providing insights for today's hvac system designer

Engineers Newsletter

volume 42–1

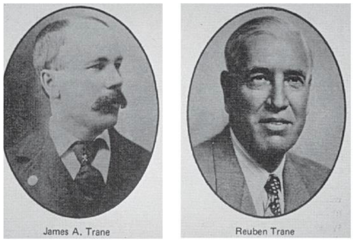
100 Years of Trane History

An Applications Engineering Perspective

The Trane *Engineers Newsletter* has been providing insight into HVAC system design for more than 40 years. This issue is quite different from our typical technical focus. As Trane begins its second century of operation as a company, Applications Engineering wanted to look back at the first 100 years and share some technology highlights with you. The research helped us understand how Trane worked with our readers—consulting engineers, design-build contractors, and technical owners—to develop, refine and offer various systems throughout the years. We hope you find it interesting and invite you to join in the anniversary celebration.

In 1864, a young James A. Trane immigrated from Norway to La Crosse, Wis., with his parents. He married Mary Miller in 1880 and opened a plumbing and heating shop on Pearl Street in 1885. On Sept. 13, 1886, his son Reuben was born.

Figure 1. James A. and Reuben Trane



The formative years

Reuben Trane worked for his father as a plumber's helper for a year after graduation from high school in 1905, earning enough money to fund his engineering education at the University of Wisconsin. Upon graduation with a Bachelor of Science degree in mechanical engineering in 1910, Reuben first worked for three years as a sales engineer with a Milwaukee machine tools firm before returning to La Crosse in 1913. That same year, Reuben, along with his sister Stella and his father, incorporated The Trane Co. to manufacture steam valve traps that James A. Trane had invented in connection with a vapor heating system.

Initially, the business included contracting, as well as manufacturing and sales of heating specialties, and the design and distribution of Trane heating systems. The primary products of the decade included vapor heating products, steam heating specialties, the direct return trap patented by Reuben in 1917, and a condensation pump line in 1918.

In 1917, Emil H. Erickson joined The Trane Co. from the Ford Motor Co. and persuaded Reuben Trane to focus on equipment manufacturing. The company discontinued its contracting business to concentrate on heating systems and specialties. In 1918 Erickson was asked to oversee the new 5,000-square-foot manufacturing operation. It was noted that Erickson dug into his own pocket to help purchase the first machines for the new plant.

1920s: Growth, innovation and seminal tenets

Frank Hood, Reuben's brother-in-law, joined the company in 1920. During this decade, the direction of the company was shaped by ideas, inventions, and business strategy. The year 1925 exemplified this and was pivotal for two reasons—one product focused and the other business inspired.

Reuben wanted to design a heating unit that could replace and improve upon the cast iron radiator. Realizing the need for a lighter material and better heat conductivity, he turned to copper. Using this new material, he created a new finned-tube design that would become today's ubiquitous coil. Once the coil design was complete, he turned his attention to a new cabinet. The cabinet was specifically designed to circulate air without a fan using the properties of natural convection. This seemingly simple change transformed the industry, but not immediately.

Two daunting factors had to be overcome: manufacturing and distribution.

Manufacturing. The Trane Co. did not have the manufacturing facilities to build the entire unit, and cast iron radiator manufacturers were not interested in manufacturing a product that could replace their primary business. This led to The Trane Co. building the cabinetry and working with partners to manufacture the heating element.

Distribution. Due to the convector's appealing aesthetics, a major proponent of the convector was the architectural community. Up until this time, the majority of business was sold through wholesalers. However, the demand for a variety of cabinet types and colors was not conducive to wholesaler stocking methods. It became evident that another distribution method would be needed to successfully sell in the market.

To address the demand, in 1925 the first "Trane assistant branch office manager class" convened. It was comprised of 16 young men who were trained in La Crosse. The graduates would become assistants to those already functioning as field manufacturer's agents, or managers for the larger Trane wholesaler customers. This program evolved into the industry renowned Trane Graduate Training Program, which is still going strong today.

The patent for the convector was filed in April of 1926, and the first was installed in the residence of J.E. Humrick, the Trane Des Moines, Iowa, office manager on Oct. 28, 1926. Combined with steam heating specialties and pumps, Trane furnished both the units and all system components. The first of the allied products combined a horizontal propeller fan with a square coil. Realizing the need to manufacture the new convector completely in-house, manufacturing was expanded. A second factory would be built in La Crosse.

1930s: Expansion, education and development

The Trane cooling coil—the core of Trane air conditioners—was invented in 1931. Reuben Trane and engineer Reuben Anderegg investigated using a fan coupled with cold water running through a convector coil for comfort cooling. A well was drilled on the property and cold ground water was pumped through the coil. In 1931 the first Trane cooling coil was installed at the Indiana Theater in Indianapolis and a similar unit in the Realto Theater in Louisville, Ky.

The Great Depression did not significantly affect Trane business until 1932, at which point more man-hours were invested in researching new applications. This was the year that the term Climate Changer™ was used for the first time—applied to an oil burning furnace.

Products included strainers on the aircraft carrier USS Yorktown, railroad air conditioners, unit heaters and ventilators and many other specialties. By 1935 Trane offered direct-expansion cooling coils that permitted air conditioning to be installed in locations where cold water was not available, such as Houston. In 1936 variable-speed, direct-current motors allowed unit heater fans to be operated at five different speeds—so the "recent advent" of variable-air-volume terminal units should not be a surprise!

TurboVac product launch. In 1938, during its 25th anniversary, The Trane Co. announced the TurboVac™ chiller design—a semi-hermetic, direct-drive, low pressure (in a vacuum) centrifugal chiller (Figure 3). Its packaging, simplicity (compared to field-erected chillers), and reliability helped Trane become an air-conditioning industry leader. The simplicity and reliability of centrifugal chiller design became a company tenet.

"The arrival of the TurboVac was huge, and it deserved a marketing plan equal in scope." [1]

To nationally market the new chiller, Trane sponsored the greatest golf marathon in history, chronicled in *King of Clubs*. Traveling in "The Trane of the Air" DC-3 Skysleeper, Reuben accompanied golfer J. Smith Ferebee to eight different cities coast-to-coast in just four days! While Ferebee golfed 600 holes, Reuben Trane met with engineers and architects in each city to help them understand how the TurboVac chiller would improve building air conditioning.

Educational products. To provide support and expand the technical content of Trane educational offerings, the company hired William Goodman, an eminent air-conditioning consulting engineer. Under his guidance, after three years of development and an investment of $40,000, Trane published its 325-page *Air Conditioning Manual* in 1938 and sold copies for $5. In 1936 Trane offered a psychrometric chart and the "Trane Air Conditioning Ruler" for a dollar. "Weather Magic" debuted in 1937, a periodical written for architects, engineers, contractors and select industrials. In later years "Weather Magic" evolved into a broader marketing campaign.

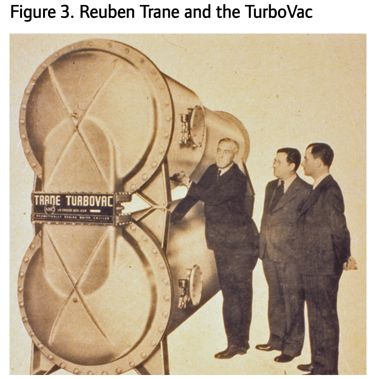
Leadership changes. On Jan. 24, 1936, the first generation of the company, James Trane, passed away. Emil Erickson assumed his position and Donald C. Minard, a member of the 1925 student class, became a vice president.

As with all U.S. companies, entry into World War II led to the departure of many of the young men on The Trane Co. roster to the services—and also changed the direction of the company.

1 *The King of Clubs* by Jim Ducibella, p.43

Figure 2. Members of the first "Trane assistant branch office manager" class

Figure 3. Reuben Trane and the TurboVac



1940s: A change of focus, and base product improvements

World War II forced many manufacturing firms, including The Trane Co., to change their focus from consumer and business products to manufacturing processes to support military production.

The Trane Co. leaders and engineers subsequently found that with slight modifications, some of their heating and cooling equipment was well-suited for process work. For example, an evaporative condensing unit was modified to cool quenching oil, a process used in small arms ammunition manufacturing.

While examining business opportunities, Trane learned that the U.S. military required a rather unusual heat exchanger. An airplane needed to cool air from its supercharger by using outside air. American planes were designed to perform best at sea level with 90 degrees F temperature conditions for pressure. At altitude, performance was lost, putting pilots and missions at risk. While the supercharger could establish the proper pressure, in doing so a great deal of heat had to be transferred through a heat exchanger (intercooler). The initial design using copper and a cement-like material to "stick" heat exchanger plates together was unsuccessful due to the pressures experienced.

Trane turned to brazing aluminum as a possible solution—something that had not been done before. Working closely with the Aluminum Co. of America, a very lightweight aluminum was precoated with brazing material during manufacture. Then, using a salt bath method, Trane was able to braze an entire intercooler with its many plate pairs simultaneously. These intercoolers allowed the U.S. planes to maintain performance at higher altitudes. Later the same concept was used to produce a heat exchanger for the first man-made vehicle on the moon, the lunar rover.

Trane supported other government projects including aluminum tubes manufactured for the Manhattan Project; and Operation Polio, where a wall fin was airlifted, under the authorization of Secretary of War Kenneth Royall, to a new Emergency Polio Hospital in Greensboro, N.C.

Trane Inventors

"If the choice were mine, I'd rather lose my business--but keep my engineers together." - Reuben Trane

Given Reuben Trane's direction, this *Engineers Newsletter* could not be published without covering the engineers whose genius and talent created the industry products, systems, controls, and devices. Here we chronicle Trane inventors with at least 10 U.S. Patents (as of November of 2012). Following that we share thoughts from their peers.

Trane inventor	Total patents	1st patent date	Last patent date	Patent description
Robert G. Miner	43	1936	1972	Chiller controls, absorption refrigeration, induction units, and self-contained air conditioners
Reuben N. Trane	31	1916	1953	Pumps, humidifiers, heat exchangers, and (of course) the convector
Robert E. Utter	24	1983	1997	Scroll compressor design, heat exchangers
Chester D. Ware	23	1960	1985	Heat transfer, multi-stage economizers, heat recovery
Robert W. Helt	22	1986	2012	Temperature, unit and airflow control
James C. Tischer	18	1984	2001	Chillers, fans, compressors
David H.Eber	17	1966	2003	Compressors, oil-free liquid chiller, refrigerant monitoring devices
Peter A. Kotlarek	17	1989	1998	Compressor design, bearing protection
Stephen S. Hancock	16	1998	2012	Centrifugal blowers, heat exchangers, residential air conditioning
Arthur L. Butterworth	15	1978	2003	Bearing design, lubrication, oil-free chiller
Paul C. Rentmeester	15	1978	2008	Product and compressor controls, sensors, diagnostics, and protection
Alan G. Butt	14	1958	1984	Heat exchangers
H. Kenneth Ring, Jr.	14	1978	2008	Variable air volume, air distribution, controls, flow measurement, valve and chiller evaporator design
Brian T. Sullivan	14	1991	2011	Chiller variable frequency drives, controls and components
Dave M. Foye	14	1984	2012	Controls, compressors, air handlers, terminal units
Lee L. Sibik	13	1995	2001	Scroll, screw and centrifugal chiller control
William A. Smiley III	13	1988	2009	Fan design, flow measurement, acoustics
G. Jeffrey Hugghins	13	2000	2012	Furnace design, control systems
James M. Porter	12	1966	1974	Absorption refrigeration design and control
Otto A. Labus	11	1949	1959	Air diffusion and registers, radiators
Daniel R. Crum	11	1992	2010	Screw and scroll compressors
Sean M. McCoy	11	2011	2012	System and product controls to increase stability, flexibility, and adaptability
John C. McNabney	10	1968	1976	Air distribution, heat exchangers, fan control
Michael D. Carey	10	1991	2002	Lubrication system design, condenser design
Sean A. Smith	10	1998	2012	Chiller controls and design, heat transfer

The following are quotes from interviews with peers of the former inventors:

- **Robert Miner.** *"Bob had genius for understanding how stuff worked. The load limiting capability he developed allowed chiller motor voltage to be crept up on. This significantly reduced the requirement for chiller safeties and allowed Trane to get to maximum capacity."*
- **Reuben Trane.** *"Reuben Trane and Dr. Willis Carrier founded and built an industry that allows habitation, productivity and tight process control even in the hottest and most humid climates."*
- **Chester Ware.** The oft-used quote was, *"Heat would not transfer without Chet Ware's specific approval."*
- **Dave Eber.** Dave allowed us to *"take no prisoners"* beginning in 1980. He set up a *"skunk works"* to allow projects to proceed without oversight. This allowed engineers to innovate and invent.

Much like today, these years saw significant emphasis on water and material reduction. A New York law disallowed "once through" well water since the reservoirs could not support air conditioning and maintain a supply of potable water. This requirement remains at the forefront of sustainable practices today, notably in American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Standard 189.1. The use of copper was restricted by U.S. Copper Regulation M12 Amendment 1. This required innovation to maintain heat transfer while using materials with less effective heat exchange properties.

As hostilities were ending, Trane began making plans for the future. Throughout the war effort, the employees had gained additional knowledge, more equipment and better tooling. The Trane Co. explored the manufacture of new products, which led to significant invention and innovation.

Beginning in 1946, Trane embarked on designing both new centrifugal and reciprocating compressors. In his 1948 leadership speech, Reuben Trane stated that the company would introduce centrifugal chillers with a range of 50 to 200 tons—or perhaps even 300 tons!

1950s: Astounding investment and expansion

At the 1951 American Society of Heating and Ventilating Engineers (ASHVE) exposition in Philadelphia, Trane displayed many new products including centrifugal chillers, reciprocating compressors, self-contained air conditioners, backward-inclined and forward-curved fans, gas unit heaters, and multi-zone climate changers.

Figure 4. The three millionth convector

An operating 75-ton Trane CenTraVac™ centrifugal chiller was on display, as were operating fans and lighted fan curves to explain how the system worked.

Industry education continued through the publication of air-conditioning design applications for various processes such as baking, brewing, poultry incubation and candy-making. The new medium of television began to take off and Trane made its TV debut when Bob Leilich of the Baltimore sales office was interviewed on the *Johns Hopkins Science Review*.

In May 1954, a new laboratory dubbed the "House of Weather Magic" was dedicated. In attendance was Robert LeBaron, assistant to the secretary of defense, who, during his address, made a plea for "The Peaceful Atom." Within three years, the House of Weather Magic would double in size. To date, the building has been expanded three times.

Prior to the death of Reuben Trane on Sept. 7, 1954, the first "non-Trane" chief executive officer (CEO) was named—Reuben's brother-in-law, Frank Hood. The decade also saw the passing of Emil Erickson, and Donald C. Minard became the first company President not related to the Trane family. Under the leadership of President Minard and CEO Hood, business boomed.

The 1950s were a decade of unprecedented growth. In 1951 the two millionth convector was sold, and just five years later the total exceeded three million (Figure 4). By 1956 sales increased by 1426 percent over the past decade (industry sales were "only" up 393 percent). A new Trane UniTrane fan-coil line was announced. The first 300-ton centrifugal chiller was sold in 1953, and by 1955 chillers as large as 600 tons were shipping.

Trane heat exchangers were used on America's first supersonic bomber, the delta-wing B-58 Hustler, and also on the Convair Jet 880 airliner—one of which was owned by Elvis Presley and christened the Lisa Marie. A new residential line and a turbine-driven, open-drive CenTraVac chiller premiered in 1958. Absorption cold generators were announced in 1959—used significantly through the 1960s and 70s and during the Cold War.

1960s: Growth and stabilization

The last family tie to the early stages of The Trane Co. was broken when Frank Hood passed away. As the company embarked on its second half century, Donald Minard became the CEO and Tom Hancock was named Trane's president.

The Trane Co. continued to move forward. In response to consulting engineer demands, templates for CenTraVac chillers were made for placement on drawings. Technology started to aid business speed via the new punch order handling service. Education moved into high gear with the first publication of the *Air Conditioning Clinics*—HVAC training designed to cover basic theory on topics from the refrigeration cycle to psychrometrics, and even compressor disassembly and reassembly. An important industry step was taken—support for the Air-conditioning and Refrigeration Institute (ARI) 210 residential certification program that helped ensure owners received equipment that delivered promised performance. System innovations included a central heat pump system designed for the American Embassy in India by Clarence Ringquist (later manager of Applications Engineering)—strikingly similar to the Central Geothermal Chiller System introduced by Trane in 2011.

New absorption cold generators as large as 1,475 tons were announced, as were 5- through 15-ton rooftop units (expanded to 60 tons later this decade). Centrifugal chiller evolution continued with the PCV CenTraVac—sometimes called the "sidewinder" because its compressor was sideways. A new air-cooled cold generator chiller was announced. It had been tested down to 0°F ambient starting conditions.

In recognition that acoustics was becoming more important to the industry, a separate acoustic laboratory was built with rooms isolated by springs so that external vibrations did not affect the acoustic measurements. A 175-pound person walking from one corner of the room to another deflected the tremendous weight of the room 3 ½ thousandths of an inch!

Job types ranged from pig farrowing to high-tech brazed aluminum heat exchangers used in the nuclear armed Talos missile system and the U.S.S. Albany. Trane also cooled Titan II missile launching facilities. Significant projects included the Boeing plant—claimed to be the world's largest structure—and the Jefferson National Monument (St. Louis Arch).

External technology changes again prodded the company's evolution. During the 1969 Air-conditioning, Heating and Refrigerating (AHR) Exposition in Chicago, computerized selections of centrifugal machines were performed right on the show floor! Data was transferred from a typewriter on the floor to a computer in downtown Chicago, then back.

1970s: Education and efficiency, efficiency, efficiency

Trane placed significant emphasis on education during this decade. In 1971, Mal Laitinen was hired to oversee the Graduate Training Program (GTP). Laitinen would train approximately 3500 GTP students over the course of his 39-year career.

To help educate the industry, acoustic seminars were developed and delivered in offices. In addition, a number of educational pieces comparing economics of various systems were produced. A 99-slide, four-hour Fan Seminar was released. At the end of its first half century, Trane Applications Engineering published the first *Engineers Newsletter*, "When is a BI Fan Quieter than an FC…and Vice Versa?"

A new product, the VariTrane™ air terminal device, was introduced in 1971 and built in the company's new plant in Rushville, Ind. Along with other variable-air-volume (VAV) providers, Trane helped a new, energy-efficient system permeate the industry.

The year 1973 was a tumultuous one. The U.S. experienced a significant economic shock when the Organization of the Petroleum Exporting Countries (OPEC) imposed an oil embargo in October of that year. This event galvanized the HVAC&R industry to concentrate on energy efficiency. The Trane Co. launched its Conserve Energy By Design campaign in that same month.

Providentially, earlier that year at the February AHR exposition in Chicago, the company had announced a two-stage absorption cold generator that was 40 percent more efficient than the single-stage unit, as well as a new, computer simulation tool, Trane Air Conditioning Economics (TRACE™).

Originally a TRACE analysis was performed by filling out a paper manual and mailing it to La Crosse, Wis., to be run on a mainframe computer. During the decade, TRACE-Direct became available through a time-sharing service via McDonnell Douglas. This greatly reduced the time required to perform analysis and allowed engineers to examine the energy savings and financial payback of various systems. Later this decade, TRACE version 500 was released and incorporated more energy saving options.

Air-cooled CenTraVac™ chillers were introduced for cooling in water-deprived regions. To help make systems more efficient, heat recovery CenTraVac chillers were often installed, and new rooftop and unitary heat pump models became available to reduce HVAC system energy use. In addition, "N stamped" products were certified for the growing nuclear energy industry. Eddy current clutch variable-speed drives were announced for use on centrifugal and "Q" fans—this dovetailed well as variable-air-volume systems became an efficient system of choice.

Trane chilled-water systems were installed in the United Services Automobile Association (USAA) headquarters in San Antonio, Texas. At three million square feet, it is one of the longest buildings in the world. (Later in 2007 Trane controls were used to connect and further reduce energy use of the "double ended" chilled-water system by interfacing its north and south chilled-water plants.)

Importantly, leadership made the visionary decision to combine HVAC equipment and controls when Trane purchased Sentinel Electronics in 1978. This launched the company into providing systems control through versions of its Tracer™ building management system, which continues to this day.

1980s: System advancement and business changes

Following significant increases in product efficiency in 1980, the "Trane for Energy Fitness™" campaign was launched via ads in magazines, the *Wall Street Journal*, and on television. E.G. Marshall (of *The Defenders* television show fame) was the spokesman (Figure 5).

In 1983 Trane increased its presence by purchasing General Electric's residential HVAC division.

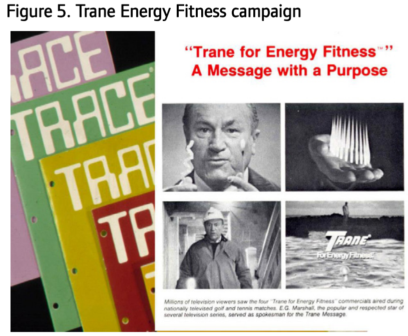
Then, after more than 70 years as an independent business, The Trane Co. was enveloped by the business climate of the day: mergers and acquisitions. Following a number of unsuccessful takeover bids by others, Trane became a division of American Standard in 1984. To serve the market more nimbly, Trane moved to a "business unit" concept where the company's various products and systems were run almost as independent businesses. New facilities were built in Pueblo, Colo. (helical rotary or "screw" chillers), and Macon, Ga. (self-contained units). Trane also purchased Command Aire water (and ground) source heat pump system operation near Waco, Texas.

On the product front, the newly designed three-stage CenTraVac chiller was unveiled in 1982—helping reach unprecedented efficiency levels. Small rooftop units were designed for higher efficiency and the Penthouse (outdoor) Climate Changer™ was introduced. Another significant innovation was the "Modular" Climate Changer that allowed stacking of modules. Without significantly increasing costs, this allowed the split dehumidification configuration still used in dedicated outdoor air units today.

The primary emphasis throughout this decade was system integration. Trane used its Building Automation System (BAS) division to offer Integrated Comfort Systems, becoming an industry innovator by providing complete product and control systems offerings. One of those systems was Direct Digital Control/Variable Air Volume (DDC/VAV)—a very efficient system then and now. This was applied with air-handling units, self-contained units, and rooftops.

Technology and industry issues also moved the company forward. TRACE 600 made its debut, allowing the industry the full power of energy analysis on a desktop computer. In addition, electronic data transfer from TRACE to the popular AutoCAD® design and drafting system was announced.

Figure 5. Trane Energy Fitness campaign



1990s: Industry issues, leadership and growth

This decade saw Trane long-term industry investments recognized in many ways.

Industry issues and standards. Atmospheric issues began to be addressed with Trane taking the long-term holistic position (in 1991) that energy efficiency, ozone depletion, and global warming all needed to be considered.

ASHRAE Standards 62.1 (ventilation), 90.1 (energy), and 15 (refrigerant safety) were significantly changed and these updates made their way into building codes. Another standard, 135 (BACnet™), defined data communication protocols for building automation systems. Trane employees participated on many of the industry's standards writing committees.

Due to the Montreal Protocol and the Kyoto Protocol, the balance between energy use, ozone depletion and global warming gained momentum and the transition to alternative refrigerants was completed in developed countries. There was also significant environmental activity, such as the promotion of the U.S. Environmental Protection Agency (EPA) Energy Star Showcase Building program, in which Trane was also active.

Products. Trane air-cooled helical-rotary (screw) chillers and a new absorption chiller design helped to round out system offerings, and large and small rooftop lines were improved. Trane CenTraVac™ chiller performance reached 0.50 kW/ton full load performance at ARI standard conditions for the first time—on its way to 0.45 kW/ton. In March of 2002 at the Earth Technologies Forum and Executive Summit in Washington D.C., Trane announced its S-Series EarthWise™ CenTraVac chiller, which was the first chiller in the industry to use refrigerant as a lubricant.

In addition, the Trane Duplex™ chiller, up to 3,750 tons, was introduced and used in many district cooling applications. In response to ASHRAE Standard 62.1, airflow measurement became more important and the company found that by using the airflow technology from its VariTrane™ VAV boxes, outdoor airflow could be measured. Outdoor Climate Changers™ were re-designed, as were the water-source/ground-source heat pump and self-contained lines.

Systems. System energy reduction was a high priority. The Spallation Neutron Source research laboratory near Oak Ridge, Tenn., used high-efficiency Trane chillers. Stockton College's ground-source heat pump system, one of the largest ground-source systems at the time, used Trane heat pumps. Variable-speed drives became more prevalent as their costs were reduced, and were used on many system components. This led to system energy reductions, for example by balancing cooling tower fan and chiller power, and the shifting of chilled-water systems to variable primary flow. These new system controls required significant updates to Trane unit controllers and Tracer™ system controls.

Employee recognition. Employee loyalty was exemplified as many people who had reached their 40th year with the company were portrayed in internal publications. Noteworthy are three field sales engineers who retired during this decade after topping 50 years of service: Jack Lozier (Philadelphia), Jim Mack (Lexington, Ky.), and Herb Krupp (St. Louis).

Engineers Newsletters Live. During the 90s, Trane installed satellite telecommunications for internal training (TRACE™ 700 and System Analyzer™). As system education became more important, this new medium was expanded to include customer education. Sher Peterson, chiller marketing, broadened the use of the satellite network for system training by extending the *Engineers Newsletter* concept. On August 18, 1999, the "Low Dollar Chiller Plant," debuted the *Engineers Newsletter Live* (ENL) series—viewed in Trane offices by more than 1,800 customers. Featuring David Peters, then with Southland Industries, and Trane Application Engineers, the 90-minute live broadcast covered reducing chilled- and condenser-water flow rates in systems to reduce both installed and first costs of chilled-water systems.

Since then, 45 ENLs have been viewed by more than 66,000 consulting engineers, technical owners, operators, contractors and architects. Subjects have ranged from acoustics to ground-source heat pumps, high-performance schools, ASHRAE Standards, and environmental programs such as LEED®.

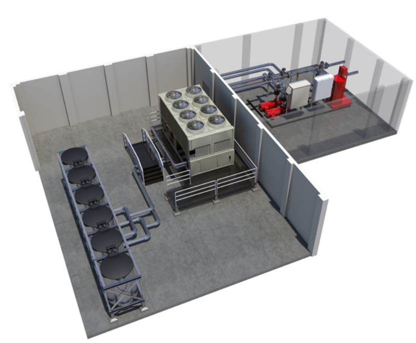
2000–Present: Technical and sustainable leadership, and a look toward the future

The last 13 years saw growing impetus toward sustainability. The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) building rating program grew—which influenced building, system, and product design. Substantial education through *Engineers Newsletters* and *Engineers Newsletter Live* events continued. Control system integration and capabilities increased due to ASHRAE Standard requirements as well as the desire to reduce system energy use. BACnet™, Modbus, and LonTalk™ communication protocols were all available in new versions of automation systems.

Business changes also occurred. By 2007 annual air conditioning sales and services topped $7.4 billion. Trane, Inc., became a public entity after American Standard Companies divested other portions of its business. On Dec. 15, 2007, it was announced that Trane would merge with Ingersoll Rand. The merger became final in June of 2008.

System and product investment and introduction continued during this time as the company again responded to customer and standard requirements, as well as the impact of the sustainability movement. New, small chillers were redesigned for high efficiency. A new packaged Climate Changer significantly reduced air leakage. Variable-speed technology was applied to both the compressors and fans of water-source heat pumps. These significantly higher efficiency levels were also coupled with ground-loop heat exchangers to deliver extremely high efficiency systems. Single-zone VAV rooftop units down to 3 tons were announced; this

Figure 6. Trane EarthWise™ Ice-enhanced, Air-cooled Chiller Plant



exceeds present ASHRAE Standard 90.1 and California Energy Code requirements. These units utilized variable-speed compressors and fans.

At the system level, Trane announced EarthWise™ systems, which are pre-configured systems that include controls, packaged pumping (when applicable) and, for the first time, system catalogs (Figure 6).

At the Dallas AHR Exposition in January of 2013, Trane introduced many new products—most notably, our newest centrifugal chiller, the CVHS. This high-efficiency chiller expands upon 75 years of centrifugal compressor history and is the second generation of the company's oil-less design.

Sharing the first century of Trane has been a great privilege for us. We hope you've learned from, been inspired by, and enjoyed the historical diversion. As we move forward, we look forward to getting your continued feedback to provide you with the right applications and systems materials that allow your business to grow.

By Mick Schwedler, manager, applications engineering; Eric Sturm, applications engineer; and Jeanne Harshaw, program manager, Trane. You can find this and previous issues of the Engineers Newsletter at www.trane.com/engineersnewsletter. To comment, e-mail us at comfort@trane.com

For more information on Trane historical achievements visit **www.trane.com/100years.**

Trane and ASHRAE

Many Trane employees have served in various capacities for the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), from the Society level to local chapters. In addition, a number of Trane employees have been recognized at the Society level.

ASHRAE Hall of Fame:

" The ASHRAE Hall of Fame award recognizes deceased members who made milestone contributions to industry growth. Inducted individuals must have been a society member and shown technical or academic distinction."

Reuben N. Trane (1997)

Presidential Members:

"ASHRAE recognizes and applauds all Society Presidential Members for their dedicated service to ASHRAE. These men … all gave selflessly during the years of their presidential terms, putting their personal lives on hold in order to serve the Society."

Neil Patterson (1993-1994) Manager, Applications Engineering
Jim Wolf (2000-2001) VP Government Affairs
Lee Burgett (2005-2006) VP Engineering
Bill Harrison (2008-2009) District Manager

ASHRAE Fellows

"The mission of the [College of Fellows of ASHRAE, Inc.] is to serve as ambassadors to enhance ASHRAE's technical image internally and in the community at large through activities such as transferring ASHRAE-generated technology and knowledge; mentoring students, engineers and educators to increase their awareness of ASHRAE activities; sharing knowledge or experience with the grassroots organization, such as chapter presentations; communicating ASHRAE recommended practices to resolve current industry problems; and supporting ASHRAE governance in conducting special technical activities."

Clarence Ringquist (1975): System design and education
Neil Patterson (1984): System design and energy conservation; education
Bill Landman (1989): Chilled water system design and optimization; education
Floyd Hayes (1991): Thermal systems expertise and alternative refrigerants
Stephen Trelease (1992): Ground-source heat pump system design and optimization
Richard (R.O.) Hunton (1993): CEO at Hunton Group
Carl Speich (1993): Compressor reliability and acoustics
Lee Burgett (2000): Chiller design and innovation, alternative refrigerants
Art Hallstrom (2000): Airside system design, control, optimization, and acoustics; education
Dennis Stanke (2007): Ventilation and indoor air quality (IAQ) expertise; education

Exceptional Service Award

"Established in 1998, this award recognizes members who have served the Society faithfully and with exemplary effort."

Jim Wolf (2003) VP Government Affairs
Art Hallstrom (2007) Airside Applications Manager

ASHRAE Standards Achievement Award

"Each year the Society recognizes the outstanding efforts of a single volunteer in the area of standards development. The Standards Achievement Award recognizes excellence in volunteer service and serves to heighten general membership awareness of, and interest in, standards activities."

Dennis Stanke (2010) SSPC 62.1 Chair
Mick Schwedler (2011) SSPC 90.1 Chair

ASHRAE Distinguished Service Award

"Established in 1962, this award recognizes members who have served ASHRAE faithfully and with distinction on committees or otherwise given freely of their time and talent on behalf of the Society."

Benny Bootle, Jr. (1981) District Manager
Carl Speich (1985) Staff Engineer
Neil Patterson (1988) Applications Engineering Manager
Jim Wolf (1991) VP Government Affairs
Jim Porter (1996) Staff Engineer
Tom Williams (1997) Sales Manager and Sales Engineer
Art Hallstrom (1998) Airside Applications Engineering Manager
Bill Landman (1998) Applications Engineering Manager
Lee Burgett (1999) VP Engineering
Bob Doerr (2000) Senior Principal Chemist
Don Eppelheimer (2002) Senior Principal Applications Engineer
Bill Harrison (2003) District Manager
Don Brandt (2005) Account Manager
Mick Schwedler (2008) Applications Engineering Manager

Journal Paper Award

"The Journal Paper Award annually honors the best paper or article published in ASHRAE Journal."

Dennis Stanke, January 2005, "Single-Path Multiple-Zone Systems Design"
John Murphy, October 2011, "High-Performance VAV Systems"

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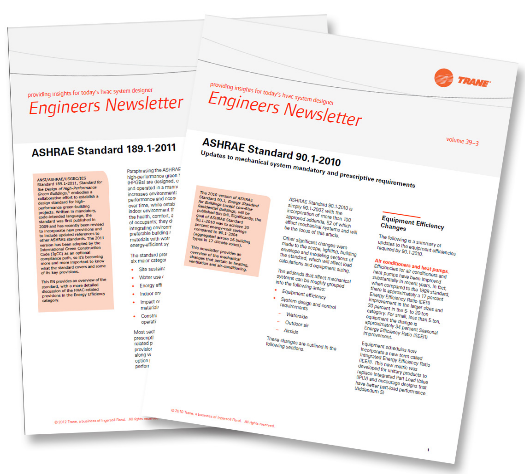

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Central Geothermal Systems discusses proper design and control of central geothermal bidirectional cascade systems that use borefields. This manual covers central geothermal system piping, system design considerations, and airside considerations. (SYS-APM009-EN, February 2011)

Chilled-Water VAV Systems focuses on chilled-water, variable-air-volume (VAV) systems. To encourage proper design and application of a chilled-water VAV system, this manual discusses the advantages and drawbacks of the system, reviews the various components that make up the system, proposes solutions to common design challenges, explores several system variations, and discusses system-level control. (SYS-APM008-EN, updated May 2012)

Water-Source and Ground-Source Heat Pump Systems examines chilled-water-system components, configurations, options, and control strategies. The goal is to provide system designers with options they can use to satisfy the building owners' desires. (SYS-APM010-EN, November 2011)

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