



2020

STRENGTH
THROUGH
RESILIENCE

ANNUAL REVIEW

ABS MISSION

The mission of ABS is to serve the public interest as well as the needs of our members and clients by promoting the security of life and property and preserving the natural environment.

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STRENGTH THROUGH RESILIENCE

2020 was a year of uncertainty and challenges, but also a year of opportunities and learning for ABS and the industry.

Among the most important lessons learned throughout the year is that we can mine advantage out of great adversity if we have the strength and resilience to endure it and the vision to see beyond it.

Together, we witnessed history in the making in the form of the first digitally driven global safety outcomes. The applications of technology in the worldwide response to a global pandemic contain powerful lessons on digital's potential to drive safety improvement at all levels of work and life, from the micro-scale of a home or workplace to the macro-scale of a global corporation. And we saw true digital transformation take place, as the future of work began to reveal itself.

Globally, we saw complete revolutions of business models through remote and virtual activities. This could lead to an overall reduced carbon footprint of global business, bringing everyone closer to the goal of building a low-carbon world, where digital activities are spurring decarbonization initiatives.

At ABS, we saw first-hand the transformative power of digital technology to change the ways in which we conduct business. We found new levels of distance collaboration among our staff and with our clients, we expanded the use of remote survey auditing functions and, for the first time in our long history, conducted our annual meeting virtually. The maritime community responded favorably to these advances and brought many new vessels into ABS class, increasing the ABS-classed fleet to more than 270 million gross tons. And amidst an upended world, we continued our incredible safety leadership and industry-leading port State performance.

It is certainly gratifying to look back on the business successes we enjoyed during one of the most challenging years in our history, but it is even more reassuring to recognize in those successes a human victory. Our people, as they strove to overcome the local adversity facing their own lives, endeavored likewise to help overcome the global adversity facing our organization. It is wholly because of such teamwork that we can look back on 2020 and say: we survived, we built and we also helped and supported each other; and in doing so we uncovered a path forward and laid the foundation of a new and even brighter future, truly demonstrating our strength through resilience.



CHAIRMAN'S MESSAGE

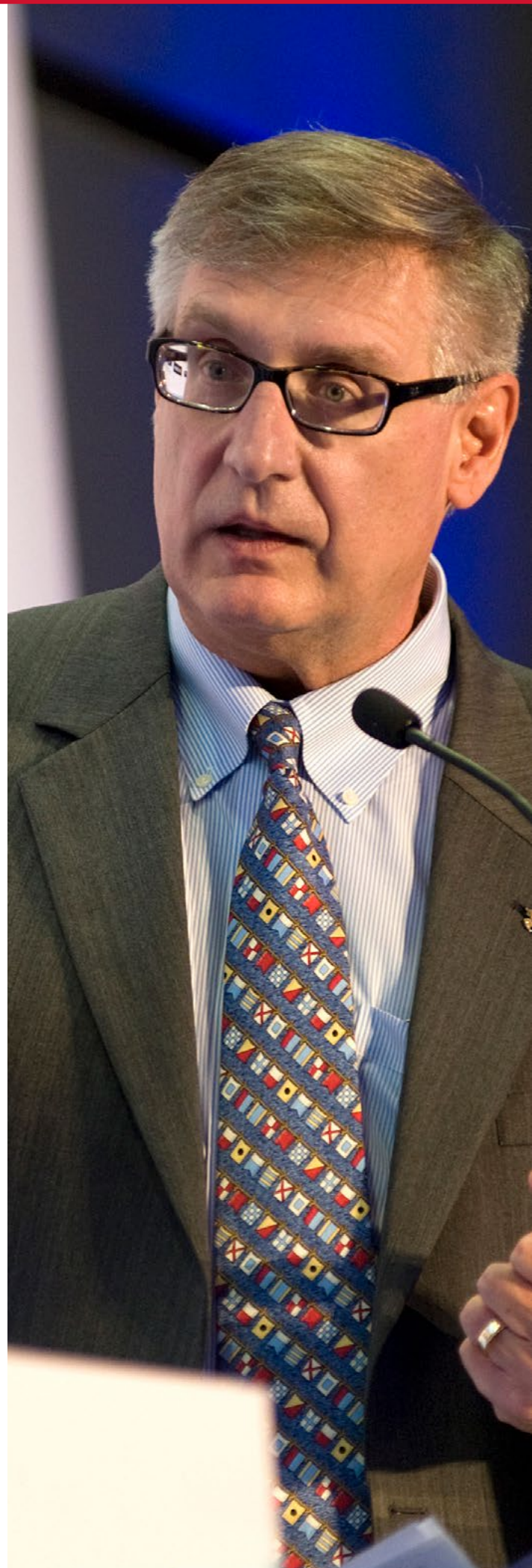
As we started the new decade, we did so amidst the onset of the COVID-19 global pandemic. The virus was, indeed, a disruptor, yet also a catalyst and an accelerator that catapulted our lives, economies and industries into new ways of thinking, working and delivering solutions.

2020 certainly presented challenges at all levels, yet it also brought forward great opportunities. From transitioning a global organization to a fully remote workplace in less than 24 hours, we realized the importance of collaboration and transparency and embraced the transformative power of digital technologies. Most importantly, the year illuminated the priceless significance of people from heroes across the medical field and logistics industry, to the seafarers and surveyors in the global maritime community who kept ships moving safely. The battle-hardened warriors of the pandemic demonstrated leadership at all levels, showing us all how to accept and adapt to uncertainty.

With determined passion from the front lines, ABS found ways to help in the fight against the virus from publishing the industry's first comprehensive guidance on cleaning and disinfecting marine and offshore assets exposed to COVID-19, and guidance and notations for mitigating infectious disease transmission on board marine and offshore assets, to undertaking joint projects to develop designs for crew accommodations and ventilation systems to mitigate infectious disease spread, and ensuring the readiness of U.S. Navy hospital ships to provide critical hospital beds. ABS also joined the worldwide effort against food-related insecurity with donations of more than 200,000 meals to communities in crisis.

With trust, transparency and teamwork integral to ABS, these traits helped us navigate an unprecedented year to strengthen our foundation as we prepare for a post-COVID era.

As we leverage lessons learned to navigate the future, there are four major changes essentially driving four underlying challenges resulting in four global shapers. The changes are (1) market uncertainty and predictability; (2) regulatory impacts on the carbon journey; (3) the introduction of new technology and the rate of change of this new technology; and (4) the impact of COVID-19, which remains to be determined. The challenges they energize are (1) the drive to achieve low-carbon shipping; (2) the speed and scope of digitalization; (3) the need to recognize and mitigate unintended safety consequences as we address and manage safety risks; and (4) most certainly valuing the people who drive and fuel our industry each day.





These changes and challenges, and indeed all our efforts, are wrapped within four forces shaping activity on a global scale: (1) Environmental, Social, and Governance (ESG); (2) International Safety Management (ISM); (3) Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII); and (4) how we lead through our next normal no longer new, as our lives and experiences have been changed forever.

Through 2020, we adjusted with the ebbs and flows of the global economic forces and strengthened our industry fundamentals ahead of regulatory obligations that allowed ABS to grow our classed fleet to 273 million gross tons (m gt), maintain our leadership role across the entire Global Offshore market, lead the Global Marine market in gas carriers and containerships with a solid share of tankers, continue to command the industry in safety, remain the top performing Recognized Organization (RO) in the three most active port State regions globally, as well as retain a solid position in the Global Orderbook.

ABS continued its steadfast support for the U.S. government during 2020, by growing the condition-based class (CBC) program with the U.S. Navy's Military Sealift Command (MSC) to implement a predictive compliance model leveraging datasets to perform risk profiles and create CBC survey plans. ABS also was awarded two projects from the National Academy of Sciences, Engineering and Medicine to strengthen the safety culture in the offshore oil and gas industry. Internationally, ABS expanded its government support for the Royal Canadian Navy and Defence Research and Development Canada to deliver a digital framework as the foundation for a broader CBC program.

We also continued delivering award-winning and patented digital and decarbonization technologies to transform the industry safely and establish clear pathways on the journey to low- and zero-carbon shipping. As the only classification organization recognized as a founding member of the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, ABS also delivered its second industry-recognized Outlook for Low Carbon Shipping focusing on the various fuel pathways to a carbon-free future.

In 2020, ABS continued its relentless focus on safety and reliability with a very low lost time incident (LTI) rate of 0.13. We believe that one safety incident is too many and continually strive toward a goal of zero incidents each year, demonstrating solid safety leadership at the heart of all we do. Our financial and operating successes would not have been possible without the professional and dedicated employees who live and work in the SPIRIT of ABS every day. Through their relentless focus on Safety, People, Integrity, Reliability and Quality, Innovation and Teamwork, the SPIRIT of ABS remains our guiding beacon and unique differentiator.

STRENGTH THROUGH RESILIENCE

As we continue to invest in people, systems and technologies, we remain a best-in-class leader because of our continuous learning models and robust career development programs. In 2020, we delivered nearly 120,000 hours of training to our employees through scenario-based classroom and online learning opportunities. Additionally, ABS designed nearly 100 hours of fresh content focused on cyber security and risk management, as well as timely courses on safety during epidemics and pandemics. Our well-trained experts, who span traditional marine and offshore architecture, engineering and data sciences, clearly demonstrate strength through resilience to continue learning, improving and delivering services and solutions safely even amidst a global pandemic.

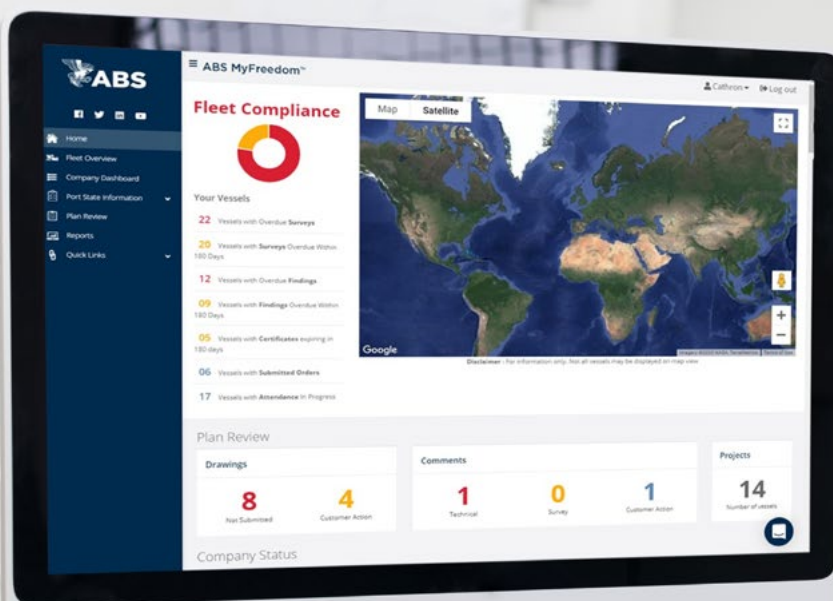
The key driver of our next normal is the development and dissemination of digital skills and digital comfort within the labor pool and, in reality, digital is more about people than technology. Therefore, we need what can be called “digital ergonomics”, an approach to digitalization and digital development that puts the human user first and blends the human and digital components of our next normal to reinforce each other’s strengths. Such a mindset is at the heart of ABS where we lead by example at the intersection of digital and decarbonization technologies and solutions.

At the center of rapid evolution for digital technologies, ABS developed award-winning tools and innovative technologies that help us work better, smarter and more efficiently.

Digital’s role in driving future safety outcomes was highlighted throughout 2020 where digital technologies from data analysis to smart manufacturing and the rapid adaptation to remote inspection technologies highlighted the accelerated ways in which we collaborate across all partners in the maritime supply chain to realize the true potential to enhance asset management, fleet performance, sustainability and crew safety. Already a leader in remote survey since launching the service in 2018, ABS rapidly expanded its offerings during 2020 to bring the most comprehensive set of remote options available to the maritime and offshore industries and was the first classification organization to introduce almost all annual surveys remotely on eligible vessels, including the majority of the world’s offshore drilling units.

During 2020, we demonstrated digital leadership through groundbreaking projects in advanced 3D modeling with shipyards and designers. This is the kind of collaboration that continues to shape ABS as the leader in the future of classification and the recognized technology leader in our increasingly digitized and data-driven world.

With the launch of the ABS MyFreedom™ client portal, we put smart shipping and the power to navigate fleet management and vessel compliance services powered by smart functionality and data analytics in the palm of the hand for owners, operators and charterers. Additionally, ABS launched the ABS My Digital Fleet™ platform,



a breakthrough digital platform for operators to connect their data and help manage risk. The customizable solution provides real-time data-driven insights to improve fleet efficiency and help owners and operators manage risks.

As an example of ABS leadership in the future of simulation, ABS completed a pioneering joint development project aimed at revolutionizing the design process for the industry's decarbonization journey. Through this effort, multiphysics simulations bring new insights into the impact of decarbonization strategies on vessel performance at the earliest design stages where analyses can serve as decision-making tools.

In further recognition of ABS' visionary leadership in technology development, the Maritime and Port Authority of Singapore (MPA) renewed its alliance with ABS in maritime research, development and innovation. Under this agreement, MPA and ABS will collaborate on projects relating to decarbonization, artificial intelligence-driven decision support tools, predictive maintenance, cyber security and other futuristic technologies such as the use of augmented and virtual-reality tools in training environments.

These landmark achievements demonstrate the strength, resilience and vision that have characterized ABS for much of its modern history and continue to define us today.

Our subsidiary, the ABS Group of Companies, Inc. (ABS Group), also quickly adapted to the fast-paced changes of 2020, accelerating the deployment of smart technologies such as distance learning, remote monitoring services for cyber security, virtual process hazard analysis and remote inspection, as well as publishing a first-of-its-kind Risk Restart Model early in the year to help businesses evaluate and manage risks associated with reopening office locations globally. Through the patented ABS FCI Cyber Risk™ model, ABS Group delivered expanded maritime cyber security solutions focused on both information technology (IT) and operational technology (OT) capabilities and landed its largest-ever ports and terminals cyber project.

In 2020, ABS Nautical Systems® – the company's proprietary fleet management software solution – leveraged its strength as the leading compliance management solution to bring to market NS eLogs™, the most comprehensive collection of electronic regulatory logbooks, including International Convention for the Prevention of Pollution from Ships (MARPOL) and others. Nautical Systems is now widely recognized as the marine industry's leader for fleet management software.

Through its risk management team, ABS Group supported the groundbreaking development of the Federal Emergency Management Agency's (FEMA) National Risk Index to use advanced data analytics in identifying communities across the United States which are most at-risk for natural hazards.

Throughout the year, ABS Group built new strengths on its core values of safety and integrity, surpassing a record-breaking five years without an LTI in 2020.

The dedicated professionals of ABS will continue to overcome challenges and lead the industry safely with the level of integrity and professionalism that our members and clients expect and deserve.

In our next normal, ABS will continue to build on its cornerstone values of safety and integrity to rise above challenges and leverage its strength to deliver consistent positive performance.

Among the most important lessons we learned in 2020 is that we can mine advantage out of great adversity if we have the strength and resilience to endure it and the vision to see beyond it. We believe that success is a team sport, and that all we accomplished together is because of our incredible employees and our loyal clients. ABS is tough and well positioned going forward thanks to each of you, as you have shown the world your strength through resilience.



Christopher J. Wiernicki
Chairman, President and CEO, ABS
Chairman, ABS Group of Companies, Inc.

SAFETY AND QUALITY

LEADERSHIP IN THE FIGHT AGAINST COVID-19

The COVID-19 pandemic challenged the world to rapidly develop and implement new safety standards and protocols for mitigating the spread of the deadly disease. The world responded with determination and much success, but the resulting economic disruption to whole industries and individual companies is ongoing and will likely require significant time for recovery. From our own experience, we can say that the qualities needed to overcome COVID-19's future challenges are the same ones that led us through 2020: strength, resilience, vision and innovation.

- As soon as the pandemic was recognized, ABS first initiated a COVID-19 Incident Management Team (IMT) that met daily and continues to do so even at the time of this publication. Our internal ABS World intranet site was used to add a COVID-19 specific section for all personnel to access updates, guidance, training and resources. ABS implemented specific personal protective equipment (PPE) for all employees and required offices to put in place PPE inventories so ABS personnel could continue to work safely. During the pandemic, ABS surveyors, auditors and other employees continued to provide services to our clients using new controls implemented by our COVID-19 IMT. ABS instituted company-wide remote working, leveraging practices and technologies developed during our digital transformation journey to redefine traditional concepts of work and collaboration. We developed a framework to safely reopen offices, along with a detailed plan that was used for over 30 offices that were reopened during the pandemic.





- ABS also joined the worldwide effort against COVID-19-related food insecurity, with donations to food banks in New York and Houston that provided more than 200,000 meals to communities in crisis.
- ABS made a key contribution to the United States' COVID-19 response effort by doing its part to ensure the readiness of two ABS-classed U.S. Navy hospital ships, the *USNS Mercy* and the *USNS Comfort*, which were called into service to provide urgently needed hospital beds in New York and Los Angeles. On the West Coast, round-the-clock survey preparation enabled an ABS team to accelerate the readiness of the *Mercy* and substantially progress the required surveys while the crew prepared for deployment to Los Angeles. On the East Coast, an ABS team worked with Military Sealift Command (MSC) to prioritize critical maintenance work, complete all surveys during reactivation and accelerate the *Comfort's* availability, which allowed it to deploy in time to reach New York City by early April.
- Meanwhile, as understanding grew about the transmission mechanisms of the disease, vessel designers took on the challenge of developing systems and arrangements to improve crew safety. ABS supported this effort by issuing the industry's first comprehensive guidance on cleaning and disinfecting marine and offshore assets exposed to COVID-19, *Response Measures to COVID-19 for the Marine and Offshore Industries*. Developed from a range of independent governmental and commercial sources, the Guide consolidated the best available information at the time of publication and answered a range of urgent questions on contamination prevention, asset sanitization and decontamination.
- Demonstrating its industry leadership, in November, ABS launched the *ABS Guide for Mitigation of Infectious Disease Transmission On Board Marine and Offshore Assets* and, in another industry first, introduced a new notation to indicate compliance with the standard. The notation, IDM-A (Infectious Disease Mitigation – Arrangements), indicates that an asset meets requirements for ventilation, accommodations and configuration of spaces that can be used for isolation and segregation of crew, passengers and visitors.

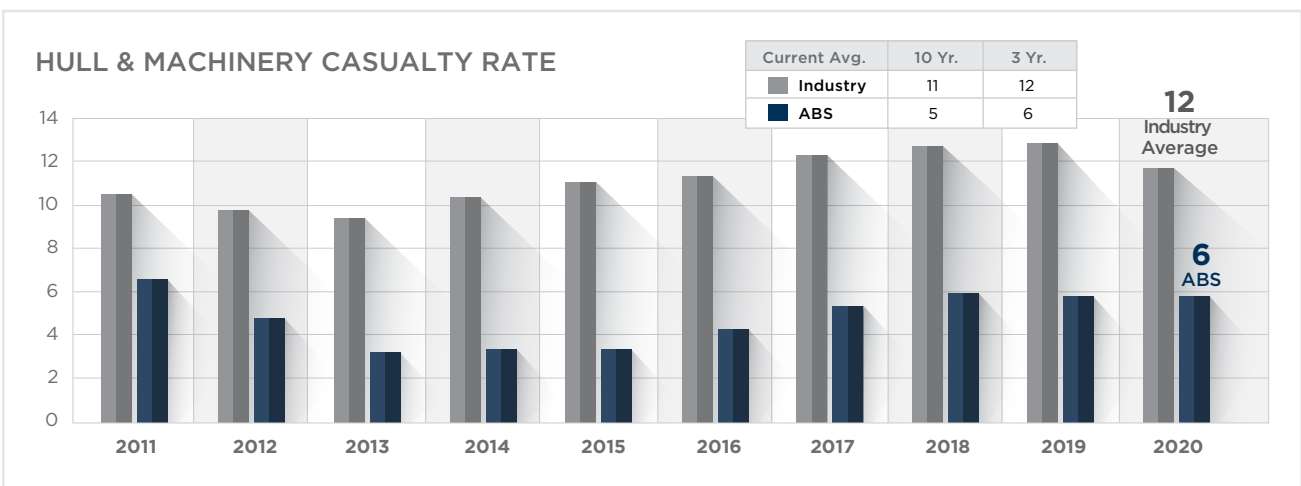
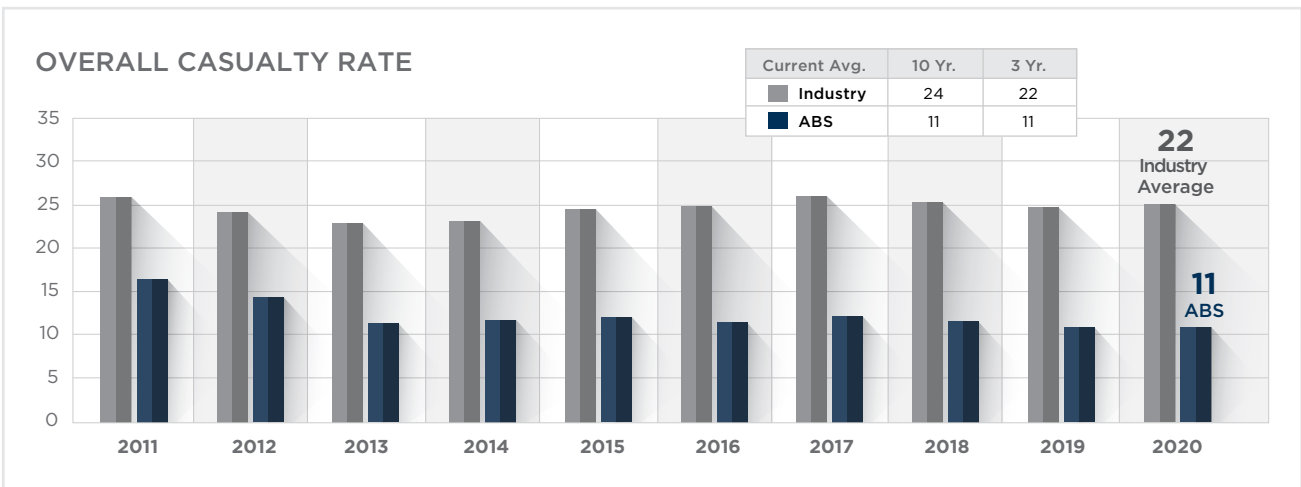
SAFETY LEADERSHIP

Safety is the foundation of everything we do at ABS and an endless pursuit. For ABS, safety is a core value. We have built our reputation as an industry leader in maritime safety underpinned by a commitment to continual improvement and developing a strong safety culture for our workforce. What we do matters to the lives of people and the quality of the environment. ABS empowers employees with the knowledge, tools and authority to maintain safety at work and in everyday life. Our safety record has been compiled on countless ships, offshore facilities, shipyards, industrial sites and corporate offices globally. We are vigilant in our goals to improve safety practices and dedicated to making our workplace a safe environment.

ABS SAFETY PERFORMANCE

In our long safety tradition, each year's successes form the foundation of next year's achievements, fueling the voyage that has made ABS a global Health, Safety, Quality and Environmental (HSQE) leader. Our field staff continue to have weekly safety meetings, and office staff meet monthly, to discuss specific safety issues locally or cover elements of our safety theme that we develop each year. In 2020, our safety theme was "hazard awareness"; in 2021, our safety theme is "working from home."

In 2020, we issued 12 Golden Eagle Health and Safety awards to individual employees worldwide, while our Chairman's Safety award was issued to all field staff. This is proof that we are a safety-driven organization and a testament to the safety awareness of our staff, their commitment to safe practices and procedures and the success of our overall safety methodology.



OCCUPATIONAL HEALTH AND SAFETY PERFORMANCE

The ABS ongoing safety excellence initiative incorporates strong occupational health and safety processes and policies, including its Stop Work Obligation rule giving all employees the authority and the responsibility to intervene if safety is in question in any aspect of their work. ABS continues to increase engagement in leading safety behaviors, including timely reporting of potential incidents or hazards and documenting near misses.

- ABS' three-year averages of key safety measurements continue to be among the best in our industry:
 - Lost time incident rate (LTIR) of 0.13
 - Total recordable injury rate (TRIR) of 0.31
- ABS employees continued to make good use of our global reporting system to capture unsafe conditions, unsafe behaviors, near misses, and work-related injuries or illnesses.
- ABS maintained our ISO 45001 certification in 2020, with external audits performed by the British Standards Institute (BSI).

QUALITY PERFORMANCE

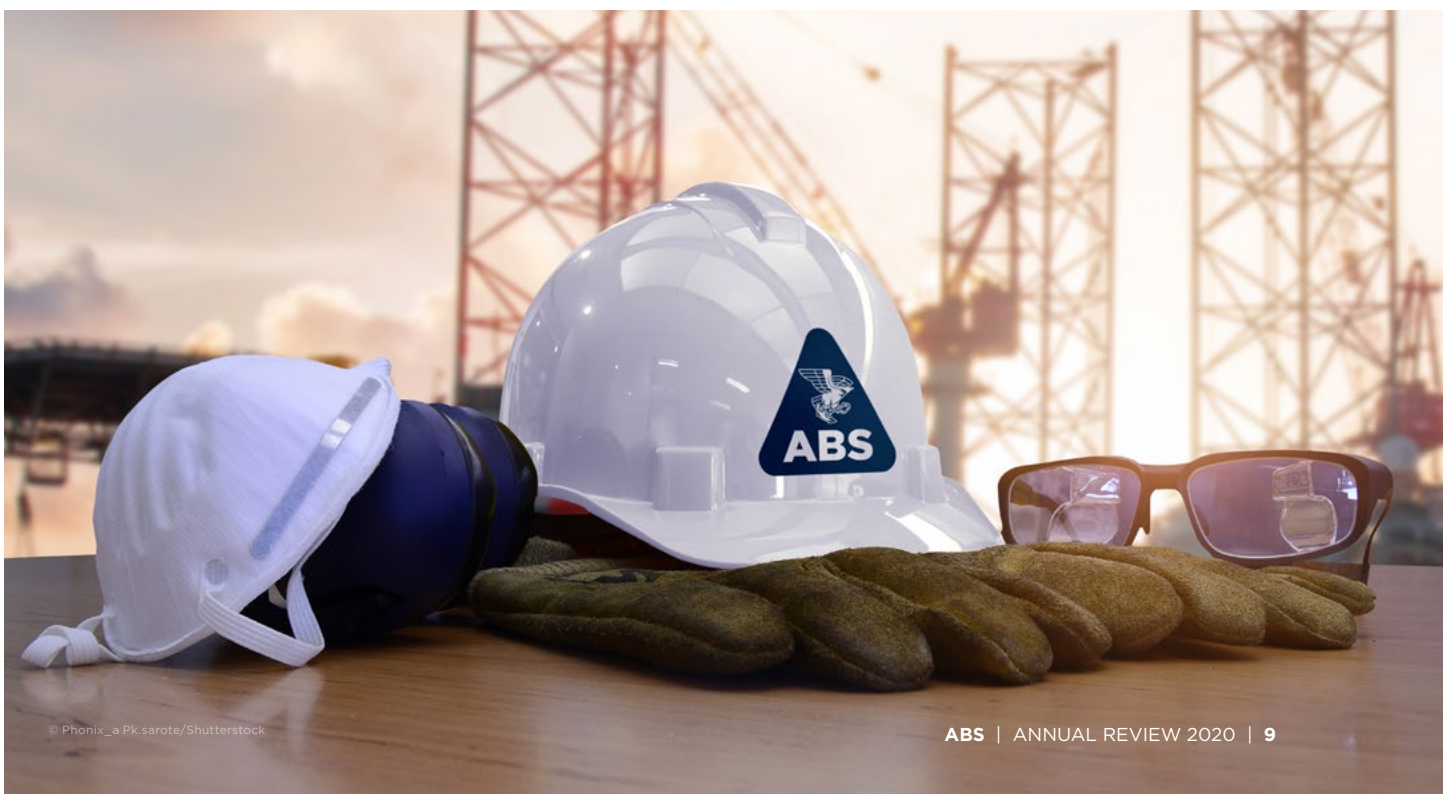
In 2020, ABS continued high-quality service delivery to our global client base. ABS maintained its leading position on overall Port State Control (PSC) performance, being the top performing Recognized Organization (RO) in the three most active PSC regions of the world from 2017 to 2020.

- U.S. Coast Guard (USCG) – ABS maintained zero RO-related detentions for the last 12 years
- Paris MoU – ABS had one or fewer RO-related detentions each year over the last seven years
- Tokyo MoU – ABS averaged one RO-related detention per year over the last five years

ABS GROUP OF COMPANIES, INC. SAFETY PERFORMANCE

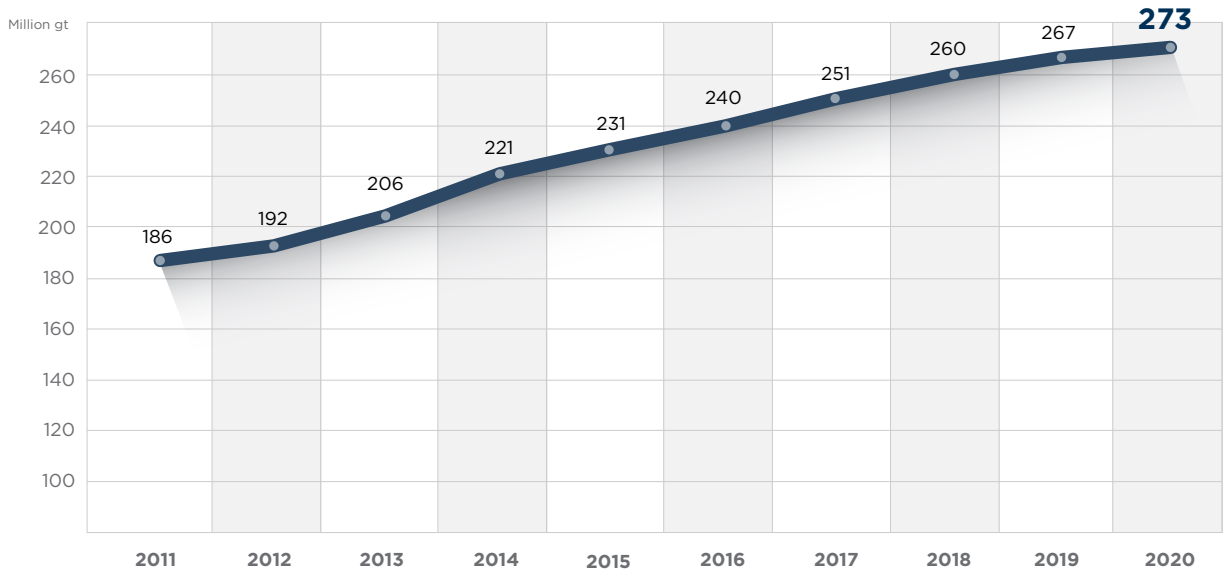
Building on the parent organization's ongoing commitment to its safety mission, ABS Group of Companies, Inc. (ABS Group) surpassed five years without an LTI in 2020.

This achievement demonstrates ABS Group's focus on continually improving the effectiveness of its health, safety, quality and environmental culture, performance and management system.

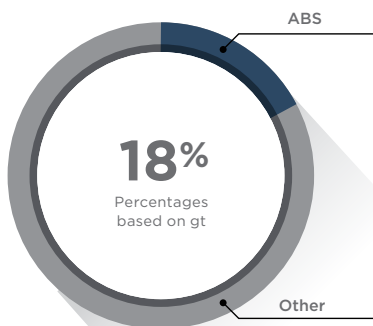


INDUSTRY LEADING PERFORMANCE

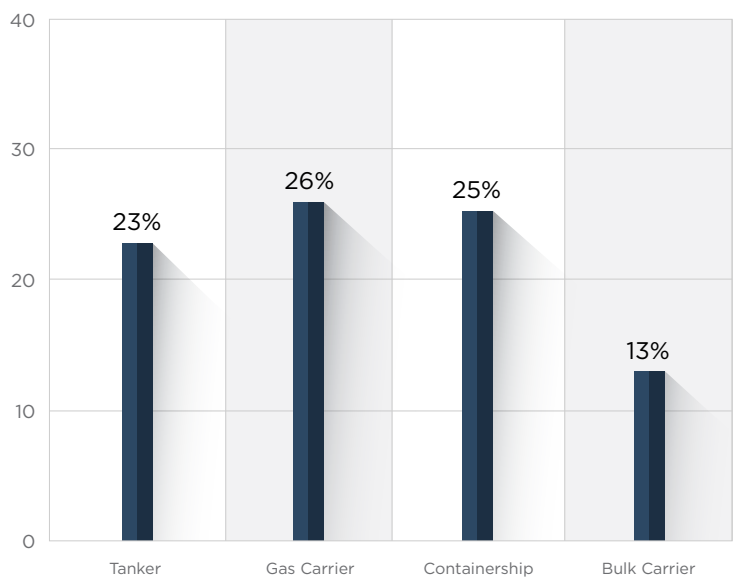
EXISTING FLEET 2020



EXISTING FLEET 2020



MARINE ORDERBOOK SHARE 2020



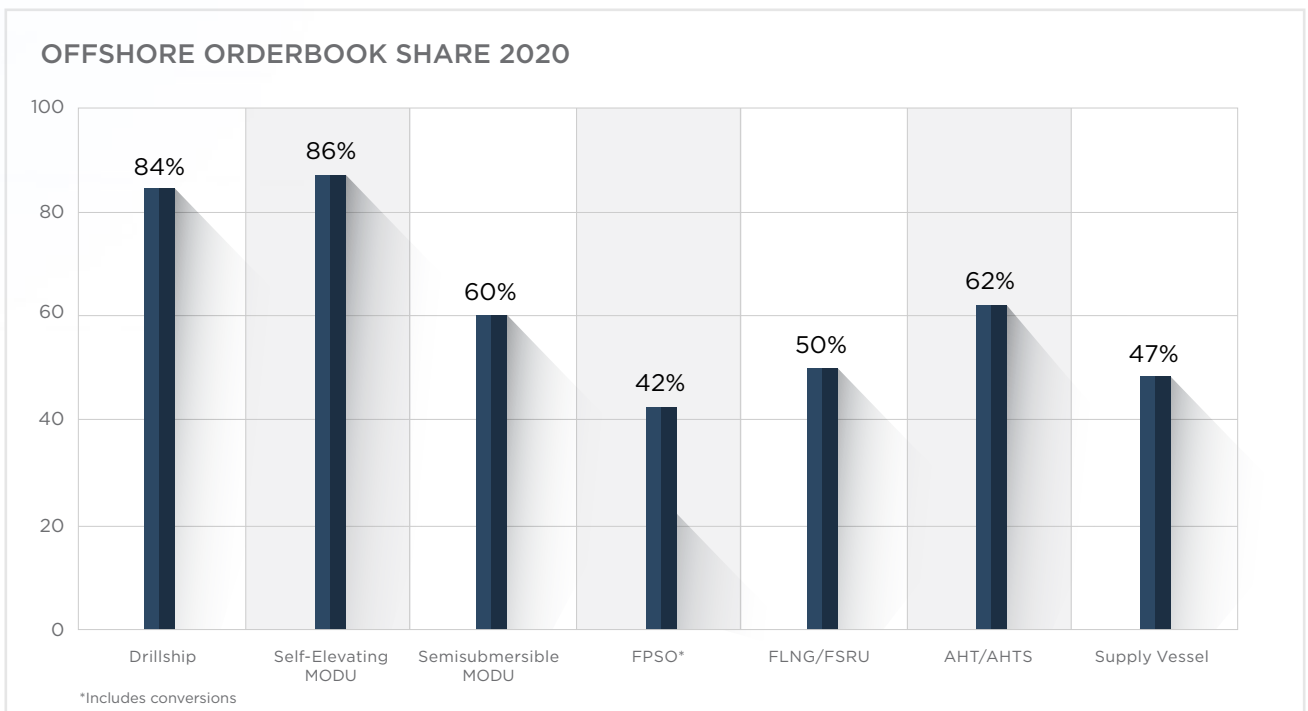
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LEADING ORDERBOOK FOR SHIPBUILDERS

BRAZIL	S KOREA
CHINA	TAIWAN
JAPAN	USA
SINGAPORE	

LEADING EXISTING FLEET FOR OWNERS

BRAZIL	SINGAPORE
DENMARK	S KOREA
GREECE	TAIWAN
JAPAN	USA



GLOBAL CORPORATE CITIZENSHIP

DEVELOPING OUR TALENT PIPELINE

As the global maritime industry continues to transform with increasing digitization, automation, machine learning and big data analytics, digital technologies will be a key enabler in our quest to build a cleaner, better, safer and more sustainable future.

In this rapid evolution of technology, ABS is well-positioned as a technical and safety leader. The core engineering and technology competence of our people and the wealth of experience they bring to problem solving is a key differentiator for us. That's why ABS is focused on continuing to develop our employee base to be best in class through continuous learning, training and preparation to support our commitment to set standards of excellence as a leader in maritime safety – now and in the future.

The path forward for ABS is clear based on three defining goals – safety, service and solutions. We have been able to achieve those goals through the innovative thinking, enthusiasm and professionalism of our highly experienced staff. Years of experience, training and continued education have made us confident in our actions and secure in our decisions.

As an organization committed to investing in and cultivating a sustainable, multiskilled talent pipeline across a broad range of disciplines – traditional marine and offshore architecture, engineering studies, data analytics and cyber security – ABS is well-prepared and ready to meet the challenges of evolving industry issues.

Our robust internal career development efforts at ABS are designed to provide a balance of development activities for employees, using a combination of job experience, mentoring, coaching and formal training.

TRAINING

The global pandemic changed the nature of our working and training environments. With offices and classrooms closed, finding new ways to collaborate both internally and externally was paramount. Both internal and external training programs were redesigned to run effectively in a virtual format.

In 2020, ABS employees completed a total of 118,682 hours of compulsory, mandatory, required, validation and other personal development training. Almost 100 hours of newly developed content was released, including programs on: Assessing Fire and Boat Drills; Cyber Security for Auditors; ISM and ISPS Auditor Qualification; Risk Management for Engineers; Offshore Emergency Shutdown Systems; and Staying Safe: Epidemics and Pandemics.

ABS launched a new library of scenario-based, technical micro-lessons for surveyors and engineers that promote critical thinking on problem solving in support of our mission. These highly successful videos were watched by ABS employees nearly 20,000 times in 2020.

ABS also maintained high standards of client training in 2020; offering virtual classrooms in lieu of in-person training. The extensive library of web-based training curricula was also a popular choice in 2020 for clients seeking self-paced learning for their employees.



CAREER DEVELOPMENT

ABS places great emphasis on career growth and development at all levels, and across all areas of our organization. In 2020, ABS launched two new development programs:

- The *Beacon Career Development Program* offers a wide variety of professional and career development tools, resources, trainings and opportunities for all staff members. In 2020, ABS employees completed over 11,800 hours of new micro-learning trainings for professional and career development available within the Beacon program, and more than 400 ABS managers attended a new virtual instructor-led training, Leader as Coach, totaling over 3,200 hours of training.
- The *Propel Accelerated Leadership Development Program* offers tailored development opportunities for identified high potential staff. In its inaugural year, over 150 high potential employees from around the world were inducted into the Propel program.

ASPIRE PROGRAM

Another way ABS cultivates the talents of our people is through the Aspire program. In this program, newly hired graduates are given the opportunity to work alongside professionals in the Engineering, Survey, Technology and Digital Solutions groups through a series of developmental rotations. The Aspire program fosters broad-based knowledge development by exposing participants to the diversity of career paths across ABS, such as

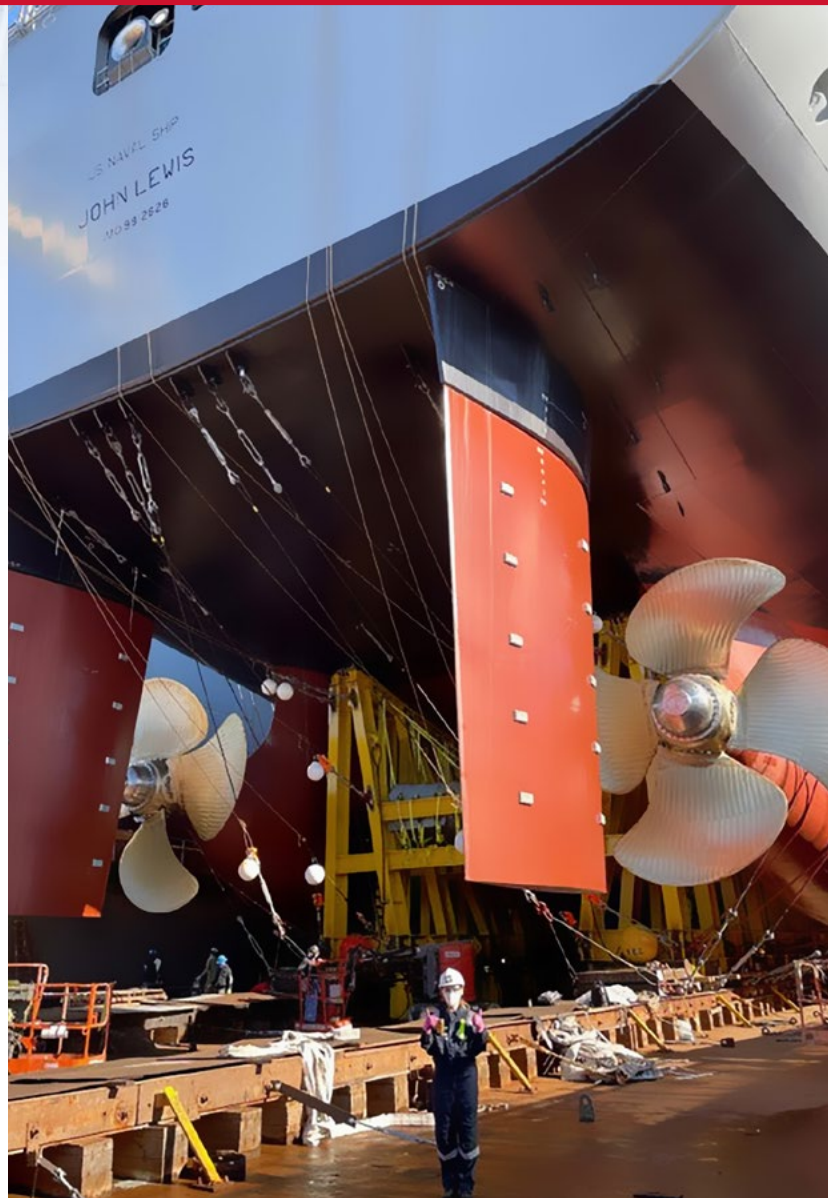
data analytics, naval architecture, ocean engineering and mechanical engineering. Since Aspire's founding, 81 employees have completed the program, gaining a strong foundational knowledge of the mission of ABS and the role we play in supporting the marine and offshore industries.

UNIVERSITY RELATIONS

In 2020, ABS provided scholarship commitments to 343 scholars at colleges and universities in the Americas, Europe, Middle East, Africa, China and Pacific regions.

Additionally, ABS supported endowed academic chairs at seven campuses:

- ABS Chair of Naval Architecture and Marine Engineering and ABS Chair of Marine Transportation at the State University of New York (SUNY) Maritime College
- ABS Chair of Engineering at the California State University Maritime Academy (formerly known as the California Maritime Academy)
- ABS Chair of Metallurgical and Materials Engineering at the Colorado School of Mines
- ABS Chair in Ocean Engineering at the University of California Berkeley (UC Berkeley)
- ABS Chair of Marine and Offshore Design Performance at the University of Michigan
- ABS Career Development Chair at the Massachusetts Institute of Technology (MIT)
- ABS Chair in Naval Architecture and Marine Engineering at the Webb Institute



ABS ESG

ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) EXCELLENCE

ABS offers solutions for addressing the key sustainability goals of the International Maritime Organization (IMO) as they relate to vessels, fleets and managing organizations. ABS is focused on industry-leading sustainability projects including:

- Studying the viability of alternative fuels and new energy sources
- Analyzing decarbonization pathways and the impact of seaborne trade growth and IMO targets
- Using digital technology to simplify transactions and increase operational efficiencies
- Comparisons of estimated survey fees across multiple ports
- Assisting companies in their journey to ESG excellence



**MÆRSK MC-KINNEY MØLLER CENTER FOR
ZERO CARBON SHIPPING**

ENVIRONMENTAL EXCELLENCE

7 AFFORDABLE AND CLEAN ENERGY



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



SOCIAL RESPONSIBILITY

3 GOOD HEALTH AND WELL-BEING




8 DECENT WORK AND ECONOMIC GROWTH




GOVERNANCE – OPERATIONAL EXCELLENCE

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



16 PEACE, JUSTICE AND STRONG INSTITUTIONS









STRENGTH THROUGH RESILIENCE

DIGITAL SOLUTIONS AND INNOVATION

DIGITAL SOLUTIONS AND INNOVATION

LEADING THE WAY TO DIGITALLY ENHANCED RESILIENCE

The maritime and offshore industries are enveloped in a continuous state of accelerated change fueled by rapidly evolving digital technologies. But in 2020, all industries were buffeted by unprecedented shocks as whole nations shut down and changed their economic and social habits to combat the COVID-19 pandemic.

Faced with the dual challenge of maintaining operations while ensuring safe working conditions, digital adoption among the maritime industry accelerated, and the demand for digital technology has since risen tenfold as businesses embrace new ways of working. The uses of technology in response to COVID-19 contain powerful lessons on digital's potential to drive safety improvement across all levels of an industrial operation, from the comparatively micro-scale of a vessel to the macro-scale of a global shipping operation.

Digital technologies – from data analysis to smart manufacturing and distribution of equipment and supplies – has facilitated the global response to the pandemic in a rapid, efficient manner. This may be the first example of digital technologies having a massive impact on a global scale, and certainly validates the potential for digital technologies to fundamentally change our industry.

“ABS is a leader in both maritime sustainability and in the application of digital technologies for enhanced asset management. ABS is uniquely well placed to offer digital services to shipowners in need of practical solutions for meeting their sustainability targets and developing a detailed understanding of their environmental performance.”

KASH MAHMOOD
SENIOR VICE PRESIDENT,
DIGITAL SOLUTIONS
ABS



REVOLUTIONIZING THE USE OF DATA AND DIGITALIZATION

Recognizing that effective digitalization depends on effective use of data, ABS developed a revolutionary means of helping industry realize the full potential of its ever-increasing data storehouse.

One thing ABS' long experience with digital technology teaches is that true digitalization depends on data integration. For a company to get the most value from its analytical capabilities and maximize the quality of digitally informed decision-making, it must first be able to fully integrate all available data about its assets.

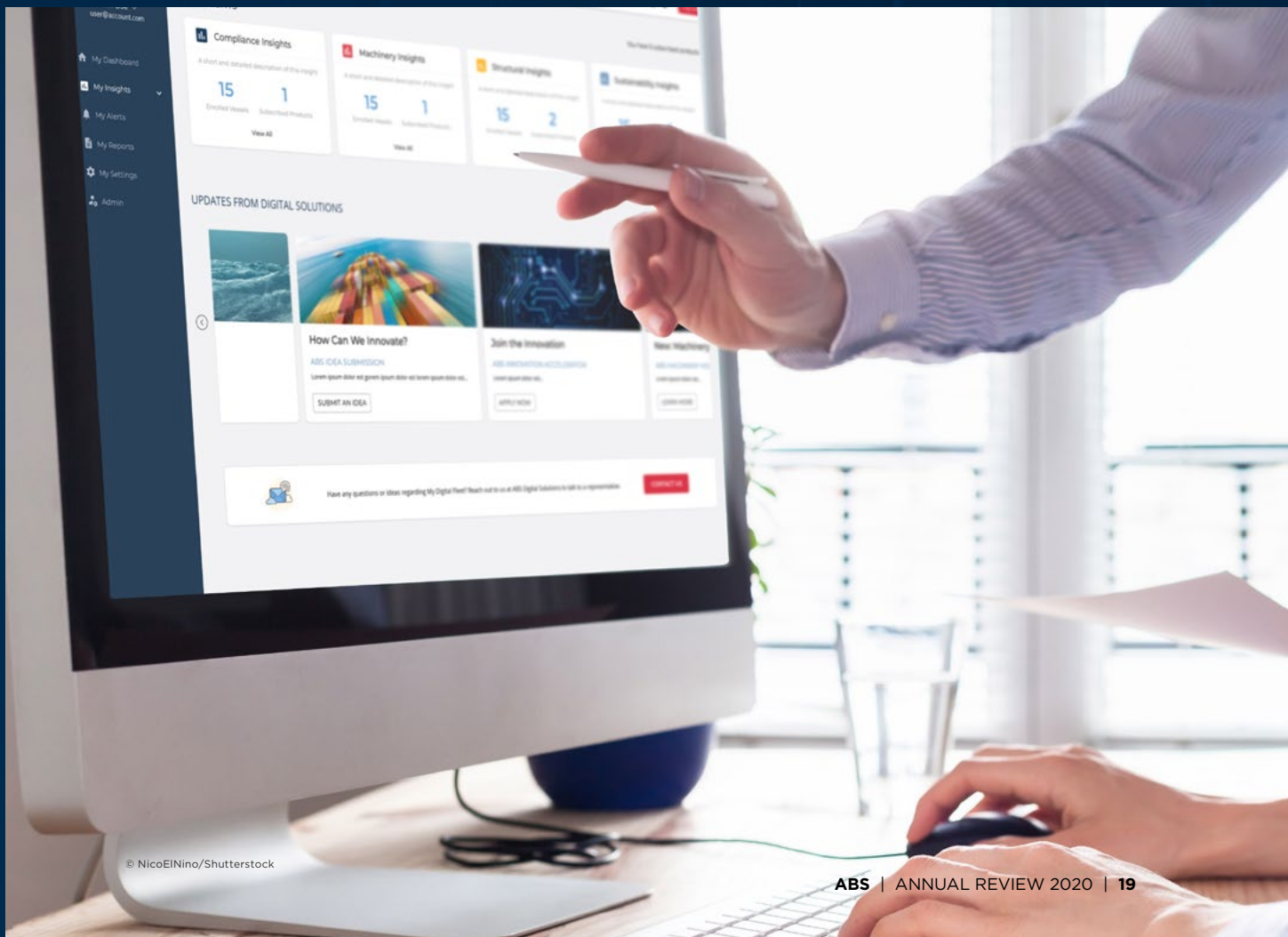
That is why, in October, ABS released the ABS My Digital Fleet™ platform, a breakthrough development designed to facilitate the digitalization of the maritime industry. The equipment and systems on board marine

assets generate a tremendous amount of data regarding what they control and monitor. But what is often an immense pool of vessel information, tends to remain an untapped resource because of siloed systems and lack of reporting mechanisms.



MY DIGITAL FLEET™

Connect Your Data.
Reduce Your Risks.



SPOTLIGHT

APP PUTS SMART SHIPPING IN THE PALM OF THE HAND

In July, ABS launched the ABS MyFreedom™ client portal — a unique suite of fleet management and vessel compliance services powered by smart functionality and advanced analytics, which, in an industry first, were also made available through a new ABS smartphone app.

Designed to provide intuitive, informed support for decision-making, the smart functionality provides simplified access to operational, technical and compliance information, and all ABS class services for managing fleet performance and operating health, including real-time survey status, smart scheduling and remote survey options. Among the app's industry-leading smart functions are:

- **ABS Smart Scheduler™.** This uses real-time automatic identification system (AIS) data to maintain fleet compliance by tracking the survey status of all vessels and issuing alerts when surveys are due. It is also a mobile survey booking tool, enabling any survey to be scheduled in less than a minute.
- **Custom Checklist.** This brings together port State data for all ABS-classed vessels to provide a port-specific checklist for crew and fleet managers prior to arrival.
- **Fee Estimator.** This compares estimated survey fees across multiple ports.
- **Port State Control (PSC) Risk.** This provides customized PSC analytics by vessel or fleet, including their destination's top deficiency items and the vessel's class record data, along with a vessel risk rating based on compliance status.
- **International Safety Management (ISM) Findings.** This matches a destination port's top ISM-related deficiency items against a vessel's class records.
- **Port-Specific External Specialists.** This provides one-touch direct client connections for upcoming surveys.



ABS has been an industry leader in digital technologies for over 50 years, ever since becoming the first classification society to computerize back in the 1960s. This tradition of leading digital development continues today. It is reflected in the digital-themed technical papers and articles published by ABS personnel, the numerous presentations given by ABS subject matter experts at conference keynotes, panels and roundtables, and in many joint projects with industry's technology leaders. One such project of 2020 that stands out, particularly because it involves collaboration with another pioneer of maritime digitalization, is the collaboration with Chevron Shipping Company.

In September 2020, ABS and Chevron Shipping Company took the first step in a pioneering digital fleet management journey, using ABS smart notations for vessels.

Chevron, a long leader in proactive maintenance, has already acquired Preventative Maintenance Program (PMP) notations for its entire fleet and presently uses a range of ABS remote survey services. Now a suezmax lightering vessel, *Pegasus Voyager*, has become the first vessel in Chevron's fleet to receive the ABS maintenance optimization notation Machinery Health Monitoring (SMART-MHM), and the first of all ABS-classed vessels to qualify for the notation. The ABS SMART-MHM notation leverages Chevron's investment in fleet sensor technologies to support remote analytics, use machinery data in class crediting, and align maintenance strategies with ABS for all accredited vessels.

This success was just the first step towards establishing condition-based maintenance for the company's fleet of 28 vessels.

Such advances show clearly that digital technologies and corporate digitalization are critical to the evolution of asset management, maintenance and repair.

- Another project that resulted in an enhanced understanding of asset health and performance was the digital collaboration ABS and P&O Maritime Logistics (POML). In February, the two companies agreed to a pioneering condition-based class (CBC) pilot project, the goal of which was to provide an alternative means of verifying compliance with hull and machinery survey requirements. In this effort, the POML platform supply vessel, *DMS Courageous*, became the first vessel of any type to use ABS Nautical Systems® fleet management software as the computerized maintenance management system transmitting planned maintenance data and condition-based maintenance information to ABS for potential class credit.



SPOTLIGHT

BREAKTHROUGH USE OF 3D MODELS IN PLAN REVIEW AND SURVEY

ABS demonstrated true digital leadership in 2020 through groundbreaking projects in advanced 3D modeling with shipyards and designers. These projects proved two important points: that ABS can fully support 3D model integration in both engineering and survey and that the future of classification is upon us.

- In April, ABS completed an industry first through a pioneering pilot project with General Dynamics NASSCO shipyard in California, in which surveyors successfully used 3D digital models for class surveys, rather than traditional paper drawings. In this pilot project, surveyors used 3D digital models to simulate new construction surveys on several steel blocks. The models were viewed remotely and in real-time through ABS software, and the surveys were completed successfully.
- In June, ABS and the Shanghai Merchant Ship Design and Research Institute (SDARI) began a joint development project (JDP) importing SDARI's 3D models into classification software so they, too, can be used for 3D model-based class reviews.
- In July, ABS and Samsung Heavy Industries (SHI) entered into a JDP to develop Korea's first end-to-end, 3D model-based classification

process for both engineering and survey. This JDP follows an earlier project, recently completed, in which ABS and SHI worked together in developing a paperless, 3D model-based design and review process. The new JDP moves that effort into a next phase by piloting 3D model-based surveys of an LNG carrier

- In September, ABS began a joint effort with Israel Shipyards Ltd. on another pioneering 3D model project, in which ABS will use Israel Shipyards Ltd's 3D models in the plan review of a 45-meter, multimission offshore patrol vessel (OPV). This project seeks to reduce the total number of paper drawings and documentation in the class review of the OPV design, replacing those documents with the original computer aided design (CAD) model. This will create efficiencies by streamlining and clarifying communications between the shipyard's designers and the class society.

Taken together, these projects represent a significant step forward in ABS' development of an end-to-end paperless class process, and our journey to bring the full benefits of digital technology to the maritime community.



The pilot project focused on the achievement of the following three objectives:

1. Improving alternative means of compliance verification
2. Expanding and evolving the application of remote survey techniques
3. Leveraging predictive capabilities to transform the class process and create efficiencies in onboard surveys

The heart of the project is to draw upon ABS' remote survey offerings and the *ABS Guide on Smart Functions for Marine Vessels and Offshore Units*, which introduced the industry's first notations on smart technology applications to support development of condition-based approaches to enhance safety and increase vessel operating time.

AT THE FOREFRONT OF DIGITAL INNOVATION

It isn't enough to be an innovator. For innovation to translate into action, widespread support and adoption is key.

- ABS opened 2020 with a three-week "digital road show" reaching nearly 240 members of the European maritime community in Genoa, Istanbul, Monaco, Geneva, London, Hamburg, Copenhagen, Athens and Limassol. The ABS Digital Solutions team presented nine seminars examining various aspects of the journey towards smarter, data-driven and digitalized maritime industries and describing the flexible, comprehensive digital solutions that can help companies achieve their digital goals. Highlights included focus sessions on the use of data analysis and digital technologies to assist in decision-making processes and to ease the transition from prescriptive to condition-based classification programs.

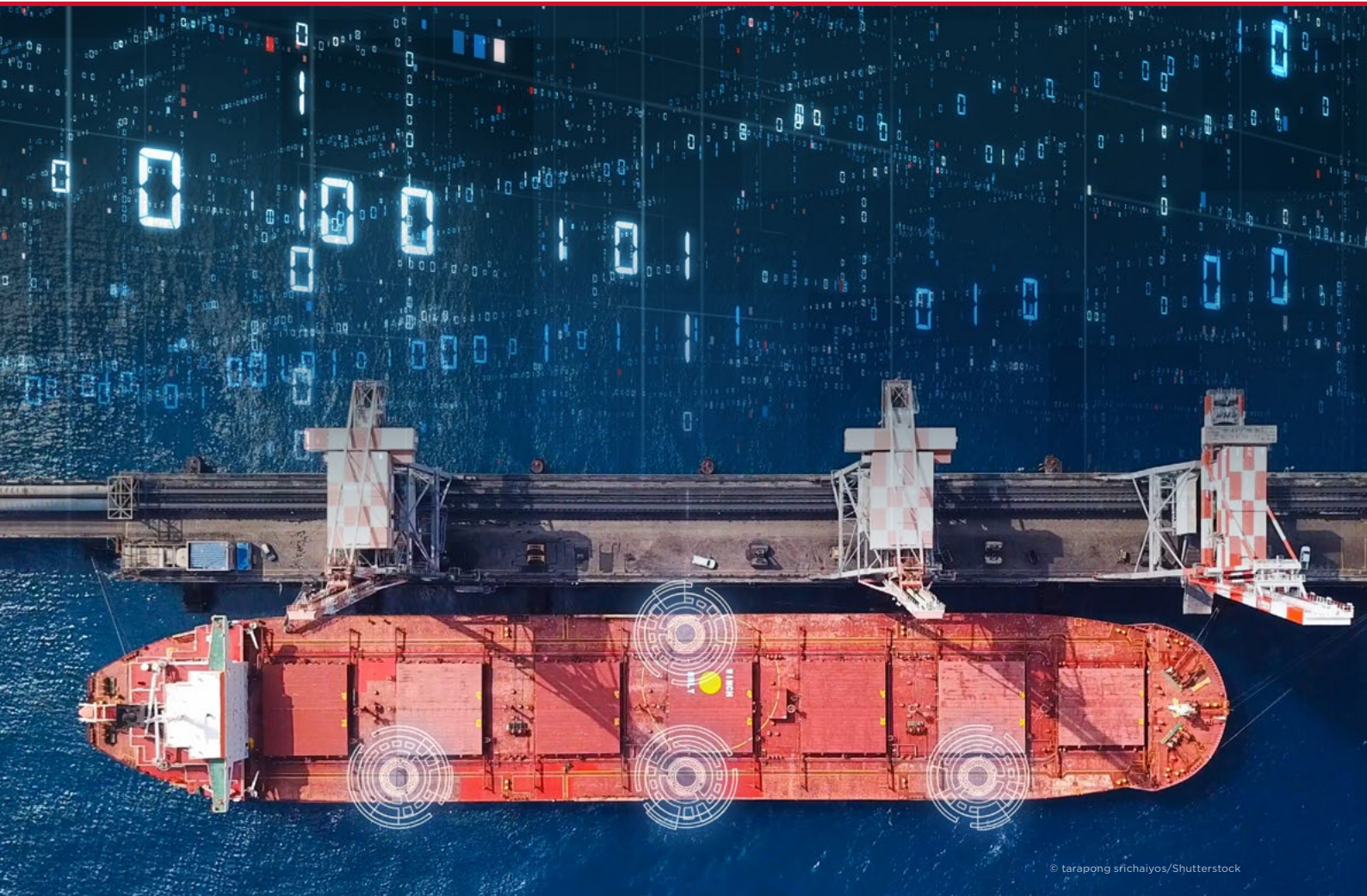
One of the most popular sessions involved an analysis of the Digital Ecosystem. Presenters looked deeply into current trends regarding digital transformation and explained how digital technologies and data management can be applied to solve business and regulatory challenges, from improving efficiency in asset management to overcoming obstacles on the road to decarbonization. Other areas discussed in detail included predictive maintenance, operational efficiency and cyber security.

Another of the most popular sessions involved an overview of the digitally enhanced class experience, which outlined the steps for enrolling assets in CBC programs and discussed such digital advances as remote survey, e-certification and the digitalization of fleet management systems.

- Not long after the digital road show concluded, ABS continued its long record of support for digital innovation with the launch of two new advisories designed to help harness the potential of digital technologies for the maritime and offshore industries: the *ABS Advisory on Structural Health Monitoring: The Application of Sensor-Based Approaches* and the *ABS Advisory on Data Quality for Marine and Offshore Application*.



STRENGTH THROUGH RESILIENCE



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The Structural Health Advisory focuses on the use of sensors to determine structural health, predict the progress of a vessel's condition, indicate any need for repairs or modifications, and to foresee and prevent future failures. It addresses common challenges including how to define and implement sensor-based structural health monitoring; how to determine what sensor packages are suitable for a particular purpose; and how to integrate the sensor approach with analyses and simulations to form a structural digital twin from which accurate and reliable structural condition insights can be obtained.

The Data Quality Advisory provides an overview of the relevant standards and industry best practices to meet stringent data quality requirements in commercial applications. It offers specific guidance for the marine and offshore industry on data quality assessment, monitoring and control within a practical data quality framework of detailed data quality rules and metrics.

- Autonomous technology is gradually reshaping the maritime industry, bringing benefits such as increased operational efficiency, human error reduction, emissions reduction, increased safety, and operational cost reduction. Always at the forefront of emerging technologies, ABS is currently collaborating with members, industry and regulators on autonomous vessel design, risk management and implementation projects all over the world. In April, ABS published industry-leading guidance on the journey to autonomy, including a goal-based framework for autonomous requirements. The *ABS Advisory on Autonomous Functionality* addresses the application of autonomous functions in the maritime and offshore industries, the infrastructure enabling these functions, and key regulatory developments.

The advisory also introduces the smart-to-autonomous framework, which is a goal-based framework to guide the implementation of autonomous and remotely controlled functions; details the importance of the development of a Concept of Operations document; and emphasizes the importance of remote control and operations centers, which will play a critical human-in-the-loop role for autonomous operations. On the regulatory side, the advisory provides a brief on the roles of the flag States and port States as well as an update on the Maritime Autonomous Surface Ships Regulatory Scoping Exercise by the IMO.

FIRST SMART BUNKERING VESSEL

In January, ABS and Keppel Offshore and Marine continued their pioneering teamwork in the application of digital technologies to shipping, by integrating smart functions into what will become the world's first smart LNG bunkering vessel. Named *FueLNG Bellina*, the vessel will be built to ABS class and equipped with Keppel's proprietary AssetCare Digital Solution.

The vessel will seek ABS class notations for Smart Infrastructure (Smart INF) and Crew Assistance and Augmentation (Smart CAA), which reflect the onboard digital systems that will enable remote monitoring, real-time operational support, predictive maintenance and various digital enhancements to vessel performance and efficiency. To be based in Singapore, the 7,500 m³ *FueLNG Bellina* will be Singapore's first LNG bunkering vessel and will supply large ocean-going, LNG-fueled vessels throughout the region.

SMART NOTATION FOR SHUTTLE TANKER

In November, ABS awarded the shuttle tanker, *Eagle Passos*, its first Smart (INF) Notation. Owned by AET and built by Samsung Heavy Industries (SHI), it is the world's first shuttle tanker to receive the notation, which recognizes data communication and network infrastructure. The ship will also be granted Operational Performance Management (OPM) and Crew Assistance and Augmentation (CAA) class record comments, in recognition of the optimization, monitoring and reporting smart functions.





GROUNDBREAKING ADVANCES IN REMOTE SURVEY

Some of the most exciting developments of the year were in the area of remote survey. Powered by digital technologies, remote surveys and audits augment the traditional survey experience by allowing surveyors to perform a range of actions without being physically present. ABS has been an industry leader in remote survey ever since launching the first remote survey services in 2018. Today, ABS offers the marine and offshore industries' most comprehensive set of remote options and became the first class society to introduce almost all classification annual surveys remotely on eligible vessels.

- During 2020, ABS created an easy, five-step process to simplify scheduling and delivery of remote survey and audit requests, expanded remote survey options and extended remote survey and audit services for equipment and materials manufacturers, as well as other key service providers.
- In November, ABS scheduled its 100th Inventory of Hazardous Materials (IHM) Certification for Seaspans Ship Management. Fully 98 percent of those surveys were performed remotely, a fact that underscores the level of efficiency and productivity that can be attained through digital technology and remote survey.
- ABS also provided a number of advances in the area of remote survey for the offshore oil and gas industry. In an industry first, ABS surveyors performed remote surveys for steel certification at a steel mill in India, which enabled work to continue on two self-elevating drilling units (SEDUs) for Lamprell Energy despite COVID-19 restrictions.

- Throughout the year, ABS bolstered its position as the global leader in offshore classification by making the majority of the world's offshore drilling units eligible for remote survey through a range of new remote survey options. Adding to the industry's most comprehensive remote survey program, ABS, which provides classification services to more than half of the global fleet of mobile offshore drilling units (MODUs), offered offshore operators a remote option for the majority of class and statutory annual surveys.

Seen individually, remote surveys, smart technologies, autonomous research, advanced analytics and predictive maintenance are impressive advances, but seen together, they are definitive proof that ABS can rightly count itself among the master craftsmen building the digital future of the maritime and offshore industries.



SPOTLIGHT

SIMULATIONS FOR ANALYZING MARINE CARBON FOOTPRINTS

In September, ABS and Hyundai Heavy Industries (HHI) completed a JDP aimed at revolutionizing the design process for the decarbonization journey. In a year-long effort, the joint team developed multiphysics simulations for analyzing the carbon footprint of vessels in the early stages of the design spiral. These simulations allow in-depth evaluation of the impact of design options and present detailed previews of vessel performance long before key investment decisions are made.

Through pioneering techniques, the simulations bring unprecedented insight into the impact of decarbonization strategies on vessel performance, at such an early stage of design that the analyses can serve as decision-making tools.

The simulations draw on a broad range of inputs, including computational fluid dynamics models, wave resistance models, and data-validated engine performance models. Examples of technologies that can be evaluated through this modeling process include air lubrication systems, energy-saving devices, voyage speed profiles and engine fuel options. The simulations can also reflect the impact of inputs from a range of data sources and optimization tools, allowing comprehensive analysis of the trade-offs between different vessel configurations.

This technology is a further example of ABS leading the way towards establishing an end-to-end paperless class process, which will be one of the truly revolutionary benefits of digitalization.





STRENGTH THROUGH RESILIENCE

GLOBAL MARINE

GLOBAL MARINE

LEADING WITH STRENGTH, RESILIENCE AND VISION

During 2020, the global maritime industry faced difficulties and challenges because of pandemic lockdowns and travel restrictions, as well as from a weakening of the supply chain that stemmed from large-scale changes in consumption and spending habits.

The global health and economic crisis triggered by the pandemic exerted a strong negative impact on freight markets in all transport sectors. Maritime transport was notably hard-hit, as it had barely rebounded from the difficulties of the previous year. This had a powerful effect on the way shipping companies operated, as stressors affected every aspect of the maritime world from newbuilding, scrapping and secondhand sales to management and the logistics of crew change.

Demonstrating resilience in the face of challenge, ABS grew its classed fleet to more than 270 million gross tons (m gt) by the end of 2020, while maintaining its leadership positions in marine classification and in overall Port State Control (PSC) performance, continuing as the top performing Recognized Organization (RO) in the three most active PSC regions of the world from 2017 to 2020.

ABS also delivered a succession of industry-leading achievements that underscored its position at the forefront of technology development and helped guide industry towards digitally enhanced resilience. Already a pioneer of remote surveys, ABS responded to marine and offshore operator's needs amidst the restrictions of the pandemic with a series of innovations that developed the industry's most comprehensive remote survey portfolio.

In addition, ABS continued its digital journey by unlocking a series of powerful new data and digital services for clients, and by breaking new ground through joint development projects with leading industry partners in such key areas as future fuels, sustainability, computer simulation and 3D modeling.





Meanwhile, an ABS-led consortium received EU funding for a study on the future of the Ship Energy Efficiency Design Index (EEDI). Entitled *Decarbonization of Shipping: Technical Study on the Future of the Ship Energy Efficiency Design Index*, the study will analyze EEDI's ability to deliver improved designs, evaluate its relationship to various technologies, and propose updated targets to accelerate deployment of low-carbon solutions.

In another recognition of ABS' visionary leadership in technology development, the Maritime and Port Authority of Singapore (MPA) renewed its partnership with ABS in maritime research, development and innovation. Under this agreement, MPA and ABS will collaborate on projects relating to decarbonization, artificial intelligence-driven decision support tools, predictive maintenance, cyber security and other futuristic technologies such as the use of augmented and virtual-reality tools in training environments.

These landmark achievements demonstrate the strength, resilience and vision that have characterized ABS for much of its modern history and continue to serve it well today.

MARINE SAFETY

Although a state of frequent disruption appears to be today's new normal, at least one maxim has remained constant for all of maritime history: the root of safety is a properly trained and educated crew, operating in a safety-first atmosphere and following strict, clear and well-thought-out procedures.

ABS has sailed under the flag of safety for nearly 160 years, and all along has worked continuously to expand the concept of safety at sea to encompass the concerns arising from emerging technologies, new practices and the changing practical realities of the seafarer.

During 2020, ABS helped industry prepare for many new challenges, such as the handling of alternative fuels and the impact of digital technologies on the human element, and assisted in confronting the single greatest safety challenge of the year: protection against COVID-19 and other infectious diseases.

In its first response to the pandemic, ABS drew upon a range of leading sources, including the United States Centers for Disease Control and Prevention, to develop a comprehensive approach to cleaning and disinfecting marine and offshore assets exposed to COVID-19. That work extended into developing guidance on addressing

STRENGTH THROUGH RESILIENCE

any infectious disease that comes onboard. The former document, *Guidance Notes on Response Measures to COVID-19 for the Marine and Offshore Industries*, answers a range of questions on contamination prevention, sanitization and decontamination, while the latter, the *ABS Guide for Mitigation of Infectious Disease Transmission On Board Marine and Offshore Assets*, provides broader guidance.

ABS also introduced a new notation, IDM-A (Infectious Disease Mitigation – Arrangements), to state that an asset meets mitigation requirements for ventilation systems, accommodations and configuration of spaces.

During the year, ABS also undertook a joint development project (JDP) with Samsung Heavy Industries (SHI) to develop designs for crew accommodations and ventilation systems that could mitigate the spread of infectious diseases. This was followed by another industry first in December, when SHI was granted approval in principle (AIP) for such designs, applying the principles in the mitigation guide to a crude oil tanker, a containership and an liquefied natural gas (LNG) carrier. The accommodations design includes designated areas that can be used to isolate infected seafarers and provides specialized facilities for medical support and dedicated laundry services.

Expanding another aspect of onboard safety, ABS offered remote surveys to verify compliance which became mandatory on December 31, 2020 for all vessels flying the flag of an EU member State or calling at a European port. ABS-classed and non-ABS-classed vessels are eligible for a remote IHM survey, which supports compliance with both EU Ship Recycling requirements and the IMO Hong Kong Convention.

LEADERSHIP IN SUSTAINABILITY AND DECARBONIZATION

In recent years, a growing number of maritime stakeholders, ranging from governments to financial institutions and global organizations, have embraced sustainability and decarbonization agendas. During 2020, ABS continued to help the industry channel this interest in productive ways.

- ABS published its second sustainability outlook *Setting the Course to Low Carbon Shipping – Pathways to Sustainable Shipping*, providing the latest trends and projections regarding carbon-reduction strategies and decarbonization ambitions. The new edition of the outlook examines a variety of fuels, technologies and operational measures and matches them with forecasts for the world's key trade lanes to envision what shipping may look like in 2030 and 2050. It also discusses the energy sources best suited for each trade lane and their impact on the design of the vessels in those services.
- In October, ABS gathered together industry leaders in the shipping, manufacturing and finance sectors for a series of discussions and debates exploring the challenges of decarbonizing the maritime industry. Named the Sustainability Summit, the event focused on key sustainability issues including fuel pathways for 2030 and 2050, the post-COVID-19 market, new operational improvements and technology advancements.
- In December, ABS published its *Guide for Sustainability Notations*, which helps marine and offshore operators meet the Environmental, Social and Governance (ESG) requirements outlined in the United Nations' Sustainable Development Goals (SDGs). ABS also launched two new sustainability notations, SUSTAIN-1 and SUSTAIN-2, to indicate alignment with the SDGs and establish a pathway for sustainability certification and reporting.

ABS has worked to help industry absorb every evolution in propulsion of the past 160 years and continues to do so as the industry attempts to produce the most dramatic advances of that technology to date.

- Development of alternative ship propulsion technologies is the cornerstone of decarbonization. In service of that effort, ABS developed an 'Alternative Fuel Ready' approach to the introduction of new fuel technologies. The *ABS Guide for Gas and Other Low-Flashpoint Fuel Ready Vessels* supports the building or conversion of ships powered by LNG, methanol, ethane, liquefied petroleum gas (LPG), hydrogen, ammonia and other gases or low-flashpoint fuels. The Guide also introduces a range of 'Alternative Fuel Ready' notations that indicate a vessel is designed to be capable of adaptation to low-flashpoint fuels and defines a readiness program that identifies key technical issues in developing vessels low-flashpoint fuel capability.
- ABS also published a series of fuels whitepapers on LNG as Marine Fuel, Ammonia as Marine Fuel, and Methanol as Marine Fuel, which provides guidance on the use of these fuels in both the near-term and long-term propulsion scenarios.

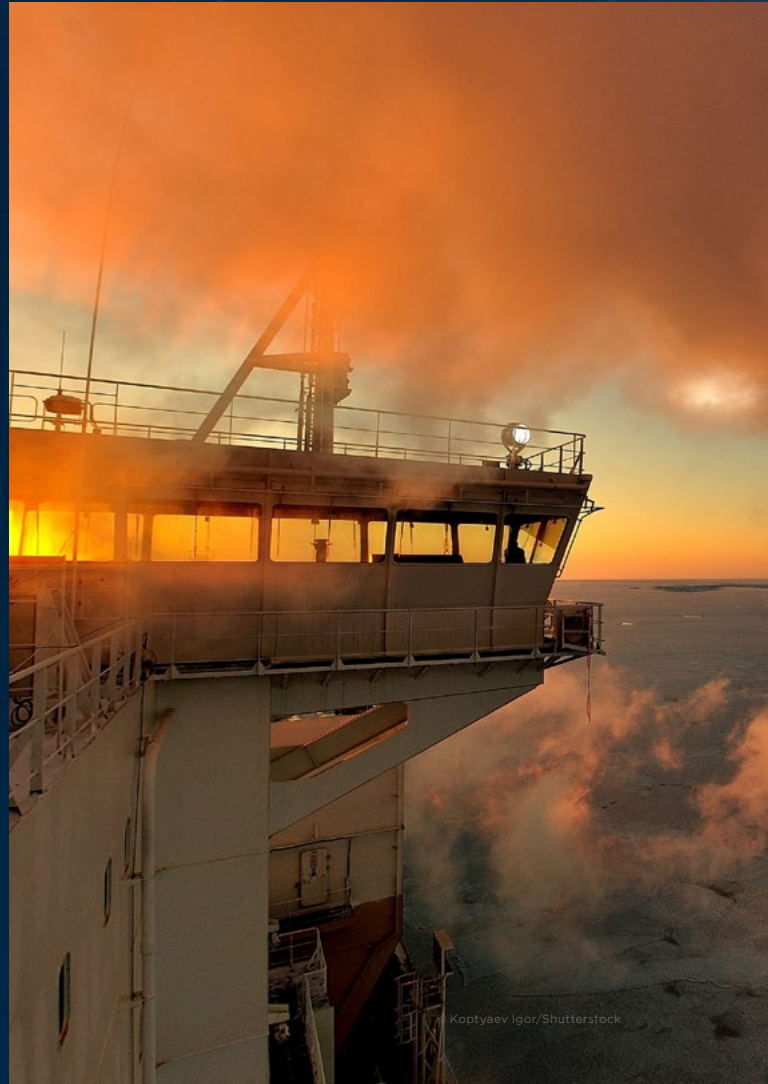
IN THE VANGUARD OF ZERO-CARBON RESEARCH

Achieving the long-term target of decarbonization requires new fuel types, new technologies and new thinking.

Accelerating the arrival of viable new technologies requires joint efforts in research and development by stakeholder teams representing a variety of expertise to be sure that proposed solutions meet the needs of both industry and regulators.

That's why, in June 2020, ABS joined a small group of industry leaders in founding the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, a research center supporting the shipping industry's decarbonization ambitions. Located in Copenhagen, Denmark, the Center is a non-profit organization supported by ABS, A.P. Møller-Maersk, Cargill, MAN Energy Solutions, Mitsubishi Heavy Industries, NYK Line and Siemens. Staffed by subject matter experts in energy, fuels and ship technology, regulatory affairs, finance and energy transition, the Center collaborates with industry, academia and authorities to create overviews of decarbonization pathways, accelerate development of new fuel and power technologies, and support industry in its pursuit of a carbon-minimal future.

During its first two to three years, the center will employ around 100 people. The founding partner companies have committed one-third of the needed staff and will donate resources and testing platforms to support the Center's operations.



- ABS and Daewoo Shipbuilding and Marine Engineering (DSME) signed a JDP that brings the industry one step closer to the practical use of fuel cells in large ships. This JDP will investigate use of solid oxide fuel cells to replace at least one of the three diesel generators that are typically on board a very large crude carrier (VLCC). It is the second JDP between ABS and DSME to focus on solid oxide fuel cells, the first being a 2019 project that investigated their use in a gas turbine hybrid system. In this latest initiative, both parties will review various aspects of the feasibility of applying the technology.
- To support rising interest in wind-assisted propulsion, ABS published the *ABS Guide to Wind-Assisted Propulsion System Installation*. The Guide provides class safety standards applicable to two leading wind-assisted propulsion technologies – Flettner rotors and wing sails, including both rigid and soft sails – and introduces the notations Wind-Assisted for vessel safety and Wind-Assisted+ for system and machinery safety.
- Recognizing that hybrid power systems have potential to contribute to the marine and offshore industries' decarbonization targets, ABS developed its *Guide for Hybrid Electric Power Systems for Marine and Offshore Applications*. The Guide addresses the design, construction, retrofit, testing and survey of systems that integrate electric power generation and storage technologies with conventional power generation, and introduces a new notation, HYBRID IEPS, that indicates a vessel meets its requirements.

SHIP TECHNOLOGY AND DESIGN

ABS has helped the maritime industry envision the future, tackle its challenges and develop advanced technologies for over six decades. This tradition continued with some notable achievements in 2020 in the areas of design and technology and the impact they can have on vessel operations.

Several of the most significant efforts highlighted the forward-looking vision that has guided ABS through every major technology change in modern maritime history. Among the most notable of these visionary efforts is a JDP between ABS and DSME that aims to bring the maritime industry closer to the practical use of fuel cells in large ships, through use of solid-oxide fuel cells.

Other important milestones in ship technology and design include:

- In February, ABS granted AIP to Kawasaki Heavy Industries (KHI) for design of a dual-fuel engine capable of using both marine diesel oil and LPG as fuel, which the manufacturer believes will simultaneously reduce fuel consumption and enable the engine to meet NOx Tier III regulations.
- In June, ABS published the *ABS Advisory on NOx Tier III Compliance*, which provides best-practice guidance for IMO Tier III compliance for newbuild vessels and retrofitted ships. The advisory provides a technology overview, evaluates a selection of compliance options and outlines processes for statutory and class approval. It also addresses installation, integration and operation of exhaust emission control systems.
 - Along with the Advisory, ABS also launched two supporting notations: the NOx notation recognizes vessels with engines complying with appropriate International Convention for the Prevention of Pollution from Ships (MARPOL) requirements, and the LEV notation recognizes low-emission vessels equipped with engines complying with EU regulations.
- In October, ABS announced that the largest self-propelled hopper dredge ever ordered in the United States will be built to ABS class. Commissioned by Manson Construction Co. at Keppel AmFELS in Texas, the U.S.-flagged dredge, *Frederick Paup*, will be 420 feet in length and is expected to be fully operational by 2023.
- In December, ABS announced it would lead a joint industry project (JIP) in additive manufacturing (AM), or 3D printing. The JIP, co-funded by the Maritime and Port Authority of Singapore (MPA), will see ShipParts.com and 3D Metalforge develop valve and pump parts for use on board an offshore support vessel (OSV) owned by PACC Offshore Services Holdings, while ABS develops a scalable certification process to streamline AM material approval for safe use.
- ABS brought together Sembcorp Marine, ConocoPhillips' Polar Tankers and 3D Metalforge on a project to install fully functional spare parts made using 3D printing technology. The project, which began last year, has successfully fabricated, tested and installed functional 3D printed parts aboard the oil tanker *Endeavor*. The additive-manufactured parts have passed rigorous approval, reliability and safety tests.

ABS also updated several of the Guides that have long provided industry-leading support for the shuttle tanker sector:

- The *ABS Shuttle Tanker Advisory* was updated with insights on global shuttle tanker design and operation and a special focus on Brazil, the North Sea and the Gulf of Mexico. This was followed by a webinar entitled *Navigating the Complex World of Shuttle Tankers*, based on topics addressed in the *Shuttle Tanker Advisory*.
- The *ABS Guide for the Class Notation Bow or Stern Loading and Unloading for Oil Carriers, Liquefied Gas Carriers or Chemical Carriers* was updated with requirements from the Norwegian Oil and Gas-recommended Guidelines for Offshore Loading Shuttle Tankers. These are widely applied for the design of shuttle tankers operating in North Sea and Brazil.

“ABS is proud to be able to support this practical project to produce and implement additive manufactured parts on a Polar vessel. It’s a key development in a technology that certainly has a significant role to play in the future of the industry. ABS is committed to ensuring these types of parts are introduced without compromising safety.”

PATRICK RYAN

SENIOR VICE PRESIDENT,
ENGINEERING AND TECHNOLOGY
ABS

GUIDING INDUSTRY'S SUSTAINABILITY AND DECARBONIZATION JOURNEYS

Achieving a sustainable footing for our industry is the defining challenge of the era. That's why everyone at ABS is working hard to play our part in meeting the industry's decarbonization targets and support our clients and members to do the same. In 2020, ABS continued to invest in talent and technology to ensure ABS is at the forefront of delivering shipping's new sustainable paradigm.

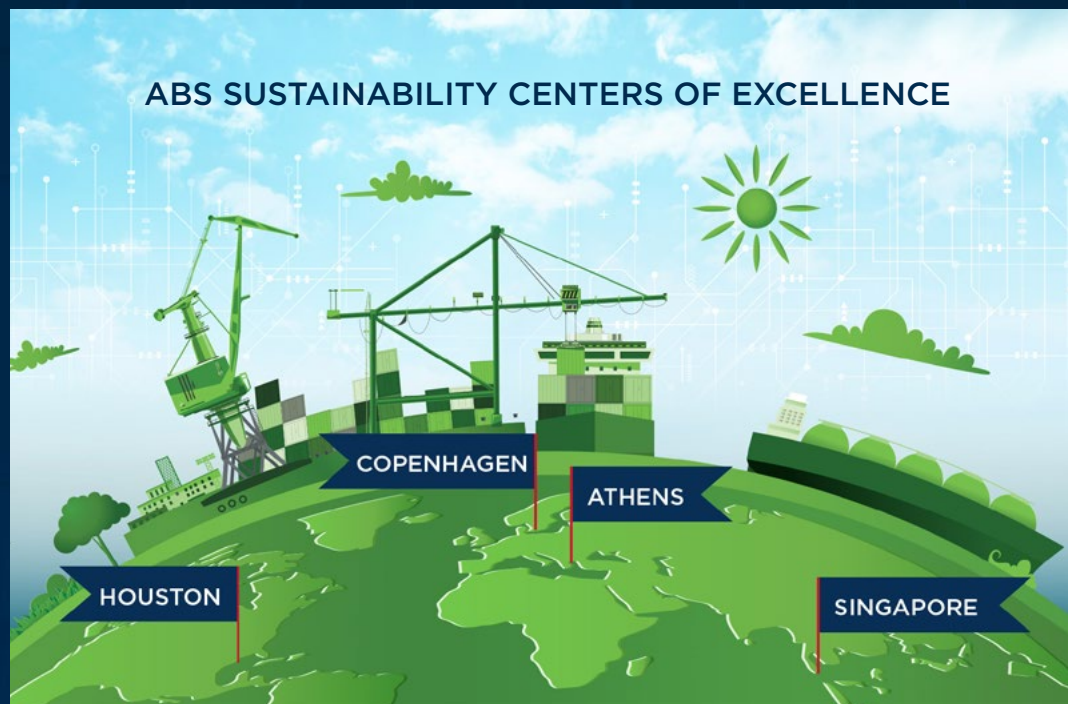
ABS created a global sustainability support network, adding three new sustainability centers in Athens, Copenhagen and Houston in addition to the one opened in Singapore the previous year. Each retains a full spectrum of sustainability expertise, but also functions as a center of excellence in key areas: Athens is the center of vessel performance and efficiency; Copenhagen is a center in vessel innovations and fuel technologies; Houston is a center for alternative fuels, waste streams and human-centric design; and Singapore is a center of sustainability reporting and Environmental, Social and Governance strategy expertise.

ABS was awarded the 2020 SAFETY4SEA Sustainability Award, which recognized ABS for its significant efforts

in fostering safety excellence and sustainable shipping, and in particular, for ABS' work through the sustainability centers to help maritime transition to a sustainable, low-emissions industry and to support industry education designed to raise awareness of maritime sustainability technologies. Following this, ABS was awarded the 2021 GREEN4SEA Sustainability Award, recognizing ABS for taking action to help operators establish a pathway for sustainability.



ABS SUSTAINABILITY CENTERS OF EXCELLENCE



- The *ABS Guide for Bridge Design and Navigational Equipment/Systems* was updated to incorporate the NBLES (COS) notation, addressing Navigational Bridge Layout and Equipment/Systems for Coastal and Offshore Service. This optional notation can be assigned to vessels that typically operate in coastal and narrow waters provided they meet enhanced requirements for bridge design, configuration, workstation arrangements and bridge instrumentation, including detailed documentation of the vessel's maneuvering characteristics based on sea trials.
- The *ABS Guide for Dynamic Positioning Systems* was updated to incorporate new requirements for station-keeping capacity and failure modes for certain static components applicable to shuttle tanker operations.





STRENGTH THROUGH RESILIENCE

GLOBAL GAS SOLUTIONS

GLOBAL GAS SOLUTIONS

ADVANCING THE USE OF GAS AS FUEL

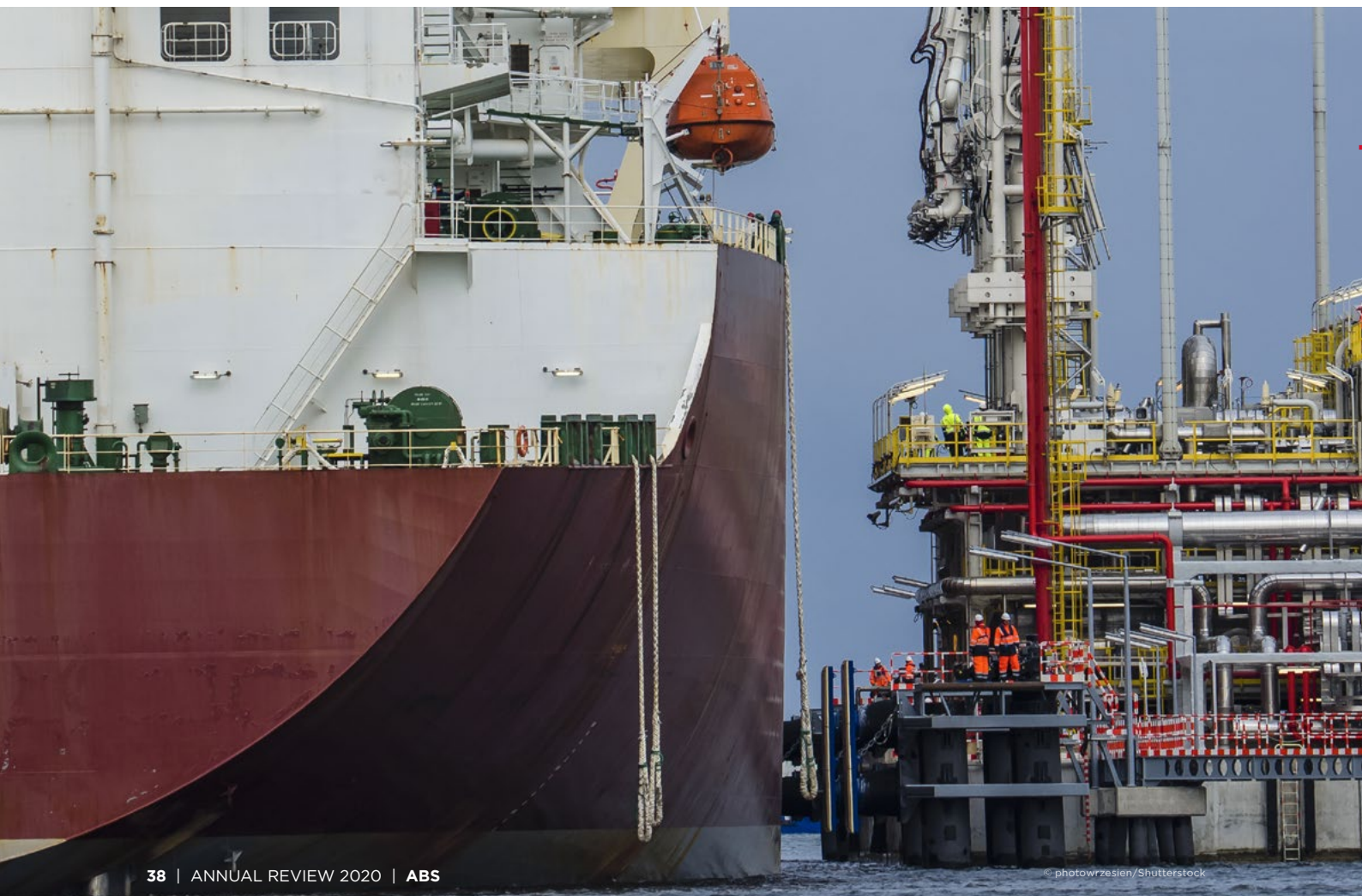
ABS was the first society in history to class a liquefied natural gas (LNG) carrier, and for over 60 years has led the industry in supporting the evolution of LNG technologies. ABS has long supported the use of natural gas and other gases as marine fuel, and in 2020 made some significant strides in aiding their advancement.

- In keeping with this history, ABS was the natural fit to provide classification services for the first LNG bunkering vessel designed for the Pacific Northwest Coast of North America. The 4,000 cubic meters (m³) articulated tug-barge (ATB) will be built for Cryopeak LNG Solutions, a gas provider in British Columbia, Canada, and is expected to enter into service in 2023. Designed in a joint effort between Cryopeak and Island Tug and Barge, a bulk transporter of petroleum products also based in British Columbia, the LNG ATB will service ports along the West Coast of Canada.

“No one understands better than ABS the potential for LNG to help shipping meet its sustainability goals. So, it is great to be able to support this project, which will further expand the availability of LNG along the west coast. We are proud to class the first LNG Bunker vessel on the west coast.”

JOHN MCDONALD

SENIOR VICE PRESIDENT,
GLOBAL BUSINESS DEVELOPMENT
ABS



- In December, ABS completed a joint development project in LNG bunkering and the use of LNG as a marine fuel – a two-year project with Sembcorp Marine and the A*STAR Institute of High Performance Computing that set out in 2018 to advance the use of LNG as a marine fuel and to make it more accessible, reliable and safer for the industry. The project brought together engineers with diverse backgrounds and expertise to study a range of key issues including leakage during bunkering, boil-off rate management for Type C tanks, and the heat transfer between LNG containment and surrounding structures.



SPOTLIGHT

ACHIEVING NEW GLOBAL MILESTONES FOR VLEC CLASSIFICATION SERVICES

In 2020, ABS continued advancing both the use of ethane as fuel and the development of very large ethane carriers (VLECs).

The first of an order of 12 VLECs now being built to ABS class has been delivered to Zhejiang Satellite Petrochemical (STL) by Samsung Heavy Industries (SHI).

The *Seri Everest*, the largest VLEC ever built with more than 98,000 m³ of capacity, is the first of a phase-one order by STL, which was subsequently sold to MISC Berhad (MISC). A second phase of the order also includes six vessels, four of which have been purchased by Eastern Pacific Shipping, bringing the total to 12, scheduled for trade from

the U.S. to China to support STL's Ethane Cracker facility in Jiangsu province.

This is the first VLEC to be delivered with the LNG Cargo Ready notation that was released by ABS in 2019. The notation provides assurance to owners and charterers that the VLEC can be upgraded to trade LNG cargoes in the future.

A further two new, 98,000 m³ VLECs ordered by Tianjin Southwest Maritime to be built to ABS class by Jiangnan Shipyard meant that all 14 VLECs presently on order worldwide are being built to ABS class, underscoring ABS as the global leader in VLEC classification services.





STRENGTH THROUGH RESILIENCE

GLOBAL OFFSHORE

GLOBAL OFFSHORE

RESILIENT SOLUTIONS FOR OFFSHORE INDUSTRIES

ABS can be considered a founding member of the offshore industry because our support was sought when the first platforms were built out of sight of land and because nearly every significant advancement of the next 50 years was achieved with our assistance. The first jackups, semisubmersibles, tension leg platforms (TLPs), drillships, floating production, storage and offloading units (FPSOs), offshore support vessels (OSVs), dynamic positioning controls were able to get to work because we helped them get to sea and operate safely. It is no idle boast to say ABS is the premier offshore classification society. We have earned that unique distinction and are proud to continue that history by helping this resilient industry bounce back from the singular challenge presented by the pandemic.

Throughout the year, the energy sector economized and rethought its petroleum-related strategies and looked towards a future that includes more alternative energy projects. ABS supported this evolution through innovation, technology development and the introduction of new products and services that helped industry advance towards its goals while keeping a firm focus on enhancing safety, operating efficiencies and sustainability.

“ABS has been a part of the FPSO industry since its earliest days. The benefit from that involvement is that we’ve been able to both witness and participate in the evolution of FPSOs in size, complexity and technology. Class has a unique role in that we are one of the few entities, if not the only one, that touches every aspect of the project life cycle. From design concept, through construction, operations, and end of life, class is connected to the asset, and the tools and systems that support it.”

MATTHEW TREMBLAY
SENIOR VICE PRESIDENT,
GLOBAL MARKETS
ABS



SUPPORTING REGULATORY COMPLIANCE FOR OFFSHORE OPERATORS IN BRAZIL

- In May, ABS launched the industry's most comprehensive support package for offshore operators in Brazil's complex regulatory environment. Reflecting the constant evolution of Brazil's floating production, storage and offloading (FPSO) market, the support package includes a detailed technical advisory, Practical Considerations for Regulatory Compliance in Brazil, and two new notations, BRZ and BRZ+.



The advisory provides detailed guidance on regulatory matters, while the BRZ and BRZ+ notations offer a design- and construction-focused approach to regulatory compliance for FPSO units and floating production units (FPU) operating in Brazilian Jurisdictional Waters. The BRZ notation covers basic requirements for design and construction, while the BRZ+ notation expands that coverage and includes a larger set of regulations from different agencies to better assist clients in the project development phase.

- Brazilian Jurisdictional Waters represent a unique regulatory environment, in which multiple agencies look after the safety of offshore assets, personnel and the environment. Production installations operating in Brazilian Jurisdictional Waters must comply with complex requirements to obtain the necessary approvals to operate. To help offshore operators in Brazil navigate and understand these regulations, ABS held a webinar in September entitled FPSOs in Brazil: Pathways to Successful Regulatory Compliance.

CONTINUING OUR PROMINENCE IN FLOATING PRODUCTION

In addition to providing guidance in relatively new areas of industry activity, we continued our technology leadership in its core sectors as well, such as floating production. ABS helped bring the concept of FPSO units into reality, having worked with FPSOs and their developers since the technology debuted in the 1970s. Today, FPSOs and their variants remain the pillars of offshore field development, and in 2020, ABS continued its historical leadership in this sector.

- ABS completed classification of the *Liza Destiny* FPSO, as the unit ramped up operations as the first in Guyana, operated by SBM Offshore for ExxonMobil on the world-class Stabroek block. ABS provided class and statutory support to the project through the conversion in Singapore and subsequently the offshore installation and commissioning offshore Guyana in a water depth of 5,000 feet. *Liza Destiny* achieved its production of 120,000 barrels of oil per day (BOPD) during 2020.
 - ABS continued its partnership with ExxonMobil and SBM Offshore with the *Liza Unity* and *Prosperity*, the second and third FPSOs in Guyana and the first newbuild units for the country under SBM Offshore's Fast4Ward® program. Construction to ABS class was ongoing in Singapore at Keppel Shipyard, with topsides provided by Dyna-Mac for the FPSOs. These designs expand on local production capabilities with 220,000 b/d of oil and associated gas treatment capacity of 400 MMcf/d and crude storage capacity of 2 MMbbl for each unit.

STRENGTH THROUGH RESILIENCE

- ABS provided the classification and statutory certification for the Petronas PFLNG DUA FLNG project for installation at the deepwater Rotan field, offshore Sabah, Malaysia. The newbuild unit was fully fabricated by Samsung Heavy Industries (SHI) in South Korea, including hull and topsides. The 393 m long unit can produce 1.5 Mtonne of LNG a year and is moored using a SOFEC external turret capable of operating in water depths up to 1,500 m (app. 4,900 ft). The unit is designed for 20 years life without drydocking and was subject to a detailed Spectral Fatigue Assessment process to confirm the design conditions meet class requirements for the expected service life.

LEADERSHIP IN ADVANCED TECHNOLOGIES

ABS' position as a class society leader for technology advancement was underscored in May when it won the coveted SNAME Best OTC Paper Award, for "The Development of a Machine Learning-based Image Recognition Tool for Coating Inspections," which addresses an important issue arising in the field of remote inspection. Although improved remote inspection technologies enable safer and more efficient visual inspections of coating conditions in historically hard-to-reach and dangerous locations on marine and offshore assets, the vast amount of data they generate (in the form of still images and video) can present a serious challenge for inspectors trying to identify potential coating failures. The paper presents the development of an artificial intelligence machine learning-based image recognition tool to aid inspectors in the review of data to help make coating condition assessments.

SPOTLIGHT

AIDING THE DEVELOPMENT OF SUBSEA MINING

Many low-carbon technologies demand precious metals, rare earths and other scarce elements and ores. As new land-based sources of these materials become more difficult to find, global interest has again turned to the mineral resources of the ocean floor.

- In an industry first, ABS published in November its *Guide for Subsea Mining*, detailing class requirements for the design, construction, installation and survey of mobile offshore mining units. This Guide underscores the ABS mission to promote the safety of life, property, and the environment by helping the industry develop safer offshore mining units, and subsea mining equipment and systems.

The Guide covers ship-type and column-stabilized units, providing class requirements for subsea mining equipment and systems placed on board mobile offshore mining units and submerged in water.

- Not long after publication of the Guide, ABS awarded China Merchants Industry approval in principle (AIP) for design of a deep-sea mining system focused on retrieving cobalt-rich ferromanganese crust deposits attached to seamounts. The project ultimately entails development of subsea mining machines, high-concentration and large-particle slurry lifting systems and offshore mining support vessels.



This award was just one of a number of notable successes ABS achieved in 2020, despite the challenges imposed by pandemic-related lockdowns and travel restrictions.

- In February, ABS and other industry stakeholders provided comments and advice for the latest edition of the *Norwegian Shipowners' Association Acknowledgment of Compliance Handbook* for offshore units operating in the Norwegian North Sea. This continues the recognition granted to ABS by the Norwegian Petroleum Safety Authority (PSA) as an equivalent provider of technical norms under the PSA regulations that allow application of relevant maritime regulations, supplemented by class Rules, as an alternative to the technical requirements of its own Facilities Regulations. This means that ABS Rules and Guides, applied to classed and flagged offshore units, can be used to meet the intentions in the PSA regulations, and ABS Certificates and Notations can be used as proof of compliance against some of the PSA's technical requirements.
- The world's first 100,000-ton deepwater semisubmersible production and storage platform was built to ABS class by China National Offshore Oil Corporation (CNOOC) and is beginning installation and commissioning in the Lingshui 17-2 gas field development project. Lingshui 17-2 is a landmark in Chinese offshore history as the country's first self-operated deepwater gas field development.

GUIDING THE PROGRESS OF OFFSHORE WIND TECHNOLOGIES

ABS has long supported the development of global offshore wind power. In July, ABS continued this support by issuing updated guidance for floating and bottom-founded wind turbines. The updated *ABS Guide for Building and Classing Floating Offshore Wind Turbines* (FOWT Guide) and the *ABS Guide for Building and Classing Bottom-Founded Offshore Wind Turbines* (BOWT Guide) address the latest industry best practices and incorporate lessons learned from a range of projects in Europe and North America, along with the latest standards for offshore wind turbines from International Electrotechnical Commission (IEC).

- The BOWT Guide includes new notations addressing the design fatigue life of the installation, as well as new load cases aligned with IEC standards for a robustness check of support structures in areas prone to tropical cyclones. The FOWT Guide includes new notations addressing design fatigue life, strength criteria for site-specific conditions and life extension, and new detailed requirements for concrete hull structures, design load cases and survey, along with appendices providing guidance on wind spectra, coherence functions and tropical cyclone wind considerations. ABS also updated its guidance notes on *Global Performance Analysis for Floating Offshore Wind Turbines*, which supports the FOWT Guide with performance analysis methodologies, modeling strategies and numerical simulation approaches.



SPOTLIGHT

ABS TO CLASS FIRST TAIWAN-BUILT OFFSHORE INSTALLATION VESSEL

Underscoring its support of offshore wind farm development, ABS was awarded classification of the first floating heavy lift and installation vessel to be built in Taiwan. Named *Green Jade*, the vessel is to be built by the CSBC shipyard in Taiwan for CDWE, a joint venture between CSBC and offshore contractor DEME. The vessel, to be

delivered in 2022, measures 216.5 meters in length and features a 4,000-ton-capacity crane, Dynamic Positioning 3 capability, dual-fuel engines and a waste heat recovery system that converts heat from exhaust gases and cooling water to electrical energy. The innovative *Green Jade* is intended to serve the regional offshore wind market.



© CDWE

- Always at the forefront of U.S. offshore wind farm development, ABS awarded approval in principle (AIP) to Vard Marine for a second construction service operations vessel (SOV) designed for Jones Act operation. Granted in June, the award follows an AIP for a previous SOV design granted in December 2019 – the first AIP awarded for a Jones Act SOV. The new vessel, a larger variant of that design, is intended for such functions as accommodation, transferring technicians to installations and storing spares and tools.
- Meanwhile, ABS was awarded classification of the first U.S.-flagged Jones Act SOV ever ordered. The vessel will be engineered, constructed and operated by Edison Chouest Offshore for long-term charter to service the planned Revolution Wind, South Fork Wind and Sunrise Wind offshore wind farms in the northeast United States.
- Soon after being selected to class the first Jones Act SOV, ABS was awarded classification of the first-ever Jones Act-compliant offshore wind turbine installation vessel. Now building at Keppel AmFELS to a GustoMSC design, the 472-foot vessel will be capable of handling turbine sizes of 12 megawatt and larger, of installing wind turbine foundations, and of performing other heavy lift operations.

AT THE CUTTING EDGE OF REMOTE SURVEY TECHNOLOGY AND PRACTICE

Not so very long ago, the idea of using machines and remote inspection technologies in the inspection stage of a marine survey was widely viewed with skepticism. Over the past few years, thanks in part to ABS' pioneering efforts, the remote survey is accepted as a useful, and safer alternative to many types of in-person survey by both the maritime and offshore industries.

Today, ABS has significantly expanded its remote survey capability and is able to conduct almost all classification annual surveys remotely on eligible vessels and has made remote survey and audit services of equipment and materials manufacturing available to clients around the world.

So, when travel restrictions imposed during the COVID-19 pandemic challenged the operational logistics of many maritime companies, particularly in terms of crew change and survey requirements, ABS was ready to step in and assist.

- In one instance, Harvey Gulf International Marine faced a difficult problem in scheduling class surveys for a chartered vessel without undergoing a major delay in operations. Because the vessel was specifically designed for the job, a replacement was not possible, so the company turned to ABS for a remote survey solution.

A client had chartered the *Harvey Sub-Sea* for an offshore operation, but pandemic-related restrictions and charter demands imposed travel difficulties on the surveyor's attendance. Although arrangements were made to extend survey windows as much as possible, it soon became clear that operations would suffer serious downtime without a new approach. ABS provided a solution via its remote survey program, which offers a seamless process through which digital tools augment traditional survey with transfer of documentation such as reports, photos and videos for non-attendance verification, thereby improving scheduling efficiencies and reducing operational disruptions. This allows select surveys to be completed on time without physical surveyor attendance.

- In another instance, ABS introduced a pioneering remote survey process for steel certification at a steel mill, to enable work on two self-elevating drilling units (SEDUs) to continue despite COVID-19 restrictions. A client ordered 8,855 tons of steel for drilling units from the Arcelor Mittal Nippon Steel Mill in Gujarat, India, but travel restrictions caused by COVID-19 mitigation measures made it impossible for surveyors to certify the steel at the mill in person, potentially delaying the project. In an industry first, ABS proposed a remote survey option, with ABS surveyors in Mumbai certifying the steel with data provided by the mill, allowing production to continue on schedule.
- Another example of cooperation and creativity in the face of crisis came about early in the pandemic, when ABS performed the industry's first-ever remote Failure Mode Effect Analysis (DP/FMEA). This was done during completion of the machinery special survey on the platform supply vessel *Cat Island*, owned by offshore operator Edison Chouest. Every five years, ABS-classed vessels are subject to a special survey, during which a full FMEA trial is carried out. This trial evaluates processes and equipment to identify ways in which they might fail and the relative impact of any failures. In recent years, Edison Chouest had established a Remote Monitoring Center to provide remote troubleshooting and inspections for its advanced fleet of support vessels. When the social distancing norms of the pandemic restricted the movement of surveyors, ABS and Chouest worked together to turn a burden into an opportunity and pilot the remote DP/FMEA survey.



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STRENGTH THROUGH RESILIENCE

GLOBAL GOVERNMENT

GLOBAL GOVERNMENT

INDUSTRY-LEADING MARITIME EXPERTISE HELPS GOVERNMENTS AROUND THE WORLD

Our uncompromising dedication to safety enabled by robust digital technologies energizes every area of our activities, especially our work with global government organizations.

SUPPORTING THE U.S. GOVERNMENT

The relationship between ABS and the U.S. government dates to World War I, when the government sought assistance from ABS in creating a larger and up-to-date merchant marine to support the war effort. Over the century since, ABS has rendered invaluable assistance to numerous U.S. government agencies, helping realize important advances in engineering, technology and construction.

For more than 100 years, ABS has been the official classification society of the United States and, under U.S. law, the only classification society authorized to class U.S. government vessels. There are over 200 government-related ABS-classed vessels in the U.S. alone – a vast fleet that benefits from our committed support and dedication to advancing technology in the service of safety. Today, ABS continues to provide steadfast support for the U.S. government and its required safety regimes, through classification services that help the Coast Guard, Navy and other government shipowners maintain uninterrupted naval, law enforcement, research, survey and logistic operations.

- The condition-based class (CBC) program between ABS and the U.S. Navy's Military Sealift Command (MSC) saw continued growth with the addition of three vessels in early 2020. The program made strides with the implementation of a Predictive Compliance Model that leverages various leading and lagging datasets to risk profile critical HM&E systems and enable the creation of CBC survey plans. The newly developed Condition Manager application provided a toolset to support the survey workflow and data capture for ship-specific condition-based annual surveys. This greater understanding of ship condition and risk not only allowed ABS to tailor onboard survey activities, but also provided MSC with pertinent information to make effective decisions for optimized maintenance and inspections.
- As part of project "Romeo Sierra" in 2020, ABS collaborated with MSC on a remote survey pilot with the objective to develop and deploy enhanced remote survey capabilities for three vessels to execute ABS annual class surveys remotely during the COVID-19 pandemic. The pilot provided proof of concept for various enhanced approaches, such as 360-degree virtual tours, sensor-based operational monitoring, and computerized maintenance management system (CMMS) system integration that enabled efficient remote survey activities. The pilot resulted in a better understanding of how the condition-based program data convergence can supplement remote class verification activities and other MSC in-service inspection programs.
- In January, the long tradition of cooperation between ABS, the offshore industry and the U.S. government was underscored when the Gulf Research Program of the U.S. National Academy of Sciences, Engineering and Medicine awarded ABS a grant of over \$2.1 million to support two projects focused on strengthening safety culture in the offshore oil and gas industry.
- The first study entitled Developing an Integrated Offshore Energy Industry Safety Culture Evaluation, Benchmarking, and Improvement Toolbox is a two-and-a-half-year effort to develop a roadmap for evaluating and improving organizational safety culture, with a focus on reducing unsafe behaviors, improving individual performance and reducing management system failures, near misses, and accidents. Its overall purpose is to serve the offshore industry by helping it achieve a better understanding of the social and organizational factors that foster professionalism during routine and emergency situations.

The project's participants are currently analyzing the current state of safety culture in the Gulf of Mexico (GOM), intending to build a way forward for identifying and addressing existing safety culture-related needs, opportunities, and challenges. The project's goal is the development of a layered, fit-for-purpose safety culture assessment toolbox that an offshore industry company, authority or regulator can use to assess the safety culture of an offshore asset, group of assets, company or region.

- Tackling another aspect of the safety question, the second study entitled *Aggregating Essential Exposure Data to Enable Meaningful Analysis of Safety Incident Rates Around the World* intends to gather and harmonize the world's vast wealth of offshore incident data and develop a tool that can help improve offshore safety. For decades, government agencies, industry groups and companies operating in offshore exploration and production regions around the world have collected incident data to help understand and improve their safety conditions. Because these datasets were collected at different times by different groups and use different terminology and data languages, it has not been possible to pool their information in a meaningful way.

This project aims to provide recommendations for viable data science technologies that could be employed to aggregate and harmonize these disparate datasets so that they can be used to improve understanding of safety risks and trends in the GOM. The overall goal is to produce a comprehensive global offshore incident dataset that will help set a foundation for predictive modeling of offshore safety. The dataset could also inform government and industry decision-making processes, for example regarding safety concerns related to emerging technologies, exploration projects, new regulations and policies for risk mitigation.

SUPPORTING INTERNATIONAL GOVERNMENTS

ABS continued to grow and develop its global partnerships in 2020, expanding the breadth and depth of its work with international governments, and extended its leadership in the development of condition-based maintenance data services in maritime and offshore applications.

For example, in February ABS began a pilot program with the Royal Canadian Navy (RCN) and Defence Research and Development Canada to deliver the ABS Digital Asset Framework for the RCN's Maritime Coastal Defence Vessels. The ABS Digital Asset Framework is being used as the foundation of a broader CBC program that transforms ship classification from a calendar-based schedule to a condition-based model.

The pilot program will generate a network of data models using a suite of ABS digital solutions, such as, advanced condition analysis tools. This network of data models will then be used to support the execution of an integrity management program developed specifically for the RCN. The multiyear program will enable the RCN to monitor a vessel's condition throughout its service life, using digital twin technology and advanced ABS analytics to identify anomalies and guide inspection and maintenance planning.

ABS digital solutions that will be applied during this pilot program include:

- A vessel-specific structural sensor plan for measurement of global hull response
- Hull sensor pre-processing and data quality checks
- Hull and operational data dashboard visualizations
- Full structural digital twin creation and analytics
- RAM Analysis

Through access to vessel-wide intelligence and a holistic view of the structural health and condition of onboard equipment, these digital solutions will allow the RCN to plan maintenance activities based on the actual evolving condition of the vessel.

Through landmark projects such as this, ABS' digital programs for commercial and government clients continue to deliver the power of digital technologies to drive improved asset performance and operational safety.





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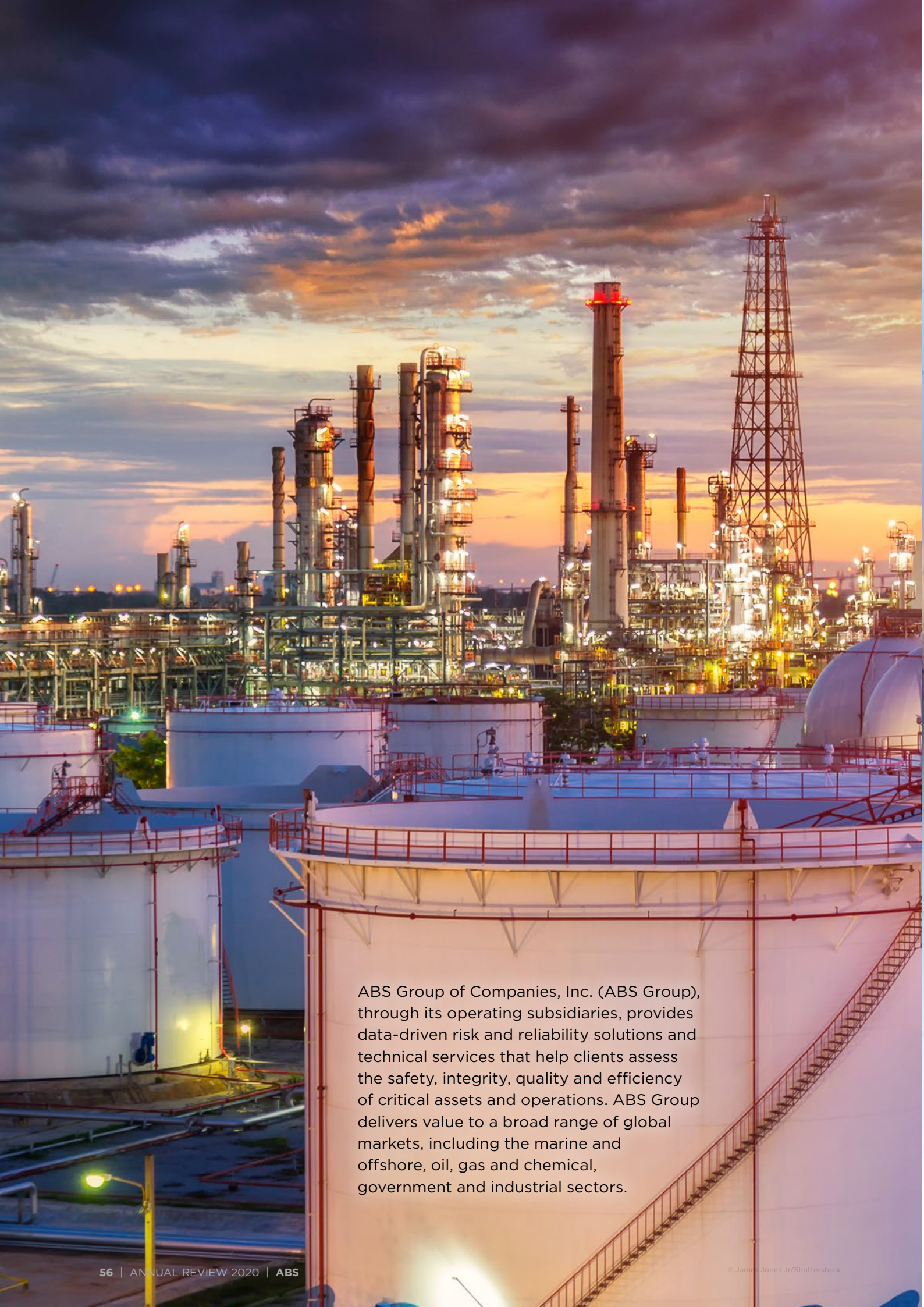
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ABS Group of Companies, Inc. (ABS Group), through its operating subsidiaries, provides data-driven risk and reliability solutions and technical services that help clients assess the safety, integrity, quality and efficiency of critical assets and operations. ABS Group delivers value to a broad range of global markets, including the marine and offshore, oil, gas and chemical, government and industrial sectors.



STRENGTH THROUGH RESILIENCE

ABS GROUP OF COMPANIES, INC.

ABS GROUP OF COMPANIES, INC.

STRENGTH THROUGH RESILIENCE: ADAPTING TO MEET CLIENT DEMANDS WITH REMOTE CAPABILITIES AND DIGITAL SOLUTIONS

2020 was a unique and unprecedented year for ABS Group of Companies Inc. (ABS Group), which encompasses safety and risk consulting operations across the Americas, Europe, Middle East and Asia Pacific regions. Impacted by the worldwide response to the COVID-19 Pandemic, ABS Group found strength through resilience, reinforcing clients on the front lines, and continuing to carry out its mission as well as strategically capturing synergies with ABS.

ABS Group shifted gears in the second quarter expanding its remote capabilities and delivering services virtually to meet client needs. The groundwork for this shift was seamless, with digital solutions and technologies already in place to support the mission of reducing operational risk and uncertainty in key market sectors. Digital innovation remains a top business driver, enabling better, faster and more accurate ways of solving customer challenges.

COVID-19 was the catalyst for the accelerated deployment of several smart technologies, including distance learning, remote monitoring services for cyber security, virtual process hazard analysis and remote inspection.

2020 dramatically shifted the way ABS Group and its diverse range of clients adapted to and managed operational risk. Despite global disruption, consulting and engineering teams stayed focused on customer needs and developed innovative solutions that positioned ABS Group into a competitive business for 2021.





PERFORMANCE AND SECURITY IN AN INCREASINGLY CONNECTED MARINE AND OFFSHORE ENVIRONMENT

In an increasingly digital world, our integrated capabilities in cyber security, asset performance management and advanced risk and reliability engineering provide increased confidence in the safety and sustainability of operations.

Cyber security is a business imperative as maritime and offshore operations become more digital and information technology (IT) converges with operational technology (OT). ABS Group's application of deep domain expertise across a range of asset types and facilities in the maritime, power and gas sectors supported the control of OT cyber security risks. This includes the service of implementing cyber security as early in the design as possible and throughout development and construction, making cyber security a consistent and integral part of operations for clients from inception.

ABS Group also invested in expanding its fleet management software to further support digital transformation across the marine industry. In 2020, ABS Group created powerful digital solutions to improve compliance and the quality and security of data.

SPOTLIGHT

FOSTERING HSE/PROCESS SAFETY EXCELLENCE FOR MAJOR OPERATOR IN DEEPWATER GULF OF MEXICO

In 2019, ABS Group was contracted by one of the largest U.S. oil and gas companies with global reach in the Middle East, Latin America and Africa to assess the company's offshore production facilities in the deepwater Gulf of Mexico for regulatory compliance condition and to determine a path forward to aid in the full life cycle of maintaining and/or decommissioning these assets. Combining nearly 50 years of

expertise delivering technical engineering and risk-based services, ABS Group is helping the energy major assess the safety, integrity and reliability of the assets' topside production equipment and machinery, improve Health Safety and Environment (HSE) process and safety management system performance, and augment any gaps in data collection and data management.



CYBER SECURITY: REMOTE AND SPECIALIZED CONSULTING

ABS Group delivered capabilities that supported the entire supply chain – owners, operators, shipyards, shipbuilders and vendors – in reducing cyber risk, from one vessel to an entire fleet. The ability to manage and mitigate cyber risk has a significant impact to a company's bottom line – from insurance rates, to investment levels, to its competitive position in the market. These business drivers are increasing across all industrial sectors, including the maritime industry, making ABS Group's cyber security services a business imperative.

Comprehensive maritime cyber security solutions included IT and OT capabilities to support every stage of a cyber security program including cyber security assessments using the ABS FCI Cyber Risk™ model, cyber security awareness training, and OT system documentation and management of change. Our portfolio includes 24/7/365 cyber security monitoring services that provide critical solutions for managing and minimizing cyber risk.

In 2020, ABS Group secured our largest ever ports and terminals cyber project. This project included an overall cyber risk profile and assisted the client in becoming more cyber secure.

ABS NAUTICAL SYSTEMS®: MOVING THE DIGITAL FLEET FORWARD

ABS Group's proprietary fleet management solutions support the digital journey through compliance management and mobile applications that deliver insights in real-time. Whether on board or onshore, ABS Nautical Systems® (NS) enhances safety and improves performance. In 2020, we have seen a dramatic transformation of the NS platform, with it now considered the leader in the marine industry in technical management for fleet management software.

Convenient remote implementation for clients has supported growth beyond the initial market of U.S.-based traditional shipping and in recent years has demonstrated success globally in the offshore supply vessel (OSV), inland transportation and offshore sectors. Historically, NS holds strong client relationships

with an in-depth knowledge of customer operations – a driver in the significant role they uphold in providing digital transformation across the marine industry. This supports a strategic link with ABS offering a competitive advantage to class clients as a key enabler to condition-based class (CBC).

In 2020, NS leveraged its strength as the leading compliance management solution to bring to market NS eLogs™, the most comprehensive collection of electronic regulatory logbooks, including MARPOL and others.

NS continues to drive growth as a digital transformation tool, adding over 285 vessels to an already large install base of 2,800 ships providing the mobility and the ability to integrate with other platforms.

A DIGITAL WORLD: ADAPTING OUR COMPLIANCE SERVICES IN OIL AND GAS MARKETS

In 2020, ABS Group piloted digital applications for several clients providing risk and asset integrity management services to improve customer experience and position ABS Group for long-term opportunities. These products provided a foundation that changed the nature of client relationships, opening opportunities for further development of game-changing digital products and leads for follow-on services.

The digital inspection application streamlined the collection of inspection data and provided clients with real-time awareness of project status and critical equipment issues. The new Facility Siting Dashboard improved data interpretation by providing intuitive and interactive exploration of analytical results to efficiently identify issues.

In addition, our highly specialized Extreme Loads and Structural Risk (ELSR) division delivered state-of-the-art engineering investigation, advanced structural analysis and design services focused on mitigating the impacts of natural and man-made hazards.

EXPANDING REMOTE CAPABILITIES FOR PROCESS SAFETY

ABS Group expanded remote process safety management (PSM) capabilities for facility owners to help the oil, gas, chemical and other process industries maintain effective and efficient safety management for critical assets and operations. The recently launched Product Development and Innovation Center (PD&I Center) built on its extensive experience performing PSM projects remotely to deliver virtual services that provided clients with the necessary flexibility to perform tasks efficiently with personnel distributed globally.

SPOTLIGHT

COVID-19 EMERGENCY PREPAREDNESS FOR HEALTH SYSTEM MEDICAL CENTERS

ABS Group's ELSR division was engaged by Riverside University Health System Medical Center, the principal emergency and healthcare provider for Riverside County, California, to provide structural engineering support for an emergency COVID-19 preparedness project and a temporary mobile laboratory. The intent of the Riverside project was to provide support for

temporary systems to achieve negative pressure and 100 percent exhaust to nearly 100 patient rooms located across three wings of the hospital, as well as portions of the Emergency Department, in response to the pandemic. Our services included providing structural seismic services for the construction of a temporary mobile lab to handle additional diagnostic caseload for COVID-19 patient testing.

STRENGTH THROUGH RESILIENCE

Offerings included virtual process hazard analyses, PSM audits and facility siting to help industries using highly hazardous chemicals meet regulatory and performance objectives. This investment allowed ABS Group to assist clients through remote process hazard analysis (PHA) and other virtual solutions and provide expert-led training through the ABS Group web-based learning platform.

In 2020, ABS Group represented one of the largest offshore oil and gas producers in the UAE in the remote pre-qualification audits of several offshore drilling pipe mills in China. Through virtual conference calls with personnel based in Abu Dhabi, China, Singapore and the United States, ABS Group conducted quality audits of each manufacturer's Quality Assurance/Quality Control (QA/QC) documentation and supported remotely-based manufacturers through the complete pipe manufacturing process.

VIRTUAL TRAINING SOLUTIONS: FOSTERING SAFETY LEADERSHIP

For decades, ABS Group training experts have delivered customized public and onsite courses that have helped thousands of professionals both in the U.S. and internationally. Our attendees receive high-quality training designed to implement programs using proven techniques in the areas of safety, security, risk, reliability, quality and the environment.

In 2020, ABS Group launched an eLearning training platform to provide state-of-the-art educational tools and offer a robust catalog of professional training courses to technical personnel worldwide. The new training solution features on-demand courses to augment classroom training in the practice areas of cyber security, risk management, asset reliability, compliance management and process safety, which support excellence in organizational performance.



THE NATIONAL RISK INDEX: DISCOVERING THE LANDSCAPE OF NATURAL HAZARD RISK IN THE U.S.

Risk experts from ABS Group's Global Government Sector supported the development of the Federal Emergency Management Agency's (FEMA) National Risk Index (NRI), a web application and dataset that helps identify communities most at-risk for natural hazards.

Launched in 2020, NRI leverages available source data for 18 natural hazards to develop a baseline relative risk measurement for each hazard and

across all hazards for each United States county and Census tract. The NRI's novel approach expands on the traditional expression of risk solely as expected losses to account for the fact that communities can experience similar levels of loss in various ways based on their social vulnerability and resilience. The NRI is intended to help a wide variety of planners, emergency managers and public users better understand the natural hazard risk of their communities or assigned areas.

STRENGTHENING AGENCY ALLIANCES IN GOVERNMENT

Our government team has worked with agencies and government clients for over 20 years providing holistic solutions and applying risk-informed strategies. With risk management at the core of what we do, our trusted consultants deliver comprehensive solutions to both civilian and military agencies. Unique challenges such as COVID-19 positioned ABS Group as trusted experts to our government partners to help local and national and global organizations and communities recover quickly and safely.

In 2020, ABS Group won several important contracts that combine our cyber and risk experience to support supply chain analysis and other nationally critical efforts for the Department of Homeland Security. ABS Group also continued support to the U.S. Coast Guard (USCG) to help the agency manage and use big data sets to reduce maritime risks more effectively and reliably. Our support to the Federal government has helped improve the risk posture of the government and advanced the resilience of the private sector owners and operators with whom the government regulates and communicates with on critical national initiatives.

SUPPORTING WORKER SAFETY AFTER COVID-19

In 2020, ABS Group launched the Restart Risk Model™ to help commercial and public organizations resume operations more safely as restrictions around the COVID-19 pandemic begin to ease. The Restart Risk Model builds on guidance from the Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA), offering a way for organizations to systematically evaluate the risk of disease transmission to their sites, operations, and work areas. This risk-based framework helps organizations develop a plan to restart operations with enhanced working practices that address the 'new normal' business environment after the pandemic.

SUPPORTING INDUSTRIAL CLIENTS WITH REMOTE CAPABILITIES AND UNIQUE OFFERINGS

ABS Group applies its experience in safety and risk management, performance optimization and quality assurance to other diverse markets, including aerospace, automotive, commercial properties, mining, pharmaceuticals and other process-driven industries. In 2020, ABS Group's Asset Performance Management service line continued to help clients in these markets reduce maintenance costs and adopt world-class asset management practices.

REMOTE AUDIT AND CERTIFICATION SERVICES

ABS Quality Evaluations, Inc. (ABS QE), the management systems certification subsidiary of ABS Group, reached its 30th year of operation as a world-leading certification body and continues providing accredited management system certification audits, supply chain assessments, and training and assurance services in over 40 countries.

ABS QE strengthened and shifted its commitment to certify and guide organizations virtually in critical areas such as quality, safety, environmental, corporate social responsibility, risk and asset management. ABS QE's remote audit approach supported clients' traditional audit programs digitally while delivering the equivalent trusted value of onsite audits. ABS QE performed the required interviews, documentation reviews and observational processes needed using a variety of Information and Communication Technologies (ICT) to provide the flexibility to gather required information and plan for the appropriate areas to access. This provided crucial, time-sensitive support to clients under COVID-19 travel bans and personnel who could not enter facilities to perform audits.

In 2020, the ABS QE's Transportation Market Vertical was awarded multiple recognitions with its Aerospace Program achieving accreditation by the ANSI-ASQ National Accreditation Board (ANAB) for the International Aerospace Quality Group (IAQG) Aviation, Space, and Defense standard, AS9110C – Quality Management Systems – Requirements for Aviation Maintenance Organizations. QE's Automotive Program received the Gold Finalist Certification Body Award from the International Automotive Oversight Board achieving high performance standards for continually raising the bar as an automotive certification body. ABS QE also certified Port Houston as the first port authority in the world to meet the ISO 28000:2007 standard, providing critical support as they continue to lead the maritime transportation sector as one of world's largest ports committed to safety and security.

MANAGING SAFETY AND RISK THROUGH DISRUPTION

In 2020, ABS Group adapted to the market challenges that COVID-19 introduced to our global network of operating companies and diverse industries worldwide. Our investment in innovation and digital solutions continues to redefine safety and operational excellence as a strategic partner with expertise in virtual enterprises. Through unprecedented disruption, ABS Group continued to add value to the key industry verticals of marine and offshore, oil, gas and chemical, government and industrial.

SPOTLIGHT

REMOTE ENVIRONMENTAL COMPLIANCE PLAN AUDIT FOR CRUISE CORPORATION

In accordance with the Environmental Compliance Plan (ECP), ABS Group acted as Third-Party Auditors (TPA) for a prominent cruise corporation auditing each brand's ship and corporate office. The ECP requirements call for an inspection of all pollution prevention equipment, confirming regulatory compliance. Among numerous requirements, inspections also include auditing logs for disposal of waste at sea and ashore, and inspection of exhaust

scrubbers for air emissions. During the first three years of inspections, auditors traveled around the globe boarding ships to conduct all audits with Federal Court touch-bases to report on status. In 2020, COVID-19 restrictions prevented travel, resulting in our team adapting to virtual audits. The remote audits have been extremely successful, with reports grounded in interviews and record keeping.

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Ryan P. Moody
President and Chief Executive Officer

Robert Truhlar
Vice President, Finance

Karim K. Shehadeh
Secretary

James M. Clutterbuck
Treasurer



WORLD HEADQUARTERS

1701 City Plaza Drive
Spring, TX 77389 USA
P 1-281-877-6000
F 1-281-877-5976
ABS-WorldHQ@eagle.org
www.eagle.org

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