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Ship Construction in Asian Emerging Markets

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Bio data

Terence Song has a degree in Naval Architecture and worked at the Guangzhou Shipyard for eight years on newbuilding design and technical evaluation or existing designs. He moved to Singapore to work as a ship repair manager with Sembawang for six years before returning to China to work for four years as a classification society surveyor with BV. He joined Inserve in 2005 where he runs the Shanghai office dealing with insurance related surveys of ships and shipyards.

Simon Groves spent many years as a seagoing engineer before finding shore based employment in the London insurance market. He spent five years as a technical consultant with Richards Hogg average adjusters before turning his attention to loss prevention and risk management. He went on to form Inserve in 2003. He is a Chartered Engineer with qualifications in engineering and ship design.

Introduction

This paper relies greatly upon the experience of Terence Song and his extensive knowledge of ship building in Asia and the Far East. It is my privilege to present this paper on his behalf.

In considering the emerging market situation in the ship construction industry, the three countries in Asia and the Far East which have shown the largest increases in shipbuilding activity in recent years are the Philippines, Vietnam and China.

We have also considered Taiwan, India, Malaysia, Thailand and Bangladesh which are also considered emerging markets in the shipbuilding sense but in a much smaller way at present. The situation in Taiwan has not been easy to assess and we have not been involved in the shipyards there but we understand the new construction industry takes second place to ship repair.

India is probably the country to watch in the future, as it has all of the ingredients needed to rapidly increase its ship construction industry but at present there are no real signs that this is happening. India satisfies a lot of the criteria for emerging market shipbuilding, i.e. low labour rates, plenty of labour resources, an active steel industry and an extensive coastline with plenty of shipyard development opportunities.

Malaysia, Thailand and Bangladesh do build ships, as do Indonesia and Singapore, but in much less quantities and without any sign of increasing their market share significantly.

Philippines

Latest information on the size of respective order books shows the Philippines with 120 ships on order, around 1.2% of the world order book in terms of tonnage. Philippines shipyards have developed through joint ventures with overseas companies such as Tsuneishi, Keppel and FBM. Such joint ventures have led to technology transfer, better management supervision and higher standards.

Local owned yards are few. Some have changed from shiprepair to shipbuilding in recent years which has been a common trend given the demand for newbuildings, but repair yards do not immediately lend themselves to newbuildings as they do not have the facilities to build large pre-fabricated sections.

Without technology transfer from established shipbuilding nations such as Korea, Japan and Europe and without investment in automation, cutting machines, and cranes the results can be quite poor.

Otherwise, with a degree of overseas investment the Philippine yards have been doing well. Tsuneishi with its permanent Japanese senior management on-site has increased its capabilities to 100,000 dwt vessels but concentrating on bulk carriers and starting off with smaller vessels of a conventional design and increasing carefully, although Keppel have been involved in more challenging offshore construction.

Shipyard surveys for insurers have been carried out in the Philippines but mainly on local yards who have sought insurance in the international insurance markets, rather than internationally run yards that have their own established insurance portfolios.

Vietnam

Shipbuilding in Vietnam has increased considerably in recent years and they are scheduled to move from 12th to 5th or possibly 4th in the world behind the big three ship building nations of Korea, China and Japan.

Vietnam has developed in a different fashion to other emerging countries. The majority of the yards are state owned to a great extent and fall within the Vinashin group. There are outside influences from Korea and Japan and joint ventures at various yards which have fuelled development while the state maintains a significant interest.

Hyundai Vinashin for example has built a 400,000 dwt dry dock, the largest in South East Asia.

Notably there are agreements with Wartsila and Mitsubishi to develop main engine manufacturing plants to build large main engines under licence from around 2010 onwards. This will fuel Vietnam shipbuilding still further and complete their emergence with the ability to manufacture the machinery and equipment rather than rely on engines imported from Europe or Korea / Japan.

Current order book information suggests around 200 ships are on order in Vietnam making 1.5% in terms of world tonnage. Even with the benefit of the main engine plant and further expansion of the 20 or so shipyards that currently make up the Vinashin group, it is difficult to envisage Vietnam threatening the big three, and increasing to more than 2 or 3% of world tonnage on order and any further than 4th place, but this would still be a great achievement for a relatively small country that doesn't have the extensive coastline, labour pool, steel industry and development opportunities which are the key ingredients.

In Vietnam the expansion has been quite well controlled and to some extent, "organic" in that the ship construction industry has grown purely on the back of sound principles along with external assistance and guidance.

The Graig Shipping Group is one that has focussed on Vietnam and with their degree of supervision the yards have increased their output in terms of number and size of ships.

China

There remains a large gap in terms of tonnage and number of ships being built by the big three and those in 4th, 5th positions and beyond i.e. Turkey, Vietnam, Germany, Italy, Philippines etc.

Statistics vary but generally speaking the world order book currently puts Korea in first place with 2,000 ships on order and 36% in terms of tonnage, China second with 2,500 ships on order and 25% in terms on tonnage and Japan in third spot with 1,500 ships on order and 20% in terms of tonnage.

So Philippines and Vietnam are still a long way behind. There is a further gap between them and Taiwan, India, Indonesia, Malaysia, Thailand and Bangladesh, with order books of between 3 and 100 vessels. None of these countries appears to be increasing their shipbuilding activities to any great extent, although India is probably the one to watch in the future.

It has been China which has increased its shipbuilding activity so significantly in recent years and which is now the focus of great attention from all sectors of the industry.

China has all the right criteria with a large pool of relatively low cost labour, plenty

of shipbuilding sites along the extensive coastline and an active steel industry.

China does not yet have sufficient main engine manufacturing facilities and is still relying on imported machinery to a great extent. Once this is resolved, China can only expand further into first place in terms of tonnage and number of ships.

The current situation in China is an interesting one. The country is ahead of Japan and Korea in terms of numbers of ships on order, but behind Korea in terms of tonnage, which suggests that like all emerging markets they start with smaller ships and then develop further. A lot of the yards in China are in this process of development, although not forgetting there is a large core of well developed state owned yards which have been building ships for many years.

The smaller, less experienced yards do however, learn very quickly and it is interesting to take note of hull numbers. Hull number 003 from one particular yard was the Mayflower Resolution. The first two were dumb barges. The Mayflower Resolution is one of the most innovative vessels ever built.

The Mayflower Resolution is a very ambitious project for a yard which had previously only built two barges. On one hand it shows how quickly the yards can develop but on the other, as long as they are accurate with their hull numbering / New Build (NB) numbering, it can give underwriters a useful insight into their experience and the likelihood that the project will be successful.

Mayflower Resolution fell short of expectations and didn't perform as it should have done, mainly because the hull went over-weight during construction. Had it been hull number 457 for example, it would probably have been a huge success, given the experience gained from the previous 456 new builds.

China differs to the Philippines and Vietnam by having a large number and a huge variety of shipyards. There are state-owned yards with many years experience building large and sometimes complex vessels for domestic customers such as COSCO. This has provided a solid foundation from which to develop.

There are large private yards operating in joint ventures with Kawasaki and other Japanese and Korean partners building ships of good quality and with good processes in place.

Then there are a large number of private yards operating without any external assistance and with little investment, tending to build ships without a proper building dock or slipway, sometimes just on the beach.

In total there are around 3,000 shipyards in China and around 1,000 of these are what we would term "Beach Yards" where vessels are constructed in a piecemeal fashion, without any huge investment in a building dock, cranes and equipment. Most of the Beach Yards have appeared in the last eight years fuelled by the boom in shipbuilding.

The larger yards have been in existence for many years. They were all state owned and came under the control of China State Shipbuilding Corporation (CSSC) until around 2000 when it was split into two groups (CSSC and CSIC)

China State Shipbuilding Corp (CSSC) now exists with yards such Waigaoqiao Shipyard, Hudong Zhonghua Shipyard, Jiangnan Shipyard and Guangzhou International Shipyard etc.

Waigaoqiao has huge impressive facilities, building cape size bulk carriers in large building docks with a good level of expertise. There is a long track record of experience, the capability of large block construction, good quality control and a record of delivering on time.

CSSC is a large organization. Each yard has its own marketing section. They build ships for overseas clients such as Anangel, Beluga Shipping, Torm, Bocimar and domestic clients such as COSCO etc.

The growth of CSSC has not been without its problems. There was a notable crane collapse at Hudong Zhonghua Shipyard.

On the other hand, CSSC have built high technology ships such as LNG carriers at this yard.

Jiangnan Shipyard is the oldest in China. Being expanded considerably by CSSC, using reclamation and coastal development.

China Shipbuilding Industry Corporation (CSIC) consists of yards such as the big Dalian Shipyard.

It was basically a north / south split as most yards of CSIC are in the north of China, and most CSSC yards are in the south.

CSIC Dalian Shipyard is the only Chinese shipyard to figure in the worlds top six ranking shipyards in terms of the number of ships on order (108) compared to the top yard Hyundai in Korea with 738 on order – although Hyundai have a number of yards.

This reinforces the view that China has moved into second place in the world based upon a large number of yards with relatively small order books rather than a small number of yards with large order books.

Then there are the China Ocean Shipping Company (COSCO) shipyards. The yards have their own account for ship repairing & building, separate to the shipping operation which now comprises a fleet of over 600 vessels.

COSCO yards & COSCO Shipping are separate entities. COSCO yards build ships for outside clients but give priority to the COSCO fleet in the same way that the COSCO shiprepair yards do.

The China Shipping Shipyards are mostly ship repair yards, repairing ships for China Shipping and also for some overseas clients. So far we are not aware of new buildings taking place at these yards although with six yards in Shanghai, Guangzhou and a large facility on Chang Xing Island near Shanghai it certainly gives them the capability to do so if they wish. China Shipping is a state owned company founded in 1997 which has grown into a huge shipping conglomerate in a short period of time.

Independent yards – Nantong Cosco Kawasaki Shipyard (NACKS) is probably the best of the private yards operating in conjunction with Kawasaki.

There has been a good transfer of technology from Kawasaki. Eight containerships currently on order of 13,750 TEU for Container Lines Co. (COSCON) one of the world's leading global providers of integrated container shipping services under the mother flag of COSCO.

New Century Shipyard is an independent yard run by the local government in Jin Jiang City not far from Nantong. It is one of the better yards and has developed very rapidly.

COSCO Shipyard Group is a joint venture of COSCO and Sembcorp Marine at Singapore.

Some notable achievements – Sevan 650 drilling unit and FSO valued at $700 million built at Nantong COSCO shipyard for Sevan Marine.

Then we come to the Beach Yards - all of which are independent.

These are mostly located on the coastal area opposite to Taiwan. They generally build vessels up to 10,000 DWT to no particular design or standard, but tend to favour bulk carriers and general cargo. There are perhaps 1,000 of these yards, one third of all yards in China.

Beach Yards do not have large cranes and cannot therefore pre-assemble large blocks for ease of construction, and similar to what he have seen in the Philippine yards there can be dimensional inaccuracies in the block assemblies and various other quality problems.

Some yards have very little craneage and build the ships directly from frames and plating without any prefabrication at all.

Construction standards are generally poor. Welds might be X rayed but multiple X rays are reproduced from a good weld and then used to show that other – poorer welds – are satisfactory.

One ship we surveyed was filled with a layer of concrete in the bottom of the ballast tanks prior to launching, so goodness knows what the condition of the bottom

plating welds were like.

After a five year period of rapid development by 2005 there were already 3,000 shipyards in China and there had been several accidents. In early 2005, new ships broke up and sank on their maiden voyages built at the Beach Yards in Wenzhou, Zhejian Province.

The state carried out an investigation at 976 yards, mostly located in the provinces of Jiangsu, Zhejiang, Anhui and Fujian and this had a significant impact. By early 2006:

186 shipyards had been closed
218 completed the improvements which were found necessary
572 were in the process of completing the improvements

At the same time, early 2006, the state issued the "China Shipbuilding Quality Standard" effectively requiring the yards to meet a requirement to obtain a licence.

In the meantime the concerns over quality at the Beach Yards which in terms of numbers still account for around a third of all Chinese yards remain:

- sub standard materials and equipment being used (either provided by the owner or the builder).

- recycled materials being used such as large areas of plating which have been cut from vessels being scrapped, and welded into place.

- second-hand equipment such as machinery, piping systems, valves taken from ships being scrapped.

- the amount of new machinery being installed is kept to a minimum, only two generators, one purifier, one steering motor etc.

- the builder has no permanent workshop facilities. Once the builder secures a contract they will find a temporary place on the beach or rent a temporary workshop for the duration of the contract, then engage sub contractors (some of them only farmers) and then training takes place on the job during construction.

- insufficient facilities such as craneage, means the ships are built in the traditional way with framing first before applying the shell plating, rather than the modern way of pre-fabricating blocks and assembling on a slipway or building dock – which reduces structural stress in welds and allows focus on butt joins only for NDT.

- no proper supervision - the builder does not follow the approved drawings / procedures, the design may be modified without approval, if the builder or owner makes changes.

- poor quality welding – welders are not trained to any standard and are not qualified, poor quality control on the welds, no drier or heater for the welding electrodes, welding on wet and dirty surfaces, oversize gaps between plates and frames filled with bare electrodes or small pieces of steel.

- attempts may be made to speed up the welding process by increasing the current on the welding sets to the extent that a lot of internal cracks appear in the welded seams after cooling down.

- no QA/QC system to provide for quality control of the welding process, no suitable NDT equipment and no qualified NDT operator for X ray and ultra sonic examination.

- no safety controls, the working area is usually a mess with welding cables and cutting hoses lying around.

- no management supervision to prevent working long hours and fatigue related issues among the workforce.

- no technical support staff.

But aside from the problems at the smaller Beach Yards, the industry continues to grow and mature.

In January 2008, CSSC and Guandong Province announced the kick-off of a new shipbuilding base located on an island at the entrance to the Pearl River, close to Hong Kong. This will comprise an area of 5,850,000 square meters. There will be 2 dry docks of 300,000 DWT capacity each. The workforce / management are mostly being shifted from Guangzhou International Shipyard and Wenchong Shipyard etc.

Then the government announced that it will invest RMB 27 billion, (approx US$3.95billion) to establish a large engine manufacturing base at Panyu next to the island, in order to provide large low speed two stroke main engines, medium and high speed main engines and generator engines for new construction.

This will mark a further leap forward in China's development as a shipbuilding nation, which has been impressive to date and will continue to be so for some years yet, no doubt taking the country into first position in terms of the number of ships on order and the percentage of the worlds order book in terms of tonnage, in the near future.

Insurance considerations

So what does all this mean for insurers? For Builder's Risk insurers the JH143 survey is not commonly applied in China. A lot of the yards are insured with the large Chinese insurers, PICC, CPIC and Ping An, and the JH143 is not a routine requirement.

In our experience only the larger projects such as the Sevan 650 for example, which

needed the support of the international insurance markets triggered the need for a JH143 survey.

The Beach Yards don't seek builders risk insurance in the usual way. They might have some way of spreading their risk exposure by using banks and local small insurance companies and private investors.

A lot of our experience of new buildings has come from surveys of newly constructed vessels which have been required by London based hull and machinery insurers where problems have arisen early in the life of the vessel sometimes on the delivery voyage. We have assisted owners who have become concerned at quality problems towards the end of construction and we have assisted owners and banks where there may be concerns over value for money - with the recent shift in exchange rates between the RMB and the USD, some yards have demanded an increase in the final instalment or they refuse to release the vessel.

Where we have carried out JH143 surveys the following are the areas which we typically comment upon:

- fire risks – bamboo scaffolding, broken gas hoses, smoking.
- falling risks – defective sling wires, no crane maintenance / testing, improperly fitted lifting eyes.
- design defects – inexperienced designer, not thinking about ease of maintenance in the longer term, satisfying the rules and regulations.
- quality control – insufficient QA supervision.
- physical defects – construction completed in a hurry, unrealistic build times being quoted in order to capitalise on a busy market.

Some examples of where things can go wring:

A shipyard contracted with an owner to construct a chemical carrier out of the same basic hull as a parcel tanker having a double bottom. Safety considerations resulted in the chemical tanks having cofferdams around them, but the tanks were of the same depth as in the parcel tanker. Whereas the parcel tanker had tanks which vented to the atmosphere, the chemical tanker had a closed containment system. Also, the specific gravity of one of the chemicals carried was over twice that of the products carried in the parcel tanker. The combination of higher static head (due to greater specific gravity) and inadvertent over-pressurization of the tank from the closed venting system caused the vertical floors in the double bottom under the tank to collapse. That occurred despite having the structural design approved by one of the major classification societies.

A vessel was designed using metric units, including model tests and development of the lines of the hull. The vessel was built using imperial units. The lines plan

developed in metric units had a linear scale of 1:100. The lines plan used by the shipyard had a scale of 1/8th inch to a foot, that is, a linear scale of 1:96.
The vessel was well under construction when it was discovered that the sum of the weights exceeded the planned displacement by about 12-13 percent -- representing the difference between 1:96 and 1:100 linear scales, converted to volumes. Consequently, the vessel carries substantially less cargo than originally intended, with a resultant loss of revenue for the owner over the vessel's entire life.

A shipyard, constructing a large tanker, was contractually required to coat all of the vessel's ballast tanks with two layers of epoxy coating. The planned master construction schedule indicated the coatings would be applied in early spring, with mean daytime temperatures of about 40ºF (4ºC). At that temperature, the first layer of epoxy coating would ordinarily require over 96 hours to cure sufficiently for the application of the second layer. As the shipyard wanted to apply the coatings on successive days, the shipyard requested the coating manufacturer to add an "accelerator" to the coatings, so they would cure in 24 hours in an environment of about 40ºF (4ºC). Due to slippage in the fabrication of the steel, the coatings were not applied until early summer, with average daytime temperatures of about 65ºF (18ºC). Because the "accelerator" was already added, the first layer of epoxy in the ballast tanks over-cured before the second layer was applied. Large areas of the second layer slid off the first layer as the second layer cured. Subsequently, it was necessary to sandblast and re-coat the ballast tanks in their entirety at a cost of several million dollars in direct costs, plus about one million dollars was repaid to the owner due to the consequential late delivery of the vessel.

A shipyard, facing a potential lack of new building contracts, negotiated a contract to construct a moderately high speed cargo vessel. Anxious to keep the yard's workers occupied, to minimize the impact of delay on other projects, and to keep cash flowing in, they began to "cut steel" before all designing and planning had been completed. An analysis of potential stern vibration had not been completed when the stern's design was finalized to ensure continuing work for the yard's production staff. During sea trials, the hydrodynamically-induced vibration was so severe the ship could not achieve the design trial speed due to the potential of shaking it apart. The ship was re-sold for conversion to a slower-speed trade, with the shipyard (and its underwriter) absorbing the considerable loss.

An operator of over twenty short-haul passenger and vehicle ferries was seeking to construct several new ferries. A consulting firm prepared bid specifications, which were sent to a number of shipyards for preparation of their bids. One of the yards that requested and received an opportunity to bid on the vessels was a small ship repair yard, never having constructed anything more sophisticated than a deck barge. In its bid, that shipyard indicated that, if awarded the contract, it would construct a new, modern shipyard in which it would construct the ferries.
That ship repairer/builder was the low bidder. Consequently, it was awarded the contract, and commenced to construct the modern shipyard while commencing the construction of the ferries.
The first few ferries were delivered late, accompanied by a claim by the shipyard for an additional twenty-five percent of the contract fee due to delay, disruption,

acceleration, change orders and over-inspection allegedly caused by owner's representatives. Upon delivery of the vessels, the owner had to invest another fifteen percent of contract price to correct construction deficiencies. Essentially a non-existent shipyard was awarded the contract based on being the low bidder. The shipyard was constructed as ferry construction commenced. The actual direct cost to the owner for procuring the ferries was approximately fifteen percent over the contract price due to the necessity of correcting construction deficiencies. The availability of the vessels for service was 2-8 months later than contract dates due to the combination of (i) late delivery by the yard and (ii) time to make those corrections to construction deficiencies.

Would the JH43 help to improve matters?

In a rapidly developing market a snapshot of a yard at any point in time is fine but it cannot assess the risks presented by the project at it grows to completion. So for it to work, it should ideally be an ongoing appraisal of the risks presented by the project. It should be project based rather than yard based, and it would be necessary to attend at regular intervals throughout the project. Is this really feasible?

What impact do Classification Societies have, and is being built to IACS class taken as a guarantee of quality?

The large state run and the larger independent yards will build to class requirements, often preferring the China Classification Society (CCS) although all the major class societies are represented in China.

I think it is fair to say that they have all faced the challenge of a rapidly increasing market, and have had difficulty finding sufficient qualified and experienced surveyors in China. Sometimes inexperienced Class surveyors were called “checklist surveyors”. They were not sufficiently experienced to consider the wider implications of ship construction, design issues, future maintenance and make suggestions accordingly.

A vessel built to Class rules and with sufficient Class and owners supervision should be of a reasonable standard in terms of quality, but we as mentioned earlier, there are concerns over cost cutting and compromises over the amount of equipment installed and the effect this has on system redundancy – only two generators, one steering motor, one purifier etc.

Class would not normally comment upon yard issues, safety, safe working practices etc, although an owner’s supervision team may do so.

The Beach Yards will build vessels to order, but often build them on-spec to local ZC standards - local Chinese government standards, without classification society involvement. When a prospective purchaser comes along and shows an interest he may appoint a classification society to oversee the remainder of the construction but this is often too late. Some partial and completed new builds have successfully transferred into IACS class but others not. Some have transferred in, but then been rejected at a later date. Most will transfer successfully into non-IACS class.

So the situation in China is an interesting one, with a large number of shipyards ranging from the best to the worst, and with a corresponding variance in the quality of the ships they build.

Using a well established yard with a good Classification society, an established design and a good degree of supervision, the results will be satisfactory.

For insurers of vessels coming out of yards in countries with rapidly increasing ship building activities, apart from taking some degree of comfort from Class and owner supervision, other points to consider are:

- newbuild numbers, or yard hull numbers – low hull numbers indicate low levels of experience.

- smaller vessels – the less experienced yards generally start with smaller vessels of relatively simple design, bulk carriers, general cargo ships.

- vessels which have changed class during construction or shortly afterwards.

- vessels which have changed ownership during construction or shortly afterwards.

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