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ANNUAL REPORT 1990-91 Academic Year DEPARTMENT OF PETROLEUM ENGINEERING AND CENTER FOR PETROLEUM AND GEOSYSTEMS ENGINEERING

Work Performed under Contract No. DE-FC07-85NV10412





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PART I

DEPARTMENT OF PETROLEUM ENGINEERING

Dr. Larry W. Lake, Chairman

1.0 SUMMARY

The Department of Petroleum Engineering at The University of Texas at Austin is one of more than 20 such departments in the United States and more than 40 worldwide. The department is housed in the five-year-old Chemical and Petroleum Engineering Building, containing (in Petroleum Engineering) more than 105,000 square feet of office space, laboratories, computer rooms and classrooms. The department has more than 20 faculty members (17.8 full-time equivalent) and, as of the fall of 1990, 146 undergraduate and 156 graduate students.

During the 1990-91 academic year, undergraduate enrollment is up slightly from the several downturns that began in 1986; graduate enrollment continues to increase, significantly in the number of Ph.D. candidates enrolled. We plan to increase enrollment of undergraduates to around 250 and to increase the number of U.S. graduate students. Both goals are being pursued with aggressive recruiting and financial aid programs.

The 1990-91 academic year was one of consolidation of gains. In my second year of being chairman, I am beginning to understand what the job entails and to actively look for ways to improve. One such way is the initiation of a remote teaching program in the Midland-Odessa area. This program, begun in September of 1990 with about 20 graduate students enrolled, appears to be successfully addressing our departmental goals and the goals of delivering upper-level petroleum engineering education to one of the state's premier producing areas.

For the production of this report I should like to thank Esther Barrientes for her work on the CPGE section, Dr. I. H. Silberberg for editorial suggestions and, especially, Samiha K. Ragab for diligently compiling the information and producing this report in timely and efficient fashion.

Dr. Larry W. Lake, Chairman

Department of Petroleum Engineering

2.0 PEN FACULTY 1990-91

Professors

Ben H. Caudle B.J. Lancaster Professor in Petroleum Engineering

Myron H. Dorfman W.A. "Tex" Moncrief, Jr. Centennial Chair in Petroleum Engineering

Kenneth E. Gray Zarrow Centennial Professor in Petroleum Engineering

Claude R. Hocott Professor of Petroleum Engineering

Larry W. Lake
Shell Distinguished Chair
Halliburton Annual Professor in Petroleum Engineering
Chairman, Department of Petroleum Engineering

Augusto L. Podio
H.B. (Burt) Harkins, Jr. Professor in Petroleum Engineering
Assistant Chairman, Department of Petroleum Engineering
Undergraduate Advisor, Department of Petroleum Engineering

Gary A. Pope J. H. Herring Centennial Professor in Petroleum Engineering Director, Center for Petroleum and Geosystems Engineering

Robert S. Schechter W.A. "Monty" Moncrief Centennial Endowed Chair in Petroleum Engineering Professor of Chemical and Petroleum Engineering

Kamy Sepehrnoorl
Frank W. Jessen Professor in Petroleum Engineering
Chairman, Graduate Studies Committee, Department of Petroleum Engineering

Willem C. J. van Rensburg George H. Fancher Professor in Petroleum Engineering Director, Energy and Mineral Resources Program

Adjunct Professors

Henry F. Dunlap

William B. Gardner

David A. Rowland

Associate Professors

A. Daniel Hill

George H. Fancher Centennial Teaching Fellowship in Petroleum Engineering Graduate Advisor, Department of Petroleum Engineering

Mark A. Miller

Gulf Oil Foundation Centennial Teaching Fellowship in Petroleum Engineering Chairman, Graduate Admissions Committee, Department of Petroleum Engineering Deputy Director, Center for Petroleum and Geosystems Engineering

Ekwere J. Peters

Frank W. Jessen Centennial Fellowship in Petroleum Engineering

Mukul M. Sharma

Sun Exploration and Production Company Centennial Fellowship No. 1 in Petroleum Engineering

Adjunct Associate Professors

Dr. Seyf-Ollah Ehdale

Assistant Professors

Steven L. Morriss

John C. Reis

Sun Exploration and Production Company Centennial Fellowship No. 2 in Petroleum Engineering

William R. Rossen

Senior Lecturers

Martin E. Chenevert Sylvain J. Pirson Centennial Lectureship in Petroleum Engineering

Krishan A. Malik

Irwin H. Silberberg

Lecturers

Frances K. Hurley

2.1 New Faculty

Dr. Steven L. Morriss

Dr. Morriss joined us in September 1990 after receiving his PhD in Petroleum Engineering that same year from our department. He received his BS in Electrical Engineering in 1979 from UT Austin also. While at UT, he was awarded the SPE Region VII Graduate Fellowship, and received the College of Engineering Award for Exemplary Performance in Engineering Teaching. His research interests are ultrasonic Doppler velocimetry and imaging in two-phase flow, cement evaluation behind pipe using acoustic logs, electromagnetic methods in formation evaluation, well log interpretation, and production logging. Dr. Morriss also wrote an interactive PC program for analysis of stress-test pressure response measurements.

Dr. David A. Rowland

Dr. Rowland is professor at UT Permian Basin and has been teaching there since 1983. He took an active part in the remote teaching program by teaching two courses; "Natural Gas Reservoir Engineering", and "Theory and Application of Reservoir Transients". He received his BS in 1949, MS in 1952, and PhD in 1969, all in Petroleum Engineering from Colorado School of Mines, University of California at Berkeley, and Stanford University, respectively. His professional experience spans reservoir engineering applications, construction of computer programs used in reservoir engineering, and natural gas reservoir engineering.

Dr. Seyf-Ollah Ehdale

Dr. Ehdaie is associate professor of engineering at UT Permian Basin and has been teaching there since 1984. He taught a course titled "Oil Field Corrosion" during the Spring 1991 in the remote teaching program at the Permian Basin. He received his BS in Chemistry from Tehran University in 1969 and his PhD in Electrochemical Engineering from Southampton University, England in 1978. His research interests are oil sludge disposal, oilfield wastes oil recovery, oil recovery plant design, fluid mechanics, and thermodynamics. He also teaches in the Engineering, Chemistry, and Natural Science Departments at UT Permian Basin.

2.2 Professional Accomplishments 1990-91

B. H. Caudle

B. J. Lancaster Professor in Petroleum Engineering; Enhanced Oil Recovery Pioneer; Member, Petroleum Engineering Alumni Committee; Member, Petroleum Engineering Laboratory, Space, and Safety Committee; Senior Member, SPE of AIME; Honorary Member, SPE; Member, NAE; Distinguished Member, SPE.

M. E. Chenevert

Sylvain Pirson Centennial Lectureship in Petroleum Engineering; Petroleum Engineering Senior Lecturer; Chairman, Petroleum Engineering Alumni Committee (ad hoc); Program Director, Wellbore Stability and Drilling Fluids Research, Center for Petroleum and Geosystems Engineering; Principal Investigator for GRI project on "Permeability of Filter Cakes on Tight Gas Sands"; Principal Investigator on SLERO project on "Wellbore Stability in Wells Drilled in State Lands"; Member, American Filtration Society, API Oil Mud Committee, International Association of Drilling Contractors, ASEE, SPE.

M. H. Dorfman

W. A. "Tex" Moncrief, Jr. Centennial Chair in Petroleum Engineering; Program Director, Geopressured-Geothermal Energy Research, Center for Petroleum and Geosystems Engineering; Member, Petroleum Engineering Alumni Committee; International Advisory Board, In Situ, 1986 - present; International Editorial Board, Journal of Geothermal Science and Technology, 1987 - present; Research Coordination Council, GRI; Member, Research Committee, 10CC; Member, SPE Distinguished Lecturer Committee, 1988 to 1991.

K. E. Gray

Zarrow Centennial Professor in Petroleum Engineering; Member, Degrees and Courses Committee, College of Engineering; Program Director, Rock Mechanics, Center for Petroleum and Geosystems Engineering; API Committee on Controlled Deviation Drilling; API Committee on Fracture Pressure Gradients; Who's Who in America; Who's Who in Environmental and Energy Management; Member, Engineering Mechanics Committee, College of Engineering; Invited Speaker on Wellbore Stability, Elf Aquitaine, Pau, France; Organizer, Conferences on Borehole Stability: Theory and Practices, and Wellbore Stability, Sand Production, Coring Practices, and Coal Gas Production, Calgary, Alberta, Canada; Member, SPE Forum "Wellbore Stability"; Distinguished Member, SPE; Member, International Society of Rock Mechanics Commission on Rock Properties for Petroleum Engineers; Member, AAM.

A. D. HIII

George H. Fancher Centennial Teaching Fellowship in Petroleum Engineering; Petroleum Engineering Associate Professor; Visiting Professor, Mining University Leoben (Austria); Petroleum Engineering Graduate Advisor; Member, Petroleum Engineering Graduate Admissions Committee; Member, Petroleum Engineering Graduate Studies Committee; Program Director, Stimulation, Logging and Formation Damage Research, Center for Petroleum and Geosystems Engineering; Member, SPE; Member, SPE Production Operations Committee; Member, SPE Cased Hole Logging Forum Committee; Member, Society of Professional Well Log Analysts; Member, AIChE.

C. R. Hocott

Professor Department of Petroleum Engineering; Enhanced Oil Recovery Pioneer; Distinguished Engineering Graduate; Anthony F. Lucas Gold Medal, AIME-SPE; Distinguished Member, SPE; Distinguished Lecturer Emeritus, SPE; Member, NAE; Member, Research Committee, IOCC; SPE Legion of Honor.

F. K. Hurley

Lecturer in Technical Communications, Departments of Petroleum and Chemical Engineering; Chemical Engineering General Dynamics Teaching Excellence Award for 1990; Member, Engineering Writing Committee; Member, Society of Technical Communication and the Modern Language Association.

L. W. Lake

Halliburton Annual Professor in Petroleum Engineering; Shell Distinguished Chair; Chairman, Petroleum Engineering Department; Program Director, Enhanced Oil and Gas Recovery Research, Center for Petroleum and Geosystems Engineering; Award of Excellence, Halliburton Education Foundation; SPE Reservoir Engineering Award; Engineering Foundation Faculty Excellence Award, UT College of Engineering; Member, SPE, AGU, AIChE;

K. A. Malik

Senior Lecturer, Department of Petroleum Engineering; Senior Research Fellow, Center for Energy Studies, Center for Petroleum and Geosystems Engineering; Member, IAEE, SPE.

M. A. Miller

Gulf Oil Foundation Centennial Teaching Fellowship; Petroleum Engineering Associate Professor; Deputy Director, Center for Petroleum and Geosystems Engineering; Program Director, Geosystems Engineering, Center for Petroleum and Geosystems Engineering; Chairman, Petroleum Engineering Graduate Admissions Committee; Member, Steering Committee, Colloquium on Petroleum Engineering Education; Member, Petroleum Engineering Graduate Studies Committee; Member, Petroleum Engineering Awards Committee; Member, Petroleum Engineering Undergraduate Studies Committee; Petroleum Engineering Minority Liaison Officer; Member, College of Engineering Graduate Student Recruitment Committee; Member, College of Engineering Bureau of Engineering Teaching Executive Committee; Member, College of Engineering Televised Instruction Committee; College of Engineering MiTE Program Lecturer; Member, SPE.

S. L. Morriss

Assistant Professor, Department of Petroleum Engineering; Petroleum Engineering Faculty Meetings Recorder; Member, SPE and SPWLA.

E. J. Peters

Frank W. Jessen Centennial Fellowship in Petroleum Engineering; Petroleum Engineering Associate Professor; Program Director, Imaging Laboratory, Center for Petroleum and Geosystems Engineering; Chairman, Petroleum Engineering Awards Committee; Chairman, Petroleum Engineering Laboratory, Space, and Safety Committee; Member, Petroleum Engineering Computers Committee; Editorial Review Committee, SPE, 1985 to present; Member, SPE, Petroleum Society of CIM.

A. L. Podlo

H. B. (Burt) Harkins, Jr. Professor in Petroleum Engineering; Assistant Chairman, Undergraduate Advisor, Department of Petroleum Engineering; Program Director, Production and Offshore Technology Research, Center for Petroleum and Geosystems Engineering; Chairman, Petroleum Engineering Undergraduate Studies Committee; Member, Petroleum Engineering Laboratory, Space, and Safety Committee; Member, College of Engineering Admissions Committee; Member, College of Engineering Undergraduate Advising and Retention Committee; In Situ Editorial Board; JPT Editorial Board.

G. A. Pope

J. H. Herring Centennial Professor in Petroleum Engineering; Director, Center for Petroleum and Geosystems Engineering; Member, Petroleum Engineering Laboratory, Space, and Safety Committee; Chairman, SPE Committee on Petroleum Engineering Research; Associate Editor, In Situ; Member, AIChE, SPE; Member, SPE Committee on National Energy Policy, SPE Committee on Education and Accreditation, SPE Tulsa Meeting Paper Selection Committee.

J. C. Rels

Sun Exploration and Production Company Centennial Fellowship No. 2 in Petroleum Engineering; Petroleum Engineering Assistant Professor; Coordinator, Petroleum Engineering Scholarship; Member, Petroleum Engineering Laboratory, Space, and Safety Committee; Member, College of Engineering Safety, Ethics, and Liability Committee; Member, College of Engineering Safety and Security Committee; Member, SPE, ASME, Tau Beta Pi, ASE, Engineering Registration: Texas.

W. R. Rossen

Assistant Professor, Department of Petroleum Engineering; Chairman, Petroleum Engineering Seminar Committee; College of Engineering Faculty Leadership Award in Petroleum Engineering; Undergraduate Math and Science Committee; Advisor, Student Chapter of SPE; Member SPE, AlChE; Engineering Registration: Texas.

R. S. Schechter

W. A. (Monty) Moncrief Centennial Endowed Chair in Petroleum Engineering; Recipient of the Joe J. King Professional Engineering Achievement Award, College of Engineering; Recipient of the Senior Research Award, American Society for Engineering Education; Published look, Oil Well Stimulation, Prentice Hall; Edited book, Acidizing, Reprint Series, Society of Petroleum Engineers.

K. Sepehrnoori

Frank W. Jessen Professor in Petroleum Engineering; Program Director, Computing and Database Research, Center for Petroleum and Geosystems Engineering; Chairman, Petroleum Engineering Graduate Studies Committee; Chairman, Petroleum Engineering Computers Committee; Member, Petroleum Engineering Graduate Admissions Committee; Member, College of Engineering Computers Committee; General Editor, In Situ; Recipient of Petroleum Engineering Excellence in Engineering Teaching Award; Member, SPE, SIAM.

M. M. Sharma

Sun Exploration and Production Company Centennial Fellowship No. 1 in Petroleum Engineering; Petroleum Engineering Associate Professor; Program Director, Petrophysics and Logging Research, Center for Petroleum and Geosystems Engineering; Member, Petroleum Engineering Reading Room Committee; Member, SPWLA, SPE, AIChE, AGU.

I. H. Silberberg

Senior Lecturer and Research Engineer, Department of Petroleum Engineering; General Associate Editor, <u>In Situ</u>; Member, SPE, ACS, AIChE.

W. C. J. van Rensburg

George H. Fancher Professor in Petroleum Engineering and Professor of Geological Sciences; Director, Energy and Minerals Resources Graduate Program; Chairman, Petroleum Engineering Geological Engineering Committee; Member, Petroleum Engineering Graduate Studies Committee; Engineering Foundation Faculty Award; Halliburton Educational Foundation Teaching Excellence Award; Board of Directors, MII; Distinguished Lecturer of the International Pacific Rim Minerals Conference, 1990; Distinguished Lecturer to the University of Missouri at Rolla; Member, Society of Economic Geologists, Panhandle Geological Society, South African Coal Preparation Society, South African Group for Future Studies, USSI.

| MAA | American Academy of Mechanics | IAEE | International Association for Energy |
|------------|--|--------------|--|
| ACS AGU | American Chemical Society American Geophysical Union | locc | Interstate Oil Compact Commission |
| AICHE | American Institute of Chemical | JPT | Journal of Petroleum Technology |
| A.O.I.L | Engineers | MII | Mineral Information Institute |
| AIME | American Institute of Mechanical | NAE | National Academy of Engineering |
| | Engineers | SIAM | Society of Industrial and Applied |
| API | American Petroleum Institute | | Mathematics |
| ASEE | American Society for Engineering Education | SLERO | State Lands Energy Resource Optimization |
| ASME | American Society of Mechanical Engineers | SPE SPWLA | Society of Petroleum Engineers Society of Petroleum Well Log |
| CIM | Canadian Institute of Mining and Metallurgy | USSI | Analysts U.S. Strategic Institute |
| GRI | Gas Research Institute | | |

2.3 Summary of Budgeted Faculty Positions

| | 198 | 36-87 | 19 | 87-88 | 198 | 8-89 | 19 | 89-90 | 19 | 90-91 |
|------------------------------------|--------------|---------|-----|---------|-----|---------|-----|---------|-----|---------|
| RANK | NO. | FTE | NO. | FTE | NO. | FTE | NO. | FTE | NO. | FTE |
| Professor Emeritus | 1 | 0.0000 | 1 | 0.0000 | 1 | 0.0000 | 0 | 0.0000 | 0 | 0.0000 |
| Professor | 9 | 7.9160 | 9 | 7.9160 | 9 | 7.9160 | 10 | 8.5000 | 10 | 8.5000 |
| Visiting Professor | 2 | 0.0000 | 1 | 0.0000 | 2 | 0.6250 | 3 | 0.2500 | 0 | 0.0000 |
| Adjunct Professor | 2 | 0.2500 | 2 | 0.2500 | 2 | 0.1250 | 2 | 0.2500 | 2 | 0.2500 |
| Associate Professor | 2 | 2.0000 | 3 | 3.0000 | 3 | 3.0000 | 3 | 3.0000 | 4 | 4.0000 |
| Visiting Associate Professor | _ | - | _ | _ | 1 | 0.1250 | Ö. | 0.0000 | 0 | 0.0000 |
| Adjunct Associate Professor | 1 | 0.1250 | _ | - | 1 | 0.1250 | 2 | 0.2500 | 0 | 0.0000 |
| Assistant Professor | 3 | 3.0000 | 2 | 2.0000 | 3 | 3.0000 | 3 | 3.0000 | 3 | 3.0000 |
| Adjunct Assistant Professor | - | _ | 1 | 0.1250 | 0 | 0.0000 | . 0 | 0.0000 | 0 | 0.0000 |
| Assistant Instructor | 1 | 0.0625 | _ | | 1 | 0.2500 | 0 | 0.0000 | 0 | 0.0000 |
| Senior Lecturer | 2 | 1.0000 | 2 | 1.0000 | 2 | 1.0000 | 3 | 1.3333 | 3 | 1.5833 |
| Lecturer | 1 | 0.5000 | 3 | 1.5000 | 1 | 1.5000 | 1 | 1.0000 | 1 | 0.5000 |
| TOTAL | 24 | 14.8535 | 24 | 16.0410 | 25 | 16.6660 | 27 | 17.5833 | 24 | 17.8333 |

3.0 PEN STAFF 1990-91

3.1 Staff

| Name and Title | Program |
|-----------------------|--|
| Gien Baum | Technical Staff Assistant V |
| Antonio Bermudez | Technical Staff Associate |
| Sharon S. Boni | Executive Assistant |
| Carline Renee Ceasar | Administrative Assistant |
| Sher-Marie Croft | Senior Office Assistant |
| Ellie Decker | Administrative Assistant Energy and Mineral Resources Program |
| Heldl Epp | Administrative Assistant |
| Bobby Ewing | Technical Staff Assistant V |
| Mary Pettengili | Library Assistant III |
| Samiha Korshed Ragab | Senior Administrative Associate |
| Bruce A. Rouse | Research Engineer/Scientist Associate IV |
| Robert Schnelder | Computer Systems Development Specialist |
| Don Sorrell | Senior Procurement Officer |
| John Stott | Technical Staff Assistant IV |
| Jimmy Walker | Technical Staff Assistant IV |
| Catherine A. Williams | Administrative Assistant |

3.2 Staff Awards

Antonio Bermudez

For his 15 years service with The University, Antonio Bermudez received a University Service Award. Tony joined The Petroleum Engineering Department staff in 1979. He designs, builds, and trains students on the use of equipment needed for their research. Prior to coming to The University of Texas at Austin, Tony worked at Precision Instrumentation Company fabricating and designing special meters and heater boxes used on special equipment for various space projects by the government. His career at UT began in the Astronomy Department in the research and prototype shop, where they fabricated special equipment for the McDonald Observatory at Fort Davis, Texas.

Sharon Bonl

Sharon Boni, Executive Assistant for the Department of Petroleum Engineering, received the first Most Helpful Staff Award from UT Student Chapter of the Society of Petroleum Engineers. The last 14 years of Sharon's UT career have been in the Petroleum Enginering Department. Sharon served as Graduate Secretary for the Department for two years. She was then promoted to Administrative Associate and worked for the Texas Petroleum Research Committee for 10 years, providing staff support for Dr. I. H. Silberberg, Associate Director of TPRC. After that, she worked with Drs. Mukul Sharma and Mark Miller, prior to accepting her present position. She received Service Awards from UT for 10 and 15 years service and this year will receive an award for having been with the University 20 years. She was nominated for a College of Engineering Staff Excellence Award last year.

4.0 PETROLEUM ENGINEERING BUILDING

4.1 Teaching and Research Facilities

The space devoted to teaching and research activities in Petroleum Engineering, excluding office space and classrooms, is summarized in the following table. There are several rooms in our building that are available to be endowed. To endow a laboratory, a minimum contribution of \$50,000 is required; for a classroom, the minimum is \$10,000.

| NAME | RM NO | SIZE (FT 2) | USER | ACTIVITY | ENDOWMENT DONOR |
|---|-------|-------------|------------------------|--|--------------------------------------|
| Kerr-McGee Petrophysics Research Laboratory | 1.104 | 1069 | Undergrad | Fluids/Thermo Laboratory | Kerr-McGee |
| # 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1.106 | 702 | Graduate | Logging/Petrophysics Lab. | (unendowed) |
| Eaton Industries Drilling Engineering Laboratory | 1.116 | 702 | Undergrad | Mud Laboratory | B. A. Eaton |
| · · · · · · · · · · · · · · · · · · · | 1.120 | 1069 | Undergrad | Petrophysics Laboratory | (unendowed) |
| Robert N. Miller Drilling Fluids Laboratory | 1.122 | 702 | Undergrad | Mud Laboratory | Robert N. Miller |
| Atlantic Richfield Company Centennial Endowed Automated Production Laboratory | 1.142 | 2190 | Undergrad/ Graduate | Two-Phase Flow, Well Control, Surface Production Systems | ARCO Oil and Gas Co. |
| e e e e e e e e e e e e e e e e e e e | 1.144 | 527 | Graduate | Rock Mechanics | (unendowed) |
| Billings Core Preparation Laboratory | 1.146 | 527 | Undergrad/ Graduate | Core Preparation | Marilyn F. and Thomas J. Billings |

| - | - |
|---|---|
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|--|-------|-------------|------------------------|--|----------------------------|
| NAME | RM NO | SIZE (FT 2) | USER | ACTIVITY | ENDOWMENT DONOR |
| Phillips Petroleum Drilling Fluids Properties Laboratory | 1.150 | 1055 | Graduate | Drilling Fluids Research Laboratory | Phillips Petroleum Co. |
| | 1.158 | 922 | Graduate | NMRI Laboratory | (unendowed) |
| | 1.172 | 500 | Graduate | Electrical Properties of Rocks Research | (unendowed) |
| | 1.176 | 517 | Graduat e | Energy and Mineral Resources Research | (unendowed) |
| | 1.180 | 500 | Graduate | Logging/Petrophysics Lab. | (unendowed) |
| R. C. Baker Foundation Seminar Room | 2.202 | 861 | Graduate | Classroom | R. C. Baker Foundation |
| Sylvain J. Pirson Classroom | 2.204 | 1537 | Undergrad/ Graduate | Classroom | William M. Evans |
| Sohio Petroleum Company Classroom | 2.206 | 1298 | Undergrad/ Graduate | Classroom | Sohio Petroleum Company |
| Ben H. Caudle Classroom | 2.208 | 1519 | Undergrad/ Graduate | Classroom | William M. Evans |
| | 2.210 | 1298 | Undergrad/ Graduate | Classroom | (unendowed) |
| W. P. (Pat) Biggs Classroom | 2.212 | 1298 | Undergrad/ Graduate | Classroom | Various Friends and Alumni |
| Folkert N. Brons Conf. Rm. | 2.236 | 998 | PEN Department | Conference Room | Various Friends and Alumni |
| | 3.110 | 518 | Graduate | Enhanced Oil Recovery Research | (unendowed) |
| *************************************** | 3.116 | 518 | Graduate | Enhanced Oil Recovery Research | (unendowed) |

| ENDOWMENT | RM NO | SIZE (FT 2) | USER | ACTIVITY | ENDOWMENT DONOR |
|---|-------|-------------|------------------------|------------------------------------|----------------------------|
| | 3.122 | 518 | Graduate | Petrophysics Research | (unendowed) |
| | 3.128 | 448 | Graduate | Flow Visualization Research | (unendowed) |
| N | 3.132 | 424 | Graduate | Numerical Simulation | (unendowed) |
| Dresser Atlas Well Logging Laboratory | 3.136 | 1069 | Graduate | Well Logging, Database Research | The Dresser Foundation |
| | 3.146 | 509 | Undergrad | Microcomputer Laboratory | (unendowed) |
| Herman J. Wetegrove Graduate Computation Laboratory | 3.148 | 413 | Graduate | Computer Terminal Room | Friends at Texas Oil & Gas |
| | 3.150 | 605 | Graduate | Computer Room | (unendowed) |
| Alumni Room Endowment | 3.158 | 1406 | Undergrad/ Graduate | Reading Room | Various Alumni |
| Frederick Byron Plummer Tutorial Room | 3.159 | 448 | Graduate | Computer Graphics Laboratory | Mrs. John E. Elliott |
| George H. Fancher Study Hall | 3.172 | 1406 | Undergrad | Study Hall | George H. Fancher, Jr. |
| | 4.106 | 518 | Graduate | Isotope Analytical Laboratory | (unendowed) |
| Chromatography Lab | 4.110 | 518 | Graduate | Chromatography Laboratory | (unendowed) |
| | 4.116 | 518 | Graduate | CT Scanner | (unendowed) |
| Tenneco Oil Advanced Petrophysics Laboratory | 4.136 | 513 | Graduate | Special Core Analysis | Tenneco Oil Company |

| • | • | |
|---|---|--|

| ENDOWMENT | RM No | SIZE (FT 2) | USER | ACTIVITY | ENDOWMENT DONOR | | |
|---|---------|-------------|----------|--|--------------------------------------|--|--|
| Sun Exploration and Production Company | 4.138 | 527 | Graduate | Petrophysics Research | Sun Exploration Productio Company | | |
| Advanced Petrophysics Laboratory | | | | en e | | | |
| · · · · · · · · · · · · · · · · · · · | _ 4.142 | 750 | Graduate | Enhanced Oil Recovery Research | (unendowed) | | |
| | 4.144 | 509 | Graduate | Enhanced Oil Recovery Research | (unendowed) | | |
| | _ 4.146 | 509 | Graduate | Formation Damage Research | (unendowed) | | |
| | _ 4.148 | 1045 | Graduate | Thermal Recovery Research | (unendowed) | | |
| | _ 4.164 | 518 | Graduate | Formation Damage Research | (unendowed) | | |
| Marathon Oil Company Enhanced Oil Recovery Laboratory | 4.166 | 518 | Graduate | Enhanced Oil Recovery Research | Marathon Oil Company | | |
| | _ 4.172 | 518 | Graduate | Energy and Mineral Resources Research | (unendowed) | | |
| Conoco North American Production Enhanced Oil Recovery Laboratory | 4.180 | 518 | Graduate | Enhanced Oil Recovery Research | Conoco, Inc. | | |
| | 5.102 | 172 | Graduate | Well Log Analysis Workstation | (unendowed) | | |
| | 5.106 | 517 | Graduate | PVT Laboratory | (unendowed) | | |
| | _ 5.110 | 528 | Graduate | Matrix Acidizing/Acid Fracturing Research | (unendowed) | | |
| Y | _ 5.128 | 450 | Graduate | Enhanced Oil Recovery Research | (unendowed) | | |

| 7 | ٢ | ì |
|---|---|---|
| | ĸ | , |
| | 1 | 3 |

| NDOWMENT | RM NO | SIZE (FT 2) | USER | ACTIVITY | ENDOWMENT DONO |
|---------------------------------------|---------|-------------|----------|--|----------------|
| · · · · · · · · · · · · · · · · · · · | 5.132 | 414 | Graduate | Formation Damage/ Petrophysics Research | (unendowed) |
| | 5.136 | 528 | Graduate | Ultrasonics Research | (unendowed) |
| | 5.138 | 531 | Graduate | Drilling Fluids Research | (unendowed) |
| | 5.142 | 378 | Graduate | Production Logging Research | (unendowed) |
| | 5.143 | 368 | Graduate | Production Logging Research | (unendowed) |
| · · · · · · · · · · · · · · · · · · · | 5.144 | 505 | Graduate | Reservoir Characterization Research | (unendowed) |
| · . | 5.146 | 1032 | Graduate | Reservoir Characterization Research | (unendowed) |
| | 5.150 | 511 | Graduate | Spectroscopy Laboratory | (unendowed) |
| | 5.164 | 524 | Graduate | Foam Research | (unendowed) |
| | _ 5.166 | 512 | Graduate | CO ₂ /Miscible Flooding Research | (unendowed) |
| | 5.172 | 535 | Graduate | Geochemical Modeling Research | (unendowed) |
| | 5.180 | 518 | Graduate | Rheology Laboratory | (unendowed) |

4.2 Nuclear Magnetic Resonance Imaging System for Oil Recovery Research

In May 1991, the Petroleum Engineering Department took delivery of its nuclear magnetic resonance imaging system (NMRI) for use in petroleum engineering research. The system is a 2 Tesla, 85 MHz (proton frequency) unit with a 31 cm horizontal-bore superconducting magnet. The unit, designated as the SIS 85/310 Imaging System, was purchased with a \$650,000 equipment grant from the W.M. Keck Foundation of California. The College of Engineering provided a matching grant of \$280,000 to create a new NMRI laboratory in the department, to maintain equipment in the laboratory, and to hire support personnel to operate the new laboratory. We conducted a national search for an NMR Imaging specialist to supervise the new laboratory. With the establishment of the new NMRI laboratory in addition to the existing X-ray computed tomography (CT) and scanning electron microscope (SEM) laboratories, the department now has one of the best-equipped core-imaging research facilities in the nation.

Plans are underway to establish a multi disciplinary imaging research program within the Center for Petroleum and Geosystems Engineering that will involve the participation of other UT departments, NMR equipment manufacturers, oil companies, service companies and governmental agencies. The imaging research program will be structured like the other research programs in CPGE whereby sponsors pay an annual fee to support various research activities in exchange for annual research reports and presentations. A research proposal is currently being prepared and will be submitted to potential sponsors in 1992.

5.0 TEACHING

5.1 Undergraduate Studies

CATALOG REQUIREMENTS DEPARTMENT OF PETROLEUM ENGINEERING 1990 - 92

FIRST YEAR

| FALL SEMESTER | | SPRING SEMESTER | |
|---|-----------------------------|---|-----------------------------|
| E 306 (Rhetoric and Composition) PHY 303K (Engineering Physics I) PHY 103 M (Laboratory for 303K) M 408C (Calculus I) CH 301(Principles of Chemistry I) PEN 102 (Intro. to Petroleum Engineering) Total Semester Hours | 3 1 4 3 1 15 | Approved Social Sciences Elective PHY 303L (Engineering Physics II) PHY 103N (Laboratory for 303L) M 408D (Calculus II) CH 302 (Principles of Chemistry II) EM 306S (Statics and Dynamics) Total Semester Hours | 3 1 4 3 3 17 |
| SE | COND | YEAR | |
| FALL SEMESTER | | SPRING SEMESTER | |
| E 316K (Masterworks of Literature) CE 354 (Elementary Mechanics of Fluids) EM 319 (Mechanics of Solids) 427K (Advanced Calculus for Applications I) GEO 312K (Geology of Engineering) Total Semester Hours | 3 3 4 3 16 | Approved Fine Arts/Humanities Elective PEN 310 (Formulation and Solution of Geosystems Engineering Problems) PEN 312 (Physical and Chemical Behavior of Petroleum Fluids I) M 340L (Matrices and Matrix Calculus) GEO 416M (Depositional Processes) Total Semester Hours | 3 3 3 4 16 |
| Т | HIRD Y | EAR . | |
| FALL SEMESTER | | SPRING SEMESTER | |
| American History American Government PEN 322K (Transport Phenomena) PEN 323 (Fluid Flow in Porous Media) PEN 326 (Thermodynamics and Phase Behavior of Petroleum Fluids) GEO 368N (Application of Geology to Energy Research) | 3 3 3 3 3 | PEN 424 (Petrophysics) PEN 421K (Physical and Chemical Behavior of Petroleum Fluids II) PEN 333T (Technical Communications) PEN 365 (Petroleum Economics and Valuation) GEO 428 (Structural Geology) | 4 3 3 4 |
| Total Semester Hours | 18 | Total Semester Hours | 18 |
| FC | URTH | YEAR | |
| FALL SEMESTER | | SPRING SEMESTER | |
| PEN 430 (Drilling and Well Completions) PEN 331 (Fund. of Reservoir Engineering) PEN 362 (Production Technology & Design) PEN 368 (Fundamentals of Well Logging) PEN 373K ((Geosystem Engineering Design & Analysis I) Total Semester Hours | 4 3 3 3 16 | PEN 373L (Geosystem Engineering Design and Anlysis II) American Government American History Approved Technical Area Electives Total Semester Hours | 3 3 6 15 |
| | | | |

5.2 Undergraduate Enrollment

Dr. Augusto L. Podio, Undergraduate Advisor

The decline in undergraduate enrollment appears to have been checked, resulting in an increase of 24 students to a total of 146. This is probably the result of the efforts to attract students through the scholarship program, mailouts to high schools and participation of alumni in various career counseling activities.

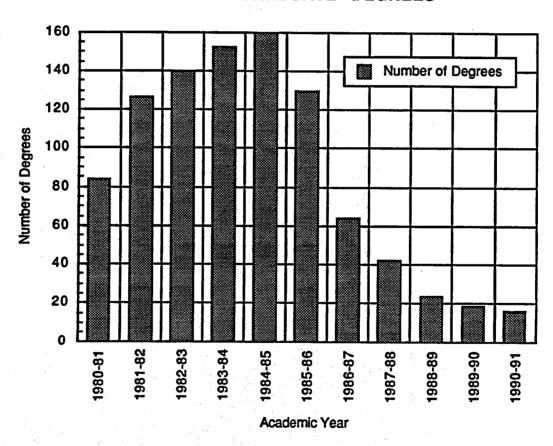
For the year, a total of 16 students received BS degrees. Given this small number of graduates and the steady demand from industry, there were no problems in finding permanent employment.

It is the consensus of the Undergraduate Studies Committee that the present level of recruiting activities should be continued.

5.3 Undergraduate Degree Recipients*

| DEGREE | 80- | 81- | 82- | 83- | 84- | 85- | 86- | 87- | 88- | 89- | 90- |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| B.S. | 84 | 126 | 140 | 152 | 160 | 130 | 64 | 42 | 24 | 19 | 16 |

UNDERGRADUATE DEGREES



*Source: Statistical Handbook, The University of Texas at Austin

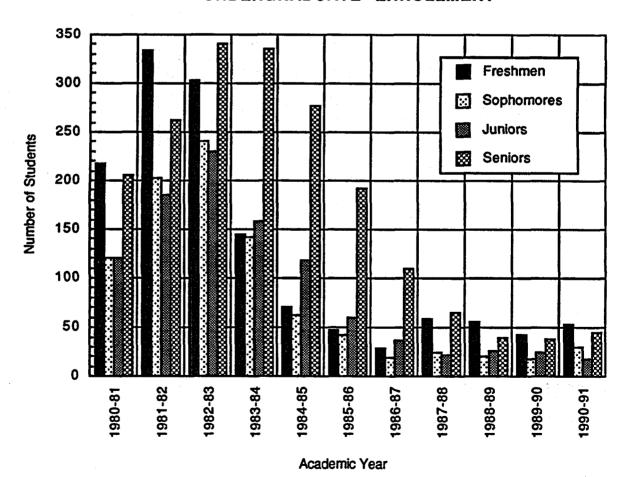
5.4 Undergraduate Student Enrollment*

Fall Semester

| STUDENTS | 80- 81 | 81- 82 | 82- 83 | 83- 84 | 84- 85 | 85- 86 | 86- 87 | 87- 88 | 88- 89 | 89- 90 | 90- 91 |
|------------|-------------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|-----------|
| Freshmen | 217 | 333 | 303 | 144 | 71 | 48 | 29 | 58 | 55 | 42 | 53 |
| Sophomores | 121 | 203 | 240 | 142 | 63 | 42 | 19 | 24 | 20 | 18 | 30 |
| Juniors | 120 | 185 | 229 | 158 | 118 | 59 | 37 | 22 | 26 | 24 | 18 |
| Seniors | 206 | 262 | 340 | 335 | 277 | 192 | 109 | 65 | 40 | 38 | 45 |
| | | | | | | | | · | | | |

TOTAL 664 983 1112 779 529 341 194 169 141 122 146

UNDERGRADUATE ENROLLMENT



*Source: Statistical Handbook, The University of Texas at Austin

5.5 Enrollment in Undergraduate Courses - Fall 1990

Required Petroleum Engineering Courses: 52 Introduction to Petroleum Engineering Reis **PEN 102** Transport Phenom. in Geosystems Rossen 22 **PEN 322K PEN 323** Fluid Flow in Porous Media Caudle 23 **PEN 326** Thermodynamics and Phase Behavior of Petroleum Fluids Hill 20 * PEN 333T **Technical Communications** Hurley 13 Production Technology and Design Podio 23 PEN 362 Petroleum Economics and Valuation van Rensburg 15 **PEN 365** Dorfman Fundamentals of Well Logging 30 **PEN 368 Podio** 16 **PEN 373** Geosyst. Eng. Design and Anlysis I 214 **Total Number of Students** 23.78 Average per class Elective Petroleum Engineering Courses: Petroleum Exploration and Production Hocott 34 **PEN 320 PEN 363** Gardner Land Leasing, Royalty, Conservation 14 48 **Total Number of Students** 24 Average per class

5.6 Enrollment in Undergraduate Courses - Spring 1991

Required Petroleum Engineering Courses:

Quantitative Well Log Analysis

PEN 369

Average per class

Total Number of Students

| PE PE PE | N 310 N 312 N 333T N 421K N 424 N 373L N 367K N 365 | Formulation/Solution Geosystems Eng. Problems Physical/Chemical Behavior of Petroleum Fluids I Technical Communication Physical/Chemical Behavior of Petroleum Fluids II Petrophysics Geosystem Engineering Design and Anlysis II Surface Production Systems Petroleum Economics and Valuation | Reis Peters Hurley Schechter Sharma Miller Podio van Rensburg | 20 27 21 24 25 20 8 30 |
|----------|--|--|---|---|
| Tot | al Number | of Students | | 175 |
| Ave | erage per ci | ass | | 21.88 |
| Electi | ve Petro | leum Engineering Courses: | | |
| | N 320 N 361 | Petroleum Exploration and Production Advanced Reservoir Engineering | Podio Caudle | 29 8 |

Morriss

11

48

16

5.7 Enrollment in Undergraduate Courses - Summer 1991

PEN 333T Technical Communication Hurley 32

5.8 Undergraduate Scholarships

Dr. John C. Reis, Coordinator

Our objective is to attract and retain the best undergraduate students in Petroleum Engineering by recognizing their academic accomplishments through scholarships.

In 1990-91, the department awarded a total of \$178,375 in scholarships. There were 155 scholarships offered to 137 students with an average award of \$1,302 per student. Some students received more than one scholarship. The list of scholarships granted in our program is provided on the following pages. Largely as a result of this program, we had an entering freshman class of 53 students with an average SAT score of 1130.

We intend to continue to actively recruit and retain top students through our scholarship program in the coming years.

5.9 Scholarship Funding and Grants for 1990-91

| SOURCE OF FUNDING | SCHOLARSHIP GRANTS | GRANTED |
|--|-----------------------|----------|
| Alex Massad Presidential Scholarship | 1 | \$ 2,000 |
| American Petroleum Institute-Houston | 2 | 2,000 |
| Amoco Production Foundation | 1 | 1,500 |
| Amoco Production Foundation (EOE)* | 1 | 1,500 |
| ARCO Oil Company (EOE)* | 1 | 1,000 |
| BP Exploration | 5 | 10,000 |
| Chevron U.S.A. | 4 | 5,000 |
| College of Engineering (EOE)* | 3 | 7,950 |
| Ernest, Jr., and Virginia Cockrell Jr Freshmen | 13 | 17,750 |
| Ernest, Jr., and Virginia Cockrell Jr General | 2 | 2,100 |
| Exxon National Minority Scholarship | 1 | 6,000 |
| Friends of Alec Foundation | 2 | 2,500 |
| Harry Trueblood Foundation in PE | 5 | 5,950 |
| Leah Moncure Scholarship | 1 | 2,200 |
| Louis C. Wagner Scholarship | 1 | 1,000 |
| Malcolm Abel Centennial Endowed in PE | 4 | 4,000 |
| Marathon Oil | 2 | 2,000 |
| Marathon Oil (EOE) | 2 | 2,000 |
| Mobil Oil Corporation (EOE) | 4 | 4,000 |
| National Action Committee for Minorities in Engineering | 3 | 1,500 |
| National Merit Scholarships | 1 | 750 |
| Oryx Energy Company | 3 | 3,000 |
| Pennzoil Exploration | 1 | 1,875 |
| PEN Department Scholarship Account | 59 | 53,750 |
| Petroleum Eng. Wives Club of Dallas | 1 | 500 |
| Phillips Petroleum Company | 3 | 2,500 |
| R. C. Baker Foundation | 5 | 6,000 |
| Shell Oil Company (EOE) | 2 | 6,450 |
| Society of Petroleum Engineers - Balcones Sec | tion 3 | 2,000 |
| Society of Petroleum Engineers - Dallas | 1 | 600 |
| Society of Petroleum Engineers - Gus Archie Sc | holar. 1 | 3,000 |
| Society of Petroleum Engineers - Permian Basin | 1 | 1,000 |
| Society of Petroleum Engineers - West Central T | exas 1 | 500 |

| SOURCE OF FUNDING | SCHOLARSHIP Grants | GRANTED |
|---|-----------------------|------------|
| Society of Professional Well Log Analysts | 2 | \$ 2,000 |
| Texas Ex-Students Association Scholarship | 1 | 500 |
| Texas Oil and Gas | 1 | 1,000 |
| Union Pacific Resources | 3 | 3,000 |
| Unocal | 4 | 3,500 |
| UT-Wide Presidential Scholarship | 1 | 2,000 |
| W. C. Melnar | 3 | 2,500 |
| TOTAL AWARDS | 155 | \$ 178,375 |
| Average Scholarship | | \$ 1,150 |
| TOTAL STUDENTS | 137 | |
| Average Award Per Student | | \$ 1,302 |

*EOE Equal Opportunity in Engineering

5.10 Graduate Enrollment

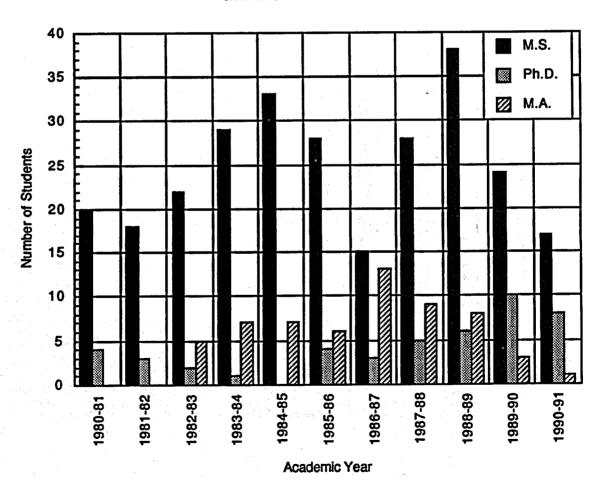
Dr. A. Daniel Hill, Graduate Advisor

In the 1990-91 academic year, there were 72 Petroleum Engineering MS students, 60 Petroleum Engineering PhD students, and 24 Energy and Mineral Resources Program MA students for a total of 156 students in our graduate program. Students from 24 countries were represented, with 39 percent of these students being from the United States. The biggest change from the past several years was the increase in the number of PhD. students. The Energy and Mineral Resources Program represented 15 percent of our total graduate enrollment in the department.

5.11 Graduate Degree Recipients*

| DEGREE | 80- 81 | 81- 82 | 82- 83 | 83- 84 | 84- 85 | 85- 86 | 86- 87 | 87- 88 | 88- 89 | 89- 90 | 90- 91 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| PEN MS | 20 | 18 | 22 | 29 | 33 | 28 | 15 | 28 | 38 | 24 | 17 |
| PhD | 4 | 3 | 2 | . 1 | 0 | 4 | 3 | 5 | 6 | 10 | 8 |
| EMR MA | - | • | 5 | 7 | 7 | 6 | 13 | 9 | 8 | 3 | 1 |
| TOTAL | 2 4 | 21 | 29 | 37 | 40 | 38 | 3 1 | 47 | 5 2 | 37 | 26 |

GRADUATE DEGREES

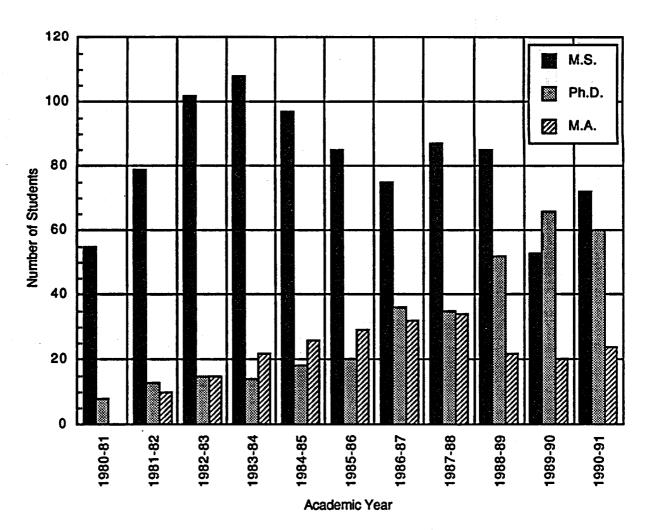


*Source: Statistical Handbook, The University of Texas at Austin

5.12 Graduate Student Enrollment*

| STUDENTS | 80- 81 | 81- 82 | 82- 83 | 83- 84 | 84- 85 | | 86- 87 | 87- 88 | 88- 89 | 89- 90 | 90- 91 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----|-----------|-----------|-----------|-----------|-----------|
| PEN MS | 55 | 79 | 102 | 108 | 97 | 85 | 75 | 87 | 85 | 53 | 72 |
| PhD | 8 | 13 | 15 | 14 | 18 | 20 | 36 | | 52 | 66 | 60 |
| EMR MA | • | 10 | 15 | 22 | 26 | 29 | 32 | 34 | 22 | 20 | 24 |
| TOTAL | 73 | 102 | 132 | 144 | 141 | 134 | 145 | 156 | 159 | 139 | 156 |

GRADUATE STUDENT ENROLLEMENT



^{*}Source: Statistical Handbook, The University of Texas at Austin

5.13 Enrollment in Graduate Courses - Fall 1990

| PEN PEN PEN PEN PEN PEN PEN PEN | 382K 382L 383 383 383 383 383 383 | Theory and Application of Reservoir Transients Numerical Methods in PEN Advanced Petrophysics - Remote Teaching Advanced Petrophysics Natural Gas Reservoir Engr Drilling in Abnormal Pressure Line Source and Sink Solutions Naturally Fractured Reservoirs Production Logging | Peters Sepehrnoori Miller Miller Rowland Chenevert Caudle Reis Morriss | 6 28 20 23 19 10 7 6 |
|--|--|---|--|---|
| PEN PEN PEN | 386K 387K 393 | Advanced Fluid Flow in Porous Media Fundamentals of Enhanced Oil Recovery I Research Seminar | Sharma Lake Rossen | 9 13 65 |
| | | r of Students | 11055611 | 223 |
| Average per class | | | | 18.58 |

5.14 Enrollment in Graduate Courses - Spring 1991

| EMR | 396 | Seminar in Energy/Mineral Resources | van Rensburg | 10 |
|-------------------|----------|--|--------------|------------|
| EMR | 396 | Seminar in Energy/Mineral Resources, Economics of Mineral Energy | van Rensburg | 7 |
| PEN | 381K | Engineering Analysis - Remote Teaching | Sepehrnoori | 18 |
| PEN | 381K | Engineering Analysis | Sepehrnoori | 45 |
| PEN | 382K | Theory and Application of Reservoir Transients - | • | |
| | | Remote Teaching | Rowland | 10 |
| PEN | 383 | Advanced Drilling Fluids | Chenevert | -5 |
| PEN | 383 | Advanced Well Treatment Design | Hill | 12 |
| PEN | 383 | Geostatistics | Lake | 13 |
| PEN | 383 | Inclined and Horizontal Wells II | Gray | 13 |
| PEN | 383 | Oilfield Corrosion - Remote Teaching | Ehdaie | 9 |
| PEN | 383 | Transport Processes in PEN | Rossen | 19 |
| PEN | 385M | Advanced Well Logging and Correlations | Dorfman | 13 |
| PEN | 387 | Second Recovery of Petroleum | Caudle | 1 <u>5</u> |
| PEN | 392K | Numerical Simulation of Reservoirs I | Pope | _7 |
| PEN | 393 | Research Seminar | Rossen | 58 |
| PEN | 393 | Research Seminar | Pope | 5 |
| Tota | l Number | of Students | | 259 |
| Average per class | | | | |

5.15 Enrollment in Graduate Courses - Summer 1991

| PEN | f383 | Transport of Dispersed Phases: Foams/Dispersions/Emulsions | Rossen | 6 |
|-----|-----------|--|---------|-------|
| PEN | s383 | Acoustics in Porous Media | Morriss | 10 |
| PEN | s383 | Offshore Drilling Operations | Podio | 16 |
| PEN | n383 | Thermal Recovery | Miller | 9 |
| Tot | al Numbe | er of Students | | 41 |
| Ave | erage per | class | | 10.25 |

5.16 Named Fellowship Recipients 1990-91

| NAMED FELLOWSHIP | RECIPIENT | AMOUNT |
|--|----------------------|-----------|
| Alex H. Massad (EPGS) | Christopher Phillips | \$ 2,000 |
| Amoco Foundation Doctoral Grant | Christopher Phillips | 13,131 |
| Amoco Foundation Masters Grant | Kenneth Kibodeaux | 6,000 |
| Engineering Foundation Masters | Thomas Maher | 6,000 |
| Engineering Foundation Doctoral | Max Roper | 2,000 |
| Link Foundation | Dieter Beike | 16,000 |
| Phillips Graduate Fellowship | Kenneth Brantferger | 9,000 |
| R.C. Baker Foundation | Tony Chien | 3,000 |
| R.C. Baker Foundation | Kun Sang Lee | 3,000 |
| Shell Graduate Grant | _• | 10,000 |
| Society of Professional Well Log Analysts | Alexander Fuhrmann | 1,000 |
| Total | | \$ 71,131 |
| 22 fellowships were granted through | \$ 27,826 | |
| TOTAL FELLOWSHIP GRA | \$ 98,957 | |

^{*}Used for tuition payment

5.17 Countries Represented in PEN and EMR Graduate
Programs 1990-91

| Country | MA Students | MS Students | PhD Students | Total |
|---------------|-------------|-------------|--------------|-------|
| ALGERIA | - | - | .1 | 1 |
| BRAZIL | • | - | 3 | 3 |
| BULGARIA | 1* | - | • | 1 |
| CAMEROON | • | - | 1 | 1 |
| CHINA | • | 4 | 16 | 20 |
| COLOMBIA | • | 2 | - | 2 |
| ENGLAND | 1 | - | - | 1 |
| INDIA | 1* | 16 | 10 | 27 |
| INDONESIA | - | 6 | • | 6 |
| JAPAN | • | 3 | - | 3 |
| JORDAN | 1* | | • | 1 |
| KOREA | - | • | 3 | 3 |
| MALAYSIA | • | 1 | • | 1 |
| MEXICO | 1* | 1 | - | 2 |
| NIGERIA | 1 | - | 1* | 2 |
| PAKISTAN | - | 2 | 3 | 5 |
| TAIWAN | - | - | 2 | 2 |
| THAILAND | - | - | 1 | 1 |
| TUNISIA | • . | 1 | 3 | 4 |
| TURKEY | • | 4 | 4* | 8 |
| UNITED STATES | 18 | 31 | 12 | 61 |
| VENEZUELA | • | 1 | • | 1 |
| TOTAL | 2 4 | 7 2 | 60 | 156 |

^{*}Students with U.S. permanent resident status

5.18 PEN Faculty Supervision of Completed MS, PhD, and MA Degrees

| Faculty | 85-86 | 86-87 | 87-88 | 88-89 | 89-90 | 90-91 |
|--------------|-------|-------|-------|-------|----------|-------|
| Caudle | 2 | 0 | 3 | 3.5 | 4 | 1.5 |
| Chenevert | | 1 | 1 | 0 | 0 | 2 |
| Dorfman | 2 | 1 | 3 | 2.5 | 1 | 0 |
| Gray | 0 | 0 | 3 | 4 | 1 | 2 |
| Hill | 3 | 3 | 3 | 4.5 | 3 | 2 |
| Lake | 7 | 0 | 4 | 5 | 4 | 1.5 |
| Miller | 4 | 1 | 2 | 5 | 4.5 | 2 |
| Morriss | - | - | - | - | • | 0 |
| Peters | 3 | 1 | 1 | 3 | 1.5 | 1 |
| Podio | 4 | 2 | 1 | 0.5 | 4 | 0 |
| Pope | 3 | 3 | 2 | 3 | 4 | 1.5 |
| Reis | • | • | • | • | 0 | 3.5 |
| Rossen | • | • | - | • | 0 | 0 |
| Schechter | 2 | 0 | 1 | - | 3 | 0.5 |
| Sepehrnoori | 7 | 5 | 6 | 6.5 | 5.5 | 1.5 |
| Sharma | 0 | 3 | 8 | 3 | 1 | 2.5 |
| van Rensburg | 5 | 16 | 9 | 3 | 0 | 1 |

5.19 Graduate Admissions Committee

Dr. Mark A. Miller, Chairman

Drs. A. Daniel Hill and Kamy Sepehrnoori

Decisions on admission of graduate students to the department's MS and PhD programs are the primary responsibility of the Graduate Admissions Committee. Of current concern to the committee are recruiting more U.S. citizens into our graduate programs and diversification of international students.

Tables 1 and 2 show the results of recruiting for the 1990-91 year. Both the number of students applying and the percentage of students accepting offers to attend UT Austin have increased — both excellent signs of the efficacy of our recruiting effort. As a result we have been able to steadily increase the quality of our graduate students over the last few years.

Table 1 — 1990-91 Graduate Student Applications, Admissions, and Enrollment

| | | U.S. | | | |
|-----------------|--------|--------|-------|--------|-------|
| | Austin | Remote | Total | Int'l. | TOTAL |
| Applied | 21 | 25 | 46 | 89 | 135 |
| Admitted | 14 | 20 | 34 | 49 | 83 |
| Enrolled PhD | 1 | 0 | 1 | 6 | 7 |
| MS | 6 | 19 | 25 | 25 | 50 |
| | 7 | 19 | 26 | 31 | 57 |

Austin = students in residence at Austin

Remote = students in Permian Basin remote program

Table 2 — Quality of 1990-91 Admitted and Enrolled Graduate Students

| | U.S. | | | | |
|-------------------|--------|-------------|-------|--------|---------|
| | Austin | Remote | Total | Int'i. | TOTAL |
| <u>Admitted</u> : | | | | | — — — — |
| GPA | 3.51 | 3.25 | 3.36 | 3.44 | 3.41 |
| GRE-Q | 667 | 674 | 671 | 707 | 693 |
| GRE-V | 619 | 536 | 570 | 429 | 484 |
| GRE-T | 1286 | 1210 | 1241 | 1136 | 1177 |
| Enrolled: | | | | | |
| GPA | 3.04 | 3.23 | 3.18 | 3.51 | 3.36 |
| GRE-Q | 682 | 681 | 681 | 726 | 707 |
| GRE-V | 630 | 533 | 559 | 449 | 495 |
| GRE-T | 1312 | 1214 | 1240 | 1175 | 1202 |

GPA = grade point average (4-point scale)

GRE-Q = quantitative Graduate Record Examination score

GRE-V = verbal Graduate Record Examination score

GRE-T = quantitative+verbal Graduate Record Examination score

Activities during 1990-91 focused primarily on increased recruiting. A new graduate brochure was printed and a videotape was produced to send to prospective graduate students. We also set up an exhibitor's booth at the Society of Petroleum Engineers Annual Fall Meeting in Dallas to contact potential graduate students. We continued to advertise our graduate program in the Journal of Petroleum Technology and the Oil and Gas Journal as another method of contacting potential students.

A decision was made this year to reduce slightly the number of students in the program. Our goal will be 60 PhD students, 30 MS students doing the thesis option, approximately 10 (or more) students doing the no thesis/no report option, plus whatever students we can attract to the remote program in the Permian Basin. Admission priorities will be: 1) U.S. students, 2) international students with external support, and 3) international students supported by UT. Because our numbers are currently above these goals, recruiting for the coming year will focus heavily on U.S. citizens and high-quality international students.

5.20 Graduate Studies Committee

Dr. Kamy Sepehrnoori, Chairman

Drs. A. Daniel A. Hill, Mark A. Miller, and Willem C. J. van Rensburg

The Graduate Studies Committee (GSC) of the Petroleum Engineering Department is responsible for administering and supervising the graduate program within the department. Dr. Hill is the graduate advisor, and Dr. Miller is in charge of graduate admissions.

Seventeen students took the Ph.D. qualifying examination given in the summer of 1991. Eleven students passed all portions of the examination, three failed unconditionally, and three failed one or two portions. The Ph.D. qualifying examination consists of three parts: Mathematics, Petrophysics, and Transport Processes. A brief description of the examinations is given below.

5.20.1 Ph.D. Qualifying Examination Procedure

<u>Mathematics</u> — This examination is based on required undergraduate mathematics courses taught at The University of Texas for Petroleum Engineering students and topics covered in PEN 381K (Engineering Analysis).

<u>Petrophysics</u> — This examination is based on material from PEN 383: Advanced Petrophysics plus the required undergraduate petrophysics course in the Department of Petroleum Engineering at The University of Texas.

<u>Transport Processes</u> — This examination is based on material covered in PEN 383:

Transport Processes in PEN taught in the Department of Petroleum Engineering at The University of Texas.

5.20.2 Options for MS Degree

Option 1: 30 semester credit hours

- 1. Two courses from Module I
- 2. Total of four courses from Modules II, III, and IV with minimum of one course from each Module
- 3. Two courses from Module V
- 4. Thesis

Option 2: 33 semester credit hours

- 1. Two courses from Module I
- 2. One course from Module II
- 3. Two courses each from Modules III, IV, and V
- 4. One additional course from either Module II, III, IV, or V
- 5. Design course

Option 3: 33 semester credit hours

- 1. Two courses from Module I
- 2. One course from Module II
- 3. Two courses each from Modules III, IV, and V
- 4. One additional course from either Module II, III, IV, or V
- 5. Report (Ph.D. research proposal)

Coursework:

Module I: Basic Courses

PEN 381K Engineering Analysis
PEN 383 Advanced Petrophysics

Module II: Numerical/Simulation/Economics Courses

| PEN 382L | Numerical Methods in Petroleum Engineering |
|-----------------|---|
| PEN 383 | Numerical Solution of Time-Dependent Problems |
| PEN 383 | Economics of Mineral Engineering |
| PEN 389 | Economic Analysis in the Petroleum Industry |
| PEN 392K | Numerical Simulation of Reservoirs I |
| PEN 392L | Numerical Simulation of Reservoirs II |

Module III: Reservoir Engineering/Enhanced Oil Recovery Courses

| PEN 382K | Theory and Application of Reservoir Transients |
|----------|--|
| PEN 383 | Line Source and Sink Solutions |
| PEN 383 | Thermal Oil Recovery |
| PEN 383 | Geochemistry of Flow Processes |
| PEN 383 | Geostatistics |
| PEN 384 | Volumetric and Phase Relationships of Oil and Gas Mixtures |
| PEN 386K | Advanced Fluid Flow in Porous Media |
| PEN 387 | Secondary Recovery of Petroleum |
| PEN 387K | Fundamentals of Enhanced Oil Recovery I |
| PEN 387L | Fundamentals of Enhanced Oil Recovery II |

Module IV: Drilling/Logging/Production Courses

| PEN | 383 | Mechanics of Modern Drilling |
|-----|------|---|
| PEN | 383 | Two-Phase Flow in Pipes |
| PEN | 383 | Advanced Drilling Fluids |
| PEN | 383 | Production Logging |
| PEN | 383 | Advanced Well Treatment Design |
| PEN | 383 | Drilling Operations in Abnormal Pressure |
| PEN | 383 | Near Wellbore Production Problems |
| PEN | 385M | Advanced Well Logging and Correlation |
| PEN | 388K | Production Processes |
| PEN | 388L | Well Completions and Stimulation |
| PEN | 395 | Rock Mechanics I |
| PEN | 396 | Rock Mechanics II |
| | | |

Module V: Outside Courses

EMR 383 Extractive Metallurgy EMR 383 Mining Methods

Other Approved Courses in Science and Engineering

5.20.3 Remote Masters Program at UT Permian Basin

In the fall of 1990 The University of Texas at Austin began offering a remote Master of Science degree program in petroleum engineering in the Midland-Odessa area, in cooperation with The University of Texas at the Permian Basin. This program was established because of the need for a graduate petroleum engineering program in the Permian Basin. To accommodate students with full-time employment, courses are offered in the evenings at The University of Texas Center for Energy and Economic Diversification near the Midland-Odessa airport.

Students in the remote program satisfy the same admissions and degree requirements as those in residence at UT Austin. Degrees are awarded from UT Austin. In addition to the UT Austin petroleum engineering faculty, faculty from UT Permian Basin also participate in teaching graduate courses. For students who elect to take at least two courses per semester, the program can be completed in under two and a half years.

Students wishing to pursue a PhD from UT Austin may also use the remote program to satisfy a large portion of their course requirements. A graduate internship program is available from UT Austin whereby PhD research may be conducted while on the job.

Course Offerings at the Remote Teaching Program

Fall 1990

Advanced Petrophysics

Dr. Mark Miller UT Austin

Natural Gas Reservoir Engineering

Dr. David Rowland UT Permian Basin

- Spring 1991

Engineering Analysis

Dr. Kamy Sepehrnoori

UT Austin

Theory and Application of Reservoir Transients

Dr. David Rowland UT Permian Basin

Oilfield Corrosion

Dr. Seyf-Ollah Ehdaie UT Permian Basin

5.21 New Graduate Courses

Olifield Corrosion

PEN 383

Dr. Seyf-Ollah Ehdale

discussed in this course are: the nature and types of corrosion and how different materials react to it are; the driving force for corrosion; polarization and electrode potential, paourbiax diagram; the concept of ionic activity and transport phenomena; and metallurgical aspects and control of corrosion with emphasis on corrosion control in the oil industry.

Acoustics in Porous Media

PEN 383

Steven L. Morriss

This is a survey course, touching on several topics. The objective is to provide the student who has little or no background in acoustics or electromagnetics with an overview of these fields of study, emphasizing applications in the characterization of porous rock.

Applications in both well logging and petrophysical research motivate the content. The course

should provide the student with a sufficient understanding so as to be able to pursue the subject in the literature and through further coursework. An outline for the six weeks is as follows:

- I. Acoustics of Fluids
- II. Acoustics of Elastic and Viscoelastic Solids
- III. Acoustics of Porous Solids
- IV. Acoustical Reflectivity at a Plane Interface
- V. Electromagnetic Theory
- VI. Electromagnetic Waves in Porous Solids

5.22 Energy and Mineral Resources (EMR) Graduate Studies Committee

Dr. Willem C. J. van Rensburg, Chairman

Drs. Martin L. Baughman, Electrical and Computer Engineering Department; Edward B. Deakin, Department of Accounting; James S. Dyer, Management Science and Information Systems; William E. Galloway, Geological Sciences Department; Stephen L. McDonald, Economics Department; James R. Moore, Department of Marine Studies; Larry W. Lake, Petroleum Engineering Department; David F. Prindle, Government Department

This interdisciplinary Master's Degree Program, which spans the Colleges of Engineering, Natural Sciences, Liberal Arts, the Graduate School of Business, and the LBJ School for Public Affairs, has been in existence since the fall of 1981. The program is administered through the Department of Petroleum Engineering and is directed by Dr. W. C. J. van Rensburg.

To date, 52 MA students have graduated from this program. Most have found employment in the corporate planning divisions of major U.S. and foreign corporations, with consulting firms, investment banks, mutual funds, independent oil companies, as officers of the U.S. Army, and in intelligence services.

Students in the graduate program in EMR continue to dominate the annual national competition for best student paper in mineral economics, sponsored by the Mining and

Metallurgical Society of America. Once more, our students have captured all three top prizes this year.

One MA degree was granted during the 1990-91 academic year. There are at present 24 MA students in this program.

5.23 Theses and Dissertations

| GRADUATE STUDENT (Supervising Professor) | TITLE OF THESIS OR DISSERTATION | DATE | DEGREE AWARDED |
|---|---|----------|-------------------|
| Alhamadah, Ahmad M. (B. H. Caudle) | A Fully Compositional Streamline Simulator for Unsteady- State Two-Phase Flow in Gas Condensate Systems | December | Ph.D. |
| Birinci, Onur I. (K. Sepehrnoori/G.A. Pope) | Improved Solution Algorithms for a Compositional Reservoir | December | M.S. |
| Bodwadkar, Suhas V. (M.E. Cheneverl) | Diffusion of Gas Through Oil Mud Filter Cakes | December | M.S. |
| Brantferger, Kenneth M. (G. A. Pope/K. Sepehrnoori) | Development of a Thermodynamically Consistent, Fully Implicit, Compositional, Equation-of-State, Steamflood Simulator | Мау | Ph.D. |
| Chaudhary, Nirmal (J. C. Reis) | Profile Modification by Thermal Precipitation | Мау | M.S. |
| Das, Sanjit (J. C. Reis) | A Model Wellbore for the Measurement of Two-Phase Injection Profiles | December | M.S. |
| Dhir, Rahul (E. J. Peters) | Pressure Transient Testing in Naturally Fractured Coal Reservoirs (Report) | August | M.S. |
| Hunt, William C. (K. E. Gray/J. T. Holder) | Mechanical Behavior of Shales | Мау | M.S. |
| Idrees, Muhammad (J. C. Reis) | Characterization of Near Wellbore Heterogeneities in Geologic Formations Using Radioactive Tracers: A Monte Carlo Study | Мау | M.S. |
| Javalagi, Mohan I. (M. E. Chenevert) | Electrical Resistivity of Hydrated Shales | December | M.S. |
| Jiao, Di (M. M. Sharma) | Formation Damage and Resistivity in the Flushed Zone (Report) | August | M.S. |

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| GRADUATE STUDENT (Supervising Professor) | TITLE OF THESIS OR DISSERTATION | DATE | DEGREE AWARDED |
|--|--|----------|-------------------|
| Kenrick, Anthony J. (K. E. Gray/J. T. Holder) | Fracture Toughness Measurements Under Varying Stress | May | M.S. |
| Khatanlar, Santanu (E. J. Peters) | A Numerical Study of the Performance of Unstable Displacements in Heterogeneous Media | August | Ph.D. |
| Lim, Min T. (G. A. Pope/K. Sepehrnoori) | Field-Scale Numerical Modeling of Multiple-Contact- Miscible Processes Using Horizontal Wells in Heterogeneous Reservoirs (Report) | December | M.S. |
| Mahajan, Jayant K. (E. J. Peters/M. E. Chenevert) | Rheology of Oil-Based Muds | December | M.S. |
| Morris, Craig W. (M. A. Miller) | A Study to Develop the Seventy-Six West Field, Duval County, Texas-Volumetrics (Report) | August | M.S. |
| Osisanya, Samuel O. (M. E. Chenevert) | Experimental Studies of Wellbore Stability in Shale | August | Ph.D. |
| Ozak, Yilmaz V. (M. A. Miller) | A Study to Redevelop Seventy-Six West Field Duval County, Texas-Reservoir Simulation (Report) | August | M.S. |
| Salas, Jose R. (J. C. Reis/M. A. Miller) | Simulation Study of Crossflow in Layered Reservoirs During Waterflooding | August | M.S. |
| Wagle, Yogeesh S. (M. A. Miller) | A Study to Develop the Seventy-Six West Field Duval County, Texas-Decline Curve Analysis (Report) | August | M.S. |
| Williams, George R. (M. M. Sharma) | The Formation Microscanner as a Measure of Heterogeneity in Core-Log Studies | August | M.S. |
| Yang, An-Ping (L. W. Lake) | Stochastic Heterogeneity and Dispersion | December | Ph.D. |

6.0 COMMITTEE REPORTS

6.1 Alumni Affairs Committee

Dr. Martin E. Chenevert, Chairman

Drs. Ben H. Caudle and Myron H. Dorfman

During the 1990-91 year, the Alumni Affairs Committee focused on the dissemination of resource materials and newsletters. Efforts were continued to distribute the recently developed undergraduate recruitment video to a wide audience. The video was advertised through the "Pen Pal" newsletter, and response was most encouraging. We are using alumni to distribute the videos to high school counselors.

Efforts to improve the "Pen Pal" newsletter were continued, and a substantial segment was dedicated to locating "lost" alumni.

6.2 Awards Committee

Dr. Ekwere J. Peters, Chairman

Drs. Mark A. Miller and Robert S. Schechter

The Petroleum Engineering Awards Committee is responsible for nominating petroleum engineering faculty members, students, and staff for the various awards for which they are qualified. The committee also coordinates the selection process for the petroleum engineering teaching excellence award. We are pleased to report the following awards for the 1990-91 academic year.

Faculty Awards

- Kamy Sepehrnoori received the Petroleum Engineering Teaching Excellence Award.
- William R. Rossen received the Petroleum Engineering Faculty Leadership Award.
- Larry W. Lake received the Society of Petroleum Engineers Reservoir Engineering
 Award.

- Larry W. Lake received an Engineering Foundation Faculty Excellence Award.
- Robert S. Schechter received the Joe J. King Professional Engineering
 Achievement Award in the College of Engineering.
- Robert S. Schechter received the Senior Research Award from the American Society
 of Engineering Education.

Staff Awards

- Antonio A. Bermudez received a 15-year Service Award from The University of Texas.
- Sharon Boni received the Most Helpful Staff Award from UT Student Chapter of the Society of Petroleum Engineers.

Student Awards

- Randall Harris won the Petroleum Engineering Student Leadership Award.
- Max Roper won the second prize in the PhD Division of the Mobil Student Paper
 Contest for his technical paper "Effects of Convective Mixing and Relative
 Permeability on Tertiary CO₂ Injectivity and Oil Recovery."
- Jayant Keshav Mahajan won the second prize in the MS Division of the Mobil Student
 Paper Contest for his technical paper "Rheology of Diesel- and Oil-based Muds."
- Mohan Ishwar Javalogi won the third prize in the MS Division of the Mobil Student
 Paper Contest for his technical paper "Electrical Resistivity of Hydrated Shales."
- Reuven Hollo won first prize for best student paper in the Mineral Economics
 Competition sponsored by the Mining and Metallurgical Society of America for his paper "The Causes of the Gulf War."
- Gary Underwood won second prize for best student paper in the Mineral Economics
 Competition sponsored by the Mining and Metallurgical Society of America for his
 paper "Risk Management in Electric Utility Generation Planning."

Nicolay Petkov won third prize for best student paper in the Mineral Economics
 Competition sponsored by the Mining and Metallurgical Society of America for his
 paper "The New Soviet Mineral Export Strategies."

6.3 Computers Committee

Dr. Kamy Sepehrnoori, Chairman

Drs. Ben Caudie and Ekwere J. Peters; Joanna Castilio and

Robert Schneider

A grant of \$1,000,000 from Digital Equipment Corporation enabled the department to replace its VAX computer with a model that is several times faster. The remaining cost of the system was provided by the sale of older equipment and grants from other individuals and oil companies. This upgrade involved increasing the capacity of the main computer system within the department and also the storage capabilities of that system. This new computer facility will be used to enhance research and academic computing carried out in the department.

The upgrade to the computing facilities was done by replacing the Digital Equipment Corporation VAX-8800 with a VAX-6520/VP. The upgrade insured complete binary compatibility between the two systems allowing migration from the old system to the new one without recompilation of code. The old VAX-8800 consisted of two 6-million instructions per second (MIPS) processors. The new VAX-6520/VP system consists of two 15-MIPS processors that are accompanied by two 60-million floating point operations-per-second vector processors. The new system is roughly four times faster than the previous system when operated in a strictly scalar mode. The use of vectors on the system will allow for much greater processing speeds.

In addition to the increased computing power offered by the new system, the department also upgraded the disk storage capability. The old system provided at most 2 billion bytes (2 gigabytes) of storage for users of the departmental system. The new system currently provides 20 gigabytes of storage.

The new system is attached to a computer network on the UT Austin campus that permits communication with virtually any computer system in the world. This computer network allows not only user communication with other users on the network but also servicing of requests from other computer systems in the department to promote the sharing of resources. Work is currently underway that will incorporate essentially all computing resources so that they may share existing resources. As an example, Macintosh- and PC-based systems in the department will be able to share disk and printer resources with the VAX-6520/VP and other machines on campus through the use of the network connections.

The departmental microcomputer facility was upgraded during the past year to enhance its performance. The laboratory that houses this facility includes five Macintosh-IIsi computer systems and five Intel-80386 IBM-PC clones. Each Macintosh-IIsi consists of a Motorola-68030 processor with a Motorola-68882 floating point co-processor, 5 megabytes of memory, a high-resolution color monitor, a 40-megabyte hard disk, a high-density floppy drive, a mono-chrome dot matrix printer, and an ethernet communications card. The department has also provided copies of Microsoft Word and Microsoft Excel on each Macintosh. Each IBM-PC clone consists of an Intel-80386 processor, 4 megabytes of memory, a 20-megabyte hard disk, a high-density floppy drive, a color monitor, a letter-quality printer, and an ethernet communications card. The department has also provided copies of Microsoft Windows for each IBM-PC clone and has ordered copies of Microsoft Word and Microsoft Excel for each IBM-PC clone. In addition to upgrading these machines, the department is integrating each PC with the departmental network to provide access to other resources such as disks and printers that may be found on the departmental network.

6.4 Laboratory, Space, and Safety Committee

Dr. Ekwere J. Peters, Chairman

Drs. Augusto L. Podio, Gary A. Pope, and John C. Rels

The Laboratory, Space and Safety Committee oversees departmental equipment and space use, coordinates safety matters, and supervises the technical staff who support departmental teaching and research activities.

New Equipment

The department took delivery of its new Magnetic Resonance Imaging (NMRI) System for use in petroleum engineering research. The NMRI system, which is described in greater detail elsewhere in this annual report, complements our X-ray computed tomography (CT) scanner, scanning electron microscope (SEM), and other imaging systems that are currently being used in our research programs.

Space

Two major renovations were undertaken to create a Nuclear Magnetic Resonance Imaging (NMRI) Laboratory and new office space for graduate students. Room CPE 1.158, previously occupied by EMR graduate students, was converted into the new NMRI Laboratory. To accommodate the displaced EMR students, Room CPE 1.176 was remodeled from a storeroom into an office for eight graduate students.

The space utilization computer data base developed last year was updated this year. The computer program continued to provide an effective way to monitor and manage the use of our limited space.

This year, the Laboratory, Space and Safety Committee tackled the problem of special keys in our section of the CPE Building. Over the years, some offices and laboratories have been re-keyed for one reason or another. The result is that at least eleven rooms in the department can no longer be accessed by the master key. These unauthorized restrictions were beginning to interfere with the smooth operation of the department. Therefore, the Committee was asked by

the Chairman to study this problem and recommend a solution. The Committee recognized the need to restrict access to certain rooms for safety reasons and to safeguard departmental equipment and supplies. Based on these considerations, it was decided that all rooms except CPE 1.120, 1.146, 1.158, 1.162 and 2.502AB should revert to the master key. In the future, all requests to re-key a room must be approved jointly by the Committee Chairman and the PEN Chairman. This new policy will be implemented in the next academic year.

Staff

Bobby Ewing, Technical Staff Assistant V, resigned from the department. Glen S. Baum was hired as a Technical Staff Assistant V to replace him. Glen previously was a Technical Staff Assistant IV in the Wellbore Stability Research Program at the Center for Petroleum and Geosystems Engineering. Before coming to the department, he had extensive industrial experience with Oryx Energy Company. The Committee has been very pleased with Glen's leadership and technical contributions to our instructional and research programs.

The job descriptions for all the technical staff were revised jointly by the Laboratory, Space and Safety Committee and the technical staff members. The revisions were necessary to streamline job responsibilities and eliminate duplications as well as to foster cooperation among the staff.

6.5 Library/Reading Room Committee

Dr. I. H. Silberberg, Chairman

The Reading Room is a small collection of basic books, journals, reports, theses, dissertations, and other material pertaining to petroleum engineering. It is open 29 hours per week, staffed by a professional librarian 20 hours per week and a student assistant the remainder of the time. During 1990-91, the Reading Room operated on a budget of \$3,500. These funds were used to purchase 24 books, 1990 SPE technical papers on micro-fiche, 19 periodical

subscriptions, journal and thesis binding, computer programs, conference proceedings, and library supplies.

The Reading Room was allocated one of the departmental IBM PCs, which assisted in the process of eliminating a backlog of 450 uncataloged volumes. Additionally, the Reading Room received a bequest of 129 titles on the subject of well logging from the estate of the late Dr. Walter H. Fertl. These acquisitions have been cataloged and integrated into the collection. Other donations include books from Drs. Martin Chenevert, Henry Dunlap, Larry Lake, Steven Morriss, and John Reis, and books and periodicals from the late Jim Stinger. All of these donations have been very useful additions to the Reading Room Collection.

The collection is primarily used by PEN graduate and undergraduate students and EMR graduate students. Other users are PEN faculty, geology and mechanical engineering graduate students, and researchers from the Bureau of Economic Geology. Students check out over 200 books a semester and photocopy 2,000 copies of journal articles and technical papers each month. The Reading Room also checks out "Reserve" reading material and assists students in locating information.

With access to two on-line bibliographic data bases, the Reading Room personnel can assist students and faculty with reference questions and subject searches on site. The Reading Room is soon to have access to internet, a long-anticipated step, which will connect it with a (noncommercial) international information-sharing network. This will be a tremendous aid in reference as well as cataloging.

6.6 Scholastic Appeals Committee

Dr. William Rossen, Departmental Representative

The Scholastic Appeals Committee met three times during the last year and reviewed the appeals from students in the College of Engineering who were facing dismissal from either The University or the College of Engineering because of poor grades.

6.7 Seminar Committee

Dr. William Rossen, Chairman

Dr. K. E. Gray

The Seminar Committee arranged the following seminars and seminar speakers:

September 10, 1990
Petroleum Engineering Faculty
The University of Texas at Austin
"Research Areas of Interest"

September 17, 1990
Petroleum Engineering Faculty
The University of Texas at Austin
"Research Areas of Interest"

October 1, 1990 Ion Adamache Husky Oil "Overview of Horizontal Wells in Canadian Hydrocarbon Reservoirs: Case Histories of Miscible-Flood Applications"

October 8, 1990
Adam T. Bourgoyne, Jr.
Louisiana State University
"Improved Procedures for Handling Shallow
Gas Hazards"

October 15, 1990
Dale E. Nierode
Exxon Production Research Co.
"Fractured-Well Productivity Modeling"

October 22, 1990
Myron I. Kuhlman
Shell Development Co.
"Controlling CO₂ Foams: Engineering of
Molecules, Surfaces, and Reservoirs"

October 29, 1990
Bob A. Hardage
Atlas Wireline Services
"Use of Borehole Seismic Data in Reservoir Characterization"

November 5, 1990
Karstin Pruess
Lawrence Berkeley Laboratory
"Modeling of Multiphase Fluid and Heat Flow in Fractured Porous Media"

November 12, 1990
Dave Jones
Chevron Corporation
"Preventing Catastrophic Accidents in the Oil Industry"

November 19, 1990
Albert C. Reynolds
University of Tulsa
"New Techniques for the Analysis of Slug and Drillstem Test Pressure Data"

November 26, 1990 Martin F. Cohen Mobil Research and Development Corporation "Some Recent Developments in Applications of Simulation Technology"

December 3, 1990
Ernie Brown
Dowell Schlumberger
"Recent Developments in Fracture
Conductivity and Implications for Well
Productivity"

January 21, 1991
Michael Sanchez
Mobil Research & Development Corporation
"Heat Transfer and the Rising Boundary
Velocity During the Steam Chamber Rise
Portion of the Steam Assisted Gravity Drainage
Process From Horizontal Well Pairs"

January 29, 1991
Christopher White
Shell Development Company
"Representation of Geometry and Heterogeneity for Simulation"

February 4, 1991
Ray Elias
Enercap Corporation
"Environmental Job Responsibilities Facing
Graduate Petroleum Engineers"

February 11, 1991
Maurice Dusseualt
University of Waterloo
"Analysis of the Petroleum Engineering
Borehole"

February 18, 1991
Margaret Armstrong
Centre de Geostatistique, Paris
"Kriging vs. Conditional Simulations"

February 25, 1991 Philip Low Purdue University "The Swelling of Clay"

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March 4, 1991
Robert K. Prud'homme
Princeton University
"The Rheology and Structure of Gels for Hydraulic Fracturing"

March 18, 1991
Michael R. Ramage
Mobil Research & Development Corporation
"New Horizons in the Petroleum Industry"

March 25, 1991
John Perrin
BP Exploration
"Wilcox Formation Evaluation: Improved
Procedures for Tight Gas Sand Evaluation
(and Other Image Analysis Applications at BP
Exploration)"

April 1, 1991
Stephen Holditch
Texas A&M University
"The Gas Research Institute Hydraulic
Fractured Test Site"

April 8, 1991
John Reis
University of Houston
"Application at First-Principles in Modeling
Steam Assisted Gravity Drainage in Tar Sands"

April 15, 1991
Robert Bretz
New Mexico Technological University
"Viscosity Data For the EOS Characterization of Heavy Fractions of Petroleum Fluids"

April 22, 1991
Johannes Bruining
University of Texas at Austin
"Random Fractal Fields and Permeability"

April 29, 1991
Thomas Bryant
Teleco Oilfield Services
"Measurement While Drilling Acoustic Gas
Influx Detection"

6.8 Student Affairs Committees

6.8.1 Pi Epsilon Tau

Min Teong Lim, President

The U.T. Kappa chapter is actively reaching out to the petroleum industry in order to foster a stronger bond between the students and the industry. Regular activities of the society included smokers, signature parties and initiation banquets. The fall 1990 banquet was held at Dr. Gary Pope's residence, where seven pledges and one honorary member, Dr. Steven Morriss, Assistant Professor in the department, were initiated into the society. The keynote address was given by an alumnus of the Petroleum Engineering department, Dr. Myra Dria.

Pi Epsilon Tau membership stands at 35 for the fall semester 1991. Fifteen new pledges and three honorary members were initiated during the Spring 1991 semester, making it the largest pledge class in recent years. This large class was the result of increased undergraduate and graduate enrollments in the U.T. Petroleum Engineering Department, coupled with increased enthusiasm among eligible students to get involved and pledge the society. The three honorary members who were initiated are Dr. Mojdeh Delshad and Dr. William B. Gardner, from the Petroleum Engineering Department., and Dr. Hans Bruining, a visiting professor from Holland. The initiation banquet was held at Dr. Sepehrnoori's residence, where Dr. Gardner spoke on maintaining excellence in academia and the petroleum engineering profession.

Pi Epsilon Tau Officers

President Min Teong Lim
Executive Vice President David Tambe
Administrative Vice President Ali Sikandar
Corresponding Secretary Kathrin Lewis
Secretary - Treasurer Walter Dobbs
Society Representative Sanjay Vittal
Faculty Advisor Dr. Gary A. Pope

6.8.2 Society of Petroleum Engineers Student Chapter

Randall Harris. President

The UT Student Chapter began the year with two significant events. Meridian Oil hosted the second SPE meeting at the County Line Barbecue Restaurant. Over 100 students and faculty attended the dinner, where Meridian engineers gave presentations on hydraulic fracturing, coal-bed methane, and horizontal drilling. The following week 50 student SPE members flew to the SPE Annual Technical Conference and Exhibition in New Orleans. Sponsors for the trip were British Gas, Meridian Oil, Chevron, and Amoco.

Two more field trips were held during the year. In November a group of students toured BP Exploration's research laboratory in Houston. Another group went on the traditional Mobil West Ranch Field tour in Vanderbilt, Texas.

Other educational activities sponsored by the SPE student chapter were the chicken seminars and regular evening meetings, including a presentation by SPE distinguished lecturer Robert Hadlow of Exxon. Mr. Hadlow gave students an "Update on Carbon Dioxide Flooding". Another interesting discussion was that given by UT professor in government Dr. David Prindle on the Texas Railroad Commission and its history. Dr. Prindle is the author of "Petroleum Politics and the Texas Railroad Commission".

Several social events were held during the 1990-91 school year. In early November a picnic was held in Eastwoods park by SPE, the Society of Women Engineers, and Theta Tau Professional Engineering Fraternity. The spring semester took off with a beverage bust hosted by both the geologists and the petroleum engineers. Members of the student chapters of AAPG, USGS, and SPE were all involved.

An active membership drive throughout the year increased the number of SPE student chapter members from 100 to 150.

The UT Student Chapter rounded out the year as the proud host to the SPE Gulf Region Student Paper Contest. Sixteen contestants competed from UT, Texas A&M, Texas A & I, LSU, and Prairie View A & M.

SPE Officers

President

Randall Harris

Vice President

Rick Soper (fall), Michael Chapman (spring)

Secretary

Linda Stephenson

Treasurer

Kathrin Lewis

S.E.C. Representatives

Michael Chapman (fall), Jennifer Speed (spring)

II Joon Lee

S.E.C. Freshmen Rep.

Albert lakovakis

Faculty Advisor

Dr. William Rossen

6.9 Visiting Committee

6.9.1 1990-91 Petroleum Engineering Visiting Committee

| Petroleum Engineering Visiting | Committee | Term Ending |
|--------------------------------|--|----------------|
| Dan M. Arnold | Vice President Technology Halliburton Logging Services, Inc. P.O. Box 42800 Houston, TX 77242 (713) 496-8100 | 1993 |
| E. B. Brauer | Regional Operations Manager, Western Region Unocal 1800 30th Street, Suite 200 Bakersfield, CA 93301-1921 (805) 395-5275 | n 1992 |
| Sam J. Byington | Director, New Business Development Amoco Production Company P.O. Box 3092, Rm 8.126 Houston, TX 77253-3092 (713) 588-5110 | 1994 |
| Aaron Cawley | President Cawley, Gillespie & Associates 302 Ft. Worth Club Bldg. 306 West 7th Ft. Worth, TX 76102-4987 (817) 336-2461 | 1993 |
| Roberto G. Ceconi | Manager, Worldwide Drilling & Production Phillips Petroleum Company 1530 A 1 Plaza Office Building Bartlesville, OK 74004 (918) 661-3039 | 1992 |
| Ramon G. (Ray) Clements | Vice President, Engineering & Technology Worldwide Production Marathon Oil Company P.O. Box 3128 Houston, TX 77253 (713) 629-6600 | 1991 |
| Al Hagedorn | Division Manager Exxon Production Research Company P. O. Box 2189 Houston, TX 77252 (713) 965-4617 | 1992 |

| Petroleum Engineering Visiting | Committee (cont'd.) | Term Ending |
|--------------------------------|---|----------------|
| Bob A. Hardage | Research Associate University of Texas at Austin Bureau of Economic Geology Austin, TX 78712 (512) 471-1534 | 1994 |
| Richard L. McGannon | Vice President, Production Chevron Corporation 225 Bush Street, Room 1753 San Francisco, CA 94104 (415) 894-5754 | 1991 |
| David J. Pritchard | Vice President, Development Programs B P Exploration (Alaska), Inc. P.O. Box 196612 Anchorage, AK 99519-6612 (907) 564-4029 | 1991 |
| James E. Roberts | Vice President, Production Oryx Energy P. O. Box 2880 Dallas, TX 75221-2880 (214) 890-5097 | 1992 |
| Jack L. Thurber | Reservoir Engineering Consultant Shell Western E&P Inc. P. O. Box 576 Houston, TX 77001 (713) 870-2998 | 1992 |
| Tom H. Timmins | General Manager, Producing Mobil Exploration & Producing U.S., Inc. P.O. Box 650232 Dallas, TX 75265-0232 (214) 951-2404 | 1993 |
| Peyton Yates | President Yates Drilling Company 105 South 4th Artesia, NM 88210 (505) 7480-1471 | 1993 |
| Gary K. Youngren | Manager, EOR Research & Reservoir Labora ARCO Oil & Gas Company 2300 W. Plano Parkway, PRC E1209 Plano, TX 75075 (214) 754-6978 | atories 1991 |

Additional Participants

E. J. Morgan

Chief Engineer, Production

Chevron Corporation

225 Bush Street, 17th Floor San Francisco, CA 94104

(415) 894-3740

Harry D. Smlth

Manager, Subsurface Technology Department

Halliburton Logging Services Inc.

P.O. Box 42800 Houston, TX 77242 (713) 496-8100

Fred Stalkup

EOR Research & Reservoir Laboratoriess

ARCO Oil & Gas Company 2300 W. Plano Parkway Plano, TX 75075 (214) 754-6978

John Turley

Marathon Oil Company

P.O. Box 3128 Houston, TX 77253

(713) 629-6600/FAX (713) 629-6600

Vidya Verma

BP Exploration 5151 San Felipe Houston, TX 77056 (713) 552-6318 FAX

6.9.2 Fall Meeting of the Petroleum Engineering Visiting Committee - Agenda

October 18-20, 1990 Brons Conference Room, CPE 2.236

Thursday, October 18, 1990

6:30 p.m.

Dinner Party

Four Seasons Hotel (San Jacinto Ballroom)

98 San Jacinto Blvd.

Fall Meeting Agenda (cont'd)

12:00 noon

| Friday. | October 19, 1990 | • | |
|---------|---------------------|---|------------------------------------|
| 8:00 | a.m. | Coffee and doughnuts (Brons Conference | Room) |
| 8:30 | a.m. | Update on College | Dr. Herbert H. Woodson |
| 9:15 | a.m. | Opening Remarks | Dr. Larry Lake/ Mr. Jim Roberts |
| 9:30 | a.m. | Departmental Overview | Dr. Larry Lake |
| 10:00 | a.m. | Coffee Break | |
| 10:15 | a.m. | Scholarships | Dr. John Reis |
| 10:30 | a.m. | Graduate Studies | Dr. Mark Miller |
| 11:00 | a.m. | Remote Teaching Program | Dr. Mark Miller |
| 11:30 | a.m. | Lunch Meeting with PEN Students (Lunch served in Fancher Study Hall, CPE 3.172) | |
| 2:00 | p.m. | Meet with Chairman | Dr. Larry Lake |
| 3:30 | p.m. | Coffee Break | |
| 3:45 | p.m. | Manpower Issues | Visiting Committee |
| 4:00 | p.m. | Student Recruiting | Dr. Martin Chenevert |
| 4:15 | p.m. | Adjourn | |
| | | | |
| Saturda | ay. October 20, 199 | Q | |
| 9:00 | a.m. | Coffee and doughnuts (Brons Conference | Room) |
| 9:30 | a.m. | Departmental Needs | Dr. Larry Lake |
| 10:00 | a.m. | MRI Purchase | Dr. Ekwere Peters |
| 10:30 | a.m. | Research Review | Dr. Steven Morriss |
| 10:45 | a.m. | Research Review | Dr. Mukul Sharma |
| 11:00 | a.m. | Adjourn | |
| | | | |

UT vs. Arkansas Football Game

6.9.3 Spring Meeting of the Petroleum Engineering Visiting Committee - Agenda

March 20-21, 1991 Brons Conference Room, CPE 2.236

Wednesday, March 20, 1991

6:30/7:30 p.m.

Dinner Party

Four Seasons Hotel, Ballroom A

98 San Jacinto Blvd.

Thursday, March 21, 1991

| 8:00 | a.m. | Coffee and doughnuts (Brons Conference Room) | |
|-------|------|---|--|
| 8:30 | a.m. | Opening Remarks | Dr. Larry Lake/ Mr. Jim Roberts |
| 8:45 | a.m. | Update of College Activities | Dr. Herbert H. Woodson |
| 9:30 | a.m. | College of Engineering Issues | Dr. Herbert H. Woodson |
| 10:00 | a.m. | Coffee Break | |
| 10:15 | a.m. | Update of Departmental Activities | Dr. Augusto Podio/ Dr. A. Daniel Hill |
| 10:45 | a.m. | Action Items from Previous VC Meeting | Dr. Larry Lake/ Dr. Karny Sepehrnoori |
| 11:30 | a.m. | Lunch Meeting with PEN Students (Lunch served in Fancher Study Hall, CPE 3.172) | |
| 1:30 | p.m. | Meet with Chairman | Dr. Larry Lake |
| 2:30 | p.m. | Coffee Break | • |
| 3:00 | p.m. | Writing Laboratory Proposal | Ms. Fran Hurley |
| 3:15 | p.m. | Recruiting Video | Dr. Martin Chenevert |
| 3:30 | p.m. | ABET Preview | Dr. Augusto Podio |
| 3:45 | p.m. | Curriculum Review | Dr. Augusto Podio |
| 4:45 | p.m. | Elect New Visiting Committee Chairman | Mr. Jim Roberts |
| 5:00 | p.m. | Adjourn | |
| | | | |

7.0 PEN SOURCES OF FUNDING 1990-91

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|---|----------|---|
| Malcolm Abel Centennial Scholarship | \$2,200 | 4 scholarships |
| Alumni Endowed Room | \$3,241 | unrestricted funds |
| American Petroleum Institute Houston Chapter | \$2,300 | scholarships |
| Amoco Foundation, Inc. | \$27,131 | \$13,131 doctoral fellowship, \$6,000 masters fellowship grant, \$5,000 unrestricted grant, \$1,500 scholarship, \$1,500 minority scholarship |
| Amoco Production Company | 1,000 | Vax purchase |
| ARCO Centennial Endowed Automated Production Lab. | \$1,928 | unrestricted funds |
| ARCO Oli and Gas Co. | \$14,000 | \$3,000 unrestricted grant, \$10,000 remote teaching program, and \$1,000 minority scholarship |
| R. C. Baker Endowed Room | \$ 840 | unrestricted funds |
| R. C. Baker Foundation Scholarship | \$12,501 | \$6,000 for 5 scholarships, \$6,000 for 2 fellowships, and \$501 unrestricted funds |
| Biggs Classroom | \$716 | unrestricted funds |
| Marilyn & Thomas Billings Core Lab. | \$4,800 | unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|--|----------|---|
| BP Exploration | \$10,000 | unrestricted grant |
| BP Exploration (Alaska) | \$3,000 | contribution for VAX 6500 purchase |
| Brons Conference Room | \$885 | unrestricted funds |
| Caudle Classroom | \$812 | unrestricted funds |
| Chevron Lectureship | \$3,252 | unrestricted funds |
| Chevron U.S.A. Corporation | \$29,000 | \$13,000 unrestricted grant, \$5,000 for 4 scholarships, \$6,000 remote teaching program, \$5,000 for VAX 6500 purchase |
| Ernest, Jr., and Virginia Cockrell Jr. Scholarship - Freshman | \$17,750 | 13 scholarships |
| Ernest, Jr., and Virginia Cockrell Jr. Scholarship - General | \$2,100 | 2 scholarships |
| Conoco - North American Production EOR Laboratory | \$4,160 | unrestricted funds |
| Conoco Inc. | \$10,000 | unrestricted grant |
| Dresser Atlas Well Logging Lab. | \$7,500 | unrestricted funds |
| Eaton Industries Drilling Laboratory | \$1,352 | unrestricted funds |
| Engineering Foundation at U.T. | \$15,950 | \$8,000 for 2 fellowships and \$7,950 for 3 minority scholarships |

| ORGANIZATION/ENDOWMENT | AMOUNT | å,sit | PURPOSE |
|---|----------|-------|--|
| Exxon Education Foundation | \$16,500 | | \$11,500 unrestricted grant and \$5,000 remote teaching program |
| Exxon National Minority Scholarship | \$6,000 | | 1 scholarship |
| George H. Fancher Centennial Teaching Fellowship | \$4,170 | | \$2,500 for Dr. Hill's research and \$1,670 unrestricted funds |
| George H. Fancher Professor | \$6,300 | | \$6,000 for Dr. van Rensburg's research and \$300 unrestricted funds |
| George H. Fancher, Jr., Study Hall | \$830 | | unrestricted funds |
| Fina Oil Company | \$2,500 | | remote teaching program |
| Friends of Alec Foundation | \$2,500 | | 2 scholarships |
| Getty Oil Company Centennial Chair | \$49,400 | | unrestricted funds |
| Gulf Oil Foundation Centennial Teaching Fellowship | \$4,000 | | \$2,500 for Dr. Miller's research and \$1,500 unrestricted funds |
| Halliburton Foundation Inc. | \$15,000 | | \$6,000 for Dr. Lake's research and \$9,000 remote teaching program |
| H. B. (Burt) Harkins, Jr., Professor | \$9,320 | | \$6,000 for Dr. Podio's research and \$3,320 unrestricted funds |
| J. H. Herring Centennial Professor | \$14,000 | | \$6,000 for Dr. Pope's research and \$8,400 unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|---|----------|---|
| Hocott Lectureship | \$4,895 | unrestricted funds |
| Frank W. Jessen Centennial Fellowship | \$4,090 | \$2,500 for Dr. Peters' research and \$1,590 unrestricted funds |
| Frank W. Jessen Professorship | \$15,100 | \$7,500 for Dr. Sepehmoori's research and \$7,600 unrestricted funds |
| Kerr-McGee Petrophysics Lab. | \$1,727 | unrestricted funds |
| B. J. Lancaster Professorship | \$18,100 | \$6,000 for Dr. Caudle's research and \$12,100 unrestricted funds |
| Link Foundation | \$16,000 | \$12,000 fellowship grant and \$4,000 unrestricted grant |
| Marathon Oil Company | \$19,000 | \$10,000 grant to augment faculty salaries, \$2,000 for two scholarships, \$2,000 for two minority scholarships and \$5,000 remote teaching program |
| Marathon Oll Co. EOR Lab. | \$5,090 | unrestricted funds |
| Alex Massad Presidential Scholarship | \$3,679 | \$2,000 scholarship and \$2,000 fellowship |
| L. F. McCollum Scholarship | 390 | unrestricted funds |
| W. C. Melnar | \$2,500 | 3 scholarships |
| Robert Miller Drilling Fluids Lab. | \$2,055 | unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|---|-------------|---|
| Mobil Oil Corporation | \$19,000 | \$15,000 unrestricted grant and \$4,000 for 4 minority scholarships |
| W. A. "Monty" Moncrief Chair | \$109,000 | \$35,628 for Dr. Schechter's research and \$73,372 unrestricted funds |
| W. A. "Tex" Moncrief, Jr., Centennial Chair | \$46,200 | \$31,118 for Dr. Dorfman's research and \$15,082 unrestricted funds |
| Leah Moncure Scholarship | \$2,200 | 1 scholarship |
| National Action Committee for Minorities in Engineering | \$1,500 | 2 scholarships |
| National Merit Scholarships | \$750 | 1 scholarship |
| Oryx Energy Company | \$33,000 | \$30,000 salary supplements to faculty and \$3,000 for 3 scholarships |
| Pennzoli Exploration & Production | \$3,750 | \$1,875 scholarship and \$1,875 unrestricted grant |
| Petroleum Engineers Wives Club | \$500 | 1 scholarship |
| Phillips Drilling Fluids Properties L | ab. \$1,675 | unrestricted funds |
| Phillips Petroleum Company | \$16,500 | \$9,000 Phillips fellowship, \$5,000 contribution for VAX 6500 purchase, and \$2,500 for 3 scholarships |
| Pioneer Corp Fellowship | \$3,270 | unrestricted funds |
| Pirson Classroom | \$644 | unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|--|----------|---|
| Pirson Lectureship | \$4,000 | \$3,000 for Dr. Chenevert's research and \$1,000 unrestricted funds |
| F. B. Plummer Scholarship | \$207 | unrestricted funds |
| F. B. Plummer Tutorial Room | \$802 | unrestricted funds |
| Jake Powers | \$50 | undergraduate recruitment grant |
| Republic Bank Professorship | \$11,500 | unrestricted funds |
| Shell Oil Company Foundation | \$16,450 | \$10,000 Shell graduate grant and \$6,450 for 2 minority scholarships |
| Society of Petroleum Engineers, Balcones Section | \$2,000 | 2 scholarships |
| Society of Petroleum Engineers, Dallas Section | \$600 | 1 scholarship |
| Society of Petroleum Engineers, Gus Archie Memorial Scholarship | \$3,000 | 1 scholarship |
| Society of Petroleum Engineers, Permian Basin Section | \$3,000 | \$2,000 remote teaching program and \$1,000 for 1 scholarship |
| Society of Petroleum Engineers, West Central Texas | \$500 | 1 scholarship |
| Society of Professional Well Log Analysts | \$3,000 | \$2,000 for 2 scholarships and a \$1,000 fellowship |
| Sohio Petroleum Co. Classroom | \$863 | unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|--|----------|--|
| Sun Exploration Co. Advanced Petrophysics Lab. | \$2,092 | unrestricted funds |
| Sun Exploration & Production Co. Centennial Fellowship #1 | \$5,600 | \$4,000 for Dr. Sharma's research and \$1,600 unrestricted funds |
| Sun Exploration & Production Co. Centennial Fellowship #2 | \$3,870 | \$2,500 for Dr. Reis' research and \$1,370 unrestricted funds |
| Tenneco Oil Advanced Petrophysics Lab. | \$5,200 | unrestricted funds |
| Texaco USA | \$13,000 | \$3,000 unrestricted grant and \$10,000 remote teaching program |
| Texas Exes | \$500 | 1 scholarship |
| Texas Oil and Gas | \$1,000 | 1 scholarship |
| Harry Trueblood Scholarship | \$4,200 | 5 scholarships |
| Union Pacific Resources | \$3,000 | 3 scholarships |
| Unocal | \$9,500 | \$6,000 unrestricted grant, \$3,000 for 4 scholarships, and \$500 minority scholarship |
| UT - Wide Presidential Scholarship | \$2,000 | 1 scholarship |
| Louis C. Wagner Scholarship | \$1,000 | 1 scholarship |
| Herman Wetegrove Grad. Comp. Lab. | \$6,170 | unrestricted funds |

| ORGANIZATION/ENDOWMENT | AMOUNT | PURPOSE |
|--|------------|---|
| Whiting Endowed Presidential Scholarship | \$1,750 | 1 scholarship |
| Zarrow Centennial Professorship | \$19,400 | \$9,000 for Dr. Gray's research and \$10,400 unrestricted funds |
| Scholarships Funded \$ | 112,965 | |
| Fellowships Funded \$ | 66,970 | |
| Unrestricted Grants | 82,876 | |
| Endowed Rooms Income | 53,382 | |
| Other Endowed Income | 341,467 | |
| Remote Teaching Program | 49,500 | |
| Vax 6500 Purchase Grants | 14,000 | |
| Designated Funds | 40,647 | |
| TOTAL | \$ 761,807 | |

PART II

CENTER FOR PETROLEUM AND GEOSYSTEMS ENGINEERING

Dr. Gary A. Pope, Director

1.0 CENTER FOR PETROLEUM AND GEOSYSTEMS ENGINEERING (CPGE)

1.1 Summary

During 1991, the Center for Petroleum and Geosystems Engineering continued its large, diversified research activities related to oil, gas and geopressured/geothermal energy production, energy and mineral resources analysis, and added new research projects in other areas such as groundwater remediation. Many of these research projects included interdisciplinary efforts involving faculty, research scientists and graduate students in chemistry, mathematics, geology, geophysics, engineering mechanics, chemical engineering, microbiology and other disciplines. Several projects were undertaken in cooperation with either the Bureau of Economic Geology or the Institute for Geophysics at The University of Texas at Austin. Collaborative research projects with scientists at Brookhaven National Laboratory, Los Alamos National Laboratory, Rice University, and Sandia National Laboratory were also initiated. About 43 companies from seven countries around the world continued to provide the largest portion of research funding to CPGE. The graph on page 73 shows the breakdown of CPGE funding amounts from state, federal, domestic private, and foreign private sources for the past several years.

1.2 Purpose

In September 1987, the Center for Petroleum and Geosystems Engineering (CPGE) was formed to:

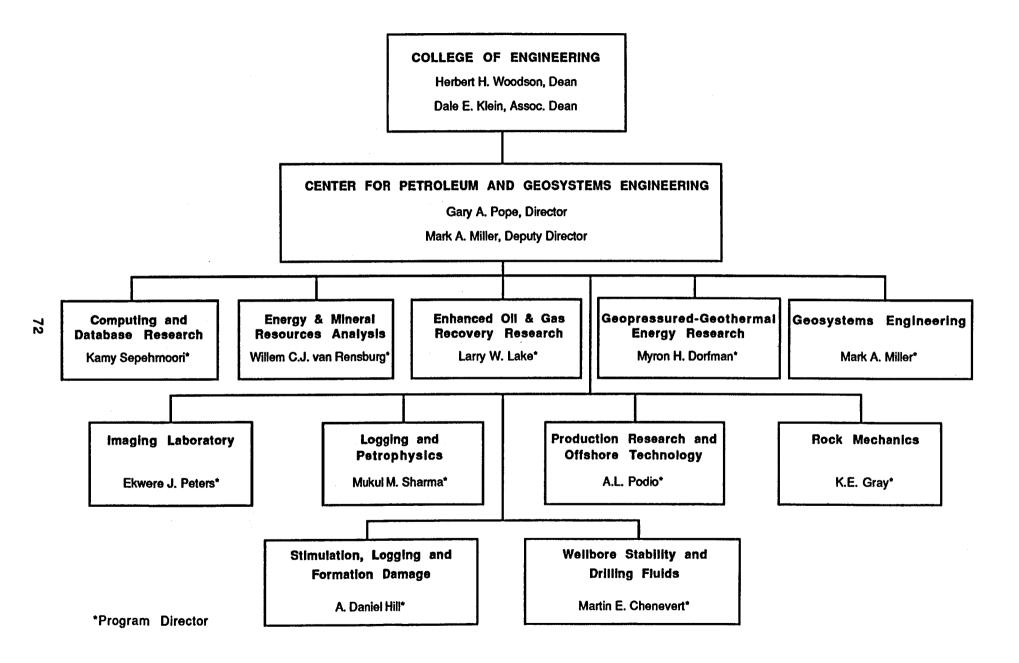
 encourage and develop large-scale, interdisciplinary research programs in petroleum and geosystems engineering at The University of Texas at Austin,

- serve as an interface between industry, government, and The University in specific areas of research,
- provide educational opportunities for graduate level research,
- provide an organizational structure for funding new areas of research,
- disseminate research results for technology transfer to industry, and
- conduct meetings that provide information on research results to funding entities.

Currently, most of CPGE's research is carried out by about 100 graduate students, supervised by faculty and assisted by both technical and non-technical staff. The Center provides an administrative structure through which the utilization of this staff may be coordinated. Externally, the Center has assumed the responsibility of representing the broad research capabilities in petroleum and geosystems engineering to potential sponsors and others outside The University.

1.3 Organization

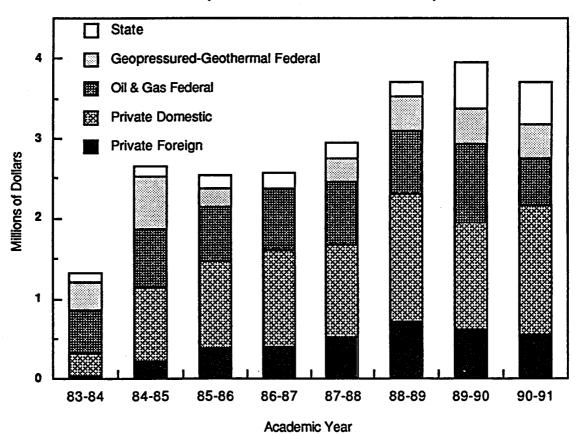
The organization of the Center for Petroleum and Geosystems Engineering is shown on the following page. Administratively, the Center is a unit of the Bureau of Engineering Research.



1983-91 Center for Petroleum & Geosystems Engineering Funding (in millions of dollars)

| | 83-84 | 84-85 | 85-86 | 86-87 | 87-88 | 88-89 | 89-90 | 90-91 |
|---|----------------|----------------|----------------|-----------------|---------------------|---------------------|---------------------|-----------------|
| Private Domestic Private Foreign | 0.278 0.045 | 0.923 0.216 | 1.076 0.390 | 1.010 0.398 | 0.960 0.520 | 1.416 0.710 | 1.346 0.610 | 1.622 0.543 |
| Geopressured- Geothermal Federal Oil & Gas Federal | 0.331 0.547 | 0.653 0.731 | 0.221 0.683 | 0 0.780 | 0.298 0.791 | 0.429 0.786 | 0.445 0.979 | 0.425 0.588 |
| Private Equipment State Equipment Federal Equipment | 0 0 0 | 0 0 0 | 0 0 0 | 0.190 0 0 | 0.190 0.066 0 | 0.190 0.050 0 | 0.840 0.316 0 | 0.468 0 0 |
| State | 0.128 | 0.128 | 0.173 | 0.191 | 0.119 | 0.130 | 0.581 | 0.533 |
| Total (excluding equipment) | 1.329 | 2.650 | 2.543 | 2.379 | 2.689 | 3.473 | 3.961 | 3.711 |
| Total (including equipment) | 1.329 | 2.650 | 2.543 | 2.569 | 2.945 | 3.713 | 5.117 | 4.179 |

ANNUAL FUNDING BREAKDOWN (EXCLUDING EQUIPMENT)



1.4 Research Funding

The funding base of the Center is diversified. Current annual funding is over four million dollars, of which more than half is derived from private organizations. The remainder comes from federal and state sources. Industry participates as industrial associates in the various programs as well as by contract or grant for specific research activities.

1.4.1 CPGE Sources of Funding

| Sponsor | Amount | Research Program or Area |
|---|--|--|
| Abu Dhabi National Reservoir Research Foundation (ADREF) | \$20,000 | Enhanced Oil & Gas Recovery Research |
| American Chemical Society | \$9,000 | Percolation of Bingham Fluids in Porous Media |
| Amoco Production Company | \$30,000 \$25,000 \$20,000 | Drilling and Completion Fluids Research Enhanced Oil & Gas Recovery Research Stimulation, Logging & Formation Damage |
| Ar∞ Oil & Gas Company | \$20,000 \$40,000 \$21,800 \$20,000 | Drilling and Completions Fluids Research Enhanced Oil & Gas Recovery Research Logging & Petrophysics Research Stimulation, Logging & Formation Damage |
| Baroid Drilling Fluids | \$30,000 | Drilling and Completion Fluids Research Equipment Grant |
| BP Exploration, Inc. | \$30,000 \$10,000 | Enhanced Oil & Gas Recovery Research Logging & Petrophysics Research |
| BP International, Ltd. | \$20,000 \$22,500 | Stimulation, Logging & Formation Damage Wellbore Stability in Deviated Boreholes |
| Chevron Oil Field Research Co. | \$24,000 \$10,000 | Enhanced Oil & Gas Recovery Research Logging & Petrophysics Research Production Logging Research |
| | \$20,000 \$30,000 | Stimulation, Logging & Formation Damage Wellbore Stability in Deviated Boreholes |
| Conoco, Inc. | \$50,000 \$10,000 | Drilling and Completion Fluids Research Enhanced Oil & Gas Recovery Research |
| Cray Research, Inc. | \$9,500 \$75,000 | Computing and Database Research Equipment Allocation |
| Digital Equipment Corporation | \$333,333 | R&D in Petroleum Engineering Discipline Computer Equipment Grant |
| Dowell Schlumberger, Inc. | \$30,000 | Stimulation, Logging & Formation Damage |

| Sponsor | Amount | Research Program or Area |
|--|--|---|
| Echometer Company | \$5,385 | Oil Field Production Optimization |
| Elf Aquitaine | \$10,000 \$30,000 | Enhanced Oil & Gas Recovery Research Stimulation, Logging & Formation Damage |
| Exxon Production Research Co. | \$20,000 \$20,000 \$20,000 | Drilling and Completion Fluids Research Enhanced Oil & Gas Recovery Research Stimulation, Logging & Formation Damage |
| Gas Research Institute | \$250,205 \$27,757 \$451,394 | Characterization and Quantification of Geologic and Petrophysical Heterogeneity in Fluvial-Deltaic Reservoirs Permeability of Filter Cakes on Tight Gas Sands (Texas A&M/GRI) Enhanced Reserve & Productivity Evaluation in Tight Gas Sands |
| Gaylord Chemical | \$335 | Drilling and Completion Fluids Research |
| Halliburton Logging Services | \$10,000 | Logging & Petrophysics Research |
| Halliburton Services | \$30,000 | Stimulation, Logging & Formation Damage |
| International Business Machines | \$10,000 | Computing and Database Research |
| Intevep | \$30,000 \$5,000 \$22,500 | Enhanced Oil & Gas Recovery Research Logging & Petrophysics Research Wellbore Stability in Deviated Boreholes |
| Japan National Oil Corporation | \$30,000 \$20,000 | Enhanced Oil & Gas Recovery Research Stimulation, Logging & Formation Damage |
| Keck Foundation | \$35,000 | Magnetic Resonance Spectrophotometer |
| Marathon Oil Company | \$18,000 | Capillary Pressure & Resistivity Index Properties of Carbonates |
| | \$10,000 | Logging & Petrophysics Research |
| Mobil E & P Services, Inc. | \$20,000 | Enhanced Oil & Gas Recovery Research |
| Mobil R&D Company | \$20,000 \$20,000 \$10,000 \$20,000 | Enhanced Oil & Gas Recovery Research Geosystems Engineering Research Logging & Petrophysics Research Stimulation, Logging & Formation Damage |
| National Science Foundation | \$33,500 \$33,500 | Coupled Processes in Inhomogeneous Geological Systems Detachment of Particles from Surfaces |
| Norsk Hydro Norsk Hydro | \$20,000 \$22,500 | Enhanced Oil & Gas Recovery Research Wellbore Stability in Deviated Boreholes |
| Offshore Technology Research Center | \$55,000 | Production and Transport of Multiphase Mixtures |

| Sponsor | Amount | Research Program or Area |
|--|--|--|
| Oryx Energy Company | \$30,000 \$10,000 \$20,000 \$22,500 | Enhanced Oil & Gas Recovery Research Logging & Petrophysics Research Stimulation, Logging & Formation Damage Wellbore Stability in Deviated Boreholes |
| Petroleum Computing, Inc. | \$15,000 | Logging & Petrophysics Research PCI Log Analysis Software Update |
| Phillips Petroleum Company | \$20,000 \$20,000 | Stimulation, Logging & Formation Damage Wellbore Stability in Deviated Boreholes |
| Research Institute of Petroleum Exploration and Development | \$10,000 | Enhanced Oil & Gas Recovery Research |
| Santa Fe Energy Resources, Inc. | \$10,000 | Enhanced Oil & Gas Recovery Research |
| Shell Development Corporation | \$20,000 \$20,000 | Enhanced Oil & Gas Recovery Research Stimulation, Logging & Formation Damage |
| Shell Oil Company Foundation | \$20,000 \$150,000 | Drilling and Completion Fluids Research Enhanced Oil & Gas Recovery Research |
| Society of Professional Well Log Analysts | \$1,000 | Logging & Petrophysics Research |
| State of Texas | \$115,383 | State Lands Energy Resource |
| | \$58,030 | Optimization (SLERO) Optimizing Oil Recovery in MEOR Processes (ATP) |
| | \$201,326 | State Lands Energy Resource Optimization (SLERO) |
| | \$128,000 | Energy Research Applications Program (ERAP) |
| | \$25,000 | Development of Emission Computed Tomography (ARP) |
| | \$5,000 | Logging & Petrophysics Research Initiation Grant |
| Tektronix, Inc. | \$4,340 | Logging & Petrophylcs Research Digitizing Signal Analyzer |
| Terra Tek, Inc. | \$1,350 | Wellbore Stability in Deviated Boreholes |
| Texaco Services, Inc. | \$30,000 \$15,000 \$20,000 | Enhanced Oil & Gas Recovery Research Foam Flow Through Porous Media Phase Behavior of CO ₂ /Crude Oil |
| | • | Systems |
| | \$20,000 | Stimulation, Logging & Formation Damage |
| Union Pacific Resources | \$10,000 | Heterogeneity and Enhanced Oil Recovery |
| U.S. Department of Energy | \$99,000 | Microbial Enhanced Oil Recovery Research |
| | \$116,490 | Innovative Techniques for the Description of Reservoir Heterogeneity Using Tracers |

| Sponsor | Amount | Research Program or Area |
|-----------------------------------|-----------|--|
| U.S. Department of Energy | \$34,522 | Oil Recovery Improvement through Profile Modification by Thermal Precipitation |
| | \$397,919 | US Gulf Coast Geopressured-Geothermal Program |
| | \$135,017 | Oil Recovery from Naturally Fractured Reservoirs |
| | \$135,706 | A Novel Approach to Modelling Unstable EOR Displacements |
| | \$27,764 | US Gulf Coast Geopressured-Geothermal Program (EG&G Idaho, Inc.) |
| Western Atlas International, Inc. | \$10,000 | Logging & Petrophysics Research |

TOTAL

\$4,178,556

1.4.2 Categories of Grants and Contracts

FEDERAL GRANTS AND CONTRACTS

| Program Sponsor | Research Project | Principal Investigator(s) | Amount Funded |
|--------------------------------|--|------------------------------|------------------|
| Department of Energy | Microbial EOR Research | Sharma | \$99,000 |
| | Innovative Techniques for the Description of Reservoir Heterogeneity Using Tracers | Pope, Sepehrnoori | \$116,490 |
| | Oil Recovery Improvement Through Profile Modification by Thermal Precipitation | Reis | \$34,522 |
| , | Oil Recovery from Naturally Fractured Reservoirs | Miller, Reis | \$135,017 |
| | A Novel Approach to Modellin Unstable EOR Displacements | | \$135,706 |
| | U.S. Gulf Coast Geopressured Geothermal Program | d- Dorfman | \$ 397,919 |
| | U.S. Gulf Coast Geopressured Geothermal Program (EG&G Idaho, Inc.) | d- Dorfman, Sepehrnoori | \$ 27,764 |
| National Science Foundation | Coupled Processes in Inhomogeneous Geological Systems | Sharma | \$33,500 |
| | Detachment of Particles from Surfaces | Sharma | \$33,500 |
| TOTAL FEDERAL SUPP | ORT | \$ | 1,013,418 |

PRIVATE GRANTS AND CONTRACTS

| Program (Sponsors) | Director | Amount |
|--|-------------|-----------|
| Computing and Database Research (Cray Research, Inc., Digital Equipment Corp., and International Business Machines) | Sepehrnoori | \$427,833 |
| Enhanced Oil and Gas Recovery Research (ADREF, American Chemical Society, Amoco Production Co., Arco Oil and Gas Co., BP Exploration, Inc., Chevron Oil Field Research Co., Conoco, Inc., Elf Aquitaine, Exxon Production Research Co., Intevep, Japan National Oil Corp., Mobil Exploration & Producing Services, Inc., Mobil R&D Co., Norsk Hydro, Oryx Energy Company, Research Institute of Petroleum Exp. & Dev., Santa Fe Energy Resources, Inc., Shell Development Corporation, Shell Oil Company Foundation, Texaco Services, Inc., and Union Pacific Resources) | Lake | \$603,000 |
| Geosystems Engineering (Gas Research Institute and Mobil R&D Company) | Miller | \$270,205 |
| Imaging Laboratory (Keck Foundation) | Peters | \$35,000 |
| Logging and Petrophysics (Arco Oil and Gas Co., BP Exploration, Inc., Gas Research Institute/CER Corp., Halliburton Logging Services, Intevep, Marathon Oil Co., Mobil R&D Co., Oryx Energy Co., Petroleum Computing, Inc., Tektronix, Inc., and Western Atlas International, Inc.) | Sharma | \$575,534 |
| Production Research and Offshore Technology (Echometer Company and Offshore Technology Research Center) | Podio | \$60,385 |
| Stimulation, Logging and Formation Damage (Amoco Production Co., Arco Oil & Gas Co., BP International, Chevron Oil Field Research Co, Dowell Schlumberger, Inc., Elf Aquitaine, Exxon Production Research Co., Halliburton Services, Japan National Oil Corp., Mobil R&D Co., Oryx Energy Co., Phillips Petroleum Co., Shell Development Corp., Society of Professional Well Log Analysts, and Texaco Houston Research Center) | Hill | \$321,000 |

| Program (Sponsors) | Director | Amount |
|--|-----------|-------------|
| Wellbore Stability and Drilling Fluids (Amoco Production Co., Arco Oil and Gas Co., Baroid Drilling Fluids, BP International Ltd., Chevron Oil Field Research Co., Conoco, Inc., Exxon Production Research Co., Gas Research Institute, Gaylord Chemical, Intevep, Norsk Hydro, Oryx Energy Co., Phillips Petroleum Co., Shell Oil Co., and Terra Tek, Inc.) | Chenevert | \$339,442 |
| TOTAL PRIVATE SUPPORT | | \$2,632,399 |

STATE GRANTS AND CONTRACTS

| Project | PI/Director(s) | Amount |
|--|----------------------------------|-----------|
| Development of Emission Computed Tomography Methods for Fluid Flow (ARP) | Reis | \$25,000 |
| Maximizing Efficiency of Petroleum Recovery (ERAP) | Miller | \$128,000 |
| Optimizing Oil Recovery in MEOR Processes | Sharma | \$58,030 |
| State Lands Energy Resource Optimization (SLERO) | Miller, Pope, Wade, Schechter | \$316,709 |
| Initiation Grant (College of Engineering) | Morriss | \$5,000 |
| TOTAL STATE SUPPORT | | \$532,739 |

TOTAL SUPPORT (Federal, State, and Private) \$4,178,556

1.5 CPGE Research Staff

| Name/Department | Research Interests |
|---|---|
| Glen S. Baum Petroleum Engineering | Wellbore stability; drilling fluids; formation permeability studies |
| Graham F. Carey* Engineering Mechanics | Computational methods for fluids and transport phenomena; finite elements; applied mathematics |
| Joanna L. Castillo Petroleum Engineering | Computer graphics; software documentation; programming |
| Ben H. Caudle* Petroleum Engineering | Reservoir engineering; water flooding; secondary and enhanced oil recovery |
| Martin E. Chenevert* Petroleum Engineering | High-temperature/high-pressure properties of drilling fluids; wellbore stability in highly deviated wellbores; liquid-solid filtration |
| Mojdeh Delshad Petroleum Engineering | Reservoir engineering; flow through porous media; simulation of chemical and CO ₂ flooding |
| Myron H. Dorfman* Petroleum Engineering | Formation evaluation/well logging; reservoir characterization; geopressured-geothermal energy |
| Henry F. Dunlap Petroleum Engineering | Well logging; geology and geophysics; petroleum economics |
| Bob V. Everett Petroleum Engineering | Production in tight gas sands; gamma ray spectrometry |
| William B. Gardner* Petroleum Engineering | Land leasing and management |
| George Georgiou* Chemical Engineering | Fermentation engineering; microbial enhanced oil recovery |
| K. E. Gray* Petroleum Engineering | Drilling and rock mechanics; wellbore mechanics; reservoir engineering; transient fluid flow; geopressured-geothermal reservoir mechanics; fracture mechanics; horizontal wells |
| A.R. Gregory Petroleum Engineering | Wave propagation; acoustic measurements; logging |
| A. Daniel Hill* Petroleum Engineering | Production logging; reservoir conformance modification techniques; well treatment design; multiphase flow in pipes |
| Claude R. Hocott* Petroleum Engineering | Reservoir engineering; geological engineering |
| Gary A. Kocurek* Geological Sciences | Sedimentology and depositional systems; eolian processes; bedform mechanics; fluid mechanics |
| Larry W. Lake* Petroleum Engineering | Enhanced oil recovery; reservoir engineering; reservoir characterization; geochemical modeling; simulation |

| Name/Department | Research Interests |
|---|--|
| F. Jerry Lucia Bur. of Economic Geology | Reservoir characterization; rock/log calibration; petrofabrics |
| Krishan A. Malik* Petroleum Engineering | Reservoir and economic evaluation; energy economics and policy; oil and gas finance; petroleum and structural geology |
| Mark A. Miller* Petroleum Engineering | Reservoir engineering; natural gas engineering; thermal oil recovery; petrophysics; naturally fractured reservoirs |
| Steven Morriss* Petroleum Engineering | Open- and cased-hole well logging; petrophysics |
| Ekwere J. Peters* Petroleum Engineering | Flow through porous media; computer imaging; viscous fingering; computer-assisted transient pressure analysis; drilling and well completions |
| Augusto L. Podio* Petroleum Engineering | Well control and drilling optimization; computer-based production systems; multiphase flow; beam pumping optimization |
| Gary A. Pope* Petroleum Engineering | Enhanced oil recovery; reservoir engineering; simulation; phase behavior and thermodynamics; transport phenomena |
| Marie Quirein Petroleum Engineering | Petrophysical modelling; log analysis |
| John C. Reis* Petroleum Engineering | Naturally fractured reservoirs; thermal oil recovery; two-phase flow; nuclear logging and imaging; Environmental Issues |
| William R. Rossen* Petroleum Engineering | Enhanced oil recovery; foams; surfactant flooding; petrophysics; flow through fractures |
| Bruce A. Rouse Petroleum Engineering | Analytical techniques; imaging |
| Robert S. Schechter* Petroleum Engineering | Enhanced oil recovery; surface chemistry; properties of surfactants in solution; oil well stimulation |
| Robert Schneider Petroleum Engineering | Computer graphics; database systems; geographic information systems |
| Kamy Sepehrnoori* Petroleum Engineering | Simulation of enhanced oil recovery; computational methods; vector and parallel computations; applied mathematics; data bases |
| Mukul M. Sharma* Petroleum Engineering | Formation damage; petrophysics; fluid flow in porous media |
| I. Harold Silberberg* Petroleum Engineering | Volumetric and phase behavior of hydrocarbon systems; equations of state; applied thermodynamics |
| Noel Tyler Bur. of Economic Geology | Development geology; extended conventional oil and gas recovery; play analysis and resource assessment; reservoir characterization |

Name/Department

Research Interests

Willem C. J. van Rensburg* Petroleum Engineering Mineral and energy economics; synthetic fuels; coal and lignite exploration

William H. Wade* Chemistry

Properties of surfactants in solution; adsorption of

gases and liquids on solids; capillarity

Ann Winger Petroleum Engineering Physical property measurements of tight gas sands

Ching-H. Yew* **Engineering Mechanics** Experimental mechanics; fracture mechanics; wave motions in solids; material properties under impulsive loadings

David M. Young* **Mathematics** Partial differential equations; iterative solution of large linear systems; vector and parallel computations

CPGE Support Staff 1.6

| Name and Title | Program |
|--|---|
| Tana T. Amstutz Administrative Assistant | Imaging Laboratory |
| Esther L. Barrientes Sr. Administrative Associate | Enhanced Oil and Gas Recovery Research Program |
| Heldi Epp Administrative Assistant | Enhanced Oil and Gas Recovery Research Program |
| Elleen Gunter Administrative Assistant | Wellbore Stability and Drilling Fluids Research Program |
| Joye Johnson Administrative Associate | Stimulation, Logging and Formation Damage Research Program |
| Jane Ann Layton Administrative Associate | Geosystems Engineering Research Program |
| Egídio Leitão Administrative Associate | Computing and Database Research Program |
| Mary McGlynn Office Assistant | Stimulation, Logging and Formation Damage Research Program |

^{*}Faculty member

| Name and Title | Program |
|--|---|
| Bonnie B. Northcutt Administrative Associate | Geosystems Engineering Research Program |
| Linda G. Ottmers Sr. Administrative Associate | Geopressured-Geothermal Energy Research Program |
| Sherry Roan Administrative Associate | Logging and Petrophysics Research Program |

1.7 Research Programs

Research activities in the Center for Petroleum and Geosystems Engineering are diverse. CPGE's research is organized into the following eleven programs. In each program, students seeking M.S. or Ph.D. degrees play major roles in the conduct of the research.

1.7.1 Computing and Database Research

The database research consists of the design and implementation of a relational and spatial data model that describes information related to the petroleum industry. The information stored in this data base is intended to be a comprehensive description of information obtained from exploration through production phases. The data model is based on an entity relationship model that describes the information. The spatial aspects of the data are stored in data models that reflect current spatial data models. Research is being done to determine the feasibility of porting these data models to other database management systems, such as object-oriented data models. The data base is currently being used to store well blowout, well log, production, performance, and reservoir simulation data.

Another research activity in this program has focused on the application of vector and parallel processors for enhanced oil recovery simulation. A three-dimensional, multicomponent, multiphase chemical flooding simulator (UTCHEM) developed at The University of Texas is being used for this work. The simulator has been optimized, vectorized, and multitasked on the CRAY

Y-MP. The vectorized code averages around 200 million floating point operations per second on the CRAY Y-MP. In a recent study, a benchmark version of the UTCHEM simulator performed at better than one Gflops (one billion floating point operation per second), utilizing Cray Autotasking on a CRAY Y-MP/8 using 8 processors. A benchmark has also been performed using the UTCHEM simulator on several vector processors, such as the CRAY X-MP, CRAY Y-MP, CRAY 2, CRAY X-MS, IBM 3090, CDC CYBER 205, Convex C2, VAX 6500, and Alliant FX/80 as well as the IBM RISC SYSTEM/6000 (RS/6000) workstations. Ongoing research activities include development of algorithms suitable for vector and parallel processors as applied to reservoir simulators.

1.7.2 Energy and Mineral Resources Analysis

Current research in this program includes natural gas trade with Canada, an overview of percentage depletion, netback pricing techniques in crude oil markets, factors affecting Soviet oil and gas production, legal aspects of petroleum evaluation practice, risk evaluation for transnational petroleum and mineral operations in developing countries, and design of an enhanced oil recovery project under uncertainties.

1.7.3 Enhanced Oil and Gas Recovery

Research on enhanced oil and gas recovery (EOGR) is divided into three categories: reservoir characterization and simulation, process chemistry and physics, and process performance and design. Reservoir characterization and simulation seeks to improve numerical modelling of EOGR processes in the reservoir. The primary focus of this research is to further fundamental understanding of the flow of fluids through permeable rocks, to evaluate and improve methods for generating numerical simulator input, to enhance the quantitative representation of geology, and to improve the efficiency and accuracy of numerical models

themselves. These objectives are met through projects dealing with database development, microscopic characterization of rocks, tracer studies, simulation techniques, reservoir characterization, and fluid flow in porous media.

The second category, process chemistry and physics, is the most fundamental and experimentally oriented of the three. It seeks to determine the chemical and physical relations governing the interactions between fluids and solid surfaces and then uses this information to improve the application of enhanced oil recovery chemicals. The work proceeds through five projects: displacement mechanisms in thermal oil recovery, foams for mobility control in both CO₂ and steam flooding, viscoelastic properties of polymeric materials, steam flooding naturally fractured reservoirs, and an in-depth examination of the effects of molecular structure on surfactant properties.

The third category is process performance and design. This research seeks to incorporate the fundamental insights gained in the previous category with the tools developed under the first category to improve the design of EOGR processes. The emphasis here is more on application than for the other two categories. The projects in this category deal with simulation of crosslinked polymer conformance treatments, estimating mixing during reservoir displacements, research into design basics of chemical flooding, viscous fingering studies, CO₂ flooding design, precipitates for channel control, and compositional steam simulation.

1.7.4 Geopressured-Geothermal Energy Research

The Geopressured-Geothermal Energy Research Program has completed its sixteenth year of research and development. Focusing its attention on the Texas-Louisiana Gulf Coast, the program has thoroughly evaluated the potential for electric power production using heat, pressure, and dissolved natural gas from geopressured fluids. CPGE is actively involved in a field demonstration of the feasibility of this energy resource. This experiment, partly funded by the

Electric Power Research Institute, is taking place on a Texas geothermal well located south of Houston.

Well log studies have been performed on a new geopressured-geothermal well in Louisiana, originally drilled by Superior Oil and now offered to DOE as a design well for geothermal research. These studies indicate substantial free gas may be expected within four discrete sand intervals in the overall large (850 ft) pay section. A cooperative program is planned with geological work at Louisiana State University and Rice University and well log interpretation through CPGE.

Related research projects that are also active include: compaction studies on geopressured-geothermal reservoirs, the effect of boron in reservoir rocks on porosity logs, reservoir simulation, and database management.

1.7.5 Geosystems Engineering

The Geosystems Engineering Program encompasses research activities in two major areas: a) multidisciplinary studies to characterize and optimize petroleum reservoir performance, and b) studies related to non-traditional petroleum activities such as in-situ mining and underground waste disposal. The following projects are currently underway:

- CPGE participates in a consortium funded by the State of Texas Energy
 Research in Applications Program (ERAP), which is conducting a
 comprehensive multidisciplinary investigation of a petroleum reservoir in an
 important Permian Basin field.
- CPGE participates in the State Lands Energy Resource Optimization (SLERO) Center, which is conducting a program of reservoir studies designed to maximize recovery of oil and gas from reservoirs on Texas state lands.

- 3. The Gas Research Institute (GRI) is funding a detailed study of an analog outcrop and a single geologically well-defined gas reservoir in which geologic variables will be related to a variety of petrophysical properties.
- 4. In-situ remediation

1.7.6 Imaging Laboratory

The Imaging Laboratory enables CPGE researchers to observe and measure in situ properties and processes in cores in order to better characterize reservoir rocks and displacement phenomena. The Laboratory currently operates four imaging systems: an X-ray computed tomography (CT) scanner, a scanning electron microscope (SEM), a microcomputer-based video imaging workstation, and a nuclear magnetic resonance spectrometer/imaging system (NMRI).

The CT-scanner is a non-intrusive device that allows objects and processes to be examined at a scale of 10⁻³m in three dimensions. Smaller than its medical counterpart and specifically designed for core analysis, it has been used to obtain macroscopic descriptions of cores and fluid flow phenomena, including the observation of viscous fingering in corefloods and of oil recovery mechanisms in heterogeneous sandstones, the measurement of wormholes developed in carbonates during acidization, the characterization of vugular porosities in carbonate cores, and the identification of mineral inclusions in natural rock samples.

The SEM is an intrusive device that allows observation of mineral samples at an extremely small scale (10⁻⁸m). It has been used extensively to examine solid precipitation and fines migration in formation damage research. Plans are under way to add a cold stage that will allow rapidly frozen rock-fluid samples to be observed to determine the distribution of fluids in the rock.

The microcomputer-based imaging workstation was designed to provide a rapid non-invasive technique to observe fluid flow fields in a visual model at a scale of 10⁻³m. The workstation has been used to observe viscous gravity instability phenomena, to determine areal sweep efficiencies, and to measure the fractal dimensions of unstable displacement fronts.

The nuclear magnetic resonance spectrometer/imager (NMRI) is a non-intrusive device that allows for the exclusive observation of the fluid(s) in a rock core at a scale of 10⁻³m. The instrument will be used to measure the petrophysical properties of laboratory cores as well as to visualize physical and chemical processes within the cores.

1.7.7 Logging and Petrophysics

Research in logging and petrophysics is currently being conducted in the following areas: whole core analysis using gamma-ray and neutron radiography; nature of fluids in the flushed zone; effective petrophysical properties in complex pore geometries; electrical impedance of shales under in-situ conditions, 100 MHz to 1.5 GHz; membrane polarization of shaly sands, 10Hz to 10 MHz; correlation of static and dynamic mechanical properties; ultrasonic reflectivity of the borehole wall; evaluation and application of geochemical logging; radioactive tracer logging; relative permeability in two-phase flow in a single fracture; and thin-section image analysis for petrophysical applications.

Research in this program is sponsored by a consortium of oil and gas companies, the Gas Research Institute, the National Science Foundation and the State of Texas.

1.7.8 Production Research and Offshore Technology

Research in this program is divided among three areas: production operations, offshore technology, and ultrasonic measurements. In the first area, work is under way to determine appropriate correction factors for gas-liquid mixtures to be used when determining bottomhole pressure in pumping wells by automatic acoustic measurements. This research is being conducted in the test well located in the basement of the Petroleum Engineering Building. Also, an experimental study has been completed comparing the accuracy of standard orifice plate meters with computer-based turbine and orifice plate meters, using the facilities in the Automated

Production Laboratory. Future activity in this project will address determination of optimum sampling rate of pressure data for time-shared applications.

In the offshore technology area, research was undertaken using the Gas Kick Simulator to determine the most probable cause and the sequence of events in the West Vanguard blowout. Also completed is a study, using the UT test well, of the flow of mixtures of air and water/polymer solutions for the purpose of developing correlations for pressure gradients and gas-slip velocity that may be applicable to improved gas-kick simulation algorithms. Future research will include studies in different annular geometries.

Another project, recently initiated as part of the NSF Offshore Technology Research Center, is aimed at developing methods for remote metering of multiphase flow streams. The impetus for this research is the need for a reliable means of monitoring flows from subsea satellite wells. In the first stage of this work, ultrasonic imaging and Doppler velocimetry are being applied to measure the characteristics of gas-liquid stug flow in pipes.

In the area of ultrasonic measurements, two experimental projects are active. Measurements on the velocity of propagation and attenuation of acoustic waves in water-based drilling fluids are made for application in the development of techniques for early detection of gas influx as well as in the design of acoustic logging tools. In other projects, compressional and shear-wave velocity and attenuation are measured in 2-inch cores using the triaxial load frame and pressure vessel in the Soil and Rock Mechanics Laboratory.

1.7.9 Rock Mechanics

In the Rock Mechanics Program, research is directed towards compaction mechanics and reservoir behavior in geopressured-geothermal reservoirs and in relating measured reservoir rock petrophysical properties to behavior-predictor models in tight gas sands.

Current work will be used in evaluating reservoir stability, especially near the wellbore and in production intervals, during pore pressure drawdown due to fluid production. Cyclic uniaxial

compaction, triaxial compaction, and pore pressure drawdown compaction tests have been conducted on geopressured-geothermal reservoir samples to obtain strength and moduli data for input into reservoir and wellbore mechanics models.

Tensile testing of sandstones and shales, as well as strength and deformational behavior tests with high-pressure, high-temperature equipment capable of true three-dimensional loading, provide needed input data for modelling reservoir production stability near the wellbore region as reservoir fluid production progresses. Realistic modelling of reservoir behavior and performance will require quantification of the anisotropic nature of the rock materials, coupled with the three-dimensional stress states, elevated temperatures, complex pore pressure loadings, and time-dependent rock behavior involved. This research is sponsored by the U.S. Department of Energy and is supervised by two faculty members.

Other research concerns rocks with very low permeabilities. This work involves simultaneous measurement of petrophysical properties such as porosity, permeability, resistivity, cementation factor, and saturation exponent along with deformations, pore volume changes, and compressional and shear wave velocities, and strengths under several sets of applied stresses (confining pressure, pore pressure, and axial load) and test temperature. The test data base will be used to develop reservoir behavior-production stability models for reservoirs in which the insitu stresses are materially altered by fluid transport in production and/or injection operations.

1.7.10 Stimulation. Logging and Formation Damage

The Stimulation, Logging and Formation Damage Research Program entered its seventh year in 1991 with research continuing in the areas of computer modeling of three-dimensional fractures; hydraulic fracturing and poroelasticity; study of hydraulic impedance method; acid fracture conductivity; effect of temperature on minifrac pressure behavior; ultrasonic imaging and velocimetry in multiphase flow; carbonate acidizing; sandstone acidizing—perforation geometry; foam diversion in acid stimulation: basic mechanisms; mechanisms in plugging, diversion, and

fluid loss; acidizing of horizontal wells; application of geochemical modeling to well treatments; fines liberation, migration, and trapping attending flow of oil and water through sandstones; modeling formation damage in radial flow systems; formation damage due to drilling mud infiltration; colloidal particles at fluid-fluid interfaces: emulsion stability and multiphase flow; and permeability reduction in porous media.

1.7.11 Wellbore Stability and Drilling Fluids

In the study of wellbore stability in deviated boreholes, a computer model has been developed for calculating the stress distribution around deviated wellbores produced by tectonic and hydration stresses. Several tasks were performed to determine constants for the computer model and to provide the basic information necessary for an advanced understanding of the wellbore instability process. These tasks include measurement of diffusion constants, shale hydration, shale resistivity, shale swelling pressures, and shale pore pressures at elevated temperatures and pressures. The effects of overburden stress on these measurements are included.

Research on drilling and completion fluids consists of studies on the diffusion of gas into wellbores, the rheology of oil-based muds at elevated temperatures and pressures, filtration rates into low-permeability rocks, and the viscoelastic properties of water-based and oil-based muds. The diffusion study measures diffusion constants for methane through mud filter cakes at temperatures to 300°F and pressures to 250 psig. In the oil-based mud rheology studies, the effects of oil-water ratio, drilled solids, and organophillic clays are determined to elevated temperatures and pressures. The viscoelastic projects develop data useful for defining the carrying capacity of drilling fluids. Slip velocities of various particles are measured and models developed using viscoelastic constants for predicting such velocities. In particular, the oil-based mud viscoelastic study concentrates on the effects of adding organophillic clays to diesel oil and

mineral oil systems. The filtration research focuses on the role that drilling mud filter cakes play in controlling invasion rates into low-permeability gas sands.

2.0 RESEARCH ACTIVITIES

Publications with more than one author are listed under each faculty member's name.

2.1 Articles Published in Journals and Proceedings

- Chenevert, M. E.; and Huycke, J.; "Control of Differential Sticking with Filtration Additives," Fluid/Particle Separation Journal, September 1990.
- Chenevert, M. E.; and Shrestha, B.K.; "Chemical Shrinkage Properties of Oilfield Cements," <u>SPE Drilling Engineering</u>, March 1991.
- Chenevert, M. E.; and Yew, C.; "Wellbore Stress Distribution Produced by Moisture Adsorption," SPE Drilling Engineering, December 1990.
- Chenevert, M. E.; Morriss, S. L.; and Javalagi, M.I.; "Time-Lapse Resistivity and Water-Content Changes in Shale," Society of Professional Well Log Analysts 32nd Annual Logging Symposium, Midland, Texas, June 1991.
- Chenevert, M. E.; Peters, E. J.; and Alhamadah, A.M.; "OILMUD: A Microcomputer Program for Predicting Oil-Based Mud Densities and Static Pressures," SPE Drilling Engineering, pp.57-59, March 1991.
- Gray, K. E.; and Holder, J.; "Towards Characterizing Shale Stability," 44th Canadian Geotechnical Conference, September 30 October 1, 1991.
- Hill, A. D.; Morriss, S. L.; Podio, A. L.; and Song, S.; "An Investigation of the Stratified-Slug Flow Transition in Horizontal Gas-Liquid Flow in Large Diameter Pipes," paper OTC 6746 presented at the 20th Annual Offshore Technology Conference in Houston, Texas, May 2-5, 1991.
- Hill, A. D.; Sepehrnoori, K; and Wu, P.; "Design of the HCI Preflush in Sandstone Acidizing," SPE 21720, Proceedings of the SPE Production Operations Symposium, Oklahoma City, Oklahoma, April 7-9, 1991.
- Lake, L. W.; Kasap, E.; and Shook, G.; "Pseudofunctions The Key to Practical Use of Reservoir Description," North Sea Oil & Gas Reservoirs- II, Proceedings of the 2nd North Sea Oil and Gas Reservoirs Conference organized and hosted by the Norwegian Institute of Technology, A.T. Buller, E. Berg, O. Hjelmeland, J. Kleppe, O Torsæter and J. O. Aasen, eds., Graham & Trotman, London, 1990.
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- Lake, L. W.; Miller, M. A.; and Wolff, M.; "Oil Recovery from Geologically Based Fractured Networks," In Situ, Vol. 14, No. 4, December 1990.
- Lake, L. W.; Miller, M. A.; Wolf, M.; and Oney, Baris; "On The Imbibition of Oil from Fractured Reservoir Matrix Blocks," In Situ, Vol. 15, No. 1, pp.1-33, 1991.
- Miller, M. A.; Lake, L. W.; and Wolf, M.; "Oil Recovery from Geologically Based Fracture Networks," In Situ, Vol. 14, No. 4, pp. 407-427, 1990.

- Miller, M. A.; Lake, L. W.; Wolff, M.; and Oney, B.; "On the Imbibition of Oil From Fractured Reservoir Matrix Blocks," In Situ, Vol. 15, No. 1, March 1991.
- Miller, M. A.; Sepehrnoori, K.; and Chen, J.; "Comparisons of Counter-Current Imbibition Transfer Functions in Dual Porosity Models of Naturally Fractured Reservoirs," <u>In Situ</u>, 15 (2), 1991.
- Morriss, S. L.; Chenevert, M. E.; and Javalagi, M.I.; "Time-Lapse Resistivity and Water-Content Changes in Shale," Society of Professional Well Log Analysts 32nd Annual Logging Symposium, Midland, Texas, June 1991.
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- Peters, E. J.; and Cavalero, S. R.; "The Fractal Nature of Viscous Fingering in Porous Media," Proceedings of the 65th Annual Technical Conference of the Society of Petroleum Engineers, New Orleans, Louisiana, September 23-26, 1990.
- Peters, E. J.; and Khataniar, S.; "A Comparison of the Finite Difference and Finite Element Methods for Simulating Unstable Displacements," <u>Journal of Petroleum Science and Engineering</u>, Vol. 5, pp. 205-218, 1991.
- Peters, E. J.; Chenevert, M. E.; and Alhamadah, A.M.; "OILMUD: A Microcomputer Program for Predicting Oil Mud Densities and Static Pressures at High Pressures and Temperatures," SPE Drilling Engineering, March 1991.
- Podio, A. L.; and Gregory, A.R.; "Ultrasonic Velocity and Attenuation Measurements in Water-Based Drilling Muds," Proceedings of ASME Drilling Technology Symposium, PD Vol 27, pp. 135-140, 1990.
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- Podio, A. L.; "Computer Applications in Drilling: Workstation-Aided Drilling, Expert Systems and Artificial Intelligence," Proceedings of the Seventh Latin American Drilling Congress, Santa Cruz, Bolivia, October 10-12, 1990.
- Podio, A. L.; McCoy, J. N.; and Becker, D.; "Improved Acoustic Liquid Level Surveys by Digital Data Acquisition, Processing and Analysis," paper presented at the 38th Annual Southwestern Petroleum Short Course, Texas Tech University, April 17-18, 1991.
- Podio, A. L.; Morriss, S. L.; Hill, A. D.; and Song, S.; "An Investigation of the Stratified-Slug Flow Transition in Horizontal Gas-Liquid Flow in Large Diameter Pipes," paper OTC 6746 presented at the 20th Annual Offshore Technology Conference in Houston, Texas, May 2-5, 1991.
- Podio, A. L.; Seghier, M.; and Dunn, W.W.; "Comparative Study of Microcomputer-Based Gas Flow Computers," SPE paper 21510, presented at the Society of Petroleum Engineers Gas Technology Symposium, pp 291, Houston, Texas, January 23-25, 1991.
- Podio, A. L.; Sepehrnoori, K.; and Hughes, V.M.P; "A Computer-Assisted Analysis of Trends Among Gulf Coast Blowouts," In Situ, 14(2), 201-228, 1990.
- Podio, A. L.; Sharma, M. M.; and Tutuncu, A.; "The Effect of Clay Content on the Compressional and Shear Velocities and Attenuations in Tight Gas Sand Formations," Proceedings of the SEG Workshop on Relating Elastic Properties to Lithology at all Scales, St. Louis, Missouri, 1991.

- Pope, G. A.; Sepehrnoori, K.; and Allison, S.B.; "Analysis of Field Tracers for Reservoir Description," <u>Journal of Petroleum Science and Engineering</u>, 5 (2), 1991.
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- Pope, G. A.; Sepehrnoori, K.; and Saad, N.; "Application of Higher-Order Methods in Compositional Simulation," SPE Reservoir Engineering, 5 (4), 1990.
- Pope, G. A.; Sepehrnoori, K.; and Shiles, G.; "Benchmark of UTCHEM Reservoir Simulator on Various Cray Computers," <u>Communications in Applied Numerical Methods</u>, 7 (1), 1991.
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- Pope, G. A.; Sepehmoori, K.; and Wreath, D.; "Dependence of Polymer Apparent Viscosity on the Permeable Media and Flow Conditions," In Situ, 14 (3), 1990.
- Reis, J. C.; "Modeling of Distillation of Light Oil During High-Temperature Nitrogen Corefloods," In Situ. Vol. 15, No. 2, pp. 149-173, 1991.
- Rossen, W. R.; and Gauglitz, P.A.; "Percolation Theory of Creation and Mobilization of Foams in Porous Media," <u>AIChE Journal</u>, 36, 1176, 1990.
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- Sharma, M. M.; Annual Report (3 projects) for the Enhanced Oil and Gas Recovery Research Program, Center for Petroleum and Geosystems Engineering, University of Texas, Austin, Texas, 1991.
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2.3 Books

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- Morriss, S. L.; and Jutten, J.; "Cement Job Evaluation," Well Cementing, Erik Nelson (ed.), Elsevier, 1990.
- Schechter, R.S. (ed.), Acidizina, Reprint Series, Society of Petroleum Engineers, Vol. 32, 1991.
- Schechter, R.S., Oil Well Stimulation, Prentice Hall, New York, August 1991.

2.4 Invited Lectures and Technical Presentations

Chenevert, M. E.; "Abnormal Pressure Detection," Milpark Company Forum, Dallas, Texas, May 23, 1991.

- Chenevert, M. E.; and Huycke, J.; "Filter Cake Structure for Typical Fluid Loss Additives," The American Filtration Society 1990 National Fall Meeting, Baton Rouge, Louisiana, October 28, 1990.
- Chenevert, M. E.; and Sharma, A.K.; "Permeability and Effective Pore Pressure of Shales," SPE paper number 21918 presented at the SPE/IADC Symposium/Workshop, Amsterdam, The Netherlands, March 11-14, 1991.
- Chenevert, M. E.; "Drilling Research at UT," ARCO Research Center, Dallas, Texas, January 23, 1991.
- Chenevert, M. E.; "Measurement of Shale Activity Using Oil Muds," API Work Group, Houston, Texas, October 3, 1990.
- Chenevert, M. E.; "Permeability of Filter Cakes," paper presented at GRI Meeting, College Station, Texas, November 5, 1990.
- Dunlap, H. F.; "The Evaluation of a Geopressured-Geothermal Prospect," presented at Industrial Consortium for Utilization of Geopressured-Geothermal Resource, Balcones Research Center, University of Texas at Austin, September 1990.
- Gray, K. E.; "Index Tests on Problem Shales," Wellbore Stability Forum, Elf Aquitaine, Pau, France, November 23, 1990.
- Gray, K. E.; "Modeling Shale Anisotropy," Research Program on Drilling and Rock Mechanics, August 8, 1991.
- Gray, K. E.; "Rock Mechanics Research at The University of Texas," Unocal Corporation, Brea, California, July 1, 1991.
- Gray, K. E.; "Rock Mechanics Research," University of Waterloo, Waterloo, Ontario, Canada, May 13-16, 1991.
- Gray, K. E.; "Solids Production," Research Program on Inclined and Horizontal Wells, August 9, 1991.
- Gray, K. E.; "Swelling Tests on Shales," Research Program on Drilling and Rock Mechancis, March 14, 1991.
- Gray, Kenneth E.; "Database on Shale Tests," Research Program on Drilling and Rock Mechancis, August 8, 1991.
- Gray, Kenneth E.; "Borehole Stability: Theory and Practice," Canadian Institute of Mining and Metallurgy, Geomechanics Group, Calgary, Alberta, Canada, march 27, 1991.
- Gray, Kenneth E.; "Wellbore Stability, Sand Production, Coring Projections and Coal Gas Production," Petroleum Division CIM, Calgary, Alberta, Canada, March 28, 1991.
- Hill, A.D.; "Acidizing of a Perforation," Society of Petroleum Engineers European Forum, Grindelwald, Switzerland, September 2-7, 1990.
- Hill, A.D.; Morriss, S.L.; Podio, A.L.; and Song, S.; "An Investigation of the Stratified-Slug Flow Transition in Horizontal Gas-Liquid Flow in Large Diameter Pipes," 20th Annual Offshore Technology Conference, Houston, Texas, May 2-5, 1991.
- Hill, A.D.; "Overview of Well Stimulation Research," Chevron Oil Field Research, La Habra, California, November 28, 1990.
- Hill, A.D.; "Overview of Well Stimulation Research," Elf Aquitaine Production Research, Pau, France, June 17, 1991.

- Hill, A.D.; "Overview of Well Stimulation Research," UNOCAL Technology Center, Los Angeles, California, November 29, 1990.
- Hill, A.D.; "Production Logging in Deviated Wells," Mining University Leoben, Society of Petroleum Engineers Student Chapter, Leoben, Austria, June 11, 1991.
- Hill, A.D.; "Production Logging in Deviated Wells," Society of Petroleum Engineers Austin Section, Austin, Texas, January 8, 1991.
- Hill, A.D.; Sepehmoori, K.; and Wu, P.; "Design of the HCI Preflush in Sandstone Acidizing," Society of Petroleum Engineers Production Operations Symposium, Oklahoma City, Oklahoma, April 7-9, 1991.
- Lake, L.W.; "Reservoir Characterization," Fifth Joint Canadian/American Conference on Hydrogeology, Calgary, Canada, September, 1991.
- Lake, L.W.; "Reservoir Characterization," Archie Conference on Petrophysics, Houston, Texas, October 1990/
- Lake, L.W.; "Reservoir Characterization," Sandia National Laboratory Colloquium, Albuquerque, New Mexico, October 1990.
- Lake, L.W.; "Reservoir Characterization," Conference on Characterization of Fluvial and Aeolian Reservoirs, University of Aberdeen, United Kingdom, March 1991.
- Lake, L.W.; "Reservoir Characterization," Department of Applied Mathematics, Rice University, Houston, Texas, March 1991.
- Lake, L.W.; "Reservoir Characterization," Annual Convention of the American Association of Petroleum Geologists, Dallas, Texas, April 1991.
- Lake, L.W.; "Reservoir Characterization," Dynamic Geologic Modeling Conference, Texaco, Houston, April 1991.
- Lake, L.W.; "Reservoir Characterization," Chevron Overseas Petroleum Incorporated, Eolian Workshop, Vernal, Utah, August 19, 1991.
- Lake, L.W.; "Reservoir Characterization," The Society of Core Analysts' Fifth Annual Technical Conference, San Anotnio, Texas, August, 20, 1991.
- Lake, L.W.; "Simulation of EOR Processes in Stochastically Generated Permeable Media," with J.R. Waggoner and J.L. Castillo, paper <u>SPE 21237</u>, presented at the 11th SPE Symposium on Reservoir Simulation, Anaheim, California, 17-20, 1991.
- Lake, L.W.; "Simulation of High-pH Coreflood Experiments Using a Compositional Chemical Flood Simulator," with Debojit Bhuyan and Gary A. Pope, paper <u>SPE 21029</u>, presented at the 11th SPE International Symposium on Oil Field Chemistry, Anaheim, California, February 20-22, 1991.
- Lake, L.W.; "A Theory of Multicomponent Chromatography with Application to Polymer Flooding." with T. Johansen, A. Tveito and R. Winther, presented at the 1991 European Conference on Improved Oil Recovery, Stavanger, Norway, May 21-23, 1991.
- Lake, L.W.; "A New Approach to Pseudo-Functions for Multiphase Flow in Stratified Porous Media," with P. Ingsøy and R. Gauchet, presented at the 1991 European Conference on Improved Oil Recovery, Stavanger, Norway, May 21-23, 1991.
- Miller, M. A.; "An Overview of Thermal Enhanced Oil Recovery," Department of Geology, University of Texas, Austin, Texas, February 6, 1991.

- Miller, M. A.; "Broadening the Petroleum Engineering Curriculum," Colloquium on Petroleum Engineering Education, Mt. Crested Butte, Colorado, July 1991.
- Miller, M. A.; "The Role of Graduate Education Research and Technology Transfer Graduate Education Issues," Colloquium on Petroleum Engineering Education, Mt. Crested Butte, Colorado, July 1991.
- Morriss, S. L.; and Hill, A. D.; "Measurement of Velocity Profiles in Upwards Oil-Water Flow Using Ultrasonic Doppler Velocimetry," SPE paper 22766, 1991 SPE Annual Technical Conference and Exhibition, Dallas, Texas, October 1991.
- Morriss, S. L.; Hill, A. D.; Podio, A. L.; and Song, S.; "An Investigation of the Stratified-Slug Flow Transition in Horizontal Gas-Liquid Flow in Large-Diameter Pipes," 23rd Annual Offshore Technology Conference, Houston, Texas, May 1991.
- Morriss, S. L.; Presented report of study group on Cement Evaluation at SPE Forum, Crested Butte, Colorado, August 1991.
- Peters, E.J.; and Afzal, N.; "Computer Image Processing in Enhanced Oil Recovery," presented at the Eighth Annual Meeting, EOGRR Program, Center for Petroleum and Geosystems Engineering, Austin, Texas, April 5, 1991.
- Peters, E.J.; and Cavalero, S.R.; "The Fractal Nature of Viscous Fingering in Porous Media," Proceedings of the 65th Annual Technical Conference of the Society of Petroleum Engineers, New Orleans, Louisiana, September 23-26, 1990.
- Peters, E.J.; "Applications of Computer Imaging in Enhanced Oil Recovery Research," Petroleum Engineering Seminar, New Mexico Institute of Mining and Technology, Socorro, New Mexico, April 18, 1991.
- Podio, A. L.; and Gregory, A.R.; "Ultrasonic Velocity and Attenuation Measurements in Water-Based Drilling Muds," Proceedings of ASME Drilling Technology Symposium, PD Vol 27, pp. 135-140, 1990.
- Podio, A. L.; and McCoy, J.N.; "Computerized Well Analysis," SPE paper 21174, presented at the Latin American Petroleum Engineering Conference, Rio de Janeiro, Brazil, October 14-19, 1990.
- Podio, A. L.; and McCoy, J.N.; "New System Analyzes Pumping Well Performance," World Oil, pp. 71, November 1990.
- Podio, A. L.; "Computer Applications in Drilling: Workstation-Aided Drilling, Expert Systems and Artificial Intelligence," Proceedings of the Seventh Latin American Drilling Congress, Santa Cruz, Bolivia, October 10-12, 1990.
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- Podio, A. L.; McCoy, J. N.; and Becker, D.; "Improved Acoustic Liquid Level Surveys by Digital Data Acquisition, Processing and Analysis," paper presented at the 38th Annual Southwestern Petroleum Short Course, Texas Tech University, April 17-18, 1991.
- Podio, A. L.; Morriss, S. L.; Hill, A. D.; and Song, S.; "An Investigation of the Stratified-Slug Flow Transition in Horizontal Gas-Liquid Flow in large Diameter Pipes," paper presented at the 20th Annual Offshore Technology Conference in Houston, Texas, May 2-5, 1991.

- Podio, A. L.; Seghier, M.; and Dunn, W.W.; "Comparative Study of Microcomputer-Based Gas Flow Computers," SPE paper 21510, presented at the Society of Petroleum Engineers Gas Technology Symposium, pp 291, Houston, Texas, January 23-25, 1991.
- Podio, A. L.; Sepehrnoori, K.; and Hughes, V.M.P; "A Computer-Assisted Analysis of Trends Among Gulf Coast Blowouts," In Situ Journal, 14(2), 201-228, 1990.
- Reis, J. C.; "Application of First Principles in Modeling Steam Assisted Gravity Drainage in Tar Sands," The University of Texas, Austin, Texas, April 18, 1991.
- Reis, J. C.; "Oil Recovery Mechanisms During Steam Flooding," Texaco, Houston, Texas, October 26, 1990.
- Rossen, W. R.; "Modeling 'Strong' Foam Mobility in Porous Media," Petroleum Recovery Institute, Calgary, Alberta, Canada, April 26, 1991.
- Rossen, W. R.; "Modeling Foam Mobility in Porous Media," Chevron Oil Field Research Company, La Habra, California, July 11, 1991.
- Rossen, W. R.; "Modeling Foam Mobility in Porous Media," Texaco E&P Technology Division, August 19, 1991.
- Rossen, W. R.; "Rheology of Foam in Porous Media at the Limiting Capillary Pressure," Koninklijke/ Shell Exploratie en Produktie Laboratorium, Rijswijk, Netherlands, May 29, 1991.
- Rossen, W. R.; "Rheology of Foam in Porous Media at the Limiting Capillary Pressure," Sixth European Symposium on Improved Oil Recovery, May 21-23, 1991.
- Rossen, W. R.; "Separating Relative Permeability and Viscosity in Foam Rheology," Institute Français du Petrole, Paris, France, May 24, 1991.
- Rossen, W. R.; "Separating Relative Permeability and Viscosity in Foam Rheology," Technical Institute of Delft, Delft, Netherlands, May 28, 1991.
- Schechter, R. S.; Aoudia, M.; Hubig, S.M.; and Wade, W.H.; "An Investigation of Coexisting Mixed Micelles Using Pulse Radiolysis," 65th Annual Colloid and Surface Science Symposium, Norman, Oklahoma, June 17-19, 1991.
- Schechter, R. S.; Graciaa, A.; and Ben Ghoulam, M.; "Effect of Ionic/Nonionic Interactions on the Partitioning of Polydistributed Nonionic Surfactants," 65th Annual Colloid and Surface Science Symposium, Norman, Oklahoma, June 17-19, 1991.
- Schechter, R.S.; "Foams in Porous Media," 65th Annual Colloid and Surface Science Symposium, Norman, Oklahoma, June 17-19, 1991.
- Sepehrnoori, K.; "Application of Vector/Parallel Processors in Enhanced Oil Recovery Simulation," Micro Electronics and Computer Technology Corporation, Austin, TX, February, 1991.
- Sepehrnoori, K.; "Application of Vector/Parallel Processors in Reservoir Simulation," Society of Industrial and Applied Mathematics, Houston, TX, March, 1991.
- Sepehrnoori, K.; "Petroleum Reservoir Simulation on the CRAY Y-MP," Cray Research, Inc., London, England, October, 1990.
- van Rensburg, W. C.J.; "Protecting Planet Earth: New Imperatives," National Council of State Garden Clubs, Inc., Hot Springs, Arkansas, October 8, 1990.

van Rensburg, W. C.J.; "Synthetic Fuels," E.L. Miller Lecture Series 1900, Texas A&M University, College Station, Texas, November 15, 1990.

2.5 Abstracts

- Lake, L. W.; Miller, C.; Collins, R. E.; and Rouse, B.A.; "Molecular Diffusion Within Aquitard Rocks," EOS Transactions, American Geophysical Union, Vol. 72, No. 17, p. 109, April 23, 1991/supplement.
- Lake, L. W.; Schechter, R.S.; and Sevougian, S.D.; "The Effect of Partial Local Equilibrium on Mineral Zonation," EOS Transactions, American Geophysical Union, Vol. 72, No. 17, p. 111, April 23, 1991/Supplement.
- Schechter, R.S.; Lake, L. W.; and Sevougian, S.D.; "The Effect of Partial Local Equilibrium on Mineral Zonation," EOS Transactions, American Geophysical Union, Vol. 72, No. 17, p. 111, April 23, 1991/Supplement.

2.6 Copyrighted Software

Peters, E.J.; Chenevert, M.E.; and Alhamadah, A.M.; "OILMUD," Copyrighted Software, SPE Book Order Department, Disk No. 48, Copyright Society of Petroleum Engineers, 1991.

2.7 Short Courses

- Chenevert, M. E.; "Wellbore Stability," Broken Hills Petroleum Company, Darwin, Australia, November 30, 1990 December 12, 1990.
- Chenevert, M. E.; "Drilling Fluids," Intevep, Caracas, Venezuela, August 5-9, 1991.
- Hill, A. D.; "Acidizing and Production Logging," Mining University Leoben, Leoben, Austria, June 5-6, 12-13, 19-20, 26, 1991.
- Hill, A. D.; "Production Logging," Cal-Tex, Pekanbaru, Indonesia, July 15-19, 1991.
- Hill, A. D.; "Production Logging: Flowmetering in Wells," Halliburton Logging Services, Houston, Texas, April 16, 1991.
- Hill, A. D.; "Well Stimulation: Acidizing and Fracturing," P.T. Loka Datamas Indah, Jakarta, Indonesia, July 22-26, 1991.
- Lake, L. W.; "Reservoir Characterization," Mobil Oil, Dallas, Texas, July 1991.
- Lake, L. W.; "Reservoir Characterization," P.T. Loka Datamas, Jakarta, Indonesia, August 1991.
- Lake, L. W.; "Reservoir Characterization," Statoil, Stavanger, Norway, May 1991.
- Lake, L. W.; "Reservoir Characterization," U.T. Continuing Engineering Studies Program, July 1991.

- Lake, L. W.; "Enhanced Oil Recovery," Caltex Pacific Indonesia, Rumbia, Indonesia, July 1991.
- Lake, L. W.; "Reservoir Characterization," University of Tulsa, Tulsa, Oklahoma, April 1991.
- Lake, L. W.; "Reservoir Characterization," Western Technologies, Cairo, Egypt, January 1991.
- Lake, L. W.; "Reservoir Characterization," Society of Petroleum Engineers, Denver, Colorado, January 1991.
- Lake, L. W.; "Reservoir Characterization," Society of Petroleum Engineers, Long Beach, California, March 1991.
- Lake, L. W.; "Reservoir Characterization," Society of Petroleum Engineers, New Orleans, Louisiana, September 1990.
- Lake, L. W.; "Reservoir Characterization," Society of Petroleum Engineers, Stavanger, Norway, May 1991.
- Malik, K.; "Energy Economics," School of Management, Oslo, Norway, June 17-21, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by AGIP S.P.A. in Milan, Italy, July 1-5, 1991.
- Malik, K.; "Energy Finance," sponsored by Institute of International Education, Austin, Texas, May 8-10, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by Petroperu, S.A., Lima, Peru, January 7-11, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by Institute for Petroleum Development, Houston, Texas, December 10-12, 1991.
- Malik, K.; "Petroleum Project Evaluation and Decision Making," sponsored by Institute of International Education, Austin, Texas, April 22-25, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by OMV Aktiengesselschaft, Vienna, Austria, June 24-28, 1991.
- Malik, K.; "Mergers and Acquisitions and Strategic Planning in the International Oil Industry," sponsored by SAGA Petroleum A.S., Oslo, Norway, June 14, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by Petromar S.A., Lima, Peru, November 19-23, 1990.
- Malik, K.; "Energy Finance," Norwegian School of Management, Oslo, Norway, February 11-15, 1991
- Malik, K.; "Global Oil Economics and Strategic Planning," sponsored by Institute of International Education, Austin, Texas, April 8-10, 1991.
- Malik, K.; "Global Oil Economics and Petroleum Project Evaluation," sponsored by Petroperu S.A., Lima, Peru, November 5-9, 1990.
- Malik, K.; "Global Oil Economics," University of Pennsylvania, Philadelphia, January 28-31, 1991.
- Malik, K.; "Energy Finance," Colorado School of Mines, Golden, Colorado, March 11-15, 1991.
- Malik, K.; "Project Finance," University of Pennsylvania,, Philadelphia, February 18-21, 1991.

- Malik, K.; "Project Economics and Analysis," Norwegian School of Management, Oslo, Norway, February, 4-8, 1991.
- Miller, M. A.; "Advanced Petrophysics," PT Loka Datamas, Jakarta, Indonesia, 40 hours, August 10-16, 1991.
- Miller, M. A.; "Basic Reservoir Engineering for Geoscientists," ARCO 40 hours, Dallas, Texas, March 17-22, 1991.
- Miller, M. A.; "Basic Reservoir Engineering for Geoscientists," 40 hours, PT Loka Datamas, Jakarta, Indonesia, August 17-24, 1991.
- Morriss, S. L.; "Use of Acoustic Measurements to Determine the Presence and Quality of Cement Behind Pipe," four one-day courses presented for Mobil Exploration and Production Services, Incorporated, Duncan, Oklahoma, February 28 May 1, 1991.
- Podio, A. L.; "Southwest Petroleum Short Course," Texas Tech University, Lubbock, Texas, April 17-18, 1991.
- van Rensburg, W. C. J.; "Economic Evaluation of International Development Project," P.T. Loka Datamas Indah, Jakarta, Indonesia, January 21, 1991.
- van Rensburg, W. C. J.; "Future Competition for International Oil," P.T. Loka Datamas Indah, Jakarta, Indonesia, January 25, 1991.
- van Rensburg, W. C. J.; "Global Energy Economics," Australian Mineral Foundation, Melbourne, Australia, July 1-5, 1991.
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