ASTM

1898-1998

A Century of Progress

100 YEARS

ASTM

A PROVEN PARTNERSHIP

This book is dedicated to the many thousands of ASTM members who, over the past century, have developed the standards that improve the quality of our lives.

“A Broader

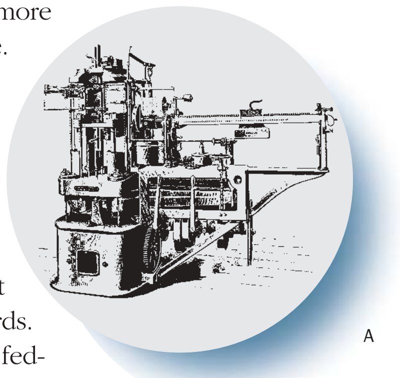
Early Standards Development and the Origins of ASTM

View”

STANDARD SPECIFICATIONS: A NOVELTY IN AMERICAN INDUSTRY

One of the first materials specifications is found in the Book of Genesis: “Make thee an ark of gopher wood; rooms shalt thou make in the ark, and shalt pitch it within and without with pitch.” Prior to the 19th century industrial revolution, craftsmen told their suppliers in similarly basic language what kinds of materials they desired. Shipwrights preparing to build a sturdy vessel usually ordered live oak, the toughest hardwood available in Europe and North America, rather than softer white oak, because they knew from experience that live oak was more durable. Craft experience was indeed key because artisans had no instruments to measure the tensile strength, chemical composition, and other characteristics of a given material.

The industrial revolution opened a new chapter in the history of material specifications. Locomotive builders, steel rail producers, and steam engine builders who used revolutionary new materials such as Bessemer steel could no longer rely on craft experiences of centuries past. The new materials and techniques invented during this period required new technical expertise. Moreover, manufacturers encountered numerous quality problems in end products such as steel rails because suppliers furnished inferior materials. American rails were so poorly-made, in fact, that many railroad companies preferred British imports, which were more expensive but reliable.



A

To avoid such problems, some manufacturers issued detailed descriptions of material to ensure that their supplies met certain quality standards. For example, when a federal arsenal ordered gun steel from a steel mill, the contract included several pages of specifications detailing chemical composition and

B

physical characteristics. The federal government also asked the steel makers to take a sample from each steel batch which was then subjected to a few simple tests determining its tensile strength and elasticity. To perform quality checks, American steel companies used new testing equipment such as the Riehle steel tester or a version of Tinius Olsen’s Little Giant, which were used to determine tensile strength.

RESISTANCE TO STANDARDS

Progress was nevertheless slow. Suppliers in many industries such as construction and metallurgy objected to standard material specifications and testing procedures because they feared that strict quality controls would make customers more inclined to reject items and default on contracts. Even in iron and steel, where quality definitions and standards made greater headway than in other industries, material specifications remained controversial. The ones that existed were highly customized and applied only to a specific order. Industrywide standard specifications were unheard of, making life difficult for large buyers. Without standard specifications, and with each mill following its own material testing procedures, buyers of industrial products were unable to ensure uniformity and frequently found reason to complain about the uneven quality of steel rails for railroads.

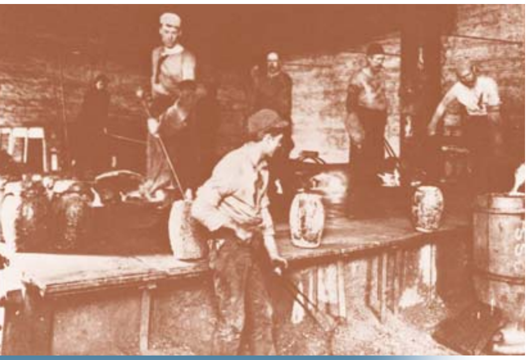
The Pennsylvania Railroad, the largest corporation of the 19th century, played a key role in the quest for standard specifications. Its efforts in this field were initiated by Charles Dudley, who received his Ph.D.

A. The Tinius Olsen autographic testing machine provided for the first time a permanent, easily interpreted record of test results from the start of each test to the end.

B. Charles Benjamin Dudley, 1842-1909.

from Yale University in 1874, and who later became the driving force behind ASTM. Dudley organized the railroad's new chemistry department, where he investigated the technical properties of oil, paint, steel, and other materials the Pennsylvania Railroad bought in large quantities. Based on his research, Dudley issued standard material specifications for the company's suppliers.

Dudley soon realized that he had taken on a formidable task. In 1878, he published his first major report, "The Chemical Composition and Physical Properties of Steel Rails," in which he analyzed the durability of different types of steel rails. It concluded that mild steel produced a longer-lasting rail than hard steel, and Dudley recommended an improved formula for mild steel for rails to be used by the Pennsylvania. His report raised a firestorm among steel masters, who disputed its findings. The application of Dudley's new formula, they charged, produced unnecessary expenses that increased production costs. Steel producers, determined to keep full control over output and quality control, viewed standard specifications issued by their customers as unacceptable meddling. Dudley later reported that steel companies often told the railroads that "if they did not take the rails offered [by the manufacturers], they would not get any."



A

The disappointing response to his first report reinforced Dudley's resolve to initiate a constructive dialogue between suppliers and their customers. Each party had much to learn from the other. Steel makers knew more about practical production issues and the industry's cost structure than their customers, while railroads, locomotive builders, and other users of steel products had better knowledge of a material's long-term performance, knowledge that could help manufacturers improve the quality of rails, plates, and beams. Dudley concluded that "a good specification needs both the knowledge of the product's behavior during manufacture and knowledge of those who know its behavior while in service."

The introduction of more powerful locomotives, heavier rolling stock, and longer trains gave buyers an additional incentive to work more closely with their suppliers. Statistics compiled by railroad engineers indicated that the average wheel load of cars increased 75%, and traffic volume rose more than 300% during the late 19th century. Rail manufacturers needed this kind of data to supply steel that conformed to higher performance standards. But the lack of cooperation between producers and users of steel rails was an enormous detriment to such improvements.

THE BIRTH OF CONSENSUS

Dudley's efforts to find a solution to these seemingly intractable problems facilitated the formation of ASTM, which was committed to building a consensus on standards for industrial materials. The founding of the organization in 1898 was preceded by several key initiatives that laid the groundwork.

B

A. The struggles between early steel makers and corporate consumers over the quality of steel led Charles Dudley to champion the need for standard material specifications. Photo credit: American Iron and Steel Institute; Historical File

B. Meeting of the Section on Alloy Steel Forgings of Committee A-1

1904 E-5 on Fire Standards

1904 D-5 on Coal and Coke

1904 D-2 on Petroleum Products and Lubricants

1904 C-4 on Vitrified Clay Pipe

1904 D-7 on Wood

1905 D-8 on Roofing, Waterproofing, and Bituminous Materials

Dudley, whose experiences during the 1880s gave him a better picture of the antagonistic attitudes that marred relationships between the Pennsylvania Railroad and its suppliers, proposed an innovative system of technical committees. These committees provided representatives of the main parties with a forum to discuss every aspect of specifications and testing procedures for a given material. The goal was to reach a consensus that was acceptable to both producers and to the customer, i.e., the railroad. Although many initial meetings ended in failure due to the inflexibility of the parties involved, Dudley's system held considerable promise and later formed the basis for ASTM's committee structure.

A

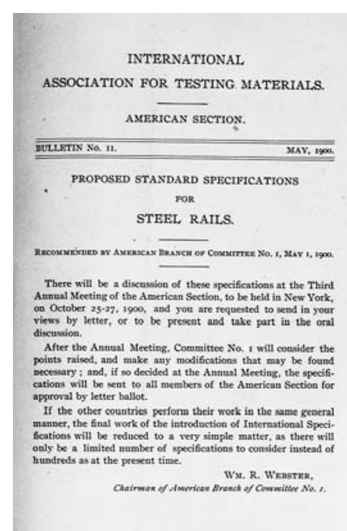
Dudley's call for consensus building, which he articulated in meetings of the American Chemical Society and the International Railway Congress, fell on fertile ground in the engineering community. His ideas contributed to the formation of the International Association for Testing Materials (IATM), which organized working committees to discuss testing methods for iron, steel, and other materials. In its by-laws, the organization dedicated itself to "the development and unification of standard methods of testing; the examination of technically important properties of materials of construction and other materials of practical value, and also to the perfection of apparatus used for this purpose."

The International Association encouraged members to form national chapters. On June 16, 1898, seventy IATM members met in Philadelphia to form the American Section of the International Association for Testing Materials. The members grappled with two questions that were widely discussed throughout the engineering community at the turn of the century. First, how could standards for materials contribute to industrial progress? And second, how could producers and users of industrial materials reach a consensus on standards? ASTM's early history was in large part a quest to find answers to these pivotal questions.

The American Section's first technical committee on steel initiated a series of discussions of testing and material standards for the railroad industry, where most of its members were employed. During the first two years, the committee drafted specifications for steel used in buildings, boiler plate, and bridges. One of the first standard specifications in the history of the organization, "Structural Steel for Bridges," was approved by the committee and submitted to all members for a final ballot vote at the annual meeting in 1901.

This specification, like its successors, was not set in stone. The organization acknowledged that "it is thoroughly appreciated that in the rapid advances made in the process of manufacture, and the increased demands made by the

B



INTERNATIONAL

ASSOCIATION FOR TESTING MATERIALS.

AMERICAN SECTION.

BULLETIN No. 11. MAY, 1900.

PROPOSED STANDARD SPECIFICATIONS

FOR

STEEL RAILS.

RECOMMENDED BY AMERICAN BRANCH OF COMMITTEE No. 1, MAY 1, 1900.

There will be a discussion of these specifications at the Third Annual Meeting of the American Section, to be held in New York, on October 25-27, 1900, and you are requested to send in your views by letter, or to be present and take part in the oral discussion.

After the Annual Meeting, Committee No. 1 will consider the points raised, and make any modifications that may be found necessary; and, if so decided at the Annual Meeting, the specifications will be sent to all members of the American Section for approval by letter ballot.

If the other countries perform their work in the same general manner, the final work of the introduction of International Specifications will be reduced to a very simple matter, as there will only be a limited number of specifications to consider instead of hundreds as at the present time.

WM. R. WEBSTER,
Chairman of American Branch of Committee No. 1.

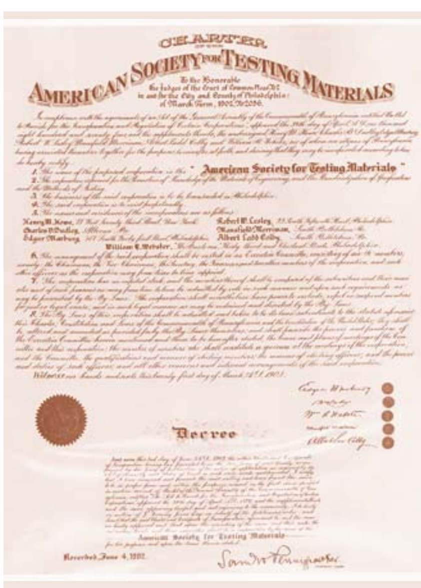
A. Critical to commerce at the turn of the century, railroads and the materials upon which they relied sparked the beginnings of ASTM. Photo credit: Library of Congress, Prints and Photographs Division, Detroit Publishing Company.

B. The first specification on carbon steel rails was published in 1901. This is the draft proposal of that specification which was circulated when the organization was the American Section of the International Association for Testing Materials.

1906	1909	1909	1912	1912	1914
A-5 on Metallic - Coated Iron and Steel Products	**D-9 on Electrical and Electronic Insulating Materials**	**B-1 on Electrical Conductors**	**D-11 on Rubber**	**C-7 on Lime**	**C-8 on Refractories**

Engineers in their Specifications, that no Standard Specification can be in force for a long time. It will of necessity have to be modified from time to time." Indeed, the above mentioned steel standard, which was later classified as ASTM's Standard Specification A 7, soon underwent a series of thorough revisions. It was widely used by large engineering companies that ordered steel for bridge construction projects during the 1920s and 1930s. The standard finally was discontinued after a long and useful life in 1967, when Committee A-1 reported that "almost no structural steel shapes have been purchased to A 7 for some time."

A



CHARTER OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

Decree

The steel committee's early work attracted widespread attention in the engineering community and helped the American Section increase its membership from 70 to 168 during its first three years. But the organization's plan to increase membership on the steel committee was vetoed by the International Association, which was determined to maintain extensive control of its national chapters and restrict committee memberships. The resulting conflict, combined with other disagreements, convinced Dudley and other American members that they had to strike out on their own. At the fifth annual meeting of the American Section in 1902, they renamed the organization the American Society for Testing Materials and elected Dudley as its first president.

B

ASTM developed what Dudley called a "broader view" of standards issues than the International Association for Testing Materials. IATM educated its members on testing procedures and the technical properties of a given material, but left the actual writing of standard specifications to unaffiliated engineers' societies. ASTM, in Dudley's words, intended to go "a step farther, and [put] its accumulated information with its recommendations into definite and serviceable shape." As the steel committee's early work indicated, ASTM wanted to write standard specifications that were directly applicable in production processes.

ASTM was not the only organization dedicated to standards development. Well-established technical associations, including the American Society of Civil Engineers and the American Society of Mechanical Engineers, formed technical committees that drafted standard specifications for the iron and steel industry. The federal government, responding to the pressing need for standards in many industries, established the National Bureau of Standards (NBS) in 1901. Manufacturers and engineers, however, resisted NBS's plans to duplicate European practices in which government standard bureaus had authority to write

A. ASTM charter incorporating the American Society for Testing Materials in 1902.

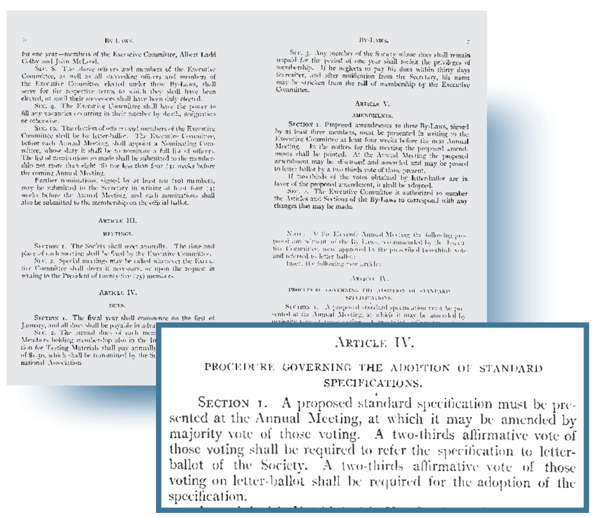
B. A turn of the century 60-inch black iron culvert.

specifications and force industry to adopt them. The result was a uniquely American system in which professional organizations such as ASTM played a key role in voluntary standards development.

During the early years, ASTM refined its consensus-building process. The key was balanced representation of producers and users of materials in technical committees. To allay old fears that producers would dominate the standard-setting process, ASTM's rules stipulated that supplier representatives on a given committee could not outnumber the representatives of buyers, and that supplier representatives could not serve as committee chairmen. Moreover, the "Procedures Governing the Adoption of Standard Specifications" adopted in 1908, required that once technical committee members had drafted a specification, a two-thirds majority was necessary to refer it to ASTM's annual meeting for consideration. At the annual meeting, a simple majority of members could amend the specification, which was finally presented to the meeting for a ballot vote. Negative votes carried considerable weight and were referred to the committee, whose members discussed them and tried to resolve differences. Negative votes that remained unreconciled could be overruled by the committee for good cause. This basic structure of checks and balances, designed to ensure fairness in the standards-setting process, proved highly effective and remains essentially in place to this day.

Most members of ASTM's technical committees were scientists and engineers who were employed by some of the nation's leading industrial enterprises and the federal government. A-1 on Steel, which together with its subcommittees remained ASTM's core committee for decades, included metallurgists, chemists, railroad engineers, and naval architects. The producer side was represented by the industry giants—U. S. Steel, Bethlehem, and Midvale—and smaller specialty firms such as Jones & Laughlin, then a proprietary steel company in Pittsburgh that later joined the ranks of the nation's leading steel producers. They were joined by a second group, variably categorized as "non-producers" and "consumers" (the latter term usually meant "end user," not "consumer" in our contemporary sense of the word) that purchased a given material. On the A-1 committee, they included engineers and scientists who represented the New York Central Railroad, General Electric, the U. S. Navy's Bureau of Steam Engineering, and other steel "consumers."

A



ARTICLE IV.

PROCEDURE GOVERNING THE ADOPTION OF STANDARD SPECIFICATIONS.

SECTION 1. A proposed standard specification must be presented at the Annual Meeting, at which it may be amended by majority vote of those voting. A two-thirds affirmative vote of those voting shall be required to refer the specification to letter-ballot of the Society. A two-thirds affirmative vote of those voting on letter-ballot shall be required for the adoption of the specification.

EXPANDING THE SCOPE OF ASTM

After the turn of the century, ASTM formed several new committees that expanded the organization's scope beyond the steel industry and responded to the growing need for standards in many areas. Committee C-1 on Cement, Lime and Clay Products, for example, founded in 1902, played a key role in standardizing test methods in the cement and concrete sector.

The American cement industry, which traces its origins to the 1870s when David Saylor received the

A. "Procedures Governing the Adoption of Standard Specifications" (1908)

1926	1928	1928	1931	1931	1932
C-18 on Dimension Stone	B-7 on Light Metals and Alloys	B-5 on Copper and Copper Alloys	C-12 on Mortars and Grouts for Unit Masonry	C-13 on Concrete Pipe	D-19 on Water

first U.S. patent for portland cement, underwent a major growth cycle during the late 19th century, when an urban construction boom generated strong demand for this versatile material. The first concrete road was built in Bellefontaine, Ohio, in 1891, followed by the first concrete high rise in Cincinnati in 1903. Despite its remarkable success, however, the cement industry suffered from a lack of basic standards that defined the material's chemical composition and performance, leading to conflicts between manufacturers and their customers in the construction industry that resembled disagreements between steel makers and users. Prior to 1900, there was no consensus on the exact ratio of stone, silica, iron, and aluminum in portland cement, or on simple properties such as tensile and compressive strength. As a result, construction companies often received cement that was unsuitable for a given project because it did not meet performance requirements.

The work of Committee C-1 was part of industry-wide efforts to develop uniform test methods. The committee defined basic testing procedures to measure tensile strength seven and twenty-eight days after the pour, researched the weather resistance of various cement formulas, and developed compression test standards that were widely adopted across the industry. During later years, committee members supported the formation of the Cement Reference Laboratory at the National Bureau of Standards, which standardized cement testing equipment used in research laboratories.

ASTM published each standard specification only once until 1910, when it introduced a yearbook which later became the world-renowned *Annual Book of ASTM Standards.* This publication constituted a major improvement; each volume made the entire set of existing, revised, and new ASTM standard specifications available to members on an annual basis. Membership rose to 1,687 in 1914, nearly a tenfold increase from 1902.

A

World War I marked another watershed in the history of standard specifications. Many steel mills and cement plants that had traditionally supplied commercial materials now geared up for military production—foreign territory to most civilian manufacturers. Standard specifications greatly facilitated this conversion. ASTM specifications, for example, provided rolling mills with detailed technical information that was necessary to produce steel plates for

B

A. *In 1918, ASTM headquarters was relocated from the Engineering Department at the University of Pennsylvania to the Engineer's Club in Philadelphia.*

B. *Officers and crew, USS Mount Vernon, October 30, 1918. Photo credit: Library of Congress, Prints and Photographs Division, Detroit Publishing Company.*

1932 — E-2 on Analytical Atomic Spectroscopy
1935 — E-3 on Chemical Analysis of Metals
1935 — D-3 on Gaseous Fuels
1936 — D-12 on Soaps and Other Detergents
1937 — D-6 on Paper and Paper Products
1937 — C-14 on Glass and Glass Products

tanks and ships. Cement producers used standard specifications to supply concrete for massive fortress construction projects on the Western Front. A senior military officer later recalled that "a big job was done, and done well, because of a U.S. industry that performed to the standards set largely by ASTM."

ASTM, firmly committed to the concept of consensus building, played a vital role in resolving conflicts among different parties involved in wartime standard-setting. Corporations, trade associations, and engineering societies often worked on the same standard problem without knowing about each other's work and produced overlapping and conflicting specifications. To streamline the process, ASTM, other professional organizations, and the U.S. departments for commerce, war, and the navy established the American Engineering Standards Committee in 1918. This committee, which was established to coordinate and review standards work in American industry, remained active after the war and was later renamed the American Standards Association and then the American National Standards Institute.

A

By the end of World War I, ASTM had found answers to the two major questions that had preoccupied the organization's founders in 1898. How could standards development contribute to industrial progress? ASTM's work in the steel and concrete sectors demonstrated that standard specifications for testing and materials enabled producers and consumers to exploit the vast potentials of new industrial materials. Practical benefits included more uniform quality and greater predictability of a given material's performance, which in turn enabled end users to improve

B

their safety record, particularly in railroad transportation. On the producer side, standard specifications improved quality and the competitiveness of the nation's steel industry, reflected in a sharp decline of American rail imports from Britain.

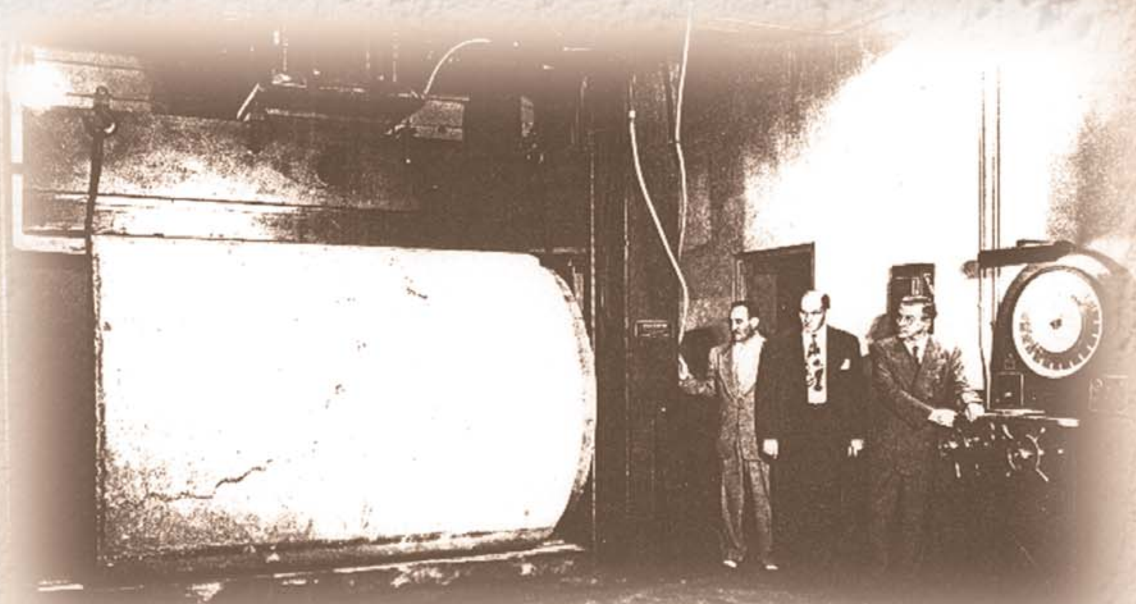
The second major question originally raised by the organization's founders—defining the parameters of an effective consensus-building process—was developed through several years of hard work. Careful reviews of procedures that guided ASTM's early technical committees finally resulted in the adoption of the "Procedures Governing the Adoption of Standard Specifications" in 1908, a milestone in the organization's history. Equipped with an effective concept for consensus-building through technical committee work, ASTM soon ventured beyond the steel, cement and other industries involved in the railroad sector and developed standard specifications on the cutting edge of American industrial development.

A. A young Charles Dudley

B. The Tenth Annual Meeting of the American Society for Testing Materials was held at the Hotel Chalfonte, in Atlantic City, NJ, June 20-22, 1907.

“Extending the

ASTM in a Maturing Industrial Society



Influence”

ASTM STANDARDS IN NEW INDUSTRIES

In the early 1920s, ASTM’s main activities still focused on the steel, railroad, and cement industries, and most of its members were based in the Northeastern part of the country. In the four decades after World War I, ASTM evolved into a truly national organization whose more than 100 technical committees formed an integral part of America’s maturing economic base, contributing to the rise of new industries in strategic areas such as highway transportation, petrochemicals, electronics, and aerospace technology, to name only a few. ASTM’s development from the 1920s to the 1960s helped facilitate the nation’s rise to economic and military superpower status.

A

The period between the two world wars witnessed a phenomenal growth of mass-production industries, which formed the back-bone of American economic strength for decades to come. Mass production, which involved interchangeable parts and manufacturing methods based on the assembly-line system, had been pioneered by Eli Whitney in small arms manufacture, Isaac Singer in sewing machine production, and Henry Ford (who was a member of ASTM) in automobile production. In the 1920s, mass-production technologies fueled skyrocketing growth in other product lines as well, including appliances, telephones, rubber tires, chemicals, and electrical equipment. The principle of interchangeability, the linchpin of the mass-production system, confronted new-growth industries with major challenges because materials used in manufacturing processes had to conform to new standards of precision and uniformity.

To meet this challenge, leading manufacturers availed themselves of ASTM standards, which gained wide acceptance well beyond the steel industry. General Electric, for example, a pioneer in the use of ASTM standards in the electrical industry, required suppliers to adhere to ASTM’s new standard specifications for non-ferrous metals in the early 1920s. A GE official commented that the company bought many supplies “directly to A.S.T.M. specifications by title and designations. … Occasionally direct reference to A.S.T.M. standards is made even on drawings.” Like most manufacturers, GE also used ASTM standards as a basis for its own specifications. “In such cases quotations from the A.S.T.M.

AMERICAN SOCIETY FOR TESTING MATERIALS

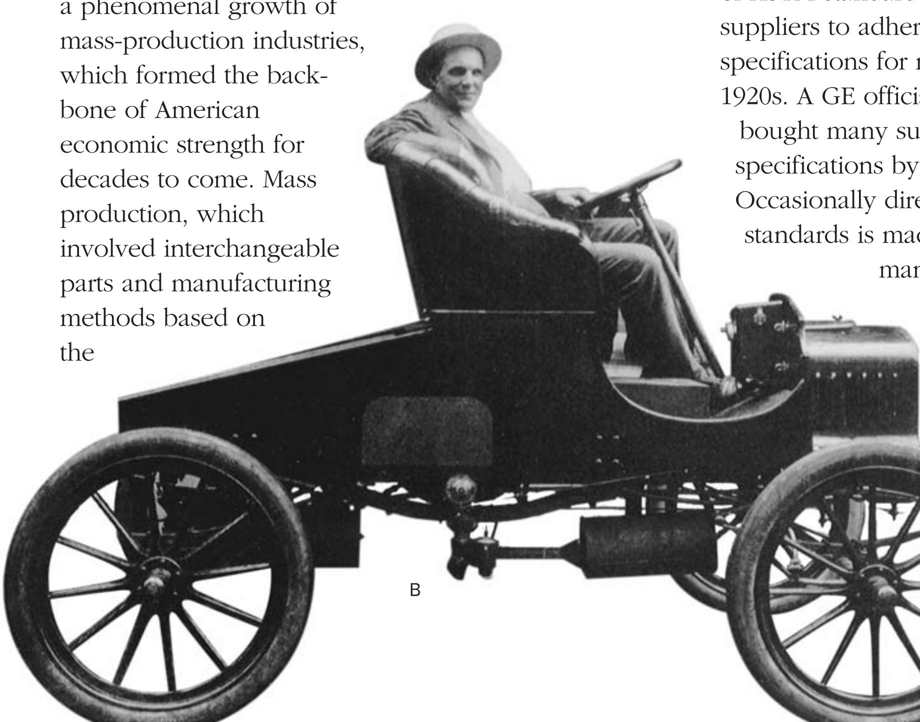
~ BULLETIN ~

ENGINEERS’ CLUB BUILDING, 1315 SPRUCE ST., PHILADELPHIA, PA.

Introducing the A.S.T.M. Bulletin

1921 Annual Meeting

C



B

A. Early auto assembly room.
Courtesy of the Detroit Public Library, National Automotive History Collection.

B. Henry Ford in his original Model A.
Courtesy George Eastman House.

C. Front page of first ASTM Bulletin, April 1921.

1937	1937	1937	1938	1938	1941
C-15 on Manufactured Masonry Units	**D-18 on Soil and Rock**	**D-20 on Plastics**	**E-7 on Nondestructive Testing**	**C-16 on Thermal Insulation**	**B-8 on Metallic and Inorganic Coatings**

standard are written [into the contract with the supplier] as freely as possible and the company's standard differs from that of the Society mainly by additions rather than in technical detail." The use of standard specifications reinforced GE's status as one of the world's leading producers of electrical equipment during the interwar period.

The automobile, another recent innovation that came into its own during the 1920s, also benefited from the widespread adoption of ASTM standards. In this era, leading car manufacturers like General Motors, Packard, Hudson, and Studebaker copied Henry Ford's mass-production system, which depended on the uniformity of materials like steel, rubber, paint, and oil—all areas where ASTM's technical committees launched a series of new activities. Committee D-11 on Rubber Products, for example, developed standards for testing the effect of vibration of rubber products used in automobile production, such as bumpers, engine supports, and universal joints in 1928. This initiative, which evolved in close coordination with the American Society of Automotive Engineers, was followed by a series of committee activities during the 1930s that resulted in 16 standards for testing the chemical properties, aging patterns, adhesion characteristics, hardness, and abrasive wear of vulcanized rubber. Most of them were quickly adopted by B. F. Goodrich (the pioneer of the modern rubber industry), Goodyear Tire & Rubber, Chrysler, and Firestone Tire & Rubber, whose representatives on ASTM's D-11 had been instrumental in formulating the standards in the first place.

Road construction, another spin-off of the automobile revolution that forever changed the American landscape, triggered a range of ASTM activities during the interwar period. The Federal Aid Road Act of 1916 and the Federal Highway Act of 1921 provided financial backing for turning many dirt tracks into concrete or asphalt roads, and for the construction of New York's Bronx River Parkway, the nation's first scenic highway. ASTM standards laid the groundwork for these vast civil engineering projects. Taking the lead role, Committee D-4 on Road and Paving Material coordinated its standards activities with the American Association of State Highway Officials, which adopted 70 standards for testing road materials in 1928. Twenty-three of them had been issued by D-4; another 16 were slightly modified versions of ASTM standards.

The automobile revolution triggered a virtual frenzy in bridge construction and led to some of the most

A

B

C

A. Bending fenders in a car factory, 1909. Courtesy of the Detroit Public Library, National Automotive History Collection.

B. A tire surgeon showing complex structure of 1930s heavy-duty truck tires.

C. Construction of a reinforced brick abutment.

1944	1944	1944	1946	1946	1946
D-14 on Adhesives	**D-16 on Aromatic Hydrocarbons and Related Chemicals**	**B-9 on Metal Powders and Metal Powder Products**	**E-6 on Performance of Buildings**	**C-17 on Fiber-Reinforced Cement Products**	**E-11 on Quality and Statistics**

A

spectacular engineering projects of the age. Several ASTM technical committees provided vital testing and materials specifications to support these efforts. The Ambassador Bridge linking Detroit—birthplace of the American automobile industry—with Windsor, Ontario, served as an example. This $23 million construction project, which was completed in 1929, produced the world's longest suspension bridge. Probably unbeknownst to the 1.6 million drivers who crossed the Ambassador Bridge during its first year of operation, the majestic span was built according to ASTM standards for structural carbon and silicon steel, steel castings, cement, concrete, and paving blocks.

THE NEW DEAL ERA

The Great Depression of the 1930s marked a difficult period as ASTM's membership and income fell significantly for the first time in the organization's history. To cope with the financial hardship, the leadership introduced austerity budgets and reduced the volume of technical papers presented in committees and at annual meetings. Despite cutbacks, technical papers remained one of ASTM's most important vehicles to disseminate the results of cutting-edge research conducted by committee members within the engineering community.

B

The greatest worry of the Depression years was ASTM's declining membership, a result of growing unemployment and tight budgets in industrial research. The Great Depression threatened the organization with "brain drain." In 1934, ASTM declared that "the regaining of membership lost under the difficult times through which we have been passing is one of the basic problems that faces the Society today—not alone because of its financial aspects, important though they are, but from the viewpoint of building up the 'manpower' of the Society and extending still wider the influence of its work." But the membership crisis reached its peak in the mid-1930s, and ASTM launched imaginative initiatives to deal with its budget problems. Most important, it introduced a new category of "sustaining members" aimed at major corporations that were willing to support ASTM with $100 in annual membership fees. By 1940, more than 100 companies with historic ties to the organization, such as International Harvester, Westinghouse, and

C

A. Built adhering to myriad ASTM standards, the Ambassador Bridge, between Detroit and Windsor, Ontario, was the world's longest suspension bridge.

B. Bread lines and makeshift urban communities were commonplace during the Great Depression. *Photo credit: Library of Congress, Prints and Photographs Division, Detroit Publishing Company.*

C. In 1940, Chrysler Corporation opened this spectrographic analysis laboratory. The ASTM president was present at its dedication.

1946 E-9 on Fatigue

1947 D-15 on Engine Coolants

1948 E-12 on Appearance

1948 C-21 on Ceramic Whitewares and Related Products

1949 C-3 on Chemical-Resistant Nonmetal Materials

1950 D-21 on Polishes

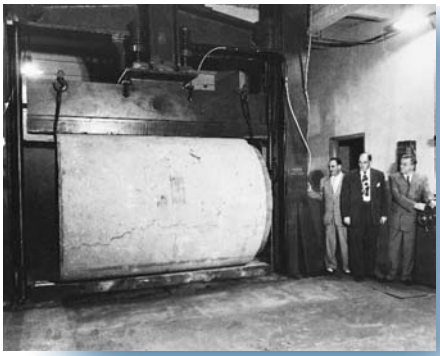
Firestone, had joined the ranks of sustaining members.

Depression-related problems did not prevent new industries from availing themselves of ASTM's consensus process. One of the most important new committees formed during the 1930s was D-20 on Plastics which evolved out of an ASTM symposium held in 1937. D-20 quickly evolved into one of the organization's most active committees and included representatives of DuPont, General Electric's plastics department, and other industry leaders.

Given ASTM's long tradition of consensus building, it was no surprise that the organization was a strong supporter of President Franklin D. Roosevelt's economic recovery programs, which encouraged private business to weather the Great Depression collectively and with government support. Major initiatives included the National Industrial Recovery Act, which introduced codes of fair practice in many industries, and the Public Works Act providing $3.3 billion for federally-funded employment programs. ASTM commented on the passage of this legislation in 1933 by stating that "codes of fair practice must in the last analysis be based on equitable standards, and the purchase of large quantities of construction materials for the public works program should, wherever possible, be based upon such standards. Moreover, there is immediately available in the Society the organization and experience to bring about the necessary cooperation between industries." ASTM soon forged close ties with New Deal programs that introduced the principle of consensus-building in many Depression-stricken industries.

A

The engineering community, hard times notwithstanding, developed key innovations during the 1930s that revolutionized materials testing, still ASTM's main field of activity. In 1932, scientists introduced the world's first electron microscope, enabling researchers to study materials at a level of detail unimaginable only a few years before. An ASTM member who used the nation's first commercially-produced electron microscope at Stanford Research Laboratories in 1940 to produce several thousand micrographs marveled, "objects commonly used were 'seen' for the first time." This had immense benefits for ASTM committees that worked on high-performance test standards involving details as small as 40 angstroms in materials such as silicone, hydrocarbons, and metal alloys.



B

Radiography was another innovation that developed during the 1930s. First introduced after World War I, radiography found acceptance among

C

A. The ASTM Executive Committee meets at the June 1940 Annual Meeting in Atlantic City, NJ.

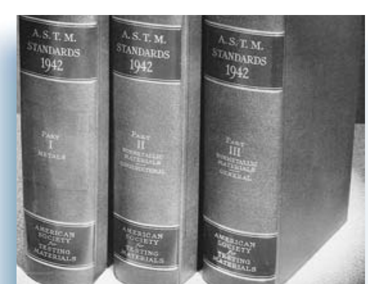
B. 112,000 pounds were required to crack this six-foot diameter reinforced concrete pipe, made in accordance with ASTM standards.

C. X-ray machine used in testing penstock welds. Boom rotates through a complete circle, giving access to steel at either side of machine.

metallurgists during the Depression decade, when several dozen welding shops introduced X-ray machines to inspect welds in high-pressure vessels. ASTM, the first engineering society to recognize the enormous potential of the new technology for test standards, held a symposium on radiography and X-ray differentiation methods in 1936, followed two years later by the formation of Committee E-7 on Radiographic Testing (today's Committee E-7 on Nondestructive Testing). ASTM X-ray test standards were used by aircraft manufacturers who had recently introduced planes that flew at high altitudes, thus requiring welds that could withstand extreme changes in temperature and pressure.

INDUSTRIAL MOBILIZATION IN WORLD WAR II

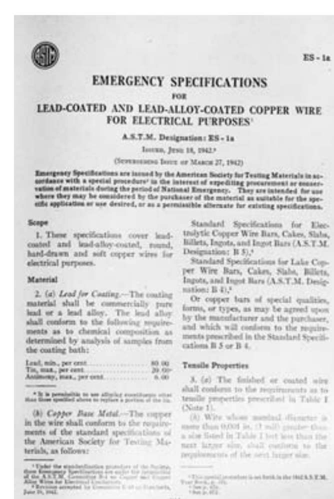
The trends of the 1930s—advances in test methods, close cooperation between government and industry, and mass production techniques—converged during World War II, when ASTM joined the industrial mobilization effort. Its first major contribution was the publication of the Society's most extensive *Book of Standards*, the three-volume 1942 books that made more than 1,000 standard specifications available to industry and government. Since more than half of these were purchase specifications, they could be written directly into tens of thousands of government contracts for war-essential materials. Existing ASTM standards also played an important role in the creation of an industrial base that was necessary to sustain the war effort. Major projects included a state-of-the-art aviation fuel plant built by the Sun Oil Company at Marcus Hook, Pennsylvania, whose builders used 50 ASTM standards for steel (including the venerable A 7 standard for structural steel).



A

The effectiveness of German submarine warfare triggered critical shortages in strategic materials imported from overseas, leading many ASTM committees to issue modifications to existing standards that enabled users to adapt to the national emergency. Faced with a severe shortage of tin, for example, a subcommittee of B-2, Non-Ferrous Metals and Alloys, issued a series of emergency modifications that reduced the amount of tin in a wide variety of alloys. The speedy passage of such emergency modifications preserved many ASTM standards for the war effort. Others had to be replaced to meet the challenges of materials shortages. Committee B-1 on Electrical Conductors wrote entirely new specifications to replace tin-wire covers with lead-coated ones. A good deal of wartime committee work involved highly sensitive material standards. ASTM distributed these standards to manufacturers hand-picked by the War Department,

B



ES - 1a

EMERGENCY SPECIFICATIONS
FOR
LEAD-COATED AND LEAD-ALLOY-COATED COPPER WIRE FOR ELECTRICAL PURPOSES[1]

A.S.T.M. Designation: ES - 1a

Issued, June 18, 1942[2]

(Superseding Issue of March 27, 1942)

Emergency Specifications are issued by the American Society for Testing Materials in accordance with a special procedure[3] in the interest of expediting procurement or conservation of materials during the period of National Emergency. They are intended for use where they may be considered by the purchaser of the material as suitable for the specific application or use desired, or as a permissible alternate for existing specifications.

Scope

1. These specifications cover lead-coated and lead-alloy-coated, round, hard-drawn and soft copper wires for electrical purposes.

Material

2. (a) *Lead for Coating.*—The coating material shall be commercially pure lead or a lead alloy. The lead alloy shall conform to the following requirements as to chemical composition as determined by analysis of samples from the coating bath:

Lead, min., per cent	80.00
Tin, max., per cent	20.00*
Antimony, max., per cent	6.00

(b) *Copper Base Metal.*—The copper in the wire shall conform to the requirements of the standard specifications of the American Society for Testing Materials, as follows:

Standard Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (A.S.T.M. Designation: B 5),[4]

Standard Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (A.S.T.M. Designation: B 4),[5]

Or copper bars of special qualities, forms, or types, as may be agreed upon by the manufacturer and the purchaser, and which will conform to the requirements prescribed in the Standard Specifications B 5 or B 4.

Tensile Properties

3. (a) The finished or coated wire shall conform to the requirements as to tensile properties prescribed in Table I (Note 1).

C

A. 1942 Book of ASTM Standards.

B. On October 12, 1944, at a special meeting of the Society, ASTM President Bates was presented the Army Ordnance Distinguished Service Award from Major General Burnes.

C. During WWII, ASTM responded to the urgent demand for standards by introducing the Emergency Standard.

1958
D-26 on Halogenated Organic Solvents and Fire Extinguishing Agents

1959
E-15 on Industrial and Specialty Chemicals

1959
D-27 on Electrical Insulating Liquids and Gases

1959
C-24 on Building Seals and Sealants

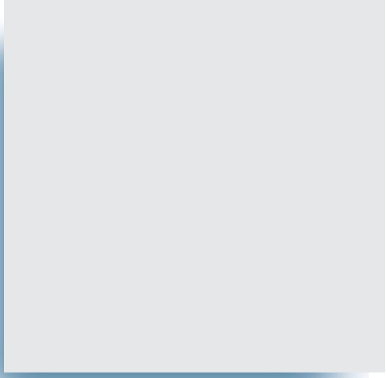
1960
E-17 on Vehicle-Pavement Systems

1960
E-18 on Sensory Evaluation of Materials and Products

which kept a keen eye on plant security. Committee D-2 on Petroleum Products and Lubricants, for example, developed ES-45, an emergency standard for testing olefins and naphthenes in aviation fuel, early during the war, but it was not printed in ASTM's *Book of Standards*. Like many wartime developments, ES-45 proved a major improvement over previous standards and found widespread acceptance in the industry once the government lifted security restrictions.

ASTM IN THE POSTWAR ECONOMY

The relationship between ASTM, the federal government, and private industry remained vital throughout the postwar era, most obviously in defense procurement. Federal spending on conventional weaponry decreased significantly during the postwar years, partly because immediate military threats had ended with Japan's surrender in August 1945, and partly because the Truman administration relied on the nation's monopoly on nuclear weapons to deter long-term threats. But this trend reversed when Soviet expansionism into Eastern Europe and Russia's acquisition of a nuclear arsenal triggered the Cold War, leading to the largest peacetime military buildup in world history.



A

B

ASTM standards played a major role in this effort. Building on positive experiences in voluntary consensus standards development during World War II, the Pentagon began to depend more on major technical societies to provide the bulk of standards used in defense procurement. Congress supported this practice with the passage of the Defense Standardization Act of 1952, which mandated the simplification of military specifications and standards, and strongly encouraged the Army, Navy, and Air Force to use established specifications developed by ASTM and other organizations. As a result, government defense specifications contained extensive references to ASTM standards. For example, 60 percent of the test methods described in a military specification of the early 1950s covering lubricants and liquid fuels were virtually identical with ASTM standards and contained extensive references to the organization's *Book of Standards*. Recognizing the outstanding work of veteran technical committees such as D-20, D-11, and B-4, the Department of Defense adopted ASTM standards for plastics, rubber, and electrical resistance *in toto* to

C

A. B.F. Goodrich tests bomber equipment — Behind sights of a 50-calibre machine gun, a marksman riddles sections of new bullet-sealing synthetic rubber hose developed to replace heavy metal fuel feed systems on combat planes providing added fuel capacity.

B. A number of ASTM standards, including those addressing building codes and construction materials, played major roles in the explosive postwar growth of American cities and suburbs.

C. 1916 Race Street as it looked in 1945, when the Society bought its own headquarters building on Philadelphia's Parkway at Logan Square.

A

replace military specs and standards.

But defense standards develop-ment remained a two-way street. Government defense laboratories, equipped with the latest research tools, produced high-performance test methods that were later adopted by ASTM. During the postwar era, a Navy research laboratory that operated X-ray testing equipment developed reference radiographs for the inspection of aluminum and magnesium castings. ASTM adopted this method and published it as standard E 98-53 T in its 1955 *Book of Standards* as a recommended practice. This made the results of defense-related research conducted by government scientists available to private inspection laboratories, foundries, and civilian consumers of high-end castings such as jetliner manufacturers.

ASTM was aware that the fit between defense and civilian standards was not always as seamless as in the example just described. More often than not, technical committees had to develop separate standards for a given material to meet the sharply divergent needs of the armed forces and commercial users. Aircraft engine manufacturers that switched from propeller to jet turbine technology during the late 1940s and early 1950s soon realized that commercial jetliners required vastly different fuel specifications than fighter jets. Military fuel standards, primarily designed for combat operations, anticipated a large variety of emergency situations and rarely considered cost issues. The latter was of course a key variable in commercial applications. A representative of the commercial aircraft industry therefore urged ASTM that "the objective must be a fuel specification which will be adequate and insure consistent power and safety and yet at the same time will not unduly limit the supply or cause too high a cost." Close familiarity with the divergent needs of military and commercial end users was critical to successful fuel standards development in technical committees.

In the civilian sector, one of the most important developments that transformed American culture and society during the postwar years was the explosive growth of suburbs, another area in which ASTM standards played a key role. Building contractors and architects, applying mass-production techniques to home construction on a massive scale to build suburban complexes in eastern metropolitan regions, Southern California, and the Southern states, developed a keen interest in material standards for construction materials. ASTM had been active in developing these standards for decades.

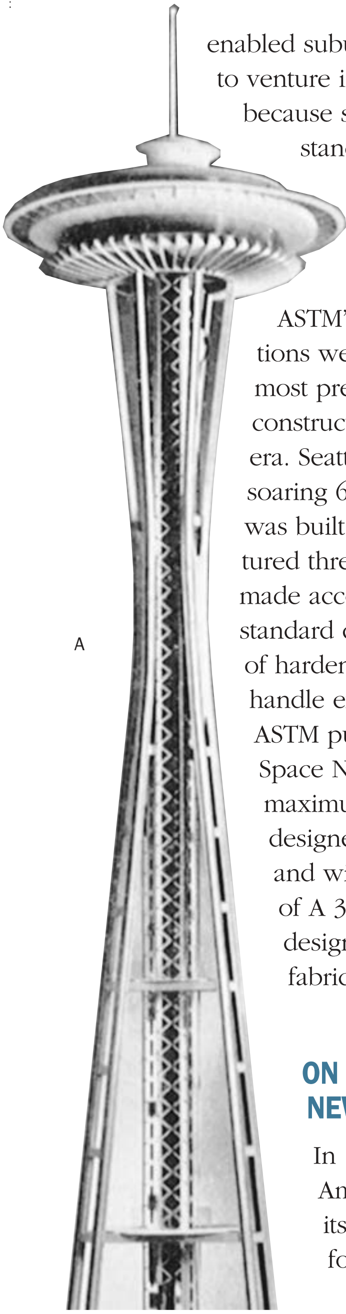
B

The need for standards was particularly pressing in the South, where construction standards were poor or nonexistent prior to the 1950s. In that decade, a rapidly growing number of municipalities adopted the Southern Standard Building Code, which used ASTM standards throughout. This particularly

A. Meeting of Division III on Elemental Analysis of Committee D-2 on Petroleum Products and Lubricants in June 1949, 45 years after the formation of D-2.

B. As automobile travel increased dramatically in the 1950s and 1960s, ASTM standards were used in building new highway systems linking the growing suburbs with urban centers.

1963	1964	1964	1964	1964	1965
C-5 on Manufactured Carbon and Graphite Products	A-4 on Iron Castings	D-30 on Composite Materials	G-1 on Corrosion of Metals	G-2 on Wear and Erosion	G-3 on Weathering and Durability



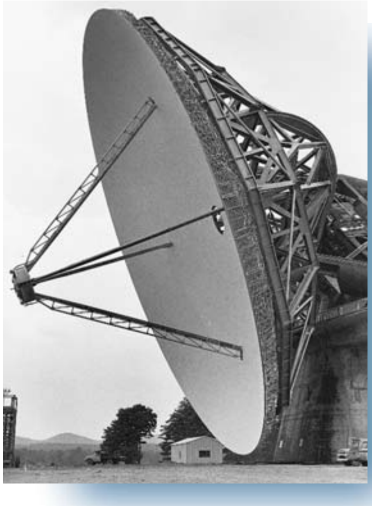
A

enabled suburban developers in the South to venture into mass-produced housing because suppliers quickly standardized materials according to ASTM standard specifications for bricks, cement, gypsum, and lime.

ASTM's structural steel specifications were applied in some of the most prestigious and demanding construction projects of the postwar era. Seattle's Space Needle, a soaring 600-foot steel tower that was built for the 1962 World's Fair, featured three sets of tapered steel legs made according to Standard A 36. The standard described a new type of hardened carbon steel that could handle extreme design stresses. An ASTM publication reported that the Space Needle had "less than 3-inch maximum sway at the top; it is designed for heavy seismic loads and wind gusts. The greater strength of A 36 steel permitted higher design stresses, welded fabrication, and cost savings."

ON THE THRESHOLD OF A NEW ERA

In 1961, sixty years after the American Section had turned itself into the American Society for Testing Materials, the organization renamed itself once again and became the American Society for Testing **and** Materials. The conjugation emphasized that ASTM was devoted to the development of standard material specifications, not only standard test methods. Fortunately, the name change that reflected this broadening of activities over five decades did not require a new acronym, enabling ASTM to use its old and widely-recognized logo.



B

C

A. The great strength of A 36 steel permitted higher design stresses, welded fabrication, and cost savings in Seattle's Space Needle.

B. In 1961, ASTM's magazine reported on the use of ASTM standards to specify the more than two million pounds of aluminum in this radio telescope, considered the world's most accurate.

C. ASTM Race Street headquarters, 1964.

1965	1965	1966	1967	1968	1969
B-10 on Reactive and Refractory Metals and Alloys	**E-24 on Fracture Testing**	**F-5 on Business Imaging Products**	**E-27 on Hazard Potential of Chemicals**	**F-6 on Resilient Floor Coverings**	**F-7 on Aerospace and Aircraft**

Internally, the Society had evolved from a handful of technical committees devoted to steel and cement standards into a fairly complex organization comprised of a management structure and more than 80 committees involved in a wide range of activities. After decades of sharing office space with other technical societies, ASTM finally moved into its own newly-built headquarters at 1916 Race Street, Philadelphia, in 1964. The building accommodated the organization's staff that supported technical committees, edited the annual Book of Standards and ASTM's member publications, organized meetings and symposia, and performed a variety of administrative functions.

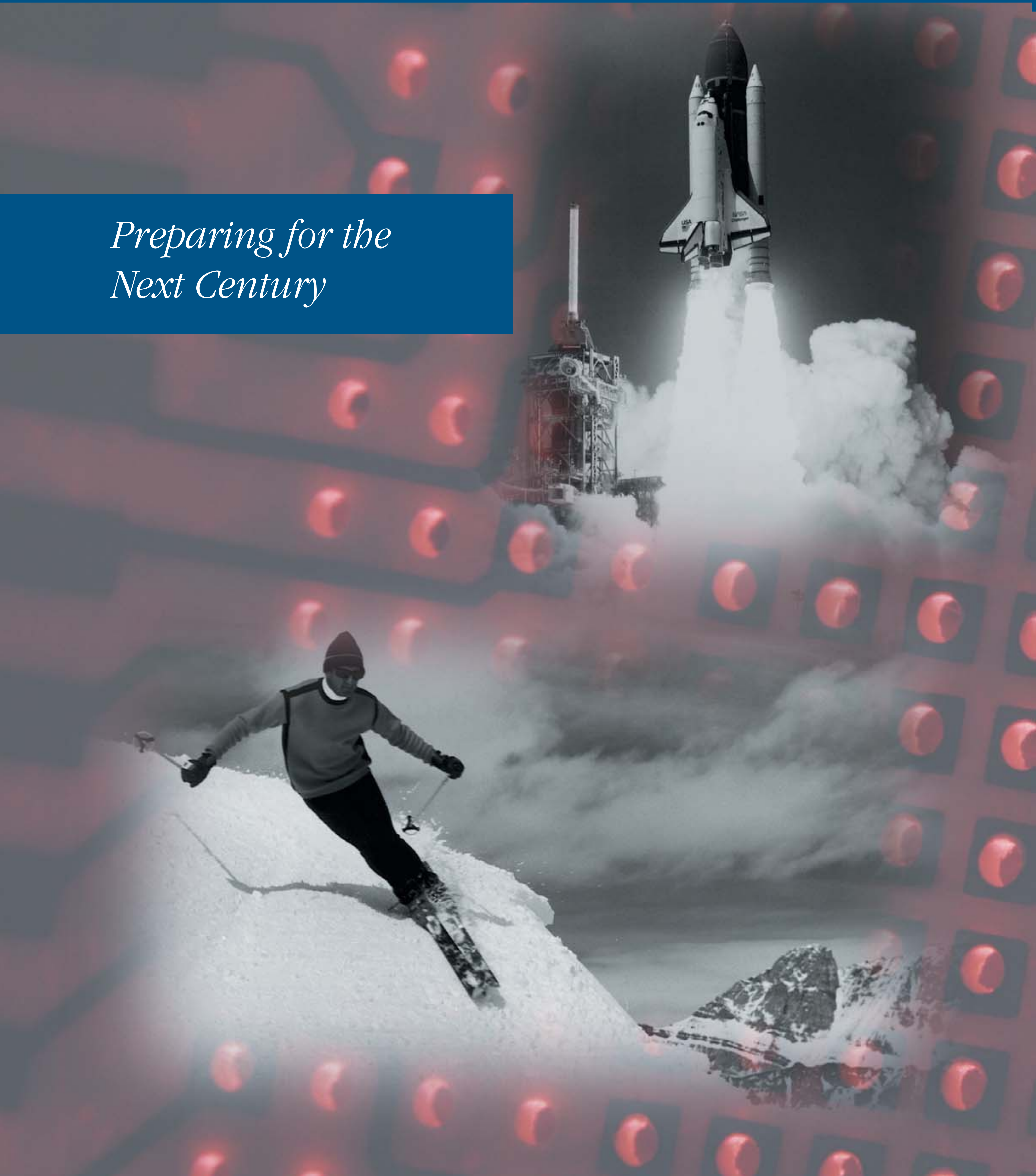
ASTM, which did much to facilitate the phenomenal success of American industry during the postwar era, also shared some of the problems plaguing the nation's businesses during the late 1960s. Not unlike many American corporations, it suffered from a lack of management expertise and accumulated considerable debts. These problems called for a strategic reconfiguration of the organization, a task that fell to William T. Cavanaugh, ASTM's "second founder."

A

A. On May 11, 1964, members and guests gathered from Europe, Canada, the United States, and Mexico to participate in the dedication ceremony of ASTM's new headquarters building at 1916 Race St. in Philadelphia.

“The Genius

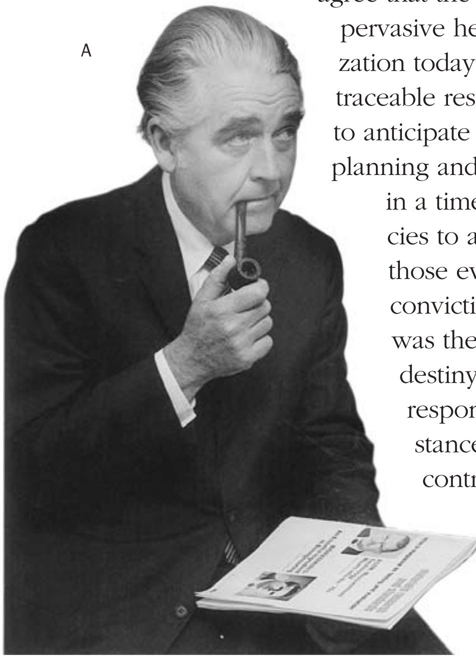
Preparing for the Next Century



A NEW DEPARTURE

William Cavanaugh, reflecting on the transformation of ASTM during his tenure as executive director, told members in 1985 that “those intimately familiar with the affairs of ASTM for the past 14 years or so would agree that the obvious and pervasive health of the organization today is the direct and traceable result of its ability to anticipate events through planning and to set in motion, in a timely fashion, policies to accommodate those events.” The firm conviction that ASTM was the master of its own destiny, not a passive respondent to circumstances beyond its control, was the essence of Cavanaugh’s philosophy. It enabled the organization to meet the extraordinary challenges of the 1970s and laid the groundwork for major new departures during subsequent decades.

A



Unlike previous ASTM leaders, Cavanaugh was not an engineer but a management expert who had been appointed executive director-secretary of the Administrative Management Society in 1959, a position he held until 1966. During his tenure, he gained close familiarity with some of the major problems that were beginning to plague American business during those years, notably its unwillingness to adapt its managerial structures and strategies to a much more volatile and competitive world economy. Earlier than most management professionals, Cavanaugh was convinced that any organization’s chance for future success hinged on its ability to streamline its administrative apparatus, develop its core competencies, and deploy its expertise in promising new areas.

B

When Cavanaugh joined ASTM as director of Field Operations in 1967, its technical committees were overburdened with administrative functions. This called for a new departure to maintain ASTM’s viability in standards development. The Board of Directors took two critical steps in this direction: First, it formulated a strategic plan titled “ASTM in the Seventies,” and second, it appointed Cavanaugh Managing Director in 1970.

“ASTM in the Seventies” was primarily a blueprint for financial consolidation but also reconfigured the organization’s mission and identity. It assessed revenue streams and concluded that ASTM needed a new membership structure and better marketing strategies for its income-generating products, notably the *Book of Standards*. Most administrative functions were to be performed by the staff, enabling committee members to concentrate on technical standards work. These and other measures initiated ASTM’s transformation from a traditional engineers’ society

A. William T. Cavanaugh, who came to ASTM in 1967, as director of field operations, was made managing director in 1970. He left a legacy of fiscal strength, management development, and a Society open and responsive to all interests.

B. Cavanaugh addresses members and visitors at ASTM headquarters. His vision guided the Society for 15 years.

1969	1969	1969	1969	1970
F-8 on Sports Equipment and Facilities	E-28 on Mechanical Testing	C-26 on Nuclear Fuel Cycle	E-29 on Particle and Spray Characterization	E-30 on Forensic Sciences

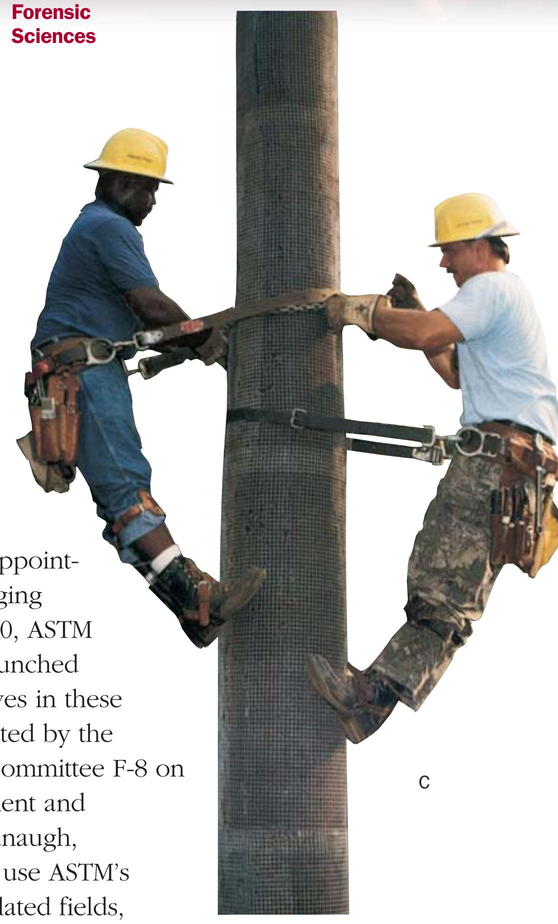
A

into a non-profit enterprise dedicated to modern business principles, including process efficiency, responsiveness to changing market conditions, and financial viability.

Cavanaugh played an important role in formulating and implementing "ASTM in the Seventies." The first item on his agenda as managing director was internal restructuring. Characteristically, Cavanaugh focused on strategic goals and gave staff members wide latitude in implementing the new departure. "The days of passive staff are over; this is a performance staff," he declared. To measure staff performance, department heads introduced short-range and long-range fiscal projections, production goals, and other managerial systems borrowed from the corporate sector.

NEW PARTNERSHIPS

Externally, ASTM reached far beyond its mainstay in industrial standards and entered rapidly-growing markets for consumer products and environmental standards. Prior to Cavanaugh's appointment as managing director in 1970, ASTM had already launched several initiatives in these areas, highlighted by the formation of Committee F-8 on Sports Equipment and Facilities. Cavanaugh, determined to use ASTM's expertise in related fields, provided strategic guidance for these activities. In one of the most important programmatic statements of his career, he declared, "The genius of ASTM—meaning the consensus approach to standards—is applicable to a broad range of problems that are only very generally related to our traditional area of activity." This call for deploying the consensus principle in cutting-edge fields precipitated the formation of new technical committees, including F-15 on Consumer Products, E-34 on Occupational Health and Safety, F-13 on Safety and Traction for Footwear, and F-20 on Hazardous Substances and Oil Spill Response, to name only a few.



C

B

As in previous decades, ASTM's initiatives were closely related to seismic shifts in American society. The 1950s had marked the beginning of the modern

A. "ASTM in the Seventies" is reviewed by (from left) L.S. Crane (president 1969-1970), T.A. Marshall (executive secretary 1960-1969 and managing director 1969-1970) and H.N. Bogart (president 1968-1969).

B. In 1972, dozens of ski industry representatives — skiers, equipment manufacturers and academicians — formed Subcommittee F08.14 on Skiing within Committee F-8 on Sports Equipment and Facilities. In 1982, Committee F-27 on Snow Skiing was established as an outgrowth of F08.14.

C. Standards that protect electric utility line workers are one example of the cooperation between OSHA, the utility industry, and ASTM.

1970	1971	1971	1972	1972	1972
E-31 on Healthcare Informatics	**D-31 on Leather**	**F-9 on Tires**	**F-11 on Vacuum Cleaners**	**C-27 on Precast Concrete Products**	**E-33 on Environmental Acoustics**

consumer age, when millions of middle-class families bought automatic washing machines, electric dryers, home freezers, television sets, and a large variety of other consumer items. American consumer-goods industries remained the undisputed leaders in this sector for close to two decades, but the steadily-growing availability of Japanese and European imports revealed problems with the quality of some American-made products. This trend coincided with the social activism of the late 1960s, which precipitated the rise of a grass-roots consumer rights movement. Activists challenged manufacturers to tackle prevailing product quality and safety problems in cooperation with consumers, but also complained about their inability to match industry's power and influence in the standards development process. This formed the backdrop to the passage of the Consumer Products Safety Act in 1972, establishing a federal commission with the power to promulgate consumer product standards.

A

B

At about the time that ASTM was enjoying a new partnership with consumer advocacy groups, a new regulatory storm gathered on the horizon. The mid 1970s saw a rash of legislation aimed at federalizing the American standards development system—a formidable threat to the voluntary standards system that had prevailed since the early 20th century.

In response, ASTM launched a spirited defense of the voluntary system at several Congressional hearings in Washington, D. C., declaring that the organization's consensus-building process, which had evolved through decades of committee work on industrial products, was a viable alternative to government-issued standards for consumer products. Responding to critics who charged that the voluntary system benefited major corporations at the expense of other interests, Cavanaugh argued, "We cannot agree that the present standardization process poses grave economic hardships for small business. … There are many small business concerns involved in ASTM. In recognition of this fact, we have done everything possible to keep the cost of participation in the ASTM process at a minimum."

C

Furthermore, Cavanaugh was committed to ensuring fair consumer participation in technical committee work. "We must make sure that

A. ASTM standards were used to test a wide variety of consumer goods, ranging from materials used in refrigerators to vacuum cleaners.

B. In the 1970s, CPSC labs conducted toy chest lid tests for an ASTM standard to assure that toy chest lids would not accidentally fall and cause injury to children. Photo credit: Consumer Product Safety Commission.

C. From wall panels to children's sleepwear, ASTM standards have made major contributions towards forwarding fire safety for the public. Photo credit: Southwest Research Institute.

1972 — **E-34 on Occupational Health and Safety**

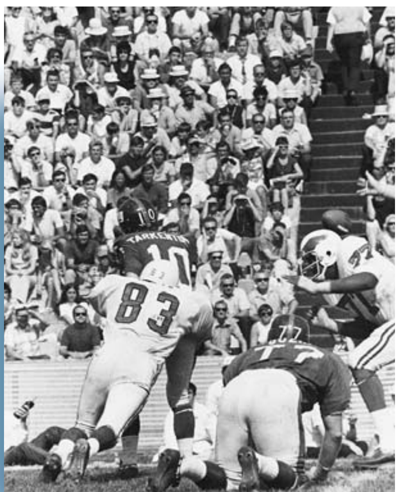
1972 — **F-12 on Security Systems and Equipment**

1973 — **E-35 on Pesticides**

1973 — **E-36 on Conformity Assessment**

1973 — **E-37 on Thermal Measurements**

1973 — **F-13 on Safety and Traction for Footwear**



A

there is no aspect of ASTM structure that can be interpreted as excluding any qualified person from participating in the consensus process of ASTM," he urged. "This is the reason we have left our door open by creating the affiliate membership. It is also the reason that we have gone so far as to suspend any meeting registration fees that ASTM has had." In addition to opening up the formal consensus-building process to consumers, ASTM established a Consumer Participation Fund to finance the participation of consumer rights groups, representatives of homemaker organizations, and others that were heretofore not involved in technical committee work.

ASTM soon accumulated an outstanding record in consumer products standards. Committee F-8 on Sports Equipment and Facilities, a pioneer in this field, issued its first standard test method for football helmets in 1971, followed by a steady stream of new initiatives involving footwear, ice hockey equipment, playing surfaces and facilities, and headgear. The committee also developed F 1446, Test Method for Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear. Established ASTM committees also contributed to the quest for consumer standards. D-13 on Textile Materials initiated a major activity on the flammability of children's sleepwear in 1971, when it organized a collaborative study involving sixteen research laboratories.

B

Organized consumer activism started to wane in the late 1970s, but its effects remain evident. ASTM established mechanisms such as the Consumer Sounding Board, by which consumers could provide input into the technical requirements of standards. The resurgence of the nation's consumer-good industry during the 1990s was partly a result of major improvements in product quality and safety that enhanced the competitiveness of U. S. manufacturers in global competition.

C

The environment was yet another area where ASTM established a major presence during the 1970s. As in consumer products, social activism and government intervention were important factors. Rachel Carson's *Silent Spring*, a penetrating analysis of pesticides such as DDT in the food chain published in 1962, helped trigger the modern environmental movement, whose participants were particularly concerned about air and

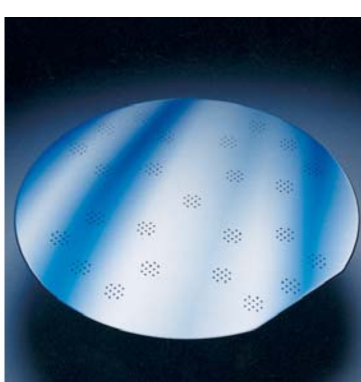
A. Standards for protective headgear for football cover shock attenuation characteristics and shock absorption requirements.

B. More than 250 producer, consumer, government and general interest representatives established ASTM Committee E-35 on Pesticides in 1973.

C. ASTM standards have played an important role in addressing modern-day environmental concerns such as clean air and water. *Photo credit: ETC Houston/Wood Allen Photography*

1973	1973	1973	1974	1974	1974
F-14 on Fences	**F-15 on Consumer Products**	**F-17 on Plastic Piping Systems**	**F-16 on Fasteners**	**F-18 on Electrical Protective Equipment for Workers**	**E-41 on Laboratory Apparatus**

water quality. Federal initiatives soon followed, including the passage of the Clean Air Act of 1970 that set standards for automobile emissions. Older ASTM committees, such as D-18 on Soil and Rock and D-19 on Water, that started to work on environmental standards during this era, developed strong relationships with the Environmental Protection Agency. EPA, which was formed in 1970, used ASTM standards for electrical generating plants, petroleum tests, and water as a basis for its own standards. Furthermore, industries with interests in environmental protection solicited the assistance of ASTM, leading to the formation of new technical committees such as F-20 on Hazardous Substances and Oil Spill Response and E-35 on Pesticides.



ASTM also responded to the establishment of the Occupational Safety and Health Administration (OSHA) in 1972. Reacting to OSHA's request that the nation's engineering and scientific communities participate in the development of federal workplace standards, ASTM convened a conference of interested parties in October 1972. The immediate result was the formation of Committee E-34, Occupational Health and Safety Aspects of Materials, Physical and Biological Agents, and its seven major subcommittees. Committee E-34 worked on such diverse subjects as storage, transportation, and disposal of hazardous agents, occupational exposure standards, medical examinations and first-aid treatment, protective equipment, and control.

Standards development for industrial materials and testing remained ASTM's largest field of activity. Some of the most significant work was done by Committee F-1 on Electronics, which focused increasingly on semiconductor technology. Building on the development of solid-state amplifiers by the Bell Telephone Laboratories in the 1950s, the semiconductor industry quickly became a major growth sector in the American and Japanese economies. Committee F-1 supplied IBM and other major manufacturers with widely-adopted standards for silicone, a material that required precise quality control techniques at the molecular level. The Committee reached a milestone with the Specification for Monocrystalline Silicon Surfaces (F 515) that enabled producers to assess material

A. Initiatives toward improved safety for the worker resulted in the establishment of the Occupational Safety and Health Administration (OSHA) in 1972 as well as the formation of Committee D-34 on Occupational Health and Safety that same year.

B. Constantly pushing the limit of manufacturing technology, semiconductor processes rely on the standards of Committee F-1 on Electronics to advance the state-of-the-art of the industry.

C. ASTM standards such as those for sampling airborne contamination have aided NASA and the aerospace industry.

1975
G-4 on Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres

1975
D-32 on Catalysts

1975
F-20 on Hazardous Substances and Oil Spill Response

1976
F-21 on Filtration

1976
E-42 on Surface Analysis

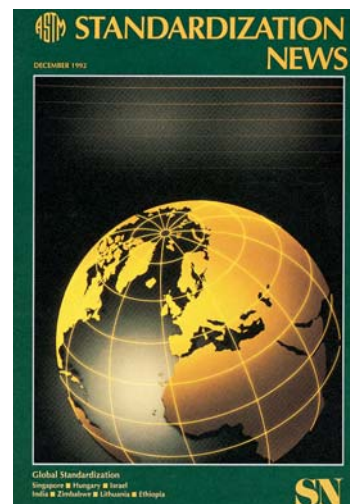
1977
E-43 on SI Practice

A

characteristics such as flatness, finish, and tolerances. Advances in semiconductor technology had been hampered by manufacturers' reluctance to share proprietary information in this highly lucrative field with competitors. A Bell Telephone Laboratory researcher who specialized in integrated circuit bonding, related: The committee "has been the only place where people concerned with this field could come and really feel free to discuss their problems." These discussions paved the way for the "third industrial revolution" that transformed the world economy at the end of the 20th century.

ASTM IN THE GLOBAL ECONOMY

The rise of the "new economic world order" of the 1980s and 1990s that transformed modern standards development was an extraordinarily complex process. Economically, it was triggered by the rebirth of Japanese and Western European industry from the ashes of World War II, and by the formation of so-called "tiger economies" on the Pacific Rim during the 1970s. Technologically, globalization fed on new communication systems that allowed instant access to and exchange of information across continents. Politically, the lowering of tariff barriers in North America and Western Europe created vast new markets in which global producers competed head-on. The buzzwords of the new, interdependent world economy were cost efficiency, customer orientation, and the ability to respond quickly to changes in the global marketplace.



B

Globalization compelled ASTM and its international counterparts to cooperate across national boundaries. In the postwar era, American voluntary standards had reigned supreme because U.S. industries had still enjoyed undisputed leadership in world markets. The International Organization for Standardization (ISO), for example, had frequently used ASTM standards as platforms for international standards in key areas such as steel, petroleum, and industrial chemicals. The end of American industrial supremacy and the rise of a multipolar world economy turned international standards development into a two-way street as American standards users paid more attention to the specific needs of emerging markets. ASTM facilitated this trend by continuing to encourage international participation in technical

C

A. In 1991, ASTM published the first Chinese-language edition of its magazine.

B. National and regional standards systems around the globe are covered in ASTM's monthly magazine, Standardization News.

C. ASTM's European Office houses meeting rooms, storage areas and mailing facilities.

1977	1978	1978	1978	1979	1979
F-23 on Protective Clothing	**F-24 on Amusement Rides and Devices**	**F-25 on Shipbuilding**	**E-44 on Solar, Geothermal, and Other Alternative Energy Sources**	**D-33 on Protective Coating and Lining Work for Power Generation Facilities**	**F-26 on Food Service Equipment**

committee work, and by establishing an overseas office in London. It also forged close ties with major foreign standards organizations such as Germany's Deutsches Institut für Normung (DIN), France's Association Francaise de Normalisation (AFNOR), the Japanese Standards Association (JSA), and the British Standards Institution (BSI).

A

International cooperation led to increased awareness of the fact that incompatible standards and certification became trade barriers in the new global economy. In a 1990 editorial in ASTM's magazine, then-ASTM President Joseph G. O'Grady (ASTM president 1985-1992) commented that "for the free flow of trade, equivalent standards, test data, and certification procedures must be mutually accepted and reciprocal. Where this reciprocity is lacking, American refrigerators and baseball bats sit on foreign docks, devoid of that magic local approval mark—soaking up sunshine and billions of dollars." Incompatibility was evident in measurement standards, reflecting America's reluctance to switch from the English measurement system to the metric system. Absent official action, ASTM continued its long-standing practice of using both English and metric measurements in all its specifications, thus helping to break down trade barriers that could exclude products in the global market.

B

Although these and other traditions enabled ASTM to master the transition into the new global economy, structural changes were necessary to meet the needs of standards users in an increasingly competitive environment. Responding to industry concerns about the relatively slow pace of standards development during the 1980s, ASTM introduced more restrictive timelines that helped technical committees stay focused on deliverables. To further accelerate the standards development process, ASTM formed the Institute for Standards Research (ISR) in 1988. ISR was primarily designed for accelerated standards research programs that exceeded the capacities of the traditional committee management system. Based on a committee proposal for a given activity, ISR developed a plan to fund the required research, contacted potential sponsors, selected appropriate research organizations, and provided continuous support during the research phase. Major activities that evolved along these lines included a unified classification scheme for advanced ceramics and projects on fire standards, degradable polymers, clothing sizing, and a wetlands standards program.

ASTM also initiated new standards-related programs to provide additional products and services to its members and customers, beginning in 1985 with the development of ASTM's Technical and Professional

A. In 1993, ASTM published for the first time a dual-language international newsletter, Standards International, *in Spanish and English.*

B. The merits of ASTM's open process of standards development, in which participation is not nation–specific, are evidenced by the wide acceptance and use of ASTM documents around the world.

1980
D-34 on Waste Management

1980
E-47 on Biological Effects and Environmental Fate

1982
F-27 on Snow Skiing

1983
F-29 on Anesthetic and Respiratory Equipment

A

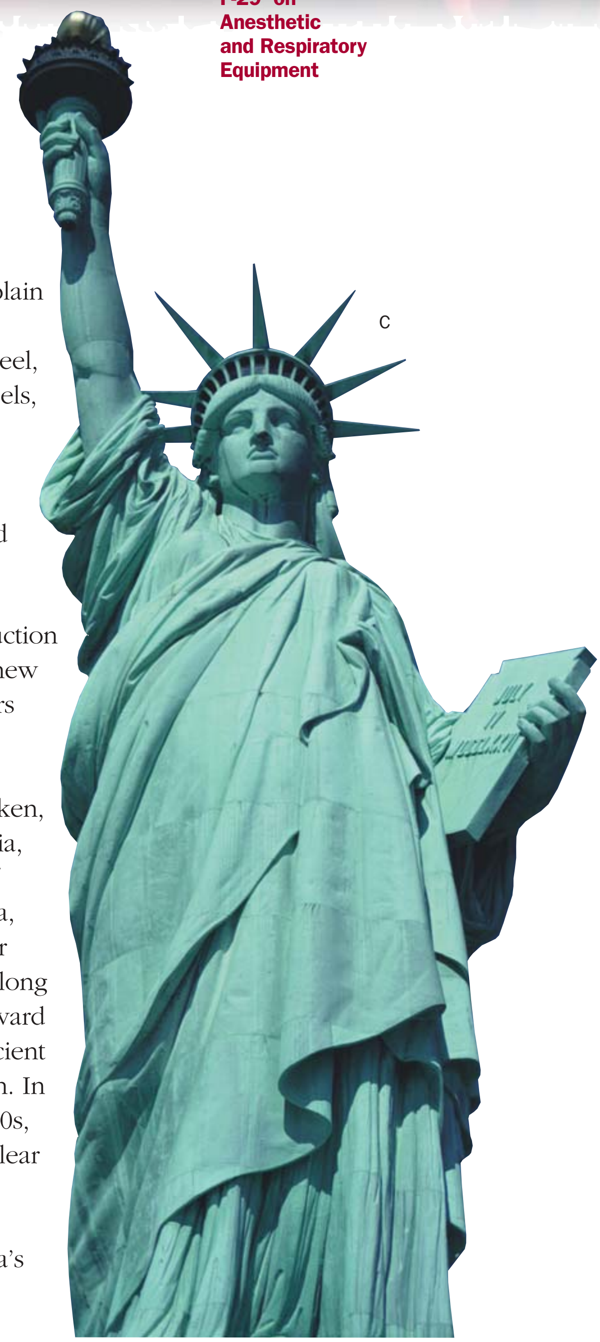

Training Courses. These courses provide continuing education in the performance and use of ASTM and other standards in areas such as petroleum, plastics, paint, steel, environmental subjects and many other areas.

In 1993, ASTM expanded its services to include a new program on Proficiency Testing. ASTM's Proficiency Testing Program provides participating laboratories with a statistical quality assurance tool, enabling laboratories to compare their performance in conducting test methods within their laboratories and against other laboratories worldwide. Programs have been launched

B


in metals (plain carbon and low-alloy steel, stainless steels, and gold in bullion), petroleum, plastics, and more.

The construction of ASTM's new headquarters building in West Conshohocken, Pennsylvania, a suburb of Philadelphia, was another milestone along the way toward a more efficient organization. In the late 1980s, it became clear that the old quarters on Philadelphia's Race Street could not accommodate state-of-the-art office technology that facilitated information management in a modern organization. “We simply exceeded the life cycle of the Race Street building,” a senior staff member later recalled. “The tune-up required to create a more operable environment in that structure would have been cost-prohibitive.”

C


A. In 1991, nearly 8,000 women across the country age 55 and older, were interviewed and measured using the Ultra Fit body suit as part of an ASTM Institute for Standards Research clothing sizing project. The goal of the project was to improve sizing and labeling by the ready-to-wear garment industry for the growing market of women age 55 and older.

B. Participants can tour laboratories and see demonstrations of the course material during many Technical and Professional Training courses, including this session on Aviation Fuels at Philadelphia International Airport.

C. A century of exposure in New York Harbor caused corrosion deterioration to the Statue of Liberty, necessitating its 1986 restoration, for which ASTM corrosion standards were used.

1984	1984	1985	1986	1986
F-30 on Emergency Medical Services	**D-35 on Geosynthetics**	**E-48 on Biotechnology**	**E-49 on Computerized Systems and Chemical and Material Information**	**C-28 on Advanced Ceramics**

The new building, which was completed in 1995, provided ultra-modern conference facilities for technical committees, ample work space for headquarters staff, and prepared ASTM to meet the challenges of the 21st century. "The new Headquarters building," a board member commented, was "a tangible indication of ASTM's movement toward the future and its responsiveness to the changing environment of standards development."

A

B

A. Instantaneous world-wide access to ASTM information was made available in 1995 when ASTM launched its web site. Later enhancements to the home page have included interactive standards development forums, which allow task group members to comment on draft standards via the World Wide Web.

B. Completed in 1995, ASTM's new headquarters building in West Conshohocken, Pa., was designed to facilitate the Society in meeting the modern-day needs of its members and customers.

1987	1988	1989	1990
F-31 on Health Care Services and Equipment	F-32 on Search and Rescue	F-33 on Detention and Correctional Facilities	E-50 on Environmental Assessment

ASTM President, James A. Thomas, reflects on ASTM's successful past and the Society's next one hundred years.

How are the principles upon which ASTM was founded relevant today?

From its inception, ASTM has emphasized the value and necessity of bringing together buyers and sellers to define issues and work cooperatively to improve product and material performance and overall quality of life. In 1898, the principles of openness, due process, balance of interests, and consensus established the basic foundation on which ASTM has matured and grown over its first 100 years. The ASTM member of 1998 relies on these same principles and the integrity of a proven process to produce standards of recognized technical excellence that have worldwide acceptance and use. We will continue to refine our process to achieve faster results in response to a significantly different social, political, and economic climate — but at the same time we will guard against compromising the principles on which we were founded.

The next 100 years will offer new challenges. What will guide ASTM in the 21st century?

ASTM is a bottom-up organization that relies on and benefits from the guidance and leadership of its technical committee members. The ASTM system of standards development is flexible and dynamic and has demonstrated its ability to expand and change to meet constantly changing needs and expectations. ASTM committees are a true reflection of the marketplace and are uniquely positioned to respond to the new technological and competitive challenges of a global economy.

How will advances in technology impact ASTM's development and delivery of standards?

The pressure to properly use advances in technology to improve efficiency, timeliness, and cost effective-ness has never been greater on ASTM. We are responding by introducing new ways of conducting committee business between meetings by using the power of the World Wide Web. Our web-based Interactive Standards Development Forums will make it possible for members and other interested parties

1990	1993	1994	1995
E-1 on Analytical Chemistry for Metals, Ores, and Related Materials	E-8 on Fatigue and Fracture	E-51 on Environmental Risk Management	E-2 on Terminology

from around the world to contribute to the development of standards that will influence the future of their industries. Modifications of our balloting process, to remove redundancies and streamline administrative procedures through use of new technology, has significantly reduced the standards development cycle time in response to the demands of our constituency. Our efforts to accelerate the standards-development process without compromising our basic principles are constant and on-going.

Information delivery has evolved rapidly due to the impact of technological advances on both suppliers and users of all forms of data. ASTM's challenge is to meet the needs of its members and customers for information delivery in multiple forms. The business climate and the demands of an evolving membership base make it imperative for ASTM to make the transition to improved electronic delivery as quickly as possible. We have already seen major advances in ASTM due to the positive application of new technology but we have much more to accomplish.

What effect has the new global economy had on ASTM?

From its beginning ASTM has been open to the direct participation of technical experts from around the world. ASTM was one of the first truly global systems for arriving at consensus on technical issues. The Society certainly benefited from the strength of the U.S. economy, which helped drive the application and use of many ASTM standards. However, the technological and economic center today is shared by the U.S. and other global partners. This change to a global economy fits the basic policy framework of ASTM. The ability of representatives from around the world to directly and materially influence the content of ASTM standards contributes to their continued acceptance on a worldwide basis. Our challenge is to find new ways to facilitate even greater direct participation of global stakeholders in our proven partnership.

As you consider ASTM's second century, what is your vision for maintaining the Society's pre-eminent position in standards development?

ASTM's founders developed a formula for success that has proven itself repeatedly for 100 years. My job is to support, strengthen and reinforce a process that brings together technical experts representing industry, government, academia, and the general public to work cooperatively to promulgate standards that contribute to improved material and product performance and enhancements to the quality of life. Our future is secure if we stay committed to the development of high-quality, technically credible standards.

The membership base of ASTM, supported by a competent and dedicated staff, is our greatest asset. Relevant standardization projects accomplished in a timely, cost-effective manner is everyone's goal. The opportunities facing ASTM are significant and will provide many challenges for the effective blending of technological and human resources. The times ahead certainly will be exciting.

James A. Thomas was appointed ASTM president in 1992. He has devoted his entire career to ASTM, where he has served in various positions since 1972. His professional focus has been concentrated on association management and the issues facing voluntary standardization.

100 YEARS

A PROVEN PARTNERSHIP

Mission Statement:

To be the foremost developer and provider of voluntary consensus standards, related technical information, and services having internationally recognized quality and applicability that

- *promote public health and safety, and the overall quality of life;*
- *contribute to the reliability of materials, products, systems and services; and*
- *facilitate national, regional and international commerce.*

ASTM International Headquarters
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
USA
Phone: 610-832-9500
FAX: 610-832-9555
e-mail: service@astm.org
Web site: www.astm.org

Washington Office
1828 L Street, NW
Suite 906
Washington, DC 20036
Phone: 202-835-0200
FAX: 610-834-7089

European Office
27-29 Knowl Piece
Wilbury Way
Hitchen, Herts SG4 OSX England
Phone: 1462 437933
FAX: 1462 433678

ASTM

Providing the value, strength, and respect of marketplace consensus