

## Creating the Perfect Engine Room

Reported by: Donald V. Gale

### Panellists:

Wayne Bridges – KiloPac Generators  
Kevin Greene – TRAC Ecological  
Jeff Sherman – MTU Detroit Diesel  
Joseph Smullin – Soundown Corporation

The ideal engine room aboard a yacht takes up no space, and ideal yacht machinery is neither seen, heard, nor felt. Bowing to realism, however, a yacht engine room should be an aesthetic marvel to the eye. Of course, the engine room must exhibit the customary hallmarks of serviceability and the capability to propel the boat and to run all the boat's hotel and other systems and functions. Crucial points discussed included sound and vibration, ventilation, plumbing, insulation, systems reliability and maintainability and the timely availability during design of engine, generator and other machinery data. While the shipyard is ultimately responsible for ensuring the best engine room is built, designers, naval architects, project managers and equipment vendors likewise take active interest in upholding practices leading to an optimal configuration.

Jeff Sherman cited the importance of relating machinery space considerations to specific engines and components, rather than allowances, where possible. He and Kevin Greene stressed early stage design development of the engine room as this space has often historically been treated as an afterthought. Early definition of generator sizes was stressed by Wayne Bridges who cited the possibility for a small increase in required output resulting in a higher engine class and a sharp increase in space, weight, heat dissipation and fuel capacity requirements. However, a key challenge to yacht engine room design generally not present with military or commercial vessels is the reliability of available machinery data. While commercial and military designers often rely on data for existing machinery, the demands of yacht customers frequently result in the development of new propulsion and generator engines. Mr. Sherman cited requests from customers for engine specifications for a new product due for release in three years, remarking that the days of keeping a naval architecture package open for two to three years are long gone. Dave Wessner, Sharp Design Naval Architects, likewise cited the prevalence of shipyards selling products prior to development resulting in machinery space configuration impacts later in construction.

Sound and vibration challenges on yachts are addressed by various means of engine room insulation, shielding and resilient machinery mounting. Joe Smullin recommends double mounting of generators on hydro elastic mounts installed in conjunction with rubber mounts. He further recommends isolated hangers containing resilient collars for plumbing and hydraulic lines, displaying several examples attractive for yachts. Exhaust systems likewise need to look good, as well as provide required noise attenuation with low back pressure and long-life, easily dismantled components.

While insulation is used to contain engine room noise, dampen structure-borne noise and contain fire, it adds significant weight and reduces interior volume. The use of sound shields, commonly found on generators, on main engines was proposed by one delegate, with Mr. Smullin citing one installation whose panels which had to be removed for access to the medium-speed diesel proving cumbersome and inconvenient. Joe suggested that small high-speed diesel main engines might better benefit from an engine shielding scheme, but ultimately questioned the effectiveness given the number of other noise makers in the engine room. Active noise cancellation was proposed, but the technology generally works well only when targeted to one discrete noise type. The number and variety of noise makers in an engine room would require numerous sensors, mounted one-half wavelength or less apart from one another, to be effective, according to Joe. Targeting a single air intake that generates bothersome noise in the cabin, for example, might be a cost-effective application of this solution. Based on my background I'm especially interested in these and any other noise control technologies used in military ships where both security-compromising noise signatures and hearing injury to personnel are key concerns and where such solutions are transferable to the yacht market.

Noise control aboard a yacht can be carried too far. Several delegates cited cases where dismayed Owners described the interiors of their boats feeling "like a crypt", leaving them quite uncomfortable, due to the silenced machinery and heavy insulation.

Regarding fire insulation, fiberglass provides a lightweight solution with a limited fire rating; ceramic provides better protection while mitigating weight, and mineral wool provides optimal protection but at the highest weight penalty and is most appropriate for full displacement boats.

Kevin Greene stressed reliability and serviceability as two key engine room attributes. Machinery selections should allow full operational redundancy. Where necessary, removable service panels should be provided and conveniently sized for handling in heavy seas. Jeff Sherman favors machinery arrangements consisting of an engine room containing all mechanical components plus a separate control room for switchgear and monitors, a configuration that Wayne Bridges said is currently most prevalent in large yachts. Clutter impinges serviceability and should be avoided. The trade-off of manned versus unmanned engine rooms was discussed. Owners are often pleased to operate with reduced crew in favor of automated systems and remote monitoring capability. The question was raised as to whether high degrees of automation and monitoring would promote lackadaisical attention and maintenance. A key concern, according to Mr. Greene, is serviceability via removable panels and ample service clearances the absence of which will promote laziness.

Air exchange into and out of the engine room is crucial to proper machinery operation and to preventing communication of heat and odors to the living and recreation areas. Ventilation systems such as those provided by Delta "T" Systems and other vendors provide ample air flow, cool the engine room and also aid in keeping salt away from equipment. A slight negative engine room air pressure compared to ambient conditions aids in minimizing odor transmission. Computational fluid dynamic analysis of air and heat flow facilitates an optimal engine room ventilation system design.

Tom Patterson, CEO Shannon Yachts, inquired about the feasibility and market penetration of diesel electric propulsion systems aboard yachts. Kevin Greene, in acknowledging diesel electric systems' versatility in balancing hotel and propulsion loads, said that they haven't gained significant market traction primarily due to high cost. The typical diesel electric cost premium is 20% to 25% compared to conventional configurations but can be significantly higher. Space and weight premiums of diesel electric equipment also frequently require larger hulls.

The idea of actively cooling the engine room drew varied responses. While Mr. Sherman cited a commercial boat system with which he had worked, Mr. Bridges felt the required system too complex to work properly on most yachts. While Mr. Smullin referenced an active cooling installation on a 70-meter yacht to reduce air duct intrusions into the cabin, he claimed that the system required extremely large sea water pumps thus indicating a cabin space trade-off for a trade-off of space and weight in the engine room.