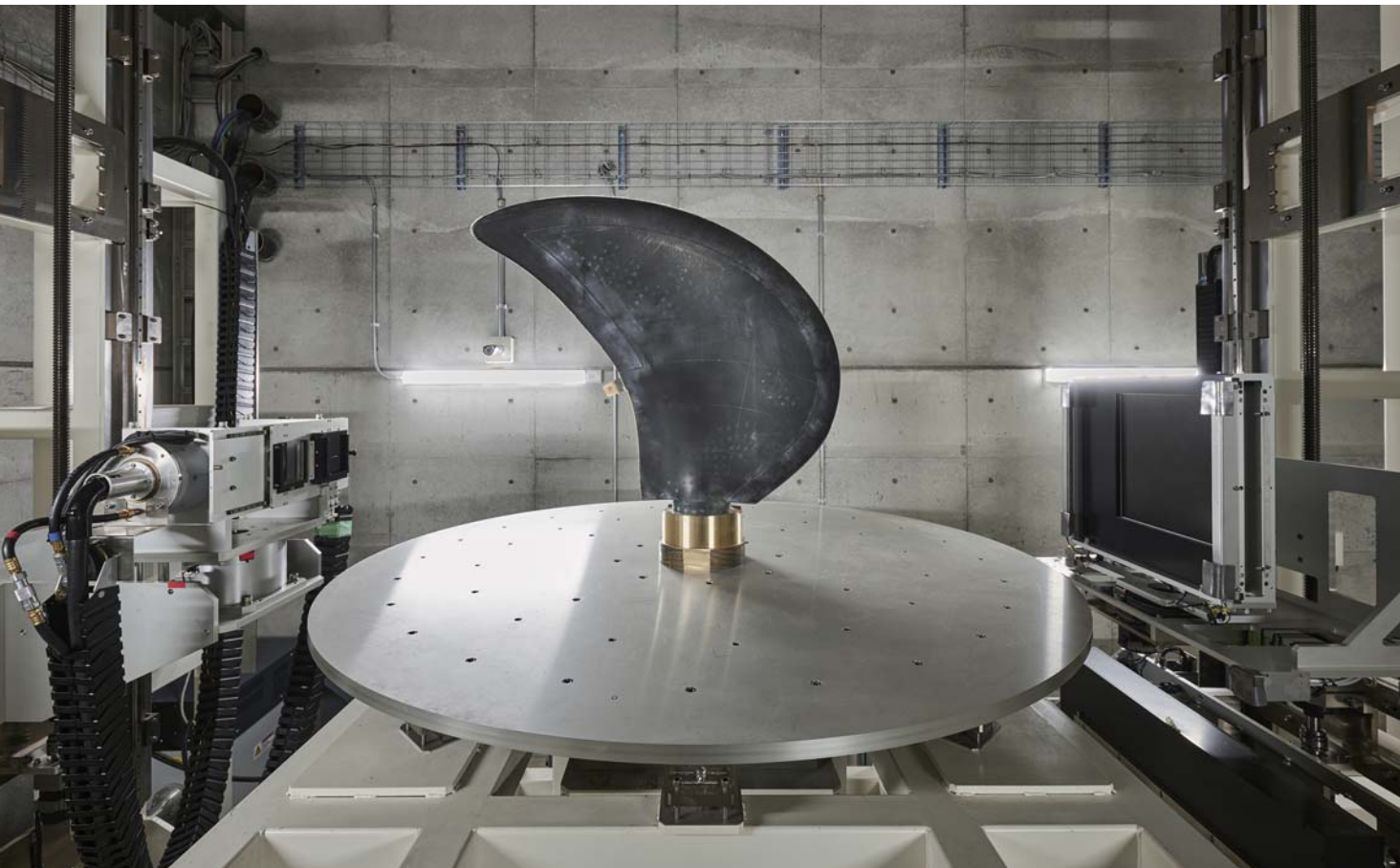


# Propelling

Issue 9



## Nakashima People Vol. 9

Toshio Yamatogi | General Manager, Composite Business Department, Nakashima Propeller

Propelling, a newsletter from Okayama, Japan, spotlights the hidden allure of propellers and aims to steer the world's ships, and their world, one step into the future

Since joining the company, Toshio Yamatogi has consistently been entrusted with product development, from conception and experimentation to commercialisation. He has also worked on various innovations that apply Nakashima's technologies developed through designing and manufacturing propellers, including the development of water quality improvement equipment and a tidal current turbine, all of which drew academic acclaim. As an innovator committed to Nakashima's spirit of looking ahead and taking on new challenges, Toshio is currently focused on developing propellers using the new material CFRP. We spoke to him about the features and the possibilities of the new propeller.

**Q. What made you start working on the CFRP propeller?**

When I learned about the work being done with this new material overseas, I felt that it had great

potential. I also recognised that we would need to conduct substantial research before being able to use it for propellers. Nakashima swiftly accepted my proposal to re-enter graduate school to take on this new challenge.

I then devoted myself to research for three years in a doctoral course at the University of Tokyo. Based on the results of my doctoral research, I received support from the Nippon Foundation and Nippon Kaiji Kyokai (NK), which respectively enabled me to proceed with commercialisation and pursue joint research with the industry group, eventually becoming the first in the world to fit a CFRP propeller to a merchant vessel.

**Q. What are the features of CFRP propellers?**

CFRP is already widely used for aircraft propellers. Since it is about one fifth the weight of copper alloy and flexible according to the load placed on it, we

*"R&D at Nakashima typically leads to results beyond the original goal and broadens the value of the technology"*

**Toshio Yamatogi**



can clearly see its benefits as a ship's propeller. Two major advantages are that it can help reduce environmental impact, and improve the environment onboard a ship by saving energy and minimising noise and vibration.

On the other hand, it is difficult to predict the corrosive effects of prolonged exposure to seawater. The problem is magnified by the difficulty of conducting frequent inspections given that propellers are submerged for much of the time. This means even manufacturers dealing with aircraft have struggled to adapt the propellers for ocean-going vessels. The material is also expensive, so there are substantial risks involved in research and development.

Despite these challenges, Nakashima was quick to start full-scale development and achieve results because of the spirit it has maintained since its founding: "We go beyond"—the determination to overcome any obstacle and to achieve what no one else has been able to as a pioneer.

Still, the material has not been easy to work with. Using it on actual ships has both confirmed its merits and highlighted shortcomings. We have been able to solve these issues through our joint research with NK and with support from the University of Tokyo and the Kanazawa Institute of Technology. This has enabled us to resume installation on coastal vessels, including fishing boats and commercial vessels, and we hope to implement them on large ships in the near future.

**Q. What are Nakashima's strengths that have helped during development?**

As I researched CFRP, I rediscovered the excellence of copper alloy. As experts in making propellers using copper alloy, I believe we have a responsibility to showcase the true value of CFRP for propellers.

It goes without saying that Nakashima's vast experience with copper alloy is invaluable in shaping propellers with CFRP. When using this material, we need to predict the level of

flexibility during operation. We have been fine-tuning the direction and shape of the fibres through repeated simulation to achieve the most desirable deformation.

With CFRP, it becomes possible to embed a sensor inside the propeller, which we could not do with copper alloy. We are also now researching ways to transmit the various data detected by the sensor from underwater. If we can do this, we could be looking at a new service that delivers health-monitoring of propellers, as well as detailed proposals in real time for optimal navigation, based on the weather and other conditions.

**Q. What does the future hold for the CFRP propeller?**

For one thing, CFRP can help reduce the weight of a ship, and allow us to fit it with both a sail and motor. When there is a good wind and the sail is in use, a lightweight CFRP propeller can act as a turbine to efficiently generate and store electricity. When there isn't enough wind, we can use the stored electricity to operate the propeller and navigate the ship. In this way, CFRP can help to create the ultimate energy-efficient hybrid ship.

One feature of research and development at Nakashima is that it typically leads to results beyond the original goal and broadens the value of the technology. For example, the company's polishing technology has been applied to make artificial joints.

I intend to devote my life as an engineer to mastering CFRP. The resulting technology combined with our unique approach will surely lead to a host of new applications by Nakashima's next-generation innovators, which I look forward to seeing. ■

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**Nakashima's Aesthetics**

*Creativity without boundaries*

Noise-prevention technology for propellers is used to form bells with a sonorous tone, while technology for three-dimensional curved-surface processing is used to impart smooth movement to a prosthetic joint. What will Nakashima create next by applying propeller manufacturing technology and the belief that anything is possible?

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## INTROSPECTION — JAPANESE INNOVATION

## Inventing a Sustainable New Normal — Part 2

The first installment of this article indicated that an issue with the new normal resulting from the COVID-19 pandemic is the human-centric perspectives of the new socioeconomic setup. This second installment looks at prospective constraints and innovations that could usher in a new era.

### Towards a Sustainable Future

A World Wildlife Fund report almost two years ago estimated that populations of vertebrate species had declined around 60% between 1970 and 2014. A United Nations report released in 2019 stated that around a million plant and animal species could be near extinction. Some leading scientists claim that multiple Earth systems could pass their tipping points in just 10 years if global warming passes 1.5°C. Such environmental concerns illustrate that humankind may be breaching its limits and entering the unknown.

The COVID-19 pandemic has exposed our collective frailty, tightening restrictions on our socioeconomic activity. The planet, not people, will dictate what is normal in a new world. If we continue to make ourselves central to how the Earth works, nature could simply swipe us away with its invisible hand. We could, however, opt to discard our self-centered worldview and leverage the compass of natural norms to journey towards a more sustainable future.

### Innovating for a New World

When we see things in this new light, we will accept that we are a small part of the community of life on Earth and tear down the wall we erected to keep nature at bay. We will then be able to eschew dualist attitudes to good and evil or life and death that have entrapped modern man and embrace pluralist, natural perspectives that are vital to innovating under the new normal and position ourselves to benefit from the infinite wisdom of mother nature.

As part of nature, humankind would move from plundering our planet to nurturing it. When we are both awed by and trusting of nature, we are inspired to work with it. This approach elevates life into a cycle of sustainable prosperity as resulting innovations inherently benefit people and nature as a single entity.

Clues to such innovative approaches and the resulting civilisation can be found in Japan until about 150 years ago. Japanese culture attuned itself over the millennia to accepting that to benefit from their four distinct seasons and lush vegetation people should also be prepared suffer frequent earthquakes, typhoons, and other

natural disasters. The Japanese people's ancient connections to nature have rapidly become a lost treasure in the rush to modernise after the Meiji Restoration of 1868 and reconstruct after World War II.

Concerns about such a loss prompted Emile H. Ishida, for example, to coauthor *Nature Technology: Creating a Fresh Approach to Technology and Lifestyle*. He contended that the Great East Japan Earthquake of 2011 demonstrated humankind's frailty in the face of nature and its need to embrace it instead of trying to vanquish it. In his two-volume *Small Architecture/Natural Architecture*, renowned Japanese architect and university professor Kengo Kuma presented a manifesto to encourage fellow professionals to commit to humility and sustainability. These and other prominent individuals in Japan encourage us to come to terms with the environment and embrace the world of nature from Japanese perspectives that Utagawa Hiroshige highlighted in his One Hundred Famous Views of Edo series of ukiyo-e prints, a paean to the seasons that is an artistic triumph. Their worldviews, founded on being an integral part of nature, are at the heart of the Japanese-style innovation that has almost become buried: one that harmonises, supports and thrives with nature, making humans another part of the ecosystem and affirming life's biodiversity.

One individual to apply innovations arising from Japan's distinct environmental conditions found success in the harsh conditions of Afghanistan. Dr. Tetsu Nakamura, who went there in the 1980s to treat people, expanded his endeavours to work with communities to apply traditional, sustainable Japanese agricultural and irrigation practices that helped stave off the ravages of desertification. During his lifetime, cut short with his assassination in 2019, he helped make around 16,500 hectares of land arable. He brought rays of hope to conflict resolution, benefiting about 600,000 farmers and helping many to cease being mercenaries and return to agriculture.

Pope Francis urged humankind not so long ago to stop being so self-centered. Can we take advantage of the COVID-19 pandemic and have the humility to reassess our collective values, in everything from individual lifestyles and corporate innovation practices to regional planning and national policies, release ourselves from dualism, and innovate for a new world? Let us hope that we swiftly enlighten ourselves, before the invisible hand of nature loses all patience with us, and commit to a new normal of innovating for the benefit of the entire planet. ■



# NAKASHIMA PROPELLER

## We Go Beyond

Headquartered in Japan's Setouchi region, the centre of the country's shipbuilding industry, Nakashima Propeller is a manufacturer of marine propulsion equipment boasting a leading share in marine propellers.

Having started as a foundry for fishing boat propellers, the company has continued to pursue innovation in the capability of propellers to deliver security, safety and comfort. It will be celebrating its 100th anniversary in 2026.

A ship's optimal state is found when it is viewed from the propeller, the centre of propulsive functions. With this fresh perspective, Nakashima Propeller seeks to offer a full range of services catering to each ship's entire life cycle while achieving fuel efficiency to reduce the burden on the environment. Nakashima Propeller works to contribute to the world, beyond the realm of its industry.

## OUR STRENGTHS

### JAPANESE QUALITY

Nakashima Propeller offers refined in-house capabilities in design and manufacturing. Using a high-performance computer with a 5000 core large-scale processor, Nakashima's craftsmen create a blueprint based on data accumulated from a world-class production history of 1 million propellers. Moreover, with its unique manufacturing skills that integrate cutting-edge technology and experienced craftsmanship, Nakashima is fully equipped to delicately reflect design in manufacturing and deliver reliable Japanese-quality products.

### CUSTOMISED PRODUCTION

The propeller is at the centre of optimising propulsion performance—and a hundred different vessels will have a hundred different propellers. Rather than pursuing efficiency as a manufacturer, Nakashima takes pride in its commitment to build-to-order production, designing and manufacturing optimal propellers for each unique ship under an integrated production system.

### CUTTING-EDGE USE OF SMART TECHNOLOGY

Nakashima's smart technology is able to define the shape of the high-efficiency propeller's complex three-dimensional, curved surface. By increasing the surface area of machining with adjustments such as modification of the trailing edge, a process requiring special craftsmanship is simplified and speedy production without dispersion is achieved.

### SERVICE ANY TIME, ANY PLACE

Nakashima Propeller promptly responds to propeller damage by sending repair engineers from its worldwide network to your site. Nakashima takes into account various conditions such as the ship's fuel efficiency, course and degradation due to ageing to propose solutions such as edge modification, fuel-saving polishing and retrofit, providing detailed support throughout the ship's entire life cycle.

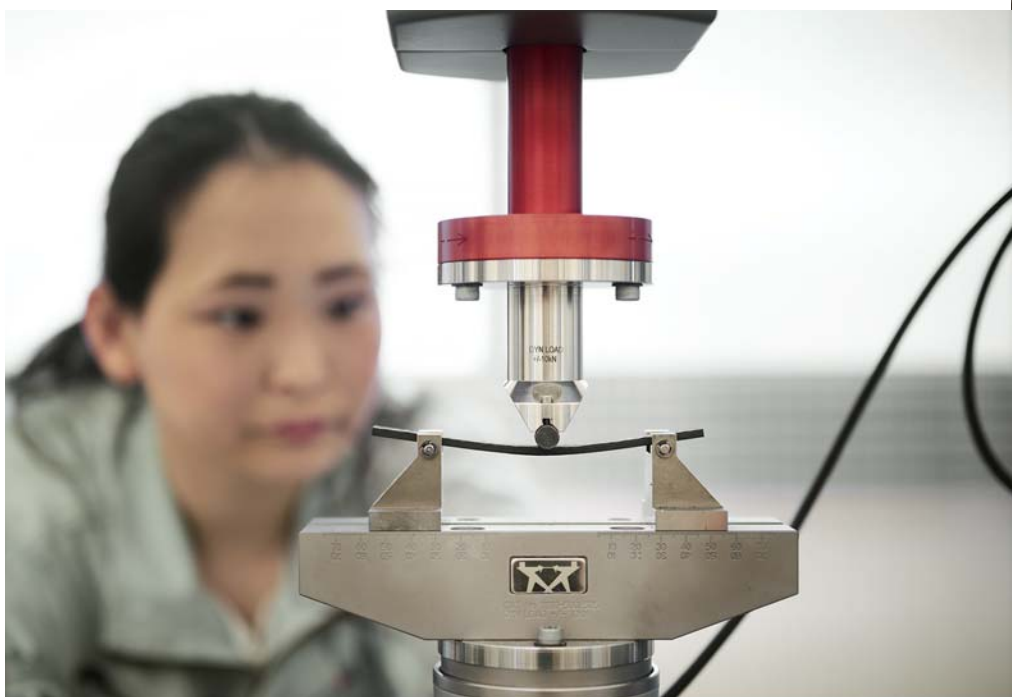
## OUR SERVICES

Nakashima Propeller designs and manufactures marine propellers (FPP and CPP), thrusters, energy-saving devices for the stern and CFRP propellers.

We also offer a full range of after-sales service, including repair of damaged propellers, edge modification, fuel-saving polishing, support of propulsion equipment for ships in operation and optimisation of propulsion performance for fuel efficiency.

\*We provide propellers for ULCS, VLCC, VLOC, VLGC, LNG/LPG-carriers, PCC, cruise ships, working boats, coastal vessels, research vessels and coast guard vessels

\*Our services satisfy requirements for all major classification certificates (including ice-class)



*"World-recognised Japanese quality cannot be described solely in terms of mechanical precision or reproducibility. Lacquerware used at the dinner table, Japanese knives that are indispensable to create Japanese delicacies—only with the deep commitment and thorough experience of the people who make them can the full potential of such products be unleashed. Our propellers embody the same spirit of Japanese quality."*

—H. Kubo, General Manager, Innovation Section, Nakashima Propeller

## EVENTS

POSITONIA - Greece

METSTRADÉ - The Netherlands

INTERNATIONAL WORKBOAT SHOW - USA

SMM HAMBURG - Germany

Please check individual websites for the latest updates from event organisers.

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