

MEDIA BACKGROUND

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Major Western Submarine Designers Ready to Proceed with Transformational Power Systems: status of lithium-ion battery technology for naval submarine propulsion

Several countries have now revealed their intention to acquire naval combat submarines within the next decade that will be powered by lithium-ion main batteries.

The following is a collection of public information to provide the media with background on the current status of development and adoption of advanced battery power systems for naval submarine propulsion.

JAPAN

On 4 October 2018 Japan launched the JS *Oryu*, a Soryu-class attack submarine fitted with lithium-ion main batteries instead of the conventional lead acid batteries used in earlier Soryu-class submarines.

<https://thediplomat.com/2018/10/japan-launches-first-lithium-ion-equipped-soryu-class-submarine/>

“The lithium-ion batteries radically extend the sub's range and time it can spend underwater.”

<https://asia.nikkei.com/Economy/Trade-war/Japan-s-silent-submarines-extend-range-with-new-batteries>

The JS *Oryu* is due to enter service in March 2020. The Japan Maritime Self-Defense Force (JMSDF) has advised that the next three Soryu-class submarines, due to enter service between 2021 and 2024, will also be fitted with lithium-ion main batteries

https://mags.shephardmedia.com/Show%20Daily/IMDEX_Asia_Day_Two/IMDEX%20Asia%202019%20Day%20Two.pdf [p7]

The JMSDF has also indicated that some earlier Soryu-class submarines may be refitted with lithium-ion main batteries.

Initial development of the next generation of Japanese attack submarines – the 29SS class – has commenced, and it is expected that these submarines will also use lithium-ion main batteries. The 29SS class will be developed and launched in a similar timeframe to Australia's new Attack-class submarines.

<https://nationalinterest.org/blog/buzz/stealth-suprise-japans-new-submarine-game-changer-65611>

SOUTH KOREA

Commencing in 2016, South Korea undertook an intensive 30-month Technology Readiness Assessment (TRA) to evaluate the suitability of commercially-available lithium-ion battery technology for naval submarine propulsion.

<https://www.globalsecurity.org/military/world/rok/kss-3-2.htm>

The outcome of the TRA process, which involved South Korean defence agencies, the prime battery system contractor and 11 research institutes, was a decision to incorporate lithium-ion main battery systems in Block 2 of South Korea's new KSS-III class attack submarines. The KSS-III Block 2 submarines will be built and commissioned in the mid-late 2020s.

<https://www.globalsecurity.org/military/world/rok/kss-3-unit.htm>

In the second quarter of 2019 Hyundai Heavy Industries (HHI) launched the lead boat of South Korea's next generation advanced midget submarine design, currently known as the HDS-400. While not confirmed, it is believed that the HDS-400 will use a lithium-ion main battery system similar to that developed and evaluated for the KSS-III Block 2 large attack submarine.

http://www.hisutton.com/HDS-400_Midget-Submarine.html

GERMANY

In October 2018 Thyssenkrupp Marine Systems (TKMS) announced that they had developed a new type of lithium-ion main battery system for submarines together with SAFT, a manufacturer of advanced battery systems for industry.

Dr. Rolf Wirtz, CEO of Thyssenkrupp Marine Systems said *"The use of the new battery technology has enormous tactical advantages. We are entering a new era of submarine construction."*

<https://www.navyrecognition.com/index.php/news/naval-exhibitions/2018/euronaval-2018/6606-euronaval-2018-tkms-showcasing-li-ion-battery-prototype-for-ssk.html>

Following the completion of extensive testing in 2019, TKMS intends to fit the new battery system to Type 212CD submarines to be supplied to the Norwegian Navy.

FRANCE

At Euronaval 2014 DCNS (now Naval Group, lead supplier for the Australian Attack-class submarines) announced three new submarine propulsion technologies including *"a hull plug equipped with new-generation high-capacity lithium-ion batteries. Easy to operate, the technology offers high submerged speeds on demand and improved response to power ramp-up and variations."*

“The (submerged) endurance of a Scorpene-type submarine is increased to seven days resulting in a significantly enhanced tactical capability.”

<https://www.naval-group.com/en/news/major-dcns-innovations-improve-submarine-capabilities/>

“DCNS has also announced new generation lithium-ion batteries offering a week's submerged endurance thanks to their increased capacity.”

“In addition to increased submerged endurance, the new-generation lithium-ion batteries offer improved response to power ramp-up and variations as well as deep discharge. Overall, the new batteries allow a submarine to maintain a submerged speed of 12kts for 24 hours, marking a significant new milestone in SSK performance.”

https://www.meretmarine.com/sites/default/files/pdf/MM2014_pp42-55.pdf [p49]

In October 2018 Naval Group announced that it had developed a high performance and highly secure Li-ion battery system (known as LIBRT) to provide its conventional submarines with outstanding operational capabilities. The LIBRT main battery system also uses lithium-ion battery cells developed and manufactured by SAFT.

<https://naval-group.com.au/2018/10/24/naval-group-presents-librt-its-new-generation-of-lithium-ion-batteries-system-for-submarines/>

Alain Guillou, Senior Executive Vice-President at Naval Group said *“The successful development of the LIBRT Li-ion batteries systems is a huge technological stride for the new generation of submarines developed by Naval Group. It provides utmost security guarantees as well as operational and technological superiority to all our clients worldwide.”*

Naval Group advised Australian industry media representatives in October 2018 that it intended to present the Australian Government with the option to integrate the LIBRT lithium-ion battery system into Batch 2 of the Attack-class program.

<https://www.manmonthly.com.au/news/naval-group-presents-new-generation-lithium-ion-batteries-submarines/>

In July 2019, in anticipation of a Dutch Navy requirement for an expeditionary submarine able to be deployed worldwide, Naval Group announced that it *“is working on a Barracuda derivative that is very close to the SMX Ocean conceptual design displayed at Euronaval 2014. This conventional submarine of around 4,700 tons shares the dimensions and external design of the Suffren and Shortfin Barracuda (Australian Attack-class) with a totally different propulsion system.”*

“The SMX Ocean displayed both an AIP (air independent propulsion) module and lithium-ion batteries instead of acid-lead batteries commonly used today. A configuration that could allow transoceanic deployment at high speed followed by a full month of underwater low-speed operation.”

“Lithium batteries offer more power and faster charging than previous generation (lead acid) batteries. If some accidental fires occurred in the civilian uses of this type of battery, Naval Group representatives stress the fact that acid-lead (batteries) are intrinsically even more dangerous. Military security applied to lithium-ion batteries is making them a safer solution.”

“Naval Group already uses lithium-ion batteries underwater, including in the training variant of the F21 torpedo and on UUVs. Recently, Naval Group simulated an 18-days dive using both their new generation AIP and lithium batteries. The final proposition to the Netherlands could use a similar propulsion configuration in order to meet the requirement of projection in the Caribbean.”

<https://www.navalnews.com/naval-news/2019/07/more-details-on-suffren-the-french-navy-next-gen-ssn-on-its-export-ssk-variants/> [sub-heading - A Barracuda derivative for the Dutch Navy]

END

This media background is provided by Derek Woolner and David Glynne Jones from published sources.

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David Glynne Jones is an independent advocate for the adoption of renewable energy technology across all sectors of the Australian economy. He is currently assessing the implications of emerging advanced battery technology for electrification of the Australian transport sector.

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