



Lighting the way

Carmanah Solar Solutions for the Marine Industry

Carmanah's cutting edge solar LED lighting technology continues to light the way. Trusted by coast guards and port authorities around the world, Carmanah's solar marine lanterns have proven to withstand submersion, impact and challenging sea conditions to help preserve safety at sea.

we put solar to work™



When Safety Counts, Performance Matters

When Carmanah pioneered the first solar LED marine light in 1996, the company began a tradition of excellence and performance that continues today. Deployed by numerous marine authorities, including the US and Canadian Coast guards, Carmanah solar marine lanterns boast rugged reliability and field-proven performance.

Using industry leading LED technology, the advanced optical design delivers unparalleled crispness and intensity with up to six nautical miles in range. Producing output in all IALA Marine Aid-to-Navigation Light colours – green, red, amber and white – Carmanah solar marine lanterns light the way on the waters.

Rugged and reliable, Carmanah's solar LED marine lanterns offer up to five years of maintenance-free performance, reducing the total cost of ownership and resulting in significant cost savings.

Solar LED marine lanterns – simply an intelligent choice

- Field-proven durability
 - Over 250,000 solar installations worldwide
- Robust, compact and fully integrated design
 - Easy, non-technical installation
 - Maintenance-free operation
 - Vandalism and theft resistant
 - Resistant to the unrelenting pounding of the sea
- Fully configurable
 - More than 250 flash characteristics
 - Available at a minimum peak intensity of 125cd and performance up to 6NM
 - Automatic light control settings
- Available options
 - GPS synchronized flashing
 - Bird deterrent

There is a reason the world's most demanding customers trust Carmanah technology.

Plain and simple: it performs.

Here at Carmanah, there is nothing more important than ensuring our products can meet the challenges we know they will face each and every day. That's why we take a total system approach to engineering. We pay attention to every component and work diligently to ensure that every step of the energy conversion process is maximized. It's our tireless attention to detail that makes our products the most compact, easy to install, endlessly reliable and ruggedly durable solar products on the market. When it comes to solar technology it's what's inside that counts, and here at Carmanah we look after what's inside better than anyone else. Just ask our clients.

The Energy Conversion Process: Every step counts

At Carmanah our goal is your peace of mind. Each component of our solar products is carefully selected, integrated and configured to ensure you receive the most compact, reliable and efficient solar product possible. We expect our products to perform and so should you.

Solar Panel

Carmanah uses only the highest quality solar panels available to ensure our solutions collect the maximum amount of energy available during sunlight hours. Allowing for increased system autonomy and aiding system performance during periods of low solar insolation, our choice in solar panels is just one of the reasons our solutions are proven to perform in some of the most difficult solar conditions on earth.

Charge Circuit

Our charge circuits are optimized to deliver the maximum amounts of energy collected from the solar panels to the battery. This means the energy collected is the energy stored, and all of this attention to energy stockpiling translates into solar products that outlast, outperform and outshine the competition.

Batteries

Carmanah employs the highest quality batteries available. We know our products are going to be put to the test in some of the most extreme environments on earth and we need to know our batteries are up to the challenge. Allowing for maximum charge efficiency, and offering field-proven performance within an impressive temperature range, our batteries are the powerhouse behind our reputation for dependability.

LED Driver

Our LED drivers are purpose built by Carmanah to deliver the optimum amount of energy to our LEDs. We know our lights are being asked to perform very specific jobs in mission critical locations, and not every job is the same. That's why we make certain our lights are delivering the right kind of illumination for the task. Our lights provide you with the purpose-specific performance you need to get down to business.

LEDs

Carmanah integrates the most advanced LEDs on the market into each and every one of our systems. Offering high-efficiency, ultra-bright illumination, our LEDs are able to perform at the top of their game because we carefully attend to our thermal management techniques, ensuring an optimum operating environment for our LEDs. All this translates into the brightest, most reliable solar illumination possible.

Light Management

Carmanah optics are some of the best in the world. Designed to meet the exact requirements of our self-contained solar lighting applications, the optics inside Carmanah solar lighting products make the most of the light produced. We're serious about our light output, and demand focused illumination from our products that minimizes light trespass and places light exactly where it's needed.



Energy Management

Dynamic and responsive, our lights are the most intelligent solar solutions on the market – and we give them a lot to think about. Our lights are constantly monitoring their surroundings and can adjust light output according to prevailing solar conditions. The brain power inside our lights ensures that you receive consistent light output regardless of conditions. Our lights also accept direction – featuring on-demand functionality and intelligent operating profiles that can be pre-programmed to allow for times of less illumination according to installation needs. Our lights are always thinking, which means you can be assured of reliable performance and functionality that meets your specific needs.

Here at Carmanah we take pride in the world-class performance of our lights. From energy input to light output and energy management, we attend to every detail of the energy conversion process. Our total system approach to engineering ensures that our lights are up for the challenge, whatever it may be. As the most compact, easily installed, durable and reliable solar technology on the market our solutions do exactly what you expect them to do: perform.

Designed around the details, built to uncompromising standards: Carmanah solar solutions put solar to work unlike any other solution on the market.



M502 Marine Lantern

- Performance up to 1NM
- User programmable
- Seven standard flash codes
- Suitable for low intensity navigation and hazard marking applications including:
 - Small buoys
 - Docks
 - Marinas
 - Aquaculture weirs

M601 Marine Lantern

- Up to 20 cd IALA peak intensity and performance up to 2NM
- User programmable with 250+ flash patterns
- Available in all IALA chromaticity colours – Red, Green, Amber, White
- Suitable for any navigation and hazard marking applications including:
 - Buoys
 - Private aids-to-navigation
 - Public piers, docks and marine walkways and entrances
 - Channel and canal markers
 - Offshore oil & gas infrastructure
 - Oil containment booms
 - Boat and barge terminals
 - Breakwaters and all types of marine infrastructure

M701-5 Marine Lantern

- Up to 45 cd IALA peak intensity and performance up to 3NM
- User programmable with 250+ flash patterns
- Available in all IALA chromaticity colours – Red, Green, Amber, White
- Suitable for navigation and hazard marking in medium latitudes and areas with varying solar illumination:
 - Aids to navigation
 - Port and marina entrances
 - Channel and canal markers
 - Offshore oil & gas infrastructure
 - Research buoys
 - Public piers, docks and marine walkways
 - Boat and barge terminals
 - Breakwaters and all types of marine infrastructure

M702-5 Marine Lantern

- Up to 46 cd IALA peak intensity and performance up to 3NM
- User programmable with 250+ flash patterns
- Available in all IALA chromaticity colours – Red, Green, Amber, White
- Suitable for navigation and hazard marking in areas with very low solar illumination:
 - Aids to navigation
 - Port and marina entrances
 - Channel and canal markers
 - Offshore oil & gas infrastructure
 - Research buoys
 - Public piers, docks and marine walkways
 - Boat and barge terminals
 - Breakwaters and all types of marine infrastructure

M704-5 Marine Lantern

- Up to 83 cd IALA peak intensity and performance up to 5NM
- User programmable with 250+ flash patterns
- Available in all IALA chromaticity colours – Red, Green, Amber, White
- Replaceable batteries
- Suitable for navigation and hazard marking in areas of varying solar illumination:
 - Aids to navigation
 - Port and marina entrances
 - Channel and canal markers
 - Offshore oil & gas infrastructure
 - Research buoys

M708 Marine Lantern

- Minimum peak intensity of 125cd and performance up to 6NM
- Fully configurable with 256 flash patterns
- Optional GPS synchronization enables two or more lanterns to flash in unison
- Available in all IALA chromaticity colours – Red, Green, Amber, White
- Suitable for all ports, harbors and coast guard applications, including:
 - Aids to navigation
 - Port and marina entrances
 - Channel and canal markers
 - Offshore oil & gas infrastructure
 - Research buoys

M708

A tough stainless steel bird deterrent helps to keep the optic clean.

Easily visible colour indicator tells you at a glance what colours you have.

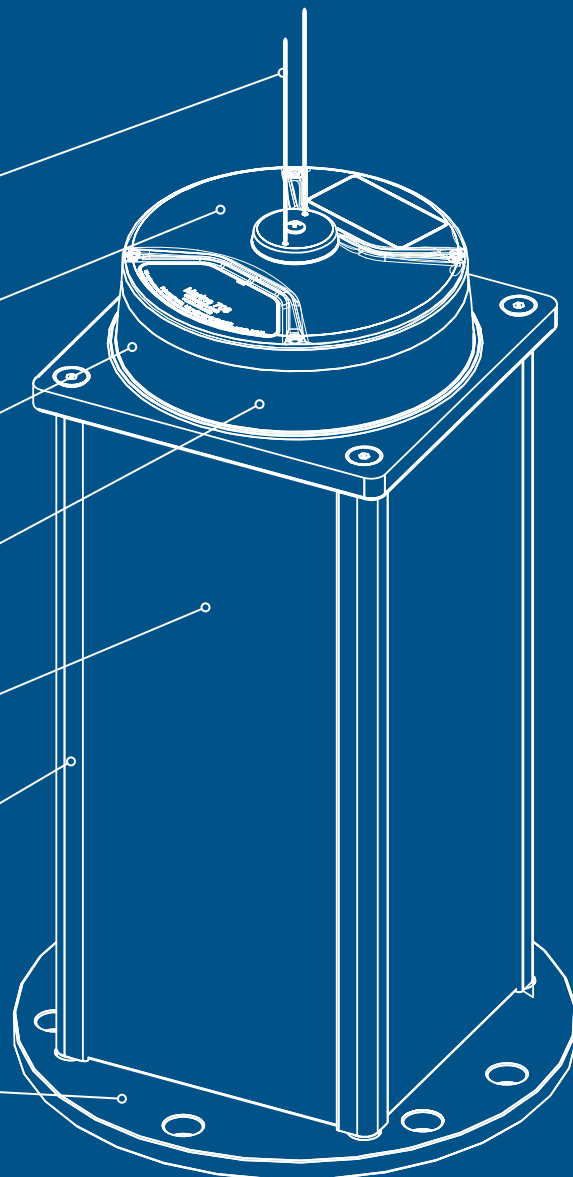
Low profile polycarbonate optic resists damage from ocean debris.

Smooth optical surface stays cleaner than traditional fresnel lens.

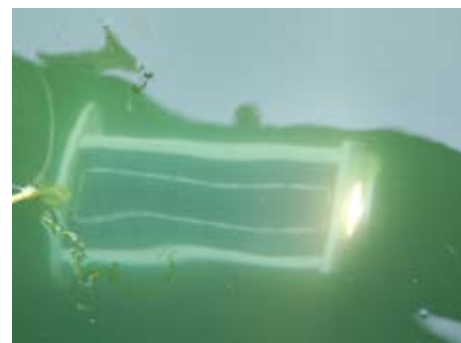
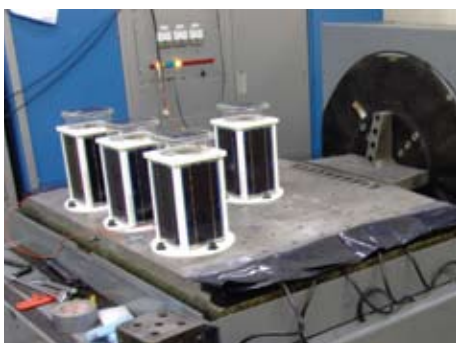
Polyurethane surface won't shatter like glass.

Rugged aluminum extrusion protects the solar panels from impact and theft.

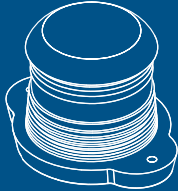
Lantern base mounts to either 3 or 4 bolt 200mm pattern.



Carmanah marine lanterns undergoing shock and vibration testing, extreme temperature testing and submersion testing.



M502



DIMENSIONS

Height	6.05" (154 mm)
Width	4.4" (113 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 1 NM (1.9 km)
Vertical divergence	–
Autonomy (flashing) at full charge	300 hours
Available LED colour	Red, green, blue, amber, or white
Coloured lens option	Yes
Flash patterns	7
GPS capable	No

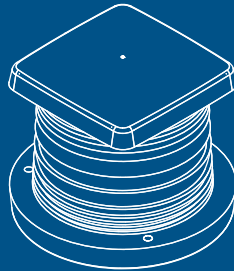
CONSTRUCTION

Battery (average 5-year life)	Non-replaceable
Mounting options	2 Bolt
Weight	2.45 lb (1.1 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Mounting plate
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M601



DIMENSIONS

Height	5.51" (140 mm)
Width	6.87" (175 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 2 NM (3.7 km)
Peak intensity, green LEDs (as per IALA rating)	20 cd
Vertical divergence	7°
Autonomy (flashing) at full charge	300 hours
Available LED colour	Red, green, amber, or white
Coloured lens option	Yes
Flash patterns	250+
GPS capable	No

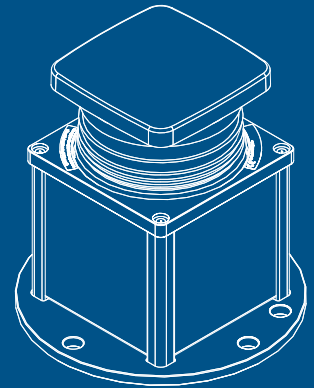
CONSTRUCTION

Battery (average 5-year life)	Non-replaceable
Mounting options	3 bolt
Weight	4.85 lb (2.2 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Bird Deterrent Mounting Plate Floor Flange Frangible Coupling
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M701-5



DIMENSIONS

Height	9.44" (240 mm)
Width	9.25" (235 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 3 NM (5.6 km)
Peak intensity, green LEDs (as per IALA rating)	45 cd
Vertical divergence	7°
Autonomy (flashing) at full charge	300 hours
Available LED colour	Red, green, amber, or white
Coloured lens option	No
Flash patterns	250+
GPS capable	Yes (Optional)

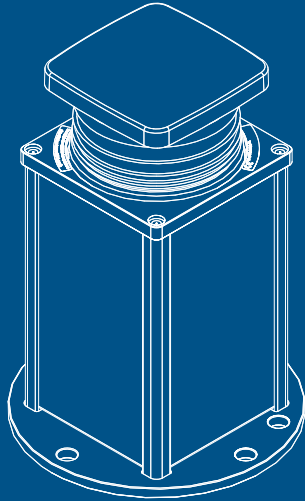
CONSTRUCTION

Battery (average 5-year life)	Replaceable and recyclable
Mounting options	3 or 4 bolt
Weight	11.5 lb (5.2 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Bird Deterrent
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M702-5



DIMENSIONS

Height	13.375" (340 mm)
Width	9.25" (235 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 3 NM (5.6 km)
Peak intensity, green LEDs (as per IALA rating)	46 cd
Vertical divergence	7°
Autonomy (flashing) at full charge	300 hours
Available LED colour	Red, green, amber, or white
Flash patterns	250+
GPS synchronised	Yes (Optional)

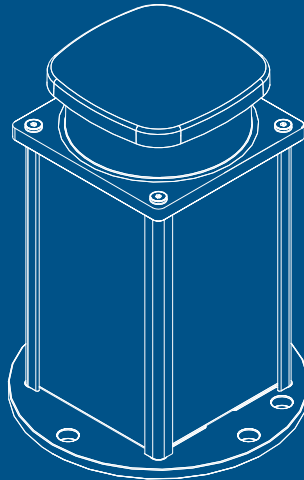
CONSTRUCTION

Battery (average 5-year life)	Replaceable and recyclable
Mounting options	3 or 4 bolt
Weight	17 lb (7.75 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Bird Deterrent
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M704-5



DIMENSIONS

Height	12.56" (319 mm)
Width	9.25" (235 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 5 NM (7.4 to 9.3 km)
Peak intensity, green LEDs (as per IALA rating)	83 cd
Vertical divergence	10°
Vibration tested	As per MIL-STD-202G Method 204D
Shock tested	As per MIL-STD-202G Method 213B at 50G
ESD tested	As per USCG 502G CH3, Section 3.5.9, +/- 25 kV air discharge
Available LED colour	Red, green, amber or white
Flash patterns	256+
GPS synchronised	Yes (Optional)

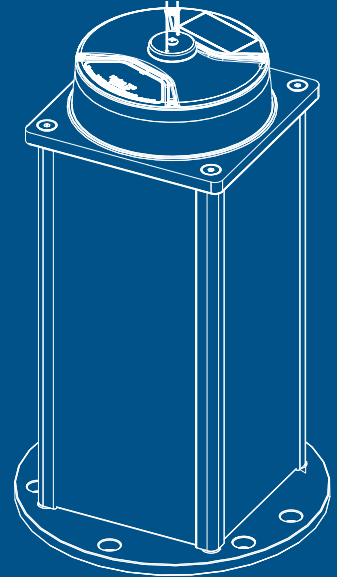
CONSTRUCTION

Battery (average 5-year life)	Replaceable and recyclable
Mounting options	3 or 4 bolt
Weight	26 lb (11.75 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Bird Deterrent
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M708



DIMENSIONS

Height	15.625" (397 mm) 20.31" (516 mm) with Bird Deterrent
Width	9.25" (235 mm)

SPECIFICATIONS

LIGHT OUTPUT AND OPERATION

Range	Up to 6 NM (to 11.1 km)
Peak intensity, green LEDs (as per IALA rating)	153 cd
Vertical divergence	7°
Vibration tested	As per MIL-STD-202G Method 204D
Shock tested	As per MIL-STD-202G Method 213B at 50G
ESD tested	As per USCG 502G CH3, Section 3.5.9, +/- 25 kV air discharge
Available LED colour	Red, green, amber or white
Flash patterns	256+
GPS synchronised	Yes (Optional)

CONSTRUCTION

Battery (average 5-year life)	Replaceable and recyclable
Mounting options	3 or 4 bolt
Weight	26.2 lb (11.88 kg)

ACCESSORIES

	Infrared Programmer Security Bolt Bird Deterrent
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COMMON SPECIFICATIONS	
LIGHT OUTPUT AND OPERATION	
Ambient storage temperature	-40 to 176 °F (-40 to 80 °C)
Ambient operating temperature	-22 to 122 °F (-30 to 50 °C)
Programmable (infrared)	Yes
CONSTRUCTION	
Light source	High-powered LEDs
Lens material	UV stabilized
Energy Management System MICROSOURCE® code suite	Yes
PATENTS AND APPROVALS	
CE approval	As per EN 60945:1997
IP68 waterproof rating	Yes
Patents	US Patents: 6573659 and 6013985 Other Patents Pending
RoHS compliant	Yes

LANTERN SELECTION CHART	EFFECTIVE INTENSITY (RANGE*)	1CD (1NM)				5 CD (2NM)				15 CD (3NM)				37 CD (4NM)				77 CD (5NM)								
		601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708
ST ANTHONY'S NEWFOUNDLAND CANADA	DUTY CYCLE	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708	601	701-5	702-5	704-5	708
	10%	x	x	x	x	x		x	x	x	x			x	x	x						x				
	16%	x	x	x	x	x		x	x	x	x			x	x	x										
	30%	x	x	x	x	x		x	x	x	x				x	x										
	Steady-On	x	x	x	x	x		x	x	x	x				x	x										
PORTLAND MAINE USA	10%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
	16%	x	x	x	x	x	x	x	x	x	x		x	x	x	x						x				
	30%	x	x	x	x	x	x	x	x	x	x			x	x	x						x				
	Steady-On	x	x	x	x	x	x	x	x	x	x			x	x	x						x				
SYDNEY AUSTRALIA	10%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				x
	16%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
	30%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
	Steady-On	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
ROTTERDAM NETHERLANDS	10%		x	x	x	x		x	x	x	x			x	x	x						x				
	16%		x	x	x	x		x	x	x	x				x	x										
	30%		x	x	x	x		x	x	x	x				x	x										
	Steady-On		x	x	x	x		x	x	x	x				x	x										
BUENOS AIRES ARGENTINA	10%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				x
	16%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
	30%	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				
	Steady-On	x	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x				

* Transmissivity Color 0.74T RED



Security Bolt Mounting Kit



Carmanah solar marine lanterns feature a unique vandal-resistant design to ensure years of flawlessly reliable performance. Each light features a rugged, self-contained design that incorporates the batteries into the housing of the light so there is no easy access to the parts.

Once secured using the tamper-resistant, ultra-hard chromium-vanadium security fasteners, the lanterns are extremely difficult to remove. As each security bolt system requires a unique, perfectly cut key to operate, lights cannot be removed by regular screwdriver heads.

The stainless steel finish is designed for tough marine environments to resist against corrosion and breakage and ensures that there is no easy way of shearing fasteners.



Mounting Plate – M601 and M700 Series

Carmanah marine mounting plates are designed for elevated lighting and easily bolt into the bottom of any Model 601 or 700-series lanterns. Applications include: security barriers, aquaculture farms or other difficult to mount places.



Bird Deterrent

The Carmanah bird deterrent accessory attaches easily to any Model 601, 701-5, 702-5 or 704-5 lantern. The spikes on the deterrent discourage birds from perching on the light.



Infrared Programmer

All Carmanah marine lanterns are user-programmable using an optional infrared programmer. Functions available through the programmer include flash code settings, intensity and autonomy adjustments, and LUX level adjustments for the photoelectric switch that automatically turns lanterns on/off at dusk/dawn. The programmer is globally compliant with ROHS, WEEE and CE directives.



From lanterns to lighthouses.... we put solar to work for you!

Lighthouses play a critical role in preserving the safety of ships and crew at sea. Remote locations, rough terrain and extreme climate conditions can make powering lighthouses difficult and expensive. Carmanah's solar power systems provide reliable power to virtually any location on earth at a fraction of the cost associated with diesel generators and the electrical grid.

Ranging in size from 525 watts to 8400 watts or more, solar power systems eliminate high maintenance and fuel costs, as well as harmful fossil fuel emissions. Backed by more than 20 years of flawless performance, Carmanah's solar power systems are the choice of the world's foremost lighthouse authorities.

- Low Maintenance Operation – no large inventory of parts or moving components.
- Durable, Reliable Power – proven performance in the most extreme climates and remote, rugged terrains.
- Easy Installation – pre-assembled and easily installed, with no trenching or cabling required.

Green means more than starboard

“The ten largest container ports in the US release more sulfur dioxide into the atmosphere than 18.5 million cars*”

Carmanah solar lighting and solar power systems not only save on energy bills and maintenance costs, but they also reduce greenhouse gas emissions. With ports, harbours and mariners continuing to grow, reducing the environmental impact of operations has never been more important.

Installing just one kilowatt of solar electric (equivalent to 10 x 100 watt lights) can reduce greenhouse gas emissions over 25 years by:

- 400 pounds of sulphur dioxide
- 125 pounds of nitrous oxide
- 49,500 pounds of carbon dioxide

Carmanah's solar lighting and solar power systems offer an eco-friendly solution that reduce the impact of operations and improve the bottom line for agencies. By eliminating high installation costs and ongoing electrical bills, Carmanah's maintenance-free solar solutions are proof that going green offers priceless benefits.

* Harboring Pollution: Strategies to Clean up US Ports, Natural Resources Defense Council, August 2004



Client: Canadian Coast Guard

Location:
 Canadian East Coast - Maritimes Region
 (Nova Scotia, New Brunswick and Prince
 Edward Island)

Goal:
 To maintain 3,800 floating aids-to-navigation
 systems at 99 percent levels, whilst improving
 efficiency and cost-effectiveness.

Details of contract:

- Estimated savings of CDN \$31 million
- Lighter” lanterns enabled the use of smaller buoys
- Smaller vessels required for servicing
- Annual maintenance cycle reduced to every 3-5 years

The implementation of Carmanah solar LED marine lanterns trimmed an estimated CDN\$31 million in fully allocated costs from the Canadian Coast Guards (CCG) annual budget.

The CCG faced the ongoing challenge of maintaining a modern aids-to-navigation system of 3,800 floating aids in the Maritime Region. With shrinking budgets and increasing demands on resources, the CCG had to find a way to maintain the aids-to-navigation system at 99 percent levels, while improving efficiency and cost-effectiveness. To do so, it turned to new technologies, introducing the Marine Aids to Modernization (MAM) initiative in 1996.

An important contributor to MAM's success, Carmanah solar LED marine lanterns had a multiplier effect on savings. Prior to 1996, the CCG spent upwards of 1500 vessel days a year maintaining its floating aids-to-navigation. With Carmanah solar LED marine lanterns, fewer hours and less resources are required to maintain and service buoys and aid-to-navigation systems, leaving more time for national security and the implementation



of other technologies. By 2004, the CCG had cut vessel support for maintenance from 1,500 to 200 vessel days.

Carmanah's innovative solar technology suite doesn't stop with just solar marine lanterns. The company's product line also includes general lighting and power system solutions for a wide variety of marine applications.



Solar Area Lighting

Experience the empowerment of solar area lighting. Featuring an intelligent operating profile and the most advanced LED technology on the market, Carmanah's solar area lighting solution provides industry leading performance and light control features that are unmatched by any other solar lighting solution on the market.

For more information, please see Carmanah's solar area lighting brochure.

DuraGEN™ Solar Engine

Designed as a standalone power supply, the DuraGEN Solar Engine comes as one complete, easy to install system that arrives pre-assembled, pre-wired and ready for use. The DuraGEN Solar Engine is available in a variety of standard outputs and configurations to accommodate a wide range of remote power needs.

For more information, please see Carmanah's DuraGEN Solar Engine brochure.

Solar Flashing Beacons

Carmanah's flashing beacons provide added visibility to important safety and roadside signage. Ideal for areas with high pedestrian or vehicle traffic, industrial worksites where signs may not be easily visible and unmarked railway crossings in remote and isolated locations, Carmanah solar flashing beacons are simple to install and integrate easily onto existing sign posts.

For more information, please see Carmanah Solar Solutions for the Traffic Industry brochure.

About Carmanah Technologies Corporation

As one of the most trusted names in solar technology, Carmanah has earned a reputation for delivering strong and effective products for industrial applications worldwide. Industry proven to perform reliably in some of the world's harshest environments, Carmanah's lights and power systems provide a durable, dependable and cost effective energy alternative.

Carmanah Technologies Corp.

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