How building ships in giant-size sections ramped up productivity at Samsung. By adding one floating dock - the yard increased annual capacity with nine aframax ships! The goal is to reduce delivery time from steel cutting to launch to seven months. The cost of a floating dock is 15-20% of a graving dock.

At the Koje Island shipyard of Samsung Heavy Industries (SHI) space, particularly quayside space, is at a premium. In 2001 SHI came up with a creative solution to the problem, acquiring a floating dock with the intent to use it as a quayside and for re-docking LNG ships for painting. Ultimately management decided on an even more creative and daring course of action, choosing to ramp up production by building new ships in the floating dock.

“Though some yards have built sections in floating docks and transferred them to a graving dock for assembly, as far as I know no shipyard has ever built an entire ship in a floating dock before us,” says Dr. Jae-Won Lee, Vice-President of Hull Erection Team One at SHI.

A key strategic element in SHI’s concept of afloat building was to reduce dock time by building ships in blocks much larger than it had ever attempted. Previously the yard typically built large ships from about 130 blocks, each weighing some 200 to 250 tons. Today the yard assembles ships from ten mega-blocks - eight hull blocks plus the accommodations and funnel blocks - weighing between 2,000 and 2,500 tons apiece.
Brought to the quayside by heavy-duty transporters, they are lifted into the floating dock for assembly by two Samsung-built floating cranes with capacities of 3,000 and 3,600 tons. The heaviest block this system is expected to handle is about 2,800 tons.

<table>
<thead>
<tr>
<th>No. of blocks</th>
<th>Block size</th>
<th>Dock time</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>250 ton</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>2300 ton</td>
<td>100 days</td>
</tr>
<tr>
<td>10</td>
<td>2750 ton</td>
<td>37 days</td>
</tr>
<tr>
<td>8</td>
<td>3450 ton</td>
<td>29 days</td>
</tr>
</tbody>
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SHI divides the labor of producing these huge components with subcontractors from around the harbor, producing almost 60 percent of its blocks outside. Subcontracted units are mostly parallel body sections, keel sections and other relatively simple structures for which the main work is welding. SHI teams concentrate on the more complex structures like engine room blocks that require extensive outfitting and the production of curved sections. *At present the floating dock can add nine vessels to the yard's yearly output.*

When SHI began this program in 2001, its ships were built from 12 mega-blocks, spending 96 days in the dock and 80 days at the quayside between launch and delivery. In 2004 the yard reduced the number of blocks to ten, slashed dock time to 45 days and cut the quayside period down to 60 days. Today dock time has been refined down to 37 days but the drive to build bigger blocks and ax assembly time is far from over. *By 2006 SHI expects to be building ships from eight even bigger giga-blocks, shaving quayside time down to six weeks, saving enough time to squeeze an additional ship into the calendar.*

SHI Hull Erection Team
No. 1 (from left) M.D. Kang, Manager, Samsung; J.W. Lee, Vice President, Samsung; and I.Y. Jeong, ABS Principal Surveyor, Koje Korea.
“Building giga-blocks means that we will be able to deliver a suzemax-size ship in seven months from steel cutting,” says Lee.

“At present SHI can build nine aframax tankers per year in the floating dock. But as it is also used for re-docking, we expect to build seven aframaxes this year in the floating dock with ten re-dockings scheduled. As each re-docking takes about a week, if we get those ten weeks back we can make two more aframaxes. In any case, our goal is to make 12 vessels a year in the dock.”

Getting to this point wasn’t easy. Realizing the daring mega-block concept required the yard to develop a whole new skill set. With the dock and the cranes afloat, relative motions became one of the chief challenges to developing the technique of afloat shipbuilding. “It is pretty difficult to place these big blocks next to each other and still keep the accuracy at +/-5 mm,” Lee says. To meet this challenge, SHI’s R&D Division developed an automatic ballast control system that controls hogging and sagging effects and keeps the dock level at all times. “When we place a mega-block into the dock it produces point forces that deform the base of the floating dock,” he explains. “These forces are countered by constant, automated ballasting and deballasting which keep the dock on an even keel.”

SHI met the challenge of maintaining high positioning accuracy through coordinating the use of 3-D measuring equipment, the floating crane and a block lifting system that is something like a set of hydraulic jacks on wheels. In this grand industrial ballet, a huge crane places an immense structure onto the lifters to an accuracy of about +/-100 mm and the measuring system and the block lifters work together to shift it into the right position. At the same time, the automated ballast control system keeps the whole stage on an even keel.

Later this year, steel cutting begins for a higher-capacity dry dock that will be built in China. For SHI the strategy of building more floating docks works on several important levels. It adds space without land; it increases flexibility, now that afloat building is an established technique; and it saves money as a floating dock can be brought into service for about one-sixth the price of a normal dry dock.

As SHI continues to build bigger blocks and cut quayside time to squeeze more vessels out of its limited space, the question arises as to just where the drive to block size will end. “Theoretically, if lifting capacity were unlimited you could build the whole vessel on land and lift it to the sea,” says Lee, “but I don’t know whether that would be efficient or not. We have considered using both floating cranes to lift blocks that are a lot larger than what we build now but that approach is limited by the geometry of the cranes.”
As unlimited lift is not SHI’s problem at the moment, Lee says the next big goal is improving block accuracy. “The more accurate the blocks, the shorter the construction period,” he says. “Once the accuracy is where we want it, we can apply more automated systems.”

Presently SHI employs welding and plasma-cutting robots in the fabrication sheds. “Many processes have been automated but our target is to see how we can automate the erection or pre-erection stages,” says Lee. “There are also some developments in automated painting that interest us. It will be difficult to automate the production of something as complex as an engine room block,” Lee says, “but we have a dream.”

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