A Half Century of Maritime Technology 1943–1993

Written by a group of authorities

Harry Benford, editor
Professor emeritus, Department of Naval Architecture and Marine Engineering, The University of Michigan, Ann Arbor, Michigan

William A. Fox, associate editor
Naval architect, John J. McMullen Associates, Inc., Newport News, Virginia

Published by
THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
Jersey City, New Jersey

Regulation

William A. Cleary, Jr.

Introduction

The Society's second half century has seen maritime regulatory development unparalleled in history. Before the half-century mark was reached there were only two sets of international maritime regulations. These comprised the agreements of the 1929 Safety of Life at Sea Convention (SOLAS) and the 1930 Load Line Convention. As we shall see in the following paragraphs, those agreements have been complemented and supplemented by many new international initiatives. In addition, the U.S. Congress has unilaterally mandated other regulations, some of which bear on foreign- as well as U.S.-flag ships. SNAME members from all segments of the marine industry have participated on many U.S. and Canadian delegations and advisory groups formulating positions for each of these international forums.

The Congress has on occasion rearranged the administrative structure of its regulatory agencies, which has in some cases caused a different shading of emphasis in interpretation and application of the laws. At the beginning of this half century, regulatory responsibility for merchant shipping lay in the Bureau of Marine Inspection and Navigation (BMIN) of the Department of Commerce. In 1942 BMIN was placed under the U.S. Coast Guard, which was then under the Department of the Treasury (a reflection on its initial primary role in discouraging smugglers). Then, in 1967 the Coast Guard (with its BMIN duties) was transferred to the newly-formed Department of Transportation, where it remains.

The national regulations for ship design and construction have existed in the same approximate location in the Code of Federal Regulations (CFR) for the entire half century, although they have been continually expanded and altered at the request of Congress. The following table is an abbreviated outline of the applicable regulations that have come into force since 1940 (as they now exist in 46 CFR Parts 1–199, subchapters A through V):

	Sub-chapter	Date of Origin
D	Tank Vessels	—
E	Load Lines	—
H	Passenger Vessels	—
I	Cargo and Miscellaneous Vessels	—
O	Bulk Dangerous Cargoes	1980
	Incineration at Sea	1988
R	Nautical Schools	1952
S	Subdivision/Stability	consolidated 1983
T	Small Passenger Vessels	1960
U	Oceanographic Research Vessels	1968
V	Marine Occupational Safety & Health, Commercial Diving Regulations	1978

In addition to their own in-house capabilities, the federal regulatory agencies rely for assistance on the American Bureau of Shipping, the National Cargo Bureau, the National Institute of Electrical Underwriters, the National Fire Protection Association, and other private organizations.

During the past half century regulations have expanded in scope and in the number of safety functions that federal agencies ask to review. There are now well over a dozen safety functions that must be satisfied in order to comply with national or international regulations. In alphabetical order these are:

Safety Function	Reviewed by U.S. Coast Guard or to USCG Satisfaction by
Automation	
Chemical cargoes	
Elec. installations/hazard. areas	
Environmental pollution	
Fire protection	
Freeboard	American Bureau of Shipping
Grain cargoes	National Cargo Bureau
Hazardous materials	
Lifesaving appliances	
Machinery	American Bureau of Shipping
Manning	
Navigation	
Offshore structures	American Bureau of Shipping
Stability	
Hull structure	American Bureau of Shipping
Subdivision	
Vapor collection systems	
Watchkeeping	
Weathertight integrity	American Bureau of Shipping

At least brief mention should be made of the Maritime Administration's role in advancing the cause of ship safety through its design standards. In particular, that agency deserves credit for keeping alive subdivision of merchant ships when other world interests tended to ignore it.

Developments in the 1940s

During the first half of the 1940s the maritime nations were too involved in World War II to give much thought to changing regulations. In 1948, however, the United Kingdom, which had been the host country for the 1929–30 SOLAS and Load Line Conferences, organized a follow-up conference to reconsider the SOLAS convention. At that conference a number of new safety functions were introduced with the intent that all nations would place them in their regulations. These new functions included stability reviews for all ships, damaged stability requirements for passenger ships, and calculations for the carriage of grain in bulk. Of the 46 executive and technical members of the U.S. delegation to the 1948 SOLAS conference, 18 were members of SNAME, including the U.S. Delegate: ADM Joseph F. Farley, USCG; among others were David Arnott, ABS; J. L. Bates, Maritime Commission; H. Gerrish Smith, Shipbuilders Council; George Sharp; and CDR C. P. Murphy, USCG (later RADM).

Attending the same conference was a six-person Canadian delegation which included another SNAME member, Lieut. D. I. Moore, RCN.

Also in 1948 the newly formed United Nations adopted a convention that led, in 1958, to the formation of the Inter-Governmental Maritime Consultative Organization (IMCO), which in 1982 changed its name to the International Maritime Organization, commonly referred to as IMO.

During the latter half of the 1940s our Coast Guard regulations for ship safety remained centered on the original passenger ship regulations; most other ships being grouped in the Cargo and Miscellaneous, or Tankship, subchapters except for the specialized regulations on engineering and electrical installations.

American regulatory practices were spread throughout the world during the post-war period as U.S. war-built ships were sold overseas to replace wartime losses.

Developments in the 1950s

In 1952, the Coast Guard began requiring approved stability information on cargo as well as passenger ships.

In 1956 the *Stockholm/Andrea Doria* collision exposed certain shortcomings in the SOLAS rules. Once again the conference met in London, this time under the United Nation's new organization for marine safety, IMCO. (At the invitation of the United Kingdom, that organization was headquartered in London.) This led to the 1960 SOLAS Convention, which differed from the 1948 Convention because of lessons learned from the *Stockholm/Andrea Doria* collision. Other changes arose from the availability of new life-saving systems, and from new operating procedures suited to the use of radar. A new part was added on the safety of nuclear ships.

The U.S. delegation to the 1960 SOLAS conference was led by ADM A. C. Richmond, USCG, and again included a wide cross section of members from the U.S. maritime industry. Among these were Robert T. Merrill, John P. Comstock, Vito L. Russo, Owen Oakley, J. B. Robertson, Jr., E. Bentzenberg, Matthew G. Forrest, RADM H. C. Shepheard, USCG (ret), and LCDR R. I. Price, USCG (later VADM). Canada sent a delegation of seven, including three SNAME members: Alan Cumyn, J. H. Kay, and H. O. Buchanan.

In 1958, after the loss of the passenger fishing boat *Montauk*, off Long Island, Congress directed the Coast Guard to develop regulations for all small passenger vessels. This led to the origin of Sub-chapter T, which eventually became the most actively applied portion of the regulations.

Also during this period the United States began pressing for a new Load Line Convention. To help generate interest, the government created a Load Line Committee entirely from U.S. industry, the Coast Guard, and the American Bureau of Shipping. (Almost all of this committee's members were also members of SNAME.)

In 1954, the first attempt was made by the international community to reduce oil pollution resulting from routine operations, such as tank cleaning, in the Convention for the Prevention of Pollution of the Sea by Oil.

Developments in the 1960s

IMCO played host to the 1960 SOLAS conference in London and began to meet regularly thereafter to discuss not only matters of ship safety, but also questions of highseas environmental protection. Since that time SNAME members have been deeply involved in the development of maritime safety matters worldwide. These SNAME members were not only federal

employees, but also members of shipping companies, naval architecture firms, shipbuilders, ship repairers, and entities dedicated to environmental protection. With so many organizations involved, and with so many new technological developments, it is not surprising that the process required increasingly frequent meetings, some at IMCO, but others closer to home. In the United States, for example, a two-level advisory group system has now evolved. Preliminary positions are developed by USCG staff, often in consultation with industry. Public meetings are held to discuss and modify positions before the official national positions are sent to IMO. Industry representatives are regularly invited to contribute throughout this process.

In 1961, IMCO formed the Maritime Safety Committee, which in turn began to create special subcommittees for such functional areas as stability, subdivision, and fire protection. A subcommittee on safety of fishing vessels was formed in 1968. By 1974 this produced a U.N. code for fishing vessels, and this became the basis for a 1977 conference on fishing vessels.

In a purely North American development during the mid-1960s, at the request of Great Lakes shipping interests, SNAME itself began research into the strength and seakeeping capabilities of Great Lakes bulk carriers. This work was instrumental in a parallel regulatory joint effort by Canada and the United States. This was centered in the Joint Technical Committee for Great Lakes Load Lines whose membership was formed, as it happened, exclusively of SNAME members from industry, classification societies, universities, and government agencies. Based on this work, in 1974 the two neighboring nations reached a joint accord on new load line regulations, and this was modified some four years later to establish new strength standards for Great Lakes ships up to 1000 feet in length.

During the 1960s there were significant developments in tanker arrangements. The tanker *Manhattan,* built early in the decade, was divided into no fewer than 45 cargo tanks. Subsequent ships (mostly built overseas) featured far fewer (but, of course, far larger) tanks. This development led to structural complications brought on by inertia forces of the liquid cargo that were not always kept under control by swash bulkheads. SNAME, the American Bureau of Shipping, and the Federal Government all supported research that eventually found satisfactory solutions to the problem.

The 1960s were also marked by massive demands for overseas grain transport. Many American ships of World War II vintage carried grain to India and other nations suffering from shortage of food. The need arose to develop and apply special bulk grain stability regulations. Owners were required to supply their officers with information necessary to ensure safety against catastrophic shift of cargoes.

A second load line conference met in early 1966 and completed the international convention that is in effect today. Of the 18-member U.S. delegation, nine were SNAME members. These included David Bannerman, ABS; R.T. Cunningham, AMMI; Captain A. H. McComb, Jr., USCG; J. B. Robertson, Jr., USCG; C. S. Smith, Lake Carriers Association; J. L. Stevens, Jr., Shipbuilders Council; and E. V. Stewart, Jr., API. The Canadian delegation included another SNAME member: H. O. Buchanan.

Another late 1960s international development, which came to regulation in the next decade, concerned bulk chemical carriers. Then, later, came the "drugstore" chemical carriers, capable of carrying more than a dozen different bulk products simultaneously and delivering any amount at any port. This sometimes created unique loading, offloading, and stability problems that came under international discussions leading to an international code for bulk chemical ships.

In the United States during this period, published figures on commercial fishing fatalities led some authorities to recommend special regulations for boats engaged in that industry. Nevertheless, the independently minded American fishermen refused all regulatory assistance and kept on losing lives at a rate far above any other industry. Improvements by regulation had to wait for another two decades, until 1990.

In 1969, another IMCO conference generated a completely new approach to tonnage measurement, one that overcame the shortcomings of the old Moorsom system and its burden of illogical rule-beating clauses that led to lessened seaworthiness. Again, SNAME members were the majority of the delegation, which was headed by RADM Murphy, USCG, and which included LCDR H. J. Kelly, USCG; R. C. Krack, MarAd; C. S. Smith, and E. V. Stewart, Jr.

Developments in the 1970s

Again, throughout the 1970s, SNAME members were active participants in national and international conferences that led to developing necessary regulations in several important maritime sectors. One example was the aforementioned code for ships carrying dangerous chemicals in bulk: CHEMCODE (1971). Another IMCO initiative was the International Convention

for the Prevention of Collisions of Ships at Sea: COLREGS (1972).

During this period there was increasing international concern over oil pollution. This led IMCO to sponsor the Marine Pollution Convention of 1973 (MARPOL 73). Once again the U.S. delegation was dominated by SNAME members under the leadership of ADM C. R. Bender and RADM W. M. Benkert. The United States was a strong proponent of these regulations. Congress accordingly directed that the new regulations be enforced in U.S. territorial waters without waiting for international signatory support.

In 1974 an IMCO conference on the SOLAS convention upgraded the 1960 SOLAS regulations, so that we now use SOLAS 74 and its amendments in lieu of the older SOLAS convention. The U.S. delegation to the 1974 SOLAS convention included SNAME members RADM W. M. Benkert, USCG; J. B. Robertson, Jr., USCG; S. F. Sammis, U.S. Cargo Bureau; and E. H. Middleton.

A unique set of problems accompanied the introduction, in the early 1970s, of liquefied natural gas (LNG) carriers. This type of ship had to carry cryogenic liquids safely in ocean storms. This led IMCO, in 1975, to produce a special code for such ships: GASCODE, which recognized both design and operating problems peculiar to LNG carriers.

In 1977 IMCO held a conference at Torremolinos, Spain at which it developed the Torremolinos Convention for the Safety of Fishing Vessels. The U.S. delegation was headed by RADM Benkert and included SNAME members E. H. Middleton, W. A. Cleary, Jr., and George C. Nickum. Mr. Nickum deserves special mention since he served, at the invitation of the U.S. Coast Guard and concurrence of the State Department, as the U.S. Representative to the Subcommittee on Safety of Fishing Vessels for the decade 1967–1977.

Three members of the Canadian delegation at the Torremolinos conference were SNAME members: W. E. Bonn, H. I. Shenker, and a Mr. Laing.

Also during the 1970s, the original few subcommittees of the 1960s were developed into a series of technical subcommittees specializing in each technical safety function, such as fire protection, stability and subdivision, bulk cargoes, etc. There are now more than ten subcommittees serving the two main committees: Maritime Safety and Marine Environmental Protection. These committees and their subcommittees meet at least once a year. During the decade leading up to the SNAME Centennial literally hundreds of SNAME members have served on these committees, subcommittees, and advisory groups. Space does not allow us to name them all, but the foregoing paragraphs have recognized at least a few of the key participants.

During the second half of the 1970s IMCO produced a steady stream of codes and conventions, some of which are mentioned below. Each conference noted as having "convened" actually sat in session, completed its assignment, offered the resulting convention or code to all nations (through IMCO), and then *disbanded* itself.

1973: Convened the Conference on Marine Pollution
1975: Formed the Maritime Satellite Organization (INMARSAT)
1977: Convened the Conference for Safety of Fishing Vessels
1977: Produced the Code for Dynamically Supported Craft
1978: Convened the Conference on Training and Watchkeeping for Seafarers
1978: Convened the Conference for Protocol on Marine Pollution
1979: Convened the Conference on Maritime Search and Rescue
1979: Produced the Code for Offshore Drilling Units

The U.S. delegation to the 1978 Protocol on Marine Pollution included SNAME members RADM Benkert, LCDR W. D. Snider, E. H. Middleton of USCG, and J. J. Nachtsheim of the Maritime Administration.

Developments in the 1980s

The 1980s saw a severe slump in shipbuilding activities, which led to a slowdown in the growth of regulations. Nevertheless, IMO turned out the following codes:

1981: Noise Levels
1981: Safety of Nuclear Merchant Ships
1983: Safety for Special Purpose Ships (training, fish factory, etc.)
1983: International Gas Carriers (superseding existing codes)
1983: International Bulk Chemicals
1983: Safety for Diving Systems
1989: MODU Code, revised

In the United States the Coast Guard consolidated the stability regulations into sub-chapter S, and rewrote the regulations pertaining to tonnage measurement and electrical engineering. The Coast Guard also developed new regulations applied to such diverse vessels as those engaged in commercial diving, sail training operations, and incineration at sea.

SNAME played an active part in the preparatory work for the total revision of SOLAS Chapter III, Survival Systems, which was adopted in 1973. Under the chairmanship of SNAME member Robert Markle, SNAME Panel 0-25 developed text for a number of new requirements and served as a sounding board for

international proposals. The new Chapter III embodies a totally new philosophy about lifesaving system design, which gives naval architects and marine engineers greater design flexibility as well as responsibility.

One of the most significant developments toward improving the safety of ships worldwide came in early 1985. The IMO Maritime Safety Committee reported then that there was a compelling need to develop a standard of subdivision and damage stability for dry cargo vessels based on the probabilistic method. Prior to that time, dry cargo ships were not required to meet any damage stability criteria. The development of these rules was a high priority for the Coast Guard and was advanced through IMO in short order through the diligent efforts of many Coast Guard, MarAd, and industry SNAME members, including: RADM J. W. Kime (now ADM), Capt. J. Card, Capt. J. Maxham, LT R. Gilbert, J. Spencer, USCG; R. Sonnenschien, MarAd; R. Tagg, Herbert Engineering; and W. Peters, C. R. Cushing & Co. The rules were approved by IMO in 1988 as amendments to the SOLAS Convention and entered into force for new ships in 1992. In 1989 SNAME President Arthur Haskell wrote a letter to the Coast Guard expressing the Society's support for the new international damage stability standards for dry cargo ships.

The passage of the Commercial Fishing Industry Vessel Safety Act of 1988 was the first successful attempt by the U.S. Congress to enact comprehensive safety legislation for one of the most dangerous industries in the country. Major provisions of the Act include a study addressing safety problems conducted by the National Academy of Engineering, development of safety regulations, development of a plan for the licensing of operators, distribution of educational material to fishermen, and formation of a safety advisory committee. Prior to the Act, the Coast Guard had set up a task group, in 1985, headed by SNAME member CAPT Gordon Piché, USCG, to study the fishing vessel problems and develop a voluntary safety program to improve the awareness level of commercial fishing vessel operators.

Developments in the 1990s

In 1990 one of the most far reaching pieces of marine legislation was passed by the U.S. Congress in response to the *Exxon Valdez* disaster—The Oil Pollution Act of 1990 (OPA 90). Major provisions of OPA 90 include: double hull construction for all tankers entering U.S. waters, certificates of financial responsibility for oil spill liability and compensation, response plans, discharge removal equipment carriage requirements for vessels, manning standards, escorts for certain tank vessels, pilotage, vessel traffic systems, and various reports and studies. To manage the enormous burden of developing the necessary regulations, studies, and reports, the Coast Guard established (under the Office of Marine Safety, Security, and Environmental Protection) the OPA 90 staff headed by SNAME member Norman Lemley. The 75-member OPA 90 staff includes naval architects, economists, lawyers, editors, and the other necessary support positions to manage the monumental undertaking of implementing the provisions of OPA 90.

Conclusion

As indicated at the start, the past fifty-year period has seen a virtual explosion of new and revised maritime regulations. Most of these have resulted from clearly perceived needs and have been hammered out in international conferences. Members of the Society of Naval Architects and Marine Engineers have played important roles in all this, and the Society, itself, has made contributions through the activities of its technical and research committees. As we look ahead to the next half-century we can expect to witness a continuation of enlightened regulatory work advancing the safety and reliability of the many kinds of boats and ships that carry out our nation's commerce and industry.

WILLIAM A. CLEARY, JR., is a maritime consultant and Adjunct Professor at Florida Institute of Technology. For two decades he served as Chief, Naval Architecture, Office of Marine Safety and Environment, U.S. Coast Guard. He represented the United States on several IMO subcommittees and special topic meetings. He chaired one of the technical committees at the Torremolinos Convention on Safety of Fishing Vessels, co-chaired the USA/Canada Joint Technical Committee for Great Lakes Load Lines, and was an active participant in international safety discussions.

He was an Engineering Duty Officer in the Naval Reserve and is now Captain, USNR (ret). He has been a registered professional engineer for over 30 years and is a Life Member of SNAME and a Fellow of the Royal Institution of Naval Architects and a European Engineer. He has served on SNAME T&R committees since 1967.