CASE STUDY

NIKON SLM SOLUTIONS

REVOLUTIONIZING MARITIME WITH
ADDITIVE MANUFACTURING

Nikon SLM SOLUTIONS

ST Engineering

A Nikon Company Nikon

INTRODUCTION TO ST ENGINEERING

ST Engineering (STE) is a global technology, defense, and engineering group with operations spanning industries such as aerospace, smart city solutions, defense, and public security. Headquartered in Singapore, the company employs over 26,000 people and serves customers in more than 100 countries.

CHALLENGES OVERCOME

The closed impeller is a critical component in many marine propulsion systems but poses significant manufacturing challenges due to its complex geometry. Additionally, the material must withstand harsh conditions, including prolonged exposure to corrosive seawater, while maintaining a smooth surface finish for optimal performance.

Traditional manufacturing methods faced obsolescence issues, with the impeller unavailable from the Original Equipment Manufacturer (OEM). Lead times for a replacement could stretch to as long as one year, creating further delays.

ADOPTING ADDITIVE MANUFACTURING (AM) AS AN ALTERNATIVE

STE adopted AlSi10Mg, a commonly used aluminum alloy in additive manufacturing, to fabricate the closed impeller. While digital manufacturing significantly reduced lead times, AlSi10Mg required secondary processing to enhance corrosion resistance, and its surface roughness fell short of the ideal performance standards, necessitating further polishing.

INNOVATIVE SOLUTIONS USING AM

Leveraging the **Nikon SLM® Solutions** and **Aheadd® CP1**, STE, in collaboration with Nikon SLM Solutions, addressed these challenges:

- **Improved Corrosion Resistance and Performance:** Aheadd® CP1 enhanced corrosion resistance and surface roughness, reducing the occurrence of cavitation and losses.
- **Optimized Geometry and Reduced Support Structures:** By combining Free Float technology with design optimization, the impeller geometry was refined for higher efficiency, while the need for support structures was significantly reduced.
- **Reduced Lead Time:** Digitally produced impellers can now be printed on demand, cutting lead times by over **90%**.

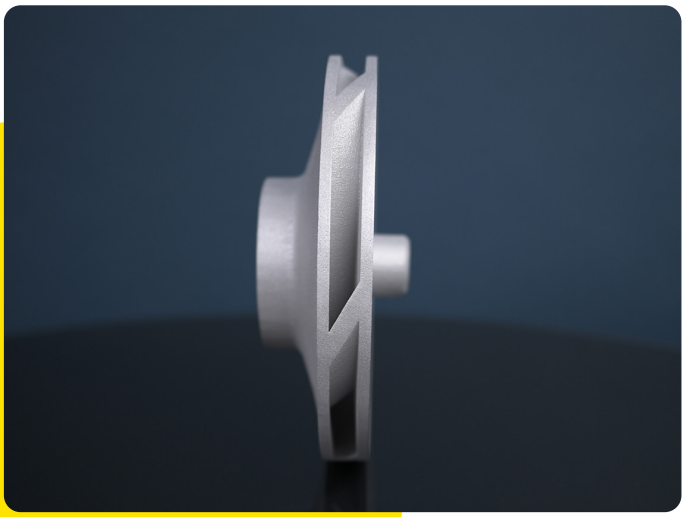
SLM® SOLUTIONS

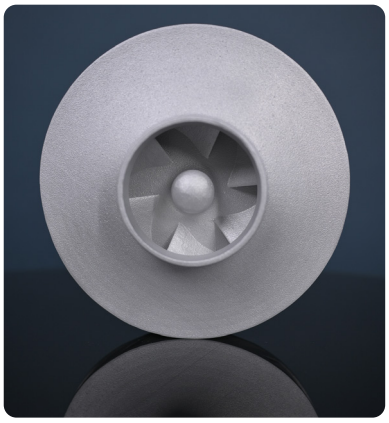
OPTIMIZING THE STE ALUMINUM IMPELLER FOR MARINE PROPULSION

COMPONENT	:	STE Aluminum Impeller
MATERIAL	:	Aheadd® CP1
SLM® MACHINE USED	:	SLM®500
BTE	:	10h 04min 34sec
ACTUAL	:	11h 21min 11sec

RESULTS THAT MATTER

- **Enhanced Performance:** The impeller operates more efficiently in demanding marine environments, offering greater durability and reliability.
- **On-Demand Manufacturing:** The impeller can now be produced as needed, eliminat-ing obsolescence issues and reducing downtime.





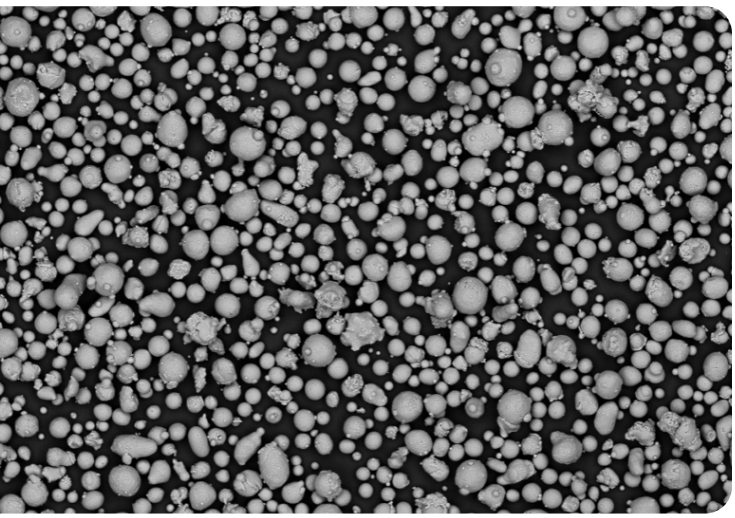
THE NIKON SLM SOLUTIONS ADVANTAGE

Nikon SLM Solutions provides advanced additive manufacturing technologies like the **SLM®280 & SLM®500** and tailored solutions for complex applications.

MATERIAL COMPARISON AND INDUSTRY IMPACT

ALSI10MG

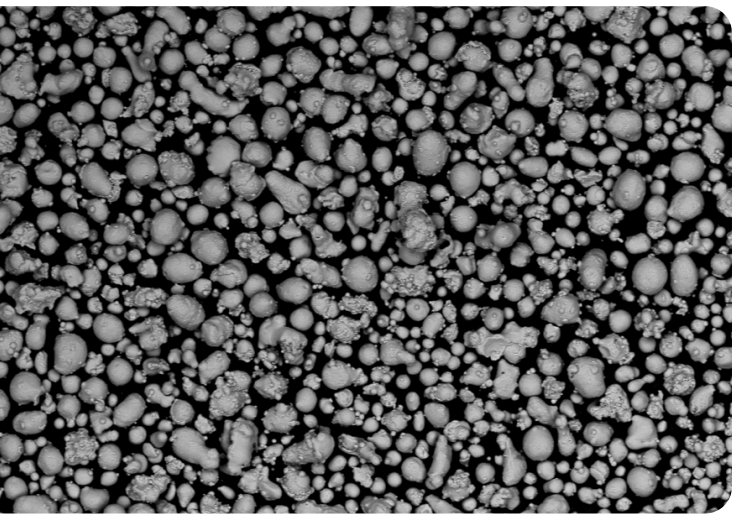
AlSi10Mg is a versatile aluminum alloy widely used in AM for lightweight components operating at standard temperatures. It offers moderate strength, high cost-effectiveness, and is ideal for prototyping and less demanding applications.



- **Nominal Composition:** Al (Balance), Si 10%, Mg 0.3%
- **Benefits:** Cost-effective, lightweight, and suitable for standard applications.

AHEADD® CP1

Aheadd® CP1 is engineered for L-PBF processes, offering high strength, superior corrosion resistance, and excellent thermal conductivity, making it ideal for demanding environments.



Nominal Composition: Al (Balance), Zr 1%, Fe 1%

Benefits: High corrosion resistance, enhanced mechanical performance, and suitability for high-temperature (up to 300°C) environments.

INDUSTRY OUTLOOK

The maritime industry is moving toward lighter and more corrosion-resistant materials, such as aluminum alloys, as alternatives to heavier nickel or steel alloys. While aluminum offers light-weight advantages, nickel and steel excel in corrosion resistance. By leveraging materials like Aheadd® CP1, the marine sector can strike a balance between weight reduction and durability, supporting green shipbuilding and sustainability initiatives.

“The purpose of green shipbuilding is to minimize environmental emissions from the design phase through manufacturing and service. Alternative materials with sustainability benefits, like aluminum, further support the industry’s move toward eco-friendly solutions.”

– **Fabrizio Ragusa**, Global Business Development Director Energy, Nikon SLM Solutions

POWERING INNOVATION THROUGH PARTNERSHIP

ST Engineering's partnership with Nikon SLM Solutions sets a new standard in marine manu-facturing. Utilizing the SLM® Solutions, Free Float technology, and advanced materials, they've redefined the possibilities for complex marine components. Together, they are driving innova-tion and laying the groundwork for future advancements in maritime applications.

NIKON SLM SOLUTIONS

Nikon SLM Solutions helped invent the laser powder bed fusion process, was the first to offer multi-laser systems and all selective laser melting machines offer patented quality, safety and productivity features. Taking a vested interest in customers' long-term success in metal additive manufacturing, Nikon SLM Solutions' experts work with customers at each stage of the process to provide support and knowledge-sharing that elevate use of the technology and ensure customers' return on investment is maximized. Optimal paired with Nikon SLM Solutions' software, powder and quality assurance products, the Nikon SLM® technology opens new geometric freedoms that can enable lightweight construction, integrate internal cooling channels or decrease time to market.

Nikon SLM Solutions AG focuses exclusively on metal additive manufacturing and is headquartered in Germany with offices in China, France, India, Italy, Singapore, and the United States and a network of global sales partners.

Further information is available on
www.nikon-slm-solutions.com