The USS Zumwalt has four gas-turbine engines, but none are directly connected to the drive shafts and propellers. Instead, these engines are used to generate as much as 78 megawatts of electricity, which is then used to power an entire ship-wide distribution network (detailed at right) along with the ship’s other systems.

Large ships have long used combustion-driven generators linked with electric motors for propulsion. What’s new about the Zumwalt is that its generators are not tied directly to its engines. Instead, electricity flows between them over a ship-wide distribution network, which allows power to be directed wherever it’s needed.

This flexibility should make it easier to refit the Zumwalt with railguns or directed-energy weapons, should these technologies one day mature. The ship’s two 155-millimeter guns fire self-propelled projectiles that can be guided in flight. Each gun can hold in excess of 300 of these high-tech rounds, which are capable of reaching targets more than 100 kilometers away. Each gun is used here to reduce the ship’s radar profile.

As the hull rises from the waterline, its sides angle inward, a feature not seen in naval warships in more than a century. It is used here to reduce the ship’s radar profile.

The upper levels of the deckhouse—the part of the ship that rises above the main deck and contains the bridge, the enlisted bunks, and various radar antennas—is made of balsawood-cored carbon-composite panels. This material, highly unusual for a warship, was used to reduce weight up top (which adds stability), enhance corrosion resistance, and make the ship more stealthy. But it’s very expensive, and in January of this year the Navy began investigating using only steel for the deckhouse of the third and final ship of the Zumwalt class, the USS Lyndon B. Johnson. Yet another departure from tradition is that its generators are not tied directly to its engines. Instead, the Navy will build more destroyers of a more conventional type and outfit them with the radars and anti-ballistic missiles needed.

In a 2009 speech, Adm. Gary Roughhead, then Chief of Naval Operations, made his reasoning for this change clear. While he applauded the Zumwalt’s advanced tech and how the program was being run, he also repeated a truism that only the most naive engineers in attendance didn’t already know: “Technology does not always equate to relevant capability.”

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Guided-missile destroyers of earlier design position their vertical-missile-launcher tubes amidships, where they are best protected from enemy fire. The Zumwalt’s designers arrayed its missiles along the ship’s flanks, positioning them between inner and outer hulls. Putting them on the periphery does make the missiles more vulnerable to enemy fire, but it lessens the consequences should they be struck. Were that to happen, the resulting blast would explode outward, leaving intact the inner, watertight hull.

In another break from the U.S. Navy’s usual designs, the Zumwalt’s propellers and drive shafts are turned by electric motors, rather than being directly attached to combustion engines. Such electric-drive systems, while a rarity for the U.S. Navy, have long been standard on big ships. What’s new and different about the one on the Zumwalt is that it’s flexible enough to propel the ship, fire railguns or directed-energy weapons should these eventually be deployed, or both at the same time. That’s because the 78 megawatts from its four gas-turbine generators can be directed through the ship’s power distribution network wherever it’s needed. The presence of such a tightly integrated power generation and distribution system has led some to call the Zumwalt the U.S. Navy’s first “all-electric ship.”

While the general idea of using electric motors to propel the ship wasn’t particularly controversial, the choice of what kind of motors to use did not come easily. The leading idea at first was to use permanent-magnet motors, but these proved challenging to develop, and the Navy ultimately opted for two 34-MW induction motors instead.