Draft
Minutes
ASC OP1 ASC OP/SC 1, Performance Based Optical Imperfections Task Force Draft Standard Meeting
Saturday, January 21, 2006, 8:30 a.m. — 12 Noon
Fairmont Hotel, Cupertino Room
170 South Market Street, San Jose, CA 95113

Attending ☒	Committee Members (8/14)	Representing
☒	David Aikens	Zygo Corporation
☒	Gordon Boultbee	JDS Uniphase Corporation
☒	Andrei Brunfeld	Xyrtex
☐	Walter Czajkowski	APOMA (Edmund Optics)
☐	Frank Dombrowski	Gage-Line Technology, Inc.
☐	Marla Dowell	IEEE/LEOS (NIST)
☒	Lincoln Endelman	SPIE, (Endelman Enterprises)
☐	Charles Gaugh	Davidson Optronics, Inc.
☒	John Hamilton	Northrop Grumman
☐	Hal Johnson	Harold Johnson Optical Lab
☐	Rudolf Hartman	Retired
☒	William Royall (by phone)	Eastman Kodak Company, Retired
☒	Trey Turner	Research Electro-Optics, Inc.
☒	Steve VanKerkhove	Corning Tropel
	Observers (3)	
☒	Gene Kohlenberg	OEOSC
☒	Stephen Martinek	4D Technology
☒	Michael Morrill	Lockheed Martin Space Systems Company

Auditor's Summary of Meeting

The committee decided that it is possible to add objective scratch and dig notation to the appearance standard OP1.002.

Northrop Grumman has made some progress in compiling data from their visual scratch and dig operator evaluation. The report will probably be completed within the next six months.

C. Gaugh was not able to participate in this meeting so information concerning a company round robin comparison of visual appearance repeatability was not available.

An addition to the OP1.002 standard was proposed: "The standard will not provide a designation for the required application of an optical element or system. The drawing for the optical element will include a notation by the optical designer of the maximum imperfection that is acceptable for the impact on elements or systems performance." A draft of a measured scratch width specification was presented. The secretary was asked to fold it into the current standard as Section 4. This will be the basis for further editing by the time the next meeting occurs.

A phase artifact notation will not be pursued unless one of the committee members can find one that already exists.

Welcome and Introductions

D. Aikens opened the meeting at 8:37 a.m. Each person introduced himself to the group.

Adoption of Agenda

J. Hamilton moved that the draft agenda be adopted. G. Boultbee seconded the motion. The motion carried unanimously.

Approval of the Sunday, July 31, 2005 ASC OP/SC 1, BSR/OEOSC-OP1.002, Optics and Electro-Optical Instruments – Optical Elements and Assemblies — Appearance Imperfections Draft Review Minutes

The minutes had been posted on the web site. The Chairperson asked if there were any additions or corrections to the minutes. G. Boultbee moved that the minutes be approved and seconded the motion. The motion carried unanimously.

Status of BSR/OEOSC-OP1.002

G. Kohlenberg proposed that the charge for the standard will be $50 for printed copy and $35 for the PDF file. G. Boultbee moved that OEOSC approve these charges; L. Endelman seconded the motion. D. Aikens stated that the goal is broad adoption of the standard, rather than providing OEOSC with the revenue. The motion carried unanimously.

L. Endelman asked if the standard would be offered to ISO. D. Aikens replied that the document would have to be split into two documents to meet the ISO requirements. J. Hamilton noted that ISO standards do not have default conditions.

G. Kohlenberg said the BSR 9 form will be submitted to ANSI for final approval of the standard.

D. Aikens asked if the group wanted to proceed with submission as a draft ISO standard. J. Hamilton recommended that this subject be tabled until a future meeting.

Report of Gage Study

J. Hamilton reported that the study is still not completed because his organization is swamped with product demands. Current status: all of the testing is done, and the data is being compiled. They looked at the eye sight of all of the inspectors. They performed visible and electron microscopic evaluations of the Kodak paddle and the army reference samples. They are mono width, variable depth grooves. Northrop Grumman has hired a former Zmax engineer to simulate the reference samples and analyze how the eye would perceive them. They conclude that flat bottomed grooves are not satisfactory and they believe that they know why. Their initial testing of a group of inspectors indicates that, at best, they have a 56% correlation between those inspectors.

For the second inspection trial, Northrop Grumman took two sets of army reference samples, cut one set in half and masked the identification marks. The inspectors were comparing army artifacts against army artifacts. Following this test, J. Hamilton concludes that at the present time we do not have a valid visual inspection system. His task is to document the test, present it to ASC OP so that it can be reported to the optics community.

G. Boultbee noted that both Brysen and Davidson state that they make their reference artifacts by diamond scribing, so one would not expect a flat bottom groove. J. Hamilton says that some scratches look as if the scribe tip has broken because there are multiple grooves at the bottom of some scratch samples.

L. Endelman asked if there is a particular group in the army that could be contacted concerning this test. Hamilton said that it would be John Salerno.

D. Aikens asked the secretary to contact J. Salerno to determine if the final draft of the standard is acceptable to the army. It may be necessary for D. Aikens and J. Hamilton to meet with John Salerno.

G. Boultbee asked when J. Hamilton expected the report to be released. J. Hamilton estimated that it would be completed within six months.

D. Aikens reported that Zygo had ordered several Kodak paddles and was informed that the paddle has been discontinued. G. Kohlenberg said that W. Royall indicated that Kodak sold the molds to a German company. It is presumed that they will once again become available.

A multiple company round-robin comparison of imperfection samples

C. Gaugh did not call in to participate in the meeting, but the group briefly discussed different artifact samples. D. Aikens noted that one of the advantages of teaching the scratch-and-dig class is that he got direct exposure to inspectors who are struggling with the inspection process. It is his experience that the majority of those attending the class are using chrome-on-glass artifacts under magnification. J. Hamilton asked if he was referring to the Rolyn Comparator. D. Aikens confirmed that he was. J. Hamilton said that he thought that the comparator would work if the lines widths were correct. D. Aikens asked what the correct widths would be since the chrome line widths would need to appear to be as bright as the army artifacts.

G. Boultbee asked what military drawing revision did Rolyn claim to meet. D. Aikens said that he thought it was rev. H or L; he was not sure. Then G. Boultbee concluded that the line widths should be the specified widths. D. Aikens confirmed that they should be, but were, in fact, not.

D. Aikens said that at the present time the optics industry is negotiating contracts on a case-by-case basis to come to agreement as to what the specifications should be. J. Hamilton added that we need to get to the point where manufacturers and customers do not have to haggle over whether a component meets the specification or not.

D. Aikens agreed that we need both the cosmetic standard and an objective test.

D. Aikens asked that this topic be put on the agenda again for the next meeting when C. Gaugh could present it.

At 9:25 a.m. the task force recessed so that W. Royall and C. Gaugh could be called to see if they could join the meeting. The meeting was reconvened at 9:37 a.m. Michael Morrill from Lockheed Martin Palo Alto joined the group at this time and introduced himself. He wants to participate on US standards development and make sure that their in-house standards are compatible with national and international standards practices.

Review Proposed Scope of Imperfection Performance Standard

L. Endelman stated that he is bothered by clause 1.1 in BSR/OEOSC OP1.002. It says that the standard does not address the impact of imperfections on element or system performance. Could we write an addendum to the just completed draft that describes what the standard does cover? He thought that the performance issues could be added in the annex of OP1.002. D. Aikens replied that perhaps in the international arena it would be better to put two notations into one standard: one for appearance and one for performance.

J. Hamilton said that in the world of circuit board soldering, the 2000 version of the military soldering standard would be prohibitively expenses for transistor radio production; however, the commercial version of the standard added classes of compliance for different types of products, so that the product could be considered when choosing the specification. The optical standard could include a similar classification system, that would specify an appearance method for low-cost, high-volume optics and a performance method for high-value, low-volume optics. A. Brunfeld agreed with the concept. T. Turner asked if examples would be included. D. Aikens thought that doing that would be daunting. J. Hamilton said that it could be simplified by putting in examples, such as a simple camera, and a piece of medical equipment. He suggested that one would be a letter system and the other numerical system. 80-50 would be cosmetic and FF would be the objective identifier. L. Endelman asked who makes that determination. A. Brunfeld said that the lens designer would make that determination. D. Aikens noted that Zygo has a piece of software called Fred to help decide the limit of the coherent imperfection. He said that there are times when accumulation of imperfections is unimportant. The largest imperfection is the important parameter. L. Endelman said that if he understood the discussion correctly, the committee does not need a separate document for performance.

D. Aikens said that if the group returned to L. Endelman's opening comments, it would be possible to strike the last sentence of the scope in OP1.002, and say that "this standard provides two alternatives for specifying and measuring surface artifacts. It is the responsibility of the optical engineer to choose which notation to use to indicate how he wants the surface artifacts to be validated."

D. Aikens envisioned a way of including an alternative notation in OP1.002 and placing the requirement of metrology into that notation. He proposed an annex that would help support the engineer making that measurement. He than asked if the task force were going to revise OP1.002 to include the performance notation. Were there other insufficiencies in the document that should be addressed? G. Boultbee asked what he had in mind. D. Aikens said that the most frequent comment at the training class was the issue of edge chips. The standard does not give the user any other option than to choose the default, which is much too loose for precision optics, according to students in the class. They would like to be able to say that a chip is a "5" or a "2". J. Hamilton suggested that some sections such as edge chips be segregated in the standard so that high performance optics could have a different default. G. Boultbee said that it is his experience that drawings usually state how far into the element the chip may extend, and how many may occur around the perimeter. D. Aikens replied that ISO 10110-7 gives a specific number, and the user scales his application from that.

D. Aikens asked L. Endelman to provide wording for a new scope clause1.4 in the next addition of OP1.002 rather than a scope for a new performance standard. L. Endelman suggested the following:

> The standard will not provide a designation for the required application of an optical element or system. The drawing for the optical element will include a notation by the optical designer of the maximum imperfection that is acceptable for the impact on elements or systems performance.

G. Boultbee urged the committee to delay deciding whether performance issues will be incorporated into OP1.002. J. Hamilton agreed that we should not make this determination at this point in the meeting.

Usefulness of drawing notation for phase artifacts in coherent systems

G. Boultbee said that for their laser systems they specify a very tight surface quality for lasers and mirrors of 5-1, which does not exist in the standard. In addition they specify surface roughness. The engineers did not indicate that anything else was required on the drawings. G. Boultbee noted that the minutes of the previous meeting indicated that C. Gaugh's customers may use other notation on their drawings.

We will drop this unless C. Gaugh has some examples.

Review of submitted drawing language that currently is used to identify coherent artifacts

At Zygo interferometers are divided into coherent and incoherent systems. For coherent optical systems, the optic is set up as it will be used when it is evaluated. L. Baker reminded D. Aikens that if the size is controlled, then the effect can be calculated. A. Brunfeld said that the same statement is true for depth measurement. D. Aikens said that Zygo has twenty years of experience to help them decide how large a perturbation in the interferogram of an optic can be allowed. Each manufacturer would have to decide how large a perturbation is acceptable. So for the standard the committee should limit its document to objective vs. subjective concepts.

D. Aikens: Rather than focusing on coherent and incoherent conditions, concentrate on the objective measurement.

Replacement of ISO 10110-7 Method I notation

Merged with below.

The creation of a MIL-C-48497 and MIL F 48616 like notation proposal to streamline the use of ISO 10110-7 notation

G. Boultbee combined the best wording from MIL-C-48497, MIL-F-48616 and OP1.002, replacing the appearance notation into an objective notation. Basically the scratch width is measured. He to use the term “objective” rather than “functional” because it is still not known if the width can be correlated to the function of an element. The document wold include notice that magnification may be used to compare the imperfection with artifacts of known widths. G. Boultbee has found that iron oxide reticles are more useful than chrome on glass because they are transparent, and can be placed directly over the imperfection. Cannot use a scratch number because that would cause continuing confusion with the current system. He presumes that the authors of the two military documents used a double letter notation to avoid such confusion. OP1.002 says that the comparison method works for transparent and reflective surfaces, but it doesn't for highly reflective surfaces. He likes the equations in OP1.002 and just incorporated them into the document that he created. He noted that the equation in clause 1.2.1 of his document should read “ $N=\frac{\phi}{20}$, rounding up.”

G. Boultbee pointed out to the task force that he proposed using the actual scratch width for the accumulation formulas, rather than using the next higher designated scratch width. D. Aikens stated that one of the complaints about ISO 10110 is that the actual scratch width is used rather than binning the scratches. G. Boultbee agreed that binning scratches to the next higher designated scratch is faster.

J. Hamilton explained that in their facility they use the Kodak paddle to quickly rank imperfections. If they find one that is borderline, then they measure it under a microscope. D. Aikens pointed out that L. Baker wrote ISO14997 so that there is an initial visual ranking of a, and then there is a more rigorous measurement of those imperfections that are perceived to be borderline. The user is able to note what level of measurement is acceptable. At the ISO Weimar, Germany meeting, the committee discussed a hierarchy of specifications: visual, measured, etc. D. Aikens said that this task force would best serve the community by offering the same options. In cases when money is an issue, do a visual width comparison. When money is not an issue, then the widths would be measured.

D. Aikens said that a second consideration is how to define the width of a scratch. The third is the case of small optics: lenses less than 2 mm in diameter. A. Brunfeld, at an earlier meeting, noted that items smaller than grade A need to be addressed. He now added that the issue of sharp edges vs. rounded edges must be addressed. T. Turner explained that he has laser applications where small scratches are vitally important.

J. Hamilton said that the significance of these measurements is in the eye of the user. His analogy compared the needs of a seamstress, a carpenter and a machinist. Each uses a length unit for measuring their products; however, one is satisfied with a precision of 1/8 in., a second with 1/16 in. and the third 0.001 in. D. Aikens said that if the standard includes provisions for various means of measurement, which could reveal different levels of imperfections depending upon the measurement technique, then there would be confusion. It would be better to be more discrete, and risk losing some applications. The committee could extend the standard to include micro-optics by adding cases below level A.

For M. Morrill's benefit, D. Aikens briefly reviewed how the committee had arrived at the current position regarding a performance standard. As recently as the last meeting, D. Aikens was convinced that there was a coherent technique that could be used to identify small phase artifacts. These artifacts could then be sorted in some fashion. Since that meeting he reviewed the current language for coherent artifacts. He consulted with L. Baker who urged him to see that only the width is necessary. If scratch width is controlled, then the optical quality is maintained. L. Baker said that we should let the user community determine what scratch width is required for individual applications. D. Aikens then noted that we could include depth, volume, etc., but the simplest would be to limit the control to width. G. Boultbee's draft covers this case,width measurement and most of the students in the scratch and dig class assume that the measure of scratches is width. They do not even think about the profile of the scratch. Limiting the standard to scratch width will cause some high end users difficulty because of different scattering possibilities. Those customers could address that situation with a drawing note.

The meeting was recessed at 11:00 a.m. and reconvened at 11:10 a.m.

D. Aikens reviewed what has transpired in the meeting thus far.

1. We will make G. Boultbee's document section 4 in OP1.002.
2. Add notation to be sub letter A and perhaps greater than G
3. Decision on whether si should be the actual scratch width or the nearest bin.
4. Some measurement technique section needs to be added.
5. Definition of scratch width (edge rounding) is needed.
6. Two or three measurement techniques that can be applied over the range, or should particular techniques be used for each range.
7. Should scratch depth be considered? A. Brunfeld said that the compact disk industry is interested in depth.

D. Aikens asked that a review of Section 4 of OP1.002 be added to the agenda of the next meeting. He asked the secretary to fold G. Boultbee's draft document into OP1.002. J. Hamilton suggested that Section 4 be called “Precision Optics.”

G. Boultbee asked that others in the meeting provide “straw-man” verbiage for this. D. Aikens said that he will look at rewriting the introduction to Section 4. He will be referring to an alternative technique for specifying an objective measurement criteria.

In a concluding conversation D. Aikens noted that students at the scratch and dig class are dismayed that they have no way to control scratch widths that makes any sense because of the limitations of ISO 10110-7 and because OP1.002 dodged the subject. There is no tool that the optical engineer can use when he is interested in scratch width. What we need to do is give the engineer a tool to control scratch width and dig size. Then those engineers who can figure out what scratch width and dig size is important to their applications will have a language to note them on their drawings. Today they do not have that tool.

Time and Place of next OP 1 Meeting

Sunday, June 25, 2006 June T. Turner volunteered to provide a meeting room at his company. The following meeting could be at Boston East. (Since the meeting, S. VanKerkhove asked that we not meet on the weekend before the ISO meetings because his daughter will be graduating that weekend.)

Adjourn

L. Endelman moved that the meeting be adjourned; G. Boultbee seconded the motion, which carried unanimously. The meeting adjourned at 11:50 p.m.