ClassNK Magazine

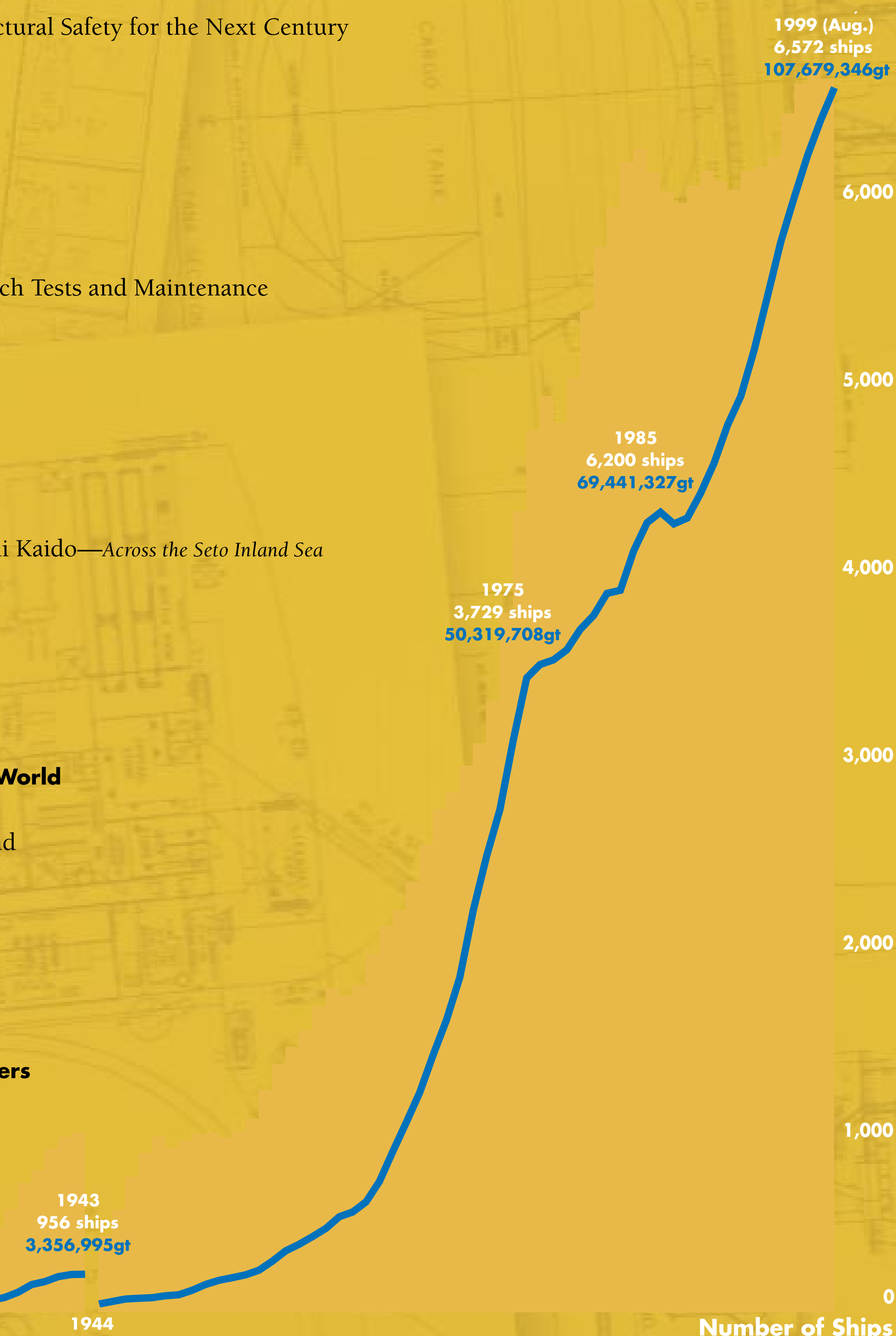
1999

51st Edition

100th Anniversary

Commemorating 100 Years of Dedication to Maritime Safety

Contents



1920
2 ships
4,694gt
1943
956 ships
3,356,995gt
1944
1975
3,729 ships
50,319,708gt
1985
6,200 ships
69,441,327gt
1999 (Aug.)
6,572 ships
107,679,346gt
6,000
5,000
4,000
3,000
2,000
1,000
0
Number of Ships

A Message from the Chairman

The Technical Organization ClassNK Embarks on Its Second Century

Tadashi Mano, Chairman and President

Our Society celebrates its 100th anniversary this year. With some 20% of the world's commercial fleet under class, we greet this momentous occasion as one of the world's largest classification societies. Through the years, the Society has survived many challenges, such as the sinking of a large portion of the ships on its register during the Second World War, the depression of shipbuilding due to the two oil shocks of 1973 and 1978, as well as other decidedly turbulent times. Yet, the Society has persevered to reach its current position as a world leader in ship classification. Recently, ClassNK has published and distributed a centenary history of its development entitled *A Class Act: the History of ClassNK 1899 to 1999,* which traces the path of the Society from its earliest days of formation and growth to the present. Thus, it is a tremendous honor for me to be a member of the Society at this momentous juncture in its history.

I believe that the Society has been able to achieve its continued growth over the years to today, because it has always been unfailing in its efforts to keep pace with the advance of science and technology as well as the progress of internationalization. During this process, the Society has always striven to improve the quality of the services that it provides.

The technical strength of the Society is judged by the increasing level of the rationalization of its Rules, the survey skills of its surveyors, and the reduction in casualties, which is a reflection of the high level of quality of the ships on its register. As discussed in the "Technical Essay" of this Magazine, the major revision of the *Rules and Guidance for the Survey and Construction of Steel Ships* currently being undertaken is aimed at improving the Rules in order to make them more flexible, balanced, and transparent. This will serve to make it easier for them to be applied to a broader range of cases, including new designs and technologies. This new revision to the Rules will also take into account recent research and development concerning loads, structural response, strength evaluation, corrosion margins, and the like.

Similarly, with regards to the progress of internationalization, the Society actively contributes to the International Association of Classification Societies (IACS) and the International Maritime Organization (IMO), is enhancing and expanding its service network of offices overseas, and has been evolving into an organization which is more responsive to the international environment. While extending its base, i.e., the infrastructure supporting its service delivery, the Society is continuously striving to provide the highest possible level of quality service to its global clients.

Currently, information technologies are becoming increasingly prevalent throughout the marine industry. Our Society is also reaping the benefits of this trend, and is working to enhance its own IT-related services. A wide range of results in this area has been achieved this past year alone. These include, for example, expanding the operational functionality of the ship information search service called NK-SHIPS, (which provides information concerned with the survey status, history, and particulars of NK-classed ships), so that it can now be accessed using the Internet. In addition, the Society has prepared and released a CD-ROM demonstration version of the *PrimeShip-HullExpert* software package, which draws upon the survey reports of NK surveyors to provide extensive information on hull structures in a readily accessible and convenient database. This CD-ROM demo version is being distributed to anyone interested in having a copy. Yet another IT-related service being provided by the Society is information on its homepage concerning the Year 2000 (Y2K) compliance status of equipment and computer-embedded devices installed onboard ships that could potentially be affected by the Y2K problem.

In a world in which information technologies are being developed to ever higher levels and where the information age is coming to play an ever more important and central role, the Society is pursuing its efforts to digitize the information which it has, and to provide information that meets the needs of its clients. Further, because it is necessary to ensure that information can still be provided even in the event of an emergency, the Society is currently building a new Information Center with the aim of protecting information from calamities or disasters, such as a major earthquake, as part of its efforts to better organize and rationalize its information systems.

In these and other ways, the steady efforts being made by the Society toward the next 100 years will, I believe, make it possible to provide more effective and thorough surveys which will inspire client trust, as well as offer an overall level of service capable of satisfying all clients, while at the same time enhancing the quality of each individual surveyor so that we can better meet the needs of all our clients.

Technical Essay

Research on Ship Structural Safety for the Next Century

1. Background

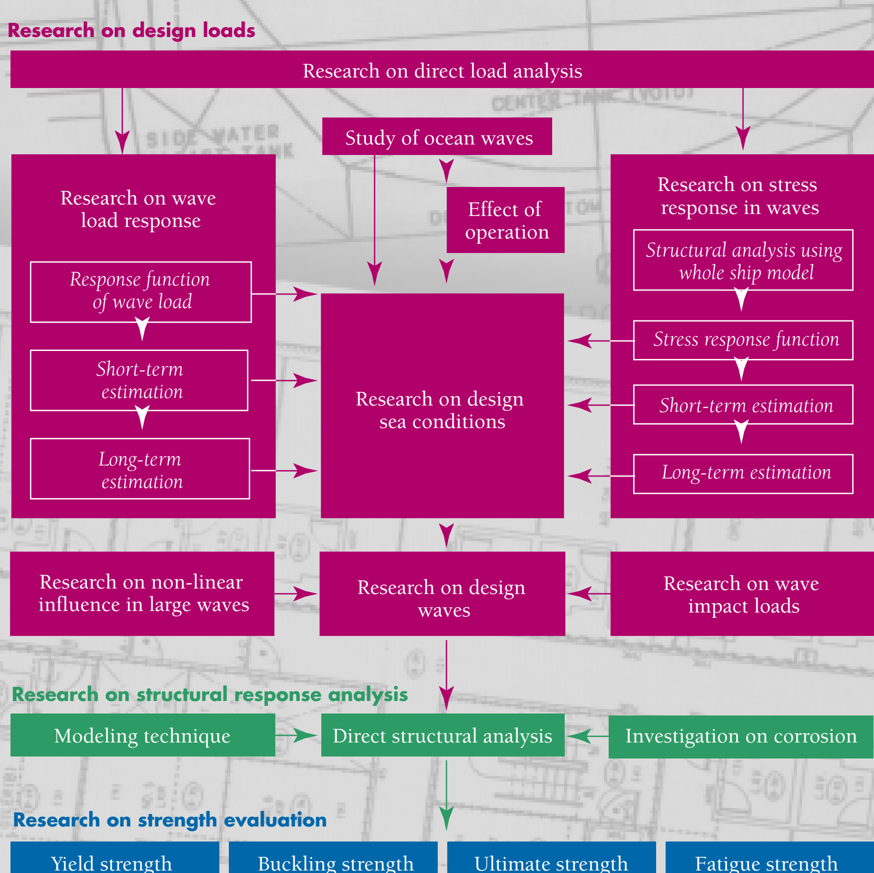
Ever greater expectations are being placed on the enhancement of the safety of ship structures by the shipbuilding industry, maritime community, and related interests. Within this context, the role which classification societies are expected to play will become increasingly important in the future. In this regard, the rules of a classification society are extremely important as the key tools in achieving these goals. Although the rules of a classification society incorporate the most recent technologies in their coverage, at the same time they are also expected to reflect the needs of the shipbuilding and maritime communities. Therefore, it is necessary that the basis and background of the rules be clear and that the understanding of all concerned is ensured by making the rules open to the public. In addition, the classification society must always monitor and demonstrate the effectiveness of the rules.

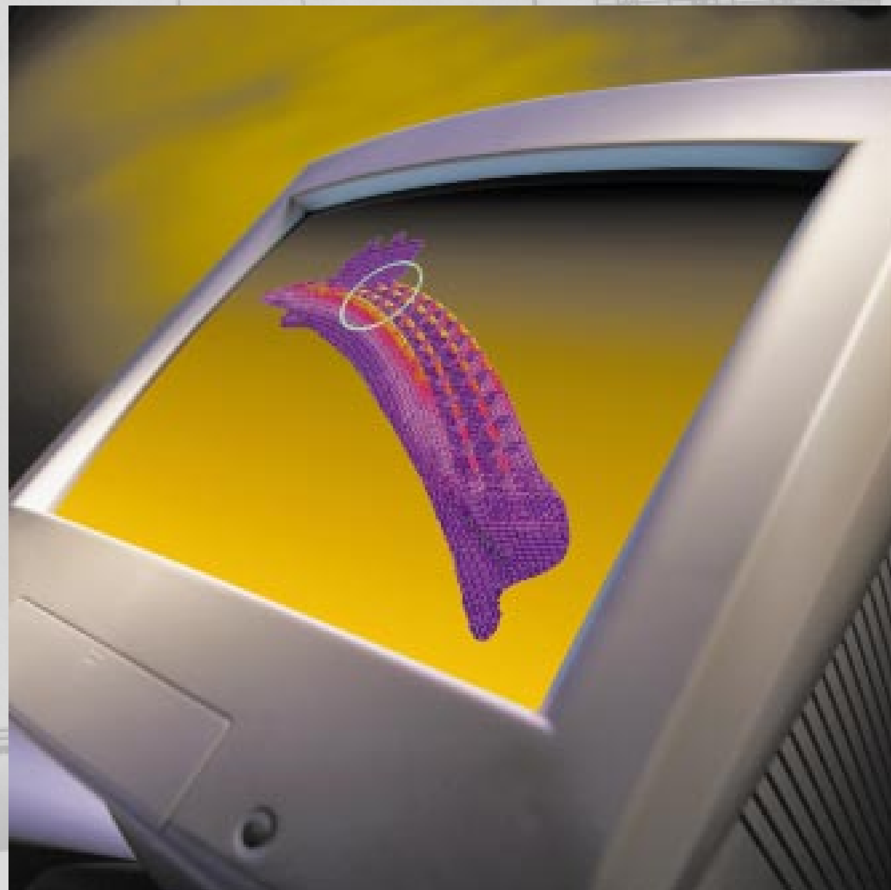
Ships are very complex structures compared with other types of structures. They are subject to a very wide range of loads in the harsh environment of the sea. As a result, it is difficult to prepare rules on the basis of theoretical analysis alone. The majority of actual structural rules of classification societies are based on the results of technical progress backed by many years of accumulated experience. The technical basis and background for the rules are at present not easily nor readily understood by those outside the process of rule development. The Society has come to recognize the need to review basic requirements concerning strength, based on current technical knowledge and past experience, in order to promote the safety of ships for the 21st century. With the marking of its 100th anniversary this year, the Society sees this as an excellent opportunity to strengthen the technical base of its current and future activities in a proactive manner.

Progress in technologies related to ship design and construction is being made daily, at an unprecedented pace. A notable example is the fact that the efforts of a majority of specialists, together with rapid advances in computer and software technology, have now made it possible to analyze complex ship structures in a practical manner using structural analysis techniques centering on finite element method (FEM) analysis. The majority of ship designers strive to develop rational and optimal designs based on direct strength analysis methods using the latest technologies in order to realize the various specifications ordered by shipowners to a high level. Moreover, when designs arise for novel structural ship forms, for which there is no prior experience, attempts are also being made to prepare designs through the application of direct strength analysis based on direct load analysis.

When carrying out direct strength analysis in order to verify the equivalence of structural strength with rule requirements, it is necessary for the classification society to clarify the strength that a hull structure should have with respect to each of the various steps taken in the analysis process, from load estimation through to strength evaluation. In addition, in order to make this a practical and effective method of analysis, it is necessary to give careful consideration to more rational and accurate methods of direct strength analysis.

● Fig. 1 Conceptual flow of research on direct strength evaluation and analysis methods





Based on a recognition of this need, extensive research has been conducted into and a careful examination made regarding the strength evaluation of hull structures. The results of this work are being compiled and will be reflected in the publication of a *Technical Guide Regarding the Strength Evaluation of Hull Structures* scheduled to be released at the end of this year. This article presents a brief overview of some of the main results obtained from this research into direct strength evaluation (see Figure 1).

2. Research into Direct Strength Evaluation Methods

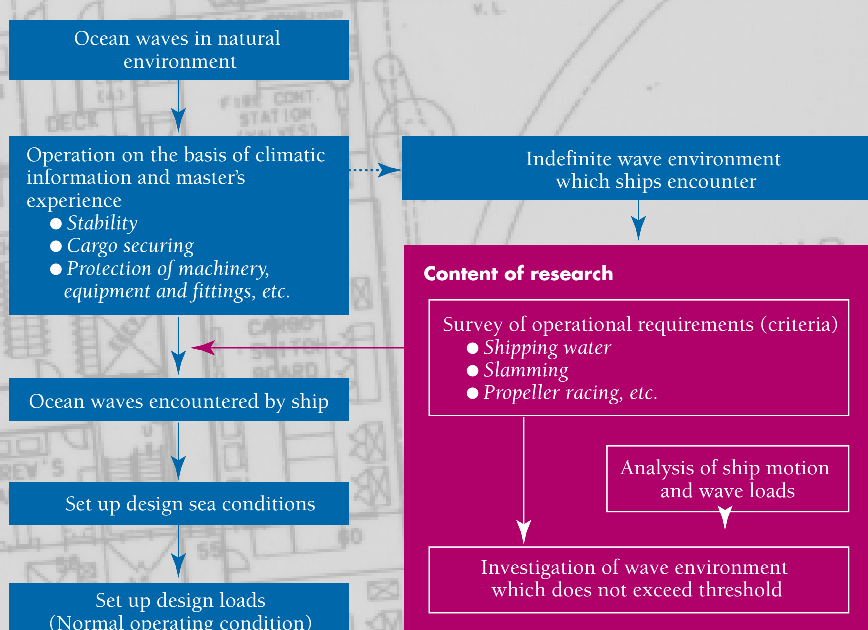
1) Design Loads

Wave loads are one of the most important loads acting on a ship. The acceptability or quality of analyses of these types of loads greatly influences the effectiveness of the strength analysis of a structure. The wave loads acting on a ship in a marine environment are extremely complex compared with the load conditions to which other types of structures are subjected. Moreover, the fact that a ship is a mobile structure which is operated by humans makes load analysis even more difficult when estimating strength.

In order to analyze the various types of loads acting upon a ship accurately, it is necessary to examine the characteristics of the loads acting on a ship under given wave conditions. This includes examining the wave conditions encountered by a ship, the motion response characteristics and structural response characteristics of the ship, as well as the mutual relationship between these loads and the responses of the hull structures to them.

When estimating the wave loads acting on a ship, it is first necessary to estimate the wave conditions being encountered by the ship accurately. This consists of conducting numerous studies into the height and frequency of waves occurring at sea and compiling statistical data on waves. At the same time, however, the master of most commercial ships selects the route of the ship based on forecasts about the weather along the course and his or her experience regarding the route up to that time. Consequently, the wave conditions actually encountered by the ship along its route may be considerably different from the statistically defined wave conditions occurring in the natural environment. Hence, in order to

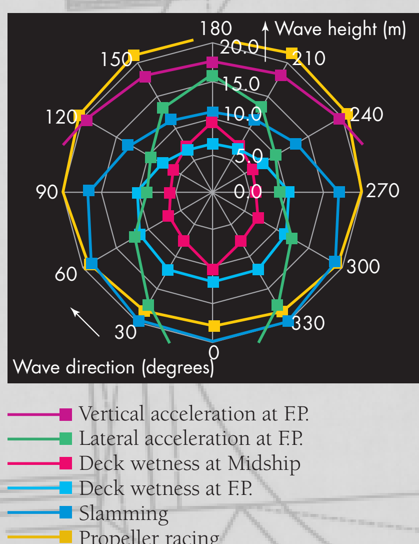
● Fig. 2 Design loads and the general wave environment encountered by ships

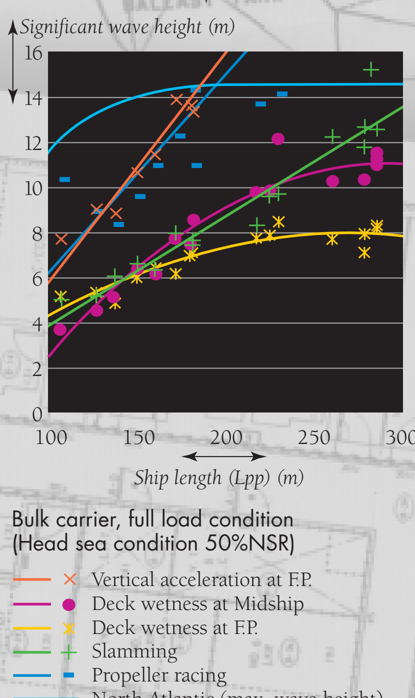


● Fig. 3 Example of research into the operational environment of a ship

Factor	Threshold: Critical value	Threshold: Probability
Vertical acceleration at Midship	0.45g	10^{-3}
Vertical acceleration at F.P.	0.8g	10^{-3}
Lateral acceleration	0.39g	10^{-3}
Deck wetness at Midship	Freeboard	10^{-1}
Deck wetness at F.P.	Freeboard	10^{-1}
Slamming	Draft	10^{-2}
Propeller racing	D/3 exposed	10^{-1}

F.P.: Fore Peak



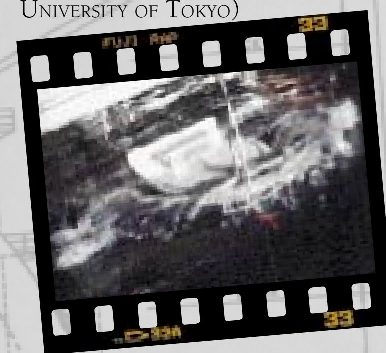


estimate the wave conditions that an average ship actually encounters and that are necessary when determining design loads, the Society conducted a study into the impact of maneuvering and ship operations under various wave conditions on ship response, as shown in Figures 2 and 3.

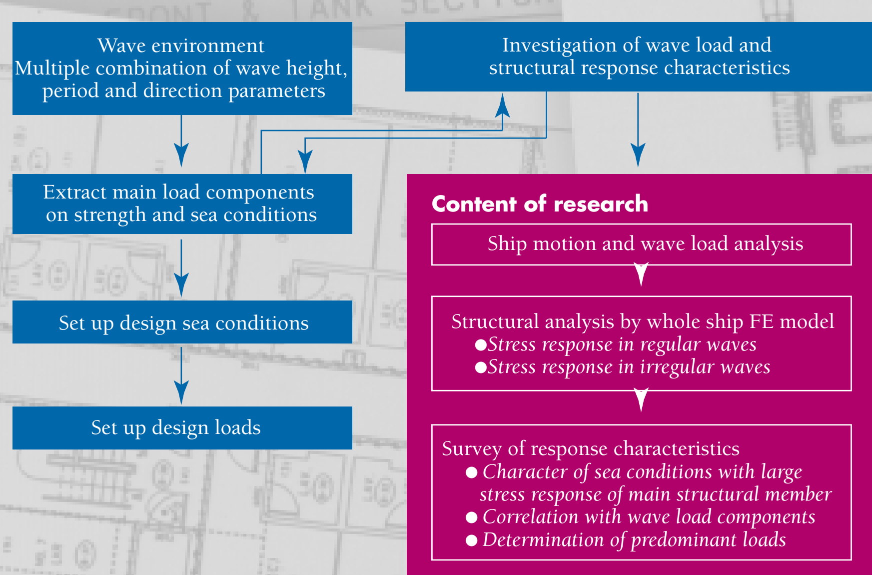
According to the results obtained, it was found that there was a significant difference between statistical quality of the wave conditions actually encountered by a ship and the wave conditions estimated from wave frequency data. On the other hand, in addition to the wave conditions encountered by a ship during the course of normal navigation being considered here, it was assumed that a ship would encounter extremely severe sea conditions. In such cases, it goes without saying that a minimum level of structural safety must be ensured for the ship under such conditions. In order to perform structural strength analysis for these types of conditions, it is necessary to estimate what loads will be acting on a ship under extreme sea conditions.

Usually, with the exception of certain specific loads, there have been cases where the wave loads under extreme sea conditions have been overestimated when applying linear theory. Under such severe conditions where the waves are particularly high, non-linear effects are large, and it is difficult to apply linear theory. Thus, it is essential that research which includes actual tests be conducted in order to estimate loads in a rational manner. This being said, however, research has thus far been limited to nothing more than reports on a limited number of results concerning the non-linearity of loads, in addition to research regarding wave pressure which acts on the side shell of a ship. As a result, tank tests have been carried out by the Society together with

● Fig. 4 Container ship model being subjected to large non-linear wave loads during tank test (research project conducted jointly with the University of Tokyo)



● Fig. 5 Characteristics of structural response and design loads



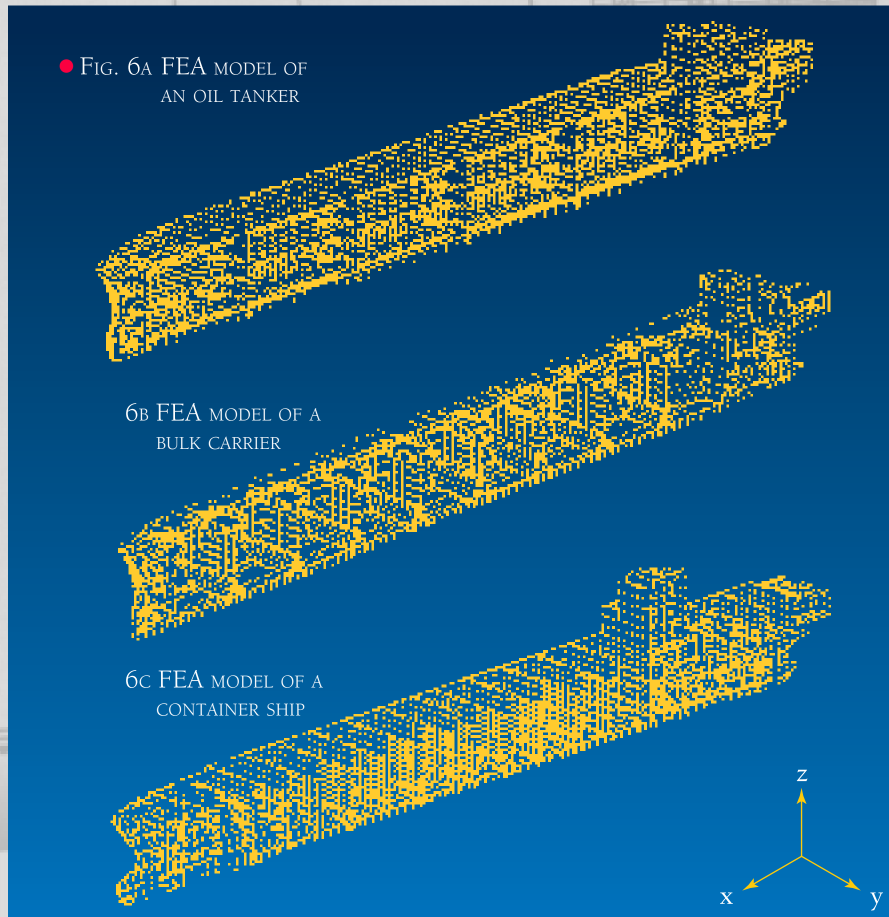


Fig. 6a FEA model of an oil tanker

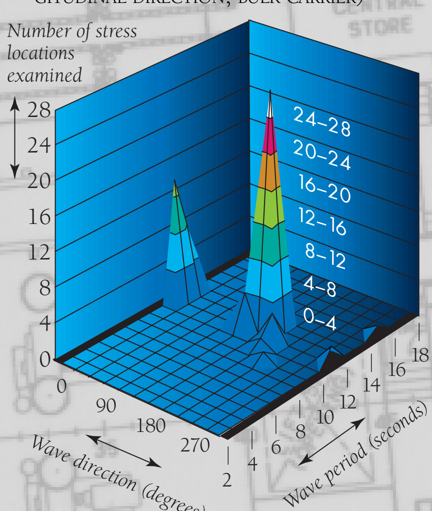
6b FEA model of a bulk carrier

6c FEA model of a container ship

theoretical research in order to estimate wave loads under extreme sea conditions (see Figure 4).

In this research, finite element analyses (FEA) of structural models of whole ships were made of a double hull tanker, container ship, and bulk carrier. Wave loads were applied under various sea conditions, in which certain wave periods and directions were specified, and the characteristics of the structural response were examined (see Figures 5 and 6). It was found that if, when carrying out structural strength analysis, strength analyses are done for a limited number of sea conditions in accordance with the specifications of the structure, it is possible to determine the loads which greatly affect the principal strength of the hull structures (see Figure 7). From this, it is possible to select those sea conditions which have a major impact on structural strength. These parameters can then be set as the design parameters for a given ship structure, with the result that it becomes possible to set the loads acting on the ship structure under given sea conditions as the design loads for that ship. One benefit of the technique proposed here is the fact that the introduction of a concept, which can be referred to as design sea conditions, makes it easier for not only ship designers, but also ship operators and others concerned, to better understand the effect that load conditions have on strength analysis and hence the actual strength of the ship. In addition, for the classification society as well, it becomes possible to directly link the loads undergone by a ship with strength analysis, thereby making it easier to check and verify the method of strength analysis and evaluation.

Fig. 7 Dominant sea conditions having the greatest impact on the structural members of a ship (Stress in longitudinal direction, bulk carrier)



2) Strength Evaluation

i) *Corrosion and Wastage*

Ships operated in the marine environment are exposed to an environment which is much harsher and more corrosive than that to which land-based structures are subjected. A look at ship casualties until now shows that in a majority of cases, the deterioration of strength due to corrosion and wastage was a significant factor. Although the rules indicate standard strength requirements based on the assumption of proper maintenance being carried out, they also stipulate corrosion margins, which anticipate a certain amount of corrosion and wastage.

In order to ensure sufficient strength throughout the service life of a ship in a more rational manner, it is necessary to set corrosion margins more suited to the corrosive environment based on the actual levels of corrosion experienced by the ship. To this end, the Society has newly developed a model of corrosion progress, which is capable of simulating the corrosion process. To develop this model, data was gathered and the results of plate thickness measurements of numerous ships analyzed in order to examine the nature and behavior of corrosion under actual operating conditions. This has made it possible to realistically grasp trends in the corrosion of hull members (see Figures 8 and 9).

ii) *Yielding, Buckling, and Ultimate Strength*

Until now, strength evaluation has consisted of verifying that the stress occurring in a structure does not exceed the allowable stress, (which is set as a standard at a value less than the yield point), and that buckling does not occur. At present, the technical Rules of the Society seek to ensure that a minimum level for collapse strength is maintained for hull structures through the verification of yield strength and buckling strength for ships with ordinary hull forms and arrangements. However, when evaluating the structural strength of ships with new hull forms or critical strengths such as longitudinal strength, it is necessary to evaluate the ultimate strength of the structure clearly and expressly.

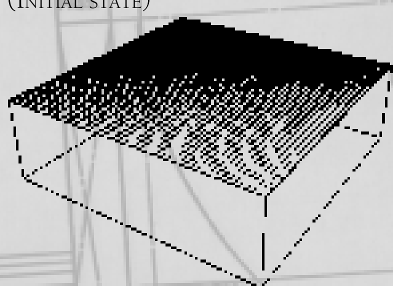
Hull structures are constructed with stiffened plates, that is, plates reinforced with stiffeners. Since it is not practical to analytically estimate the buckling strength of countless stiffened plates used in the construction of complex ship structures, researchers at the Research Center of the Society have developed a formula for easily estimating buckling stress which can be used to effectively and accurately calculate buckling strength (see Figure 10). In developing this estimation formula, particular attention was given to the accurate determination of buckling strength based on the combined stress distributions that occur in hull structures, the effect of openings in the stiffened plates, the effect of the stiffeners, as well as the effect of lateral pressure on the structure (see Figures 10 and 11).

iii) *Fatigue Strength*

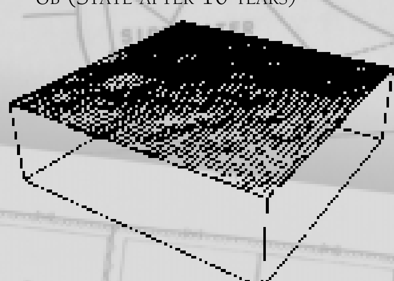
In recent years, an ever increasing number of ships have been constructed which use a significant amount of high tensile steel. At the same time, greater emphasis is also being given to efforts to preserve the marine environment. Given this background, in order to prevent oil spills where the major cause is attributable to the progression of fatigue cracks in structural members, requirements to ensure acceptable levels of fatigue strength in local ship structures are becoming more stringent. Until now, the technical Rules of the Society set forth requirements concerning the standard shape and configurations of local structures with respect to fatigue strength, at principal locations in the hull structure, with the aim of preventing damage where there is a fear that such damage might result in a major casualty. The Society published its *Guidance for Fatigue Design* in 1995 based on the results of extensive experience and research. Recent progress in structural analysis methods has made it easier to calculate hot spot stresses and perform direct calculations of fatigue strength. Thus, the Research Center has also been studying the practicality of direct calculation methods in determining fatigue strength.

When calculating fatigue strength, long-term repetition of loads is the main item of concern, rather than maximum loads as is the case with buckling strength or other

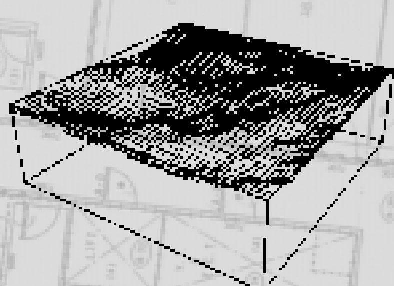
● Fig. 8a Simulated state of corrosion (Initial state)



8b (State after 10 years)

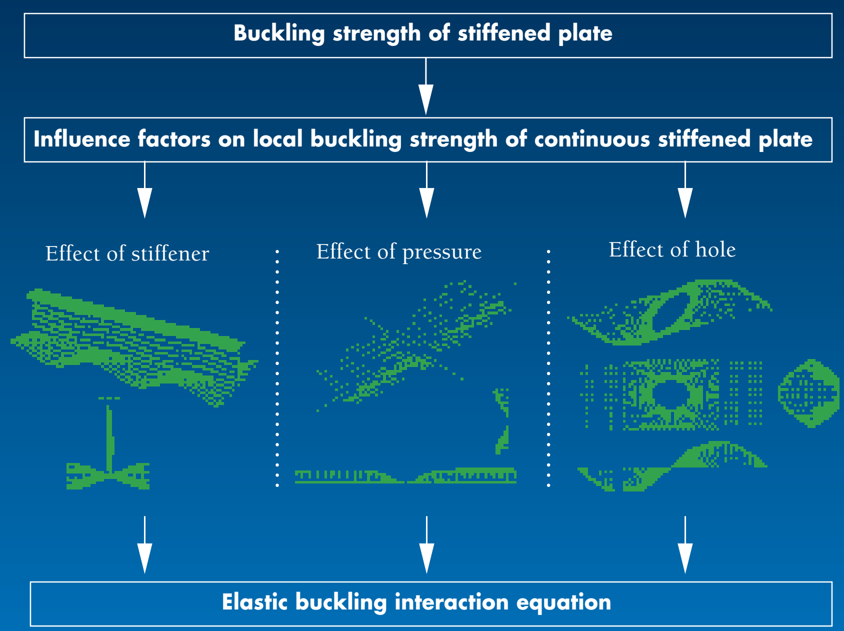


8c (State after 20 years)

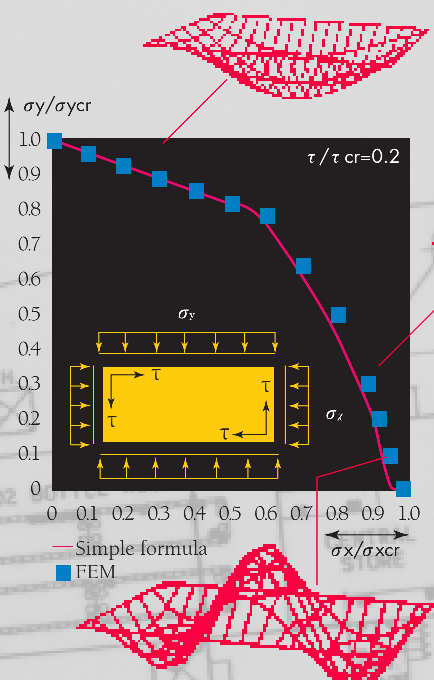


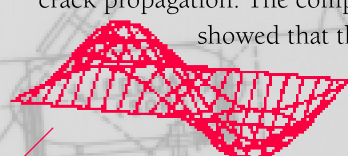
● Fig. 9 Evaluated behavior of corrosion on carriers' bulkheads (graphs show differences in speed of progression of corrosion in different locations on the bulkhead)

● Fig. 10 Determination of simplified formula for calculating elastic buckling stress from factors influencing local buckling strength of continuous stiffened plate



● Fig. 11 Example of buckling correlation curve determined using simplified formula described in Fig. 10





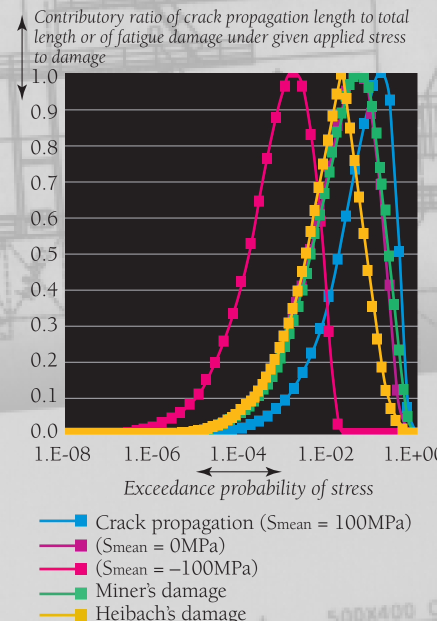
types of strength factors. Consideration was thus given to clarifying the range of the loads affecting fatigue strength (see Figure 12) and to estimating long-term frequency distributions based on the frequency of occurrence of these types of loads.

In addition, two approaches of estimating fatigue strength were compared in order to check their suitability and applicability. One method was Miner's Rule, with its focus on crack initiation, while the other method consisted of Paris' Law, which places primary emphasis on crack propagation. The comparison showed that there was no significant difference between the two methods (see Figure 13). However, since it is still difficult to estimate fatigue strength accurately using current methodologies, the Society is continuing to pursue its research into fatigue strength analysis by incorporating practical strength evaluation based on actual accumulated fatigue related data.

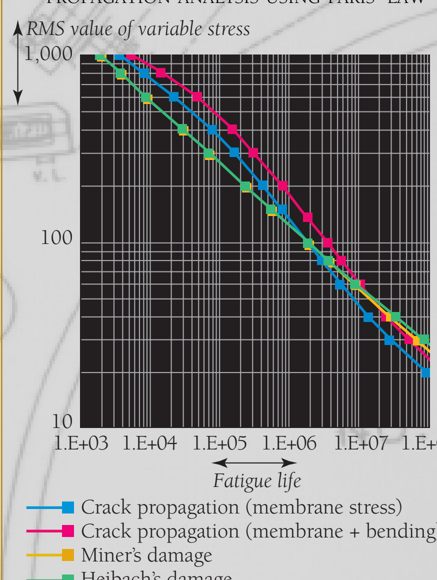
3. Conclusion

The introduction presented above is just a portion of the fruits of the extensive research being done by ClassNK with respect to the safety of the hull structures of next-generation ships. The Society believes that making the results of research available on a continuing basis will serve to stimulate further research and discussion into this important topic, and thereby contribute in a positive way to the promotion of safety for the next generation of ships.

● Fig. 12 Relation between contributory ratio of stress level leading to fatigue damage to specific values of stress due to wave load under different methods of measuring such damage



● Fig. 13 Comparison of fatigue strength estimated by S–N diagrams using Miner's rule and by crack propagation analysis using Paris' law



Special Article

MEGA-FLOAT: Research Tests and Maintenance

Research has been being conducted into the feasibility of a very large floating structure known as Mega-float. First reported on in the 1996 issue of *ClassNK Magazine* (issue No. 48), research has consisted of two phases: Phase I, spanning three years from 1995 through 1998, and Phase II, which began in 1998. The main aim of the Phase I research was to demonstrate the reliability of large-scale floating structures through the development of a 300 meter long floating steel structure test model. The Phase II test model structure will be used to conduct a number of demonstration tests and research for a planned period of three years. All the pieces of the Phase II model were brought together for final welding this past August 1999 in the waters offshore from the Yokosuka area in Tokyo Bay and classed with the Society this past September. The 1,000 meter long structure builds upon the results obtained from the Phase I model. This article presents a brief review of the content of the Phase II research and the maintenance of the Mega-float structure.

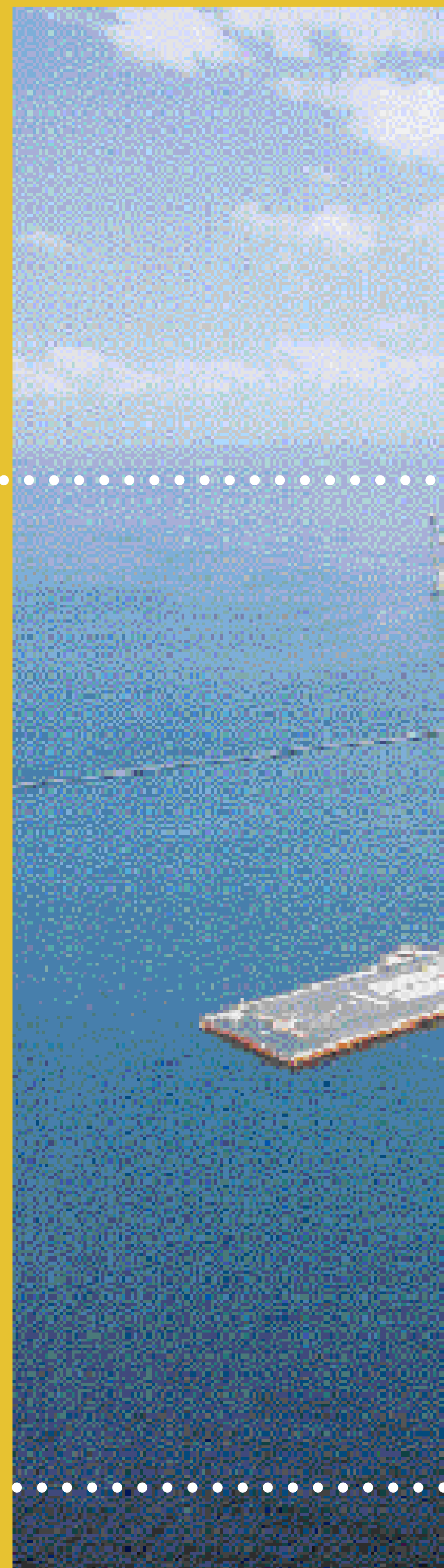
Content of Phase II Demonstration Research of the Mega-float Structure

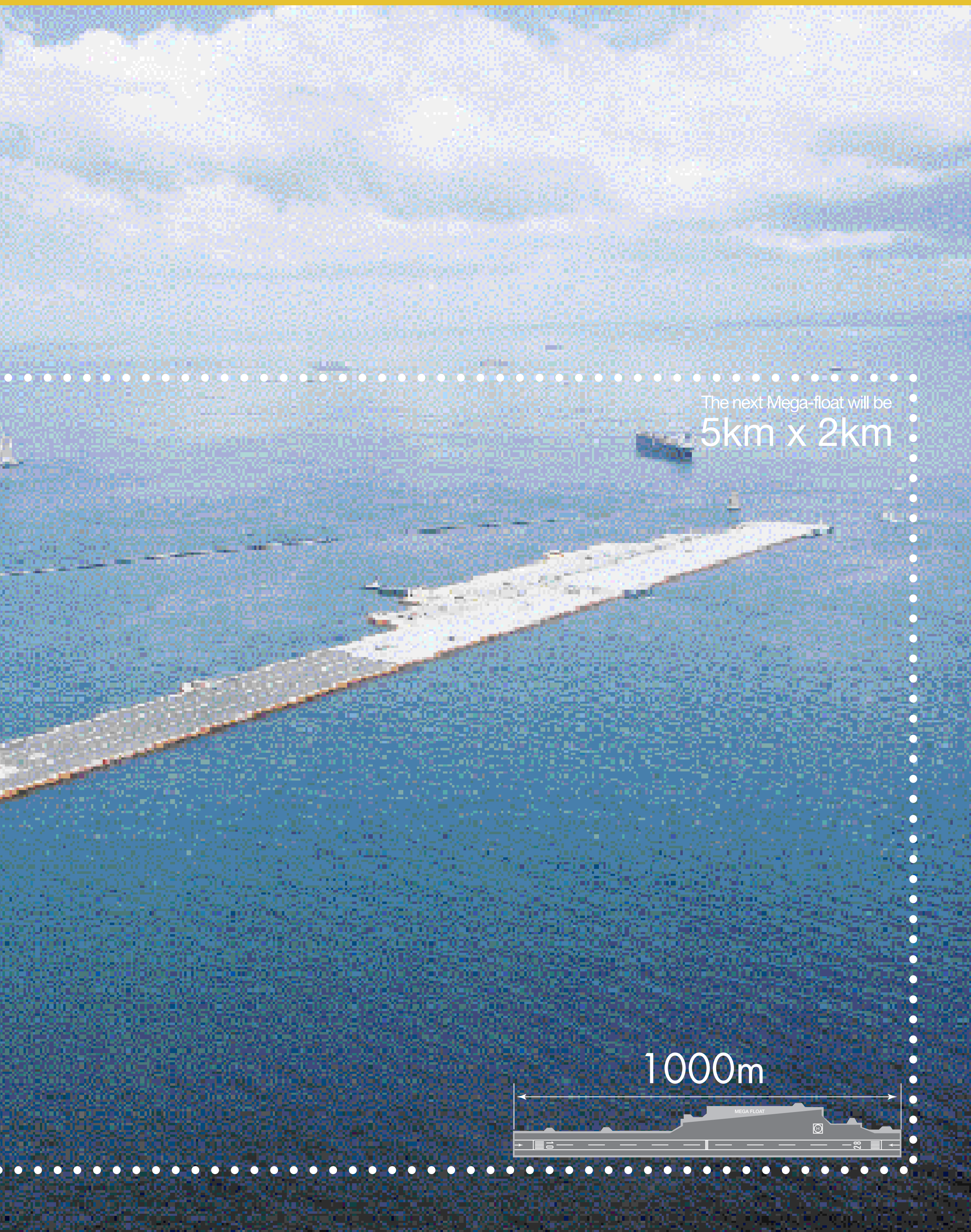
Many uses are envisioned for the Mega-float structure. These include such functions as being used; as a floating base for container yards, for amusement and sports facilities, as a disaster relief base, as well as a base for airport and related facilities, amongst other uses. Of these various uses, that of providing a reliable base for airport facilities is the most demanding and difficult to achieve. The Phase II model is thus being constructed in order to carry out many tests related to airport functions and to demonstrate the feasibility of these and other functions. At a size of 1,000m X 60m (with one portion 120m in width) X 3m, this model structure will be significantly larger than the Phase I model (300m X 60m X 2m). A floating airport measuring 5km X 2km or 1,000 hectares in size (roughly the equivalent of 700 soccer fields) is envisioned as the final structure. A brief overview of the content of the Phase II demonstration research is outlined below.

1: *Development of facilities capable of accommodating wave motions and tides* Any floating airport can be expected to rise and fall as a result of the effects of tides and the motion of the waves. Research will be carried out that contributes to the floating structure being able to be used as a runway for aircraft, such as the design and manufacture of mooring facilities suitable for a floating airport, equipment for installing landing lights, and the like.

2: *Development of airport function simulation programs* Another aim of the Phase II research is to develop simulation programs capable of imitating the conditions of radio waves as well as the sway and roll of light beams that would be used with ILS/GS (Instrument Landing System/Glide Slope) and PAPI (Precision Approach Pass Indicator) type aircraft landing systems. A 1,000 meter model airport will be used to test the programs.

3: *Demonstration tests of landing instrument and equipment systems* Even the smallest displacement in the position of the landing guidance system, which informs an aircraft of the proper approach angle for a landing, would be a matter of the utmost concern. Even the smallest variation would have a major impact on the angle of approach taken by any incoming aircraft from a great distance, and




The next Mega-float will be
5km x 2km
1000m

hence, on the safety of the plane. Actual low-pass flight approach and pull-up tests will be conducted in order to verify the performance of the ILS/GS and PAPI landing systems and determine what impact there would be on the equipment by the behavior of the floating airport structure.

4: *Take-off and landing experiments* Based on the results of simulation calculations obtained from Phase I of the research project, it is thought that there will not be any appreciable impact on the take-off and landing of aircraft due to the behavior of the floating airport structure. Thus, this phase of the research will include take-off and landing tests to corroborate these results. This will include verifying the performance of the various landing instruments as well as examining the operations and responses of the pilot.

5: *Research into the impact of the structure on the environment* Since the Mega-float structure floats in the sea, water currents flow under the structure. The necessary fluids, salts, oxygen, and other nutrients necessary for plankton and other organisms to live are thus carried by the flow of the water. Hence, it can be said that there is very little negative impact on the ecosystem under the structure in this regard. However, since no sunlight can reach the waters under the structure, plants are unable to grow, as photosynthesis is not possible. Consequently, studies carried out during Phase I concerning environmental conditions under the floating structure confirmed that, with the exception of seaweed and algae, there is little change in the ecology of the sea or sea bottom under the structure. In order to increase the precision of assessments regarding the impact of the structure on the surrounding marine environment, Phase II of the research will seek to gather further environmental impact related data. This will also include studies into the organisms adhering to the surface of the floating structure, as well as the relationship between the sounds generated by the airport and any impact they may have on fish and other organisms.

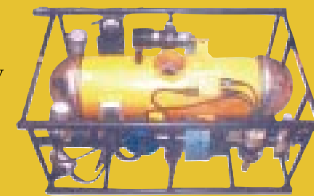
Maintenance of Mega-float

Methods for accurately inspecting and examining very large floating structures and for repairing any damage without taking them into drydocking have been developed since the demonstration research of Phase I, with the aim of realizing a service life of more than 100 years for the Mega-float structure. To support the development of these methods, the basic concepts behind Chapter 13, Part B, of the *Rules and Regulations for the Survey and Construction of Steel Ships* have been adopted. These rules are concerned with the periodical survey of oil storage barges classed with the Society, i.e., the Kami-Goto oil storage barges and the Shirashima oil storage barges, the most notable feature of which is that these surveys need not be carried out in drydock, but may be done on-site with the structure in the water as it is. These Rules are based on a careful appraisal of the successful survey history of the periodical survey program of these types of barges.

Dry chamber

The system used to accurately determine the position and amount of any damage which may have occurred to the submerged bottom plates of a very large floating structure, e.g., 5km X 2km, consists of examining the structure from both the inside and the outside. Such spot-check inspections would include examining the plates for any corrosion of the metallic materials used, deformation of the shell plating caused by excessive wave loads, current loads, and the like, and the extent of reduction of sacrifice anodes, amongst other things.

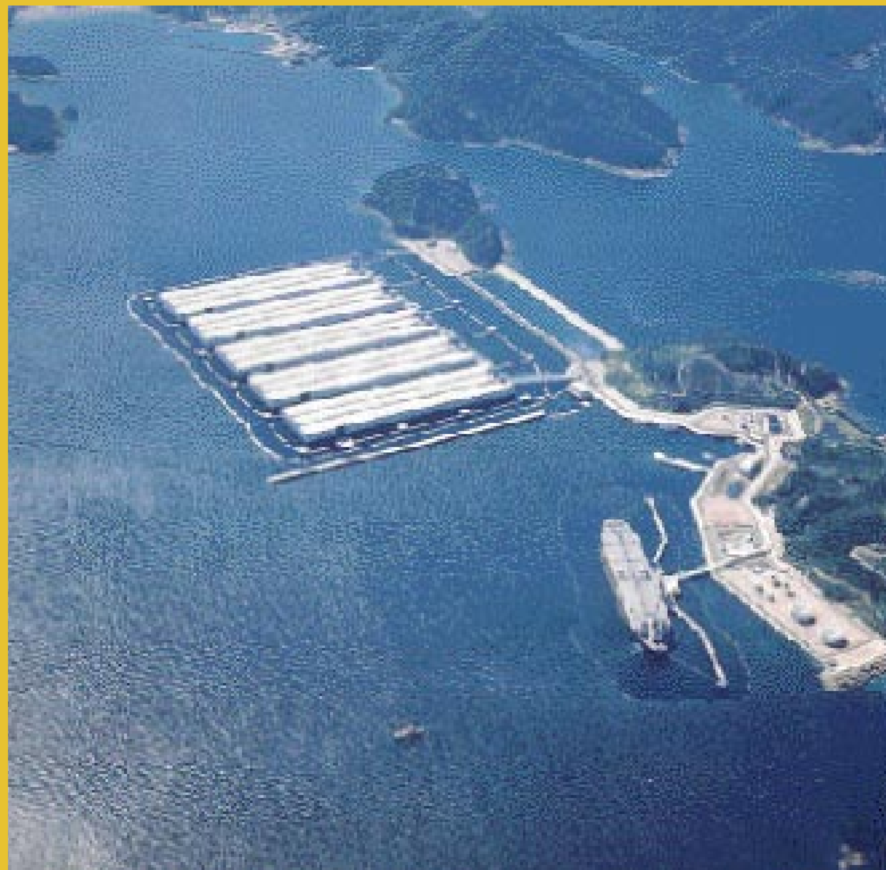
ROV in-water robot



The external inspection of the surface of the floating structure is carried out using in-water robots (ROVs). An ROV is a remote-controlled system which can be maneuvered manually by joysticks. The ROV normally has two horizontal thrusters for moving forward and backward and rotating, one vertical thruster for going up and down to control its depth of submersion, and one side thruster for moving right and left. All motion of the ROV is controlled by these remotely operated thrusters. The ROV can move close up to the structure to be inspected and maneuvers at a speed of 2 knots. The ROV also can be maneuvered autonomously (i.e., without the use of any umbilical-like control wires) to maintain its depth and direction by controlling each thruster by calculating the submerged depth, direction, and position of the unit through the use of an onboard guidance system.

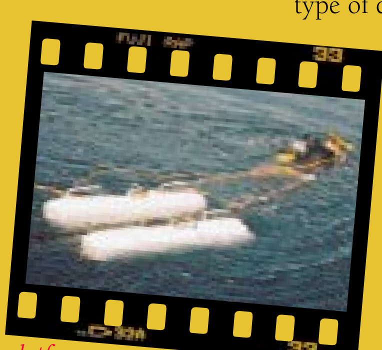
The ROV is equipped with a responder for detecting in-water conditions, an ultrasonic height meter for measuring the distance of the unit from the bottom of the

The Kami-Goto oil storage facility



structure, a TV camera and lighting for observing external surfaces, and sensors for measuring differences in electric potential in order to examine the condition of the electrical protection system of the floating structure. The ROV is also equipped with an ultrasonic profiler for indicating the surface configuration of the in-water structure. Calculations are made of the distance from the scanner to the object surface based on ultrasonic scanning measurements of the reflection times of ultrasonic waves bounced back from the object surface in order to form a profile of the surface. This technique makes it possible to inspect the submerged surface of the floating structure in the dark. The ROV can thus be used to observe the external surface of the bottom of the floating structure by creating a computer generated image of the surface based on the acoustic data obtained from the ultrasonic profiler combined with the optical data obtained from the TV camera.

Internal inspection of the floating structure consists of a visual inspection of the internal surfaces in each compartment for signs of coating damage, such as peeling. Inspections are also carried out for any cracks, corrosion, or diminution of plate thickness, especially of butt welded parts done at sea, using a suitable gauging measure and flow detector. In principle, ultrasonic equipment is used and measurement data is saved by computer. Hence, it is possible to obtain accurate results of an inspection quickly, which include the measurement data or the location where any damage has been found.



Submersible platform

In order to repair damaged parts without going into drydock, a suitable dry chamber was constructed, and the effectiveness of repair work using this chamber was demonstrated during Phase I. The function of the chamber is to discharge sea water in order to create a dry environment in which any necessary touch-up coating, as well as gas-cutting and welding of damaged parts of the surface, can be done safely and effectively. The dry chamber is securely attached to the bottom of the Mega-float structure to ensure the integrity of the dry environment.

Work to replace sacrifice anodes fitted to the bottom of the floating structure is also done using the same type of dry chamber. However, in cases where new sacrifice anodes are added to existing ones, repair work like this can be done using a different type of submersible platform. The additional anodes can be put on the special platform and brought to the affected location by divers for transfer to the damaged part.

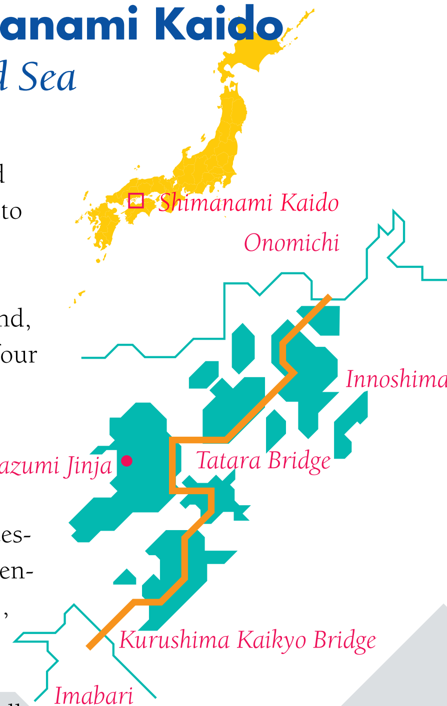
Use in Disaster-Prevention Drills

A disaster-prevention drill was held on the Mega-float structure on September 1, 1999. Some 750 persons participated in the drill which assumed that an earthquake had hit the Yokosuka region. The weather was clear and fine, with waves of 70cm and a wind speed of 8 meters per second (28.8km/hour or approx. 19 to 20 miles per hour). Ships and helicopters of the Self-Defense forces and Maritime Safety Agency were used, with residents from Yokosuka participating as refugees from the assumed disaster. These activities helped to demonstrate the effectiveness of the Mega-float structure as a base of operations for disaster relief. It is thus with great anticipation that all concerned look forward to the day when the Mega-float ultra-large floating structure will contribute to greater, more diversified benefits for society.

Focus on Japan

Cycling the Shimanami Kaido

Across the Seto Inland Sea



Celebrated in myth, legend, and literature, the Seto Inland Sea (Seto Naikai, in Japanese) region is renowned for its serene beauty. Lying between Japan's largest island, Honshu, and the smallest of the four main islands, Shikoku, the Sea is characterized by a multitude of small islands, which are mostly wooded and rural and in most cases inaccessible except by ferry. With the opening of the Tatara Bridge on May 1, 1999, the third route connecting Honshu with Shikoku across the Inland Sea was completed. Officially named the Nishiseto Expressway, this new road link is known popularly as the Shimanami Kaido (Sea Road). Running from Onomichi in Hiroshima Prefecture to Imabari in Ehime Prefecture, it spans some 60 kilometers across six islands, known as the Geiyo islands, and comprises 10 individual bridges. Utilizing the same series of bridges is an accompanying bicycle path/footpath, which runs for approximately 80 kilometers along an especially scenic route across the islands. Hoping for good weather, the two of us set out from Tokyo for Onomichi, where we were to begin our cycle across the Shimanami Kaido. Members of the Society's Marketing and Publicizing Department in the head office, our goal was to document our trip in words and in photographs, as well as to collect the series of ink stamps along the route required to receive official certificates proving that we had made the crossing.

We had waited, ironically, for the end of Japan's rainy season before making our trip, but the skies were a threatening gray as we arrived in Onomichi the day before setting out. A typhoon, bound for the Korean Peninsula, was slowly brushing southern and western Japan, depositing record levels of rainfall on Kyushu and Shikoku. Having taken a brief look around the town in the afternoon, that evening we enjoyed the hospitality of our colleagues at ClassNK Onomichi, which is one of the Society's busiest offices in terms of newbuilding survey work. As we sat eating and drinking in the back room of the traditional *izakaya* (literally, drinking place) to which we had adjourned, the typhoon rains began in earnest, hammering on the wooden roof above us and flowing in torrents through the gutters outside the open window. The following day was to be better weather, relatively speaking, though not by very much.

Onomichi

The old port town of Onomichi is well known for its busy harbor and picturesque hills crisscrossed by numerous steeply sloping roads. A climb to the summit of one of the higher hills surrounding the town presents a breathtaking view of the Geiyo islands, which follow one upon the other like stepping-stones to the horizon, with the Onomichi channel, a fast-flowing stretch of water lined with shipyards and port facilities, in the foreground. A base for navigation on the Seto Inland Sea, the city was fortunate to not have suffered any wartime damage, with the result that much of the old town with its many traditional buildings remains intact. Some 25 temples, the construction of which was paid for in many cases by


Photo: Ehime Prefecture


Onomichi

尾道

Kurushima Kaikyo Bridge

rich local merchants in times past, are scattered about the town and interconnected by a network of narrow and quiet back ways, affording modern-day visitors a glimpse of old Japan and a refreshing escape from the bustle of city life. Onomichi's scenic beauty has inspired many works of literature and, more recently, made it a prime shooting location for the production of films.

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Breakfast the next morning was followed by a check of the weather: gloomy predictions for the day ahead. Heavy rain warnings were in force for the two prefectures through which we were scheduled to pass, and a steady rainfall greeted us as we set out to the cycle hire shop on Onomichi's tidy western waterfront. With as much waterproof clothing as we could muster and with bin liners covering our rucksacks, we crossed the Onomichi Strait on a small ferry to our first island, Innoshima, and collected the first of seven ink stamps that we needed.

Crossing the bridges

Over most of the bridges, cyclists and pedestrians can safely traverse via pathways along the outside of the regular traffic lanes. In the case of Innoshima Bridge, however, the cycle/walking path runs underneath the roadway suspended from its own platform.The length of the bridge span creates an interesting illusion of being in a tunnel running to the far side. On each bridge there is an honesty system of tolls for users. At just ¥50 or ¥100 per bridge, depending on its length, crossing by foot or bicycle is much cheaper than by motorized transport, not to mention considerably more time consuming.

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Lunch on the first day was a relaxed affair, and with the rain continuing to pour we felt no desire to hurry quickly onward after finishing the *okonomiyaki* (seasoned pancakes) that we had cooked on a hotplate in a roadside restaurant. Fortunately, our schedule made no great demands on us, and despite the weather we could stop from time to time to enjoy the peaceful atmosphere and fresh sea air of the islands. The Shimanami Kaido bicycle route keeps to the flat coastlines of the islands as much as possible, linking points of interest and scenic beauty at regular intervals. The entire route is marked with colorful flags, and runs largely along specially arranged cycleways and pavements for safety. The flags made it difficult to stray from the route, although not impossible as we once or twice found out. Where the bridges meet the sea, the cycle paths split from the road and run up twisting gradients through the trees, with the occasional stopping point for taking photographs and for resting weary legs. Despite its sleepy, easy-paced atmosphere and extensive agriculture, this area of the Seto Inland Sea is home to a significant portion of Japan's shipbuilding industry. Several well-known yards, including those of Imabari Shipbuilding, Shin Kurushima Dock, Koyo Dockyard, and Onomichi Shipbuilding, are located near the deep, fast-flowing straits. Many smaller facilities building ship sections also dot the coasts of the islands, and tugs towing prefabricated sections on barges can often be seen chugging across the narrow waterways to construction yards elsewhere. The most striking feature of the route, however, is the quiet, calm atmosphere and the abundance of wildlife and plants. Occasionally, the sounds of distant industry pierce through in ringing tones of metal being hammered into shape in a waterside fabrication shed, or in resonant engine hums of fishing boats or coasters passing through one of the straits. Most of the time, however, only the sounds of nature accompany your progress. From time to time along the route, we met fellow travelers, some on foot and some on bicycles, with a cheery greeting and a word of advice often exchanged.

The Murakami Suigun

In days of old, a pirate-like naval force (*suigun*, in Japanese) made up of masterless samurai thrived among the chain of islands over which the Shimanami Kaido now runs. Known as the Murakami Suigun, these feudal-era pirates were active mainly from the Namboku-cho period up to the Azuchi Momoyama period

(1336–1600), maintaining local control of this part of the Seto Inland Sea during much of that time. The group established checkpoints at strategic locations along the main navigation routes, and all ships crossing their waters were obligated to pay an "escort", or protection, fee in order to pass. This activity provided the group's major source of revenue. Although intimately involved in the economic life of the Seto Inland Sea during times of peace, particularly in trade and sea transport, these samurai-pirates became most active whenever war broke out. Later in their history, they split into three groups, or "ie" of Innoshima, Noshima, and Kurushima and came to be known as the Santo Murakami Suigun (Murakami Suigun of the Three Islands). However, they remained as united as ever and did not diminish in power or influence, striking fear into the hearts of the daimyo, or feudal lords, of the surrounding areas during the Warring States period (1467–1573). The local power of the Murakami Suigun was finally curtailed during the Edo period, when the shogun officially restricted their activities. Today, many traces of the pirates can still be found along the Shimanami Kaido. These include ruins where entire small islands were used as Suigun strongholds, taking advantage of the hazardous, fast-flowing currents that swirled around them as a natural defense.

The Suigun in battle

Not surprisingly, the Murakami Suigun excelled at fighting at sea. In a typical attack, they brought their armored archer boats alongside an enemy vessel and, using a large sickle-type tool, cut its anchor chain while shooting longbows and, after their introduction into Japan, muskets. A wave of fire arrows and the tossing of firebombs then ensued, typically disheartening and nearly overwhelming the enemy ship's crew. Finally, the Suigun boarded and brought the battle to a rapid and decisive conclusion with hand-to-hand fighting.

Tatara Bridge

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Tatara Bridge, which together with the Kurushima Kaikyo Bridge formed the final link that completed the Shimanami Kaido, opened on May 1 this year. It is a 1,480 meter three-span continuous cable-stayed bridge connecting the islands of Ikuchishima and Ohmishima. With supporting pillars set 890 meters apart, the bridge currently has the widest single span in the world. Due to its picturesque location, set in calm waters between high hills, the bridge's purity of form makes it perhaps the most strikingly beautiful structure on the entire route.

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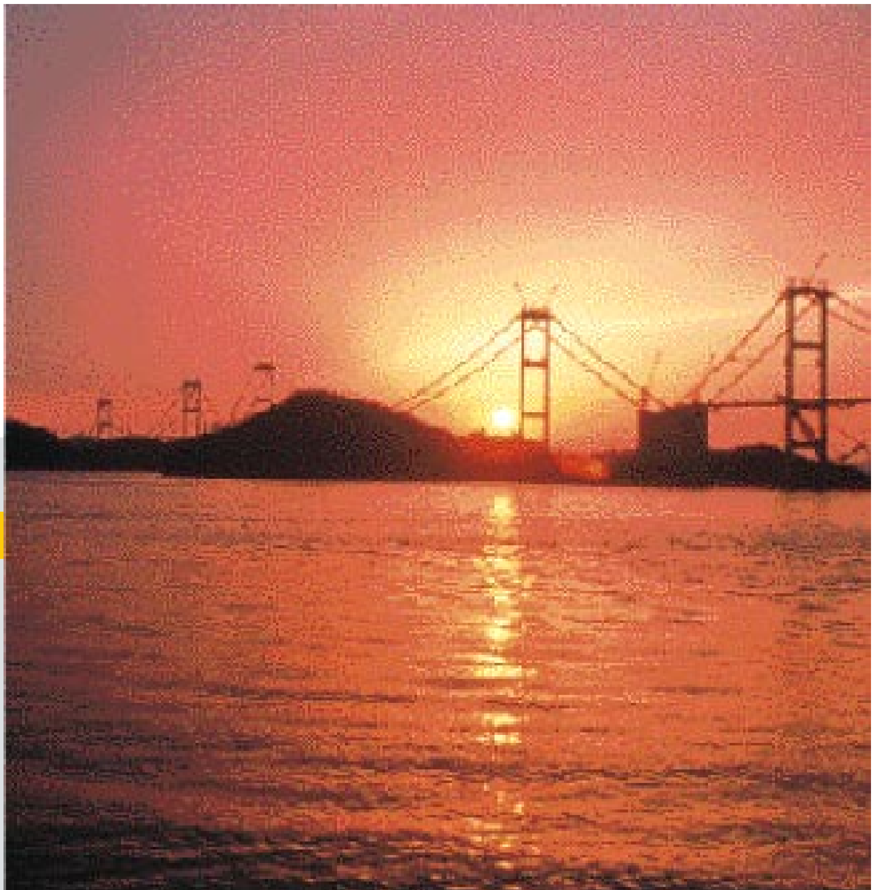
By mid-afternoon of our first day, we had finally left Hiroshima Prefecture and entered Ehime Prefecture while crossing over the Tatara Bridge, our last of the day, and arrived on Ohmishima Island. We returned our bicycles to the halfway-point rental shop, and then hiked, saddle sore, for half an hour to our guesthouse in the adjacent village of Kamiuracho. After checking in, we enjoyed a hot-spring bath at the local *onsen* built with the aid of a development grant by the villagers, who believed that to be the best way of using the grant money, fortunately for weary travelers such as ourselves. Dinner at the pension was a tasty spread of local seafood washed down with particularly satisfying cold beer. After a day of rain-soaked, hard travel, sleep came easily and early despite the incessant cacophony of the cicadas outside in the Japanese summer night.

Oyamazumi Jinja

Oyamazumi Jinja

Oyamazumi Jinja (shrine) is not located on the route of the Shimanami Kaido itself, but is without question the most magnificent temple in the Setouchi area, and worthy of a diversion. As well as the classical temple buildings, built to enshrine Oyamazumi Taishin, the brother of the Sun Goddess Amaterasu, according to mythical national lore, the shrine complex boasts a treasure-house containing the largest single concentration of National Treasures in Japan. These include a comprehensive collection of swords, knife blades, and arrowheads dating from the Kamakura period (1185–1333), which are remarkably well preserved despite, in many cases, having actually been used in battle. Also featured are many elaborate suits of samurai armor. At the entrance to the shrine stands an enormously broad, gnarled, and ancient camphor tree, a witness to

Photo: Ehime Prefecture



Kurushima Kaikyo Bridge

the ages, reputed to be nearly 2,000 years old. We trusted the estimate, as we certainly would not have wanted to count the rings to find out. To escape the incessant rain, we waited for our return taxi underneath a simple but adequate shelter near the shrine gate, overlooking a small and perfectly ordered rice paddy. We were told that the rice harvested from the paddy was used in a local festival.

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The Kurushima Kaikyo Bridge, which links Oshima Island with Imabari on Shikoku, marked the final crossing of our journey. Knowing our journey to be close to an end, we stopped under the bridge beforehand to enjoy the scenery. With a clearing sky, we had emerged from the mists and showers of the islands into the Kurushima Straits and the final stepping-stone to Shikoku. In contrast to the calm, open waters of the Seto Inland Sea reflecting the hills and islands in a beautiful and peaceful vista, the dark waters of the straits rushed and boiled in whirlpools and eddied around the jagged rocks and islands. When running at full speed, the current can reach as much as 10 knots and slower ships struggle to make their way under the bridge against the flow. In times past, it is easy to understand why such formidable natural hazards, together with the menace of the Murakami Suigun, gave this region of the Inland Sea its fearsome reputation. With a bright sky and excellent views across the islands in all directions, as well as Mount Ishizuchi dominating the skyline behind Imabari (and the final stamp on our cards), we finally reached our destination on the west coast of Shikoku. After returning our bicycles, we caught a taxi into the center of Imabari and, before making our arrival at the Society's Imabari Office, presented our battered stamp cards to the tourist office for scrutiny. So it was that we became the 882nd and 883rd certified travelers to cross the Shimanami Kaido. Neither the relaxed pace of our crossing nor the weather had dampened our sense of satisfaction and achievement. It had been a memorable journey.

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Imabari

Imabari

Imabari has been a center of government since feudal times and is the site of one of several major temples built around the country in leading regional areas, in addition to being a major stopover point for sea transport. Upon arriving in Imabari harbor, one's eyes are drawn to Imabari Castle, which is unique in that its moat is supplied with seawater rather than river water. Another, much newer, landmark on the skyline is the Imabari International Hotel, a prominent symbol of the recent success of its owners, the Imabari Shipbuilding Group. Although best known for shipbuilding, the town's location on the western edge of a fertile plain makes it ideally suited to agriculture. Cotton, once a thriving cash crop, is no longer grown, but Imabari remains a major center for the production of towels, with some 60% of Japan's towel exports still originating here. Beyond the plain to the east rise the Ishizuchi mountains, the tallest in western Japan. Mount Ishizuchi, the range's highest peak at 1,982 meters, is a place of spiritual significance for the Japanese and is renowned for the excellent panoramic views from its summit.

Imabari Castle

ClassNK Around the World

Piraeus

100th Anniversary of Japan-Greece Diplomatic Relations

Piraeus Office

The Piraeus area has been a prosperous port since ancient times. It has been a full-scale port for Athens since the 5th century B.C., and is today the most important port city in Greece. It is an important part of metropolitan Athens and its environs, and is one of the top international ports of the Mediterranean. The NK Piraeus Office is located on the Akti Miaouli, a well-known street on the coast of this international port city. One can look out from the windows of the office and never be bored by the view of international luxury liners, cruise ships bound for the Aegean Sea, or the busy comings and goings of ferries from and to the outer islands in the early morning and late evening. The scene of more than 3,000 islands surrounded by the clear deep blue waters of the Aegean and the white walled houses with blue and red tiled roofs is spectacular.

The NK Piraeus Office was established in July of 1975. The subsequent twenty-four years of service by the office make it one of the Society's older overseas offices. The office is responsible for surveying ships in Greece, the Middle East, the Eastern Mediterranean, and the Black Sea areas. As a regional office, it is responsible for overseeing and supervising NK's offices in Dubai, Kuwait, Jeddah, Alexandria, and Istanbul. The regional manager of the NK Piraeus Office also serves as the secretary of the Greek Committee, which meets in Piraeus every year and takes an active role in reflecting those views of the leaders of the local maritime community that should be reflected in the activities of the Society. At present, the Society has a total of 370 ships belonging to 130 companies totaling 8,800,000gt from the region under class. For a long time, the office has been providing a wide range of services, including surveying and consulting, while working in close cooperation with shipowners and companies in the region.

Piraeus is well known as the site of the major sea exhibition, Posidonia, held every other year. The Society has participated regularly in the event, making its eleventh appearance at last year's Posidonia98. Each fair, many visitors come to the ClassNK stand, affording them an excellent opportunity to find out about the most recent activities of the Society. Chairman and President Mano also attended Posidonia98, where he was able to meet and exchange courtesies with many leaders of the shipping community in Greece and elsewhere in the region.

The year 1999 is a major turning point in the history of the Society, as we celebrate the centenary of its founding. This year also marks another event of particular note in recent history, namely, the centenary of amity and friendly exchanges between Greece and Japan, as represented by a treaty of friendship and commercial shipping concluded between the two countries in 1899. Since then, good relations have been maintained between the two countries, with an agreement on cultural exchange in effect since 1982. Not only have political and economic ties between Greece and Japan been strengthened, but cultural exchanges have been enhanced as well. With the celebration of 100 years of friendly relations between the two countries taking place this year, a Centenary Celebration of Friendship between Greece and Japan Committee has been established.

The committee has been formed with the cooperation of the Japanese Embassy and Japanese Association, and is planning a wide variety of special events to mark the occasion. A marathon run through Athens, in which many Japanese, Greeks, and

Piraeus

Auckland

Piraeus

Photo: Hellenic Tourism Organisation

others are expected to participate, is scheduled as the final event capping off these celebrations in October this year.

The Greek people are known for being active, outward-looking, and independent. Many are ambitious and adventurous in seeking opportunities for further economic and cultural exchange with people in other lands. Greeks are also well known for the entrepreneurial spirit they bring to shipping around the world. Many Greek shipowners of the younger generation, along with their elders, have become keen to build new bulk carriers and other types of ships to refurbish their fleets. ClassNK has and will continue to draw upon its long experience and abundant expertise to provide technical service and other types of support to shipowners in the construction of these newbuildings and in their other classification needs.

Staff of the NK Piraeus Office

Auckland Office

Auckland, the largest city in New Zealand, is a major center of economic and shipping activity. It is located on the north shore of the North Island, one of the two major islands comprising this scenic country, while Wellington, the capital, is located further to the south. Trade plays a major role in the economic life of the nation, with exports consisting of primary produce such as meat, fruit, vegetables, timber, dairy, fish products, methanol, table wines, and iron sand. Imports include manufactured goods such as motor vehicles, chemicals, and oil products.

Eight principal ports within New Zealand serve as gateways for the flow of these goods. Thus, the principal activity of the NK Auckland Office is concerned with the survey of ships in service, those engaged in the transport of these many goods. Although the office itself was first established as an exclusive office only three years ago, the Society has had continuous representation here for some forty years. The office is now responsible for surveys conducted at these eight ports, in addition to a further three in the South Pacific comprising a geographical area larger than the United States or Australia. To help cover this expansive region, we have four Acting Surveyors in New Zealand and one in New Caledonia.

The NK Auckland Office is situated on the city's north shore, very close to the main highway, and therefore enjoys convenient access to the airport and other ports in the country. Survey work involves about 25,000km of driving each year and many hours of domestic and international flying. In winter, both driving and flying can be complicated by the weather conditions.

Little exists in the way of shipbuilding in New Zealand, except for the construction of pleasure yachts and small work boats, a few of which have involved NK. The New Zealand defense of the America's Cup Yacht Race next year may see renewed interest from Japan and elsewhere in yacht construction here under NK class.

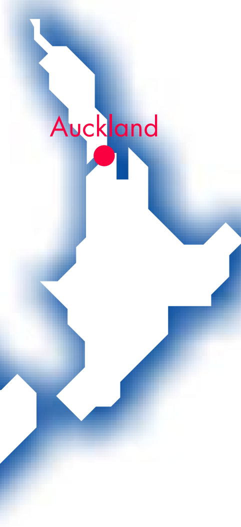
Port State Control is operated to a high standard in New Zealand, and the vast majority of ships visiting the ports are of a high quality. Detentions, when they do occur, have usually been associated with casualties rather than defects. The NK Auckland Office maintains excellent relations with the New Zealand Maritime Safety Authority, which administers Port State Control here.

Geographically, New Zealand is rather like a "mirror image" of Japan in the south. Although the seasons are reversed the two countries have a similar climate, and both countries consist of mountainous and volcanic islands as well as very long coastlines. Although English speaking, the population is made up of many European, Polynesian, and Asian cultures, all of whom help to make the country an interesting place to live and visit.

Tourism is a growth industry, and as the world economy settles down, New Zealand can expect more visitors, especially by way of cruise ships. During the summer, many marine related activities are very popular along the beautifully scenic coast, including sailing and swimming, as well as dolphin, whale, and seal watching.

Photo: New Zealand Tourism Board

Auckland



Auckland

NK-SHIPS Service Launched on the Internet

NK-SHIPS is ClassNK's information service on NK classed ships' survey status, history, and particulars. The service, which until now has only been available to shipowners and their duly appointed representatives by telephone or fax, can now also be accessed by personal computer via the Internet. Registered users can use the telephone, fax, and now the Internet to obtain information regarding such survey related information as survey status, survey due dates, survey history, recommendations, and other related information for a particular ship. ClassNK's NK-SHIPS Internet service simplifies access to this key information 24 hours a day, 365 days a year, from anywhere in the world.

Special Features of the Internet Version of the NK-SHIPS Service

● *Download only the required information directly from the Internet*

Users can search, download, and output information from the NK-SHIPS database in real time if they have access to the Internet via a browser such as Netscape Navigator Ver. 3.0 or higher or Microsoft Internet Explorer Ver. 3.0 or higher.

● *No need to install any software or special applications*

There is no need to download any program or data from the ClassNK homepage or to install any special software prior to using the NK-SHIPS service. Users can access the service as soon as registration procedures have been completed.

● *Complete security of information provided*

All information provided as part of the NK-SHIPS service via the Internet is securely protected against unauthorized access through the use of specialized security technology for protecting information provided over the Internet, thereby allowing users to access information regarding their ships with complete confidence.

● *Application to Use NK-SHIPS and Inquiries*

For further details or for an application form, please contact the Classification Department by fax at the following number:

Fax: +81-3-5226-2030

Demo Version of *PrimeShip-HullExpert* Now Available

ClassNK has compiled and organized its wealth of accumulated knowledge and experience of ship structures, based on past survey records and related activities of the Society, into a single database. Known as *PrimeShip-HullExpert*, this extensive database was mainly developed to serve as both a reference and training tool for the surveyors of the Society and to help them provide classification related services of even higher quality to all clients of the Society.

Recognizing its potential value to others, HullExpert is also being made available to others with an interest in hull structures, including ship designers, shipbuilders, shipowners representatives, repairers, inspectors, surveyors, students, researchers, teachers, and the like. Users of the database will now have access to the same wealth of information as the Society's experienced hull structure specialists.

The demonstration version of HullExpert now being distributed presents a condensed sampling of the extensive HullExpert database. It is hoped that many users will try the demo-version and offer their views and suggestions for improving the contents of the CD-ROM so that a better final product can be prepared.

The full HullExpert database is scheduled to be released starting from next year in a series of successive CD-ROMs. The first two of this series, the "Single Hull VLCCs and Tankers" and "Bulk Carriers" portions of the database, have been completed. After a test period, these portions of the database are expected to be released in the autumn of the year 2000. They will be followed by the release of the "Damage Examples", "Double Hull VLCCs and Tankers", "General Cargo Ships", "Container Ships", as well as "Inspection and Maintenance of Hull Structures" portions of the database.

Y2K is Coming—Don't be Complacent !!

As most readers will be aware by now, at midnight on December 31 this year, computer systems worldwide will face the Y2K problem. Many computers may experience problems ranging from simple glitches to major malfunctions because they improperly interpret the year date digits "00" as being the year 1900 instead of 2000. Operations of all types could be impacted, and even the safety of navigation itself may be directly affected. Therefore, it is essential that all computers and microprocessor-based equipment, including navigation, communications, and all other systems, are checked to ensure that they are Year 2000 compliant. Readers will be pleased to hear that as a result of broad awareness and sound preparations, the recent related issue of GPS rollover, passed with minimal or no difficulties in public or private systems.

ClassNK's Year 2000 Services

ClassNK offers a comprehensive range of information on Y2K compliance from our own resources as well as that supplied from outside suppliers and manufacturers. ClassNK also offers a service to shipowners/managers, which is an assessment of their Y2K programs, according to IACS (and IMO) guidelines. ClassNK may issue a statement provided that the assessment of the program is satisfactory based on the documented program. The assessment comprises a document review and an on-site audit of the company. Neither tests nor onboard inspection will be conducted by ClassNK. Shipowners/managers wanting an independent assessment of their Y2K compliance program should contact the Ship Management Assessing Department (Mr. M. Homma or Mr. T. Kuboki), Tel: +81-3-5226-2034, Fax: +81-3-5226-2030, or Email: smd@classnk.or.jp

ClassNK History

1899	Teikoku Kaiji Kyokai (Imperial Japanese Marine Corporation—former name of present Society) founded
1901	First edition of *Record of Japanese Ships* published
1903	Issued *Regulations for the Classification and Registration of Ships*
1920	First ship classed by the Society, the *Kwanan Maru*, constructed
1921	First edition of *Rules and Regulations for the Construction and Classification of Steel Ships* published
1924	First edition of the *Register of Ships* published
1926	The Society's highest class, NS*, registered in the classification clause of the Institute of London Underwriters
1946	The Society renamed Nippon Kaiji Kyokai (NK)
1952	NS* classification character recognized by the American Marine Insurance Clearing House
	The Nippon Kaiji Kyokai Award established
1953	NS*-designated ships carrying dangerous cargoes authorized passage by Suez Canal Authority and Panama Canal Commission
1955	NK Research Institute established
1958	First English edition of the *Rules and Regulations for the Construction and Classification of Steel Ships* published
1961	World's first low-temperature LPG carrier constructed under NK class
1962	Exclusive surveyor offices opened in London and New York
	World's largest oil tanker constructed under NK class
1965	First Japanese-built oceangoing vehicle carrier constructed under NK class
1968	Indian Technical Committee established
	NK becomes one of founding members of the International Association of Classification Societies (IACS)
1971	NK representative elected as chairman of the IACS Council
1972	First high-speed container ship to be built in Japan constructed under NK class
1973	Services for registering offshore structures commenced
1975	Hong Kong Committee established
1977	Oil drilling rig, *Hakuryu No. 5*, constructed under NK class
1985	Southeast Asia Committee established
1988	NK representative elected for second time as chairman of the IACS Council
1989	Oceanographic vessel, *Shinkai 6500*, constructed under NK class
1990	Korea Committee established
1991	Danish Technical Committee established
	Large-sized luxury passenger liner constructed under NK class
1992	Greek Committee established
	"ClassNK" logo created
1993	Research Center complex inaugurated. Research Institute relocated to the new Center
	Commenced Quality System assessment and certification services
	"QualityNK" logo created
	Commenced Safety Management System assessment and certification services
1994	China Committee and Korea Technical Committee established
	Indian Technical Committee reorganized as the Indian Committee
1995	China Technical Committee established
	Accredited as a quality system certification body by RvA and JAB
1996	Society receives ISO 9001:1994 certification from SGS
1997	Commenced NK-SHIPS information service on ships' survey status, history, and particulars
1998	Philippine, Singapore, and Thai Technical Committees established
	CD-ROM version of the *Register of Ships* released
	CD-ROM version of the *Rules and Regulations for the Construction and Classification of Steel Ships* released
1999	ClassNK achieved 100 years of service to the maritime community

ClassNK

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