HTRI

The Exchanger

November 2005

HTRI Engineering Services

Customized Solutions that Work for You

Turbulence 101

Exchanger Design Margins

New Contest

Win a Discount on Annual Fee

in brief

Update on Construction of HTRI Research and Technology Center Navasota, Texas, USA

Although Hurricanes Katrina and Rita caused devastation across the southern United States, our construction of the new HTRI Research and Technology Center experienced only minor delays. The site looks better every day, as you can see in the photos posted on www.HTRI.net.

Katrina forced Entergy, our electrical power supplier, to send its manpower and equipment to Louisiana and Mississippi to restore service there, but we kept the project moving forward by resorting to electrical generators. And

when Houston evacuated for Rita, structural steel fabrication at our plant was delayed for about one week, but we quickly got back on track.

Work continues on the 3000-sq.-ft. storage building and other site work. Curbing for spill containment was installed in the 15000-sq.-ft. research area. It worked quite well in holding the rains that Rita brought with her—in fact, after the hurricane passed, the area resembled an Olympic swimming pool! During the last week of October, both the main power line that will serve the site and the 15-ton overhead crane were installed.

Our construction project is very exciting for the Navasota community. Business community neighbors and the local officials are very interested in our progress because they consider it the first of many businesses they hope to recruit to The Navasota Business and Industrial Center. They continue to express their appreciation of our decision to build there.

We look forward to completing the construction phase of the project and getting the research equipment installed and operational. Acting as the general contractor for HTRI and watching out for the interests of the members on this project is proving to be very gratifying for me. The HTRI staff all join me in being proud of this new facility.

You can check ongoing progress on our website. Of course, anytime you are in the area, please know you are welcome to visit the new site, as well as our existing facility and offices in College Station.

—J. Michael (Mike) Creagor
Manager, Research Facility

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Notice

The articles and opinions in this newsletter are for general information only and are not intended to provide specific advice.

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HTRI recycles

November 2005

Dear Member:

It is my privilege to report the state of affairs of your company. FY 2005 was an outstanding year of growth and positive change. One of our primary corporate goals is to continuously add value to your membership; again last year, our engineering and technical staff made technological improvements that enhance the benefits you derive from HTRI. The high percentage of membership renewals indicates that our technology and services are an integral part of your corporate operations and day-to-day engineering. We are ever mindful of our responsibility to provide you with useful technology and services in exchange for your investment in the HTRI research and development consortium.

Between August 1, 2004 and July 31, 2005, the number of new members exceeded targets, proprietary contracts and consulting grew beyond projections, and our training activity expanded significantly. The administrative staff continued to handle myriad activities that keep legal, financial, and general corporate operational objectives on track.

There is no doubt that the improved global economy and strong petroleum market contributed to our success, but even with these positive conditions, it takes people to achieve progress. The HTRI staff applied their expertise and worked diligently to surpass our annual objectives. I am grateful for their knowledge, their dedication, and their contributions to our achievements. One full quarter into our 44th year of operation, it appears that FY 2006 will be another year of strong performance.

In the midst of our usual activity last year, we also purchased ten acres of land and completed the design phase for our new Research and Technology Center to be built in Navasota, Texas, USA. The groundbreaking ceremony was held in May 2005; construction began in July. Progress photos are on our corporate website at www.HTRI.net. We will occupy the new site no later than November 2006—scheduling testing and experimental work, along with a staged transition of equipment and units—to make the move without disrupting the HTRI research program. The grand-opening celebration will be held in October or November 2007 in conjunction with the North American Meeting.

Again this year, our sincere appreciation goes to the members of the Board of Directors, the Technical Committee, Task Forces, and Communication Committees who generously give their time and share their knowledge to help us be the best we can be. I ask you to join me in applauding these active volunteers.

It is your use of our technology and participation in the HTRI consortium that makes our success possible. On behalf of all the staff of HTRI, I thank you for your membership.

Claudette D. Beyer
President and Chief Executive Officer

HTRI Engineering Services—Customized Solutions that Work for You

Thomas G. Lestina, Director, Engineering Services

Thomas G. Lestina

HTRI offers you what you need. In Engineering Services, we work closely with you to complete contract research and testing, customize software, and train your employees.

During FY 2005 our contract work increased sixty percent over the same period last year; training almost matched that, increasing fifty percent, with almost 650 people participating in workshops or short courses held around the world. And we anticipate further growth.

Whether or not you are a member of HTRI, you can benefit from our knowledge and capability by contracting with us to

- test prototype heat exchangers and enhanced surfaces
- develop customized software for heat exchanger products
- review innovative heat transfer concepts
- evaluate problems with plant heat exchanger equipment
- conduct onsite or customized training

In recent years, dozens of companies and government agencies have used our engineering services for both large and small jobs to analyze, test, improve, and validate their own designs, proprietary devices, and products.

Our knowledge of heat transfer and fluid flow is enhanced by our use of computational fluid dynamics (CFD) to simulate conditions that may be too expensive, hazardous, or otherwise impractical for experimental research.

Contract with us to make the most of your research dollars. We can customize a solution for you based on HTRI's forty years of process heat transfer research, your proprietary technology, and our latest engineering tools.

This brief article gives you a glimpse of what we can do for you—just contact us at Contracts@HTRI.net for more information.

Developing Heat Transfer Products

Do you have a novel heat transfer product but are unsure how to bring it to market?

HTRI has experience with all aspects of the development life cycle for heat transfer products. We can assess the feasibility in the concept stage, test prototypes, develop design techniques, distribute design software to our ever increasing customer base, and provide technical support to our users worldwide.

This concept-to-market approach accelerates product development by combining data analysis, methods development, and software implementation into a "one-stop-shop". And our members gain access to the latest design technology as it is developed.

New Baffle Technology

Our work with EMbaffles™ (*Xist* 4.0) and Square One™ baffles (*Xist* 4.0 Service Pack 2) are examples of how we can facilitate development of new baffle technology.

Contact us at Contracts@HTRI.net if you are interested in having HTRI help you develop your new technology.

Analyzing Plant Data

Obtaining accurate plant data has become increasingly important for improving heat exchanger technology. HTRI relies on accurate field data that enable us to further validate our thermal analysis methods and exchanger modeling practices, especially in areas where cost prohibits testing at our own facility.

For example, because we do not have high-temperature test facilities, the only way to validate some parts of *Xfh* is to obtain data from an operating fired heater. To improve the accuracy of our vibration analysis and reduce design margins for revamps, we need vibration field cases. The newly established Exchanger Design Margins Task Force (EDMTF) will use field cases to develop new guidelines for setting exchanger margins.

HTRI has begun developing software to analyze plant data on an automated basis.

Our first effort focuses on analyzing fouling for single-phase applications, but we also plan to study plant data for condensing and boiling applications.

As we develop new diagnostic algorithms, we will offer them to our members. Stay tuned for these new capabilities.

Members of the Crude Oil Fouling Task Force (COFTF) have provided data from crude oil preheat trains in operating plants to help us identify key factors that contribute to fouling. To evaluate these data, we are developing fouling calculator software to recognize trends in plant data and compare the results from commercial neural net software. The initial results are hopeful; we are working on algorithms to determine which factors are significant.

From projects like these, we have learned the value of plant data in determining design margins for replacement exchangers. In the future we hope to be able to pinpoint thresholds for wall temperature and velocity to mitigate fouling. The challenge is significant because, at first glance, process data appear to be random.

Please contact us if you are interested in submitting field data or would like our help to analyze plant data.

Training

Throughout FY 2005, HTRI has faced a large increase in the demand for our workshops and short courses; in fact, the number of students attending our training sessions has more than doubled. This demand is not only spurred by the increase in the number of members but also reflects the interest of non-members in heat exchanger technology. Because mitigating the high energy costs in the process industry requires a sound understanding of the thermal sciences and HTRI technology, we expect demand to remain strong.

Our training program continues to expand and improve. Although we offer training at all HTRI meetings, onsite training at member facilities has been a popular cost-effective option. We continually update our existing courses and workshops, and we have added two courses, *Advanced Thermosiphon Reboilers* and *Designing Exchangers for Fouling Service*. A new web seminar, *Getting Started with HTRI Technology*, will be offered free of charge at regular intervals to those members who sign up on our website. To help members develop their skills in using our software, we also plan to develop "study-at-your-own-pace" workshops for delivery via the website or on CD / DVD.

We have ambitious goals for our training program. As the demand and our reputation continue to grow, we may be able to offer certificates in process heat transfer from an accredited HTRI university. Although a formal program like this one remains a bit in the future, industry may want just such a program to get the most from their employees.

To view our available courses, workshops, and web seminars, visit our website at www.HTRI.net. If you have not attended our training sessions, give us a try. Attend one of our sessions at an HTRI meeting or training week to see how quickly you can expand your knowledge of heat transfer technology.

Making the Grade

Dave Johnson from BP p.l.c. recently said this about HTRI training:

"As far as I'm concerned, HTRI provides the best training for software that I have experienced. You take the time to introduce the features, demonstrate them, and then give workshop problems that reinforce what was taught. You also have knowledgeable staff available to assist the students. Thank you, and keep up the good work."

Cover photo: The Prototype Test Unit (PTU) at the Research Facility

See related article in May 2005 issue of *The Exchanger*

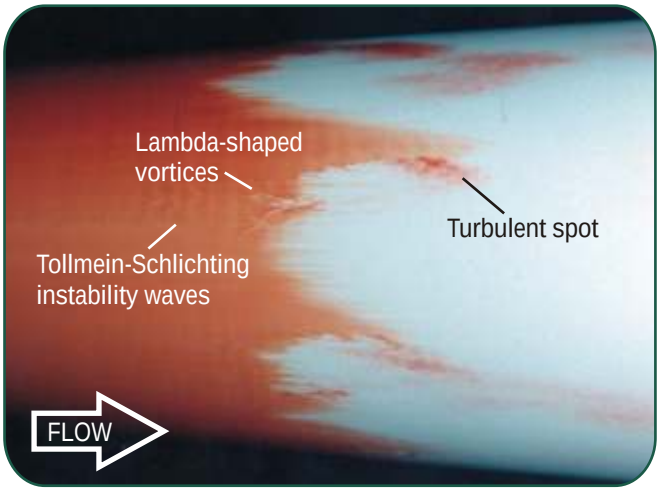
Turbulence 101

Kevin J. Farrell, Senior Project Engineer, Research

Kevin J. Farrell

Turbulent flows seem irregular and unpredictable, but they do have barely identifiable flow structures called *eddies*.

Eddies spin and stretch and divide, leading to a high rate of diffusion of mass, momentum, and heat transfer. Eventually, the turbulent energy cascades to the smallest eddies, where it dissipates as heat. A sustained turbulent flow therefore requires a continuous supply of energy that is usually provided by a sheared flow, like a boundary layer or buoyant flow. Statistical analyses of experiments have resulted in some rather crude but surprisingly useful theories and models, but a comprehensive understanding of turbulence still challenges scientists and engineers.



Dye released at the surface of a body of revolution clearly illustrates transition

Photo courtesy of Prof. Gerald Lauchle of The Pennsylvania State University

In laminar flow, fluctuations occur naturally, but they damp out. As the Reynolds number increases, random fluctuations amplify and become more frequent.

When turbulence is present, the flow seems steady on average, but a sensitive instrument like a laser Doppler velocimeter or hot wire anemometer can measure rapid, random fluctuations. At sufficiently large Reynolds numbers, the fluctuations are continual, and the flow is termed *fully turbulent*.

A profound change in the flow character occurs at a critical Reynolds number. The flow isn't smooth and steady anymore but becomes unsteady and agitated. In the changeover process (called *transition*), disturbances are amplified, vortices form, and turbulent spots are observed (refer to the illustration at left). Eventually, the turbulent spots become so frequent that the flow is fully turbulent.

Because generally a flow operation is not designed to occur in the transition regime, it is important to know the value of the critical Reynolds number and operate an order of magnitude above it, if possible. For intube transition, the critical Reynolds number is approximately 2000; for external flows along a surface, it is about $5(10^5)$.

These values are approximate because transition has many influences—e.g., wall roughness, upstream flow fluctuations, and pressure gradients—that could promote transition at a lower Reynolds number.

For further reading: *A First Course in Turbulence* by H. Tennekes and J. L. Lumley is a popular text now in its seventeenth printing (MIT Press, 1972).

Field Data Welcomed

HTRI encourages members to submit *Xchanger Suite* cases containing field data. Expanding our data banks helps us validate, extend, and / or enhance our methods so that you have the most versatile and accurate design tools.

To submit cases and field data, contact

Support@HTRI.net

Exchanger Design Margins: Moving Toward a New Vision

R. Stanley Kistler, Vice President, Research and Software Development

Setting exchanger design margins tends to be a business, not engineering, decision; margins are driven by the economics surrounding the exchanger, and a different decision is likely for every exchanger.

What is the cost if the exchanger fails? Is a lowest-cost bid required? Are spare exchangers to be provided? How much future capacity should be anticipated? What maintenance costs / schedule must be considered?

Historically, however, such design margins have not included fouling factors. Instead, designers have relied on general suggestions or guidelines widely accepted by industry but never fully tested or examined. Fluid properties, especially for some chemical and hydrocarbon streams, also have presented difficulties, causing high "uncertainty" in the heat release and transport data.

The Exchanger Design Margins Task Force (EDMTF) was formed in June 2005 to characterize important fouling issues and determine realistic confidence levels in the heat transfer coefficient. The goal is to provide information to the designer allowing the practice of designing heat exchangers to be more realistic with respect to allowances for process uncertainties and fouling.

The task force has completed its initial action plan, including developing a work plan, identifying deliverables, and establishing milestones. The next objective is to write a white paper reviewing current knowledge and summarizing key steps to improve application of heat exchanger thermal margins. As a final action, the task force will help define research projects that HTRI will implement to obtain information that will result in improved confidence in the analysis of thermal design margins.

The EDMTF is carrying out its mission electronically, with much of the work of the committee being conducted through e-mail. In addition, task force meetings and discussions have been held at HTRI meetings in North America, Europe, Korea, and Japan. The 33-member task force currently includes representatives from more than twenty industry leaders. *An EDMTF roster is available to HTRI members on our secured website at www.HTRI.net.*

R. Stanley Kistler

Task force members represent the following:

Alfa Laval Inc.
APV North America, Inc.
BASF Aktiengesellschaft
Bechtel Ltd.
BP p.l.c.
Celanese Ltd.
Chevron Energy Technology Company
ConocoPhillips Company
The Dow Chemical Company
E.I. du Pont de Nemours & Company, Inc.
Eastman Chemical Company
Ecodyne MRM, Inc.
ExxonMobil Research and Engineering Company
High Performance Tube, Inc.
Joseph Oat Corporation
Kellogg Brown & Root, Inc.
Koch Heat Transfer Company, L.P.
Mitsubishi Chemical Engineering Corporation
Nooter / Eriksen, Inc.
Reliance Engineering Associates (P) Limited
Shell Global Solutions International B.V.
Statoil ASA
Technip
Toyo Engineering Corporation

Questions About Fouling Services

To initiate meaningful discussions, the task force members completed a brief questionnaire that highlighted their experience with fouling services. Their responses to seven questions provided guidance for the initial work.

1. List applications / services (e.g., water / water) for which over 50% of thermal resistance to heat transfer is due to fouling.
2. List "clean" applications / services (ones that demonstrate no or very little tendency to foul).
3. Where do you usually place fouling fluid (shell or tube side)? Why?
4. What time period between cleanings do you typically set for the fouling services listed in Question 1?
5. Which applications / services require mechanical cleaning? How often is mechanical cleaning performed?
6. Have you used continuous online cleaning? If yes, in what type of application / service?
7. Have you used chemical cleaning? If yes, in what application / service?

Report STG-17

Annular Distributors: A Parametric Design Study — *October 2005*

Did you know that an improperly designed annular distributor can actually have a higher pressure drop and bundle entrance velocities high enough to cause flow-induced vibration? Would you like a better way to design annular distributors and insight into how the geometry of the distributor influences performance?

Annular distributors can increase the thermal effectiveness of the end zones while reducing pressure loss, providing uniform flow, and reducing the potential for flow-induced tube vibration. Because of three-dimensional viscous effects in the diffusing and turning flow path, the shell entry flow profile can have some high velocity regions that can actually exacerbate any tube vibration problem. But some simple design recommendations derived from CFD simulations can help assure you a successful annular distributor design.

Report CS-13

Shellside Crossflow Condensation of Mixtures: Vertical Downflow on Plain and Low-Finned Tubes — *October 2005*

Do you know how much heat transfer performance can improve for shellside downflow condensation of mixtures when you select low-finned tubes? Would you like some guidance in choosing a condensation method for TEMA X-shell shellside condensers?

Report CS-13 shows how existing methods predict new HTRI data; it also updates the condensing correlations to improve predictions for shellside condensation of mixtures in vertical crossflow. The experimental data demonstrate the advantages of low-finned tubes for shellside condensation of mixtures. Depending on the process conditions and finned tube geometry, the average heat transfer enhancement ratio ranges from 1.1 to 2.2.

Report PHE-10

Heat Transfer and Pressure Drop for Non-Newtonian Fluids in Plate-Type Heat Exchangers — *June 2005*

Faced with evaluating a plate-and-frame heat exchanger for service in non-Newtonian flow? Help is available. Report PHE-10 reviews non-Newtonian flow theory, analyzes literature on heat transfer and pressure drop for plate heat exchangers, and provides several typical examples.

One of the most critical issues is proper characterization of non-Newtonian fluids. In particular, the inherently high shear rates of plate exchanger geometry make viscosity very important. PHE-10 shows how to use the apparent viscosity approach in *Xphe*®, HTRI's plate heat exchanger software, to model non-Newtonian fluids.

HTRI reports are available on www.HTRI.net for all Level 3 (Categories III, IV, and V) HTRI members. Access requires the installation of HTRI e-Library and an Internet connection. For information on upgrading your membership, please contact

Membership@HTRI.net

If you have installed HTRI e-Library and are having trouble accessing www.HTRI.net, please contact Support@HTRI.net.

Other Technical Documents Issued

June – July 2005

F-14	Wax fouling
PHE-11	Spiral plate heat exchangers: single-phase methods
TPF-7	Two-phase pressure drop in bends

Prediction of Kettle Entrainment Remains Challenging

Accurate prediction of kettle entrainment is crucial for sizing kettles, reducing equipment cost, increasing column efficiency, and designing efficient processes. HTRI began studying kettle entrainment in the late 1960s and published a kettle sizing method in Report BK1-2 (1970).

After recently reviewing the method in *Xist* and other methods in the open literature, we have included vapor space height in the entrainment correlation, documented in a report to be released later this fiscal year.

However, accurately predicting kettle entrainment remains challenging. Several areas are not fully understood.

Froth height and droplet initial velocities
Vapor generation in the bundle and two-phase flow out of the bundle determine the froth height and the foaming action on top of the bundle, which in turn determines droplet initial velocities leaving the vapor-liquid interface. However, no current model predicts this "splashing" mode on top of a kettle bundle.

Droplet size and mass distributions
Terminal velocity determines the maximum droplet diameter entrained for a given vertical vapor velocity. Droplets with larger diameters settle back into the liquid pool. However, without information about droplet size and mass distributions, terminal velocity cannot predict liquid entrainment.

Non-uniform vapor generation along bundle
The entrainment can be severe when most of the duty is transferred at one end of the bundle with much less vapor generation on the other end. All available methods assume uniform vapor generation; thus, the methods cannot predict this kind of entrainment well.

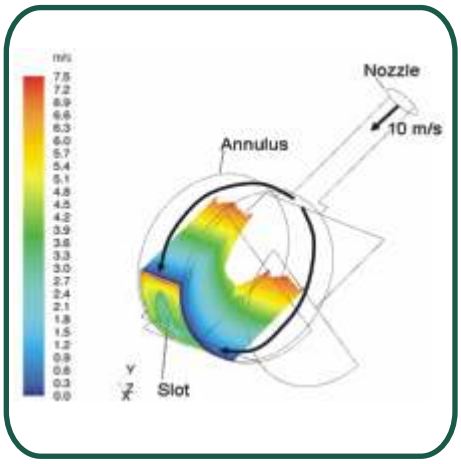
Effective vapor velocity
Vapor flow distribution in the kettle dome and near the exit nozzles is complicated. The vapor velocity distribution near the nozzle should also be studied to investigate its effect on droplet entrainment. This study requires detailed knowledge of the kettle geometry, e.g., exit nozzle location, number of exit nozzles, and two-phase inlet nozzle location.

Most studies in the open literature concentrate on the settling of droplets based on terminal velocity and provide conservative sizing guidelines. Few are devoted to droplet mass distribution measurement, droplet initial velocity, or froth height. To generate accurate predictions of kettle entrainment, HTRI needs to investigate all of these effects.

CFD Reveals Flow Patterns in Annular Distributors

Annular distributors can increase the thermal effectiveness of the end zones while reducing pressure loss, providing uniform flow, and reducing the potential for flow-induced tube vibration. We recently completed a parametric study of inlet annular distributors using computational fluid dynamics (CFD), and the results revealed some very interesting flow patterns issuing from the slots.

Because of three-dimensional viscous effects in the rapidly diffusing and turning flow path, the perimeter tubes of the bundle may see a significant crossflow velocity much higher than expected by simply calculating flow area ratios. Therefore, it is important that the heat exchanger designer maximize the benefit from the annular distributor by following some simple design recommendations derived from these CFD simulations.



Profile contours of velocity magnitude indicate regions of high crossflow velocity near slot edges

Once again, CFD has revealed flow patterns that could only be identified previously in expensive and time intensive experiments. *See the description of Report STG-17 (Annular Distributors: A Parametric Design Study) on page 8.*

Did You Know...?

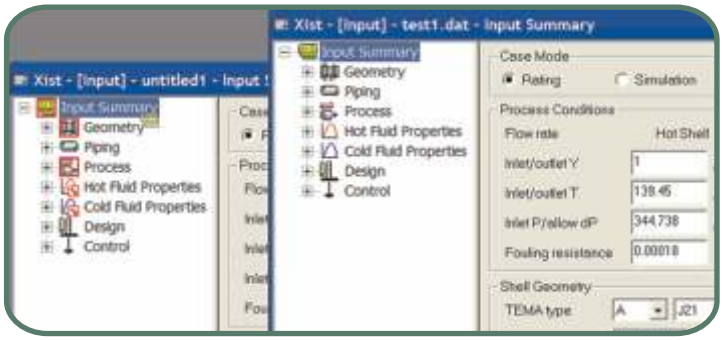
Joseph W. Holmes, Manager, Software Development

Joseph W. Holmes

HTRI *Xchanger Suite* makes performing your job faster and easier. In this series I'll explore a number of useful features that you may not have realized were available. I'll begin with five of my favorite shortcuts.

❶ Drag-and-Drop

Drag-and-drop is the ultimate time saver. To transfer input information between cases, just drag the icons from the navigation panel in one case to another. Click an icon with the left mouse button, and move the icon while holding down the mouse button. Select individual input panels or the Input Summary icon to drag an entire case. You can even transfer information like physical properties between cases of different types (e.g., between a shell-and-tube exchanger and an air cooler).



What could be more simple than drag-and-drop?

What I like best about this functionality is the ease with which I can check the effect of an input modification. You can run a "base" case, create a new case using drag-and-drop, then make your modification in the new case and run it. Then simply compare the output results side by side.

❷ Custom Unit Sets

Xchanger Suite is very flexible in its handling of units and offers three standard unit sets (U.S. Customary, SI, and MKH) that you can select to display input/output data. You can even temporarily adjust the units of any individual input field from one unit set to another. You can also extend this flexibility to create your own customized unit set?

If your company uses SI units but with temperatures displayed in degrees K rather than °C, all you have to do is define your company's particular set using Custom Unit Sets on the Edit menu.

The Custom Unit Sets dialog box lets you quickly configure a unit set that uses the standard SI set with one exception for temperature. Just save the set, and you can easily switch between this set and any other.

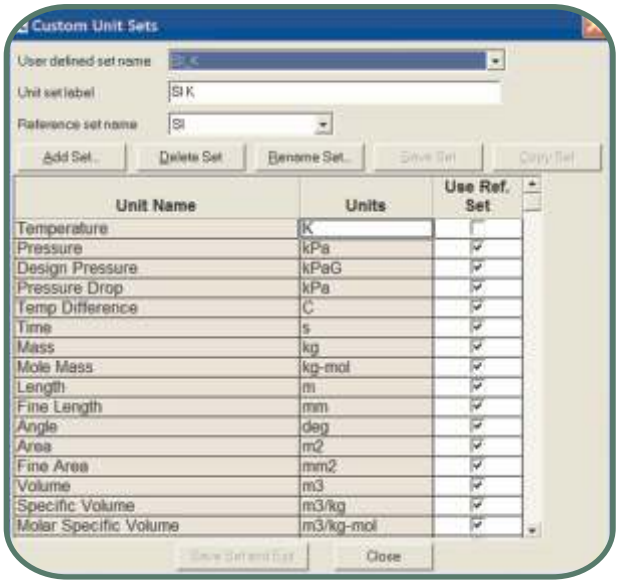
Consult the Frequently Asked Questions in *Xchanger Suite* online help for more information.

❸ Restore Input from Previous Run

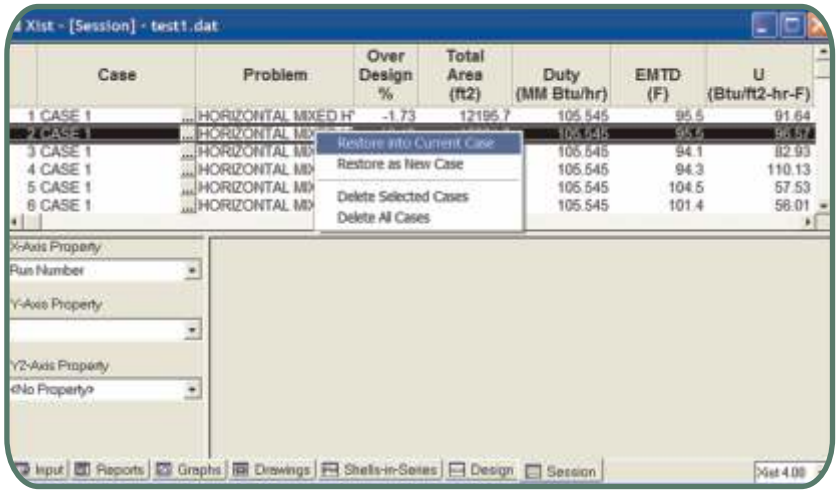
The handy Session View records summary results of all the runs made during a session. But did you know that you can use it to save the entire input for each case run and then restore any previously saved input?

To enable this functionality, select Program Settings in the Edit menu and then click the Session tab. To enable session logging, check Log session runs and then select Run summary and run restore data to set the amount of data the Session View will save.

Now anytime you make a run, a new line will appear in the session log. You can right-click



Create a custom unit set for your specific needs



Restoring input from a previous case run is simple with Session View

any case to reload the entire input from that run, either into the current case or a new case.

❹ Multiple Views of One Case

You probably know that *Xchanger Suite* can handle multiple cases simultaneously, but did you know that you can open multiple windows for the same case? If you have ever needed to look at an output report at the same time you were viewing an input panel or a graph, you know the usefulness of this feature.

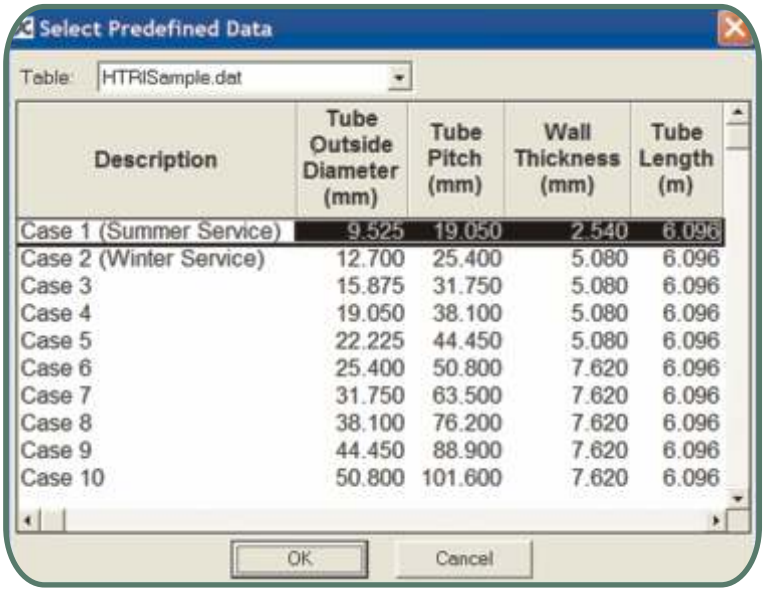
Just select New Window from the Window menu, and *Xchanger Suite* opens a new window of the current case. Then just display a dfferent view in each window.

❺ Predefined Input Data

Let's assume your company makes and/or sells a standard line of exchangers. Wouldn't it be great if you could just select one of the standard geometries and *Xchanger Suite* would automatically load the corresponding data? Well, you can, using the Predefined Data item on the Input menu.

Using any text editor like NotePad, you create your geometry table once and then simply select your list to have *Xchanger Suite* load any geometry you defined. The figure below shows a simple illustration of how this works.

To find out more, search for the term *Predefined* in the *Xchanger Suite* online help.



Set up predefined input data like geometries to quickly create cases in *Xchanger Suite*

Xchanger Suite includes many more helpful features that we'll highlight in future newsletters. And if you would like to suggest your own timesaving tips that would benefit other *Xchanger Suite* users, send them to Newsletter@HTRI.net.

Repeating Repetitive Repetition is Bad, Bad, Bad

Nathan W. Kidd, Software Developer

Nathan W. Kidd

Have you ever wanted to see what would happen to your HTRI case if you increased the flow rate in small steps?

Have you wanted to incrementally change an input item as a function of another changing input item and see the effect on your results?

The *Xchanger Suite* Parametric Response spreadsheet allows you to do just that without having to repeatedly change the input in the *Xchanger Suite* interface and rerun the case. I use the tool frequently to evaluate how newly developed methods affect trends in exchanger cases.

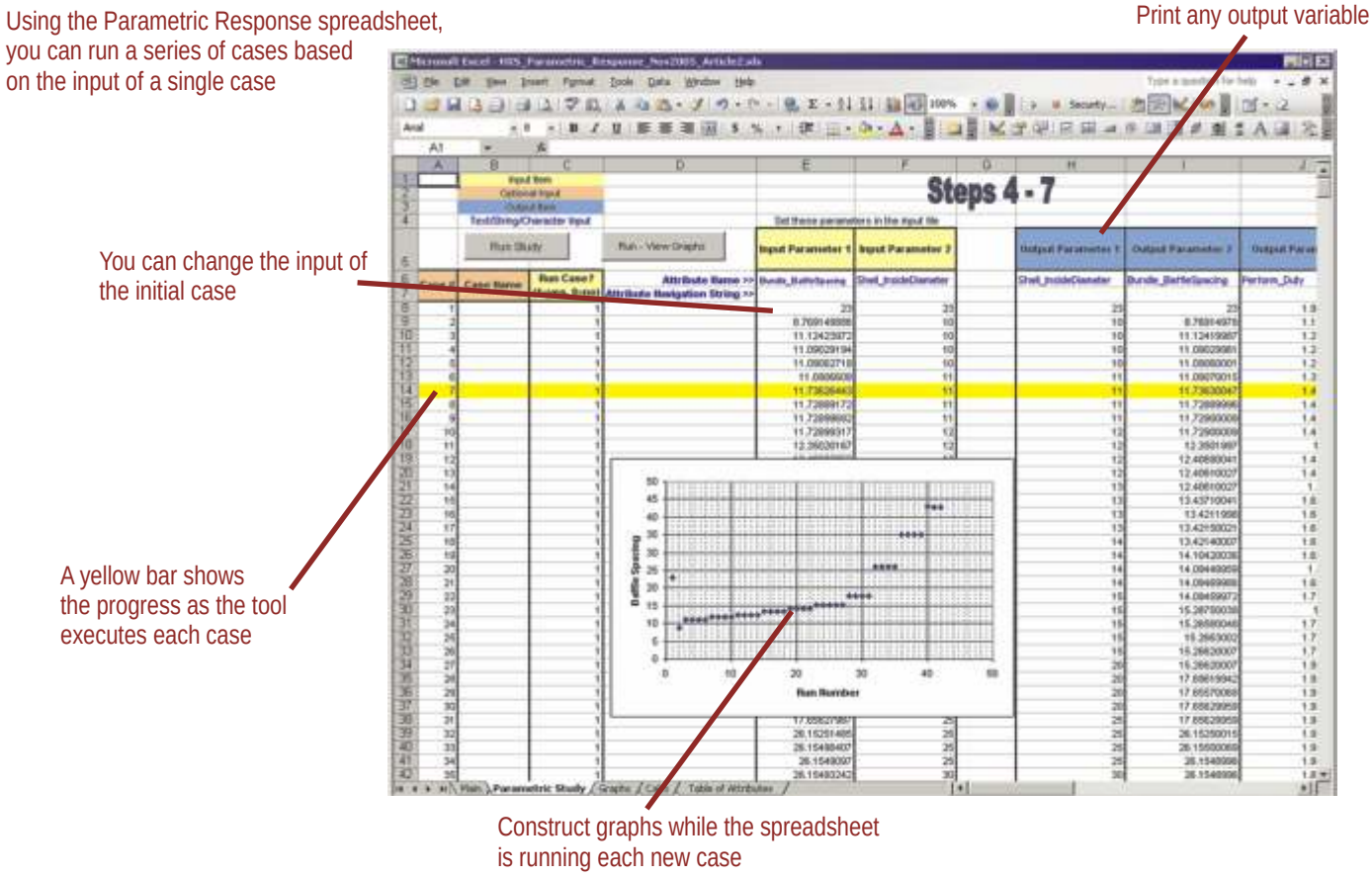
Originally developed for internal use, this spreadsheet is now available on the HTRI secured website (www.HTRI.net)—navigate to Software Patches & Device Drivers and then look for Utility Software.

Here's a common situation that the spreadsheet could make easier. Let's say you have a shell-and-tube exchanger with a crossflow-to-windowflow velocity ratio of about 0.4 and a specific baffle cut. Let's further suppose that you want to examine other shell diameters with the same velocity ratio and baffle cut.

Normally, this task would demand your full attention for a long time—you would have to check the velocity ratio and adjust the baffle spacing after each run in *Xchanger Suite* so that the velocity ratio of the next run approaches 0.4. And because you must do this for each shell size...well, you can tell that this offers a most efficient recipe for mind-numbing tedium.

To speed up this process, you can use the Parametric Response spreadsheet. First, set up an initial case (the base case) in *Xchanger Suite*. Then, in the spreadsheet, set all subsequent cases to run consecutively, changing only the parameters you specify.

For the situation described earlier, simply set the baffle spacing and shell diameter as the input parameters that the spreadsheet will



modify. The spreadsheet prints out several output parameters, including the crossflow and windowflow velocities, as each case runs. Then to determine the baffle spacing, a spreadsheet function automatically calculates how much to adjust the next baffle spacing based on the output of the previous run. You need only to allow enough runs for each shell diameter that the baffle spacing can converge.

Even though it's relatively easy to set up parametric studies with this tool, there is a learning curve. The first hurdle is figuring out how to specify the input and output parameters you desire; I work closely with the parameters every day, and I can't remember each attribute and navigation string. The Parametric Response tool includes a table of the most common parameters. You can find a complete list of parameters by opening any case using HTRIview, an executable (.exe) which is installed in the same directory as *Xchanger Suite*.

Although you may need some practice, this utility tool can help speed up your work if you find yourself running a long series of cases between which you must alter the input. More detailed instructions on how to use the tool are included in the spreadsheet.

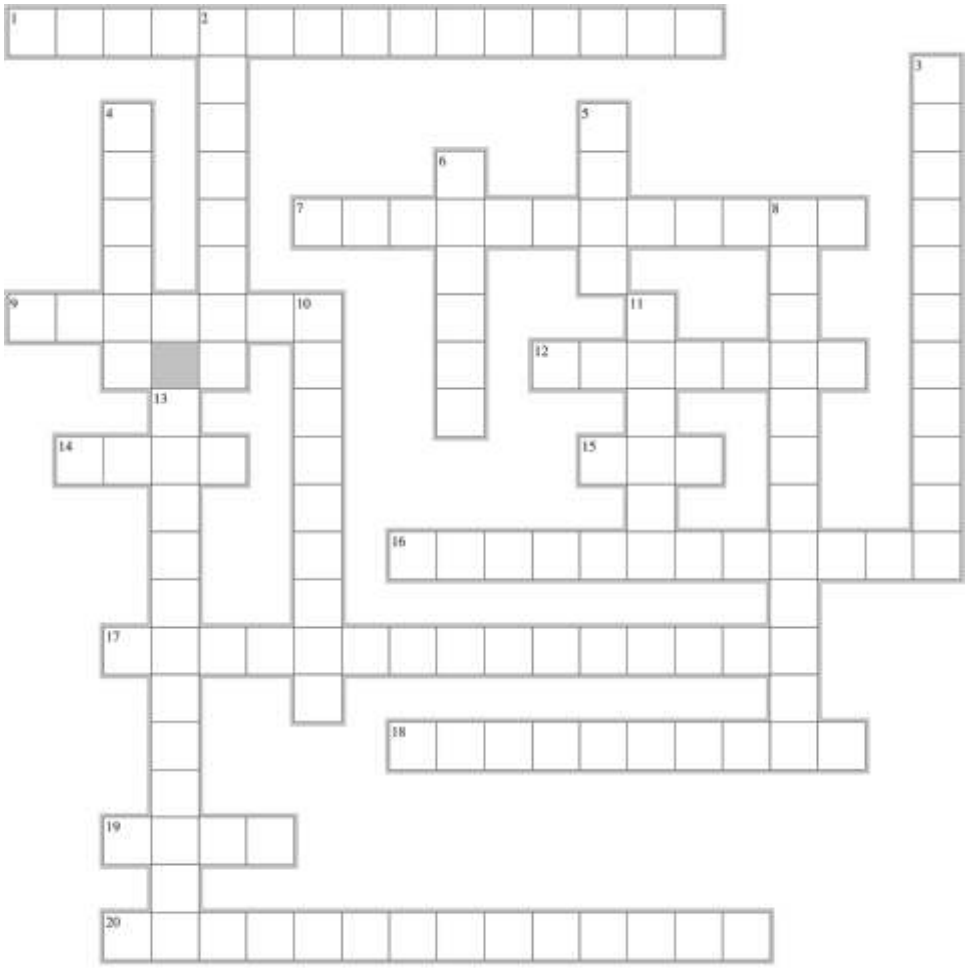
Air Cooler Puzzler *(Answers on page 27)*

Across

1. Limited to a maximum of 45° by API 661 (2 words)
7. Usually between 300 and 700 ft/min (2 words)
9. Restrict air flow over the bundle
12. Fan manufacturer added in ***X**ace* 4.0
14. Drive type
15. A unit that is 1 fan wide
16. Bundle is located below fan (2 words)
17. Common degradation mechanism
18. ***X**ace* option where tubeside fluid can be heated or cooled
19. HTRI air cooler program
20. Bundle delta-P plus auxiliary losses (2 words)

Down

2. Fin type with high API temperature rating
3. Fan is located below bundle (2 words)
4. Between the fan and the bundle
5. Fin ring type
6. Component built to ASME code section VIII
8. Affects fan performance (2 words)
10. Required in cold weather (2 words)
11. Power plant steam condenser
13. Fans off (2 words)



2005 North American Meeting Held in Boston

On September 12, 2005, Larry G. Hackemesser, Chair of the HTRI Board of Directors, welcomed the North American Meeting attendees to Boston, Massachusetts, USA.

Hackemesser introduced the re-elected members of the FY 2006 HTRI Board of Directors. With the resignations of William M. Boyle and G. E. Kluppel, the Board now has eight members; additional candidates will be considered at the February 2006 Board meeting and nominated for FY 2007.

HTRI Board of Directors

Larry G. Hackemesser, Chair
KBR

Donald W. Meyer, Vice Chair
Burns & McDonnell Engineering Co., Inc.

Naoki Dohi
Mitsubishi Chemical Engineering Corporation

Martin J. Gough
Cal Gavin Limited

Michael G. McMillion
Eastman Chemical Company

Takashi Noto
Chiyoda Corporation

T. Michael O'Connor
O'Connor Ventures, Inc.

Jinn H. Wang
UOP LLC

Minutes of the Annual Meeting of Stockholders are posted on the HTRI secured website.

HTRI Board of Directors

Standing (left to right): Noto, Wang, O'Connor, McMillion, Gough

Seated (left to right): Meyer, Hackemesser, Dohi

Technical Committee

Standing (left to right): Appleyard, Kindschi, Rumpf, Ashenhart, Hohmann, Ogawa, Grant

Seated (left to right): Piparia, Delorme, Rudy, King, Drazner, Jaguste

Not pictured: Lee

Technical Committee Expanded to Fourteen

To better represent various technical areas, as well as our increased global membership, the Technical Committee (TC) was expanded to 14 persons. In another effort to allow and encourage increased member participation, the TC adopted the same term limits as the Board of Directors, twelve consecutive years.

This year also brought a change in leadership. After serving his three-year term as Chair, Bill G. Ashenhart turned over the gavel to Thomas M. Rudy. James J. Grant was elected Vice Chair.

HTRI Technical Committee

Thomas M. Rudy, Chair
ExxonMobil Research and Engineering Company

James J. Grant III, Vice Chair
E.I. du Pont de Nemours & Company, Inc.

Steve Appleyard
ConocoPhillips Company

Bill G. Ashenhart
S & B Engineers and Constructors, Ltd.

Jean Jacques Delorme
Technip

Bennat J. Drazner
Alfa Laval Inc.

Robert P. Hohmann
Chevron Energy Technology Company

Shubhangi Jaguste
Reliance Engineering Associates (P) Limited

Michael D. Kindschi
Hughes-Anderson Heat Exchangers, Inc.

David C. King
BP p.l.c.

Robert Lee
Bechtel China Inc.

Takao Ogawa
Toyo Engineering Corporation

Jack J. Piparia
Ecodyne MRM, Inc.

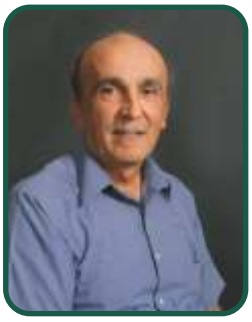
Bernd Rumpf
BASF Aktiengesellschaft

Thomas M. Rudy was recently promoted to Distinguished Engineering Associate in the Plant Engineering Division of ExxonMobil Research and Engineering Company in Fairfax, Virginia, USA. Rudy, a specialist in unfired heat transfer technology and energy utilization, has over 30 years' experience in heat transfer research, equipment design, and troubleshooting, including application of enhanced heat transfer technologies. Rudy has been named a Fellow by the American Society of Mechanical Engineers (ASME). He holds a B.S. in Mechanical Engineering from Youngstown State University, Youngstown, Ohio, USA and both a Masters in Engineering Science and a Ph.D. in Mechanical Engineering from The Pennsylvania State University, State College, Pennsylvania, USA.

Rudy was first elected to the HTRI Technical Committee in 2001 and had been serving as Vice Chair since 2002. He is also a member of the HTRI Crude Oil Fouling Task Force and the Exchanger Design Margin Task Force. Rudy is the founder and a charter member of the HTRI Communication Committee – Mid-Atlantic (USA).

James J. Grant III is a Senior Consultant, Heat, Mass & Momentum Transfer, in the Dupont Engineering Department of E.I. du Pont de Nemours & Company, Inc. in Wilmington, Delaware, USA. Grant has nearly 25 years' experience in product and process development, production, and research. Since 1989, he has provided corporate support for heat and mass transfer applications at DuPont manufacturing sites worldwide.

Grant not only teaches distillation and heat transfer courses for Dupont's Engineering Services Division, but is also on the adjunct faculty of the University of Delaware. He is a licensed Professional Engineer (P.E.) in Delaware and New York. Grant holds a B.Eng. in Chemical Engineering, from The Cooper Union, New York, New York, USA, and an M.Che. in Chemical Engineering from the University of Delaware, Newark, Delaware. He is a charter member of the HTRI Communication Committee – Mid-Atlantic (USA) and has been a member of the Technical Committee since 2003.



Thomas M. Rudy
ExxonMobil Research and Engineering Company

James J. Grant III
E.I. du Pont de Nemours & Co., Inc.

New Technical Committee Members

Steve Appleyard
ConocoPhillips Company

Shubhangi Jaguste
Reliance Engineering Associates (P) Limited

Bernd Rumpf
BASF Aktiengesellschaft

Newly elected members to the Technical Committee are Steve Appleyard, Shubhangi Jaguste, and Bernd Rumpf.

Steve Appleyard, Chief Scientist, ConocoPhillips Company, Ponca City, Oklahoma, USA, works on coking and fouling mitigation in the Downstream Technology group. He was previously a Research and Development Scientist with Foseco International Ltd. and Foseco SpA in the United Kingdom and Italy. He was also a Senior Research Fellow at the University of Leeds, Leeds, United Kingdom.

Appleyard is a referee for *Carbon Journal* and has also previously refereed articles for the *Journal of Microscopy* and the *Journal of Materials Science and Fuel*. He co-edited the NATO Science Series book *Design and Control of Structure of Advanced Carbon Materials for Enhanced Performance* published by Kluwer Academic Publishers (2001). He was a member of the British Carbon Group (1998 – 2001) and the UK Engineering and Physical Sciences Research Council (Government Funding Body) Peer Review College (2000 – 2002). Appleyard earned his B.Sc. in Material Science and Technology at The University of Sheffield, Sheffield, United Kingdom and his Ph.D. in Carbon Materials Science, Department of Materials, from the University of Leeds, Leeds, United Kingdom. He is also a member of the HTRI Crude Oil Fouling Task Force.

Shubhangi Jaguste is General Manager, Reliance Engineering Associates (P) Limited in Mumbai, India. Since 1999 she has provided process design and technical support to Reliance's petrochemical and refinery plants. Jaguste is a specialist in design, revamp, and troubleshooting of heat and mass transfer equipment, including fired heaters and distillation towers. Other areas of expertise include multiphase flow problems and reactor modeling, especially of fluidized bed reactors. Prior to joining Reliance Engineering Associates, she was employed as Assistant Manager – Process Engineering, National Organic Chemical Industries Ltd., Navi Mumbai, India.

Jaguste earned her B.Sc. (Tech) and M.Sc. (Tech), in Chemical Technology from the University Department of Chemical Technology in Matunga, India; she holds a Ph.D. in Chemical Engineering, from Indian Institute of Technology, Powai, in Bombay, India. She is a member of the HTRI Exchanger Design Margin Task Force and previously served on the *Xfh* Task Force from 2002 until it completed its mission in 2005.

Bernd Rumpf, Manager, Heat Transfer and Distillation, works at BASF Aktiengesellschaft, Ludwigshafen, Germany. Prior to joining BASF AG in 1999, he was a Research Fellow and subsequently an Assistant Professor in the Department of Technical Thermodynamics at the University of Kaiserslautern, Germany. Rumpf is currently involved in research to improve the design of heat exchangers for high viscous fluids, fouling applications, as well as research on separation technology. He is a member of the VDI-GVC Working Party on Heat and Mass Transfer.

Rumpf has published over 30 technical articles, including multiple ones in *Fluid Phase Equilibria*, *Chemie Ingenieur Technik*, and *Industrial & Engineering Chemistry Research*. He has also conducted training on Thermodynamics, Heat Transfer, and Process Design. Rumpf holds a Diploma in Engineering, with a specialization in Chemical Engineering, from the Technical University of Karlsruhe, Karlsruhe, Germany, and a Dr. -Ing. in Chemical Engineering from the University of Kaiserslautern, Kaiserlautern, Germany. He has been a member of the HTRI Communication Committee – Germany since 2001.

Appreciation for Retiring Board and Technical Committee Members

Three members of the Board and Technical Committee (TC) resigned this year. Each of them unstintingly shared their expertise in process heat transfer technology. On behalf of HTRI members throughout the world and the HTRI staff, we acknowledge the years of service of the following individuals and thank them for their dedication to HTRI. Best wishes to them and their families.

Positive Changes During Boyle's Tenure as Chair

William M. Boyle

William M. Boyle, currently Senior Process Associate, The Dow Chemical Company, joined the HTRI Board of Directors in 1994, the year it was officially established, changing the name from Executive Committee to match the Certificate of Incorporation and Bylaws. Five years later, he was elevated to Vice Chair and in 2000 was elected Chair.

Boyle brought to the Board not only extensive technical expertise in process design, troubleshooting, and consulting, but also an approach to progress that led to management achieving significant revisions in operations, continued growth, and a meaningful global presence. Boyle supported changes that allowed HTRI to operate as a for-profit corporation. Last year, in accordance with policies he helped implement, Boyle relinquished his position as Chair, but continued to serve on the Board. Contemplating retirement from The Dow Chemical Company, he resigned from the Board in July 2005, after eleven years of service.

His legacy is the support he gave to management in moving HTRI forward through myriad changes necessary to shape the future. Boyle continues to serve on the HTRI Exchanger Design Margin Task Force and remains an active user of HTRI technology.

Decades of Commitment from Johnston

Stephen W. Johnston

Stephen W. Johnston worked for Shell Oil Company, in one division or another, for his entire career spanning 35 years. He demonstrated a similar level of commitment to HTRI. Johnston was first elected to the Technical Committee in 1984 and continued to serve on the committee until his retirement from Shell Global Solutions (US) Inc. in 2005. In 1996, he was elected the TC Vice Chair and in 1999 became Chair, a position he held until 2002, when term limits for chairs became effective.

Johnston was a specialist in unfired heat transfer equipment, including shell-and-tube exchangers, air coolers, cooling water towers, and vacuum jet systems. During his two-plus decade tenure on the TC, he freely contributed his opinions and expertise, and HTRI capitalized on the expertise he and many others had in heat exchanger design, as well as the collective knowledge of boiling and condensation phenomena in the process industry.

Long-Term Service of Kluppel Recognized

G. E. "Buddy" Kluppel

In January 2005, after forty-five years of employment with Hudson Products Corporation, where he last held the position of Director, Administration, G. E. "Buddy" Kluppel retired and thus resigned from the HTRI Board of Directors. Kluppel had served on the HTRI Board since 1994, and on the preceding Executive Committee since 1991. He chaired the HTRI Board of Directors from 1994 to 2000; during his tenure, management-driven changes included retirement of subcommittees in favor of global Communication Committees, plus reduction of the membership agreement contract period from five to three years and fee structure revisions that facilitated growth around the world.

Kluppel also was active in a number of other professional societies including the American Society of Mechanical Engineers, American Petroleum Institute, Cooling Technology Institute, and International Standards Organization.

Record Membership Growth Continues

Fernando J. Aguirre, Vice President, Business Development

Fernando J. Aguirre

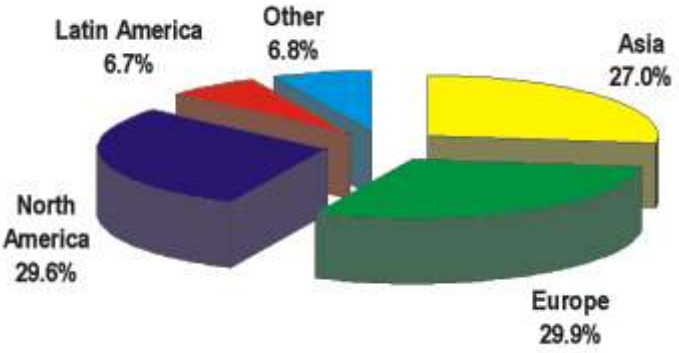
During FY 2005 we achieved a record net increase in HTRI membership, reaching a total of 585 members and Participating Affiliates (PAs) at the end of the fiscal year. The growth included 36 new members and 19 PAs from the regions in the table below, producing a total of 296 members and 289 PAs. The largest growth occurred in Asia, followed closely by Europe and North America. This increase reflects the positive business conditions there as well as the enhancements in the products we offer.

New members in FY 2005

Region	Members	PAs	Total
Asia	15	4	19
Europe	10	6	16
North America	9	4	13
Latin America	0	2	2
Other	2	3	5
TOTAL	36	19	55

By fiscal year end, the overall combined distribution of HTRI members and PAs was led by Europe with 29.9%, followed very closely by North America (29.6%) and Asia (27.0%). Representation in other regions include 6.7% in Latin America and 6.8% in Africa, Australia / Oceania, and the Middle East.

Membership distribution by region (Members and participating affiliates as of July 2005)



In business development we continued to maintain and expand alliances that would result in better products and services for HTRI members. Significant emphasis was given to participation in CO-LaN (CAPE-OPEN Laboratories Network—www.colan.org) activities together with our software development staff to ensure formal acceptance of *Xchanger Suite* as being CAPE-OPEN–compliant. This means that HTRI software can be called from CAPE-OPEN–compliant process simulators such as Aspen Plus, HYSYS, and PRO / II.

Contest Begins: Win A Discount on Annual Fee

Do You Have a Success Story to Share? We Want to Hear from You!

Our members aren't shy about telling us stories—at meetings or other informal events—about how they use HTRI technology, but now we'd like to get some of the best stories in writing.

To accomplish that, we have started a contest to find success stories about your use of HTRI technology. It's easy to participate—just e-mail us your story, including how you were able to maximize the value and benefits of HTRI technology.

For example,

- have you recently saved a significant amount in operating costs due to an improved design with HTRI software?
- have you won a bid to supply heat transfer equipment resulting from your use of HTRI methods?

We'll evaluate entries in three categories based on member type—processor companies, engineering contractors, and equipment manufacturers.

For this competition, we're measuring success in using HTRI technology as

- cost savings
- incremental revenue gained
- any measurable financial benefit

Prizes for the most successful stories include a 5% discount on your company's next annual fee payment as well as a gift to the person who submits the winning entry in each category.

All submissions should include technical and financial details of the cases, as well as permission from your company for HTRI to publish the case. Publication will occur only after each winning company reviews and approves the information to be published.

If you are interested in participating, submit your entries to the attention of Fernando J. Aguirre (FJA@HTRI.net) by January 31, 2006. Winners will be announced by March 15, 2006.

Technical Support

To ensure that your message reaches an available staff person, e-mail technical inquiries to

Support@HTRI.net

Technical support is available from all HTRI offices, as well as from representatives in China, France, India, Italy, and South Africa. Further contact information appears on page 28.

Asia

Hirohisa Uozu, Manager, Asian Office

Hirohisa Uozu

FY 2005 was a good year in the Asian region. Fifteen new members and four participating affiliates joined HTRI. The economies of this region have improved over the past months, contributing to the growth in membership. Positive economic forecasts, combined with ongoing developments in our products and services, indicate that the growth trend will likely continue in the coming year.

The Asian region now has five active Communication Committees; these groups strengthen the communications with HTRI staff and thus help contribute to the technical improvements that members value. China, India, Japan, Korea, and Singapore are the existing groups; we welcome their ongoing feedback and their assistance in organizing meetings in their areas.

In October and November, we held Asian meetings in China, Korea, and Japan. A meeting will be held in Singapore in December 2005 and in India in early 2006.

Holiday Schedule

Our USA and European offices will be closed

December 26, 2005 – January 2, 2006

Our Asian office will be closed

December 29, 2005 – January 3, 2006

During this time, we will monitor the technical support e-mail and telephone for urgent messages.

The USA and European offices resume business on Tuesday, January 3, 2006; the Asian office, on Wednesday, January 4, 2006.

From all of us at HTRI...

Happy Holidays

At each of the sessions already completed, HTRI staff presented corporate updates and technical reports, and held training sessions, while appreciating the opportunity to visit directly with members and learn of their suggestions and questions. Attendance was strong in all regions; we thank everyone for their participation in these important events.

This year we participated in exhibitions in India (CHEMTECH World Expo 2005) and Japan (INCHEM TOKYO, in November 2005). These events offer an opportunity to meet with current members and introduce our technology to prospective members. We also are able to meet professors from academia who are interested in licensing our newest educational software.

Throughout the past year, training has been in demand in the Asian region. There was strong attendance at the courses of the above sessions, where we conducted training in various locations in Chinese, in Japanese, and in English. In addition, seven courses were taught on site at six companies throughout the region. If you have an interest in training at your company site, please contact the Asian office to discuss your needs.

The Asian office also continued to handle a significant level of technical support, particularly from the Asian countries, while also assisting with some of the more challenging inquiries submitted from all over the world. We welcome the opportunity to assist with your use of our products and your understanding of our technology. Inquiries also provide knowledge that is used to improve our technology; this is another of the benefits of our consortium.

Please contact the Asian Office with your questions or suggestions of how we can further meet your engineering needs. We anticipate that the remainder of FY 2006 will be a strong and positive time; your ongoing membership is appreciated.

Europe

Hans U. Zettler, Manager, European Office

Of the fifty-five members or participating affiliates who joined HTRI in FY 2005, sixteen were from Europe. While the European economy currently seems to be on an upward swing, many companies foresee even busier times ahead. Additional growth for HTRI in this region will have a positive impact on all members.

Our consortium also is strengthened by the active participation of global members; Europe is now represented by persons from three countries serving on either the HTRI Board of Directors or the Technical Committee (TC). Dr. Bernd Rumpf (BASF AG / Germany) was recently elected to the TC, joining Jean Jacques Delorme (Technip / France) and Dave King (BP p.l.c. / UK), who already serve there. Martin Gough (Cal Gavin Limited / UK) was elected to the Board of Directors last year.

In October, as we do every year, we hosted a European meeting, this time in Killarney, Ireland, so that members could meet with HTRI staff, attend training, and network with one another. The two training days at the Killarney meeting were very well received, leading to productive discussions about fouling and thermosiphon reboilers.

At WCCE 2005 (World Congress of Chemical Engineering) in Glasgow, Scotland, and at WTT-Expo 2005 in Karlsruhe, Germany, we introduced HTRI *Xchanger Suite Educational*. Our continuing presence at such events helps promote the advantages of HTRI products in the industrial and educational sectors. As has been our practice for many years, we will be exhibiting again at ACHEMA 2006 in Frankfurt, Germany.

Along with technical support and sales efforts, the European office responds to requests for local training; thus far in 2005, we have conducted onsite training at four companies. We will continue to answer the increased demand for educational opportunities in heat transfer and fluid flow. European Training Week in March 2006 will offer two short courses (*Heat Exchanger Technology* and *Designing Exchangers for Fouling Service*), as well as two workshops (*Advanced Xist* and *Xace*).

We encourage you to call or e-mail the European office with your questions, join us at our European meetings and training weeks, and play an active role in the European Communication Committees (CCs) in France, Germany, Holland, and the United Kingdom. Participation in such activities increases your ability to gain full benefit from your HTRI membership. Your suggestions for additional ways we can serve your needs are welcome.

Hans U. Zettler

HTRI Meetings around the World

For the latest information about HTRI meetings and training, view Upcoming Events at www.HTRI.net.

2006 South African Meeting
February 13-17, 2006
Johannesburg, South Africa
- Heat Exchanger Technology
- *Xist*
- *Xvib*

2006 Asian Meeting
February or March 2006
India
- HTRI *Xchanger Suite* Essentials
- Advanced *Xace*
- Advanced *Xist*
- Advanced Vibration Analysis

2006 North American Meeting
August 21-25, 2006
Hyatt Regency Calgary
Calgary, Alberta, Canada
Training to be announced

Staff News

Farrell Promoted to Senior Project Engineer, Research

Kevin J. Farrell

In recognition of his outstanding work in flow-induced vibration and simulation of heat exchangers, HTRI recently promoted Kevin J. Farrell to Senior Project Engineer, Research.

Kevin joined HTRI in August 2001 after earning his B.S., M.S., and Ph.D. in Mechanical Engineering from The Pennsylvania State University, State College, Pennsylvania, USA. While completing his graduate studies, he worked for 16 years as a researcher and deputy head of the Fluid Machinery Department of the Applied Research Laboratory (ARL) at the university. During that time, he received awards and commendations for his technical contributions, as well as his publications, and was an invited lecturer for several classes and seminars.

The author of several refereed journal articles and symposia presentations, as well as numerous reports to sponsors of his research, Kevin is most interested in fluid dynamics, vibration, and thermal engineering. He continues his record of publication at HTRI with numerous reports on computational fluid dynamics (CFD) studies and flow-induced vibration. Kevin has also developed and conducted several workshops and short courses, including *Xvib*, *Vibration Analysis*, and *Advanced Vibration Analysis*.

Kevin has led the effort to adopt the use of CFD in our research activities, providing counsel to other staff who are incorporating CFD in their research endeavors. In addition, he has taken a leading role in identifying government-sponsored research opportunities. He recently secured funding for a desalinization research project through the U.S. Department of Interior. Although HTRI has historically not pursued external funding, we will no doubt benefit from this project and others of this nature that may follow.

An active member of ASME and the Fluent Users Group, Kevin is a licensed Professional Engineer (P.E.) in both Texas and Pennsylvania. Kevin and his wife, Lori, a Certified Public Accountant, have three school-age children, Nicole, Olivia, and Jonathan.

Four Employees Celebrate Fifteen Years of Service

Susan M. Edwards – Contract Officer – January 3, 1990

Jo Ann Cole – Accounts and Payroll Administrator – March 19, 1990

Joseph W. Holmes, P.E. – Manager, Software Development – July 1, 1990

Elaine Jimerson – Distribution Representative – August 20, 1990

New Employees Join HTRI Team

Venia R. Baldobino

Venia R. Baldobino brings over twenty years of administrative experience in the financial and insurance industries and proven organizational and customer relations skills to her position in Membership Services.

Prior to joining HTRI, Venia worked for eight years at AMS Services, Inc., a firm that provides information and software for the insurance industry. There she gained experience in contract administration, sales, and customer service. She also had previously worked as a Financial Associate at the local A. G. Edwards office where she processed brokerage transactions and maintained compliance records, as well as assisted both customers and investment brokers. In prior positions with other financial organizations, she had responsibilities in marketing and sales support. Reporting to Carol J. White, Manager of Membership Services, Venia will provide administrative support for prospective membership activities, as well as back-up for other membership activities.

Venia is married to Dolores "Bino" Baldobino, another native Texan. He is a foreman at Citation Corporation's Forging Group in Navasota, Texas, USA; they have seven children and eighteen grandchildren.

Larry Klawinsky

Larry Klawinsky, a native of Navasota, Texas, USA, joins the team at HTRI's Research Facility after working several years as a lineman with Mid-South Synergy, a regional electrical utility. Prior to that he worked as a Journeyman Diesinker with Interstate Southwest Forging (now Citation Corporation) and as a Machinist with Ram Forge and Steel Company in Navasota, Texas.

He has over thirty years of work experiences in a variety of skilled trades that complement those of the staff of four technicians at our current research facility. In prior positions he has been responsible for the installation, operation, troubleshooting, and repair of electrical and mechanical equipment. He is also a certified welder and a Machinist First Class. In addition, he has experience in operating heavy machinery and cranes. Larry will report to J. Michael Creagor, Manager of HTRI's Research Facility.

Larry is married to Laverne Klawinsky, a Teacher Assistant with Navasota Head Start. They have a teenage daughter, Stephanie, who is a student at Navasota High School, and a son, Lanny, who works for Fenway Pipeline Construction in Conroe, Texas.

Three Employees Celebrate Tenth Anniversaries at HTRI

Service of Haley, Huang, and McGarvey Recognized

Betty R. Haley

Betty R. Haley
Senior Technical Editor

Betty joined the staff of HTRI in November 1995. She earned both her B.A. and M.A. in English from Stephen F. Austin University, Nacogdoches, Texas, USA, where she worked as a Graduate Assistant for two years. After graduation, she enrolled in additional graduate studies at Texas A&M University, College Station, Texas, where she worked as a Graduate Assistant in the Department of English teaching Technical Writing and tutoring students in the Writing Center. She was also an assistant in the Chemical Engineering Unit Operations Laboratory, where she edited students' technical reports.

In addition to her academic career, Betty worked in retail for eight years, including six as the owner / manager of The Daisy Patch, a gift shop in her hometown of Center, Texas. Prior to that, she was employed by Reserve Life Insurance Company in Dallas, Texas, and Prudential Life Insurance Company in Houston, Texas.

Her career at HTRI has included the editing of technical reports and training materials, and the construction of the first online help system in IST, as well as subsequent online help systems for *Xchanger Suite* and several of its component programs. She has also been involved in the development of the demo CDs for our software.

Betty is the mother of Haley, who is married to Caleb Williams. She is grandmother to two-year-old Ava Grace Williams and stepgrandmother to eight-year-old Casey Paige Williams.

LiDong Huang

LiDong Huang
Senior Project Engineer, Research

April 2005 marked the tenth anniversary of LiDong's service to HTRI. LiDong graduated with a B.S. from Shanghai Maritime University, Shanghai, China. After graduation, he worked for one year on the ship YUXIN and then for several years as an instructor and thermal engineer at the Department of Marine Engineering at Shanghai Maritime University before beginning his graduate studies in Shanghai Institute of Mechanical Engineering, China. After completing his M.S. in Mechanical Engineering, he enrolled at the University of Houston, Houston, Texas, USA. There his studies focused on developing methods for predicting subcooled flow boiling, film boiling, and critical heat flux. In 1994, he was awarded his Ph.D. A few months later, he joined HTRI as a Research Engineer.

His career at HTRI has focused primarily on boiling phenomena, but he also had done experimental work on plate heat exchangers and organic fouling. During his ten-year tenure at HTRI, he has authored more than twenty technical articles and conducted numerous workshops and short courses in China.

LiDong is married to Dexin "Daisy" Zhang, an electrical engineer at Texas Instruments. They have one daughter, Yanshu "Jesse" Huang, who is a senior at A&M Consolidated High School and who has recently been named a National Merit Semifinalist.

Michael R. McGarvey
Research Technician

Michael R. McGarvey

In June 1995, Mike joined the staff of technicians at the HTRI Research Facility. In 2005, he was the first research technician to ever celebrate ten years of service at HTRI. When Mike came to HTRI, he brought more than 30 years of service in the construction, power, and processing industries.

Originally from New York, he found his way south after completing his military service. Although he worked for Daniels Construction in Greenville, South Carolina, USA, his job took him to manufacturing plants throughout Texas. From there, he had the opportunity to work for a drilling company in a variety of positions and received the first of several safety awards that would mark his career.

In 1982, he moved to the Brazos Valley and began working as a plant mechanic at the Texas Municipal Power Agency in nearby Carlos, Texas, USA. Mike then operated his own construction business for another eight years before entering the process industries as a boilermaker for Serv-Tech and Chem-Fab in Houston and Clute, Texas. Working on shutdowns and turnarounds, he gained valuable experience at Chevron Gas and Chemicals in El Segundo, California, USA and BASF in Freeport, Texas, and other such plants.

The research technicians are cross-trained to work on all of HTRI's research units, but with experience, technicians develop in-depth knowledge and skills and become the principal technician for a particular rig. Mike currently works as the lead technician on the High Temperature Fouling Unit.

Mike is married to Louise McGarvey. They have three grown children and six grandchildren.

HTRI Heat Transfer Research, Inc. (HTRI)
The premier global provider of process heat transfer technology

Technical Services Engineer

Heat Transfer Research, Inc. (HTRI) is the global leader in process heat transfer and heat exchanger technology. Our industrial research and development consortium serves the engineering needs of nearly 600 companies in more than 45 countries. We conduct application-oriented research on pilot-scale equipment at our state-of-the-art facility. Our staff uses these proprietary research data to develop methods and software for the thermal design and analysis of heat exchangers and fired heaters. In addition, we provide technical support and offer training, consulting, and contract services.

Primary Responsibilities

- Perform engineering analyses, including experimental testing and review of proprietary prototype heat transfer product designs, as well as analyze root cause of industrial heat transfer equipment operating problems
- Respond to requests for contract and consulting quotations; prepare proposals
- Develop workshops, short course materials, web-based tutorials, and other training products
- Conduct training and teach short courses
- Respond to technical inquiries related to HTRI software and methods; prepare technical documentation to assist members in using/interpreting HTRI technology
- Identify and solicit experimental, analytical, software development, and consulting work
- Identify potential products to complement and leverage HTRI's existing technology

Minimum Qualifications

- B.S., Chemical or Mechanical Engineering and 5 years' industrial or consulting experience
- Professional Engineer (P.E.) license (individual must qualify for Texas P.E. within one year)
- Excellent communication skills (oral and written), including proven ability to write quality technical reports and develop/deliver formal presentations
- Strong organizational and multi-tasking skills
- Willingness to travel domestically and internationally

Prefer candidates with experience using HTRI software and CFD

Individual must possess permanent authorization to work in the USA.

Send letter of application and résumé to Ms. S. Breaux Daniel, Director of Human Resources
Heat Transfer Research, Inc.
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sbd@HTRI.net • www.HTRI.net
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recognizing members

May – October 2005

Renewing Members

Aker Kvaerner Powergas Pvt. Ltd.
APEMA Aparelhos, Peças e Máquinas Industriais Ltda.
API Heat Transfer Inc.
BASF Aktiengesellschaft
Bihl Anlagen-& Verfahrenstechnik
Britannia Metal Industries (Vic.) Pty Ltd.
China American Petrochemical Co., Ltd.
Chisso Engineering Co., Ltd.
Colt Engineering Corporation
Compañía Española de Compensadores S.A. - SACOME
Cryoquip, Inc.
Dunn Heat Exchangers, Inc.
Dynatherm
Equipos Industriales del Golfo, S.A. de C.V.
EQUITHERM
Ezer Co., Ltd.
Flovex S.p.A.
GEA Energy System (India) Ltd.
GEI Hamon Industries Limited
GS Engineering & Construction Corp.
Hammco, Inc.
Hanol Technology Inc.
High Country Fabrication, Inc.
The Indian Sugar and General Engineering Corporation
ITT Standard
J. W. Williams, Inc.
KAPP Nederland B.V.
L&T-Chiyoda Limited
L&T-Valdel Engineering Pvt. Ltd.
Litwin
M. M. Metallurgica Medolago Srl
Mass and Heat Transfer Technology (Pty) Ltd
Melter, S.A. de C.V.
Parsons Infrastructure and Technology Group Inc.
Patels Airtemp (India) Ltd.
Petróleos de Venezuela, S.A.
Pörner Ingenieurgesellschaft mbH
Pressure Vessels and Heat Transfer Consultants Ltd.
Projects & Development India Limited
PT. Tripatra Engineering
S.T. Special Tanks s.r.l.
S & W Heat Exchangers (S) Pte Ltd
Scientific Design Company, Inc.
SembCorp Engineers & Constructors Pte Ltd.
Sewon E&T Corporation
Shinko Plantech Co., Ltd.
SK Corporation
SSE GmbH (SCHELL Software & Engineering)
Stamicarbon B.V.
Sterling Chemicals, Inc.
Sunoco, Inc. (R&M)
TIW WESTERN Inc.
Tokki Ltd.
Toyo-Thai Corporation Ltd.
Tsukishima Kikai Co., Ltd.
WorleyParsons Services Pty Ltd (Brisbane)

New Members

ABB Process Solutions & Services S.p.A.
Sesto San Giovanni (MI), Italy

Altex Industries Inc.
Edmonton, Alberta, Canada

ASET (Appareils Spéciaux Echangeurs de Température)
Saint-Priest, France

Bertrams Heatec AG
Muttenz, Switzerland

Canadian Natural Resources Limited
Calgary, Alberta, Canada

Chemieanlagenbau Chemnitz GmbH
Chemnitz, Germany

Chicago Power & Process, Inc.
Arlington Heights, Illinois, USA

COEK Engineering NV
Geel, Belgium

Coil Company Pvt. Ltd.
New Delhi, India

Fordham Heat Transfer Consultants Inc.
Houston, Texas, USA

IMV Projects Inc.
Calgary, Alberta, Canada

INVISTA S.à r.l.
Wilmington, Delaware, USA

ITL Enterprise Co., Ltd.
Goyang, Kyungki, Korea

IWS-Monjé Limited
Arnsberg, Germany

MECS, Inc.
Chesterfield, Missouri, USA

Myung-Ji Engineering Co.
Seoul, Korea

OGP Technical Services Sdn. Bhd.
Kuala Lumpur, Malaysia

OMV (Pakistan) Exploration GmbH
Islamabad, Pakistan

SHI Mechanical & Equipment Inc.
Saijo, Ehime, Japan

SNC-Lavalin Europe B.V. (Saudi Operations)
Al Khobar, Saudi Arabia

Spiro-Gills Ltd.
Stafford, United Kingdom

Union Machinery Ind. Co., Ltd.
Yangsan, Kyongnam, Korea

New Participating Affiliates

Alfa Laval S.p.A.
Alonte (VI), Italy

Bechtel China Inc.
Shanghai, China

BP Refinery (Bulwer Island) Pty Ltd
Pinkenba, Queensland, Australia

Colt Engineering (Ontario) Corporation
Sarnia, Ontario, Canada

Innovene
Staines, Middlesex, United Kingdom

Invensys APV A/S
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Wilton, Redcar, United Kingdom

Ishikawajima Plant Construction Co., Ltd.
Tokyo, Japan

Lurgi South Africa (Pty) Ltd
Sandton, Gauteng, South Africa

Shell Global Solutions (Malaysia) Sdn. Bhd.
Kuala Lumpur, Wilayah Persekutuan, Malaysia

SPX Cooling Technologies UK Ltd.
Worcester, United Kingdom

Washington Group International, Inc.
Houston, Texas, USA

Wolverine Tube (Shanghai) Co., Ltd.
Shanghai, China

Staff Presentations and Publications

J. Nesta and C. A. Bennett, Fouling mitigation by design, Proceedings of Heat Exchanger Fouling and Cleaning Challenges and Opportunities, Engineering Conferences International, Irsee, Germany (June 5 – 10, 2005).

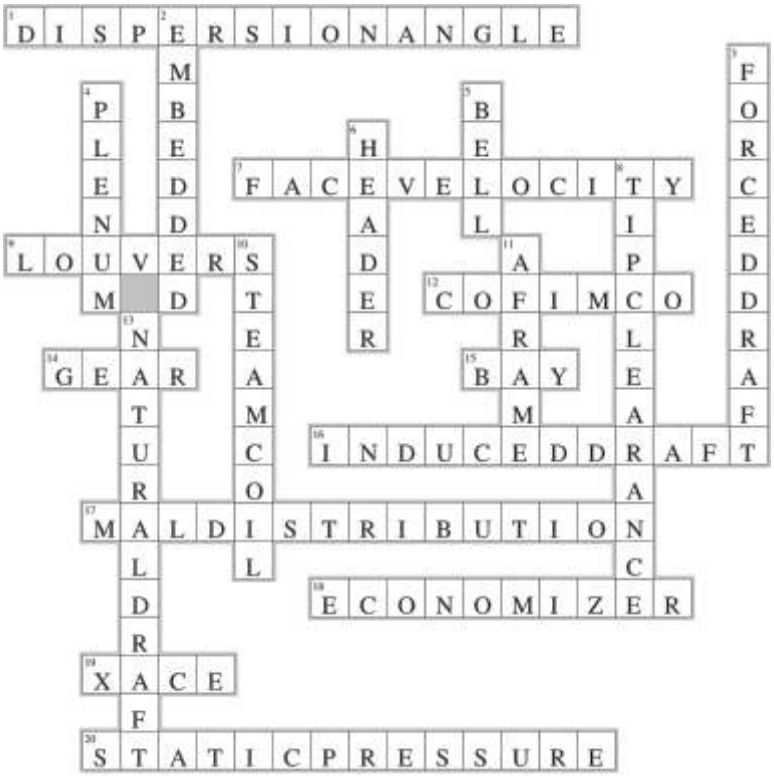
J. M. Nesta and C. A. Bennett, Fouling mitigation by design, The 6th International Conference on Petroleum Phase Behavior and Fouling, Amsterdam, The Netherlands (June 19 – 23, 2005).

Ever wish there was an itemized checklist for designing fouling resistant crude oil preheat train heat exchangers? These well-received presentations provides just such a checklist (originally published in the July 2004 issue of *Hydrocarbon Processing*). Follow these guidelines to design smaller fouling resistant heat exchangers with a lower capital cost.

H. U. Zettler, M. Weiß, Q. Zhao, and H. Müller-Steinhagen, Influence of surface properties / characteristics on fouling in plate heat exchangers, *Heat Transfer Engineering* 26(2), 3 – 17 (2005).

As the results of this research study show, appropriate surface treatment techniques to modify the surfaces of heat exchanger plates, or any other metallic heat transfer surface, may be an effective tool to significantly reduce scale formation in heat exchangers.

Air Cooler Puzzler Key



H. Uozu, VMGThermo and HTRI *Xchanger Suite*, VMG User Meeting, Yokohama, Japan (November 14, 2005).

This presentation for VMGSim / VMGThermo users and prospects introduced HTRI software, products, and services and explained details about the use of VMGThermo in *Xchanger Suite* 4.0. An example consisting of a propylene condenser was used to demonstrate the use of VMGThermo through the Property Generator in *Xist*. Also, vibration analysis using *Xvib* was demonstrated.

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current software

HTRI *Xchanger Suite* 4.0

Xace	*Xfh*
Xhpe	*Xist*
Xjpe	*Xphe*
Xtlo	*Xvib*

HTRI *Xchanger Suite Educational*

HTRI e-Library.....1.2

Software distributed by HTRI

EHT 2.1

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upcoming events

January – August 2006

2006 College Station Training Week
January 23-27, 2006
College Station, Texas, USA

Heat Exchanger Design and Operation AIChE Short Course
May 18-19, 2006
Houston, Texas, USA

June 22-23, 2006
San Francisco, California, USA

2006 South African Meeting
February 13-17, 2006
Johannesburg, South Africa

2006 Asian Meeting
February or March 2006
India

European Training Week
March 6-10, 2006
Florence, Italy

ACHEMA 2006
May 15-19, 2006
Frankfurt am Main, Germany

2006 North American Meeting
August 21-25, 2006
Hyatt Regency Calgary
Calgary, Alberta, Canada

For more details, see Upcoming Events at www.HTRI.net