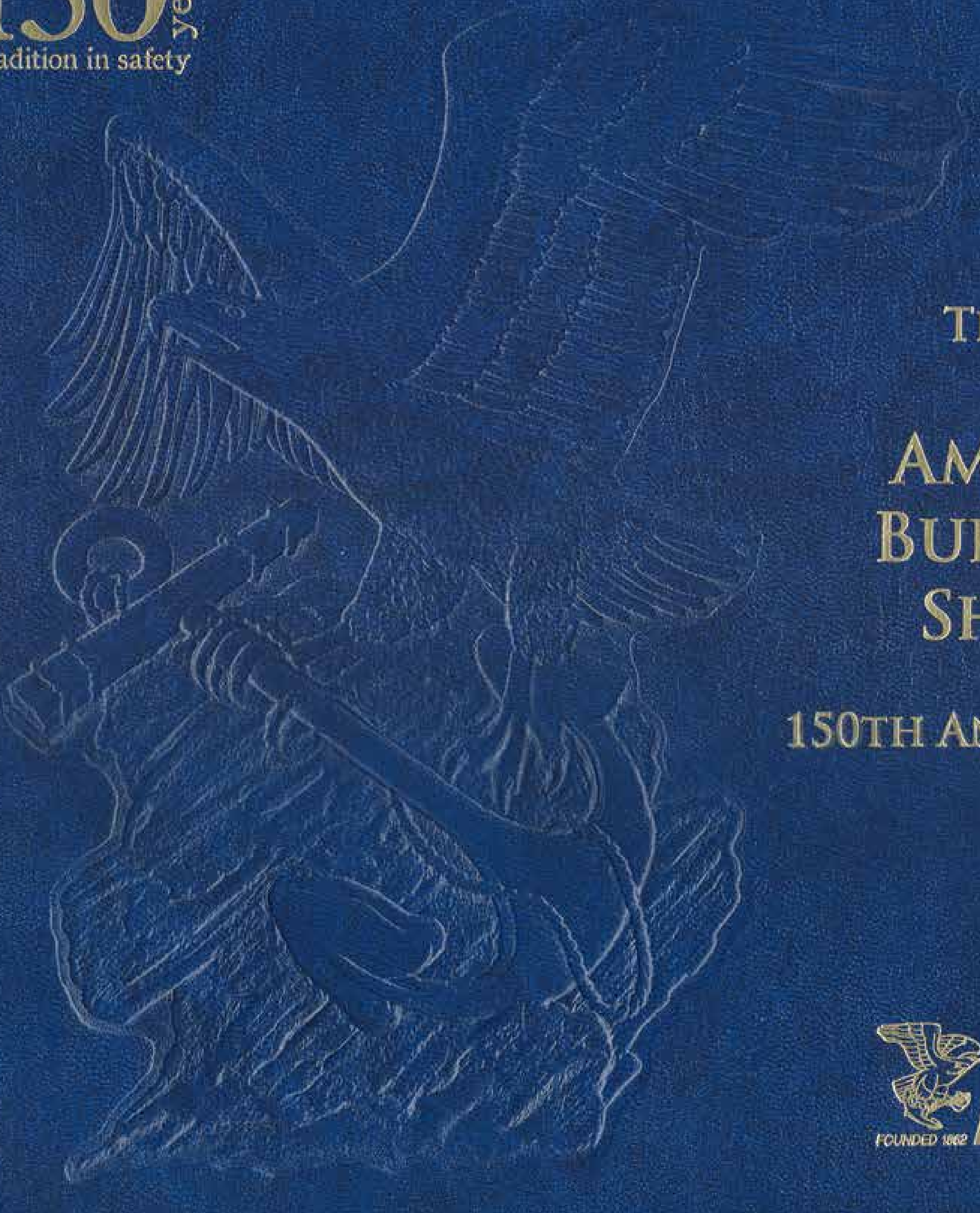
150 years
Tradition in safety



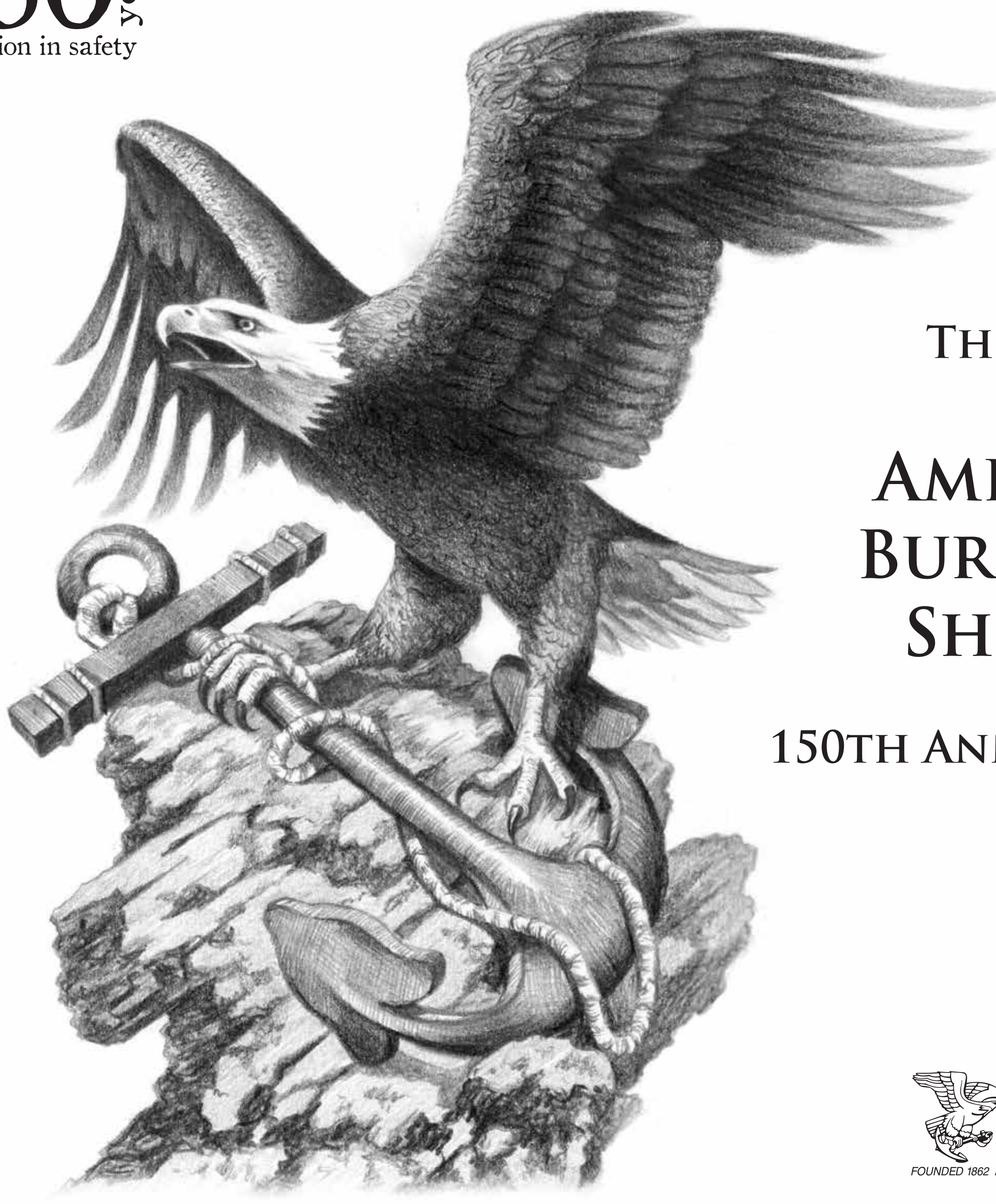
The History of the American Bureau of Shipping

150th Anniversary

ABS
FOUNDED 1862


GREAT · LAKES · REG

150 years
Tradition in safety



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Mission

The mission of ABS is to serve the public interest as well as the needs of our clients by promoting the security of life and property and protecting the natural environment.

Quality & Environmental Policy

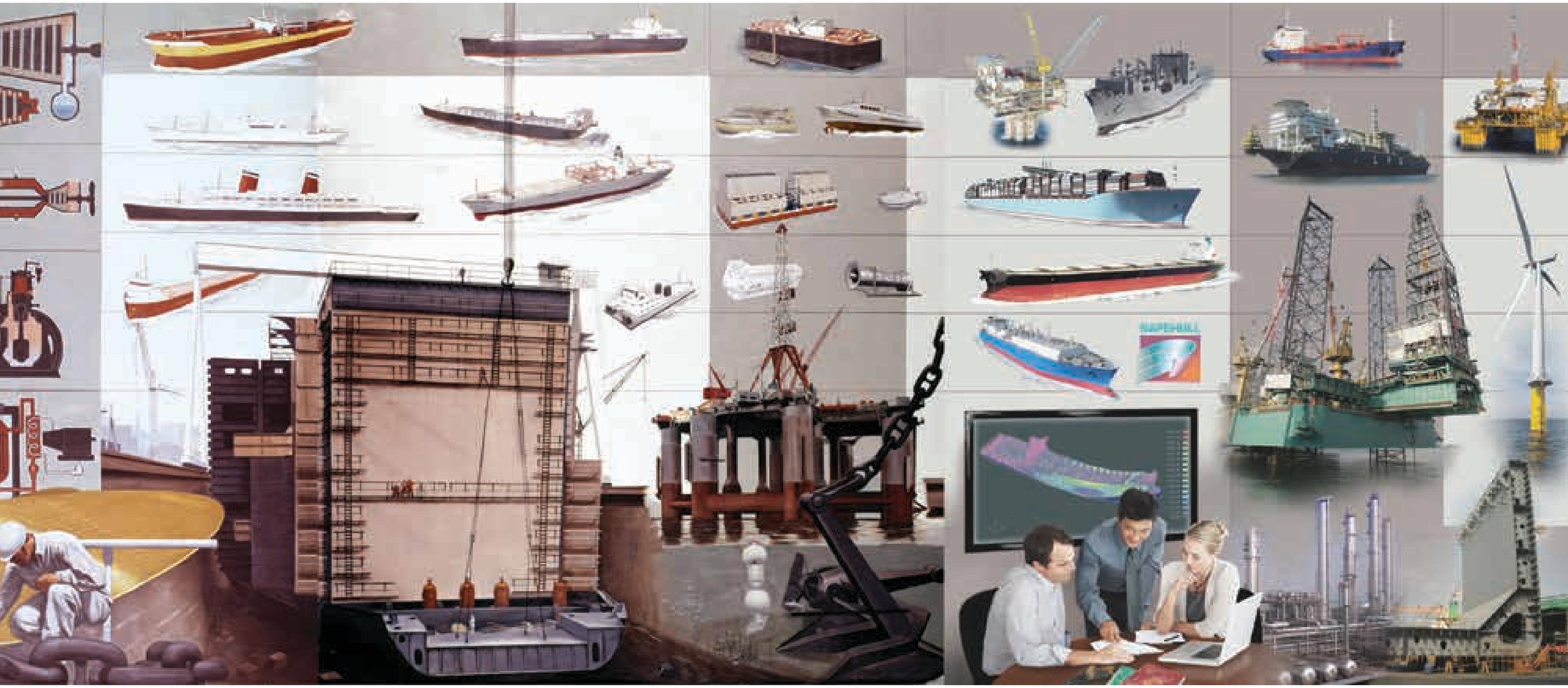
It is the policy of ABS to be responsive to the individual and collective needs of our clients as well as those of the public at large, to provide quality services in support of our mission, and to provide our services consistent with international standards developed to avoid, reduce or control pollution to the environment.

All of our client commitments, supporting actions, and services delivered must be recognized as expressions of quality. We pledge to monitor our performance as an ongoing activity and to strive for continuous improvement.

We commit to operate consistent with applicable environmental legislation and regulations and to provide a framework for establishing and reviewing environmental objectives and targets.

The History of the

American Bureau of Shipping



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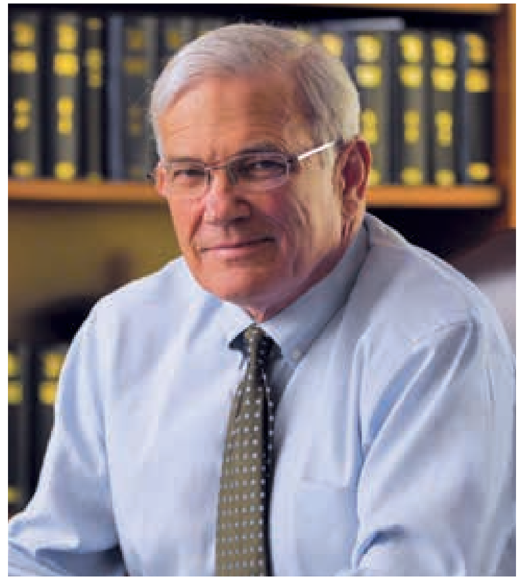
Preface



This book commemorates much more than the passage of time or an important anniversary. Most importantly, it celebrates the countless individuals who, over the past 150 years, have contributed to the success of the organization today known around the world as, simply, ABS. The company began as the American Shipmasters' Association, took the name of the American Bureau of Shipping in 1898 and, throughout the following century, was known by its formal title, its acronym and its nickname, 'the Bureau'. By whatever name, the constant through all that time was the kind of people drawn to its mission, highly skilled men and women with an unwavering commitment to the company's core mission of promoting safety.

The company's original guiding principles, first set down 150 years ago, were fourfold:

- to promote the security of life and property on the seas;
- to provide shipowners, shipbuilders, underwriters and industry with an accurate classification and registry of merchant shipping;
- to disseminate information; and
- to establish qualifications for ships' officers.

The maritime industry has changed greatly over the years, as has the scope of our work, but the commitment to these basic principles has not. It is my hope and expectation that the generations to come will continue to build on our proud past, to guard our reputation for integrity and impartiality and to continue the pursuit of our unique mission in the decades ahead.

Throughout the history of ABS, one of the key elements of our success has been the ability to evolve and adapt to change. ABS participated in the evolution of ship structures from wood to iron to steel to aluminum and carbon fiber. We established standards for the rigging of sails, for steam engines, diesel power plants and gas turbines. We were an essential partner of industry in the transition from riveting to welding and from breakbulk to container shipping. We have been collaborating with the energy sector since it first ventured offshore.

This book recounts the story of how a small American company, founded in the clipper ship era, became one of the world's foremost maritime classification societies, with more than 5,000 employees in 200 offices throughout 70 countries.

As you read the story recorded on these pages, may I ask that you join me in reflecting on the forefathers of our profession and on every person in the ABS family for all they have contributed to bringing the organization to this proud point – those whom we remember, those who have faded into history and those yet to come. This is a book written about the past, but dedicated to the future. The ABS story is one that is 150 years young. It is a story of dedication, commitment, partnerships and people. It is a story that I am personally proud to be part of.

Bob Somerville

Robert D. Somerville, ABS Chairman

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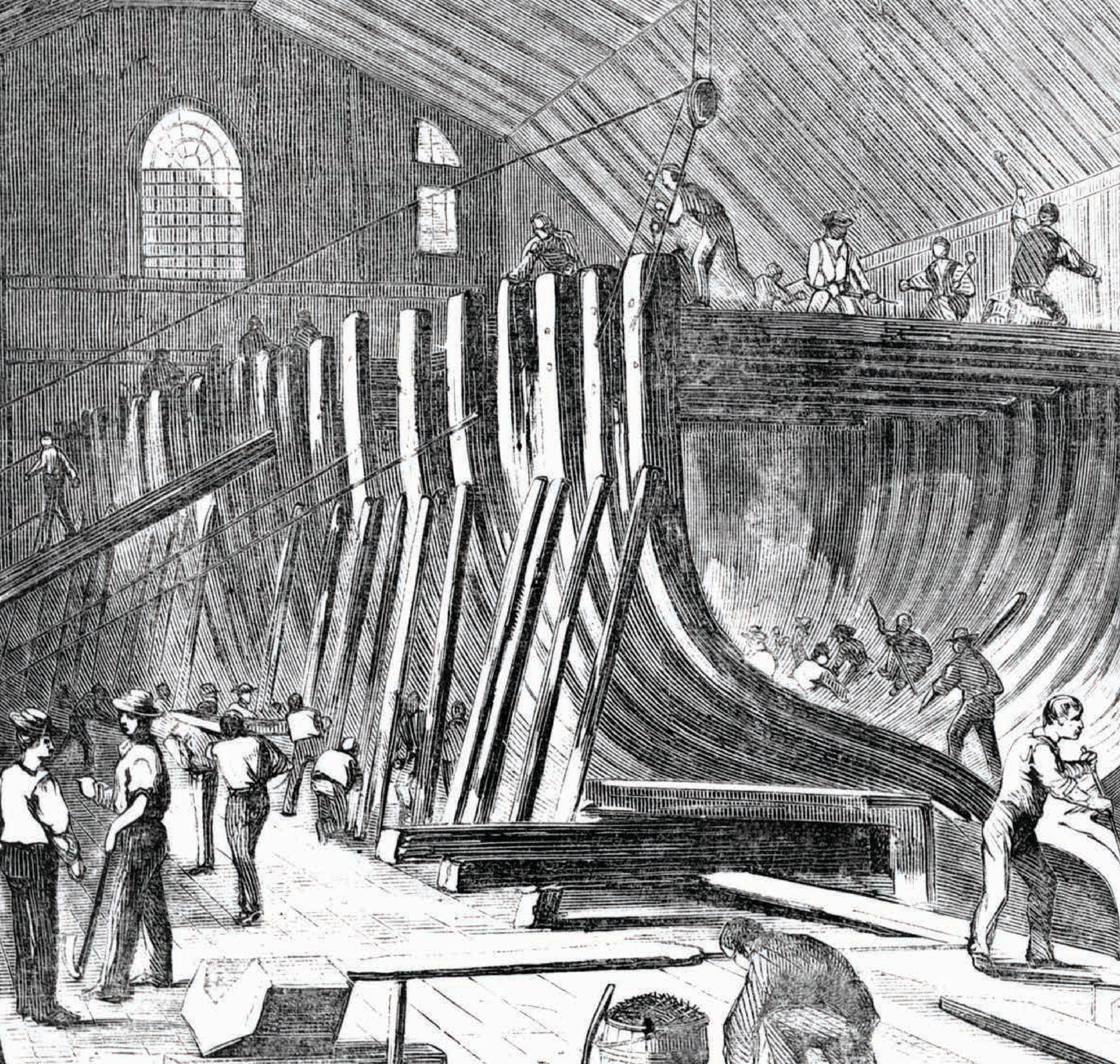


Chapter 1

American Shipmasters' Association

1862 – 1898

In the fall of 1861, a group of prominent figures from America's maritime industry gathered at the Merchants Exchange on Wall Street, just blocks from the New York Stock Exchange. As virtually all of the young country's foreign trade was conducted by ship, this group of marine underwriters, shipbuilders and shipmasters represented some of the leading forces in the national economy. With a war of secession beginning in the South, their meeting had been convened not only to protect the interests of their companies, but also to address serious issues confronting the future of their still developing industry.

The meeting was led by John Divine Jones, President of the Atlantic Mutual Insurance Company – the largest marine underwriter in the nation. Founded in 1838 by his uncle, Walter Restored Jones, the family run company had prospered as America's maritime businesses expanded throughout the 1840s and 1850s. At the start of the American Civil War, the company was the primary insurer of most of the merchant fleet that, in the war's terminology, would be identified as "Union shipping."

Of the group gathered that September day in the Merchants Exchange, Atlantic Mutual was the one with the most to lose in the conflict. Leadership in time of crisis was a familiar role for the company. Just four years before, an Atlantic Mutual-insured vessel, the *SS Central America*, had gone down with millions of dollars of gold aboard, a loss that figured high in the chain of events that brought about the Panic of 1857, an event widely recognized as history's first global financial crisis.

Still suffering the scars of the Panic, Northeastern marine insurers and shipowners now faced new problems. With oceangoing Confederate raiders threatening Union shipping, Jones had called the meeting of colleagues and competitors to discuss the protection of America's merchant fleet and to create an organization that would promote the security of life and property at sea. The proposed organization, the American Shipmasters' Association, began with the modest goal of certifying qualified ship's officers. During the next 150 years it would evolve, expand and transform into one of the world's leading marine classification societies.

Founding of the American Shipmasters' Association

American marine commerce had grown steadily during the eight decades between Independence and the founding of the American Shipmasters' Association. American shipbuilders gained prominence and American vessels carried ever larger volumes of local and foreign trade. In 1817, Congress passed the Navigation Act, allowing only US-flagged ships to participate in coastal trade, thereby excluding foreign-flag vessels and bolstering American waterborne commerce. Even with this advantage, the maritime businesses of the young nation encountered the same basic risks as had confronted seafaring merchants for thousands of years: if a ship arrived safely at port, great profits could be made; if not, all parties to the adventure could face ruin.

Systems of marine insurance, to protect against such losses, had developed long before the discovery of the New World. Marine insurance companies appeared in the United States at the end of the 18th century and quickly became vital to the developing maritime industry. As American merchantmen increased their presence around the world, so did their insurers. This growth of the American merchant fleet was accompanied by a great expansion in the number of American seafarers and, consequently, by an increasing risk that unfit captains might be manning the helm of insured ships.

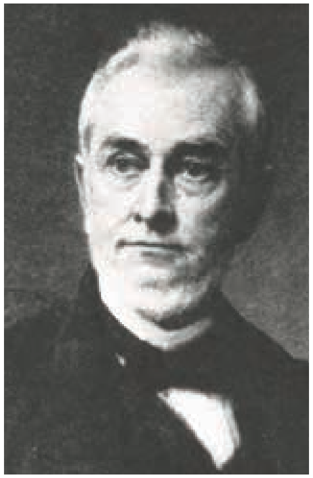
As America's shipping industry grew, so did its maritime accident rate. The general public became increasingly vocal about maritime safety, and Congress responded by passing the Act of 1838 to *"provide better security of the lives of passengers on board of vessels propelled in whole or in part by steam."* Although the safety inspection of merchant shipping was enforced by the Justice Department, the law did not have great effect and, between 1847 and 1852, a number of disasters caused by boiler explosions led to passage of the Steamboat Act of 30 May 1852. Under this law, positions for nine supervisory steamboat inspectors were created working under the US Department of the Treasury, to be responsible for specific geographic regions; it was the beginning of a Federal maritime inspection service.

The most important features of the new law were requirements for hydrostatic testing of boilers and for a boiler steam safety valve. Although this law also required that pilots and engineers be licensed by the local inspectors, there was no mandate for quality certification of the people operating a ship. This law, although an improvement over the earlier one, was also not up to the task set before it and would be replaced by the Act of 1871, which created the Steamboat Inspection Service. That change was still a decade off into the unseen and uncertain future when Jones and his colleagues met in 1861 to take the matter of safe ship operation into their own hands. Of the many uncertainties at sea, ship captain qualification was one factor

John Divine Jones

A Founder: 1862

President: 1862-1871 and 1881-1886



Born in 1814 into a family of prominent New York attorneys and business leaders, John Divine Jones grew up along the shores of Long Island. At a young age he left Cold Spring Harbor for New York and started out as a clerk in the family marine insurance business. Working his way up through the company, Jones eventually succeeded his uncle as President of the Atlantic Mutual Insurance Company in 1855. Among the claims that Jones handled were the loss of the gold-laden SS CENTRAL AMERICA in 1857 and the mysterious case of the MARY CELESTE, discovered intact on the water – with no trace of the crew – in 1872.

Jones was a fixture in New York society, serving in the Chamber of Commerce, the Life Saving Benevolent Association of the City of New York, and the Protestant Episcopal Church Missionary Society for Seaman. As his role in the American Shipmasters' Association attested, Jones was leader not only of his own company, but also of the maritime insurance industry in general. He remained so all of his life. In 1885, a group of New York businessmen met to celebrate and reminisce. A round of toasts included invocations of "The American Navy," "the Judiciary" and "Commerce." At his turn, Jones rose and offered a toast to "Insurance – an Aid to Commerce."

The Merchants Exchange Building at 55 Wall Street, New York City, was the headquarters of the American Shipmasters' Association in 1862.

that the insurers could control, by pushing for greater supervision and regulation of shipmasters.

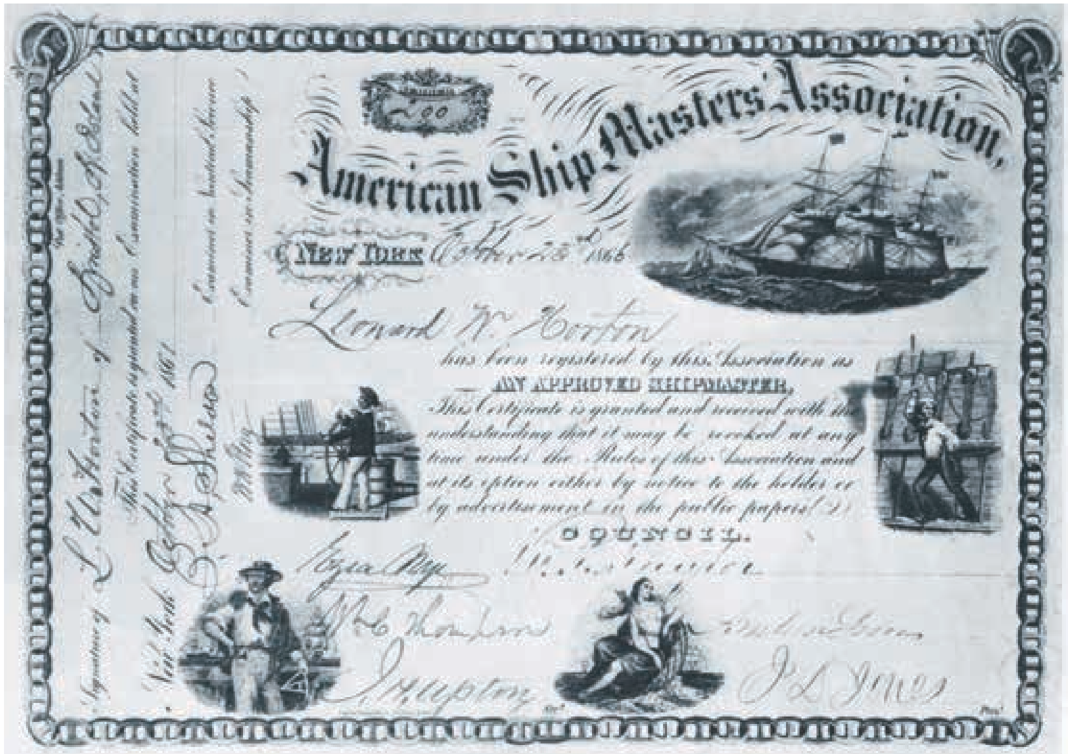
The principal founding members of the American Shipmasters' Association included officials of Sun Mutual, Mercantile Mutual, New York Mutual, Union Mutual, Oriental Mutual, Commercial Mutual, Pacific Mutual and the Anchor Insurance Company; they were joined later in the year by the Columbia Marine Insurance Company. Additional founders included wealthy shipmasters, shipbuilders and others prominent in maritime commerce, such as merchant and US Congressman Moses H. Grinnell and famed Captain Ezra Nye. Each member agreed to contribute $700 to finance the organization and the Association charged no fees during its first two years of existence. The founders outlined their objectives in its Constitution and By-laws which included:

- the collection and dissemination of information upon subjects of marine or commercial interest;
- the encouragement of worthy and well-qualified commanders and other ship's officers, and the keeping of a record of their accomplishments;
- the promoting of security of life and property on the seas;
- the provision to shipowners, shipbuilders, underwriters, shippers and all those interested in maritime commerce, of a faithful and accurate classification and registry of mercantile shipping – all with the primary purpose of helping develop the merchant marine of the United States.

Functions of the Association

On 8 October 1861, the *New York Times* announced the formation of a new Association intending to scrutinize "the moral character and professional capacity of seamen." The Association's authority was immediately recognized and accepted, and scores of ship's officers soon headed to Rooms 89 and 90 of the Merchants Exchange, known as the Shipmasters Rooms, for examination and credentialing.

The certification process developed by the Association allowed for two different grades of commissions or certificates, one of service and the other of competency. Service required the applicant to be at least 21 years of age and have six years of experience at sea. In addition to possessing superior navigation, sailing and management skills,



Shipmasters' certificates were issued for competency and service. In September 1861, the as-yet unincorporated Association received its first application for a Commission of Competency from veteran captain Isaiah Pratt.

The Shipmasters' Association went beyond examining mariners, opening its rooms in the Merchants Exchange to members with newspapers, books and records available to all subscribers willing to pay a $10 fee. The Association began publishing a booklet that listed individuals who had applied for Commissions of Competency, and gave practical suggestions for Masters of vessels and laid out the 'rules of the road' at sea.

To bolster the shipmasters' better natures, the booklet also included "The Seaman's Belief," a credo which the Association suggested be "said daily and acted on always." It concluded with an earnest resolution that "as I hope to sail my ship in safety on the ocean, as I wish to spare the lives of my fellow creatures at sea, and as I wish to go in safety all my days, so will I steadfastly practice that which I believe."

the seaman also had to be in good standing with the shipowner. To receive the Commission of Competency, the applicant must possess all of the required attributes for the Certificate of Service and also must pass a test on nautical science. All certificates were issued by a special association council, comprised of five veteran captains, with Jones presiding. During examinations, the council considered evidence of a captain's abilities and habits and encouraged good character and temperance.

Applications surged after the American Shipmasters' Association received formal incorporation from the New York Legislature on 22 April 1862. In its first year of operation, the Association received a total of 1,488 Commission applications. By the end of 1865, some 4,300 shipmasters had applied and by the end of its fifth year, the Association had become financially self-sufficient through either fees or voluntary contributions.

The founders of the Association sought to encourage not only competence but also a "steady moral character." In this endeavor, the Association joined a host of reform groups bent on eradicating the vice and exploitation ever-present in 19th century 'sailor towns'. One of the most prominent, the American Seamen's Friend Society, lauded the creation of the American Shipmasters' Association and its vow to make officers more trustworthy and cultivate the crew's moral principles.

The Association also undertook the task to help steer the direction of American merchant shipping. Its leaders presented pleas before Congress, consulted with US Presidents and generally sought to represent the industry in the halls of government.

In some cases, Association-certified shipmasters became as well-known and well-regarded as the founders, further bolstering the organization and the importance of its diplomas. During the 39 years that the

Association offered certification, many renowned captains passed through the Merchants Exchange, including William S. Samuels of the *Dreadnaught*, famous after its record-breaking voyage between New York and San Francisco. American novelist F. Marion Crawford earned certificate number 6,804 while famed Captain George A. Dearborn exemplified the label of qualified captain by never losing a single ship during his long and storied career.

The Civil War

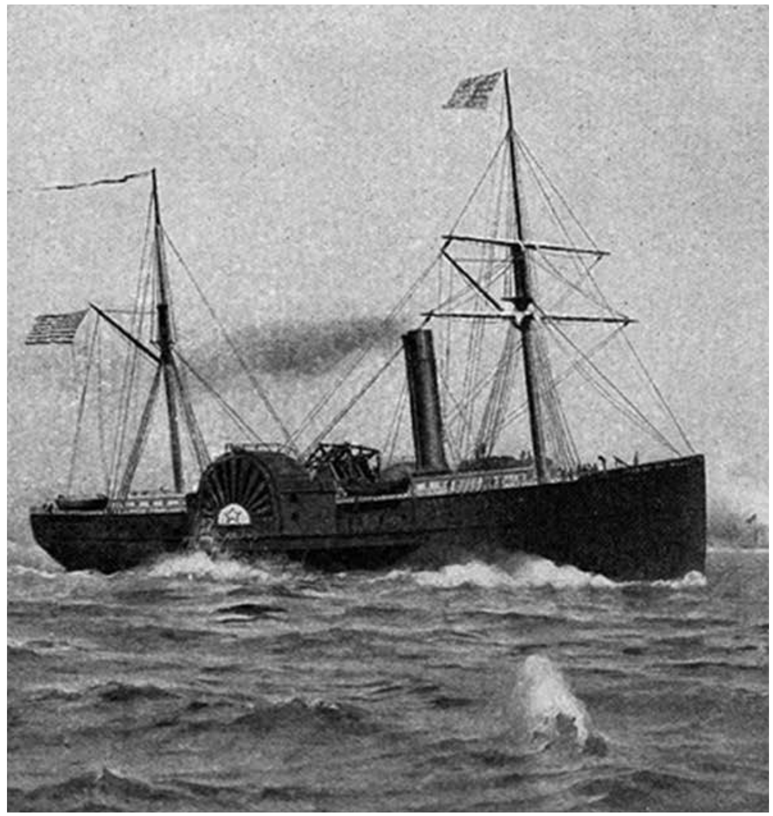
The American Shipmasters' Association issued about 65 percent of all its Masters' certificates during its first five years of operation – not coincidentally, the years of the War Between the States. Before the Civil War, raw cotton from the US South represented nearly 60 percent of America's exports, totaling nearly $200 million a year by 1860. Southern merchants could rightfully boast that "Cotton was King" and the merchant marine thrived on the trade. Cotton merchants controlled nearly half of the fleet and employed over 40,000 seamen in its export alone.

For decades, however, European buyers did most of their business with merchants in New York and Boston rather than in Southern ports. Southern merchants increasingly resented Northern control of their cotton production and tried unsuccessfully to form their own cotton syndicates. This tension just added to the ferment in which the American Shipmasters' Association was formed.

Northern shipping had been endangered even before the war officially started. On 9 January 1861, three months before the shelling of Fort Sumter, rebelling South Carolinian cadets from The Citadel fired on a merchant steamship, the *Star of the West*, as it entered Charleston Harbor to resupply and reinforce Federal defenders there. The cadets hit the vessel three times, forcing it to retreat and return to New York. American unity disintegrated even further as Northern newspapers and maritime leaders condemned the provocation. Although the new Confederacy had no navy and few merchant ships, Southern resolve at Fort Sumter demonstrated its willingness and determination to target Northern shipping as a means of achieving secession from the Union.

At the war's outset, the Confederacy organized a fleet of commerce raiders to strike at Northern merchant shipping. These state-sponsored raiders sailed steamships which were largely built in Great Britain and crewed by British sailors. They cruised in waters as far away as the Pacific Ocean. Although they were greatly outnumbered by the Union Navy, the Confederate raiders managed to slip past Northern blockades and sink scores of defenseless merchant vessels.

Great Britain's powerful Royal Navy also presented a potential threat to US maritime commerce. Although not formally allied with the Confederacy, the British were sympathetic to the Southern cause, due largely to their dependence on Southern cotton to support their textile industry. Great Britain and the US in fact came very close



The STAR OF THE WEST was a civilian steamship hired by the US Government to transport military supplies and reinforcements to the garrison of Fort Sumter. However, it was fired on by Confederates (namely, cadets from The Citadel) in its effort to do so at the dawning of the American Civil War.

A Pact with President Lincoln

The destruction caused by Confederate raiders alarmed the owners of the civilian merchant fleet and its underwriters. On behalf of the Atlantic Mutual Insurance Company, John D. Jones went to Washington, DC to make the case for protecting maritime commerce to US President Abraham Lincoln and Secretary of State William H. Seward. During what were described as "full and frank" meetings, Jones promised to insure federal shipping. In return, Lincoln assured Jones that US Navy cruisers would soon patrol the main commercial waterways and protect the merchant fleet. But with the Navy stretched to capacity, Lincoln's promise amounted to little during the Civil War.

Another, and decidedly secondary, concern that Jones expressed to the President turned out to have far greater consequences. During his meeting with Lincoln, Jones demanded that the US Government file claims against Great Britain which had provided the Confederacy with six of its eight raiders, including the soon-to-be-infamous ALABAMA. Lincoln agreed, and after the war, the United States pressed the Alabama Claims, a landmark case of international arbitration in which the British agreed to pay damages for violating their neutrality.

While the Alabama Claims set an international precedent, Jones' meeting with Lincoln served as a model for the American Bureau of Shipping, whose next generation of leaders would make supporting the nation among their highest priorities.

to war in November 1861 after the US Navy intercepted the Royal Mail Packet Steamer *Trent* and captured two Confederate diplomats aboard, James Mason and John Sliddell. Two months of tense cross-Atlantic negotiations ensued, underscored by the Royal Navy's preparations for launching a sea-based war against the US and its shipping in defense of Britain's national sovereignty and honor. Ultimately, the Lincoln Administration defused the crisis by releasing the Confederate prisoners in late December 1862 without a formal apology. But British antipathy toward the North was stirred, and a naval war between the two countries remained a possibility until at least the end of that year, when President Lincoln's Emancipation Proclamation went into effect.

During a two-year commerce-destroying campaign, the Confederate ship CSS ALABAMA was the scourge of the American merchant fleet. In an hour of intense combat, the ALABAMA was sunk during a battle with the USS KEARSARGE (shown on right) in June 1864.

Confronted by a real naval war with the Confederacy and a potential one with Great Britain, Northern merchants, shipowners and insurers realized the stakes involved in bringing their new organization to life, since a skilled captain had the best chance of evading or outrunning Confederate raiders or British warships. Many of the shipmasters certified by the Association during these years joined the ranks of the Union Navy. Others sailed commercially, but risked encountering Confederate raiders like the *Alabama*, which captured or sank over 60 Union merchant vessels during the course of the war, and the *Shenandoah*, which sank or captured 38 ships, mostly whalers before it surrendered to British authorities on 6 November 1865.

From the Shipmasters Rooms in New York, Association Secretary J.H. Upton kept a list of newly certified captains, as well as a grimmer set of statistics: the record of the lives and cargo lost at sea, which was printed each month in *The Merchant Magazine*. Records indicate that, during the course of the Civil War, the Confederacy managed to capture or destroy 237 Union merchant ships. The loss of shipping totaled 111,000 tons and decimated the US maritime sector, and marine insurance rates skyrocketed accordingly.

Upton's figures also revealed another disturbing statistic. By 1865, shipping was in rapid decline. Real losses to Confederate raiders had been damaging, but the mere fear of these marauders proved even more harmful. Recognizing that Confederate ships did not disturb foreign-flag vessels, shipowners began abandoning the American flag. About 800,000 tons transferred out of the US flag – mainly to the British flag – and short-sighted legislation prevented their return after the war. Before the war, American ships carried nearly 70 percent of US foreign trade, but by 1900 the proportion had plummeted to around 8 percent.

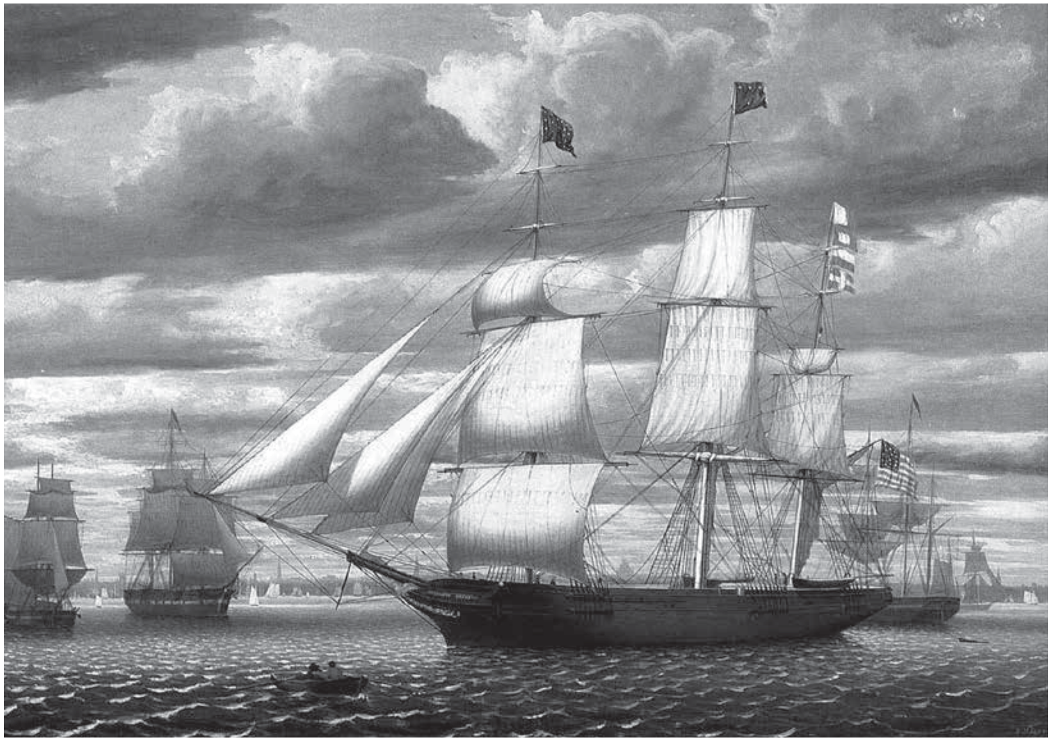
How Wooden Ships Were Rated

In the early years of classification, many surveyors working for the American Shipmasters' Association were retired ship captains who rated wooden vessels according to such items as grades of wood and quality of carpentry. In making their shipyard rounds they would make notes about the ships they saw, regardless of whether the owners had requested formal classification. The Association would then print the rating in the *Record*. Ratings of vessels that were not formally classed were distinguished by being printed in red ink.

These ratings and their period of validity depended primarily on the kinds of materials used in the vessel's construction. The 1878 *Record*, for example, allotted a maximum ten-year duration for a ship's A1 rating if it used live oak, teak, locust and greenheart, and specified that all timber was to be "of best quality, free from sap, shakes or other defects and well-seasoned. Where inferior timber is used, a reduction in time will be made."

To obtain a rating, a ship did not need to have been built under the Association's survey. Once an application for a rating was made, a surveyor carefully examined the ship, made an evaluation and assigned one of six ratings, subject to approval by headquarters. These ratings ranged from A1 to A3 – vessels rated A1 or A1½ were regarded as fit for carrying all cargoes on all voyages; those classed as A1¾ or A2 were deemed fit for cargoes "not sensitive to damage by sea water" on Atlantic voyages and "in exceptional cases" on long voyages; and those classed as A2½ or A3 were fit only for coastal voyages carrying wood or coal.

Vessels built according to the Association's *Rules for Construction of Wooden Vessels*, and under the supervision of an Association surveyor, were assigned a Maltese-style cross in the *Record* and their rating was allotted an additional number of years. The 1882 *Record* discontinued the practice of rating vessels that were not classed, although it still included their particulars. The change was made, it noted, so that non-classed vessels were not assigned ratings "better than they deserved," which would enable them to secure from shippers "a confidence to which they were not entitled."



Focusing on Classification

At the end of the Civil War, the American Shipmasters' Association counted approximately 4,300 names in its register of certified captains. By 1868, more than half of the Masters and officers in the merchant marine held a Commission of Competency and some underwriters refused to even insure a ship unless the vessel's officers held a certification.

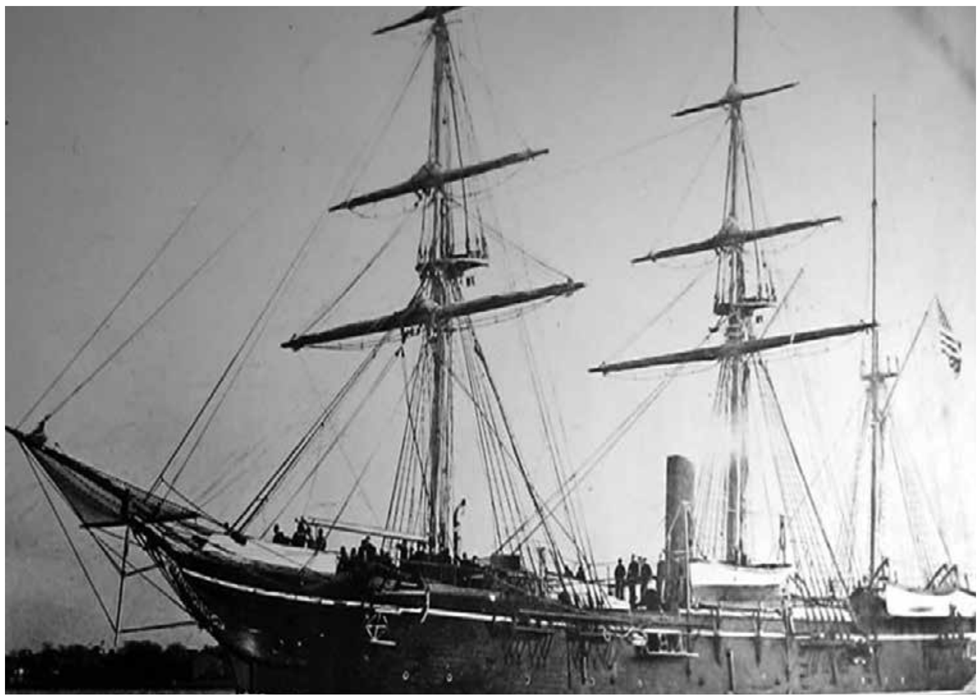
In 1884, the US Government, through the Bureau of Navigation, began certifying ships' personnel. Even though certification fees now accounted for only about a third of the Association's revenue, losing that business without replacing it would threaten the organization's future. Accordingly, the American Shipmasters' Association began developing what, since 1867, had been a secondary activity in its mission of protecting the safety of life and property at sea: ship classification.

Dividing ships into categories based on various indicators of quality was a longstanding, if not always formalized, method of establishing risk. The first classification societies compiled this information for the benefit of underwriters and charterers, but others in the industry quickly discovered its value. Shipowners, for example, were willing to pay a fee for classification because, ideally, they could recoup the expense through lower insurance rates and preferential consideration from their charterers.

Shortly after the US Civil War ended, the American Shipmasters' Association began conducting its own periodic surveys to classify American vessels. The Association's members believed that a new register was needed, in part because it appeared that British classifiers tended to unjustly downgrade American vessels. For Jones and the other founders, classification complemented the activities of the Association and furthered the interests of their insurance company sponsors.

The Association originally implemented a classification system for vessels based on levels of risk – the hull condition was classified as A, E, I, O or U; and equipment was classified as G, M or B, representing 'good', 'middling' or 'bad'. Its surveyors, many of whom were experienced in the insurance business and were veteran captains themselves, visited shipbuilders and shipyards four times a year and reported on construction, repairs and changes in shipmasters and ownership. They recorded the type of rigging and materials employed; the number of decks; the types of deck fastenings; and the number of boilers. The information was then sent back to the Association where the secretary compiled the information.

In 1867, the Association published its first pamphlet entitled the *Record of American and Foreign Shipping*. A bound volume followed in January 1869 containing a list of vessels, their specifications and other facts of interest to underwriters, financial institutions and shippers. The Master's name also appeared in the *Record* with his vessel. An



Launched in 1864, the USS YANTIC was built at the Philadelphia Navy Yard and powered by engines from Merrick and Sons. The life voyage of the YANTIC covered over six decades of maritime and American history including three wars, several skirmishes and an expedition to Greenland.

asterisk placed by his name indicated that he held a Commission with the American Shipmasters' Association.

The American maritime industry welcomed the Association's new venture but its competitors did not. There were two contemporary American classification societies, the Original American Lloyd's Register, organized in 1857, and a splinter group, the American Lloyd's Universal Register. The Original American Lloyd's published a sour-grapes statement critical of the American Shipmasters' Association, calling the *Record* "an unnecessary and mischievous innovation."

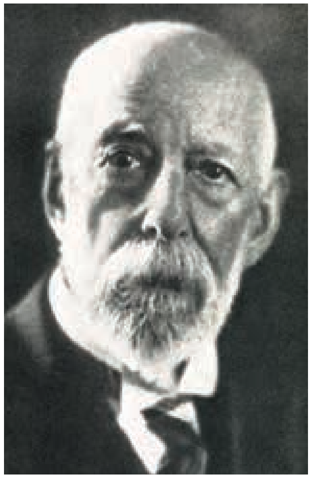
The reaction was understandable, if not quite professional. The Shipmasters' Association heads John D. Jones, Charles Dennis and Ellwood Walter had all once subscribed to American Lloyd's. Soon, the country's leading maritime companies followed the American Shipmasters' Association and on 3 June 1869, the Board of Marine Underwriters recognized the *Record* as the only approved American classification publication with the following resolutions:

> **RESOLVED:** that the *Record of American and Foreign Shipping*, published by the American Shipmasters' Association, is the only American publication of survey and classification of vessels that now has the approval of this Board; and that we recommend it as deserving the confidence of those interested in shipping.
>
> **RESOLVED:** that the Committee of the American Shipmasters' Association be requested to act with that Association in devising means to maintain the merit and extend the usefulness of the work.

The Original American Lloyd's published its last register in 1883 and, in 1884, the American Shipmasters' Association purchased the goodwill and title to the *American Lloyd's Universal Register*, which it incorporated into the *Record*.

Theophylact B. Bleecker, Jr.

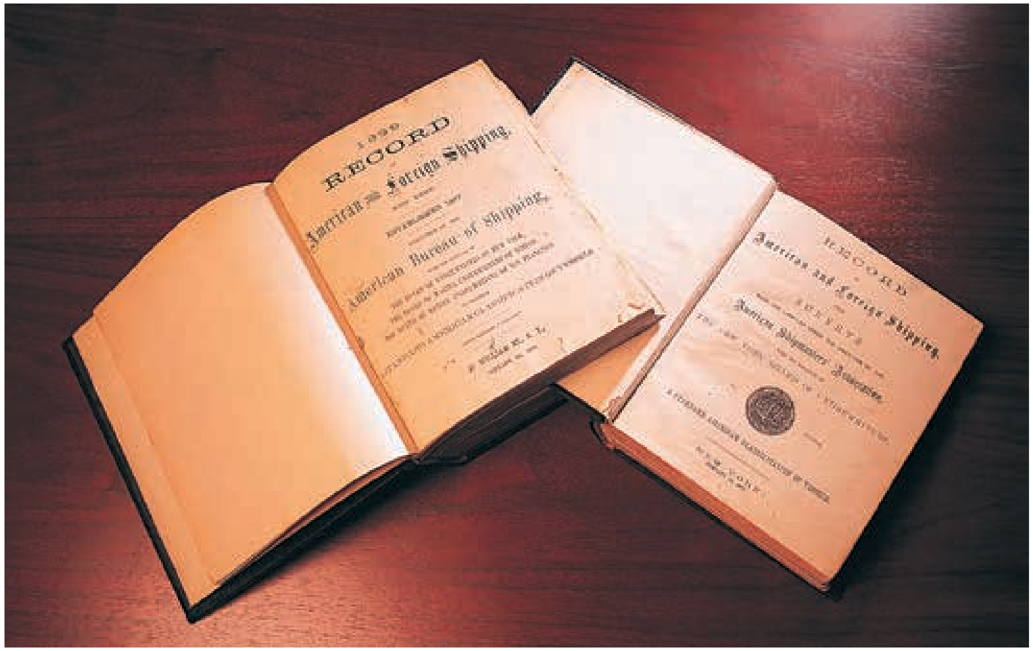
President: 1871-1879 and 1886-1898



Born into an old and prominent New York family, Theophylact B. Bleecker, Jr. was the great grandson of former New York Mayor Leonard Bleecker. His leadership of the American Shipmasters' Association can be attributed to his involvement in the marine insurance business. In the 1860s, Bleecker became President of the New York Mutual Insurance Company, one of the founding members of the Association.

Bleecker had more than insurance in common with John D. Jones. Both were born in Cold Spring Harbor on Long Island's north shore, and both held the office of President of the American Shipmasters' Association, Bleecker taking over the position and then turning it back to Jones on several occasions during the 1870s and 1880s. The second President of the Association appears not to have been quite as dynamic as his predecessor. Indeed, by the end of the century Bleecker was no longer able to compete with foreign insurers and was obliged to shut down New York Mutual. Bleecker's most visible mark was left on the world of sailing, and numerous *New York Times* articles indicate his talent. Bleecker won medals in a number of prestigious yacht races over the years, and later adopted his natural role of leader by serving as a referee.

By the 1880s, Association surveyors could be found in ports on the East, West and Gulf Coasts of America and throughout the world. Representatives as far away as Brazil, Holland and China relayed information to be included in the *Record*. Its readership grew to include the US and Canadian Governments, insurance companies outside of New York and maritime leaders. Classification brought new vitality to the American Shipmasters' Association. Survey work, rating and registering heightened collaboration between the inspectors of various marine insurance underwriters, dockyard workers and the Association. The Association also expanded its involvement with the global maritime industry, helping shipowners, seafarers and their ships adjust to the challenges and promises of rapidly changing technology.



In 1869, the first bound volume of the *Record of American and Foreign Shipping* contained a list of vessels including ship specifications and other facts of interest to underwriters, financial institutions and shippers. The Master's name also appeared alongside the vessel's listing in the *Record*.

Classification and Technology

By the end of the Civil War, American shipbuilders found themselves lagging behind their European competitors. Celebrated shipyards in New York, Maine and Massachusetts struggled to match the quality and quantity of ships emerging from British shipyards, particularly with the new skill of building ships entirely of metal. American wooden ships, once regarded as among the best vessels in the world, were now expensive and obsolete. For shipbuilders, the late 19th century was a catch-up time and the American Shipmasters' Association aided the process, embracing technology from abroad and mastering the technical challenges arising from the rapid evolution of wood to iron to steel.

As part of the 1870 *Record*, the Association published its first set of formal standards for surveying and classification, the *Rules for the Survey and Classing of Wooden Vessels*. Used in a tentative form since 1868, the formalized Rules were probably the last major new technical publication during the era of wood and sail. Wood was superseded by iron as a shipbuilding material. Iron ships were stronger, lighter and easier to maintain than those made of wood. Hulls made of riveted iron plates were more spacious and more flexible than equal-sized hulls made of longitudinal wooden planks, and iron overcame the inherent limitations of the compressive strength of wood. By the 1880s, it was nearly one-sixth cheaper to insure iron vessels than wooden ones.

Great Britain led the way in the metal hull revolution, with Scottish shipyards in particular gaining fame as iron vessel builders. Iron shipyards began appearing in the US and the American Shipmasters' Association responded in 1877 with its first *Rules for the Survey and Classing of Iron Vessels*.

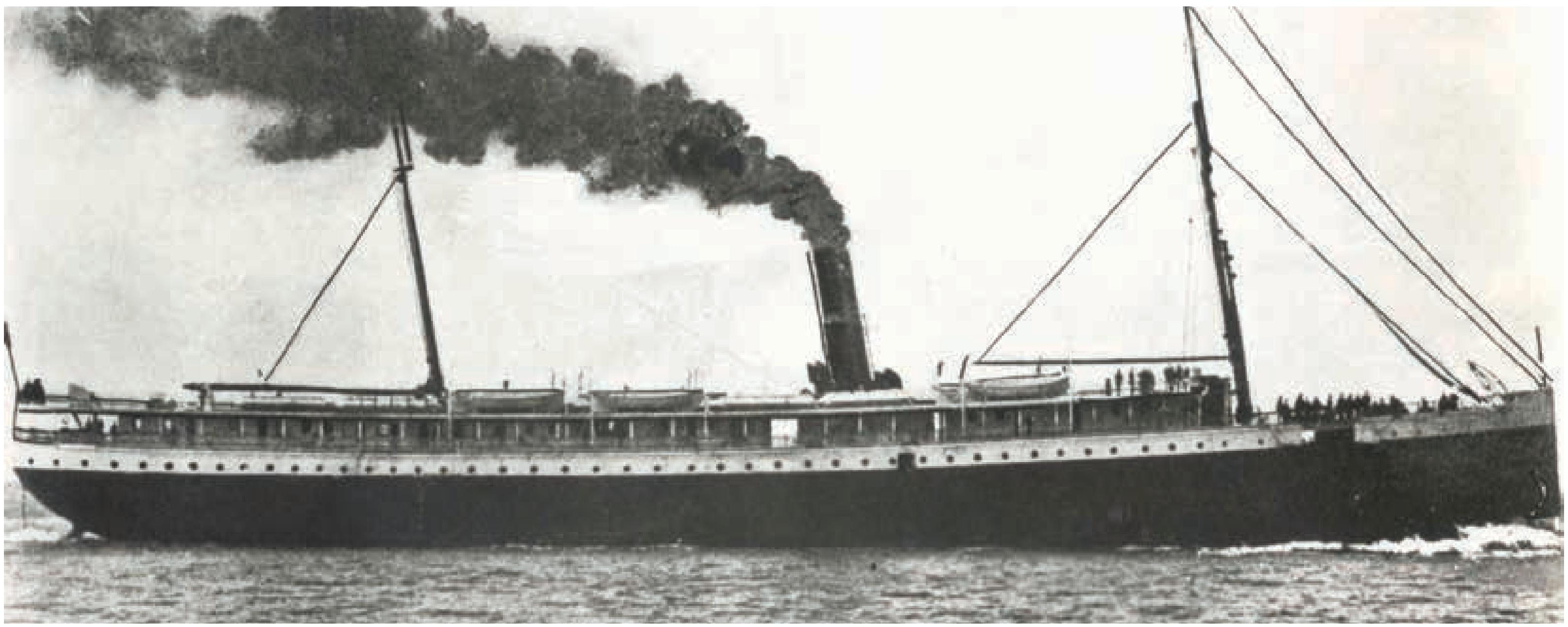
But iron had a relatively short heyday in shipbuilding as another material began to gain prominence. Even as iron gained popularity, steel, previously expensive to produce, became widely available and made for even stronger and lighter vessels. Great Britain's shipyards began producing steel vessels as early as 1863. The US Navy was slow to adopt steel construction after the Civil War, laying down its first steel-hulled warships only in 1883, the cruisers *Atlanta*, *Boston*, *Chicago* and *Dolphin*. The American Shipmasters' Association published its first *Rules for Building and Classing Steel Vessels* in 1890. The Steel Vessels Rules, as they came to be known, have been regularly updated and expanded ever since. What began as a single, slim volume is now, in its print form, a library the size of several telephone directories.

Beyond Structural Concerns

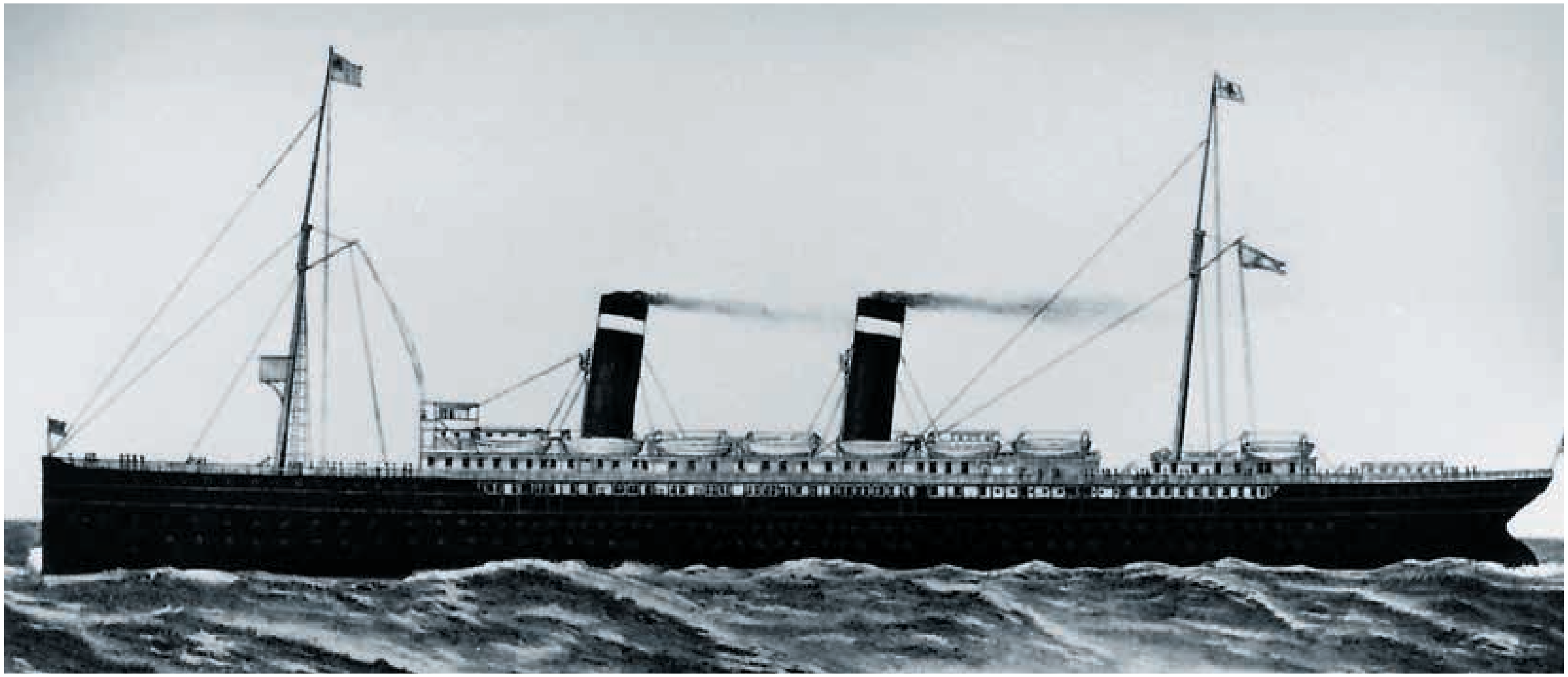
The Association's early decades in classification focused mainly on vessel hulls and structures, but, as the century drew to its close, expanded with the evolution of machinery and shipboard systems. Following this evolution, the Shipmasters' Association published its *Rules for the Construction, Survey and Classification of Machinery and Boilers for Steam* in 1891. That same year it addressed yet another technical change with the *Rules for the Installation of Electric Lighting and Power Apparatus on Shipboard*, which represented the fruits of more than ten years' experience with electric lighting.

The Association began working on marine applications of electrical systems in 1879, during the design and construction of the steamship *Columbia*, which made history as having the first commercial installation of incandescent electric lighting on board. Built for the Oregon Railroad and Navigation Company by Roach & Son of Chester, Pennsylvania and classed under the Association's Rules, the steamship was brought to New York after launching so that its electrical system and lighting could be installed under the supervision of Thomas Edison himself. A report of the time calls it "the first electric plant that was ever put into operation in the hands of strangers." Built in Edison's Menlo Park, New Jersey laboratory, the plant remained in service for more than 15 years without significant repair.

With the success of the *Columbia*, the second electric-lighted vessel, *Queen of the Pacific*, was built in 1882 by Cramp & Sons of Philadelphia for the Pacific Coast Steamship Company, also to Association class. These two vessels proved the viability of shipboard electricity and, soon, other ships started incorporating the new technology.



Delivered in 1880, the steamship COLUMBIA was the first vessel with electric lights. Three generators were installed under the direction of Thomas A. Edison.



Launched in 1894, the SS ST. LOUIS was a transatlantic passenger liner built by William Cramp & Sons Shipbuilding and Engine Company in Philadelphia. It had a length of 554 feet and propulsion machinery supplying 20,000 horsepower.

As the maritime industry began drawing on increasingly complex technologies, the Association drew upon a wider field of experts for advice. The Advisory Council of Engineering and Marine Architects, first convened in December 1892, included practitioners in naval architecture and marine engineering as well as professors from the University of Glasgow and New Jersey's Stevens Institute of Technology.

Drawing upon their collective knowledge, the group weighed in on material specifications, the design and construction of iron and steel vessels, and machinery design, all the while helping to refine the Rules.

The creation of the Advisory Council set the pattern for the formation of subsequent technical committees devoted to particular subject areas. It also marked the point at which the Association and its leaders expanded beyond the underwriters, shipbuilders and shipowners to encompass an entire industry.

By the late 1800s, the American Shipmasters' Association was placing far less emphasis on certifying shipmasters and focusing the majority of its efforts on the integrity of ships. The Association had certified over 4,300 shipmasters during the Civil War, but only about 2,500 more in the three decades afterward. On 26 September 1898, the American Shipmasters' Association adopted a new name, the American Bureau of Shipping.

The stage was set for the newly renamed organization to become something far different, and greater than its founders had dreamed. It would become a technology leader that changed ship design forever. Its reach would stretch around the world and its interests would extend far beyond ships and shipping, but one thing its founders would recognize in the organization of today is that, even after 150 years, the company still embraces the key instructions of the mission they put in its charge: the mission to serve the public interest as well as the needs of clients by promoting the security of life and property and preserving the natural environment. ✠

Chapter 2

New Century, New Mission

1899 – 1920

The American Bureau of Shipping began the new century with a new name, a new sense of identity and some tough new challenges. Certification of shipmasters had been a withering line of business for decades and was now fully replaced by ship classification. Still an important service to industry, it had long ago been subsumed in the wider certification authority given to the US Government's Bureau of Navigation. ABS officially closed the books on this part of its original mission in May 1900, issuing its final Commission of Competency, No. 6,807, to Captain Stanley Amsbury. The organization was now completely committed to ship classification and looked for ways to take its business into the future and its presence across the country – a difficult task, considering the declining state of the US merchant marine and competition from other classification societies.

In 1900, the American Bureau of Shipping could claim to be the dominant ship classification society for vessels insured on the US East Coast, but that wasn't saying much. It had just six full-time staff members: a chief surveyor; a secretary; an engineer and surveyor for steel vessels; a consulting surveyor and chairman of the classification committee; and two surveyors of wooden vessels. The newly elected ABS President Anton A. Raven served only in a part-time capacity, as his predecessors had done. Most of his time was spent as President of the Atlantic Mutual Insurance Company.

Although created and supported by marine underwriters, ABS' ties to the insurance industry were now beginning to pinch. Some accounts from the period indicate that, at one point, the Bureau was seen as so closely associated with Atlantic Mutual that other insurers did not bother to promote it. At one point, some of the marine insurance leaders on the ABS Council decided the organization should seek union with the much larger and older British classification society, Lloyd's Register. New York representatives of the competitor agreed to an arrangement, but their home office rejected the deal. This left the American Bureau of Shipping starting its new life in a dual state of hope and uncertainty. As reported in the industry magazine *Marine Engineering*, for ABS this period was one of "a continual struggle, in the face of declining American shipping activity, for recognition from shipowners and builders."

Expansion and Changes

Despite its struggles, the American Shipmasters' Association had left a legacy of many successes. Its new identity as the American Bureau of Shipping was greeted by *Marine Engineering* as "more of a separate, independent and unbiased technical organization of service to all branches of the shipping world."

The maritime world was becoming more technologically complex and, to develop further, needed the assistance that only unbiased technical organizations could render. In academics, for example, the Society of Naval Architects and Marine Engineers (SNAME) was founded in 1893 to provide a forum where developing technologies and the issues they raised could be discussed; the organization is today a world leader in the dissemination of maritime technical knowledge. For the Bureau, taking on the role of independent, impartial technical authority brought both opportunity and challenge.

Where certification had focused on the crew, classification focused on the vessel. This put the Bureau at the nexus between shipbuilders, shipowners and insurers. Addressing the subject during a SNAME meeting in 1900, ABS Surveyor E. Platt Stratton recognized that the classification society had been regarded "as an obstruction to shipbuilders and shipowners" – and that, before his association with the classification society he had shared that opinion – but added that he "hoped and believed that there was a medium ground on which the society could facilitate the work of owners and builders."

By serving as an unbiased arbiter, the organization could help achieve a balance between safety, efficiency and cost-savings; and to safeguard that impartiality, the Bureau increased its emphasis on its Advisory Council of Engineering and Marine Architects.

Meanwhile, the business had to grow. One area long targeted for expansion was the North American Great Lakes. When the American Shipmasters' Association acquired the title to the *American Lloyd's Universal Register* in 1884, it also acquired some involvement with Great Lakes shipping. It tried to develop this activity with the 1892 publication of *Rules for Steel Lake and River Vessels*. However, Great Lakes-region underwriters, located mainly near the Canadian border in the Buffalo area, sought to keep their distance from the urban New York group by publishing their own register in 1894, the *Lakes Register of the American Inland Lloyd's*. The Shipmasters' Association tried to counter by issuing its own inland vessel register, *Inland Lloyd's*. It was a short-lived venture; the last issue was released in 1907. Another register, first published in 1899 with the support of the Associated Lake Underwriters, more effectively impeded ABS' midwestern ambitions.

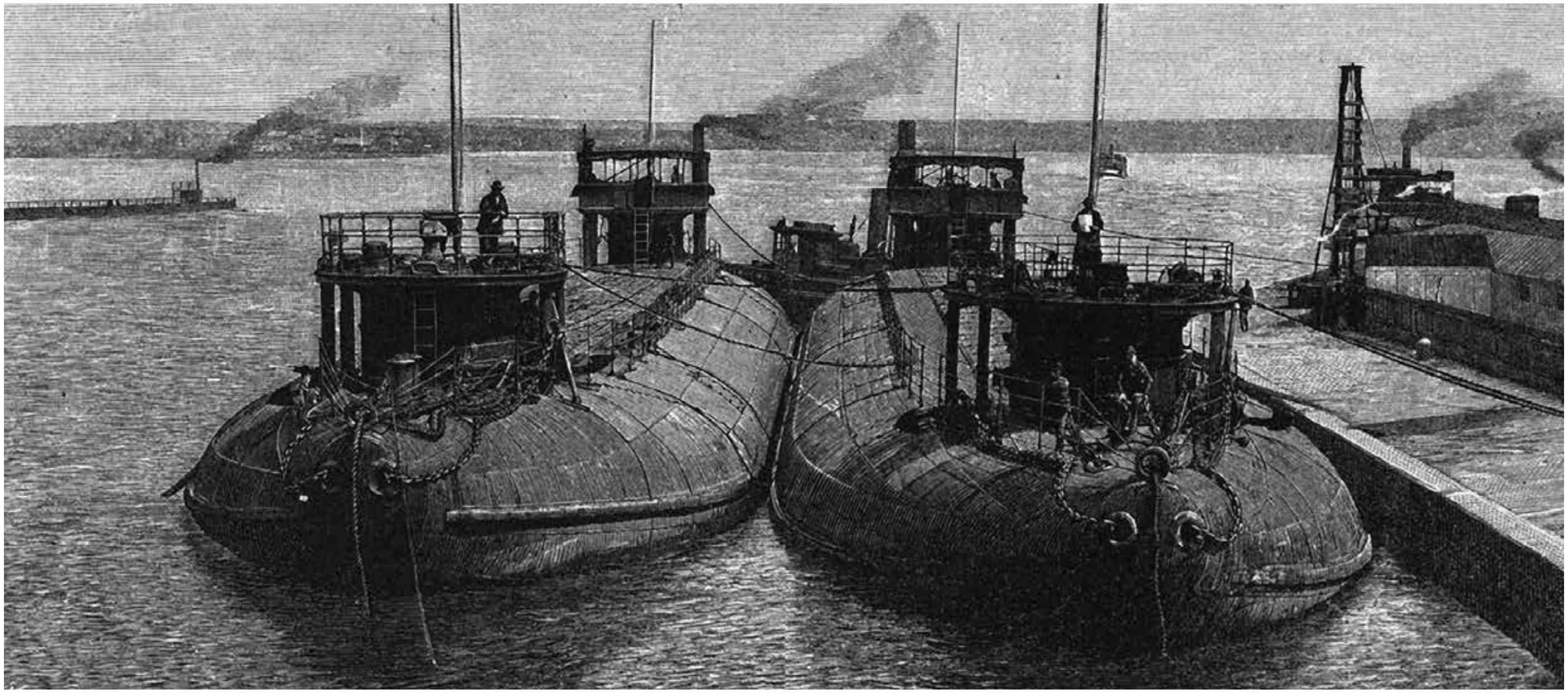
The *Great Lakes Register*, which was connected to French classification society Bureau Veritas, effectively shut the American Bureau of Shipping out of the inland market until ABS acquired it in 1916. In the

Anton A. Raven

President: 1899-1916

Anton A. Raven served as the first President of the newly constituted American Bureau of Shipping. Like his predecessors in the American Shipmasters' Association, he was elected President after taking over the Atlantic Mutual Insurance Company. He served on the New York Chamber of Commerce, belonged to a number of benevolent societies and directed other maritime institutions as well.

Born in Curaçao, Dutch West Indies, Raven lived in St. Thomas before arriving in New York in 1852 at the age of 17. There he took a position with the Atlantic Mutual Insurance Company's Department of Correspondence. His abilities were evident early and he rose from Assistant Underwriter to fourth, third and second Vice President, becoming President in 1897 following the death of John D. Jones. He served as President of Atlantic Mutual and the American Bureau of Shipping until retiring from both positions in 1915. A youth spent moving around the Caribbean may have led Raven to appreciate stability. Once settled in New York, he worked at the same company for 63 years and died in his adopted hometown in 1919. Fond memories of his peripatetic youth may also have inspired Raven's support for seafaring adventure and exploration: he was among the founders of the "Peary Arctic Club" that funded Admiral Robert E. Peary's expedition to the North Pole.



One of history's most unusual bulk carriers, the whalebacks were built in the 1880s and 1890s to carry grain and iron ore on the Great Lakes.

interim, the Bureau focused on expanding into other regions. In 1908, it acquired the United States Standard Steamship Owners, Builders and Underwriters Association, a classification society established in 1889, and incorporated its register of iron and steel ships into the *Record*. Then, as the Panama Canal neared completion, ABS expanded its activities on the US Pacific Coast, building on representative offices the Shipmasters' Association had established in San Francisco, San Diego, Portland and Vancouver during the 1880s. With the Canal expected to revolutionize US maritime trade by cutting nearly 8,000 miles off the coast-to-coast voyage, the Bureau anticipated a boom in its West Coast business. In 1911, three years prior to the Canal's scheduled completion, ABS set up a Los Angeles office and prepared for expansion into Long Beach and other parts of southern California.

Despite this apparent growth, ABS remained a relatively modest concern whose 50th anniversary passed relatively unnoticed. Even by 1916, ABS classed a mere eight percent of the US-flag fleet. Across the Atlantic, Lloyd's Register classed ten times as many vessels and was growing. Clearly, if the Bureau wanted to celebrate a 75th anniversary it would have to find a way to create a drastic reversal of fortune. The opportunity to do that emerged from the smoke and flame then engulfing the world in the Great War.

Maintaining an American Classification Society

The assassination of Austrian Archduke Franz Ferdinand in June 1914 ignited the First World War, whose participants included the world's leading maritime powers – Great Britain, France, Germany, Italy and Russia. These countries carried over seventy percent of the world's foreign commerce and, when those governments requisitioned their merchant ships for their auxiliary navies, transatlantic commerce slowed. The resulting confluence of political exigency and business opportunity united politicians and businessmen in agitating for a revival of the US merchant marine. As those efforts gained momentum, they attracted the commercial attention of classification societies across the Atlantic: a growing American fleet meant a growing classification market – a business opportunity that Lloyd's Register could not resist.

In July 1915, nearly a year after Great Britain entered the war, Lloyd's Register of Shipping sent a representative to New York to propose a merger with the American Bureau of Shipping. Lloyd's classed nearly ten times more vessels than ABS and, forgetting its rejection of a merger 15 years earlier, now saw its small competitor as the key to solidifying domination of the North American market for years to come.

The Bureau now faced a difficult decision: accept the merger or opt to remain an independent American classification society. ABS President Anton Raven recognized that, for the latter course to become feasible, the Bureau would need to become stronger. Raven began an investigation to determine why shipowners and shipbuilders were reluctant to engage ABS services. He sent two representatives to visit various shipbuilders and owners throughout the East Coast and Great Lakes during the summer of 1915. They returned with unenthusiastic evaluations, including, evidence suggests, news of widespread concern regarding inadequate leadership and insufficient expertise. It was clear that the Bureau needed to change.

In October 1915, Raven called a meeting with some 50 key individuals representing shipowners, shipbuilders and underwriters at the Atlantic Building at 51 Wall Street. Initially, many of the representatives supported merging with Lloyd's Register because of London's

Stevenson Taylor

President: 1916-1926 • Chairman: 1926

Born in New York City, Lieutenant Commander Stevenson Taylor attended public schools as a child and earned admittance into the city's Free Academy (later the City College of New York). In 1864, Taylor began an engineering apprenticeship that eventually led to his becoming chief draftsman at the North River Iron Works of Fletcher, Harrison and Company, the top marine steam engine producer in New York. When the business was reorganized as the W&A Fletcher Company in 1883, Taylor became Vice President and General Superintendent. In 1904, he purchased an interest in the Quintard Iron Works of New York, where he served as Vice President until 1914.

A respected engineer, draftsman and marine engine designer, Taylor produced many pioneering steamship designs during his career. He was a member of the Engineers' Club, the Society for Naval Architects and Marine Engineers (SNAME) and the Webb Institute of Naval Architecture in New York. Taylor also served as President of the Engineers' Club, served twice as President of the Society of Naval Architects and Marine Engineers, and was President of the Webb Institute Board of Trustees from 1900 to 1926.

Taylor was an acknowledged leader within the US maritime sector when he took charge of the American Bureau of Shipping. It is a testament to Taylor's abilities that he became best known for the work done at an age when many people slip into retirement – his 'second career' as President of ABS from 1916 until his death ten years later. In 1927, in recognition of Taylor's role in revitalizing the organization, the Bureau christened its new headquarters building at 24 Old Slip in New York City the Stevenson Taylor Memorial Building. For years, visitors to the Bureau's headquarters have been greeted by a mural that features John D. Jones, who presided over the birth of ABS; and Stevenson Taylor, who presided over its rebirth.

dominance in marine insurance and classification, while a minority favored independence. Meetings of the American Bureau of Shipping's Reorganization Committee continued throughout the winter and into the following February, when representatives from Lloyd's again visited New York. During this meeting, Bureau leaders considered all the ramifications of a merger and posed a hypothetical question: "Suppose an American naval architect designs an improvement on existing designs for a ship; can the American Committee pass such a new design for classification." Andrew Scott, Secretary of Lloyd's Register, answered that "the plans must be sent to London for approval."

Scott's answer troubled the industry representatives, who wanted strong local representation. One underwriter bluntly said that "I would regret, and I think it would be a sad day for this country, if we had to depend absolutely on London." The Reorganization Committee was convinced that, despite its flaws, the 54-year-old American Bureau of Shipping could provide a basis for a resilient, autonomous American classification society that would better serve the maritime community. Management then proposed a plan that rejected the Lloyd's offer and called for a revitalized ABS.

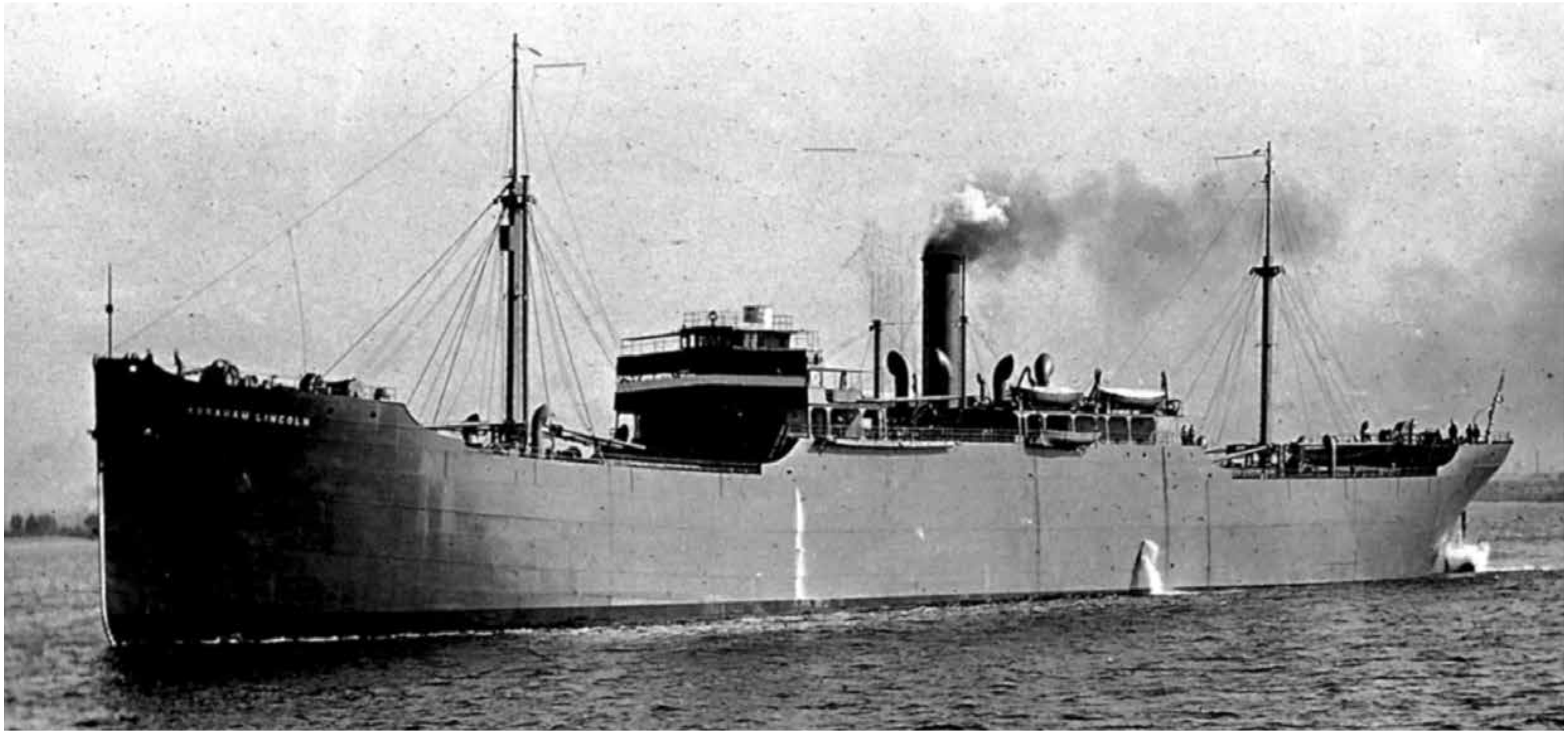
Adopted on 28 February 1916, the plan aimed to reinvent the Bureau as an extensive, efficient, accurate and progressive classification society. The reorganization began with sweeping changes in the Bureau's administration. Esteemed shipping leader and SNAME President Stevenson Taylor was appointed President of the American Bureau of Shipping, while longtime Lloyd's Register surveyor Norman E. McClelland accepted a position as Chief Surveyor. Changes were also made to the Constitution and By-laws of the organization and the Bureau was restructured as a non-profit organization with no stocks and no dividends.

American shipowners, shipbuilders and insurers expressed universal support for the reorganized society, with over 50 subscribers contributing funds to help strengthen the Bureau. Stevenson Taylor personally contributed $1,000 and accepted only half his salary for the following year.

In a significant departure from the past, Taylor had no direct connection to the Atlantic Mutual Insurance Company or the marine insurance sector. He was an engineer and draftsmen who also served as Vice President of the Quintard Iron Works, a major New York manufacturer. Close to retirement, Taylor insisted on a vast increase in salary for the ABS President, with the understanding that the position should be considered a vocation rather than a sideline. After over half a century in business, ABS had its first full-time leader.

Taylor wasted no time enacting a number of specific measures to reform the Bureau. Working to "remove old prejudices, just or unjust," as he later stated, Taylor promoted more direct involvement with ABS subscribers and corresponded frequently with shipbuilders and underwriters. He also expanded the Bureau's staff. By the end of 1916, ABS had 14 exclusive surveyors on staff, an increase of nearly three times over the previous year, and had plans to hire more surveyors for San Francisco, Portland and Seattle. The Bureau grew rapidly and by the end of 1919 could count 179 exclusive surveyors on the payroll.

Taylor also spearheaded the Bureau's drive into the Great Lakes, acquiring the *Great Lakes Register* in May 1916. Folded into the Bureau's Great Lakes department, this acquisition brought over 600 vessels into ABS class and removed its last impediments to cross-country coverage. The American Bureau of Shipping now classed 21 percent of all US-flag vessels, up from eight percent the year before.



Launched in 1919, the SS ABRAHAM LINCOLN was one of the vessels built at Philadelphia's Hog Island shipyard as part of a shipbuilding program sponsored by the US Government during World War I. The short-lived Hog Island yard produced 122 vessels in three years. None saw action in World War I, but many served in World War II.

Reorganization and commitment to growth also led ABS abroad. In January 1917, the Bureau reached an agreement with the British Corporation for the Survey and Registry of Shipping, based in Scotland. The agreement, which allowed the organizations reciprocal use of their surveyors, brought ABS international reach and recognition without limiting its independence. Additionally, it gave the Bureau access to the British Corporation's Rules and furthered exchange of ideas and knowledge. Other arrangements of mutual service followed, including one with Italy's Registro Italiano Navale in 1918 and Japan's Teikoku Kaiji Kyokai in 1919.

Like the American Bureau of Shipping, the American merchant marine had experienced a revival and was expanding into the international arena. As such, both would experience sudden, further growth when the US Government engaged them when America entered World War I in 1917.

Mobilization During World War I

As the United States mobilized for World War I, the government sought the assistance of the American Bureau of Shipping in creating a larger and up-to-date merchant fleet that would support the American war effort.

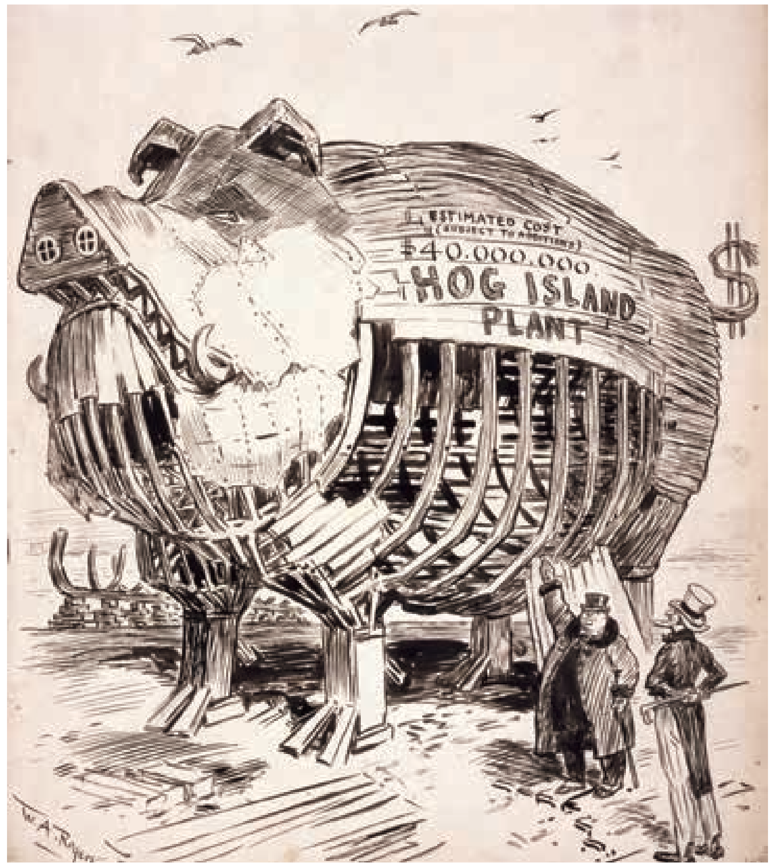
This was not the first time that the organization supported and partnered with the Federal Government. The Shipmasters' Association had furnished loss statistics during the Civil War and in 1891 received authorization to survey and rate transatlantic mail vessels in accordance with the Ocean Mail Act. The American Shipmasters' Association entered a working relationship with the United States Navy in 1889 when it provided Benjamin F. Tracy, Secretary of the Navy, with a copy of the *Rules for the Survey and Classing of Iron Vessels*. A team of naval engineers and architects reviewed these Rules and determined that "vessels built in accordance with the above referred to, modified as suggested in the report of said Board, would be useful as auxiliary naval cruisers in time of war or in cases of emergency." When war did come, this good relationship between the maritime industry and the Navy enabled both parties to cooperate in transforming the merchant fleet into a strong naval reserve.

When World War I began in 1914, the United States tried to remain neutral. However, blockades by both the Allies and the Central Powers, as well as Germany's reliance on submarine warfare to attack Allied shipping, increasingly threatened American vessels, exports and citizens. German U-boats presented the greatest menace, torpedoing the British liner *Lusitania* in May 1915, killing 128 Americans. Germany had stopped its attacks in May 1916 in the face of American outrage, but then resumed unrestricted submarine warfare in early 1917. In a three-month period, German U-boats sank nine US merchant ships, killing another 23 American citizens. As a result, President Woodrow Wilson asked Congress to declare war on Germany and the United States officially entered the war on 7 April 1917.

American shipping immediately became a top priority for the government, as material and men had to cross the sea in unprecedented amounts for the American war effort. Great Britain was running low on munitions, fuel and food since nearly one out of every four ships leaving British harbors had been sunk by German U-boats. America would have to build more ships than the enemy could destroy and the government turned to the maritime industry to make it happen.

In terms of size and tonnage, the US merchant marine had fallen well behind other nations during the pre-war period. In 1914, American shipyards built fewer ships then they had in 17 years. The American Bureau of Shipping, seeing an opportunity to rehabilitate the US merchant marine and, perhaps, a chance to surpass the fleet strength of other countries, strongly advocated the merchant marine movement and was "foremost in the effort to establish American supremacy on the ocean," according to *The Washington Post.*

In 1916, President Wilson created the United States Shipping Board, which had the right to purchase, requisition and construct vessels for an auxiliary merchant fleet. To initiate and manage the shipbuilding task, the Shipping Board formed the Emergency Fleet Corporation in 1917. These two entities, given sweeping control over private industry, built up the American Fleet by enlisting existing American merchant ships, commandeering German ships under construction in American shipyards and laying claim to all other ships in mid-production. Construction had also begun on a handful of federally funded shipyards, most notably at Hog Island, Pennsylvania (a controversial project that became the largest merchant shipyard of the time). After some delay, ship construction accelerated toward the end of 1917.



The huge cost of creating the Hog Island shipyard generated controversy and congressional investigations. Newspapers charged the builder, American International Shipbuilding Corp., with graft and corruption. W.A. Rogers' cartoon was published in the *New York Herald* on 10 February 1918.

With the creation of the United States Shipping Board and the Emergency Fleet Corporation, government supported the shipping industry as never before. American shipyards boomed as newbuilding began and existing foreign ships began flying the American flag for protection and the right to seek shelter and repair in American ports.

ABS shared its expertise as part of wartime mobilization, with Stevenson Taylor receiving an invitation to join the Shipping Board in early 1917. Assistant Secretary of the Navy Franklin Delano Roosevelt personally asked Taylor to join the Board of Appraisers of Merchant Ships and Naval Vessels. When Taylor received his commission as a Lieutenant Commander, he announced to the press that "there is only one thing that will win this war and that is the building of ships, ships and more ships."

Taylor also recognized a significant role for the American Bureau of Shipping in the war effort. As the US-flag fleet swelled with newly acquired foreign ships and newly constructed or refurbished vessels, classification work was in high demand. In September 1917, Taylor wrote to the US Navy General Manager of the Emergency Fleet Corporation, Rear Admiral W.L. Capps, to introduce him to ABS and its capabilities. He concluded the correspondence by asking Admiral Capps and the Shipping Board for full support of the American Bureau of Shipping and advising against employing a foreign classification society.

Ultimately, the immense wartime workload was shared by the American Bureau of Shipping, Lloyd's Register and, to a lesser degree, Bureau Veritas. The Shipping Board, however, tried to ensure that the American Bureau of Shipping received at least two-thirds of the work and, as a result, the total tonnage classed by the Bureau jumped from around 230,000 tons in 1916 to 3,301,000 tons in 1919.

ABS posted permanent surveyors in federally financed shipyards and the Bureau was written into most contracts between shipbuilders and the Emergency Fleet Corporation. Plan review, general inspections and classification had to go through either the American Bureau of Shipping or Lloyd's. Surveyors from ABS and Lloyd's collaborated on inspections, cultivating a strong working relationship in the process. ABS also adopted the British Bureau of Trade Rules to accommodate the standards that ships would have to meet once abroad and began marking its ships with load lines, which became required in the US during the following decade.

New Men, New Materials

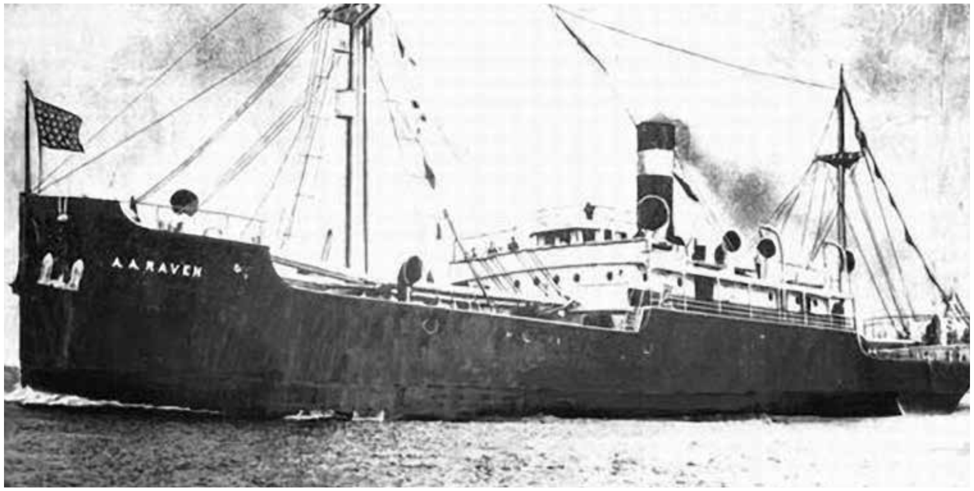
The World War I shipping boom brought the American Bureau of Shipping vital experience and boosted its authority. Between January and December 1916, the number of exclusive surveyors swelled from 18 to 68, many of whom were foreign-born American citizens with years of experience in shipbuilding or ship operations. Experience, in fact, was a prerequisite for joining ABS. The Bureau required its surveyors to be at least 33 years old and have practical training in either ship construction or marine engineering.

The organization now had exclusive surveyors stationed at important shipyards around the country and others in charge of regional shipbuilding districts. As ABS grew it became, in the words of Rear Admiral Francis Bowles, “absolutely essential” to America’s shipbuilding effort. Before the Shipping Board accepted a single vessel from a shipyard, it had to receive an American Bureau of Shipping certificate and most contracts between shipbuilders and the government required either ABS or Lloyd’s to perform inspections, review the quality of materials and approve the workmanship in a yard. These inspections were then reported to the Shipping Board, whose trust in the Bureau was consistently confirmed by Shipping Board proceedings from the period.

The rapid mobilization of World War I also brought an influx of new technologies and techniques. As Bureau surveyors approved designs, surveyed ship construction and attended existing vessels they kept up with developments in construction and hardware. For example, although diesel engines were still in their infancy, direct-drive and electric-drive configurations were already growing in popularity and, in 1917, the Bureau incorporated requirements for internal combustion engines into its Rules.

The technology of steam power also evolved during the war. Manufacturers, struggling to meet demand for standard Scotch boilers and reciprocating engines, turned to more easily manufactured double-reduction geared turbines and water tube boilers. More than half of the ships built for the Emergency Fleet Corporation contained these new boilers by the end of the war. The American Bureau of Shipping also provided technical advice when the Navy’s Bureau of Construction and Repair began development of a small group of experimental ships made entirely of concrete. The ABS Technical Committee tackled the complicated question of how to class these innovative ships, which

During World War I, steel was scarce and US President Woodrow Wilson approved construction of 24 experimental concrete ships. Only 12 were built, most of them launched after the war had ended. The SS PALO ALTO was grounded for use as a pier in Seacliff State Beach in Aptos, California, and can be seen there today.



Named for the American Bureau of Shipping's first president, the SS A.A. RAVEN was struck by a torpedo from a German U-boat in March 1918 and sank in the Celtic Sea.

were the Emergency Fleet Corporation's answer to steel shortages. Construction on 12 experimental concrete ships began, but none of the ships were finished until after the end of the war. The experience provided a foundation for larger groups of concrete vessels used to good effect in World War II and the Vietnam War.

Many American merchant ships fell victim to German U-boats during World War I, including one named for the Bureau's first President. The freighter *SS A.A. Raven*, built at the Great Lakes Engineering Works of Michigan in 1912, had been requisitioned by the Shipping Board and assigned to the Army Quartermaster's department. The *A.A. Raven* was torpedoed and sank in the Celtic Sea off the Scilly Isles on 14 March 1918, losing seven of its 38 crew members.

Fighting ceased on 11 November 1918 and World War I formally ended on 28 June 1919 with the signing of the Treaty of Versailles. Although it had been active for only a few years, the Shipping Board had a tremendous impact on the US maritime community. American shipyards, which before the war had typically taken 12 to 18 months to build a vessel, could now do so at an average rate of 12 to 18 weeks.

The US-flag fleet likewise experienced a rebirth. The Emergency Fleet Corporation started construction of 533 ships in 1918 alone and, although a majority of the ships were launched at the end of the war and afterwards, its building program transformed the industry. The United States, which began the decade with an outdated fleet handling a small percentage of its own foreign trade, ended the decade with a modern merchant fleet comparable to that of Great Britain.

The American Bureau of Shipping experienced a similar trajectory. Just five years after entertaining a proposition for acquisition by Lloyd's Register, ABS had become a cornerstone of the revitalized American maritime sector. Doubted by industry before the War, the classification society now had broad support among US shipyards, shipowners, marine underwriters and manufacturers. The Federal Government was also impressed with the Bureau's fine record of assistance during wartime and soon took measures to ensure its services would always be available.

The Jones Act

When World War I ended the Shipping Board still had a sizeable number of contracts pending, with the completion of some ships scheduled for as late as 1922. Rather than scrapping the excess ships or canceling the contracts, the Shipping Board decided to continue production and further build America's merchant marine. For the next several years, hundreds of ships steamed out of US shipyards, the majority of them classed by ABS. At the beginning of 1920, the Bureau was supervising the construction of over 3.5 million gross tons of shipping, totaling nearly 85 percent of all vessels being built in the United States. During the previous four years the Bureau classed three times as much gross tonnage of shipping as it had classed in the previous 40.

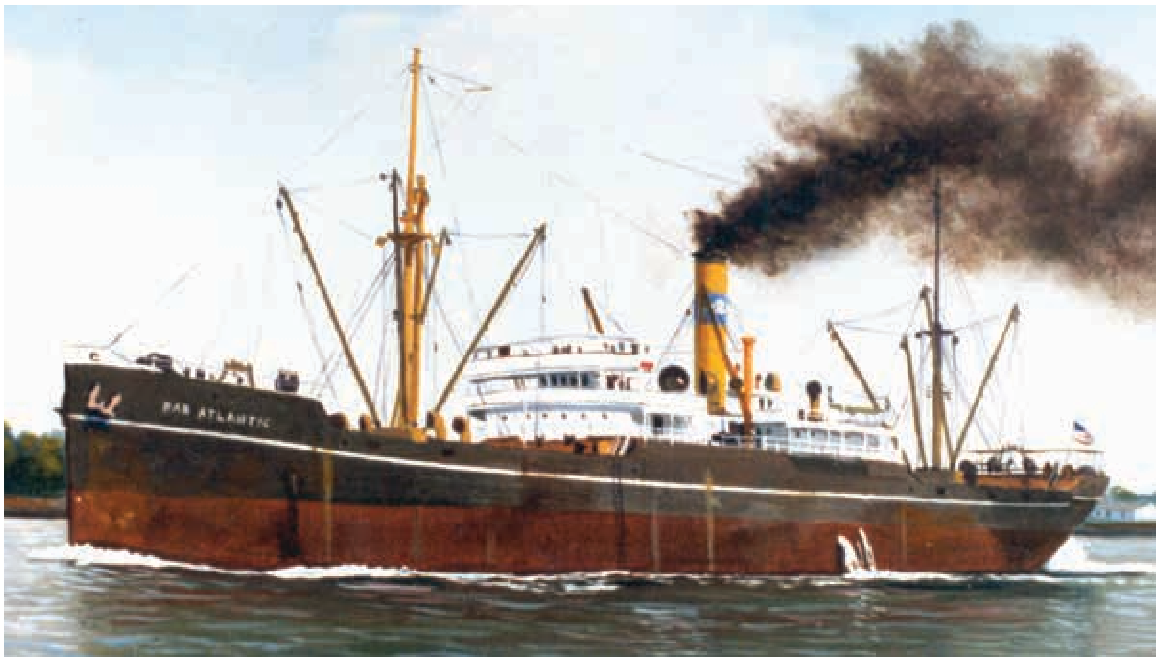
Carried forward by postwar momentum, America's maritime leaders lost no time in pushing for legislative changes that would further promote the American merchant marine and, by April 1920, had the support they needed. During National Marine Week that year, Shipping Board Chairman Rear Admiral W.S. Benson championed building up the merchant marine, declaring that “we should give the American Bureau of Shipping every encouragement and support. We should no longer depend on foreign interests to insure and survey and classify our ships.”

One month later, the Shipping Board ordered that all US-flag vessels classed by Lloyd’s Register were to be resurveyed by ABS free of charge. The Board made it clear that it was preparing for a time in the near future when all federally funded ships would be classed by the American Bureau of Shipping. One leader of this effort was Washington State Senator Wesley Jones, who sat on the Commerce Committee. Fearing that American maritime trade might again become dependent upon foreign-flag fleets, Jones promised “to drive foreign shipping from our ports” and to ensure America its fair share of foreign trade. Congress answered the call and passed the bill and, on 5 June 1920, President Wilson signed the Merchant Marine Act of 1920 into law.

Section 27 of the Merchant Marine Act (better known as the Jones Act) deals with cabotage, or coastal shipping and requires that all goods transported by water between US ports be carried in US-flag ships, constructed in the United States, owned by US citizens and crewed by US citizens or permanent residents. This had particularly widespread implications; particularly its provision that such vessels be classed by the American Bureau of Shipping. Two government representatives, including one from the US Coast Guard, were placed on the ABS Executive Committee to facilitate relations between ABS and the US Government. Lloyd’s Register, which had been viewed as discriminatory towards American shipping, was pushed out of much of the American classification market, as were other foreign classification societies.

As a result, in 1920, the American Bureau of Shipping became the second largest classification society in the world, with over 20 percent of the world fleet in class. In just two decades, ABS had transformed itself from a struggling bit player to major star, second only to Lloyd’s Register in total tonnage.

During the 1920 Annual Meeting, Stevenson Taylor announced that ABS was financially sound, with 229 employees, a newly expanded New York office and 22 branch offices around the country. In addition, the Bureau was able to fully repay investors for emergency contributions made in 1916 and, more importantly, was able to establish a pension fund. Surveyor Joseph E. Borden, who retired due to partial blindness, became the first recipient of an ABS pension on 1 January 1920. ✠



With the passing of the Merchant Marine Act, US-built and flagged ships, such as the 5,411 ton, 1919-built PAN ATLANTIC, would continue to be classed by the Bureau.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Chapter 3

Supporting the Nation

1921 – 1945

The American Bureau of Shipping began the 1920s in a spirit of buoyant optimism. Business was better than ever, US shipbuilders were going strong and ABS had a record number of vessels in class. Befitting its role as a technical authority, the Bureau also launched the *ABS Bulletin*, a publication providing internal news, tonnage statistics and editorials on issues of interest to the wider maritime community. However, the good times did not last. While the government-sponsored World War I shipbuilding boom helped the US maritime sector ride out the brief depression of 1920 to 1921, it also flooded the shipping market with cargo vessels. The vast oversupply of ships that the program created drove freight rates through the floor and eroded the fortunes of many shipowners, sending crippling ripples through the maritime industry.

As the United States entered the period of prolonged prosperity known variously as the Roaring Twenties or the Jazz Age, the maritime community lost all it had to sing about. In 1921, only one new contract to build an oceangoing vessel was placed with a US shipyard. "American shipping has suffered extraordinary stagnation," lamented the 1922 ABS *Bulletin,* leaving a fleet "laid up in harbors and rivers, clustered together in bunches; thousands of seafaring men out of employment; shipyards at a virtual standstill; and many shipyard workers without means of support."

The struggling maritime sector beseeched Washington, DC for financial assistance and ABS lent its voice to the cause. In 1922, for example, Stevenson Taylor delivered a speech before the National Merchant Marine Association Convention entitled "Government Aid: Good Business!" The efforts ultimately paid off, with Congress passing the Merchant Marine Act of 1928, or Jones-Hill Act, to provide subsidies for shipyards and mail lines.

Nonetheless, US shipbuilders suffered tremendously. Between 1922 and 1937, only two dry cargo ships were constructed in US shipyards, along with a few tankers and 29 passenger-cargo liners built with Jones-Hill subsidies. ABS weathered this depression with a combination of downsizing and new business development. For example, as yachting gained increasing popularity among America's upper crust, the New York Yacht Club approached the Bureau in 1928 with a request to create Rules for the recreational vessels. Soon after, The ABS *Rules for Wooden Racing Yachts* for vessels under 50 feet in length were issued. Classification of yachts remains a thriving business line to this day.

As business on the sea slowed, the Bureau turned its eyes skyward. The aviation industry was developing quickly and appeared to offer opportunity in the classification and registration of aircraft and airships. ABS discussed the issue with other major classification societies at the 1927 International Aviation Alliance Conference in France, and in the following year incorporated the American Bureau of Aircraft. The Bureau began registering aircraft and worked with operators and underwriters in an attempt to develop a classification system akin to that established for ships. Data on several hundred aircraft were forwarded to Bureau Veritas, which through an agreement with ABS and the other societies, compiled and published the information in the *Aeronautical International Register.*

On 9 May 1926, Richard Byrd and pilot Floyd Bennett attempted the first flight over the North Pole in a Fokker F-VII Trimotor called the JOSEPHINE FORD. This flight went from Spitsbergen (Svalbard), Norway and back to its take-off airfield. Byrd and Bennett claimed to have reached the North Pole.

The American Bureau of Aircraft published its own *American Bureau of Aircraft Register* in 1929, providing details on hundreds of aircraft including model, type of service, owners, home airport and horsepower. Among the most famous entries in the *Register* was Rear Admiral Richard Byrd's famed Fokker Trimotor *Josephine Ford*, which in 1926 had become the first airplane to fly over the North Pole. The historic aircraft can be seen today in Michigan's Henry Ford Museum, along with the aluminum-alloy Ford Trimotor in which Byrd flew over the South Pole in 1929 – still bearing its American Bureau of Aircraft plaque.

The *Aircraft Register* was developing nicely until the early 1930s, when the US Department of Commerce, acting under the 1926 Air Commerce Act, made regulation and standards development of civilian aircraft a government business. In a replay of what had happened when the Bureau of Navigation took over crew certification 50 years earlier, there was soon little demand for a private regulatory organization in the aviation industry. The American Bureau of Aircraft left the Aeronautical International Register in 1933 and formally dissolved in 1941.

The 1920s also saw the American Bureau of Shipping undertake social and professional activities, creating scholarships and awards while its top leaders and surveyors participated in technical committees, including the Marine Committee of the National Fire Protection Association; the American Welding Society; and the American Institute of Electrical Engineers.

In 1924, the Bureau began sponsoring the American Bureau of Shipping's Annual Educational Prize, through which a handful of naval architecture and marine engineering students were awarded a $100 scholarship. The Stevenson Taylor Scholarship at the Massachusetts Institute of Technology followed in 1927, setting a precedent for the establishment of other American Bureau of Shipping scholarships, educational efforts and technical presentations – activities that continue today – dedicated to fostering innovation in the marine industry.

To cap off these early social initiatives, the Bureau also began sponsoring a seafaring heroism award for merchant seamen who perform exceptional acts of bravery aiding vessels in distress. The solid gold American Bureau of Shipping Valor Medal was first awarded in 1928 to Captain George Fried, Master of the *SS President Roosevelt* and, later, the *SS America,* who rescued the crews of two different steamships on two separate occasions. Only five Valor Medals have ever been awarded.

The Government's Classification Society

The 1920s shipping recession eventually led to the closure of many small shipyards that had opened across America during the first World War. To combat the loss of newbuilding work, the Bureau sought to strengthen its ties as the Federal Government's classification society and to intensify its support of favorable legislation to the maritime industry.

Bureau Medal of Valor Recipients

CAPTAIN GEORGE FRIED
Valor Medal Recipient, 1928

CAPTAIN GILES C. STEDMAN
Valor Medal Recipient, 1933

CAPTAIN HENRIK KURT CARLSEN
Valor Medal Recipient, 1952

CAPTAIN GEORGE SAHLBERG
Valor Medal Recipient, 1966

CAPTAIN EVANGELOS NIROS
Valor Medal Recipient, 1972

Stevenson Taylor stepped down as ABS President in 1926 due to failing health and was succeeded by Vice President Charles A. McAllister. Like Taylor, Captain McAllister was well-known and widely respected in Washington, DC. Prior to World War I, he served as the Chief Engineer of the Revenue Cutter Service, which since 1790 had been the nation's armed maritime law enforcement agency – older than even the US Navy. McAllister had recommended to US President Woodrow Wilson that the Revenue Cutter Service and the United States Life-Saving Service be merged into one modernized office. Wilson agreed and in 1915 signed the Act that united the two organizations into the US Coast Guard, with McAllister as its first Chief Engineer of Aviation. He joined ABS in 1919 at Stevenson Taylor's request.

McAllister put his stamp on the American Bureau of Shipping during the late 1920s. He used his influence to push for legislation favoring the US merchant marine and the Bureau, frequently appearing before Congress to promote subsidies for American shipbuilders, stump for laws favoring American shipping and encourage construction of fast ocean liners. During World War I, McAllister started a fuel conservation program that he continued to promote as President of ABS. He remained head of the Fuel Conservation Committee after the war and encouraged the United States Shipping Board to continue research and development to increase productivity of American shipbuilders.

International regulatory efforts in maritime safety resumed towards the end of the decade and, in 1929, the maritime powers gathered in London for the second International Conference on the Safety of Life at Sea (SOLAS). The first SOLAS conference, convened in response to the 1912 sinking of the luxury liner *Titanic,* sought binding international agreement on regulations governing lifeboats and other safety equipment, but its work was short-circuited by World War I. Among the issues scheduled for discussion at the new conference were ship stability and fireproofing, subjects that ABS had studied thoroughly. Its 1928 National Safety Council Annual Meeting resolved to develop Rules and standards focused on reducing fire hazards aboard passenger ships. Recognizing this expertise, the US delegation to SOLAS invited Captain McAllister and ABS Chief Surveyor David Arnott to serve on its advisory committee.

Another major international regulatory effort came to fruition the following year with the approval of the 1930 Load Line Convention, an international treaty establishing limits on the draught to which ships may be loaded, expressed as freeboard (the minimum distance that the side of the laden ship is to project from the water). The Convention required every large merchant vessel to bear markings on its sides, positioned amidships, indicating its allowed freeboard for various weather and water conditions.

The load line is a fundamental element of safety at sea – first, because it establishes draft limits; and, second, because, in order for the load line to be assigned, its maritime authority (the flag State) must be satisfied as to the ship's watertight and weathertight integrity, structural strength and stability.

Today, load lines are calculated according to the specifications in the 1966 International Convention on Load Lines. First assigned to British merchant ships during the late 1870s, they came to be known as Plimsoll marks, named after Member of Parliament Samuel Plimsoll, a maritime safety and seafarer advocate who fought a long battle for the legislation requiring them. By World War I, all British ships were required to carry a Plimsoll mark.

Charles A. McAllister

President: 1926-1932

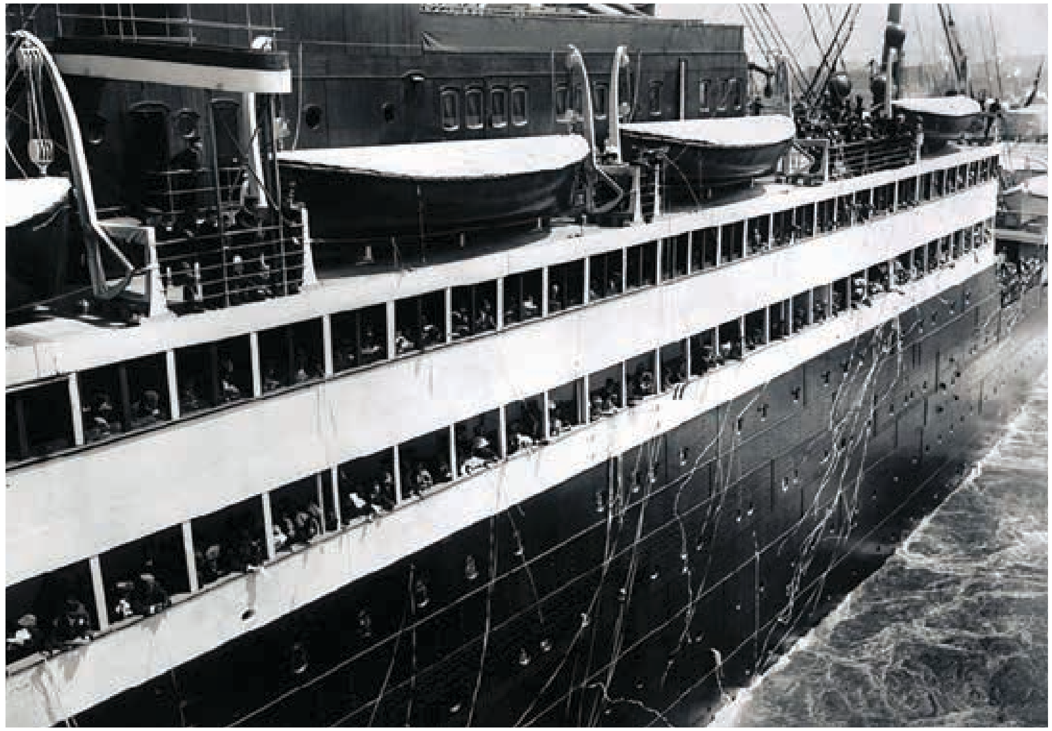
Captain Charles A. McAllister was the son of a ship's carpenter from Scotland who operated a small shipyard on City Island, New York. He worked at the yard as a boy, earned a degree in mechanical engineering on scholarship at Cornell University, joined the US Navy's Bureau of Steam Engineering and, in 1892, joined the US Revenue Cutter Service (a direct predecessor of the US Coast Guard) as Chief Designer of Machinery.

During the Spanish-American War McAllister served as an assistant engineer aboard the naval vessel USS PHILADELPHIA. Afterwards, he returned to the Revenue Cutter Service and in 1905 was appointed its Chief Engineer by President Theodore Roosevelt. When President Woodrow Wilson created the US Coast Guard in 1915, McAllister kept his title in the new agency.

Convinced that rescue services could be improved by air reconnaissance, McAllister drafted legislation in 1916, adopted by the Senate, which provided $1.5 million to establish an "Aerial Coastal Patrol" and authorized the Coast Guard to build air bases along the coasts as well as to train pilots. Thus he can be thought of as the father of Coast Guard aviation. As the Coast Guard's Chief Engineer of Aviation he oversaw its first use of aircraft, and later applied the experience in creating the American Bureau of Aircraft while President of ABS.

McAllister was also an author. He penned two books on the sea, *The Professor on Shipboard* and *McAndrew's Floating School* and, under the pen name "Old Scotch," was a contributing editor for the magazine *Marine Engineering and Shipping Age* (today's *Marine Log*). He died suddenly of a heart attack in January 1932. In his memory, ABS annually presents the Charles A. McAllister Memorial award to the Coast Guard Academy student who has shown the highest proficiency in engineering subjects during his entire course of instruction.

ABS became a strong proponent of load lines during its wartime work when the Bureau was tasked with assigning load lines to American vessels entering European ports under the British Board of Trade Rules. When the United States turned to developing its own load line legislation in 1929, the Bureau was tapped for its expertise and its Chief Surveyor was made a member of the committee that helped draft the regulation. Although the Department of Commerce did not write the Bureau into the law directly, nearly 90 percent of all vessels subsequently marked used the classification society as its service provider.



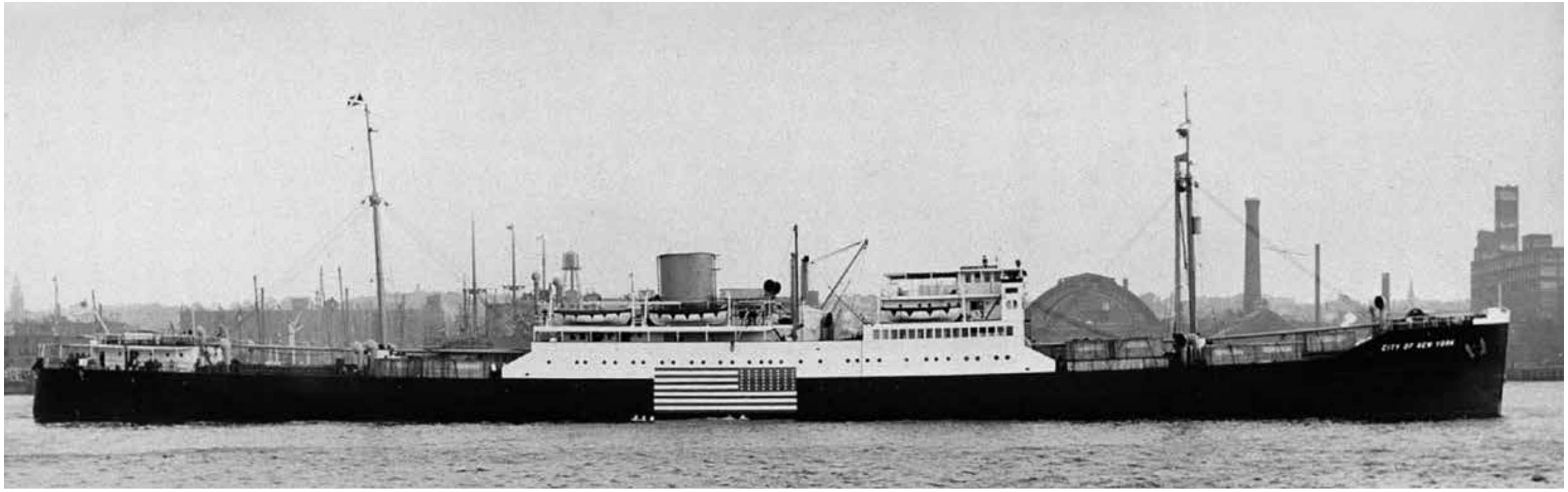
At the time of construction, the SS WASHINGTON (shown above) and sister ship SS MANHATTAN were the largest liners ever built in the United States. Built by New York Shipbuilding, the ocean liners went into service for United States Lines at a cost of approximately $21 million each. Accommodations were 580 in cabin class, 400 in tourist and 150 in third class. Both ships garnered reputations for very high standards of service and luxury.

In 1930, the US Government again turned to the Bureau in developing new boiler codes. The Rules of the Steamboat Inspection Service were by that time antiquated, with out-of-date instructions that aggravated shipbuilders and raised construction costs. The American Marine Standards Committee wanted new codes agreeable to both the government and industry. A boiler expert from the ABS technical staff was assigned to work with the American Marine Standards Committee and, by the following year, had helped draft a set of Rules amenable to all parties and consonant with the existing ABS Rules.

In what were increasingly darker times, the few bright spots for the Bureau were relatively easy to identify. The country's major shipyards were not entirely idle, launching such glamorous ocean liners as the *Washington* and the *Manhattan*, and the Department of Commerce contracted for 64 vessels under the Merchant Marine Act of 1928 – all of which were classed by the American Bureau of Shipping. The Bureau finished 1931 with its greatest annual tonnage in a decade.

But, as often happened, the flame of America's Great Depression quickly turned achievements, big and small, into ashes. In 1932, classification work fell by nearly 50 percent and the Bureau, facing a nearly $60,000 deficit, was forced to reduce staff and even close its Orient Office in Japan, which had only been established in 1929. Compounding the problems was the untimely death of Captain McAllister in early 1932. "We cannot look ahead with any optimism for the next two years," wrote J. Lewis Luckenbach, ABS' soon-to-be-president. "The falling off in business has been felt generally in all branches of the Bureau's activities."

Struggling along with the rest of the country, the American Bureau of Shipping survived the Great Depression by cutting costs, reducing staff and temporarily halting nonessential activities, such as publication of the ABS *Bulletin*. Even as it economized, the Bureau managed to expand its efforts in one area of increasing advancement and promise: technology.



The twin-screw, diesel powered CITY OF NEW YORK was a passenger liner built in 1930 by Sun Shipbuilding & Dry Dock Company for American South African Lines.

Aiding Technology's Advance

In 1922, ABS recognized the evolution of motor propulsion by forming a new Subcommittee on Internal Combustion Engines within its Engineering Committee. In the half century before, marine propulsion had undergone a true revolution, from wind-powered sail to coal-fired steam to oil-driven diesel. Throughout, ABS surveyors kept abreast of the technological changes and contributed individually to the classification society's growing body of accumulated knowledge. Now they could contribute collectively, reporting back to the Internal Combustion Subcommittee in great detail about the remarkable improvements in diesel technologies.

In the 1926 *Bulletin*, for example, an ABS engineer-surveyor meticulously detailed the new mechanical injection diesel engines being produced by the New London Ship and Engine Company. Lauding the new engine's conservation of space, weight and fuel, he expressed appreciation for the years of experience, research and knowledge that went into the development of the engine. In this and other publications, the Bureau signaled its willingness to embrace technological change. Members of the Society of Naval Architects and Marine Engineers later commended ABS for "this open-mindedness, which has been tempered by a thoroughly justified conservatism" and "has had much to do with the development of ship design."

Another advancement evolving during these years was electric welding. Research and experimentation with this cutting-edge technology began during World War I, and some farsighted developers had actually designed and had begun building a welded cargo ship. That construction was abandoned when the war ended, but ABS, which had an active role in the project, continued investigations into the technology. Its developments were reflected in the 1927 ABS Rules, which included 'tentative rules' for electric and gas welding in hull construction. Once electric welding became a controllable process, private industry and the US Navy began working on using the technique in large-scale fabrication, beginning with boiler drums and moving up to entire ship hulls.

Since the first days of metal hull construction, riveting had been the preferred method of joining plates and structural components. By the early 1930s, designers and builders could see the cost and weight savings possible with this new method of fabrication and were eager to use it – and ABS actively encouraged their work. At first, welding and riveting were used together for different parts of the ship. Vessels constructed using welding techniques were given a special class notation as 'metal arc welded' or 'carbon arc welded'. In 1931, ABS and the US Navy accepted welded boiler construction as an industry standard. Several years later, the Bureau classed the largest all-welded vessel yet built and another with an all-welded midbody made of ‘high elastic limit steel’. Because of the welding and new materials, ABS classed the ships as ‘experimental’. In 1934, once several notable vessels had been completed and put in service, ABS Chief Surveyor David Arnott presented a paper to the Society of Naval Architects and Marine Engineers entitled “Some Examples of Welded Ship Construction.”

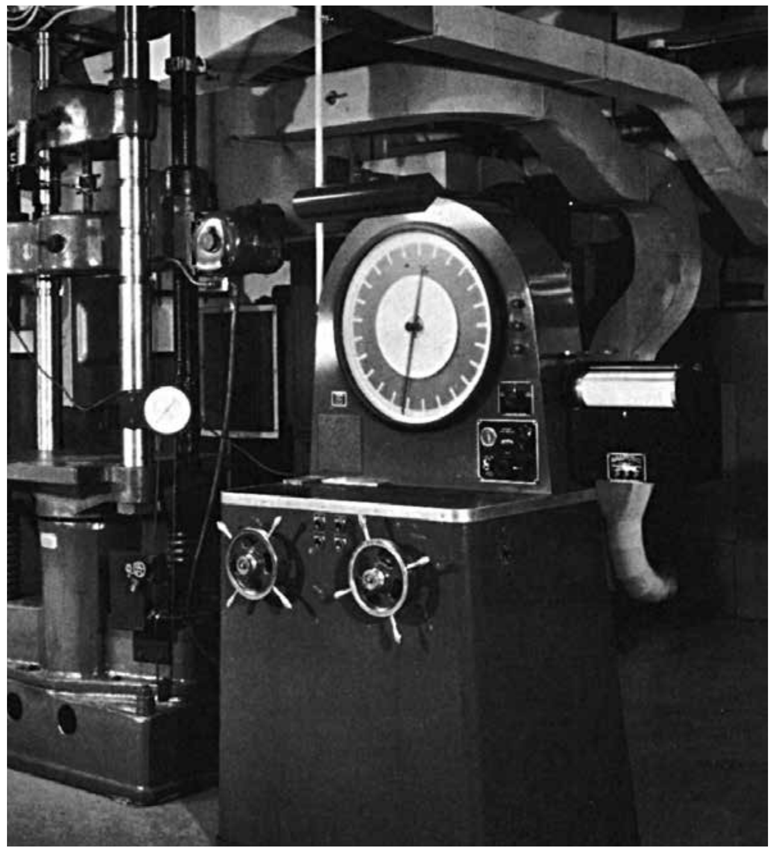
These were years of rapid development in shipbuilding technologies and shipyards frequently called ABS surveyors in to witness special tests of new materials, equipment and appliances. As materials tests on ship plates and shapes, forgings and castings, chain and anchors and even boiler components became increasingly frequent, the Bureau decided to establish a facility in which to perform its own metallurgical analyses. In 1933, ABS set up a metallurgical laboratory for micro-photostatic investigations of metals where technical staff could investigate and approve welding processes, joint designs and other procedures.

These and other exhaustive studies brought significant changes to the next edition of the ABS Rules, published in 1936. Every section of the new Rules was revised, particularly those regarding hull construction, machinery, testing of materials, electrical systems and firefighting equipment. The 1936 ABS Rules also covered welding for all parts of the hull – the first Rules from a major classification society to do so – and led to the Bureau approving the first automatic welding process a year later. By 1937, ABS was classing large oceangoing tankers of 18,000 dwt that had entire cargo spaces made of welded construction.

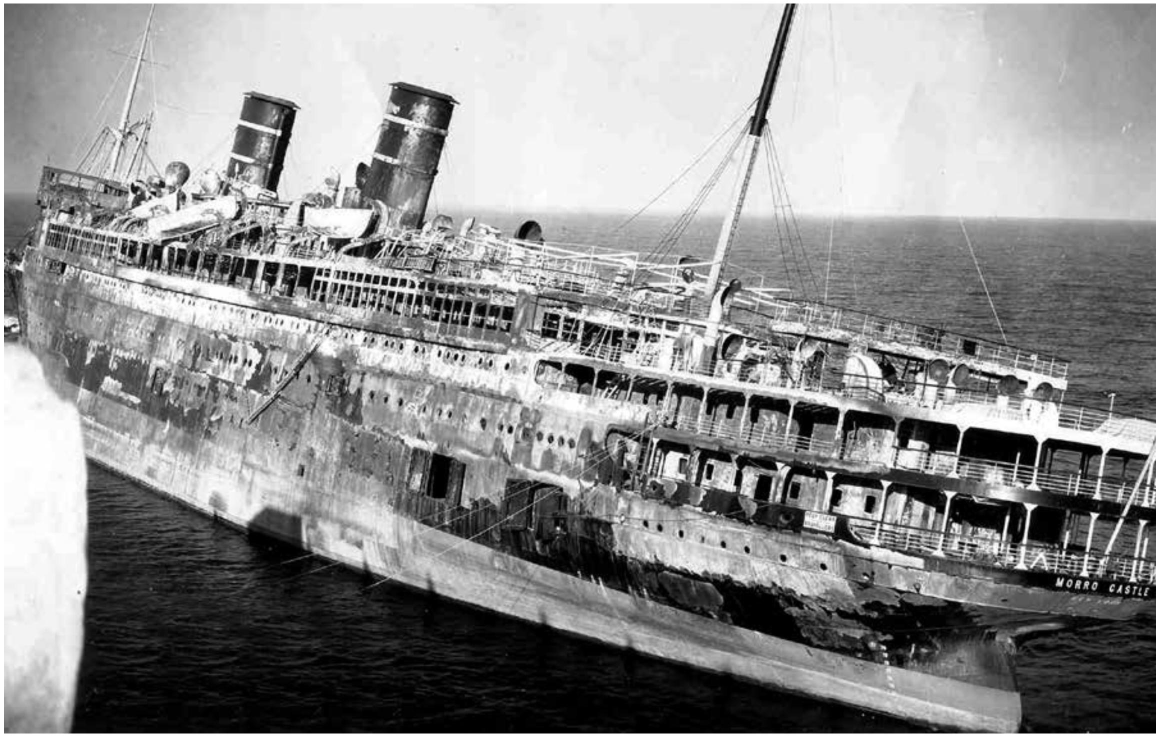
Merchant Marine Act of 1936

For the US maritime industry, the 1930s brought more than just financial hardship. Allegations of corruption marred the programs spawned by the Jones-Hill Act almost from the start, and the resulting investigations uncovered everything from bad decision-making and inefficiencies to outright abuse by companies contracted to carry mail for the United States Post Office. The United States Shipping Board had been generating controversy since its formation, as US President Franklin D. Roosevelt recalled all too well. Its best-known boondoggle was its all-out effort to build 1,000 wooden steamers for World War I – by the war’s end the program had generated a near-useless ‘white elephant fleet’ of 589 completed or partially completed vessels that were obsolete before they hit the water, costing taxpayers an estimated $500,000 apiece. Unwanted by a freight market glutted with modern steel ships, the vessels were laid up in vast ‘ghost fleets’ that, with scrap prices at rock bottom, were still sitting around on the day Roosevelt took office.

An ardent supporter of the merchant marine since his time as Assistant Secretary of the Navy, President Roosevelt did not heed the more radical calls to end all government subsidies for shipping. He kept the subsidies in place but put off further steps to assist the foundering maritime industry.



The Bureau started its own metallurgical laboratory to test weld samples and become more involved in materials testing and investigation.



On 8 September 1934, the SS MORRO CASTLE caught fire and burned, killing a total of 137 passengers and crew members. The devastating fire was a catalyst for improved shipboard fire safety. Today's requirements for using fire retardant materials, automatic fire doors, ship-wide fire alarms and increased attention to fire drills and procedures resulted directly from the disaster.

Then, amid the high-level scandals, intrigue and investigations, true tragedy struck. On 8 September 1934, the *SS Morro Castle,* a luxury liner on the New York-Havana run, caught fire and ran aground at Asbury Park, New Jersey, with a loss of 137 lives. Numerous investigations looked into everything from arson (the first reported flames came from a writing room) to accident (overheated exhaust igniting the painted interior of a smokestack). Although the actual cause of the blaze was never determined, contributing factors were identified. It was noted that, while the ship had operated reliably in nonstop service for four years, it had not yet seen a drydock. With cosmetics of utmost importance to the owner, the vessel was always freshly painted – thick layers of flammable paint reportedly peeled off walls and ceilings and helped spread the blaze. In addition, the shipowner, Ward Lines, had received government subsidies to build the $5 million vessel but had notoriously underpaid the crew and been indiscriminate in verifying crew qualifications.

As a result, the US regulatory regime, the Bureau of Marine Inspection and Investigation and the maritime community itself all came under scrutiny. The disaster eventually led to the creation of a new international fire safety regime for all ships, which included requirements for the use of fire-retardant paints and materials in vessel construction, the installation of fire doors, fire alarms and emergency generators, training of the crew in firefighting procedures and mandatory fire drills underway for all passengers and crew.

As a fallout of the *Morro Castle* disaster, critics of the shipping industry pushed for an end to shipping subsidies. Instead, the Roosevelt Administration announced its intent to increase financial assistance to the industry. Roosevelt wanted to bring shipping into his New Deal programs, seeing in the labor-intensive industry an opportunity to stimulate the economy. In contrast to the subsidies provided by the 1928 Merchant Marine Act, the new assistance programs were to be both sweeping and transparent.

Congress framed the legislation in 1935 and, during the debates the legislators scrutinized the American Bureau of Shipping. The hearings, according to ABS President Luckenbach, placed "the Bureau, its reputation and its functions in a true light." Much to the credit of the American Bureau of Shipping, a wide spectrum of industry leaders praised the classification group. Luckenbach thanked them, pointing out that the Bureau had "very little legislative protection and maintains its position by precedent and the high quality of technical services rendered."

The Bureau continued its public role as an authority in maritime safety and, in 1935, Luckenbach was appointed to a special Technical Committee on Safety at Sea and made Chairman of the Subcommittee on Structural Efficiency for the strength of vessels. Although it took Congress more than a year to agree on legislation addressing the entire merchant marine, smaller laws were enacted in the interim that boosted safety at sea and, in the process, strengthened the American Bureau of Shipping.

For example, Public Law No. 622 mandated that the Bureau of Marine Inspection and Navigation conduct periodic surveys of passenger vessels, with Section 5 stating that plan approvals and certificates issued "by the American Bureau of Shipping would be accepted by the Director as evidence of the structural efficiency of the hull and reliability of the machinery of such vessels."

The legislative package that would have the greatest impact on the fortunes of ABS was passed in the summer of the following year. The Merchant Marine Act of 1936 replaced the United States Shipping Board with a new agency, the US Maritime Commission (the immediate predecessor of today's Maritime Administration), charged with supporting the country's merchant marine, which it recognized as a strategic industry. As worded in Title I, the Act's Declaration of Policy, "It is necessary for the national defense and development of its foreign and domestic commerce that the United States shall have a merchant marine:

(a) sufficient to carry its domestic water-borne commerce and a substantial portion of the water-borne export and import foreign commerce of the United States and to provide shipping service on all routes essential for maintaining the flow of such domestic and foreign water-borne commerce at all times;

(b) capable of serving as a naval and military auxiliary in time of war or national emergency;

(c) owned and operated under the United States flag by citizens of the United States insofar as may be practicable; and

(d) composed of the best-equipped, safest and most suitable types of vessels, constructed in the United States and manned with a trained and efficient citizen personnel. It is hereby declared to be the policy of the United States to foster the development and encourage the maintenance of such a merchant marine."

One of the 14 vessels in the Exporter class owned by American Export Lines, the SS EXEMPLAR had a capacity of 9,900 deadweight tons and a length of 473 feet.

Roosevelt knew ships and, recognizing that most merchant vessels in the country dated from World War I, he also knew that the US commercial fleet was entering the last phase of its service life. The US President wanted modern ships newly built in US shipyards and newly trained seaman in a revitalized merchant marine. To help realize this vision, Roosevelt empowered the Maritime Commission to offer industry subsidies.

The effects of the new programs were felt immediately at ABS, whose reports from the period show a boom in plan approvals followed by a steady increase in the number of vessels in class. After a 15-year struggle to stay afloat, the Bureau now saw itself again steaming towards prosperity.

The 1936 edition of the ABS Rules reflected not only the evolving technologies of the maritime world, but also the government's insistence on having the highest-quality merchant marine; and the public's interest in having stronger oversight of the shipping industry. The new Rules introduced what became a foundation stone of today's international maritime safety regime: the annual classification survey. Until then, the interval between periodic ship surveys had been four years – which, clearly, had not helped the *Morro Castle.* The 1936

J. Lewis Luckenbach

President: 1933-1950 • Chairman: 1950-1951

J. Lewis Luckenbach was the only shipowner to head the American Bureau of Shipping. His family's firm, the Luckenbach Steamship Company, was a major American shipping line and J. Lewis was duly prepared to continue the business. After attending a military academy, then Princeton University and completing an engineering degree at Pratt University, he took charge of all Luckenbach ships on the US Pacific Coast. Business there boomed following the opening of the Panama Canal in 1915 and, by 1920, young Luckenbach was an executive partner driving the company's modernization.

All seemed well until 1925, when J. Lewis abruptly resigned from the firm. Reasons for the rift between father and son are unknown, but the falling out ultimately benefitted the American Bureau of Shipping, which hired Luckenbach in 1927. A natural leader, Luckenbach became acting President of the Bureau following Charles McAllister's sudden death in 1932. One year later, the Board of Managers elected Luckenbach to the position permanently.

During World War I, Luckenbach volunteered to assist overseas ship construction in China and Japan for the Allied war effort. During World War II, he served an important role as a *de facto* spokesperson for safety and good workmanship in the shipping industry. Luckenbach steamships, meanwhile, carried US troops to Europe in both wars.

To recognize Luckenbach's and the American Bureau of Shipping's activities during World War II, the US Navy awarded him the Distinguished Public Service Award in 1948. Luckenbach retired as President of the American Bureau of Shipping in 1950, serving as Chairman until his death in 1951. Annually, Webb Institute awards the J. Lewis Luckenbach Memorial Prize to the student that attains the highest general average over the course of four years.

Rules combined ABS' requirement for periodic vessel survey with the annual review and assignment of load lines mandated by the 1929 US Load Line Act.

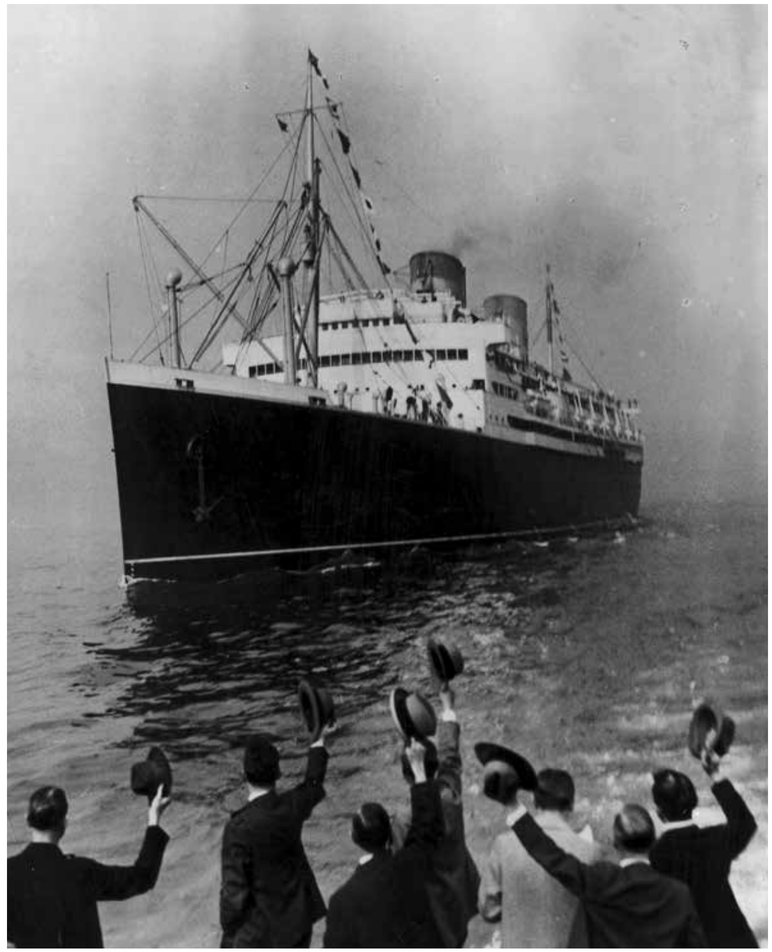
With its account books again awash in black ink and its prospects for the future good, ABS could celebrate its 75th anniversary in 1937 on a high note. While lauding the organization's collective achievements, the *History of the American Bureau of Shipping* issued that year, also gave credit for the Bureau's survival and success to the skilled individuals that represented the company in the field, declaring that "The surveyors of a classification society must of necessity be of the highest integrity, since their decisions, which frequently involve thousands of dollars to owners and underwriters, must be entirely disinterested and given without fear or favor."

As prosperity returned, the Bureau began restoring the staff benefits that had to be cut back during the depths of the Great Depression. In the 1920s, the Bureau had boosted salaries, created a pension fund, increased Christmas bonuses, allowed liberal leaves of absence for older employees and provided private group insurance. One of management's first actions when prospects improved was to restore salaries to their pre-Depression levels. Although net operating gains decreased slightly in 1938 as staff was added, ABS boosted the group life insurance and pension funds. The Bureau had begun a consistent upswing in activity that would lead into one of the most demanding and nationally important periods in its history.

Again Lending Light in the Shadows of War

In May 1939, Italian classification society Registro Italiano Navale held a conference on load line regulation in Rome, which several American Bureau of Shipping representatives attended, including President Luckenbach. The men toured Italian shipyards, compared notes on shipbuilding with their peers from other nations and concluded that, despite the impetus provided by the Maritime Commission, the United States still lagged behind Europe and Japan in new ship construction. Upon his return, Luckenbach told the ABS Board that "attention must be paid to the situation created by the increasingly nationalistic attitudes of other maritime nations and the measures they are taking to further the interests of their own merchant marine."

Indeed, soon after Germany's invasion of Poland that September, many nations represented at the load line conference were at war. Within a year, much of Europe was under German control and the United States, although remaining militarily neutral until Japan's attack on Pearl Harbor in 1941, found various ways to support Britain in the struggle. In 1940, Roosevelt signed the Destroyers for Bases agreement, under which 50 American World War I-era naval destroyers would be



The ocean liner MALOLO, built in 1927 for Matson Navigation, was the first ship designed by William Francis Gibbs, creator of the famed SS UNITED STATES. Refitted in 1937 and renamed MATSONIA, the ship was so robustly designed and built that it remained in active service under various owners for 50 years.

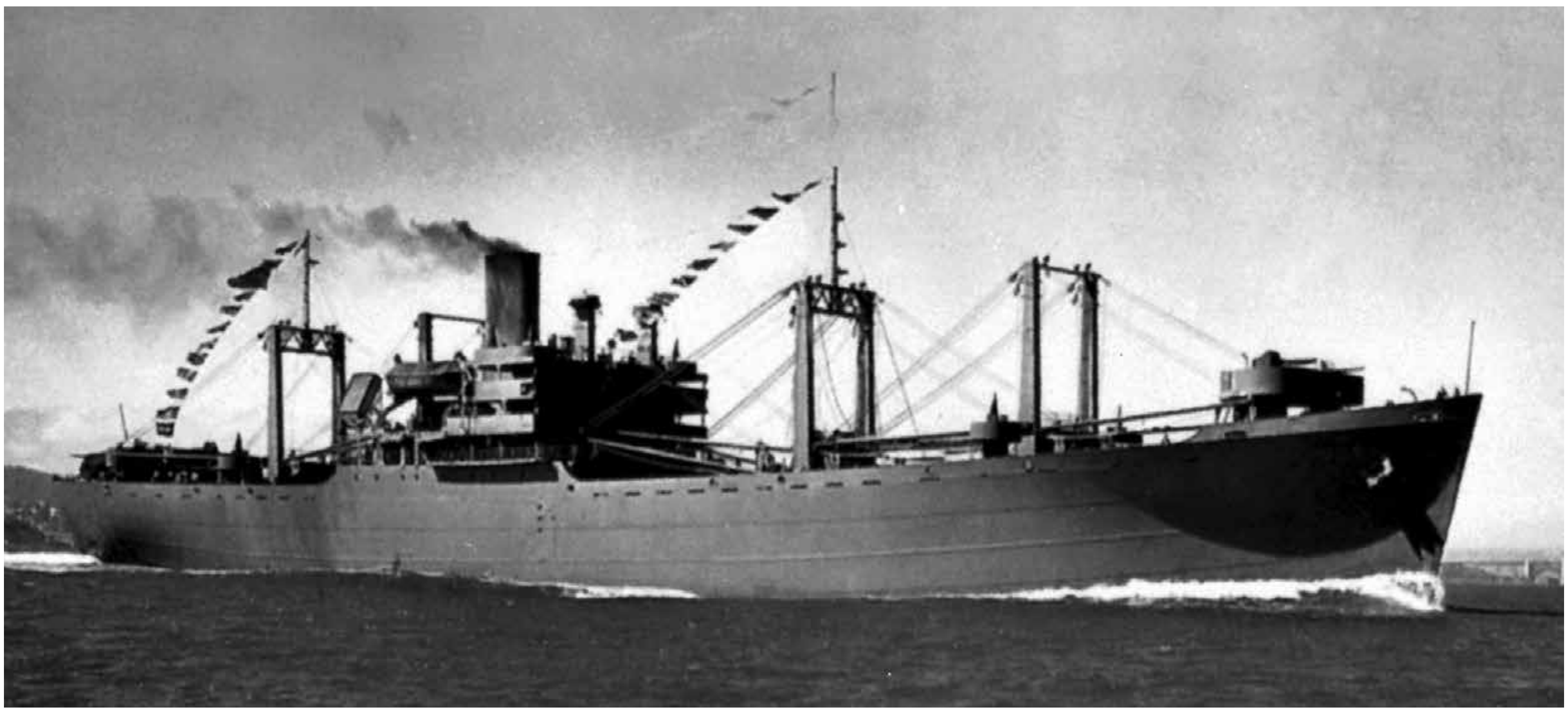
traded to Great Britain for the rights to establish military bases on the British Commonwealth Islands near the United States. He followed this with the Lend-Lease Act in 1941, which, concerning countries whose defense the President deemed vital to the defense of the United States, permitted America to "sell, transfer title to, exchange, lease, lend, or otherwise dispose of, to any such government, any defense article."

During this period, the US began openly gearing up for defense, instituting its first peacetime draft and quintupling its defense budget to $10 billion. The Maritime Commission, meanwhile, was in the fifth year of its program to restore US shipbuilding and the US-flag fleet.

When the Maritime Commission formed in 1936, there were just ten shipyards and 46 slipways in the US capable of building a ship greater than 400 ft in length and half of these yards were full with Navy work. The next year, the Commission began a ten-year peacetime construction program through which 500 new merchant ships would be put to sea at a rate of 50 per year. Designed by teams under the Maritime Commission's oversight, they were to be high-speed turbine-driven tankers and freighters designated C1, C2 and C3 (C for cargo and the number designating a relative size) and all were to be classed by the American Bureau of Shipping.

By 1940, the Commission could claim its ships were living up to the vision in the Merchant Marine Act, being both fast (one freighter clocked 17 knots on a transatlantic voyage) and innovative – deliveries included the Commission's first all-welded vessel. In 1940, the Commission doubled its original building schedule for a second time, ordering 200 ships in the now 19 US shipyards.

Across the Atlantic, in the first nine months of 1940, Great Britain lost 150 merchant ships to U-boat torpedoes – the country was losing ships at a faster rate than its yards could build them. That September, the British Merchant Shipbuilding Mission arrived in America with an order for 60 standard-design cargo ships based on a vessel produced in 1939 by Sunderland shipbuilder J.L. Thompson and



The USS JOHN LAND, built to the Maritime Commission's C2 design, was 459 ft long with a displacement of 13,893 tons and a steam turbine propulsion unit of 6,600 shaft horsepower.

Sons, whose representative headed the mission. It was less advanced and slower than the latest American ships, but it was a simpler design using familiar technology – including a triple-expansion, reciprocating steam engine whose original patent dated to 1896.

Britain was permitted to purchase the ships outright, but all existing US yards were operating at capacity. Because the ships were needed immediately, the mission concluded they would have to be built using the relatively new method of welded construction, which was much faster than traditional riveting, and would have to be built in new shipyards. The project was taken on by a partnership between Todd Shipyards and industrialist Henry J. Kaiser, whose construction works included the Grand Coulee and Hoover dams and the bridge linking San Francisco to Oakland. They constructed two shipyards that would each build 30 vessels and in October 1941 launched the first of this Ocean class vessel, named *Ocean Vanguard*.

On 27 September 1941, designated as Liberty Fleet Day, the first Liberty ship, the SS PATRICK HENRY, was launched by President Franklin D. Roosevelt at the Bethlehem-Fairfield Shipyard in Baltimore, Maryland.

As the war progressed, it became clear that an even greater number of ships would be needed. In January 1941, it was announced that a new shipbuilding program of 200 vessels for Britain would begin. The steam turbine machinery driving the latest US ships could not be produced in sufficient quantities and it was eventually decided to modify the Ocean series plans. The vessels ultimately developed for the new program, designated EC2 for 'emergency cargo ship, size 2' (400 to 450 ft), had among their standard features a raked stem, cruiser stern, single-screw and balanced rudder. They were driven by the 19th-century triple-expansion steam engine, but modified to use water-tube (instead of Scotch or fire-tube) boilers fueled by oil instead of coal. The 10,900-dwt ships could make 11 knots at top speed, had a cruising range of 8,000 miles and could cross the Atlantic in roughly two weeks.

Unfortunately, they were not beautiful. In his 1941 speech announcing the additional 200-ship project, US President Roosevelt referred to the EC2s as "dreadful-looking objects," and the vessels were soon derided in the press as "ugly ducklings" that, because of their slow speed, would be sitting ducks for the dive-bombers and U-boats. In an attempt to refute this demoralizing image, US Admiral Emory Land, Chairman of the Maritime Commission, started referring to the vessels as a "Liberty Fleet" and nominated 27 September 1941, the launch date of the first EC2 (the *SS Patrick Henry*), as Liberty Fleet Day. The idea caught on and soon the ugly ducklings were being referred to as the Liberty ships.

Nine new shipyards were approved that year to build Liberties; ultimately, a total of 18 yards would be involved in the program. In many cases, ships were under construction even as the shipyards themselves were being completed.

The ROBERT M. LAFOLLETTE was launched on 10 January 1943. The Liberty ship was built by Delta Shipbuilding Company in New Orleans, Louisiana.

ABS was swept up in the newbuilding program, just as it had been during World War I. Between 1940 and 1941, tonnage in class with the American Bureau of Shipping jumped from 1.53 million gross tons to 5.49 million gross tons. To handle the increased workload, ABS increased its surveyor staff by 40 – 26 exclusive surveyors and 14 nonexclusive. During the 1941 Annual Meeting, Luckenbach celebrated the good fortune of the Government's having "started the ball rolling with a well-defined program" in 1936. In his estimation, that effort put the United States "about two years further advanced towards our desired goal."

After Japan attacked Pearl Harbor on 7 December 1941 – less than 90 days after Liberty Fleet Day – the US Government kicked the Liberty program into high gear. Having declared war against Japan and its allies, the United States was obliged to fight a two-ocean war and needed to build vessels faster than its enemies could sink them. The Axis intensified their sea campaigns and, in 1942, the Allied forces lost 1,200 ships totaling 6 million dwt. The Liberty program was enlarged through three 'waves of expansion' and, by 1943, nearly 85 percent of all Allied merchant ships were coming from American shipyards.

The mass production scheme that Henry Kaiser developed for the Ocean class set the pattern for the Liberty ship program. He looked at ships with wholly unromantic eyes, not as craftwork wrought by the hands of a shipwright, but as industrial products that needed to be churned out of a mill to a reliable standard of quality. Thus, he developed a method of mass production in which the shipyard was just an assembly line organized according to manufacturing issues, not categories of craft. For example, it was determined that most welding tasks could be accomplished using the 'down-hand' technique, holding the torch below the waist and letting the weld flow by gravity. Unskilled workers could easily be trained to perform this task.

In a complete break with shipbuilding tradition, Kaiser built vessels in modules – forepeaks were built sideways; sides were built lying flat; deckhouses were built upside down; and bottoms, bulkheads and decks were built as discrete units. He who had never built a ship before 1940 had, by 1943, surpassed the production rates of every shipyard ever established, and in so doing invented modern shipbuilding. Brought to Japan after the war, the Kaiser method became the Japanese method and, thus, the foundation of today's shipbuilding industry.

As more Liberties were built, production time per vessel was reduced. Once the welders conquered their learning curve, the yards became efficient manufacturing plants assembling the 30,000-plus components, mass-produced in thousands of factories in some 32 states, that went into building a Liberty ship. The genius of the Liberty ship design was perhaps most apparent in its choice of old-fashioned power plant – many seafarers were familiar with the technology, the parts could be reliably mass-produced and every component was interchangeable. According to one War Shipping Administration report, "it was actually possible to remove pistons, complete with rings, from the engine of a West Coast manufacturer and install them into the engine of an East Coast manufacturer without any alteration or machine work whatsoever" and that interchangeability extended "all the way to connecting rods and even crankshafts."

As shipbuilding efficiency improved, production records were continually set, broken and set again. The national average for delivering Liberties shrunk to about one ship per day, with the fastest start-to-finish time of a single ship, the *SS Robert E. Peary*, being four days, 15 hours and 30 minutes. The breakneck pace kept the Bureau survey staff moving and expanding. Between 1939 and 1944, ABS increased its number of exclusive surveyors from 92 to 479 – each man proudly wearing a special badge identifying him to shipyard security as an ABS surveyor.

The Liberties delivered material to Allied forces at the Herculean rate of 6,000 tons per hour, earning their description as "the merchant fleet that helped win the war and preserve freedom." By the war's end, 2,710 Liberty ships, totaling nearly 19.5 million gross tons, were built to ABS class. Three of the vessels were named for ABS people, two for past presidents – the *SS Stevenson Taylor* and the *SS Charles A. McAllister* – and one for the principal surveyor who founded ABS' exclusive office in San Francisco, the *SS Frank H. Evers*.

ABS surveyors wore official badges at shipyards during the World War II building effort.

The Story Behind a Name

Liberty Ship FRANK H. EVERS

On 8 December 1943 a Liberty ship was launched from slipway No. 2 of the Permanente Metals Corporation of Richmond, California and christened the SS FRANK H. EVERS – the only Liberty ship named for an ABS surveyor.

Frank Evers was born into the seafaring culture of Plymouth, England on 16 March 1867 and developed a lifelong fondness for the sea. He worked as a machinist to pay for his naval architecture education. He then worked his way up to the position of Chief Engineer on tramp steamers plying the China trades. Soon after observing the bombardment of Tientsin in 1900 during the Boxer Rebellion, Evers left the sea to work as an independent ship surveyor on the US West Coast. In 1901, he was appointed as a nonexclusive surveyor for the Bureau based in San Francisco, California.

Evers was also Superintendent Engineer for the Union Oil Company and was instrumental in laying the first Pacific Coast pipeline. Evers often claimed he was living on borrowed time, for he had been aboard the SS PROGRESSO on 3 December 1903 when it exploded in flames at the dock of San Francisco's Fulton Iron Works. He was blown into the bay and rescued by a passing tug. Evers later opened the first exclusive ABS office in San Francisco, becoming the area's first Principal Surveyor. He hired as his secretary a promising teenager named Cecile McQuaide, who spent her entire career with the Bureau and became a valued aide to several generations of ABS West Coast surveyors.

Frank Evers shunned retirement, working until his death on 11 October 1943. His many friends in the West Coast shipping industry petitioned the Maritime Commission to name a Liberty ship for him, and succeeded. The SS FRANK H. EVERS was christened by Evers' daughter and delivered to the Maritime Commission a week later. At the helm on its maiden voyage was Captain J.H. Barnhart, nephew of Cecile McQuaide, who at 1300 hours on 1 January 1944 off Cape Mendocino deposited the ashes of Frank Henry Evers into the sea he loved so well.

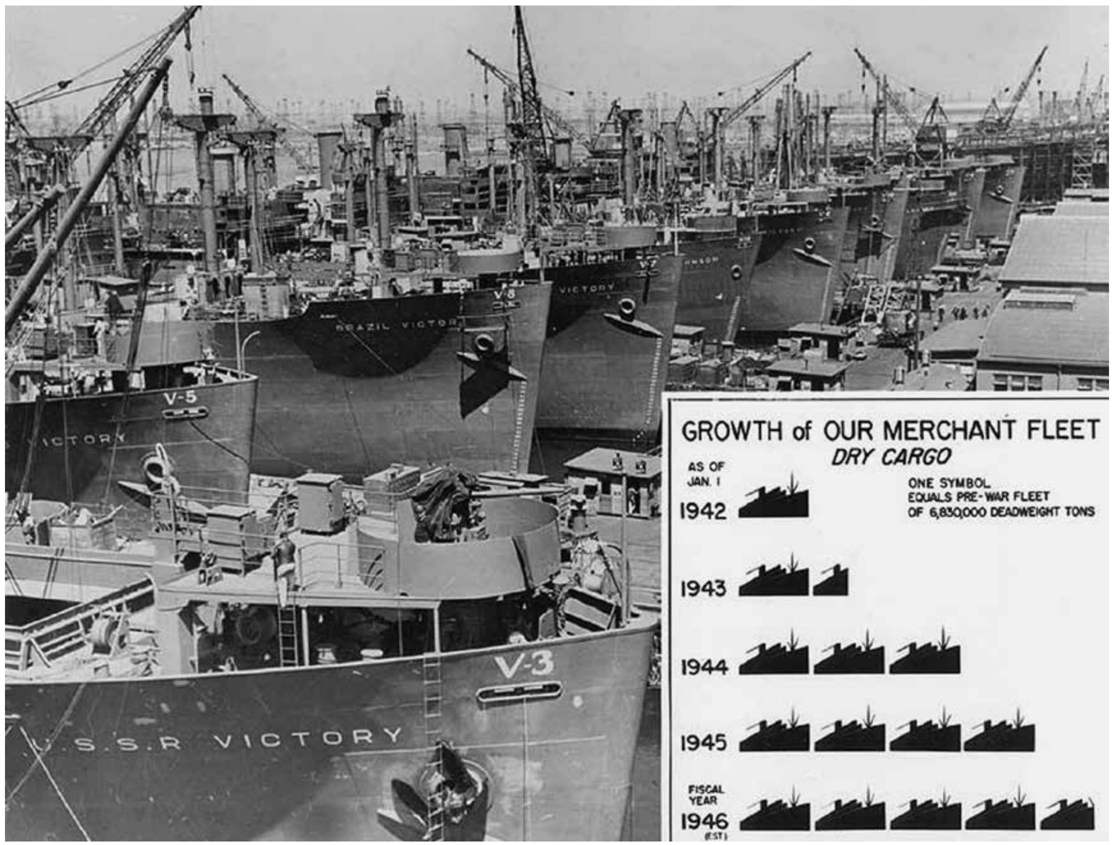
Operated through the war by American President Lines, the FRANK H. EVERS was among the 90 Liberties sold to the Government of Italy in 1947, sailing the next 16 years for Costa Lines as the ENRICO C. It was sold in 1963 and finished its career as NICHOLAS A, meeting the scrapper's torch four years later in Kaohsiung, Taiwan. In one of those magical maritime coincidences, the only Liberty ship named for an ABS surveyor was, during its construction phase, designated Hull No. 2710, which would end up being the total number of Liberty ships built, all of which were classed by ABS.

ABS made numerous technical contributions to the Liberty program, including suggesting design changes to improve the vessels. For example, ABS engineers were able to simply facilitate steel supply by reducing the number of steel plate thicknesses from 75 to 27. Another was the reassessment of the ship's deadweight capacity, which, because the scantling design specifications actually accommodated a deeper draft than originally designed, was increased by 430 dwt – boosting the collective cargo capacity of the fleet by over one million tons.

By 1943, the Maritime Commission began planning a fast cargo ship as successor to the Liberties, named the Victory ship (type VC2). The Bureau participated extensively in developing the new design, with ABS President Luckenbach taking a close personal interest in the project. Slightly longer than a Liberty (but still a C2 size) at 436 feet, the Victory ship had a capacity of 10,750 dwt and cruising speeds of 15 to 17 knots. Between 1944 and 1945, the Maritime Commission built 414 Victory cargo ships and 117 Victory transports, with all 531 Victory ships classed by ABS.

Every bit as important as the dry cargo ship programs was the Maritime Commission's emergency tanker construction program – the aircraft, tanks and other vehicles carried to the battlefront in the holds of Liberty and Victory ships could do very little without fuel. Where the Liberty program used one design, the tanker program called for three basic types, designated T1, T2 and T3. These were built in several variations to satisfy various service needs. In the smallest class (T1), 90 vessels were built to four designs with an additional 23 built to a special shallow-draft design intended to supply Pacific atolls and to access other restricted-draft areas. The 58 largest T3 emergency tankers were built to seven designs.

The most important of the emergency tanker group was the intermediate T2 size, of which 521 were built to three nearly identical principal designs. The T2s were based on a commercial design developed by Sun Shipbuilding for Standard Oil. The all-welded, 16,900-dwt single-deck tankers had a length overall of 523 ft and a capacity of 144,160 barrels, powered by turbo-electric drives. These vessels proved durable in service, many working (in part at least) into the 1990s. Although welded construction was frowned upon as temporary at best, their construction and service experiences – helped along by ABS engineers and surveyors – laid the foundation for the supertanker era that began during the world's postwar recovery.



Victory ships, an advance over Liberty ship designs, had higher speeds of 15 to 17 knots. A few Victories remain, including the fully functional SS LANE VICTORY, now a living museum ship moored in Los Angeles, California.

The INGLEWOOD HILLS, a T2 tanker, was one of more than 500 built to carry fuel to Allied Nations. Nearly 450 of the 15,850-dwt T2s were sold to private owners after the war to help the world recover and re-industrialize.

In addition to conducting plan reviews, surveys and classification, the American Bureau of Shipping was requested by the War Shipping Administration to issue speed and deadweight certificates for all American merchant vessels. The Bureau already had an enormous workload but it was able to do this job, free of charge while also working with various government agencies to standardize materials and specifications. War conditions inevitably increased demand for damage surveys and by 1944 the Bureau began sending men to foreign ports to conduct them with the War Shipping Administration. Despite these extra duties, ABS continued to publish the *Record* and the *Bulletin*, although the US Board of Censorship kept their distribution limited to "those of known reliability."

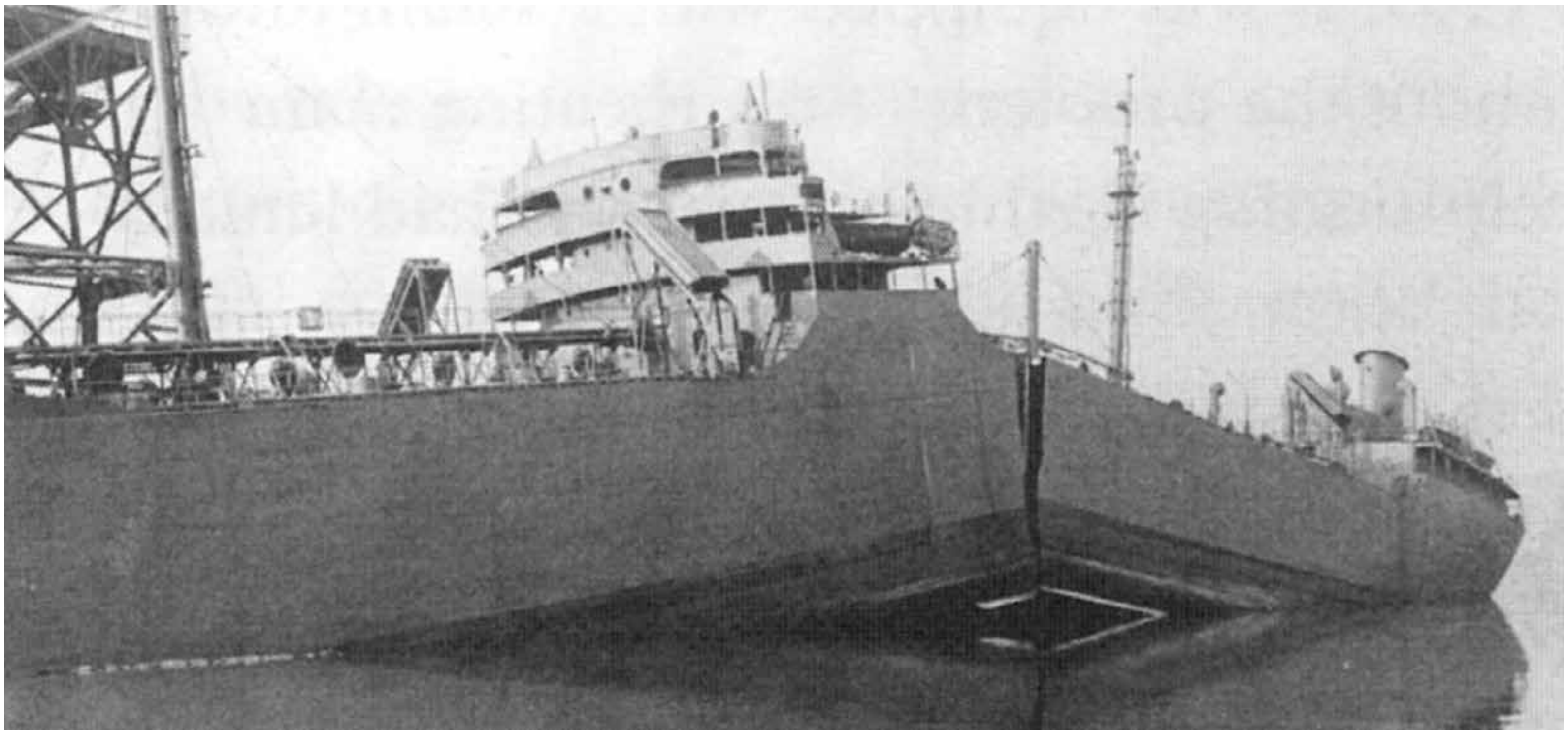
A Technology Legacy Begins

Welded hull construction methods made the emergency shipbuilding programs possible. The techniques and technologies involved had begun developing in the last few years before the war started and, as they evolved, ABS enlarged its metallurgical laboratory and testing facilities. When some emergency ships experienced sudden, mysterious structural failures, the ABS laboratory became a critical part of the effort to examine, understand and resolve the problem. The concern, which for a brief, tense moment called the future of welded ships into question, began with a bang aboard the T2 tanker *SS Schenectady*. Following sea trials in January 1943, the *Schenectady* tied up at an outfitting dock on the Willamette River in Portland, Oregon. Suddenly, the day's quiet was shattered by the sound of an explosion that could be heard for miles. The strength deck buckled, the midsection heaved up and the ship split in two, a fracture running all the way round the body just aft of the superstructure. Only a few pieces of bottom plating held the jack-knifed vessel together. The center portion of the vessel rose out of the river to such a height – with the bow and the stern resting on the bottom – that no water entered the hull.

What happened to the *Schenectady* was an extreme example of a problem experienced by a number of Liberty ships, T2 tankers and other welded bulk carriers during the early years of the war. They suffered sudden, mysterious, extensive and sometimes destructive fractures. Many Liberties had experienced cracking around the hatch corners and along the sheer strake, while others sustained damage around deckhouse connections. Though few cracked at dockside, 24 suffered complete fracture of the strength deck; one even fractured its bottom. Several broke in half during heavy storms and others limped into port with damage not caused by the enemy.

Amid outraged allegations against shipbuilders of everything from carelessness to fraud, in April 1943 the Secretary of the Navy appointed a Board to Investigate the Design and Methods of Construction of Welded Steel Merchant Vessels. Comprising the Board were the Engineer-in-Chief of the US Coast Guard; the Chief of the US Navy Bureau of Ships; the Vice Chairman of the Maritime Commission; and the Chief Surveyor of the American Bureau of Shipping. Although not a government entity, ABS was asked to join partly because of its long history of studying ship structures and its developmental work in welding and, in the words of one later report on the Board's activities, because it "supplies the needs of the commerce of the United States for a fair and thorough rating of vessels in regard to their character and competence."

"It is not a problem of Liberty ships but of welding stresses," Rear Admiral Howard Vickery, then Vice Chairman of the Maritime Commission, said at the time. Henry Kaiser blamed defective steel. Others blamed design flaws and shoddy workmanship. As the investigation would show, they all turned out to be right. The investigation was extensive. At a cost of many millions of dollars, examinations were made on various types of vessels known to have suffered structural failure. These included four Great Lakes ore carriers, 20 Liberty ships, six T2 tankers, three C4 troop carriers, 21 Victory ships and one C2 refrigerated cargo ship. Tests included full-scale hull bending studies in still water; determination of locked-in stresses, including those caused by temperature variations during assembly; and examination of thermal stresses while in service.



The SS SCHENECTADY was a T2 tanker constructed by the Kaiser Shipbuilding Company in Portland, Oregon. The keel was laid on 1 July 1942, the completed hull launched on 24 October, and the vessel was completed on 31 December. However, on 16 January 1943, shortly after returning from sea trials, the hull cracked almost in half, just aft of the superstructure. ABS had a lead role in the investigation to determine the cause of the fracture and to develop a solution.

Out of the 2,710 Liberty ships, more than 200 were lost to German U-boats, including the SS CHARLES MORGAN, which took a bomb hit aft that ignited ammunition lockers and blew off the stern when the ship was offshore Utah Beach.

At first, the phenomenon was called 'brittle fracture'. The engineering belief at the time was that the mild steel used in ship construction would stretch elastically to a certain point, after which it would deform plastically, and finally tear. That break would have a stretched, silky appearance. These fractures, instead, had a crystalline look, as if the normally ductile material had suddenly become brittle. It became clear that fracture was not very well understood – indeed, over a year passed before it was duplicated in a laboratory.

Understanding fracture mechanics, so vital to today's rational shipbuilding methods, began with the Board's inquiries. Working with the National Academy of Sciences, the Board brought some of the best engineering minds in the country to dissect the problem. After lengthy data collection and laboratory analyses, the fracture factors were found and solutions offered.

The researchers discovered that practically all fractures occurred in the presence of a notch – any discontinuity, which could be caused by design (for example, a cutout in a plate for a hatch opening or a vent) or by error (anything from faulty workmanship to a metallurgical defect). They also found a connection to seawater temperature. The Board determined that structural steel requirements for welded vessels needed to be redefined.

The Board recommended a number of solutions. The one best remembered by Liberty ship veterans is the 'crack arrestor' – either a seam strap attached along the deck just outboard of the cargo hatch or a riveted gunwale angle reinforcing the deck and shear strake. Additionally, hatch corners were modified on all vessels under construction or already completed. It was soon discovered that certain design details, which in riveted construction would have been of no special note, took on new significance when welded; abrupt changes in section, for example, could initiate cracks and raise local stresses. The Board instructed that sharp structural discontinuities and abrupt section design changes in new vessels were to be avoided wherever possible.

These and other solutions reduced the number of hull fractures from 140 per month in March 1944 to less than 20 per month two years later. Fortunately, only eight of the thousands of ships built by the Maritime Commission were lost during World War II as a direct result of brittle fracture.

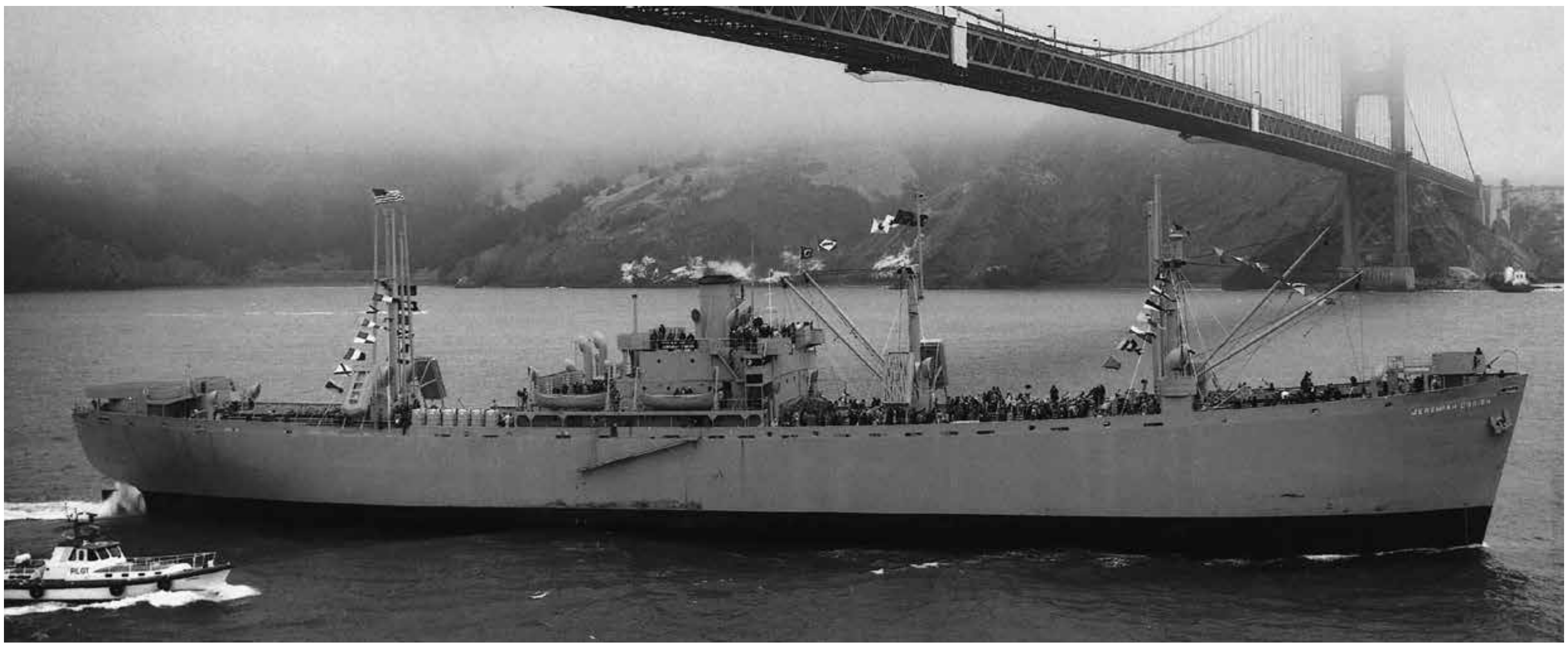
Perhaps even more important than the Board's seminal work in fracture mechanics was an after-effect of its work. The Board submitted its final report on 15 July 1946 and was to be dissolved about a month later, but those involved in its work had come to realize that they were only just beginning to develop a true in-depth understanding of what happens to ship structures at sea. They recommended establishment of a permanent committee to "investigate and study problems pertaining to the structure of ships in order to improve design details, material and methods of fabrication used in ship construction."

As a result, on 25 July 1946, the Ship Structure Committee was chartered. It quickly became a leading marine engineering think-tank, overseeing a cooperative, wide-ranging research effort to identify and tackle engineering challenges of the future. One of its later reports would inspire ABS to develop a revolutionary new technology that became a fundamental element of modern naval architecture. Today, the Ship Structure Committee is a five-member Board composed of representatives from the US Coast Guard, the Naval Sea Systems Command, the Maritime Administration, the Military Sealift command and the American Bureau of Shipping – a valuable legacy of the emergency shipbuilding effort.

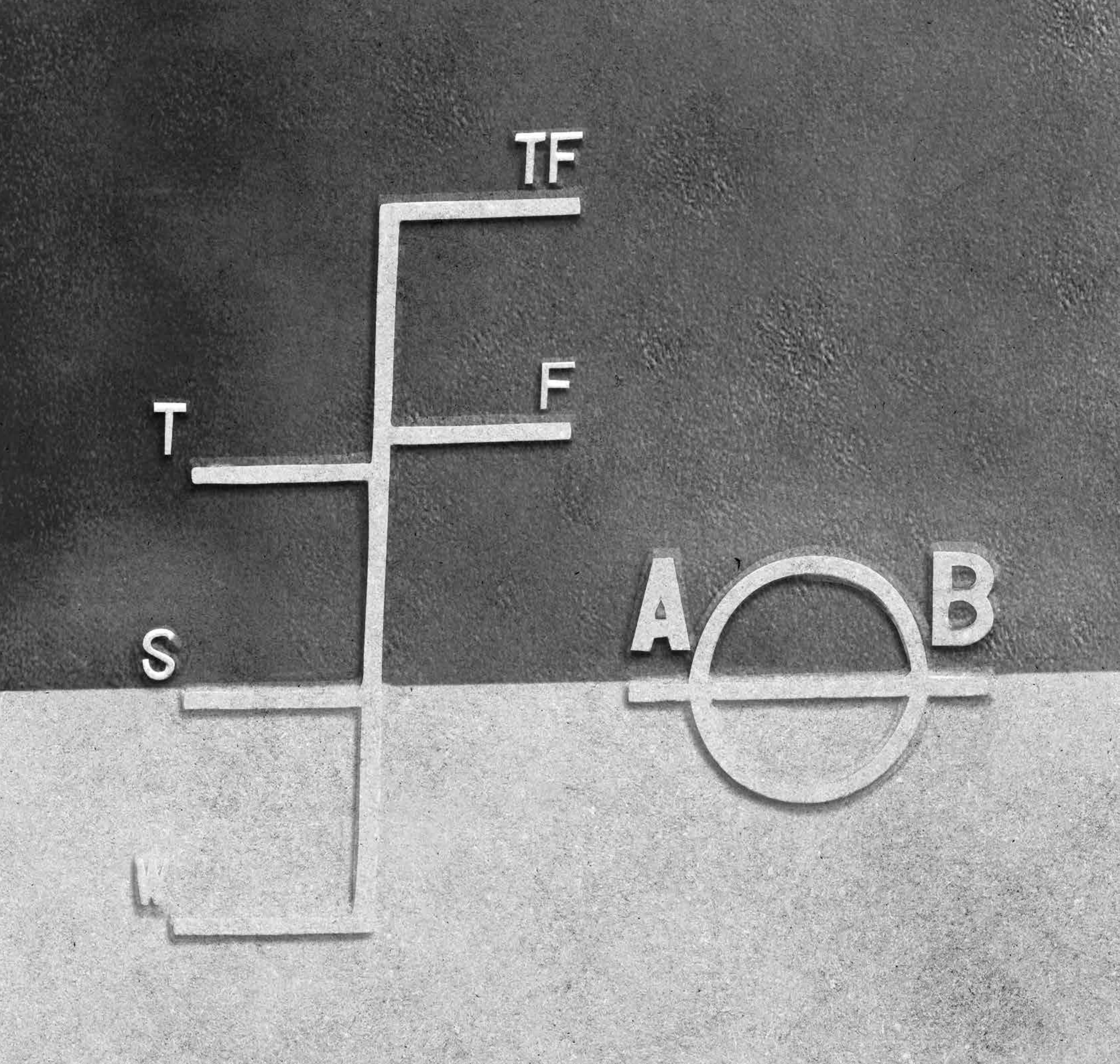
The Maritime Commission produced some 5,171 non-naval vessels of many types, including troop transports, ore carriers, small and large cargo ships and oil tankers under its wartime shipbuilding program – a total of more than 38 million gross tons, all built to ABS class.

During the war years, ABS President Luckenbach was often quoted in newspapers around the country, making this the time when ABS became most visible to average Americans. During the war, ABS had performed an unprecedented number and variety of tasks for the Federal Government, with the Navy, Coast Guard, Maritime Commission, Defense Plant Corporation and War Shipping Administration all repeatedly turning to the American Bureau of Shipping for insight and expertise. Luckenbach was awarded the Distinguished Public Service Award by the US Navy and ABS ended another war on another very high note.

This optimism carried into the Bureau's postwar outlook. In October 1944, the American Merchant Marine Conference met to discuss "Planning the Transition of American Shipbuilding and Shipping from War to Peace." J. Lewis Luckenbach led the introductory remarks, stating that "in building this merchant marine we have proven to the world what America is and what America can do – give America opportunity and we will have no fear for the future of our American merchant marine." ✠



The Liberty ship SS JEREMIAH O'BRIEN remained in operation for nearly 60 years. In 1994, the vessel was designated as a US National Historic Landmark. Still in ABS class, the fully functional museum ship sailed to Europe to celebrate the 50th anniversary of the end of World War II. It is docked in San Francisco, California.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Chapter 4

First Steps Towards Global Expansion

1946 – 1964

The American Bureau of Shipping today is a worldwide organization employing more than 4,500 individuals in 200 offices located in 70 countries. Scarcely three generations ago, ABS was a national classification society focused primarily on American shipping, with minimal overseas ambitions. Its global expansion and transformation into an international organization began with the temporary assignment of ABS surveyors to the War Shipping Administration during World War II.

ABS surveyors working with the War Shipping Administration followed American forces through North Africa and Italy. This group was responsible for surveying vessels, particularly those damaged in action. Their duties included surveying the structure and mechanical systems and approving emergency repairs that were necessary for a vessel's trip home. By the war's end these surveyors were concentrated in Genoa and Naples, Italy, where they soon established ABS offices.

When World War II ended, the United States owned more than 40 million gross tons of new merchant shipping – over 4,000 vessels – and faced the question of what to do with them. They were economical to operate, had a favorable draft for ports the world over, were equipped with the most modern cargo handling equipment and deck machinery and, with only minor structural alteration (most often, just the removal of armaments and gun tubs) could serve as excellent commercial cargo carriers in any service.

The matter had been a subject of study for some time. During the war, the Maritime Commission and the War Shipping Administration empanelled a Postwar Planning Committee to estimate probable postwar shipping requirements and to outline plans for an adequate merchant marine. ABS President Luckenbach, a strong advocate of the US merchant marine, urged the Government to make good use of them – as they had been built at the expense of the people of the United States, they should now serve them, taking American exports overseas and bringing imports home. "The American flag will then be seen throughout the ports of the nations of the world," he envisioned, "which should reflect our national prestige to those of other lands." Further, with relations between the United States and the Soviet Union chilling into the Cold War, he urged that a ready reserve of merchant shipping be kept as preparation for a national emergency.

Although the Government's disposition of its surplus ships may not have been as US flag-centric as Luckenbach had hoped, it was a vital step into one of history's great humanitarian efforts: the reconstructive assistance given a war-torn world by the United States. Two years before the Marshall Plan was announced, the Merchant Ship Sales Act of 1946 gave America's allies the opportunity to buy surplus ships, to begin restoring their merchant fleets – most of which had been destroyed during the war – and take in hand the means of importing the materials of their reconstruction. To start the program, select numbers of vessels, mostly Liberty ships and T2 tankers, were allocated to various allies: Greece and Italy were granted 100 ships each; France received 74; Norway obtained 24; China was allotted 18; and Great Britain, after some delay, received 106.

The Act granted authority to sell to foreign interests into 1948 and to buyers in the United States into 1949. As a result of the entire divestment effort, in just three years about half the surplus merchant fleet was sold, with roughly half of those vessels going to foreign interests.

The program may qualify as the largest tanker sales event in history, with 399 tankers in the T2-SE-A1 class (those equipped with turbo-electric drives), split almost evenly between US-flag and foreign operators. These were the most modern tankships of the time, and their commercial use by private shipowners and oil majors helped lay the foundation of many of today's great crude carrier fleets. In addition to the T2s, 170 Victory ships were sold, 72 to US buyers and 98 to shipowners in Europe and as far afield as Argentina, Egypt, India and Australia.

By far, Liberty ships accounted for the greatest number of vessels sold under the Merchant Ship Sales Act – 781 in total, 202 of which went into American hands. The Liberty ship silhouette soon became a familiar sight in ports around the world, as the vessels provided the springboard from which many of the great European shipping lines rebuilt their fortunes and helped rebuild their countries. The "ugly ducklings" proved to be extremely durable in war and peace, with some trading into the 1990s.

The selling price of a Liberty ship under the Merchant Ship Sales Act was £140,000 or $560,000 at the time. Wear and tear notwithstanding, it was a real bargain since the average cost of building a Liberty had been about $1.7 million. While owners had to pay 25 percent down in cash they could often find government assistance in raising the funds. On top of that, the United States fixed the loan repayment terms at the 1946 exchange rates to protect the shipowners against fragile, inflation-ridden postwar economies.

Walter L. Green

President: 1950-1952 • President & Chairman: 1952-1957 • Chairman: 1957-1959

Born in Brooklyn, New York, Walter L. Green received his engineering degree from the city's Pratt Institute and joined the operating department of the Luckenbach Steamship Company. He became the company's Superintending Engineer in 1921 and worked directly under J. Lewis Luckenbach until the shipping heir's resignation in 1925.

Green briefly followed Luckenbach to the American Bureau of Shipping, becoming Vice President in 1938. Within a year, however, he left ABS to become Vice President of the William H. Todd Corporation, one of the largest shipbuilding firms in the United States. During World War II, Green built Liberty ships as Vice President of Todd's New England Shipbuilding Corporation.

He returned to ABS in 1947, again as Vice President under Luckenbach. In 1950, with his health declining, Luckenbach moved up to the position of Chairman and Green was elected President of ABS. After Luckenbach's death in 1952, Green became both President and Chairman – the first to fill both positions at the same time. He retired as President in 1957 and remained Chairman until 1959, when the Board made him an honorary Vice President. He remains the only man to serve two non-consecutive terms as Vice President in two different decades. Green died on 26 March 1962, at the age of 68.

After World War II, the SS JOHN W. BROWN carried cargoes to help rebuild war-torn Europe and return American troops to the United States. Located in Baltimore Harbor, the ship was listed on the National Register of Historic Places in 1997. As a floating museum ship, the JOHN W. BROWN still puts out to sea for Living History Day Cruises.

In Italy, for example, the Lire lost over 65 percent of its value between 1946 and 1950, going from 225 to 640 per US dollar. Having long-term loans fixed at 225 Lire/dollar contributed immensely to stabilizing the Italian shipowning community and allowing it to accumulate profits and start building new ships during the 1950s.

The Liberty ships had a particularly important effect on the maritime communities of Greece and Italy. During the late 1940s and 1950s, in addition to Marshall Plan cargoes, the Liberty ships carried millions of tons of coal, ore, grain and fertilizer to war-ravaged Europe and the Orient, permitting these shipowners to expand beyond their traditional pre-war Mediterranean and European routes. The vessels' success also spawned an amazing sale and purchase market. By 1949, Liberty ships could command £200,000 ($800,000) and briefly sold for £700,000 ($2.8 million) during the 1956 Suez Crisis, after which they plummeted in value as more modern tonnage pushed them out of the major markets. This enabled owners to hook into the international financial network. Greek shipping legend George P. Livanos once said that, "through the Liberties, Greeks were exposed to new world financing and American banks learned that shipping finance could be secure and profitable."

The vessels also helped shipowners modernize their operations. Italian shipping great Giuseppe d'Amico, whose company Fratelli d'Amico Armatori began its postwar buildup with four Liberties and two T2 tankers, once described the Liberty ships as a "double gift" to shipowners, for the favorable financing and for the effect the vessels had on the shipping business.

"The Liberty ships were absolutely modern vessels filled with rational concepts; such ships did not exist in the mercantile world before the war," d'Amico said. "With its simplified technology, the Liberty was an enormous advance for us. Studying the rationalized technology of the Liberties, we learned to change our ways of working and improve our methods. It was the start of the professional evolution of the Italian shipowners – and of the crews, too, from whom the ships required higher-level skills."

Over the years nearly every Liberty ship sold passed through Greek hands. As the foundation on which Greeks have built themselves into today's leading shipowning nation, the Liberty ship became greatly beloved in that community. Senior Greek shipowners still talk affectionately of the "Blessed 100" Liberties. Just a few years ago, some members of the Greek shipping world acquired the last surviving Liberty ship, the *Arthur M. Huddell*, and made it into a museum vessel, renamed *Hellas Liberty*.

The ARTHUR M. HUDDELL was transferred to Greece in 2008 for conversion to a maritime museum and was renamed HELLAS LIBERTY. The ship was towed into Piraeus harbor in January 2009 for general repairs and conversion. The HELLAS LIBERTY was presented to the public in its restored form in June 2010.

After the merchant ship sales process had run its course, the remaining 2,277 surplus ships were laid up against future emergencies and humanitarian missions, included in the US National Defense Reserve Fleet (NDRF) and placed in eight anchorages around the country: Stony Point, New York; Fort Eustis, Virginia; Wilmington, North Carolina; Mobile, Alabama; Beaumont, Texas; Benicia, California; Astoria, Oregon; and Olympia, Washington. With the assistance of the American Bureau of Shipping, NDRF ships were reactivated on a number of occasions over the ensuing decades to perform humanitarian missions and to aid the United States military during the wars in Korea, Vietnam and Iraq's Operation Desert Storm/Desert Shield.

The surplus vessels released to industry, particularly the Liberty ships, not only revived the world's merchant fleet, but also propelled the American Bureau of Shipping onto the international stage. Before the war, Bureau operations had been largely confined to the US, with only a few of its own exclusive surveyors stationed in ports outside the country. Arrangements with the British Corporation Register, Italian class society RINA and Japanese class society TKK (renamed NKK after the war), coupled with the use of nonexclusive surveyors, had provided adequate worldwide coverage for the Bureau's clients. After the war, US-built and financed tonnage dominated the world's seaways and needed service that only the Bureau could provide.

Under the terms of the Merchant Ship Sales Act, any ship on which the US Government held a mortgage had to be maintained in ABS class, although the new owners were free to re-flag the ship as needed. This generated such a volume of work that ABS had to establish exclusive surveyor offices in many foreign ports – the first major step in the Bureau's global expansion.

Another term of the Act was that any ship with a US Government mortgage had to be available for service in the event of war – a transferrable obligation that led to some solemn, memorable moments. One such moment was recounted by Italian shipping patriarch Stefano Telesio, a founder of the Genoa-based Carboflotta Group. Upon the death of his father in 1952, 21-year-old Stefano and his two brothers inherited a 2/24 share in the Liberty ship *Pietro Bibolini*, which required the young shipowner to make a special trip to the local American Consulate.

"All owners had to declare that they would make their Liberty ships available to the US Government if needed," Telesio recalled. "So I went to the American Consulate to stand in front of the American flag and swear on the Bible that my 2/24 of a Liberty would indeed be available. It was a very unusual moment – a small bit of our history that you don't hear much about anymore, but still something that should not be forgotten."

Through Shipbuilding, a Role in Japan's Recovery

As postwar recovery led to re-industrialization, a worldwide shipbuilding boom began. The favorable experiences that new and old clients alike were enjoying with ABS engineering and survey services internationally led to a boom in newbuilding work for the Bureau throughout the 1950s. ABS soon opened offices to serve this growing client base in Western Europe, Africa, Asia and South America.

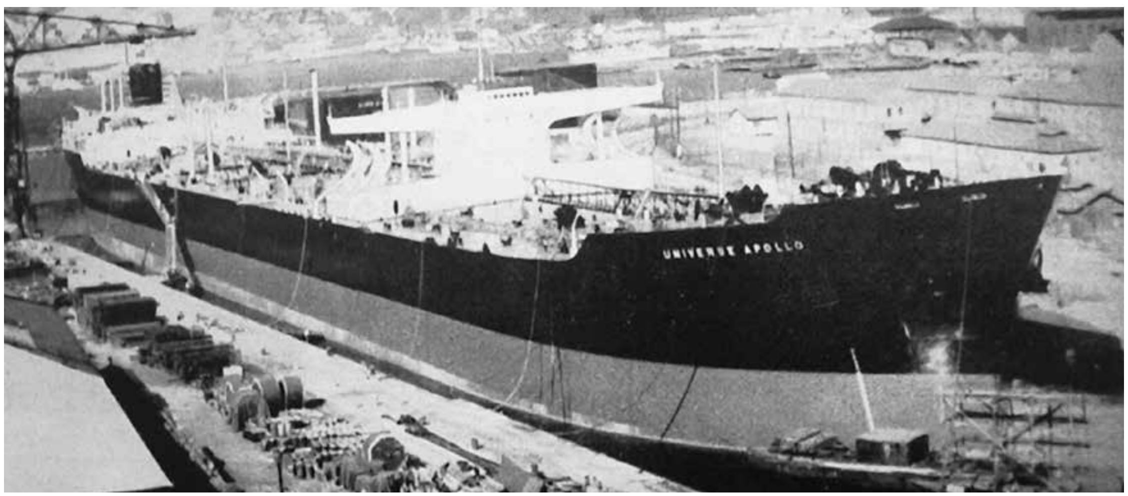
After World War II, Great Britain, Sweden, Germany and Italy rose as great modern shipbuilding centers, while US shipbuilders chose a path that ultimately led to their own demise. Henry Kaiser, who invented the 'flexible manufacturing system' to rapidly mass-produce Liberty ships during the war, wanted to continue its development in American shipyards. US builders rejected Kaiser's approach and instead returned to 'traditional' construction methods. As Kaiser opted to leave the industry, his methods were being recognized in the Pacific.

When Kaiser quit shipbuilding, his General Superintendent, Elmer Hann, went to work at the Welding Shipyard in Norfolk, Virginia owned by US industrialist Daniel K. Ludwig. Hann improved the yard's productivity so much that, when Ludwig's company National Bulk Carriers (NBC) leased its own shipyard in Japan, Hann was sent to run the operation. When Hann landed in Japan in 1951, he brought with him Kaiser's revolutionary ship manufacturing method.

Ludwig had a vision of building very large tankers and ore carriers and, by the late 1940s, his ships were pushing the Norfolk yard's size limit of 30,000 dwt. NBC secured a favorable lease on the former Imperial Japanese Navy Yard in Kure, which had a very large graving dock where Japan's World War II flagship, the *Yamato*, had been built. Under Hann's direction the NBC yard at Kure became a world-leading shipbuilder in the 1950s, producing some of the decade's largest and most advanced ships – the majority of them built to ABS class. Kure became the Bureau's foothold in the Orient. In 1958, NBC was routinely taking vessels from keel-laying to launching in five months and produced history's first 100,000-dwt ship, the ABS-classed tanker *Universe Apollo*.

The NBC yard also served as a training academy of sorts for the upcoming generation of Japanese shipbuilders. One of the students, Dr. Hisashi Shinto, became regarded as a founding father of Japanese shipbuilding. He and his colleagues studied the Kaiser-Hann Group Technology methods and soon mastered and improved upon them. In 1958, Japan passed Great Britain as the world's number one shipbuilding nation and, by 1964, was constructing 40 percent of the world's merchant ships.

ABS opened its first postwar office in the Orient in 1948, in Yokohama, following that with one in Shanghai in 1949. During the Communist Revolution, when defeated Nationalist leader Chiang Kai-shek escaped to the island of Formosa, an ABS surveyor was with him on board the flotilla. ABS became the first classification society to establish an office in Taiwan, the newly created Republic of China, which soon became an important shipping and shipbuilding center.



In 1958, the UNIVERSE APOLLO became the world's first 100,000 dwt oil tanker. Built for Universe Tankships in the National Bulk Carriers yard in Kure, Japan, the ship was completed in seven months and entered into service on 16 February 1959.

During the 1950s, Japanese and European shipbuilding began to expand while that of the United States contracted. In 1954, ABS reported that, for the first time, its foreign orderbook was twice the size of that for the United States. That year, 169 vessels totaling 1,874,662 gross tons were building to ABS class at shipyards outside the US. As world production grew from about 2 million gross tons in 1946 to almost 8.5 million gross tons in 1959, ABS saw classification work in foreign yards come to dominate its portfolio.

In 1960, the Bureau reported that global peacetime shipbuilding output records were set, with vessels totaling 12,667,000 dwt completed. The US Maritime Administration (successor to the Maritime Commission) calculated that 17,317 seagoing merchant vessels were in operation, providing more than twice the carrying capacity of the prewar fleet. On a gross tonnage basis, Japanese shipyards were the predominant builders, turning out 1,614,000 gross tons during these years, followed by the United Kingdom with 1,218,000 gross tons and West Germany with 1,024,000 gross tons.

Japan became the leading shipbuilding nation and retained the title for four decades. In a 15-year period the country built a succession of the world's largest ships, all classed by ABS: the first 100,000-dwt ship: *Universe Apollo* at 104,520 dwt, built in 1958 at NBC Kure; the first 200,000-dwt ship: *Idemitsu Maru* at 206,106 dwt, built in 1966 at Ishikawajima-Harima Heavy Industries (IHI); the first 300,000-dwt ship: *Universe Ireland* at 316,585 dwt, built in 1968 at IHI; and the first 400,000-dwt ship: *Globtik Tokyo* at 476,025 dwt, built in 1973 at IHI.

ABS was also the class society of choice when, in 1964, a Japanese shipbuilder undertook the largest commercial series shipbuilding effort in history. By the early 1960s, Liberty ships were entering the last phase of their commercial lives. Able to access virtually all ports,

David P. Brown

President: 1957-1963 • Chairman: 1963-1964

David P. Brown was born in Newport News, Virginia in 1899. Upon graduating from the Massachusetts Institute of Technology in 1920, he joined the American Bureau of Shipping and remained with the classification society for his entire career.

Brown was an ABS surveyor for his first 25 years with the company, rising to the position of Chief Surveyor in 1947. He served as an ABS representative to the 1948 SOLAS Conference and, two years later the ABS Board elected him Vice President and Technical Manager. With the retirement of Walter Green in 1957, Brown was named President and served in that capacity until 1963. He was made Chairman of the Bureau and Honorary Chairman the following year.

Brown was the first career employee to rise to the top of ABS and became the first, and only, Chief Surveyor to attain the presidency. As with other Bureau executives before him, Brown also lent his expertise to the US Government, particularly when he was appointed by the Secretary of the Navy to a special committee investigating aircraft carrier design. He passed away in May 1965.

the standard-design vessels were well-known to owners, crews and charterers and had been the backbone of world trade since World War II. The maritime industry desired a modern replacement but did not believe mass production of ships could be done commercially. In response, a marine consultant named George T.R. Campbell developed a design and a production methodology that effectively resurrected Liberty-type series shipbuilding in a commercially viable format.

Naval architect George T.R. Campbell (third from left) pioneered the commercial mass production of standard-design cargo ships in 1964 with his Freedom series vessels. By optimizing building practices and consistent pricing, the ships were among the most advanced and affordable vessels of the time. Through two decades, Campbell's Freedom, Fortune and Friendship series brought over 300 ships into ABS class.

Campbell developed a standard design, which he branded Freedom, and worked with the IHI shipyard to optimize procurement, production and unit pricing. Through project supervision under his company GTR Campbell International (GTRC), he was then able to guarantee shipowners consistent pricing over a series of ships – providing they did not ask for design changes or 'extras' or otherwise interfere with the building process. The ship design was innovative and the pricing attractive and, as a result, the Freedom became history's best-selling ship design. IHI and its licensees built 176 Freedom series ships over the next decade – virtually all to ABS class.

Series production became a fundamental component of modern shipbuilding – a development foreseen by Giroku Fujii, Managing Director of IHI, in an open letter to the shipping community written in 1965 on delivery of the first Freedom vessel, *Chian Captain*: "Mass production of commercial ships has never been carried out, except in the case of the Liberty ships during the war, but since mass production is widely adopted in the manufacturing of transport machinery on land, there should be no reason for not adopting the idea for shipbuilding."

The manufacturing methods that Japan's technical specialists had learned from Elmer Hann had been brought to new levels of efficiency. Their shipyards became engines of prosperity on which the country rebuilt its industrial infrastructure. In the three-year period from 1956 to 1959, shipbuilding accounted for about 13 percent of all exports from Japan ($350 million out of $2.8 billion, averaged annually). With a strong, authoritative presence in most of the shipyards, ABS was able to play a role in this part of the country's restoration effort.

Another Disappointment with Lloyd's Register

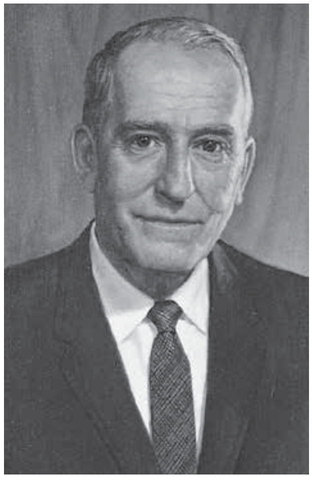
During the early postwar years, as ABS began expanding into its new global role, it explored many avenues of growth, including a few that did not go as planned. One of these involved the Bureau's third disappointing interaction with its British rival Lloyd's Register of Shipping.

In 1948, ABS reached out in a spirit of mutual cooperation to Lloyd's Register, proposing the two organizations share staff, eliminate duplicative functions and adopt common classification policies. As part of the deal, ABS agreed to cancel its 1916 working agreement with Lloyd's biggest rival in the United Kingdom, the British Corporation Register of Shipping. The ABS-Lloyd's agreement was approved unanimously by the governing bodies of each society and was publicly announced on 13 July 1948. Such was the public's interest in shipping at the time that the whole episode was recorded by the major newspapers, including the *New York Times*. ABS duly cancelled its agreement with the British Corporation and that November, Sir Ronald Garrett of Lloyd's informed ABS President Luckenbach that there was a problem with their deal. It appeared that certain private British interests had expressed last minute objections based on a murky question of fees.

A flurry of meetings and consultations followed and on 29 December 1948, the American Bureau of Shipping and Lloyd's Register announced that the agreement had fallen through. Lloyd's expressed its regret and promised that the decision would not interrupt "cordial relations which have always existed between the two societies." Neither side openly admitted what the real objections had been, but *Time* magazine later reported that the shipping community believed Lloyd's "had wanted to keep the right to classify Japan's merchant fleet, while the Bureau claimed it by right of conquest."

Arthur R. Gatewood

President: 1963-1964 • Chairman: 1964



Born in Philadelphia, Pennsylvania in 1899, Arthur R. Gatewood received a degree in civil engineering from the Virginia Military Institute in 1918 and served as an infantry lieutenant in World War I. He attended the Massachusetts Institute of Technology after the war, earning a degree in naval architecture and marine engineering and, during summer vacations, worked at the Newport News Shipbuilding and Dry Dock Company. In 1921, Gatewood became a seagoing engineer, serving first as an oiler and then as a ship's officer. After eight years at sea, Gatewood joined the American Bureau of Shipping.

As a young man, Gatewood had been determined to acquire as much experience in his chosen profession as possible, and pursued that goal his entire life. Demonstrating superior practical knowledge as a field surveyor, he was appointed to the ABS technical staff during the mid-1930s and, by 1945, had risen to the post of Principal Engineer-Surveyor in charge of the machinery technical staff.

Gatewood aided the US delegation to the 1948 and 1960 SOLAS Conferences, served on seven technical societies, authored numerous important marine engineering papers and was considered a leading expert on ship machinery. In 1963, the Society of Naval Architects and Marine Engineers awarded him the David W. Taylor Medal.

Gatewood became ABS Chief Engineer-Surveyor in 1947, Vice President of Engineering in 1957 and Senior Vice President in 1962. In 1963, after the retirement of David P. Brown, Gatewood was appointed President and became Chairman the following year. He retired in 1964. Arthur Gatewood passed away in January 1970.

Despite Lloyd's assurances of continued cordial relations, it soon became clear that competition was heating up as the world's classification societies sought to expand. After luring ABS into dropping its association with the British Corporation, Lloyd's merged with the organization, effectively monopolizing classification services of British-owned ships. ABS responded by opening its own London office and appointing 14 of its own surveyors to ten British and Irish ports. Recognizing that the escalating conflict between the two societies might somehow prove detrimental to the industry, Lloyd's offered ABS an olive branch, stating that "there should be many opportunities in the future for cooperation."

Early Role in Development of International Regulation

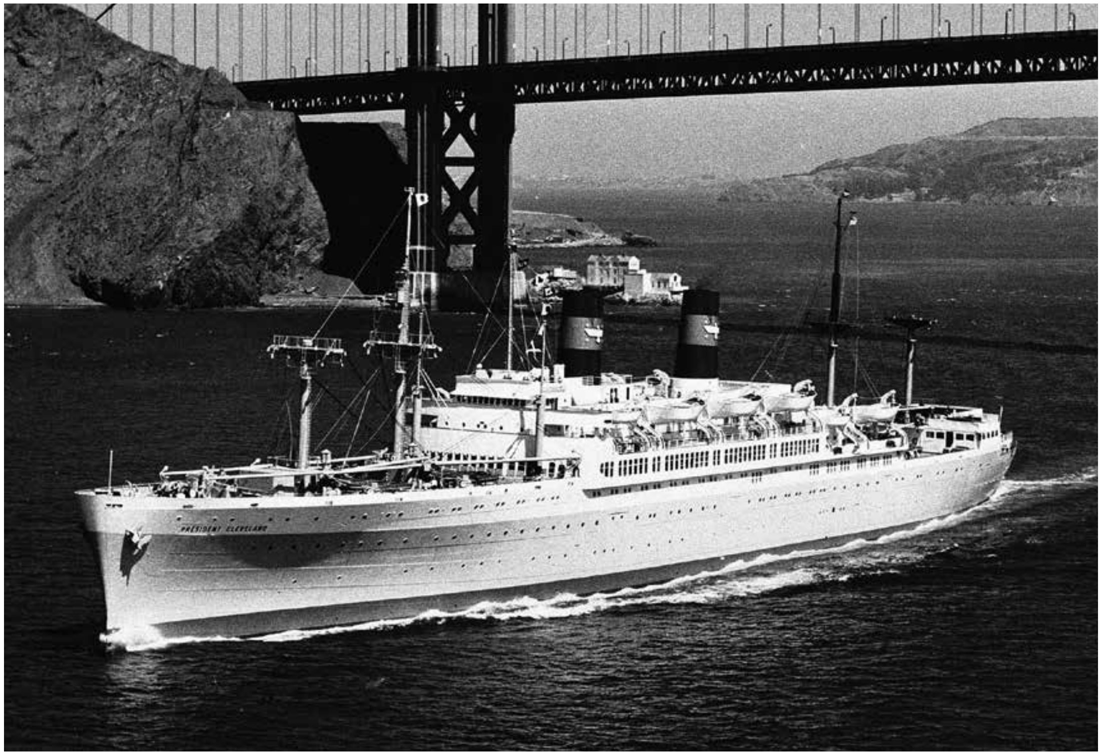
The conflict with Lloyd's notwithstanding, ABS continued building good relations with other classification societies and enhancing its presence on the international scene, notably through involvement in the development of international safety regulations in the global forum that ultimately became a specialized agency of the United Nations (UN) known today as the International Maritime Organization (IMO).

The United Nations was barely three years old when it convened the UN Maritime Conference in Geneva in 1948 to address the global desire for an authoritative body that could create common international maritime regulations. The 52 UN member States adopted the Convention (an international treaty) for the Establishment of the Inter-Governmental Maritime Consultative Organization (IMCO), which was finally ratified and entered into force in 1958. In 1982, its name was changed to the International Maritime Organization.

Even before the IMCO Convention entered into force, the world's maritime powers would convene under UN auspices for the purpose of developing international maritime regulation – examples being the 1948 Conference on the Safety of Life at Sea (SOLAS) and the 1954 Conference on Prevention of Pollution of the Sea by Oil (OILPOL). Setting the pattern for the future, at each of these important conferences the national delegations would rely on classification societies for technical advice in developing rational and practical requirements.

In front of the IMO headquarters, the International Memorial to Seafarers serves as a tribute to all seafarers who have been lost at sea, and a reminder of the pivotal role seafaring plays in world trade and development.

From the start of this regulatory endeavor, ABS has regularly been invited to serve as an advisor to the United States and other national delegations at IMO forums. In April 1948, a month after adopting the IMCO Convention, the UN convened a meeting in London to adopt the third SOLAS Convention. The new SOLAS regulations covered a wider range of ships than the 1929 version and went into considerably greater detail, making important improvements in such matters as watertight subdivision in passenger ships; stability standards; maintenance of essential services in emergencies; and structural fire protection. An international safety equipment certificate for cargo ships of 500 gross tons and above was introduced; improvements were made regarding collision procedures and on the carriage of grain and dangerous goods; and new rules were developed to account for the evolution of communications technology.



The 579-foot PRESIDENT CLEVELAND for American President Lines featured extensive use of aluminum in the deckhouse.

Because ABS had been involved in the development of electrical installations for ships since the first electric plant went to sea aboard the *Columbia*, the Bureau was asked to join the US delegation to the 1948 SOLAS Conference and help develop regulations for shipboard electrical systems. ABS Principal Engineer Arthur Gatewood, selected to be the delegation's electrical and engineering advisor, had a critical role in having electrical requirements for passenger ships inserted into the new regulation.

The 1960 SOLAS Conference, the first conference held by the IMO, addressed a wide range of measures to improve the safety of shipping and updated the regulations in the previous Convention. ABS Chief Surveyor for Machinery John Heck was asked by the Coast Guard to be the spokesman for the United States to the Engineering Committee at the conference, which was instrumental in having existing electrical safety requirements extended to cargo ships. This was part of a larger effort to bring to cargo carriers the same safety protections that were formerly accorded only to passenger vessels. The gains of these and other important efforts were officially realized in 1965, when SOLAS 1960 entered into force.

One of the new subject areas opened at the 1960 SOLAS Conference concerned nuclear ships, at that time considered important vessels of the future. The Coast Guard again requested the assistance of Arthur Gatewood, who had become ABS Vice President for Engineering, to serve as chairman of the Committee on the Safety of Nuclear Powered Ships.

Then, as now, once delegates of IMO member nations (the flag States) adopt international regulations for ship safety and pollution prevention, their home legislatures make the regulation part of the nation's laws. In addition, many governments authorize classification societies to be their agents, known today as Recognized Organizations (ROs), that conduct the design reviews and statutory surveys through which they verify that the ships flying their flag adhere to the requirements of those regulations.

Classification societies began performing statutory surveys on behalf of flag States as a significant service in 1952, the year the 1948 SOLAS Convention entered into force. As successive regulations entered into force – the most important, according to IMO, being the revised SOLAS Convention in 1980, the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1983 and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) in 1984 – statutory surveys grew to become the vital element in the maritime world's safety and pollution prevention regime that they are today.

New Technologies Advance the Merchant Fleet

The exigencies of war demanded an intense research and development effort in America that resulted in the rapid advancement of many existing technologies and the invention of many new ones. This research brought forth many products not only for military benefit, but for civilian use as well – from advanced electronics to synthetic materials and new metal alloys.

One subject of much research was the development of aluminum alloys, referred to at the time as 'light metals'. Aluminum alloys have particular properties that make them attractive for marine applications. They weigh approximately one-third that of a similar volume of steel; exhibit good strength; are easily worked and joined by all the usual methods; are non-magnetic and non-sparking; and are highly resistant to seawater corrosion.

As might be expected, aluminum alloys were successfully used in aircraft construction during World War II. Afterwards it became apparent that at least one of these new alloys could be suited for use on ships. In 1946, ABS received proposals for the construction of two oceangoing ore carriers in the 330 and 400-ft range to be built entirely of aluminum alloys.

ABS undertook a comprehensive testing program to determine the suitability of aluminum as a shipbuilding material. Bureau metallurgists soon discovered that riveted construction using aluminum alloys could not be satisfactorily caulked and, because the alloy was heat-treatable, there was no technology capable of producing aluminum welds of sufficient strength for hull structural applications. Although research indicated aluminum could only be used in above-water applications, the Bureau continued to analyze the issue at its metallurgical laboratory. While the research continued, in 1946, ABS approved the use of aluminum for the riveted upper house and stack installation on the Delta Steamship's Del Sud class of vessels built at Ingalls Shipbuilding Corporation.

More extensive use of aluminum was made on the ABS-classed *President Wilson* and *President Cleveland*, built for American President Lines. These vessels were followed by the jewel of American passenger liner construction, the *SS United States*, designed by the great American naval architect William F. Gibbs and built to ABS class in 1952 at Newport News Shipbuilding. The last ship to win the coveted Blue Riband for fastest transatlantic crossing by an ocean liner, the 'Big U' used aluminum extensively in its topside structures. ABS was deeply involved in reviewing the design and surveying the construction of the

The beloved SS UNITED STATES was the fastest ocean liner ever built. Its superstructure used more aluminum alloy than any ship at that time. This was challenging for the builders but provided extreme weight savings. Its 105-ft beam could clear the Panama Canal locks with just two feet to spare on either side.

With an overall length of 1,035 feet, the ABS-classed SS FRANCE was announced as the world's longest liner when it was launched in 1960. This vessel also used aluminum extensively in its superstructure.

ABS closely followed the development of weldable aluminum alloys in the late 1950s and issued its *Tentative Code for the Selection of Wrought Aluminum Alloys for Ship Structures.* This work led to the first modern all-aluminum vessels, including experimental hydrofoils and two special chemical barges built to ABS class in 1961. Today a variety of small, fast craft, including vessels used by several navies, are built of all-aluminum alloy construction.

Welded steel construction continued to pose challenges after World War II, and ABS took the lead in investigating fractures occurring in all-welded or largely welded war-built ships. Although the brittle facture problem had been solved during wartime, several structural failures during the postwar period resulted in loss of life and spurred investigations. Bureau metallurgists identified problems and ABS became the first classification society to issue new specifications for steel plates. Material of undesirable high-notch sensitivity was determined responsible for the casualties.

United States, developing information on the scantlings, aluminum rivets, insulation between joints made from dissimilar metals and the making of numerous special connections.

The *United States* became the pride of American shipbuilding. Its top speed of over 38 knots was a military secret and unauthorized personnel were not allowed a look at its specially designed bottom. The *United States* was the first of a number of famous passenger liners classed by ABS during the 1950s. Notable among them was the *SS France*, the longest passenger liner in the world at the time, which used 2,000 tons of light alloy in its upper structure including some of the latest weldable aluminum-magnesium alloys. Other storied ocean liners built to ABS class were the beautiful Italian-built *Leonardo Da Vinci, Cristoforo Columbo, Augustus, Giulio Cesare, Michelangelo* and the ill-fated *Andrea Doria*; the *Gripsholm*, owned by Swedish-America Lines; American Export Line's *America* and her sister ships, *Constitution* and *Independence*; and Grace Line's luxurious *Santa Paula* and *Santa Rosa*.

Even sabotage helped advance welding technology. Sabotage during World War II was not uncommon; on a large number of ships, the crews had deliberately damaged boilers, crankshafts, connecting rods, engine bed plates and sometimes the entire machinery installation. It was found that most of the damages inflicted could be repaired by welding. ABS and Navy repair experiences led to the Bureau developing its *Procedure for Repairing Cracked Steel Shafts by Welding* – a technique that still remains valuable today.

Wartime problem-solving also produced an advance in diesel engine technology. With the development of higher-power diesels a problem was encountered when a number of engines experienced disastrous crankcase explosions in service. ABS worked with the Diesel Engine

Manufacturer's Association to develop explosion relief valves and doors for the engines. The requirement for explosion relief devices was incorporated into the 1948 ABS Rules and, since then, their use has become universal practice.

Among the most ambitious postwar maritime projects was the design and construction of the world's first nuclear-powered commercial cargo and passenger ship, the *NS Savannah*. Designed by George G. Sharp and called by many as the most beautiful cargo carrier ever at sea, the *Savannah* was launched in 1959 and became the poster child for US President Dwight D. Eisenhower's Atoms for Peace initiative. Eisenhower had specifically requested the construction of a nuclear-powered merchant ship, which Congress approved in 1956. ABS participated in its design, by chairing an Atomic Energy Commission Panel convened by the Society of Naval Architects and Marine Engineers and helping draft a precedent-setting report, "Safety Considerations Affecting the Design and Installation of Water-Cooled and Water-Moderated Reactors on Merchant Ships." To class the *Savannah*, ABS published the *Guide for the Classification of Nuclear Ships.*

Owned by the US Department of Commerce and initially operated by First Atomic Ship Transport, the *Savannah* was one of only four nuclear-powered cargo ships ever built. With a capacity of 9,830 dwt, a length of 545 feet and beam of 78 feet, the single-screw vessel was driven by a pressurized water reactor nuclear plant feeding steam to a two-cycle turbine unit that developed 22,000 shaft horsepower. The *Savannah* was in service from 1962 to 1972 and sailed over 500,000 miles.

During its eight years in service, the nuclear plant performed flawlessly, with a 99.88 percent availability. But a growing fear of nuclear power and union-spawned difficulties (the ship required specially trained engine crews that unions could not supply), combined with relatively high operating costs (at a time when fuel oil cost was roughly $20/ton), led to the *Savannah* being decommissioned in 1971. Like its 1819-built namesake, which proved steam power could cross an ocean, the *Savannah* proved a new propulsion technology was viable but came too early to also prove it competitive against existing systems. Thus the nuclear-powered merchant ship, despite its initial promise, could not yet be considered the ship of the future.

The NS SAVANNAH was the first nuclear-powered cargo-passenger ship. Built in the late 1950s at a cost of $46.9 million, including a $28.3 million nuclear reactor and fuel core, it was funded by the US Government to demonstrate peacetime uses of nuclear energy. Launched on 21 July 1959, the SAVANNAH was in service from 1962 to 1972 as one of only four nuclear-powered cargo ships ever built.

Special 60-foot barges are quickly stowed on a lighter aboard ship (LASH) vessel.

Advancing Ship Structural Safety

Novel ships and new technologies notwithstanding, it was on the tanker front that the real revolution was brewing. The best-remembered aspect of 1950s shipbuilding may be the rapid growth in tanker size, with most of the largest ships in the world built by Daniel Ludwig at the NBC Kure Yard in Japan. When the yard launched the world's first 100,000-dwt ship, *Universe Apollo*, in 1958, the industry was already pushing the limits of its experienced-based understanding regarding ship structural safety at sea – and raising questions about how safe the largest vessels were.

Knowledge of ship structures was all experienced-based at the time and as a result, ship size had increased only incrementally. Just five years earlier, the biggest ship afloat was NBC's 46,600-dwt tanker *Phoenix*. With relatively few large ships in service at the time, service information about how the forces of the sea affected such big hulls was limited. Consequently, so was the ability to predict the performance of anything larger. But, once the 100,000-dwt barrier was crossed, it seemed that tankers would grow in size as quickly as designers could develop them – raising questions about the true safety and pollution potential of such large ships at sea.

The issue was tackled head-on by the US Ship Structure Committee (SSC), the think tank/research sponsor formed out of the Investigative Board that had resolved the brittle fracture crisis during World War II. In a 1959 report, the Committee concluded that achieving a better understanding of loads (the forces a ship's hull experiences at sea) was the key to establishing "rational, less empirical design procedures." That report, "A Long-Range Research Program in Ship Structural Design" started a research program that ran throughout the 1960s, in which full-scale stress data was collected from a number of ships in service. This data contributed to the first understanding of the true loads and responses of ships in service.

Another shipping innovation that hit the waters with ABS' help in the early 1960s was the lighter aboard ship (LASH) vessel. First entering service in 1968, LASH vessels carried what were, essentially, removable barges and were designed to serve as couriers between river systems in different parts of the world. Deposited at a port, the barges could begin inland navigation without unloading and with no resulting delays for the ship. An 895-foot long LASH vessel could transport 89 of these 60-foot barges, hoisted on board by a 2,000 ton capacity elevator installed on the vessel's stern.

The larger, 97-foot *SEABEE* barge, carried on a vessel of a slightly different design concept, was able to function at distribution points where only marginal port facilities, or none at all, existed. The barges were considered separate vessels, subject to ABS class and assigned load lines. More efficient than conventional ships in certain services, LASH vessels found their niche and demonstrated their value.

By 'rational' ship design, the report indicated that the functions and requirements for the hull structure can be explicitly stated at the outset of the project; all loads expected in service can be determined and combined; structural members can be arranged in the most efficient manner to resist the loads; and adequate but not excessive scantlings can be determined using a minimum of purely empirical factors. One purpose of rational ship design was to develop weight-saving ship structures. Another was to develop a theoretical basis for analyzing new ship designs. All the goals of the rational ship design movement, in fact, depended on obtaining a better understanding of the loadings a ship experiences at sea and the response of the structure to them.

Key to understanding and predicting loads and responses for ships was predicting wave forces. Good measurement of wave forces became possible during the 1960s and, under SSC-sponsored and other research programs, hundreds of thousands of at-sea wave observations and measurements were collected and analyzed by computers. Ocean scientists were then able to describe the sea surface in terms of wave spectra – such that, for any given time, a spectrum would describe the many component waves of different lengths, heights and directions, all superimposed in random fashion.

In 1960, ABS sponsored a long-term research program at the Webb Institute of Naval Architecture in New York to "develop a procedure for establishing rational design standards for wave-induced bending moments on ship hulls (the vertical and lateral bending stresses encompassing the entire hull), making due allowance for ship size and speed, hull form, and expected weather conditions." Out of this study and an SSC research program into dry cargo ships grew the ABS Vessel Instrumentation Program, a multi-year data gathering mission begun in 1967 that focused on the behavior of large hulls at sea.

ABS had begun working on the issue in 1958 with some basic research into vessel dynamics. The Bureau contracted with the Stevens Institute of Technology in Hoboken, New Jersey, to use the Institute's experimental towing tank and wave-making facilities for model experiments to determine hull bending moments induced by waves. The data obtained from the experiments improved the industry's understanding of the influences of form, speed and sea conditions on the overall longitudinal bending moments in ship's hulls.

Using the results of this research, data obtained from overseas and experiments sponsored by the US Navy and SNAME, ABS determined that it was possible to develop new methods for estimating the probable bending moments and deck-edge stresses in actual ships under a wide range of realistic form variations and sea conditions.

Working with the Webb Institute, ABS collected and analyzed data in an attempt to develop a mathematical approach for predicting probable hull bending stresses. This was the first step toward developing an accurate, realistic mathematical modeling of a ship's hull in motion on the sea.

In 1951, technicians performed a variety of steel tests in the metallurgy laboratory located in the American Bureau of Shipping's headquarters at 45 Broad Street in New York City.

International technical committees kept ABS apprised of technical developments that could aid in Rule development.

Organization and Leadership Changes

With global expansion came office expansion and with increasing size came increasing activities. By 1946, ABS had outgrown the offices on Beaver Street that it had taken just before World War II, and moved its New York headquarters to larger premises nearby: the building at 45 Broad Street, which the Bureau held onto into the 1970s.

Many organizational initiatives at ABS during the postwar years addressed specific requirements of the various countries in which it was now active. The use of technical committees at home had proven itself, so ABS established similar technical committees internationally. Each was tasked with keeping the Bureau acquainted with technical development overseas that might have an impact in Rule development or revision. The Italian and Belgian Technical Committees, the first to be established, set the pattern by including prominent professionals in the fields of naval architecture and marine engineering. These were followed in 1954 with the Netherlands Technical Committee and, two years later with the French Technical Committee.

ABS also created new special committees and panels to deal with advancing technology. For example, one focused on reinforced plastic vessels, another studied underwater systems and others dealt with welding, single-point mooring, gears and propellers. Like the technical committees, these special groups included many highly respected people in each field and gave them a voice in the creation and revision of the ABS Rules.

Luckenbach became ABS Chairman in 1950 and was succeeded as President by Walter L. Green, and the last of the veteran ABS executives began circulating through the top floor at 45 Broad Street. Chief Surveyor David P. Brown succeeded Green as Vice President and then the ABS Presidency went from Green to Brown in 1957.

Brown became Chairman for a year in 1963 and was succeeded as President by Arthur R. Gatewood, who served as President and then Chairman briefly in 1964.

Moving into the Second 100 Years

On 24 April 1962, President Brown celebrated the American Bureau of Shipping's 100th anniversary with a reception at New York's India House, a historic, exclusive club with a traditional maritime membership. Smaller receptions were held at 70 branch offices around the world. A press release issued to the *New York Times* and major newspapers in port cities worldwide noted that "Since 1869 when the Bureau classified its first vessel, the list of ships surveyed and rated has grown to 8,221 ships of 46,533,852 gross tons, or nearly one-third of the world's tonnage."

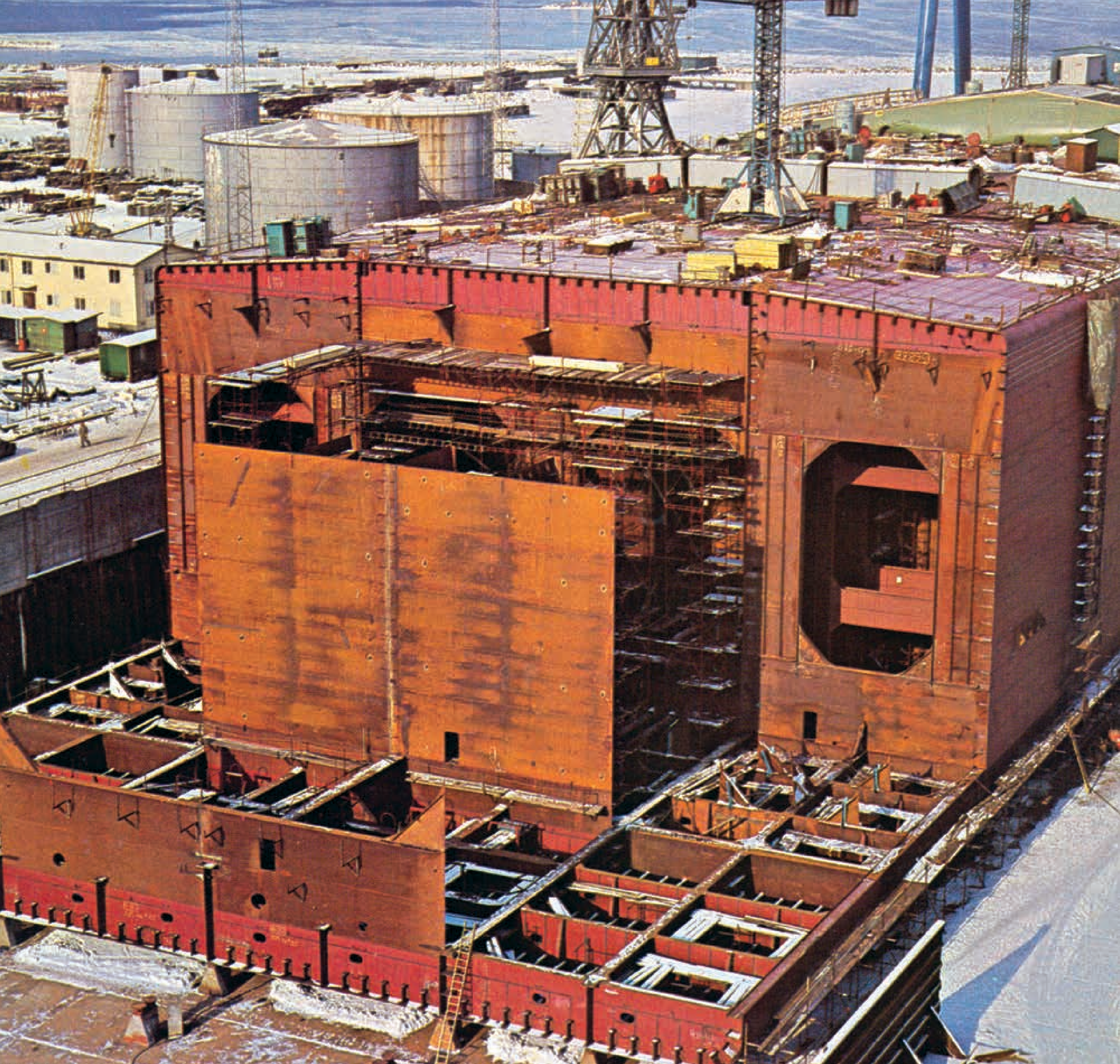
Congratulations poured in from many of ABS clients and friends. Mayor Cliff W. LeBlanc of the shipbuilding city of Beaumont, Texas even issued a Proclamation establishing 22 April 1962 as "American Bureau of Shipping Day," to pay tribute to the founders of the Bureau who "contributed so much to the safety and comfort of the American people."

As the maritime industry was experiencing a step change in technology, ABS was experiencing a generational change. The organization began a recruitment program to identify and hire recent graduates of engineering colleges with good academic background and sound practical experience. By 1964, a new generation of surveyors, naval architects and marine engineers were coming aboard, eager to tackle this new era of technical innovation in ship design and shipbuilding.

This technocratic crowd needed a technology-minded leader. To find one, the ABS Board of Managers reached beyond the Bureau for David Brown's successor, selecting Andrew Neilson to take the helm in January 1964. Neilson had spent his entire career in private industry, first as a sailor and shipmaster and then in the oil business, becoming the President of the Services Division of the California Texas Oil Corporation (Caltex) in 1957. A member of the ABS Council for several years, Neilson understood the organization well. More importantly, with Caltex known as a forward-thinking operator and an energy leader, Neilson was expected to be a pace-setting executive.

Willing and eager to introduce new technologies and methods, Neilson established an Electronic Data Processing program shortly after taking office. Within a few years, the use of computers to solve engineering problems and to serve as a memory bank for vital statistics made the Bureau's services more efficient. Although rudimentary, these early computing capabilities helped prepare the Bureau for the massive calculation effort that would be required to reassign freeboard to vessels in class under the 1966 Load Line Convention. ✠

In the age before electronic data processing, the ABS Records department managed thousands of handwritten and typed survey reports and maintained survey status data on large index cards.



Chapter 5

Leading a Technology Revolution

1965 – 1984

In May 1965, President and Chairman Andrew Neilson hosted a classification society conference in the boardroom of ABS' world headquarters in New York, reaching out to the Bureau's international counterparts with the desire of setting uniform interpretations and addressing changes in technology and construction techniques. Neilson opened the proceedings with a reference to the rational ship design movement – already making progress through research initiated by ABS and the US Ship Structure Committee – by announcing ABS' commitment to provide for "a more seaworthy ship." "This is a goal," Neilson continued, "which has captured the imagination of all those associated with the sea since the beginning of time, and will, I am sure, capture the thoughts of those generations who follow us."

In his audience were representatives of the leading class societies: Lloyd's Register; Det Norske Veritas of Norway; Bureau Veritas of France; Registro Italiano Navale of Italy; Germanischer Lloyd of Germany; and Japan's Nippon Kaiji Kyokai. The meeting was convened in anticipation of the 1966 International Conference on Load Lines (ILLC) in London, the second major conference held under the authority of the International Maritime Consultative Organization (today's IMO).

It had long been recognized that limits on the draught to which a ship may be loaded make a significant contribution to its safety. A meeting of the world's maritime powers in 1930 produced the first Load Line Convention, an international treaty establishing those limits and specifying they be expressed as a mark amidships to indicate the allowed freeboard. However, by the early 1960s, technology advances had made those specifications obsolete, to the extent that they were short-changing the cargo carrying capacity of the modern world fleet.

The 1966 ILLC determined the freeboard of ships considering subdivision and damage stability calculations, taking into account the potential hazards present in different ocean zones and different seasons. It also included a technical annex that contained additional safety measures such as doors, freeing ports and hatchways for the watertight integrity of ships' hulls below the freeboard deck.

While the ILLC did not enter into force until 1968, from the moment of its adoption by the IMO Assembly in 1966, the Convention brought important changes to the industry. Foremost among them were new safety standards and the 'extra cargo capacity' that most of the world's fleet gained through freeboard reassignment. In addition, although unforeseen at the time, the ILLC would have a significant impact on the interaction of classification societies.

Regulation 1 of the ILLC repeated a request made in the 1930 Convention, to the effect that classification societies should work together on "securing as much uniformity as possible in the application of the standards of strength on which freeboard is based." The 1966 Convention instructed that, when applying load line requirements, if a vessel complies with the Rules of a classification society, the flag State can presume that it has sufficient strength to be compatible with its requirements. The reasoning is that, because ship strength and stability are intrinsically linked, complying with a class society's strength Rules and statutory stability requirements provide the fundamental basis for ship safety on which IMO conventions build. Therefore, recognizing that each class society promulgated its own Rules, which in some matters differed significantly, regulators called for harmonization of the strength requirements. This request in the ILLC led to the formal establishment of the International Association of Classification Societies (IACS) in 1968 – its founding members were the same societies that had gathered at ABS' headquarters three years earlier.

IACS was granted 'non-governmental organization with observer status' by the IMO in 1969. Through this position, technical experts of the world's classification societies gained a place as authoritative advisors to the legislative process. For more than four decades, classification societies, acting individually as advisors and collectively through IACS, have provided the independent voice of technical reality in IMO's regulatory debates; developed critical Unified Interpretations that clarify the meaning and application of existing regulations; and provided important feedback derived from their verification of compliance requirements as Recognized Organizations (ROs).

Technology Advances through Research and Development

Until about 1970, a perfectly good cargo ship could be designed without even the aid of a slide rule, based simply on past experience. The designer only needed to decide the length and breadth of the vessel, then check a book of classification Rules for prescribed frame spacing, plate thicknesses, scantling sizes and so forth. The important design parameters were already established. Knowledge of ship structures, of vessel performance at sea and

Andrew Neilson

President: 1964-1965 • President & Chairman: 1965-1970 • Chairman: 1971

Born in South Bend, Washington, Andrew Neilson went straight to sea after high school, obtaining his Master's license while working with the Standard Oil Company of California (SOCAL). He attended Reed College in Portland, Oregon and Stanford University, graduating with a degree in economics, before returning to SOCAL in 1938 on the shore staff of the company's Marine department. Neilson was working for SOCAL in 1943 when he helped establish the Pacific Tankers Company on behalf of the US War Shipping Administration. He became General Manager of Pacific Tankers the following year.

After World War II, Neilson became Vice President, and then President, of the Overseas Tankship Corporation of New York, a subsidiary of California Texas Oil Corporation (Caltex). In 1951, he was elected Vice President of Caltex Corporation, and became President of the company's Services Division in 1957.

Elected ABS President on 1 January 1964, Neilson was responsible for bringing a new generation of surveyors and engineers into the Bureau. He promoted the introduction of new technology into ABS operations, particularly computers, and gave full support to the Arizona Project in which ABS developed finite element analysis of ship structures and the landmark DAISY program at the University of Arizona. Neilson retired on 1 April 1971 and died on 11 September 1981.

of the required dimensions of structural members (or scantlings) appropriate to ship safety was based on decades of careful observation of ships at sea, their physical condition after years of service, and the scientific accumulation and analysis of that data. It had been that way, more or less, since man first put ships to sea. As a consequence, ship sizes and structural technologies were built on the past and advanced very slowly (with a few daring exceptions) for an extremely long time.

However, the same was not true for ship shapes. Hullforms could be engineered and refined ever since William Froude developed the mathematical discipline of ship hydrodynamics and built the first experimental towing tank around 1861. For a century, hullforms could advance scientifically, but the structures supporting them had to advance empirically.

By the mid-1960s that needed to change. The size of merchant ships, of oil tankers in particular, had begun increasing at an alarming rate. Safety authorities became concerned that existing knowledge could no longer testify to the long-term structural integrity and safety of the largest ships afloat.

The very large ships built in this evolutionary period were, in reality, scaled-up versions of earlier, smaller designs. Although an enormous engineering effort had gone into developing them, it was clear to operators and regulators alike that extrapolating on the past was no longer sufficient to build vessels of the future, as the industry had no real ability to predict what would happen to larger ships over years of service at sea.

During this time of speculation and concern about the ships of the future, ABS worked with the US Ship Structure Committee, the Webb Institute and other organizations to find a path forward. Through some of the maritime industry's first major forays into research on ship structural design and analysis, the early 1960s saw ABS help develop several important advances on the path of rational ship design. Among them was the development of shipbuilding Rules that addressed the emerging class of supertankers.

As ships grew in size and complexity, computers came to replace the slide rules used to perform calculations to verify designs during the plan review process.

By the mid-1960s, ABS had published Rules containing strength requirements for vessels up to 1,000 ft. Although successfully used by designers and shipyards to build a long succession of the biggest-ever ships, they were based on the service experience of vessels up to about 750 ft in length. In 1966, ABS published the first results of this research in the report *Long Term Trends in Hull Bending Moments.* Although this work had enabled ABS to establish longitudinal strength standards for ships up to 1,000 ft, there was still no information as to how such large ships actually reacted to severe sea states. The Bureau stepped up to fill the gap by having the measurements made in situ.

The 316,000-dwt tanker UNIVERSE IRELAND went into service in 1968 as the world's largest ship, principally carrying oil from Kuwait to Ireland's Whiddy Bay.

The ABS Vessel Instrumentation Program, begun in 1967, employed a division of Teledyne to install, maintain and gather data from sensitive measurement equipment placed throughout the hulls of four large tankers that were about 1,000 feet long. It was the first such project in the industry, enabling real-time recording of the stresses, strains and bending behavior of these giant ships traveling at sea.

The program was funded by ABS and conducted under the leadership of Robert S. Little, ABS Vice President of Research and Development. Professor E.V. Lewis of Webb Institute directed the project and F.C. Bailey of Teledyne Materials Research performed the full-scale measurements and data reduction. The program's purpose was to learn more about the behavior and longitudinal strength of tankers and bulk carriers in waves and, in particular, to determine the expected extreme bending moments in random seas encountered by these large ships over a period of time.

Initially, four large tankers in different ocean zones were instrumented: the 205,000-dwt *Idemitsu Maru*, which ran between the Persian Gulf and Japan; the 170,000-dwt *Esso Malaysia*, which ran between the Persian Gulf and Northern Europe; the 74,200-dwt *Fotini L.*, sailing between Japan and the west coasts of North and South America; and the 63,041-dwt *R.G. Follis*, running between the Persian Gulf and Newfoundland. In the following year they were joined by the latest world's biggest ship, the 316,000-dwt *Universe Ireland*. In 1969, the program entered its end phase, in which the collected data was processed and made available to industry and the resulting conclusions subsequently published in the ABS Rules. In 1971, Little, Lewis and Bailey presented at SNAME a landmark technical paper, "A Statistical Study of Wave-Induced Bending Moments on Large Oceangoing Tankers and Bulk Carriers," describing the instrumentation and measurement program.

The Stirrings of Great Change

The Bureau's efforts in rational ship design, like its research and development programs, were supported by computers through a new Electronic Data Processing (EDP) program. One of the reasons why ABS established the EDP program in 1965 was to simplify the calculations involved with determining the new freeboard assignments under the 1966 ILLC. Another was to deal with what pop culture had christened 'the data dilemma' – the general problem of efficiently collecting, storing and extracting information that, thanks to modern communications, was suddenly arriving from around the world in ever-increasing quantities and at ever-increasing speeds. Within a few years, the Bureau was using computers to solve complex engineering problems and to serve as the memory bank and processor for its vital ship statistics.

"I can understand that EDP seems somewhat alarming on first acquaintance," said Dr. E.G. "Doc" Baker, Manager of the nascent EDP program, at the time. "Many people must feel that computers may take over their jobs – may even take over their lives in the not-too-distant future. But really it's not something to be afraid of. The computer can't think; it can't take over from the human brain. What it can do is handle a set of figures in a few minutes which would take a man his whole life to work out. It can eliminate many of the dreary routines of our workaday lives and help free our minds for more constructive thinking."

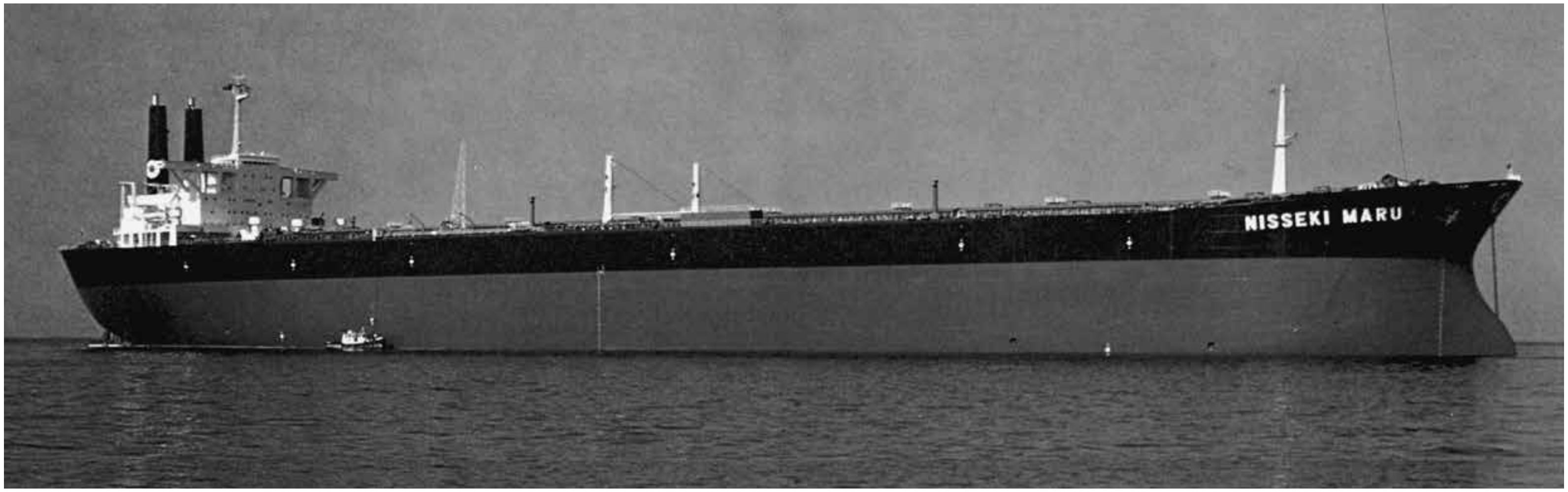
Regarding engineering and technical calculations, the immediate goal was to process routine plan approval calculations by computer, thereby releasing technical personnel from much of the burden of tedious routine checks. The complex computations required by analysis of stresses and strains in large vessels was another demanding task relinquished to the electronic brain. Sometimes, preparing the problems for computer solution required weeks of painstaking work, but the machine's calculating speed made the efforts worthwhile.

Located a few miles from headquarters in mid-town Manhattan, the General Electric computer performed ABS' electronic data processing through a time-sharing program.

By today's standards, ABS' first computing system would be called primitive. Programmers sat at teletype machines, writing their programs in BASIC language on punched paper tape. A finished tape would be run through the teletype, which linked to a General Electric mainframe computer housed in GE's midtown Manhattan office, and accessed the electronic brain via a time-sharing system. Although it wasn't the most advanced system available at the time, the system had sufficient horsepower to attract to the Bureau a group of bright young individuals enamored by computers and eager to apply their capabilities to naval architecture and marine engineering.

Among those new technical hires in 1966 was a young naval architect named Donald Liu, whose graduate work at the Massachusetts Institute of Technology (MIT) involved computer-aided design and the application of electronic computing to naval architecture. Unlike much of private industry, MIT had the latest computer systems installed, with program coding done on IBM Selectric typewriter terminals that were plugged into a remote IBM mainframe computer on campus. For MIT alumni the Bureau's system was a step backwards in technology – still, as Liu and his fellow graduates discovered during their interviews, ABS was the only private maritime industry company at the time embracing computers.

In 1967, ABS recorded the beginnings of its computerization revolution in the first issue of its new periodical, *Surveyor* magazine, a replacement for the publicly-circulated ABS *Bulletin* (which continued in internal use). In discussing the changes wrought by computers in the daily life of the Bureau, an essay from the EDP team noted their utility in solving complex structural analyses – raising a concept that, within just a few years, would develop into a new technology that would change an industry forever.



In 1971, the 366,812-dwt NISSEKI MARU was the largest tanker in the world. It was nearly 1,138 feet long with a beam of 180 feet.

The initial steps towards that change were taken in 1968, when oil major Chevron began developing specifications for its first series of very large crude carriers (VLCCs). The term VLCC had just been invented to describe tankers with a capacity of two million barrels of oil or more. At the time, there was only one VLCC and no shipbuilding Rules for such a large vessel. So, although the new vessel was to be built at one of the most advanced shipyards of the period, Kockums Mekaniska Verkstad in Sweden, Chevron had serious questions to answer.

Concerned that simply scaling up existing Rules would not provide long-term structural integrity at such a groundbreaking size, the oil major wanted to use the latest analytical technology available to help design this ship. Computerized structural analysis was available to maritime users during this period, but all existing programs had been derived from civil engineering and were not suitable for assessing anything about the ship beyond tiny details of its internal structure. For Chevron, the answer was to be found in the aerospace industry, as leading companies were designing advanced aircraft using the recently developed finite element method for structural analysis.

The finite element method develops a detailed mathematical model of a structure that enables its real-life behavior to be simulated and analyzed. The finite element model can be visualized by thinking of a giant fish net slipped tightly over a ship's hull, such that it hugs the vessel's shape perfectly. The threads of the net form a mesh, a pattern of discrete rectangles, all around the hullform. These rectangles are called 'elements', and the corners of the elements are called 'nodes'. The number of elements and nodes, although large, are finite. Each element is assigned attributes, such as thickness, elasticity and strength, that correspond to the properties of the material at the location the element represents. Once the properties are assigned, the elements can 'react' to loads placed upon them. The behavior or response that each element experiences, in the form of deformations and stresses, are calculated at node points based on loads (such as forces or pressures) that the analyst applies.

Loads applied to the structure (such as waves striking a vessel amidships) are represented by thousands of node point forces. Thousands of equations must be solved at the same time, so that all the elements respond in a consistent and compatible manner. Additional calculations are performed so that the model itself remains mathematically balanced.

Finite element mesh models, if properly proportioned and arranged, reflect the real-life response of a structure to forces it encounters.

In general, coarse-mesh global models are used to look at overall structural response, while progressively finer-mesh models are used to zero-in on local areas requiring more detailed analysis. Given enough time and computing power, extremely accurate modeling could be done. This capability made finite element analysis ideal for investigating the behavior of advanced airplane designs.

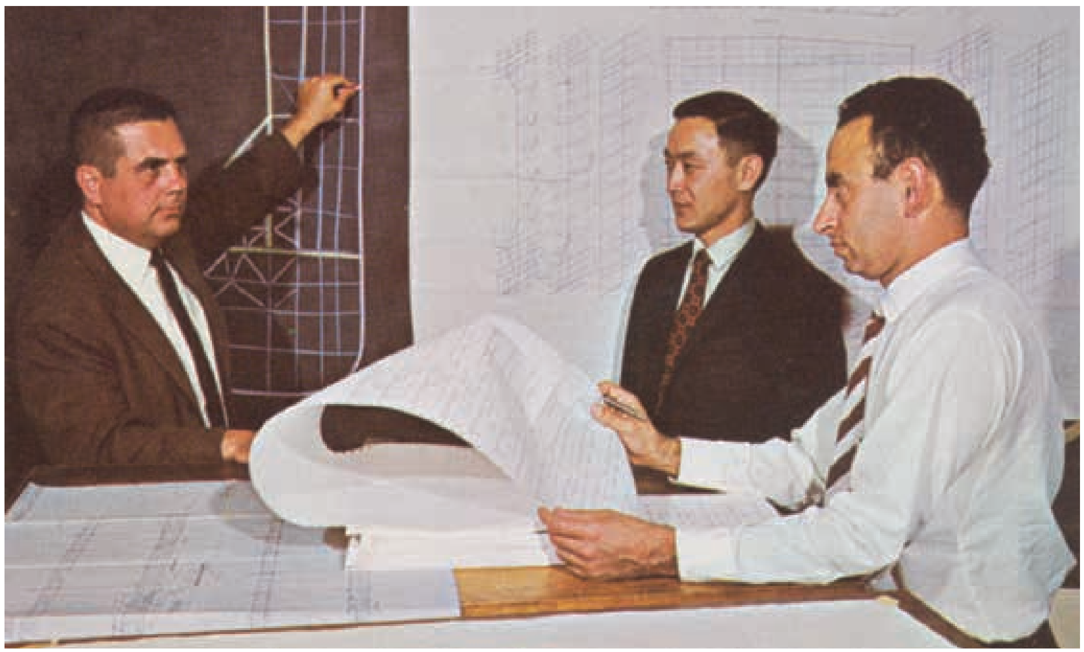
Commercial aircraft designers of the time, not unlike naval architects, were striving for higher cruising speeds and planes of unprecedented size – Boeing, for example, was developing the 747 during this period. These designers, like their maritime counterparts, had to be sure their aircraft could deal with forces of types and complexities never before quantified or even understood.

One reason Chevron looked to the aerospace industry for answers was that a ship hull and an airplane fuselage are both 'plated surfaces', structures having a skin of plates attached to a skeleton of internal stiffeners. Since Boeing was successfully using finite element analysis to tackle its design challenges, to the engineers at Chevron Shipping it seemed a short step to using the programs for ship structures.

Chevron asked Boeing for access to the finite element software it had been applying to its latest designs, but the airplane maker replied that because of proprietary reasons that could not be done. In consolation, Boeing's head of structures suggested that Chevron develop its own finite element program and directed the team to a friend of his, a newly arrived professor of aerospace engineering at the University of Arizona named Hussein Kamel. Dr. Kamel had studied at the Imperial College in London under Dr. John Argyris, one of the inventors of the finite element method, and had worked with NATO on development of the ASKA computer program, a forerunner of large-scale finite element programs for aircraft structures.

This brought the oil major a new complication. Chevron Shipping was an engineering company and didn't have programmers. Professor Kamel knew all about the finite element method and structures, but wasn't a naval architect. A missing piece was needed to take the project forward, someone who knew ships, naval architecture and computer-aided design, and who could program computers.

At this point, serendipity entered the story. The Vice President of Chevron Shipping was a friend and former college classmate of ABS Senior Vice President Robert Little, which brought a personal dimension to the longstanding professional relationship the two companies enjoyed. Knowing well the Bureau's commitment to rational ship design, its recruitment campaign for bright young minds and its developmental work in ship structural analysis, he approached Little and invited ABS to join the project. Little replied he had just the man for the job: Don Liu.



The Arizona Project team at work, from left: Project Manager Bill Reid of Chevron Shipping, ABS Engineer Don Liu and Dr. Hussein Kamel of the University of Arizona.

Sea-Land Service's SL-7 containerships were among the most advanced ships of the 1970s. There were eight high-speed, 27,358-dwt containerships of the same design, including the SEA-LAND GALLOWAY, with a twin-screw turbine drive and an operating speed of 33 knots.

The Arizona Project and the Finite-Element Revolution

In 1968, ABS sent Liu to the Tucson campus of the University of Arizona to work with Dr. Kamel and engineer Bill Reid of Chevron Shipping in developing computer programs for the finite element analysis of ships. Soon known as the Arizona Project, the effort had two primary objectives. Kamel led the effort to develop the program that would actually perform the finite element analysis, which they ultimately christened DAISY (for **D**isplacement **A**utomated **I**ntegrated **Sy**stem). Liu focused on writing a suite of pre-processing programs that would produce the ship data, create the mesh model and loads and feed the input to DAISY. The pre-processing programs would, among other things, define hullform geometry, calculate hull girder bending moments and shear forces and develop ship structural models and sea loads.

DAISY was first used to model the entire ship's hull and analyze the design of the VLCC *John A. McCone*. Launched in 1969, the *McCone* served 25 years at sea, a decade longer than the other mega-ships of the time. Right after completing the review of the *John A. McCone*, Chevron began analysis of a second VLCC design that would be built at Mitsubishi in Japan, assisted by revolving teams of ABS engineers who prepared the data and punched the computer cards.

Just as that project was winding down, containership pioneer Sea-Land approached ABS with its groundbreaking SL-7 containership project – founder Malcom McLean's revolutionary vessels. Extremely fast and sleek, the 27,000-dwt twin-screw containerships were capable of 33-knot service speeds and represented new technology on a number of levels. For example, the wide hatch openings – nearly 85 percent of the ship's beam – required intense torsional loading studies, and the abrupt change in deck stiffness where the deckhouse was joined raised serious questions about longitudinal stresses and warping restraint.

In 1970, ABS used DAISY to perform complete ship motion and stress analyses on the SL-7 design – the first containership to be subjected to finite element analysis. The studies included structural model testing, mathematical analysis and towing tank tests to determine the wave-induced torsional, vertical and lateral bending moments that might be experienced in a variety of sea conditions. These studies provided a firm basis for comparing measured and predicted values and helped refine the DAISY program.

DAISY also figured prominently in the development of a different kind of tanker, the liquefied natural gas (LNG) carrier. With increasing interest around the world in natural gas as a fuel, attention turned to the special ships needed to move it from source to user. Natural gas is over 80 percent methane, and unlike the petroleum gases butane and propane, which become liquid under pressure, natural gas is a cryogenic liquid – it only becomes liquid through deep refrigeration.

Whereas liquefied petroleum gas (LPG) is compressed and transported in pressure vessels, LNG is refrigerated to -162°C (-260°F) and transported at atmospheric pressure in insulated cargo tanks referred to as LNG containment systems. The design of the entire LNG carrier is predicated by the choice of containment system. Several alternative containment technologies have developed over the years and are currently in use, but the two most common types are membrane tanks and self-supporting independent tanks.

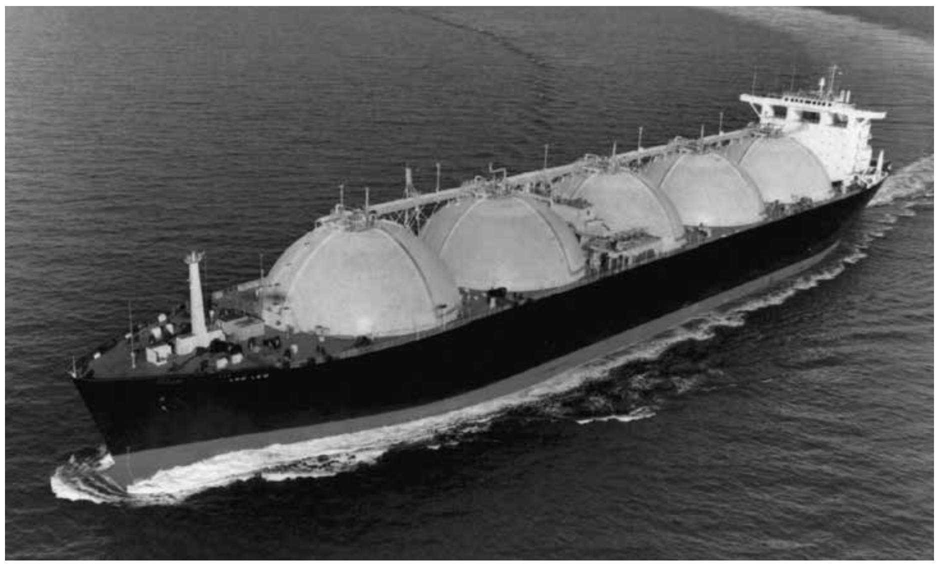
The most recognizable LNG containment system is the free-standing spherical tank, which gives the LNG carrier a unique silhouette that became the universal symbol of LNG carriage. The main alternative is the membrane tank, so called because its primary barrier (the part in contact with the cargo) is a thin 'membrane' of stainless steel or Invar (a nickel-steel alloy); depending on the actual design, the primary barrier is supported by structured layers of insulation or by plywood boxes filled with insulating material. These are built into the hull so that, ultimately, the hull structure supports the weight of the cargo.

In the early 1970s, new designs were proposed for LNG ships that increased cargo capacity by about 75 percent. At that time the largest LNG ships could carry 71,500 m^3 of liquefied gas, whereas the new designs were reaching for 125,000 m^3. This raised safety concerns for both major containment technologies, particularly regarding whether the forces generated inside the tank by these large liquid cargoes as they sloshed around during the voyage would damage the containment system or otherwise affect the ship. The industry asked ABS to investigate the forces through finite element analysis.

This led ABS to incorporate ship motions into finite element analysis and, through that, to develop what became the dynamic loading approach (DLA). "We started including motions and accelerations into our DAISY model so that, if you had liquid cargo and the ship is accelerating, you could calculate the additional dynamic forces of the cargo against the containment system," Don Liu later recalled. "That was the start of bringing seakeeping and ship motions into finite element analysis."

In 1972, ABS conducted a conceptual review of the spherical tank design for an order of ten ships of 125,000 m^3 capacity to be built by the General Dynamics shipyard in Quincy, Massachusetts. ABS worked closely with the shipyard and the containment system designer, surveyed the tank welding (spherical LNG tanks are made of very thick aluminum), and performed detailed finite element analyses, ship motion studies and heat transfer and vibration analyses of the ships. During the same period, similar studies were performed for a new series of 125,000 m^3 membrane tank ships. Finite element analysis continues to be critical to the development of the LNG carrier; ABS' work during the 1970s laid the foundations for the sophisticated analyses, widely used today, that continue to advance LNG transport technology.

Although DAISY was retired during the 1980s and replaced by finite element software developed by NASA named NASTRAN (for **NA**SA **Str**uctural **An**alysis), the pre-processing suite remains in use today, albeit in a much-evolved form.



During the 1970s, the General Dynamics shipyard delivered a ten-ship series of 125,000 m^3 LNG carriers, produced with assistance from the DAISY program, including the 936-foot, ABS-classed LNG LEO.

Embracing the Computer Age

The Arizona Project and its offspring were just one part of an evolution that ABS President Neilson alluded to in 1968: "As the world's merchant fleets have been expanding and modernizing, the American Bureau of Shipping has been keeping abreast of their needs by undergoing a similar transformation."

Information technology was the vehicle of that transformation. ABS' computer capabilities expanded in the 1970s, with the Research and Development Division writing dozens of programs for engineering analysis and plan review. Computers also changed the way ABS handled its storehouse of ship information. In the early 1970s, ABS and IBM developed a comprehensive information retrieval system named ABSIRS (ABS Information Retrieval System). Deployed in 1973, the database represented one of the best and most extensively integrated systems of its kind at that time. Its Master File incorporated all the data from the ABS *Record* – with up to 60 punched cards required for each vessel, some 750,000 cards were entered into the system.

The next year ABS developed a computer program for generating the minimum required scantlings and hull girder section modulus for wet and dry bulk carriers in accordance with the Rules. Named RULESCANT, the plan review tool was originally accessed via teletype by technical offices worldwide, resulting in more uniformity and greater speed in plan review and approval.

Robert T. Young

President: 1970 • President & Chairman: 1971-1977 • Chairman: 1977-1979

Robert T. Young was born in Kandapola, Ceylon (now Sri Lanka) on 31 December 1912. Becoming a naturalized US citizen, Young earned a degree in civil engineering at Tufts College Engineering School in 1935. While in college, he worked as an ordinary seaman, ship's oiler and repair laborer for the United Fruit Company. From 1936 to 1937, Young worked as a hull draftsman and structural engineer for the Bethlehem Shipbuilding Corporation while taking evening classes in naval architecture at the Massachusetts Institute of Technology.

In January 1938, Young joined ABS as a Junior Surveyor on the New York technical staff and, three years later was in Portland, Maine as Senior Surveyor in charge of a ten-man team. He participated directly in ABS' postwar globalization, becoming Principal Surveyor with the ABS Buenos Aires office in 1949; Principal Surveyor for Belgium in 1953; and Principal Surveyor for Great Britain, Ireland and Western Europe in 1956. On 25 July that year, Young and his family were returning to New York aboard the SS ANDREA DORIA when it collided with the MS STOCKHOLM.

In 1966, Young advised the Liberian Delegation at the International Load Lines Conference. In late 1968, the ABS Board of Managers selected Young to be Vice President for Research and, in 1970, President of ABS. He became Chairman a year later, holding both positions until 1977. While Chairman, Young served as President of the Society of Naval Architects and Marine Engineers. Young retired as ABS Chairman in April 1979. In 1992, Young received an honorary Doctor of Science degree from the Webb Institute in New York. He died on 28 August 1996.

Designed for operating in the US Great Lakes, the PRESQUE ISLE is an integrated tug and barge combination that measures nearly 1,000 feet long.

Advances on Many Fronts

As computers began changing the way the world handled information, containerships were changing the way the world handled products. By 1968, there were about 150 vessels at sea capable of carrying containers and 120 more on order. The dry cargo container, which began as a regular truck trailer, had by this time become a recognized industry tool with a developing set of manufacturing standards. That year, ABS issued a new *Guide for the Certification of Cargo Containers* and began its evolution as a major shipping container authority. As container shipping boomed, the number of containers in the ABS Container Certification program grew with it. For example, in 1974, with 200 container vessels under construction in shipyards around the world, ABS certified 32,000 containers. In 1981, ABS certified its milestone 500,000th container, and by 1985, the number exceeded one million.

Design advances were not limited to large oceangoing ships. In the early 1970s an interesting new vessel appeared, an old concept that initially found favor with shipowners desiring to cut costs by reducing crew size. The integrated tug-barge (ITB), in which a tugboat locks rigidly into a notch at the stern of a barge to form a single seagoing unit, could offer the carrying capacity of a conventional ship but required the crew size of a tugboat. Notable among these units was the 1973-built *Presque Isle*, measuring 974 ft long and 104 ft wide, which still serves the Great Lakes iron ore, coal and stone trades and routinely carries more than 2.6 million tons of cargo annually.

The early 1980s also saw a formalization of what had largely been an ad-hoc working arrangement between ABS and the US Coast Guard, through the signing of two important memorandums of understanding (MOUs). The first granted authority to ABS to issue admeasurement and tonnage certificates to US-flag vessels on behalf of the Coast Guard. The second, more comprehensive MOU provided for Coast Guard acceptance of ABS plan review and approval of hull structure and machinery for ships, MODUs and barges, as well as for crude oil washing systems and certain piping systems.

During this time, the ITB evolved into a design categorized by the US Coast Guard as the ‘dual-mode ITB’ and became better known as the articulated tug-barge (ATB). In the ATB unit, the tug still attaches to the barge in a stern notch, but does so via a special fitting that provides an articulated or hinged connection. The hinge allows movement in one axis, or plane, giving the unit the vitally important ability to handle pitching motion in the vertical plane. The ATB has proven extremely useful in service and, over the years, has become an important part of inland and coastal trades in the United States.

Another area that advanced with ABS' assistance was the use of new shipbuilding materials. As owners, builders and designers focused on improving the operating efficiencies of their ships, they looked not only for more efficient engines and propellers, but also for new designs that made more hull space available for cargo. One such evolution was combining the deckhouse and engine room into one massive, aft-mounted accommodations block. At the same time, they also began using new materials to decrease vessel weight and, thereby, increase cargo-carrying capacity. These new materials were, mainly, high-strength steels (which give desired strength properties at lower weights than traditional mild steels) and aluminum alloys.

Since the 1950s, the ABS Metallurgy department had been evaluating aluminum alloys with the aim of developing future shipbuilding Rules. The successful development of weldable aluminum alloys allowed several aluminum vessels over 200 ft long to enter into service by the late 1960s, and led ABS into an early study to determine the feasibility of constructing aluminum vessels of 500 feet in length. In 1969, the Aluminum Association of America approached ABS with a request to develop Rules for aluminum vessel construction. Investigations led ABS to determine that aluminum alloys were suitable for hulls less than 500 feet long, and the Bureau published its *Rules for Building and Classing Aluminum Vessels* in 1975.

Meanwhile, throughout the 1970s, supertankers continued to grow in size and number. The decade began with the launch of the first tankers over 400,000 dwt – the 476,025-dwt *Globtik Tokyo,* in October 1972 and its sister, *Globtik London,* the following year. These were heady days for the tanker world and speculation abounded as to when the first million-ton ship would be built. One of the world's top ship repair yards, Lisnave in Portugal, even built a graving dock capable of accepting such vessels. ABS began studies regarding ships of such size, but they never came to be. The decade's shipbuilding boom produced a tanker oversupply that caused a market crash in the early 1980s, which, in some effects, would ripple outward for almost 20 years.

Measuring 1,244 feet in length, the 472,292-dwt GLOBTIK LONDON was the world's largest ship in 1973. It had a 93-foot draft and could make a service speed of 15.5 knots.

The supertanker era did end with a bang, though. A conversion project at the Oppama yard of Sumitomo Heavy Industries capped the legacy of Japanese monster ships by delivering the largest merchant vessel ever built, the ABS-classed *Seawise Giant* (best known in later years as the *Jahre Viking*). Delivered in 1979 to Hong Kong shipping legend and philanthropist C.Y. Tung, the ship entered service at 564,763 dwt and an astounding length of 458.5 meters (slightly greater than the overall height of the Empire State Building).

The Manhattan Experiment

The tanker SS MANHATTAN, with special ABS-approved structural changes, demonstrated its ice-breaking capabilities by crossing the Northwest Passage.

In 1969, four shipyards, an international team of maritime experts and three major oil companies pitted their considerable technical, creative and financial resources against the monolithic might of nature. In one of history's biggest privately-funded experiments, the tanker *SS Manhattan* won immortality as the first merchant ship to break through the Northwest Passage.

For 500 years, the Northwest Passage had tempted merchant adventurers with its promise of a seaway connecting the Atlantic and Pacific oceans across the ice-choked top of North America. The first explorer to make it through did so in 1906, after a three-year voyage. Though followed in later decades by Coast Guard icebreakers and nuclear submarines, making the Passage with a merchant ship remained a pipe dream – until 1968, when oil was discovered on Alaska's North Slope. The question of whether to export oil from Prudhoe Bay via pipeline or ship sparked a nationwide debate, inspiring the development project's leader, Humble Oil and Refining (a predecessor of Exxon), to invent a new kind of ship: the icebreaking oil tanker.

One person on the management team of Humble's Arctic Project was William O. Gray, who had worked at Bethlehem Steel and knew the ideal vessel for the job: the *SS Manhattan*. Built in 1962 at Bethlehem for the Niarchos organization and classed by ABS, the *Manhattan* possessed a unique, transitional structure that bridged an evolutionary moment in ship design. Developed during the change from empirical, experienced-based design to computer-aided engineering, the ship combined the daring size of the future with the conservative robustness of the past.

Regulations in effect at the time of building stated that the tank length between transverse bulkheads could not exceed 40 feet. As a result, the *Manhattan* had 45 cargo tanks – 15 at three across – in the 600-plus feet between the forepeak and engine room bulkheads. Today a ship of similar length would have five or six tanks. Such excessive structural features gave the hull the inherent strength to fight the ice. Even so, in the end, over 9,000 tons of steel would be added to the ship – a task so big only one yard, Sun Shipbuilding in Chester, Pennsylvania was willing to take it on.

The *Manhattan* arrived at Sun in January 1969, leaving in August as the most heavily armored merchant ship in history. At its peak, the project occupied over 90 percent of Sun's 5,500-man workforce and 100 percent of its production capacity. Still, the job was so large that no single shipyard could finish it within the required time frame. At Sun's suggestion, the project was divided among four builders and the massive effort was conducted under the watchful eyes of ABS.

Manhattan's first trip gave it a place in exploration history. The 4,400-mile journey into one of the last frontiers was closely followed by major newspapers, riveting readers with images of ambitious man against inscrutable nature. The ship carried no cargo; its tanks were filled with water to simulate loading. In Alaska, the ship picked up a symbolic barrel of oil, returning to New York as a merchant hero.

Helping Offshore Energy Advance

The 1960s and 1970s brought great evolution to the offshore oil and gas sector, as drilling contractors and field developers, pushing the limits of their experience on a daily basis, introduced many of the technologies that today are critical elements of the world's energy supply chain. As the numbers and kinds of floating offshore equipment grew, a need for industry standards developed and, in 1968, ABS issued its *Rules for Building and Classing Mobile Offshore Drilling Units* – the first classification Rules specifically for the offshore industry.

The product of three years' work with the Offshore Operator's Committee (a group of representatives from companies that pioneered offshore exploration and development), the new Rules expressed the strong relationship with ABS that the offshore oil and gas sector had enjoyed since its early days. That relationship dates back to 1947, when, in 20 feet of water offshore Louisiana, Kerr-McGee installed the world's first drilling rig out of sight of land. Although the history-making rig was not ABS classed, the barge alongside that housed its crew and supply center was.

Friede and Goldman's SEDCO 135, the first purpose-built semisubmersible drilling unit. The design became internationally popular with its milk-bottle inspired legs.

The 1968 Rules covered floating and bottom-supported mobile offshore drilling units (MODUs) and incorporated the latest knowledge in the field, particularly regarding vessel stability and the wave heights and wind speeds that MODUs should be built to withstand. Its authoritative nature was such that the IMO adopted the Bureau's Rules for its *Code for the Construction and Equipment of Mobile Offshore Drilling Units* (the IMO MODU Code), which it first published in 1979.

The US Government also recognized the Bureau's authority and in 1978, asked ABS to develop *Requirements for Verifying the Structural Integrity of Outer Continental Shelf Platforms*. These requirements formed the basis of federal rules governing fixed offshore oil and gas platforms.

Gulf Coast yards had played an active role in the wartime shipbuilding effort, and ABS was well-known in the area for its expertise in assessing steel structural strength and safety in marine applications. As such, the Bureau was being consulted by builders of floating offshore drilling equipment as early as 1950, using the Steel Vessels Rules as the primary basis for evaluating rig designs. However, classification per se did not officially enter the offshore scene until pioneering designer Emile Brinkmann requested ABS class for his self-elevating drilling barge *Mr. Louie* in 1958.

Self-elevating drilling barges were among the earliest tool in offshore exploration. They have a set of legs that are jacked down to the sea floor in order to raise the vessel's hull out of the water, so that the derrick on deck becomes a stable platform to drill for oil. These units evolved in size and technology into the 'jackup' drilling rigs, which, in many configurations, have for 50 years been the backbone of shallow-water energy exploration and development.

The dawn of offshore drilling was a period of daring innovation, wherein many unusual-looking contrivances were floated out into the Gulf of Mexico to access the oil beneath the water. More often than not, these ancestors of today's sophisticated MODUs were designed out of untested theories, built to untried specifications, and launched on pure grit and determination.

Take, for example, the evolution of today's column-stabilized floating drilling unit. Very early submersible drilling rigs looked like houses on stilts sitting on a barge. The barge would be flooded and sink to the sea floor, leaving the drilling house above water. But these barges ballasted unevenly, making the process rather risky as the units grew taller.

In 1956, a new unit named *Rig No. 46* replaced the supporting barge with four immense columns shaped like milk bottles. They had that shape because someone was inspired by a milk bottle, and approached Emile Brinkmann and his partner Paul Wolff with the idea that a few such objects, fitted appropriately to a derrick and filled simultaneously, might make ballasting a smoother operation. The idea seemed worthwhile, so they tried it. The rig was so effective that the owner built a sister unit, which gave birth to the term 'semisubmersible' when, one day, a head driller decided to see if, instead of standing on the seabed, the thing could be moored in place and drill while floating.

Delivered in 1981, the NEDDRILL 6 column-stabilized drilling unit operates today as the NOBLE TON VAN LANGEVELD.

That unit inspired offshore contractors Sedco to acquire one of their own and, in 1963 they asked a prominent New Orleans naval architect firm for a design. The result: Friede and Goldman's ABS-approved *Sedco 135*, a landmark vessel in the history of offshore drilling. Created by pioneering designer Walter Michel, it was the first purpose-built semisubmersible drilling unit. Able to be used floating or sitting on the bottom in 135 feet of water, the design became internationally popular and the milk-bottle legs of the *135* could soon be seen in offshore fields around the world. Descendants of this design were built until the early 1980s. Five of those later rigs were eventually modified by Noble Drilling for use in water depths greater than 6,000 ft.

The concept of drilling in extremely deep water is not a new one, and not even original to the oil and gas industry. It first occurred to a group of scientists in 1961 as they worked out Project Mohole, an attempt to drill through the earth's crust and into the mantle. Knowing the thinnest part of the crust was under the deepest part of the ocean, the scientists figured to build a ship-mounted drilling rig that could keep station without anchors, a feat it would accomplish through 'dynamic positioning' – the constant adjustment of rotatable propellers that never stop churning.

The Mohole team called in as drilling consultant the manager of Shell's Marine Division, W.F. Bates, who returned from the meetings convinced that Shell should have such a ship in its exploration arsenal. Thus, two important modern technologies made their first appearance at the same time in two independent research projects, as the first two drillships – the Mohole team's *CUSS-1* and Shell's *Eureka* – tried to make dynamic positioning a reality. The Shell team, led by engineer Howard Shatto, succeeded in creating a fully automatic, accurate dynamic positioning (DP) control system. Shatto became a leading developer of DP technology and worked closely with ABS over the years to bring increasingly larger and more reliable DP systems into service.

Drillships quickly became popular exploration tools in the offshore sector, but always used mooring systems to keep station until 1970 when the first dynamically positioned drillship, the ABS-classed *Sedco 445,* was launched. Six years later, on board the ABS-classed drillship *Discoverer Seven Seas,* Shatto introduced acoustic positioning and, later, satellite-based positioning systems such as those used today.

Safety regulations were first imposed on the offshore sector in 1961. With the number of platforms and rigs in Gulf waters growing, the US Coast Guard ruled that rigs which drilled while floating were to be considered vessels and, consequently, had to be assigned a load line. It was soon discovered about MODUs that, due to their unique design characteristics, the amount of study and survey needed to assign them a load line was only slightly less than that needed for full classification. This led many designers and operators to have their rigs analyzed and classed by ABS.

Eventually, offshore drilling pushed into water depths beyond the reach of divers, and the industry began developing miniature submarines, known as 'manned submersibles', that could give technicians and workers access to the deepest parts of their worksites.

A drillship with a place in history: the HUGHES GLOMAR EXPLORER, built for a secret mission to lift a Soviet submarine off the ocean's floor in 1973, is still in service today.

This technology progressed with the aid of ABS, and soon submersibles were being used for underwater tourism as well as underwater maintenance. In 1968, ABS published the industry's first *Guide for the Classification of Manned Submersibles* and soon became the world's leading class society for underwater craft. As technology allowed divers to work at greater depths, specialist diving support vessels were developed and became very important to offshore development projects. ABS also established standards for diving support systems and, in 1979, incorporated them into its comprehensive *Rules for Building and Classing Underwater Systems and Vehicles*.

The VICKERS OCEANICS P. III, after completing a diving assignment, swings inboard at the stern of the mother ship. The manned submersible had two battery-powered electric motors and could dive to a 3,500-ft depth.

Global Operations Take Root

The 1960s and 1970s were golden years for shipbuilding. New vessel types like LNG tankers, containerships and combination carriers appeared in international fleets, supporting a worldwide evolution in energy use and freight carriage; and ever-larger dry bulk and crude oil carriers supported infrastructure buildup and urban expansion in Europe and America. Newbuilding activity around the world strengthened and secured the global presence that ABS had first staked out servicing secondhand war surplus tonnage.

In Brazil, for example, ABS enjoyed a leading role in supporting a shipbuilding boom that began during the late 1960s. As in many places around the world, the Bureau opened its first exclusive office in Rio de Janeiro in 1948 to service Liberty ships, Victory ships and T2 tankers on which international commerce revitalized – it was a tiny space for one surveyor and a secretary. When a study of South America's shipbuilding potential in 1963 led the Bureau to decide to beef up its Brazilian operation, Principal Surveyor Laudman J. Richoux convinced Chairman Nielson that success in Brazil would only come through hiring locals. In 1964, among his first hires was a young engineer named Antonio Lino Costa, who went on to become Country Manager and President of the ABS Europe Division.

In 1968, Richoux got an idea to translate the ABS Rules into Portuguese and enlisted the office staff in the project. He printed the book and offered free copies to universities and marine engineering students. The work not only embodied ABS' commitment to assisting the country's development, but also helped educate a generation of Brazilian maritime professionals. That year, large orders from Lloyd Brasileiro, Vale do Rio Doce and Petrobras led to a building boom that gave Brazil's six shipyards the world's second-largest national orderbook for a brief time in the late 1970s. Under Richoux and Lino Costa, ABS grew to capture more than 75 percent of the Brazilian market, and the ABS Rio de Janeiro office grew to become the headquarters for ABS' operations in South America.

Tales of Global Expansion

An insight into the cultural change that global expansion brought the Bureau can be gleaned from a snippet of the intake interview of Warren Anderson, who served as Principal Surveyor for the Orient from 1973 until his retirement in 1986. When he joined ABS in 1952 in the port of Los Angeles, he was interviewed by veteran Port Principal Surveyor John Black and West Coast Principal Surveyor Bill Warren.

"They said to me, if you get hired for this job you'll probably have to go on foreign assignment to Japan; I had sailed for ten years all over the world, so that was no problem for me," Anderson once recalled. "Then they said, 'we are the Foreign Legion of ABS; we can tell you all about that.' I asked where they had served. Bill Warren was first to answer. 'I was in the Canal Zone,' he said. Then John Black says, quite proudly, 'And I opened the Bureau's office in Honolulu.' At that point I figured I'd better keep my mouth shut. I worked with Black for three years before being sent to Japan; he was a very good man and often spoke of the Bureau in the old days and of his foreign service. I came to realize that, at the time they joined ABS it was just a small American company, with no overseas employees, and the Canal Zone and Honolulu really had been its 'foreign service'."

The men who first brought the Bureau around the world were a hardy, adventurous lot. The records of their work can read like tales from an old adventure novel: they did favors for kings – like Senior Surveyor for Bahrain Max Schaerer, who at the highest government request founded and trained the Bahraini Olympic rifle team; they saved ships – like Henry Millard, Principal Surveyor for South Africa, who for eight days stood on the partially awash deck of a stranded tanker and singlehandedly led its rescue, preventing a major pollution incident; and they helped developing nations learn the art of shipbuilding – like Hank Armstrong, Chief Surveyor and onetime Principal Surveyor in Singapore and the Philippines, at whose passing the ABS world headquarters was flooded with letters from senior shipping men throughout Southeast Asia expressing gratitude to an old mentor.

In a world with little regulation and no process instructions, these rugged individualists made decisions alone and operated on initiative, most bearing their authority with strength and respect that brought honor to the Bureau.

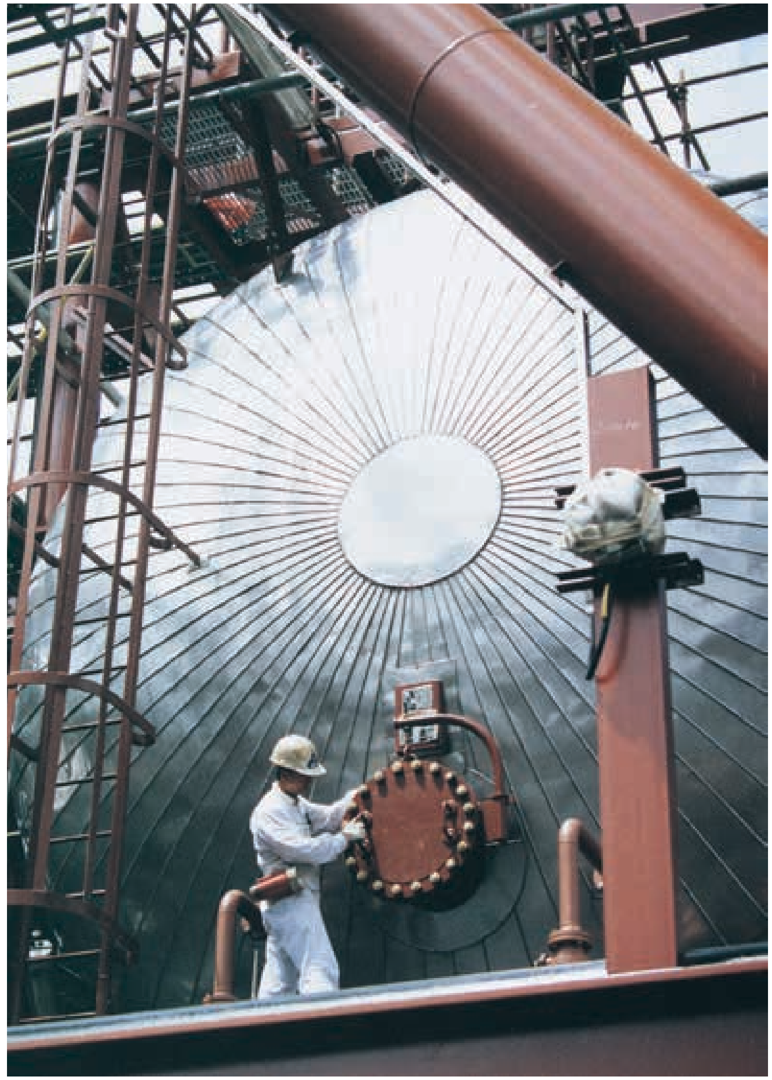
Growing and changing with the industry it serves, ABS reorganized in 1969 in an effort to promote efficiency. All exclusive and non-exclusive surveyors throughout the world now reported to 16 area principal surveyors, who in turn reported directly to Vice President Ralph C. Christensen. A year later, ABS opened new exclusive offices in Caracas, Venezuela; Valparaiso, Chile; Seoul, South Korea; and Galatz, Romania.

For many years, Japan was the Bureau's main engine of growth. By the mid-1960s, Japan had become the world's top shipbuilding nation – a position it would hold until being displaced by South Korea in 2003. ABS followed the Japanese shipyards as they grew in output and stature, and by the late 1970s had expanded from its original base in Kure to establish a firm place in eight shipbuilding centers throughout the country.

Evolution into an international company surprised many in the post-World War II generation of ABS management, who thought that the Bureau's overseas expansion was just a flash in the pan. Charlie Schoefer, Principal Surveyor for the Orient from 1956 to 1968, once recalled being told by a senior manager that "Asian shipbuilding is a bubble; eventually the owners will wake up and return to the traditional builders."

ABS grew in many ways as international shipbuilding expanded. The Bureau was first carried across the world on the shoulders of an army of surveyors and their families, who carved out new lives while building a business in sometimes daunting isolation: there was a time in Kure, for example, when to call the United States you had to reserve a line at a national telephone office two days in advance.

Meanwhile, in their sometimes challenging surroundings, the surveyors and their families formed close-knit communities that dealt with hardships together and, in the process, forged many lifelong friendships. As many of these people rose through the company and returned to headquarters, their expatriate experiences created the basis for the Bureau's evolving corporate culture.



ABSTECH was initially established to offer independent inspection, certification and quality assurance services for industrial equipment.

Diversifying Activities Beyond Marine

In 1971, the Bureau created a wholly owned subsidiary, ABS Worldwide Technical Services, Inc. (ABSTECH). Previously, ABS had done non-marine work only in exceptional cases – as, for example, when Bureau surveyors inspected the steel and caissons for San Francisco's Oakland Bay Bridge and the steel for the Golden Gate Bridge in the 1930s. Now, ABS saw opportunities for diversification in providing independent inspection services for land-based installations.

"The need for independent inspection of industrial plants and equipment has grown in proportion to the volume of international trade in equipment manufacturing, the complexity of modern engineering and the soaring costs of plant facilities," ABS Chairman Robert Young said when introducing the press to the new organization.

Initially, ABSTECH was to focus on power plants, oil refineries and process facilities and their associated pipelines, refrigeration systems and other technical needs. "These types of installations are within the competence of the Bureau's staff, as we have substantial experience through our work with super-size tankers, liquefied petroleum gas carriers and special chemical carriers," said Young.

By 1976, ABSTECH was active in 23 countries and had provided inspection and consulting services for over 6,000 projects at heavy construction and petroleum industry work sites around the world. ABSTECH later formed its own subsidiary called the EXAM Company, which used nondestructive testing techniques to inspect pipelines. In one notable project, EXAM used radiographic techniques to inspect the northern 400-mile section of the Trans-Alaska pipeline.

By this time computers had become integral to the Bureau's business and the old time-shared systems were no longer adequate. In 1976, ABS brought computing in-house by creating a subsidiary of ABSTECH, ABS Computers, Inc. (better known by the acronym

William N. Johnston

President: 1977-1979 • President & Chairman: 1979-1986

Once described as a "gregarious, people-oriented executive," William N. Johnston was also a southern gentleman and a gifted musician. Born to a seafaring family on 11 July 1922 in Mobile, Alabama, Johnston played clarinet and bassoon in high school and eventually with the Mobile Philharmonic Orchestra.

While studying mechanical engineering at Auburn University, he participated in a work-study program at the Waterman Steamship Company and, during World War II, served as an officer in the US Army Corps of Engineers. He returned to college after the war to earn a degree in naval architecture and marine engineering from the Massachusetts Institute of Technology.

Johnston once said of his career choice that "It is not enough to embark upon a career simply because it can be financially rewarding. You must like what you do." He joined ABS as a Surveyor in 1951, serving in Europe for eight years and in the United States for seven. He became Principal Surveyor for New Orleans in 1966; Principal Surveyor for the United Kingdom and Western Europe in 1968; and in 1972, was appointed Assistant to the Chairman. The Board of Managers subsequently elected him Vice President and Senior Vice President in 1976, President in 1977 and Chairman in 1979. He retired from ABS on 1 October 1987 after 36 years.

Johnston was a member of the Society of Naval Architects and Marine Engineers, the American Welding Society and a Fellow of the Royal Institution of Naval Architects and the Institute of Marine Engineers. Johnston died on 7 September 1989.

ABSCOMP), which provided data processing, analysis and computer services support to ABS, its subsidiaries and its clients.

A joint venture between the ABS Reports Section and ABSCOMP changed forever the classification society business model. In 1978, ABS launched its Online Survey Status system, becoming the first classification society to implement an electronic database of ship survey information that was accessible via computer the world over. Using a special dial-in technology named TELNET, the central files, held on an in-house IBM 370/158 mainframe, could be accessed from terminals installed in offices around the globe – including client offices. For the first time, a fleet operator could obtain up-to-date survey particulars any time of day or night.

It was a complete break with the way ship information had previously been collected and managed, which hadn't changed much since the days of sail. Until 1978, the fundamental data unit in classification was an 8½ x 11-inch index card stored at the class society's headquarters. The lines and boxes filling each card contained a vessel's life story, told through concise notes of survey history. ABS surveyors, for example, would write narrative survey reports that were typed by office secretaries and mailed to the New York office, where analysts would extract the essential survey data and record it onto the ship's card. Anyone needing information on a ship, which could only be retrieved during office hours, would call the Reports Section, whose personnel would research the vessel and respond by telephone, telex or mail.

An ABSCOMP operator reviews the hard copy produced from the data generated on the console screens in the background.

To change that way of doing business required a massive administrative effort. It took a full five years to transfer all the data for the 15,470 vessels then in ABS class, which had to be moved from the index cards and vessel information booklets to the Bureau's new IBM memory banks. Hailed as an evolutionary leap in service delivery, Online Survey Status gave ABS and its clients, around-the-clock access to more and better-organized information than ever before.

ABS continued to diversify its service offerings through its affiliated companies. In 1983, ABSTECH registered with the World Bank and eight other development banks to become a recognized industrial consultant with the United Nations Industrial Development Organization. In that same year, ABSTECH entered the fuel oil testing business. Shipowners seeking confirmation that bunkers taken on board met specified chemical characteristics could fly fuel samples to

A laboratory technician with ABS Fuel Oil Testing operates an automatic titration unit to determine if the used lubricating oil contains excessive acid.

an ABS test laboratory for analysis and get results back by telex along with recommendations for treatment, if necessary, to avoid engine damage.

Also in 1983, the ABS Boiler and Marine Insurance Company (ABS BMIC) was created to provide underwriting and financial services. The following year, ABS established the ABS BMIC Boiler and Pressure Vessel Division, which was authorized by the National Board of Boiler and Pressure Vessel Inspectors to inspect boilers, pressure vessels and pressure-related equipment according to the Code of the American Society of Mechanical Engineers.

Growth, Change and Evolution

ABS continued to evolve by establishing its Ocean Engineering Division in 1978. In 1979, the Metallurgy department was renamed the Materials and Manufacturing Processes department and became part of the Bureau's Technical Division bringing with it the Materials Laboratory, the Materials Engineering Section, the Quality Assurance Section and the Container Section.

Towards the end of 1982, ABS introduced its Quality Assurance Program, an innovative precursor to the quality management systems that the International Standards Organization (ISO) would introduce within a few years. ABS staff would evaluate manufacturing processes in an onsite audit and, on approval, issue an ABS Certificate of Manufacture. Within a decade, nearly a thousand industrial plants around the globe had enrolled in the program. Building on this legacy, ABS would go on to become the first classification society to gain ISO 9000 certification and a future ABS affiliate, ABS Quality Evaluations, would become a global leader in auditing to ISO standards.

Andrew Neilson retired in 1970 and was succeeded by Senior Manager Robert T. Young. During Neilson's tenure, said Young, "the Bureau has taken remarkable strides forward and we are all keenly aware of the debt which we owe him." Young stepped down as President in 1977, but remained Chairman for two more years. He was succeeded by William N. Johnston, a longtime ABS mechanical and marine surveyor, who served as President and Chairman from 1979 to 1986.

By the early 1970s, ABS had outgrown its offices and began renting space in two locations – 20 and 55 Broad Street – but even that proved to be inadequate. So in June 1977, the Bureau bought the attractive American Express building at 65 Broadway in Manhattan, now a city historical landmark. Built in 1917, the 21-storey neoclassical building offered 296,000 ft² of space and room for everyone, including ABSTECH and ABSCOMP. Celebrating the move, the Bureau commissioned a beautiful, solid bronze eagle sculpture for the building and installed it, with great fanfare, atop the main entrance archway. In the shipping depression of the mid-1980s, ABS would lose the building, but its majestic eagle can still be seen perched high above Broadway.

Overall, the 1980s began reasonably well for ABS. The highlight of the decade's early years came in March 1982, when the Bureau inaugurated ABS House, its new European headquarters. The modern six-storey structure stands on a little street mysteriously named Frying Pan Alley, nestled among the narrow lanes of an antique neighborhood once inhabited by ironmongers and the King's artillery makers, and a short walk from Liverpool Street Station and London's financial center.

At the opening, William Johnston called ABS House "indicative of our belief that London will continue to be a major maritime center," adding that it "demonstrates ABS' commitment to the maritime industry and to the great city of London as well. The building will allow ABS to grow while continuing to provide premium classification services as the marine industry advances into the next century."

Besides the new office, ABS had much to celebrate. The existing ABS-classed fleet registered 108.2 million gt, with another 10 percent of that figure under construction or contracted to ABS class worldwide. Meanwhile, the Bureau continued to shine as the offshore sector's classification society of choice, with 339 MODUs in class and another 255 under construction or contracted to be built to ABS class. Altogether, there was little hint of the earth-shaking recession just around the corner that would soon strike crippling blows to both the marine and the offshore sectors. ✠

Chapter 6

Bringing on the Future

1985 – 2004

Shipping is a cyclical business, the ups and downs of which are spurred and magnified both by global events – wars, economic recessions, legislative movements and so on – and by the manner in which industry responds to them. When optimistic responses to upward cycles lead to periods of over-exuberant building, the excess tonnage produced creates market imbalances that can take many years to correct. This was the case in late 1982, when the rippling effects of the worldwide recession and the oversupply of merchant ships produced by zealous shipbuilding during the 1970s began to exact a toll on the maritime community, setting in motion a series of overlapping problems, challenges and difficult episodes whose magnitude and force would totally change the maritime industry.

A standout example of this can be found in the consequences of the closure of the Suez Canal from 1967 to 1973 as a result of the Arab-Israeli War. The Canal was the key passage in the major shipping route between Europe, the Middle East and Asia and its dimensions defined a tanker class – the suezmax – that had a cargo capacity between 900,000 and 1.2 million barrels of oil. With its closure, all ships had to take the much longer sea route south around the Cape of Good Hope. The longer voyage times effectively reduced the world fleet's carrying capacity overnight, boosting freight rates to record levels. To fill this capacity reduction and cash in on a charter market that could repay the capital cost of a supertanker within its first year of operation, shipowners embarked on an ordering binge at shipyards around the world, but especially in Japan.

This ordering frenzy coincided with two technical innovations that would change the face of international shipping for the next two decades, and likewise the fortunes of ABS. In the liner shipping sector, the containerization revolution brought new ships online that not only filled the need for additional tonnage on the longer south-about sea route, but also were vastly more efficient than the traditional general cargo ships they were replacing. In the tanker sector, the new generation of crude carriers ordered to carry Mid-East oil to Europe brought new economies of scale and a change in preferred tanker size to the very large crude carrier (VLCC), which carries roughly twice as much oil as a suezmax. Shipyards quickly developed massive order backlogs for these new, larger vessels.

When the Canal re-opened in 1973, shipping economics had changed. The efficiencies of the VLCC made the voyage around Africa competitive with the smaller vessels able to transit the Suez Canal, and the ordering boom continued as speculators vied with traditional shipowners for newbuilding slots. Benefitting from this remarkable confluence of events, the ABS-classed fleet grew steadily until peaking at just over 111 million gt in 1981. By this time, however, protected anchorages around the world were gorged with laid-up tonnage, principally tankers, many of which had moved straight from the shipyard to lay-up without ever entering service, despite a steady annual increase in the total volume of oil being moved by sea.

As a result, by the mid-1980s the shipping industry was mired in one of the deepest recessions in its history – a situation only made worse by the global economy, which had slumped severely as many leading nations struggled to contain rampant inflation. Excess tonnage ordered through the 1970s now sat idle, forestalling any hope of an upturn in the fortunes of hard-pressed shipowners, who had little interest in placing new orders with the world's increasingly desperate shipyards.

Adding to the shipbuilders' plight was the rise of South Korea as an aggressive new competitor. Over the years, many higher-cost European shipyards closed – including the specialist builders in Sweden that had once made that nation the world's Number Two shipbuilder. Yards in Japan turned to heavy engineering work in an effort to retain their skilled craftsmen. All vessel orders placed during this period were subject to intense competition between shipyards, with little profit attached to the winning bid.

In this climate it was, perhaps, only natural that yards would seek to cut costs. This was largely achieved through greater production efficiencies, notably in Japanese shipyards. Many yards also turned attention to their design portfolios, raising new technical questions as they looked for ways to reduce both material and production costs. By increasing frame spacing, could they reduce the amount of steel required? By selectively using new high-strength steels, they had reduced weight and increased cargo capacity in large vessels, so could they likewise reduce scantlings and cut steelweight even further by using these steels more widely in the traditional mild steel hull – and if so, how low could they go?


In the 1980s, economic concerns drove some leading shipbuilders to push light scantling, short life ships on the market, beginning a series of industry problems that would last through three decades.

Such questions were not merely design or production issues, but also safety issues that fell squarely in the lap of the classification societies. Some class societies chose to enter this high-stakes game, hoping that willingness to meet the yards' demands would help win orders in a market that showed few signs of recovery. Their collective decision would reshape classification and the fortunes of ABS – this was the beginning of the 'light scantling' or 'short life ship' period, an ignoble episode that would cripple the image of class as an impartial arbiter of safety standards in the eyes of the public, politicians and industry.

To its everlasting credit, ABS refused to be drawn into this competitive race to approve the lightest possible ship. To have done so would have compromised its mission and its integrity, besides running counter to its guiding principles and technical knowledge. A small number of responsible shipowners appreciated the ABS stance and remained loyal throughout this sad episode. As a result of sticking to what it knew to be the right course, ABS developed a reputation for producing heavier ships – although widely known to be more robust, the additional steel carried a cost penalty that deterred most owners. The ABS fleet began an inexorable slide that was to take the society from largest (in terms of gross tonnage) to the number three position behind its principal Asian and European competitors.

For decades, ABS' engineering office in Yokohama, Japan has played an important role in the development of shipbuilding throughout Asia.

Struggling Times, Drastic Measures

The 1980s brought difficult times for ABS, as years of heady expansion gave way to an industry collapse and a long period of heavy retrenchment. ABS rode out the first few years of the shipping depression on the strength of its new construction backlog, but was soon operating at a loss. President and Chairman William Johnston and the ABS management looked for ways to streamline the company, diversify its offerings and generate new revenue streams.

In early February 1985, ABS purchased an office building in Tokyo to house its Orient headquarters. The rental market in the Japanese capitol had become so expensive that the costs of buying and operating even a desirable property like this – a freestanding structure near the Imperial Palace and overlooking the Yasukuni Shrine and Gardens – were about equal to what the Bureau had been spending to lease its former facilities. In addition to supporting ABS' growing work in Japan, Korea, Hong Kong, Singapore and China, the building would help support itself by leasing part of its 25,000-ft^2 space to local businesses. ABS would own its Orient headquarters for only two years, but the acquisition would turn out to be one of the smartest real estate moves in the organization's history.

At the same time, on the other side of the world another real estate move was underway. In 1985, ABS shocked friends, clients and competitors alike by announcing it would transplant its New York City world headquarters across the river to the New Jersey suburb of Paramus. Johnston described the move as a cost-saving measure, saying that, "By reducing overhead, the ABS organization can better utilize its financial resources both to upgrade services to our customers and to provide for the well-being of our employees." To many ABS supporters and staff, it symbolized the exigencies of the time that the Bureau felt it necessary to trade a neoclassical skyscraper on a prime Manhattan boulevard for a nondescript office building in a New Jersey industrial park.

The global shipping and offshore markets continued deteriorating, and by 1986 shipbuilding around the world had dropped to its lowest levels in 20 years and offshore units were coldstacked at US Gulf Coast ports. The industry and ABS were in a crisis.

First Steps Towards the Future

Unfortunately, the substantial organizational change did not reverse the Bureau's mounting losses. With the retirement of ABS Chairman and President William Johnston in 1986, the ABS Board faced a difficult decision. For more than 50 years, with the exception of Andrew Neilson, ultimate responsibility for the management of the class society had been vested in an executive recruited from within, several of whom (including Johnston) had been with the company for most of their careers.

With the organization facing extraordinary challenges on all sides, fresh insight was needed to find a new direction for the future. Looking to industry for a solution, the Board selected Richard Thornton Soper, a maritime industry veteran then nearing retirement as Executive Vice President of containership pioneer Sea-Land. Soper had influenced Sea-Land's changeover from steam to diesel propulsion and directed the transformation of Columbus Line (a subsidiary of German shipping line Hamburg Süd) from breakbulk freight to container shipping. The Board asked Soper to help transform the Bureau's business culture and he agreed, with the understanding that he would serve only a few years before retiring.

Soper once described the organization he took over in November 1986 as "somewhat static" – a product, he believed, of an insular corporate culture, long-standing historical traditions and a record of success that never called into question either the Bureau's business model or its management philosophy. ABS was, he said, "a victim of its own success," unprepared for the challenges of the global recession and tonnage oversupply. At the same time, he also saw in the ABS workforce a wealth of talent and expertise. He hoped to

Richard T. Soper

President: 1986-1987 • Chairman: 1987-1990

Richard Thornton Soper was born and raised in what was once one of America's most important port cities, Salem, Massachusetts. He learned to love the sea at a young age and, by his teens, was converting and sailing wooden ships and serving as a crew member aboard a local schooner. Soper graduated from high school in 1942 and enrolled in the Massachusetts Maritime Academy. America was at war and the cadets were placed on an accelerated curriculum. Soper graduated from the Academy in December 1943, received his third officer's license and took a job with American Export Lines serving on Liberty ships. It wasn't just any job, but one of the most harrowing for a merchant seaman – much of his wartime work was spent sailing the perilous Murmansk Run, where many allied ships went down in cold Arctic waters.

Soper remained with American Export Lines for several years after the war, then went to work for containership operator Sea-Land. He spent nearly 20 years with Sea-Land; served a short while as President of Columbus Lines; then returned to Sea-Land in 1973 as Executive Vice President. He was elected ABS President in 1986; and President and Chairman in 1987.

After his retirement from ABS in 1990, Soper continued to contribute to the industry, teaching a survey course on maritime technology at the World Maritime University located in Malmö, Sweden. Already fluent in three foreign languages, he found time to teach himself Swedish, so that he could better pursue his ardent passion for Swedish opera.

maximize that potential by accelerating its decentralization, so as to bring more personnel into ABS' decision-making processes and, thereby, have more people thinking up innovative ways to serve clients.

The Technical Services Group merged the functions and services provided by ship engineering, offshore engineering, research and development and regulatory affairs into one cohesive unit.

In 1986, Soper led a reorganization of ABS' worldwide operations into ten geographic regions: the Orient; Western Europe and Northern and Western Africa; Southeast Asia and Australasia; the Mediterranean; the Middle East and Southwest Asia; South America; the Great Lakes, Western Rivers and Canada; the US Gulf Coast, Central America and Mexico; the US East Coast, Florida and the Caribbean; and the US West Coast, Alaska and Hawaii.

The new regions were treated as individual business units responsible for classification and government services, as well as ABSTECH and ABS BMIC activities within their respective geographical spheres. Each region was headed by a regional manager and a technical manager – dividing the survey and administrative workload that was formerly borne by the area principal surveyor alone. These new managers had more administrative authority in their regions than the area principals, but the important survey and engineering decisions were still made from headquarters.

Soper then created a headquarters-based Technical Services Group, led by Senior Vice President Don Liu, which brought together ABS' Ship Engineering Division, Research and Development Division, Offshore Engineering Division and Regulatory Affairs Unit. The regional technical managers had a direct link to the Technical Services Group, from which they received support and oversight. ABS also opened an office in Washington DC to focus on the Bureau's growing business with the US Government.

The year 1986 brought an additional and unexpected challenge for ABS. Until then, US tax law exempted the foreign earnings of US-controlled but foreign-registered shipping companies from taxation, and profits could be reinvested in those operations without penalty. The 1986 US Tax Reform Act made these earnings subject to US tax, but rather than attract operators to the US registry, as had been hoped, the tax exposure of these entities rendered them uncompetitive internationally, and many US-controlled fleets were sold off to corporations with non-US controlling interests.

What had been a largely captive domestic market for ABS quickly evaporated. Even Soper's own Sea-Land eventually became a casualty to these market forces, being acquired by Denmark's A.P. Moller group. Across the organization Soper worked to ensure that the worldwide staff expanded its market awareness. "Knowing the market" and "knowing the world's requirements" became guiding principles for ABS during this period.

By 1989, Soper had guided the Bureau toward stability and into a more flexible, responsive structure. Convinced that ABS was now "able to move rapidly to adapt to changing times and conditions," Soper retired in April 1990. The ABS Board of Managers, as its predecessors had done a quarter-century before, reached to the energy industry for a successor who could accelerate the Bureau's modernization.

Renewal Accelerates

In February 1990, the Board elected Frank J. Iarossi, who had served as President of Exxon Shipping, as ABS President and Chairman. An industry veteran, his association with the American Bureau of Shipping began when he was an engineer with the US Coast Guard Technical Branch in the 1960s. The relationship renewed in the late 1970s when he ran a 34-tanker building program for Exxon in Japan and culminated with his gaining a position on the ABS Board of Managers in 1987. Summing up the path that led him to the helm of ABS, Iarossi once recalled that "I've seen ABS from the regulatory side, the design side, the operations side and the service side."

Although Soper had started the Bureau on the road to establishing a more modern, commercial framework, Iarossi still inherited a business culture hindered by relics from the shipping industry's more gentlemanly past – notably, a reluctance to aggressively collect debts. With an energy and drive that would come to characterize his tenure, Iarossi immediately set about addressing these problems.

ABS has helped the containership sector bring breakthrough technology into service, from the world's first container carrier to its latest mega-boxships.

To better his understanding of the organization, Iarossi called more than 50 key people from around the globe to ABS' world headquarters for individual two-hour meetings. His questions included: name five ways of cutting costs; five ways of improving products; and the five best managers at ABS. Out of this exercise an Executive Strategic Planning Team was formed and tasked with revising ABS' strategic goals into a comprehensive program. Designated ABS 2000, this program was adopted by the Board of Managers in September 1991. One of its main focal points was to further decentralize day-to-day decision-making in the Bureau while reducing, diversifying and computerizing its supporting administrative structure. As an initial step of the program, the headquarters staff was downsized and relocated back to Manhattan, to the 106th floor of World Trade Center Two. "Getting closer to the clients" became the new corporate mantra.

ABS 2000: the Future takes Shape

One core component of ABS 2000 was consolidating the Bureau's ten geographic regions into three divisions: the Americas Division, headquartered in Houston; the Europe Division, headquartered in London; and the Pacific Division, headquartered in Singapore. Each new division was to be a self-supporting enterprise structured like a company, with its own president, survey manager (now assistant chief surveyor), engineering vice president, human resources manager, financial services manager, and so on.

The ABS computing center in New York City, circa 1985. Moving from limited-access computers to a worldwide data network brought a new dimension to the company's global expansion and helped ABS transform during the 1990s.

Meanwhile, a new Technical Consistency Group based at headquarters would work to ensure that all three divisions made consistent decisions. Associated with this initiative was the company-wide introduction of Total Quality Management, intended to align the activities of all ABS employees with the common focus of performance improvement and enhanced customer satisfaction. Within two years, the discipline of this initiative led to ABS becoming the first classification society to be certified to the ISO 9000 quality management standard.

By continuing and solidifying the decentralization that had begun under Soper, Iarossi put key ABS operational decision-makers in the same time zone as their clients, a change that had substantive and positive impact on the clients and their ships. For instance, before the reorganization it would take about two days for a ship in Asia to know whether a survey extension would be approved, just because of the time difference with New York. With the new structure, headquarters would establish the strategy and policy for the organization, retain oversight and receive regular reports, but the division presidents and country managers would have control over day-to-day operational and administrative decisions.

This proposed a complete cultural change for ABS, which had long been a highly centralized company where all important matters worldwide came before the top executives in New York. Such radical decentralization and delegation of authority could only work if a global data network were in place. The success of ABS 2000, then, would depend on a successful program of 'office automation', the modernization and networking of ABS' information technology (IT) and communications systems.

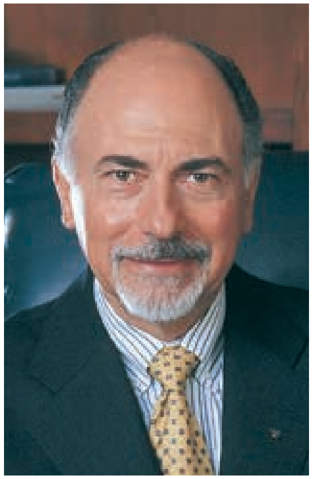
To spearhead the Bureau's second computerization revolution, Iarossi created a new IT team and tasked it with getting the company 's business off the old Paramus mainframe and onto an international network of desktop personal computers. It was a difficult challenge, as the mainframe behind the business was ready for a museum – its most recent release had been in 1976, and IBM no longer supported the system. Apart from modern workstations on which engineers ran advanced analyses, the few personal computers in the company were mostly secretarial desktops used to lighten the administrative workload. No units were networked and none were set up to send electronic messages or email. As was still common at the time, ABS offices shared information with each other by fax and, in some instances, by cable or telex.

It was truly a bootstrap operation, beginning with a company-wide rewiring to accept the new technology. At the end of 1990, headquarters had personal computers and the staff was getting used to communicating via email and sharing data on the local area network. By the middle of the following year, each division headquarters had been re-equipped and data sharing went international. By the end of 1993, the Survey Status program was up and running on a worldwide network and the accounting staff in each division could run its own financials and report regularly back to ABS headquarters.

As ABS broke with the past it began building for the future, with the creation of a formal training facility. The ABS Academy opened in 1992, providing a place where the Bureau's accumulated experience could be gathered, recorded and used in educating the coming generations of ABS staff. Previously, most of a surveyor's training occurred in the first five years of his career through apprenticeship to a senior colleague – appropriately so, since surveying, like medicine,

Frank J. Iarossi

President & Chairman: 1990-1993 • Chairman & CEO: 1993-2004



Born in Orange, New Jersey, Frank J. Iarossi enrolled in the US Coast Guard Academy in 1955. Growing up during World War II and the Korean War, Iarossi had been eager to join the armed services. After graduating with an engineering degree in 1959, he served in active duty with the Coast Guard for ten years. During that time, he graduated from the Rackam School of Graduate Studies at the University of Michigan with a master's degree in naval architecture and mechanical engineering. In 1971, he graduated from New York University with an MBA in international business.

Iarossi joined Exxon, in 1969, as an engineer with its Marine Research Group, where he worked on LNG transport development and earned five patents for an alternate LNG containment system technology. He rose through several technical positions, including Vice President heading Exxon's Asian ship construction program, and became President of Exxon Shipping in 1982.

In 1990, Iarossi was recruited to become President and Chairman of ABS. Over the next several years, he implemented comprehensive managerial and organizational changes, continued its transition into a modern business, introduced new lines of activity and formally established the ABS Group of Companies.

Iarossi was a past chairman of the Marine Transportation Committee of the American Petroleum Institute and the American Institute for Merchant Shipping. He also served as chairman of IACS. In 2001, he was awarded an honorary Doctor of Science degree from the Webb Institute. Iarossi retired as ABS Chairman in 2004 and Chairman of the ABS Group of Companies in 2006. In 2007, Iarossi and his family established an educational scholarship for the children of ABS families.

In 1992, the ABS Academy opened its doors in Houston, and continues to expand its curriculum to keep pace with regulatory changes and new construction practices.

is a combination of art and science. Each surveyor's unique knowledge base combines the Rules, training and personal experience with knowledge handed down by those who came before. The surveyor's mentor imparted lessons learned in his career, which usually included words of advice from his own mentor. In some longstanding ABS offices there are words of wisdom in circulation that were first given voice during the days of iron plate and rivet catchers.

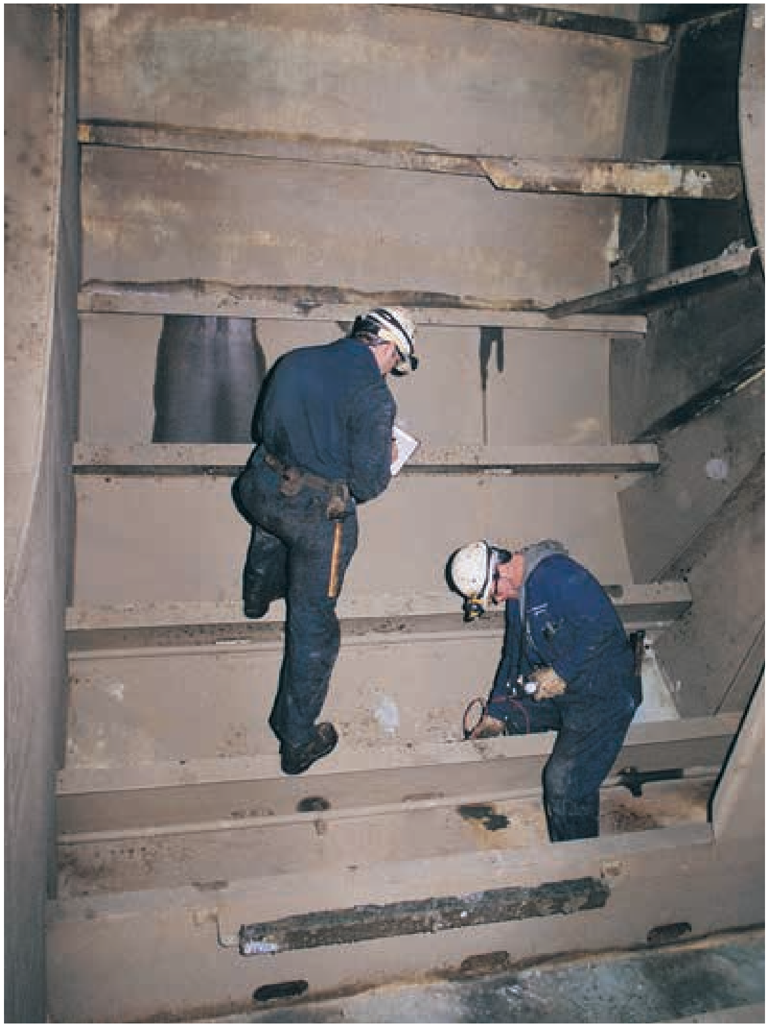
The ABS Academy began with internal training courses built on the Bureau's 'living library' of experienced personnel. Over the years the Academy developed into a global leader in maritime training that today serves both the Bureau and the wider maritime industry.

Continuing Issues with Light Scantling Ships

With an organizational and administrative structure now in-tune with the demands of the marketplace, ABS still had to face down the continuing efforts of shipyards to produce the short life, light scantling vessels that it was not prepared to accept. As a former oil company executive, Iarossi was keenly aware of the danger to the environment that structural failure of one of these vessels posed. He became a persistent, vocal critic of the practice, warning that reducing scantlings would result in a significantly shorter service life than shipowners, charterers, insurers and financiers had come to expect.

At the time, a ship's average service life was considered to be 25 years, after which, absent mitigating market conditions, the cost of repairs needed to take it through the fifth special survey could not be justified. ABS studies of the new generation of short life ships indicated that the combined effects of fatigue and corrosion could mean owners would be faced with the same economic decision with ships as young as 15 years.

Already there was growing evidence from the light scantling vessels in service that the incidence of side shell damage and cracking of structural components during what could be considered normal operations were directly attributable to the use of reduced scantlings.



The Condition Assessment Program, introduced in the early 1990s, helped improve the safety of aging vessels during a difficult period of industry history.

This evidence continued to grow, particularly in the bulk carrier sector, which suffered an unacceptable rise in casualties due to sudden and catastrophic structural failure beginning in the late 1980s and persisting through the first part of the 1990s.

Iarossi's warnings fell on largely deaf ears as economic considerations continued to take precedence over the growing concerns for safety. Not surprisingly, the reputation of class continued to decline among the governments, charterers and insurers that had traditionally relied on class societies to establish and maintain appropriate technical standards for the design, construction and maintenance of the world fleet.

There was no clearer evidence of this loss of trust in class than the development of the Condition Assessment Program (CAP) for tankers, an initiative spearheaded by charterers that went beyond classification minimums in terms of what was to be considered an acceptable ship for the carriage of some charterers' oil. Of the four CAP categories, basic classification was considered a CAP 3 rating, the bare minimum. For these pioneering charterers, vessels needed a CAP 1 or 2 rating even to be considered for selection.

Thus began a wave of alternative safety standards that rose in place of what the designation "class" had once represented. The Oil Companies International Marine Forum (OCIMF) introduced the Ship Inspection and Reporting (SIRE) standard, which went well beyond the traditional engineering based class standard of survey. Protection and Indemnity (P&I) clubs also introduced new inspection standards of their own. Most significantly, perhaps, many principal port States began believing that the class certificate, which represented traditionally accepted standards of safety, was no longer sufficient evidence of the overall standard of the vessels entering their ports.

This energized the movement that became today's Port State Control regime. Back in 1982, 14 European nations had signed the Paris Memorandum of Understanding (MOU) to pool the resources of their ship inspectorates. However, the perceived failure of class to ensure structural safety inspired the port States to reinforce this alliance and become the maritime world's de facto policemen, giving international safety regulations strong teeth through a united ability to name, shame and punish substandard ships, owners and flags. The Port State Control network, aggressively supported by the US Coast Guard and extended over the years through regional MOUs, started a new maritime safety regime in which classification still played an important role, but was no longer the sole independent and trusted arbiter of maritime safety standards.

New Technologies Challenge an Industry

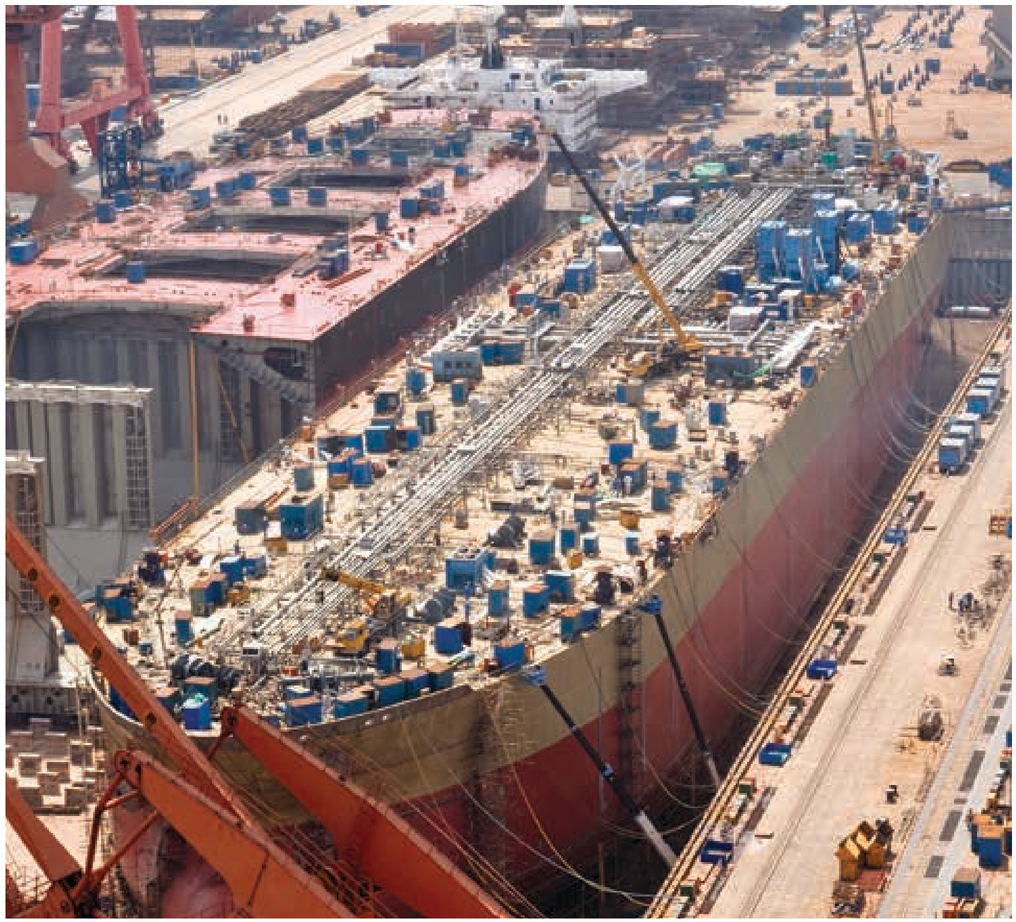
In response to the *Exxon Valdez* oil spill, the US Government enacted the Oil Pollution Act of 1990 (OPA 90), which included mandates affecting the design, operation and liabilities associated with tankships. The law required that all new tankers trading to the United States be built with double hulls and provided a phase-out schedule for single-hull tankers, which would ultimately be banned from US waters. Double-hull construction was to be the law beginning in 1993.

Apart from a few double-hull tankers built to ABS class in the mid-1980s, this was a ship type without service history and, therefore, would not be adequately covered by existing classification Rules. Safety authorities and shipowners the world over had questions regarding the long-term structural integrity of double hulls and were looking for answers. They were also still looking for answers regarding what was still an unprovable but seemingly apparent connection between high-strength steel, light scantlings and early ship failures.

To address the double hull and light scantling challenges, ABS began its Rules 2000 initiative in 1990 with a project to 'restate' the Steel Vessel Rules – to give them a true engineering basis rather than an empirical one. In technical terminology, this was described as moving to a 'first principles' engineering approach.

First principles engineering is a process in which loads are determined, load effects are analyzed and specific criteria are applied to assess a design. The process gives designers access to a thorough quantification of the stresses that may exist in a proposed design and, thus, important knowledge about the fatigue, yielding and buckling performance of the ship's structures. The idea of Rules 2000 was that first principles-based Rules would give designers the ability to calculate structural scantlings based on their various interactions within the ship and, in turn, to know how they fit into acceptable strength requirements. It required developing a simplified, faster method of taking the principles behind DAISY and the dynamic loading approach and make it applicable to evaluation of a ship design. The end result would be a hull that uses materials efficiently, in a manner consistent with the loads and failure modes considered to be dominant during its lifetime.

Through this effort, ABS was able to prove a correlation between the increasing incidence of vessel fractures and use of high-strength steels in ship construction and, ultimately, identified fatigue failure as cause of the cracking problems in light scantling, high-strength steel ships.



With the passage of OPA 90, double hulls were required for newly built tankers trading to the United States.

Dr. Donald Liu & ABS SafeHull

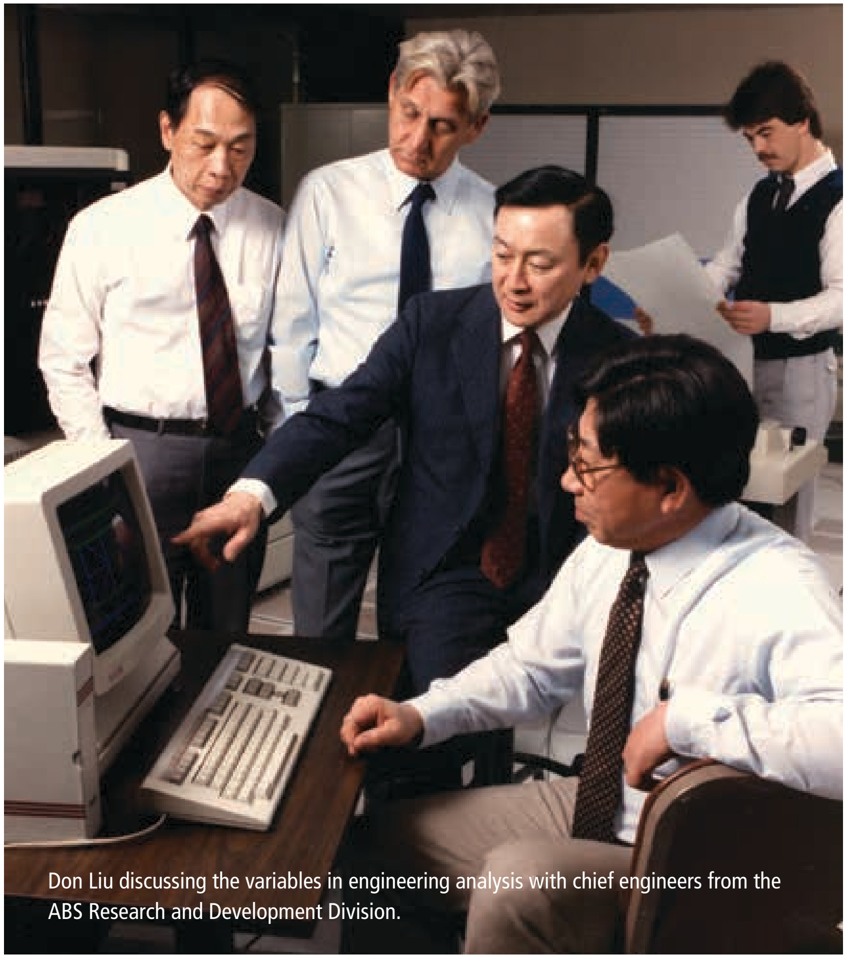
Affectionately known as the "Father of ABS SafeHull," Dr. Donald Liu joined ABS in 1966. A California native, he graduated from the US Merchant Marine Academy at Kings Point, New York and earned bachelor's and master's degrees in naval architecture and marine engineering from the Massachusetts Institute of Technology, where he specialized in computer-aided structural design.

In 1968, he was assigned to a research and development project at the University of Arizona, Tucson, to work with Chevron and the University's Dr. Hussein Kamel in developing computer programs to analyze large tanker structures. This project produced the pioneering DAISY program for Finite Element Analysis of ship structures, which ABS developed into the Dynamic Loading Approach (DLA). As DAISY and DLA developed, Liu began part-time doctoral studies under Dr. Kamel and earned his PhD in 1978.

By the 1990s, DLA technology had changed not only the ABS Rules, but also the way ships would be designed. With the full backing of ABS leadership, Liu conducted the three-year, multimillion dollar project that produced ABS SafeHull, a revolutionary suite of structural analysis programs that made a lasting impression on naval architecture.

At the University, he and Dr. Kamel gave the industry's first courses in the application of finite element analysis to ship structures. Education remains close to Liu's heart. "I first instituted engineer training at ABS to teach young engineers how to use the various computer programs and to understand the theory, logic and application of finite element analysis," said Liu. "No matter how sophisticated your analysis tools, you still have to use good, sound engineering experience and judgment. If your loads are correct, your assumptions are correct, and your programming is right, you can compute what can really happen to a structure. That's what engineering is all about."

Liu went on to become Executive Vice President and Chief Technology Officer at ABS. Although he retired in 2004, he still serves as a consultant and sits on the ABS Board of Directors.



Don Liu discussing the variables in engineering analysis with chief engineers from the ABS Research and Development Division.

The SafeHull Revolution

To deal with the ongoing issue of light scantling ships and the new challenge of double-hull tankers, Iarossi approved what was to become the largest single research and development project ever undertaken by ABS. Building on the groundbreaking work led by Dr. Don Liu that had developed the dynamic loading approach (DLA) for vessel structural evaluation, ABS began a three-year, multimillion-dollar research and development effort to produce a new analytical tool that would essentially be a 'portable' version of DLA, an easy-to-use system for evaluation of new designs that would run on a personal computer. During this project ABS engineers developed two totally new concepts that would become foundation stones of the maritime industry's technological future – embodied in the 1992 *Guide for the Fatigue Assessment of Tankers* and the 1993 *Guide for the Dynamic-Based Evaluation of Tanker Structures*.

Creating an identity for the new product became a full-time effort as well. After much consideration, a young engineer named Todd Grove (currently ABS Chief Technology Officer) came up with the name SafeHull and was assigned oversight of its logo development process. As SafeHull technology brought lasting change to the maritime world, the SafeHull brand grew into one of the most successful product lines in industry history.

Beginning with the release of SafeHull for tankers in 1993, followed by a similar suite of evaluation tools for bulk carriers in 1995 and for containerships shortly thereafter, ABS transformed the manner in which the strength of a newly designed vessel's hull was to be evaluated against the principal failure modes of buckling, yielding and fatigue.

The ABS SafeHull system was a complete technical resource that included the new strength and fatigue criteria, dedicated software applications that included finite element analysis and technical support. With the new software and its built-in simplified DLA, SafeHull gave designers the ability to explicitly account for loads and strength characteristics in new designs. It provided a new freedom to make appropriate scantling selections based on the dynamic loads and failure modes that the vessel would have to resist. There is no better proof of its appeal to responsible shipowners than the fact that the first copy of SafeHull was sold to shipowner Ole Skaarup three seconds after its first introductory press conference concluded.

What made the SafeHull approach so revolutionary was that it was able to take into account both the external, and in the case of tankers, internal dynamic loads imposed on the structure attributable to the vessel working in a seaway. The approach was a quantum leap forward from the traditional prescriptive assessment of a hull structure that was based on the empirical evidence of the past performance of previous designs. Using SafeHull, ABS was now in the position of being able to dynamically evaluate both a new design, and an existing vessel based on its previous trading history, and determine where the steel should be allocated in the former case, and where and when fatigue cracks could be expected in the latter case, with remarkable accuracy.

The more knowledgeable shipowners saw SafeHull as a clear, scientific method for evaluating their ships of the future, forcing ABS competitors to scramble in countering the technical advantage that

In the early 1990s, ABS deconstructed the empirical Rules and reconstituted them as engineering formulations.

SafeHull represented. Unable to duplicate SafeHull, they set out to destroy its reputation in the marketplace and tried labeling it a black box approach to ship design that could not be trusted. All they were able to do was transform their traditional prescriptive rules into computer spreadsheets, associated graphics and a visual presentation similar to SafeHull, which they then positioned as being as equally advanced as SafeHull.

To counter these efforts, ABS launched an aggressive program of introducing SafeHull to the shipyards on the basis that it could become not only a design tool for their own use, but would also lead to quicker review times for new designs if the shipyards themselves used SafeHull and presented ABS with the SafeHull evaluation for speedy approval.

Despite prodigious efforts by dedicated ABS SafeHull shipyard teams, builders remained reluctant to use the program in place of, or as an additional requirement to, their existing design programs. This reluctance was accentuated by two additional factors. First, the other principal classification societies had quickly developed competing computer class review programs which, although still prescriptive and quite simplistic, were faster, easier to use and more in line with existing practices. Second, since SafeHull applied engineering first principles in optimizing vessel design, it required scantlings to be heavier in the areas of highest stress, thereby interfering with the mass-production methods the shipyards employed.

Having to adapt production lines from a ‘cookie cutter’ to a more bespoke approach would, in the shipbuilders’ opinion, disrupt production schedules and impose higher production costs. To maintain standardized production, the builders wanted to ignore the steel optimization that could be gained, preferring to stick with production efficiencies. Consequently, an ABS SafeHull ship, like its prescriptive Rules-based predecessors, became the heaviest and highest-priced alternative in what continued to be an intensely competitive market.

An aggressive ABS educational and marketing program was successful in persuading many of the more responsible owners to insist upon a SafeHull-approved design when ordering new vessels. Some owners were prepared to pay the cost premium associated with that selection as they were confident that the capital cost would be more than covered by reduced in-service maintenance and a longer, trouble free service life.

A decade later, validation for this technical superiority was accorded to its groundbreaking approach when the three large societies, ABS, Det Norske Veritas (DNV) and Lloyd’s Register (LR) agreed to finally put an end to the light scantling competition by developing common rules for tankers and bulk carriers. When the joint teams came together to reconcile the differences in their respective approaches, it was SafeHull's dynamic-based approach that was unanimously selected as the foundation for developing the structural classification rules of the future.

A Dynamic Team

Throughout the 1990s, ABS attempted to remake itself and rebuild confidence in class on several fronts simultaneously. In 1993, recognizing the growing challenges were greater than one man alone could oversee, Iarossi looked into the ABS organization for an able right hand who was both familiar with the inner workings of ABS and committed to the reforms he envisaged.

His choice was Robert D. "Bob" Somerville, whom Iarossi had previously selected from the ABS 2000 strategy team to be President of the ABS Europe Division. Somerville relocated from London to corporate headquarters in New York, and over the next 11 years he and Iarrosi forged one of the most dynamic and effective management teams in ABS history. Iarossi, the former energy executive, excelled in big picture analysis of the problems facing ABS, classification and the industry in general, and brought an achievement-driven, large corporation mentality to an organization mired in tradition. Somerville, the former surveyor, country manager and division president, brought a deep understanding of ABS, its clients' expectations and the workings of the international shipping industry – and knew how to introduce operational efficiencies to a global staff threatened by change.

The subsequent period from 1993 to 2004 will go down as one of the most remarkable in ABS' history. It saw the organization attempt, almost single-handedly and against pronounced opposition from other leading class societies, to raise traditional class standards for the approval of the design, construction and maintenance of ships of all types. ABS' persistence resulted in more stringent design standards for bulk carriers and tougher survey standards for both tankers and bulk carriers as they aged. In 1995, ABS initiated and then joined with DNV and LR to push through new IACS requirements that put an end to what had become known as 'class-hopping', whereby an owner could easily change class to a more liberal society rather than undertake expensive repairs required by the class society of record. The IACS Transfer of Class Agreement (TOCA) was a major instrument in helping to restore the reputation of class with underwriters.

During this period, IMO adopted and implemented the International Management Code for the Safe Operation of Ships and for Pollution Prevention, more commonly known as the International Safety

The IACS Transfer of Class Agreement helped impede the use of substandard ships by increasing the difficulty of 'class hopping'.

The Wisdom of Mentors, the Strength of Surveyors

When older surveyors mentor younger ones, they pass on not just tales of adventure from the belly of a ship, but also practical wisdom that represents the distilled experiences of a lifetime. Some describe the techniques they developed with an eloquence that reaches the poetic.

Lifelong Surveyor Fortunato Crocetta, last stationed in Palermo, Italy, used to say that to start surveying a new construction block, you must first sit down and "listen" to the structure with your eyes – because "the pieces must flow together like a Beethoven sonata." If an inexplicable feeling of disharmony overtakes you, find the place that caused that feeling and there you will find a welding defect.

Tony Salgado, whose decades with ABS concluded as Country Manager of Portugal, often described how you could rap an aging steel bulkhead with your hammer and, from the way the metal sings in reply, could tell not only whether it had a problem, but where on the house-sized structure that problem was. Using the 'southern end' of the hammer, the handle, he could sound out the health of a tailshaft liner or a bearing.

Peter Schmitz, veteran Country Manager of both Germany and China, used to describe how a surveyor's hands are the most sensitive pieces of test equipment in the world – the fingertips can analyze workmanship of even micro-machined turbine components, where defects are invisible to the eye.

Surveyors also develop techniques to deal with people, which are surprisingly similar around the world. "In our business it's important to know how to talk to people," Behçet Tuglan, for decades Country Manager of Turkey, used to advise. "There is only one way to say yes, meaning you accept everything. But there are 41 ways to say no, including saying 'yes' such that the client agrees that there are necessary repairs before the ship can leave."

Antonio Lino Costa, former President of ABS Europe and current Vice President, Global Marketing, still recalls the advice of his old boss Laudman Richoux, who summed up the human side of surveying by describing the surveyor as "a mixture of a doctor and a priest: a doctor because you have to be ready to attend a ship whenever it is sick and to help as much as you can, within the Rules; and a priest because, sometimes, you have to tell owners exactly what they have to do and explain why they have to do it."

Management (ISM) Code, to address the human element on board the world's ships. Because the majority of flag States looked to classification societies to enforce statutory requirements, this meant an entirely new line of activity for the societies – auditing to a safety management standard that focused on areas that were entirely outside traditional classification activities. Since ABS had been the first society to receive accreditation to the ISO 9000 quality management standard, which was the philosophical basis of the ISM Code, and had a large body of experienced ex-mariners – former Chief Engineers and Masters – among its survey staff, it was ideally placed to embrace this challenge.

Unfortunately, as with many well-intentioned regulatory initiatives, the ISM Code contained a significant loophole that shipowners quickly exploited. The Code required no direct linkage between the issuer of the ISM certificates and the issuer of the vessel's class and statutory certificates. Traditional practice had established that, until the introduction of the ISM Code as part of SOLAS, the class society of record would also, as appropriate, act as the statutory agent for the flag State in the capacity of a Recognized Organization. When boarding the vessel to conduct an annual survey, the class society representative would, in most instances, wear two hats. Using the first, the surveyor would conduct the required annual class survey. Under the second, the surveyor would become an agent of the flag State and conduct the necessary statutory inspections.

The two roles were complementary. In conducting one survey or inspection, the surveyor would inevitably identify elements that may fall under the alternative authority. The result was a more thorough and comprehensive integrated assessment of the condition of the ship and its equipment. If the same surveyor was then to also act as the ISM auditor, such a holistic assessment of the safety preparedness of the vessel would be taken to an additional level, one to which many shipowners were reluctant to be exposed. Accordingly, many owners chose ISM auditors that were not also their vessel's class society of record.

ABS sought out DNV and LR in an attempt to close this loophole, but, found their efforts opposed in practice, if not publicly, by other IACS members that had seen in it an opportunity to expand activities. The issue was fundamental to the still wavering government and public perceptions of class as willing to carry out the broader responsibilities

The implementation of the ISM Code broadened the reach of the SOLAS Convention to include the human factor in addition to safety equipment.

that history had entrusted to it: to be an effective, international, independent arbiter of safety standards. Fortunately wiser heads prevailed and the reform was ultimately agreed to by IACS. This became even more important years later, with IMO's adoption of the International Ship and Port Facility Security (ISPS) Code as a further extension of SOLAS.

Bulk Carrier Failure Mystery Resolved

During the 1990s, the maritime industry was gripped by a mysterious and painful trouble: a growing number of large, aging bulk carriers began disappearing without a trace while on laden voyage. Some of those ships sank so rapidly that the crew did not even have time for a distress call. Others had time for just one Mayday before their radios were forever silenced. Altogether more than 700 seafarers lost their lives in this period.

Analysis of loss statistics revealed between 1980 and 1997, a total of 259 dry bulk carriers suffered casualties in which severe, sudden structural failure was a probable factor. In addition to the losses of aging ships, a number of bulk carriers less than ten years old had begun incurring structural failure in the side shell and associated framing. ABS took a leading role in the investigations into bulk carrier failures and the initiative to develop a new survey procedure. The IACS Working Party on Surveys, Reporting and Certification, chaired at the time by ABS Chief Surveyor Gus Bourneuf, established the requirements for the enhanced survey of older bulk carriers and tankers. These 'enhanced surveys' required arm's-length visual inspection of the critical areas of the hull's structure which had to be cleaned in order to give the surveyor a good look at the condition of coatings and a chance to check for possible cracking or deterioration of the steel and weldments.

In 1993, the Enhanced Survey Program was adopted by IACS member societies, as well as new regulations and requirements for single side-skin bulk carriers.

ABS applied SafeHull technology to conventional single side-skin bulk carrier structures and discovered that they could sustain and accumulate high levels of damage and fatigue. Exacerbated by corrosion, this damage and fatigue could weaken sections of the hull in even the strongest ships under certain conditions. By analyzing aging bulk carriers, ABS more clearly identified the loads and stresses they would encounter in service and the structural failures that could threaten them. The principal failure was the detachment of a portion of the side shell plating in the forward part of the vessel – the sudden ingress of water led to the progressive collapse of the transverse bulkheads.

The IMO and IACS subsequently developed rules and regulations to better protect these vessels. The immediate response was the Enhanced Survey Program, which was followed by the development of remedial measures for existing ships. ABS led the IACS effort within IMO to develop a set of Unified Requirements on Strength for the existing fleet of bulk carriers; the requirements took effect in 2004.

Mobil Oil's AMERICAN PROGRESS, a US-built 45,367 dwt product carrier, entered into the Alternate Compliance Program on delivery in 1997.

Working with the US Government

The 1980s also saw a formalization of what had largely been an ad-hoc working arrangement between ABS and the US Coast Guard, through the signing of two important memorandums of understanding (MOUs). The first MOU granted authority to ABS to issue admeasurement and tonnage certificates to US-flag vessels on behalf of the Coast Guard. The second, more comprehensive MOU provided for Coast Guard acceptance of ABS plan review and approval of hull structure and machinery for ships, MODUs and barges, as well as for crude oil washing systems and certain piping systems.

The later 1990s saw the relationship between ABS and the US Coast Guard take new steps forward. In 1995, an MOU expanded the scope of plan review and inspection procedures of earlier MOUs and established the Alternate Compliance Program (ACP), under which US-flag vessels satisfying ABS reviews and surveys would also be declared as satisfying those reviews and surveys normally performed by the Coast Guard.

The ACP was an extremely important aid to the Coast Guard during a period when the service received reduced financial support from Congress. Under the ACP, the Coast Guard was able to reduce its presence on US-flag ships and reassign those personnel to law enforcement, interdiction and safety services. At the time, the Coast Guard cited ABS' Quality System, and its landmark certification under ISO 9001, as key factors in realizing the MOU.

ABS also strengthened its relationship with the US Navy during the mid-1980s, working with Navy personnel on applying classification Rules and specifications to noncombatant ships, and on developing requirements for military use. This period also saw the creation of the US Navy's 'prepositioned' fleet, 13 cargo ships operated by the Military Sealift Command that would be kept on standby around the world, ready to support the rapid deployment of US military forces. Five of the ships would be newly built, including the first prepositioning ship, the *2nd Lieutenant John P. Bobo*; while eight would be merchant ships acquired and converted for the new service.

The conversions included the series of innovative SL-7 containerships built to ABS class for Sea-Land in the early 1970s. Even after extensive conversion to roll-on/roll-off capabilities, the unique ships remained among the fastest of all merchant vessels, reportedly able to achieve speeds up to 36 knots. This began a program that continued for two decades, in which extensive support from ABS helped bring a new generation of flexible, rapid-response military support vessels online.

The Offshore Sector's Deepwater Recovery

The global economic factors that had sparked so much of the maritime industry's troubles also brought a coincident downturn in ABS' other mainstay area of activity, the offshore energy sector. High oil prices drive increased oil and gas exploration, much of which for the past 40 years has occurred offshore. As happened with ships, the rising cost of oil in the 1970s sparked a massive increase in orders placed for new offshore drilling rigs and related equipment. As the leading provider of classification services to the offshore sector, ABS saw its activities flourish – in fact, as the energy industry advanced further offshore, ABS became an integral part of the evolution of the marine technologies on which it depended.

But, just as global instability stemming from the Arab-Israeli war had sent oil prices to historic highs, when the Middle East's supply lines were re-established those prices collapsed. By the early 1980s, the price of oil could no longer sustain the cost of exploration. New rig orders dried up and existing units went into lay-up around the world.

The PETROBRAS 35 floating production offloading and storage facility was converted from an ABS-classed tanker, the JOSE BONIFACIO.

Between roughly 1983 and 1993, the US oil and gas industry lost over 40,000 jobs, about 50 percent of its total employment. All along the Gulf, shipyards shut down, design houses went dormant, suppliers closed shops and drilling rigs the size of office towers lay idle and unemployed.

The steel-encased Arctic drilling rig MOLIQPAK, built to ABS class in 1984 for exploration in the Beaufort Sea, was refitted under ABS class for service in Russia's Sakhalin I Field in 1999.

By 1996, the outlook for the industry was appreciably different. Earlier in the decade, the US Government released to the public technology that had been used to track Soviet submarines during the Cold War. The technology revolutionized seismic mapping, the process by which the energy industry locates potential oil and gas reserves deep beneath the sea. According to one oil major, the development of three-dimensional seismic mapping improved the success rate of exploratory drilling from 13 percent to 48 percent – with deepwater wells costing $10 to $20 million to drill at the time, a fourfold improvement in the chance of success made many new projects possible. Soon, oil majors began pouring billions of dollars into a renewed search for offshore oil, with most of their efforts, and major successes, in water depths between 2,500 and 7,500 feet.

Industry analysts who once called the Gulf of Mexico 'the dead sea' now began calling it 'the new Alaska', likening its recently discovered deepwater oil reserves to the billions of barrels found beneath Prudhoe Bay three decades earlier. In fact, the frozen North had remained an area of exploration even during the recession of the 1980s. In the middle of the decade, ABS worked with offshore industry pioneers to develop a variety of unique mobile submersible drilling units able to endure the severe 'multi-year' ice (ice that survives the summers and grows stronger each year) of the North American Arctic. These insular worlds were floating caisson units, artificial islands of either all-steel or concrete and steel construction.

There developed from this early Arctic research a new type of rig named the Concrete Island Drilling System, an immense reinforced concrete structure mounted atop an impregnable steel base. The first of these, the ABS-classed *Glomar Beaufort Sea 1*, was deployed in 1984 and in 2003 the unit was moved to offshore Sakhalin Island in Russia. There it joined the ABS-classed steel-encased drilling rig *Moliqpak*, which also had been deployed in 1984 in the Beaufort Sea.

The SANHA LPG FPSO, the first floating production facility to combine LPG processing and export functions on board the same unit.

The *Moliqpak* had been converted in 1999, under ABS class, to a MODU with floating production capabilities for use in the Sakhalin I field. ABS released new *Rules for Building and Classing Mobile Offshore Drilling Units* in 1985 to account for these and other technology advances to mobile rigs.

Elsewhere, however, much of the energy sector's MODU fleet went into lay-up during the 1980s and remained there into the 1990s. First to return to service in the deepwater energy exploration boom was the semisubmersible drilling rig fleet. Units that had been laid up through the 1980s experienced rebirth through conversion for deepwater activities – like the ABS-classed *Ocean Quest*, built in the 1970s for drilling in water depths of up to 2,500 feet, which received multimillion-dollar refits to become capable of exploration in depths of 5,000 feet and beyond.

Floating production also saw some dramatic new technology. The tension leg platform (TLP) was developed in 1984 as a way to handle increased depths using tethers in place of mooring, a system that has challenges at deeper depths. In 1996, the spar platform emerged as a potential solution for producing oil in depths of 10,000 feet.

One dramatic change during the 1990s was the increased use of floating production, storage and offloading (FPSO) units, a production solution first devised for 'marginal' offshore oil fields (isolated reserves too small to justify the cost of a pipeline). Initially, FPSOs were retired single-hull supertankers converted for production use by the installation of modular refinery equipment topsides.

During the 1990s, the FPSO evolved into a favored solution for large, deepwater field development, and its uses began expanding. For example, in 2002, ABS classed the *Sanha*, the first FPSO for liquefied petroleum gas (LPG) production, and was assisting clients with exploring the possibilities of using the technology for the production and storage of liquefied natural gas. At the time, there were 84 FPSOs in service processing about 6 million barrels of oil per day (bopd). Today, nearly 160 FPSOs are in service worldwide with an aggregate production of about 13 million bopd.

Pursuing Further Diversification

Despite the aggressive policies adopted by Iarossi and Somerville's deep roots with the ABS client base, ABS experienced a long, slow rebuilding from the dark days of the 1980s. True, ABS' newly efficient client-centered organization began to bear fruit in increased orders as a new administrative structure and the efficiencies of a global IT system reined in costs, boosted productivity and enhanced efficiency. Nonetheless, Iarossi was convinced that ABS should not remain exposed to shipping's inevitable boom and bust cycles, and saw its future as one of diversifying business activities and revenue streams beyond marine classification.

At the time, non-class activities accounted for around 2 percent of ABS' consolidated revenues, but nearly all of that contribution was derived from the maritime sector, and subject to the same business cycles from which it was seeking to protect itself. With Somerville as President and Chief Operating Officer of classification services, Iarossi had more time to devote to building a diversified base. In this, ABS sought to catch up with some of its principal competitors – DNV, LR and France's Bureau Veritas were already earning a significant proportion of their annual revenues from non-class business. For Iarossi, their growing size and increasing, more diversified revenue streams placed ABS at some risk in what continued to be a highly competitive classification sector.

The corporate structures of these competitors made diversification relatively straightforward for them. Not so for ABS. The Bureau had been accorded tax-exempt status by the US Government long ago, based on the assessment that its classification activity, in promoting maritime safety, was also in the public interest. In essence, it was determined that if ABS did not carry out the function of establishing and applying these maritime safety standards, the job would fall on the Federal Government itself.

ABS had to be extraordinarily careful not to contravene its tax-exempt status. It could not directly provide products and services outside of the narrow confine of marine classification without coming into competition with taxable, commercial entities. Any such activity would have to operate as a similar taxable entity on the other side of a financial firewall from any and all tax-exempt, classification-related activity.

This stricture could have placed ABS at a disadvantage against its competitors who were free to offer completely integrated safety, risk and consulting packages to the same marine and offshore clients ABS

In the 1990s, ABS Quality Evaluations became a leading registrar and auditor of safety and quality management systems.

was pursuing. Tirelessly optimistic, Iarossi saw opportunities anyway and began a decade-long effort to build what was to become the ABS Group of Companies into an international leader in the provision of risk and safety-related services to a broader base of international clients.

The vehicle of diversification was to be a new entity that built on the industrial services pioneered by ABSTECH. The for-profit subsidiary needed restructuring but had been enjoying success in the energy sector with the Rapid Response Damage Assessment (RRDA) service it established in 1989. Particularly well-received in the tanker sector, RRDA was the industry's first immediate technical support service for shipowners and offshore operators following a maritime disaster. The naval architects, engineers and ex-mariners on the RRDA team would assess vessel damage, help the owner's staff monitor its survivability (through updated calculations of such important parameters as longitudinal strength and intact and damage stability), and provide recommendations for moving the vessel to a safe refuge. After nearly a quarter century in operation, RRDA remains a service highly valued by industry.

In the early 1990s, ABSTECH separated into three new entities – ABS Quality Evaluations, ABS Industrial Verification and ABS Marine Services – that in 1996, coalesced into the foundation of today's ABS Group of Companies. ABS Quality Evaluations had grown steadily to become a leading ISO registrar. But future growth for the Group was focused on a new consulting arm to expand its activities into risk management and mitigation.

In 1996, ABS Consulting won its transformative project: verification and validation of multiple engineering, procurement and construction (EPC) contracts for Mexican national oil company PEMEX, pertaining to a massive development project in the Cantarell offshore oilfield. Calling for simultaneous management of some two dozen EPC contracts around the world, as well as engineering verification for some 350 km of pipeline, the multi-year project was the first world-scale demonstration of the capabilities of ABS Group.

The Rapid Response Damage Assessment service has expanded and evolved over the years. Currently, approximately 2,000 vessels and offshore structures are enrolled in the program.

That said, it took time for the various operating entities of ABS Group to find their feet, their market niches and the right product mix. Slowly Iarossi weaned their activities away from high volume, low revenue, inspection-related services into higher-margin and much more technically sophisticated consulting services. Two key acquisitions, of JBF Associates of Knoxville, Tennessee and EQE International of Oakland, California proved to be the significant stepping stones

The multi-year project with PEMEX for the modernization of the Cantarell offshore oil field was the single largest contract ever undertaken by ABS and its affiliates.

in this transformation. Both were well-established, reputable and profitable providers of risk management services, JBF primarily to the nuclear utility industry and EQE to a broad range of government, insurance and industrial entities.

Although these acquisitions involved a considerable financial stretch for a still-recovering ABS, the wisdom in the strategy quickly became apparent as ABS Consulting, the principal operating entity of the ABS Group of Companies, thrived in the enterprise risk management sector and built a growing portfolio of governmental and Fortune 500 clients.

Disaster, Hope and Opportunity

In the eyes of history, all events opening the 21st century shrink when compared to the terrorist attacks on New York City and Washington, DC on 11 September 2001 (known forever as 9/11). The 9/11 attacks in New York City dwarfed what, until then, had been the worst-yet terrorist assault in the nation's financial capitol when, in 1993, a truck bomb was detonated in the basement of World Trade Center One with the intent to topple the towers. The attack failed in its goal but killed six and injured thousands; the 125 staff members at ABS' world headquarters were among the tens of thousands who successfully filed out of the building amid the chaos.

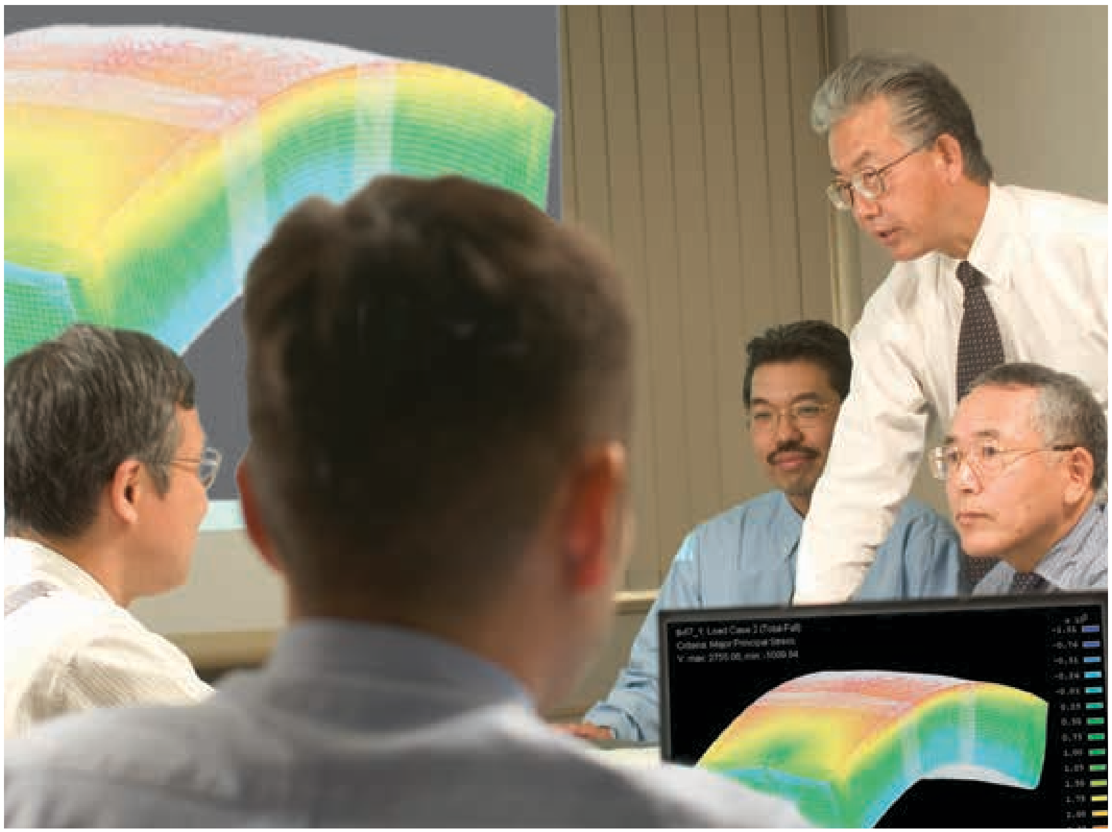
The ABS family also was spared the full depth of the tragedy on 9/11, but for other reasons. At the end of 1999, ABS had moved its world headquarters and most of its New York-based employees from the 106th floor of World Trade Center Two to Houston, Texas to better control costs. At the same time, the approximately two dozen remaining New York City staff members were relocated to an office on the 91st floor of World Trade Center One. These veterans of the first attack came even closer to tragedy on 9/11. The first jetliner struck World Trade Center One just above the ABS office – in fact, some of the employees reported being able to see into the airplane moments before impact. Miraculously, the plane spared the ABS office and all 11 individuals present at that horrible moment were able to flee the skyscraper before its collapse.

A Continuing Problem

By this time ABS had been transformed from the struggling, tradition-bound organization that Soper had inherited in 1986. Under Iarossi's leadership and Somerville's stewardship its market position had first stabilized and then began an inexorable upward trend. A strong management team had made the decentralized divisional structure a resounding success. Innovative new IT programs had transformed the manner in which ABS shared its survey information with its clients and had opened up new electronic channels for receiving and reviewing plans and drawings from shipyards and designers.

But one problem remained that continued to affect not just ABS but the entire classification sector – the continued attempts by leading shipyards to force the classification societies to accept the short life, light scantling designs they presented. With the superior analytical capabilities of SafeHull, ABS determined that, in some instances, these designs had been pared to such an extent that ships were being delivered into other class societies' registers with no effective corrosion margin at all.

Iarossi led one final assault against the practice. ABS, DNV and LR, in an alliance named the LAN group, made a landmark decision to work together to produce common structural rules (CSR) for tankers and bulk carriers that all three would apply equally, thus removing any incentive for shipyards to continue cutting steelweight in their designs. Because the three societies together accounted for around 50 percent of all newbuilding orders, the assumption was that the yards and the other IACS members would have no choice but to follow their lead.



IMO's 2002 adoption of the philosophy of goal-based standards helped pave the path to realization of today's common structural rules.

Shipowners, long tired of having to accept short life ships requiring enhanced maintenance and frequent repairs, welcomed the LAN initiative. The other seven IACS member societies were less enthusiastic, forcefully and publicly expressing their opposition and resentment. The LAN group pushed ahead anyway, starting development of new harmonized standards for tankers. The initiative was validated by IMO's adoption in 2002 of the philosophy of goal-based standards (GBS) for the establishment of future regulation, replacing the traditional prescriptive approach, which dovetailed neatly with the LAN proposal.

Responding to this alteration of the playing field, the other seven IACS members abruptly changed stance and announced that they would assume the task of developing common structural rules for bulk carriers. Initial enthusiasm for this conversion in attitude quickly dimmed; the bulk carrier group rejected the LAN group's offer to help ensure that both projects were based on the same engineering principles and struck off in an entirely separate direction. The decision was to cause several years of disharmony between the two camps, further muddying the reputation of class with shipowners, shipyards and regulators.

Technology advances may have changed the face of shipping, but at its heart it remains what it has always been – an industry of people working together.

A Seamless Transition of Leadership

This was one of the major challenges that Bob Somerville inherited when, in a seamless transition, he assumed the responsibilities of Chairman and Chief Executive Officer from Iarossi who retired from these positions and the ABS Board in 2004 and the ABS Group of Companies Board the following year. No one could have been better prepared to continue the resurrection of ABS than Somerville, who had been instrumental in implementing the many changes and adjusting the organization to the increasingly activist regulatory environment of the previous 11 years.

Somerville inherited an organization that was immeasurably different from the one he had joined over three decades earlier. Like the industry it served, the new ABS was far bigger, far stronger and far more 'corporate' – more formalized, structured, professionally impersonal and, consequently, culturally quite unlike the self-enclosed small town it once was. Now only old-timers referred to the company as 'the Bureau'; everyone else knew it as ABS. Using the acronym alone started as a security move after terrorists invaded the Istanbul office and held the staff captive in 1993, but it suited the company's evolution as a multinational organization.

The cultural change can be likened to the passing of the old maritime industry itself. The once-raucous offices of tanker owners, for example, now resemble the sedate establishments of the oil companies they serve. Gone were the days when a big shipowner ran a multimillion-dollar business off the top of his head and figured his current accounts on the back of a cigarette pack. Likewise, the 'old' ABS had to pass into history for the new ABS to rise to the top of its sector in a modern, more demanding, technology-driven world. The challenge facing ABS management as it prepared to take the company into the 21st century was no longer economic survival, but cultural survival – how to continue growing and expanding while preserving the 'people power' and camaraderie that made a small company grow great. ✠


ABS

Chapter 7

Transition and Transformation

2005 – 2012

The 'new' ABS of the 21st century would, in many ways, be unrecognizable to the august body of gentlemen that founded the American Shipmasters' Association so long ago. Proud as they would doubtless be to see its guiding principles intact and the organization flourishing, they would certainly look with astonished disbelief at the scope of the company's activities and the technologies employed in promoting the security of life and property on the seas – and on the dramatic change in the relationship between the maritime world and society at-large. Once colored by shadiness, romanticized by mystery and ruled by suspicion and secrecy, the maritime world now touted the financial and organizational transparency of sophisticated operators able to satisfy the scrutiny of major energy companies and financial analysts alike.

The first decade of the new millennium saw step changes in the way shipping lines do business, spurred by a flood of increasingly restrictive maritime legislation that, for the most part, sprang from three European 'legislative packages' generated by the 1999 sinking of the tanker *Erika* and the resulting oil spill along the French coast. Initiatives from the major oil company charterers soon forced the tankship sector to reform dramatically in appearance and practice and, shortly thereafter, the rest of the maritime industry also adopted new levels of corporatization and rigid professionalism.

This drive towards corporatization was accompanied by an unprecedented level of prosperity for shipowners, as industrialization in the developing world stimulated a boom in freight rates that revitalized the tanker, bulk carrier and containership markets. Ship values increased by upwards of four times so that, despite the rapidly escalating cost of steel, shipbuilders were able to receive the prices that supported a lengthy period of new construction and the large-scale renewal of the world fleet.

As a leading provider of classification services, ABS benefited from this remarkable level of activity. In these years, ABS steadily published new Rules and Guides drawing on its experience with a fleet that set new records – between 2005 and 2012 the number of ships in class rose from 9,503 to 11,930, while aggregate tonnage soared from 121 million gross tons to a record 193.5 million gross tons.

The maritime and offshore sectors were equally poised for dramatic change when Bob Somerville assumed the role of ABS Chairman and CEO in 2004 and ABS Americas President Robert Kramek took on the responsibilities of ABS President and COO. In the first few years after this accession, evolving technical and environmental regulatory regimes posed challenges for ABS as well as potential opportunities for growth. Strong and visionary leadership during the next eight years would turn that potential for growth into record-breaking performance.

Threats Against Class

With continued strong leadership in the society's divisions, Somerville was able to devote a significant portion of his time to keeping the common structural rules (CSR) project on track, despite several bumps and near-derailments, and to dealing with the increasingly aggressive demands on the shipping and classification

Robert D. Somerville

President: 1993-2003 • President & CEO: 2003-2004 • Chairman & CEO: 2004-2011 • Chairman: 2011-present

Born in landlocked Houlton, Maine, Robert D. "Bob" Somerville was raised on maritime tales of his great grandfather, a ship captain lost at sea who had lived what appeared to be an exciting, dangerous and exotic life of a world traveler at a time when most Americans rarely journeyed more than 50 miles from their homes. He pursued his seafaring interest by entering the Maine Maritime Academy, graduating in 1965 with a bachelor's degree in marine engineering. Somerville went to sea right out of the academy, an employee of Texaco as progressively a 3rd, 2nd and 1st assistant engineer. In 1968, he took a position with Newport News Shipbuilding and Dry Dock, at the time, the largest shipbuilder in the world. He joined the Atomic Power Division, working on the construction of nuclear-powered submarines and aircraft carriers.

Over his time at Newport News he came to know and respect many ABS employees and had a sense that ABS was the place to further his own career. He could easily relate to the mission of the organization – which was to serve the public interest by promoting the security of life and property, and preserving the natural environment. Somerville joined ABS as a field surveyor in 1970 and has held increasingly senior positions throughout his 43-year career with the organization.

During the first 20 years with ABS, stationed in ports around the globe, Somerville's career steadily rose as Surveyor, Senior Surveyor, Principal Surveyor to Regional Manager for Western Europe. With the 1990 reorganization of ABS, he became President and Chief Operating Officer of the ABS Europe Division. In 1993, he was named President and Chief Operating Officer for ABS and President and CEO in 2003. Somerville was elected Chairman and CEO of ABS in 2004. Currently, Somerville serves as Chairman of the Board for both ABS and the ABS Group of Companies. He holds the distinct position in ABS' history as the longest serving executive in the key roles of President and Chairman.

Somerville received honorary Doctor's of Science degrees from Maine Maritime Academy and from Webb Institute. He is a graduate of the Harvard Business School's Advanced Management Program and a Fellow of SNAME. Somerville currently serves as Vice Chairman of the Board of Trustees for Maine Maritime Academy; member of the Massachusetts Maritime Academy Foundation Board of Trustees; and member of the Board of Directors for GasLog Ltd. He also served as Vice Chairman and Chairman of IACS.

Somerville is an active member of many professional associations and has received numerous awards in recognition of his contributions to maritime safety. He was inducted into the International Maritime Hall of Fame at the United Nations in 2006. In 2007, the US Chamber of Shipping of America awarded him the Admiral Halert C. Shepheard Award. In 2009, he received both SNAME's Vice Admiral "Jerry" Land Medal and the Massachusetts Maritime Academy Foundation's Captain Emery Rice Medal. In 2011, he received the United Seamen's Service Admiral of the Ocean Seas Award. In 2012, Somerville was awarded the Lifetime Achievement Award from Seatrade. In accepting his most recent award, Somerville credited the ABS employees indicating that the achievements and successes of the society have and always will be a collective effort of the men and women of ABS.

sectors from the European Commission (EC) in Brussels. These demands reflected rising mistrust of shipowners and classification societies that, in part, stemmed from two recent maritime pollution incidents involving older tankers in European waters.

Two years after the sinking of the *Erika* in 1999, another pollution incident occurred when the tanker *Prestige* sank off northwestern Spain. In both cases, the vessels had experienced structural failure while on passage in European waters under extremely heavy weather conditions. In addition, both vessels had been refused a place of refuge by the maritime Administrations of several coastal States.

Following the *Erika* casualty, the European Union (EU) proposed measures to ban single-hull tankers from European waters on a 'fast track' basis, accelerating the already scheduled phase-out agreed through IMO. Various commentators pointed out that the acceleration would simply push single-hull tankers to other parts of the world, parts of the world with fewer resources to combat pollution or enforce international standards. At the same time, the implementation of plans for places of refuge languished, affording no confidence that coastal States would act in time to stop another manageable casualty from turning into a disaster.

The EU also proposed criminal liability for accidental pollution from ships, and extended criminal liability to potentially include the ship manager, charterer and class society.

The legislative process stemming from the two tanker casualties became a long, drawn-out affair, with new requirements entering into force over the course of a decade, under three separate legislative packages that addressed a broad range of issues. In addition, in 2003, the Spanish Government instituted legal proceedings against ABS in the Federal Court of New York, relative to the pollution that had occurred from the *Prestige* casualty. The suit highlighted the potential exposure of class to unlimited liability for the result of actions by the shipowner, coastal State or other party directly involved in a marine casualty. After nine years of exhaustive litigation, in August 2012 the US Second Circuit Court of Appeals upheld ABS' request for a summary judgment and dismissed the case.

Liability, both criminal and civil, continued to be a vexing question for classification societies as the costs associated with any amount of pollution rose astronomically. In addition to introducing financial sanctions for poorly performing class societies, the EU proposed eliminating liability limits for shipowners, but retreated from that position, adopting a more internationalist stance by asking the IMO to revise the ceilings in various conventions limiting shipowner liability. Class societies hoped to persuade both the EU and IMO that class should also be protected with a limit of liability as a service to the international community, not merely to one nation or one region.

Machinery inspection and certification are among the often unsung, critical roles of classification in maritime safety.

Overcoming CSR Development Struggles

On top of the external threats against class during this period, some significant internal challenges arose. Perhaps the most dramatic were the issues surrounding the efforts to make the common structural rules for tankers and bulk carriers a practical reality.

Because of the tension that had grown up between the LR-ABS-DNV alliance (the LAN societies) and the other seven IACS members, the tanker and bulk carrier CSR projects had progressed on quite different, if parallel, tracks. The bulk carrier project team, which started its work two years after the tanker project began, rushed to complete the development of the Rules to meet the established joint release date. They did not accept the significant groundwork that had been undertaken by the tanker project team to establish a clear, first-principles engineering basis for the criteria. When released, the tanker common rules were greeted with a generally favorable response from shipowners and their associations, but the bulk carrier rules caused an uproar of protest.

ABS had made it clear from the outset of both projects that it would not accept the new criteria unless a vessel design meeting the new CSR standards also would meet the existing ABS SafeHull evaluation criteria. The tanker rules, which had followed the SafeHull philosophy to a great extent, met this test. The first release of the bulk carrier rules did not, a fact that gave further support to the protests being voiced by shipowners who expected the new rules to lead to more robust, longer-life tonnage.

A hasty reworking of the bulk carrier rules addressed these concerns, but a fundamental weakness remained. The two sets of 'common' rules were based in different engineering principles and used different building blocks, which negated the concept of 'common' rules that could be uniformly understood and fairly implemented by all sectors of industry.

This and other issues continued to plague final acceptance of both CSR sets by all members of IACS – the impasse leading to a call for the LAN societies to abandon IACS and establish a 'super-IACS' that used truly common rules to advance maritime safety. To Somerville, preservation of IACS was of the utmost importance, given its critical role in working with the IMO to develop and interpret the constant flow of new technical regulations for which the United Nations body was responsible.

Technical experts from ABS, Det Norske Veritas and Lloyd's Register formed the Joint Tanker Project to develop common structural design criteria for double hull oil tankers.

As Chairman of IACS, Somerville called a critical eleventh-hour meeting of the chairmen of all the IACS societies, hoping to hammer out differences, agree to the common rules and preserve the association. A key component of the agreement forged between the societies was that the two groups would work together to develop a new set of harmonized rules for both tankers and bulk carriers based on the same engineering principles. This new endeavor was launched shortly after the CSR were officially released in 2006.

Development and implementation of the common structural rules for these two principal ship types proved to be a tortuous, drawn out and expensive affair. However, it was a goal that ABS pursued because it represented a step change for classification and brought a degree of harmony to the often conflicting approaches to standards that had been part of the system since the outset of classification. Ultimately, these efforts put an end to overt acceptance of the design, construction and delivery of light scantling ships.

In addition, application of the CSR required use of sophisticated analytical software, which led to a serious complication. Depending upon how this analytical software was written, the results of the design evaluation could differ significantly, to the point where shipyards and their supporters in classification could still promote light scantling, short life ships.

Shipowners are able to access their data in ABS Eagle Survey Manager from multiple locations – in the office, on board a vessel or in the repair or construction yard.

Instead of working for harmony, the major societies spent significant sums producing their own complex suite of software programs. It was not until 2010 that LR and ABS united to establish a joint company for developing and maintaining common tanker and bulk carrier software to be used by both societies.

Technology Evolves, Service Grows

With CSR, steelweight competition was relegated to the ash heap of history and the classification sector entered a new competitive landscape. Particularly over the past decade, technology has transformed the classification world and has sparked dramatic changes in the core roles of classification, vessel survey and engineering plan review.

Survey reporting and retrieval entered the Digital Age in 2007, with the conclusion of the ten-year-long project that developed the ABS Eagle Survey Manager system. With this release, ABS yet again revolutionized its business model.

Survey status had been available through various forms of online access since the 1970s, but the database for it was managed manually throughout the 1990s. Survey reports were typed in the field office, mailed to headquarters and manually entered into the survey status data bank – even if the original surveyor's report had been created on a computer. Today, surveyors fill in survey forms on their laptop computers and upload them to the survey department database – often while still on board the vessel. Where it once took a week to a month for a ship to get credited for its survey, now the information is available online within hours.

While this has changed both the administrative aspects of the surveyor's job and the speed at which survey information flows to ABS clients, no amount of electronic wizardry will change the art of ship survey itself. And it is an art, an assessment based on years of standardized instruction that is conditioned by accumulated personal experience, a job done by an individual applying all his knowledge, understanding, experience and training towards one goal: to make the best judgment possible regarding the condition of the vessel under survey – and, sometimes, to help the owner figure out how to put things right so the ship can safely get back out to sea.

Survey is a job that no machine can do, no matter how sophisticated it may be, because it calls for much more than just collecting facts and observing condition; it calls for a quality that often goes by the name "heart" – a combination of understanding, integrity, conviction and experience that encapsulates all the surveyor's training and knowledge and puts it in the service of making a right and proper decision.

This art is strengthened by some age-old practices that technology helps improve but will never replace, particularly the mentoring of new surveyors by their experienced colleagues, and the collaboration, teamwork and personal exchange of knowledge that, since surveying began, have helped make the people better at their jobs and the organization better at its work.

Technology has also improved the delivery of ABS' engineering services. In 2005, ABS introduced an electronic plan review system that brought a generational change to the age-old profession of the classification society engineer. The system, which evolved into ABS Eagle Engineering Manager, gave ABS clients a secure digital work environment in which ABS engineers could review plans entirely online, raising questions and comments, and 'virtually' stamping approved drawings. Clients could submit plans for review, track the status of ABS review, check for and answer comments, receive real-time answers to questions and download approved drawings.

ABS Eagle Engineering Manager allows project managers, designers and engineers to work together by recording comments and drawing versions in one secure location to reduce approval turnaround time.

The digital alternative removed an ocean of paper. For a ship to be built, thousands of plans and schematics need to be reviewed by classification engineers, as thousands of additional documents – calculations, letters, permissions and the like – circulate to support their findings. When everything was on paper, mail and courier services were an integral part of the classification and construction processes. Engineers needing to view drawings stored in a different part of the world could lose several days' project time just waiting for photocopied plans to arrive. The ABS Eagle system changed that by allowing engineering offices around the world to instantly collaborate in the plan review process without losing project time.

Large-scale use of electronic plan review for ships debuted on a ferry-building project at Flensburger Schiffbau-Gesellschaft in Germany. On the offshore side, the ABS Eagle system was first used on a major rig-building project at Keppel FELS in Singapore. Users reported cumulative project time savings of a month and more, attributable directly to the benefits of the digital work environment. The ABS Eagle electronic system has proven itself over the ensuing years and is now a valuable aid in the ship construction process.

Expanding into Key Developing Nations

The beginning years of the 21st century saw one of the greatest bull markets in the history of shipping, and an additional confluence of forces that spurred another shipbuilding frenzy. As world trade boomed, fueled largely by the rapid industrialization and development in China, the last ships launched during the 1970s building binge were nearing the end of their working lives. At the same time, the accelerated phase-out of single hull tankers – part of the regulatory initiatives sparked by the *Exxon Valdez* and *Erika* casualties – was sending even teenage tankers into early retirement. Amid such pressure and opportunity, the lessons of history were forgotten and the industry launched into another period of mad ship ordering. This time, however, the madness was not restricted to tankers but encompassed ships of every type, including bulk carriers, containerships and gas and chemical carriers.

Being a leading classification society, ABS benefited significantly from the boom time, particularly in China where dozens of shipyards – along with tens of thousands of shipyard workers – came into the business out of, seemingly, nowhere and shipowners lined up to give them orders. This brand-new workforce acquired its skills sets on the job and China's maritime sector expanded with extreme rapidity; the intensely increased activity demanded much from ABS surveyors and engineers, and the organization responded by expanding staff and improving organizational and administrative efficiencies. The activity reached such a fevered pitch that in 2010, just a few years after the boom began, ABS decided to create a fourth operating division: the Greater China Division, which started up with more than 500 employees in 30 offices throughout China, Hong Kong and Taiwan.


ABS continues as the leader in providing class services to the gas transport sector.

The first decade of the new millennium also saw an industrial revolution begin in Brazil, which again became a shipbuilding nation. This resurgence began in the period between 2005 and 2009 as Transpetro, a subsidiary of Brazilian national oil company Petrobras and the largest shipowner in Latin America, placed orders for 49 tankers with Brazilian builders. This fleet renewal program sparked a rebirth of the nation's shipyards, most of which had consolidated or closed down completely.

If this boom had remained the product of one shipowner it could have been just a bubble of activity, but it became a prolonged regeneration with the confirmation of a new offshore oil find in

A Long Relationship with Greece

The quality, character and integrity of ABS field surveyors have helped forge some of ABS' most important and enduring professional relationships. One of these, at the heart of the ABS world, is the company's longstanding rapport with the Greek maritime community, which has strengthened continuously since its beginnings at the end of World War II.

The Greek shipping community made its ships and its men available to the Allied cause during the war, but paid a high price for their love of liberty. At the war's end, over 2,000 Greek merchant seamen had perished fighting for freedom and the Greek merchant fleet had been reduced by over two-thirds, to some 150 ships totaling about 580,000 dwt. Shipowners struggled to rebuild, but the future of the Greek merchant marine was in doubt. Relief came in 1946, when the US Government sold 98 Liberty ships plus some other cargo carriers to Greek owners who had lost tonnage during the war. These became known as the "Blessed 100" and formed the nucleus of the postwar Greek fleet.

The Greek-owned fleet soon expanded through the purchase of many more Liberty ships and other surplus tonnage. These provided leverage for newbuilding, much of which went into Japan as that country's shipyards developed during the 1950s. Soon, the Greek-owned fleet, which was largely split between tankers and bulk carriers, came to dominate the world of shipping. By 1980, Greek interests controlled over 4,000 ships, and the Greek maritime community could claim to hold more tonnage than any other single group – a position it holds to this day.

ABS surveyors and engineers have long been part of the growth and expansion of Greek shipping. ABS was the first foreign class society to open a technical and engineering office in Greece. In 2009, ABS relocated its survey and engineering department headquarters for the Europe Division from London to Piraeus.

Today, the Greek fleet continues to grow and evolve – in recent years, LNG carriers, containerships and offshore drilling and production equipment have been entering the Greek fleets in large numbers. ABS' support has expanded with this growth and is today supplemented by comprehensive skill-building programs for the industry, offered through the ABS Academy in Piraeus. The Academy training and services assist owners with improving the capabilities of their personnel, the quality of the fleets and the efficiency of their operations.

2008. That year a test well reaching more than 4,400 meters below the surface of the sea indicated the existence of potentially immense oil reserves, previously shielded from seismic probing by a massive layer of salt, that were found to be deeper and more extensive than any reserves Petrobras had yet found.

Termed 'pre-salt' (or 'subsalt') reserves, these new oilfields lay beneath salt layers over 2,000 meters thick along the country's coastline, and have been estimated to contain tens of billions of barrels of oil. Petrobras' plans to develop this deeply buried treasure spurred a building boom for semisubmersible MODUs, FPSOs and offshore support vessels that not only continued the revitalization of the country's old shipyards, but also caused new ones to be built. By 2010, more than 400 vessels were contracted for construction at shipyards around the country, and ABS had strengthened its position as the leading classification society in Brazil.

In 2010, the JOÃO CÂNDIDO was the first in a series of ten 160,000 dwt suezmax tankers built at Brazil's Atlântico Sul Shipyard for Petrobras' transport subsidiary, Transpetro.

Focusing on Containerships

One ship type to benefit considerably from ABS' technology development in recent years has been the containership. ABS has worked with shipowners and designers at the leading edge of containership technology since the invention of container shipping in 1956, when Malcom McLean added a spar deck to an ABS-classed T2 tanker named *Ideal X* and hauled 58 truck trailers from Newark to Houston.

Every significant advance in containership technology since then had been pioneered on an ABS-classed vessel. The world's first purpose-built containerships, ordered at Bremer Vulkan by Matson Lines, were constructed to ABS class. Likewise, the revolutionary SL-7 series and the world's first ice-strengthened containerships, both built by Sea-Land, were realized using advanced engineering analyses developed by ABS. ABS was also proud to be chosen as the classification society for a series of the world's largest containerships, beginning with the first vessel to carry more than 4,000 containers, built for US Lines, and continuing through the first ultra-large containership, A.P. Moller-Maersk's *Emma Maersk* and the company's subsequent Triple-E series of even larger 18,000 teu ships.

Building with Korea

ABS has worked closely with Korean shipbuilders throughout their development and rise to prominence. ABS opened its first Korean office in the port of Busan in 1961, and was on hand to help when Korea targeted shipbuilding as a strategic industry for national growth in the 1970s. The country's first large shipyard was Hyundai Heavy Industries (HHI) in 1972, which has since become the world's biggest commercial shipbuilder. HHI was followed by Samsung Heavy Industries (SHI) in 1974 and Daewoo Shipbuilding and Marine Engineering (DSME) in 1978. By 1983, these three yards were in full swing, together turning out 179 ships totaling more than 4.1 million gt – more than double the previous year's output – prompting ABS to establish its Korean Technical Committee.

Other yards followed these three leaders during the succeeding two decades and, in 2003, their collective efforts paid off when Korea displaced Japan as the world's leading shipbuilder in terms of new orders received, gross tonnage of ships built and order backlog. In 2008, Korean yards built more than half the world's ships, and shipbuilding outpaced automobile and semiconductor manufacture to become Korea's Number One export industry for the first time in the country's history. By 2009, the country also claimed seven of the world's top ten shipyards.

ABS expanded with the Korean builders, helping the yards reach notable technical milestones during the first decade of the 21st century. Among these were the 2007 delivery of AGBAMI, the world's largest FPSO at the time.

ABS also assisted Korean shipyards in building the world's largest membrane-type LNG carriers when, in 2005, several Korean yards won orders totaling $10-billion for a series of very large LNG carriers for Qatar Liquefied Gas Company. In 2004, ABS had established a specialist LNG Carrier Project Team, based in Busan, as a focal point of ABS' experience with the carriage of gas accumulated over more than 60 years of experience in the sector.

When built at Denmark's Odense Steel Shipyard and launched in 2006, the EMMA MAERSK was the world's largest containership and a technological landmark.

Nearly 400 meters long, 56 meters wide and capable of 25-knot service speeds, *Emma Maersk* was a groundbreaking vessel when launched in 2006. The ship required more than a year of advanced analyses, including risk assessment methodologies using many technologies pioneered by ABS, such as: dynamic loading and spectral fatigue analyses; finite element-based lashing assessment; hull springing and whipping analyses; shaft alignment analysis; bow and stern slamming analyses; and parametric roll analysis.

Advancing Technologies for Offshore

The offshore energy sector has also benefited from the application of risk assessment and mitigation methodologies. As the search for new sources of crude oil drove the energy industry into ever-deeper waters, floating exploration and production platforms grew to unprecedented levels of size and complexity – a relentless advance into the unknown that often called for untried solutions and, as a result, bred a growing reliance on risk-based decision-making. To help with development and review of novel designs, in 2008 ABS released the ABS Eagle Offshore Structure Assessment Program (OSAP), which communicated with computer-aided design and engineering software to create structural load cases for unprecedented designs and check their compliance with class requirements.

ABS drew heavily on risk technologies in developing its class services for the offshore sector. This was particularly true with the emergence of so-called 'hybrid' designs that combined elements of different families of floating platform. Because there was no long operational experience with such units, ABS was often called upon to employ risk analysis techniques in determining their levels of safety and practicality. These risk-based techniques were used between 2007 and 2010 during the design review and classification of the *ATP Titan*, built to a revolutionary new concept named the MinDOC – a cross between a deep-draft semisubmersible and a spar, the unit became the world's first 'multi-column floater'. ABS also applied risk and reliability methodologies to develop a comprehensive approach to managing risk throughout the service life of an offshore rig, which was released in 2011 as the ABS Offshore Asset Integrity Management Program.

Today, ABS is helping write a new chapter in the history of offshore energy, working with US and international authorities to help migrate offshore oil and gas experience and technologies to the wind power sector. Over the last five years, ABS has been an important contributor to the development of technical standards for onshore and offshore wind farms in North America and, in 2011, took a key

Christopher J. Wiernicki

President: 2007-2011 • President & CEO: 2011-present

Christopher J. Wiernicki was born in Philadelphia, Pennsylvania and raised in Maryland as the son of immigrant parents who came to the United States aboard the SS UNITED STATES. He earned a bachelor's degree in civil engineering at Vanderbilt University, and in 1983, he earned a master's degree in structural engineering from George Washington University. That same year, Wiernicki was awarded the US Ship Structure Committee's Graduate Scholarship, funded by ABS, as well as a scholarship from the Society of Naval Architects and Marine Engineers which supported another master's degree in ocean engineering from the Massachusetts Institute of Technology. He also graduated from the Harvard Business School's Advanced Management Program.

Wiernicki began his career at the US Navy Research and Development Center and then went on to work as an engineer for several private companies. Before joining ABS, he served as President and CEO of Designers and Planners Inc., a leading US naval architecture firm. In 1993, he was recruited to become Vice President of Engineering for the ABS Americas Division. Three years later he was named President and COO for the ABS Group of Companies. Wiernicki returned to ABS in 2004 as Executive Vice President and Chief Technology Officer. In April 2005, he was named President and COO of the ABS Europe Division. In January 2007, Wiernicki was appointed President and Chief Operating Officer of ABS, and assumed CEO responsibilities for the society in April 2011. He also serves as a member of the Board of Directors for ABS and ABS Group.

Wiernicki is a registered Professional Engineer and has authored numerous papers on design and analysis of marine structures, and has lectured at the university level on topics ranging from ship structure design to residual strength of damaged structures. Wiernicki is a Fellow of the Royal Institution of Naval Architects. He serves as a member of SNAME and the American Society of Naval Engineers as well as the Engineering Advisory Council for the University of Michigan's College of Engineering. He is a member of the Board of Trustees for the Webb Institute and serves on an Advisory Committee for the Department of Ocean Engineering at Massachusetts Institute of Technology.

role in the construction and deployment of the world's first commercial floating wind turbine.

Ever since its days as the first classification society to address offshore oil and gas exploration more than six decades ago, ABS has been a trusted aide to regulatory authorities in the pursuit of developing better technologies, better standards and better regulations regarding the safety of offshore drilling and production in their waters.

Novel floating production unit designs combine basic ideas from spars, TLPs and semisubmersibles to create entirely new hybrid arrangements. ABS engineers work with designers as they develop these novel design concepts.

In 2005, the US Government called on ABS Consulting to lead an effort to improve MODU mooring performance. This request came in the wake of hurricanes Katrina and Rita, which caused extensive damage to energy production in the Gulf of Mexico (GoM) – in fact, the first major MODU incident in five decades of offshore oil and gas production, in which a dozen units broke free of their moorings and drifted, some for hundreds of miles. Although they caused no pollution or loss of life, their path of devastation brought a strong response from the US Government and the energy industry.

Sponsored by the GoM Offshore Operators Committee, the MODU mooring joint industry project delved into the science underlying MODU mooring criteria and determined that a major new revision had to be made in the way GoM weather was understood. The 18-month effort produced a number of technology advances in industry knowledge and field practice and led to revisions of the relevant API Recommended Practices, which are among the key technical guides for the offshore sector. As a result of this project, MODUs operating in the GoM were required to be upgraded to a new standard of mooring safety, with most units increasing the number of mooring lines from eight to 12.

Offshore Incident Catalyzes Change

In 2010, the *Deepwater Horizon* semisubmersible drilling rig experienced a well blowout, explosion and fire that resulted in the loss of 11 lives and the sinking of the rig – and an outflow of oil from the Macondo field that could not be stopped for three months. The incident underscored the potential vulnerabilities in drilling systems and the need for new and enhanced requirements.

In the wake of this tragic incident, ABS launched a concerted effort to work with industry and government to help prevent future loss of life. This began with ABS providing technical support to legislators and regulators in Washington, DC as they wrestled with the question of how best to improve existing safety standards for the offshore industry. This included educating stakeholders on the vital role classification does play, and also can play, in the offshore safety regime.

Extending Innovation and Research

In 2005, Chief Technology Officer Christopher J. Wiernicki (now ABS President and CEO) saw an opportunity to build on ABS' close association with leading universities around the world, beginning the company's efforts to extend its Research and Development efforts through the establishment of dedicated technology centers.

The first of these, the ABS Singapore Offshore Technology Center (SOTC), opened in 2006 and became a key research and development facility in Southeast Asia. In a notable project in 2009, the SOTC collaborated with Shanghai Jiao Tong University to conduct model tests of jackup legs to investigate the hydrodynamic forces caused by currents and waves. It was the first joint research and development project between the class society and university. The test strengthened ABS' advanced computational fluid dynamic (CFD) simulation capability, and moved ABS to the forefront of applying CFD to ships and offshore structures.

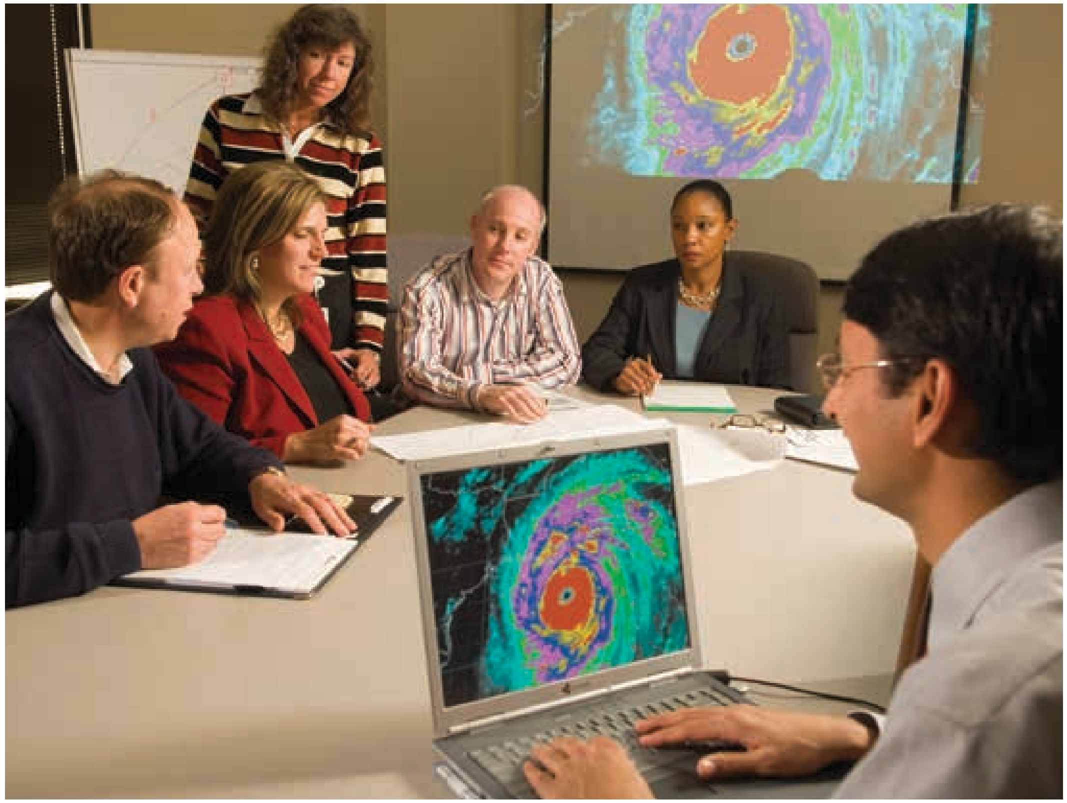
In 2009, ABS established a Harsh Environment Technology Center, located at Memorial University in St. John's Newfoundland, Canada, to support the development of technologies for ships and offshore structures operating in harsh environments, particularly the Arctic. Applied research is conducted to study vessels and units operating in ice-covered waters, low temperature environments and severe wave and wind climates.

The ABS Brazil Offshore Technology Center was formed in 2010 in partnership with the Federal University of Rio de Janeiro (COPPE/UFRJ) to conduct research in support of new technologies for offshore facilities. The research efforts placed particular emphasis on facilities intended for use in ultra deep waters. The Center's first project was a study on torpedo piles, an innovative mooring anchor system developed by Petrobras.

ABS announced the opening of its fourth research center in May 2011, the ABS China Offshore Technology Center. Founded in partnership with Shanghai's Jiao Tong University, the center focuses on technology research for offshore facilities located in the Greater China region.

In early 2012, the ABS Korea Energy Technology Center was established in Busan. As ABS' first energy research center, its efforts will be focused on offshore exploration and production technology, subsea applications, LNG technology, ship energy efficiency and renewable energy.

The impact of the accident was not limited to the Gulf of Mexico. Governments whose waters were sites of offshore energy exploration and development projects began reassessing their own regulatory oversight of these activities, bringing about a variety of changes from new safety standards to new spill response organizations. Along the way ABS worked with governments and industry to help improve the safety of offshore operations.



In 2005, ABS Consulting was selected to lead and manage a joint industry project investigation to revise hurricane metocean criteria and improve understanding of MODU mooring failures.

In the Caspian Sea region, for example, the Macondo incident sparked change in raising offshore safety improvements from the Republic of Kazakhstan, which has been very active in pushing environmental protection reforms. In fact, ABS has collaborated extensively with the governments of Kazakhstan and Azerbaijan to promote the safe development of oil and gas reserves since the nations gained their independence more than two decades ago.

ABS also took the lessons learned to reassess its own requirements. In March 2011, ABS released the latest edition of its *Guide for the Classification of Drilling Systems*, which took a comprehensive approach to drilling systems and the associated equipment and well control systems – a publication welcomed by many national offshore energy safety authorities seeking to elevate their initiatives and best practices.

Another Dynamic Leadership Team

At the end of 2006, strategic succession plans to ready the next generation of ABS leaders began as executive-level officers neared retirement. Having nearly 37 years of experience with the organization, Bob Somerville was well aware that the role of class had continuously evolved over the years and the pace of change was accelerating. The Board also recognized that he needed a second in command that could complement his strengths and a strong leader that could be prepared to take the helm.

Somerville's recommendation to replace the retiring Robert Kramek as ABS President and COO was Christopher J. Wiernicki, whose advancement was approved by the ABS Board as of 1 January 2007. A 14-year veteran of the organization, Wiernicki had served in several key positions including President and Chief Operating Officer of the ABS Group of Companies, Executive Vice President and Chief Technology Officer of ABS, and President and COO of the ABS Europe Division.

It was another ideal melding of two individuals with a common commitment to building the future of ABS. The overarching goal of the new leadership team was to position ABS to effectively and

ABS collaborated with NAVSEA to develop Rules for building and classing naval vessels to provide the technical basis for ABS classification of combatants.

efficiently assist its clients, and the maritime industry in general, to manage risk and improve performance within a more clearly defined safety framework. Their primary focus was to ensure that the organization would be at the forefront when it came to providing the innovative products and efficient services that would define ABS as the class society of the future.

The new leadership team's focus on risk highlights one of the truly notable evolutions in the maritime world of the 21st century: the steadily increasing incorporation of risk assessment and mitigation technologies into classification. In this area, ABS produced three pioneering risk-oriented publications that responded to the industry's growing interest in risk-based methodologies, and continues to develop analytical technologies in the service of promoting safer ships through better ship design and construction.

In April 2011, Wiernicki was named President and Chief Executive Officer, while Bob Somerville remained Chairman.

A Naval Courtship

Of all the world's maritime administrations ABS has, understandably, the longest and closest relationship with the US Government and today provides services to numerous government entities, such as the Navy, Coast Guard, Military Sealift Command, Maritime Administration, Army Corps of Engineers and the National Oceanic and Atmospheric Administration.

The dawn of the new century saw this relationship expand. Under the direction of Bob Somerville, then President and COO, ABS opened a long and delicate courtship with the US Navy that ultimately led to development of ABS Rules for naval vessels. There were numerous challenges that the nation's armed services faced when looking to modernize their fleets – and ABS' new construction experience could help. The relationship came to fruition in 2003, when, facing increasing budgetary constraints, the Navy turned to ABS for an alternative approach to its shipbuilding activities that could help control construction costs without diminishing safety levels.

It was, in a sense, a further step in a journey that had begun a decade earlier, when the Naval Sea Systems Command (NAVSEA) contracted with ABS to conduct surveys of naval vessels under construction. Now the Navy requested ABS to enter into a partnership to develop Rules that could be applied to the design of certain new combat ships designed for littoral and open ocean operations. Although these particular vessels were ultimately not maintained in ABS class, the project led to NAVSEA and ABS jointly completing the *Rules for Building and Classing Naval Vessels* (NVR) in 2004 – the first set of formal shipbuilding Rules created for the Department of Defense.

The Navy/ABS partnership took advantage of ABS' commercial ship classification experience and made use of many aspects of traditional ABS rulemaking, including ABS' committee process and the practice of involving industry in Rule development – and the resulting NVR was considered an improvement over existing Navy requirements. Accordingly, the Rules were developed under the technical authority of the Navy and the USCG, along with their technical warrant holders, resulting in the retention of hundreds of military design documents. As the NVR neared completion, ABS released the *Guide for Building and Classing High Speed Naval Craft*, which is used to class patrol boats and support vehicles for the US and other foreign navies.

At the end of 2011, in light of new budget limitations, NAVSEA and ABS reassessed their collaboration, changing their plans regarding combatant classification but continuing to have ABS apply its experience to help NAVSEA's shipbuilding programs. Working with NAVSEA, as President and CEO, Wiernicki oversaw the development of the Achieving Service Life Program (ASLP) for the existing non-nuclear fleet. Launched as a pilot program in 2009, ASLP uses risk-based survey programs developed for commercial ships and tailors them to the specific needs of Navy vessels. The Navy's long-term goal is for each of its more than 100 non-nuclear surface combatants to enter the ASLP, in order to achieve maximum fleet service life and mission-readiness.

Because US Coast Guard requirements often differ from those of the Navy, ABS then created a Coast Guard Appendix within the Naval Vessel Rules. By the end of 2012, ABS prepared to release its *Guide for Building and Classing International Naval Ships* (INSG) for international navies and other coastal defense applications.

By the end of 2012, more than 50 of the US Navy's non-nuclear surface combatants were enrolled in the ABS Achieving Service Life Program.

Aiding the Race to Save Trapped Miners in Chile

The 2010 Chilean mining incident received worldwide attention. The saga began on 5 August 2010 with a significant cave-in at the 121-year-old San José copper-gold mine located deep in the Atacama Desert in northern Chile where 33 miners were trapped more than 2,300 ft below ground. It took a record 69 days before the miners were rescued.

The country of Chile had just endured an earthquake in 2010 and its associated tsunami less than six months before the incident. Keeping the miners alive and in good spirits, much less getting them out, would be an enormous challenge. The Chileans were in uncharted territory. To their knowledge, no one had tried a rescue so far underground.

The nation's outpouring of public concern for the plight of the buried miners and the Chilean people's strong empathy for the workers' grief-stricken families led the national government to take over the faltering search and rescue operation from the mine's financially strapped owners.

Once the government rescuers knew that the men were alive, Chile implemented a comprehensive plan to both nurture the workers during their entrapment and to rescue them. It included deployment of three large, international drilling rig teams, nearly every government ministry, the expertise of United States NASA space agency and more than a dozen multinational corporations including ABS Consulting.

ABS Consulting conducted risk analyses to aid the Chilean mine rescue operation. The risk assessment verified the safety of the capsules used to bring the men out of the collapsed mine. Although a single capsule was used in the rescue, three cages were manufactured as a backup in case of a problem. ABS Consulting utilized the "what-if" technique on the capsules during the risk assessment process.

Following the rescue, the Chilean Government established a special safety review committee to develop a proposal for safety practice improvement. ABS Consulting participated in the review and presented its safety management systems' capabilities for mining to the committee.

Parallel Developments

At the beginning of the new century, the ABS Group of Companies was struggling with its future in doubt. Shortly after Somerville took over as ABS Chairman in 2004, he made a recommendation to the Board to sell the suffering company. However, the bids were unacceptable and a decision was reached that a change of leadership for the Group, rather than a bill of sale, was in order.

As a global provider of safety, risk and integrity management services, the ABS Group of Companies has built a solid reputation in the oil and gas, nuclear, government, maritime and renewable energy market sectors.

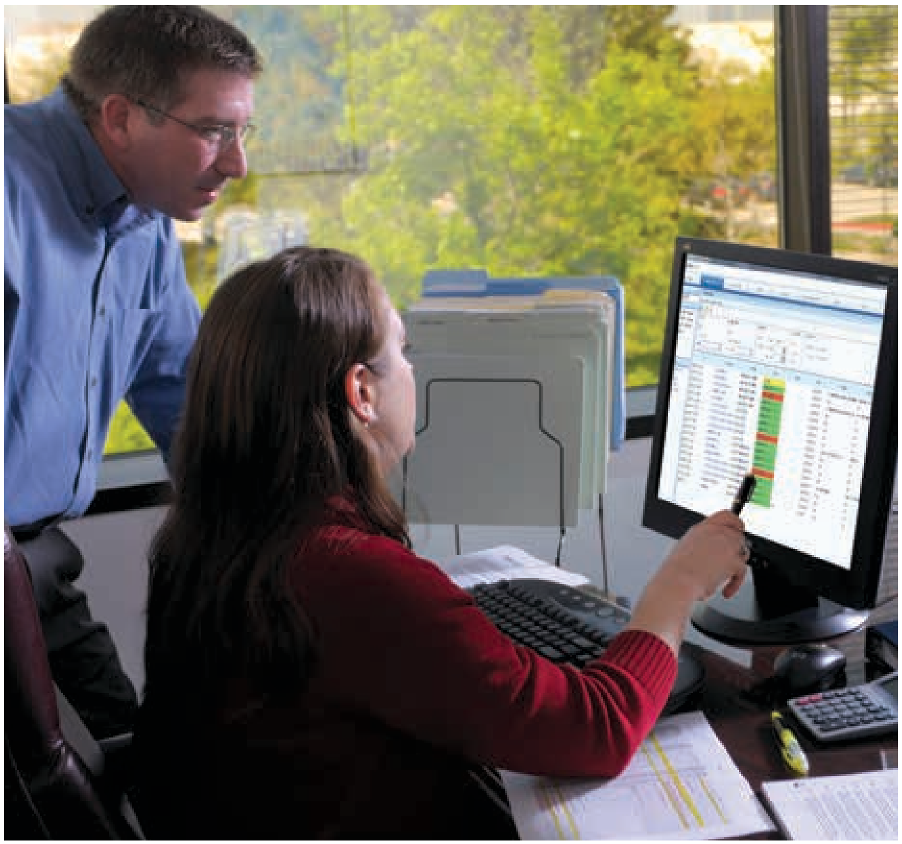
In 2006, Somerville was named Chairman of the Board for ABS Group in addition to his role as ABS Chairman. Agreeing with his recommendation, the ABS Group Board placed the Group's future in the hands of Tony Nassif (today ABS Executive Vice President and COO), a Group veteran who had been with the company throughout its evolutions of the previous two decades. As ABS Group President and CEO, Nassif drew together colleagues from within the organization and additional leaders from outside, reshaping the company for a future built upon a new spectrum of safety, risk and asset integrity management services.

Under its new leadership team, the activities of the various ABS Group companies grew steadily even during the global economic recession that began in 2008, and the company became profitable. By the time ABS entered its 150th year of operation in 2012, the ABS Group had expanded its inspection, independent verification and project quality management services across a range of market sectors, enjoying steady growth despite the softening global economy.

There were now three principal operating entities under the ABS Group umbrella. ABS Consulting Inc. was a worldwide operation offering a range of safety, risk, integrity and performance management services to clients in process industries (primarily oil and gas) and the maritime, nuclear power, renewable energy and government sectors. In the process industry, for example, the company helped clients maintain their licenses to operate and leverage their competitiveness through programs supporting sustainable safety, managed risk, and optimized asset integrity and operational performance. In the power industry, the nuclear team delivered technology-based solutions to manage risks associated with commercial nuclear power generation and the renewable energy team provided a full range of life cycle services to developers and operators of onshore and offshore wind projects. The government sector, meanwhile, grew as a trusted contractor to US and international governmental agencies, for which it applied risk-based methods to security and threat assessment, asset acquisition, training, and a range of programs associated with each agency's mission and objectives.

ABS Consulting's subsidiary, EQECAT Inc., was a market leader in providing proprietary catastrophe modeling software and alternative risk transfer experience to the insurance industry. With unique software as its key differentiator in the market, EQECAT built a reputation for a technology-based approach to manage the financial consequences of natural hazards, operational and security risks.

Representing some of the Group's founding product lines, ABS Quality Evaluations (ABS QE) had become an established, accredited third-party auditor of management systems to international standards for a wide range of industries. With a legacy of experience stretching back to the first days of the quality movement, ABS QE evolved into a role as an active contributor to the development of industrial, national and international quality standards.



Released in 2011, NS5 Enterprise offers advanced usability, reporting, speed and overall performance for users to minimize downtime by monitoring trends and streamlining processes.

Based on its success from 2005 through 2010, ABS Group began to target certain mergers and acquisitions to further accelerate the company's growth as part of the overall ABS enterprise strategy. The first acquisitions in this multi-year program began in 2012: initially, Safetec Nordic AS joined the fold, further expanding ABS Group's market penetration in key areas, particularly the North Sea and the rapidly expanding Australian energy sector; then came GenesisSolutions, a leading provider of integrated enterprise asset management services; soon after, ABS Group hired key individuals from Agile TCP to enhance its experience in systems integrity management.

A particular strength of ABS had become this ability to bring together its core competency in marine classification, developed over the last 150 years, with the broader spectrum of safety, risk, integrity, quality and performance management services offered through the operating entities within the ABS Group of Companies. ABS Group acquisitions which complement existing strengths within the marine, offshore and energy sectors contribute to the mission of promoting the security of life and property and protecting the natural environment.

Fleet Management Solutions

As risk assessment and mitigation philosophies took root in the ABS organization, Bob Somerville instituted an enterprise-wide review to chart the future courses for ABS and ABS Group. At the study's conclusion it was determined that, while diversification remained beneficial, non-class activities and future acquisitions should directly support ABS' mission and its delivery of a coordinated portfolio of safety and enterprise risk management products and services to clients in the marine and offshore sectors.

This determination led ABS to move ABS Nautical Systems out of the Group of Companies and make of it a new ABS division concentrating on software development for the maritime community. Nautical Systems had started its product line by amalgamating internally developed engineering and survey-related software with programs picked up in the acquisition of an independent fleet management software provider in 1998, and was now offering clients an integrated suite of fleet management modules covering such items as purchasing and inventory management, maintenance and repair, and crew management.


Nautical Systems programs such as the Energy & Environmental Manager help ships operate efficiently and reduce their environmental impacts.

When Frank Iarossi envisaged a future in which a vessel's life cycle would be managed and monitored through sophisticated computer programs, maritime industry technologies were not yet at a stage of development where they could properly embrace the concept. Now circumstances had changed. When Somerville brought Nautical Systems into ABS, there were a growing number of regulatory initiatives requiring demonstration of conformance from the shipowner, and the need for an integrated fleet management software package had progressed beyond economic concerns – it was now essential to promote safety.

Moreover, advances in computer capabilities now made possible the development and use of shipboard programs containing detailed class-generated vessel information. In 2009, Nautical Systems launched the ABS Newbuild Initiative, which placed the user-friendly ABS Hull Inspection and Maintenance Program (HIMP) on board every newly delivered vessel to ABS class. HIMP creates a vessel-specific compartment-and-zone presentation to help the owner's staff monitor the hull's structural condition throughout the vessel's service life. The information can then be shared with the attending surveyor to help develop targeted surveys that are more efficient and hopefully less intrusive.

The Newbuild Initiative met with immediate success, and embodied a vision of how class would one day evolve to where it made use of remote monitoring of vessel operations to refine and improve the Rules. In this vision, everything from individual pieces of machinery and equipment to energy usage and environmental conformance could be captured electronically and analyzed to allow for risk-based surveys, demonstrating regulatory and class performance and, thereby, improving maritime safety while also helping shipowners operate more efficiently.

As energy efficiency became the watchword of an evolving industry, in 2012, Wiernicki directed Nautical Systems to form a joint venture with San Francisco-based Herbert Engineering Corporation to develop new software. One product of this collaboration, the Trim Optimization tool, is a program that identifies trim and draft optimization measures for enhanced fuel savings.

Energy efficiency also became the focus of several regulatory evolutions, in particular three from the IMO: the mandatory Ship

Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Design Index (EEDI), and the imposition of the North American Emissions Control Area (ECA). To help ship operators with the data gathering, analysis and reporting demands of these measures and realize more environmentally sound voyage management, Nautical Systems released the Energy & Environmental Manager in 2012. Useable as a standalone program or an integrated part of NS5 Enterprise software suite, the module has shipboard and shoreside components that help management and crew work together to keep the ship in a state of continuously improving operational efficiency.

The People of ABS

"Our history is the story of the transformation of a small American-based organization, founded in the Clipper Ship Era, into one of the world's foremost maritime classification societies," said Bob Somerville reflecting on ABS' 150th anniversary. "We are celebrating much more than just the passage of time or the reaching of an important milestone in the continuing evolution of maritime classification. We are celebrating the men and women who have shaped the direction and contributed to the success of this organization over the past 150 years."

During his tenure as Chairman, the number of employees in ABS and in the ABS Group of Companies has more than doubled. As ABS is an organization that focuses on providing high-quality client service, this growth has necessitated changes in how ABS hires, trains and integrates new employees.

In 2008, ABS expanded the services provided by ABS Academy to accommodate the influx of new employees. The initiatives included special mentorship programs, development of compressed learning courses, and accelerated training programs for employees in the field. By 2011, multiphase orientation and training programs had been introduced to answer the challenge of integrating this new crop of young professionals; the same multiphase training philosophy was also applied to the continuous professional development of experienced personnel. Soon, new accelerated survey and engineering training programs were introduced and satellite training centers opened around the world to accommodate the increasingly international workforce. Human Resources offices expanded accordingly and a new Learning Organization dedicated exclusively to training and developing staff was established.

Safety, service and practical solutions – three goals at the heart of ABS' activities upon which its commitment to set standards of excellence in marine and offshore classification is founded.

Meanwhile, although a detailed analysis of employee safety records, benchmarked against comparable industries, confirmed that ABS' safety performance significantly exceeded industry norms, the organization set its sight on attaining a zero reportable casualty/job-related injury score sheet.

Safety has been the byword of ABS since the inception of the organization and it is the cornerstone upon which ABS was built. For the safety mindset to be truly lasting and effective it has to become a way of working, a way of thinking and a way of living.

This 'safety first' concept is the basis for the company-wide **Always Be Safe** initiative. Under the direction of Wiernicki, the safety awareness program was elevated from a level of outward compliance to a culture that embraces safety every day. It is the guiding principle behind ABS' operations, whether the work takes place in an office environment, in a shipyard, on a vessel or at any other worksite. Its unique role makes it incumbent upon all ABS employees to demonstrate safety leadership no matter where they are working. The **Always Be Safe** program tasks each ABS employee with internalizing safe working practices and acting as a safety ambassador in every work environment.

During the first global Safety Day, ABS senior management launched the new Golden Eagle Award program – an initiative created to recognize safety leadership in the office and in the field.

In 2012, ABS created its department of Occupational Health and Safety to provide guidance to internal and external stakeholders on health and safety-related issues, and lead the organization as safety issues change. Later the same year, ABS and ABS Group employees around the world took part in the organization's first global Safety Day. A full day of planned events encouraged field and office personnel to not only pay particular attention to safety but to create a safer work environment.

Endowing the Future

ABS has assisted the academic aspirations of the next generation of maritime professionals for over eight decades by gifting educational scholarships to maritime colleges. During shipping's difficult years in the 1980s, these gifts continued but dwindled in size. When Somerville took the helm in 2004, the ABS Scholarship Committee had not met for five years, although annual gifts to several schools were still given. Within a few months of taking office, Somerville ordered a restructuring of the Scholarship Committee and expanded the ABS maritime scholarship program. He began by supporting students at the United States' state-run maritime academies, the alma maters of a very large percentage of ABS' staff. He soon championed a further expansion of this program, endowing chaired professorships and providing undergraduate student scholarships at maritime academic centers around the world, including institutes and universities in China, Greece, India, Indonesia, Italy, Japan, Korea, Malaysia, Portugal, Singapore, Sweden, the United Kingdom and Vietnam.

Beginning in 2008, ABS increased its commitment to education by arranging substantial, multi-year agreements with institutes in the United States and the United Kingdom. These included a multi-year grant to establish an ABS endowed professorship in Naval

In 2011, the American Bureau of Shipping Information Commons on the Massachusetts Maritime Academy campus was opened. A group of ABS employees and retirees who graduated from the Academy, with ABS Chairman Bob Somerville in the center, attended the dedication ceremony.

Engineering at the Massachusetts Institute of Technology (MIT), which supports an outstanding junior faculty member with a focus or specialization in naval architecture and ship design at the school's Center for Ocean Engineering; an endowed professorship of Naval Architecture and Marine Engineering at New York's Webb Institute; two endowed chairs at the State University of New York (SUNY) Maritime College, in Naval Architecture and Marine Engineering and in Marine Transportation; and, most recently, an endowed chair of Ocean Engineering at the University of California, Berkeley.

ABS' support of higher learning has also taken on some notable physical manifestations: a grant helped underwrite the costs of building the ABS School of Maritime Policy and Management on the campus of the California Maritime Academy; ABS donations were used to create a laboratory at the University of Michigan providing freshman engineering students with hands-on experience in marine systems engineering; and at Maine Maritime Academy, ABS funds will be applied to the building of a modern engineering facility, the ABS Center for Applied Engineering and Research. At Massachusetts Maritime Academy, ABS' support was the catalyst to attract additional grants for a state-of-the-art library, also referred to as an information commons. Opened in 2011, the facility extrapolates the traditional library concept to encompass learning environments emphasizing collaboration for study, research and training, all supported by the latest information technologies.

"In most parts of the world, shipping has become a forgotten industry. Without some personal connection to shipping, it is highly unlikely that bright young graduates will be aware of the career opportunities it offers," said ABS Chairman Bob Somerville, speaking on ABS' longstanding commitment to training and education as crucial to the future of the shipping industry. "ABS is constantly enriching its student scholarship program as part of our contribution towards rectifying this situation. We have launched an expanded program to support maritime training around the world as we believe this will benefit industry."

Prepared to Move Forward

In the late 2000s, a financial crisis in the United States spurred an economic recession that reached around the globe. As has happened before, this exacerbated the low points of shipping's normal business cycle – global commerce shrunk, new vessel orders decreased and many existing ships went into lay-up. This time, however, the new, diversified ABS continued to grow and, by 2010, could reclaim its place as the world's second largest classification society. The ABS Group of Companies too had grown significantly during the previous decade and was positioned for continued success.

In January 2011, leaders within the organization developed a vision for the coordinated ABS enterprise. Although ABS and the ABS Group of Companies are separate legal entities, both companies are driven by a common set of values and a harmonized strategic direction – promoting safety, maintaining quality and protecting the environment. In support of this, the ABS Board of Directors approved a revision to the ABS mission, which reflected the broader and more comprehensive activities provided across the organization.

By the end of 2012, ABS was stronger, larger, more financially secure and better prepared than at any time in its history to lead the continual evolution of marine and offshore classification. The small company that was formally brought into existence in April 1862 had grown into a diversified global organization of more than 5,000 dedicated employees staffing 200 offices in 70 countries around the world. As ABS surveys a landscape of many milestones in its 150 years of service to maritime safety, standing high among them is the work of the dedicated people who, individually and collectively, have brought the organization to a place of leadership in many fields of human endeavor.

The creation of groundbreaking analytical computer programs, the enhanced survey of ship structures, the personal assistance given by countless surveyors to nations developing the art of shipbuilding, the contributions of engineers in the creation and implementation of rational international regulation – these are but some of the new chapters in the history of shipping that were written by the men and women of ABS, just part of their common heritage of contributing to safety at sea.

The achievements of ABS through the decades are collective achievements, sometimes made in leaps and bounds and sometimes made just an inch at a time, but always made by people working together. A long chain of people can rightly claim a share in the proud accomplishments of the American Bureau of Shipping, which for a century and a half has successfully made its business the pursuit of a noble goal: promoting the security of life and property and protecting the natural environment. ✠

On the anniversary of ABS' 150th anniversary, flags were proudly displayed on Wall Street in New York City at the original location of the organization's formation.

Appendix 1

ABS Corporate Governance

The first elected Board of Managers of the American Shipmasters' Association, 23 July 1862:

John D. Jones, President
Daniel Drake Smith
Elisha E. Morgan
Theo. B. Satterthwaite
Charles H. Marshall
Francis S. Lathrop
Robert L. Taylor
Richard Lathers
Ezra Nye
Alfred Edwards
William C. Thompson
Benjamin C. Morris
Moses H. Grinnell
C. Henry Koop
Leopold Bierwith
William H.H. Moore
Elwood Walter
Isaac H. Upton

Chairmen of the American Bureau of Shipping:

Stevenson Taylor	1926
J. Lewis Luckenbach	1950-1951
Walter L. Green	1952-1959
David P. Brown	1963-1964
Arthur R. Gatewood	1964
Andrew Neilson	1965-1971
Robert T. Young	1971-1979
William N. Johnston	1979-1987
Richard T. Soper	1987-1990
Frank J. Iarossi	1990-2004
Robert D. Somerville	2004-present

Presidents of the American Shipmasters' Association and ABS:

John D. Jones	1862-1871
Theo B. Bleecker, Jr.	1871-1879
Horace J. Moody	1879-1881
John D. Jones	1881-1886
Theo B. Bleecker, Jr.	1886-1898
Anton A. Raven	1899-1916
Stevenson Taylor	1916-1926
Charles A. McAllister	1926-1932
J. Lewis Luckenbach	1933-1950
Walter L. Green	1950-1957
David P. Brown	1957-1963
Arthur R. Gatewood	1963-1964
Andrew Neilson	1964-1970
Robert T. Young	1970-1977
William N. Johnston	1977-1986
Richard T. Soper	1986-1990
Frank J. Iarossi	1990-1993
Robert D. Somerville	1993-2004
Robert E. Kramek	2004-2006
Christopher J. Wiernicki	2007-present

The First Advisory Council of Scientific and Practical Experts in the Construction of Iron and Steel Vessels (aka the Advisory Council of Engineering and Marine Architects), 2 December 1892:

Robert Thurston, Chairman
Commodore Theodore D. Wilson, US Navy
Commodore George W. Melville, US Navy
J. Harvard Biles, University of Glasgow
James E. Denton, Stevens Institute of Technology
William Gardner
Lewis Nixon
James S. Doran, Superintendent Engineer

Appendix 2

The ABS Organization and Activities

The American Bureau of Shipping is a not-for-profit organization. It has no capital stock and pays no dividends. The income derived from its classification activity is generated from fees for its services. All funds are used solely for the performance of these services, and any surplus of receipts in any one year is used for the extension and improvement of such services, including research and development.

Management responsibilities are vested in the elected Board of Directors and the Council, chosen from the nearly 1,200 members of ABS. This membership is drawn from persons considered to be eminent within their marine field of endeavor, principally shipowners, shipbuilders, naval architects, marine engineers, engine builders, material manufacturers, marine underwriters and government representatives. None of the members receive any compensation for services rendered.

As an international technical organization it is essential that ABS stays informed of and, when appropriate leads marine-related developments worldwide. ABS accomplishes this through a general committee structure consisting of individuals eminent in marine and offshore related industries.

Organized and managed in this manner, and reflective of the wide spectrum of interests of its members, ABS provides the industry with a recognized organization for self-regulation.

Activity outside the realm of classification is conducted through the operating subsidiaries of ABS Group of Companies, an affiliate of ABS. These activities are conducted on a for-profit basis. Income is generated from fees for the products and services offered.

The ABS Board of Directors as of 31 December 2012:

- Robert D. Somerville, Chairman
- Michael L. Carthew, Chevron Shipping Company LLC
- Choo Chiau Beng, Keppel Corporation Ltd.
- Dr. Peter H. Cressy, DISCUS
- Richard D. DeSimone, XL Insurance
- John A. Hickey
- Dr. Donald Liu
- T. Peter Pappas, Atlantic Capital LLC
- Philip J. Shapiro, Liberty Maritime Corporation
- Craig H. Stevenson, Jr., Diamond S Management, LLC
- Dean E. Taylor, Tidewater, Inc.
- Leonard H. Tyler
- Elizabeth D. Whitaker, Esq.
- Christopher J. Wiernicki, ABS
- Douglas C. Wolcott, Wolcott Associates

Appendix 3

ABS Classification Services

The responsibility of the classification society is to verify that merchant ships, marine and offshore structures comply with Rules that the society has established for design, construction and periodic survey. Classification itself does not judge the economic viability of a vessel or structure. Neither is the society in a position to judge whether a vessel is ultimately employed according to the stated intended service for which it was classed. The classification society cannot assume responsibility for managerial decisions of an owner or operator concerning crewing practices or the operation of a classed vessel. It records, reports and recommends in accordance with what is seen at the time of a vessel's construction and subsequent surveys.

Classification Procedure

The primary means by which ABS pursues its mission is through classification of ships and other marine and offshore structures. Classification is a procedure involving:

- the development of standards, known as Rules
- technical plan review and design analysis
- surveys during construction and source inspection of materials, equipment and machinery
- acceptance by the Classification Committee
- subsequent periodic surveys for maintenance of class
- survey of damage, repairs and modifications

The Establishment of Rules

Rules are derived from principles of naval architecture, marine engineering and other kindred disciplines. ABS develops and upgrades its Rules through a structure of special technical committees, and national and area technical committees. These committees permit ABS to maintain close contact with the numerous technological and scientific disciplines associated with the design, construction and maintenance of ships and other maritime structures around the world. ABS Rules are also based on recommendations from IACS or from ongoing research. Research projects are conducted either directly by ABS or are undertaken jointly with industry, with academic and governmental organizations or other appropriate partners to best draw on the most qualified sources available.

Technical Plan Review and Design Analysis

When an owner first requests that the vessel or structure be classed, the shipyard or design agent presents drawings and calculations to ABS for a systematic detailed review for compliance with the Rules. ABS engineers review the plans to verify that the structural and mechanical details conform to the Rule requirements. The review may also include sophisticated computer-based analytical procedures. In this way, ABS is able to determine whether the design is adequate in its structural and mechanical concept.

Surveys During Construction

After a design has been reviewed and approved by ABS engineers, ABS field surveyors attend the vessel at the shipyard during the construction of the vessel. The surveyors verify that the approved plans are followed, good workmanship practices are applied, and the Rules are adhered to. During the construction of a vessel, ABS surveyors witness, at the place of manufacture or fabrication, the tests of materials for the hull and certain items of machinery as required by the Rules. They also survey the building, installation and testing of the structural and principal mechanical and electrical systems. Throughout construction ABS maintains an ongoing dialogue with the owner and the builder to make sure the Rules are understood and adhered to, and assists in resolving differences that may arise.

Source Inspection of Materials, Equipment and Machinery

For a vessel to meet ABS classification standards, the principal material and machinery must also meet ABS established Rules, as confirmed by survey. Other components are required to meet the requirements for ABS Type Approval which provides certification of marine equipment, materials and other products. ABS Type Approval certification is based on design review, prototype testing and annual surveys of the manufacturing facility. In the voluntary Type Approval program, ABS certifies that enrolled manufacturers are capable of consistently producing a product in compliance with product specifications. ABS is also recognized by many governments to approve lifesaving, firefighting, fire protection, pollution prevention and control equipment on their behalf.

Acceptance into Class

When completed, a vessel undergoes sea trials attended by an ABS surveyor to verify that the vessel performs according to Rule requirements. The vessel is then presented to the ABS Classification Committee which assesses the vessel's compliance with the Rules. When accepted by the committee, formal certification is issued to the vessel. The vessel's classification information, characteristics and other particulars are then entered into the ABS *Record* – the registry of ABS classed vessels.

Surveys After Construction

ABS Rules require that every classed vessel be subject to periodic surveys of its hull and machinery to determine whether it is maintained in accordance with classification standards.

Survey of Damage, Repairs and Modifications

Should an ABS classed vessel sustain damage that may affect its classification status, the owner is required to inform the society. Upon request, ABS surveyors would then survey the vessel to determine whether the structure and machinery continue to meet the ABS Rules and, if not, verify that the repairs made return the vessel to a state of compliance with the Rules. Similarly, any structural modification of the vessel must be carried out in accordance with classification society requirements for the vessel to remain in class.

Appendix 4

Government Authorizations and Statutory Responsibilities

More than 120 governments have recognized the professional integrity and experience of ABS by authorizing the classification society to act as their statutory agent. These duties may include conducting surveys and issuing certificates in accordance with various international and national maritime conventions and codes. These governments recognize that ABS possesses a global network of exclusive, qualified surveyors and extensive resources in manpower and technology to conduct the technical reviews and surveys necessary to fulfill the various convention requirements, as most governments do not have comparable resources or skills.

Through this longstanding relationship with the maritime agencies of national governments, ABS has acquired extensive knowledge of national and international maritime regulations. It is able to draw on this knowledge in advising clients on how best to conform to these requirements, meet the documentary needs and accurately apply the criteria.

International Conventions and Statutory Certifications

Although there are many international conventions that apply to the shipping and offshore industries, four principal conventions (and their subsequent amendments and/or protocols) have the most far reaching influence on the safety and environmental impact of these industries. They are the International Convention for the Safety of Life at Sea (SOLAS); the International Convention for the Prevention of Pollution from Ships (MARPOL); the International Tonnage Convention; and the International Convention on Load Lines.

As a Recognized Organization, ABS is authorized by many governments to perform technical reviews, inspect ships and marine structures, and issue certificates indicating compliance to these requirements.

SOLAS Certificates

ABS engineers and surveyors, working with industry and government representatives, can verify that the vessel is built and provided with the necessary equipment and features required by the SOLAS Convention.

Based on a satisfactory review and survey of the vessel, certificates can be issued indicating compliance with the requirements of the SOLAS regulation. These include:

- Safety Construction Certificate (SLC)
- Safety Equipment Certificate (SLE)
- Safety Radio Certificate (SLR)
- Passenger Ship Safety Certificate (SLP)

Where authorized by the flag State, document review and onshore and shipboard audits are also carried out by ABS verifying that the safety management system complies with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code).

As a Recognized Organization, ABS is authorized to review and approve the Declaration of Maritime Labour Compliance (DMLC) and carry out onboard inspections to verify compliance with the ILO Maritime Labour Convention and issue the Maritime Labour Certificate on behalf of the flag State.

In addition, ABS acts as a Recognized Security Organization by many governments, conducting security audits and verifying conformance with the International Ship and Port Facility Security (ISPS) Code.

MARPOL Certificates

ABS will, upon request, perform review and survey relating to the issuance of the following MARPOL certificates:

- International Oil Pollution Prevention Certificate (IOPP)
- IMO Certificate of Fitness for Ships Carrying Liquefied Gases in Bulk (IGC)
- IMO Certificate of Fitness for Carriage of Dangerous Chemicals in Bulk (IBC)

Tonnage Certificates

In addition to the National or International Tonnage Certificates, Panama and Suez Canal Tonnage Certificates can be issued by ABS on behalf of those authorities. SOLAS and MARPOL regulations specify arrangements and equipment requirements based on the ship's admeasured tonnage.

Load Line Certificates

A Load Line Certificate is issued on behalf of an Administration to indicate that a vessel is capable of carrying its intended cargo in a stable condition. The load line itself is a hull mark that indicates the maximum draft to which a vessel is permitted to safely load.

Appendix 5

ABS Milestones

1861 American Shipmasters' Association organized

1862 American Shipmasters' Association receives formal incorporation from New York Legislature

1867 *Record of American and Foreign Shipping* first published

1870 *Rules for the Survey and Classing of Wooden Vessels* first published

1877 *Rules for the Survey and Classing of Iron Vessels* first published

1879 *Columbia*, first steamship with incandescent electric lighting installed on board, classed

1884 Purchased the goodwill and title to the *American Lloyd's Universal Register*

1890 *Rules for Building and Classing Steel Vessels* first published

1891 *Rules for the Construction, Survey and Classification of Machinery and Boiler Systems* first published

Rules for the Installation of Electric Lighting and Power Apparatus on Shipboard first published

1892 Advisory Council of Engineering and Marine Architects first convened

1894 *Inland Lloyd's*, an inland vessel register, first published

1898 American Shipmasters' Association becomes the American Bureau of Shipping

1908 US Standard Steamship Owners, Builders and Underwriters Association acquired

1916 *Great Lakes Register* acquired

1920 Merchant Marine Act of 1920 requires US Government vessels be classed by ABS

1922 Subcommittee on Internal Combustion Engines formed

1928 American Bureau of Aircraft formed

1929 *American Bureau of Aircraft Register* first published

1931 ABS and US Navy accepted welded boiler construction as an industry standard

1933 ABS' Metallurgical Laboratory established

1937 First automatic welding process approved

1941 *Patrick Henry*, the first Liberty ship, classed

1947 Conversion of cargo ship *Natalie O. Warren* into the first LPG carrier, classed

1952 *SS United States*, fastest-ever ocean liner and first to use aluminum extensively in its superstructure, classed

1956 *Ideal X*, the first containership (a tanker conversion), classed

1958 *Mr. Louie*, first mobile offshore drilling unit, classed

Methane Pioneer, the first LNG carrier (a cargo ship conversion), classed

1958 Oil tanker *Universe Apollo*, history's first 100,000-dwt ship, classed

1959 *NS Savannah*, the first nuclear-powered cargo-passenger ship, classed

1960 *SS France*, the longest ocean liner, classed

1962 *Glomar II*, first purpose-built drillship, classed

1963 *Sedco 135*, the first purpose-built semisubmersible drilling rig, classed

1964 *Methane Progress* and *Methane Princess*, the first purpose-built LNG carriers, classed

1965 *Chian Captain*, first Freedom vessel, classed

ABS electronic data processing services established

1966 *Idemitsu Maru*, the first 200,000 dwt ship, classed

Manukai and *Manulani*, the first purpose-built containerships, classed

1968 *Rules for Building and Classing Mobile Offshore Drilling Units* first published

Universe Ireland, the first 300,000-dwt ship, classed

DAISY program developed to use finite element analysis to evaluate ship structures

Guide for the Classification of Manned Submersibles first published

1969 ABS collaborates on the Manhattan Project to convert the tanker *Manhattan* into the largest icebreaking cargo ship

Acadia Forest, first LASH vessel, classed

1970 *Sedco 445*, first dynamically positioned drillship, classed

Sea-Land's SL-7 series, the fastest-ever containerships, classed

1972 General Dynamics series of 125,000 m^3 LNG carriers, classed

Stewart Cort, first integrated tug-barge, classed

1973 *Globtik Tokyo*, first 400,000-dwt oil ship, classed

1971 ABS Worldwide Technical Services (ABSTECH) formed

1975 *Transworld 58*, first floating production system, classed

1976 ABS Computers Inc (ABSCOMP) formed

1978 *Exxon Santa Ynez*, world's second FPSO and first to operate in US waters, classed

1980 *Seawise Giant*, world's largest merchant ship, classed

1981 ABS grants approval-in-principal to design world's first tension-leg platform (TLP), *Hutton*

1981 *FPSO II*, world's first commercially leased FPSO, classed

1983 ABS Boiler and Marine Insurance Company formed

ABS Fuel Oil Testing Services formed

1984 *Glomar Beaufort Sea 1*, world's first concrete island drilling system, classed

Moliqpak, world's first steel-encased drilling rig, classed

1985 *2nd Lieutenant John P. Bobo*, first prepositioning ship for the US Navy, classed

ABS certifies one million container units

1989 ABS named certified verification agent (CVA) for *Jolliet*, first TLP in the Gulf of Mexico

ABS Rapid Response Damage Assessment program formed

1990 ABS Quality Evaluations formed

ABS Industrial Verification formed

1992 ABS Academy established

1993 ABS SafeHull released

1995 ABS SafeHull applied to first FPSO conversion

1996 *Neptune*, world's first production spar, classed

ABS SafeNet released

1997 *Escravos*, world's first LPG FSO, classed

1998 ABS Nautical Systems formed

2000 ABS issues 1,000th Type Approval certificate

2001 *Boomvang* and *Nansen*, the first truss spars, classed

ABS Consulting formed

2002 *Sanha*, world's first LPG FPSO, classed

2003 *Guide for Ship Security* first published

2004 First class society accepted into membership by the Society of International Gas Tanker & Terminal Operators

ABS classes submerged turret loading buoy system for first offshore LNG terminal in Gulf of Mexico

Joint Tanker Project with Lloyd's Register and Det Norske Veritas to develop common structural rules for tankers

ABS SafeHull for LNG carriers released

2006 *Emma Maersk*, world's first ultra-large containership, classed

Red Hawk, first cell spar, classed

Singapore Offshore Technology Center established

2007 *Thunder Horse*, largest floating production semisubmersible, classed

Agbami, the largest newbuild FPSO, classed

2008 Offshore Structure Assessment Program introduced

2009 *ATP Titan*, first multi-column deep-draft floater, classed

ABS Harsh Environment Technology Center established

2010 Classed first Littoral Combat Ship, *USS Freedom*

Brazil Offshore Technology Center established

2011 China Offshore Technology Center established

Selected to class series of world's largest containerships, Maersk's 18,000-teu Triple E series

2012 Selected to class new dual fueled LNG-powered offshore supply vessels

Korea Energy Technology Center established

Appendix 6

Selected Bibliography and Sources

BOOKS

American Bureau of Shipping: Seventy-Fifth Anniversary 1862-1937. New York: American Bureau of Shipping, 1937

American Bureau of Shipping: 100th Anniversary 1862-1962. New York: American Bureau of Shipping, 1962

American Bureau of Shipping: 125th Anniversary 1862-1987. New York: American Bureau of Shipping, 1987

America's Merchant Marine: A Presentation of Its History and Development to Date. New York: Banker's Trust Co., 1920

Albion, Robert, *The Rise of the Port of New York*. New York, 1939

Alden, John D., Cdr., USN (Retired), *The American Steel Navy: A Photographic History of the U.S. Navy from the Introduction of the Steel Hull in 1883 to the Cruise of the Great White Fleet, 1907-1909*. Annapolis, MD: U.S. Naval Institute, 1972

Bourneuf, Gus Jr., *Workhorse of the Fleet: A History of the Liberty Ships*. New York: ABS, 1990

Carlisle, Rodney P., *Civil War and Reconstruction*. New York: Facts on File, 2008

Carlisle, Rodney P., *World War I*. New York: Facts on File, 2007

De La Pedraja, Rene, *A Historical Dictionary of the U.S. Merchant Marine and Shipping Industry: Since the Introduction of Steam*. Westport, CT: Greenwood Press, 1994

Fassett, F. G., Jr., *The Shipbuilding Business in the United States. Vol. 2.* New York: The Society of Naval Architects and Marine Engineers, 1948

Goodspeed, M. Hill, *U.S. Navy: A Complete History*. Washington, DC: Naval Historical Foundation, 2003.

History of the American Bureau of Shipping, 1862-1994. 4th ed. New York: ABS, 1995

History of the American Bureau of Shipping, 1862-2000. 5th ed. Houston: ABS, 2001

History of the American Bureau of Shipping: 1862-2005. Houston: ABS, 2006

International Convention on Load Lines. International Maritime Organization, 1966

Jean and Petit, *Methane by Sea*. Paris, 1993

J.J. Henry Company, *State of the Art of LNG Transport*. 1971

Kemp, Peter ed., *The Oxford Companion to Ships and the Sea*. London 1994

Labaree, Benjamin W., William M. Fowler, Jr., John B. Hattendorf, Jeffrey J. Safford, Edward W. Sloan and Andrew W. German, *America and the Sea: A Maritime History*. Mystic: Mystic Seaport, 1998

Owsley, Frank Lawrence, *King Cotton Diplomacy: Foreign Relations of the Confederate States of America*. Chicago, 1931

Maine Historical Society, *Maine: A History*. Vol. 4. New York: American Historical Society, 1919

Sawyer and Mitchell, *The Liberty Ships*. London, 1970

Sawyer and Mitchell, *Victory Ships and Tankers*. London, 1974

ARTICLES

Bourne, Kenneth, "British Preparations for War with the North, 1861-1862," *English Historical Review*, October 1961

Haviland, E.K., "Classification Society Registers from the Point of View of a Marine Historian," *American Neptune* 30, no. 1, January 1970

Library of Congress, "The Panic of 1857," January 2011

Luchenbach, J. Lewis, "American Bureau of Shipping, 1862-1943," *Historical Transactions, 1893-1943*. New York: The Society of Naval Architects and Marine Engineers, 1945

Oakley et al, "Design and Construction of FPSO *Anoa Natuna,*" SNAME 1990

Proceedings of the 1965 Conference of Classification Societies, New York, 3-7 May 1965

"The 1966 Load Line Convention and the Loss of the *MV Derbyshire*"

"Tributes to the Memory of John D. Jones: Born August 15th, 1814, Died September 22d, 1895." New York: Atlantic Mutual Insurance Company, 1895

"US Navy's Military Sealift Command Fact Sheet."

NEWSPAPERS AND MAGAZINES

American Express Plaza News, 17 June 1977
American Shipper, May 1992
Atlanta Constitution, 26 July 1882
Bankers, July 1861
Baltimore Sun, 1889-1971
Chicago Tribune, 7 January 1894
Clarksons Research, Bulk Carrier Reports, 1995-1997, 2004
Daily Graphic, 22 November 1876
Engineer, 1889
Evening Post, 27 July 1882
Guardian, 2001
Intercargo Bulk Carriers Casualty Report, 1991-2000
International Marine Engineering, May 1916
Journal of Commerce, 13 March 1993
Journal of Nautical Intelligence, 1 November 1861
Kaiji Press, March-May 1997
Lloyd's List Bulk Carrier Supplement, 2004
Los Angeles Times, 1911-1917
Marine Engineering, 1900-1916
Marine Engineering and Shipping Age, 1923-1932
Marine Engineering and Shipping Review, 1923-1978
Marine Log, 1991-1996
Maritime Executive, 2002
Maritime Blog, 5 September 2009
Merchants' Magazine and Commercial Review, 1861-1865
Niagara Falls Gazette, 21 July 1920
New York Evening Post, 27 July 1882
New York Herald, 10 June1868
New York Times, 1861-2010
Offshore Magazine, 1996-2001
Sailor's Magazine, December 1861
St. Louis Post-Dispatch, 6 July 1891
Shipping: A Weekly Journal of Marine Trades, 8 February 1919
Spectator, 18 February 1915
Telegraph, 3 August 2010
Time Magazine, 22 June 1981
Wall Street Journal, 1920-1993
Washington Post, 21 September 1914

GOVERNMENT DOCUMENTS

Annual Reports of US Shipping Board
Docket SDNY 03-cv-03573
United States Shipping Board Emergency Fleet Corporation: Hearings Before the Senate Committee on Commerce

ABS RECORDS

ABS Report of the President to the Board of Managers, 1916-1947
ABS *Advisory on Buckling*, 1997
ABS *Annual Reports*, 1966-1990
ABS *Annual Reviews*, 1991-2010
ABS *Activity Reports*
ABS *Activities*
ABS *Connections*
ABS Consulting News Releases
ABS *Dispatch*
ABS News Releases
ABS *Record*
ABS *Surveyor Magazine*, 1967-1985, 1990-2011
Archival Records from the American Bureau of Shipping, including articles and correspondence
Bulletin of the American Bureau of Shipping, 1922-1966
Offshore Innovation: A History of Offshore Developments
Record of American and Foreign Shipping
Reliability-based Study of Classification Rules, 1996

WEBSITES

www.archives.gov
www.aukevisser.nl/supertankers/id19.htm
www.bbc.co.uk
www.concreteships.org
www.gwpda.org
www.imo.org
www.museumofnjmh.org/morrocastleanniversary.html
www.state.gov
www.thc.state.tx.us
www.oceantugbarge.com
www.uscg.mil
www.usmm.org

INTERVIEWS AND REMINISCENCES

Anderson, Warren
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