UNIVERSITY - NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

RESEARCH VESSEL SAFETY STANDARDS

Revised March 2003

University-National Oceanographic Laboratory System

UNOLS RVSS - Eighth Edition – March 2003

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This edition of the Research Vessel Safety Standards is dedicated to Tex Treadwell, in appreciation for all of his work with UNOLS and in particular for his promotion of these standards for the academic research fleet.

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The RVOC Safety Committee would also like to thank Laura Dippold of the UNOLS office for her support during the revision and publishing of this edition of the RVSS.

PREFACE

The research vessel safety standards were first adopted by UNOLS Member Institutions in May 1976. Later editions were adopted by members at UNOLS meetings in May 1981, May 1985, October 1989, September 1992, October 1995, and July 1999. This eighth edition was adopted by the UNOLS Council in March 2003. In lieu of published institutional policy, these safety standards are considered the guidelines for UNOLS Research Vessels. For that reason, all UNOLS Members, both Operators and others, should be thoroughly familiar with the contents of this manual and comply with its recommendations as appropriate.

Changes made since last revision (July 1999):

Chapter 5 has been updated to reflect current CFR, GMDSS, and SOLAS regulations. It appears that most of the information still stands.

Chapter 7 has had minor updates and changes in language to CFR references and some subchapters. Addition of two subchapters: Self Contained Breathing Apparatus and Fire Control Plans. Major edits to subchapter 7.7 Additional Protection and 7.13 Emergency Escape Breathing Device.

Chapter 8 has been renamed to reflect the variety of Lifesaving Equipment and Appliances that are now in use. Requirements for Commercial Fishing Industry Vessels were used to update this chapter (specifically Subchapter W Lifesaving Appliances and Subchapter C Uninspected Vessels, part 28). Subchapters were added with a section addressing Muster List and Emergency Instructions and section on Training and Drills (also referenced in Chapter 15 Operations). One section on Hard Hats was deleted. This is an item of Personal Protective Equipment, the Safety Committee agreed to remove it. Finally, the section for Self Contained Breathing Apparatus was moved to Chapter 7 Firefighting.

Chapter 9 had minor changes in language and updates on Storage Containers, Cruise Planning, and Chemical Spill Response. Subchapters 9.3 Inventory List has been integrated into subchapter 9.1 Cruise Planning.

Chapter 10 had only minor revisions, paragraphs 10.5 and 10.8 have been modified.

Chapter 11 had only minor editorial changes.

Chapter 12 had minor changes in language.

Chapter 13 has been updated to reflect current CFR, GMDSS, and SOLAS regulations. It appears that most of the information still stands. Chapter 13 had some minor changes mainly to reflect that GMDSS is now mandatory for all ships subject to SOLAS and that licensed radio operators are no longer required. In 13.7 Survival Craft Radios 46 CFR 192.55 & .65 were referenced and were unable to be found because 192 is reserved.

Chapter 14 was updated with the addition of subchapter 14.1 Manning-Crew and Standards of Training and Certification of Watchkeepers (STCW). Subchapter 14.2 Manning-Scientific Personnel has also been revised.

RESEARCH VESSEL SAFETY STANDARDS

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1. INTRODUCTION

These safety standards provide guidelines for the operation of oceanographic research vessels owned, operated or chartered by Members of the University-National Oceanographic Laboratory System (UNOLS), to assure that research at sea is conducted to the highest practicable standards of safety and prudence. Each Member is encouraged to comply with them as applicable to all ships and boats under his or her control. The operators of other research vessels are invited to make use of them as well.

These standards are based in major part on applicable laws and regulations. In addition and where appropriate, they supplement, extend, and assist in the interpretation of the legal requirements. Nothing herein is intended to conflict with the legal standards, but rather to encourage and assist the operator to not only meet, but to go beyond the legal minimums, as may be desirable and practicable. It is recognized that the wide variety of vessel types and sizes, and their diverse operational usage, will necessarily lead to many discretionary interpretations. In such cases, a common-sense application of the principles of good seamanship and sound marine engineering practice will be more effective than attempting to cover all conceivable cases. The absence of a law, regulation or standard covering any particular matter should not be regarded as necessarily lessening the importance of it.

Assistance to operating institutions by providing reference materials, and interpreting the laws, regulations and standards is available through the UNOLS Research Vessel Operators' Committee (RVOC). The RVOC has published a Safety Training Manual as a companion to these standards to serve as a more detailed reference for the safe operation of research vessels. Operators are encouraged to make this manual and its supplements available to their crews and to scientific parties.

Operators are reminded that in addition to the legal responsibilities and liabilities associated with Federal laws and regulations, and maritime law, safe operation is one of the factors used by Federal science sponsors in evaluating the merit of a ship as a research platform.

These standards do not apply to research submersibles, which are covered by a different, and detailed, set of regulations.

Recognizing that research vessels and ocean research in general should be in the forefront of contributing to maritime safety, research vessels should take every opportunity to participate in innovative research, procedures, and equipment operation evaluations which would enhance the practice of safety at sea.

Institutions are strongly encouraged to make available "Cruise Handbooks" or "User Manuals" incorporating important parts of these standards, plus additional information on their particular ships and any pertinent institutional regulations or procedures. These have been found to be extremely useful both to the scientists and the ship's crew.

This document deals solely with safety standards for craft engaged in oceanographic or limnological research, or related instruction. To avoid constant repetition of the adjective "research," it is to be understood to apply throughout to the terms "ship," "vessel," "boat," "motorboat," etc., unless some other sense is specified.

2. PROCEDURES

2.0 SCOPE

These safety standards are not intended to cover all possible cases, but only those where there is a clear-cut, widespread need for guidance, or to fill a gap not covered by laws and regulations.

2.1 PROPOSED STANDARDS

Draft standards, or a statement of the need may be proposed by any UNOLS Member, or any other person or group having an interest in the safe operation of academic research vessels. Proposed standards will be referred to the RVOC, which will establish a Safety Committee to review them and make recommendations for action.

2.2 ADOPTION

Standards approved by the RVOC will be transmitted to the UNOLS Council for consideration and possible adoption under the terms of the UNOLS charter.

2.3 APPLICABILITY

Use of these standards by UNOLS Members shall be as provided for under the terms of the UNOLS charter.

2.4 REFERENCE MATERIAL

The UNOLS Office will maintain and provide to Members pertinent reference materials, circulars, and other information. The RVOC will provide assistance in interpretation of laws, regulations, and these standards, and suggest assistance in areas not covered herein.

2.5 CHANGES TO RESEARCH VESSEL SAFETY STANDARDS MANUAL

Changes to laws, rules, or regulations, which affect or supplement these standards shall be brought to the attention of the member institutions by the RVOC. Periodically, not later than every three years, the RVOC Safety Standards Committee shall review the safety standards to ensure that these standards are current and complete. Necessary changes shall be submitted by the Chairman of the RVOC to the UNOLS Council for approval.

3. CERTIFICATION, DOCUMENTATION AND INSPECTION

3.0 BACKGROUND

All seagoing vessels are subject to various requirements for documenting their ownership, occupation, and safety. These requirements vary greatly, depending on the size and type of vessel, its employment, the area of operations, etc. Given below are the common factors in this process, including organizations, laws, and so forth. The language used herein is chosen to convey the sense of the regulations; for the actual legal wording, reference is made to the pertinent parts of CFR, USC, or other sources.

3.1 ORGANIZATIONS

AMERICAN BUREAU OF SHIPPING (ABS): A non-profit organization authorized by the Coast Guard to ensure compliance with load line regulations and other related safety factors. The organization provides inspection services to operators for a fee. ABS documents and publications (including Rules for Shipbuilding) are available on line at www.eagle.org.

AMERICAN BOAT AND YACHT COUNCIL (ABYC): This organization is primarily concerned with private pleasure craft and sets standards for small vessel construction. Some of their standards are referenced in portions of these safety standards and some are incorporated by reference in Coast Guard regulations concerning small craft and commercial fishing vessels. The address for obtaining information is ABYC, POB 747, 405 Headquarters Dr., Suite 3, Millersville, MD 21108-0747.

U.S. COAST GUARD (USCG): The Federal agency charged with enforcement of many laws and regulations concerning ships and seagoing operations. Information and inspection services are provided either from headquarters in Washington or from several regional offices around the country. Since application of laws and regulations permits some latitude in interpretation, their effect depends to some extent on the individuals with which the operator must deal in a particular district.

FEDERAL COMMUNICATIONS COMMISSION (FCC): Federal agency charged with the regulation of radio communications, including those to, from and between ships. (47 CFR)

INTERNATIONAL MARITIME ORGANIZATION (IMO): A United Nations agency concerned, among other things, with establishment of safety standards, pollution regulations, etc. It develops modifications to Safety of Life at Sea (SOLAS) conventions.

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE): A professional group, which develops standards in electrical and electronic practices. Many of these are incorporated as legal or prudent requirements for ships.

UNDERWRITERS LABORATORIES (UL): A testing and certification laboratory that provides standards and tests equipment for safety. Some of their standards are used in Coast Guard regulations by reference such as those for smoke detectors and commercial cooking exhaust hoods. The address for UL is 333 Pfingsten Rd., Northbrook, IL 60062.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA): A professional organization that sets standards for fire fighting equipment and standards for fire prevention. Some

of their standards are included in Coast Guard regulations by reference such as those for a National Electrical Code and for pleasure and commercial motor craft. The address for NFPA is 60 Batterymarch Park, Quincy, MA 02269.

SEAFARERS HEALTH IMPROVEMENT PROGRAM (SHIP): A collaborative group with membership from ship owners/operators, seafarers, shipping associations, U.S. Public Health Service, U.S. Maritime Administration and the U.S. Coast Guard.

3.2 LAWS AND REGULATIONS

CODE OF FEDERAL REGULATIONS (CFR): A compilation of the rules and regulations made by Federal executive departments and agencies, pursuant to the authority of a Federal law. Most material concerning shipping is contained in Title 46 of the CFR. This is divided into chapters and subchapters, of which Subchapter U contains rules for oceanographic vessels. For example, "46 CFR 192" means Part 192 of Title 46 of the CFR.

UNITED STATES CODE (USC): A compilation of the laws of the U.S., generally arranged by subject matter under "Titles." Shipping laws are primarily contained in Title 46 of the code, which contains the Oceanographic Vessels Acts of 1964. Note that the USC contains actual laws from Congress, and the CFR contains agency-generated regulations.

MOTORBOAT ACT: Federal law enacted originally in 1940 and subsequently amended, which covers many aspects of safety for small craft. (46 CFR 1451-1489).

INTERNATIONAL CONVENTION FOR SAFETY OF LIFE AT SEA (SOLAS): An international treaty, periodically modified, concerning safety at sea. The U.S. follows the provisions of the treaty and incorporates them in U.S. laws and regulations. Undocumented vessels, fishing vessels, and certain others are not subject to the general SOLAS rules. (46 CFR 188.05-10)

FEDERAL BOAT SAFETY ACT OF 1971: Act setting forth certain requirements concerning documentation and safety, principally applicable to small craft. (46 USC 43, 46 CFR 24-27) Safety for recreational vessels is contained in 33 CFR, Subchapter S, 173, *et. seq*.

INTERNATIONAL LOAD LINE ACT: Act concerning stability standards and inspections. (46 USC 71 and 46 CFR 42, *et. seq*.)

SAFETY STANDARDS FOR SMALL CRAFT: Standards issued by the ABYC concerning safety of small craft. (e.g. ABYC E-1-1972)

IEEE 45: Document issued by IEEE concerning "Recommended Practices for Electrical Installations on Shipboard", provides many good standards in this area, commonly accepted for prudent use.

MARPOL 73/78 ANNEX I, REGULATION 9 and 26: Contains requirements for maintaining an oil record log for all vessels over 400 GT, specifies the requirements for maintaining a shipboard oil pollution plan and oil transfer procedures. See NVIC 2-93 change 1 for more information.

THE SEAMAN'S COMPETENCY ACT AND OFFICER'S COMPETENCY ACT: Set standards for the competency of officers and seamen, and are enforced by the USCG.

OIL POLLUTION ACT of 1990 (OPA 90): Requires vessels over 400 gross tons to have an Oil Spill Response Plan that is approved by the US Coast Guard in order to sail.

NAVIGATION AND VESSEL INSPECTION CIRCULARS (NVIC): Informational material published by the USCG.

INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING (STCW): Adopted by IMO in 1978 and amended in 1995, this convention outlines training requirements for personnel serving as crewmembers aboard vessels in order for them to qualify for the required STCW certification. Its requirements are contained in 46 CFR parts 10, 12 and 15.

INTERNATIONAL MANAGEMENT CODE FOR THE SAFE OPERATIONS OF SHIPS AND FOR POLLUTION PREVENTION (ISM CODE): Adopted under IMO resolution A.680 (17), it requires a formal safety management system (SMS). It must be in place by 1 July 2002 for specific vessels. Audits are required to insure compliance with the safety management system. The SMS must be formally written, address ISM Code requirements, and be subjected to continual verification, review and evaluation by auditors. Classification societies (e.g. American Bureau of Shipping) are authorized to act as auditors. Many questions concerning the implementation of the ISM Code in the United States were still being resolved at the time the safety standards revision was published.

3.3 TYPES OF VESSELS

VESSEL: Any watercraft, other than a seaplane, used as a means of transportation. (P.L. 92-75)

SHIP: Often used interchangeably with "vessel," the preferred legal term.

MOTOR VESSEL: A vessel that is more than 65' in length, which is equipped with propulsion machinery. Motorboats are classed as: Class A -- less than 16'; Class 1 -- 16'-26'; Class 2 -- 26'-40'; Class 3 -- 40'-65'. (46 CFR 24.10.19)

Motor Boat includes every vessel propelled by machinery and not more than sixty – five feet. Excluded are tugboats and towboats propelled by steam, tank vessels, cargo and miscellaneous vessels, and research vessels. (46 USC 526, 46 CFR 24.10-17).

DOCUMENTED VESSEL: A vessel of greater than 5 *net* tons, which is registered, enrolled, or licensed as a "vessel of the United States." This is a requirement for engaging in "trade or commerce." UNOLS research vessels are not ordinarily engaged in "trade or commerce;" commercial vessels ordinarily are.

UNDOCUMENTED VESSEL: Any vessel that is not required to, and does not, have a marine document issued by the USCG. (46 CFR 188.10-75)

INSPECTED VESSEL: Is one that is inspected and certificated by the USCG. Motor vessels, tank vessels, and the majority of other non-public vessels over 300 gross tons are required to be inspected. 46 CFR Table 188.05-1(a) identifies vessels to which the inspection laws apply. (46 CFR 188.01-1, Subchapter U)

UNINSPECTED VESSEL: A vessel not certificated under the inspection laws or subjected to regular inspections by the USCG. Examples are, fishing vessels, recreational motorboats, and oceanographic research vessels under 300 gross tons.

Uninspected vessels, however, are still subject to rules about safety and, in some cases, licensed personnel. (46 CFR, Subchapter C, 24, *et. seq*.)

VESSEL IN CLASS: A vessel is said to be "in class" when it holds a current certificate of classification issued by a recognized classification society, such as American Bureau of Shipping, Lloyds, Bureau Veritas, etc. The certificate of classification signifies conformity with prescribed standards of structural strength, machinery, and equipment, providing for seaworthiness and safety in connection with marine insurance.

OCEANOGRAPHIC RESEARCH VESSEL: A vessel, which the USCG determines is being employed exclusively in instruction in oceanography or in oceanographic research. This is a formal designation in writing by the cognizant Coast Guard Officer in Charge of Marine Inspection (OCMI). (46 CFR 24.10-20, 46 USC 2101(18) and 2113)

NUMBERED VESSEL: One which is numbered under the provisions of the Federal Boat Safety Act of 1971. Oceanographic research vessels not engaged in commerce are not required to be documented, and may therefore become numbered vessels (except for certain federal and state owned vessels). (46 CFR 188.10-49)

PUBLIC VESSEL: Under federal shipping laws (46 USC 2101), a public vessel means a vessel that is owned, or chartered, and operated by the U.S. Government and is not engaged in commercial service. Examples would be USCG and NOAA research vessels.

3.4 OPERATIONS

OCEAN: Used to describe an operating area or route in any ocean or the Gulf of Mexico, more than 20 nm offshore. (46 CFR 188.10-15)

COASTWISE: Used to describe a route or operating area which is not more than 20 nm offshore, on any ocean, Gulf of Mexico, Caribbean Sea, Gulf of Alaska, and such other waters as may be designated. (46 CFR 175.10-3, 188.10-15)

INTERNATIONAL VOYAGE: A sea voyage, by a mechanically propelled vessel of 500 gross tons or more, from a country to which the International Convention for Safety of Life at Sea, (SOLAS), 1960 applies, to a port outside that country, or conversely. Within Subchapter U of 46 CFR, voyages between the continental United States, Hawaii, and Alaska are treated as international voyages by the United States Coast Guard. NOTE: State numbered vessels in accordance with the Federal Boating Safety Act of 1971, or vessels holding a special exemption issued by the Coast Guard need not comply with regulations applicable to vessels on an international voyage. Such voyages are therefore termed "foreign voyages." (46 CFR 188.05-10, 188.10-35)

FOREIGN VOYAGE: A voyage between two countries or between two territories or possessions of the U.S. by a vessel which is not subject to the SOLAS provisions because of its size, propulsion, or documentation. Vessels engaged in such voyages, if 150 gross tons or over that were built before 21 July 1968 or if 79 feet or greater in length and built on or after 21 July 1968, must comply with load line requirements. After July 1984 any existing vessels over 79 feet in length, and engaged in a foreign

voyage, must be admeasured under the convention measurement system. (46 CFR 42.03-5, 69.9 & 69.11)

NAUTICAL MILE (nm): The internationally agreed standard sea mile, of 6,076 feet, commonly used in laws, regulations and treaties for specifying distance at sea or offshore.

RESEARCH CRUISE: Cruise by vessel primarily for the purpose of conducting marine research at sea. It is commonly defined as commencing on the day of departure, and terminating on the day of return to a port.

TRANSIT: Voyage of a vessel during which little or no research is being carried out, primarily for the purpose of going from one port to another, or to/from a port and an area of research.

LAY DAYS: Days in homeport for purposes of fitting out, cruise preparation, crew rest, and upkeep. May in rare cases include similar periods in other ports.

MAINTENANCE DAYS: Days undergoing overhauls, drydocking, or other scheduled or unscheduled repairs during which the ship is not available for service.

OPERATING DAY: All days away from homeport in an operating status incident to the scientific mission.

DAYS AT SEA: All days actually at sea incident to the scientific mission.

DAYS OUT OF SERVICE: Periods in which a ship is laid up out of service for an extended period for reasons of economy, unemployment, or unfitness for service.

3.5 TONNAGE

Other than weight as in displacement, discussed below, other forms of tons and tonnages are arcane descriptors of ship size that may readily be traced back to the *Magna Carta* and beyond. The numbers so derived are used to determine fees and applicability of national and international regulations. For officially determining which version and formula applies and calculating tonnage the services of a professional Naval Architect are required.

REGISTERED TONS: A "registered ton" is a measure of volume, in which one registered ton = 100 ft^3. There are two types of registered tonnages: "Gross" and "Net". Gross Registered Tonnage (GRT) is the total enclosed volume of the vessel, minus certain exempted spaces. Net Registered Tonnage (NRT) is the GRT minus certain deducted spaces. Exempted and deducted spaces are determined according to measurement regulations for U.S., Panama, and Suez tonnage. Tonnage certificates, to the extent required by the vessel's operations, are carried on board with GRT and NRT being permanently affixed to the vessel. (46 CFR 69.107)

CONVENTION TONNAGE*:* This is tonnage as determined under the International Convention on Tonnage Measurement of Ships, 1969. New documented vessels and new vessels engaged on a foreign voyage that are 79 feet or over are required to be measured under the Convention Measurement system. Existing vessels that undergo a change that substantially affects the gross tonnage and are otherwise required would have to be measured under the Convention Tonnage system. Existing vessels over 79 feet that engage in a foreign voyage after July 1994 will have to be measured under the Convention Tonnage System as well as the existing system. The Standard

Measurement system (the existing method of measurement for most vessels) is currently still the system to be used for determining the applicability of U.S. Regulations. (46 CFR 69.11)

DISPLACEMENT: Displacement is the weight of water displaced by a vessel and is equal to the vessel's actual weight. Displacement is used in stability calculations. A "displacement ton" is a measure of weight stated in long tons of 2,240 pounds/ton.

DEADWEIGHT: The "deadweight" of a vessel is its total weight when floating at the load waterline, minus its "lightship weight". Lightship weight includes the vessel's structure, machinery, permanent outfit and so forth. Deadweight may be subdivided into "operating deadweight" and "payload." Operating deadweight includes all items required to operate the vessel, including crew and effects, fuel, lube oil, fresh water and stores. Payload includes all items of deadweight not directly concerned with operations, including non-crew personnel and effects, equipment other than that considered part of the ship, instrumentation not concerned with ship operations, and cargo.

Note that the variations of displacement provide an accurate "weight" of the ship, and are to be used in calculations involving stability, loading, and the like. Registered tonnages are to a large extent artificialities, but they are those which are involved in many licensing and documenting procedures, rather than the actual displacements.

3.6 PERSONNEL

CREW: Personnel involved exclusively or primarily in the navigation and operation of a vessel.

PASSENGER: Every person other than the crew or other persons engaged on board a vessel in the business of the vessel. However, on oceanographic research vessels scientific personnel are not considered as passengers. Research vessels may not carry passengers for hire, since this would constitute engaging in "trade or commerce." (46 CFR 24.10-23)

SCIENTIFIC PERSONNEL: Those persons aboard a vessel solely for the purpose of engaging in scientific research, or for giving or receiving instructions in oceanography. Scientific personnel are considered neither crew nor passengers. (46 CFR 188.10-71, 46 CFR 188.05-32)

MASTER: The designated member of the crew of a vessel who is in legal overall charge of the entire operation of the vessel. See section on "Manning" for further discussion. The term "captain" is used almost interchangeably.

CHIEF SCIENTIST: The designated member of the scientific personnel who is in overall charge of the research operations on board ship. See section on "Manning" for further discussion.

3.7 TYPES OF CERTIFICATION AND DOCUMENTATION

Certification and documentation in the various forms is not in itself a safety standard. Rather, it defines categories of vessels to which certain safety rules and standards apply. In most instances certification and documentation are dictated by the pertinent laws and regulations, with which the operator must comply. In a few cases, there is a choice, owing to the unique nature of research vessel operation. In general the

standards set by each category of certification will be adequate for ordinary operations, but prudent operators will often go beyond the legal minimums. Examples of this would be in the case of additional fire extinguishers, or lifesaving equipment. UNOLS operators are urged to recognize the legal requirements as minimums, and take additional steps as the situation may justify in each case.

DOCUMENTATION: Certificates of registry, enrollment, or license are Federal maritime documents required by vessels engaged in trade or commerce. Oceanographic research vessels under 46 USC 2101(18) are not required to be documented, but may be at the option of the operator. If documented, however, the certification should clearly define the vessel's service as "Oceanographic Research." No special advantages accrue, nor are restrictions avoided, by documentation, insofar as research vessel safety is concerned. (46 USC 121, 46 CFR 67.01)

NUMBERING: Undocumented research vessels are usually numbered in accordance with the Federal Boat Safety Act (excepting certain federal- or state-owned vessels). Thus, the state-issued "Award of Number" becomes the official certificate identifying the vessel. Most state certificates do not have a routine box to check for "research," and it is important for the operator to see that this special use is clearly indicated.

OWNER'S CERTIFICATE: The unique and sometimes confusing role of marine research in the context of the U.S. shipping laws and regulations makes it advisable that all research vessels carry a letter, certificate, or plaque stating that the vessel is operated in oceanographic research under the laws of the U.S. This should include positive evidence that the vessel is complying with the provisions of 46 USC 2101(18). Such certification will help to avoid difficulties both in the U.S. and abroad.

USCG LETTER OF DESIGNATION AS OCEANOGRAPHIC RESEARCH VESSEL: 46 CFR 3 establishes US Coast Guard procedures for a designation as an oceanographic research vessel. The designation is voluntary and is for the purpose of providing relief from otherwise applicable vessel inspection and the "Employment of Seamen" requirements. Such designation is necessary for the vessel to benefit from the exemptions of Subchapter U (46 CFR 188). Without this letter of designation, scientific personnel on board must be considered either crew or passengers. To be designated, a written request should be made to the local USCG officer in charge of marine inspection. The request must contain the information specified by 46 CFR 3.10-1. If the vessel is found to be employed, exclusively in oceanographic or limnologic research and/or instruction, a designation will usually be granted. For inspected research vessels, designation will be indicated on the certificate of inspection and is valid for the duration of the certificate. For uninspected research vessels a letter of designation will be issued. This letter, which is valid for two years, must be requested by mail 60 days in advance of expiration.

INSPECTION CERTIFICATE: Vessels over 300 gross tons are usually required to be inspected and certificated by the USCG. (46 CFR, Subchapter U; 46 CFR 188.05-1)

LOAD LINE CERTIFICATE: This certificate is issued by ABS for U.S. vessels and is required for certain vessels in foreign or international voyages. Uninspected research vessels, which do not engage in international voyages, are not required to have a Load Line Certificate, but unless there is some strong reason to the contrary, it is recommended. Further details may be found in 46 CFR Subchapter E, 42, *et. seq*.

ABS CLASSIFICATION: ABS classification of both hull and machinery is a detailed survey of the material condition of the vessel. This is not directly safety-related, but obviously bears heavily on the basic safety and operability of the vessel. In most matters of insurance and equity, ABS classification is attractive, and unless there is some strong reason to the contrary, it is recommended.

"COURTESY INSPECTION" OR "UNINSPECTED VESSEL EXAMINATIONS": Courtesy motorboat inspections are offered by the USCG auxiliary for vessels moored as well as underway. The USCG may board and inspect any U.S. vessel at any time while underway. The annual sticker that is issued by the auxiliary as a result of a satisfactory inspection will be recognized by the USCG as showing the vessel as in compliance with the Boating Safety Act of 1971. Uninspected vessels may request an "Uninspected Vessel Examination" from a local USCG Marine Inspection Office. This service, which is advisory rather than regulatory, depends on the availability of USCG personnel and is not available from all offices. Neither of these "inspections" are mandatory but it is recommended that vessels under 65' undergo an auxiliary inspection and large vessels undergo the uninspected vessel examination, if available.

4. STABILITY

4.0 FOREWORD

Stability standards, tests, and information are covered in this section. The presentation, in each instance, is divided into a brief background of the subject at hand and its applicability to inspected and/or uninspected oceanographic research vessels on either a required or recommended basis. Principal references include Title 46 CFR 170 - Subchapter S, the International Maritime Organization (IMO) Resolution A.168 (ES.IV) which is often called the "Torremolinos Convention Criteria," the IMO Severe Wind and Rolling Criteria, the RVOC Safety Training Manual, and the Commercial Fishing Vessel regulations (46 CFR 28). The last reference concerns commercial fishing vessels but contains much information of value for uninspected oceanographic research vessels.

The subject of Ship Stability is encumbered with a sense of mystery in addition to its inherent complexity. For these reasons it is important that operating institutions seek and use the services of a qualified Naval Architect whenever stability questions arise.

4.1 STABILITY STANDARDS

BACKGROUND: Stability standards for the design, construction, and operation of oceanographic research vessels may be placed into one of two categories: 1) standards required for inspected and certain uninspected vessels, and 2) those recommended for the remaining uninspected vessels. Required standards are contained in Title 46 CFR, Subchapter S, Parts 170 and 173, with the latter referring to Part 171 pertaining to vessels carrying 400 or fewer passengers. Recommended standards may be based on criteria in the above references and/or as set forth in publications such as the IMO Resolution A.168 (ES.IV).

Both required and recommended stability standards should, in general, be viewed as being minimal. In applying them to the design and operation of individual vessels, they should be upgraded as appropriate considering any unique aspects of the vessel's mission requirements and/or design features pertinent to stability.

APPLICABILITY: Inspected oceanographic vessels, including motor-driven vessels of 300 and over gross registered tons and steam ships over 65' long, must comply with stability criteria set forth in Title 46 CFR, Subchapter S, Parts 170 and 173. These uninspected vessels have no subdivision or damage stability requirements.

Other uninspected vessels have no required stability standards. These vessels may be divided into two groups: 1) vessels from 79 feet to 328 feet in length, and 2) vessels shorter than 79 feet.

Recommended intact stability standards for group (1) vessels are contained in IMO Resolution A.168 (ES.IV) and the IMO Severe Wind and Rolling Criteria. 46 CFR 28.500 through 28.580 contains stability regulations for fishing vessels 79 feet long and over and could be used as a useful guideline for similar sized research vessels. These regulations are based on the IMO standards and the information contained in the Coast Guard's NVIC 5-86, which contains voluntary safety guidelines for fishing vessels.

No firm criteria exist for recommended stability standards applicable to group (2) vessels. Again, criteria set forth in the fishing vessel regulations provide useful guidelines but one must be cautious in their direct use to establish stability standards for

these small vessels and it may be necessary to increase IMO Resolution A.168 (ES.IV) criteria. While the basis for this increase has not been established, the practice of some European countries is to increase all criteria by twenty percent.

4.2 STABILITY TESTS

BACKGROUND: Stability tests include formal inclining experiments and rolling period tests. Inclining experiments are conducted to obtain "as inclined" data from which "light ship" displacement and centers of gravity can be derived to define the "light ship condition." This experiment is normally conducted under the auspices of a qualified Naval Architect, and witnessed by the US Coast Guard or its designee, commonly ABS. Various loadings can then be added to this basic condition to obtain prescribed "service conditions" and associated stability information. This becomes the basis for a "Stability Letter" or "Stability Book".

Rolling period tests have the purpose of approximating GM_T in any condition by use of the expression

$$GM_T = \{fB/T_R\}^2$$

In this expression, "f" is a factor having an average value of about 0.44 for various mono hull forms, "B" is the vessel's maximum beam, and "T_R" is the full period of roll of the vessel in calm waters in seconds. This test is useful for vessels whose sizes are such that rolling can easily be induced by a procedure known as a "sallying ship."

APPLICABILITY: New inspected oceanographic vessels are required to be inclined in accordance with inclining experiment details set forth in Subchapter S, Part 170, Subpart F. These vessels should also be re-inclined any time a significant change in magnitude and/or location of a "light ship" weight occurs or there is a major change in hull shape. As an example the Coast Guard's Marine Safety Manual calls for a deadweight survey or possibly a re-inclining if accumulated changes in weight exceed 2% of lightship weight. It also calls for re-inclining if, after major conversions, calculated lightship is changed by more than 3% of displacement or if the Longitudinal Center of Gravity (LCG) changes by more than 1% of the length between perpendiculars (LCP).

Uninspected oceanographic vessels engaged in international/foreign voyages, as applicable, and subject to load line assignment, as previously identified, are treated as inspected vessels in this regard.

Other uninspected oceanographic vessels, while not required to undergo inclining experiments, should nevertheless be inclined or have sufficient data and documentation to determine safe loading.

A rolling period test should be conducted on a vessel, size permitting, anytime the Master has reason to question the adequacy of the vessel's stability. It must be emphasized that this test is not to be considered as a substitute for an inclining experiment.

4.3 STABILITY INFORMATION

BACKGROUND: Stability information includes: 1) specific information pertinent to the safe operation of a specific vessel and 2) general information the understanding of which promotes the safe operation of vessels in a more general sense. Specific

information is contained in "Stability Booklets" and "Stability Letters," or their equivalents, which are carried on board. General information should also be carried on board and made readily available to all personnel on board having duties or functions, which may affect the vessel's stability.

Instructions and data contained in Stability Booklets and Stability Letters, or their equivalents, should be set forth in a clear and concise manner to facilitate stability analysis either by hand or by use of a personal computer. In this regard, it is recommended that vessels be provided with user-friendly stability software for intact and damaged conditions (if feasible) installed on on-board personal computers.

The RVOC Safety Training Manual contains chapters on Stability and on Load Lines and Watertight Integrity that should be used to help in understanding the principals covered by regulations and guidelines. The information provided includes diagrams and example calculations as well as useful safety practices that will minimize or eliminate adverse effects on stability. The North Pacific Fishing Vessel Operators Association (NPFVOA) also publishes a safety manual and a series of video tapes that are excellent training resources with regard to stability on smaller vessels.

APPLICABILITY: Inspected oceanographic vessels are required to carry the following stability information on board as set forth in Title 46 CFR, Subchapter S, Part 170, Subpart D:

- Stability Booklet (Section 170.110)
- Stability Letter (Section 170.120)
- Lifting information for vessels engaged in lifting operations (Section 170.125)

The above reference does not specify that vessels engaged in towing are required to carry towing information pertinent to stability. Nevertheless, it is recommended that these vessels carry this information.

Uninspected oceanographic vessels engaged in international voyages or foreign voyages and subject to load line assignment, as previously identified, are treated as inspected vessels in this regard.

Other uninspected oceanographic vessels, which are not subject to these requirements, should, however, carry operators' directives containing specific stability information equivalent to that required for inspected vessels.

It is recommended that all uninspected oceanographic vessels carry general stability information on board, particularly the RVOC Safety Training Manual. Consideration should be given to following the regulations for commercial fishing vessels in 46 CFR 28.

4.4 RESPONSIBILITY

It shall be the Master's responsibility to maintain the vessel in a satisfactory stability condition at all times through control and management of liquid, solid, and science loads. It is the Operating Institution's responsibility to insure that 1) current stability data are correct and available to the Master, 2) changes to the vessel are controlled and managed to insure compliance with all regulatory requirements and the recommendations of this section.

5. LOAD LINES AND WATERTIGHT INTEGRITY

5.0 FOREWORD

This section is concerned with the assignment of load lines and watertight integrity, which are closely associated, and the subjects of 46 CFR Subchapter E, 42, *et. seq*. The discussion of load lines necessitates reference to certain aspects of subdivision and hull strength and, consequently, these topics are presented to the extent required for an understanding of the principal subject. The background of load lines and watertight integrity and their applicability to inspected and uninspected oceanographic research vessels are given on a required or recommended basis.

5.1 LOAD LINES

BACKGROUND: Load line requirements, set forth in 46 CFR 42, Subchapter E, are the bases for locating load line marks on a vessel. These marks, affixed to the vessel amidships, indicate the maximum drafts to which the vessel can be legally loaded under prescribed conditions. The distance measured vertically at the side of a vessel from the edge of the so-called "freeboard deck" to the upper edge of a particular load line mark is called "statutory freeboard" -- the "minimum statutory freeboard" measured to the uppermost load line mark applicable for a specified set of conditions taking into account considerations of 1) reserve buoyancy (buoyancy which can be supplied by the hull and watertight superstructure above the water line) and height of weather deck above this water line, 2) subdivision, and 3) hull strength. In the United States, the American Bureau of Shipping (ABS) is the load line assigning authority on behalf of the U.S. Coast Guard.

Consideration 1) provides for a minimum statutory freeboard by specifying the maximum draft amidships based on the degree of reserve buoyancy and height of weather deck above the waterline, which have been found adequate from past experience in providing for vessel and personnel safety. The basic load line mark thus determined which passes through the center of the load line disk, fixes the "minimum summer freeboard" in salt water. A series of adjacent load line marks above/below this basic mark provide for decreased/increased minimum statutory freeboard when the vessel is operating during seasons and in ocean areas where less/more severe weather-sea conditions are likely to be encountered than assumed in loading the basic mark. Fresh water marks above the basic mark may be authorized for a vessel in ocean service. If such is the case, care must be taken in loading to these marks as these allowances require the vessel to be in virtually fresh water with a specific gravity of 1.000. If the vessel is in brackish water, proportional use of the fresh water allowances must be based on the actual water specific gravity and standard salt-water specific gravity of 1.025.

Consideration 2) concerns vessels whose hulls are subdivided by transverse watertight bulkheads to limit the extent of damage by flooding due to hull penetration -- such damage causing sinkage, trim and reduction of stability. Subdivision of a vessel is either required or made on a voluntary basis -- it being required for inspected oceanographic vessels as per 46 CFR, Subchapter S, Parts 171 and 173. In design, the location of these bulkheads along the length of the vessel is based on the vessel floating at a specific water line called the "subdivision load line." If subdivision is such that the flooding of any one main compartment can be sustained without submerging

the so-called "margin line" just below the freeboard deck while retaining adequate after damage, or residual, stability, the vessel is said to meet a "one compartment standard of subdivision." The validity of this, or a higher, standard of subdivision is, of course, dependent on the subdivision load line mark being at or above the waterline of the undamaged vessel. Consequently, a vessel subject to these requirements cannot be loaded deeper than this mark. Note, however, that the subdivision mark has no meaning and is not affixed to the vessel if it lies above other load line marks. Conversely, any marks above the subdivision mark become meaningless and are not affixed to the vessel. In this case, the minimum statutory freeboard is based on the subdivision load line mark.

Consideration 3) refers to the maximum draft amidships to which a vessel can be loaded from a hull strength point of view -- this draft being called the "scantling draft" (scantling being the cross-section dimensions of plates and shapes comprising the hull girders). The authorizing authority must be satisfied that the hull strength is adequate for the minimum freeboard assigned from consideration 1) or 2). If for any reason the scantling draft mark lies below other marks, these marks are meaningless and not affixed to the vessel. In this instance, the minimum statutory freeboard would be the scantling draft freeboard.

In addition to the above considerations, a vessel's freeboard has an important affect on its intact stability curve. As freeboard increases, the freeboard deck edge is immersed at greater angles of inclination, which increases the maximum righting arm and angle of occurrence. The result is increased righting energy and resistance to heeling by wind/wave action. This consideration is extremely important for smaller vessels. In general, vessels with higher freeboards have better performance in stormy weather and are less affected by water on deck.

APPLICABILITY: Inspected oceanographic vessels of 300 gross registered tons and over must comply with load line requirements set forth in 46 CFR, Subchapter U, Subpart 188.05 which states that these vessels shall be subject to the requirements of 46 CFR, Subchapter E, Parts 42 or 45. Any uninspected vessels, 150 gross tons or over that were built before 21 July 1968 or an uninspected vessel built after this date that is 79 feet or greater in length, shall also comply with load line requirements of 46 CFR, Subchapter E if they engage in foreign voyages. Other uninspected vessels exempted from load line regulations, including those having state boat registration numbers and not sailing in foreign or international waters should strive to adhere to load line and related requirements given in Subchapter E to the extent feasible for vessels of their size.

LOAD LINES INFORMATION: Load lines information is given in the vessel's "Load Lines Certificate." This document certifies to the correctness of the load line marks and that the vessel is in compliance with all applicable requirements. It also provides a diagram of the assigned load line marks and the freeboard deck line, locating the marks with reference to this line in terms of assigned freeboard, as well as stating any conditions, restrictions and exemptions that the vessel shall observe. The validity of these certificates is reviewed annually in load line inspections and every five years in more thorough load line surveys. During these inspections and surveys, ABS is particularly concerned with the following items:

- Freeing ports - Drainage must be adequate from all weather deck areas and not blocked. Particular attention is given to potential water-trapping areas such as wells formed by structure or pockets formed by cargo or equipment.
- Sill heights - Access openings in superstructure and deck houses must have 15 - inch sills. A reduction of one inch in sill height is allowed for each foot of excess freeboard with a minimum height of 6 inches.
- Vent and hatch coaming heights and fittings above the assigned freeboard deck are carefully checked.
- Watertight doors and fittings - Any penetration of watertight boundaries must be as high and as far inboard as possible. As a minimum, three dogs are required on a circular fitting and four on an oblong fitting.
- Subdivision in general - Subdivision requirements must be met as applicable for vessels being inspected/surveyed. These requirements are the same as for those passenger vessels carrying 400 or fewer passengers and include provisions for a collision bulkhead.

A load line map showing zones and seasonal areas of the world's oceans provides the Master with information regarding the maximum draft amidships to which his vessel can be loaded during various segments of a cruise. The vessel must be loaded at the beginning of a cruise so that at no time during the cruise will, the applicable seasonal/zone mark, be submerged.

Freeboard is vitally important on smaller vessels, which are not subject to load line requirements. Consequently, these vessels should carry information on board regarding maximum drafts amidships to which they can be loaded safely.

5.2 WATERTIGHT INTEGRITY

BACKGROUND: The watertight integrity of a vessel is absolutely essential to the viability of calculations on which freeboard assignment is based as it is for stability and subdivision considerations. In general, it involves providing, maintaining and correctly operating sure and efficient means of protecting all openings in the hull, watertight bulkheads and superstructure considered watertight -- these openings including hatches, side openings and the like. The myriad of requirements concerning the design, construction, location and operation are grouped together in "Conditions of Assignment." These conditions are reviewed annually and periodically, every five years, during load line inspection and surveys.

APPLICABILITY: Watertight requirements are given in 46 CFR, Subchapter E, Subpart 42.15, "Conditions of Assignment," for oceanographic vessels requiring load line/freeboard assignment and also in 46 CFR, Subchapter S, Part 171, Subparts E, F, and G for oceanographic vessels subject to subdivision and stability requirements. For uninspected oceanographic vessels not subject to the above requirements, watertight integrity guidelines are given in the stability section of 46 CFR 28 and, for vessels under 65' long, in "Safety Standards for Small Craft" by ABYC (ABYC H-3-70, H-4-70, H 15-66 and H-27-70). These vessels should be surveyed in a manner paralleling the annual and five-year periodic surveys made in reviewing the Conditions of Assignment for vessels requiring load line assignments.

INFORMATION: A summary of sources of information on the details of watertight integrity includes:

- 46 CFR, Subchapter E, Subpart 42.15, entitled "Conditions of Assignment of Freeboard," contains details on doors, hatches, machinery space openings, miscellaneous openings, ventilators, air pipes, cargo ports, scuppers, inlets and discharges, side scuttles, and freeing ports.
- 46 CFR, Subchapter G, Subpart 69.117 contains information on tonnage openings.
- 46 CFR, Subchapter H, Subpart 72.05 contains information on windows and air ports.
- 46 CFR, Subchapter H, Subparts 78.15 and 78.17 contain information on doors to be closed at sea and closing appliances.
- 46 CFR, Subchapter I, Subpart 97.15 contains information on hatches and other openings.
- 46 CFR, Subchapter S, Subparts 170.248 and 171.070 contain information on watertight bulkhead doors and oceanographic research vessel subdivision.
- 46 CFR, Subchapter C, Part 28 Subpart E contains regulations for commercial fishing vessels on stability and watertight integrity.

5.3 RESPONSIBILITIES

Masters of oceanographic vessels subject to load line requirements have the responsibility to maintain load line certificates and current survey reports on board their vessels and to comply with all terms and conditions stated in these documents. Further, they should keep logbook records as prescribed in 46 CFR, Subchapter E, Section 42.07-20.

Masters of other oceanographic vessels not subject to these requirements should comply with load line, or maximum draft amidships, information supplied to the vessels in lieu of load line certificates. Such information for very small craft is given in the ABYC's "Safety Standards for Small Craft". (ABYC H-5-83)

Masters of all oceanographic vessels have the responsibility for maintaining the watertight integrity of these vessels. This responsibility involves the careful maintenance of all watertight closures and associated systems and the assurance that their functions, operation and status in various normal and emergency conditions are clearly understood by members of the crew and science party.

Operations managers or Marine Superintendents shall oversee and assist the Master in fulfilling these responsibilities.

6. ELECTRICAL AND MARINE ENGINEERING

6.0 GENERAL

In many respects, electrical and engineering safety procedures for research vessels are not different from those of commercial vessels. In addition to the requirements set out below, good marine practices for electrical and engineering installations should be followed or exceeded. However, due to the addition to the vessel of scientific or science-related equipment, particular attention should be given to such specialized installations, since they are frequently experimental or non-standard in nature, and the researchers using them may not be familiar with accepted marine practices. Consideration should also be given in general to standards, inspections, and preventive maintenance well beyond minimal levels, since equipment failures will result in delay of the research program.

Useful information that can be applied to smaller uninspected research vessels is contained in the commercial fishing vessel safety regulations (46 CFR 28) and the small passenger vessel regulations (46 CFR 175, *et. seq*.).

6.1 ELECTRICAL

Inspected vessels of 300 gross tons and over are subject to the requirements of Subchapter J, 46 CFR 110, *et. seq*. for the standards, installation, inspecting and testing of electrical apparatus and wiring systems. Whenever possible, uninspected vessels and those under 300 gross tons should follow these CFR requirements as closely as possible. Also, as a guide for minimum standards, IEEE 45, "Recommended Practice for Electrical Installations on Shipboard" should be followed. (The current version of IEEE 45 was issued in 1998.) One area of frequent confusion and occasional problems is the use of equipment designed for use with grounded neutral electrical systems (the norm for office and laboratory equipment) on ship with ungrounded distribution systems. Special attention should also be given to the marking and monitoring of power and other cables installed for scientific purposes, since these often will be left in place after the need for them has passed, leading to clutter and confusion.

6.2 TESTING AND INSPECTION OF ELECTRICAL MATERIALS

As a guide for maintaining safe standards of electrical systems and apparatus on uninspected vessels, the provisions in 46 CFR 110.30 should be followed.

6.3 MARINE ENGINEERING

Inspected vessels of 300 gross tons and over are subject to the requirements of Subchapter F, 46 CFR 50, *et. seq*. for the specifications, standards and requirements for strength and adequacy of design, construction, installations, inspection and choice of materials for machinery boilers, pressure vessels, safety valves, and piping systems upon which safety is dependent. It is recommended that uninspected vessels and those under 300 gross tons should follow these CFR requirements as far as appropriate. Piping and valves should be clearly marked or identified, particularly those installed for scientific usage, since scientists cannot be expected to be familiar with the layout and operation of the system.

6.4 TESTING AND INSPECTION, ENGINEERING

Drydock examinations are required for inspected oceanographic research vessels by 46 CFR 189.40-3 and for uninspected vessels by 46 CFR 61.01 through 61.20 at prescribed intervals by for inspected vessels. At the time of this revision the basic interval for the dry docking of vessels in ocean service is twice every five years with no more than three years between dry dockings.

As a guide for maintaining safety standards for boilers, pressure vessels and associated piping systems, vital machinery and steering systems, the requirements of 46 CFR 61.01 through 61.20 should be followed as appropriate.

7. FIRE FIGHTING EQUIPMENT

7.0 BACKGROUND

Required fire extinguishing equipment for inspected vessels is prescribed by 46 CFR Subchapter U, and for uninspected vessels by 46 CFR Subchapter C, and further practices and standards for them are contained in ABYC's "Safety Standards For Small Craft." In general, the minimum requirements of Subchapter C are substandard for a research vessel. All research vessels over 65' should strive to meet the standards set out in Subchapter U, and those under 65' should strive to meet those of Section 10 of the Motorboat Act. Particular standards are singled out below:

7.1 EQUIPMENT INSTALLED BUT NOT REQUIRED

On all vessels, including non-self-propelled vessels of less than 300 gross tons, where fire detecting or extinguishing systems or equipment are not required, but are installed, the system or equipment and its installation shall meet the requirements of 46 CFR, Part 193.

7.2 PORTABLE FIRE EXTINGUISHERS

All vessels should carry a number and type of USCG approved portable fire extinguishers using guidelines set forth in 46 CFR, Subchapter U, 193.50. Inspected vessels over 300 gross tons must follow the requirements of this subpart. Uninspected vessels under 65' are required to follow the requirements in Subchapter C concerning the carriage of portable fire extinguishers. (46 CFR 25.30)

7.3 FIXED FIRE EXTINGUISHING SYSTEMS

All research vessels, wherever possible, should have a fixed CO_2, or other approved fixed fire extinguisher system installed to protect machinery spaces, paint lockers, chemical storerooms, and similar spaces. Equipment for a fixed system installed on an uninspected vessel must be type-accepted by the USCG and installed properly. Protected spaces which are normally accessible to personnel while the vessel is underway should be fitted with an approved audible alarm which will sound automatically during a 20 second delay prior to CO_2 being discharged into the space. (46 CFR 25.30-15, 46CFR193.05-10, 46 CFR 193.15)

7.4 FIRE PUMPS

Inspected vessels must be equipped with at least one (two if over 1,000 gross tons) independently driven fire pump and the appropriate number of hydrants and hose. Uninspected vessels over 65' whenever practicable should be equipped with at least one independently driven fire pump and provided with an appropriate number of 1 1/2 inch-hydrants and hoses. If the fire pump is located in an unmanned machinery space, inspected vessels must have the controls for its operation remotely located at a fire control station, on the bridge, or other readily accessible space. All other vessels should, so far as practicable, have the ability to start a fire pump remotely from an unmanned engine room. All vessels should consider carrying portable pumps of appropriate size for fire fighting and dewatering. (46 CFR 193.10)

7.5 FIRE AXES

All vessels shall carry on board at least the minimum number of fire axes using guidelines set forth in 46 CFR 193.60. The axes should be distributed so as to be most readily available in the event of an emergency. Fire axes shall be located where they maybe readily seen or they should be placed in enclosures together with firehose and the enclosure so marked.

7.6 TESTS AND INSPECTIONS

Tests and inspections of portable and fixed fire extinguishing equipment must be conducted at least once every twelve months. Records of these tests shall be maintained and the equipment tagged to indicate that it has been inspected. It is encouraged, where practicable, that such tests and inspections be conducted by a company recommended by the manufacturer and for classed vessels by a company approved by the classification society. Fire hoses shall be tested every 12 months at a pressure equivalent to the maximum pressure they will be subjected to in service, but not less than 100 p.s.i. (46 CFR 189.25-20; 46 CFR 196.15-60)

7.7 ADDITIONAL PROTECTION

Operators should be aware of hazards posed by specialized spaces or contents of spaces e.g. labs, spaces with hydraulic oil storage, etc. and insure these specialized hazards are identified and addressed with additional fire fighting systems to accommodate the added potential danger.

7.8 GALLEY

Galley areas in general, and deep-fat fryers in particular, are high fire risk areas and merit specialized protection by a smothering system which can be remotely or automatically activated.

7.9 FIREMAN'S OUTFIT

Where space permits, all vessels must have aboard, in an accessible area, at least one Fireman's Outfit, to include: one pressure-demand or positive-pressure self contained breathing apparatus (SCBA), one flashlight, one flame safety lamp or combination oxygen/combustible gas indicator (must be intrinsically safe and UL or FM approved), one spanner wrench, an approved firefighters outfit (to include approved rigid helmet, boots, gloves, coat, trousers and coveralls), and one fire axe. Inspected vessels over 300 gross tons are required to carry at least two Fireman's Outfits, stored in widely separated, accessible locations. (46 CFR 195.35, NVIC 12-86, NVIC 06-01)

These are minimum requirements. It is strongly suggested that smaller vessels have two outfits and larger inspected vessels have at least four to allow relief and rotation of personnel engaged in fire fighting.

7.10 SELF CONTAINED BREATHING APPARATUS

Two of these appliances are mandatory for inspected vessels as part of a fireman's outfit (46 CFR 195.35). At least one shall be carried on uninspected vessels of 65' and over as well, and on smaller vessels if practicable. Consideration should be given to ease of operation and response time in selecting from the list of approved equipment.

Lockers and spaces containing the apparatus shall be marked "Self-Contained Breathing Apparatus." Selected members of the crew should be instructed in its use. Apparatus shall be MSHA or NIOSH approved for 30 minutes. A spare bottle shall be available for each apparatus and one additional bottle for training. This equipment is not approved for medical use. (46 CFR 196.37-20)

7.11 FIRE FIGHTING TRAINING

Vessel crews must receive adequate training to properly operate the fire fighting equipment available aboard their vessel. It is recommended that all crew members attend a USCG approved fire fighting school at least every five years. If possible, the crew should attend as a group. Under STCW mariners with safety related duties must complete a Basic Safety Training course. Incorporated in this requirement is 16 hours of Basic Fire Fighting. STCW also requires that “Seafarers designated to control fire-fighting operations shall have successfully completed advanced training in techniques for fighting fires, with organizational tactics and command.” This competence must have been demonstrated within the previous five years. Participation and compliance with these training requirements is encouraged, however the U.S. exempts mariners from STCW requirements who serve on small passenger vessels under subchapters T and K and other vessels of less than 200 Gross tons sailing on near coastal, domestic voyage; that being a voyage that begins and ends in a U.S. port, does not touch at a foreign port or enter foreign waters, and is not more than 200 miles from shore.

7.12 FIRE ALARMS AND DETECTORS

At a minimum, good quality smoke detectors shall be installed in all stairways, passageways, and escape routes within accommodations spaces. Where practical, unattended machinery spaces should be fitted with a smoke or fire alarm that initiates an audiovisual alarm in a remote, attended, or watchkeeping location. These detectors should be supplied with an automatic, emergency source of power or be battery powered. Smoke or fire detection systems should also be installed in galleys or other high-risk spaces. Smoke or fire detection equipment must meet the requirements of 46 CFR 161.002 or NVIC 7-80, or be listed and labeled by a nationally recognized testing laboratory such as Underwriters Laboratory, Inc. (UL)

7.13 EMERGENCY ESCAPE BREATHING DEVICE (EEBD)

EEBD’s are required on SOLAS ships as of 1 July 2002. The intent of an EEBD is to allow personnel to escape from smoke filled areas as well as areas where a total flooding CO2 system has been discharged. They are not intended for confined space entry or firefighting purposes. Coast Guard will accept NIOSH approved EEBD’s that have a minimum service time of 10 minutes; are supplied air or oxygen type device; and have a full face piece or hood. Minimum Coast Guard requirements are at least two units and one spare unit for the overall crew or passenger living area, and one EEBD for each crewmember normally assigned to continuous or periodic duty in machinery spaces, and at least one spare EEBD such that any person visiting machinery spaces will have access to a unit. Note that compressed air or oxygen cylinders over two inches in diameter will require periodic hydrostatic testing per 49CFR173.34. Consideration should be given to providing these devices on uninspected vessels with the number available taking into account the location and arrangement of berthing spaces as well

the science and crew. Training in the use of EEBD's should be considered as part of shipboard familiarization training. (NVIC 06-02)

7.14 MARKINGS FOR FIRE EQUIPMENT

Fire equipment shall so far as practicable, be marked in accordance with the guidelines as set forth in 46 CFR 196.37.

7.15 FIRE CONTROL PLANS

Fire control plans are submitted to the Coast Guard for new construction under 46 CFR 189.55-5. It is required that all manned vessels have available for guidance of the officer in charge of the vessel a set of plans which include a general arrangement showing fire retardant bulkheads with particulars of fire-detection, manual alarm and fire extinguishing systems, fire doors, ingress to various compartments, ventilation, location of remote means of stopping fans and identification of sections of ship served by. While these requirements are stated for inspected vessels this type of information should be readily available for persons in charge of all research vessels. When in port it is recommended having fire control plans immediately available for emergency personnel called to the vessel for fire emergencies. (46 CFR 196.36)

8. LIFESAVING APPLIANCES

8.0 REQUIREMENTS

Required lifesaving equipment for inspected vessels is specified under Subchapter W of Title 46 Code of Federal Regulations, and for uninspected vessels by Subchapter C.

For inspected vessels, the requirements of 46 CFR 199 set an entirely adequate standard for lifesaving equipment.

In general, the minimum standards set forth by Subchapter C for uninspected vessels are considered substandard for any vessel, which operates on coastal or ocean routes unless a vessel is operating well inshore. Wherever practicable all vessels given the size and nature of their operation, while operating on ocean routes (20 or more miles offshore) should strive to meet the general principles and standards set forth by Subchapter W for vessels not subject to SOLAS. Within Subchapter W, oceanographic research vessels fall into a group defined as special purpose vessels and are subsequently grouped as cargo vessels. Particular standards are singled out in the following sections. It is important to note that lifesaving equipment carried in excess of CFR requirements should still be of a type approved by those regulations and should be maintained in accordance with those regulations.

8.1 SURVIVAL CRAFT

Survival craft is a craft capable of sustaining the lives of persons in distress from the time of abandoning the vessel on which the persons were originally carried. This term includes lifeboats, life rafts, buoyant apparatus and life floats, but does not include rescue boats.

Buoyant apparatus is flotation equipment, (other than a lifeboat, liferafts, and personal flotation devices), designed to support a specified number of persons in the water and of such construction that it retains its shape and properties and requires no adjustment or preparation for use. The types generally in use are of a box float type or peripheral buoyant apparatus. (46 CFR 160.010-2)

Inflatable buoyant apparatus is flotation equipment that depends on inflated compartments for buoyancy and is designed to support a specific number of persons completely out of the water. (46 CFR 160.010-2)

Life float is a buoyant apparatus, with a peripheral body designed so that persons are supported only partially submerged with approximately 40 lbs of buoyancy required per person. Each float must have a platform that drops through the center of the float. (46 CFRR 160.027)

(b) NVIC 2-92 addresses survival equipment for liferafts. A transition has been in progress which has resulted in oceangoing vessels replacing “ocean” and “limited” service liferafts. The new liferafts will be “SOLAS A” (equivalent to ocean service), “SOLAS B” (equivalent to limited service) and “coastal” service liferafts. The changes to the SOLAS requirements for A and B Pack rafts include “an efficient radar reflector”, “thermal protective aids ...sufficient for 10% of the number of persons the liferaft is permitted”, and being “fitted with retroreflective material”.

SOLAS vessels constructed after July 1, 1986 must be conformance with the new requirements. Existing SOLAS ships were subject to these requirements July 1, 1991.

Older vessels may continue to use liferafts approved for “ocean service” with an “ocean service” equipment pack so long as they remain in good condition. Inspected vessels not required to comply with SOLAS may use the SOLAS A Pack, Ocean Service, or Limited Service (with SOLAS B equipment pack) liferafts as appropriate. “Coastal” service liferafts with a “coastal” equipment pack shall only be used for uninspected vessels operating within 20 miles of the coast. Care must be used in designating and marking liferafts. Liferafts are approved for service separate from the equipment pack provided.

Survival Craft needs for uninspected vessels are unclear to operators therefore, the following minimum standards shall apply:

Inflatable life rafts are the only type of buoyant apparatus acceptable for uninspected vessels operating in the open ocean more than 20 miles from shore. Each vessel shall carry liferafts or a SOLAS A liferaft (or equivalent ocean service if they remain in good condition) with an aggregate capacity sufficient to accommodate the total number of persons on board and that are stowed in a position providing for easy side to side transfer at a single open deck level or with an aggregate capacity on each side of the ship to accommodate the total number of persons on board (46 CFR 199.261, 46 CFR 199.640). Life raft capacity shall be prominently displayed near each raft. They shall be of a capacity of six persons or more. They shall be stowed and equipped with hydrostatic release or float free link (46 CFR 199.130). Life rafts and releases shall be inspected and serviced at approximately 12-month intervals at a facility approved by the manufacturer and US Coast Guard to service the specific type of liferaft

Vessels over 65 ft in length and not operating more than 20 miles beyond shore shall give due consideration to vessels service, operating area, and environmental conditions including water temperature when selecting an appropriate survival craft.

Vessels operating in “cold water” where the monthly mean low water temperature is below 59 degrees F (15 degrees C) shall carry an inflatable liferaft with at coastal service pack. Cold water areas are defined in NVIC 7-91. Each vessel shall carry liferafts with an aggregate capacity sufficient to accommodate the total number of persons on board and are stowed in position providing easy side to side transfer at a single open deck level or with an aggregate capacity on each side of the ship to accommodate the total number of persons on board. Life raft capacity shall be prominently displayed by each raft. Rafts shall be stowed and equipped with a hydrostatic release or float free link. Life rafts and releases shall be inspected at approximately 12 month intervals at a facility approved by the manufacturer and the U. S. Coast Guard to service the specific type of life raft. If a life raft canister is damaged or the seal broken, the life raft shall be serviced again promptly by an approved facility. Hydrostatic releases shall be provided with stainless steel tags on which is stamped their annual test dates (46 CFR 160.062-4). Embarkation aids in the form of ladders or other suitable devices and continuous illumination shall be provided at life raft stowage and launching areas. (46 CFR 199.110)

Vessels operating in “warm water” where the monthly mean low water temperature is normally more the 59 degrees F (15 degrees C) may give consideration to carrying inflatable buoyant apparatus. Vessels opting to carry inflatable buoyant apparatus or life floats shall insure they are stowed, equipped and marked in accordance with guidelines set forth in 46 CFR 640(j).

Any US Coast Guard approved type buoyant apparatus may be used by uninspected vessels less than 65' in length not operating in the open ocean more than 20 miles off shore. The institutional decision to carry equipment must be based on the vessel's service and operating area. When carried, the apparatus should be of a capacity sufficient for all persons on board, or the number of persons on board limited to the capacity of the apparatus. The apparatus shall be mounted so it can be readily launched and, when unlashed, will float free should the vessel sink. Each will be attached to the vessel by a painter and float free link (NVIC 1-83). Each apparatus will be marked as per 46 CFR 199.640(j)(3). Also, each shall be equipped for the service of the vessel and periodically examined for integrity and condition.

8.2 PERSONAL FLOATATION DEVICES (PFD)

(a) Lifejackets: All vessels shall be provided with a USCG approved PFD for each person on board. Vessels over 65' and all vessels operating in the open ocean should carry Type 1 PFDs. Vessels under 65' operating in protected waters should carry life jackets for their size as prescribed by 46 CFR 25.25-5. Vessels should carry an additional number of life preservers readily accessible for the personnel on watch in the engine room, pilot house, laboratories, and lookout. Lifejackets should be distributed throughout the crew and scientific quarters, and other places accessible to each person on board. Lifejackets should be marked with the name of the vessel or operating institution. Chemiluminescent type lights should be avoided on vessels operating in near-freezing waters. Each life preserver must have a USCG approved light, and retroreflective material of approved type must be attached. Details on lifejackets may be found in 46 CFR 199.70 and 46 CFR 25.25. When re-stowing life preservers after drills, each shall be checked for condition. At least semi-annually a thorough inspection of each lifejacket shall be made by a qualified crew member, including a squeeze to ensure floatation pads are still sealed.

(b) Immersion (Exposure) Suits: Immersion suits are required for vessels operating north of 32 degrees north and south of 32 degrees south and should be type approved under series 160.171. See 46 CFR 199.170 for details of requirements, markings, stowage, and required attachments and fittings. In addition to the legal requirements, each operator should consider whether use of this equipment is prudent, based on local circumstances, especially water temperature. The immersion suits should be marked and equipped the same as life preservers, and stowed in close proximity to working or living areas. Remember that immersion suits take longer to don than life preservers, so periodic donning drills should be scheduled for both crew and scientists. To save wear on emergency equipment, operators may want to have some suits marked "not serviceable -- drill only" separately stowed for this purpose. These suits often tend to crack along fold lines when packed and stored for long periods, and at least quarterly suits should be hung unfolded for a day. Vessels should have available small adult and oversize adult sizes if there will be persons on board under 110 lbs or over 330 lbs. Immersion suits shall be tagged or marked on the outside of the bag with the date of the last inspection.

(c) Work Vests and Suits: The work vest, Type V PFD, is an item of safety apparel, and an appropriate number of approved work vests must be carried for use by personnel working near or over water. They are not an acceptable substitute for life jackets and should not be stowed in the same location. Operators are encouraged to

outfit their work vests with retroreflective material. Because of the nature of their use, these vests will require replacement more frequently than other lifesaving equipment, and frequent inspections are therefore necessary. There are a number of floatation suits and coats available that are recommended when operations take place in a low temperature environment. However, unless these are Coast Guard approved, they may not be substituted for work vests. (46 CFR 26.30 and 196.34)

8.3 RING LIFE BUOYS

All inspected and uninspected vessels under 328 ft (100m) in length in ocean service shall carry a minimum of 8 ring life buoys that shall be stowed marked and with attachments as per 46 CFR 199.70(a). Life buoys must be stowed so they can be rapidly cast loose; may not be permanently attached to the vessel; and each position must be marked with either the words “LIFEBUOY” or “LIFE BUOY” or the appropriate IMO designated symbol. They must be distributed so they are readily available on either side of the vessel, with at least one near the stern. At least two life buoys fitted with self-activating smoke signals shall be stowed near the bridge where they can be easily released. Life buoys fitted with self-activating smoke shall also be fitted with self-igniting lights. Each life buoy must be marked in block capital letters with the vessels name and homeport. At least one life buoy on each side shall be fitted with a buoyant life line at least 100 ft long. Half the total number of life buoys shall be fitted with approved self-igniting lights.

For 65 ft or over in length and in services other than ocean (not more than 20 miles offshore), lifebuoys should be stored, marked, and fitted with attachments and fittings as per 46 CFR 199.70(a). For vessels over 65 ft and under 98 ft the minimum number of life buoys to be carried shall be 3 and for vessels over 98 ft and under 196 ft a minimum of 4 life rings shall be carried. (46 CFR 640(i)) One ring buoy on either side of the vessel shall have100 ft (30m)' of buoyant line attached. All ring buoys shall be marked in capital letters with the name and homeport of the vessel. At least two of the ring buoys with water lights attached shall also be provided with a self-activated smoke signal and capable of quick release from the bridge. While these are not legally required on other voyages, they are strongly recommended minimums.

All uninspected vessels over 26ft and under 65 ft in services other than ocean (not more than 20 miles off shore) shall be equipped with a minimum of at least 1 ring life buoys which shall be equipped with a line at least 60 ft in length shall be placed so as to be readily accessible to the persons on board. The position of the life buoy shall be plainly indicated. (46 CFR 25.25-5)

8.4 PYROTECHNIC DISTRESS SIGNALS

All vessels in coastwise or ocean service must carry, in the pilothouse or other suitable location, the following minimum pyrotechnic distress signals: 12 approved rocket, parachute, red flare distress signals contained in an approved portable water-tight container. Each approved signal must have an expiration date marked on it and that date must not be more than 42 months from the date of manufacture. (46 CFR 199.60(c))

8.5 LINE THROWING APPLIANCE

Most research vessels have the need for lifesaving equipment, which exceed the regulatory requirements. The handling of oceanographic equipment poses a high risk of a person on deck falling overboard, and a vessel with equipment over the side is usually not able to maneuver freely to make a recovery. All vessels should maintain a capability to recover a person in the water, which may include a line-throwing appliance, depending on the vessel's operating characteristics and responses to weather and sea conditions. Reliability and speed are the main criteria for developing a recovery capability. There are, on the approved equipment list, two approved line-throwing devices:

Rocket propelled, canister type, line-throwing appliances which are relatively inexpensive to procure and maintain, but the rocket which is used to propel the line must be replaced at its expiration. Two should be carried to provide a back up capability.

The shoulder gun type has a higher initial cost, and greater maintenance requirements. However, it has the advantage of allowing more that one shot with out having multiple units. One gun can be provided with several projectiles and canisters of line. At least one reload should be available if a line-throwing appliance is carried.

Training in the use of the line throwing gun or device should be held quarterly and logged. All vessels should actually fire these devices at a frequency appropriate to maintain proficiency. (46 CFR 199.170, 46 CFR 199.180(e))

8.6 RESCUE BOATS

As noted in the previous section all vessels need to maintain a capability to quickly recover a person in the water. Rescue boats provide this means. Rescue boat as defined in the CFR's means a boat designed to rescue persons in distress and to marshal survival craft.

All inspected vessels must have a rescue boat approved under approval series 160.056 and be equipped as specified in table 199.175 and shall comply with requirements for stowage, launch and embarkation. (46 CFR 199.262)

All uninspected vessels have a responsibility and should maintain a capability to recover a person in the water. There is no requirement for uninspected vessels to carry rescue boats however consideration should be given to types of operations the vessel will be conducting, vessel maneuverability, and vessel freeboard. It is recommended that uninspected vessels have a designated rescue boat when operating in ocean service, coast wise service, or in the Great Lakes. The vessel's workboat may be designated as the rescue boat. In so doing due consideration must be given to the workboats suitability for such purposes and the need to be readily launched, embarked, easily recovered, and suitable for existing conditions. (46 CFR 640(g))

8.7 TETHERS (LIFELINES)

Vessel operators shall also make available tethers for use as appropriate by persons involved in deck operations. These should be comprised of an easy-release belt or shoulder harness and buoyant line. No Coast Guard approval requirement.

8.8 RETROREFLECTIVE MATERIAL

Lifeboats, life rafts, ring life buoys, rescue boats, life floats, and personal flotation devices shall have retroreflective material which is Coast Guard approved for that application and is approved under 46 CFR 164.018. (46 CFR 25-15)

8.9 LITTERS & STRETCHERS

Litters or stretchers that are used to evacuate an ill or injured person from a vessel should be equipped with floatation.

8.10 DATED MATERIALS

Many items of lifesaving equipment, such as flares, EPIRB batteries and liferaft supplies, have a specified, limited service life. Care shall be taken to ensure these items are marked with an expiration date upon being placed into service, and records shall be kept to ensure timely replacement.

8.11 MUSTER

Inspected vessels shall comply with those requirements for Muster List and Emergency Instructions contained in 46 CFR 199.80. These same requirements should apply to all vessels in ocean service.

For uninspected vessels clear instructions must be provided to each person on board a vessel in the event of an emergency. Copies of muster lists should be posted in conspicuous locations and shall be current for the particular voyage. Each muster list should include at a minimum instructions for operating general emergency alarm system, emergency signals, actions to be taken when an emergency signal is sounded, duties assigned to members of the ship's crew.

Emergency instructions and illustrations should be posted in each cabin occupied by special personnel on board which should include fire and emergency signals, muster station, location of lifejackets, methods of donning lifejackets.

As an alternative smaller uninpsected research vessels may consider complying with 46 CFR 28.265 for uninpsected fishing vessels.

8.12 TRAINING AND DRILLS

Training and drills for inspected vessels are addressed in 46CFR199.180. These same requirements should apply to all vessels in ocean service.

The key to emergency response is training and drills. Therefore uninspected should at minimum:

-Have training materials relating to emergency equipment and procedures readily available on board

-Insure every crewmember on board is familiar with emergency duties before a voyage.

-Provide a safety briefing for special personnel/science party before sailing or immediately after sailing.

-Drills shall include:

- One fire abandon ship drill every month and within 24hours of leaving port.
- As far as practical rescue boats should be launched with assigned crew aboard and maneuvered in the water at a minimum of every three months.
- Emergency lighting for muster and abandon ship should be tested at every abandon ship drill.
- Line throwing appliance drills shall be conducted every quarter with actual firing at master's discretion.

-Every new crewmember shall be provided:

- Onboard training in use of vessels lifesaving appliances, survival craft and fire extinguishing appliances within two weeks of arrival.
- Onboard training in the problems with hyperthermia and other appropriate first aid.
- Instruction in the use of fire and lifesaving equipment at the same interval as drills.

As an alternative uninpsected vessels may comply with those requirements contained in 46 CFR 28.270.

A record of all training, drills and personnel attending should be maintained on board the vessel. The date, time and type of drill should be documented in the vessel's log.

9. SCIENTIFIC AND SHIPBOARD HAZARDOUS MATERIALS

9.0 HAZARDOUS SCIENTIFIC MATERIALS

A hazardous scientific material is any substance, which because of its chemical or biological properties can cause the deterioration of other materials or injury to living organisms. Hazardous scientific materials may be grouped into five major classes: Flammable, corrosive, reactive including explosive, toxic or poisonous, and cryogenic. Included in the above classes that are routinely utilized on research vessels are compressed gases and radioactive materials. Research explosives and radioactive materials are covered separately in Sections 10 and 11 respectively.

Rules for the stowage, labeling, and protection of flammables and other hazardous scientific stores on inspected vessels are given in Subchapter U, Title 46 CFR, Part 194. All research vessels insofar as practicable should follow these rules. Particular standards are singled out below:

Storage containers should be marked, labeled, and stored in a ventilated and protected area under the supervision of the Chief Scientist with the knowledge and approval of the Master. The labeling must include the common or trade name, the nature of the hazard (flammable, carcinogenic, etc.), and the manufacturer's name, address, and telephone number. Consideration should be given to transporting and storing hazardous materials, normally shipped in glass containers, in special, non-breakable containers, or where glass is a necessity PVC coated bottles. Secondary containment should be utilized when moving breakable containers around the vessel. These are available from laboratory supply companies.

Compressed gases should be securely held to solid ship structure. Metal brackets or positive cargo straps should be used to hold them in place. Ropes or other similar lashings must be avoided. All gas cylinders must have their safety cap in place unless they are in use with a regulator. No cylinder should be moved without the cap in place

(b) Working quantities only should be stored in the laboratory. A reasonable working quantity would be a one-day supply, considering the hazard posed by the material. Containers should be marked with the material's chemical and common names, type and classification. Bench top holders should be provided to restrain the container when in the laboratory.

(c) Storerooms for chemicals and flammables, where practicable, should be protected by fixed CO_2 or other fire suppressant systems, and used for no other purpose. Where it is not practical to provide such a storeroom, consideration should be given to a hazardous material locker appropriate for the type and quantity of material being stored. (46 CFR 194.05, 194.15, 194.20)

(d) Incompatible materials must not be stored together. A close review of the Material Safety Data Sheets will help to determine if two materials are incompatible.

9.1 CRUISE PLANNING

The Chief Scientist will be responsible for providing the following to the ship operator at least four weeks prior to the cruise departure date.

A list of hazardous materials they plan to bring on their cruise by chemical name, common name, type and classification.

(b) MSDS sheets for all of the materials listed in (a)

A listing of the neutralizing agents, buffers and/or absorbents required for the materials, in the event of a spill. These agents must be provided by the science party in quantities consistent with the amount of hazardous material that could be potentially involved in a spill. Containers for disposing of the spent cleanup materials must also be included.

The Chief Scientist's plan for temporarily storing and/or ultimately removing the hazardous materials from the vessel. At the end of the cruise the Chief Scientist will provide the Master with an updated inventory that lists materials that are depleted and those quantities remaining for removal at the end of the cruise, or properly stored onboard for removal at the end of the voyage.

The ship operator will review the provided material and contact the Chief Scientists if there are any questions or concerns. The ship operator will then forward copies of the materials to the vessel or request that the Chief Scientist carry a copy to the vessel for delivery to the Master.

9.2 TRANSPORTATION AND DISPOSAL

The Chief Scientist will be responsible for the proper transportation, shipping and disposal of hazardous materials and waste, including empty containers, associated with their project. Transportation and disposal must be carried out in accordance with Federal, State and Local regulations. In no case will this responsibility be passed to the ship's crew or operating institution unless specifically arranged in advance.

9.3 CHEMICAL SPILL RESPONSE

The scientific party will be the first to realize that a spill has occurred. It is vitally important that the ship be immediately alerted when this happens even if the spill is considered minor. The science party and crew must work together to minimize the impact of the spill on the vessel. Depending on the nature of the spill, ventilation systems may have to be shut down and Self Contained Breathing Apparatus (SCBA's) might have to be utilized to safely neutralize the spilled material. This will be done by the crew. The science party will have the expertise in applying the proper neutralizing agents and final mopping up of the spilled material.

During the safety briefing at the beginning of the cruise the crew member giving the briefing will point out eye wash stations and the location of the deluge shower. All science party members should make note of these facilities as well as the locations of fire extinguishers liberally placed throughout the laboratory areas.

9.4 MATERIAL SAFETY DATA SHEETS

Hazardous materials will be found among both ship and scientific stores and include such items as organic solvents, corrosives, compressed gases, flammable liquids, and toxic or reactive chemicals. Material Safety Data Sheets (MSDS contain a list of product ingredients, indicating which are hazardous and why; recommended personnel protection and precautions; spill or leak procedures; and fire, explosion, health (including first aid), and reactivity data; and most importantly, an emergency telephone number for assistance in the event of an accident. Employers are required to inform employees of what hazardous materials are present in the work place and train them in proper use and handling with the aid of MSDSs. It is important for vessel operators to

ensure a listing of hazardous materials and copies of MSDSs are provided by participating scientific parties. Laboratories have no specific status or exemption with regard to these regulations. (29 CFR 1910)

9.5 SHIPBOARD HAZARDOUS MATERIALS AND POLLUTION

Many of the materials associated with the normal operation and maintenance of research vessels are classified as hazardous materials. In addition, some materials, waste products and sewage are the subject of pollution control regulations issued by the Coast Guard and other agencies. Research Vessel operators have an obligation to ensure that their crews and scientific parties are informed of the hazards associated with these materials and that they are aware of the pollution control regulations so that wastes are not disposed of in violation of the law.

10. EXPLOSIVES

10.0 EXPLOSIVES ORGANIZATION

Each oceanographic institution using explosives for research at sea shall have the following organization as a minimum:

(a) COMMITTEE ON EXPLOSIVES USE AND SAFETY: The responsibilities of this committee shall include judging scientific merit, and also approval at each stage of planning, acquisition of permits, purchasing, loading, storage, and the overall use of explosives for their institutions.

(b) EXPLOSIVES CONTROL OFFICER: The responsibilities of the Explosives Officer shall include working contact with local authorities and with the local USCG office; supervision of the institution's explosive shooters; custody of explosive handling and shooting equipment; purchasing explosives; vendor contacts; maintenance of operations; technical files; knowledge of local, state, and federal explosives regulations; and safety. The Explosives Officer should go to sea and shoot explosives as part of his/her duties.

(c) EXPLOSIVE SHOOTERS: Shooting of explosives shall only be done by those thoroughly qualified. Personnel assigned to this task should be trained formally outside the institution involved. As an example, the Basic Underwater Demolitions School, Naval Amphibious Base Coronado, San Diego, CA 92155 has provided training to civilian oceanographers and marine technicians in the use and safe handling of explosives, including class work and practical application.

10.1 EXPLOSIVES, PERMITS, AND AUTHORIZATION

Since USCG rules dealing with explosives are stringent and strictly enforced, the Port Captain, USCG Office should be contacted at least 8 weeks prior to the cruise departure date. In addition, Fish and Game Departments, local and state law enforcement agencies, the fire department etc., should be contacted for information on possible restrictions, truck routing, spot assistance and inspections, etc.

The use of explosives, sonic emitters, or towed devices (as well as instrumentation moorings) present special hazards to submarine operations and navigation. The National Imagery and Mapping Agency (NIMA) Navigation Safety Desk has agreed to disseminate information concerning underwater hazards as part of the Notice to Mariner system. See chapter 15 section 15.7 for details on reporting these hazards.

10.2 EXPLOSIVES STOWAGE

Rules for carrying, stowage, and labeling of explosives on board inspected ships are given in Subchapter U, CFR. These rules should be followed by all research vessels. In addition, 49 CFR 176 prescribes requirements for all vessels carrying hazardous materials in the domestic waters of the United States, with some exceptions. Magazines and storage areas should be properly labeled and inspected daily, and safety precautions should be posted. (46 CFR 194.05, 194.10, 196.80, 196.85)

10.3 MILITARY EXPLOSIVES

Since military explosives such as Navy SUS charges may be used by research institutions, users should be aware that there are special requirements for these munitions. See 46 CFR 147.40, 147.95, 194 and 49 CFR 173, *et. seq*. for guidance in handling explosives.

10.4 EXPLOSIVE STAND OFF LIMITS

Explosive Safety Precautions for Research Vessels, NAVORD OP-3696, Appendix B, provides vital information that should be used in calculating stand off distances, in order to prevent hull damage.

10.5 EXPLOSIVE BLASTING CAPS

Electric blasting caps should not, in general, be used on board ships because of the potential hazard of pre-fires from induced current through radio and radar radiated energy. If electric blasting caps must be used then ship radios and radars must be secured and their switches tagged so they are not inadvertantly turned on.

The following references can be accessed for more detail.

Handbook of Electric Blasting. Atlas Powder Company (1985).

Dupont Explosives Specialties, E-119 High output-pressure resistant detonators. E.I. du Pont de Nemours, Wilmington, DE 19898 (1994).

NAVORD OP 3696, Published by Direction Commander, Naval Ordnance Systems Command (1966).

10.6 EXPLOSIVES HANDLING GEAR

Slings, nets, and other portable handling gear used with explosives should be maintained exclusively for that use.

10.7 RESPONSIBILITY FOR CARRYING OUT THESE PRECAUTIONS

Cases may arise in which one institution's scientists may be doing research involving explosives on another institution's ship. In such cases, the primary responsibility for assuring adherence to safety standards shall lie with the ship's operating institution. If the operating institution does not have in house expertise in the handling and use of explosives they should obtain the services of an institution or organization where such expertise exists to review the documentation and plans for the experiment. The institution using the explosives must provide the operating institution with copies of all permits and authorizations for the purchase, transport and loading of the explosives as well as approvals of the magazines and cap lockers that will be placed aboard the vessel. In addition a detailed protocol will be provided for review that defines the experiment and the amount and nature of the explosive to be used. This material must be available to the operating institution with sufficient lead time to have it properly reviewed.

In the event that the operating institution has any concerns about the legality or safety of the planned experiment it is their prerogative to deny the use of the explosives aboard their vessel, if the differences cannot be resolved to their satisfaction.

10.8 ASSISTANCE

Cruises that use explosives are becoming rare. As a result shooter expertise is limited within the UNOLS fleet. For advice on dealing with explosives and federal, state and/or local transportation regulations, the following person can be contacted:

Bob Wilson, Scripps Institution of Oceanography
Telephone - 858-534-1632
Email - Resident Technicians [restech@sdsioa.ucsd.edu]

11. RADIOACTIVE MATERIALS

11.0 BACKGROUND

Radioactive materials on board ship pose problems not found in shore laboratories. Instead of a dedicated laboratory often used for no other purpose, radioactive materials at sea occupy laboratory spaces that will be used by other researchers. Because of this, research ship operators and scientists have a particular obligation to assure the most careful procedures; including monitoring, clean-up, and record keeping. These precautions are necessary not only for the protection of personnel but also to ensure the integrity of measurement made by different investigators of environmental levels of natural or artificial radio nuclides. In most cases, it is necessary for these programs to measure as close to zero values of radio nuclides as is made possible by the state of the art. The work is therefore sensitive to contamination by very small amounts of radioactivity lost by others, far below those having any public health significance.

11.1 REGULATIONS

Activity and quantity of the materials shall not exceed that authorized by the operating institution's Nuclear Regulatory Commission (NRC) Byproduct Material License, or equivalent, which is monitored by that institution's Radioisotope Users Committee, or equivalent. This committee should consist of a Radiation Safety Officer (RSO and representatives from ship operations and the user community. Provisions of such a license usually apply to a research vessel at sea or away from homeport. The use, storage, transportation, labeling and disposal of such materials shall conform to applicable regulations of the NRC, any state agencies that have jurisdiction, and the operating institution's procedures.

11.2 PRACTICES

As part of the procedure for obtaining authorization to use radioisotopes at sea, the Chief Scientist must submit an application which includes information on the amount and type of isotope to be used, protocols for the experiments in which these isotopes will be used, and how radioactive waste will be stored or disposed of. The operating institution's Radioisotope Users Committee (or equivalent) will review and authorize the proposed research.

Laboratory vans and other work areas designated for isotope use should conform to minimum standards for such facilities. A properly vented fume hood should be available for all activities for which there is a potential of airborne radioactivity. It is important to know where this fume hood exhaust exits the ship to make sure that personnel are not exposed directly or indirectly. All working surfaces should be constructed of materials that are nonporous and resistant to corrosion by seawater and radioactive solutions. A refrigerator/freezer capable of being locked should also be available for storage of isotope stocks. No food items should be stored in this appliance.

The trend toward the use of laboratory vans restricted for radioisotope use is encouraged; i.e., all operating institutions should maintain at least one laboratory van for this purpose. Appendix B contains the minimum standards to be used in fabricating a van for this purpose. Using this van for other purposes; e.g., storing gear and paints, transporting spares, etc., should be prohibited.

In order to ensure proper monitoring of work areas, all UNOLS vessels should be equipped with monitoring equipment such as a liquid scintillation counter and Geiger counter with pancake probe. Personal dosimeters should be provided as appropriate for the isotopes in use.

Likewise, UNOLS institutions are encouraged to require a member of the ship's complement to be trained in basic radiation safety procedures. At the beginning of each cruise, this person would be responsible for briefing the crew and scientific party on the isotopes to be used, where they are to be used and stored, the disposition of wastes, and potential hazards.

The disposition of radioactive wastes is an increasing problem. Radioactive wastes should not be disposed of at sea. In terms of safety and the risk of contamination, it is clear that the number of transfers between localities should be minimized. Either the operator or scientific user should provide shipboard facilities for the safe and secure storage of liquid waste. The operating institution RSO will approve these containers. The PI assumes all responsibility for the necessary activities and costs to dispose of all radioactive materials at the end of the cruise.

It is essential that ship operators be informed of the intent to use radioisotopes as early in the scheduling process as possible. To this end, the following is recommended:

1. The amounts and types of isotopes to be used aboard ship and the name and telephone number of the RSO from the Principal Investigator's home institution should be provided on the UNOLS Ship Request form.
2. Upon notification of funding, the PI should initiate the procedure required to obtain authorization to use radioisotopes on UNOLS vessels; i.e., to immediately contact ship operations for instructions and to notify their own RSO.

11.3 PRINCIPAL INVESTIGATOR

The Principal Investigator (PI) must have been granted written authority by the home institution's Radiation Safety Committee to possess and use radioisotopes. Upon notification of funding, the PI must contact the operating institution and initiate the procedures required to obtain authorization to use radioisotopes on the assigned vessel. The Radiation Safety Officer (RSO) of the PI's home institution must also be notified and requested to verify to the operating institution that the PI is an authorized user.

Once the PI has been authorized to use isotopes by the operating institution, the PI should notify the Chief Scientist of the cruise and confirm the laboratory space or van which will be restricted for isotope use (during the period of isotope use). The PI will be responsible for posting the area, for monitoring, for clean up of spills, and for ensuring that the work area is clean once work has been completed. All users must have personal dosimeters (except when using low energy beta emitters C-14, H-3, and S-35) and work areas must be surveyed as required by the operating institution. All spills must be reported to the Chief Scientist who will immediately report them to the Captain. Upon completion of the cruise, the PI will report the results of all surveys and the disposition of waste, unused isotopes, and labeled samples to the Chief Scientist. The Chief Scientist must include this information in the cruise report to the operating institution.

The responsibilities for clean up, disposal and transport of all waste and the associated costs will be borne by the PI.

11.4 OPERATING INSTITUTION

Operators must ensure that scientists are familiar not only with the usual regulations and procedures, but also with the special shipboard practices. Procedures must be established as to action to be taken in case of an accidental spill. The shipboard practices, together with a summary of or reference to, other regulations, should be in the ship's Cruise Handbook and discussed with the scientists well in advance of the cruise so that all hands will be alerted.

Of central importance is the establishment of procedures by which a PI may be granted the authority to use radioisotopes at sea. This responsibility rests with the operating institution and their RSO. The information upon which authority is granted should include at least the following:

1. The names of all personnel that will be engaged in the use of isotopes aboard ship, and the quantities and forms of all isotopes to be used.
2. Written verification by the RSO of the PI's home institution that the PI and/or the personnel listed above is currently authorized to possess and use the quantity and type(s) of isotope(s) proposed by the P.I.
3. A description of experimental protocol. This should include the proposed location of the work and procedures for storage and manipulation, for isolation and control of samples, for containment and cleanup of spills, and for the disposition of liquid and solid waste.

To ensure the safe and orderly use of radioisotopes at sea, the operating institution should also assume the following responsibilities:

1. Provide suitable facilities for use and storage. Such facilities include appropriately designed laboratory space and monitoring equipment (scintillation counter and, when required, personal dosimeters).
2. Prior to departure, ship's personnel and the scientific party should be briefed on the types of isotopes to be used, location of van and storage, and potential hazards.
3. A member of the ship's complement (e.g., an officer or marine technician) should be trained in basic radiation safety and emergency procedures. This individual, designated as the ship's radiation safety officer, would work with the scientist to ensure that the isotope work is conducted in designated areas, that these areas are properly posted and monitored, and that spills are properly cleaned up and reported.

Operators and PI's should be aware of the SWAB team operated by the Tritium Lab at the University of Miami. This group will conduct tests for extremely low levels of Radioactivity before and/or after a cruise. This serves not only as a deterrent, but also as an important ingredient in the process of policing a spill. SWAB tests can be requested directly from the University of Miami with all associated costs borne by UNOLS. The address and phone number for the Tritium Lab is:

Tritium Laboratory 11
Rosenstiel School of Marine and Atmospheric Sciences
4600 Rickenbacker Causeway
Miami, Fl 33149
Phone: 305-361-4100

12. SCIENTIFIC EQUIPMENT

12.0 BACKGROUND

Scientific equipment carried on board research vessels ranges from the familiar equipment standard on most cruises (such as CTD/Rosettes and rock dredges) to one-of-a-kind developmental hardware which is largely unknown to all hands, including the scientists who brought it. From this, two safety concerns arise: first, extreme familiarity may lead to carelessness with gear which is still inherently dangerous in itself. At the other extreme, novel equipment whose potential hazards are not known can lead to unpleasant surprises. In either case, and those in between, both crew and scientific party should exercise prudence and caution, particularly if the scientific operation might be dangerous to the ship and to personnel other than the immediate users.

With very few exceptions, scientific equipment is not covered by federal laws and regulations. It is all the more important, then, that all hands approach research operations with particular care, using the principles of good seamanship, sound marine engineering practices, and common sense. In the case of inspected vessels, CFR Subchapter U contains rules for certain examination and testing procedures. Uninspected vessels should strive to meet these safety standards as applicable. But in the majority of cases CFR and other rules delegate the responsibility for safety procedures to the operator, thus placing a heavy burden on those involved.

It is not possible to cover all the myriad of cases of safety problems involved with research operations. Noted below are the major instances in which pertinent parts of the CFR's and other regulations and standards do apply.

12.1 WEIGHT HANDLING EQUIPMENT

Many heavy or bulky items of research equipment are handled over the side, usually on wires. All the handling gear involved should be installed to meet recognized regulations, codes and manufacturer's specifications. The entire installation should be in accordance with the approved stability data. Where applicable, stress and general design calculations should be performed. Particular attention should be paid to 46 CFR 189.35-9 which requires that the "safety factor for all metal structural parts … be a minimum of 1.5 … times the calculated stresses resulting from application of a load equal to the nominal breakstrength of … wire rope to be used." Operating limitations should be clearly posted, and operators of winches, cranes, and the like qualified in their use. Installation and periodic tests (see 46 CFR 189.35.5 (a)) should be made to exercise the entire suite of equipment to 125% of maximum working load (See Chapter 15, section 15.15 for further information). Labels giving test information should be placed on the equipment. Since overstresses may degrade the long-term safety factor, records should be maintained of tests, excessive loading, maintenance, alterations, and other factors. It should be noted that these strength precautions become even more important as the value of the equipment being lowered increases, in addition to potential delays of the scientific program and hazards to operating personnel. (46 CFR 189.35)

12.2 SCIENTIFIC LABORATORIES

The Chief Scientist is responsible for the general operation and safety of the scientific laboratories and storage areas. As a matter of prudence, periodic inspections should be made by a scientist and one of the ship's officers. Common problem areas are

stowage and use of chemicals, flammables, and other hazardous materials; safety labeling; posted standard safety precautions, and common-sense safe operating procedures. Fire extinguishers, ventilation, eye-wash facilities, and the like should be adequate for the equipment, both in use and while stowed; motion is by far the most common cause of damage and personal injury aboard ship. Cooperation between the ship's crew and the scientific party is most important, since for the most part the scientists are not experienced mariners, and thus are unfamiliar with even the common problems associated with a moving vessel. It should be remembered that although in practice, the Chief Scientist is primarily responsible for safety of the science operations, and the ultimate legal responsibility (and authority) lies with the master of the vessel. (46 CFR 194.15-3)

12.3 PORTABLE VANS, TANKS, AND OTHER EQUIPMENT

The carrying of portable vans, tanks, special winches, deck-loaded crates of equipment, etc., must be carefully checked for conformity with approved stability and load line conditions. It is particularly important that accurate weights be provided for equipment being brought on board. Since such installations are temporary, their design and the selection of materials, especially for weather surfaces and the attachments and hold-downs, should be carefully thought through in light of probable weather conditions and ship's motion. The use of standard-sized hold-down holes at 2-foot spacing on the deck is commonplace throughout the research fleet. With these readily available, there is no excuse for portable structures coming adrift. While each installation will of course be somewhat different, as a basic guide, the van itself and accessory components should be designed and constructed to good marine commercial standards. Electrical and other connections to the permanent ship systems should be to marine standards. Adequate ventilation for the intended use must be provided. Particular attention should be given to van electrical systems since building electrical systems have “grounded neutrals” while ship systems are generally ungrounded. Proper design of van electrical systems, including the provisions to isolate van electrical circuits is particularly important, since it can avoid problems both as shock source and electrolysis. Machinery brought on board should be in good repair and operating condition, as hydraulic leaks and electrical problems pose a safety risk to scientists and crew alike. Acceptable “marine standards” are those standards published by UL for marine service, found in IEEE-45 or Coast Guard regulations.

46 CFR 195.11 contains the Coast Guard regulations concerning the use of vans aboard inspected vessels. It classifies vans into four categories; accommodation vans, power vans, vans for use or storage of chemicals, and scientific equipment vans. If installed on an inspected vessel, all but scientific vans are subject to both Coast Guard regulatory plan approval and inspections at a two year interval. Most vans used aboard research vessel are classified as science equipment. See 46 CFR 188.10 – 67 to determine if a van is science equipment. More detailed information concerning vessel vans may be found in ISO standard 1496, and the ABS Guide for Certification of Container Securing Systems, and Certification of Cargo Containers.

Uninspected vessels must also be aware that a van placed aboard a vessel does count as measurable volume for admeasurement purposes. It is, therefore, possible for a van to increase tonnage to 300 or more tons and place the vessel into an inspected status. Accommodation vans, power vans and vans for use or storage of chemicals designed

for use aboard uninspected vessels are not subject to Coast Guard inspection; therefore, such a van designed for use on an uninspected vessel cannot be transferred to an inspected vessel unless the Coast Guard has inspected it.

Appendix B contains recommendations for the construction, inspection and installation of vans aboard a research vessel. These are the minimum safety requirements for placing a van aboard a UNOLS vessel and should be followed by both inspected and uninspected vessels.

13. COMMUNICATIONS

13.0 BASIC RADIO COMMUNICATIONS

Adequate radio communications are essential to the safety of a vessel, which operates in the open ocean and must be functional at all times when the vessel is underway. All research vessels should have radio equipment appropriate for the operation, even if not legally required. Certain types of research vessels are required to carry radio communications equipment that meets specific requirements in accordance with 47 CFR, Chapter 1, Part 80, Stations in Maritime Service Subpart E. Federal Communications Commission Rules and Regulations, Volume IV is also applicable.

13.1 EQUIPMENT

The Global Maritime Distress and Safety System (GMDSS) (www.navcen.uscg.gov/marcomms/gmdss/default.htm) adopted by the International Maritime Organization (IMO and published as an amendment to the International Convention for Safety of Life At Sea (SOLAS) replaces manual morse code and voice radio for distress alerting with an automated satellite and terrestrial based calling systems. Under GMDSS ships at sea will now use Digital Selective Calling (DSC), INMARSAT, and EPIRBs for distress alerting.

GMDSS is mandatory for all ships subject to SOLAS as of 1 February 1999. This includes all US passenger vessels carrying more than 12 passengers and all ships of more than 300 gross tons. At present GMDSS does not apply to research vessels under 300 gross tons. However, GMDSS does require ships to carry various types of communications equipment depending upon the type of voyages that ship sails on rather than solely the gross tonnage.

Research vessels traveling outside of the 20 mile coastal zone are encouraged to participate in the GMDSS program. Any vessel engaged in foreign voyages must participate in the GMDSS program.

Regardless of size or tonnage, a research vessel should not deploy without at least two working means of communications that are both adequate for every area of intended operations.

13.2 EMERGENCY POWER

Radio-equipped vessels 36 feet and over should have an emergency source of power either by generator or battery located above the main deck sufficient for emergency radio power. The power source should be frequently checked to ensure proper operation. (46 CFR 28.375)

13.3 REPORTING

All research vessels, while operating should make the following radio (or telephone) reports to their home base or other base designated to receive such reports:

1. At least once daily when underway on cruises overnight or longer than one day.
2. When any change in the cruise plan affects the planned position or ETA at any previously designated point.
3. When any equipment failure adversely affects the capability of the vessel.

4. When adverse weather or other factors affect the planned operations of the vessel.

On arrival and departure from an overnight or other designated stop.

When an injury occurs to personnel that prohibits them from performing their regularly scheduled duties for 24 hours or more.

13.4 LOSS OF RADIO CONTACT

As required by the Maritime Safety Act of 1984 (46 CFR 4.04), an operating institution's representative having reason to believe (because of the lack of daily communications for two successive days, 48 hours, or non-appearance of a vessel, or other unusual instance) that the status of a vessel is uncertain or imperiled shall notify the cognizant USCG Rescue Coordination Center (RCC). The operating institution shall continue to use all available means to establish communications with the vessel and determine its status. The person notifying the Coast Guard shall provide complete information concerning the vessel's itinerary, identification, and communication capabilities. The purpose of notification is to make the Coast Guard aware that some uncertainty exists concerning the status of the vessel and to save time if and when it becomes necessary to declare an emergency. A vessel unable to communicate with any station for a period of 60 hours will terminate all operations and proceed to the nearest point where communications can be re-established. Normally, the vessel will proceed to the nearest port having communications capability.

13.5 WEATHER REPORTS

Research vessels while underway should make frequent weather checks. The use of an all-band receiver and a facsimile recorder for weather maps is strongly recommended for those vessels engaged in deep ocean research.

13.6 BASE RADIO STATION

Marine facilities, which operate vessels on frequent cruises, should establish and operate a properly licensed base radio station to assure prompt and positive communications, or make positive arrangements to use an existing station. Marine facilities within UNOLS that operate base radio stations should make their services available to all research vessels. In the absence of a base radio, there should be a routine and positive system of ensuring timely receipt and delivery of reports.

13.7 SURVIVAL CRAFT RADIOS

The requirements for having a lifeboat radio pertains to vessels on international voyages and are discussed in 46 CFR 192.55 and 47 CFR, Chapter 1, Part 80. Portable VHF radios should be available for use with other survival craft. GMDSS compliant portable VHF radios with special required features are now available and are required for vessels that comply with GMDSS certification.

13.8 EPIRB

An Emergency Position Indicating Radio Beacon (EPIRB) is mandatory equipment for inspected research vessels over 300 gross tons in ocean and coastwise service. NVIC 9-93 provides requirements for this equipment and instructions for the four classes of

UNOLS vessels-inspected over 500 GT (SOLAS certificated), inspected 300 to 500 GT, uninspected operating on the high seas (3 miles beyond the baseline) and uninspected operating in Great Lakes. Note there is some slight variation in equipment requirements depending upon whether the vessel was built before or after February 1, 1992. In general, all UNOLS vessels are required to carry an EPIRB. The EPIRB must be a Category 1 satellite tracked unit of the float-free type. Stowage locations shall be carefully selected so the EPIRB will float free should the vessel sink in any conceivable attitude. Manufacturers installation instructions, test and battery replacement schedules shall be carefully followed. In addition care must be taken to register the EPIRB with NOAA. EPIRBs shall be tested in accordance with 46 CFR 196.15-65 and marked in accordance with 46 CFR 196.37-49.

SOLAS certificated vessels are required to carry three or more survival craft portable two-way radios, which operate on channels 6 and 16. Vessels from 300 to 500 GT are required to carry two such radios. Uninspected oceangoing and coastwise vessels should meet the same general requirement and carry at least one portable survivor craft radio. Consideration should be given to carrying a Category 1 406/121.5 MHz float-free, automatically activated EPIRB. Inspected vessels over 300 gross tons are required to carry a Category 1 EPIRB as of August 1, 1993. Reference 46 CFR 192.65, 196.15-65, 196.37-49, 47 CFR 80.1053

Ocean going and coastwise vessels are also required to carry 9 Ghz radar transponders (SARTs). Inspected oceanographic research vessels over 500 GT are required to carry two SARTs, one mounted on each side of the vessel in a position ready to be taken to one of the survival craft. Inspected vessels 300 to 500 GT are only required to carry one SART. The Coast Guard notes that recent tests of 9 Ghz radar transponders have shown they do not have the 10-mile operational radius that was expected when the 1988 SOLAS Amendments were developed. Therefore the Coast Guard recommends vessels continue to carry Category 2 EPIRBs or Class S EPIRBS in addition to the required SARTs for use in survival craft. Uninspected oceangoing vessels should continue to carry at least one suitable EPIRB or a SART.

13.9 AMVER

All UNOLS vessels on international or foreign voyages are encouraged to participate in the Automated Mutual Vessel Rescue Systems Program (AMVER). Institutions may obtain information on this system in the AMVER User's Manual, which can be obtained from the U.S. Coast Guard.

14. MANNING

14.0 BACKGROUND

As noted in the legal definitions, personnel aboard a research vessel are divided into crew, and scientific personnel who are neither crew nor passengers. The number, composition, and qualifications of the ship's crew on inspected vessels are basically dictated by laws and regulations. The makeup of the scientific party is naturally governed by the nature of the research work. Its size is limited in some cases by laws and regulations and in all cases by the housekeeping facilities on board ship. A research vessel is prohibited from carrying "passengers for hire" by its letter of designation.

While it varies somewhat from ship to ship, basically the scientific party is responsible for carrying out the research, and the crew is primarily engaged in operating the vessel. From the stand point of safety, it should be noted that there are major differences in the makeup of the crew and the scientific party. A crew adequate to operate the ship in a safe manner and if required for around the clock operations for extended periods will be provided. The scientific party seldom can afford such luxury; the work-load will usually be heavy. This can lead to fatigue, both mental and physical, which in turn can increase the likelihood of accidents and mistakes. The Chief Scientist has responsibility for ensuring that the scientific party is adequately manned and for planning the employment of his/her personnel to ensure unsafe conditions are not generated.

14.1 MANNING-CREW

Manning requirements and crew composition for inspected oceanographic vessels is set forth in the Certificate of Inspection issued by the U.S. Coast Guard, as is the total number of personnel allowed on board.

Manning requirements and the crew composition for uninspected oceanographic vessels is addressed in federal regulations all of which possess a mix of wording (e.g. "commercial", "merchant", or "documented" vessels) potentially precluding their applicability to an uninspected, undocumented oceanographic research . Because of this it is recommended that operators of these vessels consult directly with the responsible Marine Safety Office for any questions regarding manning.

Operators should be guided by 46 CFR15.1111 Work Hours and Rest Periods, when identifying the final crew complement.

STANDARDS OF TRAINING AND CERTIFICATION OF WATCHKEEPERS (STCW)

Effective 31 July 2002 STCW-95 was fully implemented. STCW 95 sets standards for shipboard familiarization and basic safety training; requires the maintenance of records for merchant mariners to reflect medical fitness, experience and training, and competence is shipboard duties; principles concerning watchkeeping; and work hours and rest periods. (46 CFR 15.1101-1111)

STCW-95 certificates or endorsements are required as follows on board <u>seagoing vessels</u> operating beyond the boundary line as established by 46 CFR7:

- No person may serve as master, chief mate, chief engineer, first assistant engineer, officer in charge of the navigating watch or engineering watch unless the person holds an appropriate, valid STCW certificate or endorsement.

- On board a seagoing vessel of 500 GT (200 GRT) or more no person may serve as a rating forming a part of a navigational watch unless the person holds an appropriate, valid STCW certificate or endorsement.
- On board a seagoing vessel driven by main propulsion machinery of 750 kw (1000 hp) propulsion power or more, no person may serve in a rating forming part of a watch in a manned or perform duties in a periodically unmanned engine room except for training or duties of an unskilled nature unless the person holds an appropriate, valid STCW certificate or endorsement. (Note: STCW does not apply to engineering officers serving on a seagoing vessel less than 750 kw (1000hp).

See note below and definition of seagoing vessel

The applicability of STCW remains confusing in particular for small vessels. It is instructive to note that neither mariners serving on any of the following vessels, nor the owner or operator of these vessels is required to meet the requirements STCW, because they are either exempt by STCW or by U. S. law including- fishing vessels; fish tenders as defined by 46 USC 2101; pleasure yachts not engaged in trade; wooden vessels of primitive build; uninspected passenger vessels as defined in 46 USC 2102; barges as defined in 46 USC 2101; vessels operating exclusively on the Great Lakes or inland waters of the U.S. Inland waters meaning shoreward of the boundary line.

For purposes of these rules 200 Gross Registered Tons (domestic tonnage) is equal to 500 Gross Tons (international tonnage). Specific rules regarding the applicability of STCW for vessels under 200 GRT are summarized below:

Domestic Voyages

The Coast Guard, as per NVIC 7-00, has determined that, for certain small vessels on domestic near coast voyages that safety provided through the current licensing, inspection and oversight programs for small vessels delivers a level of safety comparable to STCW. As such the Coast Guard has imposed no new requirements either on mariners serving on passenger vessels of less than 100 GRT inspected under subchapter T or K or on other vessels less than 200 GRT on domestic voyages or on the owners or operators of such vessels.

The Coast Guard considers near coastal voyages to be those within 200 miles of the U.S. shore and within the jurisdiction of the U.S.

As a result, when a master or other mariner is serving on a vessel of less than 200 GRT on a domestic near coastal voyage, no new training requirements have been imposed beyond the regulations. Holding a suitably endorsed license for service complies with the STCW under domestic law.

An officer operating a vessel on a domestic voyage will have an appropriate STCW endorsement automatically placed directly on his or her license. This endorsement is available to any officer on an inspected passenger vessel less than 100 GRT and on any other U. S. vessel less than 200 GRT (500 GT) that is operating exclusively on a domestic voyage, if this mariner does not already hold a STCW certificate. This endorsement should read as follows:

When the holder of this license is serving on an U. S. Vessel of less than 200 gross register tons (500 gross tonnage) in domestic service, no added STCW endorsement is necessary to meet the U. S. regulations implementing the STCW Convention.

International Voyage

This section uses the terminology found in NVIC 7-00, addressing International Voyages. We know from Chapter 3 RVSS that International Voyages are made by vessels subject to SOLAS. However NVIC 7-00 seems to cast a broader net regarding "International Voyages" since when referring to applicability on an international voyage it states "where they apply to mariners not engaged on vessels on near coastal voyages".

Mariners licensed for service on vessels of less than 100 GRT inspected under subchapter T or K and on other vessels less than 200 GRT (500GT), when operating on an international voyages (except for the specific exemptions identified in (NVIC 7-00) must meet the training and assessments required by the applicable U. S. and STCW regulations, in accordance with 46 CFR 10.202. A mariner seeking a license or certificate valid for international voyages must meet the requirements for training and assessment required by STCW as maybe applicable to the license or rating.

Any unlicensed mariner assigned a watch in an engine room or designated to perform duties in a periodically unmanned engine room on a vessel on an international voyage, must have an STCW endorsement documenting that he or she meets the competencies of the STCW. This requirement applies only to those vessels driven by machinery of 750kw (1000 hp) or more.

NVIC 7-00 also sets forth a method to issue a STCW certificate to a mariner required to make an occasional international voyage, whose routine operations are domestic voyage.

Note: In the regulations 46 CFR 15.1101 "Seagoing vessel" is defined as a self propelled vessel in commercial service that operates beyond the boundary line established be 46 CFR 7. The key word here is "commercial" and whether the Coast Guard's intent is to exclude oceanographic research vessel. Seagoing vessel is a key term in determining the applicability of STCW. Since there is a specific list of those vessels exempted from STCW (noted above) it seems reasonable to assume that oceanographic vessels are included under STCW. Most smaller oceanographic vessels are exempted as a result of the 200 gross ton domestic voyage NVIC. Inspected oceanographic vessels under Subchapter U already comply with the requirements of STCW. The real issue then to be addressed is the impact on vessels 200 gross tons and under 300 gross tons. This is an issue that the entire committee needs to examine.

PHYSICAL EVALUTION STANDARDS

Institutions employing personnel as crewmembers not possessing a Coast Guard issued license or merchant marine document should insure these crewmembers meet the physical standards of NVIC 2-98 or an equivalent set of physical standards established by their institution.

14.2 MANNING- SCIENTIFIC PERSONNEL

As noted above, the maximum number of scientific personnel is regulated for inspected vessels.

For uninspected vessels, the operator shall determine the maximum number allowable. This must be consistent with the safety and lifesaving equipment available on board the vessel and consistent with crew and science accommodations provided on the vessel. For smaller vessels which have a labeled boat capacity provided by the manufacturer these ratings shall not be exceeded. This limit should be made known to prospective chief scientists well in advance, so their staffing can be adequately planned. Recommended guidelines in this regard are to be found in manufacturers' specifications, ABYC publications, the Federal Safe Boating Act, and similar sources. (46 CFR 188.05-33; ABYC H-5)

14.3 MASTER OF THE VESSEL

The interrelationship of the Master of a vessel and the Chief Scientist is almost unique. The ship's Master is, in both law and tradition, solely and ultimately responsible for the safety and good conduct of the ship and all persons embarked, including the scientific party. Some specific regulatory requirements concerning the responsibilities of the Master of inspected vessels are found in Subchapter U, 46 CFR, and these can profitably be extrapolated to the Master of any vessel. To avoid disputes and misunderstandings, the substance of these regulations and customs should be clearly set forth in the ship's Cruise Handbook or similar publication, since many scientists are not aware of the legal and customary constraints.

Because of these legal responsibilities, the Master is also given full legal authority over all operations and personnel, both on board ship and in foreign port. The Master and the crew, however, are there solely to facilitate carrying out the research. In practice, the Chief Scientist informs the Master what is desired, and unless it is unsafe or illegal, it will be carried out. In case of serious disagreement, the question can be referred to the institution's marine manager by radio, but it must be emphasized that if a decision has to be made quickly on the spot, the authority of the Master is absolute. (46 CFR, Subchapter U)

14.4 CHIEF SCIENTIST

One member of the scientific party shall be designated Chief Scientist. Rarely, co-Chief Scientists may be designated, but in such cases one should be clearly identified as spokesperson. This is to avoid placing conflicting demands from scientists on the Master, and asking the Master to referee disputes on scientific matters. The Chief Scientist is responsible for the coordination and execution of the entire scientific mission, not just their own portion of it. By custom, the personal and professional conduct of the scientific party on board ship and ashore is the responsibility of the Chief Scientist, under the overall control of the ship's Master.

In matters of safety, the Chief Scientist must always defer to the Master in case of dispute. In many cases, safety matters are common knowledge, and not unique to research vessels. In other cases there may be safety hazards unique to the research which the ship's crew may not be aware of.

In such instances, the Chief Scientist has a special responsibility to assure safety, and consult with the Master as necessary. (46 CFR 19415-3; 195.09)

15. OPERATIONS

15.0 INTRODUCTION

All the routine precautions and procedures of usual maritime operations of course apply to research vessel operations. But in addition, further measures are necessary to insure a safe scientific program and integrate it into a safe general operation. Many of these extra precautions are discussed in detail in other sections, such as manning, communications, and so on. The operational aspects of the research program are potential trouble spots because of the non-standard nature of the work, the participation of non-mariners, and the element of dual control by the Captain and Chief Scientist. Given below are the principal topics of prudent general operations and some special items relating to the research program.

15.1 GENERAL

Certain operations for inspected vessels are regulated by 46 CFR, Part 196 of Subchapter U and for uninspected vessels by 46 CFR, Part 26 of Subchapter C. Other operations affecting the navigation of vessels, and "rules of the road" are contained in 33 CFR, Chapter I. To achieve sound operational guidelines, uninspected vessels insofar as practicable should use the provisions of 46 CFR 196. In addition to the points mentioned herein, the internal policies set by the operating institution are an essential part of overall operational safety.

15.2 STATION BILLS

All research vessels should have posted in conspicuous places station bills setting forth the duties of the crew and scientific personnel under emergency situations. New personnel should be indoctrinated in their duties. (46 CFR 199.80)

15.3 DRILLS

At least once weekly, and within 24 hours of leaving port, emergency drills should be conducted which shall include at least fire and boat (or raft) drills. (46 CFR 199.180(b)) Special safety and procedural instructions should also be given. Drills should simulate actual emergencies and all fire and emergency equipment should be exercised on a regular basis. All embarked personnel should participate in drills unless ship or scientific operations dictate otherwise. A ship specific training manual should be developed to address any items not covered in the RVOC Safety Training Manual. Conduct of drills should be noted in the official log.

15.4 MEDICAL

All research ships and boats, of whatever size, should carry first aid and other medical supplies as appropriate for the size of vessel, number of persons aboard, and operational pattern. In particular, ships on extended voyages, or in areas remote from shore medical assistance should carry fully adequate medical supplies and instructions.

Specific guidance as to medical supplies should be obtained from a competent medical support activity. Selected personnel should be trained in basic First Aid and CPR. Additionally, the STCW requires crew members to demonstrate competence to undertake listed tasks, duties, and responsiblities. Competency can be demonstrated

by successful completion of an STCW approved medical training courses. Vessels on ocean, international, or extended voyages should have firmly established procedures for obtaining medical assistance by radio from a medical support activity, and administering it on board. Support involving radio advisory services, pharmaceuticals, medical supplies, training, evaluation and repatriation are available from commercial sources on a subscription and/or contractual basis. (The U.S. Health Service is no longer able to provide such support.) All operators should be familiar with and avail themselves to the current NSF/UNOLS medical contractor who provides emergency medical advice at sea and routine medical support activity ashore.

"The Ship's Medicine Chest and First Aid At Sea," 1978 (USGPO Stock Number 017-029-000-26-6) is still a useful reference to have aboard.

15.5 LOG BOOKS AND REPORTS

A properly kept ship's log is a recognized part of a well-operated vessel. All research vessels, except small boats on day trips, should maintain a formal log book in which is entered all appropriate records and data. If in doubt, it is much better to log too much than too little. In addition to the purely operational considerations, it is often found that the ship's log is a useful adjunct source of information for the scientific program, and it thus should include sufficient notations of the research operation to permit relating the scientific log books to the ship's operational activities. (46 CFR 196.35)

15.6 CRUISE PLANS

Recognizing that planned cruise tracks are often changed between the time a proposal is submitted and the time of the voyage, either the master or marine superintendent of all research vessels shall ensure that a cruise plan is on file with their home office, prior to sailing, which includes the following information:

1. The names of all ship's crew (unless recorded elsewhere).
2. The names of scientific personnel (including technicians).
3. Designation of Master and Chief Scientist.
4. Date/time and place of departure.
5. Estimated date/time and place of arrival.
6. Cruise track and operating areas.
7. Capsule summary of science planned.
8. Communications instructions to comply with standards as set out in Chapter 13 herein, and institutional requirements.
9. Early and complete information concerning the use of hazardous materials, explosives and radioactive material. See Chapters 9, 10, and 11 of these standards.
10. Other information as appropriate to safe and effective vessel operations.

A copy of the Cruise Plan should be kept at the institutional facility or other designated base, and a copy on board. The termination of the cruise or a port arrival should be reported, and it is the responsibility of the Master to see that this is done. The base

facility should establish procedures for prompt follow-up action in case of receipt (or non-receipt) of reports.

15.7 NOTIFICATION OF HAZARDS

The National Imagery and Mapping Agency (NIMA) is the point of contact for ship operations that use sonic emitters, towed devices, explosive charges or deploy moored instrumentation. These items could pose a hazard to the safe navigation and operation of submarines and in some cases to surface vessels, particularly those engaged in fishing, towing or other research work. NIMA will disseminate this information through the Notice to Mariners and broadcast warnings as well as directly to appropriate Naval commands. Sending the same information directly to the Aids to Navigation (oan) office of the appropriate Coast Guard District and in some cases to local Naval Commanders may improve the level of notification and improve local co-ordination of operations.

The contact address and phone numbers for NIMA is:

NIMA
4600 Sangamore Rd.
Attn: MCC3 D-44
Bethesda, MD 20816-5003
Phone number: 301-227-3147
Fax number: 301-227-3731

(This is the fastest and easiest way to make notification.)

15.8 COLLISIONS, CASUALTIES, AND ACCIDENTS

The actions required at the scene of a collision, accident, or casualty, and the follow-up paperwork, vary with the legal requirements. In most cases, submission of USCG forms to the USCG OCMI is required. As a general rule, if another vessel is involved, the ship is required to render all practicable assistance, in addition to identifying itself. Operators and captains should be thoroughly familiar with the particular requirements which apply to their vessel, since legal and administrative liability will likely be at stake.

In the case of accidents involving injury to personnel, most institutions have very specific requirements for reporting, in addition to the USCG requirement noted above. Ship's personnel should be thoroughly familiar with these, since they are often crucial to liability or insurance proceedings at the federal, state, or institutional level. Notice of collisions, casualties, and accidents are usually required by the owner of the vessel as part of the Charter Party Agreement.

If the incident qualifies as a "serious marine incident," as defined in 46 CFR 4.03-2, then drug and alcohol testing of the individuals involved, including scientists, is required within twenty four hours and must be reported to the Coast Guard.

15.9 SECURITY

All reasonable steps must be taken to provide security to research vessels and embarked personnel from acts of terrorism, piracy, and other untoward situations which may be encountered on the high seas or in port. In this regard and prior to the beginning of a cruise, the Master of the vessel should become thoroughly acquainted with the nature of the cruise from a security point of view and should share this

knowledge with the members of the crew and science party. During the cruise, precautions considered necessary and appropriate by the Master should be exercised, including, for example, approaching any vessel or small craft requesting assistance with extreme caution, increasing the deck watch in port, posting additional lookouts in restricted waters, limiting or restricting shore leave, and so forth. The vigilance of all hands on board is necessary to the well-being of a cruise from a security point of view. Personnel training in security and vessel security surveys are now being conducted by companies specializing in these matters. Use of their services by UNOLS institutions engaged in research in medium- to high-risk areas of the world is encouraged.

15.10 INSTITUTIONAL POLICIES

Policies of a laboratory or institution operating research vessels regarding their safe operation should be clearly stated in written directives, and posted or disseminated as appropriate. As operators implement safety management systems in compliance with ISM requirements, these policies will become part of the organization's structure of accountability and will be subjected to regular audits and reviews – both at home and by foreign port state autorities. As a minimum, the following should be covered:

1. Preparation, use, and handling of cruise plans.
2. Communications instructions.
3. Authority and responsibility of the Captain and the Chief Scientist.
4. Safe loading standards for equipment and personnel.
5. Instructions concerning hazardous materials.
6. Responsibilities of base personnel for vessel operations, and procedures for follow-ups in case of overdue vessels or vessels not reporting on schedule.
7. A security plan.

15.11 CRUISE HANDBOOK

Research vessel operators should provide cruise handbooks or user manuals with complete information on ship's capabilities and procedures for planning and conducting cruises. These manuals should be kept current and dated so that users can be sure they have the most current version. Principal Investigators and Chief Scientists should make sure that they thoroughly review and use the appropriate manual when they schedule, prepare for and carry out their cruise.

In addition the first chapter of the RVOC Safety Training Manual has been published separately as a stand alone safety indoctrination for members of the Scientific Party and new crew members. This RESEARCH PARTY SUPPLEMENT should be read by all members of the science party. The complete Safety Training Manual should be made available to regular scientific users, crew members and any other interested persons.

15.12 OIL TRANSFER PROCEDURES

All vessels, whether inspected or uninspected, with a fuel capacity of more then 250 barrels of oil are required to have written oil transfer procedures. These procedures must be available during a US Coast Guard inspection and must be permanently mounted where the procedures can be easily seen and used by crew members

engaged in oil transfers. These procedures must apply to both bulk fuel oil transfers to or from another facility and internal transfers between the vessel's tanks. The requirements for these procedures are contained in 33 CFR 155.720, 33 CFR 155.730 and 33 CFR 155.20.

15.13 REFUSE RECORD BOOK:

33 CFR 151.55 requires that vessels over 40 meters in length maintain a Refuse Record Book in which log entries are made by the Master whenever garbage is transferred to another ship or shore facility, or whenever garbage is incinerated or dumped overboad. The log entry is to include the date, position, or port where disposal occurred and the amount in cubic meters. The log must be available to the US Coast Guard during a boarding or inspection. The log must also be kept for two years after a log book is full. A waste management plan and mounted warning placard that prohibits the discharge of prohibited refuse overboard is also required.

15.14 OIL RECORD BOOK

An oil record book (Form CG-4602A) is required to be maintained by all vessels 400 GT and above under MARPOL 73/78, Annex I, Chapter II, Regulation 9. Log entries are to be made whenever a vessel discharges ballast or cleaning water from fuel tanks, disposes oily residue (sludge), bunkers, discharges engine room bilge water or has an accidental discharge into the water. Detailed instructions for maintaining the log are contained in the record book.

Weight Handling Gear:

> Inspected vessels must meet the requirements of 46 CFR 189.35 and uninspected vessels should comply as well. Particular attention should be directed towards 46CFR189.35-9(c)(1), Wet Weight Handling. This regulation basically states that all components involved in fairleading a wire over the side must be able to at least support a load of 1.5 times the breaking strength of the wire.

Ballast Water Management

> Due to the serious problem of invasive species in US waters, all UNOLS vessels should follow the guidelines established in USCG Voluntary Ballast Water Management Program. Information can be obtained at http://www.uscg.mil/hq/g-m/mso/mso4/bwm.html.

16. DIVING OPERATIONS

16.0 POLICY

Scientific diving is a normal part of oceanographic research vessel operations. Such diving conducted from a University National Oceanographic Laboratory System (UNOLS) vessel must be under the auspices of a diving program that meets the minimum American Academy of Underwater Sciences' (AAUS) Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. Operators without a program may accommodate scientific diving cruises which are under the auspices of an institution with such a diving program.

16.1 DIVING PROCEDURES, RULES AND REGULATIONS

For all cruises a single lead institution's campus diving administration will be designated. This is usually accomplished by agreement of all campus diving administrations involved. Items which refer to the campus diving administration may, in fact, be the concern of the Diving Safety Officer according to the practices of the institutions involved. The procedures, rules and regulations that govern the diving operation are those of the designated lead institution, subject to the approval of the operator's Marine Office.

16.2 CRUISE PLANNING

In a timely fashion prior to the cruise:

1. The Principal Investigator will prepare and supply a cruise dive plan to his or her campus diving administration who will forward the cruise plan, once approved, to the lead institution's campus diving administration and the Chief Scientist. The dive plan, prepared in a standard format includes: diving credentials for all diving members of the scientific party, detailed operational plans, emergency plans including accident management and emergency evacuation protocols, a list of needed medical supplies, a specified quantity of medical grade oxygen with a positive pressure demand delivery system and required diving support equipment (e.g., small boats).
2. The lead institution's diving administration will, after approving this plan, forward it to the operator's Marine Office.

16.3 CRUISE PERSONNEL

1. The Master has responsibility for the safety of all activities aboard including diving (Section 14.4).
2. The Chief Scientist is responsible for the coordination and execution of the entire scientific mission (Section 14.5).
3. The Principal Investigator of the diving project (who may or may not be the Chief Scientist) is responsible for the planning and co-ordination of the research diving operations.
4. The On-Board Diving Supervisor will be proposed by the Principal Investigator and approved by the lead institution's diving administration. The On-Board Diving Supervisor is responsible for the execution of the research diving

operations in accord with the cruise dive plan. He or she has the authority to restrict or suspend diving operations and alter the cruise dive plan in consultation with the Master and the Principal Investigator/Chief Scientist. The On-Board Diving Supervisor's responsibilities include:

a. Meeting with the Master and Chief Scientist to review the cruise dive plan and emergency procedures prior to diving.

b. Remaining in regular communication with the Master on the progress of the research diving operation.

c. Assuring that both the lead and operating institution's diving manual are available to the scientists and crew aboard the vessel.

Inspecting high pressure cylinders and breathing air compressors to assure that they meet the lead institutions' standards.

Ensure that air used to refill tanks is of proper quality and that all air tanks used by divers have a current hydrostatic test.

5. Research Divers must recognize their individual responsibility for their safety.

17. CHARTERING OF NON-INSTITUTION VESSELS

17.0 BACKGROUND

When a UNOLS institution charters a non-UNOLS vessel for marine research that is not operated by that institution, the guidelines of this chapter must be followed. The Principal Investigator, institution contracting office and institution marine office all have a responsibility to ensure that only vessels that are safe and suitable for a project are chartered. Institutions should establish procedures, utilizing the expertise of marine operations staff, to ensure that all applicable USCG documentation, inspections and licenses to which the vessel is subject are complete and current. Particular attention should be paid to the safety, material condition, and crew competency of vessels chartered for oceanographic research. When Federal funding for ship support from NSF, ONR and other agencies are involved the requirements of this chapter are mandatory.

This process should take place as early as possible so that any necessary corrections can be made in a timely manner. The correction of any deficiencies should be insisted upon before entering into a charter agreement. The overall goal is to ensure a chartered vessel meets the same safety standards expected of a comparable size UNOLS vessel.

If chartering is done by the marine operations staff, such factors will be taken care of routinely. The situation becomes more difficult when principal investigators, unfamiliar with marine operations, undertake charters of vessels on their own. It is emphasized that all institutions should set up procedures which will ensure safe, effective operations regardless of who undertakes a charter.

Chartered vessels that possess a current U.S. Coast Guard, SOLAS or U.S. Navy INSURV inspection certificate have been physically inspected by competent marine personnel and such inspections may be used to satisfy the requirements of this chapter. A current inspection is one that has been performed within 12 months of the vessel's charter date. Certain large projects or those involving international cooperation may require a contract inspection by an NSF approved inspection group.

Small vessels that carry less than six scientists and possess a current U.S. Coast Guard safety inspection performed under the Federal Boating Safety Act of 1971 or the Commercial Fishing Industry Vessel Safety Act of 1988 may also satisfy this inspection requirement if these safety requirement are considered sufficient for the expected area of operation and mission by the chartering institution's marine staff.

Any non-inspected vessel that fails to meet the above criteria, should be physically inspected by the chartering institution's Marine Superintendent (or equivalent) or other competent marine personnel such as another member of the marine staff, a marine surveyor, marine architect, etc. that the marine superintendent might designate. The purpose of this inspection is to ensure the proposed vessel meets UNOLS Research Vessel Safety Standards and is otherwise suited for the intended purpose. Appendix A provides a set of guidelines to be used in conducting these inspections.

17.1 PRE-CHARTER

1. Collect particulars on the vessel being contemplated for charter so as to have complete data and an understanding of the vessel's safety and capability. Data

should include vessel description, radio call sign, owner and operator name and addresses, licenses, inspections, surveys, safety equipment, communications equipment, and navigation equipment. Investigate any information relative to the stability and watertight integrity of the vessel.

2. Ensure owner has an appropriate Coast Guard Certificate of Inspection or a letter of designation as an Oceanographic Research Vessel or can legally operate as a six passenger charter vessel. Vessels less than 65 feet in length can carry up to six passengers with a properly licensed master. Vessels 65 feet and over must be inspected to carry even one passenger or have a letter of designation that exempts the vessel from Coast Guard Inspection.

3. Reserve the right to have vessel examined by institution's marine operations personnel and/or a professional marine surveyor if any questions exist as to vessel's condition, stability or general sea worthiness.

4. Conduct whatever inquiry may be necessary to establish the competency of captain, crew, or operator to provide for a safe voyage, including examination of licenses, etc.

5. Establish a formal institutional procedure for documenting approvals of charters. Ensure Chief Scientists are aware of these procedures, especially the safety-related terms of the charter.

6. Ensure that insurance coverage is in accordance with the institution's policy.

7. If the vessel is not otherwise inspected or certificated (USCG, SOLAS, USN INSURV, NSF/ABSTECH), require a marine survey or, if appropriate, a USCG courtesy examination. If none of the foregoing can be obtained in a timely manner, the marine operations staff of a UNOLS Institution should inspect the vessel prior to charter. RVOC has produced and the UNOLS Council has approved guidelines for the inspection of vessels proposed for charter. See Appendix A for the UNOLS Council approved check list for chartering non-UNOLS vessels.

17.2 DURING CHARTER

1. Require the charterer to prepare a formal cruise plan for each voyage which shall include, as a minimum, the elements listed under paragraph 15.6 of these standards.

2. Require reporting of all significant cruise plan changes to the to the Institution’s shore based contact.

3. Require the charterer to provide a list of names for all scientific personnel participating in a charter voyage. List should include next of kin, addresses and telephone numbers, and should be filed with designated base personnel.

4. Ensure the vessel is equipped with an appropriate EPIRB, and that the vessel’s operator is familiar with its purpose and operation.

5. Require a report of all vessel departures and arrivals. Ensure a return to port notice is received within two hours of scheduled time, or that radio notice of a change in plans has been received if the vessel is to be more than two hours

late. If required reports are not received, the charterer's shore-based contact will initiate institutional procedures for notification and action.

6. For voyages planned to last over 24 hours, a designated shore-based contact should receive daily radio report of the vessel's present location, and planned movements for the next 24 hours. This report should also include reports of adverse weather, equipment failures or other factors affecting the vessel and its planned operations.

APPENDICES

A. Inspection Check List for Chartering Non-UNOLS Vessels

B. Recommended Check List for Shipboard Vans

APPENDIX A

Inspection Check List for Chartering Non-UNOLS Vessels

Check each category listed below as appropriate for the charter mission and operating area. Ensure necessary equipment is aboard and operates properly.

Bridge and Navigation Equipment:

_____ Compass
_____ LORAN/GPS/TRANSIT/OMEGA
_____ Depth Sounder
_____ Radar
_____ Navigation Lights
_____ Ships Bell
_____ Whistle or Sound Device
_____ Emergency Alarm
_____ Pyrotechnics Expiration Date Not Exceeded?_____
_____ Navigational Charts and Publications

Communications Equipment:

_____ Radios, VHF and/or SSB
_____ INMARSAT or Teletype
_____ Cellular Phone
_____ Emergency Radio with backup battery or power
_____ EPIRBs

Documentation:

_____ Ensure vessel can be legally chartered based on certificate of inspection, letter of designation or limitation of charter to less than 6 persons.
_____ Ensure documentation, ownership, inspection certificate, load line certificate and stability letter are current and appropriate for planned mission.
_____ Ensure Master's license is current and appropriate for vessel being chartered.
_____ Ensure crew size and credentials are appropriate for charter's mission.
_____ Ensure insurance coverage meets chartering Institutes minimum requirements for charter duration.

Life Saving Equipment:

_____ PFDs
_____ Immersion Suits
_____ Inflatable Life Rafts
_____ Lifering Buoys
_____ Rescue Boats

Inspection Check List for
Chartering Non-UNOLS Vessels (cont.)

Exterior Decks and Equipment:

_____ Anchors and Associated Equipment
_____ Watertight Doors and Hatches
_____ Freeing Ports
_____ Deck Vents
_____ Cargo and Weight Handling Equipment (Safe Work Load posted & tested)
_____ Deck Surfaces Non-Skid
_____ Life Lines and Safety Chains

Fire Fighting Equipment:

_____ Fixed and Portable Fire Extinguishers Inspection Dates Current?_____
_____ Smoke and Fire Detectors
_____ Fire Stations and Hoses
_____ Self Contained Breathing Apparatus
_____ Fire and Damage Control Locker
_____ Emergency Stations Bill

Engineering:

_____ Gas Engines. Check flame arrestor, vents, gas hoses, no sparking devices in bilges.
_____ Diesel Engines. Check oil and exhaust leaks, starting system, maintenance, hours since last overhaul.
_____ Inspect overall cleanliness and condition of power sources
_____ Check emergency lights
_____ Check bilge and ballast systems and pumps
_____ Check fueling system and pumps
_____ Check refrigeration systems
_____ Check fire pump
_____ Check engine room fire suppression capability
_____ Check all manifolds for saltwater, fuel, etc.
_____ Check condition of switchboards, wiring and auxiliary generators

Miscellaneous:

_____ First Aid Kits and Medical Supplies
_____ Damage Control Equipment
_____ Emergency Steering
_____ General Appearance and Cleanliness
_____ Oil Pollution Placard and other required notices are posted.
_____ Sanitary System Operations
_____ Assess vessel's overall stability
_____ Assess vessel's overall ability to perform charter mission. Include laboratory and deck space, berthing and feeding capability, scientific equipment, winches, etc.

APPENDIX B

Recommended Check List for Shipboard Vans

I. Applies To All Portable Vans:

A. Design and Construction

- Constructed of steel, aluminum or other substantial material suitable for marine use. (195.11-10(b))
- Suitable attachment points for securing to vessel. (195.11-10(b))
- Electrical system meets good commercial standards. (195.11-09(a))
- Electrical grounding installed and adequate.
- Electrical and Pressure connections to ship's systems will meet marine standards. (195.11-099a))
- All electrical systems will be free from shock hazards.
- Doors will be equipped with mechanisms to prevent self-releasing or shock.
- Electrical connections are adequately supported.
- Doors designed to be left open during van use will be equipped with hold backs.
- All occupied vans, e.g. lab vans, will have two means of egress.
- Lab vans must be adequately ventilated. (8x8x20 = 600cfm, 8x8x40 = 1200cfm)
- Electrical systems must be equipped with adequate circuit breaker protection.
- All wires are to be low smoke type and connections made in proper boxes.
- All materials will be of a non-combustible nature per the guidelines cited for accommodation vans below.

B. Marking and Labeling:

- Provided with a label plate stating the lightweight and gross weight. (195.11-20(b))
- When applicable, provided with a label plate stating power requirements. (195.11-20(b))

C. Loading and Storage

- Determine that electrical connections are adequate and in good condition. (195.11-25(a)(1))
- Determine that all pressure connections are adequate and in good condition. (195-11-25(b))
- Locate van to prevent recirculation from vessel's exhaust system. (195.11-25©)
- Loaded in accordance with stability requirements of the vessel. (195.11-25(d)
- Entered in the official log book. (195.11-2)

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