GREEN STEALTH
approx 1100 words

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ABSTRACT Environmental issues are becoming ever more important to the ferry industry. Ferry designers and operators are looking for ways to reduce the impact of a ship upon its environment. It is this author's contention that a large collection of tools already exists for reduction ship environmental impact, tools which are currently found in military "Stealth" technology. In the following article the author will explore what those tools may be and how they may be applied to ferries.

Environmental issues are becoming ever more important to the ferry industry. In years well past ship designers didn't think about the environmental impact of their ships, except perhaps to prohibit cleaning of exhaust stacks during daylight hours. Today, on the other hand, almost every ferry operator is familiar with the issue of vessel wake wash, and the work that has been done to minimize wash impact through vessel design and operational routing.

But wake wash is only one of a ship's many environmental "signatures." In addition to putting out waves a ship also radiates noise. In one incident in the USA State of Washington, the Washington State Ferries found that one catamaran ferry generated slightly fewer wake wash complaints than another. Upon a bit of further research it was found that while they had similar wake wash characteristics, one was quieter than another. The supposition is that waterfront watchers weren't alerted to the ferry's passage, and thus couldn't dash out to watch those nasty waves rolling ashore.

In other situations we may easily imagine areas where the roar of the diesel is unacceptable: Perhaps a waterway with homes close ashore, who do not fancy having morning coffee interrupted by the sound of 20 MW passing a hundred meters away.

Both of these examples concern airborne noise: Noise that is radiated by the ship and borne by the atmosphere to a listener.

Another type of acoustic radiation (noise) is waterborne noise. This is noise that is heard by fish - that is it is carried by the water to a waterborne listener. In the US Pacific North West this type of radiation is very interesting for whale watching operators. Whales have very sensitive ears and will avoid noisy (underwater) boats.

I have heard, although I can not substantiate it, that there is a cove in Alaska which has an underwater noise limit, much as any other harbor might have a speed limit. This cove is frequented by Humpback whales, which move in to mate. During mating time the whales move very slowly, and are particularly acoustically sensitive. If interrupted by a loud noise they will not return to their behaviors for quite some time. To prevent this sort of interruption and protect the whale's bedroom privacy an underwater noise limit has been put in place. I have even heard that their are hydrophone arrays on the bottom of this cove trapping "loudsters" in much the same way a patrolman's radar gun traps speeders.

Noise is probably the second most commercially-important signature after wake. But the list does continue: We may imagine that underwater heat emissions may disturb the migration patterns of some animals - will we see heat emission limits imposed on Salmon runs? We might imagine some region which insists that ferries be painted in subdued colors in order to reduce their visual impact, because the region's city fathers imagine the ships to be unscenic. These last are admittedly fictional today, but given the pace at which environmental regulations have grown in the last decade, how much longer will these remain fiction?

These four types of ship signature have been of interest for many years to military engineers. Each of these is a factor in what is called "ship detectability". Clearly there is a relationship between detectability and environmental impact: If one can't detect the ship at all, then it is probably not impacting the environment at all, eh? At least not in those signature areas.

This then leads to considering the use of military-derived detectability-reducing tools for producing Green ferries.

Most ferry designers have come from a commercial background. Few ferry naval architects have participated in the design of the French FL-2000 low-detectability frigate, or the US Navy's low-detectability DDG 51, or the Swedish low-detectability YS-2000. And similarly few of these military naval architects are active in the ferry design community. This article is an attempt to foster some flow of information across this divide.

The tools for acoustic signature reduction are straight forward: First, one attempts to reduce the energy at its source: Find an engine that vibrates less. Find an engine that puts less noise in its exhaust pipe.

Secondly, given that you have to have some noise, can we put the noise into a more easily handled band? Gas turbine noise is higher pitched than diesel noise. High pitched noises don't carry as far as low pitched ones, and they are generally easier to attenuate. Thus, in the quest for a quieter ferry, turbines may be the power plant of choice.

Having tried to select machinery which puts out little noise at the source, one then tries to impede the progress of that noise from its source to the ultimate listener. For underwater noise this means putting losses into the acoustic path to the ship's structure. Most ship's have resilient engine mounts, but the efficiency of this scheme can be greatly increased by using double mounts with a large intermediate mass. And it's no good mounting the engines softly if the vibrations are going to radiate out the tailshaft bearings. The entire system must be considered. It is also known, for example, that propellers and waterjets have different acoustic radiation patterns (not necessarily one better than the other - just "different.")

The same basic principles apply to airborne noise: Eliminate it at the source if you can, and then put losses between the source and the listener. There are also peculiarities relating the frequency of the noise. High pitched noise tends to be more directional than low pitched noise. In that case, aim the turbine inlets straight up, so that the high pitched whine goes up to space, not aft or sideways to shore.

Thermal energy is again treated by eliminating it at the source (find machinery the doesn't radiate heat to water) and / or introducing losses in the path to the observer (usually accomplished by diluting the heat with a large supply of cold air or water.)

This article is not intended as a primer on acoustic or thermal radiation design, but is instead an invitation to ferry designers to consider the tools which are available in the military toolbox. In an era of military downsizing and "dual use" the ability to recoup commercial value from our investment in Stealth may be very attractive - to both parties.