CAP-XX Compares Xenon Flash and High-Current LED BriteFlash for Camera Phones

Monterey, Calif., 6Sight Future of Imaging – October 24, 2006 – CAP-XX Limited, a leader in thin-form supercapacitors, today presented its results of a study comparing flash solutions – xenon, standard LEDs and high-current LEDs powered by a supercapacitor, or CAP-XX's LED BriteFlash – for their ability to provide the Light Energy that camera phones of 2-megapixels or more need to take digital-still-camera-quality pictures in low light.

Tests showed that the Light Energy from CAP-XX's LED BriteFlash exceeds most Xenon flashes. Additionally, a thin supercapacitor 1) fits a slim handset more easily than the electrolytic storage capacitor required for Xenon, and 2) can offload demands from the battery and handle all mobile-phone functions that need peak power – wireless voice and data, GPS readings, digital video, music and TV – improving talk time, battery life and audio quality.

"Camera phones are improving with more megapixels, and better lenses, image-processing software and anti-handshake features," explained Pierre Mars, CAP-XX vice president of applications engineering. "The area that lags behind is the power and energy of the flash for taking pictures in low light."

The key to clear pictures is Light Energy – the total amount of light that fills a camera's pixels during image-capture time. On the other hand, Light Power refers to the intensity of a flash. Light power, along with the flash exposure time is used to calculate Light Energy: light power (lux) x flash exposure time (secs) = Light Energy (lux.secs). 10 to 15 lux.secs of Light Energy is ideal for high-resolution pictures.

- Xenon flash has excellent light power, but a very short flash exposure time.
- An LED flash, powered by a supercapacitor, delivers lower light power over a longer flash exposure time for total Light Energy that exceeds or equals most Xenon flashes.

"We have seen images taken with well-known camera-phone models both with and without CAP-XX's supercapacitor-enabled LED flash and the differences are dramatic," said Tony Henning, Mobile Imaging Analyst, 6Sight™ Future of Imaging. "Subjects up to 10 feet from the camera are well-illuminated with the CAP-XX solution and all but pitch black without."

CAP-XX CEO Anthony Kongats said, "We are working with key mobile-phone manufacturers and expect the first designs that are power-boosted by our supercapacitors to hit market late 2007 or 2008."

The study compares light power and energy, shutter requirements, ease of design-in, safety and size of both solutions. For results, see Mr. Mars' technical article on *MobileHandsetDesignLine*, http://www.mobilehandsetdesignline.com/howto/showArticle.jhtml;jsessionid=RQWN3JJXHSMIOQSNDLSCKHA?articleID=193401161 or
http://www.cap-xx.com/news/**CAP-XX_LED_Flash_and_Xenon_Comparison.pdf**

Test Setup – Measuring Light Power over Time and Integrating to Calculate Light Energy:

Equipment tested included:

1) Xenon camera phones with varying size electrolytic storage capacitors for varying power and energy levels. As the electrolytic capacitor's size decreases, so does the Light Energy:
   - SonyEricsson K750 with large external flash accessory with 60μF of capacitance.
   - SonyEricsson K800 with two internal electrolytic capacitors, each 7mm dia. x 18mm long, with a total of 28μF capacitance.
   - Gigabyte phone with a small 15μF electrolytic capacitor.

2) Standard LED flash, using the Nokia N73 as an example
3) High-current LEDs supported by a supercapacitor, or CAP-XX's BriteFlash power solution. In this test, two supercapacitors, 17mm wide x 28.5mm long x 1.6mm thick, drive multiple high-current Luxeon PWF1 LEDs during each flash.

High-current LEDs need up to 400% more power than a battery can provide to achieve full light intensity. In the BriteFlash power architecture, supercapacitors deliver the pulse power needed (>1A), allowing the battery to focus only on recharging the supercapacitors between flashes while the supercapacitors drive the LEDs at very high current for the flash pulse.

Measurement included several steps. CAP-XX:

1) Used a photo detector calibrated by the National Measurement Institute in Australia to measure on axis illumination of the xenon and LED flash sources.
2) Captured light power over time at 1 and 2 meters from the source using a digital storage oscilloscope.
3) Integrated the area under the power curves to measure the Light Energy at the detector as a function of time (or of the flash pulsewidth).

Light Power and Light Energy Measurements:

The following shows light power and energy for the 2-meter-distance tests.
For 1- and 2-meter tests and test parameters such as shutter and CMOS sensor exposure times used: http://www.cap-xx.com/news/photogallery.htm#2

Source	Storage Capacitor	Distance (m)	Peak Light Power (lux)	Exposure Time (msecs)	Light Energy (lux.secs)
Xenon, SonyEricsson K750	60µF, 330V	2	97,000	<1	9.5
Xenon, SonyEricsson K800	2 x 14µF, 330V	2	53,000	<1	4.2
Xenon, Gigabyte cell phone	15µF, 330V	2	36,000	<1	1.7
4 x LEDs @ 1A each	0.55F, 5V	2	175	67	10.8
2 x LEDs @ 1A each	0.55F, 5V	2	86	67	5.3
Nokia N73 std. LED flash	NA	2	5	90	0.43

Key points:

- 4 high-current LEDs deliver 18% more Light Energy than the SonyEricsson K750 with a xenon attachment that has the highest power in the study.
- 2 high-current LEDs deliver 34% more Light Energy than the SonyEricsson K800 with medium power.
- 1 high-current LED driven at 1A (not shown) would deliver 75% more Light Energy than the small Gigabyte phone with the least power of the xenon flashes.
- A standard low-current LED flash, the Nokia N73 as an example, generates much less Light Energy than the other solutions, i.e. 8% of that produced by 2 high-current LEDs and 11% of that generated by the SonyEricsson K800.

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Conclusions - Comparing Design Solutions:

A supercapacitor-powered LED flash delivers lower power over longer time for total Light Energy that exceeds or equals most Xenon flashes. This solution is capable of higher-quality still shots, but not action shots, in low light. A designer can use image-stabilization software to correct for hand movement that may cause blurry photos. Xenon, with its short exposure time, is superior for capturing fast-moving action shots in low light.

Xenon	LED Flash with Supercapacitor
Bulky: – Large electrolytic storage capacitor , total volume of xenon solution in SonyEricsson K800 camera phone ~3.8cc	Thin, < 2mm – Typically < 2cc
Safety: 1.5J of energy stored at 330V can give a nasty shock, particularly near the ear.	Low voltage, no safety issues
Still need a separate LED for video/torch mode	Same LEDs used for flash and video/torch
Long time to re-charge electrolytic capacitor between photos (~8s for SonyEricsson K800)	Short time to re-charge supercapacitor between photos (~2s)
Electrolytic capacitor cannot be used for any other peak power needs	Supercapacitor can be used to meet all peak power needs in the cell phone including: – Flash pulse – RF Transmission for GPRS – Audio – HDD for storing audio & video
Very high powered light delivered in < 200µsec: – No photo blur, can take an action shot in low light	Light Energy delivered over longer time: – Capable of high-quality still shots, but cannot take action shot in low light. However, image-stabilization software can correct for hand shake

A more complete comparison is available here: http://www.cap-xx.com/news/photogallery.htm#3

About CAP-XX:

CAP-XX Ltd. is a world leader in the design and manufacture of thin, flat supercapacitors and power architectures for portable electronic devices. Supercapacitors resolve the power and performance limitations of batteries, bridging the gap between the power demanded and that available from a battery.

CAP-XX supercapacitors enable manufacturers to make smaller, thinner, longer-running portable electronics such as cell phones, PDAs, medical devices, AMRs and notebooks. The company, which is listed on the Alternative Investment Markets (AIM) in London, is based in Sydney, Australia, has additional production facilities in Malaysia, and sales offices in South Carolina, USA and Taipei, Taiwan. For more information visit http://www.cap-xx.com or email sales@cap-xx.com.

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Note: For light power and energy comparisons, electrolytic storage capacitor and supercapacitor comparisons, diagrams and photographs: http://www.cap-xx.com/news/photogallery.htm

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