (Broad Band (8-18 GHz))	Up to 5000 m ²	Up to 10,000 m ²
Volume	7700 cm ³ (470 in ³)	12,500 cm ³ (750 in ³)
Weight	8.2 kg (18lb)	12.7 kg (28.0 lb)



SUPER CHAFFSTAR

EXPENDABLE DECOY CARTRIDGES

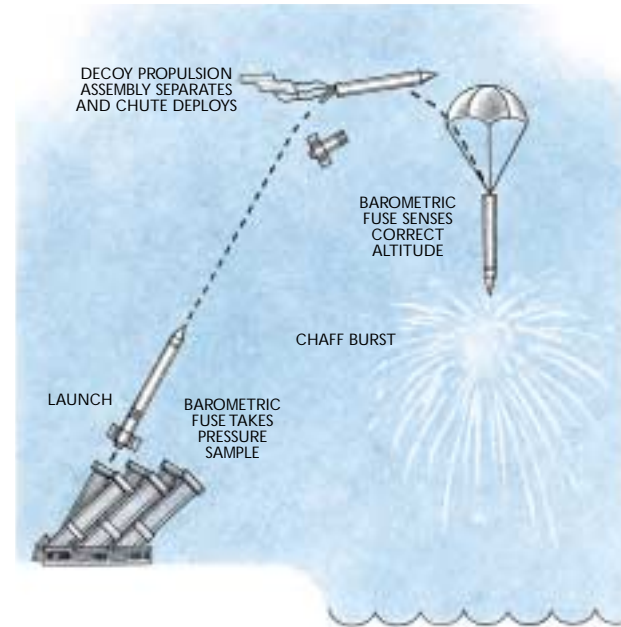
DISTRACTION

LOROC (Long Range Off-board Chaff) is the Hycor Group-developed export version of the NATO standard SEA GNAT MK 216 distraction round. This family of cartridges, Super LOROC

(130 mm) and LOROC (112 mm), is rocket-launched to extend the range, which is selectable between 1- 4.5 km. An electronic fuse, set prior to launch, triggers the separation of the rocket motor from the chaff payload assembly

and deploys a drogue chute at the predetermined range. As the payload descends, a barometric fuse ignites the burst charge at the optimum height, dispersing the chaff package to form a large chaff cloud.

PHYSICAL DATA	LOROC	SUPER LOROC
Diameter	112 mm (4.4 in)	130 mm (5.125 in)
Overall length	1067 mm (4.2 in)	1200 mm (47.2 in)
Weight	14.74 kg (32.4 lb)	21.8 kg (48 lb)
PAYLOAD DATA	All types available	
Chaff	All types available	
Frequency Coverage	Any single frequency, multiple frequencies, or band coverage within the limits of 8 to 18 GHz	
Radar Cross Section (RCS) (Single Frequency)	Up to 5000 m ²	Up to 10,000 m ²
Radar Cross Section (RCS) (Broad Band (8-18 GHz))	Up to 2000 m ²	Up to 6000 m ²
Volume	2043 cm ³ (124.6 in ³)	1850 cm ³ (120 in ³)
Weight	2.3 kg (5.1 lb)	1.8 kg (4lb)- 6.8 kg (15 lb) (range dependent)

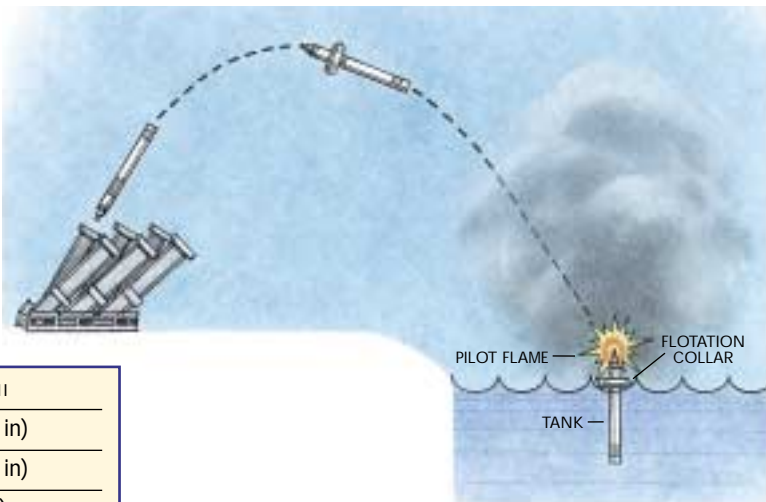


INFRARED (IR) DECOYS

Sippican's original family of Infrared (IR) decoys, HIRAM (Hycor InfraRed Anti-Missile), can be fired from RBOC II (112 mm launchers) and Super RBOC (130 mm launchers) to decoy anti-ship missiles armed with IR seekers. Both HIRAM II (112 mm) and Super HIRAM III (130 mm) decoys are fired from the ship and, within seconds after launch, splash into the sea, igniting the flare upon water impact. A flotation collar stabilizes the cartridge

on the water's surface and a bright flame (2 meters in height for the HIRAM II; 2.5 m for the Super HIRAM III) is generated. This flame is sufficient to simulate the radiant intensity of a ship, "seducing" the missile away from the intended target. The cartridge's fuel ignition device stays lit during the duration of the burn

(approximately 45 seconds) to provide automatic re-ignition if necessary.



PHYSICAL DATA	HIRAM II	SUPER HIRAM III
Diameter	112 mm (4.4 in)	130 mm (5.125 in)
Overall length	1220 mm (48.0 in)	1220 mm (48.0 in)
Weight	15.9 kg (35.0 lb)	22.0 kg (48.5 lb)
PAYLOAD DATA	Liquid	
Type fuel	Liquid	Liquid
Burn time	45s (minimum)	45s (minimum)
Flotation	Inflation collar	Inflation collar
Volume	7500 cm ³ (450 in ³)	10,000 cm ³ (600 in ³)
Weight	4.7 kg (10.3 lb)	6.4 kg (14 lb)

EXPENDABLE DECOY CARTRIDGES

SUPER WALK-OFF IR DECOY

The Super Walk-Off IR Seduction and Distraction decoy cartridge is the latest addition to the Sippican family of IR decoy cartridges. It is mechanically and electronically compatible with the SRBOC launching system. The cartridge, when launched, produces six(6) IR clouds in sequence, at progressive distances from the ship, that step-by-step, lure the IR missile seeker from the ship. As each cloud "decays," the seeker of the incoming missile is attracted to the next fresh cloud, "walking" the threat away from the ship. Following the deployment of the sixth cloud, the cartridge fires, almost simultaneously, seven(7) small IR clouds to form a larger, longer duration, "keeper"/distraction cloud to finally capture the incoming IR missile. The infrared clouds are comprised of phosphorous-based IR material, chemically balanced to present an IR

signature properly distributed in both the 3-5 μm and 8-12 μm bands. The output of a single Walk-Off IR cloud is sufficient to simulate the radiant intensity of a large ship. The Super

Walk-Off IR Decoy cartridge thus provides a highly effective countermeasure against anti-ship missiles with imaging infrared seekers.



PHYSICAL DATA

Diameter	130 mm (5.125 in)
Overall length	1200 mm (47.2 in)
Weight	23 kg (50 lb)

PAYLOAD DATA

Infrared material	Red phosphorous IR material
Burn time	40 seconds (minimum)

COLLOCATED CHAFF / IR CARTRIDGES

The Gemini series of RF/IR cartridges embodies the salient features of the PDS Group's chaff and infrared decoys. The basic GEMINI (112 mm) and the Super GEMINI (130 mm) both operate like other chaff cartridges, up to the dispersion of the chaff into a cloud. At the same time, a solid flare

is deployed and suspended on a parachute. The flare ignites and moves with the chaff cloud to present a collocated radar and infrared source, providing a highly effective countermeasure against anti-ship missiles employing radar and/or infrared seekers. A single GEMINI series

cartridge can neutralize a missile equipped with radar mid-course guidance and infrared terminal guidance. The basic GEMINI (112 mm) is suitable for use with small vessels (ie., a fast patrol boat) while the Super GEMINI (130 mm) can protect a large ship with a single round.



PHYSICAL DATA

	GEMINI	SUPER GEMINI
Diameter	112 mm (4.4 in)	130 mm (5.125 in)
Overall length	434 mm (17 in)	1200 mm (47.2 in)
Weight	5.2 kg (11.4 lb)	20 kg (44 lb)

PAYLOAD DATA

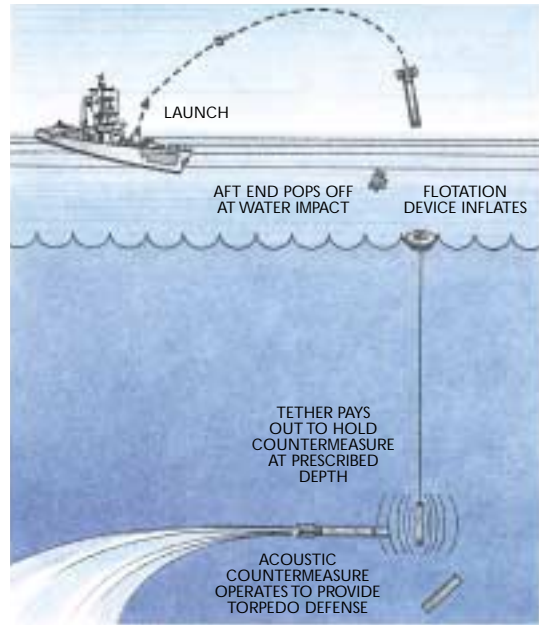
Chaff	Aluminized glass	
Frequency coverage	Any single frequency, multiple frequencies, or band coverage, within the limits of 8 to 18 GHz	
Infrared flare	Proprietary formulation	
Burn time (minimum)	30s	40s (minimum)
Chaff volume	1550 cm ³ (450in ³)	8000 cm ³ (500 in ³)
Chaff weight	1.5 kg (3.3 lb)	8.2 kg (18 lb)



SHIP-LAUNCHED ACOUSTIC DECOY

The Ship-Launched Acoustic Decoy (SLAD) is used to protect surface ships against torpedoes with sonar seekers. The cartridge (available in a 112 mm or 130 mm version) may be either mortar or rocket launched from the standard RBOC II or SRBOC launcher. When launched, and upon water impact, the payload assembly is separated from the rest of the cartridge and a float is inflated. The payload assembly is then suspended on a tether beneath the float, and the acoustic device initially transmits a wide-band, high-power acoustic signal to interfere or jam the torpedo seeker. Following a pre-set time interval, the device automatically switches to a "ship-like" acoustic signature to seduce the incoming torpedo away from the ship.

The cartridge is fully compatible with the Sippican's ALEX Decoy Launching System. ALEX can be programmed to deploy cartridges automatically and recommend the correct ship maneuver when an incoming torpedo is detected. The deployment of one or more SLAD cartridges, in conjunction with the appropriate ship maneuver, is highly effective in defeating acoustic homing torpedoes.



LAUNCHERS

SUPER RBOC / MK 137

This is the 130 mm NATO Standard Launcher, which is a component of the MK 36 Launch System. It consists of six (6) barrels, mounted on a fixed pedestal. The barrels vary in elevation to provide dispersion and optimum altitude for the burst. All 130 mm expendable decoy cartridges from the PDS Group may be fired from this launcher.



SRBOC LAUNCHER

RBOC II

This is the 112 mm launcher designed for use on smaller ships and is the same basic configuration as the Super RBOC launcher discussed above. These launchers have been adapted by the PDS Group to fire rounds with payloads that will provide proper protection for smaller ships.

PHYSICAL DATA	RBOC II	SUPER RBOC
Length	124.2 cm	160.0 cm
Width	40.0 cm	46.0 cm
Height	70.0 cm	90.0 cm
Weight	125.0 kg	209.0 kg

PRODUCT	CHARACTERISTICS
CHAFFSTAR II Decoy Cartridge	RBOC II. 112 mm, Anti-Radar, Mortar
HIRAM II Decoy Cartridge	RBOC II. 112 mm, Anti-Infrared, Mortar
GEMINI Decoy Cartridge	RBOC II. 112 mm, Anti-Radar/Anti-Infrared, Mortar
Ship-Launched Acoustic Decoy (SLAD)	RBOC II. 112 mm, Anti-Torpedo, Mortar
LOROC Decoy Cartridge	RBOC II. 112 mm, Anti-Radar, Rocket
Ship-Launched Acoustic Decoy (SLAD)	RBOC II. 112 mm, Anti-Torpedo, Rocket
Walk-Off IR Decoy	RBOC II, 112 mm, Anti-Infrared, Mortar
Super CHAFFSTAR	SRBOC, 130 mm, Anti-Radar, Mortar
Super HIRAM III	SRBOC, 130 mm, Anti-Infrared, Mortar
Super GEMINI	SRBOC, 130 mm, Anti-Radar/Anti-Infrared, Mortar
Ship-Launched Acoustic Decoy (SLAD)	SRBOC, 130 mm, Anti-Torpedo, Mortar
Super LOROC Decoy Cartridge	SRBOC, 130 mm, Anti-Radar, Rocket
Ship-Launched Acoustic Decoy (SLAD)	SRBOC, 130 mm, Anti-Torpedo, Rocket
Super Walk-Off IR Decoy	SRBOC, 130 mm, Anti-Infrared, Mortar

ABOUT SIPPICAN'S PASSIVE DECOY SYSTEMS GROUP

Sippican's Passive Decoy Systems Group is the world leader in the design, development, testing and production of Off-Board Countermeasures Systems and Decoy Cartridges. Sippican Inc. acquired the Hycor Group in January, 1998, from L-3 COMMUNICATIONS CORP. The Group is now fully integrated into Sippican's Countermeasure Systems Division.

Since its inception in 1967, Hycor has been supplying expendable cartridges for ship-borne chaff, infra-red and acoustic decoys, decoy launchers and decoy launching systems (ALEX), and related training and tactics development systems to the US Navy as well as to twenty-five international navies.

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