T U F F P

Tulsa University Fluid Flow Projects

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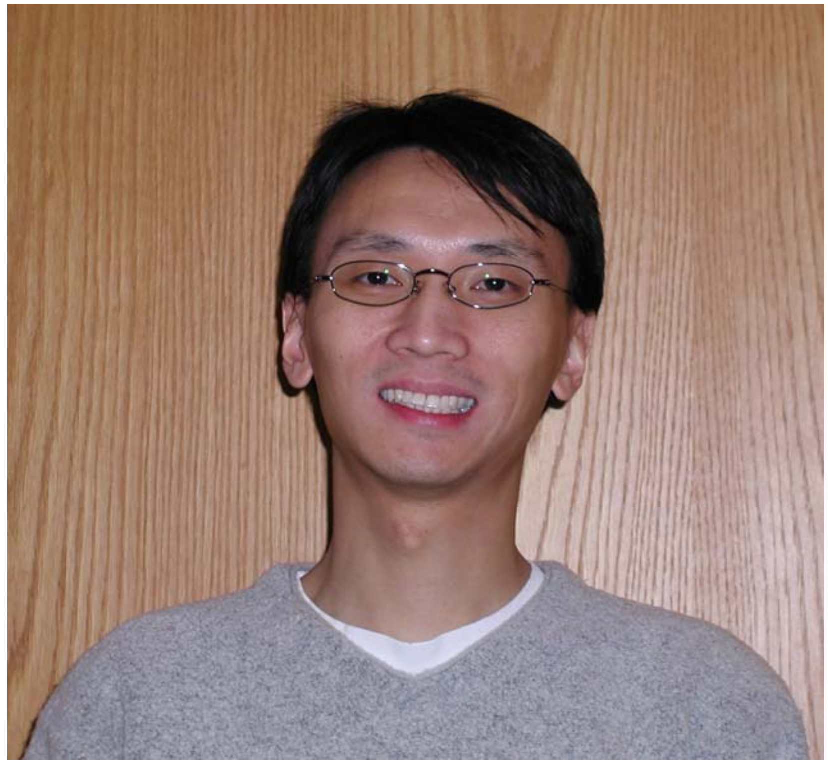


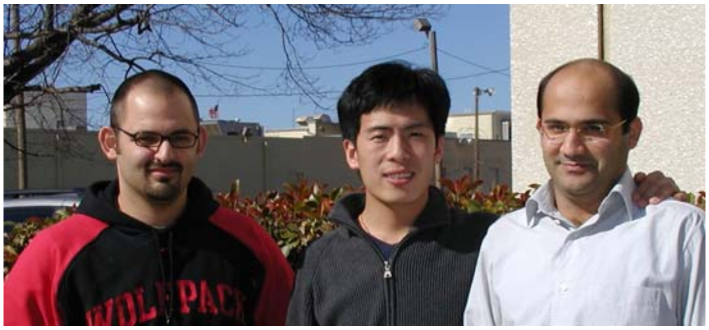
New Post Doctoral Research Associate Joins TUFFP

We are very pleased to introduce Dr. Ying Tsang as our newest Post Doctoral Research Associate. Before joining TUFFP, he spent a year at Intel Corp., Hillsboro, OR, to develop the latest generation of microprocessors for PCs and laptops.

Ying received his PhD (2004) degree in Chemical Engineering from Cornell University, Ithaca, NY. His doctoral dissertation is on the subject of experimental studies of millimeter-sized bubbles. In this research, he examined the fluid mechanics of individual bubble motion and that of the bubbly suspension in an electrolytic solution. In this environment, the gas-liquid interface maintains a zero tangential stress condition and a potential flow approximation can be applied to describe the fluctuating component of the fluid velocity.

Ying's background allowed him to hit the ground running. He is currently involved in oil-water project helping Ms. Nina Vielma. He is investigating the applicability of hot-film probes in oil-water flows. He is also working with Dr. Holden Zhang on short term contract work titled the methodology of blockage detection in gas pipelines. In addition, he will be participating in the study of droplet dynamics in multiphase flows under TUCoRE auspices.

New Research Assistants Arrived



Serdar Atmaca, Hongkun Dong and Reza Majidi

Two new MS students joined TUFFP team last fall. Mr. Serdar Atmaca, from Turkey, received a BS degree in Petroleum and Natural Gas Engineering from Middle East Technical University. He was the top student of his graduating class. Mr. Hongkun (Tom) Dong, from Peoples Republic of China, received a BS degree in Petroleum Engineering from China University of Geosciences with a distinction of ranking first in his graduating class. Serdar will be continuing where Cengizhan left off in gas-oil-water three-phase flow research. Tom is assigned gas-oil-water low liquid loading project.

The newest addition to our team is Reza Majidi from Islamic Republic of Iran. Reza received BS from Petroleum University of technology and MS from Sharif University of Technology both in Petroleum Engineering. Reza will be pursuing a Ph.D. degree in Petroleum Engineering. He is fully funded by National Iranian Oil Company (NIOC). Reza will soon be assigned to new TUFFP project.

Post Doctoral Research Associate and Computer Manager Leave

One of our post doctoral research associates, Dr. Xianghui (Paul) Chen, has resigned effective October 1, 2005 to assume a position with Alion Science and Technology, a local engineering consulting company focusing on CFD applications. Paul's responsibilities are assumed by Dr. Ying Tsang.

Mr. Edward (Ted) Chapman, MS, Computer Manager with TUFFP and related projects, has resigned effective January 2, 2006 to accept a position with Flight Safety. Currently, a search is underway to find Ted's replacement.

We wish Paul and Ted the best in their future endeavors.

Congratulations to Our Recent Graduates

Bahadir Gokcal and Gizem Ersoy

Mr. Bahadir Gokcal, (TUFFP) and Ms. Gizem Ersoy (TUCoRE) have successfully completed their MS degree requirements. Both will be continuing on their graduate studies at TU by pursuing Ph.D degrees. Bahadir will continue on High Viscosity Two-phase Flow research. Gizem will continue with a TUCoRE research project.

TUFFP Membership and Support

We have lost PDVSA as a member for 2006. I am happy to announce that TENARIS (CINI/Siderca) is the newest member of TUFFP. The current membership of TUFFP stands at 14 industrial members and Mineral Management Services of Department of Interior (MMS). We expect Kuwait Oil Company and Shell Global Solutions to join TUFFP in 2006.

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, effective July 2003.

TUFFP Financial Status

The total of 2005 TUFFP expenditures through Industry, MMS, and DOE accounts projected to be $461,274. The breakdown of the expenditures is $251,037, $39,135, and $171,102 for Industry, MMS and DOE accounts, respectively. The 2005 total income including Industry and MMS membership fees and the DOE contribution is $741,102. We entered 2005 with an Industry and MMS reserve account balance of $220,374. We expect to close 2005 with a combined reserve balance close to $540,000. The projected increase in the reserves is primarily due to recent increase in our 2005 membership, savings in equipment expenditures, and salary relief from related projects. TUFFP's 2005 Industry and MMS membership income is anticipated to be $640,000. Currently, 2 out of 14 members have already paid their 2006 membership dues.

Software Improvement Efforts

We are always exploring ways to make TUPDP and TUFFP software to be more user friendly to our members. Recently, TOTAL approached us to see the possibility of us making TUPDP software CAPE-OPEN complaint. CAPE-OPEN is a new set of protocols for various software to communicate with each other without any problems. CAPE-OPEN has the promise of PLUG and PLAY. A specific software can be plugged into another software and run if the specific software and the other software are CAPE-OPEN complaint. For example, TUFFP Pro software and TUWAX software would be used with any other commercially available thermodynamics software. Moreover our software can be plugged into other all purpose software. This seems to have the promise of increased use of TU produced software in market place.

Recent Publications and Presentations

Since the last Advisory Board meeting, the following publications and presentations are made.

1. Fan Y., Wang, Q., Zhang, H. Q., Sarica, C., and Danielson, T.: "A Model To Predict Liquid Holdup and Pressure Gradient of Near-Horizontal Wet-Gas Pipelines," SPE 95674, Presented at the 2005 SPE Annual Technical Conference and Exhibition, Dallas, TX, October 9 – 12, 2005.

2. Zhang, H. Q., and Sarica, C.: "Unified Modeling of Gas/Oil/Water Pipe Flow – Basic Approaches and Preliminary Validation," SPE 95749, Presented at the 2005 SPE Annual Technical Conference and Exhibition, Dallas, TX, October 9 – 12, 2005.

3. Hossain, M. S., Sarica, C., Zhang, H. Q., Rhyne, L., and Greenhill, K. L.: "Assessment and Development of Heavy Oil Viscosity Correlations," SPE 97907, Presented at the 2005 SPE International Thermal Operations and Heavy Oil Symposium, Calgary, Alberta, Canada, 1-3 November, 2005.

4. Wang, Q., Sarica, C. and Chen, X. T.: "An Experimental Study on Mechanics of Wax Removal," *Journal of Energy Resources Technology*, December 2005.

Upcoming ABM's

March 28, 2006

Hydrate JIP Advisory Board Meeting
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
8:00 a.m. - 2:45 p.m.

TUHFP/TUPDP/TUFFP Facilities Tour
The University of Tulsa North Campus
2450 East Marshall
Tulsa, Oklahoma
3:00 - 5:00 p.m.

TUHFP/TUPDP/TUFFP Barbeque
The University of Tulsa North Campus
2450 East Marshall
Tulsa, Oklahoma
5:00 - 7:00 p.m.

March 29, 2006

TUPDP Advisory Board Meeting
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
8:00 a.m. - 5:00 p.m.

TUFFP/TUPDP Reception
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
6:00 - 9:00 p.m.

March 30, 2006

TUFFP Advisory Board Meeting
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
8:00 a.m. - 5:00 p.m.

September 19, 2006

Hydrate JIP Advisory Board Meeting
Location to be determined
Tulsa, Oklahoma
8:00 a.m. - 2:45 p.m.

TUHFP/TUPDP/TUFFP Facilities Tour
The University of Tulsa North Campus
2450 East Marshall
Tulsa, Oklahoma
3:00 - 5:00 p.m.

TUHFP/TUPDP/TUFFP Barbeque
The University of Tulsa North Campus
2450 East Marshall
Tulsa, Oklahoma
5:00 - 7:00 p.m.

September 20, 2006

TUPDP Advisory Board Meeting
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
8:00 a.m. - 5:00 p.m.

TUFFP/TUPDP Reception
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
6:00 - 9:00 p.m.

September 21, 2006

TUFFP Advisory Board Meeting
The University of Tulsa
Allen Chapman Activity Center
Tulsa, Oklahoma
8:00 a.m. - 5:00 p.m.

Spring 2006 Advisory Board Meetings

Plans have now been finalized for the Spring 2006 Advisory Board meetings. The TUHFP JIP, TUPDP Advisory Board meetings, the TUFFP/TUPDP reception, and the TUFFP Advisory Board meeting will all be held on the University of Tulsa Campus in the Allan Chapman Activity Center. The TU Hydrate JIP (TUHFP) Advisory Board meeting will be held on Tuesday, March 28th. The meeting will begin at 8:00 a.m. and adjourn at approximately 2:45 p.m. A tour of the test facilities will follow the TUHFP meeting at 3:00 p.m. on the University of Tulsa North Campus. Following the tour, there will be a joint TUHFP/TUPDP/TUFFP BBQ between 5:00 - 7:00 p.m. The TUPDP Advisory Board meeting will be held on Wednesday, March 29th. The meeting will begin at 9:15 a.m. with breakfast at 8:30. The meeting will adjourn at approximately 4:00 p.m. Following the TUPDP meeting, there will be a joint TUFFP/TUPDP reception from 6:00 - 9:00 p.m. The TUFFP Advisory Board meeting will begin at 8:30 a.m. on Thursday, March 30th with breakfast at 8:00 and will adjourn at approximately 4:30 p.m. The Request for Information form and hotel information will be placed on the web page soon. 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. You can then follow the links for the Request for Information form. 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 web site 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.

BHRg's 5th North American Conference on Multiphase Technology to Be Held in Banff, Canada

BHR Group's 5th North American Conference on Multiphase Production Technology is scheduled to be held between May 31 and June 2, 2006 in Banff, Canada. This conference is co-sponsored by Neotechnology Consultants of Calgary, Canada, and TUFFP. It brings together experts from across the American Continents and Worldwide. The conference will benefit anyone engaged in the application, development and research of multiphase technology for the oil and gas industry. Applications in the oil and gas industry will also be of interest to engineers from other industries for whom multiphase technology offers a novel solution to their problems. The conference will also be of particular value to designers, facility and operations engineers, consultants and researchers from operating, contracting, consultancy and technology companies.

Over 40 papers in various multiphase flow and flow assurance subjects will be presented at this conference. The detailed information about the conference can be found on BHRg's web site www.brhgroup.com.

TUFFP Short Course

The 31st TUFFP "Two-Phase Flow in Pipes" short course is scheduled to be taught May 15-19, 2006 in Tulsa by Dr. Sarica and Dr. Brill. The course covers the most current, up-to-date-research performed at the TUFFP and TUPDP. This five-day course is focused on the fundamentals of two-phase flow in piping systems encountered in the production and transportation of oil and gas. The short course will include a half-day session on paraffin deposition in pipes. For this short course to be self sustaining, at least 10 enrollees are needed. We urge our TUFFP and TUPDP members to let us know soon if they plan to enroll people in the short course. Information regarding the short course and online registration can be found at http://www.cese.utulsa.edu/coursedetail.jsp?id=53.

Current TUFFP Members

Baker Atlas	**Petrobras**
BP	**Petronas**
Chevron	**Rosneft Oil Co.**
ConocoPhillips	**Saudi Aramco**
Landmark Graphics	**Schlumberger**
Marathon Oil Co.	**TENARIS**
Pemex	**TOTAL**

Progress Updates

An Experimental and Modeling Study of Gas-Oil-Water Flow in Horizontal Pipes

Cengizhan Keskin

The ultimate objective 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 tubing and flow lines. This study is the first of a series of gas-oil-water studies. The objective of this study is to investigate three-phase flow of gas-oil-water in horizontal pipes.

The experimental work has been conducted using the TUFFP facility for gas-oil-water flow located at The University of Tulsa North Campus Research Complex. 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 composed of two 69.3-ft (21.1-m) long straight transparent pipes, connected by a 4.0-ft (1.2-m) long PVC bend. The pipeline has a 2.0-in. internal diameter. The transparent pipes are instrumented to permit continuous monitoring of the temperature, pressure, differential pressure, holdup and spatial distribution of the phases. Quick-closing valves, conductance probes and capacitance sensors were used to measure phase fractions and flow characteristics. In addition, High Speed Video system was used to investigate the three-phase flow patterns in detail.

Three-phase gas-oil-water tests were conducted for 20, 40, 50, 60 and 80% water fractions. Based on the observations and high speed video recordings, three-phase gas-oil-water flow patterns in horizontal pipes were identified, and a new classification was proposed. Twelve individual three-phase gas-oil-water flow patterns in horizontal pipes have been identified. The names of the gas-oil-water flow patterns consist of two words. First word stands for gas-liquid flow pattern and the second word indicates oil-water flow pattern. The new three-phase gas-oil-water flow patterns are: Stratified-Stratified (ST-ST), Stratified-Dual Continuous (ST-DC), Stratified-Oil Continuous (ST-OC), Stratified-Water Continuous (ST-WC), Intermittent-Stratified (IN-ST), Intermittent-Dual Continuous (IN-DC), Intermittent-Oil Continuous (IN-OC), Intermittent-Water Continuous (IN-WC), Annular-Oil Continuous (AN-OC), Annular-Water Continuous (AN-WC), Dispersed Bubble-Oil Continuous (DB-OC) and Dispersed Bubble-Water Continuous (DB-WC).

Basic equations and approaches of unified modeling of gas-oil-water pipe flow were developed. The required closure relationships such as, oil-water mixing status and interfacial shear were proposed. The translational velocities for three-phase gas-oil-water slugs were calculated using Nicklin's (1962) correlation. The correlation was in good agreement with the experimental results. Therefore, Nicklin's correlation can be used to predict three-phase translational velocities. Similarly, the average slug length of 32d for horizontal two-phase flows presented by Taitel *et al.* (1980) is applicable to three-phase flow.

Current efforts are focused on the comparison of the experimental results with the model and the completion of the final report.

Three-Phase Redistribution in Subsea Flowline-Riser System after Shut-in

Kwon Il Choi

Modeling transient three-phase segregation phenomena in the flowline-riser system will support the prediction of hydrate formation following the cool-down of the fluids and high pressure surge during the extended shut-in.

The first stage of the study will be qualitative identification of different transient flow patterns during shut-in to define the scope of the components of the computational model. Then, a transient three-phase flow model will be formulated using the "moving numerical discretization grid" concept which is intended to minimize the numerical diffusion problem. This becomes very important for tracking the precise locations of water, oil and gas along the flowline and riser. The computational model will be validated with experimental measurements and observations on the TUFFP severe-slugging facility consisting of 65-ft pipeline followed by a 48-ft riser.

The main part of the experimental study will be measuring the holdup values of oil, water and gas in the mixture trapped in 7 vertical sections of the riser divided by quick closing valves in a series of different time lapses after closing the top valve. The horizontal part of the pipeline may also require similar experimental measurements. The same operation will be simulated by the computational model and compared to the experimental data.

The following modifications to the facility are being planned for the research:

- Installation of progressive cavity pump replacing the centrifugal pumps to minimize oil-water emulsification
- Reposition the oil tank's outlet to a higher point to reduce water carry-over
- Installation of quick closing valves
- Replacement of the transparent PVC pipes with new graded pipes
- Installation of video cameras for each section of the pipes where visual holdup measurements will be done
- Installation of an acoustic (or magnetic) level detector

Currently the literature review is being done on oil-water flow in vertical and deviated wells. At the same time, some computational techniques are being tested to make possible the Lagrangian numerical grid for three different fluids.

Bahadir Gokcal

Effect of High Viscosity on Multiphase Flow Behavior

High viscosity oils are discovered and produced all around the world. There are fields that are currently producing oils with viscosities as high as 10,000 cp. High viscosity or "heavy oil" has become one of the most important future hydrocarbon resources with the ever increasing world energy demand and the depletion of conventional oils. Commonly used laboratory liquids have viscosities less than 20 cp. Thus, the gap between actual laboratory data and field data is three orders of magnitude or more. Therefore, existing mechanistic models need to be verified with higher liquid viscosity experimental results. If necessary, the existing models need to be modified or new models should be developed to predict flow patterns, pressure losses and liquid holdup accurately for higher viscosity oils.

The objectives of this study are to investigate the effects of high viscosity oil on flow patterns, pressure drop and liquid holdup experimentally and to identify the differences in flow behavior of high and low viscosity oils. In addition to that, the performance of existing flow pattern, pressure gradient and holdup prediction models are evaluated using the data acquired in the experimental part of this study.

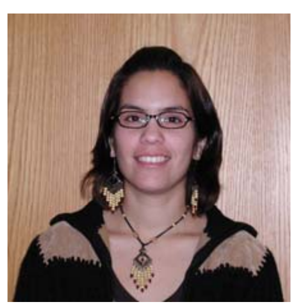
A new 2-in. ID high viscosity indoor test facility was designed and constructed to conduct two-phase high viscosity oil-air flow experiments. The metering section, test section, heating and cooling systems are the major components of the high viscosity facility. The indoor test facility is comprised of a 62-ft long, 2-in. ID pipe with a 30-ft long transparent acrylic pipe section to visually observe the flow. The inclination angle can be changed from -2° to 2° from horizontal.

Gas and oil flow rates, and oil temperature are varied in this study. The superficial liquid and air velocities vary from 0.01 to 1.75 m/s and from 0 to 20 m/s, respectively. The lower limits of superficial velocities are due to the accuracies of the Micro Motion^{TM} flow meters. The higher limits are determined by the pressure gradient and pump capacity. The experiments are performed at temperatures of 70, 80, 90, and 100°F for horizontal pipe. The oil viscosities corresponding to the above temperatures are 587, 378, 257, and 181 cp, respectively.

A total of 203 tests were conducted. Data analysis was performed to understand the effects of high oil viscosity on flow pattern, pressure drop and liquid holdup and to identify the differences in flow behavior of high and low viscosity oils. The experimental results showed significant differences in two-phase flow behaviors at high oil viscosities. The experimental data were also used to evaluate the performances of the Barnea and TUFFP unified models for flow pattern prediction, and the Xiao mechanistic and TUFFP unified models for pressure gradient and liquid holdup predictions. Based on the assessments, several improvements have been suggested for the TUFFP unified model including slug translational velocity and slug liquid holdup correlations.

The facility will be revised based on the findings from the study. The project will continue to improve the existing mechanistic models or develop new models for high viscosity oils.

Characterization of Oil-Water Flow in Horizontal and Slightly Inclined Pipes



Maria Vielma

Liquid-liquid two-phase pipe flow is encountered in different industries and processes such as oil production and transportation. Despite its importance, liquid-liquid flows have not been investigated as much as gas-liquid flows.

The objectives of this study are:

- Acquire detailed experimental

data on oil-water flow including droplet sizes and velocity fields in horizontal and slightly inclined pipes (-1º and +1º) under different operating conditions to better understand the physics of oil-water flow.

- Improve the existing oil-water flow models or develop new ones if necessary.

The experimental part of this study will be conducted on the TUFFP gas-oil-water flow facility. Some modifications need to be made to the existing Gas-Oil-Water facility:

- The existing test section is being modified by changing the temperature and pressure transducers from Validyne to Rosemount for better accuracy and maintenance.

- A new optical probe set will be used to obtain instantaneous phase concentration of oil and water across the pipe as well as volume fraction, drop size and drop velocity in the flow.

- Hot film anemometers will be used in order to identify phases and measure in-situ velocities.

- A High Speed Video system will be used to measure droplet sizes and identify flow structures. The camera captures high resolution images at high speed. The images will be evaluated with an image analysis software.

The High Speed Video system and the image analysis software will be first tested using a simple setup, a glass square container, in which different dispersions will be created and maintained with an impeller. Then, a large number of data points will be acquired in the flow loop at various conditions. The inclination angles used for the experiments will be 0°, and ±1.0º. The superficial oil and water velocities ranged from 0.025 to 1.8 m/sec. The oil and water flow rates will be chosen such that the flow pattern transition boundaries could be identified clearly. Moreover, a large number of data will be taken for the dispersed flow patterns to characterize the droplet size and phase distributions.

The near future tasks of this project are:

- Data acquisition for oil-water pipe flow.

- Droplet size and distribution analyses of the images taken in dual continuous and dispersed flows.

- Perform uncertainty analysis for all measurements.

- Consideration of model development.

An Experimental Study of Gas-Oil-Water Flow in Inclined Pipes

Serdar Atmaca

An experimental study of gas-oil-water flow in horizontal pipes has been conducted by Cengizhan Keskin (2006). This study is a continuation of the gas-oil-water pipe flow study and has been assigned to Serdar Atmaca, a new master graduate student who joined TUFFP in fall 2005. The main objectives of this study are to measure gas-oil-water flow in inclined pipes and compare the data with the existing models.

The experimental work will be conducted on the TUFFP gas-oil-water flow facility. A new set of optical probes will be used to determine the flow behaviors including liquid holdup and slug characteristics. The high speed camera system will also be used to identify the flow patterns and phase distributions. The test section is attached to a boom whose inclination angle can be changed with a cable system and a vertical tower. Gas-oil-water flow experiments can be carried out at different inclination angles.

The literature review is under way. The required facility modifications will be done in the spring and early summer of this year. Experimental data collection is tentatively scheduled to start in July 2006.

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

Hongkun Dong

Gas-oil-water three phase flow exists in the production and transportation of hydrocarbons. 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 three phase flow in near-horizontal pipes, and to develop improved design models for wet-gas pipelines.

Low liquid loading gas-liquid two-phase flow has been studied both experimentally and theoretically on the flow loops of 50.8-mm ID (2-in.) and 152.4-mm ID (6-in.) by

Richard Fan (2005) at TUFFP. A mechanistic two-fluid model with new closure relationships was developed to better predict low liquid loading gas-liquid two-phase flow characteristics.

The objectives of this study are to:

- Collect experimental data of low-liquid loading three-phase flow in near horizontal pipes,
- Evaluate existing models with experimental data,
- Identify the differences between low liquid loading two-phase flow and low-liquid loading three-phase flow, and
- Suggest modifications and new development for modeling.

This project has been recently assigned to Tom Dong who joined TUFFP in fall 2005 as a Master graduate student. In this study, the 152.4-mm (6-in.) ID, 54.9-m (180-ft) long PVC flow loop will be modified to investigate low liquid loading three phase flow. An oil tank, pump and metering section will be added to the existing system for three-phase flow study. The measured parameters will include pressure gradients, holdups of the three phases, wetted wall fractions by oil and water under different gas, oil and water flow rates.

Updates of TUFFP Unified Model Computer Programs

Two changes have been made to the unified model computer programs for gas-liquid pipe flow based on comparisons with Bahadir Gokcal's (2005) high oil viscosity data. One is the slug translational velocity correlation. In the previous computer programs, only the Nicklin equation for turbulent flow was used and it caused inaccurate predictions of both flow pattern transition and hydrodynamics. At high viscosity and low Reynolds number, the majority of Bahadir Gokcal's experiments were laminar slug flows. Now the laminar flow option has been added to the slug translational velocity correlation.

The second change has been made in the model of slug liquid holdup prediction. The momentum term for gas entrapment is modified based on Reynolds number. At low Reynolds number the model gives unreasonably high prediction of gas void fraction in slug body due to high shear. The shear is high because of the high viscosity. However at high oil viscosity, the turbulence is low due to the low Reynolds number. Gas is not easily entrapped under such flow conditions. Therefore, the momentum term is modified by a factor of Re/5000.0 when the Reynolds number (Re) is less than 5000.0.

After the above changes, the predictions are much better when compared with experimental results at high oil viscosity for flow pattern transition, pressure gradient and liquid holdups.

A unified model for gas-oil-water three-phase pipe flow has been recently constructed and presented at the 2005 SPE ATCE. Preliminary validation has been done with experimental results. Further detailed comparisons will be carried out with the TUFFP three-phase experimental results acquired by Cengizhan Keskin (2006) and improvement will be made accordingly.

New Award—Shell Project

This project will be administered by Dr. Holden Zhang, The objective of this project is to investigate the technical feasibility of using the pressure wave propagation method to detect and characterize blockages caused by wax or hydrate deposition in subsea flowlines under single and multiphase flowing conditions. The project involves combination of experimental and modeling research. The multiphase flow behavior (liquid film thickness, entrainment fraction, etc) is predicted with the mechanistic models developed by at TU. The pressure wave reflection and propagation through the flowline with blockages will be numerically simulated. The relationship between the pressure wave propagation behaviors and the blockage characteristics (location, size, and length) will also be examined through experiments using the 1,400-ft flow loop on the North Campus. With this research, Dr. Zhang intends to advance our understanding of blockages in sub-sea pipelines.

Calendar of Events

2006

March 14-15	Technologies for Thermal Heavy Oil and Bitumen Recovery and Production—ATW, Calgary, Canada
March 28	TUHFP JIP Advisory Board Meeting, University of Tulsa Campus, President's Lounge, Allen Chapman Activity Center, Tulsa, Oklahoma
March 29	TUPDP Advisory Board Meeting, University of Tulsa Campus, Gallery, Allen Chapman Activity Center, Tulsa, Oklahoma
March 30	TUFFP Advisory Board Meeting, University of Tulsa Campus, Gallery, Allen Chapman Activity Center, Tulsa, Oklahoma
April 22-26	SPE/DOE Symposium on Improved Oil Recovery, Tulsa, Oklahoma
May 1-4	Offshore Technology Conference, Houston, Texas
September 19	TUHFP JIP Advisory Board Meeting, University of Tulsa Campus, Room to be Determined, Tulsa, Oklahoma
September 20	TUPDP Advisory Board Meeting, University of Tulsa Campus, Allen Chapman Activity Center, Tulsa, Oklahoma
September 21	TUFFP Advisory Board Meeting, University of Tulsa Campus, Allen Chapman Activity Center, Tulsa, Oklahoma
September 24-27	SPE Annual Technical Conference and Exhibition, San Antonio, Texas
TBA	The Heavy Oil Challenge: Recognition, Evaluation and Mobilization—Forum, Portugal
TBA	Who Owns the Deepwater Riser and Who Solves its Production Problems? - Forum, Portugal
October 3-6	SPE Russian Oil and Gas Technical Conference and Exhibition, Moscow, Russia
November 5-8	Deepwater Technology—ATW, Bangkok or Phuket, Thailand
November 5-8	Abu Dhabi International Petroleum Exhibition and Conference, Abu Dhabi, UAE

2007

February 28-March 2	International Symposium on Oilfield Chemistry, Houston, Texas
March 12-15	Middle East Oil and Gas Show and Conference, Bahrain
March 31-April 3	Production Operations Symposium, Oklahoma City, Oklahoma
April 15-18	Latin American and Caribbean Petroleum Engineering Conference, Buenos Aires, Argentina
April 30-May 3	Offshore Technology Conference, Houston, Texas
September 4-7	Offshore Europe, Aberdeen, Scotland
November 10-14	SPE Annual Technical Conference and Exhibition, Anaheim, California