THE UNIVERSITY of TULSA

TUFFP

TULSA UNIVERSITY FLUID FLOW PROJECTS NEWSLETTER

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Dr. Holden Zhang Joins Faculty

I have been working for TUFFP and TUPDP as a Research Associate and Senior Research Associate for about five years. I am joining the TU Petroleum Engineering Department as an Assistant Professor, effective Fall 2003 semester.

I would like to take this opportunity to introduce myself. I received B.S. (1982) and M.S. (1985) degrees in Thermal Energy Engineering from Xian Jaotong University. My MS was an experimental study of multiphase flow using Laser Doppler Velocimetry (LDV) techniques. My Ph.D. (1988) degree in Fluid Mechanics was from Tianjin University and involved both experimental and numerical research. Thereafter, I served as a Lecturer and Associate Professor at Tianjin University where I taught experimental techniques in fluid mechanics, turbulence, and computational fluid dynamics (CFD). In 1993 and 1994, I was awarded the Alexander von Humboldt Research Fellowship and conducted research on three-dimensional CFD at the Max-Plank-Institute of Fluid Mechanics and the German Aerospace Research Establishment, Göttingen, Germany.

The last five years have been a fruitful period in my career. I enjoyed working on different research projects in both TUFFP and TUPDP with graduate students and other Research Associates. I developed unified models for predictions of multiphase flow pattern transitions, hydrodynamic behaviors and heat transfer. At the same time, my expertise in petroleum production, flow assurance, heavy oil and emulsion rheology was developed.

The faculty position will allow me to contribute in a wider domain of teaching, research and service. At the same time, I'll continue to play an active role in the research consortia and diligently work with the members on different practical projects.

Fax Numbers	Web Sites
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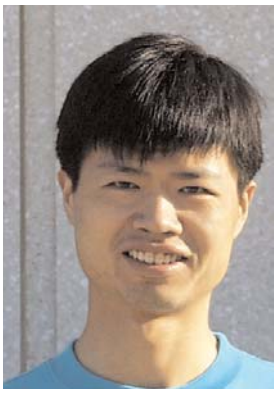


Yongqian (Richard) Defends His Ph.D. Proposal

Mr. Yongqian Fan successfully defended his Ph.D. proposal on Low Liquid Loading research in May 2003. He continues with his research as summarized in the progress report section of this Newsletter.

Post Doctoral Research Associate Search

A search process is underway for a post doctoral Research Associate position in our research group. Dr. Hong-Quan (Holden) Zhang's promotion to a Faculty position in the Petroleum Engineering Department prompted our efforts to fill at least one Research Associate position to assume some of Dr. Zhang's responsibilities. An advertisement appeared in the April and June issues of the JPT. Several qualified candidates have already applied for the position. One or two positions are expected to be filled during the Fall 2003 semester.

TUFFP Membership and Support

TUFFP 2003 membership stands at 12, 11 industrial companies and MMS. Through the PRIME Solicitation, DOE supports TUFFP in the development of new generation multiphase flow predictive tools for three-phase flow research. DOE's support translates into the equivalent 4 additional members for five years starting July 2003.

Efforts are underway to increase TUFFP membership. Yukos Oil, the second largest Oil & Gas Company in Russia, has recently indicated their intent to join TUFFP. We have recently had a positive meeting with Petrobras for their rejoining TUFFP. Several other companies have been contacted and communications continue towards their involvement in TUFFP.

TUFFP Financial Status

TUFFP's financial status remains stable for 2003. We entered 2003 with approximately $320,000 in our reserve fund. Our 2003 membership income is $420,000 from 12 members. The DOE PRIME support started June 2003 with an expected income contribution for fiscal year 2003 of $98,000. Our total expenditures for 2003 are estimated to be $453,698.

Space Utilization

The current TUFFP Library will be remodeled into office space for Dr. Holden Zhang. The space formerly used as a periodical room will become the new TUFFP Library.

Future Advisory Board Meetings Schedule

September 30, 2003

TUFFP/TUPDP/TUHFP JIP
Tour of Test Facilities
University of Tulsa North Campus - Tulsa, OK
3:00 - 5:00 p.m.

TUFFP/TUPDP/TUHFP JIP
Barbeque
University of Tulsa North Campus - Tulsa, OK
5:00 - 7:00 p.m.

October 1, 2003

Tulsa University Fluid Flow Projects (TUFFP)
Advisory Board Meeting
Renaissance Tulsa Hotel - Tulsa, OK
8:30 a.m. - 5:00 p.m.

TUFFP/TUPDP/TUHFP
Reception
Renaissance Tulsa Hotel - Tulsa, OK
6:00 - 9:00 p.m.

October 2, 2003

Tulsa University Paraffin Deposition Projects (TUPDP)
Advisory Board Meeting
Renaissance Tulsa Hotel - Tulsa, OK
8:00 a.m. - 5:00 p.m.

New Graduate Course - Transient Multiphase Production Design

During the 2003 Fall semester, Dr. Holden Zhang is teaching a new graduate course titled "Transient Multiphase Production Design." This is probably the first transient design course offered in any university curriculum. The course combines theoretical modeling of transient multiphase flow with realistic design projects by use of state-of-the-art transient multiphase flow simulators. Transient multiphase flow modeling techniques will be reviewed. Flow assurance topics related to transient multiphase production will be discussed. Transient multiphase flow simulators, such as OLGA and TACITE, will be introduced through workshops. Industrial practices of transient multiphase production design will be covered through special seminars given by experts from oil companies. Comprehensive realistic design projects will be conducted by students using OLGA (and/or TACITE).

New Faculty Join Petroleum Engineering Department

The Petroleum Engineering Department had hired two new Assistant Professors, Drs Hong-Quan (Holden) Zhang and Gaoming Lee. Dr. Zhang is featured in the front page of this newsletter. Dr. Lee has an M.S. degree from the University of Petroleum (China) in Petroleum Engineering and a Ph.D. in Petroleum Engineering from Pennsylvania State University. Dr. Lee's major area of research interest is flow through porous media.

Two New Research Assistants

Ms. Gizem Ersoy and Mr. Bahadir Gokcal will be joining our team at the beginning of the coming Fall Semester as Research Assistants pursuing MS degrees in Petroleum Engineering. Gizem and Bahadir were ranked first and second in their graduating class, respectively. They will be assigned research projects in TUFFP and TUCoRE.

Gizem received her BS degree in Petroleum and Natural Gas Engineering from Middle East Technical University, Turkey (June 2003). She also holds a minor degree on European Studies from the International Relations Department.

Bahadir received a BS in Petroleum and Natural Gas Engineering from Middle East Technical University, Turkey (June 2003). He also has a minor degree on Geographic Information Systems and Remote Sensing from the Geological Engineering Department.

Newest TUFFP Alum

Dr. Eissa Al-Safran, a TU Petroleum Engineering graduate, started his graduate studies in 1997 at TUFFP. He received his MS degree in 1999. Eissa successfully completed both his Ph.D. in Petroleum Engineering and an MS in Education at The University of Tulsa in 2003. Besides conducting a fine Ph.D. research project, Eissa will always be remembered for his pleasant personality. The Al-Safran Family is back in Kuwait where Eissa will be teaching Petroleum Engineering at The Kuwait University. We wish the best for Dr. Al-Safran in his future endeavors.

Software Improvement

A major effort is underway to improve software deliverables to our members. The objective of the effort is to ease and increase the use of the developed multiphase technology by our membership. Microsoft's Excel platform was selected as the interface, regardless of the scientific programming language such as FORTRAN, C++, etc. As a pilot project, the TUFFP Flow Pattern Prediction Software is currently being developed based on a new set of standards. The rest of the TUFFP software is being prioritized for similar improvements.

SPE Annual Technical Conference and Exhibition

This years meeting will be held October 5-8 in Denver Colorado. TUFFP and TUPDP will be participating in the University of Tulsa Petroleum Engineering Departments exhibition activities to promote our research and technology development efforts. Please come and visit us at our booth.

Four papers presenting results of our research will be presented at the 2003 SPE ATCE as part of our technology transfer efforts. These papers are listed below.

1) Tengesdal, J. Ø., Thompson, L., and Sarica, C.: "A Design Approach for "Self-Lifting" Method to Eliminate Severe Slugging in Offshore Production Systems," SPE 84227, To Be Presented at the 2003 SPE Annual Technical Conference and Exhibition, Denver, CO, October 5 - 8, 2003.

2) Hernandez, O. C., Sarica, C., Volk, M., Brill, J. P., Delle-Case, E. and Hensley, H.: "Improvements in Single-Phase Paraffin Deposition Modeling," SPE 84502, To Be Presented at the 2003 SPE Annual Technical Conference and Exhibition, Denver, CO, October 5 - 8, 2003.

3) Al-Safran, E. Sarica, C. Zhang, H. Q., and Brill, J.P: "Probabilistic/Mechanistic Modeling of Slug Length Distribution in Horizontal Pipelines," SPE 84230, To Be Presented at the 2003 SPE Annual Technical Conference and Exhibition, Denver, CO, October 5 - 8, 2003.

4) Manabe, R., Wang, Q., Zhang, H., Sarica, C., and Brill, J. P.: "A Mechanistic Heat Transfer Model for Vertical Two-Phase Flow," SPE 84226, To Be Presented at the 2003 SPE Annual Technical Conference and Exhibition, Denver, CO, October 5-8, 2003.

Meetings and Conferences

Fall 2003 Advisory Board Meetings

Final plans have now been made for the Fall 2003 Advisory Board meetings. A tour of test facilities will be held on Tuesday, September 30 at 3 p.m. Following the tour, there will be a joint TUFFP and TUPDP BBQ between 5:00 - 7:00 p.m. The TUFFP Advisory Board meeting will begin at 8:30 a.m. on Wednesday, October 1 and will adjourn at 5:00 p.m. Following the meeting, there will be a joint TUFFP and TUPDP reception at the new Renaissance Tulsa Hotel and Convention Center from 6:00-9:00 p.m. On October 2, the TUPDP Advisory Board meeting will be held. The meeting will start at 8:00 a.m. and will adjourn at 5:00 p.m.

We have a new location for the Fall meetings. The Renaissance Tulsa Hotel and Convention Center is located at 71st and Highway 169 (6808 South 107th East Avenue). The Request for Information form and the Renaissance Tulsa Hotel and Convention Center Reservation form will be placed on the TUFFP web page in early August. 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 meetings can also be found on our web site at www.tufpc.org. You can then follow the links for the Request for Information form. The hotel reservation form is a word document for downloading and faxing to the hotel.

Tentative dates for the Spring 2004 Advisory Board meetings are March 30 - April 1, 2004.

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.tufpc.org 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 Short Course

Drs. Sarica and Brill taught the 28th annual TUFFP Short Course on Two-Phase Flow in Pipes May 19-23, 2003 at the Tulsa Marriott Southern Hills Hotel. There were 13 attendees from 5 member and 3 non-member companies. The course covered the most current, up-to-date-research done at the Tulsa University Fluid Flow Projects (TUFFP) and Tulsa University Paraffin Deposition Projects (TUPDP). This five-day course focused on the fundamentals of two-phase flow in piping systems encountered in the production and transportation of oil and gas.

BHR Group's Multiphase '03 Conference

Since 1991, TUFFP has participated as a co-sponsor of BHR Group Conferences on Multiphase Production. TUFFP personnel participate in reviewing papers, serving as session chairs, and advertising the conference to our members.

BHR Group's Multiphase '03 Conference was successfully held June 11-13, 2003 in San Remo, Italy. There were about 125 attendees from several countries and companies and universities. James P. Brill gave the opening key note speech titled "Multiphase Technology - Past, Present and Future, the World According to Brill". Cem Sarica chaired one of the sessions on Modeling. Moreover, the following two technical papers were presented by Oris Hernandez and Cem Sarica.

1) Hernandez, O. C., Sarica, C., Brill, J. P., Delle-Case, E. and Creek, J.: "Effect of Flow Regime, Temperature Gradient and Shear Stripping in Single-Phase Paraffin Deposition"

2) Tengesdal, J. Ø. and Sarica, C.: "A Simplified Transient Model to Predict Flow Behavior of "Self-Lifting", a Severe Slugging Attenuation Technique, in Pipeline-Riser Systems"

BHR Group's 4th North American Conference on Multiphase Technology is scheduled for June 3-4, 2004 in Banff, Canada. The abstract submission deadline is September 30, 2003. We strongly encourage our members to participate in this conference by both submitting abstracts and attending. It is expected that the conference will benefit anyone engaged in the application, development and research of multiphase technology for the oil and gas industry.

Web Site News

Exciting Changes to our Web Sites!!!

During the past few months, our web page has undergone a drastic transformation! We think you are going to like the new look and content and hope that you find the website more useful and easier to navigate.

From the opening page of the website - you will be able to access both TUFFP and TUPDP websites. Shown below is a screen shot of the home page for TUFFP. From this page you can access all the information regarding TUFFP, background information, publications, newsletters, calendar, our facilities, and research projects and personnel. By the time you read this, all past TUFFP reports will be available to member companies on the website. There is also a valiant effort underway to resurrect all past programs written by students and placed them on the web.

Member company names have now been linked to their respective websites. Links to TU Consortia will be provided along with links to other sites of interest. All users will have a unique login and password - if you haven't been notified of your login and password, please contact Linda Jones at jones@utulsa.edu or (918) 631-5110.

There have been two very significant additions to the web site. There is now a search engine available in the members' area, where you could look for research reports, programs, papers, etc., either by name, keywords, or author. Another addition will be mail lists that you can subscribe to. This will be a great place to come if you have inquiries and want input from other members. The new url is www.tufpc.org. Please let us know how we can further improve the Web site.

Investigation of Occurrence and Elimination of Severe Slugging for Gas-Oil-Water Flow in Pipeline-Riser Systems

Severe slugging can occur in multiphase flow systems where a pipeline segment with a downward inclination angle is followed by another segment/riser with an upward inclination angle. For such a system, severe slugging will cause periods of no liquid and gas production in the separator followed by very high liquid and gas flow rates. This phenomenon is very undesirable due to large pressure and flow rate fluctuations. The large liquid production might cause possible overflow and shut down of the separator. Fluctuations in gas production may cause operational and safety problems during flaring, and the high pressure fluctuations can reduce the ultimate recovery from the field, reducing the amount of the recoverable reserves.

The main purpose of this study is to investigate severe slugging occurrence, prediction and elimination for gas-oil-water flow. In order to accomplish this, the objectives of the project will include:

- investigation of characteristics of severe slugging for three-phase flow in a pipeline-riser system, varying the water cut in the liquid phase;
- assess the applicability of two-phase severe slugging prediction methods for three-phase flow, and develop new prediction methods if necessary;
- better understanding of the physics of severe slugging in a deep-water pipeline-riser system for three-phase flows;
- investigate the elimination techniques, such as self-lifting, choking, gas lifting, etc. for three-phase flow.

To meet these objectives, the TUFFP severe slugging test facility is being modified to operate with three-phase flow. The modified facility consists of a 65-ft long pipeline followed by a 40-ft high riser. The inner diameter of the transparent R-4000 PVC pipe is 3 in. The liquid and gas flow rates will change in the ranges of 0.1 - 2.0 m/s and 0.1 - 5.0 m/s, respectively. Different water cuts, ranging from zero (two-phase flow, studied by Tengesdal) to 25%, 50% and 100% in the liquid phase will be used to study the effects of water on severe slugging occurrence. The riser is attached to the available tower and the downward sloping pipeline is attached to the boom. Since the boom is inclinable, this arrangement will permit investigating several pipeline inclination angles. Several connection points for the bypass, both on the pipeline and the riser, will be used to investigate both conventional gas lift and self-lifting.

Water and mineral oil will be used as the liquid phases. The water will be supplied directly from the city water supply. Mineral oil will be taken from an available tank, and air will be used as the gas phase and supplied by an existing compressor. The flow rates for both gas and liquid phases will be measured with MicroMotion™ mass flow meters. Absolute and differential pressure transducers will be used to monitor the flow behavior.

Modifications of the two-phase flow facility include the addition of a water tank with its respective pump, a mass flow meter, a gas-oil-water separator, and water pipe up to the mixing tee. An additional gas-lift line and a choke upstream of the riser top separator are being added to facilitate external gas-lift and choking, respectively, as severe slugging elimination techniques. Once the modifications are completed, preliminary testing will be conducted during the Fall 2003.

Gas-Oil-Water Pipe Flow

Three-phase gas-oil-water flow is a common occurrence in the petroleum industry. Three-phase flow may also be encountered in pumping systems, especially in surface gathering lines, and in wellbore and surface gathering systems of many flowing and gas lift wells which produce water along with oil and gas.

Because of the importance and wide applications of three-phase gas-oil-water flow, a reliable model is needed to predict three-phase flow behavior. There are some experimental measurements and theoretical modeling that have been done in the past. Those existing models need to be reviewed and evaluated before new models are developed.

The objectives of this study are to:

- collect experimental data and review theoretical models for gas-oil-water pipe flow from the open literature.
- evaluate existing models with experimental results.
- identify limitations and shortcomings of the models.
- suggest modifications and new developments for future studies.
- develop a preliminary three-phase flow model.

The major part of the data collection and literature review has been completed. Evaluation and implementation of existing models are underway. The selected (three-phase and two-phase) models are being evaluated against existing experimental data. Each model will be tested against a standard set of data to evaluate shortcomings and limitations.

Please complete and send in your Request for Information form and make hotel reservations for the upcoming Advisory Board meetings as soon as possible.

Experiments and Modeling of Gas-Oil-Water Flow in Horizontal and Slightly Inclined Pipes

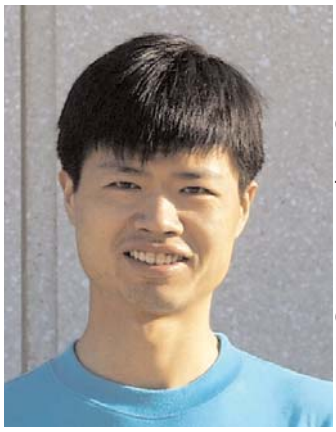
The ultimate goal of TUFFP for gas-oil-water studies is to develop a mechanistic model based on theoretical analysis and experimental results for the prediction of flow behavior during production and transportation of gas-oil-water in pipes. The objective of this study is to investigate three-phase flow of gas-oil-water in horizontal and slightly inclined pipes.

The experimental work will be conducted at the TUFFP facility for oil-water flow located at The University of Tulsa North Campus Research Center. The facility consists of a closed circuit loop with the following components: pumps, heat exchangers, metering sections, filters, test section, separator and storage tanks. The test section is attached to a boom whose angle can be changed with a cable system and a vertical tower. Since it is a facility designed for only oil-water flow, modifications are needed to both the flow loop and the test section to perform three-phase flow experiments. A gas metering run was constructed. The existing test section was modified by building a new mixing tee. Aluminum nets were constructed all around the test section for protection against explosion. Wiring of the flow loop and test section was completed. For the measurement of phase fractions and flow characteristics, fiber optic conductance probes and a gamma densitometer were installed. The testing program for the experiments was established. A number of emulsion and separation experiments were performed using Tulco Tech 80 oil sample, and 2500 gallons of that oil were purchased. The oil tank, separator and pipes were cleaned and existing equipment such as pumps, heat exchangers, flow meters, and separator and storage tanks were checked and made operational.

Currently, efforts are focused on determination of a method to obtain droplet size distribution of water-in-oil dispersions. Calibration of the instruments and updating the data acquisition program were started and will be completed soon. Testing is expected to begin in August 2003.

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

A more accurate prediction of pressure gradient and liquid holdup in near-horizontal, wet-gas pipelines is needed to better size pipelines and downstream processing facilities. 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 (2-in) diameter, 19-m long acrylic flow loop is being used for this study. Both air-oil and air-water low liquid loading two-phase flow experiments have been completed, for inclination angles of from -2° to 2° from horizontal. The measured parameters include gas flow rate, liquid flow rate, pressure, differential pressure, temperature, liquid holdup, liquid film flow rate and liquid entrainment fraction.

A 152.4-mm (6-in) diameter, 54.9-m (180-ft) long PVC flow loop is being modified to investigate low liquid loading stratified flow. Gas velocities of 5-15 m/s with liquid loading changing between 50 and 2500 m^3/MMm^3 will be studied. The measured parameters will include gas flow rate, liquid flow rate, pressure, pressure drop, temperature, liquid holdup, liquid film velocity, and liquid film thickness at the bottom of the pipe. Equipment installation and wiring have been finished, and the data acquisition program is being developed.

A two-fluid model based on the double-circle assumption is being developed to predict the pressure gradient, liquid holdup, wetted perimeters, liquid film thickness at the bottom in low liquid loading stratified flow for given operation conditions, liquid properties and pipeline orientation.

Unified Model for Gas-Liquid Flow in Wells and Pipelines

During oil and gas production, fluids are transported upwards from vertical or deviated wells, through hilly-terrain pipelines to downstream processing facilities. Steam, water and gas injection are often used to boost production rate. Therefore, gas-liquid two-phase flows at all inclination angles from vertical downward to vertical upward are frequently encountered in the oil and gas industry. A unified model is required which can accurately predict two-phase flow behavior at all inclination angles.

The TUFFP unified hydrodynamic model has been developed for predictions of flow pattern transitions, pressure gradient, liquid holdup and slug characteristics in gas-liquid pipe flow at different inclination angles of -90^0 to 90^0 from horizontal. The model is based on the dynamics of slug flow. The equations of slug flow are used not only to calculate the slug characteristics, but also to predict transitions from slug flow to other flow patterns.

The new model has been validated with extensive experimental data acquired with different pipe diameters, inclination angles, fluid physical properties, gas-liquid flow rates and flow patterns. Good agreement is observed in every aspect of the two-phase pipe flow. Further validations and modifications will be made when new experimental results are available and improved new closure relationships are developed.

The Fortran computer program for the unified model is being integrated with an Excel interface to make it more user friendly. The input file can be generated using Excel and then the Fortran executable is called to perform the calculations. Finally, the outputs from the calculations are retrieved and processed with Excel.

2003 Fluid Flow Projects Membership

Baker Atlas	PDVSA - Intevep
BP Exploration	Pemex
ChevronTexaco	Petronas
ConocoPhillips, Inc.	Saudi Aramco
Marathon Oil Company	Schlumberger
Minerals Management Service	TotalFinaElf

Upscaling Studies in Multiphase Flow

One of the most important issues that we face in multiphase flow technology development is scaling up of small diameter and low pressure results to large diameter and high pressure conditions. Studies with a large diameter facility would significantly improve our understanding of flow characteristics in actual field conditions. Therefore, our main objective in this study is to investigate the effect of pipe diameter and pressures on flow behavior using a larger diameter flow loop and using a heavy gas as the working fluid.

Gas-liquid pipe flow characteristics, such as flow patterns, pressure drop and liquid holdup, have been mostly investigated in small-diameter pipes (2 or 3 in.). Flow behaviors in large diameter pipes must be studied to evaluate the scale-up ability of existing models, make improvements to existing models and/or develop new models, if necessary.

As the first phase of this study, air-water flow tests will be carried out in the 6-in. ID loop. The air-water flow characteristics will be investigated under low liquid loading conditions. Comparisons of results with those from the low liquid loading air-water 2-in. ID flow loop can reveal scale-up effects of pipe diameter (from 2 to 6 in.). Then, the investigation will be extended to flow behaviors under different flow conditions, such as flow pattern transitions and slug characteristics.

The existing 1400-ft long hilly-terrain pipeline is also being considered to be upgraded with a 4-in. ID parallel line.

Two-phase flow behaviors at high pressure are different than at low pressure. The pressure affects liquid holdup significantly at low gas velocity. In order to study the operating pressure effect, a heavy gas, SF6 (sulfur hexafluoride), has been considered to simulate the lower density difference between liquid and gas at high-pressure conditions.

In order to carry out SF6-oil-water tests in the 6-in. ID loop, significant modifications are needed for the existing facility. The capital expenditures for such a facility are expected to be significant. Efforts are underway to obtain supplementary funds to cover the capital expenditures. The high pressure simulation project is pending, contingent on obtaining supplementary financial support.

Two-Phase Flow in a Hilly-Terrain Pipeline

A hilly-terrain pipeline consists of interconnected horizontal, uphill, and downhill sections. The characteristics of liquid slugs will change when the pipe inclination angle is reduced or increased. 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.

The objectives of this project are to:

- investigate, experimentally and theoretically, slug initiation at the bottom elbow,
- develop closure relationships for slug tracking models,
- generate data to evaluate the developed models.

Eissa Al-safran worked on this project for his M.S. and Ph.D. studies. He conducted extensive experimental measurements of slug characteristics in hilly terrain pipe flow and developed models for predictions of average slug length and distribution in both a fully developed state and upon slug initiation.

Currently, the slug tracking program developed by Tel-Aviv University is being studied carefully and necessary programming changes will be incorporated to make the program user-friendly.

Related Projects

Cold, Heavy Oil, Multiphase Flow

This project is part of the TUCoRE program. TUCoRE is a ChevronTexaco initiative. Several of our research personnel are currently involved in the Cold, Heavy Oil, Multiphase Flow project.

Paraffin Deposition Consortium

Single-Phase Paraffin Deposition Studies

The objective of this study is to continue investigation of paraffin deposition phenomena during single-phase oil flow. Experimental data are being gathered from the 164-ft long horizontal test facility. The studies continue with CBI oil tests.

Jose Alana

Two-Phase Paraffin Deposition

The objective of this project is to investigate two-phase(natural gas - hydrocarbon liquid) flow paraffin deposition phenomena. This research includes conducting two-phase flow deposition tests in different flow patterns and model development. Both horizontal and vertical two-phase flow test matrices with the Garden Banks condensate have been completed.

Nilifur Kilincer

Three-Phase Flow Paraffin Deposition

The objective of this project is to investigate paraffin deposition in high pressure pipelines with flowing oil, water and gas. Cold Finger experiments with emulsions are ongoing in order to investigate wax deposition in the presence of water. A series of tests using South Pelto crude and Garden Banks condensate with different flow conditions are scheduled to be performed before the beginning of the tests in the multiphase flow loop.

Guilherme Couto

Investigation of Long Term Paraffin Deposition Behavior

The objective of this project is to run long-term paraffin deposition tests without constant attendance. These long-term tests will yield important data for modeling aging and shear stripping effects. Several long term preliminary tests have been completed in the 1.5, 1.0 and 0.5 in. diameter test sections with South Pelto oil. Based on the test results, modifications have been made to improve the facility performance. Repeat tests are underway to improve the previous test data.

Charlie Gao

Calendar of Events

2003

August 11 - 12, 2003	ATW - Subsea Facilities Management - Houston, Texas, USA
August 19 - 22, 2003	ATW - Deepwater Technology - Kota Kinabalu, Sabah, Malaysia
August 25 - 29, 2003	Applied Statistical Physics - Molecular Engineering International Conference - Puerto Vallarta, Jalisco, Mexico
Aug. 31 - Sept. 5, 2003	2003 Forum Series - Multiphase Capabilities in Frontier Environments - Ste. Maxime, France
September 2 - 5, 2003	Offshore Europe - Aberdeen, Scotland
Sept. 30, 2003	TUFFP/TUPDP Facility Tour & Bar-B-Q, Tulsa, OK
October 1, 2003	TUFFP Advisory Board Meeting, Tulsa, OK
October 2, 2003	TUPDP Advisory Board Meeting, Tulsa, OK
October 5 - 8, 2003	SPE Annual Technical Conference and Exhibition - Denver, Colorado, USA
October 22 - 24, 2003	Rio Pipeline Conference and Exposition - Hotel Inter-Continental Rio-Rio de Janeiro, Brazil

2004

March 30, 2004	TUFFP/TUPDP Facility Tour & Bar-B-Q, Tulsa, OK
March 31, 2004	TUFFP Advisory Board Meeting, Tulsa, OK
April 1, 2004	TUPDP Advisory Board Meeting, Tulsa, OK
April 25-29, 2004	2004 Spring National Meeting (AIChE), Hyatt Regency, New Orleans, LA
May 3 - 6, 2004	Offshore Technology Conference - Houston, Texas, USA
June 3-4, 2004	4th North American Conference on Multiphase Technology (BHRG), Banff, Canada
July 25-29, 2004	ASME Heat Transfer & Fluid Engineering Summer Conference, Charlotte, NC
September 26 - 29, 2004	SPE Annual Technical Conference and Exhibition - Houston, Texas, USA
October 4-8, 2004	International Pipeline Conference (IPC 2004) (ASME) Calgary, Alberta, Canada

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