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Limited Meaning: Misunderstanding the Role of Class Org

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Abstract: Misunderstandings of the roles, capabilities, standards, and procedures of ship classification organizations have contributed to physical casualties, financial losses, and loss of life of shipboard personnel. The purpose of this paper is to shine light on the actual roles of classification organizations and thereby assist the marine industry in understanding why unchallenged reliance on classification standards and assessments may not be suitable in certain instances.

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Introduction

Structural failures of ships, while infrequent, are of great concern due to the impact on personnel, environment, and contamination of the seas, as well as the financial consequences. Each failure, whether a complete loss or a limited damage scenario, presents an opportunity to learn from it by thorough post-casualty analyses. A major factor in the design of ships is the set of rules, standards and procedures that are prescribed by the classification organization that is involved in the ship construction, ship modification, or ship repair project.

The role of a project's involved classification organization has an historical basis. Namely, classification for commercial ships is primarily due to marine insurance requirements. The marine insurance industry generally does not provide hull and machinery insurance unless an independent agency – not ship owner or ship builder – assesses the design and construction to be worthy of the insurance risk being undertaken by the marine insurers. This was the starting point for the development of classification organizations, starting in 1760 (that is not a typo, yes, 1760).

Gradually, multiple classification organizations developed worldwide. Each one established its own set of rules, standards, and procedures that it would use to measure and assess the suitability of the design and construction of vessels. Knowing those rules and standards would be used to assess the insurability of the vessels, designers and ship builders used conformance to those classification standards as their targets in the design and construction. Generally, designers, ship builders and ship owners understood that achievement of those classification standards would be sufficient to ensure reasonable performance during the life of the vessel.

In many instances, reliance on that understanding of the sufficiency of those classification standards has been inappropriate. It was a misunderstanding. There are multiple factors that have contributed to those misunderstandings of the roles, responsibilities, obligations and sufficiency of the standards and assessments produced by the classification organization.

However, the actual commitments of the classification organizations are not as generally perceived. Compliance with classification standards does not guarantee that the ship is tight,

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staunch, strong, or seaworthy. Rather, the actual commitments of the classification organization are found in the contracts between the classification organizations and their clients.

Accordingly, the purpose of this paper is to shine light on the actual roles of classification organizations and thereby assist the marine industry in understanding why any unchallenged reliance on classification standards and assessments may not be suitable in certain instances.

The Role of Classification Organizations:

As of this writing in 2023, there are eleven (11) major, widely used and recognized classification organizations ("class orgs"), in addition to several lesser used ones. These eleven, in order of their founding dates, are listed in Exhibit 1, below. Together they constitute the International Association of Classification Societies ("IACS").

Exhibit 1 – International Association of Classification Societies

Lloyd's Register	1760
Bureau Veritas	1828
Registro Italiano Navale	1861
American Bureau of Shipping	1862
Det Norske Veritas**	1864
Nippon Kaiji Kyokai	1899
Polish Register of Shipping	1936
Croatian Register of Shipping	1949
China Classification Society	1956
Korean Register of Shipping	1960
Indian Register of Shipping	1975

** Det Norske Veritas merged with Germanischer Lloyd in 2013.

Lloyd's Register

Lloyd's Register, the oldest known class org, describes its founding in 1760 and its purpose in its own publication. (Lloyd's Register, 2023.)

> *To turn back to 1760 is to realise just how much the world has changed since Lloyd's Register was founded. At that time the sailing ship was the only reliable and speedy form of transport and the steam engine's full potential was only just being developed. Industrialisation of the western world had not yet accelerated to encourage the wide-spread exploitation of natural resources such as oil and gas, and the nuclear and jet ages were not even envisaged.*
>
> *The Society for the Registry of Shipping was set up in 1760 by customers of Edward Lloyd's Coffee House in Lombard Street, London. The aim was to give merchants and underwriters recorded information on the quality of their vessels. The Register Book listed vessels rated, or classed, after the condition of their hulls and equipment had been surveyed. The subscriptions generated by the Register Book paid for the surveyors to carry out the work. This was the true beginning of classification and the Society was the world's first classification society.*

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> *Classification was and continues to be all about quality. Put simply, it is an assessment against defined standards of the condition of a ship either under construction or already in existence. From 1768 the Society used a1 to indicate a ship of the highest class. From 1775 A1 was used and is now famous as a symbol of quality.*

Note that the central focus of classification, as defined in that statement, is *"an assessment against defined standards of the condition of the ship …"* This explains why the significance of a class certificate is only that it meets the class org's own interpretation *("assessment")* of its own rules (*"defined standards"*). This is not a criticism of the classification process. Rather, it clearly spells out a fundamental limitation of the significance of a certificate of classification. It does not indicate an assessment that the vessel is tight, strong, staunch or seaworthy.

American Bureau of Shipping

The origins of the current form of the American Bureau of Shipping are also commercially based. The pre-1900 organization (the American Shipmasters' Association) that evolved to become the American Bureau of Shipping had several key functions in the development of the US fleet of east coast commercial ships, including standards for the manning of vessels, some safety issues, and the rating of the quality and durability of ships, among other functions. The manning and safety functions were essentially transferred to government agencies, leaving the ship design and construction assessments as the basis of its business. (ABS, 2016)

Starting in 1900,

> *"[t]he organization [ABS] 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. … 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."*

This excerpt from the ABS publication confirms two important factors. First, it was a commercial-like organization competing with other class orgs for business. (Example: To capture the Great Lakes region's market for ship classification, ABS absorbed a North American branch of Bureau Veritas in 1916.) Second, ABS was led by insurance interests. Initially, ABS's major client was a single insurance entity. But gradually the client base was expanded to other marine insurance organizations. This is not a criticism of ABS, but simply reflects the fact that ABS's growth was fueled by a need to serve the marine insurance industry's requirement for an independent assessment of the designs and construction of the ships it would insure.

Det Norske Veritas

A similar history of development and business relationships had also developed the foundations for class orgs in other western countries. (DNV, 2023)

> *Det Norske Veritas (DNV) was founded as a membership organization in Oslo, Norway in 1864. Norway's mutual marine insurance clubs banded together to establish a uniform set of rules and procedures, used in assessing the risk of underwriting individual vessels. The group aimed to provide "reliable and uniform classification and taxation of Norwegian ships".*

This excerpt from DNV, again, emphasizes that the purpose of the formation of this class org was to serve the needs of the marine insurance industry. It would be done using *"a uniform set of rules and procedures"* developed by DNV. The foundational relationship between class orgs and marine insurers is central to understanding the role of them.

Also, illustrating the commercial-like and competitive nature of its business, DNV merged with another class org, Germanischer Lloyd, in 2013. Prior to that merger, DNV had acquired several commercial consultancies having specialist practices in the marine industry. Similarly, before the DNV/GL merger, GL had acquired commercial consultancies serving other segments of the marine industry. Similar histories of the commercial-like activities other IACS member organizations can be cited.

Classification: A Business Organization

Class orgs are commercial businesses; they are not government organizations. The employees of class orgs are not government employees. The revenues received by class orgs do not go into the coffers of governments. Some of the world's class orgs enjoy the non-taxing benefit of being registered as a charity or tax-free (not-for-profit) entity; but that does not alter the fact that they are commercial-like, non-governmental entities.

Class orgs are supported by the fees they are paid in accordance with the agreements or contracts they have with their clients. Class orgs have sought to increase their size and revenues by marketing themselves to owners of previously unclassed vessels. Although the class orgs started as an adjunct to the marine insurance industry for commercial vessels, they now also regularly provide their services to government organizations. Those client government organizations include governmental owners of ferries, search and rescue vessels, coast guards, naval auxiliary ships, and naval combatants, among others. This has proven to be a significant addition to their annual revenues.

Further, although class orgs started as being part of the marine industry, some of them now provide classification services to land-based industrial facilities, including the non-marine oil, gas, chemical, and power generation sectors.

This appreciation of the fundamental characteristic of class orgs as business entities, not altruistic charities or providers of government services, is not meant to be a negative characterization. Rather, it is provided only to point out that reliance on the products (i.e., certifications) and services of class orgs do not merit uncritical acceptance, but rather should be used with the same caution that any other commercial products and services are developed and provided.

Most importantly, those products and services should be accepted as useful only within the limits of their applicability as spelled out in the contracts between the class org and its client. Those contractual limitations of usefulness and applicability represent the class org's risk minimization technique – a reasonable business practice. As illustrated by examples described in this paper, those contractual limitations often mean that uncritical reliance on the class org's products and services is misplaced and can lead to a disappointing -- or possibly disastrous – outcome.

Qualifications of Classification Staff

Every class org has a staff of engineers and analysts who are well educated in their respective fields. The staffs often include persons holding higher degrees in specialized fields of study and analysis. The class orgs sometimes re-examine their own rules *("defined standards")* of *"assess-*

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ment" used to rate the quality of a ship to determine if modification of those rules is merited. Class orgs hire naval architects, marine engineers, structural engineers, materials engineers, and persons qualified in other similarly specialized fields that are applicable to ships (and sometimes other forms of structure).

However, the individual staff members of class orgs do not inherently possess greater skills, greater understandings, deeper insights or greater experience than do the staff members of other commercial consultancies or government agencies. Class org staff members do not inherently have skills that are not available to the staff of a commercial consultancy or a government agency.

The significance of this appreciation is that reliance on class orgs as the source of the most appropriate analyses and detailed design decisions is not merited. Class orgs do not have all the correct answers. Class orgs have their rules which may lead to results that have not been as thoroughly developed as other entities may expect. As illustrated by the rudder stock example and the *MOL Comfort* example below, such reliance may constitute a misunderstanding that can lead to significant negative consequences.

Yacht Rudder Stocks

An example of possibly misplaced reliance on class orgs pertains to the dimension of rudder stocks on production sailing yachts, as identified by Dr. K. Klaka (Klaka, 2020). There are three published standards that provide a methodology for determining an appropriate diameter of the rudder stock for a specified type and grade of material (stainless or aluminum). The standards are published by two class orgs and ISO. For a specified vessel design, the three methodologies result in approximately the same rudder diameter. Such commonality of results appears to give credibility to each of them.

However, historically, the rudder stocks incorporated into such yachts have experienced a high failure rate, as described by Klaka (2020). It is noted that rudder stock failures occur on "close to 1%" of all ocean crossings (Casey, 2017). The 1998 Sydney/Hobart race had a 2% rudder failure (CYCA, 1999). Also, 6% of the yachts in the 1979 Fastnet race experienced rudder failures (Forbes *et al*, 1979).

These constitute a significant failure rate, yet the methodologies used to determine the size of the yacht rudder stocks appear to be relied upon because they are published by class orgs and ISO. The 2020 analysis by K. Klaka proposes a modification to the methodologies, in which different fundamental assumptions about possible boat speed (when coming down off a large wave) and a particular force coefficient merit re-examination. In other words, designers of rudder stocks for those yachts have relied on possibly misleading design criteria simply because those criteria are published by class orgs and ISO.

That is, because those standards are published by those organizations, they have been assumed to have adequate credibility, leading the yacht-designing naval architects to not undertake their own, independent analyses, as Dr. Klaka has done. Notably, the actual number of experienced rudder failures appears to indicate that those methodologies result in misleadingly insufficient results.

As noted previously, the engineers and analysts employed by class orgs do not inherently possess greater insights, more advanced methods, or deeper understandings of the science of naval architecture than any other equally educated and qualified naval architects. Reliance on a class org's standards and rules is misplaced if such reliance is based on a fundamental misunderstanding

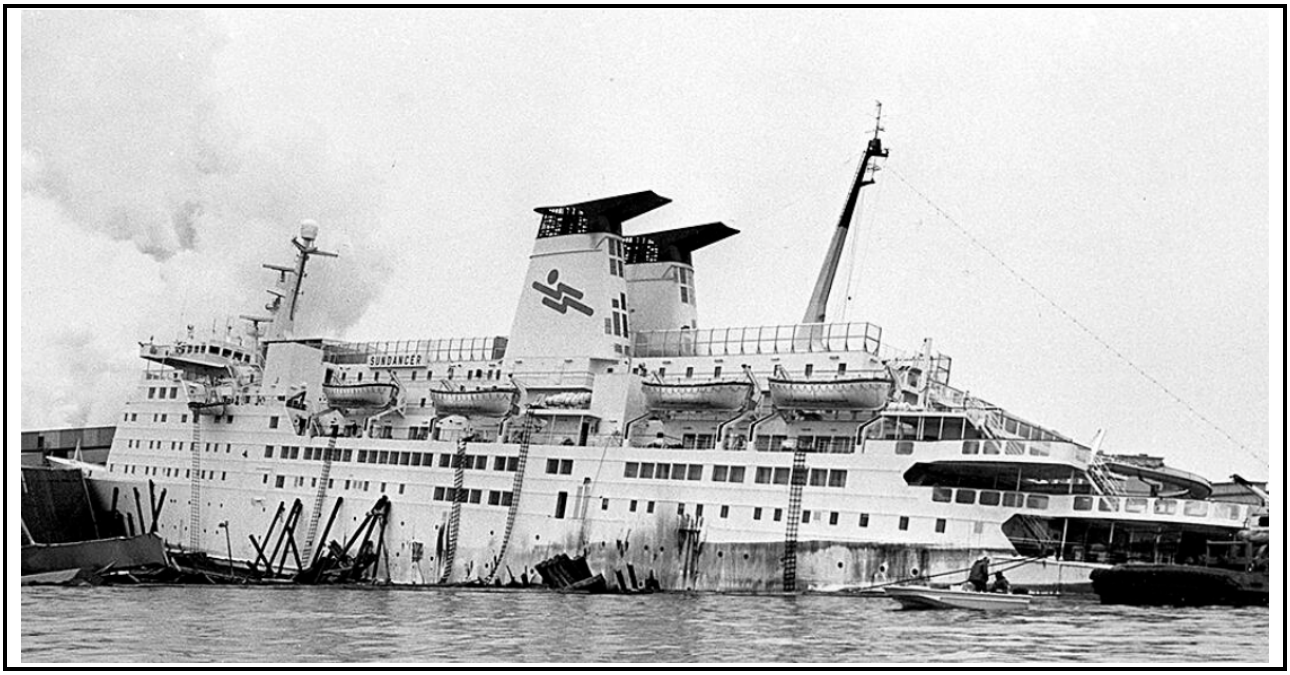
that ascribes to classification's engineers and analysts greater capabilities than other qualified engineers and analysts. Apparently, just because classification advocates a methodology does not guarantee it is correct or appropriate.

Limited Significance of Classification Certificates

Assumptions regarding the nature and extent of obligations that arise from the issuance of certificates of classification are, more likely than not, misunderstandings. The misunderstandings are *not* those of class orgs. They are misunderstandings of other parties involved in the ownership, construction and maintenance of ships. The conclusions drawn from the following *Sundancer* example are far from unique to this case.

The *Sundancer* foundered after striking rocks soon after it was converted from being a North Sea ferry to become a cruise ship. The immediate extent of damage was within the allowable floodable length, meaning that the water ingress should not have resulted in complete sinking. However, as described below, the vessel subsequently experienced progressive flooding into other compartments. As seen in **Exhibit 2**, the vessel sank onto the seabed by a pier due to insufficient watertight integrity that was not noticed by the class org that had issued a certificate of classification and had issued a certificate of compliance with applicable SOLAS regulations.

Exhibit 2: *Sundancer* at Roberts Bank, British Columbia, Canada in July 1984



The following indented sections are the words of the US Court of Appeals (Court of Appeals, 1993). The order of the selected paragraphs has been modified, and references to law and prior court cases are omitted to make these excerpts serve the limited purpose of illustrating the misunderstandings arising from the role of classification.

> *In early 1984 Sundance purchased an overnight car ferry and converted it at a Swedish shipyard into a luxury cruise ship capable of making week-long voyages along the west coast of North America, with accommodations for over seven hundred passengers.*

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On March 5, 1984, Sundance formally retained ABS by executing … an agreement denoted "Request for Classification Survey and Agreement". By that agreement, ABS was engaged to inspect the vessel to determine its compliance with ABS class rules and to perform regulatory checks on behalf of the Bahamian government in connection with the issuance of [applicable] statutory and class certificates. Classification of a vessel by ABS represents that the ship has been found structurally and mechanically fit for a particular use or service in accordance with ABS rules and standards.

ABS representatives were on site during some portions of the conversion process in the Swedish shipyard. Sundance provided ABS with many plans for the vessel, although for some reason no plans for the grey-water piping system, which channels water from the ship's showers and sinks, were ever provided. Inspections of the converted ship took place in Sweden and on board the vessel during its initial voyages.

On June 14, 1984, acting on behalf of the Bahamian government, ABS issued a five-month provisional Load Line certificate and a SOLAS passenger ship safety certificate to the vessel. The SOLAS certificate represented, among other things, that the vessel possessed the water-tight integrity required by the SOLAS Convention. Shortly thereafter, ABS issued a provisional classification certificate to the vessel, which represented that the vessel was in compliance with ABS's rules, including rules on the watertight integrity of vessels.

On June 29, 1984, the luxury cruise ship SUNDANCER struck an underwater rock off the coast of British Columbia and sank.

The SUNDANCER was a two-compartment ship, meaning that it could survive the flooding of any two of the watertight compartments of its thirteen. When the SUNDANCER struck the underwater rock, its hull was breached below the waterline. While only two watertight compartments initially flooded, progressive flooding of other compartments occurred when water passed through two holes in bulkhead 124 and through the unvalved grey-water system. As a result of the progressive flooding, the vessel listed heavily and eventually sank at a nearby pier.

The absence of valves in the grey-water system was a SOLAS violation; the two holes in bulkhead 124 were a violation of both SOLAS and ABS's rules. Neither violation had been reported by ABS. The SUNDANCER was declared a constructive total loss, and some passengers and crew members were injured. Fortunately, no lives were lost.

Sundance claims that the vessel would not have sunk but for ABS's (1) negligence, (2) gross negligence, (3) negligent misrepresentation, (4) breach of contract, and (5) breach of [an] implied warranty of workmanlike performance in issuing the relevant certificates …. ABS was paid a fee of $85,000 under the contract. Sundance seeks actual and punitive damages totaling $264,000,000.

First, the great disparity between the fee charged ($85,000) by ABS for its services and the damages sought by Sundance ($264,000,000) is strong evidence that such a result was not intended by the parties. We can only conclude that the small fees charged could not have been intended to cover the risk of such liability; the ship classification industry could not continue to exist under such terms (… "fact that price [charged] is relatively small suggests that it was not intended to cover the risk of such liability").

> *Second, and probably most significantly, the shipowner, not ABS, is ultimately responsible for and in control of the activities aboard ship. In the case of the SUNDANCER, for example, Sundance had full responsibility for the conversion, repairs, and maintenance of the vessel. This ongoing responsibility for the vessel is supplemented by the maritime-law requirement that the shipowner has a nondelegable duty to furnish a seaworthy vessel. ABS cannot be said to have taken over Sundance's obligations in this regard by agreeing to inspect and issue a classification certificate to Sundance.*
>
> *We affirm the district court's dismissal of all of Sundance's tort and contract claims against ABS. … In addition, Sundance did not provide any evidence that it suffered damage from ABS's issuance of the classification certificate [that would not otherwise have been encountered]; Sundance may not create a condition of unseaworthiness, exercise all control over the reconstruction and servicing of the vessel and then burden a classification society with liability that is seven hundred times that of the fee for the classification contract.*

Clearly, the actions of ABS did not meet the expectations of the ship owner that retained ABS. The court determined that the actions of ABS in issuing certificates of class and SOLAS compliance were erroneous, but nevertheless did not cause the fatal progressive flooding. The actions of ABS were found to not have relieved the vessel owner of the fundamental obligation to ensure that the vessel was seaworthy. This example, among others that could be cited, reminds the marine industry that classification does not serve to relieve others of their fundamental obligations.

Moreover, the contracts between class orgs and their clients serve to define the limited purposes and objectives of the products and services provided by the class orgs. In other words, classification means only that the vessel reasonably complies with the class org's own interpretation of its own rules, and no other organization can make such interpretations to determine if the vessel merits being classed.

Competition: The Origin of Common Structural Rules

As noted above, class orgs are commercial institutions. Further, class orgs compete with one another. Sometimes that competitive marketing of a class org's services can lead to unexpected and possibly disastrous results. When a major corporation is in the process of enlarging its fleet, often two or more class orgs each seek to be retained to be the one that will issue the new vessels' classification certificates. Class orgs also will review the entire material selection and manufacturing process of items of equipment used for ships, to allow the manufacturer to market its products as being acceptable for ship classification purposes. This earns the class org additional fees. But first, the class org must be selected by the ship owner to be the class org for those vessels.

Historically, the rules and standards of the class orgs were not uniform. Each class org developed its own rules and standards that would minimize the risk undertaken by marine insurers for having insured against damage or loss of the vessels due to insufficient design, construction, or maintenance of the vessels.

As the size of ocean-going tankers grew in the 1970s to 1990s, the financial and environmental consequences of a vessel loss also grew, both categories of which had to be addressed by marine insurers and their client ship owners. Concurrently, to capture a larger share of the market demand for classification of tankers, the class orgs realized that they could compete in a particular

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manner. That form of competition focused on the total weight of steel that was determined appropriate for those large tankers. It was appreciated that if the steel weight of a large tanker could be reduced, the cargo carrying capacity could be reciprocally increased. That is, for every 100 tons of steel weight reduction, the ship could transport an additional 100 tons of cargo, resulting in greater revenue and profit for the ship owner. Lower capital costs were also realized by the lighter ships.

As a consequence of these realizations, especially as it pertained to large tankers, some of the class orgs modified their structural rules to allow less steel weight. For example, a ship that would have, say, 24,000 tons of steel under one class org's rules might need only 23,640 tons of steel under a different class org's rules – a 1.5% reduction in lightship weight – resulting in a corresponding increase of 360 tons of cargo capacity. This competitive "shaving" of steel weight had consequences. Namely, tanker owners and their marine insurers began to see disproportionately increased vessel structural damages and losses. By the 1990s, associations of tanker owners began to consider developing their own class org that would not be competing with other class orgs to ensure the structures of their tankers were adequately robust to reduce losses.

Faced with the possibility of losing a significant portion of their classification business, the members of IACS determined that it would be necessary to have a non-competing set of common structural rules for those large tankers. If such common structural rules were implemented, they would no longer face the possibility of losing tanker owner clients. This was accomplished by the IACS members, as noted in an IACS publication. (IACS, 2023).

> *On 14 December 2005 the Common Structural Rules for Double Hull Oil Tankers (CSR-OT) and Common Structural Rules for Bulk Carriers (CSR-BC) were unanimously adopted by the IACS Council for implementation on 1 April 2006. The Council was satisfied that these Rules were based on sound technical grounds, and achieved the goals of more robust and safer ships.*

> *These two sets of Rules were developed independently and in order to remove variations and achieve consistency, IACS decided to harmonise these Rules. There is now a single set of Rules "Common Structural Rules for Bulk Carriers and Oil Tankers" (CSR BC & OT) comprising of two parts; Part One gives requirements common to both Bulk Carriers and Double Hull Oil Tankers and Part Two provides additional specialised requirements specific to either Bulk Carriers or Double Hull Oil Tankers.*

In other words, that IACS publication implicitly acknowledges that the prior competition among the class orgs did not always result in adequately *"robust and safer ships."* By removing variations of the structural weights amongst the class orgs, they would now *"achieve consistency,"* i.e, eliminate competitive weight shaving that endangered the ships. Prior to the IACS adoption of common structural rules, ship owners and their marine insurers had relied on the suitability of each class org's structural rules. But this was a significant misunderstanding that resulted in vessel structural damage and losses, environmental damage, as well as personnel losses.

However, typically the class orgs were not held accountable for those losses, in whole or in part, because the contract between each class org and its client ship owner typically stated that the issuance of a certificate of classification meant only that the design, construction and maintenance of the vessel reasonably complied with the class org's own interpretation of its own rules, and specifically did not guarantee that the vessel was tight, staunch, strong or seaworthy.

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Lesson of the *M/V MOL Comfort*

The 8110 TEU container ship *MOL Comfort* was constructed in Japan, owned by a Japanese firm, but registered in Bahamas. The ship experienced a compression and buckling at the lower midship hull while transiting the Indian Ocean in June 2015. At first, the two halves of the hull remained joined, as shown below in Exhibit 3. Within a few days, the actions of the sea on the vessel caused the two halves to separate and subsequently sink.

Exhibit 3: Buckled *MOL Comfort* Before Separation of Hull Sections

Close-up photos of the side of the still-joined halves of the hull show that the main deck remained connected, but that the double bottom had buckled, allowing the ship to take the shape shown in Exhibit 3. Analytical reports identifying the cause of the structural failure were performed by several organizations, including ClassNK that had classed the vessel continuously since its construction five years earlier in 2008. (Class NK 2014) (Bahamas 2020). Documentation during construction showed that the structure of the *MOL Comfort* had been in accordance with the intended design, including all structural components and their welded joints.

Post-casualty investigations included examination of the structural condition of several sister ships. They were found to have experienced the commencement of buckling in their double bottoms. The several sister ships were temporarily taken out of service to have structural modifications that would prevent such buckling to commence or continue.

ClassNK confirmed that the scantlings (steel thicknesses and connections) were based on anticipated vertical flexing of the hull ("hogging" and "sagging") from hull encounters with waves. The strength and fatigue life calculations assumed the hogging and sagging would be roughly equal, with the vessel having an at-rest position of a level keel.

This level keel assumption proved to be erroneous. It was determined that due to the routine method of cargo loading, the hull would normally be in a hogged condition, creating longitudinal compressive forces on the double bottom. Typical loading was with greater cargo loads fore and aft while the majority of buoyancy was near midships. That is why the typical loading would create

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a hogged configuration, not a level keel, thereby increasing the longitudinal compressive stresses in the double bottom. This appears to have been an erroneous assumption by the involved class org (and possibly other class orgs, as well).

A second factor contributing to the structural failure was the determination that, as the ship proceeds through significant waves, the vessel also flexes horizontally. In fact, this phenomenon can be seen in a video tape from the *MOL Excellence,* which is slightly shorter than the *MOL Comfort.* In that video, a camera is secured on the aft bulkhead of the box girder just below the main deck. The box girder has no intermediate transverse bulkheads, allowing the camera to focus on the collision bulkhead about 150 m forward.* That video clearly shows that the hull is flexing horizontally as well as vertically as the vessel proceeds through an oblique sea.

The horizontal flexing introduces alternating tension/compression stresses at the midship outboard portions of the double bottom as well as at the main deck. These horizontally induced stresses do not necessary occur concurrently with the vertically induced stresses. But when they do occur concurrently, the stress levels are much higher than those arising from only vertical flexing and an assumed level keel basis. Those horizontally induced stresses also serve to increase the number of flexes that the affected structure encounters, thereby reducing the fatigue life of the affected structure. ClassNK appears to acknowledge that these stresses from horizontal flexing were not considered when developing the rules for containership structural design.

The Japanese governmental Committee on Large Container Ship Safety that also included ClassNK, joined by Bahamas Maritime Authority, made recommendations to the IMO Maritime Safety Committee in 2015. The recommendations included the necessity of addressing the lateral loads (horizontal flexing) that would be experienced in addition to the consequences of vertical flexing when considering the hull girder strength.

An IACS statement responding to that June 2015 submission to the IMO Maritime Safety Committee included the following in 2015.

> *[The proposed revision to the standard] relates to the bi-axial stresses which would be induced by lateral loading, i.e. external pressure on the bottom shell. Most, if not all, IACS Members have for many years addressed these bi-axial stresses in their individual rules and procedures. However, to ensure that in the future all IACS Members consider this effect in a consistent way, text has been included in the new IACS Longitudinal Strength Standard for Container Ships …*

This appears to be an implicit acknowledgement that hull strength calculations made by IACS members may not have included consideration of the described bi-axial flexing of the hull girder and the residual hogging of the vessels. In other words, the rules and procedures class orgs had been applying to proposed containership design and construction were based on an insufficient understanding of the actual conditions that would be encountered.

This description of the loss of the *MOL Comfort* reinforces the previous observation regarding the analytical capabilities and engineering practices used by class orgs to develop their rules, standards, and procedures. Specifically, a class org's capabilities and practices are not superior to those achievable from other consultancies and governmental agencies. Further, reliance on such a fundamental misunderstanding as to a class org's capabilities may be a predicate to damage

* The 38 minute video on the *MOL Excellence*, time compressed to 2.7 minutes, shows that the hull is flexing horizontally as well as flexing vertically. https://www.youtube.com/watch?v=rHlEXn37dVg

and/or loss of vessels and personnel. Lastly, as seen in the discussion regarding yacht rudder stocks, commonality of results from several class orgs' rules does not "prove" they are correct.

Summary of Common Misunderstandings about Classification

(a) The benefits of the products (certificates) and services provided by a class org are limited to only those benefits that are described within the contract between a class org and its client. It is a misunderstanding of the significance of that contract to expect any other benefits.

(b) Typically, the contract between a class org and its client limits the meaning of a vessel's classification to a representation by the class org that the design, construction, and maintenance of the vessel reasonably complies with the class org's own interpretation of its own rules, standards, and procedures. It is a misunderstanding by the client of a class org to believe that the classification status assures to any extent that the vessel is tight, staunch, strong or seaworthy.

(c) Achievement of compliance with the class org's rules, standards and procedures may be necessary to obtain marine insurance on the vessel, but such compliance is not necessarily sufficient to achieve a vessel's expected operational characteristics and long-term capabilities. It is a misunderstanding of this limitation to believe that nothing more than such minimal compliance is needed for ship owners to achieve their ownership goals.

(d) It is a misunderstanding to believe that by awarding a classification to a vessel, the class org has assumed any responsibility relieving the shipowner of its nondelegable duty to furnish a seaworthy vessel.

(e) The professional qualifications and expertise of a class org's engineers and analysts are not inherently superior to those of similarly educated engineers and analysts at other consultancies and within governmental organizations. It is a misunderstanding of that lack of inherent superiority to rely on class org analyses and standards instead of those of other similarly qualified engineers and analysts.

(f) Class orgs are simply commercial consultancies providing independent analyses of the design, construction and maintenance of vessels owned and operated by other entities. Regardless of the name or title it gives itself, a class org is only an independent consultancy. It is a misunderstanding to equate the products and services of a class org with those of a governmental agency.

(g) Class orgs compete with one another for business, even when they are not competing on structural design matters, as in the use of common structural standards. It is a misunderstanding to believe that each class org provides products and services that are equivalent to those provided by competing class orgs. They are no more equivalent than are mechanical components from different manufacturers.

(h) Some class orgs provide reporting services to governmental organizations that are substitutions for the use of government surveyors and inspectors. These reporting services, effected through a contract (a.k.a. memorandum of understanding), do not replace the governmental organization's authority to determine compliance with applicable regulations and laws. Those services are separate from the class org's normal form of classification services. It is a misunderstanding to believe that a class org can stand in the shoes of a governmental organization when the class org is only reporting, separate from classifying per its own rules and standards.

(i) The rules, standards and procedures used by class orgs to assess suitability for classification are not necessarily sufficient for their intended purposes. On multiple occasions, the rules, standards, and procedures used by class orgs have been found to be insufficient for a vessel to achieve the expected operational characteristics and long-term capabilities. It is a misunderstanding to believe that such rules, standards, and procedures never need to be revised, amended, changed, or replaced in order to be appropriate. This is especially relevant as new technologies are introduced into the industry as well as when existing technologies are extended into areas that have not previously utilized those technologies. Also, this is equally relevant when new forms, shapes, and functional capabilities of vessels are being developed.

(j) Commonality of designs that concurrently minimally satisfy the requirements of multiple class org's does not constitute proof that the rules, standards, and procedures of those class orgs are sufficient. It is quite possible that different class orgs make the same erroneous assumptions when engaging in complex analyses. It is a misunderstanding of the limitations of analyses based on possibly erroneous assumptions to disregard the possibility that several class orgs can be simultaneously wrong about the same subject (e.g., *MOL Comfort,* yacht rudder stocks).

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