The Market for Submarines
2019-2028

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The Market for Submarines

Executive Summary

This edition of "The Market for Submarines" sees the number of submarines constructed during the period 2018-2027 totaling 157, a 7.5 percent increase over the 146 submarines projected in last year's analysis. This significant increase reflects more than just an accelerating rate of submarine construction. It also includes the long-awaited arrival of the Chinese submarine construction industry on the world market. Over this period, the Chinese will be exporting a total of 13 submarines to countries in the Far East, 11 of these orders having been won against world-standard competition. This is a profoundly important structural change in the market for submarines.

Following the nadir of the submarine construction industry in the late 1990s and early 2000s, the number of submarines projected in each successive 10-year forecast period has continued to increase. In many ways, this steady increase can be compared to a tsunami; the key feature of a tsunami is not the height of the wave but its length – the water just keeps on coming. The scale of the increases in submarine construction in the successive forecasts was not startling until the major increase recorded this year, but the cumulative effect has been a substantial increase in the size of the submarine market sector and the projected scale of the world submarine fleet.

The total value of the submarines projected to be produced over the 2018-2027 period is $151.52 billion, an 11.8 percent increase over the $135.44 billion projected in last year's analysis for the 2017-2026 decade. The effect is a 4.05 percent increase in the average unit value of the submarines covered in this edition, pushing the average unit cost to $965.1 million, up from $927.5 million. This means that the average cost of a new submarine is continuing to close in on the $1.0 billion figure, a yardstick that shows the importance nations place on the establishment or maintenance of their submarine force.

This increase has taken place despite the appearance of first Russian and now Chinese submarines on the international market. Once viewed as low-cost solutions for countries that were isolated from top-tier submarines, Russian and Chinese submarines are now becoming significant market competitors. In making this transition, these submarines are moving into line with world standards where cost is concerned. The fact that they are achieving export sales despite their narrowing cost advantage also suggests that the technical standards of the Russian and Chinese submarines are moving into line with world standards as well. This perception is supported by the Thai justification for the purchase of Chinese Project 041C class submarines: according to the Thai Navy, these submarines offer three-quarters of the capability of a European-built submarine at two-thirds the price. This is a major change from the days when a Chinese-built submarine was only a small percentage of the cost of a European one.

An interesting factor that bears upon unit cost is that the long-standing cost differential between nuclear-powered and diesel-electric submarines is fading. This is partly due to the growing complexity of the modern submarine and the increasing use of air-independent propulsion (AIP), both of which add substantially to the cost of diesel-electric boats. At the same time, China, Russia, and India are entering (or re-entering) the market with nuclear-powered submarines that cost significantly less than the British and American boats that had dominated that sector to date.

This issue brings with it an aspect that is sometimes neglected when comparing the costs of diesel-electric submarines and their nuclear siblings. Until recently, the British and American domination of the nuclear submarine sector meant that the nuclear boats in question were equipped to very high standards in terms of their onboard sensors and command systems. Diesel-electric boats did not reach these standards. This difference was a major driver behind the perceived cost differential between the two types of submarines. In recent years, the arrival of nuclear-powered submarines that are equipped to similar standards as the diesel-electric boats has allowed a more equitable comparison between the two, and the apparent cost penalty of nuclear power is reduced as a result. Analysis of costings suggests that the actual cost of providing nuclear power for a submarine is around $200 million assuming no other specification changes are made.

Shifting Market Balance

The pattern of submarine construction highlights the long-term growth prospects of the submarine market. A total of 85 submarines are due for completion over the next five years, as opposed to the corresponding total of 83 projected in last year's analysis – an increase of 2.4 percent. These have a total value of $77.9 billion, an increase of 4.7 percent over the corresponding figure for last year. A total of 72 submarines are due for completion in the five years of the far term – a startling increase of 14.3 percent from last year's figure. These

are valued at $73.54 billion, an increase of 20.5 percent over the equivalent value in last year's analysis.

The significance of these figures is that the unit cost of the submarines built in the near term is $916.5 million, while the unit cost of those built in the long term is $1.02 billion. For some years, the differential between these two values shrank as older, lower-cost submarine projects were completed and dropped out of the production schedule. Now, it is beginning to increase again as their place is taken by submarines that reflect the growing increase in sophistication of the world submarine fleet and the growing number of nuclear-powered boats in that fleet.

A significant factor here is that program times are slowly but steadily increasing, expanding the time required for construction. A side effect is that speculative construction or construction based on plans that are currently in the early stages of formulation no longer result in deliveries within the forecast period. Two decades ago, it was quite normal for a diesel-electric submarine procurement program to be formulated, the contracts negotiated and signed, and then the boats built and commissioned within a 10-year period. This is no longer the case, and a similar program may now take 15 or even 20 years to complete.

Division of Labor

The submarine market is divided into three subsectors. The first is the market for ballistic missile submarines, or SSBNs. The production of 12 SSBNs is projected over the forecast period, representing 7.6 percent of the total market in terms of numbers. They are valued at $25.1 billion, representing 16.6 percent of the total value of the market. The average unit cost of the SSBNs is $2.09 billion. Note that this figure is slightly artificial, since all the submarines in question are built in yards where construction values are much lower than the value of their Western equivalents. Once the next generation of U.S., British, and French SSBNs join the projections, something that will happen in the next two or three years, this unit cost will rise steeply.

The re-entry of the Russians, the arrival of the Indians, and the acceleration of the Chinese programs have thus revived the dying SSBN market. Were it not for the decision by India to go for the SSBN sector first and follow with nuclear-powered attack submarines later, the market would be monopolized by the Russians and Chinese. The navies of both Russia and China were predicting their new SSBNs would be in service during the 2008-2009 timeframe. China actually achieved this target, with the first of its Project 094 class boats running trials in late 2008. Then, in late 2009, the first new Russian SSBN was put to sea for preliminary trials. However, beyond this point, construction appears to have been more erratic, with commissioning dates for future boats shifting unpredictably. This suggests that both navies are having problems with their SSBN designs and missiles, an analysis confirmed by statements from both Russian and Chinese sources.

In the longer term, both the British and U.S. navies are in the process of designing successors to their existing Vanguard and Ohio class SSBNs. The British Dreadnought class and the U.S. Columbia class stay with the traditional SSBN concept, although both carry significantly fewer missiles than their predecessors. It is, however, unlikely that either class will enter service before 2030. Overall, the SSBN sector looks healthier now than it has in many years.

The second sector is the market for nuclear-powered attack submarines, or SSNs. These submarines are the backbone of the world navy submarine fleets, and it is significant that navies with ambitions to achieve more than local power status have made the acquisition of SSNs a priority. Our projections show sales of 45 such submarines over the 2018-2027 decade, an increase of five from the figure for 2017-2026. The SSNs represent 28.7 percent of the total number of submarines and are valued at $77.5 billion, an increase of 7.0 percent from last year's analysis. This represents 51.1 percent of the total funding for all submarines over the forecast period. The average unit value of the SSNs covered in this survey is $1.72 billion. Interestingly, the differential in value between SSNs and SSBNs has fallen precipitously over the last few years, and the average SSN unit cost now exceeds that of the SSBNs. There is a simple reason for this: the SSBNs are under construction in China and Russia, where unit costs are low. The majority of SSNs are being built in the U.S., the U.K., and France, where costs are much higher.

At least three Chinese Project 093 class SSNs have been sighted, apparently in operational condition, at the Qingdao Chinese nuclear submarine base, and two more are running trials. In this respect, Chinese SSN construction is following the same pattern as the country's diesel-electric submarine programs – build two submarines as prototypes, run them for three or four years, and then employ the "lessons learned" in a production version. The first hulls of that production version are now appearing. However, it appears that the patrol rate of these submarines is abysmally low, with the submarines apparently putting to sea less than once per year.

The Brazilian Navy is continuing to plow ahead with its SSN program (revitalized by a technical agreement with DCNS for the joint development of nuclear submarine technology), and this is now emerging as a solid program for at least three SSNs, with a final target of up to six.

SSK Market Recovering

The final sector is the SSK, or diesel-electric submarine, market. This rebounded in 2007 following a steady decline in the early years of the 21st century. During the 2018-2027 period, a total of 100 boats will be built, an increase of six from the 2017-2026 period. These boats represent 63.6 percent of the forecast total. They are valued at $48.93 billion, an increase of 19.2 percent over the total for last year. This represents 32.3 percent of the total expenditure on submarines over the decade. A notable factor this year is that the average cost of diesel-electric submarines has increased to $489.3 million, a 12.0 percent increase from the figure cited last year. This gives a useful indicator of cost inflation in the SSK category.

The stable nature of the submarine market combined with the average hull life of a submarine suggests that the current production rate will sustain a fleet of roughly 245 SSKs, 130 SSNs, and 44 SSBNs, for a total of 419 submarines. This is still slightly less than the current worldwide fleet of around 430 hulls, but the differential has shrunk to the point where it is within analytical error margins. Assuming that the current worldwide submarine fleet is roughly in balance with current operational requirements, it appears as if production and inventories are quickly coming into balance. This tends to suggest that a relatively steady state is in prospect.

However, the SSBN figure is misleading, since the majority of the world's SSBNs are relatively new. A calculated force assessment would suggest that Russia intends to keep a fleet of around 10 SSBNs, with the U.S. likely to maintain a fleet of around 14 and the U.K. and France adding a further four each. It appears that China is aiming at a fleet of five SSBNs, although it is unlikely that the nation will achieve this within the forecast period. India has announced an intention to build six SSBNs of the Arihant class. This brings the total number of SSBNs to 43, a number that is beginning to near the levels projected by current production numbers. There is still a deficit, though, leading us to expect a further uptick in the construction rate of SSBNs that will be accommodated by the SSBN(R) and SSBN(X) programs.

The projected SSN fleet figure does seem realistic. If the projected force level for the U.S. (now down to 50) is subtracted, we are left with a total of 43 SSNs worldwide, of which 12 will be Russian and an additional 14 British and French. The total of 17 for the Brazilian, Indian, and Chinese navies (the existing Chinese fleet of five is being decommissioned as the Project 093s enter service) does not seem implausible given the financial and technical problems facing those navies.

The world submarine fleet today is far removed from what it was in the late 1980s, when more than 800 submarines were in service around the world. The decline in the worldwide fleet of SSKs has long been masked by navies retaining old submarines in the inventory long after their operational life has ended. Some submarines still listed as "operational" have for years been used as little more than training vessels or battery-charging hulks. It appears that the last survivors of the Chinese Project 035 Ming class now fall into this category.

Compete No More

Because of the dramatic decline in market size during the 1990s, the range of companies has imploded. For all practical purposes, there is no competition in the SSN and SSBN sectors. Such competition as still exists is concentrated in the SSK sector, where the number of viable competitors is essentially restricted to two: ThyssenKrupp and DCN International. If the Russian submarine industry is able to turn its claims into reality, it would undoubtedly establish itself as a world-level submarine supplier. It has publicized its submarine technologies and design abilities widely in a determined effort to seize some of the available market. Until quite recently, this was largely unsuccessful; the Russians sold some submarines to existing customers and made one innovative sale, but that was all. The sticking points were the Russians' ability to support the equipment and doubts over production issues.

China and Japan are now making a serious push toward establishing a presence in the SSK market. The Japanese hoped to establish a new position in the market by selling diesel-electric submarines to Australia. This didn't happen, and the Royal Australian Navy selected the French Shortfin Barracuda class, primarily due to the great experience of the French sales and technical teams. As the Japanese learn from experience, they are likely to become formidable competitors.

China's new submarines are significantly more advanced than the older designs and may have bridged enough of the gap between their products and those of the German and French design teams to make some market impact. Recently, China has succeeded in gaining major export orders from Pakistan and Thailand for its Project 041 diesel-electric submarine. This design certainly does not fall into the previous categorization of Chinese-built submarines as obsolete, but its full potential is not yet known, so whether it will become a major player remains unclear at this time.

Analysis 1

Note: *This analysis provides essentially complete coverage of the world submarine market. It is inclusive of every known and plausible submarine program. Highly improbable or speculative programs are not included because they would not have a serious impact on the market.*

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PROGRAMS

The following reports are included in this section: (**Note:** a single report may cover several programs.)

Astute Class
Barracuda
Brazilian SSN
Chinese Diesel-Electric Submarines
Chinese Nuclear Submarines
Columbia Class SSBN
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