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DYNAMIC POSITIONING CONFERENCE

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WORKBOAT SESSION

Classification of Gulf of Mexico Workboats

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1 Introduction

Historically, the American Bureau of Shipping (ABS) has been the industry leader for the Classification of workboats for the oil and gas industry in the Gulf of Mexico. There are close to 1000 offshore supply vessels (OSV's) currently in class, and with 54 new OSV's added within the last year, ABS has the ability and the foresight to help fleet owners ensure that they are operating a world class vessel. The Classification of a vessel involves a three-step process starting with the technical plan review, survey's during construction, and periodic surveys during the life of the vessel.

We were one of the first Classification Societies to establish Rules specifically for smaller vessels with the publication of the ***1973 Rules for Building and Classing Steel Vessels under 61 meters in Length***. Since this time ABS Rules for small vessels have evolved into the ***1997 Rules for Building and Classing Steel Vessels under 90 meters in Length*** which contain rules for optional notations such as offshore support vessel, towing service, oil recovery vessels, fire fighting vessels, safety standby service, and vessels utilizing dynamic positioning.

The optional notations for dynamic positioning have been of specific interest for vessels involved with anchor handling, remotely operated vehicle (ROV) support, and pipe/cable laying. We offer dynamic positioning notations DPS-0, DPS-1, DPS-2, and DPS-3. The requirements for these notation vary in complexity from DPS-0 which requires no redundancy to DPS-3 requiring maintaining position due to the loss of any one compartment due to fire or flood. The DPS-3 notation is typically obtained for drill rigs and would be very difficult for an OSV to obtain. In addition to dynamic positioning notations, ABS also offers notations for thrusters installed on vessel not obtaining DPS notations. The optional notations for thrusters are APS for Athwartship thrusters (tunnel thrusters) and PAS for Propulsion Assist thrusters (azimuthing thrusters). These options have also been very popular with the owners and operators of OVS's.

Over the years ABS has been able to assist owners and operators of workboats during the design phase of the vessel with the knowledge from the numerous vessels we have reviewed; during the construction of the vessel with the attendance by our Surveyor's; and during the life of the vessels with our periodic surveys and our fleet management tools, such as ***SafeNet***.

2 Classification and International Requirements

2.1 What is Classification?

Classification represents that a vessel adheres to the Rules (or Guides) and to that extent is structurally and mechanically fit for its intended service. The basic functions of a Classification Society may be summarized as follows:

1) The preparation and promulgation of Rules and Guides for the design and construction of vessels, including material specifications and detailed regulations for periodic surveys. These Rules and Guides are modified from time to time in order to keep pace with the developments in shipbuilding and marine engineering. They are the standards by which the eligibility of vessels submitted for Classification is determined.
2) The publication of an annual Record of the essential details of hull and machinery of all ABS Classed vessels and the dates when principal surveys have been carried out.
3) The review and analysis of the plans and specifications of proposed new vessels or conversions of existing vessels, to verify that they meet the standards set by the Society's Rules or Guides.
4) To carry out structural analysis on new and unusual vessels for which Rules or Guides have not yet been developed.
5) To conduct surveys during the construction of the hull and its propulsion machinery, boilers, and vital auxiliaries and surveys of the conversion of existing vessels for compliance with the Rules and Guides.
6) To witness the testing of materials for the construction of the hull and machinery.
7) To survey the completed vessel throughout its Classed life as called for by the Rules and Guides. Reports of these surveys are forwarded to the ship owners who may use them to support their claims to

interested parties that they maintained the vessel, exercised due diligence for insurance agreements and claims, and satisfied government requirements.

8) To issue statutory surveys such as Load Line, SOLAS, MARPOL, and Tonnage Admeasurement and to issue the relevant certificates under the authority of the cognizant government and international convention.
9) To maintain a history of the surveys from the time of keel laying and during the vessel's entire Classed life. The Classification Society is able to collate this data on both hull and machinery toward the improvement of design and operation. Owners often do the same thing for their own vessels, but the Classification Society does it for all vessels Classed with it, and is thus able to formulate an overall picture.

We have a very specific mission, quality policy, and code of ethics that require a method of conducting business that is not like a typical company. Some of the items that are not normally understood are:

1) The parties involved in the construction of a vessel must recognize that the Class Society usually has a contract with the shipbuilder who signed the "Request for Classification Agreement". The owner should have an agreement with the shipbuilder to share all information between the shipyard the Class Society, and the owner, but this is not always the case.
2) The parties involved in the construction of a vessel should be fully aware of the differences between contractual conditions and Rule requirements and between inspection and surveying. The Classification Society's interest is seeing that the vessel is reasonable for the purpose for which it is built. This gives great latitude for new designs, improvements in the science of shipbuilding and individual style. To take an example: the contract between the builder and the owner may specify the size and spacing of the frames in the hull. The Classification Society's Rules give acceptable ranges for the section modulus derived from those frames; but, leaves the choice of framing to the shipyard designer and owner. Common contractual provision on such matters as vibration, noise levels, speed, or fuel consumption do not fall within the Classification Society's purview unless they represent a hazard to the vessel.
3) "Inspection" is the responsibility and function of the builder's quality control arrangements.
4) "Surveying" is a free and random access to all portions of the builder's facilities. The Rules require specific attendance of a Surveyor at some construction activities such as tank testing. However, the overall responsibility belongs to the builder. The Surveyors check the builder's arrangements.
5) "A Survey" is an examination of a piece of equipment, representative features of the equipment, or a vessel in accordance with the appropriate Rules, Guides, standards, other criteria of ABS, or in accordance with the specific standards. The examination may be pursuant to Classification, certification, or requested as a result of damage sustained by the piece of equipment or vessel.
6) The primary function of the Surveyors is to determine and report on the fitness for service relative to the applicable ABS Rules for the particular vessel. Other functions of ABS Surveyors are to survey vessel for compliance with statutory requirements on behalf of the cognizant government administrations and to issue the relevant certifications including those for Safety of Life at Sea (SOLAS), Load Line, Tonnage, and Pollution Prevention.

2.2 Why Class your Vessel?

Historically, the main purpose of Classification is the issuance of insurance. The idea of Classification Societies started in the mid 18th century when individuals serving as underwriters became increasingly concerned about continued losses they suffered because of poorly equipped and maintained ships. So at this time the underwriters formed a group of knowledgeable individuals with maritime backgrounds to judge the seaworthiness of merchant ships. This group established an elemental rating system to serve as a basis for decisions on whether or not to extend insurance coverage to the ships and their cargoes.

Today insurance is only one of several reasons to Class your vessel. The research, development, and investigations carried our by the classification societies offer the shipbuilding industry a service which is probably unsurpassed. For vessels that are over 500 gross tons, it is part of international maritime law that the vessel maintain a class certificate. For vessels that are under 500 gross tons, Class may not be needed to operate your vessel, but for most vessels over 79' in length they will require an International Loadline Certificate (ILC).

In addition to the benefits of reduced insurance rates, the owner of the vessel will have another arm to their own maintenance and refurbishment programs. With our annual Surveys, drydocking surveys, and special periodical Surveys a vessel owner is assured to have a vessel that is properly maintained to the highest standards.

In today's climate of heavy litigation, Classification is considered to be the highest level of safety available for a vessel.

With the research and development work done and investigations carried out by a Classification Society by Classing your vessel you are contributing to the overall safety and advances in the shipbuilding industry.

2.3 The 1997 Rules for Building and Classing Steel Vessel under 90m in Length

In the mid 1960's the first generation of supply vessels emerged to deliver pipe and fluids to the fixed platforms in 20-150 ft coastal waters. As these vessels became more prevalent ABS recognized the need to develop a Rule book that was designed specifically for these type of vessels, and in 1973 we published our first Rules for Building and Classing Steel Vessels under 200' in Length.

In the mid 1970's the offshore supply vessels began to grow and develop into a type of tow/supply vessels, with the capability to tow jackups into deeper waters. These vessels started to feature towing bitts and the use of nozzles type propellers. Then, with the oil boom in the early 1980's, the supply vessels continued to grow and operate worldwide. Their role also expanded to involve the towing and anchoring of large floating semisubmersible exploration and production platforms. ABS recognized this trend and realized that there was a need to update our Rules. In 1983 we published our second edition of the Rules for Building and Classing Steel Vessels under 200' in Length. When the oil industry went bust between the years of 1984-1990, the number of new construction supply vessels dropped off dramatically.

During the 1990's, the oil industry recovered and the length of offshore supply vessels steadily increased in size to typical lengths of 200' - 250'. Several issues relating to class, service, and safety aspects had to be revisited. The new supply vessels are designed to support all types of offshore installations. In response to this ever-growing group of vessels and industries' concern that the Steel Vessel Rules were too restrictive, the ABS published the "Rules for Building and Classing Steel Vessels Under 90 meters (295 ft) in Length" in 1997. The development of this rule was started at the request of industry and the resulting effort was a smoothing out of the discontinuities between the Steel Vessel Rules and the Small Vessel Rules. Another of the major reasons for the introduction of the 90 meter Rules was to bring the small vessel Rules in line with similar rules of other IACS members. As can be expected, this has led to a few oversights and/or complaints from the industry, including well-established builders with highly qualified technical staff. In the case of vessels built to operate solely for restricted service in domestic waters, some of the class and safety requirements will be replaced with national regulations. Tugboats, towboats, launches, fire fighting, oil recovery, and safety standby vessels have also been a part of the evolution of the small vessel rules. Many of these types of vessels have special requirements for them in Part 5 of the 90 meter Rules. These vessels have also seen a natural progression in sizes and features. Most tug perform multiple operations such as towing, fire fighting, and oil recovery .

2.4 ABS Reviews on Behalf of the USCG

2.4.1 NVIC 10-82

To improve efficiency of plan review and inspection of classed vessels, the USCG, through a memorandum of understanding, will accept ABS plan review and inspection for compliance with USCG rules for most classed vessels. Under this program, plan review and inspection will be conducted by ABS for most of the plans. However, under the 10-82 program certain plans and inspections are still retained by USCG, as outlined in NVIC 10-82.

2.4.2 NVIC 10-92

NVIC 10-92, Change 1 identifies ABS stamped plans as stamped by a Professional Engineer (PE). This allows ABS to conduct plan review on behalf of the USCG for items typically retained by the USCG. This is particularly helpful for uninspected vessels which require international certificates. Once plans are reviewed by ABS, the plans are sent to the USCG - MSC for their oversight review.

The MSC at its discretion may conduct full, partial, or no oversight review of any or all documents submitted under the provision of NVIC 10-92. The level of plan review oversight conducted will be determined by the Commanding Officer, MSC, similar to that of the NVIC 10-82 and ACP Programs.

2.4.3 Alternative Compliance Program (ACP)

In the early 1990s, the USCG set out to enhance the position of US maritime industry in the highly competitive global market through:

1. elimination of unnecessarily duplicative regulations
2. increased acceptance of international and third party standards determined to provide a level of safety and environmental protection equivalent to current Coast guard regulations

Thus reducing the overall cost associated with the construction of an U.S. flagged vessel.

A joint task force of ABS and USCG compared the requirements in the CFR's with ABS Rules, 1974 SOLAS and MARPOL. After identifying redundancies it was determined that many of the CFR requirements were satisfied by compliance with ABS Rules, SOLAS and MARPOL. They developed a supplement to ABS Rules, which addressed those areas in which current Coast Guard requirements were not included in either ABS Rules or applicable international conventions. USCG concluded that the design requirements and survey provisions of ABS Rules and applicable international codes and convention regulations, in conjunction with this US supplement, provided a level of safety and environmental protection equivalent to corresponding federal regulations which govern the inspection of US vessels. The result was the publication of "U.S Supplement to ABS Rules for Steel Vessels for Vessels on International

As a result of the success of the ACP for large vessels, industry demand, and the publishing of the 90 m Rules, a new supplement was issued to cover vessels under 90 m on international voyages. Under this program, the Bureau is authorized to act as agents of the USCG to review plans and conduct surveys on behalf of the USCG. Unlike the NVIC 10-82 program, for vessels enrolled in the ACP program (under NVIC 2-95) ABS will be responsible for issuing all relevant documents to support the issuance of a full-term USCG Certificate of Inspection including the following:

SOLAS Cargo Ship Safety Construction Certificate
SOLAS Cargo Ship Safety Equipment Certificate.
SOLAS Certificate of Fitness for the Carriage of dangerous Chemicals in Bulk
MARPOL 73/78 International Oil Pollution Prevention Certificates
MARPOL 73/78 International Oil Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk.

The USCG still retains some aspects of vessel inspection activities like manning. For cargo vessels, currently this program is limited to vessels of length greater than 150 ft on international voyages and in addition are subject to the following conditions:

Over 500 GRT (ITC)
SOLAS and MARPOL certificates are to be issued
Electrical plants have an aggregate capacity of 75 KW or greater
Automation notation +ACCU is to be assigned

Presently, it should also be noted that this program covers cargo, tank, miscellaneous, MODU's and passenger vessels.

2.5 National Requirements (USCG) and International Requirements

2.5.1 Subchapter I and Subchapter C

The most general of all the US Coast Guard Rules are Subchapter I and Subchapter C. Subchapter C governs all of the uninspected vessels and Subchapter I governs all of the inspected cargo and miscellaneous vessels. The USCG has defined the break point between an inspected and uninspected vessel at 300 US Regulatory Gross Tons. The underlying assumption of the choice of tonnage is that a vessel over 300 GT regulatory will most likely be on an international voyage and thus meet SOLAS requirements. Also note that the majority of these vessels are tugs or other special service vessels since Subchapter L covers the Offshore Supply Vessels. The problem with the 300 GT regulatory break point is that it is possible for a tug to be over 500 GT ITC tonnage and be less than 300 GT Regulatory. As the USCG does not inspect vessels of this size, in the past ABS has conducted plan review on behalf of the USCG under NVIC 10-92 , Change 1 so that the vessels could receive it's SLC, SLE, IOPP, and IOPP NLS Certificates. In light of the recent success of the ACP program, ABS and the USCG are currently revisiting this issue to determine if plan review under NVIC 10-92 is even required.

2.5.2 Subchapter L

After evaluating Rules existing in the early 1990s, the USCG set out to eliminate requirements that create an unwarranted differential between domestic rules and corresponding responsible international standards. In 1997, USCG introduced Sub Chapter L of 46 CFR specifically for OSVs. The most significant aspect of this sub chapter being the consolidation of requirements applicable for OSVs. Prior to implementation of these regulations, existing OSVs had been inspected and certified under a number of regulations depending on their age and tonnage, such as Subchapter I(cargo & miscellaneous vessels) or Subchapter T(small passenger vessels). This led to uncertainty and inconsistency. Implementation of a new subchapter L removed this uncertainty and inconsistency by consolidating existing standards and policy into a single subchapter. Many of the requirements are similar to corresponding requirements in subchapters I and T. Subchapter L became effective in March 1996. Sub Chapter L regulations are stated to contain requirements NOT in excess of international standards. A major point is the inclusion of damage stability requirements for OSVs to bring it in line with IMO Resolution A469. Presently, the ABS Rules are indirectly written in Sub Ch L in that USCG will accept hull structures which comply with ABS Rules as proof that the hull is acceptable to the USCG (127.210).

2.5.3 Other Nations Requirements

ABS has relationships with many governments all over the world. Many governments have given ABS either complete or partial authority to issue a wide range of certificates on their behalf. The list of countries and certificates that we can issue are indicated in Annex 1.

2.5.4 SOLAS

The requirements of the Safety of Life at Sea Convention 1974, as amended (SOLAS) are required for all ocean going vessels that travel on an international route and are over 500 ITC tons. The only exemptions for this are pleasure vessels and military vessels. The requirements in SOLAS are in the tradition of designing, building, operating, and assessing seaworthiness. These vessels are to be constructed of steel and be self-sustaining with all necessary emergency equipment being carried on board.

2.6 Special Service Notations

ABS offers various optional notations for work boats. The requirements of the following systems can be found in Part 5 of the 1997 90 meter Rules. An example of such optional notations would be A1 Offshore Support Vessel AMS FFV1. A list of some of the optional notations is shown below:

- Dynamic Positioning System (DPS) – Classification of vessel's ability to maintain position up to a maximum sea condition.
- Towing – Classification of the vessel's structural adequacy for towing service. The following are further options to the Towing vessel notation:
  - QR – Quick Release: A remotely operable quick release device is provided for the towing hook or towing winch.
  - Bollard Pull test results may also be indicated in the Record

- Fire Fighting Vessel (FFV) Class 1 through Class 3 – Classification of the off-ship fire fighting capability and shipboard protection systems.
- Offshore Support Vessel – Classification of the systems intended to support offshore operations. The following are further options to the Offshore Support Vessel notation:
  - AH – Anchor Handling.
  - WS – Well Stimulation.
- Oil Recovery Vessel (ORV) Class 1 or Class 2 – Classification of the oil recovery systems.
- Safety Standby Service – Classification of a vessel intended for the evacuation and reception of personnel from either an offshore installation or from another vessel or from the sea.
- Automation – Classification of the degree of automation of the machinery spaces
- Propulsion Redundancy – Classification of the ability of the vessel to maintain propulsion and steering with any single fault or loss of propulsion machinery space.

2.6.1 Dynamic Positioning Systems

DP systems are installed on Offshore Supply Vessels for a number of reasons.

- Remotely Operated Vehicle (ROV) support
- Well stimulation operations
- Pipe & cable laying
- Anchor handling and placement
- Diving Support
- Research

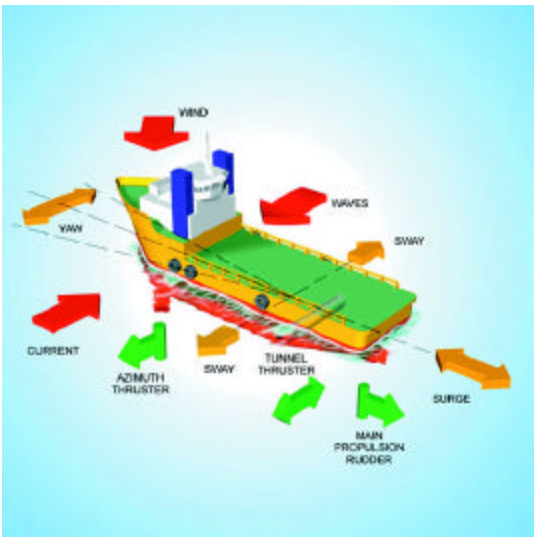

Figure 1: Courtesy of Kongsberg Simrad

Dynamic Positioning Systems work by measuring wind, wave, and current conditions and automatically adjusting the amount and direction of thrust to maintain the vessel's position (see Figure 1). The ability to maintain position is only good up to the specified Maximum Environmental Conditions which are defined by the vessel's owners and the shipyard, not ABS. Typically, these conditions are dictated by the vessel's design and ABS only verifies that the calculations and data submitted are accurate for the vessel.

ABS classification of the DP System covers all the major components from the control system to the prime movers and thrusters. Classification involves engineering design review of all components as well as construction, testing, and installation of the components under ABS survey. Such an installation is noted in the record with a Maltese Cross (i.e. DPS-2). When any one, or all, of the components are not constructed under ABS Survey, the Maltese cross is omitted from the class notation (i.e. DPS-2).

ABS offers four levels of classification for DP Systems, ✠DPS-0 through ✠DPS-3. The differences in the requirements between the systems are too numerous to list. Specific requirements can currently be found in the 1994 Guide for Thrusters and Dynamic Positioning Systems and in the soon to be released Machinery 2000 Rules. A summary of the requirements for each DPS notation is shown below.

- ✠DPS-0: Vessels fitted with a dynamic positioning system with centralized manual position control and automatic heading control to maintain the position and heading under the specified maximum environmental conditions.

- ✠DPS-1: Vessels fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel under specified maximum environmental conditions having an independent centralized manual position control with automatic heading control.

- ✠DPS-2: Vessels fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel with a specified operating envelope under specified maximum environmental conditions and following and single fault excluding a loss of compartment or compartments

- ✠DPS-3: Vessels fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel with a specified operating envelope under specified maximum environmental conditions and following and single fault including complete loss of a compartment due to fire or flood. Note: Due to the single engine room design of most supply vessels, the DPS-3 notation can not be obtained.

2.6.2 Towing Service Vessels

This notation applies to tug boats and offshore supply vessels intended for unrestricted towing services. The requirements for Towing Service are primarily for structures and stability. This section requires the submission and review of the following items:

1) Structural details and arrangements of the structures in ways of the towing hook, towing winch, or towing bollards, or bitts, towing guide rollers and fairleads.
2) Details of connections such as the hold down bolts and welds for towing hook or towing winch.
3) Braking power of winch
4) Static bollard pull, together with the method of prediction.
5) The minimum specified breaking strength of towline.
6) Stability data and calculations.

In addition to receiving the towing service notation the vessel can also receive Quick Release Notation that signifies that a remotely controlled quick release device is provided for the towing hook or towing winch. Another option for a vessel receiving the towing vessel notation would be to publish the bollard pull in column 5 of the record. To do this, the static bollard pull would have to be determined by an approved bollard pull test in the presence of a Surveyor.

2.6.3 Fire Fighting Classed Vessels

Fire Fighting Vessel Classification certify the vessel's off-ship fire fighting capabilities, the vessel's stability, the ability to maintain station while the fire monitors are in operation, and the degree of fire protection to protect the vessel itself. Fire fighting class notation is broken down into three classes, Class 1, Class 2, and Class 3. The basic requirements for each class of fire fighting vessel are listed in Table 1. All components associated with the fire fighting systems are design reviewed, constructed, installed, and tested under ABS Survey.

Table 1 Basic Requirements for Fire Fighting Class Vessels

Class Notation	Class 1	Class 2	Class 3
Number of Water monitors	2	3 or 4	4
Discharge rate per monitor (gpm)	5280	10560 or 7920	10560
Number of Pumps	1-2	2-4	2-4
Total Capacity (gpm)	10560	31680	44240
Monitor Range [1] (ft)	394	492	492
Height, Monitor [2] (ft)	148	230	230

Number of hose connections each side of the vessel	4	8	10
Number of fireman's outfits	4	8	10
Fuel Oil Capacity [3] (hours)	24	96	96
Fixed Water-Spray System	Required	N/A	N/A
Foam Generators	N/A	Required	Required
Foam Monitor	N/A	N/A	Required
Air compressors for air bottles (SCBA)	Required	Required	Required

Notes:
1 Range: Measured horizontally from the monitor outlet to the mean impact area
2 Height: Minimum height of the trajectory of the water monitor jet measured vertically from sea level assuming a mean impact area located at a horizontal distance not less than 230 feet from the nearest part of the fire fighting vessel
3 Fuel oil capacity is to include provisions for continuous operation of all monitors in addition to the total capacity of the vessel's fuel oil tanks required for continuous fire fighting operations.

2.6.4 Offshore Support Vessels

The Offshore Support Vessel optional notation is assigned to vessels primarily engaged in the transport of stores, materials, and equipment to offshore installations. Included in this notation are specific requirements for liquid cargo systems, dry bulk systems, side shell, frames, stability (intact and damage) and cargo decks. Furthermore, additional Offshore Support Vessel notations for anchor handling equipment (AH) and well stimulation systems (WS) can be added (i.e. A1 AH/Offshore Support Vessel AMS).

2.6.5 Oil Recovery Vessels

The Oil Recovery Vessel optional notation is broken into two classes. Class 1 notation is assigned to vessels intended to recover oil of unknown flash point and Class 2 notation is assigned to vessels intended to recover oil with a flash point exceeding 140°F (60°C). ABS requirements are designed to prevent the ignition of oil vapors while recovering and transporting recovered oil as well as protect the vessel and crew.

2.6.6 Safety Standby Service

Safety Standby Service vessels are vessels which are classed for unrestricted ocean service which have been adapted and have special features for evacuation and reception of personnel from an offshore installation and the rescue and care of persons from another vessel or from the sea. ABS requires vessels receiving this notation to be able to operate and rescue people in winds up to condition 8 on the Beaufort scale (34 – 40 knots), a minimum sea state of 8 (wave heights of 29.5 – 45.5 ft), and be capable of travelling at least 12 knots trial speed in calm seas. Vessels must also carry a SOLAS approved rescue boat, crane, and specific radio communication and navigation equipment as well has have accommodations for survivors and medical stores onboard. Also entered in the vessel's record is the number of survivors for which the vessel is capable of rescuing.

2.6.7 Automation Notation

2.6.7.1 Optional Notations

ABS offers ACCU or ABCU notations for the automation of unattended machinery spaces. Section 4/11 of the rules contain requirements for the basic automation requirements for all vessels and the requirements for the optional notations. The differences between the notations are listed below.

ACCU – Vessels having the means to control and monitor the propulsion machinery and propulsion-machinery space from the navigating bridge and from a centralized control and monitoring station installed within or adjacent to a periodically unattended propulsion-machinery space.

ABCU – Vessels capable of operating as ACCU classed vessels but because of their compact propulsion-machinery space design are not fitted with the means to control the propulsion and it's associated machinery from a centralized location within the propulsion-machinery space.

2.6.7.2 Vessels with periodically unattended machinery spaces not receiving an optional notation

The basic automation requirements for all vessels are based on having a manned machinery space at all times. Vessels having periodically unattended machinery space and opting to not receive an optional automation notation are subject to special consideration on a case by case basis. SOLAS contains requirements for periodically unattended machinery spaces, however, ABS rules in this matter require some clarification. Typically vessels of this type are required to meet the basic requirements for alarm points and select rules from the requirements for
already provided in the automation packages provided by the various venders and only minor changes or additions are necessary.

2.6.8 Propulsion Redundancy

One of the newer and lesser known optional notations is for propulsion redundancy. Requirements can be found in the June 1997 Guide for Propulsion Redundancy. The objective of propulsion redundancy is to reduce the risk to personnel, the vessel, other vessels or structures, the environment, the economic consequences due to a single failure causing loss of propulsion or steering capability. The overall requirements can be broken into two categories, redundancy for any single fault and redundancy for the loss of any one machinery compartment due to fire or flood. Requirements for degrees of redundancy cover main propulsion, steering, all associated auxiliaries, main electrical systems, and control systems. It should also be noted that some flag administrations may not require an emergency generator if the appropriate level of redundancy is provided.

3 SOLAS Ready vs. Domestic Service Notation

With the recent boom in the Gulf of Mexico oil, shipyards and owners began to class new Offshore Supply Vessels with a U.S. Domestic Service notation, which many shipyards sold as "SOLAS ready." The U.S. Domestic Service notation allowed the shipyards to save money and expedite delivery of the vessel in order to meet the owner's demands. In theory this was a good idea, however, the definition of "SO
varied from shipyard to shipyard. As far as ABS was concerned, SOLAS was not used for any part of the review and the US Coast Guard standards for Domestic Service were applied for US flagged vessels. Furthermore, some owners were under the perception that in order to receive their SOLAS certificates, all that was required was to install an emergency generator. In reality, this was not the case.

As work in the Gulf of Mexico slowed and contracts became available overseas, vessel owners began converting their vessels to unrestricted service. Many found out that "SOLAS Ready" meant more than the addition of an emergency generator and that substantial modifications were required. Modifications typically involve major modifications to the vessel's structural fire protection arrangements, fire main system, and lifesaving appliances in order to meet SOLAS. US Domestic Service vessels undergoing the conversion to Unrestricted Service must submit plans to ABS and the USCG for full compliance with SOLAS requirements. Below is a partial list of the drawings required to be submitted:

	Drawing	Plans submitted to:
1)	Structural fire protection	ABS (NVIC 10-82) or USCG
2)	Heating, ventilation and air conditioning (HVAC)	ABS (NVIC 10-82) or USCG
3)	Summary of openings	ABS (NVIC 10-82) or USCG
4)	Fire control plan	ABS and USCG
5)	Joiner work details	ABS and USCG
6)	Electrical one line	ABS and USCG
7)	Emergency switchboard	ABS and USCG
8)	Firemain arrangements	ABS and USCG
9)	Fire Detection and Alarm system	ABS and USCG

4 Offshore Supply Vessels

One of the well established and universally accepted definition of offshore supply vessel (OSV) is from IMO : "a vessel which is primarily engaged in the transport of stores, materials and equipment to offshore installations; and which is designed with accommodation and bridge erections in the forward part of the vessel and an exposed cargo deck in the after part for handling of cargo at sea". Conventional OSVs have traditionally provided a wide range of supply & support services to offshore industries extracting oil and minerals from the sea. Although, they historically operated almost exclusively in the Gulf of Mexico, they now operate worldwide.

4.1 Market Trends

During the early 1990's the OSV fleet made a jump in vessel length with the smallest of OSV being constructed today are 180' and the largest extending up to 285'. We see the major trend in the industry is not necessarily in the increase of vessel size, but in the capabilities and areas of operation of the vessels. With the domestic day rates dropping off dramatically in 1998 and the international day rates remaining steady, the need for an OSV to operate worldwide increased. Industry experts do not see an end to this trend in the next year. Therefore, the trend to build large numbers of "SOLAS Ready" vessels will not be seen again until the day rates in the Gulf pick-up again, and it will be up to the industry to determine if building a vessel that cannot operate globally is a good economic decision.

With the need for vessels to operate world wide and the domestic day rates at almost 50% of what they were a year ago the utilization rate also began to fall. The current utilization rate is around 70%. This has caused many operators to begin laying-up their vessels. Some operators have chosen to "hot stack" their vessels or a partial lay-up of a vessel with the ability to get back on-line very quickly. This indicates that if there is an increase in the Gulf day rates, many owners will be able to bring existing vessels on-line rapidly as opposed to start a new construction program.

The new construction OSV's will continue to be built for global applications. Additionally, vessels will be built for a multitude of assignments. The current newbuild OSV will be able to shift from job to job without having to go to the shipyard for modification. There will be two major types of OSV's with the first type being the 205' design. These vessels will be able to operate in deep, mid-range, and shallow waters, and will have the ability to tow, carry cargo, and light anchor handling. The second type of vessel will be the 240' or greater designs. These vessels will be almost exclusively for the deepwater platforms. They will have increased towing capabilities, larger cargo capacity, and major anchor handling functions. With the larger tonnage capacities of this generation of OSV's they will not be replacing existing OSV's on a one to one ratio. Based on the tonnage of the newer OSV's, a new OSV will be able to replace approximately one and a half existing OSV's.

In regards to the future trends for regulations we see the development of a "safety culture" as opposed to an increase in perscriptive regulations. With the current method of regulation we see three major shortcomings:

1) The regulatory process has been reactive. Each time there is a costly mishap, the regulatory process responds by redesigning the vessels so as to make it difficult for humans to recreate the previous mishap. We cannot continue to offset the human factor in the marine safety equation by redesigning the vessel.
2) The marine industry has been segmented into a regulatory compliance spectrum, with the safety conscious on one end and the rule beaters at the opposite end. We have reached the point where adding more regulation in order to bring the compliance avoiders into the acceptable range only adds further burden to the safety conscious. Each time new regulations are added the rule beaters gain added economic advantage over the safety conscious. This new approach to safety will specifically target the rule beaters.
3) Some of the most famous marine mishaps have occurred to relatively new vessels rather than the substandard vessels. Some of these mishaps have occurred to owners that industry would clearly place in the safety conscious end of the spectrum and to crews that have been well trained and well qualified by long experience. This new approach to safety will address this anomaly.

The basis for this safety culture will not involve the creation of a large number of new regulations, it will be based on proven safety and quality standards. ABS believes that the basis for the culture will fall within the following standards:

1) The ISM Code.
2) The Standards for Training, Certification, and Watchkeeping.
3) The ISO 9000 Quality Management Standard.
4) The ISO 14000 Environmental Management Standard.

4.2 Hull Issues for OSV's

1. Longitudinal strength check expanded to account for vessels of increased length. For vessels of length more than 200 ft, a still water bending moment calculation is required which will be used in calculating the hull girder bending and shear stresses based on the loaded, transitional and ballast conditions anticipated for the vessel while in service.
2. Cookbook type scantling check for rudders replaced by detailed and more accurate calculations based on the bending moment and torque of the individual rudders as a function of the vessel speed and rudder angle.
3. Windows & portlights requirements which have now been incorporated to make it consistent with international standards (ISO5779, BSMA 24 & BSMA 25). Rubber framed windows will not be accepted except on individual basis for side and aft bulkheads of higher tiers and only in conjunction with metal clips. Even though the requirement for windows, frames and glazing have been incorporated into the Rules, we would like to bring to the attention of the builders and operators that these requirements essentially stem from International Load Line Regulations and are beyond the Bureau's control.
4. Vessels over 500 GRT are required to have a double bottom between the peaks. While it is noted that single bottom construction for OSVs are rapidly reducing, it must be pointed out that owners whose vessels get an exception or exemption from this requirement by USCG will have to produce documentary evidence of concurrence from the new administration if and when they change Flag.
5. ABS rules do require engine room to be enclosed by watertight bulkheads to the weather deck. For vessels over 500 GRT(ITC), SOLAS requires machinery spaces to be separated from cargo spaces. By opening up the engine room to the dry bulk compartment and calling the combined space as "engine room", the time required for safe egress by the engine crew is certainly increased in that longer distances need to be covered before escaping to sheltered spaces above deck or the open deck. The short delay between warning and actual release of CO2 in the space further compound this.
6. A new development is the requirement of a loading manual for vessels of length greater than 213 feet and contracted after 1 July 1998.
7. For vessels on unrestricted service with length greater than 262.5 ft, doors on W.T bulkheads below deck will require to be sliding type.

4.3 Machinery Issues for OSV's

1. The International Association of Classification Societies (IACS) has developed interpretations of SOLAS requirements which are reflected in ABS Rules. Many of these interpretations are more stringent than the literal translation SOLAS and can create a conflict between the Flag Administration's requirements (agency issuing the SOLAS Certificates) and ABS rules (issuing Class Certificates). This potential conflict is resolved by Section 4/9.1.2 of the 90 meter Rules which allows consideration of the flag administration requirements in lieu of ABS rule requirements. However, where ABS is authorized to issue the SOLAS certificates on behalf of the Flag Administration, IACS and ABS requirements are strictly applied. For example, Chapter II-2, Regulation 4/3.3 of SOLAS require that cargo vessels over 2000GT separate their fire pumps and fire main piping such that a casualty in any one space containing a fire pump will not render the remaining fire pump and firemain unable to fight fires. IACS on the other hand draws the line for cargo vessels at 500GT, which is reflected in Section 4/9.15 of the 90 meter Rules.
2. Fire Control Plans required by Section 4/9.1.7 of the 90 meter Rules are typically submitted at the end of vessel construction and are many times incomplete and inaccurate. This can potentially cause delays in the delivery of the vessel. Note that the exact locations of fire fighting/detection appliances,

emergency shutdown controls, access locations to critical spaces, and the location and type of fire retarding bulkheads is required to be specified in the plans. Plans are to be accurate and be conspicuously posted in the vessel for the guidance of the crew.

3. Separation of main and emergency electrical and control systems is another item which is commonly overlooked. Various sections of ABS rules require that emergency systems be routed clear of Category A machinery spaces and high fire risk areas. Furthermore, main and emergency feeders are to be separated throughout their length as far as practical. ABS Surveyors have noted that in some installations, main and emergency feeders pass though the same bulkhead / deck penetration rather than be run through separate penetrations such that a single fault could not sever both feeders.
4. Flexible hoses for oil service is another item for which ABS and USCG requirements differ. The USCG currently and ABS prior to 1996 accepted SAE J-1942 flexible hoses for use in oil service. In 1996 the Steel Vessel Rules were revised, and subsequently incorporated into the 90 meter Rules, to include an IACS unified interpretation of the definition of a fire resistant hose. Such hoses are required to meet a 30 minute flame test as opposed to the 2 ½ minute flame test required by SAE J-1942. Currently hose manufacturers are retesting their hoses in order to meet ABS requirements in Section 4/6.7.11 of the 90 meter Rules.

4.4 Structural Fire Protection and SOLAS Issues for OSV's

Three years ago ABS sponsored a SOLAS workshop for anyone interested in learning Structural Fire Protection and SOLAS requirements. From this two day workshop a SOLAS Workshop Guide was published for industry use. It is the intention of these guidelines to help industry with areas that are commonly under debate and interpretation.

ABS is authorized to issue the Cargo Ship Safety Construction Certificates (SLC) on behalf of the USCG under NVIC 10-82 or the ACP program. The governing documents for structural fire protection on this type of designation are the ABS 90 Meter Rules, SOLAS Consolidated Edition 1997, IMO Resolutions, and NVIC 9-97. A helpful reference among the many IMO resolutions is "Interpretations of Vague Expressions and other Vague Wording in SOLAS Chapter II-2". The 1996 SOLAS Amendments contain some major changes that affect vessels with keels laid after 1 July 1998, one is that the provision of the International Code for Application of Fire Test Procedures (FTP Code) becomes mandatory under the Convention.

Some areas of concern and areas that can be overlooked regarding a SOLAS review are as follows:

1) Aluminum floors plates
2) Separation of Category A machinery space and cargo space
3) Means of escape
4) Protection of escape from engine room by fire shelter
5) Ventilation systems, in particular those serving galley
6) Electrical and piping penetrations through fire rated bulkheads
7) Galley exhaust ducting
8) Method (IC, IIC, or IIIC) of Construction

4.5 Vessels carrying Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk

Recently, ABS has seen an increase in Well Stimulation Vessels. Several vessels have opted not to receive the Offshore Support Vessel optional notation, but are still required to comply with Section 5/10.13 of the 90 meter Rules. This section states the such vessels are required to comply with IMO Resolution A.673 (16), "Guidelines for the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk in Offshore Support Vessels."

5 Conclusions

ABS recognizes that building and operating a vessel in today's climate of regulation can be a daunting task. We have attempted to outline the various regulations that face the shipbuilder today, and give a perspective of how ABS perceives the trends in our industry. Over the years ABS has partnered with industry to keep classification costs low and attempt to remove redundant inspections by way of the programs such as ACP. We have created software programs (such as spreadsheets) for our scantlings to ensure that industry uses the same tools as the plan review engineers. In order to inform industry in what ABS is seeking, we have openly exchanged information such as list of outstanding items, typical machinery comments, and SOLAS interpretations. ABS firmly believes that service is an intangible measured in things like trust, integrity, and commitment.