

**Minutes: Properties Subcommittee,
ASME Research & Technology Committee on Water and Steam in Thermal Systems
Midlothian, VA, October 6, 2015**

Attendance:

Rich Harwood, Siemens Energy (Chair)
Jim Bellows, James Bellows & Associates
Dan Friend, NIST (U.S. IAPWS Delegate)
John Gallagher, NIST
Allan Harvey, NIST (Secretary)
Anneke Levelt Sengers, NIST
Peter Murphy, Alstom Power
Jan Sengers, University of Maryland
Anurag Singh, General Electric (by phone)

[NOTE: Items numbered as on Preliminary Agenda, which is attached.]

1-2. Approval of Agenda and Review of Action Items

A preliminary agenda was distributed and approved. Minutes of the Spring 2015 meeting had been approved by email. Progress on action items was briefly reviewed. Pending **Action** items (some of which are left over from the previous Minutes) are mentioned under related agenda items below.

3. ASME Steam Tables Books

The Third Edition of the book became available for sale in mid-2014. Total sales of the Third Edition so far are 133 copies (about 100 sales in the past 12 months).

The Compact Steam Tables booklet has sold over 11,700 copies, with approximately 1600 in the past 12 months; this is a somewhat increased rate compared to the previous few years.

4. ASME Software for IAPWS-IF97

3 copies of the “Professional” version were sold in the past year. One customer has reported convergence issues in certain routines; in one case Allan Harvey diagnosed and fixed the problem (and supplied corrected code to the customer and to Anurag Singh) while in the other case no clear fix (without a danger of introducing other problems) was identified.

Another customer has discovered that the stdtable.exe program distributed with our software, which is supposed to provide validation values, is mistaken for some points (apparently due to using equations for the wrong region). The recommended course of action is to look at the IAPWS Release for check values. **Action:** Harvey send information on remaining convergence issue to Murphy, and follow up with Mary Grace at ASME Press about either getting stdtable.exe removed from the product or giving purchasers advice that it should be ignored.

For the new DLL software, Anurag Singh had made some edits to the documentation based on input, and received clarification on some remaining items. There are still some comments on the manual to be addressed, particularly from Layla Bellows. Our **Action** items for finalizing the product are now:

- o Singh produce next iteration of the manual by October 31, with one intermediate iteration with Layla and Jim Bellows if needed.
- o Singh address software issues with functions identified as not working by Murphy, placement of ASME functions in their own category, renaming GAMMA routines, and fixing function descriptions by October 31.

- Murphy: Write a note (to be an Appendix in the manual) regarding iterative calculations, backward functions, and drift issues associated with cyclic calculations (by October 31).
- Singh add a brief “Getting Started” document (already written) to manual.
- Singh check on how add-in deals with backward iterations and convergence tolerances, making sure that it allows user to switch between iterations and backward equations but does not allow tolerances to be changed, by October 31.
- Singh and Murphy address issue of what is returned when functions are out of range, etc., so that instead of a numeric code Excel will show #NUM (by October 31).
- Singh send out new iteration of software install and manual by November 2.
- All: check installation (both clarity of instructions and whether it works) and report back any problems, also listing systems tested on (version of Windows and of Excel).
- All: test functions and boundaries and documentation as their time permits, with testing to be done by end of December.
- Continue to work with ASME Press to include appropriate logos and legal agreement text as part of the product, and also arrangement where John Gallagher can be paid (by ASME Press) to provide support - Singh
- Continue to work with GE and ASME legal to renegotiate the steam property license for GE (probably as a modification of the 2003 agreement) - Singh
- Provide examples to be include in the package – Murphy finalize a spreadsheet showing calling of all the functions with different sets of independent variables, and Bellows develop an example of calculations on a Mollier chart.
- Harvey: discuss pricing with ASME Press (see Fall 2014 Minutes) after above items are complete.

It was decided that it would be helpful to have a phone meeting (probably 2 hours) among people working with the software at some point after the next iteration comes out.

[**Action:** Singh work with Harvey and Harwood to schedule such a meeting – tentatively scheduled for December 2.]

Incorporation of splines for fast calculation (according to the pending IAPWS Guideline) and thermodynamic derivatives (according to the IAPWS Advisory Note) for our software in the future are deferred until after this first version of the software is issued.

5. Web sites

Harvey reported he set up Google Analytics on the IAPWS site but has not yet examined the results in any detail other than to note that the IAPWS site gets roughly 100-200 visitors per day.

6. U.S. Implementation of Formulation for General and Scientific Use

Sales of the new Version 3.0 of the NIST software were approximately 30 in FY15; this is a slight increase over the pace of the previous version in the prior few years. It may be considered to add IAPWS properties of seawater and/or heavy water to this product in the future.

7. IAPWS Issues

After discussion, a candidate was identified to be nominated for IAPWS Honorary Fellow (nominations due Jan. 31). It was noted that Helmholtz award nominations are due Jan. 31.

[**Action:** Friend send reminder and example of Honorary Fellow nomination to Bellows ASAP. Bellows send Friend draft nomination by October 31. Friend finalize and submit nomination by deadline.]

An ICRN on supercooled water properties is being circulated; the U.S. delegate was authorized to vote for it. The document on the Spline-Based Table Lookup method for fast calculations has not yet been received for circulation.

The 2016 IAPWS meeting will be in Dresden, Germany, September 11-16.

The program for travel subsidies for early-career workers to attend IAPWS meetings on hold until our finances and procedures for dealing with expenditures with ASME are worked out.

Jim Bellows is working on a PCAS project with Andrzej Anderko to produce Guidelines on aqueous amines, and plans to have the first one drafted by the 2016 IAPWS meeting. A new Task Group is working on an ICRN for interfacial issues involving supercooled water. Much progress has been made on the new equation of state for heavy water (D₂O), but finalizing it is waiting on new forthcoming data from theory for the ideal-gas heat capacity and 2nd and 3rd virial coefficients, and possible new experimental data for the vapor pressure. It is hoped that an EOS ready for IAPWS evaluation will be completed before the Dresden meeting. For D₂O transport properties, progress has been made on the dilute-gas properties; the rest of the work depends on the EOS being completed.

8. Finances and ASME issues

Our Custodial Account balance is approximately \$58,000. 2015 IAPWS dues (about \$8400) and travel expenses to the 2015 IAPWS meeting have been paid.

EPRI has informed us they can no longer support the Subcommittee at the previous level; the part of the payment that covers IAPWS dues is a particular problem. There may still be room for EPRI to pay some other Subcommittee expenses, such as meeting expenses and the travel of our IAPWS delegate. A preliminary draft of a proposal has been sent to our EPRI contact.

[Action: Harvey and Friend follow up with EPRI contact, keeping Harwood informed. Also follow up with Norma at ASME (particularly about whether EPRI funds could be designated for our use in ASME's new structure) if it seems that this funding will materialize.

There was much discussion about our relationship with ASME, including the perceived obstacles to fulfilling our obligations to IAPWS in the new ASME structure where our Custodial Account will eventually disappear. It was decided that we need to make the case to ASME for the importance of "steam tables" work as something ASME needs to support on an ongoing basis (in part because it puts ASME's name in front of a large number of students); the importance of IAPWS for ASME's focus on the "water/energy nexus" will also be emphasized. We will see if we can do this through the new ASME "GPS" system, but a letter to the Board of Governors might be an option if the GPS path is not fruitful.

[Actions: A Task Group consisting of Harwood, Friend, Harvey, and Bellows will work on these matters. Bellows write a first draft of a letter to the Board of Governors along these lines; it will not be sent at this point but the thoughts will inform our GPS submission. The Task Group will work on a submission (to be submitted before the end of 2015) through GPS requesting ASME commitment as an ongoing obligation to support our IAPWS expenses. Harvey will check with Norma at ASME to find out what was submitted for our request for 2015 IAPWS expenses, and for assistance with the GPS system if needed.]

There was discussion of our relationship with the Power Plant and Environmental Chemistry committee, which was a part of ASME but left due to the restructuring of ASME and is now affiliated with EPRI. There is interest in PPEC in keeping informed about IAPWS and having some ties with our committee. These matters were discussed further in a dinner with PPEC officers after our meeting.

[Actions: Friend and Bellows take lead in furthering this cooperation.]

9. New Business

Allan Harvey noted that NIST Conference Services was now requiring some money for hosting our April meetings; it was \$774 in April 2015 which was covered by his group at NIST. It is apparently difficult

for NIST bureaucracy to accept money from ASME for this service, but the same thing could be accomplished if ASME covered an equivalent amount of travel expense. While some details still need to be looked into, **the Subcommittee authorized the spending of our funds in an amount to offset this expense to partially cover travel expenses for the Subcommittee Secretary to attend the April meeting.** We will explore asking the main WSTS committee to cover this in alternating years.

Some of our “long-term” topics were covered above. The current long-term list includes: desalination and seawater; properties for carbon capture and sequestration; properties for concentrating solar power cycles; fast property calculations for CFD; non-Fortran languages (like Java) for our products and apps related to our products; the possibility of having ASME steam-tables calculations on our Subcommittee website; other working fluids such as carbon dioxide for power cycles; needs for distributed power.

10. Membership

There were no proposals for new members. There was some discussion of members who had not recently been active. **It was decided to remove Bob Hendricks from the list of official Subcommittee members (but to keep him on the email list along with other interested parties who are not official members). It was decided that Don Palmer should be contacted to see what he wanted to do concerning his membership.**

[**Action:** Harvey send email to Don Palmer.]

11. Next Meetings

Our Spring 2016 meeting is scheduled for Wednesday, April 13 (possibly also the morning of April 14) at NIST headquarters in Gaithersburg, MD.

Possibilities for Fall 2016 include GE in Schenectady or meeting in conjunction with the PPEC meeting (Denver in early/mid October; we might hold our meeting in Boulder in that case).

[**Actions:** Harvey and Harwood (with Singh in the loop for the GE option) develop a proposal for the Fall 2016 meeting by the time we meet in April.]

12. Adjournment

The meeting adjourned at approximately 4:00 PM.

Preliminary Agenda: ASME Subcommittee on Properties of Water and Steam

Location: Alstom Power, 2800 Waterford Lake Drive, Midlothian, VA

Time: Tuesday, October 6, 2015, 9:00 AM to 5:00 PM

- 1. Approval of Agenda**
- 2. Review of Action Items from Spring 2015 Minutes**
- 3. ASME Steam Tables book and booklet**
 - 3.1. Report on sales Allan Harvey
- 4. ASME Software for IAPWS-IF97**
 - 4.1. Report on sales Allan Harvey
 - 4.2. Technical support, bugs John Gallagher, Harvey
 - 4.3. Code revision and DLL/Excel product Anurag Singh
 - 4.4. Future incorporation of splines, derivatives?
- 5. U.S. Subcommittee and IAPWS Web pages** Allan Harvey
- 6. Update on implementation of general/scientific formulation** Allan Harvey
- 7. IAPWS issues**
 - 7.1. IAPWS Awards Dan Friend
 - 7.2. IAPWS documents for consideration Dan Friend
 - 7.3. Any other items from 2015 IAPWS meeting in Stockholm Friend
 - 7.4. Current IAPWS projects (supercooled water [Sengers], D₂O [Harvey, Sengers])
 - 7.5. Proposed travel subsidy program Friend, Peter Murphy
- 8. Finances and ASME issues**
 - 8.1. Committee finances Harwood, Friend, Harvey
 - 8.2. US participation in IAPWS PCC activities (EPRI, PPEC)
 - 8.3. Effects of ASME reorganization
 - 8.4. Preparation of 2016 request to ASME GPS
 - 8.5. Preparation for discussions with PPEC leadership
- 9. New Business**
 - 9.1. New Gaithersburg meeting expenses Harvey
 - 9.2. Review of “long-term” items All
- 10. Membership**
- 11. Next Meeting** – April 13-14, 2016, NIST Headquarters, Gaithersburg, MD.
Fall 2016?
- 12. Adjournment**