

# TUFFFP

TULSA UNIVERSITY FLUID FLOW PROJECTS NEWSLETTER

SUMMER/FALL 1992

A Semiannual Publication

Volume 6, Number 2

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### TU Selects Key Engineering Administrators

In June 1992, Dr. Lewis M. Duncan became the new Dean of the College of Engineering and Applied Sciences and Professor of Physics at The University of Tulsa. Professor Duncan comes to us from Clemson University where he was Associate Dean of the College of Sciences and Special Assistant to the Vice President for Research and Dean of the Graduate School. At Clemson, Dean Duncan successfully maintained an internationally recognized experimental research program in the areas of radiophysics and space plasma physics. He has also been active in international security studies, including nuclear testing and nonproliferation, verification technologies, and nuclear terrorism.

In August 1992 Dr. Stefan Miska became Chairman and Professor of Petroleum Engineering at The University of Tulsa. Dr. Miska previously held the same positions at the New Mexico Institute of Mining and Technology in Socorro, New Mexico. Since receiving the Doctor of Technical Sciences from the University of Mining and Technology in Cracow, Poland, he has compiled 19 years of experience in Petroleum Engineering education, drilling, well completions and production of oil and gas. He has conducted extensive research and published in the areas of downhole pneumatic motors, drill string mechanics, drilling modeling, sucker rod pumping systems, and pressure transient well testing for improved reservoir characterization. Stefan's background in these areas will make him a valuable resource to TUFFP and other research consortiums in the department.



### 1992 TUFFP Questionnaire

The 1992 TUFFP Questionnaire was distributed to the official Advisory Board representative for each member company at the beginning of September. Members were asked to express their relative interest on 18 existing and possible future research projects. A request was made that the questionnaire be returned by October 5, 1992 and results will be tabulated and summarized in the November Advisory Board meeting brochure.

## SPE Forum on Multiphase Flow a Resounding Success

A very successful SPE Forum on Multiphase Flow was held at Snowmass Village, Colorado during the week of August 2-7, 1992. Approximately 75 of the worlds top experts on multiphase flow through pipes gathered for a week of intense technical exchanges. TUFFP played a major role in the forum, with former Research Assistant Dr. Stuart Scott serving as Chairman of the forum, Dr. Gene Kouba and Dr. Ovadia Shoham serving on the organizing committee, and numerous TUFFP Advisory Board Representatives, former Research Assistants, Dr. Brill and Dr. Taitel serving as organizing committee members, invited speakers, poster session participants or attendees.

## Yehuda Taitel Returns to TUFFP

Dr. Yehuda Taitel again returned to TUFFP for a period of five weeks this summer as a consultant. During this period he attended the SPE forum on multiphase flow to further improve his knowledge of multiphase flow problems in the petroleum industry. He was available during all of August to lend his unique expertise to assisting TUFFP researchers in their modeling problems. One of his assignments was to work with Dr. Guohua Zheng to complete development of a slug tracking model for hilly terrain pipelines.

## TUFFP Short Course - Big Success

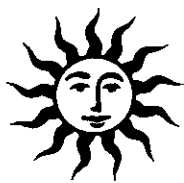
Once again a very successful short course on "Two-Phase Flow in Pipes" was held May 18 - 22, 1992 in Tulsa, Oklahoma. The



course was attended by 23 engineers and scientists, including 17 from 9 TUFFP member companies and 6 from 4 non-member companies. Income from the course was sufficient to pay all expenses incurred.

## Technician Assistant Leaves TUFFP

During the past 8 months, Tim Schneider has served as a technician assistant at TUFFP with his primary responsibility being to perform maintenance and modifications to test facilities. Tim has been a valuable employee but has decided to terminate his employment at TUFFP to permit increased involvement in church activities.



## Summer Students Again Help Out at TUFFP

Two students were hired full-time to assist with TUFFP activities during the summer of 1992. Mario Ballesteros completed his B.S. degree in Mechanical Engineering in May 1992 and will begin an M.S. program in Petroleum Engineering this fall. During the first part of the summer he helped with maintenance of test facilities and in the last part of the summer he assisted Hector Felizola with processing experimental data on the project dealing with Two-Phase Slug Flow in Deviated Wells. Robert Marcano, a junior in Petroleum Engineering worked all summer on maintenance of experimental test facilities.

## Visiting Scholar Arrives at TUFFP

Dr. Emilio Guevara, previously Crude Handling Section Head at INTEVEP, the Venezuelan research affiliate of PDVSA, has arrived to spend a year as a Visiting Scholar at TUFFP. Emilio has been actively involved in conducting research on the transportation of viscous oils with core-annular flow. He has also been INTEVEP's Advisory Board representative to TUFFP for the past several years. INTEVEP plans to significantly expand their research activities in multiphase flow, and sending Dr. Guevara to work with TUFFP for a year will be mutually beneficial. During his stay at TUFFP, he will help define our future research projects involving oil/water and gas/oil/water flow in pipes.

Dr. M. P. Sharma, Associate Professor of Petroleum Engineering at the University of Wyoming, canceled his plans to spend a sabbatical year at TUFFP.

## TUFFP Hires New Staff Assistant



A decision was made to hire a new temporary, part time Staff Assistant to help with the design, procurement, bid preparation, construction and modifications of test facilities. Mr. Jerry Wilson, an experienced Civil Engineer who recently retired from the US Army Corps of Engineers, was hired in late July to fill this position. He will provide a needed interface between Dr. Brill, graduate students and the TUFFP research technicians to ensure that test facilities meet appropriate engineering specifications, including safety and environmental considerations. His first assignment has been to work with Philippe Roumazeilles during the design and constructions of a new facility to investigate downward two-phase flow. His responsibilities will also include providing direction to TUFFP computing needs.



## TUFFP Membership Stable

At this time, it appears likely that TUFFP will have one new member in 1993. Verbal confirmation has been received that AGIP plans to join our research program. Since one cancellation has been received for 1993, we anticipate that we will enter 1993 with 33 member companies. A list of 1992 members appears on a following page.



## Four New Graduate Students Join TUFFP

Jose Luis Trallero, a research engineer for INTEVEP in Venezuela, has arrived at TUFFP to pursue a Ph.D. in Petroleum Engineering. Jose Luis received a B.S. in Physics and an M.S. in Mechanical Engineering from Central University in Venezuela. His Ph.D. research topic will probably involve an investigation of gas-oil-water flow in pipelines.

Jiede Yang has begun his Ph.D. program in Petroleum Engineering under a Research Assistantship funded by TUFFP. He received BS (1982) and MS (1985) degrees in Chemical Engineering from the University of Petroleum in the People's Republic of China and an MS (1992) degree in Petroleum Engineering from the University of Alaska at Fairbanks. A research topic will not be assigned to him until after the November Advisory Board meeting.

Hong Yuan has begun work on her MS degree in Petroleum Engineering under a Research Assistantship funded by TUFFP. She received her BS (1983) in Mechanical Engineering from the University of Petroleum in the People's Republic of China. She was a teaching assistant and a lecturer in fluid mechanics at Shengli Petroleum School from 1984-1992.

Fabrice Vigneron will serve as a visiting scholar at TUFFP for a period of one year beginning in early November. In 1992, Mr. Vigneron received his Diploma (M.S.) from ENSEEIHT in Toulouse, France, specializing in fluid mechanics under Professor Jean Fabre. During his stay in Tulsa he will work primarily on a project that will be selected jointly by TUFFP, ELF, TOTAL and IFP.

## New TUFFP Post-Doctoral Research Associates Selected

The search for new TUFFP Post-Doctoral Research Associates has now been completed. Over 30 applications were received from the advertisements in the Journal of Petroleum Technology and Chemical Engineering Progress. After carefully reviewing the applications, a decision was made to hire two persons, and possibly a third one, depending on whether the GRI contract research project is funded.

Dr. Cem Sarica has accepted an offer to fill the Research Associate position that will concentrate on multiphase flow simulation and modeling. Dr. Sarica received his Ph.D. in Petroleum Engineering from The University of Tulsa in 1990, working in TUFFP on simulating transient multiphase flow in low velocity pipelines. For the past two years he has been an Assistant Professor of Petroleum Engineering at the Istanbul Technical Institute in Turkey. Dr. Sarica is scheduled to arrive as soon as he receives a visa, probably in late September.

Dr. X. Chen has accepted an offer to fill the Research Associate position that will concentrate on experimental research and modeling of multiphase flow behavior. In 1991 Dr. Chen received his Ph.D. in Thermal Energy Engineering from Xi'an Jiaotong University in the Peoples Republic of China working on the topic "Oil-Gas-Water Three-Phase Flow in Vertical Tubes." Dr. Chen is scheduled to arrive as soon as he receives a visa, probably in December.

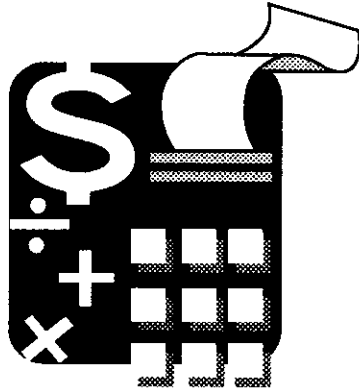
In addition, serious consideration is being given to hire Dr. Dennis Cai as a third Research Associate, primarily to work on the proposed GRI project to investigate PCB migration in gas distribution systems. Dr. Cai has just received his Ph.D. in Engineering Sciences from Thayer School of Engineering, Dartmouth Col-

lege, working under Professor G. B. Wallis on the topic "Inertial Coupling in Two-Phase Flow: A Few Tested Cases and their Impacts on the Two-Fluid Modeling." A final decision will be made prior to the Advisory Board meeting.

## TUFFP Financial Status

### A-OK!

Minor changes have been made in planned expenditures over the summer, and a revised budget confirms that the current financial condition of TUFFP is ex-



cellent. It now appears that the year-end reserve fund balance will be approximately \$150,000 and could be slightly higher if some 1992 expenditures are not actually paid until 1993. Membership fees for 1993 will again be \$20,000.

At the present time, four member companies have not yet paid their membership fees for 1992. However, all have been contacted and payment is anticipated before the end of the year. Invoices for 1993 membership fees will be sent to members in mid-October to accommodate those companies who prefer to pay 1993 membership fees from their 1992 budgets.

## BHRG Conferences Scheduled

BHRG's 6th International Conference on Multiphase Production will be held 16 - 18, June, 1993 in Cannes, France. A "call for papers" and advance information brochure was

distributed to all TUFFP members with the 1992 questionnaire. Persons wishing to submit papers for this meeting must send a title and abstract to BHRG by September 25, 1992.

Enrollment from North American Engineers in past BHRG conferences has been low. For this reason, BHRG is pursuing the possibility of sponsoring a similar conference at Banff Springs, Canada, September 5 - 7, 1994. Preliminary plans for this conference are currently underway and the conference would be co-sponsored by TUFFP.

## TUFFP and Penn State University Seek Joint Research Project With GRI

TUFFP and Penn State University have continued to pursue a joint research project dealing with modeling and control of PCB/Condensate in Gas Pipelines. A preliminary proposal was submitted to the Gas Research Institute in February, 1992. In May, we received notification from GRI that there was significant interest in the pre-proposal and that attempts were being made to find funds to support the initial phase of the proposed work. In early July, Dr. Michael Adewumi of Penn State University and Dr. Brill met in Tulsa to restructure the research program to reflect a reduced budget for the first phase of the work that would be conducted in 1992 and 1993. On this basis, a proposal was submitted by Penn State University to GRI entitled "Development of the Thermal-Hydrodynamic Basis for PCB Transport Modeling in Natural Gas Pipelines". Included in the proposal was a sub-contract to TUFFP entitled "Tracer Tests for PCB Transport in Natural Gas Pipelines". Contract negotiations are currently underway

between GRI and Penn State University. A meeting will be held in Houston on September 28 - 29 at which time final plans and schedules will be formulated.

TUFFP's responsibility during the first phase of the project will be to conduct experiments with our 1400 ft long 3 in. diameter pipeline using an appropriate tracer to represent the PCB component. The purpose of these experiments is to gain necessary understanding about the nature in which PCB's are transported in a natural gas/condensate environment. Sampling will be done at various points along the pipeline as a function of time. Tests will be conducted at velocities comparable to those in natural gas transmission pipelines. Analysis of the tracer concentration will help understand the transport mechanism in the pipeline. The flow loop will be modified to incorporate the necessary instrumentation for injecting the tracer and monitoring its transportation through the flow loop. Modification of the test facility will be accomplished during the last quarter of 1992. Preliminary runs to develop and validate an acceptable test procedure will be conducted during the first quarter of 1993 with production runs, analysis of data and reporting of results continuing until the end of 1993.

## Advisory Board Meetings Scheduled

The next two Advisory Board meetings will be held November 17-18, 1992 and May 12 - 13, 1993. Please note that the November meeting is one week later than is normally scheduled. Also, the May meeting is scheduled for Wednesday and Thursday rather than Tuesday and Wednesday following a decision to alternate days with TUALP for the two Advisory Board meetings held each year.

The November meeting will be held at the Doubletree Hotel at Warren Place in Tulsa and the May meeting will probably be held at the same hotel. Request for Information forms will be mailed to member companies approximately six weeks prior to each meeting to help determine attendance. The forms will be accompanied by information on hotel reservations and travel to and from the airport.

The November Advisory Board meeting will begin at 8:30 a.m. on Wednesday, November 18, 1992 and will adjourn at 4:30 p.m. A pre-meeting cocktail party will be held on the 19th floor of the adjacent Two Warren Place building from 5:30 - 7:30 p.m. on Tuesday, November 17, 1992. A tour of TUFFP test facilities will also be held on Tuesday afternoon from 3:00 - 4:30 p.m.

The above meeting dates were selected to accommodate persons who attend Advisory Board meetings of other cooperative research programs at The University of Tulsa. The following is a summary of these meetings for November 1992.

Erosion/Corrosion	November 16,1992
TUPREP	November 17,1992
TUDRP	November 17,1992
<b>TUFFP</b>	<b>November 18,1992</b>
TUALP	November 19,1992

TUFFP Advisory Board meeting brochures will be mailed to all members prior to the meeting. The brochures will contain sufficient information to help each attendee actively participate in discussions on current and future research projects, financial matters and operating procedures. Brochures containing slide copy for all presentations will be distributed at the meeting but will not be mailed to members.

## TUFFP Participates in Several Technical Conferences

Papers based on TUFFP research have been submitted to various technical meetings. In addition, TUFFP personnel are involved in planning for several multiphase flow conferences. The following is a summary of these activities.



- “Experimental and Theoretical Investigation of Two-Phase Flow in Horizontal Wells” by M. Ihara, J. P. Brill and O. Shoham will be presented at the SPE Annual Technical Conference and Exhibition, October 4 - 7, 1992, Washington, D.C.
- “An Experimental Study on Two-Phase Slug Flow in Hilly Terrain Pipeline”, by G. Zheng, J. P. Brill and O. Shoham will be presented at the SPE Annual Technical Conference and Exhibition, October 4 - 7, 1992, Washington, D.C.
- Dr. Shoham served on the organizing committee for the SPE Forum on Multiphase Flow in Snowmass Village, Colorado, August 2 - 7, 1992. He also co-chaired the Mechanistic Modeling section. Dr. Brill made a presentation at one of the sessions and representatives from several TUFFP member companies were also involved in the Forum.
- Dr. Brill will give a Keynote Lecture at one of the sessions in the “International Symposium on Multiphase Flow in Wells and Pipelines” at the ASME Winter Annual meeting, November 8 - 13, 1992, Anaheim, CA.
- Dr. Brill will serve on the organizing committee for the BHRG 6th International Conference on Multiphase Production to be held in Cannes, France, June 16 - 18, 1993. He will also serve on the organizing committee for a BHRG conference being planned for Banff Springs, Canada, September 5 - 7, 1994.



## Calendar for Two-Phase Flow Technical Meetings

Several conferences that include technical sessions involving multiphase flow in pipes are scheduled for 1992, 1993 and 1994. A calendar for these and other multiphase flow events is given below.

### 1992

September 21 - 22	Norwegian Petroleum Society - Multiphase Transportation III - Roros, Norway
September 27 - October 2	Short Course on Multiphase Flow in Heat Transfer: Bases, Modeling and Applications, Santa Barbara, CA
October 4 - 7	SPE Annual Technical Conference and Exhibition, Washington, D.C.
October 22 - 23	PSIG Meeting - Corpus Christi, Texas
November 1 - 6	AIChE Annual Meeting, Miami Beach, Florida
November 8 - 13	ASME Winter Annual Meeting, Anaheim, CA
November 18	TUFFP Advisory Board Meeting, Tulsa, Oklahoma
November 19	TUALP Advisory Board Meeting, Tulsa, Oklahoma

### 1993

January 31 - February 4	ASME Energy Sources Technical Conference and Exhibition, Houston, Texas
June 6 - 11	3rd International Offshore and Polar Engineering Conference, Singapore (Session on Transport of Mixed Wellhead Fluids)
June 16 - 18	BHRG 6th International Conference on Multiphase Production, Cannes, France

### 1994

September 5 - 7	BHRG/TUFFP Conference on Multiphase Production, Banff Springs, Canada
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# Bits &

# BYTES

## Computer Manager Leaves TUFFP

In August Mrs. An-Lee Cox, who had been TUFFP's Computer Resources Manager for the past year, moved to Dallas when her husband was transferred by American Airlines. An-Lee had been working for TUFFP for two years and made significant contributions in helping maintain an effective, efficient computer network system for all TUFFP personnel. We already miss her charming and cooperative personality and wish her well.

## TUFFP Upgrades Quadra

In August, TUFFP purchased a second Apple Macintosh Quadra 700. This new Quadra 700 came with 8 Mb RAM, a 68040 25 MHz CPU, 230 Mb Hard Disk, 3.5" disk drive, Video Card and high resolution RGB monitor. We received the Quadra in August and have now upgraded both this machine and the first Quadra to 20 Mb of RAM. The new machine was necessary to provide quality computing needs for the increased number of TUFFP personnel.

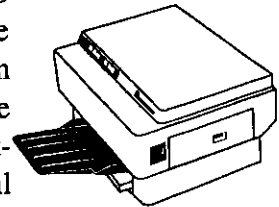
## TUFFP Babies are Born

Our Computer Manager, An-Lee Cox, and the Computer Assistant, Yesenia Rincon, gave birth to Austin Cox and Rafael Paz during the summer. Rafael Paz Jr. is also the son of one of the TUFFP Research Assistants, Rafael Paz.



## HP Laser Jet Printer Added

Last June, the NEC Silent Writer located in the TUFFP Computer Room and connected to the Apollo Token Ring network developed technical problems which would have required significant expenditures to repair. A decision was made to surplus the NEC and purchase a new Hewlett Packard HP Laser Jet III D Postscript Printer. The new printer is now connected to the Apollo Token Ring Network and also to the PC 486 located in the TUFFP Computer Room.

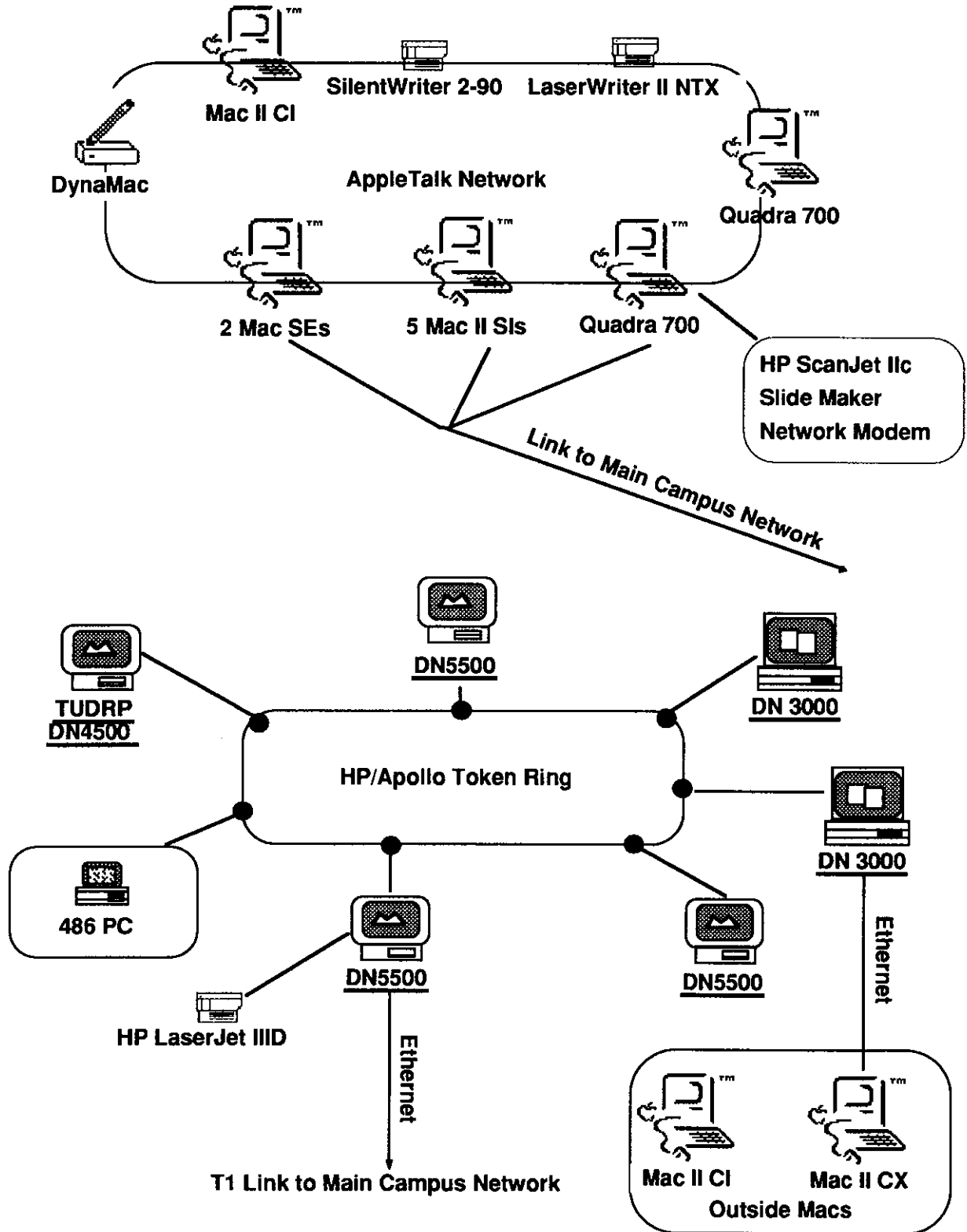


## TUFFP Computer Network Upgraded

A new Ethernet network was installed at TUFFP in May that allows selected Macintosh and the HP/Apollo computers to communicate. TUFFP purchased four Macintosh Ethernet cards and one HP/Apollo Ethernet card and The University of Tulsa assisted with the upgrade by providing us with the coaxial cable, repeater, and circuit protectors, and installed the Ethernet board in one of the HP/Apollo workstations.

The Ethernet Network consists four Macintosh computers that are used for data acquisition and are connected via coaxial cable to an HP/Apollo that is located near the experimental test facilities. The HP/Apollo is connected to the token ring network used for all the TUFFP HP/Apollo computers through a Repeater that enables TCP/IP capability.

### TUFFP Network





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