# Naval bronze/brass electrical equipment

Navantia

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**Sector:** Naval

**Challenge:** Many of the electrical elements that are exposed to the elements in a ship are made of naval bronze or brass. They are equipment with a high price.

**Solution:** Use FA technologies to change the original brass parts for others made of polymeric material. Here we present one of the cases studied, a lamp.

## CHALLENGE

Of all the copper alloys used in the naval sector, the most widespread are naval bronzes, which contain around 85% copper, 5% tin, 5% lead and 5% tin, as well as brass. naval vessels, which contain approximately 59% copper, 40% zinc and 1% tin with traces of lead. Due to their particular composition and properties, both mechanical and corrosive, the elements made with these materials have a high cost.

As a starting point, a traditional naval ceiling lamp from the company Mateo Miletich e Hijos has been taken as a model. This model is made of cast brass, with threaded glass panels, having an overall weight of 1450 g and an approximate market cost of € 175.

The biggest challenge is to get a product that meets the IP (Ingress Protection) of the original product and its anti-corrosion capacity, reducing its weight, its price and production time.

*Exploded view of the original brass lamp.*

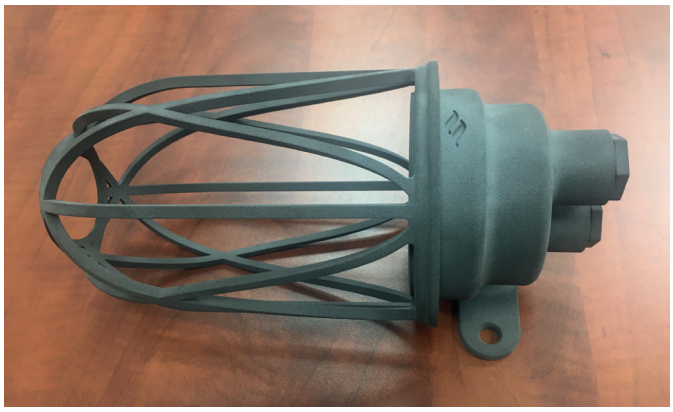
## SOLUTION

At the Navantia Additive Manufacturing Center (CEFAN) we analyze all bronze or brass electrical equipment that is assembled in different areas of the ship to study the feasibility of using AM technologies to change the original parts for others made of polymeric material. Here we present one of the cases studied, a lamp, but there are also switches, connectors, etc., all originally made of brass or naval bronze. In this particular case, it is desired to address the redesign of the brass parts.

After the realization and manufacture of the pieces, it has been possible to obtain customized geometries adaptable to the original elements already in service. This adaptation to the new geometries does not significantly affect the final cost of the printed parts.

By using FA technologies we can reduce the weight, price and manufacturing time of parts. After analyzing and testing various AM technologies we have selected the polymer powder bed as the most suitable for this purpose. In this case, the powder bed technologies using HP JF or Formlab Fuse1 and using PA12 as the base material since the final pieces have water-repellent properties, something essential to pass the IP protection tests. In addition, the use of polymeric powder bed technologies would avoid the need for support structures, this being one of their greatest advantages, along with the mechanical properties that can be achieved. It is for this and for the use of a waterproof material that it has been decided to use this technology.

On the other hand, the use of this technology allows us to print all the self-assembled parts in a single impression if necessary.



*Lamp made of PA12 with a FUSE 1 printer.*

## ADVANTAGES

It can be seen that a total weight saving of up to 650% is achieved, going from 1235 g to only 190g with the printed parts. Regarding the cost, if we look at the FDM technology, we go from € 175 to € 60 approximately, which means a saving of about 300%. In the case of using the powder bed technology, the savings are even greater, the final piece already finished would cost about 30 euros.

The main improvements achieved are:

- Reduction in the weight of the final assembly by approximately 650%.
- Reduction of the cost of the brass parts of the set by around 300%.
- Customization of the pieces according to the desired project without an increase in cost.
- Manufacture of polymeric materials with adequate behavior in front of the marine environment.
- Savings in time of design iterations of the final pieces.
- Adaptation of parts with existing ones to enable the replacement of damaged parts that were installed in operation.
- Reduction of operational stocks both in warehouses and on the ship.
- Possibility of including a digital catalog of parts so that the shipowner could print these parts on the ship itself or at a base of operations.

The next step would be the certification of the IP (Degree of protection) of the printed part by an approved entity.

*Comparison between printed part and original part.*