

LEADING CLASS

Annual Review 2016





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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LEADING CLASS

For more than 150 years, ABS has been committed to setting standards for safety and excellence as one of the world's leading classification organizations. Much has changed since the beginning - for the industry and for ABS.

For many years, classification focused on the condition of the ship's hull and equipment. Today, class is growing wider and deeper, encapsulating the sophisticated machinery and complexity of systems used throughout modern marine and offshore assets while transitioning to more predictive and preventive applications. With this evolution, ABS continues to fulfill its mission to serve the public interest as well as the needs of ABS members and clients by promoting the security of life and property and preserving the natural environment.



CHAIRMAN'S MESSAGE

For ABS, 2016 was a year of navigating challenging market conditions while leading classification into the future. Sustained low oil and gas prices coupled with the sharpest slowdown of new construction projects in three decades posed serious obstacles, yet I am proud of the resiliency and substantial achievements we made in spite of these very strong headwinds. Shipping legend Aristotle Onassis once said, "We must free ourselves of the hope that the sea will ever rest. We must learn to sail in high winds." We faced the high winds of 2016 head-on and we continue not only to persevere, but lead the way.

ABS

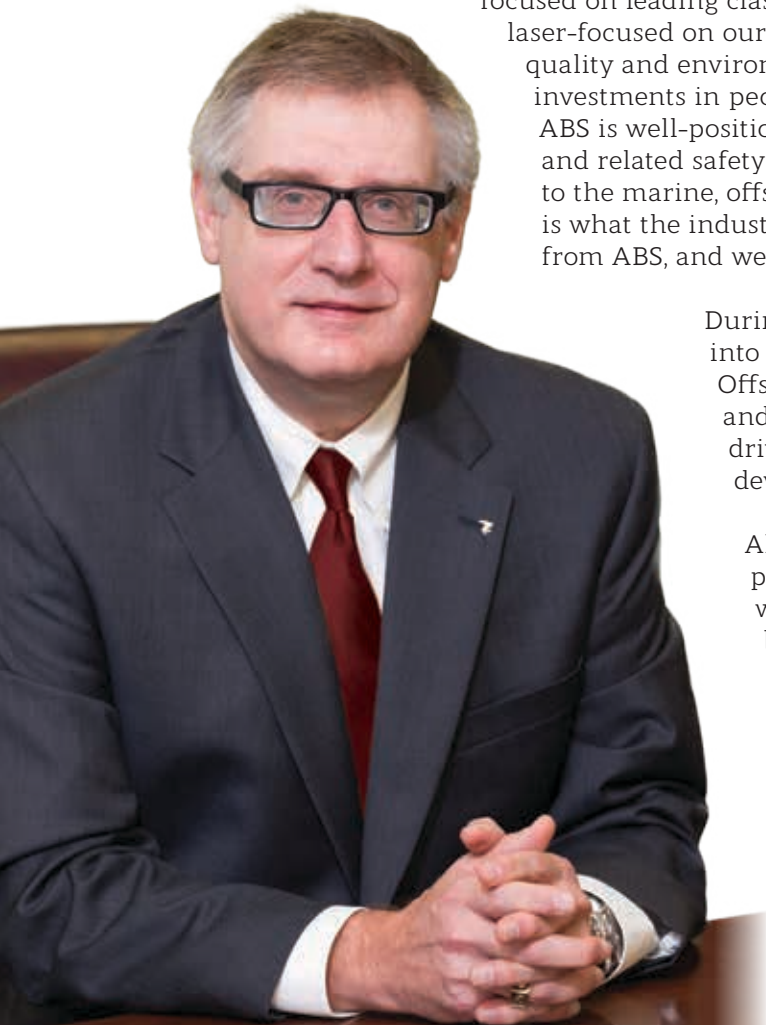
Born from the need to establish the maritime industry's standards, classification enhances vessel, crew and environmental safety. Classification is a fundamental aspect of the maritime activity and no organization has a stronger class core than ABS.

ABS held its own during a year of substantial market challenges and focused on leading class services into the future by staying laser-focused on our mission and delivering superb safety, quality and environmental services. Through our continued investments in people, information systems and technology, ABS is well-positioned to be the global leader in classification and related safety and environmental certification services to the marine, offshore/energy and government sectors. This is what the industry, our members and our clients expect from ABS, and we absolutely continue to deliver.

During 2016, ABS centralized its primary market sectors into two operating groups - Global Marine and Global Offshore, resulting in improved client service delivery and relationships, a closer position to key market drivers and a more consistent structure for technology development.

Although these operational alignment investments position ABS well for the future, the organization was not immune from cost reduction necessitated by the downturn in the shipping and offshore sectors. Right-sizing our team for the industry recovery has kept us steady on our course to continue our mission-driven efforts, while never compromising on delivering exceptional client solutions and service.

Among our top innovative efforts during the year, ABS delivered a multitude of industry-first solutions to lead class into the cyber, data





and digitally-driven world in which we operate. Such leading efforts include ABS CyberSafety®, the industry's first actionable guidance to address key issues in cybersecurity, automated systems, safety, data integrity and software verification. This unique approach charts a new path, delivering wider and deeper class services as technology evolves and becomes more sophisticated, reaching far beyond standard compliance and directly to asset and facility security.

Defining the future of class is all about data and digital technology, and ABS continued its development of ABS FutureClass™ in 2016. Cost savings are a top priority for our clients. And our ABS FutureClass efforts can result in increased utilization with more days at sea and faster turnaround times in port, reduced failure risk through optimized inspection and maintenance, decreased periodical maintenance, repair and inventory costs, and optimized data leveraging for improved decision making and maximized operational efficiency.

This future is today as new technologies bring a different set of tools and require a different type of thinking. And ABS leads the way in defining the absolute value of talent. As technology and regulations move the industry to risk-based, data-centric, cyber-influenced decision making, our team is beginning to look different. We are well on our way to shaping our workforce with a balance of traditional and non-traditional skill sets from professionals who are able to make the right data-driven, techno-economic and risk-based decisions while embracing disruptive technologies. We continue to leverage lessons learned from the automotive, aerospace and technology industries, among others, as we strengthen our commitment to a continuous learning model to develop this next generation of talent.



With class as our core service, ABS continues to lead the industry and maintain our position as recognized and trusted technical advisors. Despite ongoing market pressures, our fleet continued to grow at an annual rate of nearly 10 percent in 2016. Our classed fleet surpassed 240 million gross tons (gt) and we maintained the highest orderbook share among all class societies. Not only did ABS hold its own, it held the top position among shipbuilders in South Korea, Brazil, Singapore, India, the United Arab Emirates and the United States; and we remain the top class organization by existing fleet among owners in Denmark, Greece, Brazil, Taiwan, and the United States.

With safety at our core, every day is Safety Day at ABS. We achieved best-in-class safety performance, significantly improving our overall safety metrics and strengthening our safety culture which drives us toward our goal of zero workplace incidents. Consistently among the top tier within the International Association of Classification Societies (IACS), ABS demonstrated superior Port State performance in 2016 ranking in the #1 position for the U.S. Coast Guard (USCG), the Paris MOU and the Tokyo MOU. This demonstrated leadership is a testament to our trusted partner relationships with owners, operators and global flags to enhance overall safety performance.

The ABS-classed fleet also continues performing better than industry averages with 46 percent fewer serious hull and machinery casualties over the last decade, demonstrating the effectiveness of a complete life cycle safety network and the quality of the owners and operators of ABS-classed vessels.

While the year proved to be challenging for a variety of reasons related to market fundamentals, one core value remained constant for ABS – maintaining our principles of ethics and integrity around the world. ABS leadership in adhering to its stringent Code of Ethics cascades throughout the organization and is something that is predictable and expected from our employees, vendors and associates in all circumstances.

None of the success ABS achieved in 2016 would 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 continues to thrive and differentiate ABS. It is our DNA.

ABS GROUP OF COMPANIES, INC.

A subsidiary of ABS, ABS Group of Companies, Inc. worked through challenging market conditions in 2016 by emphasizing its core risk management and advanced engineering-related business and focusing on driving greater efficiencies across its service lines. ABS Group maintained its leading position across a wide range of industrial and public sector markets, including the chemical, automotive, aerospace, pharmaceutical and renewable energy industries.

Notable successes in 2016, included continued strong performance in our Asia-Pacific inspection business, aided in the successful completion of the first offshore wind farm in U.S. waters and strong value-added performance on projects in our government division through Enterprise Risk Management (ERM). ABS Group's proactive efforts to establish advisory resources and risk management tools helped U.S. federal departments and agencies understand and adopt effective ERM strategies as this became a U.S. government requirement during 2016. Additionally, ABS Group was the first company called to lead several major incident investigations and root cause analyses for key industry and public stakeholders, and we were selected as the preferred inspection contractor for major oil and gas clients globally. When challenging situations arise and operators need answers quickly, ABS Group is the go-to resource to determine what happened and why, as well as how to prevent it from happening again.

These accomplishments reaffirm ABS Group's role as the trusted technical advisor to diverse markets.

Looking Ahead

I sincerely thank our clients for their continued trust in our services, our employees for their unwavering commitment to our mission and values, and our governing Board of Directors which always provides steady leadership.

Though we expect 2017 to bring strong undercurrents, ABS is well-positioned to continue leading class into the future. Positioning ABS as the class-centric leader globally builds on our established 154-year history of success and achievements, reinforces our trusted advisor role across the marine, offshore/energy and government sectors, and elevates us as the clear leader in delivering groundbreaking technology solutions and services to guide the industry into tomorrow safely. We will succeed in charting our future success because our class-centric plans focus on our mission and our values. And our people will lead the way.



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

LEADING INDUSTRY

Globally, ABS continued its Health, Safety, Quality and Environmental (HSQE) leadership in 2016, with increasing emphasis on several core safety behaviors. It was ABS' best safety year to date, holding a leading position in safety with all major Port State Control (PSC) disciplines while focusing on service delivery.

OCCUPATIONAL HEALTH AND SAFETY PERFORMANCE

ABS leadership actively worked to guide employees toward safety excellence. A structure to enable safety excellence was put in place, and various processes and actions were implemented to help improve safety performance.

- ABS Lost Time Incident Rate (LTIR) of 0.18 has remained low year-on-year
- ABS Total Recordable Injury Rate (TRIR) of 0.21 has improved year-on-year
- ABS total number of safety reports increased year-on-year, helping to prevent unsafe conditions and behaviors
- ABS received its new 3-year OHSAS 18001 certificate, certifying occupational health and safety best practices (external audits by BSI)

QUALITY PERFORMANCE

In 2016, ABS sustained its high-quality performance level related to service delivery.

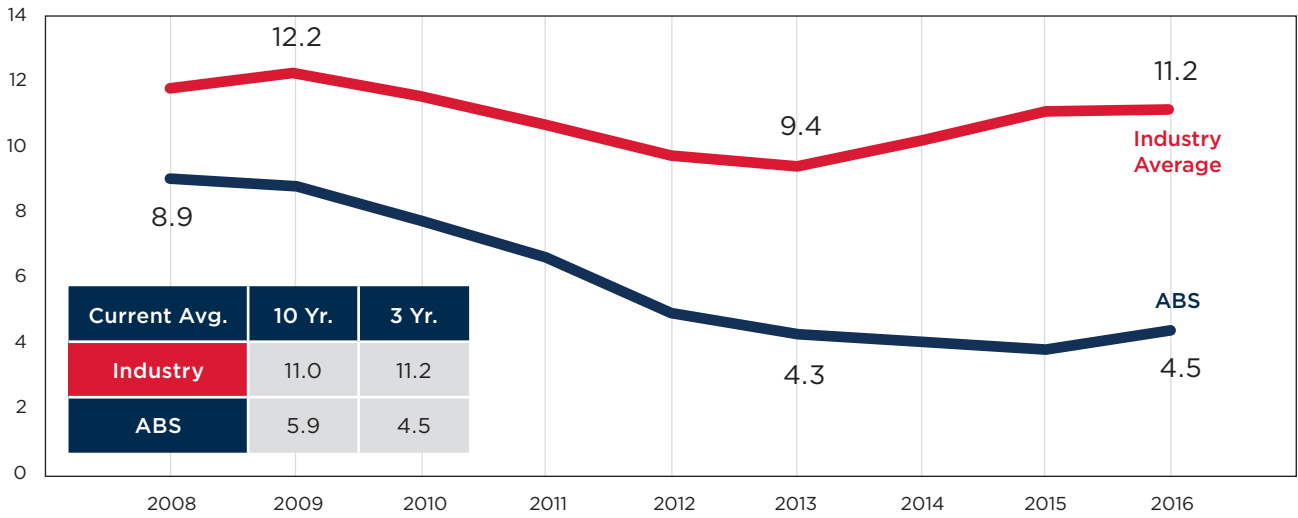
- ABS maintained a leading position on overall PSC performance, and reported a low ratio of 0.291 for the total number of ships detained more than once

2016 PSC RANKINGS

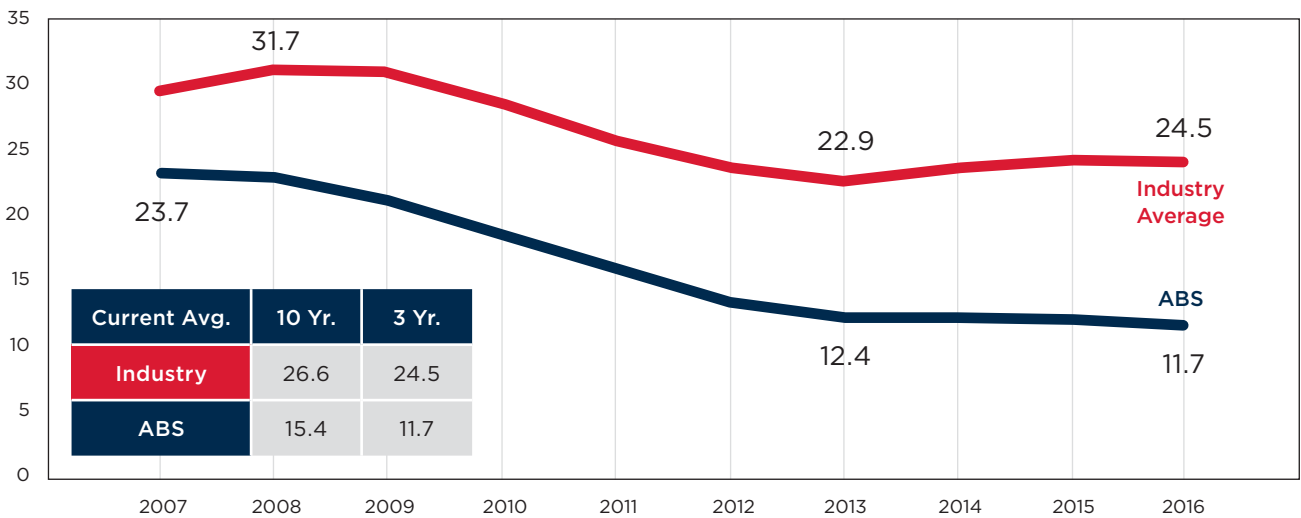
	USCG	PARIS MOU	TOKYO MOU	GLOBAL
ABS	1	1	1	1



HULL MACHINERY SERIOUS CASUALTY RATE



OVERALL SERIOUS CASUALTY RATE



OVER 10 YEARS

ABS-CLASSED FLEET

OUTPERFORMED THE INDUSTRY AVERAGE



46 PERCENT

FEWER

SERIOUS HULL AND MACHINERY CASUALTIES

42 PERCENT

FEWER

SERIOUS OVERALL CASUALTIES

STRONG FLEET SAFETY PERFORMANCE DEMONSTRATES:

EFFECTIVENESS OF THE ABS COMPLETE LIFE CYCLE SAFETY NETWORK

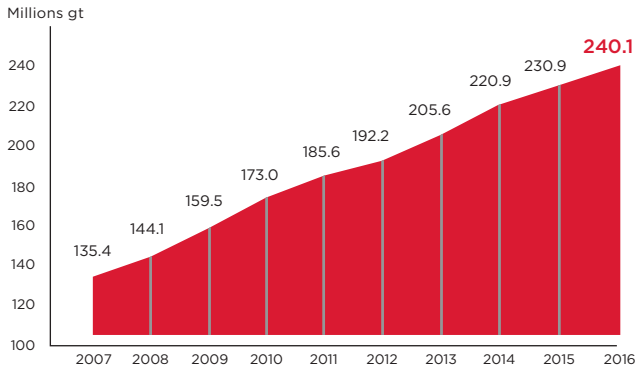


QUALITY OF THE OWNERS AND OPERATORS OF ABS-CLASSED VESSELS



LEADING CLASS IN PERFORMANCE

EXISTING FLEET 2016



JAN 2016 - DEC 2016

672 NEW ASSETS

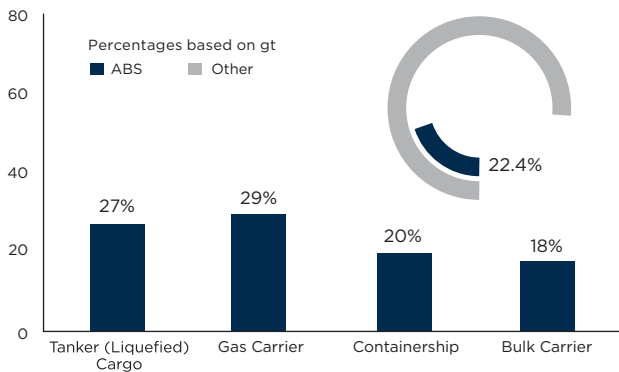


15.6 MARINE AND OFFSHORE GROWTH
m gt



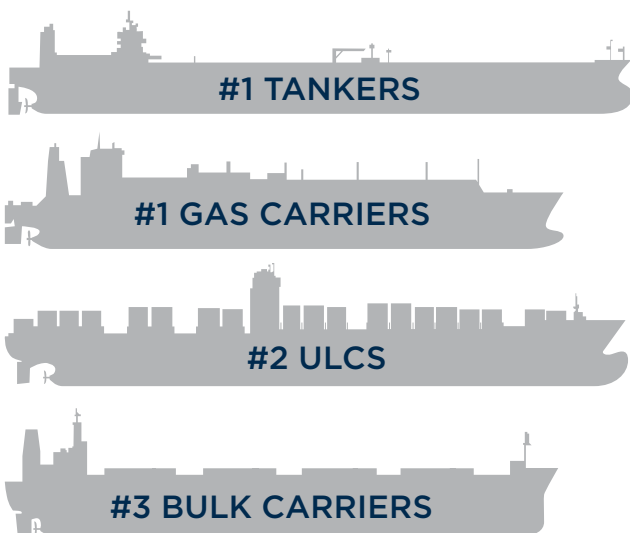
MARINE ACTIVITY

MARINE ORDERBOOK SHARE 2016



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ORDERBOOK



EXISTING FLEET

BULK CARRIERS

1,052 VESSELS > **52** m gt

OIL CARRIERS

1,477 VESSELS > **84.9** m gt

GAS CARRIERS

172 VESSELS > **13.2** m gt

MARINE ACTIVITY

LEADING ORDERBOOK FOR SHIPBUILDERS

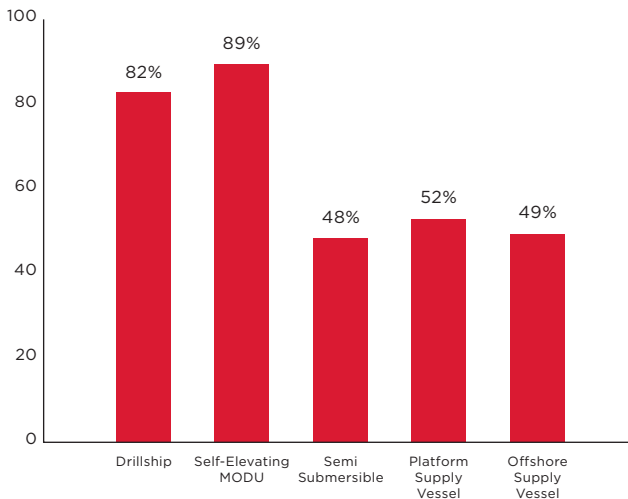


LEADING EXISTING FLEET FOR OWNERS



OFFSHORE ACTIVITY

OFFSHORE ORDERBOOK SHARE 2016



OSVs

1,435 UNITS > **3.6** m gt

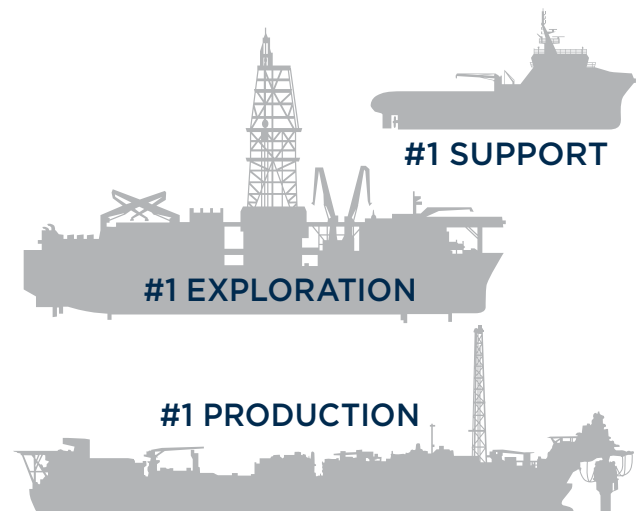
FPSOs

103 UNITS > **10.7** m gt

SELF-ELEVATING DRILLING UNITS

449 UNITS > **3.5** m gt

EXISTING FLEET



GLOBAL CORPORATE CITIZENSHIP AND SUSTAINABILITY

DEVELOPING TALENT PIPELINE

It will take a highly educated, well-trained and qualified workforce to lead ABS and the industries it serves in the future. ABS is committed to building a sustainable pipeline of the up-and-coming generation of professionals in the marine, offshore/energy and gas industries through planned philanthropic giving to academic institutions around the world as well as robust internal talent development programs.



In 2016, ABS partnered with Stevens Institute of Technology in Hoboken, New Jersey, to dedicate the ABS Engineering Center. ABS donated the funds for the center to provide an environment both for learning the various engineering disciplines and for looking ahead toward new technologies that could transform the marine industry.

ABS continued to fund the Cass Business School at City University of London for the development of two master's degree programs from the university's Costas Grammenos Centre for Shipping, Trade and Finance. ABS also provided scholarship commitments to 373 scholars at colleges and universities in the Americas, China, Europe and the Pacific regions.

ABS funded nine endowed academic chairs at campuses worldwide:

- Chair of Naval Architecture and Marine Engineering and ABS Chair of Marine Transportation at the State University of New York Maritime College
- Chair at Maritime Policy and Management at California Maritime
- Chair of Metallurgical and Materials Engineering at Colorado School of Mines
- Chair in Ocean Engineering at University of California Berkeley
- Chair at Marine and Offshore Design Performance at University of Michigan
- Chair in Ocean Engineering at Massachusetts Institute of Technology
- Chair in Naval Architecture and Marine Engineering at Webb Institute
- Distinguished Chair at the Singapore University of Technology and Design

ASPIRE

Not only is ABS committed to making a difference at universities and technical institutes globally, it is dedicated to growing the talent of its own people. In 2016, 30 recent graduates were in various stages of the ABS ASPIRE program. ASPIRE participants bring diverse backgrounds and skill sets to ABS, including naval architecture, ocean engineering, mechanical engineering, and now data analytics to support the growing marine and offshore industries and the future of ABS. Through the ASPIRE program, newly hired graduates take an active role on the ABS team working alongside professionals from more than 70 countries to develop broad-based knowledge of maritime and offshore industries through rotations in our Engineering, Survey and Technology departments.

LEADING CLASS IN TECHNOLOGY AND INNOVATION

RULES, GUIDES, GUIDANCE NOTES AND ADVISORIES

TOP 10 INDUSTRY FIRSTS

CYBER, SOFTWARE AND DATA

- *GUIDANCE NOTES ON THE APPLICATION OF CYBERSECURITY PRINCIPLES TO MARINE AND OFFSHORE OPERATIONS - CYBERSAFETY VOLUME 1*
- *GUIDE FOR CYBERSECURITY IMPLEMENTATION FOR MARINE AND OFFSHORE OPERATIONS - CYBERSAFETY VOLUME 2*
- *GUIDANCE NOTES ON DATA INTEGRITY FOR MARINE AND OFFSHORE OPERATIONS - CYBERSAFETY VOLUME 3*

ASSET INTEGRITY

- *GUIDANCE NOTES ON STRUCTURAL MONITORING USING ACOUSTIC EMISSIONS*

HARSH ENVIRONMENT

- *POLAR CODE ADVISORY*

OFFSHORE

- *GUIDANCE NOTES ON DESIGN AND INSTALLATION OF DYNAMICALLY INSTALLED PILES*
- *GUIDANCE NOTES ON SUBSEA PIPELINE ROUTE DETERMINATION*
- *GUIDANCE NOTES ON SUBSEA HYBRID RISER SYSTEMS*
- *GUIDANCE NOTES ON SELF-ELEVATING UNIT MOTION MONITORING*

HUMAN FACTORS

- *GUIDANCE NOTES ON DEVELOPMENT OF PROCEDURES AND TECHNICAL MANUALS*

LOCAL REGULATION

- *GUIDE FOR SUBCHAPTER M VESSELS*

ABS FUTURECLASS

Class is becoming wider and deeper. Wider to address new safety concerns such as cybersecurity, and deeper in transitioning from time-based and corrective to condition-based and preventive services. In 2016, ABS continued to build on its vision for the future of class with new developments in the ABS FutureClass™ program. The ABS FutureClass program applies advanced technology and unique approaches to improve marine and offshore classification services.

By addressing industry needs and future capabilities throughout an asset's life cycle, and by incorporating new inspection technologies, data analytics and diagnostics, class services can be delivered with an increased level of accuracy and efficiency with the potential for less intrusive surveys and cost savings.

ABS is redefining class without compromising the safety mission that is at its core. Data management and analytics help to verify that the right information is provided to the right people at the right time, thus enabling more informed, data-driven decisions. ABS is harnessing this information through intelligent systems monitoring that will foster improved decision-making and enhanced performance. However, data information and control can be compromised as a result of the wider use of devices with internet and intranet connectivity. ABS remains steadfast in its cybersecurity development to protect the integrity of the data.



ABS CYBERSAFETY

ABS announced its groundbreaking research into cybersecurity with the introduction of the ABS CyberSafety® program. The ABS CyberSafety program delivers several industry firsts, including published best practices and requirements to enable practical application and the industry's first cyber classification notation issued to a vessel, as well as a research and development (R&D) contract with the U.S. Department of Homeland Security (DHS) delving into the fundamentals of cybersecurity.

The ABS CyberSafety program series included the following new releases in 2016:

- *Volume 1 - Guidance Notes on the Application of Cybersecurity Principles to Marine and Offshore Operations (revised and expanded)*
- *Volume 2 - Guide for Cybersecurity Implementation for the Marine and Offshore Operations*
- *Volume 3 - Guidance Notes on Data Integrity for Marine and Offshore Operations*
- *Volume 4 - Guide for Software Systems Verification*
- *Volume 5 - Guidance Notes on Software Provider Conformity Program*

Volume 1 documents the best practices followed by leading companies to help mitigate cyberattacks and enhance preparedness for all pertinent aspects, from both operational and information technologies on the assets through to human and organizational behavior issues that need to be controlled. Volume 2 defines the requirements for owners to achieve classification notations. Tiered classification notations define different levels of preparedness for cybersecurity.

74 

**INDUSTRY
PUBLICATIONS**

212 

**TECHNICAL
PAPERS, ARTICLES
AND WORKSHOPS**

32 

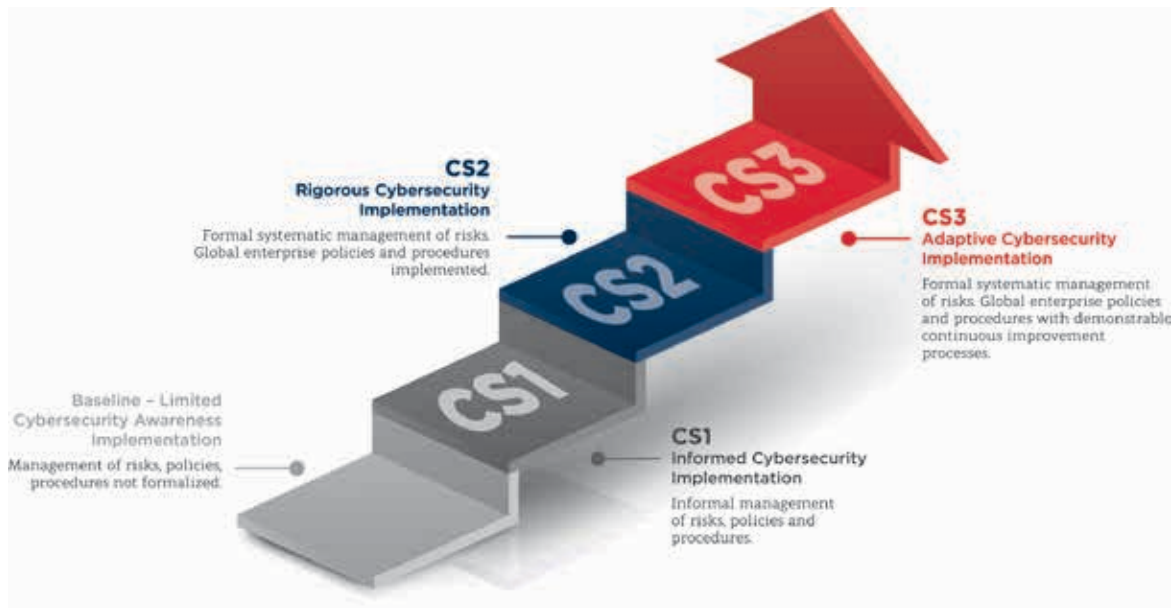
**JOINT DEVELOPMENT
PROJECTS**

For those vessels that are highly automated, software quality is of increasing importance and may be identified in the risk register from a cyber survey. It is with this in mind that ABS upgraded its capabilities and requirements with optional notations, and for enabling suitable software quality control assessment via a Type Approval service. To address these needs, ABS updated its *Guide for Software Systems Verification* and published its *Guidance Notes on Software Providers Conformity Program*. Further R&D continues to augment its *Guide for Integrated Software Quality Management*.

Contract R&D is the fundamental research that establishes ABS as the class organization with the most significant depth and breadth of knowledge in the practical application of cybersecurity in the marine and offshore communities. The ABS contract with DHS is a testament to this hardy capability. 2017 will see additional research and bring new cyber services, coordinated with class organization activities through IACS and supporting USCG in developing proficiency and readiness.

“The ABS CyberSafety® program provides the first actionable guidance for addressing and assessing cyber-enabled systems that emphasize human, systems and environmental safety. Our unique approach charts a new path, delivering wider and deeper classification services as technology evolves and becomes more sophisticated.”

HOWARD FIREMAN,
ABS SENIOR VICE PRESIDENT AND
CHIEF TECHNOLOGY OFFICER



DATA ANALYTICS AND DIAGNOSTICS

The current wave of digitalization and the tools used to collect, store and analyze the mass of data streaming from marine and offshore assets are vital to improving asset integrity and performance.

A data-enabled vessel can:

- Provide information to operations and maintenance teams that can preclude failures on equipment and transition maintenance schemes from traditional, planned, maintenance-based tasks to ones that are condition-driven and predictive in nature
- Better understand the correlation between operations, efficient performance and vessel health
- Help crew members understand the effects of vessel operations and working within different operating parameters, which can affect fuel consumption and equipment longevity

However, with these enhanced capabilities come added risks and complexities. There are many hardware and software considerations to be addressed in verifying that the infrastructure on a vessel is both robust and safe to operate in a marine and offshore environment and, more importantly, durable and maintainable for the life of the vessel.

ABS updated its *Guide for Surveys Based on Machinery Reliability and Maintenance Techniques* and developed new *Guidance Notes on Equipment Condition Monitoring Techniques* to further support maintenance planning and prepare for the “smart” vessels now entering service more widely.





INNOVATIVE INSPECTION TECHNIQUES

Suitable means of access to structures is required for surveys and inspections to be carried out safely, effectively and efficiently. Remote inspection techniques provide alternative methods for accessing assets and help reduce safety risks to the surveyor and the owners' inspection crew.

Recognizing that Unmanned Aerial Vehicle (UAV) technology can be a powerful tool to reduce both the invasiveness of surveys and work-related risks, ABS provides a path to incorporating these new remote inspection tools to support class surveys. In 2016, ABS announced the publication of the *ABS Guidance Notes on Using Unmanned Aerial Vehicles (UAVs)*, which provides best practices recommendations on the application of UAVs, on the qualification and proficiency of UAV service providers and on UAV operations and data handling. This comprehensive set of best practices was developed through extensive trials and testing on both marine and offshore asset types.

ACOUSTIC EMISSION TESTING

Acoustic emission testing (AET) has been accepted by ABS for more than a decade as a passive, nondestructive examination technique. More recently, IACS also extended acceptance. After several years of extensive research and testing onboard vessels, ABS released in 2016 the *Guidance Notes on Structural Monitoring using Acoustic Emissions*. This industry-leading publication discusses best practices for a technique capable of monitoring crack propagation, corrosion activity, cavitation erosion and leaking of structures made from steel, aluminum, composite and other materials. The document also outlines the performance steps such as applicable standards and best practices in installation, data processing and test procedures.





SHAFTING

Recent design trends and the introduction of Environmentally Accepted Lubricants have resulted in the increasingly sensitive alignment of propulsion shafting systems. As such, these systems now require lower tolerances and margins to prevent stern tube bearing failures.

As a result, ABS led a substantial effort in proper shaft alignment and optimization, to develop new tools to assist methods and analyses to verify proper alignment, and acceptable load distribution between the bearings.

To address the latest design trends and shipyard operations, ABS published the *Guide for Enhanced Shaft Alignment* and assisted numerous owners and shipyards with shaft alignment and stern tube bearing issues during 2016.

In fact, ABS developed an innovative concept called the ABS Smart Bearing™ solution. The ABS Smart Bearing solution, which has been tested in various vessels, provides operators the ability to identify the bearing loads of all propulsion shafting bearings, as well as the ability to detect misalignment problems.

Moreover, ABS carried out an investigation into single stern tube bearing designs. Single stern tube bearing designs have demonstrated a decreased tolerance to eccentric propeller thrust, or propeller forces in general, as well as reduced tolerance on shaft alignment sighting errors, bearing offset inaccuracies and general shaft installation errors. As a result of the investigation, certain ABS Rule changes were adopted to better accommodate these designs, and ABS provides more comprehensive guidance when these arrangements are used.

HARSH ENVIRONMENTS

ABS helped in the development of the Polar Code through its role in IACS. Publishing its Polar Code Advisory in January 2016, ABS provided the industry with demonstrated leadership and comprehensive knowledge to guide preparations during the year prior to the Polar Code taking effect in January 2017.

Additionally, ABS released its *Guidance Notes on Ice Loads on Azimuthing Propulsion Units* during 2016. Validated with leading industry partners, the Guidance Notes define design ice load formulations and are intended to assist ship designers and engineers in identifying operational capabilities in extreme conditions.

SUBCHAPTER M—U.S. TOWING VESSELS

With many towing vessel owners in the U.S. focused on USCG Subchapter M requirements, ABS released the *Guide for Building and Classing Subchapter M Towing Vessels*. This Guide clarifies the supplemental requirements applicable to classing existing and new towing vessels for service on major rivers and connected intracoastal waterways for vessels that comply with the 46 CFR Subchapter M Final Rule.



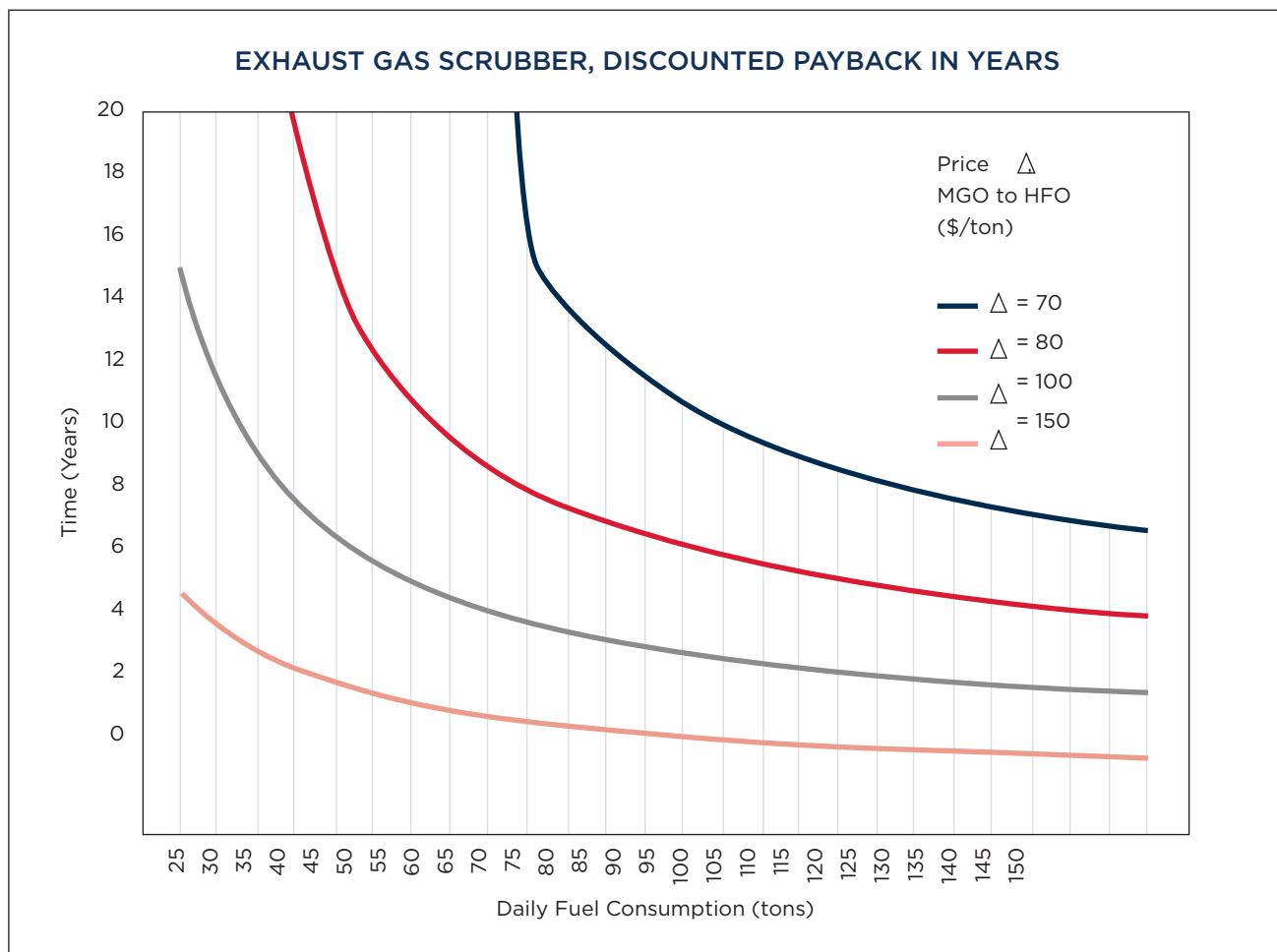
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Furthermore, ABS was among the first classification organizations to be approved by the American Waterways Operators (AWO) to carry out audits under its Responsible Carrier Program (RCP). The RCP, a safety management system for tugboat, towboat and barge companies, requires AWO member companies to undergo periodic management and vessel audits conducted by an independent third party. Towing vessel operators serving the inland waterways, coasts and harbors are looking closely at their fleets to determine the best way to meet the new USCG Subchapter M regulations establishing vessel safety and inspection requirements. Vessel owners and operators can choose whether to opt for annual USCG inspections or adopt a Towing Safety Management System.



TECHNO-ECONOMIC ANALYSIS

ABS developed techno-economic analysis capabilities to support decision-making on operational aspects, technical management, equipment selection and strategic business planning. These comprehensive sensitivity studies are used to assist with project evaluations and provide efficiency options with a transparent understanding of expected savings and potential trade-offs. By tailoring a techno-economic model to a vessel's technical specification, owners look to ABS to gain deeper understanding and insight which leads to a more informed decision.



NAUTICAL SYSTEMS FLEET MANAGEMENT SOFTWARE

The ABS Nautical Systems (NS) software team continued its multiyear focus to transform the NS Enterprise software suite from a transaction-based system into a state-of-the-art management information system. This vision was realized in 2016 with the launch of NS Vessel Performance software, the first web-based module offered by NS, with an easy-to-use graphical interface and business intelligence (BI) capabilities built into the module. With a platform for BI in-place, NS is integrating this capability across all its modules during 2017 through the NS Performance Manager module.

As global environmental regulations such as monitoring, reporting and verification—plus challenging economic markets—continue to put pressure on owners and operators, NS is committed to developing software solutions that facilitate compliance now and into the future while improving performance. The ABS NS Vessel Performance software allows for the collection, management and visualization of critical operational and performance data. The addition of the NS AutoLogger software, also launched in 2016, improves data accuracy by automatically capturing onboard sensor data. Previously, this data was captured in noon reports. Through benchmarking and analysis of this data, owners and operators can achieve environmental compliance while improving operational compliance.

The ABS NS Mobile platform was launched at the 2016 Global User Conference to support both iOS and Android platforms. The NS Mobile platform makes key features of NS Enterprise accessible on any mobile device and improves process efficiency by reducing the cycle time of maintenance, purchasing and HSQE tasks. The first phase of the rollout focused on purchasing and shoreside efficiency, and is applicable to vessel superintendents, fleet managers and other senior management. NS Mobile pilot programs continue to progress with two large global clients.



GLOBAL MARINE



LEADING CLASS IN GLOBAL MARINE

Throughout 2016, the industry continued to cope with a challenging global economy and increasingly complex regulatory landscape. To help address these challenges, ABS led delivery of new tools and solutions aimed at increasing efficiencies and optimizing vessels to meet current and prepare for future regulatory requirements.

In an effort to centralize strategic planning, client development and product and service offerings, ABS formed its Global Marine organization in 2016. Dedicated market sector leads were assigned to focus on gas-fueled assets and gas carriers, containerships, tankers and bulk carriers, in order to reinforce industry relationships and position ABS for a quick reaction to market trends and technology development.

“This new global approach positions us more closely to industry drivers and provides a more consistent structure for technology development and even stronger client relationships. As a result, we are better positioned to execute on our mission to support industry safety.”

DR. KIRSI TIKKA,
ABS EXECUTIVE VICE PRESIDENT,
GLOBAL MARINE

MARINE SECTOR LEADERSHIP

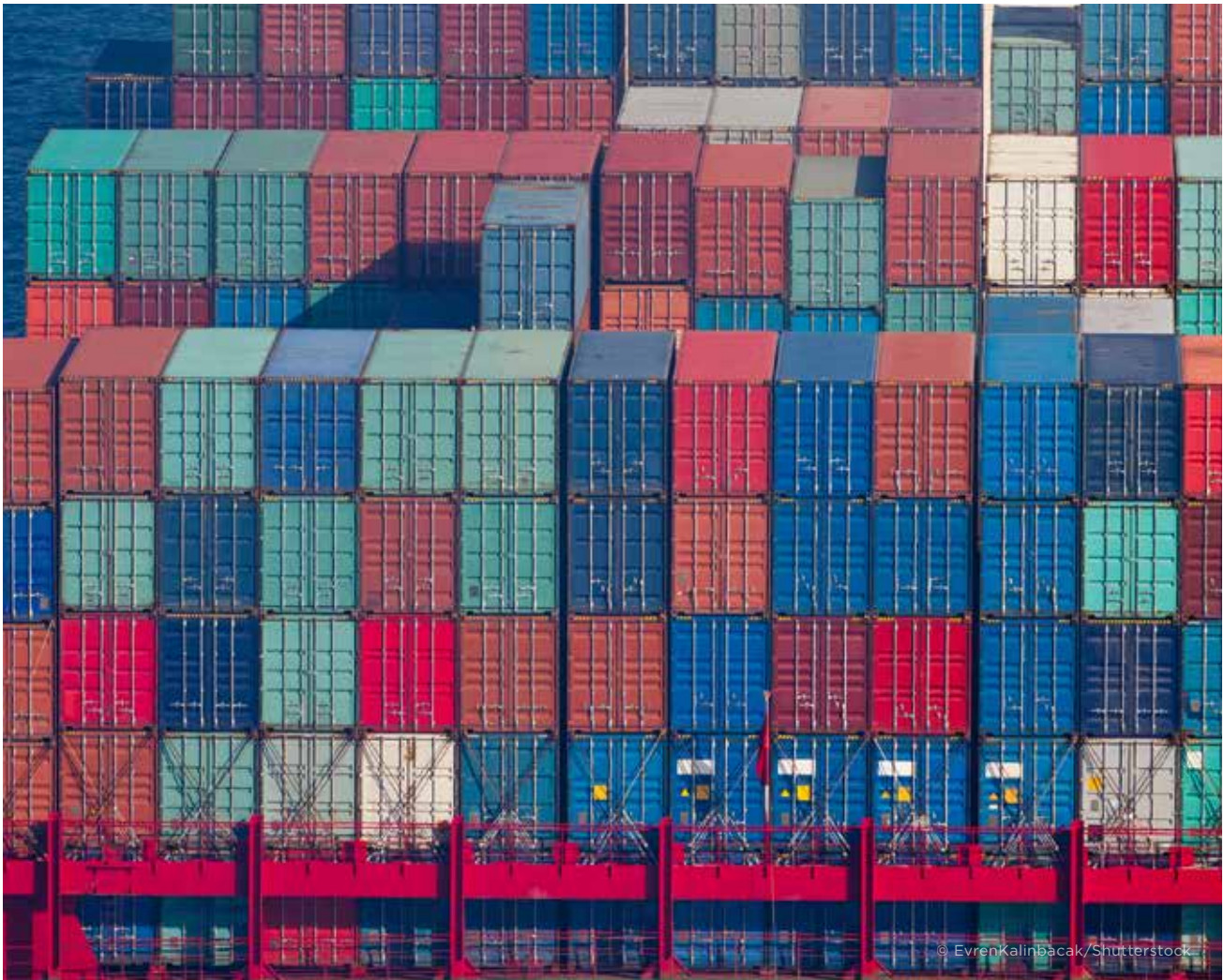
CONTAINERSHIPS

The containership markets saw weak demand growth coupled with increased supply of ships resulting in depressed freight rates. As a result, owners focused on their existing fleets and on improving operational efficiencies while maintaining safety which is where ABS led the way.

- The new *ABS Guide for Fire-Fighting Systems for On-Deck Cargo Areas of Container Carriers* takes a comprehensive approach and goes beyond SOLAS to assess the firefighting system pressure and capacity requirements



© Oleksandr Kalinichenko/Shutterstock







- ABS laid the groundwork for the 2017 release of an update to the *ABS Guide for Certification of Container Securing Systems* along with an associated tool, ABS C-LASH™ software, to support owners and operators in developing and maintaining smarter lashing systems that reduce risk and increase efficiency and safety

TANKERS AND BULK CARRIERS

The ABS-classed tanker and bulk carrier fleets grew to record highs with 1,470 tankers representing 84m gt and 1,052 bulk carriers representing 52m gt.

- Four new 400k very large ore carriers (VLOC) from China were contracted to ABS class
- ABS held the largest tanker and dry bulk new construction market share by foreign class in Japanese shipyards
- ABS published its *Guide for Enhanced Cargo Tank Cleaning (ECTC)* that sets forth requirements for the optional notation ECTC. It is applicable for vessels intended to carry oil and vessels intended to carry chemical cargoes
- ABS increased orderbook share for small stainless steel chemical tankers in China

2016 VESSELS DELIVERED

Type	#	m gt
Bulk Carriers 	81	5.3
Containerships 	5	0.3
Gas Carriers 	24	1.6
Tankers 	106	6.7

GLOBAL MARINE REGULATION

As the regional and international regulatory landscape evolved throughout the year, ABS remained diligent in keeping up with the changes by responding with new Rules and Guides and compliance solutions.

- In response to the International Maritime Organization (IMO) ratification of the Ballast Water Management Convention, ABS updated its *Guide for Ballast Water Treatment* and developed a Ballast Water Management Technology Evaluation service to support industry in the assessment of ballast water management solutions that meet both regulatory and operational requirements
- ABS developed a new mobile-friendly, interactive *Guidance for Reducing Port State Control Detention* that makes it easy to define and address Port State Control compliance concerns to help reduce detentions
- With the compliance deadline for the IMO global sulfur cap now set for 2020, owners and operators turned to ABS to understand options for an effective fuel strategy that balances operational and regulatory requirements
- To help industry navigate new European Union (EU) MRV requirements for CO₂ emissions, ABS worked with clients to identify the steps necessary to achieve compliance
- To meet requirements of the IACS Common Structural Rules (CSR) and in conjunction with Lloyd's Register, ABS released the CSR software that includes prescriptive and finite element assessment of whole vessel structures for new bulk carrier and oil tanker designs



GLOBAL GAS SOLUTIONS

ABS further strengthened its role as the industry leader in classification of liquefied gas carriers and maintained the largest global orderbook for the classification of LNG-fueled vessels. ABS also brought its decades of LNG experience to the SEA/LNG coalition, an organization formed to accelerate the worldwide adoption of LNG as marine fuel.

The Global Gas Solutions team helped achieve a number of milestones and industry firsts throughout the year, including the world's first VLEC, the world's largest LNG-powered ethane carrier and the world's first compressed natural gas (CNG) carrier.



DELIVERY OF TWO SHUTTLE TANKERS

Tordis Knutsen and *Vigdis Knutsen*, the first two vessels in a series of three vessels built in Korea, have a unique combination of ABS Notations, DPS-2, EHS-PC, EFP-AMC and R1+, which denotes a very sophisticated system for propulsion control, DP control and systems redundancy and are designed for shuttle operations in both Brazil and the North Sea.



© David Gowans / Alamy Stock Photo

ABS CLASSES WORLD'S FIRST VERY LARGE ETHANE CARRIER

ABS classed the world's first VLEC that features multi-cargo capability of ethane and liquefied petroleum gas based on an eco-friendly design. With an 87,000 cbm cargo carrying capacity, the vessel represents a significant step up from the largest ethane carriers delivered to date, which had capacity of 37,000 cbm. The vessel is also the first of its kind to be constructed with a specially designed GTT Mark III membrane cargo containment system.

Delivered in November, the *Ethane Crystal* is the first of six VLECs that will be delivered with ABS Class through 2017. The second vessel, the *Ethane Emerald*, was delivered in early December. It is intended for trade routes between North America and India, carrying ethane that will be used as feedstock for petrochemical production. The vessel loaded its first shipment of ethane cargo from the U.S. at the end of 2016.



© Samsung Heavy Industries Co., Ltd.

ABS LAUNCHES TECHNICAL ADVISORY AND GLOBAL CLIENT SUPPORT SERVICES

Vessel Performance Services enables shipowners and operators to achieve environmental compliance while reducing operational costs.

- Energy Efficiency Services provide valuable guidance to shipowners to improve performance across their fleet
- Ballast Water Technology Evaluation Services leverage ABS' knowledge of regulations and experience with Ballast Water Management Systems (BWMS) to provide vessel owners and operators with key information to make informed decisions on equipment selection on individual vessels or across a fleet
- Exhaust Gas Cleaning System Evaluation Services leverage ABS' technical knowledge of gas cleaning systems and vessel operations to provide owners and operators with key information on equipment selection

To complement the Technical Advisory Services, ABS launched its Global Client Support team in 2016. This invaluable service is available 24 hours a day, 7 days a week. The team consists of a group of ABS leaders with extensive survey and engineering experience who are strategically positioned around the world to provide direct-access service to clients.



LAUNCHING OF THE WORLD'S FIRST CNG SHIP

The world's first CNG carrier, the *Jayanti Baruna*, was launched in early 2016. The CNG carrier is classed by ABS using the *Guide for Vessels Intended to Carry Compressed Natural Gases in Bulk*.

The ship is expected to transport natural gas from Indonesian fields in East Java to communities on the island of Lombok, benefiting relatively remote communities that are not economically feasible to supply by pipeline.



WORLD'S SECOND LNG-FUELED CONTAINERSHIP DELIVERED

The ABS-Classed *Perla Del Caribe* and its companion, the *Isla Bella* delivered in 2015, are the largest dry cargo ships powered by LNG. These 764-foot long Marlin Class Containerships are the cleanest cargo-carrying ships anywhere in the world. This groundbreaking green ship technology will dramatically decrease emissions and increase fuel efficiency when compared to conventionally-powered ships, the equivalent of removing 15,700 automobiles from the road.



© Nassco

ABS JOINS FORCES BRINGING LNG-FUELED VESSELS INTO SHIPPING'S MAINSTREAM

ABS teamed with partners Arista Shipping, Deltamarin, GTT and Wärtsilä, in the “Project Forward” joint development project (JDP) to review a dry bulk carrier concept that employs LNG as fuel. The goal was to develop a Kamsarmax bulk carrier design that would be the first of its type suitable for worldwide services, powered by LNG and in compliance with the IMO’s Energy Efficiency Design Index 2025 standards and MARPOL Annex VI requirements.

Technical challenges in developing this design were considerable, as there is a need to carry a large volume of LNG (2,500 cbm) – which corresponds to full-range operation and 40 days – in a ship where available space is limited and cargo space is at a premium.

ABS provided approval in principle (AIP) for the concept, which is based on the highly optimized Deltamarin B.Delta 82 design, utilizing a GTT membrane LNG fuel tank. This design also could be applied to other bulk carrier sizes and serve as the basis for an LNG-fueled tanker.



© Deltamarin

GLOBAL OFFSHORE



LEADING CLASS IN GLOBAL OFFSHORE

Oil prices remained low in 2016, continuing a challenging environment for the offshore industry. Pressed to contain costs, owners and operators focused on getting more out of their assets, increasing integrity management, life extension and continuous service.

The industry looked to ABS, the recognized leader in offshore classification, to provide advice, technical solutions and exceptional class service during this difficult time. In the course of the year, ABS addressed a broad spectrum of concerns, including how best to leverage operational data, how to streamline verification and validation and how to move into exacting operating environments at the edge of industry frontiers.

OFFSHORE SECTOR LEADERSHIP

SHALLOW WATER

In 2016, ABS remained the industry leader in jackup classification and continued its multi-pronged program to improve machinery, systems and structural safety, working with industry and analyzing operational data to identify potential safety issues for working assets. The ABS jackup safety program elements in 2016 included the publication of a suite of new Guides and Guidance Notes.

- *Guide for Load and Resistance Factor Design (LRFD) Criteria for Offshore Structures*
- *Guide for Buckling and Ultimate Strength Assessment for Offshore Structures (LRFD Version)*
- *Guidance Notes on Structure Analysis of Self-Elevation Units*
- *Guide for Survey and Inspection of Jacking Systems*
- *Guidance Notes on Self-Elevating Unit Motions Monitoring*
- *Guide for Lay-Up and Reactivation of Mobile Offshore Drilling Units (MODUs)*
- *Guidance Notes on Geotechnical Performance of Spudcan Foundations*

Focusing on the safety and life extension of MODUs, ABS released its *Guide for Lay-Up and Reactivation of Mobile Offshore Drilling Units*. This Guide provides requirements for stacking units based on the type of lay-up to be carried out and provides valuable information for moving rigs back into active operation.

Additionally, ABS developed innovative solutions that help determine a more rational operation limit and a more reliable means of monitoring jackup moves on and off location. The ABS assessment for jackups moving on and off location was developed based on decades of experience in jackup classifications and an in-depth knowledge of jackup performance. Applying experience powered by state-of-the-art simulation capabilities, ABS offers assessment services for three primary categories: moving on location, moving off location and motions monitoring to support go or no-go decision-making for moving on and off location.

DEEP WATER

While many deepwater projects were put on hold in 2016, ABS worked toward advances in safety, standardization and continued service for aging assets. Leading the offshore industry in addressing challenges, ABS achieved a number of significant accomplishments.

- Awarded new floating production platform, the only project moving forward currently in the Gulf of Mexico (GOM)
- The Heidelberg Spar is the 18th spar classed by ABS and the 20th certified verification agent Spar delivered in the GOM. Heidelberg Spar is part of the client's "Design One, Build Two" strategy, modeled after the Lucius Spar
- Established processes and criteria to address key considerations for life extension for offshore assets, releasing the *ABS Guidance Notes on Life Extension Methodology for Floating Production Installations*. Currently initiated three FPSOs Life Extension projects for a Brazilian client
- Classed a multi-purpose field support vessel that will serve as a dedicated field support vessel for a newly installed FPSO
- Classed three major FPSOs for the Brazilian market
- Staying at the forefront of managed pressure drilling (MPD) to allow operators to lower costs and reduce risks, ABS approved equipment for a number of MPD projects and revised the *ABS Guide for the Classification of Drilling Systems (CDS)* to provide the requisite industry standards for MPD equipment and procedures

SUBSEA

As deepwater and ultra-deepwater subsea fields come online within the next decade, offshore infrastructure will need to be expanded. Foreseeing the emergence of safety considerations as this industry segment expands, ABS invested in R&D targeting a range of subsea safety issues with the objective of developing a suite of guidance documents for industry.

In 2016, ABS expanded its subsea capabilities to meet the increasing need for independent third-party validation and verification.

- Created a Subsea Services team made up of industry-recognized leaders
- Launched efforts to become a Bureau of Safety and Environment Enforcement (BSEE) approved organization for wellhead equipment verification
- Published the industry-first *Guidance Notes on Subsea Pipeline Route Determination*
- Updated *Guide for Building and Classing Subsea Riser Systems*
- Published *Guidance Notes on Subsea Hybrid Riser Systems*

FLOATING LIQUEFIED NATURAL GAS

Many floating liquefied natural gas (FLNG) projects around the world were impacted by low oil and gas prices, leading to some projects being delayed. The current state of the energy markets presents an opportunity for companies to be innovative and competitive by reducing engineering, procurement and commissioning costs. Such organizations continued to invest in research to develop novel FLNG systems, with ABS playing a key role.

- Granted AIP to an FLNG hull design for near-shore operations that, according to the builder, delivers an estimated one-third cost reduction compared to a standard FLNG hull



ABS CLASSES FPSO FOR RECORD-SETTING GOM PROJECT

ABS achieved a significant industry milestone with its work as Certified Verification Agent and Classification Organization for the FPSO vessel that will act as the host facility of the world's deepest offshore oil and gas development, which set a record for ultra-deepwater oil and gas production.

The FPSO came online the first week of September, producing oil and gas through a subsea infrastructure at 9,500 ft. water depth, approximately 200 miles offshore Louisiana in the GOM. The vessel has a daily design capacity of 60,000 BOPD of oil and 15 MMscf/d of gas and can store 800,000 barrels of oil.

“It was a great vote of confidence to be selected as the classification organization for this landmark project, and we are pleased to add this achievement to our list of offshore industry ‘firsts.’”

KEN RICHARDSON,
ABS EXECUTIVE VICE PRESIDENT,
GLOBAL OFFSHORE



© Shell

Engineered and constructed by SBM Offshore, the FPSO is operated by a joint venture owned by affiliated companies of SBM Offshore and partners.

STANDARDIZATION JOINT INDUSTRY PARTNERSHIP

In 2016, ABS convened industry partners at the Offshore Technology Conference in Houston to sign a memorandum of understanding, establishing a unified joint industry project (JIP) for standardization to develop offshore design standards that will help to improve safety and increase efficiency for offshore projects. The scope of work includes developing processes and criteria for bulk materials and equipment packages, construction procedures and quality management. The standard specification development program consists of two JIPs, one focusing on offshore bulk materials which include structure, piping, electrical and instrument with design and construction procedure. The other JIP is focusing on equipment packages which defines system requirements, material selection and functional requirements including quality control, inspection, testing and certification procedure.

The two JIPs are interconnected through their participating companies with shipbuilders, oil and gas companies and engineering companies. This integrated effort seeks to find acceptable common ground between the numerous individual standards and requirements in offshore projects. Although all these requirements are proven and effective standards, they reflect the particular philosophies of the organizations that develop them and, thus, are not in harmony with design optimization. These JIPs will consolidate the best practices and form industry standards.



LIFE EXTENSION OF NEPTUNE SPAR

The Neptune floating production unit is the first spar installed in the GOM in 1997, and the first classed spar in the world. Installed in Viosca Knoll Block 826 in 1,930 ft of water, the Neptune spar was originally built with a 20 years design life. The current owner and operator of the spar approached ABS to extend the life of the unit. The reservoir characteristics warrant the effort of evaluating the unit for continued services beyond the original design life.

The Neptune is the first non-ship shaped facility to be granted life extension by ABS, and the first spar ever to do so. The life extension criteria applied to the project complies with the provisions of the *ABS Guidance Notes on Life Extension Methodology for Floating Production Installations*, which incorporates many of the lessons learned during its development. ABS pioneered spar classification with the Neptune, and once again pioneers in the life extension process.



IMPROVING HIGH-PRESSURE, HIGH-TEMPERATURE EQUIPMENT

In recent years, the offshore oil and gas industry has categorized reservoirs with wellbore fluid pressures greater than 15,000 psi and/or temperatures greater than 350° F as high-pressure, high-temperature (HP/HT) environments. These conditions exceed the capabilities of existing drilling equipment, which are rated to 15,000 psi and 250° F. Although there are high-level guidelines for HP/HT in publications by the American Petroleum Institute, there is a lack of specific design and manufacturing codes, standards and regulations for technology qualification of HP/HT equipment.

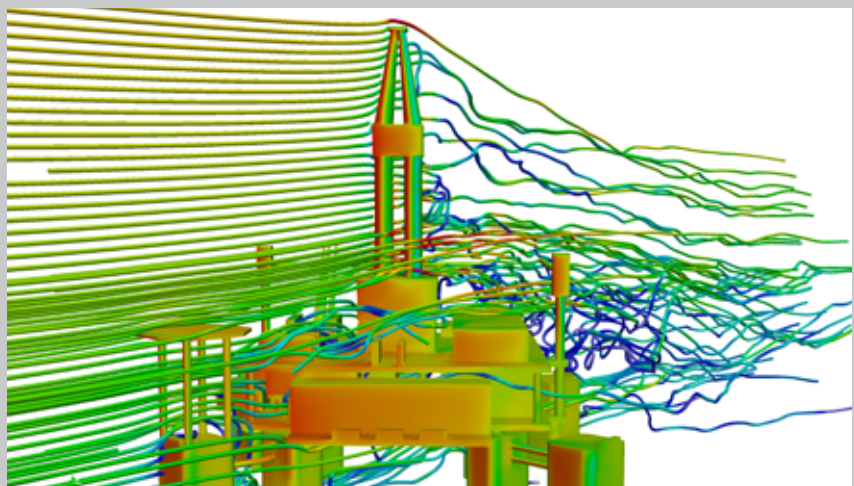
ABS is actively working with vendors and contractors that are designing HP/HT technology to develop a set of criteria based on industry standards to start modifying equipment requirements and defining technology qualification procedures. ABS is appointed to perform independent third party verification on HP/HT equipment for compliance with BSEE requirements with a growing number of projects and clients in the U.S. ABS completed technology qualification projects with leading system designers and manufacturers for 20,000 psi HP/HT systems equipment, sharing its findings through technical papers and presentations at offshore events in the U.S., Europe and Asia.



COMPUTATIONAL FLUID DYNAMICS

The key drivers in today's offshore industry are productivity, efficiency and satisfying regulatory compliance without undue cost. As design complexity grows to address these concerns, owners, operators and designers seek optimal solutions to meet their objectives. The data used to guide their decisions has to keep pace with design complexity. Computational Fluid Dynamics (CFD) provides a first-principle approach to enhance the design process and improve operational efficiency.

In 2016, ABS used CFD to assist clients with the analysis of energy efficiency, safety, prediction of extreme design loads and operational performance. CFD fulfills a wide array of needs from improved loads prediction, such as slamming and sloshing, to system performance evaluation, vessel operation and efficiency assessment.



GLOBAL GOVERNMENT



LEADING CLASS THROUGH GOVERNMENT PARTNERSHIPS

GLOBAL GOVERNMENT SERVICES

ABS continued its partnership with global governments by providing leading classification and related services. There are nearly 200 government-related ABS-classed vessels in the U.S. alone, with ABS expanding its reach in international governments work.

SUPPORTING THE U.S. GOVERNMENT

- For nearly 100 years, ABS has been the official classification organization of the U.S. Under U.S. law, ABS is the only classification organization permitted to class U.S. Government vessels
- ABS is a Recognized Organization (RO) that works with and on behalf of the U.S. Government to provide steadfast support for their required safety regimes
- Throughout 2016, ABS continued to support the Military Sealift Command (MSC) and MARAD to enhance its fleet's capability. ABS also reinforced the U.S. Navy's commitment to expanding its strategic sealift and global logistics capabilities by incorporating the ABS Class Rules into its design, construction and maintenance processes



Wikipedia, The Free Encyclopedia

- ABS continued to support the U.S. Navy, U.S. Army Corps of Engineers, U.S. Army Watercraft Division and National Oceanic and Atmospheric Administration (NOAA) in maintaining statutory certifications, such as MARPOL (marine pollution) and International Load Line Convention
- ABS continued to grow its Service Life Evaluation activities for NOAA, the U.S. Army Corps of Engineers and MARAD. The ABS



Wikipedia, The Free Encyclopedia

Service Life Evaluation Program (SLEP) leverages the extensive engineering and survey experience ABS has on commercial vessels to tailor applications for existing U.S. Government vessels

- The USCG contracted ABS to class all new vessels, including those for the Fast Response Cutter program. ABS also supported the USCG in preparing to class future Offshore Patrol Cutter (OPC) and Heavy Polar Icebreaker acquisitions. The OPC program is expected to span more than 20 years, with the acquisition of 25 cutters. The Polar Icebreaker program is expected to extend well past 2020
- ABS classed the U.S. Navy's T-AO205 Fleet Replenishment Oilers, the Mobile Landing Platform and Joint High Speed Vessels
- ABS classification of the future U.S. Army Watercraft Division's Maneuver Support Vessel Light, a high-speed landing craft, will support the Army's land maneuver forces



Wikipedia, The Free Encyclopedia



SUPPORTING INTERNATIONAL GOVERNMENTS

- ABS was awarded a contract by the Indian Coast Guard to class five 48m-long fast patrol vessels to be built at Garden Reach Shipbuilders and Engineers, as well as classing five additional 105m-long Sankalp-Class offshore patrol vessels
- The ABS-classed *Mark IV* Landing Craft Utility was delivered to the Indian Navy in 2016, in addition to five FPVs built for the Indian Coast Guard
- Along with classification services, ABS provided SLEP services, Naval Ship Code (ANEP-77) certification, CFD evaluations and ABS CyberSafety program assessments to various international navies
- ABS was awarded a contract by the Canadian Navy to develop and assist in the implementation of the Standards Plans for two classes of Canadian Navy vessels to the Naval Ship Code (Allied Naval Engineering Publication (ANEP) 77)



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ABS GROUP OF COMPANIES, INC.



LEADING INDUSTRY BY ALIGNING WITH CLIENT PRIORITIES IN RISK, RELIABILITY, INTEGRITY AND QUALITY MANAGEMENT

A subsidiary of ABS, ABS Group and its affiliated companies provide a range of technical and certification solutions to support safer, more reliable and compliant assets and operations for a variety of market sectors including oil, gas and chemical, power generation, marine, offshore and government.

Every year brings dynamic changes in the diverse markets that ABS Group serves but by working closely with its clients, ABS Group continues to provide highly valued risk, reliability, integrity and quality management services, with tools and information that reduce uncertainty, drive safer, more reliable performance and improve profitability.

Major trends in 2016 included advances in

- Inspection and verification data management for major capital projects
- Fitness for service and life extension evaluations for aging assets and infrastructure
- Investigation and root cause analysis for major accidents
- Management system certifications for asset management programs under ISO 55001

To sustain its enduring leadership in the areas of risk, reliability, integrity and quality management, ABS Group positioned itself competitively in 2016 in a broad range of markets.

INSPECTION AND VERIFICATION DATA MANAGEMENT FOR MAJOR CAPITAL PROJECTS

2016 saw a global decline in major capital project spending, most notably in the offshore oil and gas industry, and the importance of verifying the quality of construction of major capital projects to help ensure positive returns on invested capital has never been higher. ABS Group continued its long, successful history of project quality management support on some of the world's largest industrial and infrastructure projects.

ABS Group began delivering project inspection services during the design review, prefabrication and construction phases of a refinery and terminal facilities in southwestern Saudi Arabia, which will process an estimated 400,000 BOPD when completed. ABS Group also began providing project inspection services for new construction on an offshore field development in the United Arab Emirates, which will increase production from 640,000 BOPD to 750,000 BOPD. Such projects are large and complex with vast amounts of data generated, so in 2016 ABS Group introduced a new Global Inspection Management System to make the project quality management process more efficient and collaborative with clients, as well as improve the way in which the clients manage, access and archive these large amounts of data for ongoing use.



FITNESS FOR SERVICE AND LIFE EXTENSION FOR AGING ASSETS AND INFRASTRUCTURE

As companies were increasingly focused on maximizing the return on investment from existing assets, verifying the fitness for continued service and determining the ability to extend the useful life of assets became a top priority for many. ABS Group leveraged damage mechanism analysis and Risk-Based Inspection (RBI) strategies to support this work which increased substantially for ABS Group in 2016.

2016 was also a ground-breaking year with regard to ABS Group's Mechanical Integrity services in the U.S., with significant progress made in the number of projects completed. ABS Group built a portfolio of service offerings covering fitness for service evaluation, finite element analysis, remaining life assessment, shut-down inspections, mechanical integrity program development and implementation, damage mechanism review and RBI program development.

ABS Group continued to provide Asset Integrity Management (AIM) services and engineering solutions for clients that otherwise would have to repair, replace or alter the process conditions of their existing equipment. ABS Group engineers performed assessments to validate and document the mechanical integrity of in-service equipment that have experienced damage, lack regulatory required design documentation and/or require a change of operational service or physical location.

INVESTIGATION AND ROOT CAUSE ANALYSIS OF MAJOR ACCIDENTS

A major accident with serious losses can be a challenging situation for any organization. In 2016, ABS Group handled a number of major accident investigations covering everything from data collection, chain of custody handling/storage, forensic analysis, incident investigation, root cause analysis (RCA), improvement planning and implementation as well as organizational learning activities to prevent future similar incidents.

In 2016, ABS Group led a major offshore accident investigation for a national oil company in the Americas by delivering incident scene/emergency management and RCA for the operator, while also interfacing with governmental authorities and stakeholders.

ABS Group's Advanced Engineering team provided structural engineering services for a wide range of structures and equipment to determine their performance under extreme loads, including seismic, wind and flood hazards. After a magnitude 7.8 earthquake occurred on the Ecuador coast in 2016, a reconnaissance team from ABS Group surveyed the damage and developed a report summarizing observations and lessons learned from the structural assessment.

MANAGEMENT SYSTEM CERTIFICATION FOR ISO 55001

In 2016, ABS Quality Evaluations (ABS QE), a subsidiary of ABS Group, was the first certification body through the ANSI-RAB Accreditation Board (ANAB) to begin offering management system certification for ISO 55001 for Asset Management. Through this offering, ABS QE helps clients verify and certify that their Asset Management strategies meet the requirements of the international standard and industry best practice.

ABS QE also helped a number of companies understand revisions to leading international standards, including the Aerospace Quality Management Standard (AS9100D: 2016), the Automotive Quality Management Standard (ISO/TS 16949:2016), the Quality Management Standard (ISO 9001:2015) and the Environmental Management Standard (ISO 14001:2015).



SUPPORT FOR LNG PRODUCTION AND DISTRIBUTION SYSTEM INVESTMENTS

Globally, LNG is changing the energy mix for commercial power production, home energy usage and transportation fuels, especially for marine vessels. ABS Group is at the forefront of helping companies across the entire LNG supply chain manage the safety, reliability and efficiency of their operations.

ABS Group was contracted in 2016 to develop and implement a comprehensive maintenance and integrity program for a LNG regasification terminal. This project leverages ABS Group's proven AIM methodology and extensive experience in providing Enterprise Asset Management (EAM) and mechanical integrity services and is just one example of how ABS Group supports LNG infrastructure projects by helping operators manage asset safety, reliability and efficiency.

RENEWABLE ENERGY - OFFSHORE WIND

Renewable energy continues to grow in importance around the world as countries focus on sustainable energy solutions for the future. Offshore wind is an important part of the renewable energy solution and ABS Group provides a complete range of services across the life cycle of offshore wind projects and works to verify innovative design concepts for wind projects.

In 2016, ABS Group was awarded two significant multiyear quality surveillance contracts: a novel floating foundation project in Scottish waters and one of the largest offshore wind farms planned in Germany. In addition, a U.K. operator selected ABS Group to provide certification services for what will be the world's first offshore wind farm to exceed 1,000 MW in capacity. ABS Group also served as the certified verification agent of the first offshore wind farm in the U.S., which came online in December 2016, and confirmed that the project met and exceeded the appropriate regulatory, safety and quality requirements.

Also in 2016, ABS Group signed an agreement with a leading drone services company to deliver joint aerial wind turbine and equipment inspections using a cost-effective solution. As an advanced technology, drones provide a data-driven alternative to traditional inspections of aerial wind turbine blades at heights which may be hazardous and time-consuming for human access, which will drive safer, more efficient wind farm operations.





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NORTH AMERICAN PIPELINES AND MIDSTREAM OIL & GAS

The newfound abundance of North American oil and gas has spurred development in pipelines and midstream infrastructure. This was a strategic investment area for ABS Group in 2016 resulting in new guidance focused on improving pipeline integrity management, implementing pipeline safety management best practices and preparing for compliance with evolving U.S. regulatory requirements. ABS Group's recommendation to use data analytics and management will help drive safer pipeline operations, aid in compliance with the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) and maximize return on investment by promoting enhanced safety, reliability and efficiency.

NORTH AMERICAN REFINERIES AND DOWNSTREAM OIL, GAS & CHEMICALS

In 2016, ABS Group focused on helping clients in North America understand proposed new requirements for improving safety in petroleum refineries. The recently revised Process Safety Management (PSM) standard set forth by the California Department of Industrial Relations aims to reduce the risk of major accidents by eliminating or minimizing the process safety hazards to which employees may be exposed. To prepare industry for compliance with updates to the PSM regulations, ABS Group developed knowledge-sharing resources addressing new requirements for damage mechanism review, incident investigation/RCA, human factors, recognized and generally accepted good engineering practices, and facility siting and revalidation.

Globally, ABS Group maintained its position as a leading provider of facility siting services for a wide range of explosion, fire and toxic release hazards in refining, petrochemical and specialty chemical process installations.



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GOVERNMENT AND PUBLIC SECTOR SERVICES

In 2016, ABS Group continued to support various organizations as they managed diverse risks. Anticipating the U.S. Office of Management and Budget's 2016 publication of Circular A-123 requiring U.S. federal departments and agencies to establish ERM, ABS Group's Global Government team developed advisory resources and risk management tools to help organizations understand and adopt an effective ERM strategy. In 2016, the Government team also continued to assist the USCG in the development, implementation and maintenance of the Risk Based Maritime Security Response Operations (RBMSRO) program, which was awarded the 2015 USCG Commander Joel Magnussen Innovation Award for Management. RBMSRO is a risk-based tool that allows users to optimize available resources toward the reduction of the greatest risk, in support of the Ports, Waterways and Coastal Security mission. The USCG also uses RBMSRO for performance measurement/management and to support resource decisions.

PHARMACEUTICAL

ABS Group maintained a leading position for asset management and reliability support for the pharmaceutical industry. The ABS Group experience and understanding of the regulatory requirements in this highly regulated industry makes ABS Group a preferred provider for pharmaceutical and life science companies. In 2016, ABS Group provided its new solution, Safeguard Robustness for Operational Excellence, to one large, global pharmaceutical client to help the company reduce the risk of error during the setup of an EAM/Computerized Maintenance Management System (CMMS), as well as to reduce the likelihood and/or severity of impact of a critical asset failure.

IMPROVING SAFETY CULTURE AND HSE PERFORMANCE

In recent years, ABS Group has been advancing safety culture analysis tools and training as its clients move to improve their health, safety and environmental (HSE) performance. ABS Group developed a comprehensive approach to assess company culture, identify gaps in safety programs and their implementation, and produce effective mitigation actions to address shortcomings. ABS Group is assisting a major national oil company with improving its overall safety performance by gathering safety performance data at the company's major assets, interviewing management and operations personnel, upgrading the HSE program, safety culture training and personal coaching of plant staff and management over a multiyear period.

ABS GROUP OF COMPANIES, INC. CORPORATE GOVERNANCE

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Dennis M. Houston

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Todd W. Grove
President and Chief Executive Officer

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Secretary

Jeffrey J. Weiner
Chief Financial Officer

David A. Walker
Chief Operating Officer

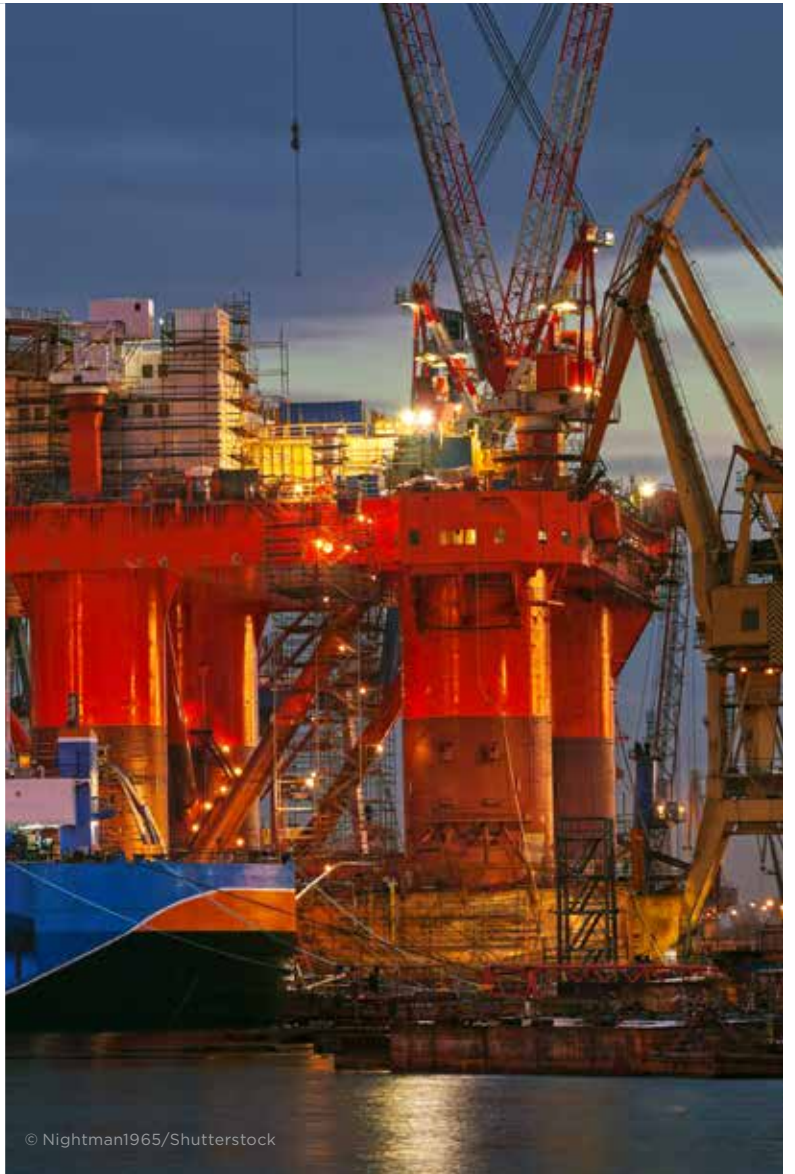
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