ORGANIZATION CHANGES AT PTI

PTI started in 1969 with a staff of internationally known technical leaders. Once successful, the question was "could the company regenerate that kind of leadership within its ranks?" Not only has it done so, it has also produced depth in management skills. Recognizing that depth, the growth facing the company, and the desire of several senior staff members to concentrate on technical project assignments, PTI has made a number of changes in its management structure.

Effective March 31, 1986, Del Wilson will become President and Chief Executive Officer of PTI. Wilson, a Principal Engineer since joining PTI in 1974, was named Vice President in 1984. He was initially responsible for settling up PTI's experimental research activities and facilities after which, in 1982, assumed responsibility for PTI's entry into simulator, control, and instrumentation businesses.

Del Wilson named President of PTI

Lionel Barthold, one of the founders of the firm, will serve as Chairman of PTI's Board and as a Principal Consultant. The Principal Consultant role, a new one at PTI, will assure ongoing availability and direct project involvement of PTI's most experienced staff members. Other Principal Consultants will be Al Wood, Bob Ringlee, and John Westcott.

John Undrill will assume a new post as Vice President and Manager of Technology and Market Development. Undrill's responsibility for leading the developing of new software products for PTI will be extended to both control and services businesses.

Dale Hedman, who leads the dual life of expert in HVDC and transient analysis, plus manager of PTI's Business Operations, will continue in both roles. Hedman was named a Vice President in the reorganization.

PTI's operations have been subdivided into four departments, each a major segment of the company's business. The first, largest, and most central to PTI's purpose, is the Engineering Services Department. It will be under the direction of Paul deMello, a founding member of the firm, a Vice President, and well known to PTI clients. Seven business units have been established within the Department. They are:

- Utility System Performance  — Harrison Clark, Mgr.
- Industrial Power Systems  — Ray Stratford, Mgr.
- Power Delivery  — Roger Clayton, Mgr.
- Underground Cable Systems  — Jay Williams, Mgr.
- Planning  — Hyde Merrill, Mgr.
- Power Generation  — Bob de Mello, Mgr.
- Education  — Margaret Stambach, Mgr.

In addition, six Senior Consultant posts have been established, representing talents available to all business units. Named to those posts were John Anderson, Jim Burke, Steve Lambert, John Mountford, Dag Reppen, and Jim Stewart.

(Continued on Page 2)

REDUCING THE NEED FOR STAGED FIELD TESTING THROUGH COMPUTER CONTROLLED INSTRUMENTATION

S.J. Balse, Manager
Simulator, Control & Instrumentation Dept.

B.F. Fitzgerald,
Analytical Engineer

Field measurements have proven to be an effective, but often expensive, method for understanding system-dependent phenomena. Yet no amount of computer simulation will substitute for actual measurement of disturbances, particularly when their nature and cause are not well defined. Furthermore, field tests often reveal system characteristics and equipment performance characteristics not otherwise recognized.

Field measurements must often be made within a relatively short period of time, requiring special scheduling of system operations. In the case of capacitor switching transients, for example, the severity of each transient is governed by the statistical-relationship between instantaneous system voltage and the characteristics of the switching device. Thus many closing operations are required. Under normal operating conditions, the bank might be switched only in the morning and again in the evening and it would take weeks to get a statistically accurate sample. Recording equipment and an operator would have to be available throughout this time. The alternative is to "stage" the tests, making a lot of closing operations in a short time.

While staged testing shortens the measurement period, it still requires the continual presence of maintenance and/or operations personnel, often at premium time rates. Since staged operations don't displace normal operations, the net result is a substantial increase in the total number of operations to which the equipment is subjected. If equipment failures were the motivation for the measurements, the risk of failures is substantially increased by virtue of the tests themselves. In some cases the degree of interaction between dispersed system conditions makes staged tests impractical. For example, with harmonic measurement it is difficult to stage the complicated interaction between source and system effects. In this case there is seldom any alternative to measuring over a period of time long enough to capture all significant events. Even when staged tests are possible, they can risk degradation of service or security. For example, in the case of capacitor switching, undervoltage and overvoltage limits may be encountered during the staged test period due to normal load patterns.

Recognizing the problems of staged testing, PTI has developed an instrumentation system that makes long term monitoring economic and practical. The equipment used operates for extended periods of time without an operator, captures data, reduces it to useful form, and stores it in a nonvolatile memory. The data is retrievable at the end of the measurement period or can be retrieved remotely during the measurement period.

The PTI-developed system uses an IBM PC compatible computer as a controller for an unattended monitoring system. Through a standard communication bus, a variety of off-the-shelf instruments can be interfaced to the controller. Using a general purpose personal computer as the controller provided a high degree of compatibility with commercially available hardware and software.

(Continued on Page 3)
APPLICATIONS IN STUDIES OF VARIABLE SPEED FAN
APPLICATIONS IN POWER PLANTS

F.P. de Mello, V.P. & Mgr., Consulting Services Dept.

J.W. Feltes, Senior Engineer

Variable speed drive systems for large motors (5000 to 10000 HP) are now available from several manufacturers. In power plant applications considerable operating savings are possible through conversion of constant speed to variable speed forced draft and induced draft fans, particularly on units subjected to cyclic duty. The savings stem from improved variable speed fan efficiency at part load.

PTI has recently conducted a study for the New York State Power Authority of the implications, from a dynamic and control point of view, of conversion to variable speed of the 6000 HP and 7000 HP forced and induced draft fans at the Charles Poletti Plant's 826 MW oil or gas fired unit.

The coordination of induced and forced draft fans is a critical function of boiler controls both in maintaining air flow requirements and holding furnace pressure at safe values during normal operation and during plant upsets such as a main fuel trip. A major consideration is ensuring against furnace implosions.1,3

A dynamic model of furnace and fans (Figure 1) for Charles Poletti Unit 1 had been developed by PTI in 1978 in the course of an extensive study of control of furnace pressure and air flow during loss of fuel upsets. The model was developed using PTI's IDAP program (interactive dynamic analysis program)2 and was validated through a series of master fuel trip field tests. Controls acted on fan dampers and inlet vanes.

Figure 1. Furnace — Ducting Configuration for Gas Path Dynamics Simulation

The 1978 Model was, in this study, now augmented to accommodate variable speed drive characteristics applied to the existing induction motors and alternately variable speed drives using assumed replacement synchronous motors.

Prediction of the full range response characteristics of the drives required modeling from first principles including motor rotor transient flux effects, motor and fan inertia, fan head, flow, speed and damper characteristics, and converter drive logic.

An example of simulation results is shown in Figure 2 showing response to a main fuel trip with variable speed fans responding to a typical set of control sequences.

Although fan inertias are large and response to air flow is different to changes in speed demand than to changes in damper position, results look very promising in terms of dynamic control possible with variable speed.

The study of such a vitally important plant control function was possible in view of the ease with which many highly nonlinear effects of both the drives, fans and furnace could be modeled using the interactive digital simulation program.

Figure 2. Main Fuel Trip with Variable Speed Fans

References

ORGANIZATION CHANGES AT PTI

(Continued from Page 1)

The Software Products Department, a major outlet for PTI's system analysis and computer science generation know-how, will be under the direction of Ian Grant. Grant has been responsible for many of PTI's software developments in transmission line design. Arnold Weekley will continue to support PTI's Software Products Department as Manager of Software Engineering.

The Simulator, Control & Instrumentation Department will be under the direction of Steve Balsar, till now manager of the simulator segment of that business. Last year, PTI's role as a supplier of special purpose, microprocessor-based hardware systems was strongly enhanced with the company's introduction of an all-digital Power System Stabilizer (See "Power Technology," Issue No. 40, January 1985).

The Technology Assessment Group (TAG), a means of building teams of scientists and engineers in virtually all technical fields (See "Power Technology," Issue No. 43, October 1985), will remain under the direction of George Hupman.

These are the most important organizational changes in the company's seventeen year history. They put PTI in an excellent position to serve its clients in all business areas, and in doing so, will actually increase the availability of PTI's most experienced staff for project assignments.
REDUCING THE NEED FOR STAGED TESTING THROUGH COMPUTER CONTROLLED INSTRUMENTATION
(Continued from Page 1)

Unattended Monitoring System

A block diagram of the Unattended Monitoring System is shown in Figure 1. The system includes a control computer which runs a monitoring and control program. The system is designed so that no operator keyboard commands are required. In fact, during normal operation the monitor and keyboard are not connected except during data retrieval. The system automatically starts the monitor and control program when the unit is turned on. It initializes the test and measurement instruments by sending commands via the interface. Once the instruments are initialized, the program continuously interrogates the instruments, receives data from them, processes the data as necessary, and archives it on the hard disk until data retrieval by the operator. Data retrieval is initiated either by an incoming telephone call via the modem, or by connecting a keyboard. In either case the control and monitoring program halts and control of the system passes to the operator.

Figure 1. Unattended Monitoring System

An industrial grade IBM PC compatible computer with the MS-DOS operating system is used as the controller. The computer is configured with 640 KByte RAM, 10 MByte Winchester disk storage, 360 KByte floppy disk storage, IEEE-488 interface and Hayes/Bell 212A modem. Rack mounting, vibration tolerant disk drive mounting, and positive pressure ventilation are incorporated to make the computer suitable for industrial use. The computer's boot procedure allows it to automatically start running a program when powered up without having a keyboard or monitor connected. The computer is designed to be mounted in a standard 19" rack.

Special consideration is given the interface between the central computer and the measurement instrument. The IEEE-488 interface was selected because it is universally accepted in the industry as a standard computer interface for test and measurement instruments. The IEEE-488 can be used in a rudimentary mode using simple ASCII data transfers and polled responses or in a more sophisticated mode using interrupts and high speed data transfer for applications where high performance is required. The parallel bus structure and addressing capability of the IEEE-488 interface supports multiple test instruments, allowing simultaneous measurement of various system quantities requiring different instruments.

Data can be retrieved from the monitoring system by copying the data to floppy diskettes and physically transporting them to another PC type computer, or by modem over conventional telephone lines. Data transfer via telephone is reliable and relatively inexpensive especially when the transfer is performed automatically in the evening. The modem is compatible with Bell 212A type modems and incorporates a microprocessor which can interpret standard commands to automatically answer an incoming call, originate a call, and terminate a call. Because large amounts of data may be sent via an electrically noisy telephone line, an error checking communications protocol is used when transferring data.

Using this general approach, PTI has explored cases where:

- In an industrial plant equipment was failing — apparently as a result of utility capacitor switching.
- Harmonics were suspected as the cause of misoperation of a sensitive load. Since the misoperations appeared to be random, direct correlation with harmonic levels was difficult.
- An arc furnace operator was concerned with flicker. Furnace operation was monitored over a two week period to determine the flicker produced for different melts and system conditions.
- Random misoperations were occurring on a ripple control system. Long term measurements were necessary to coordinate voltage harmonics with misoperations.

The unattended measurement system was recently used to monitor a 12 kV commercial feed for a five week period. In this application a four channel transient waveform recorder, triggered by voltage surges, captured the corresponding transients on all three phases. Each phase contained 4000 voltage samples over a 4 millisecond period or 1 sample every microsecond. The data was automatically transferred to the computer and stored on a hard disk. The system recorded a total of 275 transients with only a few misoperations. These appear to have resulted from a complete power shutdown where all power to the system was lost. In all cases the system recovered automatically when power was restored. Even this type of misoperation is easily avoided if the system is driven by an uninterruptible power supply (UPS).

New options for standardized low cost hardware and software for the personal computer has allowed PTI to put together an extremely economic and reliable on-line monitoring system. Sophisticated microprocessor instruments with communication capability are used to measure quantities of interest. Interfacing these instruments with a low cost controller allows this equipment to be used where previously only staged testing was practical. It is reasonable to expect that still more advanced board level instruments, which plug directly into a chassis slot on the PC, will reduce the costs of the individual instruments still further. PTI's instrumentation system and support service increases the attractiveness of long term unattended instrumentation, drastically reducing the need for staged testing and reducing the cost associated with system measurements.

“A TOUCH OF CLASS”

As with most young companies, PTI’s early growth forced it to move several times. In each location, including the present one, finding the reception area has taxed the ingenuity of most visitors. The company’s classrooms, too, have been rather Spartan. Because of these inconveniences, and the need for more office space, PTI completed another portion of the unfinished first floor in January. The new classrooms will be a welcome upgrade for course participants, and the entrance area allows PTI, for the first time, to properly receive visitors. For those who enjoy the nostalgia of PTI’s traditional second story walk-up entrance, that option still remains.

(See Photographs on Page 4)
New Classrooms and Reception Area Put Into Service in January 1986

**SHORT COURSE SCHEDULE**
To be presented at PTI offices in Schenectady, NY

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<thead>
<tr>
<th>Dates</th>
<th>Title</th>
<th>Tuition (per participant)</th>
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<tr>
<td>Apr. 29-May 1, 1986</td>
<td>Industrial Power System Harmonics and Power Factor Improvement</td>
<td>$750</td>
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<tr>
<td>May 5-7, 1986</td>
<td>Cable &amp; Accessory Failure Analysis</td>
<td>$750</td>
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<tr>
<td>May 5-9, 1986</td>
<td>Simulation &amp; Control Analysis</td>
<td>$1000</td>
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<tr>
<td>May 12-16, 1986</td>
<td>Power System Planning Techniques</td>
<td>$850</td>
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<tr>
<td>May 19-21, 1986</td>
<td>Corporate Modeling Using a Personal Computer</td>
<td>$750</td>
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<tr>
<td>June 3-5, 1986</td>
<td>Industrial Power System Protection</td>
<td>$750</td>
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<td>Sept. 8-12, 1986</td>
<td>Power Plant Performance</td>
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<td>Sept. 22-26, 1986</td>
<td>Power System Planning Techniques</td>
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<td>Sept. 29-Oct. 3, 1986</td>
<td>Underground Cable Systems</td>
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<td>Oct. 6-10, 1986</td>
<td>Utility Economics and Finance</td>
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<td>Oct. 14-17, 1986</td>
<td>Transmission Reliability Assessment</td>
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<td>Oct. 15-17, 1986</td>
<td>Industrial Power System Harmonics and Power Factor Improvement</td>
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