

Frog Eye™

Amphibious
Field
Camera



Survive
Perform
Deliver



Concept

You are a professional. You operate in all places and under all conditions. Your objective moves and is never the same. You demand agility and access to all methods of image collection and transmission. Your images represent valuable knowledge and intelligence. They must survive. Your camera is FrogEye™



Remote & Autonomous Operation

FrogEye™'s remote and autonomous modes support scientific observation and target surveillance alike. Using wired differential signaling, the camera can be operated from up to 1.2 km away – from a safe location behind a hill top and with near zero chance of RF signature detection. Wireless capability enables monitoring from up to tens of miles away. Support of high-capacity batteries such as BA-5590, an external hard disk and sleep modes provide the capacity for up to a day of solid recording and virtually unlimited mission duration in autonomous mode.

Operating Modes

FrogEye™ operating modes meet the unique requirements of military and professional field users. Its never-dark technology features an ultra-wide 1:1000 exposure range and avoids under/over exposure. Smoothly sweep from longer times that times for better definition to shorter times that cancels reaction time and captures a moment even the shortest target opportunity maximizes maximization pulls detail out of the haze.

Optics for long-standoff, night and underwater work

FrogEye™ features exchangeable optics. The all-weather/portable FL-400 lens detects people and classifies vehicles at over 6 km distance. In fact, target resolution is under 2 cm (3/4") at 1 km distance. FrogEye™ is also compatible with standard Canon EF lenses, providing access to one of the widest lens selections in the world. Use a high-sensitivity lens for night work, or a fish eye lens for underwater jobs. Tough, light-weight lens hoods protect Canon lenses for use under any conditions and underwater.

Night & Multi-Spectral Vision

Operate FrogEye™ in visible light, near IR to defeat camouflage in vegetation or UV to detect camouflage in snow. Work at day, and then with a click of a button switch to the on-chip intensified 'single photon detector' (SPD) sensor for low light and night operation. Dual-stage light intensification is available for extreme low light conditions. Snap an image onto intensifier tube onto FrogEye and focus the image on the SPD sensor. Result: Operating capability down to 10 icrolux, or about one order of magnitude better than current night vision equipment.

Confident Operation in any Environment

FrogEye™ is amphibious. It operates with confidence in rain, dust and snow. It functions in any environment on land, and underwater at depths to 100 meters. It is rugged enough to sustain the knocks and drops of field use. Yet, it easily fits into a pack or clips to a belt. FrogEye™ can be operated with gloves, and is light enough to float in water. FrogEye's ruggedness significantly reduces task loading. Focus on the task at hand, not on equipment protection.



Standard camera (Nikon 4200)

FrogEye at Night (SPD & 105mm Canon Lens)



Gear

FrogEye gear is outdoor gear. It is light-weight, tough and simple. You can put it in the dirt when you need a free hand. FrogEye gear is performance gear. It provides real-time image quality control. It IDs targets at long distance, day or night. It pulls detail out of haze. It stores data or transmits it. It sustains rapid firing and it has no trigger delay. FrogEye gear is your gear.



Exchangeable Image Sensor Modules

FISM-1 dual-sensor module including single photon detector (SPD) sensor for on-demand day/night vision. FISM-2 module with 16-Mpixel CMOS sensor for wide-field autonomous & remote surveillance. Custom modules available for operation in different spectral regions, high frame rates etc.

FrogEye FC-2 Body

- Hermetically sealed housing; 100m depth rating
- Multi-standard lens port for Canon & FrogEye lenses
- Simple four-button control
- Electronic viewfinder for real-time image quality control
- Multi-function port for remote control, radio interface, high capacity battery and storage

FPAK-3 Wired Remote

For camera ops from safe or hidden location. Does not need line of sight. Near zero RF emission. Up to 1.2km wire.



FBH-1 / FBM-1 Remote Ops Box

Houses BA-5590 batteries for 24h continuous operation; days or weeks of operation with sleep mode. FBH-1 with integrated hard disk for extended storage. FBM-1 with RF modem for wireless remote operation.



FL-400 Lens
Free-floated design, light-weight high telephoto lens. 2 cm target resolution at 1 km distance. Personnel detection and vehicle type identification at over 6 km distance.

Canon EF Lenses

Compatible with the Canon EF standard. Use high sensitivity lenses for night work, fisheye lenses for underwater work, zoom lenses for general operations.

FLH-94 Lens Hood

Protect Canon lenses against sand, mud, water and impact. Depth rating 100m.



Performance Specs



FrogEye™ offers a significantly greater field performance range than standard digital SLR cameras. The performance graphs provide an approximate comparison between the two solutions. Green indicates full applicability, Yellow is limited applicability and Red is not applicable.

Light Levels

	Below Starlight	Starlight	Moonlight	Dusk	Daylight
FrogEye™	L	L	Yes	Yes	Yes
Digital SLR	No	L	L	Yes/L	Yes

Note: FrogEye can be used down to moonlight conditions with built-in SPD sensor. When using SPD and an image intensifier tube, operational range extends to below starlight levels. Digital SLR can be used down to starlight levels with intensifier, but image becomes too dark below starlight levels.

Spectral Region

	LWIR	MWIR	NIR	Visible	UV
FrogEye™	Custom	Custom	Yes	Yes	Yes
Digital SLR	No	No	No	Yes	No

Note: Existing FrogEye sensors are sensitive in the visible, near IR and UV regions. Range can be extended to medium and long wave IR with custom sensor modules. Digital SLR are generally limited to the visible region.

Sensor Module	Sensor & operating mode	Pixels	Min. light level (with F/1.4 lens)	Spectral Resp.
FISM-1	TC-253 SPD sensor (cooler ON)	640K (656x496)	0.00003 Lux	300-1000 nm
FISM-1	KAI-1020 color daytime CCD	1M (1004x1004)	1 Lux	370nm-860nm
FISM-2	IBIS4-14000	16M (4560x3048)	1 Lux	TBD

All-Environment Operating and Target ID Distance

	< 0.3 M	0.3M-100M	100M-1000M	1000M-10000M
FrogEye	Yes	Yes	Yes	Yes
Digital SLR	L	Yes	L	L

Note: FrogEye FL-400 lens detects people and identifies vehicle types at over 6km distance. Lens is light weight and can be used and transported in any environment, including underwater. FrogEye internal focus supports macro imaging down to < 2 cm standoff distance. Digital SLR telephoto lenses are fragile and must be protected against water/dirt.

Pixel resolution at 1km with FL-400 lens (grayscale sensor):	1.9 cm
Approx. max. distance for person identification:	500 m
Approx. max. distance for person detection:	6 km
Approx. max. distance for vehicle type identification:	10 km

Operating Environment & Survivability

	Underwater	Rain/Wet	Dry	Dusty/Muddy	High Altitude/Ice	High Shock/Vibration
FrogEye	Yes	Yes	Yes	Yes	Yes	Yes
Digital SLR	L	L	Yes	L	L	L

Note: FrogEye's sealed housing is compatible with any environment, underwater to 100m and sustains shock/vibration. Digital SLR can be protected with environmental housings, cases or bags. However, these protections add weight, bulk and restrict operation.

Equipment	Size (mm)	Weight (kg)
FC-2 camera body	228L x 92W x 101H	1.5 (positive buoyant in water)
FL-400 400mm F/5.2 lens (collapsed)	215L x 115D	0.9
FLH-94 lens hood for Canon lenses	115L x 115D	0.3
FBH-1 Battery & Hard Disk Box	165L x 117W x 190H	2.7
FBM-1 Battery & RF Modem Box	165L x 117W x 190H	2.7

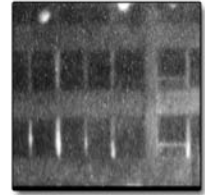
Operating Modes

	Autonomous	Remote	Hand Held	Rapid Fire
FrogEye	Yes	Yes	Yes	Yes
Digital SLR	No	No	Yes	Limited

Note: FrogEye supports hand-held, wired remote, RF remote and autonomous operations. The camera shoots single frames or sustained motion sequences. Digital SLR do not offer full long-distance remote or autonomous capabilities, though a remote trigger may be available. Rapid fire in digital SLR tends to be limited to short bursts.

Operating Mode

Operating Mode	Performance Parameters
Hand-held	4-button control, 2 hour battery life, Image storage on internal CF card (1-8 GB), Real-time image quality control through light shielded electronic viewfinder, on-demand night vision (SPD sensor), single shot or motion imagery with sustained frame rate up to ten frames/sec.
Wired remote	Camera operation from remote PC. Up to 1.2 km twisted wire link, near zero RF emission, line-of-sight not required. Operate up to 24 hours with BA-5590 battery in FBH-1 box.
Wireless remote	FC-2 camera with FBM-1 RF modem/battery box. 800 MHz modem 115 kbit/sec. Operating distance from 500m (indoor/urban) to 32km (outdoor with high-gain antenna). Military modem support & direct interface to military radios in progress.
Autonomous Mode	Camera on programmed / timed trigger. Normally used with FBH-1 battery / hard disk module. Sleep mode extends operating life. Capacity about 24h continuous, or 17,000 5-sec image cycles. Acquire stills or motion sequences. Automatic motion or change detection in progress.



Building façade at 10 microlux



Cars at 6900m distance with FL-400 lens



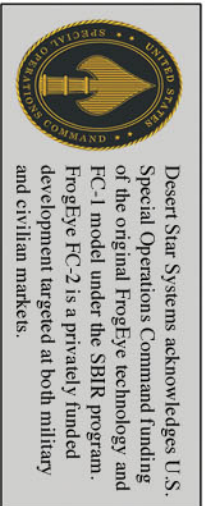
Near infrared image of fake plant (left) and real plant (right)



Extreme motion freeze 1/10000 sec exposure



Underwater ops to 100m depth



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