Digital classification

Industry 4.0 and the Future of Classification
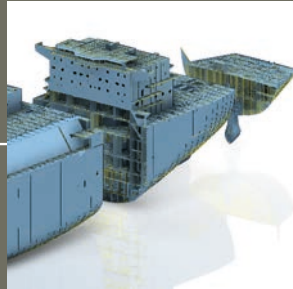
A technology report from Bureau Veritas Marine & Offshore

TR

TECHNOLOGY REPORT

INDEX

INDUSTRY 4.0

FOR SAFER, SMARTER, MORE EFFICIENT AND SUSTAINABLE SHIPPING

"At Bureau Veritas we believe that working together with our clients and partners on digital classification will continue increasing safety and efficiency in the shipping industry."

Matthieu de Tugny
President of Marine & Offshore,
Bureau Veritas

© Bureau Veritas
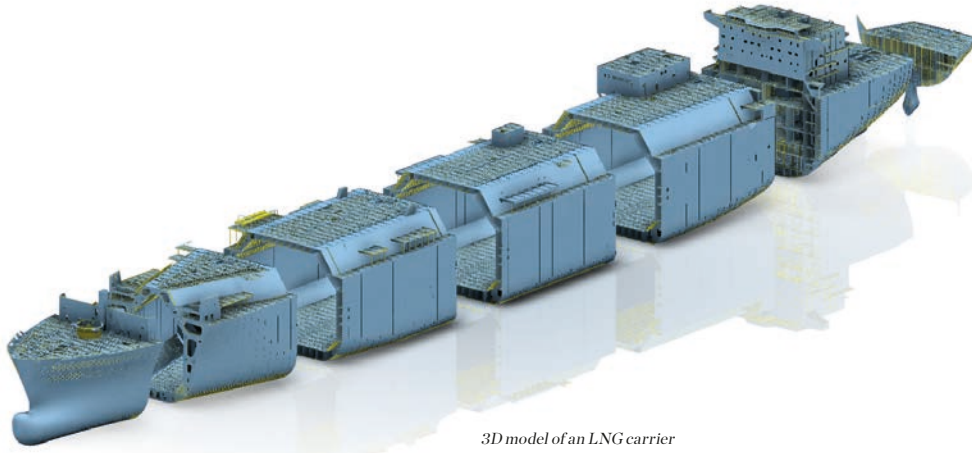
3D model of an LNG carrier

Today, the words 'Industry 4.0' are everywhere. Every consultancy has its own definition of it, every company has its own strategy of implementation, and the Internet is saturated with articles and videos offering a wide variety of interpretations and explanations for it. The shipping industry, of course, is no stranger to the concept either. Maritime news media suggest ways to make the most of it, blogs abound to explain how it is making shipping 'smarter', and institutions, such as the UK Royal Institution of Naval Architects, hold conferences on the maritime industry 4.0.
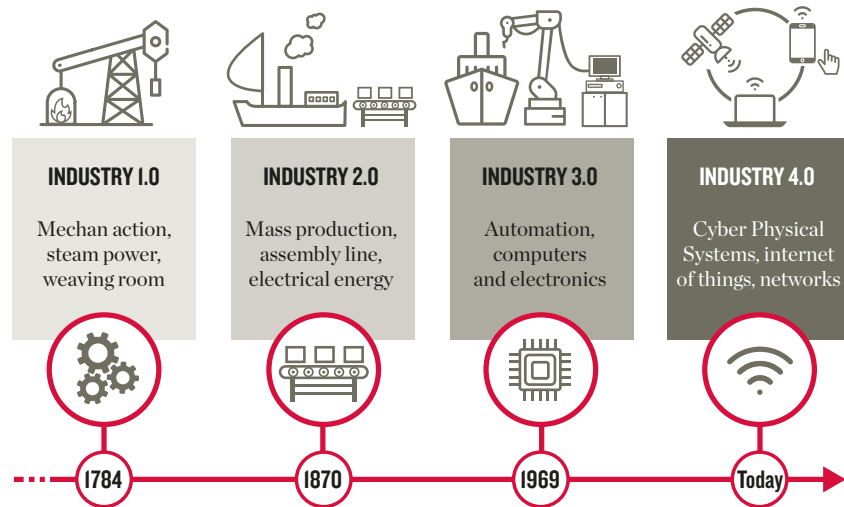
What is 'Industry 4.0'?

'Industry 4.0', in fact, is short for the fourth industrial revolution. In an entry on the topic in the Britannica Online Encyclopedia, Klaus Schwab, founder and executive chairman of the World Economic Forum, wrote: *"The Fourth Industrial Revolution's technologies, such as artificial intelligence [AI], genome editing, augmented reality [AR], robotics and 3D printing, are rapidly changing the way humans create, exchange, and distribute value. As occurred in the previous revolutions, this will profoundly transform institutions, industries and individuals."* The shipping industry will be no exception.

Building on the widespread availability of digital technologies brought about by the third industrial revolution, key actors in the shipping industry are already progressively transforming a ship's lifecycle: from design through construction all the way to operations, these actors are bringing in new technologies capitalizing on the digitalization of the industry to increase efficiency and optimization. Efficiency in ensuring that shipping complies with increasing demands for a safer and more environmentally sustainable industry. And optimization in meeting these demands while controlling costs.

A Modern Approach to Classification

These changes have a significant impact on Classification Societies, which can choose to either be passive agents of such transformation, merely going with the current, or act as dynamic agents of change in a complex ecosystem by actively developing new partnerships and seeking collaboration across the industry. Bureau Veritas has chosen to be pro-active, building on digitalization to offer a modern approach to classification for the key marine stakeholder groups:

• Shipowners;

• Shipbuilders;

• Equipment Manufacturers;

• Flag states and regulatory agencies.

INDUSTRY 1.0	INDUSTRY 2.0	INDUSTRY 3.0	INDUSTRY 4.0
Mechan action, steam power, weaving room	Mass production, assembly line, electrical energy	Automation, computers and electronics	Cyber Physical Systems, internet of things, networks
1784	1870	1969	Today

Industrial revolutions since 1784.

DIGITAL CLASSIFICATION
THE BUREAU VERITAS STRATEGIC PERSPECTIVE

Since their creation in the 18th and 19th centuries, Classification Societies have been playing a vital role in the safety of the shipping industry. The services Classification provides ensure that the shipping industry, regulated by IMO, is able to function effectively. Class develops rules and technical standards – for ship design and ship condition – and helps ensure that they are met. Despite more ships in the water than ever before, shipping is probably now also as safe as it has ever been: continual improvement is accepted as a requirement. This is necessary as new challenges are always emerging. Examples of these new challenges include the development of gas fueled ships as well as ever larger containerships and cruise ships. As the shipping industry moves from 3.0 to 4.0, these new challenges also now include connected ships – such as smartships – with their associated cybersecurity risks and opportunities.

Digital Acceleration – From Pioneering Initiatives to Digital Classification

To tackle these new challenges, Bureau Veritas embarked into its own digital transformation led by Laurent Hentges, Vice President Operational Excellence, Marine & Offshore. It started over a decade ago with pioneering initiatives.

VeriSTAR Project Management (VPM)

Launched in 2003, it was the first, and is still a leading, digital collaborative platform supporting the new construction process in both design and construction phases. Bureau Veritas has now established an internal digital factory and delivered a wide range of applications and tools, focusing on client experience and efficiency in class and regulatory compliance.

© Bureau Veritas

The 3D webviewer allows ship designer and class society to work together simultaneously
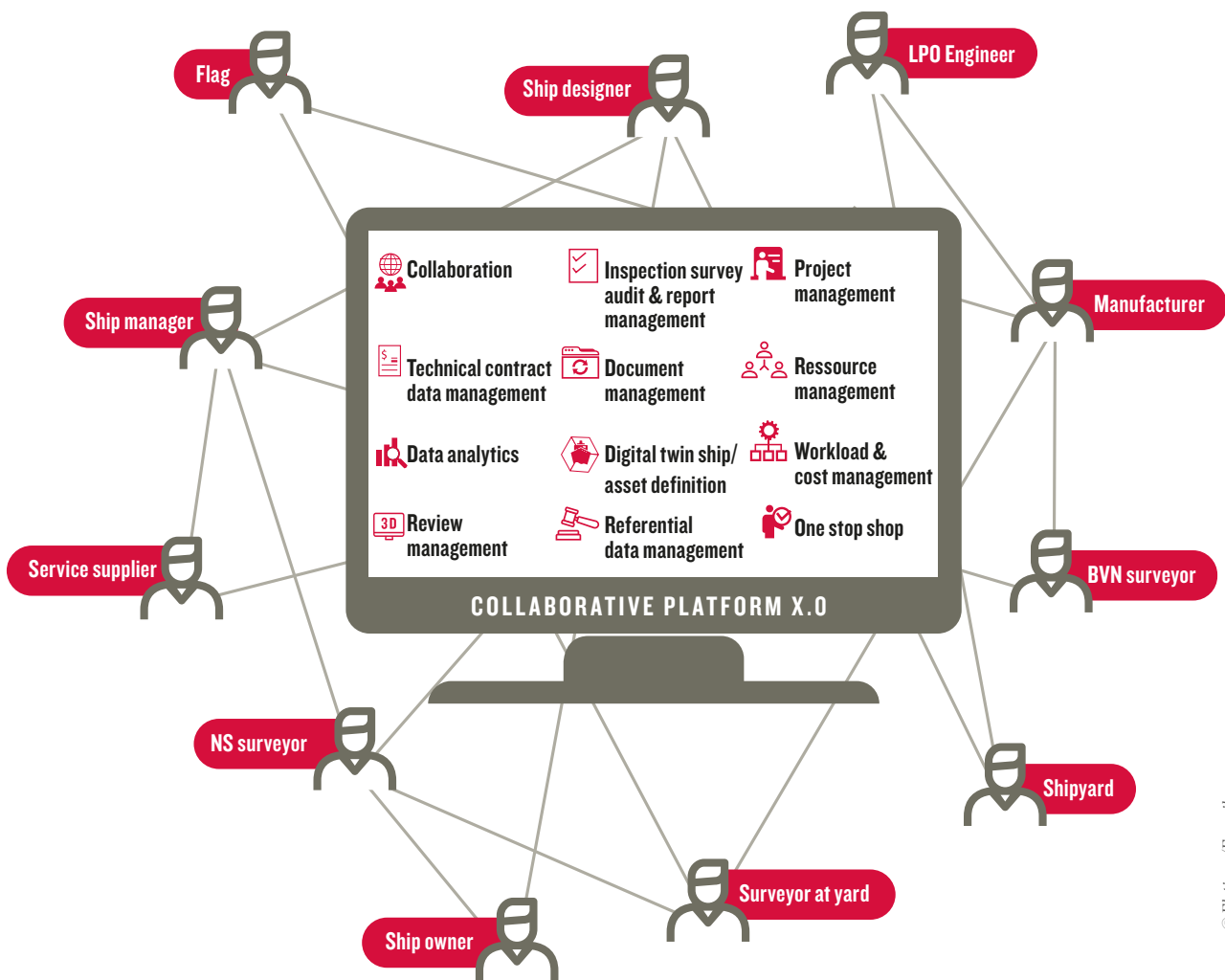
Collaborative cloud-platforms to enable closer and more effective interactions for shipping stakeholders in the design and management of ships and across fleets.

Today Bureau Veritas is building on its digital track record to take the next step in its digital transformation: Digital Classification. Digital Classification will leverage the most appropriate and best digital technologies to transform Bureau Veritas's operating model:

- Industrial Internet of Things (IoT) to enable remote and continuous data collection for continuous verification;

- Remote Inspection Techniques (RIT) such as drones, robotics and smartglasses to enable remote surveys and data collection;

- AI and simulation to improve safety and environmental critical decision-making processes and data analysis;

- 3D digital twin technology to record data during both the design and in-service phases of a ship to maintain a continually updated twin of the ship;

- Collaborative cloud-platforms to enable closer and more effective interactions for shipping stakeholders in the design and management of ships and across fleets – this includes 'asset integrity' approaches.

## Digital Classification – A Single Source of Truth

The continuous collection and analysis of the digital data that these technologies facilitate will simplify the number of providers stakeholders have to interact with in the process of Testing, Inspection and Certification (TIC). With all the information collected and shared through one single collaborative platform, a digital Classification Society becomes a single source of truth for the whole ecosystem of stakeholders and tasks involved in the classification process.

Digital Classification is a pathway to deepening and adding value to services, moving beyond the classification survey as a 'sample' of quality to classification based on the analysis of enormous amounts of data to drive better decision-making. This process will be supported by AI and enabled by the power of the 'cloud' to make smarter decisions and make best use of, as well as to inform, predictive tools. Increased visibility and transparency provides better awareness and enables better responses, creating a better view of likely actual outcomes.

FROM THE START OF A PROJECT TO IN SERVICE OPERATION

DESIGN ▶
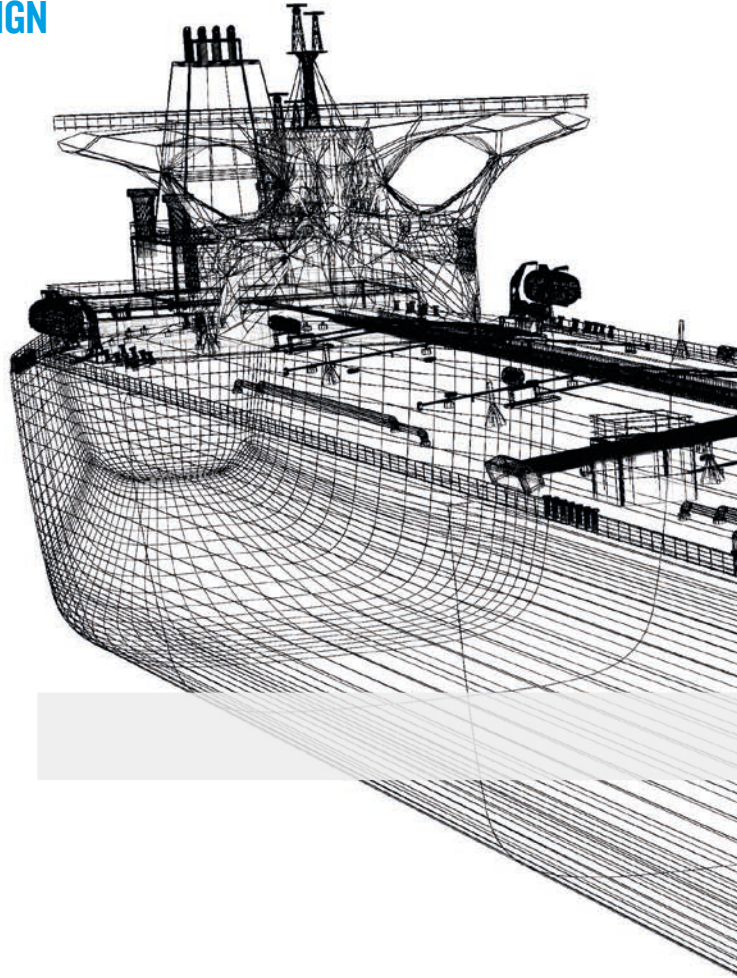
CONSTRUCTION ▶

VISUALIZATION

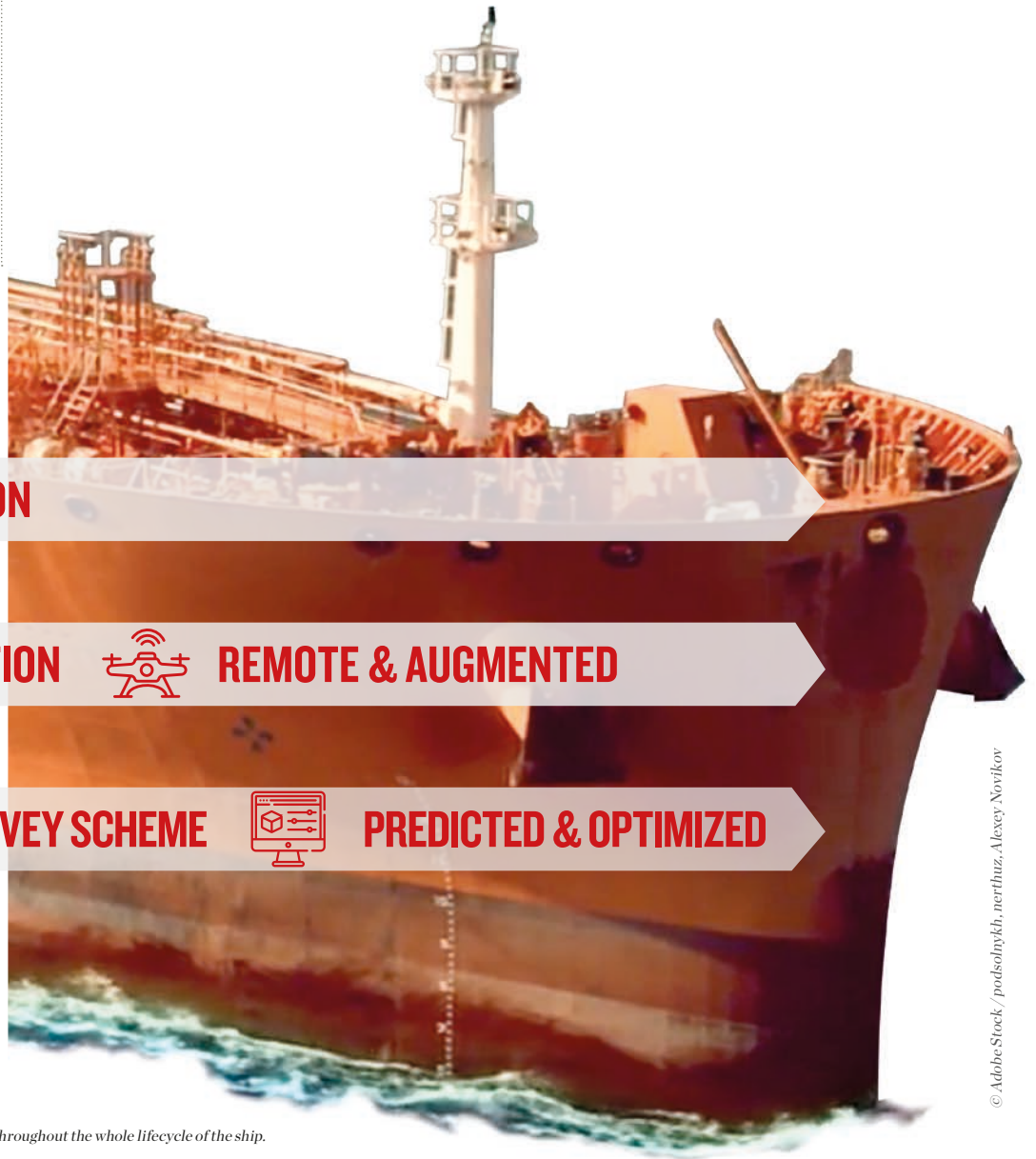**COLLABORATIVE EXCHANGES**

DIGITAL TWIN

DATA DRIVEN

OPERATION
▶

3D CLASSIFICATION

INSPECTION   **REMOTE & AUGMENTED**

SURVEY SCHEME   **PREDICTED & OPTIMIZED**

© Adobe Stock / podsolnykh, nerthuz, Alexey Novikov

Bureau Veritas vision for digital classification - throughout the whole lifecycle of the ship.

T FROM THE START OF A PROJECT TO IN SERVICE OPERATION

Digital Classification covers all steps of the ship lifecycle – from design, construction and integration of equipment and systems, to in-service integrity and modification management – thanks to innovation in the plan review and approval process and in surveying techniques and technology:

• 3D Classification:

  Replacing batches of 2D drawings with a single 3D model becoming the digital twin that will follow the ship from design as well as construction through to operation;

• Inspection:

  – Going from fully physical to partially remote and augmented surveys to reduce costs of survey preparation, including transportation, while improving the safety of the operators and surveyors by avoiding entry into enclosed spaces and working at height,

  – Reporting – inspection input and reports on digital dashboards;

• Survey:

  – New survey schemes – from planned and prescriptive to predictive and optimized,

  – Moving from offline data exchange to real time data sharing and collaboration.

3D Classification & Digital Twin

Today for the classification process of a new ship design, design review time is critical. While most shipyards now build and use 3D models of their ships for the purpose of the design and construction processes, the exchanges with the Classification still remain based on 2D drawings. This has two critical implications:

• From the 3D model of their ship, Designer/Shipyard need to extract a set of 2D drawings to proceed with Classification Societies and then reintegrate into the 3D model the comments received from the classification society on 2D drawings – an iterative and time-consuming process;

• In case of modifications on the 3D model of their ship, designer/shipyard need to update several 2D drawings which generates a quality risk due to potential inconsistencies in the revisions of these different 2D drawings.

Neither of these options is optimal for the two key stakeholders involved.

Happening Now - 3D Classification

That is why Bureau Veritas has been working with three key partners – Naval Group, Dassault Systèmes and Aerys – to develop 3D Classification. Building on Bureau Veritas's successful digital collaborative platform, VPM, the new 3D Classification process now only requires five easy steps:

1. After logging into VPM, the shipyard uploads its 3D model of the ship;

2. Bureau Veritas imports this 3D Model in the 3DExperience platform of Dassault Systèmes to generate automatically calculation models from this one single CAD model. This reduces significantly the time necessary to perform independent calculation, thus improving the overall efficiency of the classification process;

3. Once the calculations are done, Bureau Veritas attaches all the comments directly on the 3D model thanks to the SmartShape 3D web viewer developed by AERYS;

4. After this review, Bureau Veritas comments are shared directly to the designer/shipyard thanks to the SmartShpae 3D web viewer without any additional required license;

5. All the actors collaborate in real time by replying to the comments directly on the 3D model.

Looking into the Future – The Digital Twin

Next steps will see the 3D Classification widened to include new disciplines like fire safety, stability and machinery requirements. It will also include significant time and cost savings for survey at yard with mobile and disconnected surveyors, who will be able to see the 3D model on their tablets, make comments offline as they progress in their survey, and synchronize the comments once they are back in the office for the shipyard to see.

Bureau Veritas' vision for 3D classification does not stop with the design and construction processes. The elaboration of the 3D model will serve as a digital twin that will accompany the ship throughout its lifecycle, allowing all stakeholders to communicate across the collaborative platform for enhanced transparency and quality.
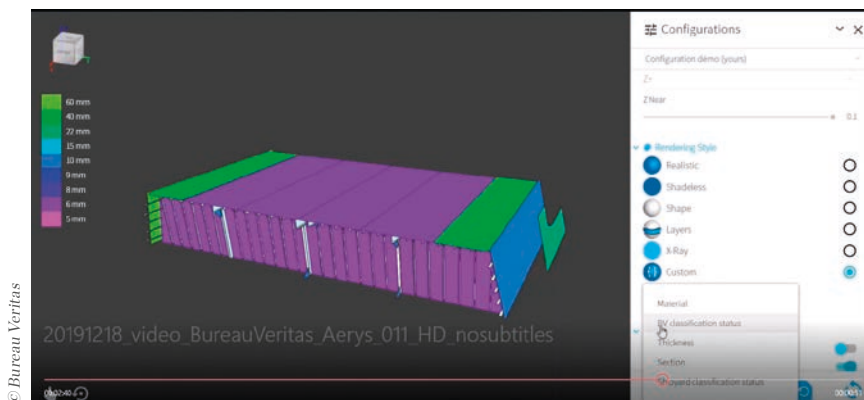
© Bureau Veritas

The new collaborative tool allows all key actors to follow the progress of the revision process through a colour scheme.

The first pilot for Bureau Veritas' 3D Classification solution is already running in production with Naval Group's state-of-the-art FDI frigates.

"We are proud to have achieved a world's premiere with Bureau Veritas and our partners in the French Team. Today, thanks to the digitalization tools developed with Dassault Systèmes, we are able to fully design our ships in a digital model. This transformation allows us to considerably shorten our design and construction times. Bureau Veritas directly participates in this revolution by integrating data from the digital model into its workflow. Thus, we no longer print plans but exchange directly in the workflow, which saves us between three and six months of certification time."

Hervé Guillou
CEO of Naval Group

3D Classification of Naval Group's FDI

The first pilot, which proved Bureau Veritas' 3D Classification solution on Naval Group's state-of-the-art Frégates de Défense et d'Intervention (FDI), is already running in production. Bureau Veritas is working closely with all its partners to continuously refine and improve the efficiency of the solution. This new classification process is fully operational, and reduces significantly the classification leadtime while improving the quality of the process and the customer experience – accordingly also considerably reducing costs.

© Bureau Veritas
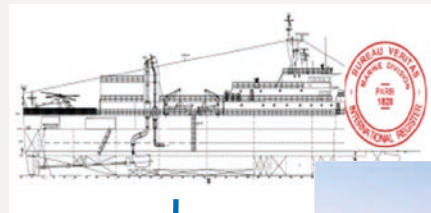
"Drone surveys are now going to be part of everyday life for ship surveys. They can save time and money. Above all drones provide a level of detail and new level of safety that will benefit our clients and our surveyors."

Laurent Leblanc
Senior Vice-President,
Technical & Operations,
Bureau Veritas

Remote and Augmented Surveys – Seeing and Deciding Remotely

Today surveyors have to be onboard a ship to carry out their inspections. This is time consuming and, even more importantly for an industry whose core mission is safety, it also involves a number of manoeuvers in certain parts of the ship that require additional and costly safety measures – such as management of the entry into confined spaces, control of gas dangerous zones, installation of temporary ventilation, lighting and scaffoldings to access the inspected area, measures for safely working at height, safety measures when using rafts for inspections inside ballast tanks, etc.

Bureau Veritas' vision is to facilitate the surveyors' task by reducing the need for their presence on-board the ship allowing them to see remotely thanks to Remote Inspection Techniques and AI. Remote Surveys:

– To see remotely as well as avoid cost and risk from going into complex areas, through the use of unmanned vehicles (aerial drones, ROV, crawlers),

– To verify and decide remotely saving time and travel as well as gaining reactivity through the use of connected devices such as smart glasses, webcams, smartphones and tablets used by the crew on board and the surveyor attending remotely from the office. This would combine the view from the digital twin – on the Bureau Veritas expert's laptop – and images taken in real time onboard for remotely operated occasional surveys and/or on-demand remote support from the most experts Classification surveyors.

Three options will be available for implementation:

1. Offline remote verification – the client sends the data to Bureau Veritas who subsequently verifies the information later on,

2. Partly online remote verification – the client shares the data with Bureau Veritas via a video conference, and decisions are made in real time,

3. Fully online remote verification – onboard data capure, submission and verification are carried simultaneously thanks to connected devices onboard, offering a real time and immersive experience for the surveyor attending remotely;

• Augmented Surveys:
Automatic defect recognition through AI to be developed.

Predicted and Optimized Surveys

A further step will be predictive and optimized inspections and surveys in a culture that moves from paper documents to data.

The current system of surveys for in service ships is planned and prescriptive – ships come in for surveys on set dates and surveyors run through a prescriptive list that remains the same throughout the life of the ship. Bureau Veritas' vision for digital classification is to capitalize on the ongoing digitalization of the data gathering process to feed data analytics and be able to schedule predictive and optimized inspections.

© Bureau Veritas

The use of smart glasses on board ships open the possibility to verify and decide remotely, saving time and travel.

Through the use of connected devices such as smart glasses, webcams, smartphones and tablets used by the crew on board and the surveyor attending remotely from the office, it will be possible to see and decide remotely.
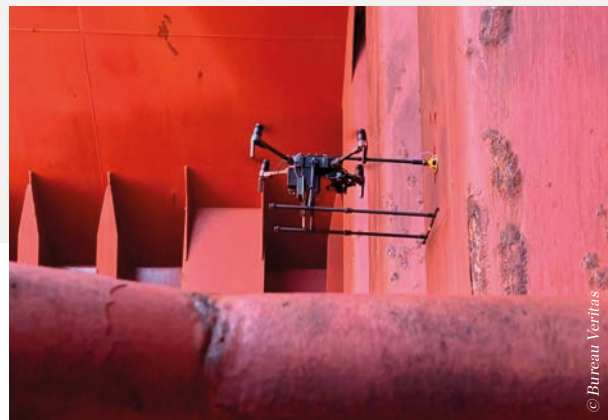
Bureau Veritas performs first survey by drone

In February, Bureau Veritas completed its first survey by drone in a bulk carrier in an Italian port. The scope was an intermediate survey and consisted of a close-up inspection and ultrasonic thickness measurement (UTM) both conducted by the drone in two cargo hold spaces. Compared to traditional survey practices, immediate benefits include the obvious reduction in time and cost in needing staging, raft surveys or rope access specialists combined with the required thickness measurement capability.

Remote Inspection Techniques (RIT) were reflected in Bureau Veritas' rules in 2019 and the done operator is certified by Bureau Veritas for both RIT and UTM. Bureau Veritas has conducted tests and established 'proof of concept' for the most advanced inspection techniques to confirm that the technologies are providing safer and even better quality evidence to conduct and support the survey process while also offering benefits and advantages for ship-owners and ship-managers.
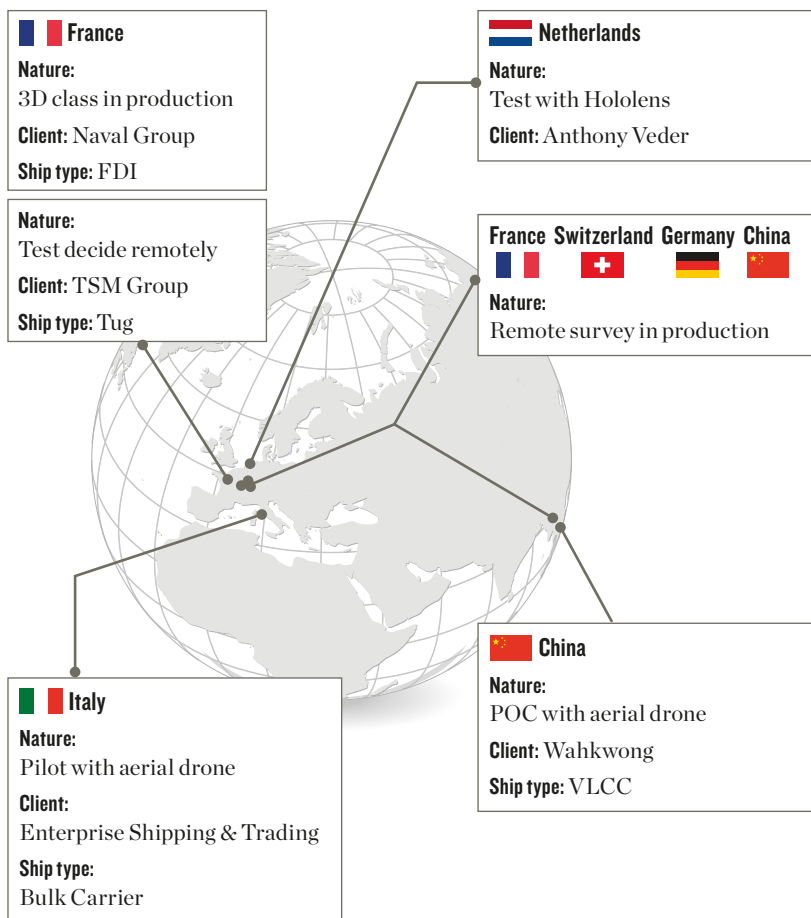
Bureau Veritas confirms that aerial drones are now mature, they are survey ready on a commercial basis and provide:
• Safer conditions for the surveyor and the operator who are no longer exposed to the risks of working at height nor, necessarily, will they be required to enter into the confined spaces for the inspection;
• Time saving during the inspection;
• Better quality evidence when assessing the condition of the hull;
• Optimized maintenance costs and planning by reducing ship's immobilization and optimizing the preparation before the repairs.

Airborne drone conducting ultrasonic thickness measurements inside the hold of a bulk carrier.

France
Nature:
3D class in production
Client: Naval Group
Ship type: FDI

Nature:
Test decide remotely
Client: TSM Group
Ship type: Tug

Netherlands
Nature:
Test with Hololens
Client: Anthony Veder

France Switzerland Germany China
Nature:
Remote survey in production

Italy
Nature:
Pilot with aerial drone
Client:
Enterprise Shipping & Trading
Ship type:
Bulk Carrier

China
Nature:
POC with aerial drone
Client: Wahkwong
Ship type: VLCC

" We must work with the maritime and digital worlds to define and implement the best solutions. We work with pilot clients when defining and launching any offer. We are building partnerships with major digital players and we are moving with start-ups as well in agile mode to accelerate access to new, innovative technologies."

Laurent Hentges
Vice-president,
Operational excellence & Information systems,
Bureau Veritas

MOVING FORWARD

Today Bureau Veritas has made real strides in advancing its vision for digital classification. The use of 3D classification for the design review process is already in production with yards such as Naval Group, while a number of proof of concepts (POC) have been successfully carried out with ship owners and technology partners for remote surveys. This shows that Bureau Veritas' cooperation with its clients and partners is key to taking classification to the next dimension, and we look forward to continuing this journey with existing and new clients and partners.

Digital classification will be accessible to all our clients, regarless of where they are in their own digital transformation journey. Rather than seeing it as a challenge, Bureau Veritas sees these differences as an opportunity to support each other in a mutually beneficial process of digital evolution.

For Bureau Veritas, the development of digital classification is not merely driven by technological development. We have embarked on this journey with clients and partners to work together on the development of a more efficient classification operating model, and we have charted a clear course for how digital classification will enable us to further keep clients' crews and assets safe.

BUREAU VERITAS
MARINE & OFFSHORE
8 Cours du Triangle
92937 Paris-La Défense, France

marine-offshore.bureauveritas.com