

**Project Number:** STIN-0151  
**Project Title:** Development of Stress Intensity Factor Solutions for External Cracks in Thick-Walled Cylinder Vessels  
**Solicitation Date:** February 16, 2016  
**Proposal Due Date:** March 11, 2016

## 1 Summary

ASME Standards Technology, LLC (“ASME ST-LLC”) is soliciting proposals for the referenced project. This project results from an ASME Pressure Technology Codes and Standards (“PTCS”) Standards Committee request to identify, prioritize, and address potential technology gaps in the ASME PTCS so as to maintain the technical relevance of ASME PTCS products.

This Request-for-Proposal (“RFP”) and all open RFPs are posted on the ASME ST-LLC webpage: ([http://stllc.asme.org/ST-LLC\\_RequestsProposals.html](http://stllc.asme.org/ST-LLC_RequestsProposals.html))

## 2 Background

Linear elastic fracture mechanics are used to evaluate critical crack sizes and to predict crack growth. Fracture mechanics methods as delineated in the ASME Boiler & Pressure Vessel Code (“BPVC”), Section VIII, Division 3 (“ASME BPVC-VIII-3”), Article KD-4 are central to fatigue and fracture evaluations, particularly for high-pressure vessels. Up to recently, the stress intensity factor solutions available and referenced are those listed in the current ASME BPVC-VIII-3, Nonmandatory Appendix D and the American Petroleum Institute (“API”) 579-1/ASME FFS-1, Fitness-for-Service, Second Edition. The ASME BPVC-VIII-3, Nonmandatory Appendix D solutions are of limited applicability and out-of-date compared to some of the newer solutions currently listed in API 579-1/ASME FFS-1; therefore, ASME BPVC-VIII-3 should refer to API579-1/ASME FFS-1 stress intensity factor solutions.

Recently, ASME ST-LLC completed its project STIN-0130 whereby the API 579-1/ASME FFS-1 solutions were extended for internal cracks in cylinders for Y values (OD/ID) up to 4. The work proposed in this RFP involves obtaining solutions for external cracks in cylinders for Y values up to 4 (refer to Section 3 herein for more information).

The need for this analytical parametric study centers on the increased use of fracture mechanics solutions for all pressure vessels, and, in particular, high-pressure vessels. There are currently no solutions for many thick-walled situations. Established, verified stress intensity factor solutions are needed to ensure that critical crack sizes and crack growth predictions are accurate. The results are expected to be applicable to both ASME BPVC-VIII-3 and API 579-1/ASME FFS-1. The results need to be presented in a format that allows extension of the existing tables in API 579-1/ASME FFS-1, Annex C. This work will allow both updating ASME BPVC-VIII-3 and expansion of the range of use of API 579-1/ASME FFS-1 into the high-pressure industry.

### **3 Scope of Work**

#### **3.1 Summary**

Stress intensity factors shall be obtained using the finite element method (Abaqus) utilizing J integrals around the crack fronts. A series of finite element models shall be created to cover permutations on the following: Y values (OD/ID), crack aspect ratio ( $a/l$ ), loading, and crack orientation. To elaborate, Y values from 2 to 4 shall be established for several crack aspect ratios (e.g.  $a/l=1/3$ ,  $1/5$ , and  $1/10$ ). External circumferential and axial surface cracks shall be modeled for crack types E and F and infinitely long cracks both axial and circumferential (refer to ASME BPVC-VIII-3, Nonmandatory Appendix D). Stress intensity factor solutions at the free surface and at the deepest point of surface cracks shall be tabulated.

Because the solutions are an extension of known solutions, the accuracy of the models shall be checked against published data both from the ASME BPVC-VIII-3, Nonmandatory Appendix D, API 579-1/ASME FFS-1, and other published stress intensity factor solutions.

#### **3.2 Deliverables**

The project deliverables shall be a report providing stress intensity factor solutions for external thick-walled vessels at the free surface and at the deepest point of surface cracks, and included in this report, an appendix of tabulated constants formatted for direct insertion into the API 579-1/ASME FFS-1, Appendix C.

The report shall be provided initially as a draft report and subsequently as a final report that incorporates the comments of ASME ST-LLC and/or applicable ASME Peer Review Group (“PRG”).

All written deliverables shall be provided as an MS Word file that is formatted in accordance with the ASME Style Guide. One peer review cycle is anticipated and modifications required to the draft, as a result of the review cycle, are the responsibility of the respondent awarded the contract.

#### **3.3 Schedule**

The respondent shall submit a schedule with its proposal that provides major milestones for draft and final deliverables and a reporting schedule. The final deliverable shall be completed no later than June 30, 2016.

#### **3.4 Reporting**

The respondent shall provide a brief status report on a monthly basis, via email, to the ASME ST-LLC project manager identified herein. Progress reports shall be presented at ASME BPVC Section VIII Committee meetings, as requested by ASME ST-LLC.

## **4 Respondent Eligibility Requirements**

ASME ST-LLC is seeking proposals from all qualified organizations including, but not limited to, engineering firms, independent consultants, academic institutions, and federally funded research and development centers. In addition to relevant technical qualifications and experience, respondents must possess an understanding of relevant ASME codes and standards.

## **5 Basis for Selection and Award**

ASME ST-LLC will select the winning proposal by evaluating and comparing the merits of each respondent's complete proposal. This process reflects ASME ST-LLC's desire to select application proposal based on its potential to achieve program objectives, rather than solely on evaluated technical merit or cost. Evaluation criteria include, but are not limited to, the following:

- Respondent's technical capabilities
- Respondent's applicable experience
- Proposal price
- Project schedule
- Any exceptions to ASME ST-LLC's standard agreement

ASME ST-LLC reserves the right to award, in whole or in part, any, all, or none of the proposals/respondents answering this solicitation.

## **6 Contract Terms and Conditions**

The contract to perform the Scope of Work shall be fixed-price. A form of ASME ST-LLC's standard agreement applicable to this Scope of Work is attached as Attachment 1 to this RFP.

ASME ST-LLC will provide access to applicable codes, standards, and other technical references as needed to perform the Scope of Work.

## **7 Submission Requirements**

### **7.1 Proposal Due Date**

Proposal must be submitted by March 11, 2016. Respondents are encouraged to transmit its proposal well before this deadline. Requests for extra time must be sent by February 26, 2016 to the contact listed in Section 8 of this RFP.

ASME ST-LLC intends to select the winning proposal within three weeks of the proposal deadline.

## **7.2 Proposal Preparation Costs**

Proposal costs shall be borne by the respondent. This solicitation does not obligate ASME ST-LLC to pay any costs incurred in the preparation and submission of the proposal, in making necessary studies or designs for the preparation thereof, or to acquire, or contract for any services.

## **7.3 Proposal Clarification**

ASME ST-LLC reserves the right to request clarification of the proposal and/or supplemental information. The award may be made after few or no exchanges, discussions, or negotiations. Therefore, all respondents are advised to submit its most favorable application to ASME ST-LLC. ASME ST-LLC reserves the right, without qualification, to reject any or all proposals received in response to this solicitation and to select any proposal, in whole or in part, as a basis for negotiation and/or award. ASME ST-LLC reserves the right to modify or cancel this solicitation. All questions relating to the solicitation must be submitted to the contact listed in Section 8 herein. Any amendments to the solicitation will be posted on the ASME ST-LLC website previously referenced.

## **7.4 Treatment of Proprietary Information**

A proposal may include technical and/or other data, including trade secrets and/or privileged, confidential commercial or financial information, which the respondent does not want disclosed to the public or used by ASME ST-LLC for any purpose other than proposal evaluation. To protect such data, the respondent should specifically identify the data or information to be protected.

## **7.5 Proposal Preparation and Submittal Instructions**

ASME ST-LLC may form a committee of subject matter experts to evaluate the technical qualifications of applicants. To help facilitate this evaluation, proposals should be separated into two separate documents: (1) a Technical Proposal; and (2) a Financial Proposal.

### **7.5.1 Technical Proposal contents must include:**

- 7.5.1.1. Provide organization name and contact information.
- 7.5.1.2. Provide evidence of technical capabilities: credentials, qualifications, capabilities, and experience of individuals and the organization.
- 7.5.1.3. Describe approach to accomplish the Scope of Work (refer to Section 3).
- 7.5.1.4. Demonstration of agreement with the Scope of Work (refer to Section 3).

### **7.5.2 Financial Proposal contents must include:**

- 7.5.2.1. Provide a fixed-price quotation.

7.5.2.2. Confirm agreement with the form of agreement attached herein, or state any requested exceptions to same.

7.5.3 The respondent must submit the Technical and Financial Proposals files via e-mail to the ASME ST-LLC contact identified in Section 8 of this RFP. Responses must be received on or before the proposal due date identified in Section 7.1 of this RFP.

## **8 ASME Standards Technology, LLC Contact Information**

All correspondence regarding this RFP is to be directed to the following person:

Mr. Carlton Ramcharran  
Project Manager  
ASME Standards Technology, LLC  
Two Park Avenue  
New York, NY 10016  
Telephone: 212-591-7955  
E-mail: ramcharranc@asme.org

**ASME Standards Technology, LLC**  
**Nonexclusive Independent Consultant Agreement**  
**Standard Terms and Conditions**  
**[STIN-0151]**

This Agreement, dated as of [REDACTED], is made between ASME Standards Technology, LLC (“ASME ST-LLC”), a New York not-for-profit corporation with its principal office at Two Park Avenue, New York, New York 10016 and [Consultant Name and Address] (the “Independent Consultant”).

**W I T N E S S E T H:**

**WHEREAS** ASME ST-LLC desires to engage the Independent Consultant to perform [insert scope description] for [STIN-0151]; and

**WHEREAS** the Independent Consultant agrees to accept such engagement and to perform the services hereinafter specified;

**NOW, THEREFORE**, in consideration of the foregoing and the mutual agreements of the parties contained in this Agreement, it is agreed as follows:

**1. Engagement.** ASME ST-LLC hereby engages the Independent Consultant, on an as needed and nonexclusive basis, to perform the services defined in Annex 1 to this Agreement (the “Work”).

**2. Performance.** The Independent Consultant agrees to perform the services set forth above. The Independent Consultant agrees to perform such services professionally and to the best of its ability, to provide the services in an ethical manner, and to avoid conflicts of interest and any appearance thereof. It is understood that the Independent Consultant may obtain other consulting work and, as a result, may be unavailable, from time to time, to perform consulting services for ASME ST-LLC, but the Independent Consultant agrees to adhere to the ASME Policies on Conflicts of Interest and Ethics. ASME ST-LLC will not set specific daily schedules. ASME ST-LLC will not provide tools, materials, supplies or equipment necessary for the Independent Consultant to perform the Work except for the necessary codes, standards, and procedures. Neither will ASME ST-LLC reimburse the Independent Consultant for the use of its tools, materials, supplies or equipment. The Independent Consultant shall not engage

subcontractors to perform any portion of the Work without the written approval of ASME ST-LLC.

**3. Fees.** For all services to be rendered by the Independent Consultant to ASME ST-LLC, as required by ASME ST-LLC, the Independent Consultant will receive fees as specified in Annex 2 to this Agreement. It is understood and agreed that the Independent Consultant is performing services as an independent contractor. As a result, ASME ST-LLC will not withhold any tax, of whatever nature, from payments made by ASME ST-LLC to the Independent Consultant. The Independent Consultant is solely responsible for meeting federal, state, or local income tax liabilities. The total charges for all fees and expenses shall not exceed the contract value specified in Annex 2 to this Agreement.

**4. Expenses.** Expenses incurred by the Independent Consultant in connection with the Work shall be borne by the Independent Consultant as part of the total compensation for the Work.

**5. Terms of Payment.** The Independent Consultant shall submit associated invoices for acceptance by ASME ST-LLC prior to payment. Invoices shall be submitted following achievement of milestones specified in Annex 2 to this Agreement. Payment shall be 100 percent net due 30 days after receipt of an acceptable invoice from the Independent Consultant.

**6. Benefits.** The Independent Consultant is not eligible for, and will not receive, any benefits from ASME ST-LLC based on services performed under this Agreement.

**7. Copyright and Ownership.** The Independent Consultant agrees that ASME ST-LLC specially ordered and commissioned the Work as “work made for hire” as that term is defined in the United States Copyright Act (17 U.S.C. §101), and that for purposes of the copyright laws, ASME ST-LLC shall be deemed the “author” of the Work. If it is determined that the Work is not a work made for hire under the U.S. Copyright laws, then, as of the creation of the Work, the Independent Consultant hereby assigns exclusively and irrevocably to ASME ST-LLC all worldwide, present and future right, title and interest in the Work, including the copyrights and other proprietary rights existing in the Work (including all United States and foreign copyrights, all copyrights under any treaties, conventions, proclamations, or the like, and all extensions of such copyrights; all artistic and literary property rights; all moral rights; all

rights to apply for or obtain any registrations for copyright in the Independent Consultant's name; and the right to sue and recover for any infringement of the Work). The Independent Consultant may not reproduce the Work in any form without ASME ST-LLC's prior written permission.

**8. Indemnification and Hold Harmless.**

**a. Obligation of the Independent Consultant** – The Independent Consultant shall indemnify, defend and hold harmless ASME ST-LLC and its officers, directors, employees and agents and each of them from any and all claims, actions, causes of action, demands, liabilities of whatsoever kind and nature including judgments, interest, attorney's fees, and all other costs, fees, expenses and charges which ASME ST-LLC, its officers, directors, employees, agents and each of them, may incur arising out of the negligence, gross negligence or willful or wanton misconduct of the Independent Consultant, its officers, directors, employees or agents.

**b. Obligation of ASME ST-LLC** – ASME ST-LLC shall indemnify, defend and hold harmless the Independent Consultant and its officers, directors, employees and agents and each of them from any and all claims, actions, causes of action, demands, liabilities of whatsoever kind and nature including judgments, interest, attorney's fees, and all other costs, fees, expenses and charges which the Independent Consultant, its officers, directors, employees, agents and each of them, may incur arising out of the negligence, gross negligence or willful or wanton misconduct of ASME ST-LLC, its officers, directors, employees or agents.

**9. Term.** It is mutually agreed that the Independent Consultant will commence work on this project immediately upon execution of this Agreement, and continue until completion, estimated as on or about [Contract End Date]. This termination date may be extended by mutual agreement, which must be confirmed in writing.

**10. Termination.** ASME ST-LLC shall have the right to terminate this agreement upon 14 days notice in writing to the Independent Consultant at any time that ASME ST-LLC shall in its judgment decide that such termination is in the best interests of ASME ST-LLC. Conversely, the Independent Consultant shall have the right to terminate this agreement upon 14 days' notice in writing to ASME ST-LLC at any time that the Independent Consultant shall in its judgment decide that such termination is in the best interests of the engineering profession. In the event of such termination, ASME ST-LLC shall pay the

Independent Consultant on a pro rata basis for percent of work completed as determined by mutual agreement subject to the provisions of Sections 3 and 4 of this Agreement.

**11. Force Majeure.** The parties' performance under this contract is subject to acts of God, war, government regulation, terrorism, disaster, strikes, civil disorder, curtailment of transportation facilities, or any other emergency beyond the parties' control, making it inadvisable, illegal or which materially affects a party's ability to perform its obligations under this contract. Either party may terminate this contract for any one or more of such reasons upon written notice to the other party.

**12. Trademark Usage.** Independent Consultant may not use any of ASME ST-LLC's trademarks or other identifiers (including the ASME ST-LLC logo) in any manner without ASME ST-LLC's prior written approval or consent. ASME ST-LLC reserves the right to review any approved use of its trademarks and to require changes in any further use, and Independent Consultant agrees to comply with those requirements.

**13. Publicity Release and Public Affairs.** The Independent Consultant shall not make without prior review and approval of ASME ST-LLC, any publicity release of any nature of general, non-technical information in connection with this Agreement. For purposes of this Agreement, general, non-technical information means any information concerning the existence of the Agreement, the identity of the parties, and the scope and general character of the research or technical activity.

**14. Entire Agreement.** This Agreement entirely supersedes, terminates, and replaces any and all prior agreements between the parties relating to the subject matter hereof and may not be amended except by an instrument in writing signed by both parties to this Agreement.

**15. Notices.** Any notices hereunder shall be given to the parties at their respective addresses set forth above by registered mail until a new and different address shall be established for either party on the basis of notice given to the other party.

**16. Governing Law.** This Agreement shall be subject to and governed by the substantive laws of the State of New York (without regard to its conflict of laws rules).

**IN WITNESS WHEREOF**, ASME ST-LLC has caused this Agreement to be executed on its behalf by its officer thereunto duly authorized and the Independent Consultant has executed this Agreement as of the day and year first above written.

**ASME STANDARDS TECHNOLOGY, LLC**

By: \_\_\_\_\_

Name: John J. Koehr  
Title: President

**INDEPENDENT CONSULTANT**

By: \_\_\_\_\_

Name:

Title:

Social Security or Federal Tax ID number: [\_\_\_\_\_]

## **Annex 1 – Statement of Work**

### **Scope Description**

[TBD]



## Annex 2 – Financial Terms

### Reporting

### Fees and Expenses

Technical services rate: [REDACTED].

Travel rate (if applicable): [REDACTED].

Travel expenses: [REDACTED].

Contract Maximum: [REDACTED].

