



TUFFP

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Hong Yuan Named New TUFFP Research Associate

Hong (Jasmine) Yuan was hired as a temporary postdoctoral Research Associate at TUFFP after she completed her Ph.D. in Petroleum Engineering in November 1997. She was hired to serve as the lead researcher on the project to investigate slug dissipation in

downward inclined pipes, which is a vital part of a larger project on two-phase flow in hilly terrain pipelines. This project required a person with strong experimental and modeling expertise to overcome delays incurred when Nobutoshi Shimizu found it necessary to return to Japan prematurely.

Over the past five years, Jasmine served as a Research Assistant with TUFFP as she pursued M.S. and Ph.D. degrees in Petroleum Engineering. She designed, constructed and operated the TUFFP horizontal well test facility and modeled horizontal well flow using theoretical analysis, numerical simulation and experimental investigation techniques.

Jasmine's background also includes nine years of experience as a Fluid Mechanics and Hydraulics instructor with the Shengli Petroleum School in China.

Jasmine is interested in pursuing a career in which she can apply her academic and practical skills. Her areas of specialization include: Horizontal Well Production and Completion, Multiphase Flow Measurements and Modeling, Petroleum Production, Artificial Lift, CFD, Turbulence Modeling, Heat and Mass Transfer, Drilling Fluid Rheology and Reservoir Simulation. Following completion of her Research Associate assignment in April, she will seek employment in the greater Houston area.

Changes Occur in TUFFP Research Assistants

Ms. Banu Alkaya has arrived to begin her M.S. degree program in Petroleum Engineering at The University of Tulsa. Banu was one of the top B.S. graduates from Istanbul Technical University in Turkey last year.

Eissa Al-Safron is nearing completion of the course work requirement for an M.S. degree in Petroleum Engineering at The University of Tulsa. Since his goal is to complete both an M.S. and a Ph.D. degree, a project will be selected for him that will satisfy the research requirements for both degrees.



Eissa Al-Safron

Nobutoshi Shimizu found it necessary to return to Japan before completing all requirements for the M.S. degree in Petroleum Engineering. His services were required immediately by JAPEX on an engineering design project in Japan. It is unknown at this time if he will have an opportunity to return and complete his degree. His research project on slug dissipation in downward flow has been assigned to a new temporary Research Associate, Hong Yuan.

Negotiations are underway with both IMP/PEMEX in Mexico and CIED/PDVSA in Venezuela to sponsor Ph.D. students at TUFFP. A tentative starting date for both students would be Fall, 1998.

The possible Ph.D. program in Petroleum Engineering for Ryo Manabe of JNOC in Japan is still in the discussion stage. In addition, to satisfying the admission requirements, his academic program would require approval by both TU and JNOC to permit completing all academic parts of this Ph.D. degree in residence at The University of Tulsa with his research being conducted in the area of slug tracking at a JNOC facility in Japan.

The TUFFP budget for 1998 includes funding for an additional Ph.D. student. A decision to fill this position will be delayed until we receive more information on the possible students from Mexico and Venezuela.

New Research Associate Hired

An advertisement for post doctoral Research Associates for TUFFP and the WAX JIP appeared in Spring 1997 issues of various engineering journals. Approximately 50 applications were received, evaluated, and a short list was developed. Three candidates have been interviewed for the position. One was found to be unsuitable for TUFFP and the another is not available at this time. The third candidate, Dr. Hong-Quan Zhang from Tianjin University in the People's Republic of China was interviewed in early January.

An offer has been made to Dr. Zhang and accepted by him, subject to being able to obtain an H-1 Visa. Forms are currently being prepared to apply for the visa and we anticipate Dr. Zhang's arrival in Tulsa by late March.

Fluid Flow Projects Advisory Board Meeting

April 23, 1998

1998 Fluid Flow Projects Membership

Amoco Production Company
Arabian Oil Co. Ltd.
ARCO Oil & Gas Company
BP Exploration
Borealis
Chevron Petroleum Technology Company
Conoco, Inc.
ECOPETROL/Instituto Colombiano del Petroleo
Elf Aquitaine
Exxon Production Research Company
Institut Français du Pétrole
Instituto Mexicano del Petroleo (IMP)
INTEVEP
Japan National Oil Corporation
Marathon Oil Company
Mobil Research and Development Corporation
Pertamina
Petrobras
Petroneas
Phillips Petroleum Company
Saudi Arabian Oil Company
Shell Internationale Petroleum MIJ B.V. (SIPM)
Simulation Sciences, Inc.
Texaco
TOTAL
UNOCAL
Western Atlas

TUFFP Membership Rises

One company, ONGC, terminated its membership in TUFFP for 1998. An additional member, Petronas, has informed us that the financial crisis in Asia could require them to terminate their membership for 1999. Western Atlas has joined TUFFP as a new member for 1998 and IMP/PEMEX has rejoined after a one year lapse in membership. Communications with Phillips Petroleum Company confirms that they too will rejoin TUFFP after a lapse of three years.

With our decision to expand TUFFP hilly terrain pipeline research and also incorporate slug tracking in this program, we are still optimistic that both Statoil and NKK could rejoin TUFFP for 1998. A proposal being submitted to the U.S. Department of Interior's Minerals Management Service (MMS) to fund much of our hilly terrain pipeline research activity could result in the MMS also becoming a member of TUFFP.

A list of 1998 member companies appears on the preceding page.

TUFFP Financial Status Stable for 1998

Sincere appreciation is expressed to all TUFFP member companies for their continued financial support. As of January 16, 1998, 3 1/2 companies have paid their 1998 membership fees.

TUFFP accounts are in the process of being closed for 1997 by the Office of Research. An unofficial reserve fund balance at the end of 1997 is now projected to be \$142,000. With newly projected expenditures for 1998 of \$814,000 and projected income of \$729,000, we now anticipate a decrease in the reserve fund to approximately \$57,000 by the end of 1998. With this decline in reserve fund it will be necessary to increase membership fees for 1999. This is consistent with our past history of adjusting rates every three years. The magnitude of increase will be reported at the April Advisory Board meeting after we have an opportunity to project expenditures and membership more accurately for both 1998 and 1999.

Second TUFFP Transient Forum a Big Success

The second TUFFP Multiphase Flow Transient Forum was held in Tulsa, Oklahoma on October 3, 1997. Forty attendees from twenty-two companies were present at the forum. Twelve presentations were made covering various interesting aspects of multiphase transient flow. No minutes, recordings, or publications were permitted to enhance the possibility of open discussions and informal sharing of information. The forum met all of our expectations for attendance, presentations and discussions. The feed back we received from some of the attendees indicates that similar forums covering topics of mutual interest should be held in the future. Included with this Newsletter is a ballot to determine the next forum topic and the date. Please complete the ballot and return the ballot to Linda Jones by fax or mail to help us plan the next forum.

Hilly Terrain Pipeline Research Proposal Submitted to MMS

In response to an announcement from the U.S. Department of Interior's Minerals Management Service soliciting proposals in an October issue of The Commerce Business Daily, TUFFP submitted a proposal to the MMS in late October. The nature of the proposal was very general but primarily addressed our planned research on multiphase flow in hilly terrain pipelines. The MMS subsequently determined that the preliminary proposal or white paper had merit and requested a more detailed technical proposal. After reviewing the format, it was clearly more appropriate to identify a specific research project for the MMS to fund and a proposal has been submitted dealing with two-phase flow in hilly terrain pipelines for their consideration. If the proposal is funded by MMS, it is likely that we will also incorporate within the proposal a clause that makes the MMS a member of TUFFP until cumulative membership fees exceed the proposal funding.

Tony Butler Improves TUFFP Capacitance Void Fraction Sensor Design

The TUFFP capacitance void fraction or liquid holdup sensor has undergone significant improvements recently compared with previous models. The environmental housing has been redesigned and o-ring seals were added to each end. The new housing is lighter weight, which reduces the physical stress on the acrylic pipe. The o-rings are now self sealing when the housing is vacuumed. This reduces the time required after tuning or maintenance before the sensor can be used. The Valldyne reluctance bridge has been replaced with a carrier-demodulator specifically designed for the capacitance sensor. The advantage gained is a better signal to noise ratio and higher resolution. The split ring design was retained. Two split ring sensors are placed perpendicular to one another inside each environmental housing, one vertical and one horizontal. By cross-correlating the outputs, we expect to attain better spatial resolution of the liquid phase. This will enable improved flow pattern identification techniques to be developed. In slug flow, velocity can be determined by the time of flight between the ring pairs. Currently, 13 of the new models are in use by Hong Yuan in the Slug Dissipation Project.



TUFFP Gains Access to Commercial Simulators

TUFFP now has version 7.1 of Pipephase with Tacite from Simulation Sciences, Inc. and anticipates receiving a copy of their NETOPT software in the near future. These programs will be available for use in support of TUFFP research projects and will also be used as design tools in undergraduate and graduate courses in Petroleum Engineering at The University of Tulsa.

Scandpower has now made OLGA available to TUFFP for both academic and research purposes. Cem Sarica attended a user's course for OLGA in Houston last fall.

TUFFP Considers Funding Slug Tracking Software Development at Tel Aviv University

A proposal of cooperation with Tel Aviv University dealing with slug tracking in hilly terrain pipelines is currently being evaluated. The proposal was developed by Yehuda Taitel, Dvora Barnea and Lev Shemer from the Department of Fluid Mechanics and Heat Transfer at Tel Aviv University. Included would be an investigation of the behavior of slugs in hilly terrain pipelines and completion of a slug tracking computer program over a period of approximately three years. Serious consideration is being given to the proposal since the Tel Aviv study would be very complimentary to planned research activity within TUFFP.

Future Advisory Board Meetings Scheduled

Final plans have now been made for the Spring 1998 TUFFP Advisory Board and related meetings. An exciting collection of meetings have been scheduled to immediately precede the TUFFP short course. Also, the Offshore Technology Conference occurs the week following the short course. It is hoped that TUFFP international members might consider attending the Advisory Board meetings and the short course before going to the OTC.

All meetings, with the exception of the short course, will be held at the Adam's Mark Hotel at Williams Center in downtown Tulsa. A Request for Information form is enclosed with this Newsletter, together with information on hotel reservations and travel to and from the airport. Persons attending the meetings should complete the form and return it to us as soon as possible.

The TUFFP Advisory Board meeting will begin at 8:30 a.m. on Thursday, April 23, 1998 and will adjourn at 4:30 p.m. A pre-meeting reception will be held at the Adam's Mark Hotel from 6:00 - 8:00 p.m. on Wednesday, April 22, 1998 and will include those persons that attend the Paraffin Deposition JIP Advisory Board meeting on Wednesday. A tour of TUFFP test facilities will be conducted on both Tuesday afternoon and Wednesday afternoon. The Tuesday afternoon tour will occur from 3:00 - 5:00

p.m. and will be a combined tour with the Paraffin Deposition JIP. A BBQ dinner will be held at the Paraffin Deposition JIP test facility site immediately following the tour on Tuesday. The tour on Wednesday will occur from 3:00 - 4:30 p.m. and will end in time for persons to attend the reception on Wednesday evening.

TUFFP members that are not members of the Paraffin Deposition JIP, but are considering membership, are welcome to attend the Paraffin Deposition JIP Advisory Board meeting on Wednesday.

A summary of the dates for Spring, 1998 and Fall, 1998 Advisory Board meetings are shown in the table. The hotel for the Fall 1998 Advisory Board meetings has not yet been determined.

TUFFP Advisory Board meeting brochures will be available for members at the meeting and will be mailed to all members following 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. A brochure containing slide copy for all presentations will also be distributed at the meeting but will not be mailed to members.

Spring 1998 Short Course Scheduled

The TUFFP short course "Two-Phase Flow in Pipes" is scheduled to be taught again in Tulsa, Oklahoma at the Marriott Southern Hills Hotel on April 27 - May 1, 1998. Taught by Dr. Brill and Dr. Sarica, the course will give participants a well-grounded understanding of the fundamentals of two-phase flow through pipes and restrictions. Completed and current research projects permit teaching the latest techniques for designing multiphase flow piping systems for the production and transportation of oil and gas. Upon completion, the participants will be able to apply knowledge gained to design fluid flow conduits encountered in petroleum, natural gas and chemical engineering operations.

Following is the pricing schedule for the 1998 short course.

TUFFP Member Company Course Fee Schedule

\$950 per person - regular tuition (net U.S. dollars)
\$850 per person - group discount (net U.S. dollars)

Non-Member Company Course Fee Schedule

\$1,445 per person - regular tuition (net U.S. dollars)
\$1,195 per person - group tuition (net U.S. dollars)

We urge member companies to enroll engineers as soon as possible. A brochure describing the course is enclosed and includes enrollment information. Members may enroll by calling The University of Tulsa Department of Continuing Education at (918) 631-2347, sending a fax to (918) 631-2154 or e-mail to conted_cee@utulsa.edu.

BHRG Multiphase Conference in North America on Schedule

Final plans are underway for the multiphase technology conference jointly sponsored by BHRG, TUFFP and NeoTechnology Consultants, Ltd. The conference is scheduled for June 10 - 11, 1998 in beautiful Banff Springs, Alberta, Canada. The conference will be held at the Banff Park Lodge with the technical program consisting of approximately 30 papers over a two-day period. A registration brochure will be mailed to potential participants in the near future. We urge TUFFP members to attend this exciting conference. If successful, it could continue on a bi-annual basis.

ETCE '98 Conference Features Multiphase Flow Papers

The ASME Energy Technology Conference and Exhibition (ETCE) was held in Houston February 2-4, 1998. One part of ETCE was a Petroleum Production Technology Symposium featuring presentations of over 20 specially solicited technical papers on multiphase flow in pipes, erosion and corrosion, multiphase pumping, and drilling. These papers were submitted to an accelerated peer review process and 14 of them will appear in the March 1998 issue of the Journal of Energy Resources Technology. TUFFP members will be interested in several of these papers and should watch for this ASME Transaction Journal. The success of this symposium will probably lead to a similar one for ETCE '99.

Please send in your Request for Information form and hotel reservations for the upcoming Advisory Board meetings as soon as possible. See you there!

Paraffin Deposition JIP Update



A large Joint Industry Project (JIP) was initiated at The University of Tulsa on May 1, 1995 to investigate paraffin deposition under both single phase liquid and multiphase flow conditions in pipelines and wellbores. This \$4 million, four-year project is funded by membership

fees from 33 domestic and international oil and gas related companies, DOE, and the US Department of Interior's Minerals Management Service. Recent new members include BG plc and PEMEX. Statoil has rejoined the JIP and an agreement is currently being processed with Champion Technologies for membership in 1998. The JIP is coordinated through five committees chaired by industry members. These committees are: Flow Loop and Deposition Studies; Thermodynamics and Fluid Characterization; Heat Transfer; Operational Issues; and Technology Transfer. Deliverables in the form of literature searches, computer programs, experimental data, and reports describing models for predicting deposition phenomena are scheduled throughout the four-year study.

Monitoring of progress in the JIP is accomplished through frequent committee meetings and semi-annual Advisory Board meetings. The next Advisory Board meeting will be held in Tulsa on April 22, 1998, the day before the TUFFP Advisory Board meeting. The purpose of this update is to describe progress made in the JIP since the last TUFFP Advisory Board meeting on October 1, 1997. Following is the Executive Summary for the Quarterly Report recently distributed to JIP members.

The single phase tests using South Pelto crude oil were completed and processed. These tests demonstrated the effects on deposition rate from changing the following four parameters.

1. Difference between the inlet oil and inlet glycol temperature,
2. inlet oil temperature,
3. flow regime (laminar vs. turbulent) and velocity, and
4. time or the aging process.

Detailed analyses of the data revealed some interesting findings related to flow rate and shear dispersion. As a result, several additional single phase tests are planned using the South Pelto Crude Oil. Upon completion, the single phase loop will be cleaned and several tests will be conducted using a condensate fluid from Shell's Garden Banks Field.

Additional major pieces of equipment for the multiphase loop were received and construction continued. Most construction of the multiphase flow loop will be completed during the first quarter of 1998.

A Preliminary Multiphase Test Matrix was developed. The program that is being proposed for implementation is as follows:

1. Test flow patterns and develop flow pattern map in a non-deposition environment.
2. Run single phase tests to verify reproducibility with those conducted on the single phase flow loop.
3. Run several test cases to refine operational procedures in a multiphase environment.
4. Conduct horizontal tests.
5. Conduct vertical tests.
6. Conduct uphill and downhill tests.

The test conditions will utilize one inlet T_o and one inlet T_g with one liquid. The duration of the test program would be approximately seven months:

one month for preliminary tests and six months for the multiphase test program. The multiphase test program will consist of 16 to 22 runs in order to investigate all flow patterns: 6 to 10 tests in a horizontal loop; 4 to 6 tests in a



Single Phase Loop Feed System

vertical loop; 3 tests in an uphill loop; and 3 tests in a downhill loop.

Development of a GUI for the single phase and multiphase deposition model began. There will be three releases.

- The first one, to be completed in January, 1998 and released in February, will be developed for the Conoco single phase model with MSI's thermodynamic model upgrade. The model will permit only one elevation change.

- The second release will occur by June, 1998. This release will incorporate OSU's heat transfer work and TU's kinetic deposition model from the single phase experiments.
- The third release will be the multiphase model and will occur in June, 1999.

The models will be delivered with a GUI, a set-up program, instructions for installation for both Windows 95 and Windows NT 4.0, as well as user documentation.

Optimization of Horizontal-Well Completion: Joint Industry Project (JIP) Kicks Off

The kick-off meeting of the new JIP on the Optimization of Horizontal-Well Completion was held on January 19, 1998 at TU. The objectives of the JIP are to provide completion guidelines for horizontal wells and to develop software to be used in the design of optimum well completions. Completion optimization will provide members of the JIP with a low or no-cost means of increasing the economic benefit expected from horizontal wells. The project is expected to last for two years.

During the kick-off meeting, the objectives, work schedule, and deliverables of the project were reviewed and the current status of the project was discussed. The open forum session provided valuable input to the project by both current and potential member companies. A tour of the North Campus experimental facility to be used in the investigation of wellbore flow phenomena was also given to attendees. Tables 1 and 2 below show, respectively, the current membership and funding status of the JIP. During the short period of time since the project proposal was first introduced in June 1997, funding for 50% of the budget has been obtained. Membership is expected to increase when the 1998-research budgets of prospective companies become available.

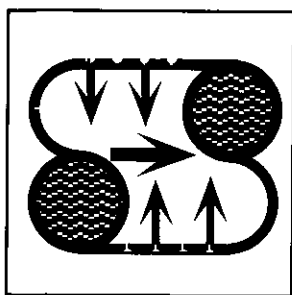
Table 1: Optimization of Horizontal Well Completion: JIP Membership

Company Name	Address	City	State	Country
Phillips	10000	Houston	TX	USA
Amoco	10000	Denver	CO	USA
BP	10000	London	UK	UK
Shell	10000	London	UK	UK
Exxon	10000	London	UK	UK
Conoco	10000	Houston	TX	USA

Table 2: Optimization of Horizontal Well Completion: JIP Funding Status

Company Name	Funding Status
Phillips	50%
Amoco	50%
BP	50%
Shell	50%
Exxon	50%
Conoco	50%

Investigation of Single Phase Liquid Flow Behavior in Horizontal Wells



Horizontal wells can have very complex flow geometries, in part due to interaction between the main flow stream and the influxes along the wellbore, and also due to completion type.

A small scale test facility was used to simulate flow in

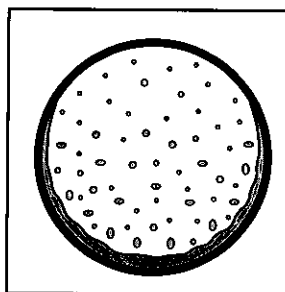
horizontal wells and seven new test sections were designed and constructed to investigate the effects of completion geometries and the density and phasing of injection openings. Two completion types are considered. One is perforated horizontal wells and the other is horizontal wells completed with slotted liners. Three test sections are used for the study of multiple perforation horizontal wells, with perforation densities of 5, 10 and 20 shots per foot and phasings of 360°, 180° and 90°, respectively. Four test sections are used for the study of horizontal wells completed with slotted liners, including one single slot case and three multiple slot cases. The numbers of slots for multiple slot cases are 18, 18 and 36 on 4-ft. long sections with slot phasings of 360°, 180° and 90°, respectively. A total of 1257 tests were conducted for no fluid injection, no main flow at the test section inlet, and with fluid injection for Reynolds numbers ranging from 4,000 to 60,000. The influx to main flow rate ratios range from 1/5 to 1/100 for the single slot case, from 1/50 to 1/2000 for multiple slot cases, and from 1/100 to 1/2000 for multiple perforation cases.

The flow behavior in horizontal wells was investigated theoretically using the principles of conservation of mass and momentum. A general new friction factor expression for horizontal wells with multiple injection openings was developed. New simple correlations for the horizontal well friction factors were developed by applying experimental data to the general friction factor expression. Very good agreement between the friction factor correlations and experimental data was found.

A commercial Computational Fluid Dynamics (CFD) computer program was used to simulate single phase liquid flow in a horizontal well. A

correlation was developed based on the simulation data to determine the length of the flow developing region in a horizontal well after the flow is disturbed due to radial influx.

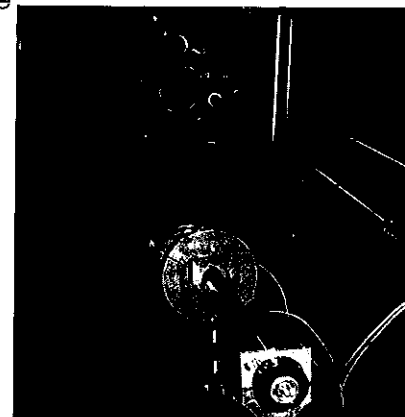
Low Liquid Loading Two-Phase Flow In Near-Horizontal Pipelines



Gas-liquid two-phase flow with small amounts of liquid is frequently encountered in natural gas pipelines. Even when single phase gas enters a pipeline, condensate traces can be formed by retrograde condensation. The presence

of these liquid traces can lead to a significant increase in pressure loss compared to single phase gas flow. Despite numerous theoretical and experimental investigations into gas-liquid pipeline flow, only a few studies on low liquid loading two-phase flow have appeared in the recent literature and the topic has not been adequately studied. Existing models do not predict the flow characteristics of gas-condensate mixtures in natural gas pipelines with sufficient accuracy.

The objective of this project is to investigate, experimentally and theoretically, low liquid loading two-phase flow in near-horizontal pipelines. Both stratified-wavy and annular flows, the most common flow patterns encountered in wet-gas pipelines, will be studied. Compressed air and a highly refined oil will be used as testing fluids. Liquid film thickness distribution around the pipe wall will be measured using the newly developed TUFFP capacitance probes. Overall liquid holdup and liquid entrainment fraction in the gas phase will be measured using quick-closing valves and a liquid film removal technique,

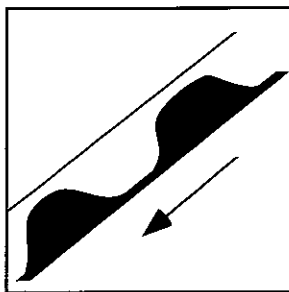


respectively. Pressure drops will also be measured using differential pressure transducers. Based on experimental results obtained, a comprehensive mechanistic model and its closure relationships will be developed.

Significant progress has been made since last Advisory Board meeting on Oct. 2, 1997. Test loop modifications have been completed. Construction of a new liquid removal device was completed and successfully tested. Capacitance probes for liquid film thickness measurement have been statically calibrated. Experimental tests began in mid December, 1997.

Modeling studies are underway. A preliminary model for the onset point of entrainment is developed. The model assumes that the onset of entrainment is associated with interfacial waves.

Slug Dissipation in Downward Flow



Slug flow is a common occurrence in hilly terrain pipelines. The standard engineering method has been to divide a pipeline into various sections of constant slopes, and apply steady state flow models to simulate flow behavior in each

section, without considering the interaction between upward and downward sections. An important consequence of this interaction is carryover of large slugs into downhill sections that were created in uphill sections, even though modern flow pattern prediction models indicate that stratified flow should exist in the downhill sections. The objective of this project is to conduct an experimental and theoretical study to investigate slug flow dissipation in a hilly terrain pipeline.

Significant progress has been made since the last Advisory Board meeting on October 2, 1997. A new slug dissipation model has been developed. The model predicts the dissipation occurrence and mechanisms. The slug dissipation region is conveniently identified on a flow pattern map. The model also predicts slug dissipation lengths, but still needs to be verified by experimental data. Test facility modifications have already been completed. Currently, calibration of instruments is underway. Data acquisition and analysis of the data will be completed by March 1998.

Comprehensive Mechanistic Modeling of Two-Phase Flow in Deviated Wells

The objectives of this project are to develop and evaluate a comprehensive mechanistic model for predicting two-phase flow behavior in deviated wells and to expand the current TUFFP well databank. The fundamental



postulate of the modeling approach is the existence of flow patterns. Various mechanistic models have been developed to predict flow patterns. For each flow pattern, separate models were developed to predict flow characteristics like holdup and pressure drop. By considering basic fluid mechanics, the resulting models can be applied with confidence to flow conditions other than those used for their development.

Although one can use vertical flow models for deviated wells by simply applying an inclination angle correction to the gravity component of the pressure gradient equation, the results are questionable, and should not be expected to reflect the actual flow behavior. Therefore, it was recognized that additional studies were needed to improve predictions for deviated wells.

Considerable progress has been achieved since the last Advisory Board meeting on October 2, 1997. TUALP well data have already been incorporated into the TUFFP well databank. Currently, we are in the process of obtaining additional field data from a few TUFFP member companies. Databank updating is expected to be completed by late January 1998. Available mechanistic models for both vertical and deviated wells, and the Barnea Unified Model for flow pattern detection were thoroughly studied and evaluated. The Barnea Model is currently being tested against the TUFFP well databank. An inherent problem of the mechanistic modeling approach is the discontinuities caused by abrupt flow pattern transitions. In previous studies, elongated bubble and churn flow patterns were considered as belonging to the slug flow pattern for pressure gradient and holdup calculations. In this study, elongated bubble and churn flow patterns will respectively be considered as transition regions between bubbly and slug flows, and slug and annular flows to minimize discontinuities.

1998 Two-Phase Flow Calendar

February 2 - 4	ASME Energy-Sources Technology Conference and Exhibition (ETCE), Houston, Texas
March 3 - 5	SPE International Petroleum Conference and Exhibition in Mexico, Villahermosa, Mexico
March 18 - 20	Multiphase Technologies for Offshore Production, IBC Group plc, Doubletree Hotel at Allen Center, Houston, Texas
March 31	Louisiana State University/Minerals Management Service Workshop on Deep-Water Production, Baton Rouge, Louisiana
April 22	Paraffin Deposition JIP Advisory Board meeting, Tulsa, Oklahoma
April 23	TUFFP Advisory Board meeting, Tulsa, Oklahoma
April 28 - May 1	TUFFP Short Course on Two-Phase Flow in Pipes, Tulsa, Oklahoma
May 4 - 7	Offshore Technology Conference, Houston, Texas
June 10 - 11	1st North American Conference on Multiphase Technology, Banff, Canada
June 21 - 25	1998 ASME Fluids Engineering Division Summer Meeting, The Stouffer Renaissance Mayflower Hotel, Washington, D.C.
July 5 - 10	Forum Series in North America, Optimization of Production Systems - AKA Simultaneous Reservoir and Production Optimization and Fluid Applications in Drilling and Completing High-Angle and Horizontal Wells, Breckenridge, Colorado
September 13 - 18	Forum Series in Europe, Technical Solutions for Offshore Field Life Extension, Aviemore, United Kingdom
September 24	Paraffin Deposition JIP Advisory Board meeting, Tulsa, Oklahoma
September 25	TUFFP Advisory Board meeting, Tulsa, Oklahoma
September 27 - 30	SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana
October 20 - 22	SPE European Petroleum Conference, The Hague, The Netherlands
November 1 - 4	SPE/CIM International Conference on Horizontal Well Technology, Calgary, Alberta, Canada
November 2 - 6	SPE International Oil and Gas Conference and Exhibition in China, Beijing, China
November 15 - 20	1998 ASME International Congress and Exhibition (IMECE 98), Anaheim, California

The University of Tulsa
Fluid Flow Projects
Department of Petroleum Engineering
600 South College Avenue
Tulsa, Oklahoma 74104-3189