



Norman Rockwell was commissioned to do paintings for American Optical and they now reside in the Optical Heritage Museum.

● ● ● REGIONAL NEWS

New England



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“And now for something completely different” is a quote which I think best described the New England Region’s fall meeting held October 12, 2016. It started with the location...Southbridge, Massachusetts. Located about 60 miles west of Boston, Southbridge describes itself as the “Eye of the Commonwealth,” a phrase which harkens back to the town’s long history of manufacturing optical products. The venue itself was also very untraditional for a region meeting. Once a cannery, the building at 12 Crane Street now houses a music hall, brewery, pub and, pertinent to our meeting, the Optical Heritage Museum.

The museum houses over 3,000 items relevant to optics. There are microscopes, lensometers, dioptometers and standard lenses which at one point were calibrated by NIST. Exhibits range from some of the first steel-framed spectacles produced in America to the development of fiber optics that was sponsored by the CIA.

Even the original wide screen version of the film *Oklahoma*, which premiered in New York City on October 11, 1955, is on display. This was the first Todd AO film, and used a process and lens developed at American Optical. The American Optical Company and its affiliates were instrumental in many

innovations through history including the solid state laser, cardiac defibrillator, safety goggles and the executive bifocals. Items on display include an order from John F. Kennedy for executive bifocals which was received by mail at the plant the day JFK was assassinated.

Our tour guide through the museum was Dick Whitney, Executive Director at Optical Heritage Museum. He is presently the Manager of Global Standards for Carl Zeiss Vision and is an FDA Ophthalmic lens impact testing expert.

After the tour, we settled in to learn about vibration measurement and testing. Our subject expert was Bob Craft. Bob is an Application Engineer with Bently Nevada, a subsidiary of GE, and has over 35 years of experience in the field of condition



Bill Hinton getting ready for Halloween with some less traditional frames on display at the Optical Heritage Museum.



Dick Whitney continuing the tour of the Optical Heritage Museum.

monitoring systems. He developed and instructed the courses that taught TRIDENT class submarines forces, who work regularly with TRIDENT ballistic missiles, how to use the installed Noise and Vibration Monitoring System for both ship silencing and machinery condition analysis. He also worked in the nuclear power industry at Detroit Edison's Enrico Fermi Unit 2 Nuclear Generating Station as the lead vibration engineer.

Bob related to us that the US Navy was one of the major forces behind the development of modern vibration analysis and monitoring systems. Vibration analysis involves monitoring critical systems for abnormalities. The "normal" vibrations of a properly running system need to be filtered out, so things like

bearing degradation, or gear tooth issues, and other anomalies of interest can be detected.

A properly engineered system allows for detection of machinery defects long before a critical failure or unplanned outage is encountered. Vibration systems can also provide alarms and shutdown for machinery in critical applications, and can protect not only machinery, but can be a major factor in plant safety as well.

Bob described the major types of sensors used in today's modern systems. These are primarily accelerometers and proximitors. Each has their specific benefits, depending on the application. As with most modern-day instrumentation, much is dependent on the software and he touched on the complexity of that as well.

Bob left us with the overriding principle that proactive maintenance is important in any number of industries and applications. The Navy found that by monitoring critical systems, they had a 3:1 savings when comparing costs of unplanned repairs and downtime to the cost of the monitoring equipment.

A key point, as Bob explained, is that functional failure is a process and not an event. The trick is in detecting the process early on. With today's systems, changes as subtle as contaminated or degrading lubricants in machinery can be detected.

With that, we were back on the topic of visible elements and turned the meeting over to Dr. Jing Zhou. For the past 10 years she has been engaged



Dick Whitney, Executive Director of the Optical Heritage Museum, conducting a tour of the museum.



Dr. Jing Zhou, International Light, during her presentation on the measurement of visible light.



Bob Craft, Bently Nevada, presenting on vibration measurement.

in research and development of optical measurement systems and calibration for both academic and industrial fields. Dr. Zhou also presently works for International Light. Light measurement takes on increasing importance as we evolve from incandescent light sources to other technologies at home and in the workplace. Dr. Zhou first discussed the concepts and techniques of measurement in the visible spectrum which, for humans, is in the range of approximately 380 to 770 nm.

Important facts to understand are the definitions and parameters unique to light measurement. Radiant flux is the measure of radiometric power. Luminous flux is the measurement of visible light and is expressed in lumens and weighted to match the responsivity of the human eye. Finally, Scotopic flux measurements are weighted to the human eye in the dark-adapted state.

Measurement geometries were discussed and illustrated. Of the many challenges in measuring light, key factors are choosing the right detector(s), input optics and filters. Particular challenges with measuring in the UV regions were presented. Dr. Zhou mentioned that a new 2.4 micron laser-driven Zenon source was helping them expand their capabilities on this frontier. An excellent reference, *The Light Measurement Hand Book*, is available to browse or download from International Light's website (www.intl-lighttech.com). The handbook even introduces the basic principles of setting up an optical bench.

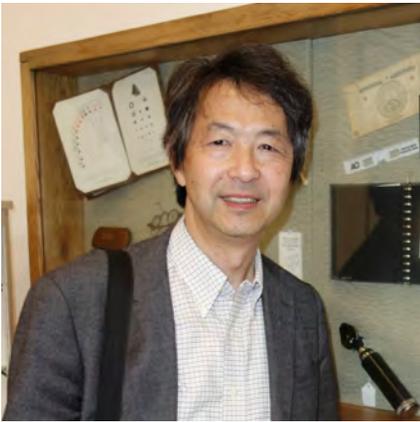
What happens when you run light down a glass "pipe?" Fiber optics! Tony Irujo, a technical support Engineer with OFS, led us on a mission of exploration in terminology and applications for fiber optics. There are a multitude of advantages to using fiber in the use of high speed data transmission. They include no EMF, low signal loss and the cables are small, light, and easy to test.

Multi-mode, typically 850 nm/50 micron, is usually a shorter run vehicle

of transmission, and used in data centers and networks, whereas single mode (8 micron) is used for runs sometimes in excess of 100 miles. For even longer runs, such as transoceanic cables, repeaters are utilized. The concept of the cones of acceptance (angle of light entrance to the cable) was introduced and diagrammed for both fiber types.

Modal dispersion, the cause and effect of signals arriving at different points in time, was discussed, as were the ways OFS engineers have met the unique challenges of signal transmission in a world that sees a need for exponential growth for transmission rates of data.

Causes of other transmission problems, such as attenuation from microbending and macrobending, were discussed. However, Tony explained that the vast majority of transmission link failures were not from the fiber itself, but rather due to improper or



Yoshi Ohno enjoying an exhibit on the development of standard reading tests at the Optical Heritage Museum.



Tony Irujo, OFS, presenting on fiber optics.



Tim Cooke giving Dick Whitney a Certificate of Appreciation.

dirty interfaces and connections.

Instrumentation for fiber measurements were introduced, including the use of Optical Time Domain Reflectometers (OTDR). Tony also shared a video with us that highlighted the science that goes into drawing the fiber at their plant in the neighboring town of Sturbridge.

Rounding out the meeting, we were honored to have a speaker all the way from NIST, Dr. Yoshi Ohno, who spoke on the fundamentals of colorimetry. Dr. Ohno's presentation blended quite well with the museum venue as he expounded on not only color measurement technique, but also presented how the technology had changed and the progression of the science over time.

The CIE 1931 RGB color space and CIE 1931 XYZ color space were the first defined color quantities. They were created by the International Commission on Illumination (CIE) in 1931. The foundation for these came

from experiments done in the late 1920s by William David Wright and John Guild. Additional developments included the 1960 CIE and the plotting of the Planckian locus on the MacAdam (u, v) chromaticity diagram.

Dr. Ohno brought us through the historical refinements in the technology and to the challenges in measurement with today's fluorescent and LED lighting. The specification of white light chromaticity was introduced. He reviewed recent research on the preference of white points outside the current standard. NIST has a spectrally tunable lighting facility which has been utilized for studies with as many as 40 participants. The goal is a preferred and improved color quality of lighting.

I'd like to thank all the speakers for an interesting program. I think it was nice to take a break from measurement uncertainties for at least one meeting! I would also like to thank all of the meeting attendees for making the trip out to Southbridge.

Our attendees came from as far away as Rochester, New York and Rochester, New Hampshire! The feedback from the meeting was that those in attendance really liked the unique venue as well as my wife's orzo salad, which we had with lunch. I'd like to mention that my employer, Cal-Tek Company, Inc., sponsored the meeting by providing the meeting room rental, sandwiches and additional refreshments. I would like to thank Cal-Tek as well as NCSL International for their support.

Thoughts and suggestions for future meetings included Network Analyzer calibration training and more hands-on sessions. Have a suggestion for a potential meeting topic? Please contact me via email.