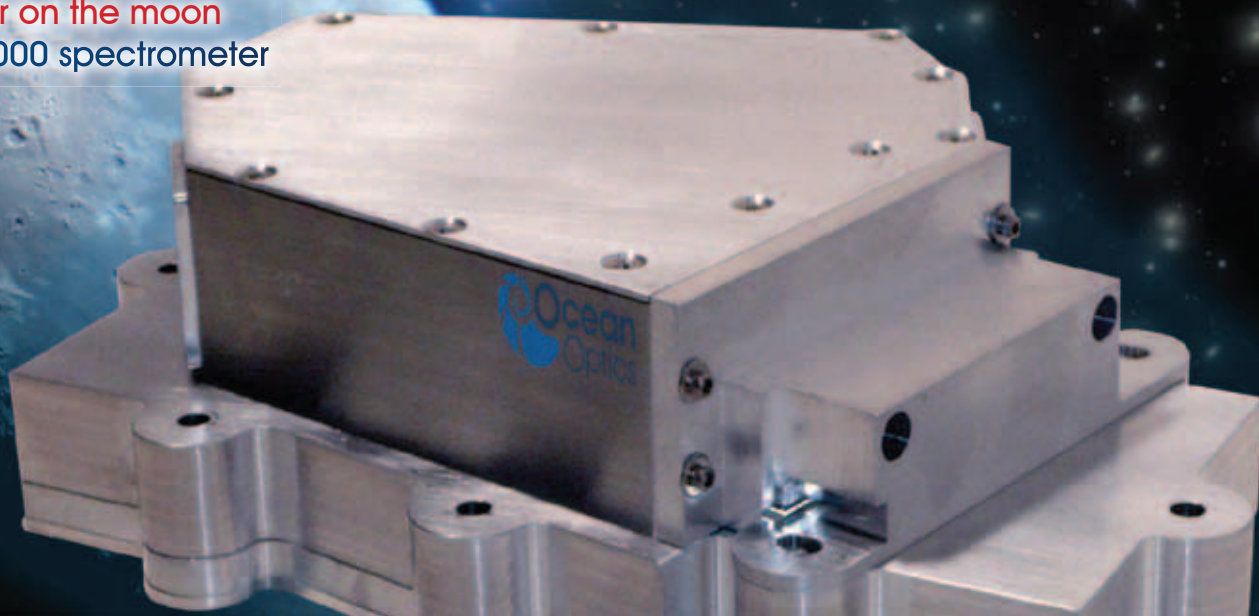


**PAGE 5**

**Locating water on the moon**  
with the QE65000 spectrometer



# Applications in Photonics

Autumn 2009

## Read all about it

Welcome to Ocean News, the platform where you can read about the latest topics and innovations in the field of photonics.

In this newsletter we will give you an overview of some exciting applications that involve Ocean Optics products. Read how our QE65000 is used to locate water beneath the moon's surface or how Jaz was used to analyse UV intensity levels on Mount Everest.

You can also read more about this year's year end promotion. For any order above 10.000 euro we will give away a netbook. For all other orders including a spectrometer you will receive a USB stick or SpectraSuite software.

**Enjoy your reading!**  
The Ocean Optics EMEA Team

## ISO certification

Our production facility and worldwide headquarters in the USA is now ISO 9001:2008 certified. This certification means that Ocean Optics has met the comprehensive set of standards dictated by the International Standards Organization (ISO) in all aspects of business including design, sales, manufacturing and service.

"While we've always made the quality of our products and meeting customer expectations a priority, we welcomed the opportunity that certification presented to benchmark our processes versus known industry best practice".

**By Rob Randelman**  
Ocean Optics President

**ISO9001:2008**  
**CERTIFIED** 

## Some of our stories

**PAGE 3**

**Explosive detection in**  
liquids using the QE65000

**PAGE 3**

**Determining UV levels on**  
Mount Everest with Jaz

**PAGE 6**

**Online quality control**  
using NIR spectroscopy

**PAGE 5**

**Measuring oxygen in**  
bioprocesses with NeoFox

## A special gift from Ocean Optics\*

Get a netbook, USB-stick or SpectraSuite software

From now through December 31<sup>st</sup> 2009 you get a free gift with your purchase of an Ocean Optics spectrometer.

Choose between our SpectraSuite software or a special Ocean Optics USB stick containing our video tutorials. And, for orders of €10.000 or more, you receive an Acer Aspire One Netbook.

Contact us now to learn more about this special offer at [sales@oceanoptics.eu](mailto:sales@oceanoptics.eu).

*Special gift with your next spectrometer order*

*Reader reply*

01



Check out how to get a free Netbook, USB stick or SpectraSuite software



Silicone hydrogel lenses analysed with the NanoCalc-2000-UV/VIS

## NanoCalc to analyse contact lenses

### Accurate measurements

A major manufacturer of contact lenses requested a very accurate measurement of the thickness of polymer CH<sub>4</sub> coating on silicone hydrogel lenses. The typical thickness range for the coating is about 20-40 nm. The NanoCalc-2000-UV/VIS system in conjunction with microscope with 20 x magnification was used to perform the measurements at wavelength ranges of 250 to 850 nm.

### The set-up

For best results, a specially configured reflection probe with 6 illumination and 1 read fibre was

used. Our set-up was based on a designated customer sample which enabled a quick and easy execution. The microscope was used to generate a very small measuring spot on the sample to avoid any influence given by the samples form. Best measurement results are achieved in the UV range, as the shorter wavelength provides better interference modulation of the signal from the thin layer of only a few nm thickness. Therefore the complete optical path – including microscope – was transparent for UV wavelength.

*Analysing contact lenses*

*Reader reply*

02



## NanoCalc

The fibre optic reflectometer, NanoCalc-2000 operates in UV, VIS and NIR spectral ranges and can measure the thickness of up to 10 layers. In addition the analyses of optical properties like refractive index or absorption can be provided.

NanoCalc measures layers from 10 nm up to several hundred microns and its flexible fibre optics sensor head accommodates almost any sample.

*The NanoCalc system*

*Reader reply*

03

## Mikropack series

Our Mikropack thin film metrology and plasma control systems are compact, precise, modular and flexible. These bench top systems from our thin film metrology centre in Ostfildern, Germany bring together the latest technology to provide you the perfect solution. Our thin-film technical team is ready to assist you in choosing the right system and configuration for your application. Our technical staff can also test your sample so that you have complete confidence in the Mikropack solution prior to purchase.

*Thin film metrology / Mikropack systems*

*Reader reply*

04

# QE65000 spectrometer used in explosive detection device

## A Raman configuration

The Third Research Institute of the Ministry of Public Security in Shanghai has obtained ten QE65000 scientific-grade spectrometers for integration into their AY01-01 systems. The AY01-01 Rapid Liquid Contraband Detector systems use Raman spectroscopy to detect a number of liquid and crystal contraband substances.

## Identifying 200 different compounds

Currently deployed in airports and border crossings with Vietnam, the AY01-01 is used to detect explosives, drugs, dangerous chemicals and other hazardous liquids and transparent crystals. The device is currently capable of detecting up to 200 different compounds with the speed and accuracy of Raman spectroscopy. The AY01-01's use is expected to expand beyond airports and borders to public gatherings, conferences and sporting events. Its unlimited language options also make it suitable for global use.

### *OEM solutions*

*Reader reply*

05



A water bottle is tested with the AY01-01 Rapid Liquid Contraband Detector, enabled by Ocean Optics' QE65000

## ! Featured Product !

### QE65000

The scientific grade QE65000 modular spectrometer can achieve up to 90% quantum efficiency with high signal-to-noise and rapid signal processing speed.

Its high-speed electronics are designed for superior flexibility in connecting to various modules and external interfaces through USB or RS-232 communications.

Our QE65000 is a popular choice for Raman analysis and other low-light level applications such as fluorescence, DNA sequencing, thin film reflectivity and astronomy.

### *The QE65000*

*Reader reply*

06



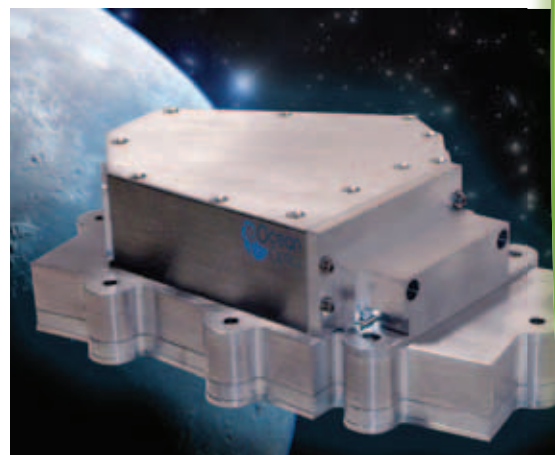
# QE65000 spectrometer launched on NASA LCROSS mission

## Locating water on the moon

A custom-engineered Ocean Optics QE65000 spectrometer named ALICE was successfully launched into space on June 18<sup>th</sup> 2009. As part of the scientific payload on NASA's Lunar Crater Observation and Sensing Satellite (LCROSS) mission, ALICE was drafted to help analyse the makeup of lunar craters with the goal of locating water beneath the moon's surface.

## ALICE in action

During phase two (scheduled for October 9<sup>th</sup> 2009), the Centaur rocket carrying LCROSS will separate. The rocket will be sent crashing into the moon, creating a 2.2 million pound plume of matter. Another spacecraft carrying ALICE will fly through the ejecta, looking for signs of water and other compounds. ALICE will measure the reflectivity of the ejecta cloud as it rises into the sunlight. This will enable scientists to distinguish between water vapour, ice and hydrated minerals such as salts or clays.



Ocean Optics' ALICE Spectrometer is part of the scientific payload of NASA's LCROSS mission, launched June 18<sup>th</sup> 2009

### *User configured spectrometers*

*Reader reply*

07

# JAZ

Latest News

## ! Featured Product !

### Jaz light meter

Ocean Optics now introduces the Jaz light meter. This pre-configured spectrophotometer is the ideal tool for field and laboratory measurements of any type of lighting.

With the Jaz light meter you can measure the spectral characteristics and calculate key parameters like Lux, Lumen and PAR values. The Jaz battery module enables you to measure up to 8 hours without recharging and its SD card slot gives you a convenient way to store spectral data.

*The Jaz light meter*  
*Reader reply*

08



## Horti Fair

### Visit us at the Horti Fair

13-16 October 2009 in Amsterdam, NL  
The Horti Fair is the most complete horticultural tradeshow, with hundreds of innovations by more than 900 participants from around fifty countries providing insiders on the latest developments in horticulture. You can find us at stand 04.0430.

*Meet Ocean Optics at the Hortifair*  
*Reader reply*

10

## Measuring light levels in greenhouses

### Increasing yield

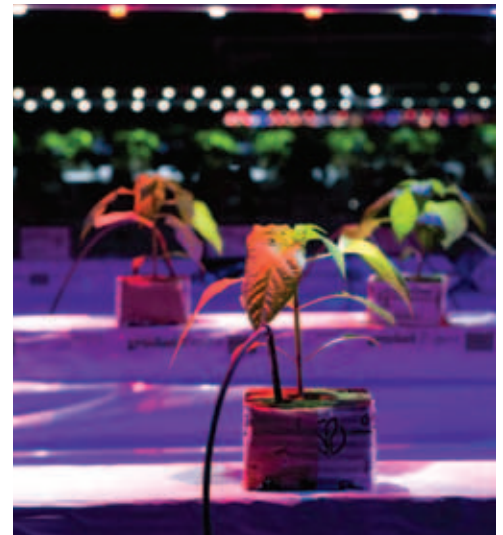
Along with LED manufacturer, Flowmagic, Dutch grower Jack Alblas is testing LEDs for increasing his yield of sweet peppers. The testbed of LEDs Alblas has installed in his greenhouse illuminates from the top as well as the side of the plants to increase the efficiency of his lighting. Because of the lower temperature radiation of LEDs, Alblas is able to get lighting closer to his crop.

### Comparing lighting

To make a fair comparison between the various lighting options, the light energy in Alblas's greenhouse is being monitored with an Ocean Optics spectrometer.

"To investigate PAR energy in the blue and red spectral area, we need to split the total energy in 3 spectral bins of 400-500 nm, 500-600 nm and 600-700 nm," said Mark van der Ende from Flowmagic. "Using a radiometrically calibrated spectrometer, this can easily be measured and calculated."

The first results are looking very positive. You can learn more by following Jack Alblas's blog at [www.flowmagic.nl](http://www.flowmagic.nl).



Blue and red LEDs are of most interest to growers

*Measuring light levels in greenhouses*  
*Reader reply*

09



Jaz configured for solar irradiance was used at the summit of Mt. Everest to determine UV intensity levels

## Jaz spectrometer determines UV levels on Mount Everest

### The mission

Ocean Optics recently provided a Jaz modular sensing suite to the trek crew of Return to Everest 2009 – a group including Keith Cowling, Miles O'Brien, NASA astronaut Scott Parazynski and others. Part of their mission was to measure solar irradiance at the extreme altitude on Everest's summit.

### The system

Jaz was utilized to determine UV intensity levels in the Everest region -- where such levels are typically extremely high. The handheld Jaz that accompanied

the Back to Everest 2009 group included solar irradiance scripting language, an SD card for storage of spectral data and Jaz's lithium-ion battery.

### The experiment

The participants used Jaz to measure solar irradiance with their focus on UV levels at extreme altitude. It is suggested that UV levels on Everest should be among the highest on Earth and Jaz was used to perform analysis of the nature of sunlight during the experiment phase of the summit. The amazing expedition was completed successfully on

May 25<sup>th</sup> 2009.

### Flexibility is key

Jaz performs in a number of challenging applications. Its compact, handheld design makes it ideal for field work and in demanding environments like the world's highest mountain. Its portability was particularly important for the Everest expedition since equipment must be portable enough to be carried by climbers. Jaz is also flexible enough to be configured with multiple spectrometer channels for process management, quality control and life sciences applications.

[\*Jaz configured for solar irradiance\*](#)  
[\*Reader reply\*](#)

11

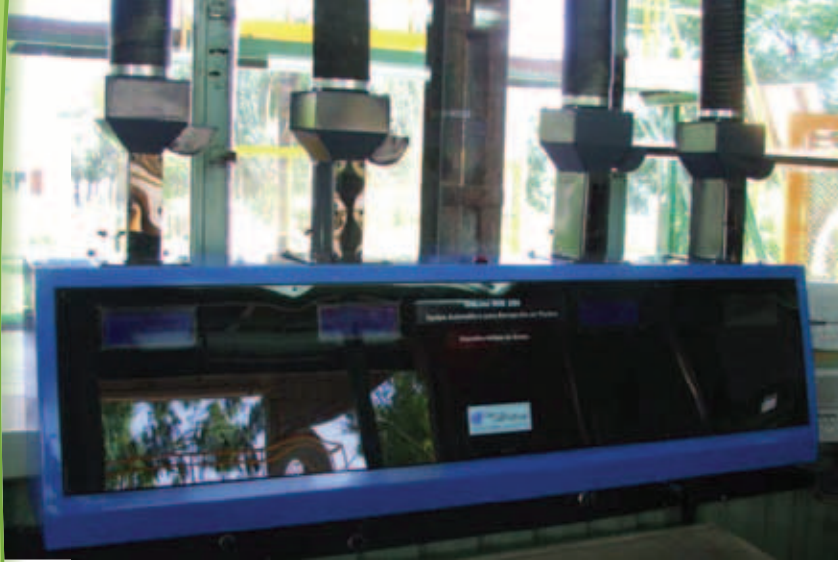
### More about Jaz

Jaz is a family of stackable, modular and autonomous components that share common electronics and communications. Included in the Jaz stack is a microprocessor with onboard display and a CCD-array spectrometer that can be optimised for a variety of radiometric measurements and. Jaz allows users to capture, process and store full spectra

without the need for a PC. Spectral data can be transferred to a laptop or desktop PC for additional post-acquisition processing, such as calculating colour temperature, spectral intensity and colour space values.

[\*Other configuration possibilities for Jaz\*](#)  
[\*Reader reply\*](#)

12



Multipoint device for analysing incoming grains

## Online quality control using NIR Spectroscopy

### Classify and separate 100% of the incoming feed

At a grain reception unit in Argentina, our distributor TecnoCientifica has installed a multipoint detection system that uses NIR spectroscopy. This unique system allows the classification and separation of 100% of the incoming feed. Its fast operation saves time and helps eliminate worker intervention – making the process fully automatic. The system analyses the whole sample from an optical sensor to obtain a high representative result. By working in this manner, the truck classification and destiny decisions reach optimum safety levels.

### Determine moisture, protein and fat content

Besides the analysis to classify incoming materials, moisture, protein and fat content of soybeans, wheat and corn can be determined. Argentina has a total grain reception average of 450 trucks per day. So, being able to classify any incoming truck in real time gives a company valuable information. The system provides critical data such as automatic quality averages per truck and automatic ID by sampling quickly and accurately.

## ! Featured Product !

### NIRQuest spectrometers

NIRQuest spectrometers are compact units capable of analysing the spectrum from 900 to 2500 nm. NIRQuest delivers a high performance optical bench with low-noise electronics and more customization for a wider variety of applications including medical diagnostics, pharmaceutical analysis, environmental monitoring and process control.

If you use NIR spectroscopy for research, process or diagnostics, NIRQuest is a less costly, less complex alternative to FT-IR and comparable technologies.

*The NIRQuest spectrometers*  
Reader reply

13



*Online quality control using NIRS*  
Reader reply

14

### ANIR Series

The ANIR Fourier Transform Spectrometers (FTS) provides an exclusive micro-actuated lamellar grating and operates with a single photodiode detector. The actuation of the interferometer system is controlled by a laser, enabling more precise and reliable operation. The single photodiode detection also

ensures high dynamic range and signal quality. The spectrometer is fibre based, USB powered and portable. The modular ANIR allows you to adapt it into your specific application.

*ANIR series of scanning fourier transform spectrometers*  
Reader reply

15



# Measuring dissolved oxygen (DO) in bioprocesses

## Cell growth in bioreactors

In a bioreactor, the process of oxygen consumption by cells is a sequential process. The oxygen first transfers from the bubble state to liquid contents through the diffusion process. The cells consume oxygen from the liquid media. Oxygen consumption is one of the primary factors which leads to cell growth. The cells also consume oxygen for maintenance after the growth phase. Dissolved oxygen in the liquid media gives us an idea of the oxygen uptake rate of the cells and is also a good indicator of cell viability.

## Cell culture system design

An optical system is integrated to monitor the oxygen levels in a bioprocess system in a continuous fashion. The system built is a small scale version of the bioreactor and consists of a RedEye™ oxygen sensor patch, a cuvette, a QPod and a NeoFox optical oxygen sensor.

## Calibration process

The oxygen sensing experiment was carried out in a transparent cuvette. To build a two point calibration, the nitrogen gas is diffused into the cuvette for 0% oxygen and then air is diffused into the cuvette for 20.9% oxygen. The two points are captured and a calibration curve is built to quantify the oxygen levels in the range of 0 - 21%. To validate our calibration, distilled water is placed into the cuvette. Air saturated distilled water has a dissolved oxygen of 20.9%. If the sensor measures this value with a small deviation of 0.2%, the system is validated to perform cell culture experiments.

## The experiment

As the validation process is completed, we start our experiment by placing 5 mgs of yeast cells in 4 ml of distilled water in the cuvette, magnetic stirrer is placed in the cuvette and the stirring speed is set to a

maximum using the qpod temperature and magnetic controller interface. The temperature is set at room temperature. The OOI sensors software starts logging the data from the instant the yeast cells are placed in the distilled water. After each 30 minute run all of the dissolved oxygen sensor data is logged. The cuvette is washed and dried and placed back into the qpod for the next run. The experiment is conducted 3 times with no nutrients. To replicate the bioprocess conditions in the bioreactor, nutrients were added to the cell culture to study the rate of dissolved oxygen in the cell culture media. The experiments were repeated with the yeast cells (5mgs) and sugar (50 mgs) added simultaneously.

## Results and conclusion

The yeast cells when dissolved in distilled water started consuming the oxygen through the liquid cell membrane interface by the diffusion process. As the cells are consuming the oxygen in the liquid media through diffusion, the oxygen depleted in the liquid media is what the RedEye™ oxygen patch is really sensing. The small scale culture applications have the advantage of studying the effect of multiple nutrients/environmental conditions on the oxygen levels consumed and also on the process throughput. With an objective to study the performance of redevye patch in sensing oxygen levels in the cell culture, we have performed the experiment using sugar as a nutrient. Sugar which is the fuel for the cells gain the energy necessary to reproduce is added along with the cell simultaneously. The cells are grown at a faster rate in the presence of sugar and consume the oxygen levels in the liquid media at a faster rate.

## Measuring dissolved oxygen in bioprocesses

Reader reply

16

## ! Featured Product !

## NeoFox oxygen sensors

NeoFox is our oxygen sensor that can be used to monitor oxygen in biological samples, headspace gases, slurries, cosmetics, foods, gases and liquids in natural environments. This phase measurement system is a fluorescence-based optical sensor system that offer fast response times.

The system has no need for frequent calibration and we offer multiple probe options for lab, field and process environments. NeoFox is the benchtop device for measurement of fluorescence lifetime, phase and intensity and is particularly suited for applications where sensitivity to drift and system stability are critical.

## The NeoFox oxygen sensor

Reader reply

17



## Requesting More Information

I would like to receive more information about:

- 01  Special gift with your next spectrometer order
- 02  Analysing contact lenses
- 03  The NanoCalc system
- 04  Thin film metrology / Mikropack series
- 05  OEM solutions
- 06  The QE65000 scientific grade spectrometer
- 07  User-configured spectrometers
- 08  The Jaz light meter
- 09  Measuring light levels in greenhouses
- 10  Meet Ocean Optics at the Hortifair
- 11  Jaz configured for solar irradiance measurements
- 12  Other configuration possibilities for Jaz
- 13  The NIRQuest spectrometers
- 14  Online quality control using NIRS
- 15  ANIR series of scanning Fourier Transform Spectrometers
- 16  Measuring dissolved oxygen in bioprocesses
- 17  The NeoFox oxygen sensor
- 18  Other: \_\_\_\_\_

## My Details

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Country \_\_\_\_\_

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Email \_\_\_\_\_

**Fax this form back to: +31 - 26 319 0505**

## Tradeshows overview

[Semicon Europe 2009](#)

6-8 Oct 2009

Dresden, D - Stand 1.568



[Hortifair 2009](#)

13-16 October 2009

Amsterdam, NL - Stand 04.0430

[Photonex 2009](#)

14-15 October 2009

Coventry, UK - Stand D30

[Photonica Expo 2009](#)

25-27 November 2009

Milan, Italy - Stand B12

[Precisiebeurs 2009](#)

2-3 December 2009

Veldhoven, NL - Stand 87

[ArabLab 2010](#)

9-12 January 2010

Dubai, UAE - Stand



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