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Safety standards and quality assurance in research vessel programs

by

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Abstract:

Research vessels (RVs) are complex and costly platforms for data collection and data handling in marine science. The RVs must be built, maintained, manned and operated in accordance with laws and regulations developed by individual nations and international organizations, and at the same time be functional and safe for the marine scientists to use in their field work in addition to be cost effective for the owners and operators of the vessels.
This paper discusses some aspects of this, with special emphasis on safety and quality, two of the most important factors concerning the operation and use of research vessels. Both the scientists using the vessel as a platform and tool for their field work, the sailors manning the vessels and the agency managing the vessel must work in close cooperation in order to ensure safe and costeffective cruises. Some of the available tools and means to achieve this are the ISM-code, the ISO 9000 and 14000 series quality assurance procedures, health requirements, STCW 95 training requirements and procedures for instrument calibration, which is discussed in some detail in this paper. The need for internationally agreed standards and procedures for vessel operations, data collection and calibration of systems is also focused on. In addition a short description of existing groups of RV operators is given.

1. Background

Research vessels (RVs) are in general purpose built, sophisticated and complex platforms dedicated to collect, handle, process and transfer valid and accurate data about the marine resources and the marine environment. The RVs are expensive to operate and maintain, and the use of the vessels must therefore be cost efficient. At the same time, the operations must be safe in order to avoid endangering life and health of personnel, the environment and the ship itself. This paper discusses some of these basic requirements for safe and efficient use of RVs, seen from an RV manager's point of view.

2. Safety

"Safety first" is a much used slogan and it also applies to operation of research vessels. Safety at sea has improved significantly over the years, especially fire safety, stability and prevention of oil spillage. The list of improvements done to ship design and equipment standards on board ships is long and quite impressive, but it is still the standards of conduct and quality of the personnel onboard the ships and in the ship management offices ashore that are the most significant factors in order to ensure and improve the safety at sea.

2.1 STCW 95

In order to improve the quality of the seafarers, the United Nations (UN) International Maritime Organization (IMO) and most flag states have developed the 1978 "Standards of Training, Certification and Watchkeeping" (STCW), with amendments in 1995 (STCW 95), with implementation deadline of 1 February 2002.

To satisfy the STCW 95 standards, all sailors who are part of the vessel's safety organization have renewed their certificates and skills regarding ship safety, fire fighting and first aid through formal, certified training.

2.2 Health requirements

New, stricter international health standards are also implemented since 1 January 2002 to ensure that the sailors have the necessary fitness to perform their routine tasks and their special tasks, should an emergency situation occur.

2.3 ISM code

All cargo vessels over 500 grt must be certified in accordance with the International Safety Management (ISM) code by 1 July 2002. The ISM code is a formal way to document and implement a safety management system for the safe operation of ships and is developed by IMO. The purpose is to ensure that vessels are maintained and operated in a way that minimizes the risk to ship personnel, the environment, the ship's cargo and the ship itself. The ISM code applies to both the ships and the ship management agency ashore. The certification, inspections and audits are done by the flag state or are delegated to a classification society. It is stated in the code that state owned ships are not mandated to be certified, but this applies only to naval ships, not other government owned vessels such as research vessels.

2.4 Safety Management System

The introduction of the ISM code, together with the already existing system to ensure a safe and sound working environment for all personnel on shore and at sea has led to the development and implementation of a Safety Management system (SMS) at the Institute of Marine Research/Research Vessel department. Inputs to the system are Safety and inspection reports (SAFIR) in accordance with the ISM code and reports from the regular health and safety meetings held regularly onboard every vessel. In 2001, the first year the SMS was operational, a total of 70 reports was received, but pr 8 August 2002, the number of reports so far in in 2002 was 108, which shows that the system is working, the sailors are motivated and regards safety and health as important issues.

The ISM code is developed for all types of vessels, so it is therefore of a general nature and is focused on "standard ship operations". Research vessels performs a number of "non-standard" operations such as bottom coring, towing of sensors, nets and other kinds of scientific instruments, Remotely Operated Vehicle (ROV) operations, Remotely Operated Towed Vehichles (ROTV), Autonomous Underwater Vehicle (AUV) operations, trawling etc. In addition comes laboratory work that includes the use of toxic chemicals and radioactive materials. These operations should also be included in the ISM-code in order to have a safety management system that covers every aspect of the activities performed by the vessels.

3. Supernumerary personnel

Research vessels carries a large number of non-sailors onboard on every cruise. It is important to ensure that these persons are physically and mentally fit to endure the hardships onboard a vessel operating for long periods of time at sea and very often in harsh weather conditions. It is also important that each and everyone can contribute positively in an emergency situation and not become an extra burden to the crew. It is therefore mandatory that scientific and technical personnel signs on to the ship, which means that they have to have a medical health certificate issued from a certified seafarers doctor.

It is also important that they have gone through basic training in personal survival techniques, fire fighting, first aid and so on, in order to be able to take action if something happens and/or be able to behave in a calm and orderly manner during an emergency situation.

4. Quality assurance

Many private and government ship management agencies are ISO 9001 certified and some are even ISO 14000 certified, which means that they have documented that they have a working quality assurance system and a system to avoid polluting the environment. In order to achieve an ISO 9001 and 14000 certificate a ship management agency can build on the ISM code, which covers the main elements of the ISO standards already. It is not often a demand from customers that ships have the ISO certificates, but many shipping companies have implemented these standards anyway, because it is a potential for cost saving and more efficient operations if the ISO standards are implemented.

5. Validity of data

Data collected at sea shall usually be compared with similar data collected at the same place at different times or at the same time in different places. In order to develop statistics or be able to say something sensible about changes in the environment, variability in stock and so on, the data has to be comparable which means the data sets must have a minimum accuracy or maximum uncertainty in order to be valid. All equipment used to make direct measurements or collecting samples must therefore be calibrated and controlled on a regular basis.

5.1 Sensors

There are established "de facto" standards for calibration of temperature and salinity sensors today, and for hydro acoustical equipment there are also common ways to calibrate the sensors and often so-called "intercalibration" is performed before two vessels starts a common survey. But if two vessels are covering the same geographical area at different times, no intercalibration is done and that introduces an uncertainty if the datasets from the two vessels shall be used in the same data model. A comprehensive system of calibration procedures for hydroacoustical sensors, formally agreed upon and maintained by an international body would be very useful for us. Maybe the ICES Fisheries Acoustics Science & Technology Working Group (FAST) is the appropriate body to undertake that responsibility?

5.2 Fishing gear and other mechanical sampling devices

Other very important tools onboard research vessels are fishing gear used to collect samples of fish in combination with hydro acoustic surveys and other mechanical systems used to collect other samples such as plankton etc. We have noticed that there a limited number of standards and procedures established for the use of such equipment and we have therefore just started a three years program to develop and implement a quality assurance system for trawling, trawl equipment and other mechanical sampling devices. This is done on order to establish necessary documented procedures for every part of the sampling process, from developing specifications when ordering new equipment, through the use of the equipment, to the control and repairs in order to achieve constant swept area and constant sampling efficiency for fishing gear and other equipment, such as towed nets etc. We assume that the ICES Fishing Technology & Fish Behaviour Working Group (FTFB) is the right group to address such issues and to be the right ICES body to support us in this effort.

5.3 Radiated noise

The most important performance criteria for an RV engaged in stock assessment is the level of radiated noise to water. The vessels built these days are all using the recommendations from the ICES cooperative research report 209 as a target for the vessels radiated noise to

water. The ICES criteria are well defined and easy to understand and use as design criteria, the problem is how to verify the performance of the RV once it is built and during its lifetime.

Today the different RV operators uses different test ranges and different methods to verify whether their vessel meets the ICES criteria or not. This lack of common test criteria and common test ranges introduces uncertainties regarding the validity of the data collected and whether they are comparable or not. It should therefore be of interest to every agency involved in stock assessment to develop common testprocedures and agree on which testranges are considered as "certified ranges" for the measurment of radiated noise from research vessels. The institute of Marine Research uses the Royal Norwegian Navy test range just outside Bergen as test range. Both the new Irish RV "Celtic Explorer" and the new Norwegian RV "G.O.Sars" will be measured on that range within the next six months.

6. International standards

The international community of marine science and the operators of RV's supporting the marine science would benefit from common development, implementation and maintenance of agreed standards for the calibration and use of equipment for data collection and data handling, in addition to management and control of radiated noise to water. ICES may be one of the best suited organizations within the marine science community to initiate such work and identify the best way to handle such tasks.

7. Efficiency

Research vessels are very expensive to operate with a daily rate in the area between 6000 and 12000 Euro. It is therefore important to utilize the ship time in an optimum way. At the IMR we have just finished a study of how we can make more combined cruises where different kinds of data collection is done on the same cruise rather than let the same vessel cover the same area multiple times with different equipment and different cruise personnel. We have also decided to reduce the towing time when trawling in order to increase the data collection efficiency. This new kind of combined cruises and reduced towing times will be tried out in 2003 when the new Norwegian RV "G.O.Sars" is operational. Another question that has been asked and answered by the same group of experts that recommended combined cruises is how many samples is necessary in order to have sufficient amount of data.

It is also important to find ways to ensure the most cost efficient ways to organize the land-based management of the RVs. In Norway the Government has established a working group that will look into the establishment of a common ship management agency for all government owned research vessels instead of today's system where ownership and management is spread out on a number of different agencies.

8. ERVO and ISOM

There are two meeting places for RV operators today. One is the International Ship Operator Meeting (ISOM), which has existed for more than ten years, where RV operators from all over the world meet once a year. The other one is the European Research Vessel Operators (ERVO) where RV operators within Europe have met annually since 1999. These two groups have shown their merit by their growth in participants and agenda items every year.

It is of vital importance that such groups exist in order to support the necessary continuous improvements in the safe and efficient operations of RVs. It has also led to the establishment and continuous expansion of an RV operator network.

9. Conclusions

The use of dedicated research vessels to support data collection at sea is common in most nations engaged in the field of marine science. The RV's are generally well maintained, manned by very capable sailors and managed by professional agencies ashore. The day-to-day management and operation of the vessels is therefore in good order. The introduction of the STCW 95, the ISM code and new health standards also contributes to that.

The main area of improvement today is therefore development and implementation of international standards for the calibration, use and maintenance of equipment used for data collection and data handling at sea, in addition to common standards for measurement of radiated noise to water and the verification that these requirements have been met by the use of certified test ranges.