

## MARINE

# Princess Yachts

Reducing the time necessary to hone acoustic performance for luxury vessels

### Product

Simcenter

### Business challenges

Master acoustic performance in each customized hand-crafted ship

Limit acoustic testing for each custom-built ship

Ensure efficient sea trials

### Keys to success

Deploy NVH strategic plan, leveraging acoustic testing to understand sound energy radiation

Leverage efficient and versatile NVH data acquisition system for automated in-field testing

Streamline data management so it is easily accessible to all stakeholders

### Results

Saved time honing acoustic performance throughout ship development

Developed NVH process that is tough, versatile and dependable

Advanced cooperation with suppliers

Enhanced transparency of the overall engineering process

### Princess Yachts uses Simcenter to leverage NVH technology that is tough, versatile and dependable

#### Prioritizing NVH

Commonly scrutinized in the automotive market, acoustic performance has become a significant differentiator when it comes to considering a new purchase in all kinds of industries, including the luxury yacht market. That being said, the luxury yacht market is still one of customization and artisanal craftsmanship. Every Princess yacht is unique and this makes noise, harshness and vibration (NHV) engineering and perfecting the overall acoustic

performance, both inside and outside, a tremendous challenge. This is where Michal Tomaszczyk, an NVH engineer at Princess Yachts, comes in. Tomaszczyk started to work on NVH thanks to the TRANQuil project, a 3-year research project with Princess Yachts, The University of Southampton and TBG Solutions, which focused on innovation, like an active noise control system, to overcome noise and vibration issues caused by secondary generators on yachts.

“Princess Yachts is my first great engineering challenge,” says Tomaszczyk. “Right after university, I was given the task to investigate and integrate NVH tools and



Image courtesy of Princess Yachts Limited.



Princess Yachts uses five main engine manufacturers. All these engine options add their distinctive sound signature to the yacht. This potentially creates dozens of test configurations. (image courtesy of Princess Yachts Limited)

processes into our production process. We are very fortunate at Princess Yachts because we have great people with vast experience constructing luxury yachts so they are more than capable of building the best product using best practices and years of artisanal experience and specialty skills. However, there really wasn't too much NVH data to start from."

#### **One size doesn't fit all**

Practically every Princess yacht is hand-crafted to the customer's exact specifications and this creates a plethora of unique NVH challenges. But like other industries, yacht construction is undergoing a

revolution in design as well as production. Besides streamlining the simulation and design process and coordinating with suppliers, the Princess Yachts team needs to account for different engine options, interior elements and an entire realm of new materials, including cutting-edge composites. "Not so long ago we dispatched a Princess 35-meter that had been highly specified," explains Tomaszczyk. "The boat has dark furniture, lots of chandeliers and special features. It is beautiful, but every boat is decorated individually. We handle a variety of special requests and customized elements. You can imagine what this does to our testing process.

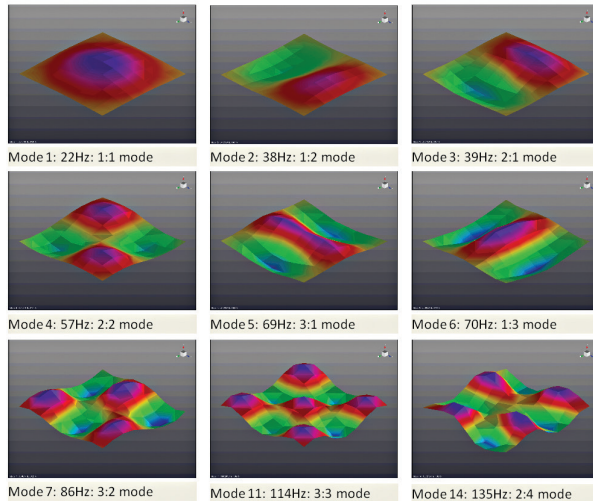
"We use five main engine manufacturers: Volvo, Cummins, MAN, MTU and Caterpillar. All these engine options add their own signature to the yacht, which is custom built. So there are a lot of variables to test. It is important to prevent the noise and vibration from influencing the hull of the yacht itself, and in turn, the yachting experience. This is our main job.

"Princess Yachts invested very heavily in development last year. Projects like TRANQUIL allowed us to choose partners that would really push our capabilities forward and not just provide the equipment. We needed an NVH strategic plan as well as an NVH quality plan. Today, we have this and the constant support from the Siemens Digital Industries Software team in the U.K."

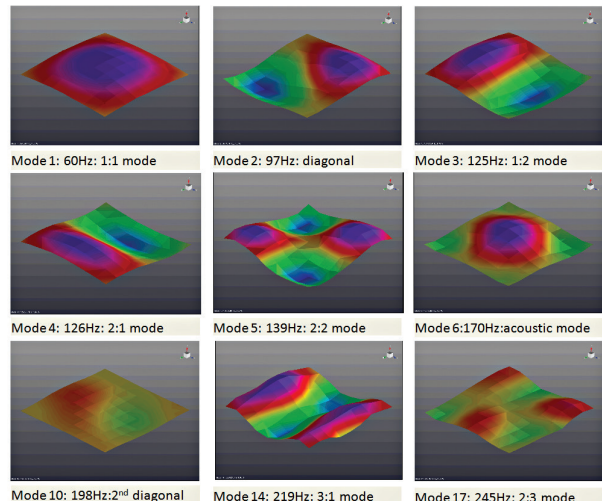
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Michal Tomaszczyk  
NVH Engineer  
Princess Yachts

### Modal characterization of plywood panel



### Modal characterization of composite panel



One new NVH area that Princess Yachts works on is comparing how sound energy radiates through plywood and composite panels that are used in the bulkhead. The company built a dedicated testing facility to acquire data and study the sound fields to compare and display panel attenuation more easily. (Image courtesy of Princess Yachts Limited)

#### Acoustic testing for plywood and composites

One of the new areas that Princess Yachts works on is looking at how sound energy radiates through plywood and composite panels that are used in the bulkhead. The idea is to study the sound fields and display panel attenuation easily. A dedicated testing facility has been built in one of the factory units in Plymouth, United Kingdom (U.K.). This is practical, but also means that background noise needs to be taken into consideration when measuring the sound field.

“You could call my testing environment rather unique,” says Tomaszczyk. “The process of building a yacht is still very hands-on. As an engineer, you have to be on the floor and right in the process. You can imagine there is a lot of noise. People are sanding wood, hammering and sawing. With all this action, we have to think about clever ways to get things tested. One example is that we use sound-directional techniques, which makes our testing insusceptible to background noise.”

For panel testing, Tomaszczyk sets up a typical test using microphones, an intensity probe to find the transmission loss and the Simcenter™ SCADAS™ Recorder hardware 16-channel data acquisition solution, which can be used remotely thanks to its flash drive and internal battery. “Testing a panel like this is especially interesting on the supply side to confirm performance before we put it on the yacht,” says Tomaszczyk. “We use Simcenter Testlab software and Simcenter SCADAS hardware. They work flawlessly and are very robust solutions.”

#### The ever-important sea trial

Every Princess yacht must undergo strict, multiple sea trials prior to delivery. During the trials, Tomaszczyk works onboard taking measurements as the yacht is put through its paces to guarantee excellent performance.

“There are many data acquisition systems available on the market, but we have a saying at Princess Yachts, ‘Good is not good enough,’” says Tomaszczyk. “We not only wanted a good and effective testing

**“We not only wanted a good and effective testing solution; we wanted the best. A single NVH test on a multi-million-pound M Class yacht takes a minimum of seven hours. You can imagine it is very important to have a testing system that is tough, versatile and highly dependable.”**

Michal Tomaszczyk  
NVH Engineer  
Princess Yachts



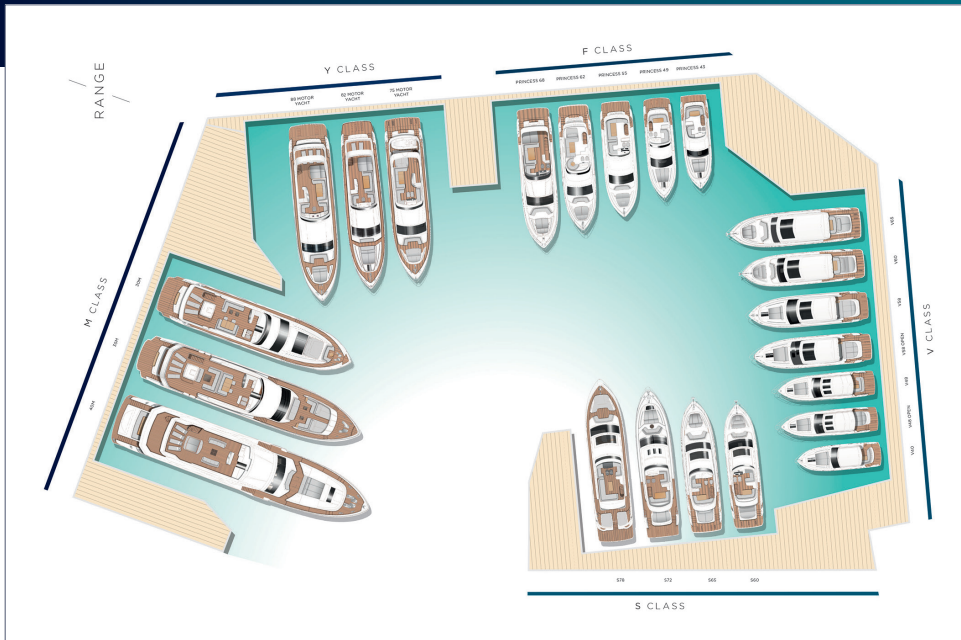


Image courtesy of Princess Yachts Limited.

solution; we wanted the best. A single NVH test on a multimillion-pound M Class yacht takes a minimum of seven hours. You can imagine it is very important to have a testing system that is tough, versatile and highly dependable. You have to work fast and you don't want to repeat the measurements."

Simcenter SCADAS Recorder is an excellent tool for sea trials. Not only does it meet the stringent military standard (MIL-STD) 810F specifications, which means it can easily handle rough sea conditions, it can also record data on the fly without a personal computer (PC) connection. The Simcenter Testlab™ Scope App is well suited to mobile use on the tablet for quick measurements and can be used in addition

to Global Positioning System (GPS) functionality, which is a great way to track speed versus turning angles and other maneuvers at sea.

"On the sea I instrument the entire yacht with sensors, paying special attention to the engines, gearboxes and mufflers," says Tomaszczyk. "We measure the vibrations and look at various correlations like the helm and the rotating machinery. We also conduct acoustic measurements in critical areas, like the master bedroom and staterooms, to make sure the yachting experience is exceptional and that disturbing noise is minimal. As far as I know, no other yacht manufacturer has such a comprehensive NVH program."

"Having the Simcenter testing solution aligned with the entire process will help minimize the 'monkey jobs,' so to speak. It leaves much more time for larger scale test campaigns."

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## Solutions/Services

Simcenter Testlab  
[siemens.com/simcentertestlab](https://www.siemens.com/simcentertestlab)  
Simcenter SCADAS  
[siemens.com/simcenterscadas](https://www.siemens.com/simcenterscadas)  
Teamcenter  
[siemens.com/teamcenter](https://www.siemens.com/teamcenter)

## Customer's primary business

Princess Yachts is a leading British luxury yacht manufacturer with meticulous attention to detail, delivering unforgettable experiences.  
[www.princessyachts.com](https://www.princessyachts.com)

## Customer location

Plymouth  
United Kingdom

## The one-man test department

In addition to Simcenter SCADAS, Tomaszczyk appreciates automation features, like the Simcenter Testlab software advanced signature testing worksheet. This worksheet provides a set of standard analysis tools to quickly identify the source of noise and vibration issues related to rotating machinery, hydrodynamic effects or other auxiliary systems on the yacht. "Our entire production process is centralized in Teamcenter, which makes it easily accessible for everyone involved in design, development, construction and delivery of the yacht," says Tomaszczyk. "Having the Simcenter testing solution aligned with the entire process will help minimize the 'monkey jobs,' so to speak. It leaves much more time for larger scale test campaigns.

"To give an example, the NVH report for the Princess 40-meter is more than 40 pages. There is quite a lot of data to manage and the reporting capabilities in Simcenter Testlab really help to automate this process. This wasn't possible before."

Siemens Xcelerator business platform of software, hardware and services.

## The Simcenter advantage

In the future, the team is looking at integrating more of the Simcenter portfolio. "We really feel that having the Simcenter simulation capabilities and a digital twin will benefit us in the near future," says Tomaszczyk. "This will bring more transparency to the overall engineering process so that the data acquired during testing can help improve the simulation of future yacht designs.

"In my opinion, our new testing process based on Simcenter testing solutions has dramatically changed how we work. First of all, we are able to communicate effectively with other NVH engineers on the supply side. We can interpret the specs and apply measurement techniques to set NVH targets. This is a huge market advantage because each and every one of the approximately 250 yachts we create annually must be of the highest possible quality.

"As market leaders our main challenge is to stay ahead of the competition. Our customers are starting to appreciate the distinctive NVH qualities of Princess yachts. As an NVH engineer, this makes my day."

## Siemens Digital Industries Software

Americas 1 800 498 5351  
Europe 00 800 70002222  
Asia-Pacific 001 800 03061910  
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