The design of the nozzles of ship propellers is extremely important for the overall fluid mechanics and the energy efficiency of sea vessels. A manufacturer of ship propulsion systems in the north of Spain has specified stainless steel for the parts that constitute the nozzles. They used grade 316L for its combination of high corrosion resistance with excellent formability and weldability. Depending on customer requirements, the stainless steel ratio in the fabricated component ranges from 33% to 100%. A design challenge lies in the fact that the carbon steel of the hull, the stainless steel used for the nozzle and the copper alloy of the propeller can interact electrochemically causing galvanic corrosion. Furthermore, because of its salt content, seawater is exceptionally corrosive to metals and the chloride increases the electrical conductivity, potentially exacerbating galvanic corrosion effects. Cathodic protection ensures that the mixed-material system safely meets the durability requirements.

Photo courtesy of Wartsila Ibérica S.A.