BULLETIN

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The National Board of Boiler and Pressure Vessel Inspectors was organized for the purpose of promoting greater safety by securing concerted action and maintaining uniformity in the construction, installation, inspection, and repair of boilers and other pressure vessels and their appurtenances, thereby assuring acceptance and interchangeability among jurisdictional authorities empowered to assure adherence to code construction and repair of boilers and pressure vessels.

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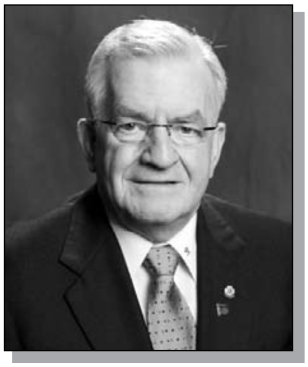
VESSEL VIBRATO. Street Jam performers launched the Opening Session of the 75th General Meeting with a variety of dance and rhythmic poundings of metal objects, including an unpressurized vessel. See more on page 16.

Cover Story

Features

Departments



Got Training?

BY DONALD E. TANNER, EXECUTIVE DIRECTOR

Having recently returned from the latest NBIC Committee meeting, I am reminded of numerous changes taking place in the boiler and pressure vessel industry. At times, it appears almost impossible to keep up with what seems like an endless evolutionary cycle.

Being privy to these changes prompts me to ask the question: *how can we at the National Board effectively communicate these crucial modifications to you, the industry professional?*

While the avenues of communication are many, training is without a doubt the best way to impart the nuances or subtleties of new regulatory parameters affecting you or your company.

It is for this very reason the National Board recommends industry professionals reinforce their credentials every three years by attending one, if not several, training courses.

Our research has shown that those taking an extensive hiatus from training are forever attempting to catch up with the latest industry developments. That not only hampers one's career direction, it compromises the safety process. Given the various training options available to industry professionals today, there is really no viable excuse for *not* remaining technically current.

Yes, the cost to travel to Columbus, Ohio, for a single training exercise is not inexpensive. Understanding this, we have made every effort to minimize travel-related costs. However, attending a National Board seminar — including travel expense — is still competitively priced with *any* technical course *anywhere*.

It is gratifying to note many of you have come to value inclusion of National Board training on your résumés. Without a doubt, it is a credential of extraordinary achievement and worth.

So what can *we* do to help *you* keep up with continuing industry developments?

First, we are initiating a brand-new program that will remind those attending National Board seminars that it is time to revisit the core body of knowledge. Three years after attending one of our courses, students will now receive a notice from the National Board as a reminder to consider a follow-up seminar. Remember: every National Board program is kept up to date as changes to codes and standards are made. Nowhere else can students feel confident they are receiving the very latest regulatory information available.

Secondly, we will make more regional seminars available. While it is impossible to blanket the country with these on-the-road programs, this hugely popular approach does cut down on travel time and expense and significantly adds to the convenience of our students.

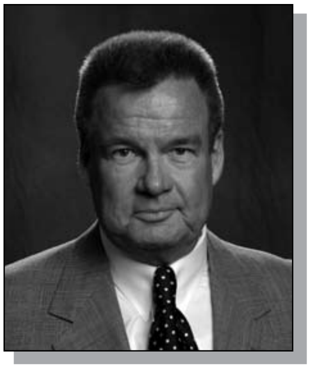
Lastly, the National Board will accelerate development of Web-based courses that can be easily taken online. As of this writing, we presently feature 10 such courses with more in development. If you have never availed yourself of online training, please check out our current offerings — as well as listings of regional seminar courses and locations — at *nationalboard.org*. Information on customized courses can be obtained from Richard McGuire, manager of training.

The National Board appreciates the time commitment and expense companies devote to training. But some are of the opinion training is an activity that simply takes time away from the job. Others see its real value: an investment in the people who define a company's standards and reputation. Of course, the prevention of a single accident often justifies the investment. From a productivity standpoint, proper training can also prevent rework and delays.

Remember: unlike many other industries, our focus is safety. And it is built on the discipline of training.

Yes, safety is an intangible. But only until something goes wrong.

It is only then its true value is revealed. ❖



Passing the Torch of Knowledge

BY PAUL BRENNAN, DIRECTOR OF PUBLIC AFFAIRS

At the conclusion of my last *Regulatory Review*, I addressed last year's unusually high number of new chief inspectors entering the ranks of National Board's membership. Although seemingly benign, there is a message to be inferred from this data, and it is one that should give our industry pause.

To recap: 11 chief inspectors were replaced in 2005. That is believed to be the most number of new members in the National Board's 87-year history. Interestingly, it comes at a time when our industry is about to experience a metamorphous of remarkable dimension.

The first wave of baby boomers will be 60 this year. And that means we will shortly experience a phenomenon that will not only affect the boiler and pressure vessel sector, but businesses and organizations across North America.

That phenomenon is *Brain Drain,* and it will directly impact a significant number of National Board members, many of whom are of the baby boom generation and will soon qualify for pensions. Unless our industry is prepared to address this imminent professional migration, jurisdiction officials of the boomer era will be taking more than gold watches into retirement.

Consider, if you will, the aforementioned 11 new faces in 2005 (three of whom replaced retiring members). They represent an 18 percent turnover in National Board membership in one year! But this is only the apex of an iceberg lurking far below a sea of change.

If we use 65 as the standard retirement age, here is what the industry can come to expect in the not-so-distant future:

1. As many as six percent of current chiefs will retire within the next year.
2. As many as 23 percent will retire within the next five years.
3. And within the next 10 years, as many as 50 percent will be retired. Coupled with the 2005 transition, that is almost a 70 percent turnover in just over a decade. General attrition (i.e., early retirement, taking a new position in a related industry, etc.) could appreciably compound the impact.

Analyzing this data from another perspective, we will see in the next ten years a depletion of knowledge unlike that ever witnessed in National Board history. Assuming each of the aforementioned retirees accumulates — say — 42 years in the industry, we will lose more than 450 years of experience to retirement in five years, and an additional 700 years over the next ten.

While a mass exodus of jurisdictional officials may not loom large in the overall scheme of things, it *is* indicative of a wider, more complex problem: similar retirement patterns among commissioned inspectors. Juxtapose this issue against the current, critical shortage of qualified inspection professionals, and the future of our industry becomes a never-never land of uncertainty.

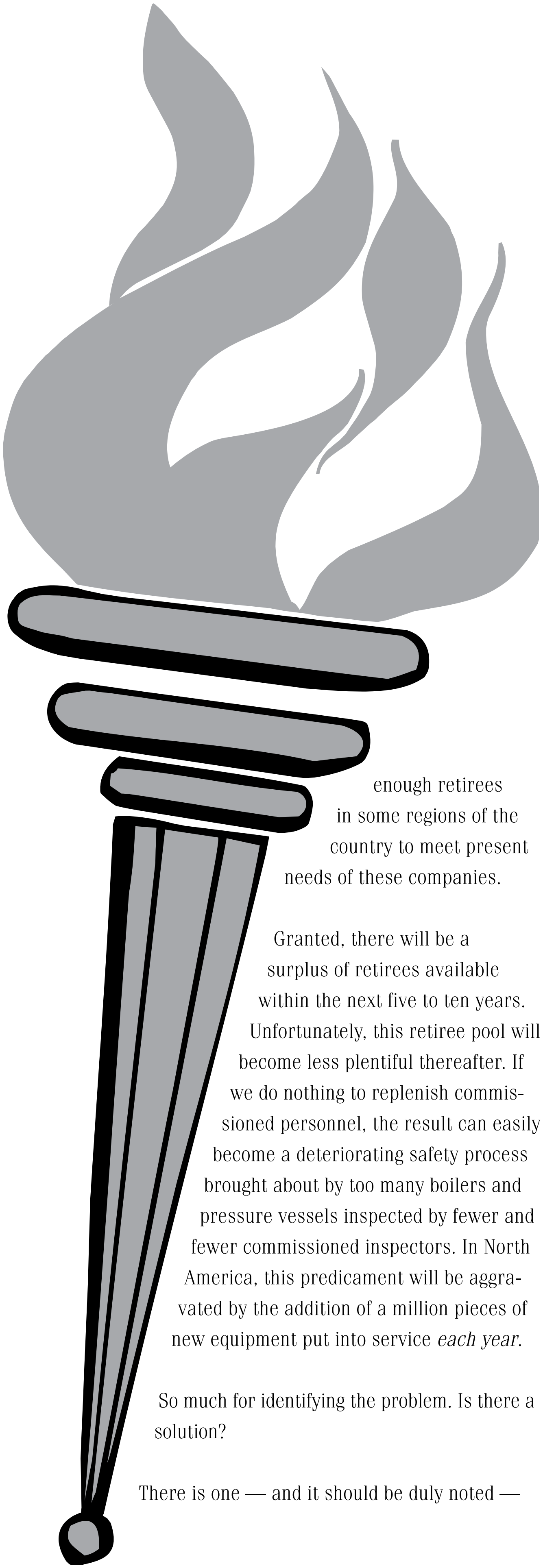
Over the past ten years, the number of commissioned inspectors — taking into account those retiring and replaced by new commissioned inspectors — has remained essentially flat. As anyone can deduce, a decade's lack of growth portends a potentially uncomfortable scenario: what if the delicate balance gradually tilts toward the *departure* of retirees? Given the baby boom phenomenon, that possibility could begin to occur within years.

Are we preparing for the *Brain Drain*?

Not based on conversations I have had with professionals around the industry.

Several jurisdictions report ongoing difficulty recruiting commissioned inspectors — even in parts of the country considered to have inviting geographical and lifestyle appeal.

Some insurance organizations are employing retired inspectors to perform part-time inspection work. Trouble is, there are not



enough retirees in some regions of the country to meet present needs of these companies.

Granted, there will be a surplus of retirees available within the next five to ten years. Unfortunately, this retiree pool will become less plentiful thereafter. If we do nothing to replenish commissioned personnel, the result can easily become a deteriorating safety process brought about by too many boilers and pressure vessels inspected by fewer and fewer commissioned inspectors. In North America, this predicament will be aggravated by the addition of a million pieces of new equipment put into service *each year*.

So much for identifying the problem. Is there a solution?

There is one — and it should be duly noted — *only one* effective way to alter our impending dilemma: *increasing inspector salaries*.

Jurisdictions with higher pay scales seldom have difficulty recruiting commissioned inspectors. Nor do they experience much turnover. Money is an ideal incentive to not only attract people to the profession (particularly young people), but remain *in* it.

If over the next five to 10 years our industry seeks to retard a depletion of knowledge — and perhaps more important, experience — it will need to encourage salaries competitive with other skilled trades. That translates to increased or perhaps new jurisdictional revenue sources. States, provinces, and cities must come to realize keeping fees and processing costs artificially low only serve to exacerbate a worsening condition.

Don't get me wrong. Prudent control of public funds is admirable. But why has the cost of living risen more than 20 percent over the past ten years while boiler and pressure vessel inspection fees and processing costs in North America have climbed less than two percent?!

As we all know, the latter part of the twentieth century saw the boiler inspection profession enjoying a ready-made source of inspection personnel: the armed forces. There were literally thousands of individuals who received solid training and appreciable experience with boilers during their service time.

Those days are over. Many of the veterans who drifted toward careers in the boiler and pressure vessel industry have taken retirement or are close thereto.

As much as we promote the noble and professionally satisfying endeavor of boiler inspection, many young people coming out of school today are in search of immediate job gratification punctuated by a dollar sign. Those who *do* opt for an inspection career bring with them knowledge carefully culled from books and classrooms, but little real world experience. As we all know, there is *no* substitute for professional know-how when working on a piece of equipment that can instantly kill a lot of people.

Thusly, bringing new personnel into the industry is only part of the solution. The other and perhaps more important component, is passing the torch of knowledge — particularly when there may be a significant gap in experience.

Unfortunately, the most effective teaching mechanism in life is failure. These are lessons, however, commissioned inspectors — and the public — can ill-afford.

As compared to the current generation of inspectors, those coming into the industry today subscribe to entirely new values and standards. Over the next 10 to 20 years, these new professionals will leave a weighty imprint on the regulatory landscape. Tomorrow's inspectors will need more than technical experience, they will need to be tutors themselves, politically savvy, and knowledgeable in writing regulations (as well as knowing how to bring those standards to fruition).

Lest you think the *Brain Drain* is unique to inspectors, it is anything but. Other areas of our industry are equally as vulnerable. Take for example boiler design. Schools offering design courses report a disturbing decline in the number of students pursuing this curriculum. No need to comment on the ramifications.

While the exact timing of this phenomenon is subject to debate (i.e., people working longer, new retirement parameters, improved health expectations), the *Brain Drain* is inevitable. This depletion of knowledge could influence regulatory parameters for decades to come.

In 15 years as many as 97 percent of current chief inspectors will be retired from their respective jurisdictions. That begs the question: to what degree will regulation be affected? And it also prompts one to ask:

1. Will future inspectors have the experience and technical knowledge of their present-day predecessors?
2. How will these inspectors handle what is sure to be an ever-mounting workload?
3. What will be the impact on public safety?

Legitimate concerns, all. And that is why our industry must mount a concerted effort to preserve the integrity of its mission. Any compromise in the level of experience and knowledge will only serve to erode public trust — a trust each and every inspector has enjoyed for nearly 90 years.

And so it all comes back to money.

As challenging as it may be, there is legitimate reasoning for jurisdictions to increase revenues, if for no other purpose than to attract quality personnel to the profession. While I fully respect the purist's notion that inspectors ideally should be motivated by devotion to duty (a quality so well instilled by the armed forces), new generations are inspired today by a different set of incentives.

Until someone discovers a way to bottle experience and knowledge for the enlightenment of a new generation of inspectors, our alternatives are limited.

While money and safety may seem a strange marriage in our industry, it is a marriage that is with us to stay — *for better or worse.* ❖

The Strength of Standards in Global Economies

by Chuck Withers, NBIC Chairman

There is no doubt our lives revolve around standards. The clothes and shoes we wear, the cars we drive, the homes we live in, the offices where we work — these all meet specific, proven acceptable standards. Applying standards provides safe, reliable, and excellent products and services, which in turn improve our lives.

In today's global trade environment, standards must meet both national and international objectives to promote and advance global economies. Therefore, to ensure relevant criteria meet global objectives, we need to understand how standards are developed and how they can be used effectively.

Developing standards begins with a common vision of need. Because the U.S. and many other nations are safety-conscious and market-driven, visions stem from both public and private sectors — from alliances and processes within government, industry, consumer organizations, and trade, professional, and academic associations. In the U.S., public and private sectors share common visions to meet the needs of their stakeholders by voluntarily contributing their intellectual and technical knowledge and experience to develop consensus-based standards. Major principles of consensus include openness (anyone may participate), balance (no one interest dominates), and due process (all views are considered and appeals are possible). These principles are well recognized and followed by standards-developing organizations throughout the U.S., Canada, Japan, and many other countries. Following these principles enhances safety, reliability, technology, competitiveness, and trade, all of which contribute to and build the foundation for global economies.

National standards bodies such as the American National Standards Institute (ANSI) and Standards Council of Canada (SCC) provide the guidance, principles, and essential requirements to meet, develop, and maintain consensus standards. These organizations not only oversee the development of standards within their own country but also represent their national body in the development of international standards in organizations such as the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC). This participation ensures that each country's viewpoint is understood and represented.

In August 2000, the U.S. government revised its strategy for developing and adopting standards. This new strategy — known as the United States Standards Strategy (USSS) — recognizes the need for global standards designed to meet societal and market needs of all stakeholders. The strategy also incorporates and reflects new types of standards-developing activities, such as creating structures that represent the vision of global competitiveness and diversity. Improvements combined with widespread advantages in technology are the driving force for the U.S. to develop standards that can be effective in today's globally competitive economy.

This strategy can be seen in the work of standards-developing organizations such as the American Society of Mechanical Engineers (ASME) — for example, when some ASME Code Sections reduced design margins from 4.0 to 3.5. To understand why this change was made, we, as stakeholders, must ask ourselves a specific question: If these design margins for pressure-retaining items are reduced, will they still provide the appropriate assurance of safety and reliability dictated by our interests, needs, and objectives? As organizations move forward to implement strategies to become globally competitive, we, as stakeholders, must understand the underlying relevance for developing and revising standards. This understanding will provide some assurance that specific objectives such as safety and reliability can still be met.

The World Trade Organization Technical Barriers to Trade Agreement recognized that standards should not act as barriers to trade. Therefore, the USSS follows established globally accepted principles to promote cooperation and discourage using standards as trade barriers. By following and understanding these principles, we can be assured that national and international objectives are being met. These principles include:

Transparency — information for standards activities is accessible to all interested parties
Openness — participation is open to all
Impartiality — no one interest group dominates the process
Effectiveness and Relevance — standards respond to regulatory, market, scientific, and technological needs and developments
Consensus — decisions are reached by consensus
Performance Based — performance specifies essential characteristics where possible
Coherence — consistency avoids overlapping and conflicting requirements
Due Process — all views are considered and appeals are possible
Technical Assistance — assistance is offered to developing countries in the formulation and application of standards
Flexibility — allows use of different methods
Timely — matters do not result in failure to meet expectations
Balanced — affected interests are equally represented

Standards-developing organizations must learn to incorporate these principles into their standards to make them effective, current, and useful. Following these principles will provide the clear foundation for developing standards; however, strengthening and developing partnerships within industries, governments, and business and consumer organizations should also be part of the organization's vision for a successful strategy in developing global standards.

Strengthening and developing public and private partnerships involves encouraging participation and individual representation to address global issues pertaining to health, safety, and the environment. The strength of a standards organization to develop broad effective standards that address these issues is directly related to the partnerships that are generated and maintained.

Government representation is a needed partnership and key to establishing standards that are appropriate, effective, and enforceable. Health, safety, and environmental issues are vital interests within government agencies; thus, they should be encouraged to participate in promoting the use of voluntary consensus standards, which is a focus of the USSS. When government representatives participate in standards-developing organizations, these organizations provide additional strength and greater support for developing and promoting voluntary consensus standards. As government agencies adopt and enforce standards, they raise public awareness about the benefits of standards.

As local and national government issues are addressed by national standards-developing organizations, improvement in international standards can be encouraged. In other words, we can learn from each other. Government agreements such as the World Trade Organization Technical Barriers to Trade and the National Technology Transfer and Advancement Act should provide the drive for participation needed to advance and unify global issues within standards.

Partnerships within varied industries can provide numerous benefits to the standards developer. The use of specific standards addressing specific needs can be promoted and easily maintained with the help of each affected industry. Industries bring to the standards developer technological improvements, needs, concerns, and future interests to pave the way for developing and revising standards. Since industries are global, competition, collaboration, and consistency are encouraged through industry. Industry can — and often does — provide the needed resources to support the development and promotion of effective standards.

Partnerships with businesses, consumers, and other interested organizations can provide and facilitate innovation and strengthen economic competitiveness. Business and consumer organizations are market-driven and can offer international assistance to promote and provide globally relevant standards. Standards developers seeking the participation of businesses, consumers, and other organizations can benefit from asking them about their needs and whether those needs are being met. This partnership further encourages continual improvement and simplicity, and seeks to minimize duplication of standards so they can be easily understood and used effectively.

The National Board publishes the *National Board Inspection Code* (NBIC), an internationally recognized technical and safety standard. As a standards-developing organization seeking to expand and remain effective in these existing global economies, our vision is to continually pursue and consider needs, concerns, and objectives within governments, industry, and business, consumer, and other interested organizations both nationally and internationally. The strength, effectiveness, and use of the NBIC is directly related to achieving our vision. The NBIC is just one of thousands of standards used worldwide on a daily basis. When standards cannot meet global objectives, they become less effective, causing our global economies to become fragmented and our lives more difficult. Therefore, NBIC committees will move forward to incorporate global needs, concerns, and objectives that are needed for a standard recognized worldwide. We welcome your voluntary participation! ❖

New NBIC to Feature Metrication

by Robert D. Schueler Jr., Senior Staff Engineer

The *National Board Inspection Code* (NBIC) will, with its next edition, provide revised metric equivalents along with a "Policy for Metrication."

The goal of this effort will be to permit all users of the *National Board Inspection Code* to freely move between unit systems, such as US customary or the International System of Units (SI) without affecting the product being inspected, repaired, or altered.

The Metric Conversion process starts with understanding the following pair of key definitions:

Soft Conversion – A soft conversion is an exact conversion.
Hard Conversion – A hard conversion simply involves performing a soft conversion and then rounding off within a range of intended precision.

An equivalent rationale is the policy being followed throughout the NBIC. If an exact value is needed to maintain safety or required based on using good engineering judgment, then a soft conversion will be used. In general, approximate accuracy is acceptable for most repairs or alterations performed using the requirements of the NBIC. Therefore, within the NBIC, metric equivalent units are primarily hard conversions.

The following examples illustrate this process:

Base Unit (3)	Soft Conversion Factor	Rounded Value with Intended Precision (1)	Sample Value to be Converted (3)	Resultant Converted Value (2)
1 lb/in^2	6,894.757 Pa	6,900 Pa	400 lb/in^2	2,760,000 Pa
1 lb/in^2	6.894757 kPa	6.9 kPa	400 lb/in^2	2,760 kPa
1 lb/in^2	0.06894757 bar	0.069 bar	400 lb/in^2	27.6 bar
1 lb/in^2	0.006894757 MPa	0.0069 MPa	400 lb/in^2	2.76 MPa

Notes:
(1) The inaccuracy of the above conversions is approximately 0.15 percent. Should your conversion require better precision, additional significant figures should be considered when applying the rounded value shown above. In the above example, the next higher level of precision would be to use 1 lb/in^2 = 6890 Pa = 6.89 kPa = 0.0689 bar = 0.00689 MPa.
(2) When stepping between metric units descriptors (Pa, kPa, bar, MPa, etc.), decimal point relocation is the only change in the resultant.
(3) The metric system does not use absolute pressure (pounds per square inch absolute [psia]). Gage pressure (pounds per square inch gage [psig]) is the condition used. Therefore, descriptors for vacuum or differential pressure must be explained.

To convert compound units such as lb/ft^3 at °F to kg/m^3 at °C, it is necessary to solve a formula to convert the temperature and to determine the soft values for 1 lb to kg and for 1 ft^3 to m^3:

$$1 \text{ lb} = 0.4535924 \text{ kg}$$
$$1 \text{ ft}^3 = 0.02831685 \text{ m}^3$$
$$°C = (°F - 32) \cdot (5/9)$$

The soft factor for the compound unit is then equal to 1 lb/ft^3 = (0.4535924/0.02831685) = 16.018463 kg/m^3. This would yield a rounded value of 16 kg/m^3.

Water, with a weight of 62.4245 lb/ft^3 at 39.1 °F, would convert to 1000 kg/m^3 at 4° C.

If a change in temperature occurs rather than a conversion, the effect would change the soft conversion factor for weight per unit volume as a function of media and temperature change.

To accomplish the conversion in the NBIC, a number of tables have been derived to standardize some of the conversions. A number of engineering judgments were made in the tables to simplify and clarify the units. Tables will be provided for factors/examples of:

- Soft conversion factors
- Temperature conversion, °F to °C
- U.S. fractions/metric equivalents
- Strength of materials
- Areas
- Pipe sizes/equivalents
- Pressure/equivalents

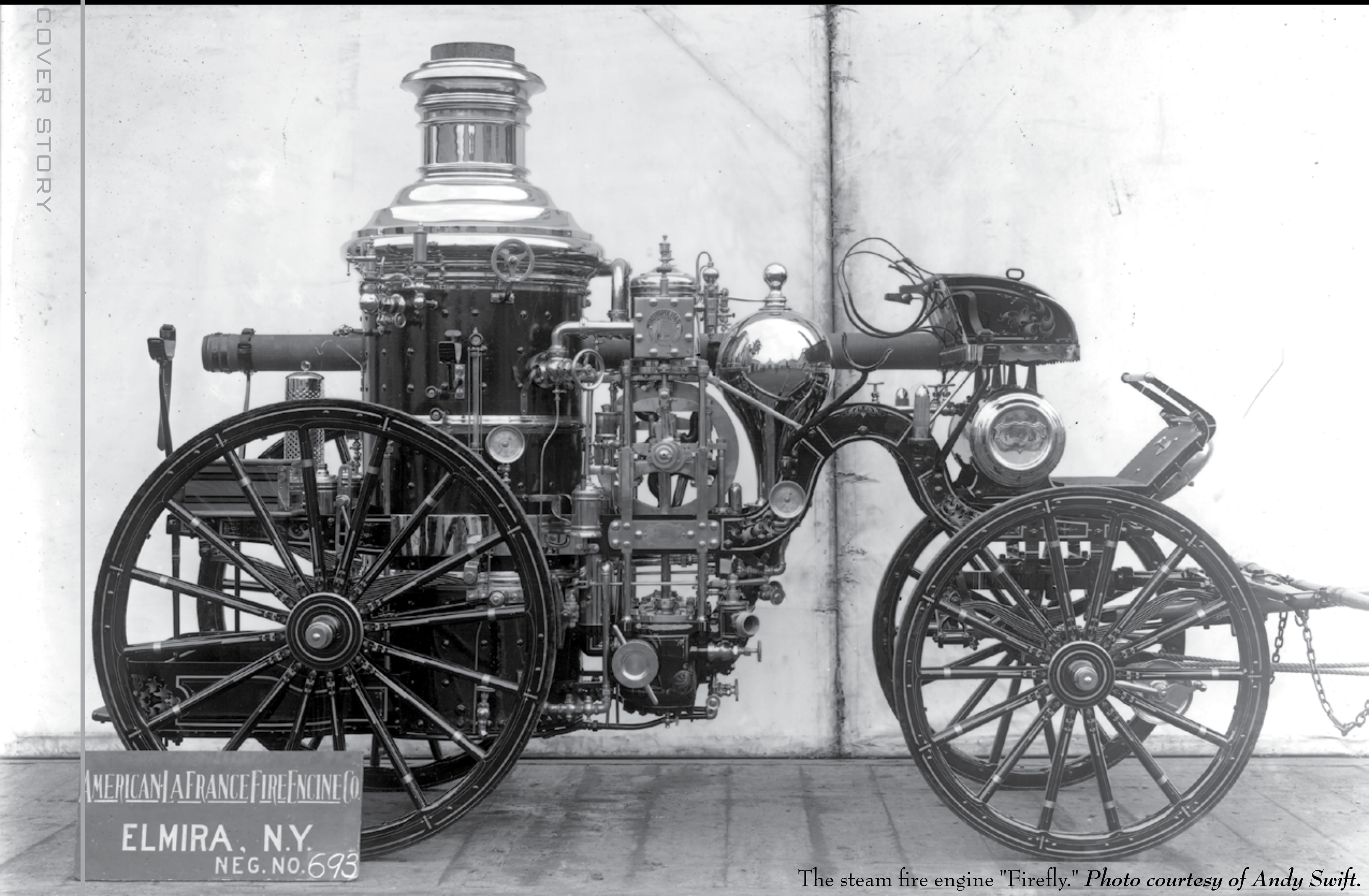
Similarly, a number of existing data tables will be revised to show dual units along with the creation of new tables with metric values.

Users of the NBIC may work in any nationally recognized system of units.

Calculations for remaining life, alterations, and reratings need to be performed in a single unit system. Where progressive calculations are required, care should be taken not to introduce inaccuracies due to intermediate rounding or conversion of resultants.

Stamping and reports may be produced in any recognized unit system; however, dual units are permitted. This shall be done in a way to clearly define the units expressed.

The policy, when published, will provide additional details. Until then, please note that boiler horsepower did not make it through the conversion process and will not be addressed in either system. For the history buffs, the actual value of one boiler horsepower was published in 1909 by Marks and Davis as 33,479 Btu per hour. ❖



The steam fire engine "Firefly." ***Photo courtesy of Andy Swift.***

Restoring Steam Fire Engines: The Passionate A

"Behold! How she shines in her beauty,
Resplendent in silver and gold . . . ."
— from "The Steam Fire-Engine," Fireman's Herald, March 9, 1882

Late 1800s. A metropolitan American city. Near midnight. A streetlamp casts a sallow glow on the closed door of a two-story redbrick firehouse. Inside, on the second floor, men snore in bunks, beside which sit pants carefully implanted in boots. On the first floor, in a hay-covered stall, a gray-speckled Percheron draft horse, ghostly in the half darkness, stands dozing while another Percheron stamps its hoof. Nearby sits an Ahrens steam fire engine with crane-neck frame and double piston pump. The steamer boiler, jacketed in brass for show, is at rest, but connected to a stationary boiler on the floor. The latter circulates low-pressure steam in the former, heating the water in its tubes.

Ding! Ding! Ding! announces the electric bell. On the second floor, men throw off their covers, step into their pants and boots, hurry to the brass pole, and slide down to the first floor. At the bell's first ring, a chain at the rear of the stall drops and the two fifteen-hundred-pound

Percherons back themselves to the steamer to be hitched by the driver. An engineer disconnects the stationary boiler, climbs onto the steamer, and opens the firebox door. He strikes a match and tosses it onto the grate; the kerosene-soaked rags, lying atop kindling and coal, ignite.

The firehouse door is opened. The driver, gripping the reins, shouts at the horses, and the steamer jerks into motion and rolls out the door onto the street, the boiler stack puffing gray smoke. The horses start running, hooves clopping; the steamer flies down the street, then turns a corner and disappears . . . to show up more than a hundred years later, maybe, in the workshop of Andy Swift.

For Swift, 52, steam fire engines are a passion. And that is why he restores and repairs these rare pieces of fine equipment in southern Maine, in the town of Hope. His shop, a former chicken barn 300-feet long and three stories high, sided with silver aluminum, is called Firefly Restorations (*www.fireflyrestoration.com*). He named it "Firefly" after a steam fire engine at a US arsenal in Augusta, the capital of Maine.

"You've got to understand," he says in a New England accent, "that steam fire engines were named. There was the *Daniel Webster*, *George Washington*, *Uncle Joe Ross*. The reason this steam fire engine was named the *Firefly* was because when horses pulled a steam fire engine down the street, the coal shook on the grate of the boiler and sparks flew out the stack. People would say that looked

Artisan

A Visit with Andy Swift, Owner of Firefly Restorations

like fireflies coming out of there. I remember reading through some literature and seeing that and thinking that was just the coolest name for a fire engine."

The first steam fire engine ever made was built in 1829 in London, England, by George Braithwaite and John Ericsson. (Ericsson later immigrated to America, where he designed the ironclad warship *Monitor*.) The first steam fire engine, the *Novelty*, weighed a little more than 4,000 pounds and had a vertical boiler. A pump and steam cylinder lay horizontally on each side of the engine. Exhaust steam from the cylinders traveled through two coiled pipes in the feed water tank, heating the water before it was pumped into the boiler. The *Novelty* was used at several fires, but the London Fire Brigade did not buy it because it took too long — 20 minutes or so — to raise steam.

It was in America that development of the steam fire engine took hold. The first American-made version was built in 1841 in New York City by Paul Rapsey Hodge. It was about 14-feet long, weighed more than 16,000 pounds, and had a tubular boiler with steam dome. As on the *Novelty*, a pump and steam cylinder lay horizontally on each side of the engine.

At that time, major American cities did not have paid fire departments but volunteer companies usually composed of lower-class citizens more interested in fighting one another than in fighting fires. New York City companies rejected Hodge's engine, on the surface, because they said it was too unwieldy, which was true but remediable. The real reason was they feared it would lead to paid departments and, thus, municipal control.

The steam fire engine that revolutionized firefighting was built in 1852 in Cincinnati, Ohio, by Alexander Latta and Abel Shawk. Called the *Uncle Joe Ross* after the city council member who had persuaded the council to appropriate $5,000 to build it, the engine weighed more than 20,000 pounds and had a square vertical boiler called a gunpowder boiler. It generated steam in just over four minutes by injecting cold water into preheated tubes.

Andy Swift

On December 22, 1852, the engine was demonstrated to the public and threw a stream of water 225 feet; on January 1, 1853, the *Uncle Joe Ross* was put into service. Of the steamer, City Council Member Miles Greenwood said, sarcastically alluding to the Cincinnati volunteer firemen's unreliability and penchant for fighting, "First, it never gets drunk; second, it never throws brickbats."

Between 1853 and 1913, more than 80 firms built a total of about 5,000 steamers. The main manufacturers included Silsby, Ahrens, Amoskeag, and American LaFrance. The steamers' designs differed primarily in their frames, pumps, and boilers. Frames were straight or arched; the latter were called crane-neck frames. Pumps were single piston, double piston, or rotary. A single piston was positioned vertically or horizontally; a double piston, vertically; and a rotary, horizontally.

Steamers ranged in size from the American-LaFrance Cosmopolitan, which weighed 1,500 pounds and could discharge 250 gallons per minute, to the double extra first size Amoskeag, which weighed 17,000 pounds and could discharge 1,350 gallons per minute. Depending on the size, steamers were pulled by two or three draft horses, usually Percherons, Belgians, or Morgans.

To put out a fire, a steamer drew water from a fire hydrant or reservoir. The piston pump, powered by steam from the boiler, pushed the water through a hose while the air chamber, shaped like a balloon and often made of copper, evened out the pulsations of the piston, so the water came out in streams instead of spurts.

After 1913, the manufacture of steamers plummeted because of the emergence of gasoline-powered engines. Many existing steamers were scrapped. Of the 5,000 steamers built between 1853 and 1913, fewer than 400 still exist.

Copper balloon air chamber found on a steam fire engine.

The *Firefly* — the steamer after which Andy Swift named his shop — is not one of them, so he never got the chance to count it among the 20 or so steamers he has restored or repaired since going into business in 1984. To the layperson, 20 may seem kind of paltry — only 20 steamers in 20-plus years of business?

Layperson, take heed: It sometimes takes Swift, who employs three in-house workers, two or three years to restore an engine.

One reason: "There's a lot to it if you're doing a quality job," he says. "We give a lot of time. In-house right now, we've got eight fire engines we're working on. We're doing disassembly and reassembly, trying to keep track of all the parts and pieces. If I can't find a piece, I have to borrow it off another engine."

Another reason: He has to take work he cannot do in his shop to three outside vendors — a machinist, a woodworker, and a man who works in gold leaf. "They all have their own shops, so we all meet basically once a week. Everybody brings me what they've completed. I pay him and hand him something else."

Although he has been restoring steam fire engines professionally since 1984, Swift, who does not consider himself an expert but an enthusiast, says he has always been interested in steam engines. In fact, when he was five, he accidentally melted his father's Weeden electric steam engine. He laughs and says, "I left it plugged in and let the water run low, and it melted. That was my first boiler incident. Maybe that wasn't a good sign."

He has also always been interested in firefighting. "There are pictures of me underneath a Christmas tree in a foot-

Firetube boiler of an 1884 Ahrens.

pedaled fire engine. When I was 18, I bought my first fire engine, not a steamer but a 1941 McCann. It was my dream — to be a paid fireman."

His dream finally came true in the late 1970s, when he moved from Maine, where he had been a volunteer fireman, to Valdez, Alaska, to become a professional fireman. There, in the early 1980s, he became interested in restoring steam fire engines.

In the collection of the Valdez Museum & Historical Archive was a 1907 Ahrens. The museum wanted to restore it and was mustering volunteers. One day some workers from the museum took it to the fire station where Swift worked. When he saw the engine, he told the workers he wanted to head the restoration. "I said, 'Look, I have a fire engine at home in Maine, and I know how to restore stuff.' They finally let me have the reins."

He worked on the Ahrens with several people from Valdez and with a man from Jackson, Michigan, Ken Soderbeck, whom Swift considers the finest fire-engine restorer in the country and his mentor. The result was a first-class restoration that, as Swift says, "would stand next to any of the stuff we're doing now."

In 1984 he moved back to Maine, not sure what he wanted to do with his life. Then Ken Soderbeck called: American LaFrance, which had built 539 steamers between 1873 and 1904, wanted two steamers restored. Was Swift interested?

No doubt. So he and Soderbeck, whom Swift still talks to almost every day, went to work.

One of the two steamers was a 1904 Cosmopolitan. At 1,500 pounds and with a 250-gallon capacity, it was the smallest steamer ever built. Of it Swift says, as if talking about a plump-cheeked baby, "That's a cute little steamer. And it's probably one of the most collectible because it's small and rare." So rare — of the 21 built between 1902 and 1912, only seven remain — the auction price would probably be, according to Swift, "off the map."

Which is how those who bring steamers to him for restoration — private collectors, fire departments, and museums — might characterize his fee, which on average is more than $100,000. "Yes, it sounds like big money," he admits. "But if you came and saw the detail, you'd see it's a give-away."

In other words, he ain't gettin' rich. "The guy who cleans the bathrooms at American LaFrance is making more money than I am," he laughs. "Of course I could raise my shop rate, but what do I need — a flat-screen TV? a snowmobile?"

Much of the restoration cost can stem from the boiler. Swift says if the original boiler is in poor condition and customers want it restored to their specifications because they plan on doing a lot of steaming, they can expect to pay — and this before he even attaches it to the fire engine frame — a minimum of $30,000.

The reason: He has to get a new boiler built in accordance with ASME Code. "We have to go with an ASME boiler because we have to follow the boiler codes of the states, and I don't want anyone to get hurt."

A steam fire engine has either a firetube or a watertube boiler. In a firetube boiler, fire from the firebox passes through tubes extending through a large quantity of water and heats it. In a watertube boiler, water from a reservoir in the boiler flows through many small-diameter tubes, which are heated by the surrounding fire. In both types, steam accumulates near the boiler's top, then is throttled into the engine's intake side, driving the piston or rotary fire pump. From the engine's exhaust ports, steam flows back into the stack, increasing the draft and heat. Both kinds of boilers have steam safety valves.

Watertube boiler of an 1892 Ahrens.

In general, firetube boilers produce more steam than watertube boilers because more water is heated. On the other hand, watertube boilers are faster at getting steam to working pressures because the small quantity of water in the tubes can be heated more quickly than the large quantity of water in the firetube boiler.

By the late nineteenth century, steamer boilers were all built from riveted sheets of steel ½- to ¾-inches thick. Some were decorated with brass or nickel-plated brass or even silver. Most were less than eight-feet high, and none were built wider than four feet. They usually held 30 to 40 gallons of water.

When at rest in the firehouse, the steamer boiler was usually connected by two quick-release couplings to a stationary boiler, which fed the former low-pressure steam. At an alarm, the stationary boiler was disconnected, and the firebox lit. Within three to five minutes, the engine could generate 40 to 50 pounds of steam; within 10 minutes, 70 to 80. At the fire, the pump, depending on the amount of hose laid out and the number of lines in use, generated between 70 and 120 psi.

Though steam fire engines often malfunctioned, their boilers rarely exploded. Dr. Peter Molloy, who is director of the Hall of Flame Museum of Firefighting in Phoenix, Arizona, and who spoke at the 75th General Meeting of the National Board (see page 17), has documented only two incidents. The first involved the very engine that revolutionized firefighting — the *Uncle Joe Ross*. On December 6, 1855, as Alexander Latta demonstrated it to some Chicago firemen, a hose burst, and the engine was shut down. Steam pressure rose to 180 psi, and the boiler exploded; the engineer and two bystanders were killed. The second was in 1868, when the boiler on an Amoskeag exploded because the engineer had tied down the leaky safety valve. The engineer survived, but five other people were killed and 23 injured.

Swift agrees explosions were rare. "I have a lot of photographs of steamers working, but I don't think I've ever seen a picture of a steamer that's come unwrapped. You would think that, if they did blow up, the press would have gotten pictures."

To say Swift is conscious about safety is an understatement. When customers tell him they want their steamers restored because they want to "throw a stream of water" whenever they get a chance, he thoroughly interviews them to make sure they know how to safely operate the steamers. "When you're dealing with live steam, I can do everything right. But if the operator does the wrong thing, he can turn that boiler into a grenade very easily. If you're a cowboy, I don't want to talk to you."

Customers are not the only ones he talks to. "I've also got to talk to the boiler inspectors of the states that these steamers are going to."

If he is satisfied the customer will operate the steamer safely, he then examines the boiler, which can be as layered as an onion. One of the boilers he is working on now is jacketed with three sheets of glass and gold. Underneath that is a lagging of wood. Underneath that, to protect the wood, is a woven sheet of asbestos. "The jacketing and wood and asbestos insulate that boiler to keep it more efficient, to keep it hotter longer," he says. "And until I take off all that jacketing, all that lagging, and all that asbestos, I don't know anything about that boiler."

When he finally pulls off all the layers, he brings in someone to do an ultrasound of the boiler's thickness. One area susceptible to corrosion — an area Swift calls "a real nasty place" — is the area of the water level. "Where the water is boiling, where air is coming out — that's where it will corrode the worst. That's where a guy who knows his stuff will put his ultrasound. Another area to watch is around corners, around a sheet making a 90-degree bend — that's where you want to watch because the stress of making that bend is also susceptible to corrosion. And of course there's the crown sheet and all the corners around the crown sheet."

If the boiler is in good condition, Swift tests it hydrostatically at what he thinks is a safe working pressure. If the boiler is in poor condition — as it was on the 1904 Cosmopolitan he and Soderbeck restored in 1984 — he gets a new boiler built in accordance with ASME Code. "For the Cosmopolitan, we had a firetube boiler built exactly like the original, same amount of tubes and everything, except this one was welded, not riveted."

His respect for the workers of the past is quickly evident. "And as far as I'm concerned, those riveted boilers were just as good as the welded boilers of today. The guys who riveted those boilers were artisans — I mean, they were artists."

When the ASME-stamped boiler arrives at his workshop is when the "fun," as he ironically calls it, begins. "When you talk about live steam, you just quadrupled the job. There are a million holes on a steam fire engine. If a hole on the boiler is off so much as a sixteenth of an inch, we have to make all our adjustments on the plumbing. It can take me days and days to set an engine together."

But what else would a man who at five years of age melted his father's electric boiler be doing? Watching TV? Snowmobiling?

Hardly. He would be doing just that — setting an engine together. ❖

Sources

• W. Fred Conway, *Those Magnificent Old Steam Fire Engines*, FBH Publishers, New Albany, IN, 1997.
• William T. King, *History of the American Steam Fire-Engine*, DOVER, Mineola, NY, 2001.
• Dr. Peter Molloy, *The American Steam Fire Engine: 1920–1940*, 75th General Meeting of the National Board of Boiler and Pressure Vessel Inspectors, Phoenix, AZ, May 15, 2006.

A parade of steam fire engines led by an 1892 Ahrens.

75 YEARS of SAFETY

TAKES A MOMENT. LASTS A LIFETIME.

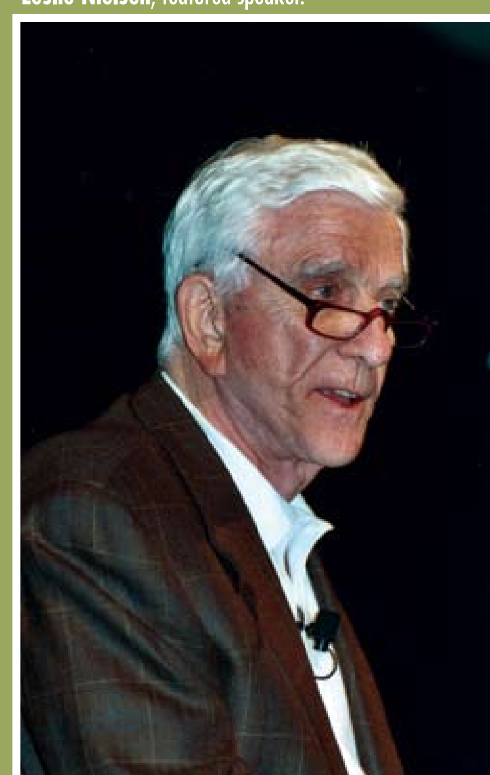
PHOENIX • 2006

CARRYING THE LOAD. National Board members James McGimpsey of Montana (center left) and Michael Verhagen of Wisconsin (right) do the heavy lifting for wives Janice McGimpsey (right center) and Kathy Verhagen (left) following registration.

CAN-CAN CONCERTO. No object was safe from an astounding pounding during Street Jam's rhythm review.

opening sess

Leslie Nielsen, featured speaker.



LIVELY LIDS. Street Jam's banging and bouncing created a high-energy atmosphere during the session's opening moments.

Todd Kuntz, P.E., Sr. Consulting Metallurgical Engineer, Arizona Public Service Company.

Scott Stookey, Fire Protection Engineer, City of Phoenix Fire Department.

Glen Sundstrom, Industrial Market Manager, USFilter.

Glenn McGinnis, Chief Executive Officer, Arizona Clean Fuels LLC.

Dr. Peter Molloy, Executive Director, Hall of Flame Museum of Firefighting, Phoenix, Arizona.

ion

June Ling, Associate Executive Director of Codes and Standards, ASME.

speakers

"... AND DON'T CALL ME SHORTY." Featured speaker Leslie Nielsen (right) mugs with National Board Board Chairman David Douin prior to the Opening Session.

Tim Terry delivers the invocation.

Phil Gordon, Mayor of Phoenix.

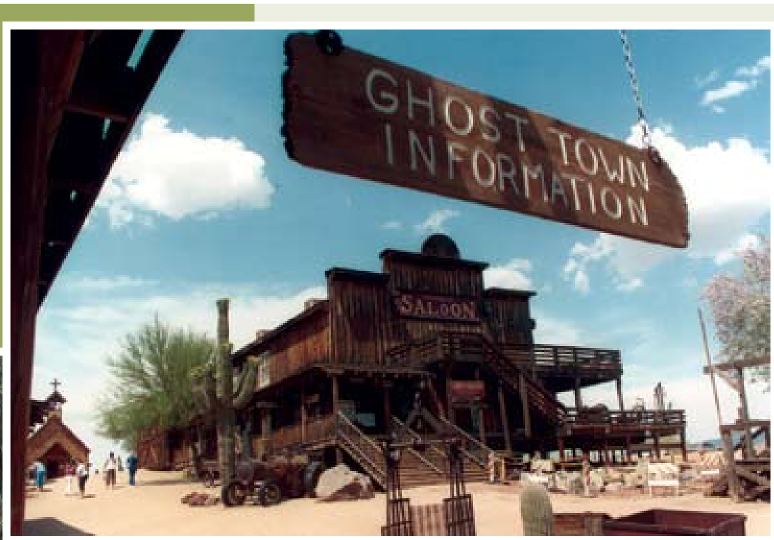
SAFETY
TAKES A MOMENT. LASTS A LIFETIME.
PHOENIX • 2006

FESTIVE FOOD & FUN. Helping themselves during the Monday National Board reception (left to right) are Edith Pfaff, Joan Ciancarelli, and Jerry Byers.

reception

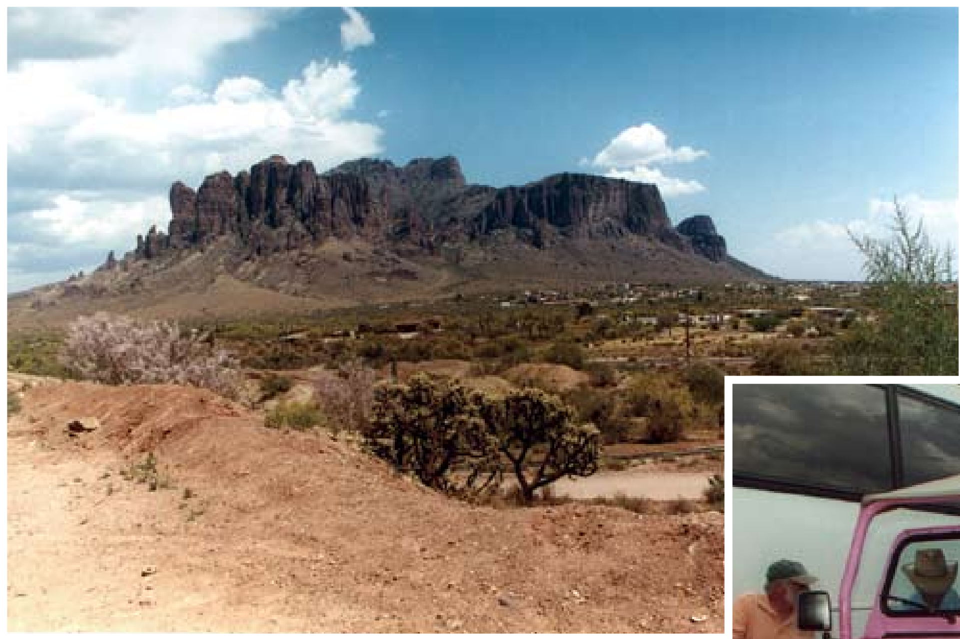
MIST-A-FIED. It was no mystery why portable misters were necessary during a scorching Monday National Board reception.

outings



SALOON SOLITUDE. Guests concluded the Tuesday tour with lunch at Goldfield Ghost Town's Mammoth Steakhouse.

HELLO, DOLLY! Registered guests got a close-up view of the Superstition Mountains surrounding Canyon Lake onboard the steamship *Dolly* during the Tuesday tour.



PICTURE PERFECT. A view of a Sonoran mesa as seen through the eyes of Wednesday outing participants visiting Sedona.

PINK PARADE. Many General Meeting participants and guests took advantage of optional Jeep tours of the Sonoran desert during the Wednesday Outing.

THE LINE STARTS HERE. Wednesday Outing participants flash smiles of anticipation as they queue up for lunch at the Casa Rincon restaurant in Sedona.

banquet

MAKING HIS MARK. Johnny Lee signs autographs following his performance.

LEE-WAY. Johnny Lee does it his way, delighting attendees at the Wednesday evening banquet.

2006 Registrations

National Board Certificate of Authorization to Register guarantees the third-party inspection process, providing for uniform acceptance of pressure-retaining equipment by member jurisdictions. This important safety process is documented via submission of data reports by the manufacturer to the National Board. These data reports are the only reports carrying the National Board registration number. Once registered, each report is maintained in a permanent file by manufacturer name and National Board number.

The list below identifies boiler, pressure vessel, and nuclear vessel registrations by size for the past five fiscal years. The National Board fiscal year is from July 1 to June 30.

The total number of registrations on file with the National Board at the end of the 2006 reporting period was 40,008,395. ❖

	Size	FY 2006	FY 2005	FY 2004	FY 2003	FY 2002
BOILERS						
square feet of heating surface						
≤ 55	(A)	106,285	111,360	109,064	98,312	78,695
> 55 and ≤ 200	(B)	28,999	31,331	30,642	32,927	25,445
> 200 and ≤ 2000	(C)	9,225	9,325	9,322	9,797	9,130
> 2000 and ≤ 5000	(D)	641	651	629	846	689
> 5000	(E)	738	733	912	2,105	1,184
TOTAL		145,888	153,400	150,569	143,987	115,143
PRESSURE VESSELS						
in square feet						
≤ 10	(A)	825,423	741,220	718,214	745,601	671,433
> 10 and ≤ 36	(B)	363,092	399,534	449,968	370,780	340,818
> 36 and ≤ 60	(C)	58,987	58,447	64,790	50,263	60,992
> 60 and ≤ 100	(D)	11,729	10,160	9,794	9,628	10,343
> 100	(E)	13,160	10,626	10,426	12,975	11,585
TOTAL		1,272,391	1,219,987	1,253,192	1,189,247	1,095,171
NUCLEAR VESSELS						
in square feet						
≤ 10	(A)	519	553	702	1,725	565
> 10 and ≤ 36	(B)	71	5	90	137	424
> 36 and ≤ 60	(C)	9	1	1	33	45
> 60 and ≤ 100	(D)	23	5	132	14	15
> 100	(E)	24	15	15	17	17
TOTAL		646	579	940	1,926	1,066
ATTACHMENTS*		76,707	70,736	77,715	100,136	79,272
GRAND TOTAL		1,495,632	1,444,702	1,482,416	1,435,296	1,290,652

*An attachment is any type of additional information to be submitted with the primary data report.

For more information on the Authorization to Register Program, access the National Board Web site at **nationalboard**.*org*.

Board of Trustees Election Results

The National Board Board of Trustees elections were held during the 75th General Meeting in Phoenix, Arizona, May 15-18.


Mark A. Mooney

Mark Mooney, assistant chief of inspections for the Massachusetts Department of Safety, was re-elected to a three-year term on the Board of Trustees as second vice chairman. He was elected to National Board membership in 1998 and to the board position in 2001.

Mr. Mooney has more than 20 years' experience in the boiler and pressure vessel industry. Before his current position, he served as boiler operator, shift supervisor, and chief engineer for Bechtel-Semass Operations. He joined the state in 1996. Previously, he was an instructor for L.J. Technical and a service engineer for Mooney Engineering.

He holds National Board Commission No. 12062.


Joel T. Amato

Joel T. Amato, chief boiler inspector for the state of Minnesota, was elected to the Board of Trustees as member at large for a three-year term.

Mr. Amato has been employed as chief inspector with the Minnesota Department of Labor and Industry since 1999. He was elected to National Board membership in October 1999.

He was employed for several years with Stroh's Brewery as a power plant operator and with Kemper Inspection and Hartford Steam Boiler Company as a boiler inspector before joining the state in 1999.

He served in the US Navy for more than four years as a boiler technician, receiving two letters of commendation and the Good Conduct medal.

He holds National Board Commission No. 11907 with "A" and "B" endorsements. ❖

Larry McManamon Elected to Advisory Committee

Lawrence J. McManamon Jr. has been elected to the National Board Advisory Committee as the new member representing organized labor. He is coordinator for Great Lakes Area Boilermakers Apprenticeship Program, a position he has held since 1995.

Larry McManamon Jr.

Mr. McManamon began working for Allied Boiler in Cleveland, Ohio, in 1988 as a mechanic and welder before moving in 1991 to National Boilerworks, also in Cleveland. He worked at National Boilerworks for three years as foreman and superintendent. Since 1987, he has also been part of Boilermaker Local Lodge 744 in Cleveland as apprentice, journeyman, welder, and foreman.

Graduated from Ohio University with a degree in communications, Mr. McManamon holds minors in labor relations and management.

Mr. McManamon resides in Fairview Park, Ohio, with his wife Lisa. He has two children, Meghan and Jack. ❖

National Board Membership Elects Honorary Member

A former chief inspector was chosen for National Board Honorary Membership during the 75th General Meeting.

Robert A. West

Robert A. West was honored for dedicated service to the industry and to the National Board.

He is a former chief boiler inspector for the state of Iowa. He served in this role at the Iowa Division of Labor for more than 10 years, joining the state in 1984 and becoming chief in 1985. Prior to joining the state, Mr. West was employed by Commercial Union Insurance Company and the Continental Insurance Company. He started his career in the industry as a loss control engineer.

Mr. West was elected to National Board membership in 1985. In 1989, he was elected to the Board of Trustees as member at large and served a three-year term.

A veteran of the US Air Force, he holds National Board Commission No. 9469. ❖

Malcolm J. Wheel of Vermont Retires

Former National Board Member Malcolm J. Wheel has retired as assistant fire marshal/chief boiler inspector, state of Vermont, effective June 1.

Malcolm J. Wheel

Mr. Wheel began his career as a boiler inspector in 1961 with the Continental Insurance Company before joining Vermont in a similar capacity in 1966. The state made him chief boiler inspector in 1984. That same year he became Vermont's first member of the National Board. He served as member at large on the National Board Board of Trustees from May 1993 to May 1994.

Mr. Wheel served in the US Navy from 1946 to 1948 and in the US Coast Guard from 1950 to 1953.

Mr. Wheel holds National Board Commission No. 5351 with "A" endorsement. ❖

Nova Scotia Inspector Charles J. Castle Retires

Former National Board Member Charles J. Castle retired June 30 as chief inspector for the province of Nova Scotia.

Charles J. Castle

A boiler inspector with the Nova Scotia Department of Labour since 1974, Mr.Castle previously served as a boilermaker for 10 years with the Department of National Defense. He was trained as a boilermaker apprentice at the HMC Dockyard in Halifax, Nova Scotia. Before his work at the Department of National Defense, Mr. Castle served as an officer cadet with the Royal Canadian Air Force.

He was elected to National Board membership in 1995.

Mr. Castle holds National Board Commission No. 8241 with "A" and "B" endorsements. ❖

Safety Medal Recipient for 2006

Albert Justin (left) is presented the 17th National Board Safety Medal by National Board Executive Director Don Tanner.

Retired Executive Director Albert J. Justin was awarded the 2006 National Board Safety Medal during the 75th General Meeting in Phoenix.

The National Board's most prestigious award, the Safety Medal is awarded each year to an individual based on his or her extensive experience and commitment to safety in the boiler and pressure vessel industry.

Before he came to the National Board as executive director, Mr. Justin joined the Minnesota Division of Code Enforcement in 1984 as assistant chief inspector and was promoted to chief inspector in 1986. He retired in 1993. Prior to joining the state, Mr. Justin was employed for 30 years by Continental Insurance Company as an inspector and manager.

He was elected to National Board membership in 1986. During that time, he served as chairman of the Board of Trustees for three years.

Mr. Justin served the National Board as the fifth executive director for eight years. During his tenure, he oversaw major organizational transition, including the construction of the National Board Training and Conference Center. Furthermore, Mr. Justin directed the development of the National Board Web site, as well as the Electronic Data Transfer system, leading the organization into electronic communications through the 1990s.

Mr. Justin retired from the National Board in 2001 and was awarded National Board honorary membership during the 74th General Meeting for his outstanding service.

A veteran of the US Navy, he holds National Board Commission No. 3572. ❖

Call for 2007 Safety Medal Nominees

The National Board of Boiler and Pressure Vessel Inspectors is seeking nominations for the 2007 Safety Medal Award. This award, the highest honor bestowed by the National Board, will be presented at the 76th General Meeting in Grapevine, Texas.

To be considered for the Safety Medal Award, letters of recommendation must be submitted by three individuals who are acquainted with the candidate and can attest to his or her safety contributions within the boiler and pressure vessel industry. At least two of the letters must be from National Board members.

Each letter of recommendation should include:
- The name, title, employer, and business address of the candidate.
- A listing of specific candidate contributions or achievements relative to the award.
- A brief biography of the candidate that includes positions held, National Board involvement, and participation in industry activities, including any honors and awards known to the individual making the nomination. (Note: In order to be considered, a candidate must have served on a National Board committee or a nationally recognized standards committee, have participated in National Board activities for not less than 15 years, and have been recognized as a contributor to professional organizations related to the boiler and pressure vessel industry.)
- The name, title, employer, and business address of the individual submitting the nomination.

Letters of recommendation must be received by December 31, 2006, and be addressed to the Executive Director, The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229. ❖

Call for 76th General Meeting Presentations Announced

The National Board of Boiler and Pressure Vessel Inspectors has announced a call for presentations to be delivered at the 76th General Meeting, May 14-18, 2007, at the Gaylord Texan Resort in Grapevine, Texas.

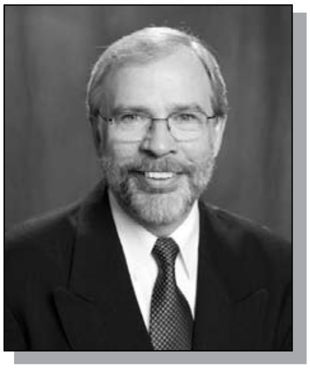
The General Meeting is conducted each year to address important issues relative to the safe operation, maintenance, construction, repair, and inspection of boilers and pressure vessels.

To be considered, presentations should address one or more aspects of the aforementioned subject areas and should be limited to 30 minutes. Additional subject areas may include safety valves as well as other unit components, testing, codes and standards, risks and reliability, and training. Presentations of a commercial or promotional nature will not be accepted.

Those interested in submitting presentations for consideration should send an abstract of no longer than 200 words in English (do not include supplementary materials) to: Paul Brennan, Director of Public Affairs, The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229. Submissions must be postmarked by October 15, 2006.

Speakers chosen to deliver General Session presentations will be notified by November 15, 2006. Each will receive one complimentary National Board registration packet, which includes one ticket to the Wednesday Banquet, as well as entry to the General Session, all guest activities, and receptions. It is requested that speakers assume their own travel and hotel expenses.

All speakers will be required to submit a paper for publication. Submission due date is January 31, 2007. ❖



What Makes a Good Inspector?

BY PATRICK M. NIGHTENGALE, SENIOR STAFF ENGINEER

I recently was asked, what makes a good inspector? First of all, which inspectors come to mind? In the boiler and pressure vessel industry, we have commissioned inspectors and authorized inspectors qualified for non-nuclear and, sometimes, nuclear inspection activities. They may be employed by jurisdictions or authorized inspection agencies or, in select circumstances, owner-user organizations.

Inspectors can be employed to work daily within their qualified capacity, or may perform inspections occasionally with other work assignments as their employers require. Foremost, a good inspector must exhibit certain desirable characteristics:

Honesty — An inspector must be honest in his or her dealings with others and also when determining the condition of the inspected equipment. An honest inspection may identify satisfactory conditions, but it can also result in costly repairs or replacements. Downtime can also be expensive when equipment problems affect work activities or production schedules.

It's all right for an inspector to say "I don't know" as long as steps are taken to get the answers. All inspectors work for an employer organization that provides support for the inspector's activities. Honesty is the first step in developing successful working relationships with employers and clients.

Trustworthy — Changes in construction, operation or maintenance practices, and even personnel may result because of reported conditions. The contents of a report must be trustworthy. Personal opinions and preferences have no part in an inspector's work activities. An inspector must have a reputation for accuracy and fairness when performing his or her duties and when reporting conditions. Trustworthy inspectors are an asset to their employer and to the clients they serve.

Dependable — The codes we enforce are safety codes, and the public depends on the inspector to do the job correctly. An employer has expectations regarding job performance in terms of the amount and quality of the work: A person must be reliable and perform the job to the best of his or her ability. Required reports of activities must be prepared and distributed in a timely fashion to better serve the recipient and the employer.

Professional — An inspector has to maintain a professional appearance, manner, and attitude. Appropriate inspection tools and equipment must be in good repair. Ethical conduct is mandatory. Reports prepared neatly and accurately inspire confidence and trust.

An inspector occasionally will have to report negative conditions which may not be well accepted. The inspector has no control over how reported problems are received by others, but must always maintain a professional attitude and manner. Inspectors exhibiting a professional demeanor will command the respect of their employer, coworkers, and the clients they serve.

Communication Skills — The ability to communicate orally and in writing is extremely important. Changes may be required based upon what the inspector says and writes. Reference to the applicable standard, the equipment identification, and problems observed must be reported clearly. Communication skills also involve active listening. The inspector must hear and assess responses to questions asked and factor in those responses as part of the overall determination of condition.

Knowledgeable — A successful inspector must keep abreast of advancing techniques used for the manufacture, repair, and alteration of pressure equipment. Along those lines, advances have been made in the complexity and applicability of the tools used to perform adequate inspections.

The technology to manage an inspector's administrative actions has also come a long way. In the last few years, computers have become the dominant tool, replacing hard copies of documents such as instructions, procedures, and activity and billing reports. Computers also provide an excellent resource to increase an inspector's technical knowledge.

The desire to adapt in order to maintain an acceptable level of knowledge is critical to ensure quality inspections.

Self-Reliant — Job performance in this industry is by its nature solitary. An inspector will typically arrange his or her work schedule, contact clients, perform inspections, prepare, and issue reports. Follow-up and reinspections of deficient areas may also be necessary. Even vacation days and time off for other reasons must be arranged.

The ability to keep an inspection district running requires a self-starter with organizational and time management skills. A solid commitment to action is required to keep all these activities in motion. Good inspectors must like the freedom that comes from working independently, yet be accountable for their own actions.

Job Satisfaction — The work of an inspector is performed in the interest of public safety. A good inspector must like dealing with the public and those within the individual's company. The inspector must understand that inspections will take place in a variety of situations and environments. While there are similarities in the equipment a person inspects, the actual results can be vastly different. Different responses are required for different situations. Work days are seldom the same. A good inspector must like this type of career environment.

In conclusion, what makes a good inspector? I'm sure there are some worthy characteristics that haven't been included, but I think this provides a pretty good start. The characteristics listed above are intended to work together and must be present in a good inspector. Many of these skills can be learned provided one more characteristic is present: desire. Good inspectors must have the desire not necessarily to be the best, but to be the best they can. An honest self-assessment to determine individual strengths as well as areas needing improvement should be made from time to time.

We all can fall into routines, ruts, and comfort zones. No one is in a better position or more responsible for an inspector's professional development than the inspector. The individual must put forth the effort to recognize any needs and then commit to making improvements. Inspectors and those they work with will be the beneficiaries of such improvements.

A good inspector must have the same desirable characteristics as any good person one knows either professionally or personally. After all, aren't these the traits we would like to see in ourselves, coworkers, clients, and others? ❖

Pressure Testing: Fact and Fiction

by George Galanes, P.E.,
Midwest Generation EME, LLC

Pressure testing is a practical method used by industry to determine the leak tightness of pressure-retaining items; this is fact. Over the years, industry has expanded the hydrostatic (pressure) testing concept specified by most construction codes or standards, using this approach to verify leak tightness and, to some extent, ensure structural integrity of inservice pressure-retaining equipment. This reliance of pressure testing for integrity is built on fiction. This article outlines some of the common facts and fiction of pressure testing inservice components.

Hydrostatic testing was originally conceived and used by early boiler and pressure vessel manufacturers to verify that a component, after it had been designed and fabricated, could withstand a level of pressure to prove the design in a safe manner. Water was selected as the working fluid for pressure testing because of its abundance and, more important, because it is relatively incompressible. Since the water cannot be compressed, pressure can be safely applied in all directions, as there is no storage of potential energy (as would occur with compressible fluids, like air). Thus, if the pressure-retaining component failed during testing, the likelihood of explosion or a shock wave from sudden decompression would be averted with water as a fluid medium.

Pressure Testing for Leak Tightness

Over the years, as pressure-retaining items were placed into service, it became practice that pressure testing with treated water could ensure leak tightness. This approach is acceptable for most inservice components, provided the test pressure does not exceed working pressure, and the metal temperature of the component is above the ductile-to-brittle transition temperature (DBTT).

The ductile-to-brittle transition temperature (DBTT) is the metal temperature at which the fracture behavior of the steel changes from ductile to brittle. This is of concern when pressure testing because if the metal temperature during a hydrostatic test is colder than the DBTT, any areas of local stress concentration containing flaws or cracks can suddenly fail in a brittle manner. Performing a hydrostatic test to provide a second "proof test" of an inservice item with poor fracture toughness (i.e., a DBTT above the testing metal temperature) could result in brittle fracture at locations of stress concentration. This concern is something that inspectors and owner-users need to understand completely before conducting inservice pressure testing of aged components.

Pressure Testing for Structural Integrity

Two structural "benefits" of hydrostatic testing are commonly reported. The first is that pressure testing of a newly fabricated object at or above the working pressure results in a redistribution of stresses at locations of stress concentration. Such areas of stress concentration include nozzle openings or other appurtenances. The other benefit reported is that the testing acts as a "proof testing" of the design.

During normal component fabrication, the materials are subject to forming stresses, including those caused by thermal treatments, which are well below the service stresses designed for service conditions. During the first hydrostatic test, the bulk of new material is subject to stress levels below the yield point of the material and most service stresses. However, at local areas of stress concentration from openings and appurtenances, the new material under pressure during a hydrostatic test can experience loads that exceed the yield strength, resulting in a redistribution of stresses. This redistribution of stresses locally strengthens the material prior to being placed into service. In addition, the component was "proof tested" to ensure adequacy of design.

One major point of pressure testing fiction is that repeated hydrostatic tests are beneficial, and can ensure the structural integrity of the component. The fact is that once the component has been subjected to a one-time hydrostatic test, any additional hydrostatic tests over the life of the component will serve no useful purpose regarding structural integrity or benefits of redistribution of stresses. In addition, performing a hydrostatic test above the normal working pressure of an inservice component can result in significant exposure to brittle fracture — especially if the material of construction has been subjected to some degree of thermal embrittlement under normal service conditions or possesses poor fracture toughness as a result of steel melting practices. Certain carbon and low-alloy steel drums that were used in older boilers can exhibit poor fracture toughness or brittle fracture behavior, even at room temperature.

Ensuring the structural integrity of a pressure-retaining item can be accomplished by methods other than hydrostatic testing. These methods can involve a process beginning with a detailed engineering review of past operating and maintenance history of the item, followed by nondestructive testing (NDT) to obtain current wall thicknesses and provide detection and sizing of any inservice flaws or cracks in seam or girth welds. Finally, metallurgical expertise can assist in the removal and evaluation of targeted samples from the component to evaluate the current condition of the material(s) of construction, and, more important, to determine the ductile-to-brittle transition temperature.

Inservice inspectors and owner-users need to be aware of material degradation concerns prior to any hydrostatic testing. Susceptibility to brittle fracture is temperature dependant; even equipment designed and operated at temperatures well in excess of the material DBTT are susceptible if hydrostatic testing is performed at temperatures colder than the DBTT. ❖

Pete Hackford

Inspector/Safety Director, State of Utah

BULLETIN *photograph by Nick Sockoloff*

It has all of the elements of a good screenplay: roustabouts, an oil boom, love, and a boot-wearing protagonist determined to pull himself up by, well . . . the bootstraps.

Urban Cowboy? Nope.

It's the real-life story of Utah Inspector/Safety Director Pete Hackford.

Born in Roosevelt, located in northeast Utah, the youngest son of a heavy construction worker and postal clerk mom admits to a happy childhood. "My older [by one year] brother Greg and I were raised on an Indian reservation," Pete recalls with a smile. "We attended school in American Legion halls."

The future Utah official led a fairly routine adolescence until the age of 15 when he took a summer job as an oilfield roustabout. "The oil business in east Utah was booming in the 60s and 70s," he explains. "There was work for *everybody*!"

Unfortunately for Pete, or perhaps fortunately, work for a 15-year-old — while not glamorous — gave the newly hired roustabout an inside look at his future career. Literally.

"One of my first jobs was to climb into a boiler, remove the tubes, and clean out the gunk at the bottom," he shares while stroking a neatly trimmed goatee. "Life was good growing up in northeastern Utah." But it was youth unexpectedly cut short.

A year after Pete took the oilfield job, his father passed away. "I guess the things I remember most about my dad were *two* philosophies he instilled in me," he fondly observes. "The one I try to live by is: 'Do what is right in your head.' That advice has guided me in the right direction for as long as I can remember."

Midway through Pete's senior year in high school, misfortune again struck: his mother died in a car accident. Suddenly, the young Hackford brothers were all alone.

Over the next several years, each helped the other into adulthood. Having returned to the oilfields following high school, Pete admits he had no ideas on what he wanted to do professionally.

It was in1983 that Pete was introduced (through relatives) to someone who would profoundly alter his life. "That's when I met Kathy," he beams. "It was love at first sight." They married two months later.

Shortly after Pete popped the question, Kathy posed one of her own: what is it, she inquired, would *he* like to do for the rest of his life?

Still working the oilfields in eastern Utah, Pete drove to Salt Lake City to speak with a Navy recruiter. "He told me my background in oil might make me a suitable candidate for an engineering program," the state official recollects. Following an aptitude test, Pete was offered an opportunity to enter the Navy's boiler program.

Heading to boot camp at the Great Lakes Naval Base, the Roosevelt native saved enough money to bring his wife and new baby son to join him in Chicago. In November 1985, the Hackfords headed to Oakland, California, and Pete's first deployment: the fast attack oiler USS *Kansas City*. As a 3rd Class Boiler Technician, the future National Board member traveled world ports of call for two years before receiving orders to deploy aboard the destroyer escort USS *Bradley* in San Diego. At that time a 2nd Class Boiler Technician, he was serving on the *Bradley* prior to decommission in 1987.

With three years remaining on his service commitment, Pete moved Kathy and his two young sons with him to San Diego and then shipped out on the destroyer tender USS *Cape Cod*.

With six years at sea, the Utah native grew restless and increasingly missed family. "Those were particularly tough times for Kathy as well," Pete laments. "In 1986, I was off the coast of Siberia onboard the USS *Kansas City* when I was summoned to the chaplain's office. I was informed Kathy had given birth — but the chaplain couldn't tell me the baby's sex, only the birth weight."

While at sea, the future National Board member finally came up with an answer to Kathy's question regarding his future. "Having spent nearly 10 years working on boilers, I knew where my career was headed," he explains.

Returning home following a six-month tour, Pete was met at the ship by Kathy and their two boys. "Upon seeing me, my oldest son hugged me and wouldn't let go for several hours," he notes with a smile. "When something like that occurs, you see what is really important in life."

Discharged from the Navy in 1991, Pete moved his family to Ogden, Utah. Leaving no doubt of his intentions, the Roosevelt native lost little time driving to Salt Lake and interviewing with an insurance company before visiting with then Utah chief Jim Parsell. "Jim told me a position would open in a few months," Pete reveals, "if I could just be patient."

And patient he was. "After working several months at a burn plant, I received a call from the state and started as a boiler inspector in November of 1991 and eventually moved back to the oil fields of eastern Utah to perform inspections." During this time, Pete would make the daily 260-mile roundtrip to Salt Lake City and keep a full work schedule in the office.

The years between 1997 and 2002 marked a transition for the state official. First he assumed the position of Utah chief inspector and five years later accepted an appointment to become safety director and, consequently, responsibility for the state safety division overseeing boilers, pressure vessels, elevators, and miners. And so the Hackfords finally moved to Salt Lake City.

One of Pete's first priorities upon taking over his new duties was approaching and successfully convincing the state to provide operating revenue for a Utah pressure vessel law that had never been funded. Today, his operation tracks 17 owner-user programs, 60,000 pressure vessels, 20,000 boilers, and approximately 7,500 elevators. The department also administers a certification program for miners.

More recently, Pete has completely modernized department operations by mobilizing his entire inspection staff of 15. "Each has a laptop computer in the car and is expected to file electronic inspection reports from the field," he acknowledges with pride. "By not requiring our people to come in the office, we have increased our productivity threefold and completely eliminated a ton of overdue inspections."

If Pete sounds like a man at peace with himself, that's because he is. And he attributes it all to his wife of 23 years. "She literally saved my life," he acknowledges with a nod.

Like *Urban Cowboy*, this story has a happy ending. Brother Greg is a ranch foreman in Utah. Kathy has a thriving Web business selling cross-stitch designs. The Hackford's two grown sons Chase and Pete Jr., now respectively 22 and 20 years of age, work for a civil engineering firm in northern Utah.

And Pete no longer travels 4 ½ hours to and from work each day dodging the countless elk frequenting the 260-mile stretch of mountainous roadway. Instead, he uses the time skiing in the winter, and off-roading or navigating his Harley Davidson Electra Glide in the summer.

" 'Work hard,' " he grins, " 'and everything falls into place.' "

That was his father's *other* philosophy. ❖

National Board Unveils Online Training Discounts

The National Board has announced a brand-new pricing structure for its online courses purchased in quantity.

"The National Board Online Discount Program was created to provide companies a more economical option in keeping their commissioned inspectors up to date on industry developments and in compliance with our organization's regulations," explains National Board Executive Director Donald Tanner.

National Board commissioned inspectors are required every three years to attend one National Board seminar or receive other instruction related to inspections through home study and/or Web-based courses.

Beginning with the popular CSD-1 and NBIC (parts RB, RC/RD, RE, and Appendix I) online courses, companies can now buy as few as 26 courses to receive a generous discount.

Ranging from 10 to 50 percent, discounts apply to ALL National Board online courses bought in quantities over 25 — the same course or any combination thereof. Regularly priced at $100 each, the tuition for these courses is only $50 with the advanced purchase of more than 125.

According to National Board Manager of Training Richard McGuire, the quantity discount is only available for online courses purchased in advance and time restrictions do apply.

"This discount process is in direct response to the demand of what has proved to be a very popular and effective online training program," Mr. Tanner emphasizes. "It only stands to reason companies purchasing in larger quantities should be afforded some price relief."

For more information on the National Board Online Discount Program, contact Mr. McGuire by telephone at 614.431.3214, or via email at *rmcguire@nationalboard.org.* ❖

"This discount process is in direct response to the demand of what has proved to be a very popular and effective online training program."

— Donald Tanner

Barb Catlett
Executive Assistant, Administrative

BULLETIN *photograph by Greg Sailor*

To know her is to love her.

That is the sentiment many of Barb Catlett's National Board coworkers have about her. She is administrative assistant to Dick Allison — her official title is executive assistant, administrative — and those who work with Barb day in and day out appreciate her friendly personality, her patient ways, and her infectious spirit. You just can't help it.

With her ever-present smile and contagious laughter, she explains what she enjoys most about coming to work each day: "Every day is an adventure! That keeps life interesting."

In early 1988, a Columbus employment agency approached Barb about an opportunity with an international safety organization. Barb had just left one company and was looking for a good fit with a new one. She found it with the National Board. After interviewing with Executive Director D.J. McDonald, Barb was offered the job. She began her run at the National Board February 1, 1988.

Although she was hired as an executive secretary, her title and responsibilities have changed along the way. "I have a wide variety of duties that continually change. I always have a new project or am working on a new database. I am able to constantly keep my computer skills updated, which is nice. I appreciate the company having that confidence in me," she explains gratefully.

Her biggest duty of all arrived in November 2000, when she gave birth to her and her husband Rick's little girl, Mollie. Barb loves being a mother and makes spending time with her family a high priority.

"We are an active family. When Mollie isn't in preschool, we are at the park or at the zoo, at friends' birthday parties, playing games, or just outside enjoying the fresh air. She is full of energy and loves to have fun, so we are always doing something," Barb says enthusiastically.

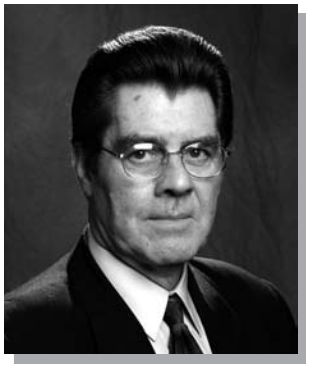
The three reside northwest of Columbus in Powell, with their full-blooded German shepherd, Baron. After meeting through friends and dating for a year, Rick and Barb will celebrate their eighth wedding anniversary in February.

Known as "Barbie" to her family and close friends, Barb was born in Batavia, New York, where most of her extended family still resides. When she was five, she, her parents, her two sisters, and her brother moved to Central Ohio. A close-knit family, they all still live within 20 miles of each other.

And what would she be doing if she didn't work at the National Board? After some consideration, Barb says she would enjoy being involved with the zoo. But it isn't a strong bet she will be leaving her desk at the National Board soon. "I love the company and enjoy what I do and the people I work with. It is important to have that balance of work and fun," she shares, flashing her trademark smile.

Which certainly helps to keep life interesting. ❖

"Do You Know . . .?" is a BULLETIN *feature introducing readers to the dedicated men and women who comprise the National Board staff.*



Training Matters, By the Numbers

BY RICHARD MCGUIRE, MANAGER OF TRAINING

Over time, the National Board Training Center has been host to many students from across the country and around the globe. Our students become our friends and colleagues, and sometimes it's entertaining to share some fun facts about training — the courses and the students — that occurred during the 12 months ending in June 2006.

Last year, 530 students were enrolled in courses given at the Training and Conference Center in Columbus. This number is easily doubled if our off-site programs are included, but let's focus on the 33 courses that were held at the Training Center. That translates to 167 days of training in a year, which breaks down to 1,376 hours of training, right here in Columbus.

That amounts to about 900 pots of coffee brewed last year; 200 pounds of doughnuts consumed; 99 quizzes taken; 607 course manuals printed — which is almost 1 ½ tons (2,892 pounds, to be exact) of books our students were lugging around, not including code books! If you stacked the training course manuals on top of one another, they would reach 11 stories high!

An increased student count provides for an increased opportunity for funny situations to occur, and they do. For example, seven pieces of luggage were lost; one student arrived in Columbus for a class that was scheduled in Texas; and one student arrived a week before class was to start. Would you believe we had a student who arrived here when he was in reality enrolled in a class given at his hotel by another company? True story.

Fourteen women became commissioned inspectors last year!

Many students took multiple courses — the record must go to the students who each spent 30 days in training class. The students attended three full two-week courses.

The highest exam grade last year was a perfect 100 percent. Only four out of our 530 students matched that high, all in the Valve Repair seminar.

Fifty-four jurisdictions were represented: 43 states, eight Canadian provinces, and three cities. Aside from our jurisdictions, students from 11 other countries were present. One student traveled all the way from India! That's 18,042 miles, round trip! Additional countries were Japan, Guam, South Africa, Aruba, Korea, England, Germany, Italy, Peru, and Columbia.

We went high-tech last year, enrolling 130 students in one or more of our online courses. Not bad, considering the year before there were only 28.

Sometimes it's fun to examine the numbers closely and to reflect on a year that has seen so many friendly faces, such tremendous growth, and wonderful students. The staff at the Training and Conference Center is looking forward to what the next 12 months will bring. We are hoping for more pleasant and interesting students and less lost luggage! ❖

ENDORSEMENT COURSES

(A) **Authorized Inspector Course** — TUITION: $2,500
October 23–November 3

(B) **Authorized Inspector Supervisor Course** — TUITION: $1,250
February 5–8, 2007

(C) **Authorized Nuclear Inspector (Concrete) Course** — TUITION: $1,250
December 11–15

(N) **Basic Nuclear Inspector Course** — TUITION: $1,250
October 16–20

(NS) **Nuclear Supervisor Course** — TUITION: $1,250
November 27–December 1

CONTINUING EDUCATIONAL OPPORTUNITIES

(CWI) **Certified Welding Inspector Review Seminar** —
TUITION: $1,250 (complete seminar with D1.1 Code)
$1,210 (complete seminar with API-1104 Code)
$405 Structural Welding (D1.1) Code Clinic ONLY
$365 API-1104 Clinic ONLY
$480 Welding Inspection Technology (WIT) ONLY
$365 Visual Inspection Workshop (VIW) ONLY
December 11–15 (Examination December 16)

(PEC) **Pre-Commission Examination Course** —
TUITION: $2,500 Full two-week course
$660 Self-Study (week 1) portion
(self-study materials sent upon payment)
$1,190 Week 2 of course
February 19–March 2, 2007

(R) **Boiler and Pressure Vessel Repair Seminar** — TUITION: $400
October 16–17 January 17–18, 2007 (Houston, TX)

(VR) **Repair of Pressure Relief Valves Seminar** — TUITION: $1,250
October 16–20 (Houston, TX) December 4–8

(WPS) **Welding Procedure Workshop** — TUITION: $670
October 18–20

REGISTRATION FORM

Please circle the seminar/course(s) and date(s) you wish to attend. Please print.

☐ Mr. ☐ Ms. ☐ Mrs.

Name ____________________

Title ____________________

Company ____________________

Address ____________________

City ____________________

State/Zip ____________________

Telephone ____________________

Fax ____________________

Email ____________________

NB Commission No. ____________________

Payment Information (check one):

☐ Check/Money Order Enclosed
☐ P.O. # ____________
☐ Payment by Wire Transfer
☐ VISA ☐ MasterCard ☐ American Express

Cardholder ____________________
Card # ____________________
Expiration Date ____________________
Signature ____________________

Hotel Reservations

A list of hotels will be sent with each National Board registration confirmation.

All seminars and courses are held at the National Board Training and Conference Center in Columbus, Ohio, unless otherwise noted, and are subject to cancellation.

For additional information regarding seminars and courses, contact the National Board Training Department at 1055 Crupper Avenue, Columbus, Ohio 43229-1183, 614.431.3216, or visit the National Board Web site at nationalboard.org.

In the Midst of Life . . .

BOILER EXPLOSION WESTVILLE N.S APRIL 2ND 1914

"In the midst of life we are in death." So says the ***Book of Common Prayer***. And so said a newspaper reporter on viewing the aftermath of a boiler explosion on April 2, 1914, at the Drummond Colliery in Westville, Nova Scotia.

On that snow-blanketed day, Number 5 Boiler — one of six boilers used at the colliery — exploded. The boiler, a little more than 19 feet long and four feet wide, broke in half, nearly destroying the boiler house, tumbling all the smokestacks, and overturning railway cars loaded with coal. In Westville, windows rattled. One part of the boiler landed 70 feet from the boiler house; the other part landed the same distance in the opposite direction.

Seven men, several of whom were eating lunch in the boiler house when the boiler blew up, were killed and five men injured.

An inquest jury was sworn in to investigate the accident. The jury was told the maximum permissible pressure on the boiler was 165 psi. The safety valve was set at 100 psi, and pressure was maintained at 80 psi. Samuel Fisher, the company inspector, said he had inspected the boiler in January, giving it a thorough hammer test and washing it out, and found nothing wrong. W. C. McDonald, who was inspector for the Boiler Inspection Company of Canada and who had examined the boiler after the explosion, was then called to testify. He said the boiler had ruptured on the longitudinal seam of the first course along the rivets. He was not sure, however, what had caused the explosion, since there was no sign of overpressure. He recommended a chemical analysis of the boiler plate.

The jury later ruled that it was "unable to determine the exact cause of the explosion but from the evidence given would say that the boiler plate was not up to standard" and that "the company took all necessary precautions."

Have any information about this picture? We would like to know more!
Email getinfo@nationalboard.org.

Thanks to Karen MacLeod of the New Glasgow Library in New Glasgow, Nova Scotia, for her contribution to this column. ❖