

TC 08.05 RESEARCH REPORT – JUN 2007 / LONG BEACH

1316-RP: Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch on a Highly Enhanced Surface Tube Bundle. PI: Bruce Babin & Steve Eckels, Kansas State Univ. PMS: Petur Thors (chair), Ben Dingel, Satheesh Kulankara, Axel Kriegsmann. Status: active (start date: Jan-06. original target completion date: Jul-08).

A review of pool boiling literature has been conducted. Most have used electrically heated specimens. 1089-RP (EPFL) and this project are using water as heat source.

The pool boiling rig is now operational. Heat flux can range from 7-88 kW/m² (2-28 BTU/ft²). The first sets of data with R134a and a ¾" OD Turbo-BIIHP tube (1 m long) have been taken and appear to agree reasonably well with previously published results. The in-tube RTD insert is not yet providing a good representation of water temperature profile. A new design with the small RTDs extending into the water path will be tried. The insert also creates extremely high water-side pressure drop. It was suggested that the effect of pressure drop on the enthalpy change be checked to ensure accurate calculation of the heat transfer rate. A modified Wilson Plot technique has been used in a preliminary analysis. The resulting shell-side heat transfer coefficients agree reasonably well with other published data.

Assembly of the bundle facility is underway, but is being slowed by attention given to pool boiling rig and in-tube RTD insert. PIs expect to have bundle data by the next meeting.

1324-WS: Study of Single and Two-Phase Flow-Induced Tube Vibration in Shell and Tube Heat Exchangers. WS author: Mahesh Valiya Naduvath

Ben Dingel phoned the two parties that had responded to the first RFP. Dr. Moretti of Oklahoma State University (emeritus) commented that the work requested was "too applied"; his interest was for projects of a more fundamental nature. He had the impression that the project was targeted to someone who already had the necessary equipment. Stan Kistler of HRTI commented that the project did not contain enough funds if didn't already have the necessary equipment.

Mahesh can't afford to spend more time on the work statement, but still believes the project to have value. John Thome suggested that the funding level be raised to \$190K and resubmitted. I suggested that we should do some further checking with potential bidders to see if the project is do-able and what level of funding would be needed to accomplish it. *(I suggested it, so it becomes my task.)* We should target the Aug 15th deadline for the next RAC meeting.

1345-WS: Waterside Fouling Performance of Brazed-Plate Type Condensers in Cooling Tower Applications. WS author: Jim Bogart

ARI continues to have interest in this project and is still holding the \$47K in cofunding they have offered. It seems that the bidders list might have been off-target. Axel and Zahid offered to suggest other potential bidders. I volunteered to follow-up on this, again by the Aug 15th deadline for the next RAC meeting. (Although if we compile a new bidders list, this could possibly go directly to MORTS for rebidding with liaison only approval. ??)

1394-RFP: Study of Carbon Dioxide Condensation in a Chevron Angle Plate Geometry Exchanger. WS author: Zahid Ayub. PES: Zahid Ayub (chair), Joe Huber, Jim Bogart.

1394-RFP was issued this spring. Four bids were received and reviewed thoroughly by the PES over the course of about a month *via* phone calls and emails. Their rates are summarized in the table below.

bidder	Washington State Univ - Vancouver	University of Illinois – UC	Oklahoma State University	KTH / Sweden (Royal Institute of Technology)
rating (out of 100)	90.3	86.1	90.1	88.4
cost to ASHRAE	\$89K	\$148K	\$119K	\$149K

The WSU-V bid contains \$66K in cofunding for a total cost of \$155K; this supports the solid rating given for project scope and capability. John Thome moved to recommend awarding the project to WSU-V with Steve Eckels seconding. The vote during the meeting was 7-0-0 (of 11 members). Due to some confusion about the definition of "2/3rds of voting members" at the time, it was thought we needed to have at least 8 yes votes to make the recommendation to RAC & MORTS. Our liaison (Ron Bailey) indicated it would be okay to do a paper ballot for those at the meeting and an email ballot from those not attending. Three yes votes were obtained by email by the next day, making the vote 10-0-1. (The abstention came from Jim Bogart because of his contention that the original 7-0-0 vote was legitimate. In the end, I agree the definitions are clear in the MOP and the 7-0-0 vote should have sufficed.)

Fouling of Tube-in-Tube Type Condensers

This is the only remaining topic on TC 8.5's research priority list. HTRI has expressed interest in doing this project. ARI has indicated cofunding might also be available for this project. Need RTAR and then WS. Continues to be on the shelf until PHE fouling project gets off the ground.

1444-URP: Experimental Evaluation of Two-Phase Pressure Drops and Flow Patterns in U-Bends for R-134a, R-410A, and Ammonia. submitted by John Thome, EPFL

The PES assembled by TC 1.3 addressed their question and concerns, raised at the previous Dallas meeting, to John. He satisfactorily responded and TC 1.3 voted (by email) to recommend this project be awarded. Because there was no spring RAC meeting, RAC will handle this item at the current Long Beach meeting.

Future Research Projects

Fouling of tube-in-tube condensers is now the only remaining topic on our research list. It was suggested that we set aside time during the TC 1.3/8.5 research meeting in New York (Jan08) to brainstorm and discuss potential new projects.

Repeating from last time... Based on recent experience, several strategies were discussed to improve the prospects of receiving responsive bids to RFPs. These include managing the scope of proposed work and estimating resources and costs more accurately. Identifying prospective bidders by direct contact early in the work statement process is allowed and encouraged. Thorough and careful evaluation of proposals/bids is encouraged. A PES can go back to bidders for more information if there are questions that need to be addressed. Proposals can be rescored based on this new information.

Summary of Research Chair Breakfast

- Noting a 25% and 40% decline in RTARs and WSs, respectively, submitted in 05-06 compared with the previous year, MORTS conducted a survey of research subcommittee chairs at the Dallas meeting. With 45 responses from the 99 committees/groups, the survey indicated the three highest ranked factors for the decline in RTARs to be: 1) members' lack of time to write RTARs (26%), 2) reluctance to write because authors are discouraged from bidding (26%), and 3) RTARs returned for arbitrary, unclear, and conflicting reasons (20%). Similarly, the three highest ranked factors for the decline in WSs are: 1) members' lack of time (32%), 2) reluctance to write because authors are discouraged from bidding (29%), and 3) lack of approved RTARs (27%).

RAC is attempting to address the second and third concerns. It was noted that 82% of WSs were approved during the last go-around as were 72% of RTARs. In particular, it is being emphasized to RAC that the “T” in RTAR stands for “Topic” and that an RTAR doesn’t have to be a mini-WS. RAC is also proposing to relax the policy on potential bidders participating in the development of RTARs and WSs. In particular, the rule that a participating author’s bid be within 10% of the guideline price be relaxed or eliminated. It is judged that there are plenty of other checks in the system to prevent abuse. Finally, research funding levels are going to be stabilized and be more predictable. Funds are up 30% with \$200K surplus. There is \$6.5M in a reserve fund that will be used to keep funding levels stable over time.

- The Research Manual is still under revision. This is being done by Piotr Domanski.
- The next Research Advisory Panel has been set up with the objective to update the Research Strategic Plan by 2010 (to be done every 5 years). Jeff Spittler is the chair. Zahid Ayub is a member.
- It was noted that Direction #1 from the current Plan is “ASHRAE shall lead the advancement of sustainable building design and operations.” Activities focused in this direction are good. An “Appendix, ASHRAE 2020: NZEB Research Topics”, containing a list of possible research topic needs to provide net zero energy design guidance was submitted to the Board on Friday; see attachment.
- Cofunding is available from several sources:
 - ARTI is currently cofunding ASHRAE work to the tune of \$365K
 - CEC/BERG (California Energy Commission/Building Energy Research Grant) program. Reviews accepted RTARs and selects projects of interest – no action needed by TC. Collaborations with USGBC and CIBSE.
- RTARs and WS due May 15th, Aug 15th, and Dec 15th. WSs approved at Sep RAC meeting can go out for bid in October.
- Each TC is encouraged to have a Research Plan. This should be done for good planning and execution. It is suggested that the Plan be listed on the TC website as a way to attract potential collaborating TCs. However, this plan no longer needs to be filed with MORTS. The “Research Plan Priority” number on the RTAR and WS forms will be dropped.