

INTERNATIONAL TRIP REPORT

Subject: Meetings of the American Society for Testing and Materials (ASTM) Committee on Fatigue and Fracture Mechanics, the Subcommittee on Fracture Mechanics, and Related Task Groups

Dates of Travel, Countries, and Organizations Visited:

May 17 – 20, 2009
Vancouver, Canada
Hyatt Regency Vancouver Hotel (site of the meetings)

Authors, Titles, and Agency Affiliations:

Robert L. Tregoning, Senior Technical Advisor
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Office of Nuclear Regulatory Research

Sensitivity: N/A

Purposes of the Trip:

- (1) To participate as the chairman and as a representative of the U.S. Nuclear Regulatory Commission (NRC) for the Task Group on Ductile-Brittle Transition (E080706) in meetings of the ASTM Subcommittee on Fracture Mechanics (E0807),
- (2) To participate as the NRC representative in the task group meetings of E0807,
- (3) To report on E080706 activities, serve as the secretary, and participate as the NRC representative in the E0807 meeting,
- (4) To report the activities of the E0807 meeting and participate as the NRC representative in the ASTM Committee on Fatigue and Fracture Mechanics (E08) meeting.

Summary of Pertinent Points/Issues:

On May 17 – 20, 2009, Dr. Tregoning traveled to Vancouver, Canada to participate in the ASTM meetings of Main Committee E08, Subcommittee E0807, and the task groups affiliated with E0807. On May 18, Dr. Tregoning participated in task group meetings on Ductile Crack Growth and Initiation (E080705), Crack Tip Opening Angle (CTOA) – δ_5 Concepts and Procedures (E080707), Ductile-Brittle Transition (E080706), and Crack Tip Opening Displacement (CTOD)/ Fracture Toughness of Welds (E080708). Dr. Tregoning is also chairman of the E080706 task group. The principal topics covered during these task group meetings included

- (1) discussing the subcommittee ballot on the addition of a high rate loading annex to ASTM E1820 “Standard Test Method for Measurement of Fracture Toughness,”
- (2) proposing E1820 revisions for ballot,
- (3) discussing plans to make ASTM and international standards on CTOA- δ_5 more consistent,
- (4) presenting the current knowledge of predicting ductile fracture of low-constraint specimens using CTOA,
- (5) resolving issues associated with the ballot on ASTM E1921, “Standard Test Method for Determination of Reference Temperature, T_0 , for Ferritic Steels in the Transition Range,”

- (6) proposing E1921 revisions for ballot, and
- (7) discussing the proposed test practice on weld testing changes.

On May 19, Dr. Tregoning participated in task group meetings on Elastic Fracture Mechanics (E080701), and Dynamic Fracture and Crack Arrest_(E080704). The principal topics covered during these meetings included

- (1) resolving issues associated with the ballot on ASTM E399, "Standard Test Method for Linear-Elastic Plane-Strain Fracture Toughness, K_{Ic} of Metallic Materials,"
- (2) addressing the status of ASTM E338 "Standard Test Method of Sharp-Notch Tension Testing of High-Strength Sheet Materials" and ASTM E602 "Standard Test Method for Sharp-Notch Tension Testing with Cylindrical Specimens,"
- (3) discussing the new crack arrest annex to E1221 "Standard Test Method for Determining Plane-Strain Crack-Arrest Fracture Toughness, K_{Ia} , of Ferritic Steels," and
- (4) discussing a study to identify recommendations for improved crack arrest testing criteria.

On May 19, Dr. Tregoning also participated in the Subcommittee meeting of E0807, and the Main Committee meeting of E08. Dr. Tregoning also served as secretary of E0807, and reported on the E0807 activities to E08. The principal topics covered during the E0807 meeting included

- (1) providing reports on task group activities, and
- (2) identifying ballot proposals and actions to be addressed during the E08 meeting.

The principal topics covered during the E0808 meeting included

- (1) providing reports on all subcommittee activities,
- (2) providing reports on related international standards activities and upcoming symposia,
- (3) resolving outstanding ballot issues, and
- (4) dispositioning ballot initiatives proposed by the subcommittees.

This trip did not result in any recommended actions by the Commission or the Office of Nuclear Regulatory Research.

Discussion:

The ASTM E08 Main Committee currently oversees all fracture toughness testing standards. Several of these standards support NRC regulations. Several open ballots were addressed during the subject meeting and decisions were made on the proposed revisions. Specifically balloted changes on ASTM E399, ASTM E1820, and ASTM E1921 were accepted. In addition, several new ballot proposals were proposed and approved for ASTM E1820, ASTM E1921, ASTM E338, and ASTM E602. The E08 Main Committee also approved ballot proposals for fatigue testing standards ASTM E468, "Standard Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials," and ASTM E606, "Standard Practice for Strain-Controlled Fatigue Testing." In addition, a ballot proposal for ASTM E1922, "Standard Test Method for Translaminar Fracture Toughness of Laminated and Pultruded Polymer Matrix

Composite Materials” was approved. The E08 Main Committee also identified upcoming international symposiums that are sponsored by E08, discussed related International Standards Organizations (ISO) activities, and nominated members for the E08 Executive Committee. More details on the results of these meeting follow.

E0807 Task Group Meetings

E080701: Elastic Fracture Mechanics

The first item of business addressed the E399 ballot item to revise the precision and bias sections. There was one negative ballot from Mr. Stephen Hopkins for disposition by the task group. The negative ballot was reviewed. The ballot implied that the data analyzed for the tables in the precision section was inadequate because there was no evaluation of data for specimens from the same lot of material but with different specimen designs. In fact, four materials were analyzed using both compact tension [C(T)] and single-edge notched bend [SE(B)] test geometries and yielded very similar results. Mr. Hopkins also stated that specimens with varying crack lengths should be included in the analysis. However, the balloted precision and bias sections explicitly state that toughness is likely to be dependent on crack length using the method. The target crack length to specimen width ratio (a/W) has always been 0.5 for ASTM E399. However, the allowable a/W range from 0.45 to 0.55 in E399 exists so that reasonable precracking variations are allowed. The task group adopted a proposal to consider this negative ballot as non-persuasive with a vote of 12 affirmative, 0 negative, and 2 abstentions.

Comments received from other voters were then reviewed and two planned editorial changes to E399 were discussed. The first change will modify loading rate terminology in Section 7.1.1 and the second change will revise Figure A2.2 to allow loose loading pins on the tension clevis drawing.

The E080701 Task Group then considered revising notched fracture test standards E338 and E602. These standards will elapse in 2009 if they are not reapproved. The task group members reviewed proposed revisions to these standards that would be balloted as part of the reapproval ballot. However, serious concerns were raised about statements in the scope and significance sections of both standards and by implications that plane-strain fracture toughness can be measured using specimens without fatigue precracks. Task group members adopted a proposal that both standards be withdrawn by a vote of 10 affirmative, 0 negative, and 3 abstentions. The members believe that the ballot to withdrawn this standard will provide interested parties with the opportunity to revise this standard if there is a desire to keep it active.

E080702: K-R Curve Determination

This task group meeting was not held.

E080703: Surface Cracks

This task group meeting was not formally held. However, there was discussion about reapproving ASTM E740, “Standard Practice for Fracture Testing with Surface-Crack Tension Specimens.” This standard must be reapproved or it will be dropped in 2010. The members of the E080701 Task Group unanimously recommended balloting to reapprove E740 so that it

does not lapse. The E080703 Task Group will determine if the units and other aspects of the standard need to be updated as part of this ballot.

E080704: Dynamic Fracture and Crack Arrest

The old business consisted of a review of a draft annex to E1221 for calculating a crack arrest reference temperature, T_{Kia} , that is analogous to the T_o reference temperature for the initiation fracture toughness. The task group reviewed several technical issues that need to be addressed before a draft annex can be completed. Issues include data censoring, the required number of specimen tests, and the appropriate procedure for calculating tolerance bounds. Dr. Kim Wallin presented an approach for censoring invalid specimens having low crack arrest values. The censoring procedure is inclusive but requires an iterative numerical solution. Therefore, the task group first plans to investigate the effect of data censoring on T_{Kia} to determine if censoring needs to be addressed within the draft annex. Professor Richard Link presented the results of a Monte Carlo analysis to characterize the effect of the number of specimens in a data set on the accuracy of the T_{Kia} estimation. The results of this analysis were used to specify the number of data points required in the draft annex.

The new business consisted of two technical presentations. The first presentation by Mr. Arnulf Gundermann and Dr. Elisabeth Keim of AREVA summarized recent experiences with crack arrest testing of unirradiated and irradiated reactor pressure vessel materials. This extensive investigation included approximately 85 crack arrest tests and evaluated the effect of specimen thickness, initial notch length and crack starter notch preparation on the crack arrest toughness. The data demonstrated an apparent effect of specimen thickness on the crack arrest toughness even though all specimens met the validity requirements. Thinner specimens resulted in higher crack arrest toughness values, Task group members encouraged the presenters to publish the results of this study and to recommend modification to E1221 acceptance criteria based on the results.

The second presentation by Dr. Marc Scibetta of SCK provided a brief overview of some recent crack arrest tests on clad specimens where the crack initiated in the base material within the cladding heat-affected zone. The cladding significantly affected crack arrest. However, the final analyses of these tests have yet to be completed.

E080705: Ductile Crack Growth and Initiation

Professor James Joyce reviewed the ballot results from the E0807 Subcommittee ballot on a new annex (A17) on fracture toughness tests using impact-loaded precracked Charpy specimens. Negative ballots were received from Professor James Joyce, Dr. Robert Tregoning, Dr. John Merkle, and Ms. Charlotte Belsick. A major concern expressed by the negative from Professor Joyce was that the annex did not describe the required procedures in sufficient detail for users to perform the tests and analysis in a reproducible manner. Professor Joyce proposed several revisions to the annex that provided greater detail about the testing and analysis procedure and the requirements of the test method. The proposed annex was withdrawn from consideration and it will be revised and resubmitted for Subcommittee ballot after addressing the concerns of the negative voters.

Dr. Xian-Kui Zhu next made a presentation on crack growth correction procedures for determining J-R curves. He reviewed many previous proposals for crack growth correction formulas from the literature and compared corrected J-R curves using several different

approaches. The current crack growth correction procedure in E1820 was demonstrated to be slightly conservative, within approximately 2%. Jim Joyce proposed a combined Subcommittee, Main Committee ballot to revise to E1820 to include a crack growth correction expression for determining J-R curves from SE(B) specimens using the η_{CMOD} formulation. The task group unanimously accepted this proposal.

E080706: Ductile-Brittle Transition

The old business first consisted of discussing the concurrent Subcommittee and Main Committee ballot items on revisions to ASTM E1921. The four ballot items proposed

- 1) to modify the machine notch design requirements in Section 7.4 so that they are consistent with the contents of ASTM E1820,
- 2) to clarify precracking requirements for continuous and multiple-step procedures in Section 7.8.2,
- 3) to modify the determination of loading rate for unloading compliance tests, and
- 4) to recast the dynamic tensile strain rate equation in Section 8.7.2.1 in terms of measured fracture toughness properties.

The item to modify the machine notch design requirements in Section 7.4 received 116 affirmatives, 2 negatives, 1 comment, and 126 abstentions from the main committee ballot. One negative, from Ms. Charlotte Belsick, stated that "... Figures 2 & 3 reference Figure 4 but it looks like a new Figure 4 was added the last time this was updated (even if the reference in 7.4 wasn't updated). Should Figures 2 & 3 reference the envelope info in Figure 5 or the crack starter notch configurations of Figure 4?" Ms. Belsick goes on to state that "...7.4 says three types of starter notches but Figure 4 has 4 types and none of them are called 'slot tipped with a hole.'"

Dr. Tregoning noted that current Figures 4 and 5 in E1921 were reversed editorially after a ballot over a year ago. However, references in figures and throughout the text that reference Figures 4 and 5 were not updated. Dr. Tregoning noted that if the ballot is accepted then current Figures 4 and 5 should be switched in order yet again. Once the figures are switched, the notes in Figures 1 and 3 will be correct. Dr. Tregoning also proposed to editorially correct 7.4 to reference the "four" types of starter notches and also to editorially correct the text to refer to a notch ending in drilled hole to be consistent with the figure. Ms. Belsick agreed to withdraw her negative based on this proposal.

The other negative on this item came from Mr. Tamal Dutta and stated that either the last sentence in Section 7.4 "...must specify the size and/or shape of the stress raiser" or the option of allowing a notch ending in a drilled hole should be deleted. Dr. Tregoning indicated that the stress raiser exists only to initiate the fatigue precrack. Requirements exist for the fatigue precrack to ensure that the machined notch does not affect measured toughness. The E0807 subcommittee agreed that additional requirements for the notch stress raiser are not needed. The group unanimously voted to consider this negative technically non persuasive by a vote of 8 affirmatives with 2 abstentions. Dr. Tregoning will also contact Mr. Dutta to determine if he will withdraw his negative based on the task group discussion.

The ballot item to clarify precracking requirements for continuous and multiple-step procedures in Section 7.8.2 received 114 affirmatives, 1 comment, and 130 abstentions from the Main Committee ballot. The comment requires no further action on this ballot item. The ballot item to

modify the determination of loading rate for unloading compliance tests received 112 affirmatives, 1 comment, and 132 abstentions from the Main Committee ballot. The comment identified a typographical error (an extraneous parenthetical) that will be editorially corrected.

The ballot item to recast the dynamic tensile strain rate equation in Section 8.7.2.1 in terms of measured fracture toughness properties received 104 affirmatives, 1 negative, and 139 abstentions from the Main Committee ballot. The negative, from Dr. John Merkle, stated that there is a factor of 2 missing in the numerator of Equation (6) and in References 23 and 24 of E1921. The negative then derives the Irwin expression which differs from Equation (6) by the factor of 2 in the numerator. Dr. Merkle has agreed to withdraw his negative based on the agreement that a subsequent ballot will add the factor of 2 is added to the numerator of Equation (6). Task group members agreed with the recommendation to issue a combined Subcommittee and Main Committee ballot on this issue before the next meeting with 11 affirmative, 0 negative, and 3 abstention votes.

There was additional discussion on other items for ballot prior to the November 2009 meeting. The E080805 Task Group balloted and passed equations for the η_{CMOD} expression for SE(B) specimens in E1820 prior to the May 2009 meeting. In addition, the E1820 standard has updated equations for η_{LLD} and γ that are currently not consistent with the formula in E1921. The task group unanimously decided that E1921 should conduct a combined Subcommittee and Main Committee ballot to change the η_{CMOD} , η_{LLD} and γ expressions so that they are consistent with those currently in E1820. The task group vote tallied 9 affirmatives, 0 negatives, and 3 abstentions.

Another proposed ballot item combined and attempted to clarify the precracking requirements that currently exist in Section 7.8.2 and Figure 4. In this proposal, all precracking requirements would be contained in a revised Section 7.8.2. The task group decided that the current proposal does not clarify Section 7.8.2. Additionally, it was noted that no technical basis was provided for new crack length requirements for constant K-shedding. Dr. Tregoning will work to revise this proposal prior to the November 2009 meeting.

The final proposed ballot item relates to the pop-in procedure currently in E1921. Currently the procedures in E1820 and E1921 are different. The E1820 procedure is based on the procedure in E1290, "Standard Test Method for Crack-Tip Opening Displacement (CTOD) Fracture Toughness Measurement". The E1921 pop-in procedure is more likely than E1820 to characterize a pop-in as significant. However, the E1921 procedure requires a measurement of the initial and post-pop-in compliance. This compliance measurement may not always be possible unless the pop-in occurs within the elastic region. The task group made no recommendation on whether the E1820 or E1921 pop-in procedures are preferable. Dr. Tregoning indicated that he would discuss this issue further with Dr. Enrico Lucon, who identified this issue, to develop a proposal to harmonize the E1820 and E1921 pop-in procedures.

The final old business item relates to the precision and bias statement in E1921. This statement should be revised in order to be consistent with current ASTM requirements. It is planned that this topic will be investigated prior to the November 2009 meeting, and a course of action will be presented to the task group at that time.

The new business consisted of a presentation by Professor James Joyce and Dr. Robert Tregoning entitled "Evaluation of Proposed Annex X5: Treatment of Non Homogeneous Data." The objectives of this study were to develop a more rigorous technical basis to support the proposed annex by 1) understanding and identify gaps in the technical basis, 2) identifying additional requirements needed in annex, and 3) developing user guidance. The study found that several limitations exist with the methods and criteria proposed to characterize material inhomogeneity using E1921 and proposed annex A5.

Following this presentation, there was discussion within the task group on the path forward for annex A5. The task group needs to decide how inhomogeneity should be addressed within E1921. Currently, E1921 assumes material homogeneity and there is little guidance provided to the user on when the material may be inhomogeneous. An alternative philosophy to the current E1921 assumptions would be to assume that materials are inhomogeneous and require the user to demonstrate homogeneity. However, this is a significant departure from the current E1921 philosophy and would greatly increase the complexity of the analysis.

At least one hour of the November 2009 task group meeting will be devoted to discussing the proper approach for addressing material inhomogeneity within E1921. In order to allow for sufficient discussion, presentations will be limited to a few slides per participant, and only used to present ideas and buttress possible proposals. The objective of this discussion will be to develop a consensus among the task group members as to the approach and methods for addressing material homogeneity. Following the November meeting, there will be a workshop in May 2010 in St. Louis on "Characterizing Material Inhomogeneity within the Ductile-to-Brittle Transition Region." The objective of the workshop will be to present information to support the development of specific acceptance criteria and requirements within the standard. These presentations will be published and used as the technical basis for revising E1921 and adding an annex to allow users to characterize material homogeneity.

E080707: CTOA/ δ_5 Concepts and Procedures

The old business identified that there is an equivalent ISO standard to ASTM E2472, Standard Test Method for Determination of Resistance to Stable Crack Extension under Low-Constraint Conditions." The ISO standard is ISO 22889:2007. Professor James Newman, co-chairman of E080707 plans to work with Dr. Karl Schwalbe, chairman of the corresponding ISO group, to identify and address differences among the standards. The objective is to make these standards as consistent as possible.

The new business consisted of a notification that current co-chairman, Professor Newman would like to step down once a suitable replacement has been found. Professor Newman solicited those in attendance for possible suggestions. Professor Newman also presented a talk entitled "Fracture Under Low-Constraint Conditions – from Laboratory Coupons to Structural Applications." This talk provided the history of the development of the CTOA method to characterize stable tearing resistance. It discussed determining a material's critical CTOA using laboratory specimens and then using this criterion in finite element modeling to predict both the maximum structural load and the reduction in the structural load carrying capacity as the crack grows. The CTOA method has been used to analyze large-scale, thin-section structural tests and it has been found to provide a reasonable approximation of the load carrying capacity for structures that contain single and multi-site damage.

E080708: CTOD/Fracture Toughness of Welds

The old business consisted of two items. First, the latest draft of the weld metal fracture toughness test practice was presented. This document was distributed one week prior to this meeting to the attendees of the November 2008 task group meeting. The principal difference between this draft and previous drafts is that it heavily references the ISO weld metal fracture toughness standard, ISO 15653:2009. E080708 Co-chairman Professor Stephen Graham presented a comparison between the ISO standard and the previous version of the ASTM draft test practice. This comparison revealed that the documents were very similar and provided the motive to heavily reference the ISO standard within the ASTM test practice. However, the E080708 chairmen plan to replace references to ISO standards with references to applicable ASTM standards. This revised test practice, along with the current version of the ISO standard, will then be distributed for review prior the November 2009 meeting.

The second old business item discussed updating the η_{CMOD} equations for SE(B) and C(T) specimens in E 1290. This revision would improve the CTOD accuracy and unify equations among all the elastic-plastic fracture toughness test standards that determine values of J and CTOD. However, this proposal led to a discussion about the existing utility of maintaining E1290 since CTOD determination is now very similar to the method prescribe in E1820. Therefore, the task group discussed possibly withdrawing E1290. The task group consensus was to first review the differences between procedures for the calculating CTOD in E1290 and E1820 and then determine if E1290 should be modified or withdrawn.

E0807 Subcommittee Meeting

The principal business of the E0807 Subcommittee meeting consisted of reports by all of the associated task groups, discussion of new business items, and identification of ballot items and other issues that need to be addressed at the E08 Main Committee meeting. The E08 Main Committee approves any proposals related to E0807 standards to 1) disposition negative votes on existing Main Committee ballot items or 2) add new ballot items for Main Committee voting.

E080701 report

The E080701 Task Group report was provided by Professor James Joyce. Details on this task group meeting are found in the "E0807 Task Group Meetings Section" of this report. Several task group items required action by the E0807 Subcommittee. Professor Joyce discussed the negative by Mr. Stephen Hopkins on the ASTM E399 ballot item. Prof. Joyce then proposed to vote this negative ballot as non-persuasive. The subcommittee adopted this proposal with 10 affirmative, 0 negative, and 2 abstention votes. Prof. Joyce next proposed to withdraw ASTM standards E338 and E602. The Subcommittee adopted this proposal with 9 affirmative, 0 negative, and 3 abstention votes.

E080702 report

As indicated earlier, the E080702 Task Group did not meet.

E080703 report

As indicated earlier, this task group meeting was not formally held. However, Professor James Joyce discussed the need to reapprove ASTM E740 so that it does not lapse. The E080703 task group will determine if the units and other aspects of the standard need to be updated prior

to balloting. Professor Joyce proposed that ASTM E740 be balloted for reapproval concurrently by the E0807 Subcommittee and E08 Main Committee. This proposal was approved by the subcommittee with 12 affirmative, 0 negative, and 2 abstention votes.

E080704 report

The E080701 Task Group report was provided by Professor Richard Link. Details on this task group meeting are found in the “E0807 Task Group Meetings Section” of this report. The group principally discussed the basis for the minimum valid data requirements in the current crack arrest annex to ASTM E1221. The group also considered the possibility for including censored data in the analysis, but will first determine the effect that censored values have on the crack arrest reference temperature. There were also two presentations. The first presentation summarized extensive crack arrest testing on unirradiated and irradiated materials. The second presentation summarized crack arrest testing on clad materials where the cracking initiated in the base material within the subclad heat-affected zone. No task group items required action by the E0807 Subcommittee.

E080705 report

The E080705 Task Group report was provided by Professor Richard Link. Details on this task group meeting are found in the “E0807 Task Group Meetings Section” of this report. There was a subcommittee ballot to add an impact-loaded precracked Charpy testing annex to ASTM E1820. Several negative responses to this ballot were received. The annex will be revised after addressing the concerns of negative voters and resubmitted for Subcommittee ballot. One task group item required action by the E0807 Subcommittee. A method has been developed for determining the incremental J-integral using CMOD measurements for SE(B) specimens. The E080705 Task Group recommended that a combined Subcommittee and Main Committee ballot be issued to add this method to E1820. The subcommittee adopted this recommendation with 10 affirmative, 0 negative, and 3 abstention votes.

E080706 report

The E080706 Task Group report was provided by Dr. Robert Tregoning. Details on this task group meeting are found in the “E0807 Task Group Meetings Section” of this report. Several task group items required action by the E0807 Subcommittee. Dr. Tregoning presented Mr. Tamal Dutta’s negative on the ASTM E1921 ballot item to revise Section 7.4 on machine notch design. Dr. Tregoning also discussed Mr. Dutta’s recommendation that the standard should prescribe the size and/or shape of the stress raiser for a notch ending in a drilled hole. Dr. Tregoning proposed that this negative be ruled non persuasive. The E0807 Subcommittee adopted this proposal with 11 affirmative, 0 negative, and 1 abstention votes.

Dr. Tregoning next identified proposed ballot items to revise ASTM E1921. These modifications would 1) add the factor of 2 to the dynamic tensile strain rate equation [Equation (6)] in Section 8.7.2.1 and 2) change the η_{CMOD} , η_{LLD} and γ expressions so that they are consistent with the expressions in E1820. Dr. Tregoning proposed to ballot these items concurrently through the Subcommittee and Main Committee. This proposal for balloting the first item was approved by the E0807 Subcommittee with 12 affirmative, 0 negative, and 1 abstention votes. The proposal for balloting the second item was approved by the E0807 Subcommittee with 11 affirmative, 0 negative, and 2 abstention votes.

E080707 report

The E080707 Task Group report was provided by Professor James Newman. Details on this task group meeting are found in the “E0807 Task Group Meetings Section” of this report. The task group will be identifying and addressing differences between ASTM E2472 and the equivalent ISO standard so that these standards are as consistent as possible. Additionally, Professor Newman made a presentation on the fracture of low constraint specimens. No task group items required action by the E0807 Subcommittee.

E080708 report

The E080708 Task Group report was provided by Professor Stephen Graham. Details on this task group meeting are found in the “E0807 Task Group Meetings Section” of this report. The draft test practice on weldment testing heavily references the ISO standard. The task group agrees with this approach but recognizes that both the ISO standard and test practice will be required for review and balloting. There may be no precedent for ASTM documents to extensively reference an ISO standard. Therefore, this issue will need to be resolved between ASTM and ISO prior to balloting the test practice. The task group is also considering withdrawing ASTM E1290 and will make a recommendation on this action during the November 2009 meeting. No task group items required action by the E0807 Subcommittee.

New Business

The E0807 new business indicated that the ASTM Executive Committee had approved the proposed workshop on “Characterizing Material Inhomogeneity within the Ductile-to-Brittle Transition Region.” This workshop was proposed by the E080706 task group and will be held concurrently with the May 2010 ASTM E08 Committee Meetings in St. Louis, MO. Ms. Charlotte Belsick also indicated that the task group on fracture and fatigue terminology are proposing a combined Subcommittee and Main Committee ballot to revise the definition of effective modulus and elastic modulus, E' . Both of these terms are defined within E1921, although elastic modulus is typically synonymous with Young’s Modulus in other standards. In addition, a different definition of effective modulus is provided within ASTM E561 “Standard Test Method for K-R Curve Determination.” Dr. Tregoning and Dr. Richard Brazil will work with the terminology task group to develop consistent definitions that will be mutually applicable within all the E08 standards.

E08 Main Committee Meeting

The principal business of the E08 Main Committee meeting consisted of receiving meeting reports for the E08 subcommittees, receiving meeting reports for the E08 Executive Committee, discussing new business, and voting on any subcommittee recommendations that require Main Committee action. Action is specifically needed to approve future ballots for consideration by the Main Committee and to disposition negative votes on existing Main Committee ballots .

E0801 – Research and Education

Professor Stephen Daniewicz provided the subcommittee report. The ASTM E08 Executive Committee recently decided to provide hotel cost reimbursement during both the May and November meetings for students if they are actively participating ASTM members. However, reimbursement for May 2009 hotel costs will not be available until a process is established for students to request pre-approval from the E08 Chair. A technical presentation entitled

“Extension of Standard Fracture and Fatigue Crack Growth Test Methods to Include the Effects of Residual Stress” was also provided by Mr. John VanDalen from Hill Engineering.

E0802 – Standards and Terminology

Ms. Charlotte Belsick provided the subcommittee report. There was one negative provided on a ballot item to change references to “crack size” to “crack length” within ASTM E1823, “Standard Terminology Relating to Fatigue and Fracture Testing.” The negative was provided by Mr. Stephen Hopkins and was based on the fact that meeting minutes discussing this ballot item had not been provided prior to the ballot being issued. The Subcommittee proposed voting this negative non-persuasive because it is not an ASTM requirement to provide this information to members as part of the ballot. This proposal was adopted by the E08 members with 33 affirmative, 0 negative, and 1 abstention vote.

This Subcommittee proposed a concurrent Subcommittee and Main Committee ballot item to revise the definitions for effective modulus, elastic constraint modulus, and modulus of elasticity. This subcommittee also proposed a separate concurrent Subcommittee and Main Committee ballot item to revise the definitions for fatigue ductility and fatigue ductility exponent, elastic constraint modulus, and modulus of elasticity. The E08 members unanimously adopted these recommendations.

E0803 – Advanced Apparatus and Techniques

Mr. Art Braun provided the subcommittee report. No main committee actions are required for any Subcommittee proposals. A complete subcommittee report will be provided on the ASTM website (www.ASTM.org) prior to the next meeting in November 2009.

E0804 – Structural Applications

Dr. Markus Heinimann provided the subcommittee report. The Subcommittee is sponsoring two half-day workshops during the May 2010 meetings in St. Louis. The first workshop is titled “Probabilistic Fatigue Crack Growth and Life Prediction” while the second is titled “Surface Crack Shape Evolution: Testing & Prediction.” Additionally, ASTM E739 “Standard Practice for Statistical Analysis of Linearized Stress-Life (S-N) and Strain-Life (ϵ -N) Fatigue Data” is due for reapproval. The Subcommittee unanimously approved a request for a concurrent Main and Subcommittee ballot to reapprove E739 with only editorial changes. The Main Committee unanimously passed this motion.

The Subcommittee has also decided to eliminate task groups E080406 on Structural Proof Testing and E080407 on Fracture Mechanics of Fasteners, since neither one has met or had any other activity in more than 3 years.

E0805 – Cyclic Deformation and Crack Formation

Dr. Sreeramesh Kalluri provided the subcommittee report. Several Subcommittee proposals required approval by the Main Committee. The Subcommittee proposed to have a concurrent Subcommittee, Main Committee ballot to reapprove or approve, as applicable, the following standards:

- ASTM E468, “Standard Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials,”

- ASTM E606, "Standard Practice for Strain-Controlled Fatigue Testing,"
- ASTM E1922, "Standard Test Method for Translaminar Fracture Toughness of Laminated and Pultruded Polymer Matrix Composite Materials"

A reapproval ballot is used if the standards are largely unchanged from the existing version. An approval ballot is required if significant changes to the existing standard are proposed. The Main Committee unanimously adopted the Subcommittee's recommendation to either reapprove or rebalot these standards. A complete subcommittee report will be provided on the ASTM website (www.ASTM.org) prior to the next meeting in November 2009.

E0806 – Crack Growth Behavior

Mr. John Ruschau provided the subcommittee report. No Main Committee actions are required for any Subcommittee proposals. A complete subcommittee report will be provided on the ASTM website (www.ASTM.org) prior to the next meeting in November 2009.

E0807 – Fracture Mechanics

Dr. Robert Tregoning provided the subcommittee report. Several Subcommittee proposals required Main Committee approval. The subcommittee proposed to have several separate items for concurrent Subcommittee, Main Committee ballot. The proposed actions are to

- reapprove or ballot, as applicable, ASTM E740,
- ballot E1820 to add the method to estimate the incremental J-integral using CMOD measurements for SE(B) specimens,
- ballot E1921 to add the factor of 2 to the dynamic tensile strain rate equation [Equation (6)] in Section 8.7.2.1, and
- ballot E1921 to change the η_{CMOD} , η_{LLD} and γ expressions so that they are consistent with those currently in E1820.

The Main Committee unanimously adopted these Subcommittee recommendations.

The Subcommittee proposed to consider that the negative ballot on the precision and bias section of ASTM E399 was technically non-persuasive. The Main Committee adopted this proposal with 27 affirmative, 0 negative, and 4 abstention votes. The Subcommittee also proposed to consider that the negative ballot on ASTM E1921 related to the ballot item to revise the machine notch design section was technically non-persuasive. The Main Committee adopted this proposal with 31 affirmative, 0 negative, and 2 abstention votes. Finally, the Subcommittee recommended to withdraw ASTM E338 and E602. The Main Committee unanimously adopted this proposal as well. Additional details on the subcommittee and task group meetings are found earlier in this report.

E08 Executive Subcommittee Reports

E0892 - International Symposia

Mr. Matthew Mitchell reported on this Subcommittee. The jointly sponsored ESIS/ASTM/DVM ECF 18 "Fracture of Materials and Structures from Micro and Macro Scale" will take place in Dresden, Germany on August 30 – September 03, 2010. Professors. Meinhard Kuna, Dietmar Klingbeil and Klaus-Georg Eulitz will serve as co-chairmen. The Eleventh International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics (38th ASTM National

Symposium on Fatigue and Fracture Mechanics) will be held in Anaheim, CA in 2011. Professor Steve Daniewicz, Ms. Charlotte Belsick and Mr. Emmanuel Gdoutos will be the co-chairpersons

E0893 - ISO Fatigue and Fracture Activities

Mr. Matthew Mitchell reported on this Subcommittee. Mr. Jay Millane summarized the status of ISO fracture testing standards. Fracture toughness standards on crack tip opening displacement testing, pre-cracked Charpy testing, the unified test method, and specimen orientation to texture have been approved. The weldment fracture toughness standard is currently being balloted and the plane strain fracture toughness standard is undergoing review. Mr. Matthew Mitchell summarized the status of ISO fatigue testing standards. Standards on force control fatigue and thermal-mechanical fatigue have been approved. Standards on torsional fatigue, bending fatigue, dynamic calibration of testing machines, strain control fatigue, statistics, fatigue crack propagation, variable amplitude fatigue, multiaxial fatigue, and machine alignment are being submitted for voting. Mr. Millane also stressed that both organizations should identify possible duplication of efforts.

New Business

Under new business, Professor Richard Link indicated that units in standards must comply with the ASTM Form & Style Manual. Units need to conform to these requirements as standards come up for reapproval. Mr. Matthew Mitchell indicated that ASTM E08 has entered into preliminary negotiations to co-sponsor conferences with the International Congress on Fracture (ICF) in much the same manner as the present cooperation with the European Structural Integrity Society (ESIS) for the European Conference on Fracture (ECF). Finally, the Nominating Committee proposed the following nominations for the E08 Executive Board:

Ravi Chona, Chairman
Rick Link, Vice-Chair Standards
Jerry Petrak, Vice-Chair Long Range Planning
Charlotte Belsick, Recording Secretary
Mike McGaw, Membership Secretary

Members at Large:

Mark James, Ken Jerina, Craig McClung, Jim Newman, Rick Neu, Kamran Nikbin,
Robert Piascik, Steve Smith, Steve Thompson, and Kim Wallin

The Main Committee unanimously accepted those nominations.

Pending Actions/Planned Next Steps for the NRC:

Dr. Tregoning will continue to serve as the NRC representative on the ASTM E08 Main Committee, the E0807 Subcommittee, and associated E0807 task groups. Dr. Tregoning will also continue to serve as the Secretary of ASTM E0807 and as a co-chairman of the E080706 Task Group. These roles will require Dr. Tregoning to express his views on new standards and modifications to existing ASTM E08 standards that are used in commercial nuclear power plant design, operation, and evaluation. Dr. Tregoning will also identify current issues related to these standards based on NRC's research and regulatory programs. Finally, Dr. Tregoning will

continue to lead the development of ASTM E1921, "Standard Test Method for Determination of Reference Temperature, T_O , for Ferritic Steels in the Transition Range."

Dr. Tregoning also will pursue the following list of specific actions that arose during the ASTM E08 Committee Meetings.

- prepare and finalize the E080706 Task Group meeting minutes for incorporation into the E0807 Subcommittee meeting minutes,
- prepare and finalize the E0807 Subcommittee meeting minutes by gathering and editing reports from the task group chairmen and compiling all task group presentations for dissemination via the ASTM website.
- finalize the spring 2009 ballot on ASTM E1921 and ensure that ballot items are correctly incorporated into latest revision of ASTM E1921
- prepare concurrent Subcommittee and Main Committee ballot items to add the factor of 2 to the dynamic tensile strain rate equation [Equation (6)] in Section 8.7.2.1 and change the η_{CMOD} , η_{LLD} and γ expressions so that they are consistent with those currently in E1820,
- develop discussion topics on the approach to be used to evaluate material inhomogeneity within ASTM E1921 to support discussion at the November 2009 meeting and solicit presentations for the May 2010 workshop on "Characterizing Material Inhomogeneity within the Ductile-to-Brittle Transition Region.", and
- evaluate and develop proposals to clarify existing precracking requirements and modify the current pop-in procedure within ASTM E1921

Points for Commission Consideration or Items of Interest:

This trip did not result in any recommended actions to be taken by the Commission.

Attachments:

The agendas for the E0807 Task Group Meetings, the E0807 Subcommittee Meeting, and the E08 Main Committee Meeting are available in ADAMS under accession # ML091480106.