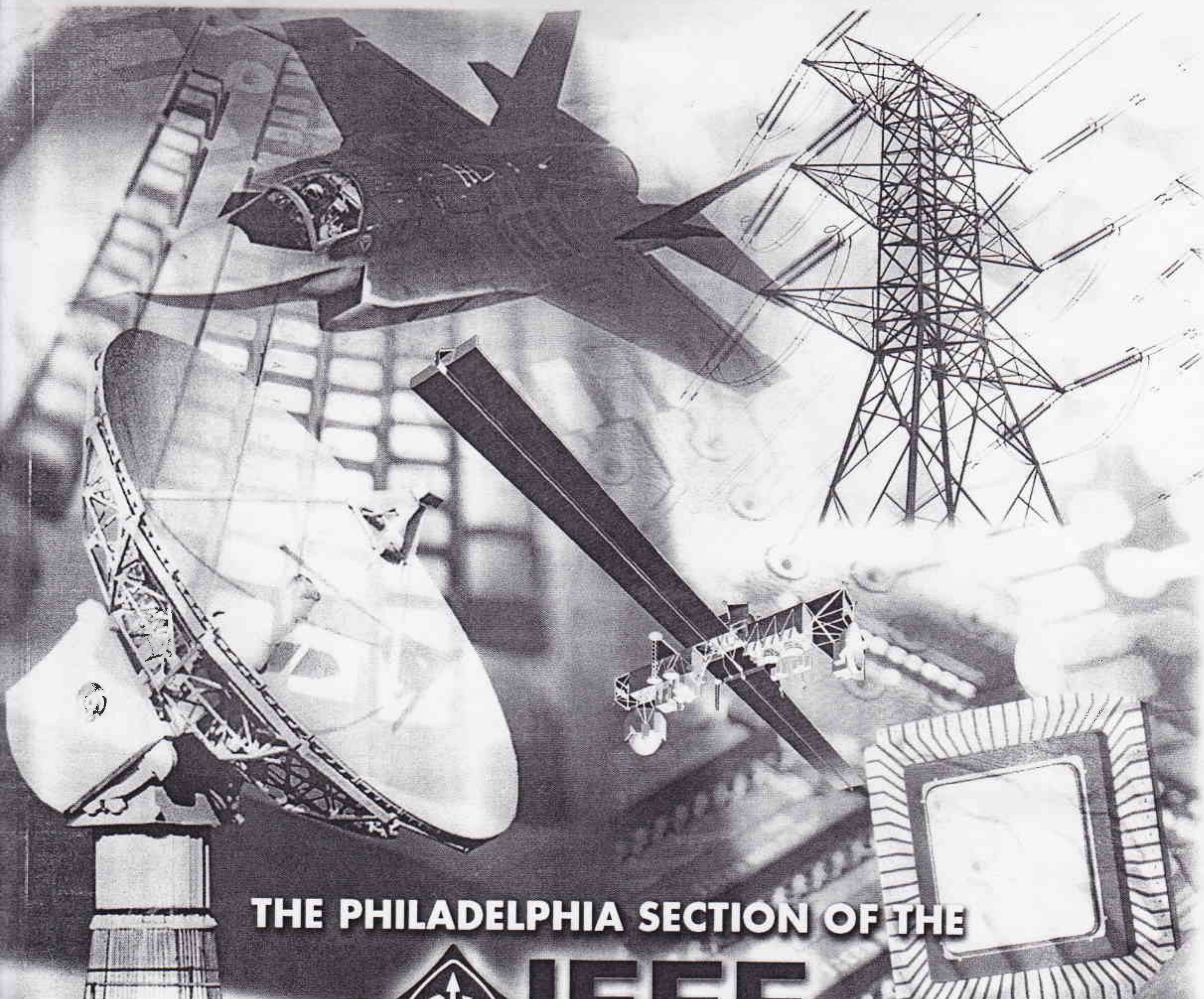

THE PHILADELPHIA SECTION OF THE

IEEE

The Institute of Electrical and Electronics Engineers, Inc.

100th Anniversary 1903 - 2003

The Development of the Electrical, Electronic and Computer Industries in the Delaware Valley in the Past 100 Years

PUBLISHED WITH THE GENEROUS SUPPORT OF L3 communications LOCKHEED MARTIN

IEEE in the Delaware Valley from 1903 to 2003

Electro-Technology has played an important role in the development of the Delaware Valley, and the IEEE has been instrumental in bringing together the professionals who have made it all possible.

During this, the Centennial Year of the IEEE Philadelphia Section, we are endeavoring to highlight many of the projects, products, and services that have taken place here. This is the first of four issues of the Almanack that will tell this story.

THE ALMANACK ISSUES WILL INCLUDE:

- Electric Power Industry.
- Consumer, Commercial, and Industrial Products and Communications.
- Computers and Instrumentation.
- Defense and Aerospace.

A good case can be made that what was accomplished within the territory of the Philadelphia Section is the most innovative and far reaching of any of the IEEE USA Sections. You can form your own assessment after reading this history.

Electric Power Industry in the Delaware Valley

Delaware Valley's electric power industry started in Philadelphia in the late 19th century when many small electric companies began supplying AC power at several different voltages and frequencies. The Philadelphia Electric Company (PECO) was formed from a citywide mandate to eliminate the confusion and inefficiencies. Since this beginning, the electric utility industry has evolved into three companies that serve the IEEE Section's area: PECO Energy (Exelon) in Pennsylvania, Conectiv and Public Service Electric and Gas Company (PSE&G) in New Jersey.

Before the 1960's, any new electric power capacity had to be fossil-fuel based and built along either the Delaware or Schuylkill rivers near population centers. However, the advent of 500 KV transmission freed the industry from this limitation. Examples are Keystone (1967-68) and Conemaugh (1970-71) Mine Mouth generating plants and the Peach Bottom (1974) nuclear generation units, all remote from population centers.

ELECTRIC POWER UTILITIES

PJM (PA, NJ, MD) Interconnection – A Partnership of Excellence

The advantages of interconnecting electric power systems are derived from the diversity introduced in system loading, timing of forced outages and requirements for reserve capacity. Less generation equipment is required and diversity offers economies of scale in the distribution of electric energy.

The original PA-NJ interconnection agreement was signed by PSE&G and PECO. With this 1927 agreement, 210 miles of new 230 KV transmission lines were installed. An integrated management operated the interconnection and the savings were equally split. These savings more than offset the cost of the new transmission.

The pool was expanded to five members in 1956 with the inclusion of Baltimore Gas and Electric Company and General Public Utilities Corporation (GPU). GPU includes the following operating companies: Pennsylvania Electric Company, Metropolitan Edison Company, New Jersey Power and Light Company, and Jersey Central Power and Light Company.

In giant steps, the PJM system was permanently connected in 1962 to the Canada, United States Eastern (CASUSE) Interconnect and to the Interconnected Systems Group (ISG), thereby combining most of the United States and Ontario Hydro from the Atlantic Ocean to the Rocky Mountains. Also, in 1962, PJM installed its first automatic generation control analog computer. During the late 1960's and early 1970's, large-scale digital computers were installed.

In 1986, PJM included 11 investor–owned utility systems in Pennsylvania, New Jersey, Maryland, Delaware, Virginia, and Washington, D.C., serving 7.5 million customers and a population of 21 million. Included as part of PJM are generating unities of several municipal and industrial systems.

By 2004, four large transmission systems will be added to the PJM, more than doubling the generation and people served. The PJM system is the largest control area in North America and is noted nationally for concept, design and operational excellence.

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Susquehanna River Hydro-Electric Project – The Conowingo Dam

In 1921, PECO initiated a study to build a hydro-electric dam across the Susquehanna River, in Conowingo, MD. Construction began in March 1926 and was completed in 1928. The initial rating of 252 MW has grown to 512 MW. The concrete dam impounds 150 billion gallons of water and is 4,648 feet long and 96 feet above a solid rock foundation. At that time, this hydro-electric project was second in size only to the Niagara project.

Two 60-mile long 230 KV lines were constructed to a new Plymouth Meeting substation outside of Philadelphia. Two other 230 KV lines were constructed from the Plymouth Meeting substation, one to PP&L and the other to PSE&G. As a result, the Plymouth Meeting substation became the largest transmission substation in the world.

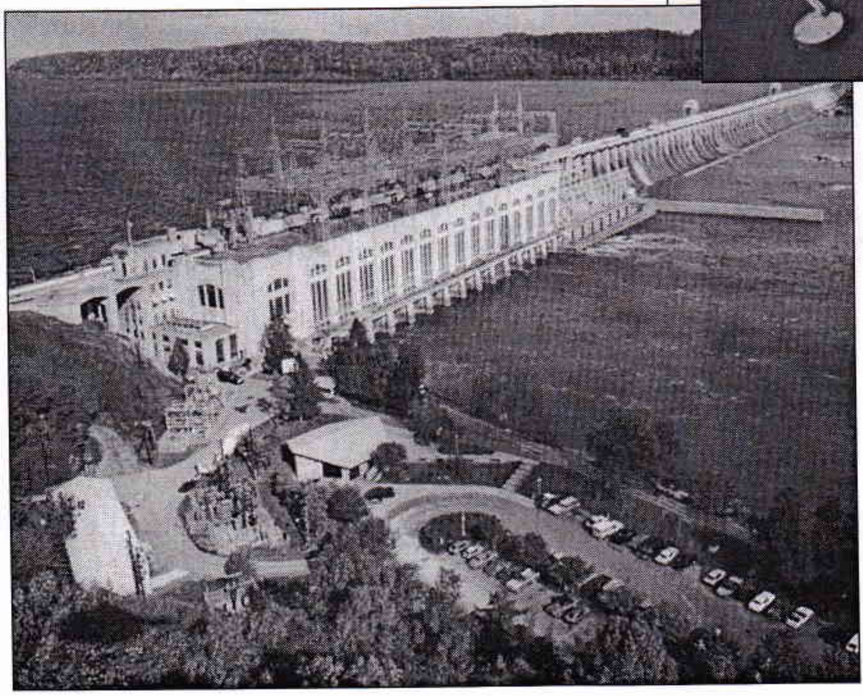
Eddystone Station – Fossil Fuel

A supercritical P-T system went commercial in 1960 when both of Eddystone station's first two fossil-fueled generating units were constructed for supercritical pressures (P) and temperatures (T). Unit 1 was built to set a new industry generation efficiency standard. In supercritical high P-T, water does not boil but passes directly into a gaseous state. This gas (steam) is superheated and thus increases efficiency, providing more kilowatt-hours per unit of fuel.

After establishing a fuel rate of approximately 0.6 pounds of coal per Kmhr, Unit 1 was reduced from operating at supercritical because of P-T metallurgical problems. The turbine and boiler suppliers were Westinghouse and Combustion Engineering, respectively.

In 1960, Eddystone was PECO's largest power plant with a project cost of $162 million for the station and $30.5 million for substations and approximately 100 miles of transmission lines. Units 3 and 4 became commercial in 1974 and 1976, respectively.

Eddystone Station



The Conowingo Dam

Keystone Project – Mine Mouth Generation

During 1967-68, over 600 miles of 500 KV transmission lines were constructed within four eastern states to provide for the Keystone and subsequently for the Conemaugh Mine-Mouth generation projects. The Keystone generating station was constructed at the mouth of a coal mine near Johnstown, Pennsylvania, by PECO Energy, PP&L, and Jersey Central Power and Light Company. Its 1700 MW of generation (two units) was supplied to over 30 million people via the

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500 KV lines. The $350 million cost was shared by 10 electric utilities. The 500 KV transmission was a commercial first and the voltage level was the nations highest at the time. The Conemaugh station, almost identical to Keystone, was placed in commercial service during 1970-71.

Muddy Run Creek Project – Hydro-Electric Pump Storage

During 1967-68, PECO placed a unique pump storage hydroelectric system in operation. Located on Muddy Run Creek adjacent to the Conowingo Dam reservoir, a dam-reservoir and a 1040 MW generator-turbine system more fully utilized Susquehanna River water to generate electricity. The eight 130 MW generator-turbines can be used either as pumps, during low-cost generation periods to fill the Muddy Run reservoir, or as generators during periods when generation costs are higher, to provide low-cost electricity. Two 230 KV lines connect Muddy Run to the Peach Bottom substation.

PECO Power Control Center – SAMAC

In 1969, the decision was made to install a new digital power control system center at PECO corporate headquarters. This digital system was named SAMAC for system automatic monitoring and control. Similar to the analog control system center before it, its purpose was to keep loads and generation automatically in balance and to communicate with the PJM.

SAMAC monitors the transmission system and develops a strategy for responding to the loss of equipment or transmission line that would cause a system overload. This contingency aid was not possible with the analog system.

For operator convenience, multicolor graphic cathode ray tubes display dynamic graphics and tabular data to aid in determining where and in what magnitude problems exist. SAMAC was replaced in 1993-94 with more modern technology using state-estimating methods, large rear-projection screens and PC monitors to display the transmission system at operator consoles for application programs.

Nuclear Generation – Four Plants

Nuclear generation has been very attractive to electric utilities because of lower fuel, operation, and maintenance costs and minimal air emissions. In addition, with 500 KV transmission systems, plant locations can be relatively remote from population centers, thus minimizing NRC licensing difficulties. The following table identifies nuclear power plants that directly supply the Delaware Valley:

	Peach Bottom	Salem	Hope Creek	Limerick
Location →	Susquehanna River	Delaware Bay	Delaware Bay	Schuylkill River
Units	2 & 3	1 & 2	1	1 & 2
Commercial Operation (year)	Both 1974 2/5/74–12/23/74	1977&1981	1986	1986 & 1981 2/1/86–1/1/91
Rating (Nameplate) MVA per Unit	1231	1130	1067	1231
Reactor Type	BWR	PWR	BWR	BWR
Vendor	GE	Westinghouse	GE	GE
Contractor	Bechtel	UE&C	Bechtel	Bechtel
Owner(s)	Exelon and PSE&G	PSE&G (58%) Exelon (42%)	PSE&G Power	Exelon
Operator	Exelon	PSE&G Power	PSE&G Power	Exelon

During construction of Limerick 1, a reactor accident occurred at PP&L's Three Mile Island Nuclear Plant near Harrisburg, PA. This resulted in NRC-mandated design changes, including safe shutdown systems for both Limerick 1 and 2. These changes significantly increased Limerick's construction costs. No additional base generation units are being planned by Delaware Valley utilities at this time.

Note that Peach Bottom 1 was an experimental 40 MW helium-cooled nuclear unit. Due to its high operating cost, it was removed from service.

THE EVOLUTION OF REAL TIME CONTROL APPLICATION TO POWER SYSTEMS

Throughout the history of the power industry, dependable, real time automatic control for safe, reliable, responsive operation has been a necessary element of power system installations. That was true at Thomas Edison's first central generating sta-

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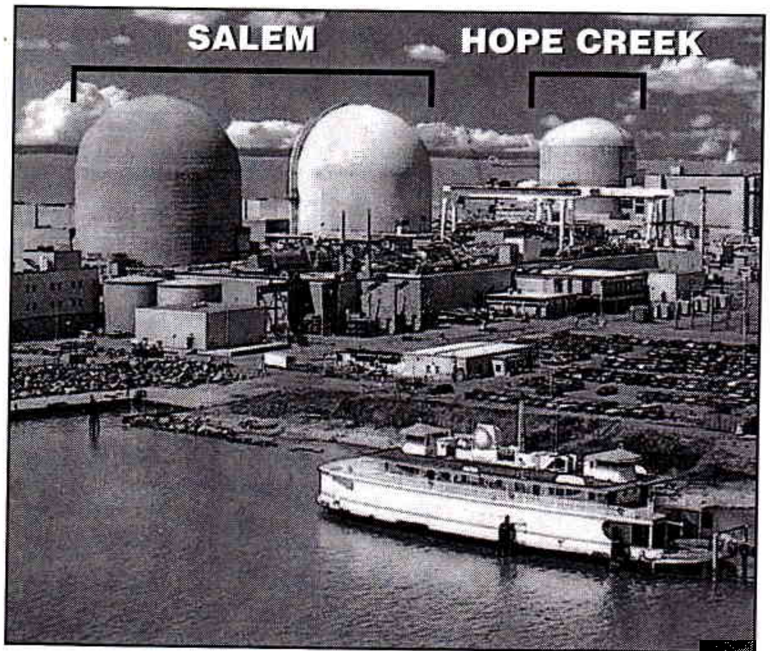

Salem and Hope Creek Power Plants

tion at the Pearl Street Station in New York, which was placed into operation on Sept. 4, 1882, and generally regarded as marking the founding of the electric power industry. Each of the station's six 100 KW generators was equipped with speed governors.

Speed governors are still required. Such governors throughout the system, together with other controls, are required to reallocate generation changes in order to satisfy individual interconnected area responsibilities and objectives.

Two of the major parameters involved in power systems control are system frequency and megawatt load, the latter applying either to generators or transmission tie lines, or both. Apparatus for making such measurements prior to 1924 was of limited flexibility or precision, or of inadequate applicability to control systems, or far too costly.

Two developments filled the measurement voids for power systems applications and were major factors in stimulating the early work in power systems real time control:

1. The self-balancing potentiometer high torque servo recorder, invented by Leeds (1912).
2. The adaptation of the Leeds self-balancing recorder to a self-balancing AC Wien bridge frequency recorder by Wunsch of Leeds & Northrup (1925).

Conventional practice in power systems operations had been to depend on generator governors to respond to system load changes and to utilize manual adjustments of governor settings on one or more machines to achieve desired distribution of generation between alternative sources. An early central dispatching installation to facilitate such operation was the Philadelphia Electric Company. Recorders showing the generation at each of their four stations, the total system generation and the first Wunsch recorder showing the system frequency were provided at the dispatching center. A transmitting potentiometer slidewire, attached to each station's recorder, transmitted station output by telephone line to a recorder at the central office.

In 1961, the Pennsylvania-New Jersey-Maryland (PJM) 12-company system planned to establish permanent ties north to the New York, New England, and Canada systems and west to the Interconnected Systems Group.

As a result of additional ties it was necessary to install automatic area controls which would utilize the by then well developed frequency based technique for inter-area bulk power transfers. In addition, it was desired to supplement such control with a system that would closely emulate, automatically, the previous manually notifying operating companies of incremental power costs.

The system preformed well over the years. Though now replaced with digital equipment, it has been retained for standby use at the PJM Valley Forge Control Center.

ALTERNATE SOURCES – COGENS AND IPPs

Non-utility owned cogeneration and Independent Power Producer (IPP) generation was encouraged during the 1980s by state legislation requiring such electricity to be purchased by electric utilities. Initially New Jersey's laws required a premium for this outside generation, but subsequently the premium was rescinded. Typical cogeneration sources are refinery plants, using waste gas and natural gas as fuel, and trash-to-steam plants. PECO Energy estimates its system cogeneration at approximately 5%. The Marcus Hook (PA) Sunoco Refinery 760 MW (3 units) cogeneration plant is an example of a large refinery cogen project. After completion in 2004, its excess electricity will be sold through PECO Energy's transmission system. Stone and Webster is providing project engineering and management. An older cogen facility on PECO Energy's system is a 150 MW Philadelphia Thermal plant in Schuylkill station that supplies both electricity and steam.

Conectiv lists trash-to-steam generation at 6.8% of its 2002 energy sources. Despite utilities having little control over electric availability or magnitude, cogens and IPPs can provide additional capacity and thus delay future base-generation construction.

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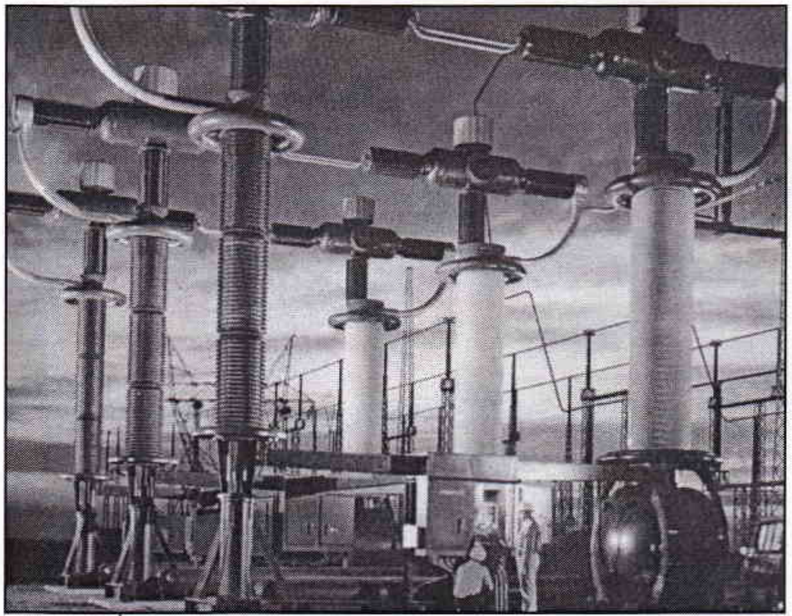
ELECTRIC UTILITY EQUIPMENT SUPPLIERS

Delaware Valley's electric utility equipment suppliers are nationally known innovators and manufacturers of generation, transmission and distribution equipment.

This section describes such suppliers with references to product firsts:

GE – A Switchgear Giant

For over 77 years, GE's Philadelphia area headquarters has been the center of its electric power system design, marketing, and manufacturing of protection and controls equipment supplied worldwide. Its testing facilities include the Skeats High Voltage Lab near the Philadelphia International Airport.



General Electric Air-Blast power circuit breakers.

GE's comprehensive line of unique products includes:

- High voltage circuit breakers (Air Blast & EHV oil filled).
- Vacuum type circuit breakers.
- Switchgear equipment for low and medium voltages.
- Miscellaneous power generation support needs.
- Protection relays.
- Solid state converter applications.
- Control, using microprocessors, for automation of customer loads: e.g., water heater, air conditioning, substations, etc.

Honeywell Process Control Division

Honeywell's Process Control division primarily produces instruments for measuring, recording, and controlling manufacturing processes. Its roots date back to an 1859 portable pyrometer invention that measured iron expansion in industrial furnaces. In 1965, the Division was consolidated in Fort Washington and the facility was, at that time, the largest in the world employing more than 2,500 people. Division technological breakthroughs include:

- First digital computer designed specifically for process control.
- A digital control programmer.
- A microprocessor-based control system for any system size and complexity.

The Division's products and services extend throughout the world.

ITE Power Equipment – Brown Boveri Electric, Inc.

With a corporate history dating back to 1888, ITE (Inverse Time Element) was a major supplier of circuit breakers and switchgear. Based in Philadelphia, ITE was a principal supplier for the Boulder Dam project and for US Navy ships during World War II.

ITE's innovative firsts were many, including:

- 1890 – First air circuit breakers.
- 1926 – First vertical compartment circuit breakers.
- 1934 – First segregated phase metal-enclosed bus duct (installed at Boulder Dam).
- 1958 – Kline low-voltage power circuit breaker.
- 1960s – SF_6 gas insulated (cable) system.
- 1960s – 500 KV, 1800 BIL vertical break-switch.

ITE was purchased in 1980 by Brown Boveri and Co.

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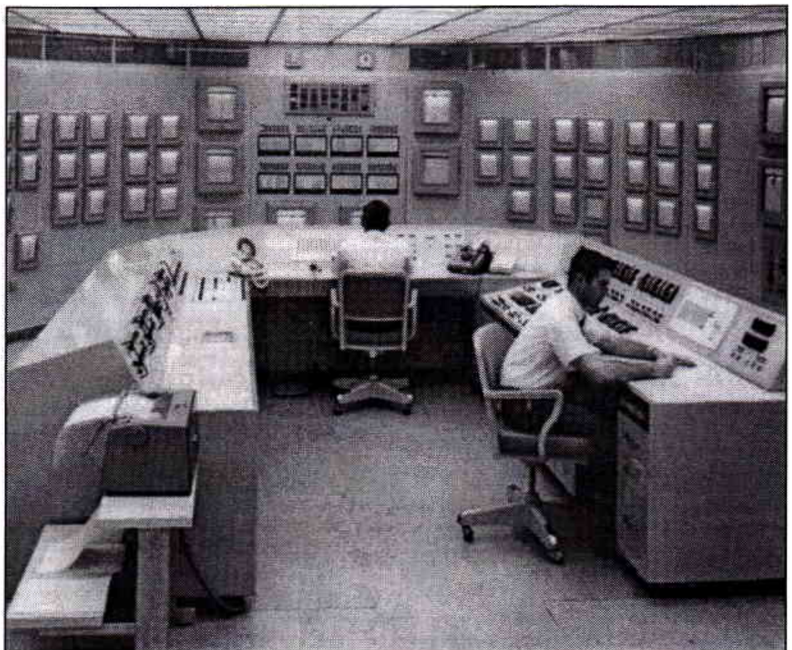

Modern Utility Control Room with L&N Systems Equipment

Leads and Northrup Company – General Signal Corporation

Leeds and Northrup (L&N) expertise and equipment have played a major role in the development of control applications for electric power systems throughout the world. Incorporated in 1903, the company's history actually started in 1899 when Morris E. Leeds began building laboratory-type electrical measuring instruments. World Firsts include:

- 1912 – First successful, automatically-balanced industrial recorder.
- 1932 – First high-speed electronic recorder.
- 1942 – First centralized load-dispatching system for power plants
- 1958 – "Temtip" expendable immersion thermocouple for measuring molten metal temperatures.
- 1977 – First combination pH electrode for accuracy and reliable lab or plant performance.
- 1982 – First domestic optical electrical highway.

L&N's world headquarters is in North Wales, Pennsylvania. In 1978 it merged with General Signal Corporation of Stamford, Connecticut.

Westinghouse Steam Turbine Division – Lester, Pennsylvania

Westinghouse Steam Turbine Division's Lester plant began about 1927 and subsequently became a major supplier of turbines for utility power plants until the 1980's. During the 1950's and 1960's, the Lester plant manufactured as many as 40% of the U.S. steam turbines, second only to GE. Also, during that period, the Lester plant had as many as 20,000 employees. In the Delaware Valley, Westinghouse steam turbines were supplied to such base load plants as Eddystone (two 340 MW units) and Salem (two 1130 MW units). Also, the Division provided the turbine-generation for the 40 MW, helium-cooled experimental nuclear unit, Peach Bottom 1. During the 1970's, parts of the Steam Turbine Division were moved to Charlotte and Winston Salem, NC. During the 1980's, and after acquiring CBS, Westinghouse sold the Division to Seimens. Subsequently the 60-year old Lester plant was closed.

CONTRACTORS AND CONSTRUCTION COMPANIES

Stone & Webster – A Shaw Group Company

Stone & Webster is one of the foremost engineering and construction organizations in the world. Originally founded in 1889 as an electrical testing laboratory and consulting firm, Stone & Webster grew to become a network of companies employing more than 6,000 people worldwide.

Stone & Webster has had a continuing presence in the Delaware Valley since 1972. For most of that time, the local offices have been located in Cherry Hill, NJ.

Stone & Webster provided significant engineering and design services to the fossil and nuclear generating stations in the Delaware Valley including Salem, Hope Creek, Limerick, Eddystone, Cromby and Deepwater.

Recent projects of interest in the Delaware Valley include:

- Richmond Station Static Frequency Converter Facility (11 KV, 25 Hz supply to Amtrak).
- Boiler upgrade project at the Coastal Eagle Point Refinery.

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• Marcus Hook Cogeneration Facility (fueled either by natural or refinery gas).

Shaw, the parent company, is headquartered in Baton Rouge, Louisiana, and currently has offices and operations in North America, South America, Europe, the Middle East, and Asia-Pacific. Worldwide, the Company employs more than 20,000 people. Additional regional and project offices are located throughout the United States.

United Engineers and Construction – Raytheon Division

United Engineers and Construction (UE&C) has had an illustrious history since its 1928 founding from the merger of four internationally known engineering and construction firms. Headquartered in Philadelphia, its projects included many Philadelphia landmarks such as 30th Street Station and the Franklin Institute. UE&C expertise extends internationally into the steel, chemical and manufacturing industries and includes projects in public transportation, hospitals, aerospace, research, and electric utility facilities. In the Delaware Valley, UE&C designed and constructed power plants, substations and transmission lines. A 1931 example of a PE Company power plant project is the now retired $6.1 million Richmond Generating Station.

RAIL TRANSPORTATION IN THE DELAWARE VALLEY

History of SEPTA

ELECTRIC TROLLEY CARS, introduced in Philadelphia in 1892, reached their apex in 1911 when 4,000 streetcars operated on 86 routes. SEPTA's City Transit division owns and operates 141 trolleys on 12 routes running over 194 track miles throughout the city. The newest trolleys, Light Rail Vehicles (LRVs), put in operation in 1982 have air conditioning, acceleration controls, air suspension and public address systems.

SUBWAY ELEVATED LINES on Market Street opened between 69th and 15th Street in 1907, and extended to 2nd Street in 1908. The original line operated as an elevated between 69th Street and the eastern bank of the Schuylkill River and as a subway east of the river. The subway tunnel was extended from 23rd Street westward to 45th Street in 1955. The Frankford elevated Line was constructed by the City of Philadelphia and opened for service in 1922. This addition provided uninterrupted service between 69th Street and the Bridge Street Terminal.

BROAD STREET SUBWAY opened for service in 1928 extending from Olney Avenue to City Hall. In 1930 the subway extended to South Street, and in 1938 to Snyder Avenue. Northern service was extended to the Fern

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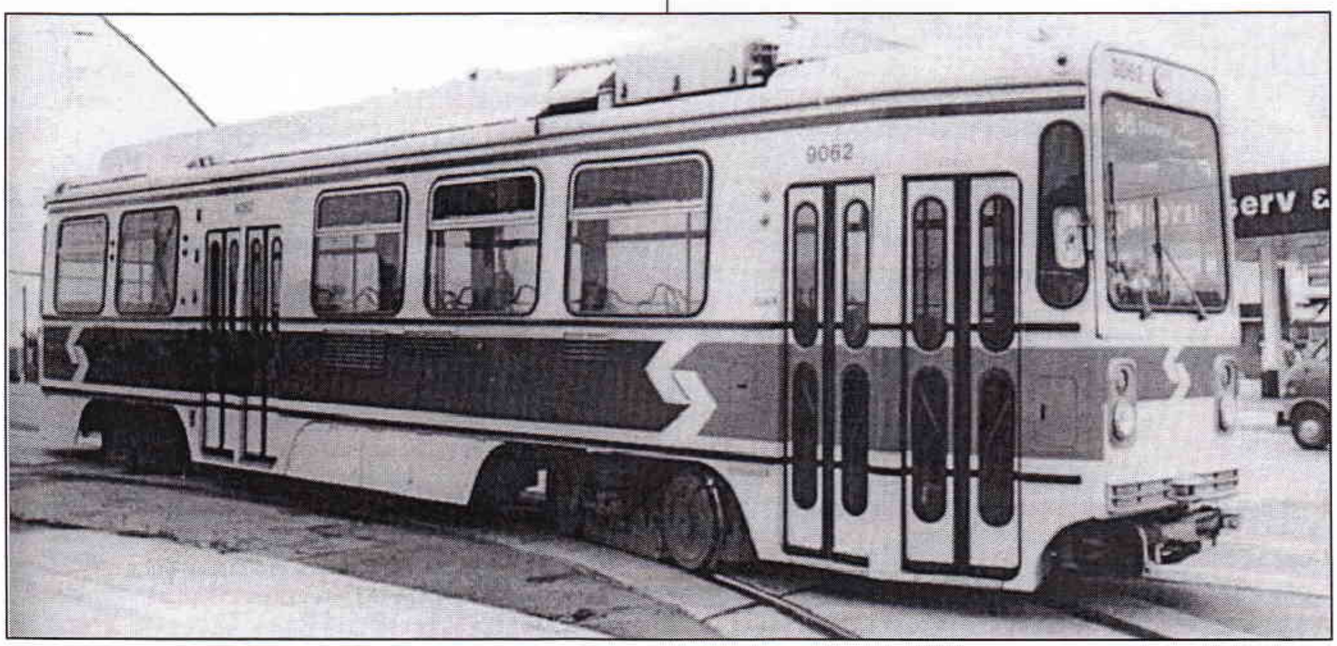

SEPTA's Light Rail Vehicle

Rock Terminal (10th and Nedro Streets) in 1956. In 1973 the subway was extended south to Pattison Avenue. The Ridge Avenue Subway Spur was opened in 1932.

TRACKLESS TROLLEYS were introduced to Philadelphia on October 24, 1923, along Oregon Ave. Today SEPTA operates 110 trackless trolleys over five routes, covering 42 miles within the city.

SUBURBAN LINES opened in stages between 1906 and 1917. One of the country's few remaining inter/urban trolley systems, the Media and Sharon Hill Lines, link Upper Darby's 69th Street Terminal and the Delaware Country towns of Media and Sharon Hill.

Railroad Electrification

The New Haven (now a section of Amtrak's Northeast Corridor) was the world's first AC electrified railroad, installing an autotransformer 11 KV, 25 Hz electric traction system, which the Japanese National Railroad adopted many years later, using 50/80 Hz at higher voltages.

The pioneer electrification in the U.S. was installed before the turn of the century by the B&O and the Pennsylvania Railroad (PRR) in 1895, followed by a Camden to Atlantic City run in 1906.

In 1915, the PRR completed its overhead 12.5 KV electrification between Philadelphia and Paoli on its suburban commuter service and later in 1931 this 25 Hz system was made continuous to New York.

The PRR continued expansion of its electrification with the 1935 electrification extension southward to Washington, DC. The final stage from Paoli, PA and Perryville, MD to Harrisburg, PA was completed in 1938. This final electrification included wiring railroad distribution and storage yards at Washington Potomic Yard and Ivy City, along with Harrisburg-Enola and Sunnyside Yard. The total electrification was 656 route miles and 2,350 track miles.

During the early days of railroad electrification there were no utility company interconnections by high voltage transmission lines and the railroad load at times exceeded the total generation of local companies. In order to provide this large power demand, PRR erected its own high voltage transmission lines. These lines spanned the PRR system at 132 KV (now 138 KV) single phase, 25 Hz, from step-up stations generating this power at 13.2 KV (now 13.6 KV).

PRR also initiated its own signal power transmission facilities. This provided a 100 Hz (+96.7) modulated signal used to provide the locomotive (MU) engineman with signal information regardless of fog or other masking of the distant wayside signal. The coded energy in the rails is also available for wayside signals, eliminating the need for line wires.

This signal power is generated at various substations through motor/generator sets that convert the single phase 25 Hz to single phase 100 Hz (96.7) which is transmitted at 6.9 KV, using space on existing high catenary poles.

Amtrak's Northeast Corridor has used several types of equipment. Many rail fans associate electric train operation with the famous GGI, the first streamlined electric locomotive in the world to pull railroad trains. For many years this locomotive was the world's most powerful with its 12 large drivers and 8 ponies. The GGI has been retired after almost half a century of faithful service and its original prototype (4800) now rests at Pennsylvania's State Railroad museum in Strasburg, PA.

Stone & Webster is providing engineering, design, procurement, construction, and startup services to Amtrak for a 180 MW Static Frequency Converter (SFC) facility, located in Philadelphia, just south of the Betsy Ross Bridge along the Delaware River. This station is designed to supply power to the 25 Hz Northeast Corridor Traction Poser System operated by Amtrak between Washington, New York, and Harrisburg. The new SFC station will replace the existing 60 MW Richmond Rotary Frequency Converter (RFC) Station upon its removal from service.

The new $140 million SFC station consists of five identical 45 MVA DC-link static frequency converter volts which convert 60 Hz, 69 KV, three-phase power to 25 Hz, 138 KV, single-phase power for a total station capacity of 180 MW. Each of the five converter units comprises the following major equipment:

- 1 – 60 Hz four-winding input transformer.
- 2 – six-pulse bridge thyriator controlled rectifiers.
- 1 – de-link including smoothing reactors and do filters.
- 8 – four-quadrant GTO thyriator pulse-controlled inverters.
- 2 – 25 Hz five-winding output transformers.

This SFC station is the largest of its type in the world.

Membership Committee Chair Named

The Philadelphia Section of the IEEE is pleased to announce that Li Bai has agreed to chair the Membership Committee. We are grateful to Mr. Bai, and all our committee volunteers. You can contact him at:

Li Bai, Assistant Professor
Temple University ECE Department
215-204-6616
bai@thoth.eng.temple.edu

Committee Chairs and Chapter Officers List Correction Update

SCHANELY, John R., Lockheed Martin NE&SS-SS, M/S 13000-1C, Moorestown, NJ 08057-0927, 856-638-7222, FAX 856-638-4301.

Philadelphia Section Chairs for AIEE and IRE (1903-1963)

The following 95 engineers served as Chairs of the AIEE and IRE in Philadelphia, before the IEEE was formed in 1963.

1903-04	C. Hering, AIEE	1931-32	G. W. Carpenter, IRE	1947-48	P. M. Craig, IRE
1904-05	C. E. Hewitt, AIEE	1932-33	L. Fussell, AIEE	1948-49	A. P. Godsho, AIEE
1905-06	H. A. Foster, AIEE	1932-33	H. W. Byler, IRE	1948-49	A. N. Curtiss, IRE
1906-07	C. W. Pike, AIEE	1933-34	P. S. Harkins, AIEE	1949-50	W. F. Henn, AIEE
1907-08	W. C. L. Eglin, AIEE	1933-34	W. F. Diehl, IRE	1949-50	J. T. Brothers, IRE
1908-09	J. Stevens, AIEE	1934-35	H. C. Albrecht, AIEE	1950-51	S. R. Warren, Jr., AIEE
1909-10	P. Spencer, AIEE	1934-35	E. D. Cook, IRE	1950-51	C. A. Gunther, IRE
1910-11	G. Hoadley, AIEE	1935-36	R. W. Wilbraham, AIEE	1951-52	H. H. Sheppard, AIEE
1911-12	C. Young, AIEE	1935-36	K. McIlwain, IRE	1951-52	L. M. Rodgers, IRE
1912-13	H. A. Homer, AIEE	1936-37	O. C. Traver, AIEE	1952-53	L. R. Gafy, AIEE
1913-14	A. R. Cheney, AIEE	1936-37	I. G. Wolff, IRE	1952-53	C. M. Sinnett, IRE
1914-15	H. Sanville, AIEE	1937-38	J. B. Harris, Jr., AIEE	1953-54	W. F. Denkhaus, AIEE
1915-16	J. H. Tracy, AIEE	1937-38	A. F. Murray, IRE	1953-54	J. G. Brainerd, IRE
1916-17	H. P. Liversidge, AIEE	1938-39	H. S. Phelps, AIEE	1954-55	A. E. Pringle, II, AIEE
1917-18	N. Hayward, AIEE	1938-39	H. J. Schrader, IRE	1954-55	S. C. Spielman, IRE
1918-19	W. F. Jones, AIEE	1939-40	E. P. Yerkes, AIEE	1955-56	T. E. Shieber, AIEE
1919-20	C. E. Clewell, AIEE	1939-40	R. S. Hayes, IRE	1955-56	C. R. Kraus, IRE
1920-21	C. E. Bonnie, AIEE	1940-41	D. C. Prince, AIEE	1956-57	M. J. A. Dugan, AIEE
1921-22	P. H. Chase, AIEE	1940-41	C. M. Burrill, IRE	1956-57	M. S. Corington, IRE
1922-23	E. Tuttle, AIEE	1941-42	W. B. Morton, AIEE	1957-58	B. H. Zacherle, AIEE
1923-24	R. B. Mateer, AIEE	1941-42	C. C. Chambers, IRE	1957-58	N. Johnson, IRE
1924-25	C. D. Fawcett, AIEE	1942-43	G. W. Bower, AIEE	1958-59	G. B. Schleicher, AIEE
1925-26	N. Shute, AIEE	1942-43	J. B. Coleman, IRE	1958-59	I. L. Auerbach, IRE
1925-26	S. Ballantine, IRE	1943-44	H. E. Strang, AIEE	1959-60	R. S. Hewett, AIEE
1926-27	L. J. Costa, AIEE	1943-44	W. P. West, IRE	1959-60	W. A. Howard, IRE
1926-30	J. C. Van Horn, IRE	1944-45	A. C. Muir, AIEE	1960-61	R. L. Halberstadt, AIEE
1927-28	I. M. Stein, AIEE	1944-45	T. A. Smith, AIEE	1960-61	W. T. Sumerlin, IRE
1928-29	L. M. Deming, AIEE	1945-46	C. T. Pearce, AIEE	1961-62	W. O. Mascaro, AIEE
1929-30	R. H. Silbert, AIEE	1945-46	D. B. Smith, IRE	1961-62	R. M. Showers, IRE
1930-31	D. H. Kelley, AIEE	1946-47	H. A. Dambly, AIEE	1962-63	T. H. Story, AIEE/IEEE
1930-31	W. R. G. Baker, IRE	1946-47	S. Gubin, IRE	1962-63	H. J. Woll, IRE/IEEE
1931-32	C. N. Johnson, AIEE	1947-48	W. R. Clark, AIEE		

Philadelphia Section Chairs for IEEE (1963-2003)

The following 40 Engineers served as Chairs of the IEEE in Philadelphia.

YEAR	CHAIR	COMPANY	YEAR	CHAIR	COMPANY
1963-64	E. W. Boehne	ITE Incorporated	1983-84	A. L. Smith	Honeywell
1964-65	K. H. Emerson	Philco-Ford	1984-85	J. E. Bauer	Naval Engr.
1965-66	W. E. Scholz	PECO	1985-86	Ned Kornfield	Widener
1966-67	J. E. Snook		1986-87	Marvin Rozansky	RCA
1967-68	J. E. Casey		1987-88	Joseph A. Bordogna	U of P
1968-69	W. W. Middleton	Bell of PA	1988-89	Mark S. Zimmerman	Magnavox
1969-70	S. Zebrowitz	Philco-Ford	1989-90	Bruce A. Eisenstein	Drexel
1970-71	O. M. Salati	U of P	1990-91	Stanley B. Disson	Consultant
1971-72	H. O. Wood	Ford Aero	1991-92	Gary C. Ridge	Bell Atlantic
1972-73	R. Mayer	Sun Tech., G.P.	1992-93	Walter Schoppe	NADC
1973-74	E. F. Halfmann	PECO	1993-94	Nihat Bilgutay	Drexel
1974-75	Fred Haber	U of P	1994-95	Kenneth R. Laker	U of P
1975-76	C. Williams	Bell of PA	1996	Margaret Haag	PECO
1976-77	D. C. Dunn	PECO	1997	Stu Levy	Consultant
1977-78	V, K. Schutz	Temple	1998	Moshe Kam	Drexel
1978-79	T. L. Fagan	GE	1999	Marv Weilerstein	Consultant
1979-80	M. W. Buckley, Jr.	RCA	2000	Brian Butz	Temple
1980-81	J. C. Bry, Jr.	RCA	2001	Jim Kubeck	Lockheed Martin
1981-82	K. A. Fegley	U of P	2002	Tasos Malapetsas	Access International
1982-83	G. W. Gordon	PECO	2003	Janet Rochester	Lockheed Martin

IEEE Medalists & Award Recipients

In The Philadelphia Section

MEDALISTS

M. E. Leeds – Edison 1948
N. Cohn – Lamme 1968
Y. H. Ku – Lamme 1972
J. C. Brainerd – Founders 1975
N. Cohn – Edison 1982
Herman P. Schwan – Edison 1983
Joseph T. Threston – Simon Ramo 1995

FIELD AWARDS

F. J. Bingley – Zworykin 1956
C. S. Schifreen – Habirshaw 1964
W. F. Skeats – Habirshaw 1965
R. A. Stampfl – Diamond 1967
A. J. Williams, Jr. – Leeds 1968
A. C. Schoeder – Zworykin 1971
E. G. Ramberg – Sarnoff 1972
E. W. Boehne – Habirshaw 1973
J. P. Eckert – Piore 1978
J. W. Mauchly – Piore 1978
R. M. Showers – Steinmetz 1982
F. J. Buckley – Stienmetz 1991

SERVICE AWARD

W. W. Middleton – Haraden Pratt 1984

IEEE-USA AWARDS

Distinguished Contributions to Engineering Professionalism
W. W. Middleton – 1998

Professional Achievement Award
E. J. Podell – 2002

REGIONAL ACTIVITIES AWARDS

William W. Middleton Award for Distinguished Contributions
W. W. Middleton – 1990

Leadership Award
G. W. Gordon – 1999

Achievement Award
R. B. Adler – 2002

Philadelphia Section Award Recipients

I. L. Auerbach 1961
W. E. Bradley 1962
H. P. Schwan. 1963
L. Stegg 1964
J. P. Eckert, Jr. 1965
J. W. Mauchly. 1965
G. E. Beggs, Jr.. . . . 1966
W. E. Scholz 1967
W. M. Scott, Jr. . . . 1967
J. G. Brainerd 1968
Grace Hopper 1968
W. R. Clark, Jr. . . . 1969
E. W. Boehne 1969
V. Cox 1969
C. T. Pearce 1970
G. E. Heberlin. 1970
S. R. Warren, Jr. . . . 1970
T. Travis 1970
I. Riebman 1971
H. J. Woll 1971
O. M. Salati 1972
G. M. Gunther 1972
C. R. Kraus. 1972
C. C. Chambers. . . . 1973
P. J. Bingley 1973
A. Williams, Jr.. . . . 1973
M. S. Corrington. . . 1974
W. Middleton 1974
N. Cohn 1975
H. R. Paxson. 1975
J. F. Fisher 1976
C. N Weygandt 1976
R. Mayer. 1977
H. H. Sheppard 1977
K. V. Amatneck. . . . 1978
H. Rappaport 1978
S. Zebrowitz 1978
F. Oliveto 1979
Emily Sirjane 1976
C. Williams. 1979
J. E. Bauer 1980
R. M. Showers 1980
Helen Yonan 1980
G. L. Fredendall . . . 1981
W. R. Rowland 1981
T. L. Fagan 1982
L.T. Klauder 1983
J. B. Owens 1983
M. W. Buckley, Jr.. . 1984
B. Chance. 1984
B. Fell. 1984
K. A. Ringo 1984
J. C. Bry, Jr. 1985
G. W. Gordon 1986
K. A. Fegley 1986
G. E. Bodenstein. . . 1987
N. Kornfield 1988
E. S. Wheeler 1988
W. W. Middleton. . . 1989
J. Bordogna. 1990
D. Jaron 1991
V. K. Schutz 1991
M. W. Buckley, Jr.. . 1992
H. P. Schwan. 1992
B. A. Eisenstein . . . 1993
J. D. Rittenhouse . . 1993
S. B. Disson 1994
R. G. Goldblum . . . 1994
S. Levy 1994
M. Weilerstein. 1994
J. Bordogna. 1995
F. Oliveto 1995
W. Schoppe. 1994
V. Monshaw 1996
L. Riebman. 1996
H. Urkowitz 1996
M. Amin 1997
B. A. Eisenstein . . . 1997
K. R. Laker. 1997
R. B. Adler 1998
A. Johnson, Jr. 1999
H. H. Sheppard 1999
N. Bilgutay 2000
E. J. Podell 2001
S. R. Showdhury. . . 2002
D. Graham 2002