Draft Minutes
ASC OP1 Optics and Electro-Optical Instruments – Optical Elements and Assemblies – Wavefront Standard
Sunday, October 8, 2006, 1:30 p.m. – 6:00 p.m.
Hyatt Regency Rochester, 125 East Main Street, Rochester, New York, USA 14604
Loftus C. Carlson Room, Section B

Attending

☒	**Committee Members (10 of 14)**	**Representing**
☒	David Aikens	Zygo Corporation.
☒	Gordon Boultbee	JDSU
☒	Benjamin Catching (Alternate)	JDSU
☒	Walter Czajkowski	APOMA (Edmund Optics)
☒	Marla Dowell	IEEE/LEOS (NIST)
☐	Andrei Brunfeld	Xyratex
☒	Lincoln Endelman (by phone)	SPIE
☐	John M. Hamilton	Northrop Grumman Corporation
☐	Hal Johnson	Harold Johnson Optical Lab
☐	Michael Morrill	Lockheed Martin Space Systems Co.
☒	William Royall	Eastman Kodak Company (Retired)
☒	Peter Z. Takacs	Brookhaven National Lab
☒	Trey Turner	Research Electro-Optics, Inc.
☒	Steven VanKerkhove	Corning Tropel
	Observers (2)	
☐	Lahsen Assoufid	Argonne National Laboratory
☒	Gene Kohlenberg	OEOSC
☒	Alan Tourtlotte	OSA

Auditor's Summary of Meeting

The task force reviewed what transpired at the ISO/TC 172/SC 1 meeting in Boulder, CO in June of 2006. They looked at the ISO 10110 documents and the ISO 14999 documents to see how they could be used as a basis for a US standard. The US is the project leader for for the ISO 10110-8 draft. It will probably be developed simultaneously as a US and an ISO standard.

There was a long discussion concerning the need for revision of ISO 10110-5 ,-14, ISO 14999-1 through -5. The group decided to propose two new US standards, BSR/OEOSCOP1.004 and BSR/OEOSC OP1.005 that will be developed to rectify the problems with the afore mentioned set of ISO standards. After struggling some time to list items that should be included in the scope, the task force decided that it should first determine the purpose of these two new drafts.

The project will be continued at the next meeting in San Jose, CA, in January 2007.

1. **Welcome and Introductions**

D. Aikens opened the meeting at 1:35 p.m. with a round of introductions.

2. **Adoption of Agenda**

M. Dowell moved that the draft agenda as modified at this meeting be adopted. P. Takacs seconded the motion. The motion carried unanimously.

3. **Approval of draft minutes of June 25, 2006 meeting**

M. Dowell moved that the minutes of the previous meeting be approved as presented on the OEOSC web site. P. Takacs seconded the motion. The motion carried unanimously.

4. Review Results of ISO Boulder Meeting

D. Aikens said that the issue of ISO 10110-5 (surface form) and ISO 10110-14 (transmitted wavefront) notation standards that were originally released in 1996 was not completely resolved at the meeting. The inertia of the ISO development process means that these documents will be re-released in their current form. They contain information on measurement and fringe interpretation. Japan released them as national standards.

In 1997 the committee decided to split the documents so that notation would be contained in one standard and measurement requirements in another. There was an effort to create a measurment standard for each notation. ISO 14999 was the measurement standard that corresponds to the wavefront notation. During the development of the standard, it was broken into four parts. The four parts start from fundamental definitions, and proceed through actual interferometric setup. The documents were written in German and then converted into English. Then the project leader left the standards effort. Nothing was done with them for several years. Unfortunately ISO 10110-5 and -14 were already modified to take out all of the testing information. In order to beat the ISO development deadline, ISO 14999-1 through -3 were released as technical reports because they were not written well enough to be classified as a standard. Then ISO 14999-4 was going to be developed as an international standard for measurement.

Many persons did not like the evolution of ISO 1499904. Keith Birch from the UK wrote his own version of interferometric testing. It was very hands-on and detailed with a lot of lore and opinion.

In Boulder the committee was supposed to finalize the wording of ISO 10110-5 and -14, along with ISO 13999-4. Part five was in limbo. In order to salvage part 4 the original language from ISO 10110-5 and -14 replaced what had been written. It still had serious problems, however. One day was spent on the document.

Keith Birch proposed that they begin work on ISO 14999-5. The plan is to release ISO 14999-4 as a standard, and then immediately begin to revise it. Part five is the draft of the work done in the UK; there is some overlap with part 4. By the end of the meeting the committee decided to merge unique material in -5 into -4. The ISO 14999 series of documents needs to be overhauled to make a good standard.

There was progress with the ISO 10110-12 aspheric draft. It is ready to be released at the international level. In order to have an aspheric standard one needs to deal with mid-spatial-frequency ripple and power spectrum. This subject is not well documented in ISO 10110-8 as yet. The problem is treated as roughness rather than mid-spatial-frequency ripple, or waviness. The committee decided to draft a slope and power spectrum section to be incorporated into the body of the notation, recognizing that ultimately it needs to be moved to a roughness standard. Aspheres must have the slope controlled in order to achieve the design intent.

The US volunteered to chair the rewriting of ISO 10110-8. Peter Takacs has volunteered to be the project leader.

P. Takacs said that the philosophy is that ISO 10110-8 will be generic, not limited to mid-spatial-frequency ripple. He said that he obtained a copy of the SEMI draft document 3807 standard from John Sover (sp), is a detailed description of what is distilled in -8. D. Aikens suggested that this document could be referenced if it is good work. The specification is SEMI MF-1811-97 (2002). P. Takacs said that SEMI 3807, "Guide for Estimating the Power Spectral Density Function and Related Finish Parameters from Surface Profile Data." has a history of bouncing amoung several standards groups. It started at ASTM and then moved to an ANSI group before SEMI picked it up. D. Aikens read from the document that SEMI has obtained the copy right from ASTM documents that relate to silicon issues.

L. Endelman asked if anyone has used the document. P. Takacs said that there are a number of the standards developed by ASTM that the semiconductor industry has picked up.

D. Aikens said that a properly drafted ISO 10110-8 solves the problem of notation for mid-spatial-frequency ripple and rms. It leaves the problem of how to measure them and specify figure. If we were to release ISO 10110-8 as an ANSI standard, half of the problem is solved.

L. Endelman asked if ASTM now has to pay a royalty if it continues to use the standards transferred to SEMI. D. Aikens replied that in the document there is a note that says that ASTM has the right to continue using its original version of the standard. The revised document will be owned by SEMI. P. Takacs said that he understood that there will only be one version of the standard.

D. Aikens said that there are other member nations who voiced an interest in participating in the development of the revised -8. Normally the US would prepare a New Work Item Proposal (NWIP) for the project now, but Elisabeth Leitner (ISO) said that -8 comes up for reaffirmation in 2007, so work can be started now without filing the NWIP until the review of the standard is initiated. G. Kohlenberg reminded the group that five member nations must volunteer before any project can be initiated. The nations that are assumed to be willing to work on this project are the US, Switzerland, Germany, Japan and the UK.

L. Endleman asked if the work would be submitted as an ISO document rather than making it a US standard first. D. Aikens suggested that both avenues could be processed concurrently.

D. Aikens told P. Takacs that he could develop the draft by any means that he chooses. He suggested that part of the wavefront meetings could be devoted to the -8 rewrite, or we could set up a separate task force. For the US version, this draft standard will be BSR/OEOSC OP1.004, "Surface Texture."

5. Establish Scope Statement of Wavefront Standard

D. Aikens said that there is still a need to clean up ISO 10110-5, -14 and ISO 14999-1 through -5. At the previous meeting D. Aikens stated that the committee decided to develop a US standard for wavefront notation and metrology in a single standard. The US

version will be BSR/OEOSC OP1.005. L. Endelman asked who the primary users of the wavefront standard will be. Are they in the semiconductor area, or some other group? D. Aikens said that the users of OP1.004 would be anyone who specifies optics, and it would replace what is currently written on drawings. OP1.005 would cover how you write down and validate surface form. It would apply to all optics. L. Endelman asked what he meant by surface form. D. Aikens replied that it would include power, irregularity, coma, etc. L. Endelman said that he was trying to determine why the semiconductor industry would be interested in this standard. D. Aikens replied that SEMI and the auto industry have already developed methods for defining surface texture and mid-spatial-frequency ripple. Those standards exits today. At the last meeting, P. Takacs agreed to get the SEMI specs. G. Boultbee asked if we expect to borrow relevant sections. D, Aikens replied that we would attribute where we can.

T. Turner said that there were some scope questions whose answers were not obvious to him. For example, P. Takacs said earlier that OP1.004 should be independent from spatial frequency. How does that work with a fixed form specification? Where is form and ripple divided? ISO 10110-5 and -14 specify form and wavefront. Will the new document include both form and wavefront? D. Aikens said that it would include form and wavefront, plus form and wavefront metrology. D. Aikens agreed that the dividing line between form and waviness of ripple is an issue.

D. Aikens listed what would be included in OP1.004 and OP1.005:

OP1.004	OP1.005
Surface Texture	Form
Mid-Spatial-Frequency Ripple	Wavefront
MSF and Texture Metrology	(Form Metrology)
	(MSF & Texture Metrology)

L. Endelman asked if the scope would state that the standard is limited to optical components. D. Aikens replied that that is the task forces charter and it should be in the scope. L. Endelman wanted to make sure that the task force did not get into a contest with other standards organizations to see who was responsible for what. M. Dowell reported that does IEC have standards covering radio wavefronts and acoustic wavefronts.

D. Aikens read S. VanKerkhove's comment concerning the scope, “What issues should be considered as well as neglected when defining the scope for creating a wavefront standard? The first necessary step on the path to an adopted wavefront standard is a scope statement that will act as a guideline for setting the boundary’s.

“Issues to be considered or neglected when writing the wavefront standard. This is a list of issues that were raised at the June 25th meeting in Boulder.”

	BSR/OEOSC OP1.004	BSR/OEOSC OP1.005
Managing the calibration of the measuring instrument	ISO/IEC 17025-2005	ISO/IEC 17025-2005
Instrument calibration procedures		
Management of the uncertainty (14999 is inconsistent with GUMs)	NIST Guide to Uncertainty Measurement (GUM) ANSI/NCSL Z540-2-1997	NIST Guide to Uncertainty Measurement (GUM) ANSI/NCSL Z540-2-1997
Focusing of the interferometer		
PSD; yes or No	Yes	No
Specific types of errors to be defined		
Dividing line between form and ripple (T. Turner)		
RMS of the slope	Yes	Yes
Environmental effects (temperature, pressure, humidity, vibration etc. etc.)	Site references to existing standards	Site references to existing standards
Polarization effects on the measurement		
Noise sources that degrade the integrity of the measurement.		
Aperture shape and size		
Distortion		

Interferometers, Profilers, Optical Profilers, AFM, Confocal Microscopes		

D. Aikens asked L. Endelman if he thought that calibration procedures should be part of the standard. L. Endelman said that if the standard designates a calibration procedure, he thought that there would have to be some device to compare to. And that device would have to have a basic procedure for its own calibration before using it to calibrate other instruments. D. Aikens said that before defining the scope of the standard, the task force needs to take all of the aspects of wavefront specification and measurement and consider them for inclusion or exclusion.

W. Royall said that before you can determine the scope you have to have a purpose statement. Is the purpose of the standard to allow two facilities to measure the part the same way? If it is then you write the scope to say that. What we have here is a list of interesting topics, but what do they accomplish? Right now it is a definitions list. P. Takacs said that perhaps the task force is looking at the trees when it should be stepping back to look at the forest. W. Royall added that there should be a target. L. Endelman added that if the scope is chosen then the task force can take a look at what needs to be included to accomplish the scope. D. Aikens agreed that the task force should step back and decide what is the purpose of BSR/OEOSC OP1.005.

At this point the task force took a ten minute break. L. Endelman left the meeting for the day.

After the break W. Royall asked if the OP1.005 was intended to replace the ISO standards. If so, then the purposes of the ISO standards should be reviewed. D. Aikens said that ISO 10110-5 is notation for surface form, and ISO 10110-14 is notation for transmitted wavefront errors. P. Takacs said that he thought the document should be useful in the optical shop. D. Aikens asked what kind of an optical shop – sticks and test plates? P. Takacs replied that it should be a guide for those who are using the test instruments to provide documentation to their customers.

The task force developed the following lists to define the purpose of the two US draft standards:

Purpose of BSR/OEOSC OP1.004	Purpose of BSR/OEOSC OP1.005
Provide replacement for ISO 10110-8, ISO 14999-1 through -5	Provide alternatives to ISO standards 10110-5, -14, 14999-1 through-5
Define limits of surface texture and mid-spatial-frequency ripple	Useful to persons who provide test data to customers **not** shop floor testing
Useful to persons who provide test data to customers	Create unambiguous statements of requirements for form, RWF and TWF – notation
Create unambiguous statements of requirements for texture and mid-spatial-frequency ripple vs. spatial frequency– notation	Notation on measurement method requirements?
Notation on measurement method requirements	Use fundamental, scientific, traceable units (e.g. nm)
Use fundamental, traceable, scientific units	Keep language consistent with aspheres
(Applicable to aspheres)	Language must be clear to a non-engineer or easily translated
Method for communicating roughness and aerial texture data, measurement conditions and uncertainty	Method of communicating form or wavefront data, measurement conditions and uncertainty
Test methods to be used	Test methods to be used

6. Time and Place for next OP1 Wavefront Meeting

M. Dowell moved that the group meet next in San Jose, CA, during Photonics West. G. Boultbee seconded the motion. T. Turner moved that the following meeting be held in conjunction with Optifab in Rochester, NY, May 14 – 17, 2007. G. Boultbee seconded the motion.

7. Adjournment

G. Boultbee moved that the meeting be adjourned. T. Turner seconded the motion. The meeting was adjourned at 5:05 p.m.