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TUFFP

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Editorial by Cem Sarica

Greetings to all. Jim asked me to write an Editorial for this issue of the Newsletter as incoming Director of the Tulsa University Fluid Flow Projects (TUFFP). First, I would like to say that it is an honor and a privilege for me to be trusted with one of the most prestigious and successful research consortia at Tulsa University. Secondly, my family and I are very excited about returning to Tulsa. This will truly be a homecoming for the Sarica Family.

For those of you whom I have not had the opportunity to meet, let me introduce myself. My name is Cem Sarica. I hold BS and MS degrees in Petroleum Engineering from Istanbul Technical University (ITU) and a Ph.D. degree in Petroleum Engineering from The University of Tulsa (TU). Since receiving my Ph.D. degree, I have worked for ITU as an Assistant Professor of Petroleum Engineering, TU as the Associate Director of TUFFP, and The Pennsylvania State University (PSU) as an Associate Professor of Petroleum and Natural Gas Engineering in the Energy and Geo-Environmental Engineering Department.

Jim Brill has founded and nurtured TUFFP with success over 28 years with his leadership, inspiration and wisdom. He is leaving a legacy that is hard to match. Although Jim has stepped down from his faculty position, he has assured me that he will continue to be actively involved in TUFFP and TUPDP for years to come.

One would be foolish not to look at the past and learn from previous experiences before going forward. I can see four major elements that have contributed significantly to the success of TUFFP over the years. These elements are the well-established mutual relationship with industry, the existence of a very talented team consisting of students, research associates, technicians and administrative staff working harmoniously towards a common goal under an effective leadership, the support of the TU administration, and the adaptability to changes. My goal is to further TUFFP as one of the premier applied multiphase flow research centers by continuing the strong relationship with industry and governmental funding agencies, maintaining and managing a talented and efficient team, and adapting to future changes.

As Jim stated in the Fall 2000 TUFFP Newsletter Editorial, these are interesting, challenging, and exciting times in both industry and academia. The current advances in multiphase flow technologies have enabled us to exploit deep-water fields. Now, the oil and gas industry is considering exploration and exploitation of ultra deep-water fields. This presents unique challenges and opportunities to develop the needed technologies. We believe that we are well equipped to address these challenges. At TUFFP, we would welcome the opportunity to continue working with industry and governmental institutions to develop tomorrow's multiphase flow technologies.

As incoming Director of TUFFP, I will do everything I can to keep the torch lit with your support and active participation. I am very much looking forward to working with current and future members.

Editorial by James P. Brill

This will be my farewell as the Director of TUFFP. In the words of Jerry Wilson, it has been a good gig. Although my attempts at retirement failed last time, I have complete confidence that this one will be successful.

We are so fortunate to have attracted a perfect candidate as our new Director. Cem Sarica will arrive in May, as not only a recognized multiphase flow expert, but also someone thoroughly familiar with TUFFP and The University of Tulsa. For me he is also a special choice since this neat guy wants my continued involvement and will accommodate my hunger for freedom and relaxation, coupled with my desire to continue working with member companies and students.

Cem and I will start by once again jointly teaching the TUFFP short course in May, but with a new segment on paraffin deposition in multiphase flow. In June, I hope to reduce my level of activity to about ½ time and continue at this level for another 2 or 3 years. This will ensure a smooth transition for Cem as the new Director, and will also enable me to continue advising current graduate students.

Cem has some exciting new ideas on how to invigorate TUFFP through increased efficiency, greater cooperation with other consortia in and outside of TU, greater involvement of industry in research activities, becoming more responsive to short term technology needs, and others. These are the types of benefits that flourish from new and younger leadership. I endorse them wholeheartedly and know that you, the members, do also.

Personnel Status Changes Announced

Dr. Qian Wang was hired as a new post Doctoral Research Associate effective October 1, 2000. She has over 10 years of experience in experimental, modeling and simulation research on multiphase flow following completion of her PhD in Mechanical Engineering from Jiaotong Univeristy in China. Most recently, she served as a Research Associate at The Energy Institute at Penn State University, working with Dr. Cem Sarica on a wax removal mechanics project for Deepstar. Dr. Wang is devoting 75% of her efforts to TUFFP research with the remaining 25% to TUPDP.

A rigorous search for several Petroleum Engineering graduate students to serve as Research Assistants in TUFFP is bearing fruit. Offers have now been extended to three students from China, one from Turkey and one from Kuwait. Three of these will be MS and two will be PhD students. Additional offers will soon be extended to two new graduate students for TUPDP, one at the PhD level and one at the MS level. Confirmation of acceptances from all students is anticipated and all should arrive in May or August. Names of the students will be reported at the May Advisory Board meeting.

Dan Underwood recently vacated his Research Assistantship to accept a similar offer in the Computer Science Department. He is an MS student in Computer Science and was managing the TUFFP/TUPDP computer network. Dan was outstanding and his talents are sorely missed. Until an alternative is found, Linda Jones will serve as Network Manager.

TUFFP Financial Status Stable

Aggressive cost cutting by TUFFP during 1999 and 2000 resulted in a reserve fund balance of approximately $120,000 at the end of 2000. Cost containment has continued the first quarter of 2001 for all but essential items. Only four companies have paid their 2001 membership fees and all remaining companies will soon be contacted and urged to pay fees as soon as possible to prevent cash flow shortfalls.

TUFFP Membership Stabilizes

Membership in TUFFP has finally stabilized after two very difficult years characterized by several mergers and continued cost cutting for R&D expenditures. We have leveled out with 16 members for 2001, having regained Petronas as a member. At this time we anticipate losing one member for 2002, Texaco, as a result of the pending merger with Chevron. Efforts are underway to develop a professional prospectus and summaries of our experimental facilities. This will be followed by a concerted effort to communicate with past and possible new members in an effort to expand our membership. Discussions are underway with the U.S. Department of Energy, Saudi Arabian Oil Company, Statoil, Petrobras, Norsk Hydro, Schlumberger, Halliburton, Simulation Sciences and R. J. Brown.

2001 Fluid Flow Projects Membership

Arabian Oil Co., Ltd.
Baker Atlas
BG International
BP Exploration
Chevron Petroleum Technology Company
Conoco, Inc.
ECOPETROL/Instituto Colombiano del Petroleo
Japan National Oil Corporation
Marathon Oil Company
Minerals Management Service
Pemex
Petronas
Phillips Petroleum Company
PDVSA - Intevep
Texaco
TotalFinaElf

Meetings and Conferences

Spring 2001 TUFFP Advisory Board Meeting

Final plans have now been made for the Spring 2001 TUFFP Advisory Board and related meetings. All meetings will be held at the Adams Mark Hotel in downtown Tulsa. The TUFFP Advisory Board meeting will begin at 8:30 a.m. on Thursday, May 24 and will adjourn at 5:00 p.m. A tour of test facilities will be held at 4:00 p.m. on Wednesday, May 23rd. Following the tour on Wednesday there will be a joint reception at the Adams Mark Hotel from 6:00 – 9:00 p.m. TUFFP members will be joined by those attending the paraffin deposition projects consortium (TUPDP) Advisory Board meeting that will be held earlier that day.

The Request for Information form and the Hotel Information form are included with this Newsletter. All persons from your company that plan to attend the Advisory Board meetings should complete and return these forms as soon as possible to help us plan the meetings. Information on the Advisory Board meeting can also be found on our web site at www.tuffp.utulsa.edu/ABM/index.html. You can then follow the links for the Request for Information form and the Hotel Reservation form. The Hotel Reservation form is a word document for downloading and faxing to the hotel.

A summary of the tentative dates for the Fall 2001 and the Spring 2002 Advisory Board activities are shown in the table below. The location for the meetings is still being negotiated with local hotels.

TUFFP Advisory Board meeting brochures will be available for members at the meeting and a concerted effort will again be made to have the combined brochure and slide copy available for downloading from the TUFFP web site at www.tuffp.utulsa.edu shortly before the meeting. The brochure will contain sufficient information to help each attendee actively participate in discussions on current and future research projects, financial matters, and operating procedures.

TUFFP Announces Revised Short Course

The 27th annual TUFFP Short Course on Two-Phase Flow in Pipes will be taught May 14-18, 2001 at the Tulsa Marriott Southern Hills Hotel. Dr. Sarica and Dr. Brill will once again team up to jointly teach the course.

A major change in the 2001 course will be to replace the module on Inflow Performance Relationship with one on paraffin deposition. This will include material on fluid characterization, deposition models, effects of turbulence, wall shear and flow pattern, and a software demonstration using TUWAX, the multiphase paraffin deposition program available to members of both the previous Wax JIP and the new Wax Consortium (TUPDP) at The University of Tulsa.

The TUFFP member registration fee for the short course will again be $1,200 for the first enrollee and $1,100 for subsequent enrollees. Non-members companies will be charged $1,845 for the first enrollee and $1,545 for subsequent enrollees, with a provision that on-line registrants will be charged $1,480. A brochure advertising the course will soon be mailed to TUFFP and TUPDP members and interested persons are urged to enroll as soon as possible to help us plan the course.

ETCE 2001 and ETCE 2002, Past and Future

The Production Technology Symposium at ETCE 2001 was another resounding success. Most of the papers were of excellent quality and attendance was modest but acceptable for most sessions. A total of 33 papers were presented in 11 technical sessions with an average attendance of about 30 in each session. As a result, the ASME Petroleum Division has scheduled ETCE 2002 for February 6-8, 2002 again at the Sheraton North Houston Hotel. Stuart Scott will serve as the Production Technology Symposium Chair for ETCE 2002 and is already planning some innovative changes to make the conference even more attractive.

Future Advisory Board Meetings Schedule

May 23, 2001

Advisory Board Meeting
TUPDP Advisory Board Meeting
Adam's Mark Hotel

Tour
Tour of TUFFP/TUPDP Test Facilities
University of Tulsa - North Campus

Reception
Joint TUFFP/TUPDP Cocktail Reception
Adam's Mark Hotel

May 24, 2001

Advisory Board Meeting
TUFFP Advisory Board Meeting
Adam's Mark Hotel

November 14, 2001

Advisory Board Meeting
TUPDP Advisory Board Meeting
Location to be announced

Tour
Tour of TUFFP Test Facilities
University of Tulsa - North Campus

Reception
Joint TUFFP/TUPDP Cocktail Reception
Location to be announced

November 15, 2001

Advisory Board Meeting
TUFFP Advisory Board Meeting
Location to be announced

BHR Group Conference in Cannes Looks Exciting

Since 1991, TUFFP has participated as a co-sponsor of BHR Group conferences on Multiphase Production. In odd years, the June conference is held in Cannes, France. In 1998 and 2000, conferences were also held in Banff Springs, Alberta, Canada. In addition to submitting technical papers, TUFFP personnel participate in reviewing papers, serving as session chairs, and advertising the conferences to our member companies.

The 2001 conference in Cannes, France is scheduled for June 13-15, 2001 at the Gray d'Albion Hotel. Over 30 excellent papers will be presented in 10 technical sessions and Masterclass problem solving forums. Approximately 150 persons actively involved in addressing multiphase production problems are expected to attend. Registration brochures will soon be available and will be mailed to all TUFFP members.

Building on the success of the past two BHR Group conferences in Banff Springs, another conference is now planned for Banff Springs June 6-7, 2002 and will be preceded by the BHR Groups Hydrotransport conference on June 3-5.

Progress Reports

Paraffin Deposition Consortium History and Projects

TUPDP was officially started on June 1, 2000 with 18 paying member companies and three non-paying companies. DOE funds were not secured until January 1, 2001, but member companies unanimously asked that TUPDP start to permit addressing some of their deep water flow assurance needs. Current members include: Amoco Exploration, Alberta Research Council (in kind), Baker Petrolite, BG Technology, BHP Petroleum, Champion Technologies, Chevron, Conoco, Elf Exploration, ExxonMobil, Marathon, MMS, MSI (in kind), Nalco/Exxon, Pemex, PetroCanada (in kind), Petrobras, Phillips, Shell, Statoil and Texaco. Negotiations are underway for Halliburton, ONGC and Unocal to join and other member companies are also anticipated.

Significant efforts will be devoted during the next three years to modeling at both the macroscopic and microscopic levels. The entire area of deposition physics will be studied, including investigation of deposit aging and physical characteristics of deposits. A new generation of sensors will be pursued to permit monitoring of deposits in the field. Additional oils will be tested, as will the effect of water fraction on deposition. Following is a brief summary of progress since November 2000 and planned activities this Spring.

Single-Phase Facility

Modifications of the single-phase facility have been carried out to accommodate new control valves and a new data acquisition system. Calibration of the instruments is on-going and will be completed in early March. A new spool piece is under construction that will allow sampling of deposits while testing. This new spool piece will permit us to analyze wax samples and quantify their aging with time. Commissioning and testing will take place in March. Development of the test matrix for future single-phase deposition testing will also be completed in March.

Single-Phase Paraffin Deposition Flow Loop

Two-Phase Flow Facility

All high-pressure flow pattern tests were completed last December. Unfortunately, an oil pump failure occurred which delayed beginning heat transfer tests for about a month. The heat transfer tests began in mid February and should be completed by early March. A new spool piece accommodating a CMR ultrasonic sensor will then be installed in place of the high-pressure capacitance sensor. Testing of this new ultrasonic sensor will take place in March.

Multiphase, High Pressure Paraffin Deposition Flow Loop

Deposition Physics

A Perkin-Elmer differential scanning calorimeter will be purchased and will allow us to monitor depletion of our crude oils during testing as well as assess the aging of the wax being deposited. A pigging test rig is also being built in order to evaluate the shear strength of the deposited wax.

Two-Phase Flow in Hilly Terrain Pipelines

Eissa Al-safran

A hilly-terrain pipeline consists of interconnected horizontal, uphill, and downhill sections. Both offshore and onshore pipelines exhibit such configurations. The ability to predict the behavior of long slugs generated in these pipelines is important. These long slugs often cause operational problems, flooding of downstream facilities, severe pipe corrosion, and structural instability of the pipeline, as well as production loss and poor reservoir management.

In this study, two-phase flow in hilly-terrain pipelines is being investigated experimentally and theoretically. The objectives of this project are four fold:

- investigate slug initiation at the bottom elbow and slug dissipation at the top elbow.
- develop closure relationships for slug tracking models.

- generate data to evaluate the developed models.
- develop a model to simulate two-phase flow in hilly-terrain pipelines.

The test facility used is a 420-m (1378-ft) long, 50.8-mm (2-in.) diameter, horizontal steel pipeline that was modified for this study. A new test section made of 2-in. diameter transparent acrylic pipe simulated a single hilly-terrain unit of 70-ft uphill (downhill) and 70 ft downhill (uphill) sections. The inclination angles investigated were horizontal and ±1°, ±2° from horizontal, including valley and hill configurations. The test section contained four measurement stations to monitor the change in slug flow characteristics along the test section. A total of 115 tests were conducted with hill and valley configurations. The superficial liquid and gas velocities ranged from 0.2 to 4 ft/s and from 2 to 15 ft/s, respectively.

A two-phase flow mechanistic model to predict slug initiation at the bottom elbow, slug dissipation at the top elbow, and slug length distribution at the hilly-terrain pipeline entrance are the focused modeling tasks of this project. Furthermore, closure relationships will be developed from the experimental data to improve the prediction of slug dissipation, generation and growth in the downhill and uphill sections, respectively. The film hydrodynamics will be examined carefully because of its crucial role in the above-mentioned mechanisms. These models and closure relationships will be integrated into the TUFFP slug-tracking model to improve its predictions.

Significant progress has been made since the last Advisory Board meeting in November 2000. After completing the experimental part of this project last summer, the focus now is on data processing and data analysis. Furthermore, the TUFFP slug-tracking model is being validated with the acquired data to identify the areas that need improvement in terms of modeling. A detailed progress report will be presented at the Advisory Board meeting in May 2001.

A Comprehensive Mechanistic Heat Transfer Model and High Pressure Flow Pattern Validation for Two-Phase Flow

Ryo Manabe

Estimating heat transfer, including the prediction of convective heat transfer coefficients, for gas-liquid two-phase flow is a main concern in modeling thermal behavior of petroleum multiphase systems. However, the petroleum industry has paid less attention to heat transfer in multiphase flow than to the hydrodynamics, such as flow pattern, pressure drop and liquid holdup. Thus, the heat transfer for crude oil-natural gas two-phase flow is not well understood, and a robust prediction method for all possible operating conditions in petroleum multiphase systems does not exist.

Flow pattern is a central issue in two-phase hydrodynamics. Clearly, two-phase heat transfer also strongly depends on the existing flow pattern. Although existing flow pattern models have been well validated in low-pressure systems, the validity of these models under high-pressure conditions has not been adequately documented in the literature.

The objectives of this project are to:

- acquire experimental data on flow pattern transition boundaries and heat transfer for high-pressure, gas-liquid (natural gas-crude oil) two-phase flow in horizontal, vertical and inclined pipes.
- verify and extend the mechanistic flow pattern transition models to high-pressure conditions.
- develop a comprehensive mechanistic heat transfer model, and
- validate the proposed model with experimental data.

A set of high-pressure flow-pattern validation tests has been completed and were reported at the Advisory Board meeting in November 2000. During the meeting, a significant amount of positive feedback was received.

After the Advisory Board meeting, the experimental setup for conducting two-phase heat transfer measurements was completed. However, an unexpected catastrophic stator failure in the Moyno pump occurred in early December 2000 and this delayed the test schedule for about a month. The stator was replaced in early February 2001. New probes have been installed for heat transfer measurements. The heat transfer data acquisition began in mid February and should be completed by early March. This requires employing a 24 hours a day operation to restore the original time schedule. During the pump troubleshooting, some progress was made in the area of heat transfer modeling.

The results of the two-phase heat transfer measurements and part of the modeling study will be presented at the Advisory Board meeting in May 2001.

Low Liquid Loading Gas-Liquid Flow in Near-Horizontal Pipes

Qian Wang

Gas-liquid two-phase flow exists extensively in the transportation of hydrocarbon fluids. A more precise prediction of liquid holdup in near-horizontal, wet-gas pipelines is needed in order to better size downstream processing facilities. Stratified flow and annular flow are the two flow patterns observed most often in near-horizontal pipelines under low liquid loading conditions.

The objective of this study is to investigate, experimentally and theoretically, low liquid loading gas-liquid two-phase flow in near-horizontal pipes, and to develop improved design models for wet-gas pipelines.

A 50.8-mm inner diameter, 19-m long test facility is being used for this study. The test loop can be inclined from –2° to +2° from the horizontal. The fluids used for this study are air and water. The measured parameters include gas flow rate, liquid flow rate, pressure, differential pressure, temperature, liquid holdup, liquid film flow rate, wave characteristics (frequency and amplitude), droplet entrainment fraction and droplet deposition rate. A new capacitance probe was built and installed which can be used to measure the wave frequency and amplitude.

This study was reoriented after the May 2000 TUFFP Advisory Board meeting. According to the comments and

expectations from member companies, the liquid loading range was changed from 300-1800 m^3/MMm^3 to 50-900 m^3/MMm^3. A new turbine meter for water flow rate was installed in the flow loop. With this new flow meter, we can measure liquid loadings as low as 50 m^3/MMm^3 (about 10 bbl/MMscf). Data acquisition at the lower liquid loadings and with the new capacitance probe will soon begin.

A new model will be developed for prediction of liquid holdup and pressure gradient in wet-gas transportation. The interfacial friction factor will be evaluated in terms of the interfacial wave structures. The characterizations of the waves will be correlated to the gas and liquid flow rates based on the experimental results. A correlation developed by Lopez (1994) will be used to calculate the friction factor from wave characteristics.

BP Flow Loop Status

A 6-in. ID, 400 ft long flow loop was donated to TUFFP by BP Amoco. BP also funded most of the expenses incurred to reassemble the flow loop at TUFFP. On behalf of the other TUFFP members and The University of Tulsa, we thank BP for this marvelous donation. The flow loop was installed on the TU north campus and was commissioned during the November 2000 Advisory Board meeting. After the meeting, the liquid (water) was removed from the flow loop to prevent damage from freezing weather during the winter months. The water tank was then sent to the manufacturer for minor modifications and improved anti-corrosion treatment. Current plans call for installation of instrumentation during the Spring

The BP flow loop will be used as a research facility and also as a multiphase flow demonstration apparatus for petroleum engineering students and professionals. The initial research project will be an investigation of stratified flow behavior. Due to its large diameter, the 6-in. flow loop is an ideal facility to study interfacial wave characteristics and shear stress in stratified flow.

A Unified Mechanistic Model for Gas-Liquid Flow in Wells and Pipelines

Development of a unified comprehensive mechanistic model for predicting two-phase flow behavior in pipes at any inclination angle was one of the highest ranked projects by TUFFP members in the 1999 questionnaire. A comprehensive flow behavior (hydrodynamic) model is also the first essential step in the development of a mechanistic model for predicting multiphase heat transfer in wells and pipelines (another highly rated project in the 1999 questionnaire). These two projects are clearly interrelated.

An improved multiphase heat transfer model is needed to calculate different parameters for heat and mass transfer in the paraffin deposition process. Consequently, the high-pressure multiphase flow paraffin deposition flow loop was loaned to TUFFP by the new Paraffin Deposition Consortium to complete the experimental part of the project “Mechanistic Heat Transfer Model”. This project is described elsewhere in the Newsletter.

It is now time to proceed with the development of a unified hydrodynamic model. TUFFP has developed different comprehensive mechanistic models in the past (Ansari model for upward vertical flow, Xiao model for near horizontal flow, and Kaya model for deviated wells). However, there are gaps between these models that must be filled to create a unified model. The major difficulty in development of the unified mechanistic model is the closure relationships for the momentum equations. These relationships must behave smoothly for inclination angles from –90° to 90°.

A unified mechanistic model for slug liquid holdup and the transition between slug and dispersed bubble flows had been developed and reported at the November 2000 TUFFP Advisory Board meeting. Some problems in the existing models have now been identified and solutions for these problems have been proposed. Additional progress has been made in developing a unified model for predicting flow pattern transitions based on slug dynamics. A progress report will be presented at the May 2001 Advisory Board meeting.

TUFFP Updating Flow Pattern Map Generation Program

The prediction of flow patterns is one of the most important problems in two-phase flow in pipes. During the last 25 years efforts have been directed towards the development of physical or mechanistic models that allow the prediction of transition boundaries between flow patterns in steady-state two-phase flow. With these models, flow pattern transition boundaries for a specific two-phase flow system can be predicted numerically. However, calculation of the flow pattern transition boundaries is a complex and tedious task. It is necessary to develop a computer program to generate the flow pattern map for different fluids and flow conditions.

TUFFP developed its first program for generating flow pattern maps in the mid 1980’s. This program, FLOPAT, was based on the mechanistic models presented by Taitel & Dukler in 1976 and others. Using this program, the main flow patterns, such as dispersed bubble flow, annular flow, stratified flow and intermittent flow can be distinguished. However, different mechanistic models were used in FLOPAT for different inclination angle ranges. The pipe inclination is divided into four ranges, horizontal and slightly inclined, vertical and inclined upward, inclined downward and vertical downward. As a result, there may be a discontinuity in mechanisms as the inclination angle changes.

To prevent these discontinuities, recent studies have been conducted to better understand the phenomena related to flow pattern transitions, and to develop unified models which incorporate the inclination angle in such a way that a smooth change in mechanisms is obtained as the pipe inclination varies over all possible inclination angles. Based on recent progress made in developing comprehensive physical models, efforts are underway in TUFFP to update FLOPAT. The new program uses the unified model presented by Barnea in 1986. In this new program, the inclination angle is entered as a parameter to calculate the transition boundaries and the physical models remain the same. Using this program, besides the main flow patterns such as dispersed bubble flow, annular flow, stratified flow and intermittent flow, some subregions such as bubble flow, elongated bubble flow, and churn flow can also be predicted. The transition boundaries can be better predicted using the new program than the original FLOPAT. For example, the transition boundary between annular flow and intermittent flow for upward inclined pipes considers flow phenomena in the liquid film

The revised program for generating flow pattern maps will

be placed on the TUFFP website once numerical tests are completed. Companies will be able to use this program to generate flow pattern maps for their own operating conditions. Once the input parameters such as densities, viscosities, surface tension, pipe diameter, pipe roughness and inclination angle are entered into the input file, the transition boundaries will be generated. If the user provides a pair of superficial velocities, the flow pattern will also be identified.

Instructions for using this program and examples of flow pattern maps generated will be included in the Fall Newsletter.

Two-Phase Flow Calendar

2001

March 14-16	First International Conference on Computational Methods in Multiphase Flow – Multiphase Flow 2001 – Orlando, Florida
March 24-27	SPE Production and Operations Symposium – Oklahoma City
April 30 – May 3	OTC 2001 – Houston, Texas
May 14 – 18	TUFFP Short Course on Two-Phase Flow in Pipes
May 23	TUPDP Advisory Board Meeting – Tulsa, Oklahoma
May 24	TUFFP Advisory Board Meeting – Tulsa, Oklahoma
May 27 – June 1	4th International Conference on Multiphase Flows, New Orleans, Louisiana
June 13 – 15	BHR Group Conference on Multiphase Production, Cannes, France
August 5 – 10	SPE Forum Series in North America III – Subsea Well Design and Intervention, Park City, Utah, USA
September 30 - October 3	2001 SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana

2002

February 6 – 8	ETCE 2002 – Houston, Texas
June 6 - 7	BHR Group Conference on Multiphase Production – Banff Springs, Alberta, Canada

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