Building the vessels of tomorrow – today
(with a regulatory framework still in the making or without fuel pathway maturity)

Ahead of the rules

by PhD Eng. George *Balan, Head of Shipbuilding Supervision and Plan Approval, Bluestone Group*

As hybrid propulsion, alternative fuels, and high-voltage systems move from concept to commercial construction, newbuild supervision is becoming a frontline decarbonisation discipline. Decisions made during construction are already determining future compliance costs, retrofit feasibility, and vessel value – and reversing them is more expensive than most owners appreciate.

While future fuels, new technologies, and regulatory ambition are important for achieving shipping's decarbonisation, there's a more practical constraint often overlooked. The industry is not only deciding which technological solutions will define the next generation of vessels. It is also trying to build them, integrate them, and keep future options open while the rules, systems, and operational assumptions surrounding those technologies are still evolving.

This is where some of the hardest decarbonisation decisions are now being made: not in strategy papers but in shipyards – where everything has to be discovered in real life for the first time.

Beyond conventional

Vessels ordered today incorporate multi-hybrid propulsion, advanced energy storage, high-voltage distribution architectures, and alternative-fuel arrangements. These are not experimental systems being tested at the concept stage. They are entering commercial contracts on vessels that will operate for 25 to 30 years, serving trades where regulatory requirements are tightening on every cycle.

Less widely discussed is the regulatory position these vessels occupy at the time of construction. For ambitious projects, class-society approval for certain systems may exist only in principle when contracts are signed. Engine certification for the fuels a vessel will eventually burn may still be in progress when steel is being cut. Guidance from classification societies and European regulatory authorities on battery management system architecture may not be aligned. In short, the rules are often developing in parallel with the ships being built to meet them.

On two recent projects – *Monna Lisa*, awarded Ship of the Year 2025 by Skipsrevyen, and *Nerea*, recognised with a Shippax Award 2025 – this dynamic was a central feature of the newbuild phase. The former is a 171-metre deep-water cable-laying vessel built by VARD for Prysmian, featuring DP3 capability, an enhanced energy storage system, and a high-voltage shore connection enabling zero-emission in-port operations. The latter is a 110-metre ro-pax built by Sefine Shipyard for Siremar (Caronte & Tourist), combining LNG, batteries, diesel propulsion, and photovoltaic (PV) panels on routes between mainland Italy and Sicily (the Shippax jury credited the ferry with a 45% reduction in CO_2 emissions).

Both projects reflected a wider reality now facing advanced newbuild programmes: regulatory guidance, class expectations, and technology integration practices are continuing to mature as these systems move into commercial application. In that environment, supervision teams are required to go beyond conventional compliance verification. Their role is to help translate evolving requirements into practical, buildable solutions, working closely with owners, shipyards, class societies, and equipment manufacturers to ensure the final on-board arrangement is safe, compliant, and operationally robust.

On *Monna Lisa*, the battery management system architecture had to be structured into two distinct operational frameworks. One handled peak shaving and load sharing; the second controlled AC/DC grid switching and spinning reserve functions tied to the vessel's DP3 redundancy requirements. These were developed during construction, validated against battery risk assessments, and coordinated against European safety guidance and class society requirements at the time of building. High-voltage cable segregation required continuous on-site assessment. DP3 vessels require maintained redundancy throughout. Every routing decision – from forward to aft, from the keel upward – had consequences for availability, fire-zone separation, and fault isolation. In several locations, dual-fed circuits with automatic changeover were the only viable solution within the vessel's physical constraints. This kind of decision-making requires an engineering-led presence throughout the construction process.

The *Nerea* ferry project raised different integration questions. Injecting PV power into the main grid required an operational matrix to be built from the ground up, specifically to ensure that solar generation could not interfere with blackout recovery procedures. If PV supply affects emergency restart sequencing, the vessel's ability to recover safely from a blackout could be compromised. The LNG venting arrangement had to be routed through a structural duct that was precisely dimensioned to preserve passenger accommodation without compromising safety or maintainability. For a vessel combining four energy sources within 110 metres, every spatial allocation carries consequences.

Before steel is cut

There is a tendency in discussions of newbuilding supervision to frame the primary objective as delivery: whether the vessel is built to specification, on time, and to class. However, a pure focus on delivery understates the real risk. The more significant issue for owners is what decisions taken during construction – often under time and commercial pressure – will mean for the vessel 10 or 15 years later. Those decisions are difficult and expensive to reverse.

Choices made during construction about cable routing, spare capacity in distribution panels, the number of available penetrations through structural bulkheads, and access to battery compartments will define what is technically and economically feasible when the vessel requires upgrading. Where technical spaces are already fully utilised, or where access was not planned with future modification in mind, subsequent retrofit costs rise considerably. Main engine modifications required by future regulations are among the most expensive and disruptive to address post-delivery. Systems not originally designed for hull air lubrication, selective catalytic reduction, or more capable wastewater treatment become significantly more complex when the vessel was not built to accommodate them.

The Baltic Sea region encompasses an active regulatory environment: a Sulphur Emission Control Area, NOx Tier III requirements, and EU environmental legislation that applies to vessels operating between Member State ports. Ferry operators and short-sea shipping companies that

Photos: Bluestone Group

sail here have to manage fleets with multi-decade operational lives against compliance horizons that will continue to shift. In a transport system where schedules are tight, and vessel downtime has direct consequences for passengers, cargo flows, and logistics chains, the ability to plan and execute future works with minimum disruption is both an operational and a commercial concern. The decisions embedded in today's newbuilds are already shaping how much flexibility operators will retain in the future.

The practical implication for owners is that technical oversight needs to begin earlier than most project timelines currently allow – not at the point of construction but at design interpretation and contract formation. The most consequential decisions in a complex newbuild are often locked in before steel is cut. Space allocations, routing assumptions, equipment selections, and access arrangements made during early design reviews define what is buildable, maintainable, and adaptable over the vessel's life. Once compartments are closed and structures are welded, correcting them is disproportionately expensive.

Documentation deserves equal attention. An as-built record that is complete, structured, and permanently owned by the buyer – rather than held within a shipyard's proprietary system or fragmented across delivery files – is the foundation for all future engineering work. For dry-dockings and retrofits, accurate records of cable routes, foundations, ventilation paths, and commissioning data reduce uncertainty and support faster, safer engineering decisions. Where that record is absent or incomplete, future programmes begin with reconstruction and verification rather than execution, extending time in dry-dock.

Acting effectively as this bridge – between what the owner has contracted, what class requires, what the yard can practically execute, and what the vessel will need across its working life – requires multidisciplinary competence across electrical systems, mechanical installation, accommodation, automation, structure, coatings, safety, hazard mitigation, commissioning, and project management. It also demands continuous learning. Staying ahead of new fuels, high-voltage systems, and evolving hybrid architectures – where the rules are still catching up with the technology – is a technical necessity.

Long before

The industry cannot wait for every regulatory framework or fuel pathway to be fully mature before building new ships. The commercial reality does not allow that. But if vessels are being built while the rules are still catching up, then the discipline of supervision becomes more important – not less.

Today's construction decisions are already locking in tomorrow's compliance costs, retrofit options, and operational flexibility – vessel by vessel, drawing by drawing, cable route by cable route, long before service begins. □