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Near Future Submarine: development of a combined Air Independent and Lithium Battery propulsion system (AiLiP)

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Submarines are vehicles where efficiency plays a key role in energy management: conventional submarines, with a diesel engine to recharge the batteries, rely on full electric propulsion.

The search for better performance in terms of efficiency and energy storage capacity, has led the World Navies with submarines, to develop alternatives to the classic lead-acid batteries.

The decision of the Italian Navy Submarine Flotilla to engineer the development of a LiB propulsion system aims to provide its submarines with greater autonomy and more installed energy.

Integrating this innovative technology into the new Near Future Submarine project, according to a design “space constraint” driven, involves the rethink of various critical aspects: starting from the choice of the manufacturing chemistry throughout the on board integration process, the risk assessment, the management of the entire life cycle, the spaces and weights distribution, the auxiliaries systems, involving also operational procedures for missions and the logistic supportability of the submarine in the home base and abroad, including details as maintenance at sea of LiB cells in reduced spaces.

In addition, this type of technology perfectly integrates with the NFS Air Independent Propulsion (AIP) system based on fuel cells: due to twenty years of operation use of the AIP Submarines, the ITN Submarine Flotilla has developed extremely specialized know how and mature skills on the production, storage, transportation, and consumption of hydrogen as modern energy carrier.

Future submarines powertrain will be like a grid and each energy source will be optimized to minimize the fuel consumption at the maximum efficiency.

The achieved results will be an incentive for further R&D also in the space sector, where lithium and hydrogen have coexisted for decades in spacecraft energy storage; once again, a strong technological correlation between submarine and spacecraft has been identified, confirming the similarities between the two.

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