APPENDIX III

DRAFT
Safety Position Paper for UNOLS FIC

Safe operation of UNOLS vessels is an issue of fleet improvement. During recent discussions of the FIC, various safety issues were raised. These issues may be particularly timely for several reasons. 1) The fleet profile is changing, with increased inclusion of smaller vessels and more specialized platforms. 2) Scientific operations at sea are continually evolving, often in the direction of increased complexity and expense. 3) Fleet users are changing. Multi-institution and multi-national user groups are now the norm on the larger vessels. Use of research vessels by students and other first-time or inexperienced users may be increasing; certainly NSF now stipulates that even the large vessels be used for undergraduate education on a regular basis. These changes are likely to accelerate due to the changing nature of national and international.

support for ocean science. This position paper will outline some safety issues and pose potential solutions. It should be a starting point for future discussions and policy decisions on the part of the FIC and UNOLS.

A. Responsibility and liability for safety at sea: Historically and currently, the captain and his/her institution have been held 100% responsible for safe vessel operations. This includes responsibility for safe conduct of scientific operations. In practice this assumes a more detailed involvement in scientific activities than is practical or desirable on most cruises. Research cruises are perhaps unique in that they involve a mix of typical ship operations and scientific operations that may be technically and logistically complex. The current situation could cause the captain to play a much larger role in the conduct of science that the scientists want. Conversely, the chief scientist, who in actuality oversees the details of daily and hourly scientific operations, currently may not take an active part in safety-related training and decision-making.

Is it fair and proper to hold the captain completely liable for scientific operations at sea? To what extent should the chief scientist be responsible for safety? What are the trade-offs between liability and autonomy in the conduct of safe science? To what extent can or should UNOLS be involved in formalizing this partitioning of responsibility?

B. Actual and potential safety problems: It is important to determine whether UNOLS safety issues stem from actual or merely potential problems in conduct, training, and operation. Qualitative information suggests that the UNOLS fleet is actually quite safe relative to other fleets. The fleet has not been criticized for being unsafe, and the results of the last questionnaire indicated that the fleet was perceived as very safety conscious. According to Jack Bash, there have been 5 fatalities in the past 15 years. Three occurred during routine ship operations/maintenance and two during transit at night. Two small research vessels were lost at sea without a trace in about 1978. These vessels were from UNOLS institutions and, though technically they did not come under UNOLS rules, in at least one case the courts held their activity to the UNOLS safety standards. It is not clear how this safety record compares with that of other fleets, e.g. in terms of accidents or fatalities per hour of vessel operation time. A quantitative comparison may not be possible as records of exposure time, the denominator of the equation, apparently are not kept.

Potential safety problems may exist. These arise from the unique organization of a science mission. Ship time is expensive and scientists tend to work extremely long hours while at sea. Science operations may equal or exceed routine ship operations in logistical complexity, e.g. putting large pieces of expensive gear over the side in rough seas. Scientific personnel change frequently and nearly every cruise has untrained and inexperienced people in the scientific party. Currently there appears to be no mechanism or program that explicitly addresses the safety issues arising from these features of a research cruise. Should the FIC/UNOLS be involved in developing such a program?

Some considerations:

Pre-cruise training: Currently consists of a safety lecture by captain or first mate, generally on the first day of the cruise, as well as a fire and boat drill. The safety lectures I have heard have been thorough, but are mystifying to the seasick first-time sailor with no knowledge of the jargon. They may or may not cover aspects of scientific operations. Should a more rigorous safety training program be required?

Safety information: a copy of the Research Party Supplement to the RVOC Safety Training Manual theoretically resides in every stateroom of every research vessel. It is admirably free of jargon and touches on the major safety issues of sea-going research life. I had never heard of it, however, until I joined the FIC. This seems like a problem. How widely distributed is the Supplement in actuality? How can the research party be made aware of its existence? How can anyone be made to actually read it in the rush to load, set up, and get underway?

Diving operations model: the dive community has addressed the safety issue by instituting a set of training and procedural standards (Chapter 16, UNOLS Research Vessel Safety Standards). Research dives do not happen until the dive master has met with the captain and presented a dive plan and evidence of qualification for each of the divers. A single lead institution is designated for each cruise; the procedures and regulations of this institution govern the diving operation and this institution approves the dive plan of any scientist involved in diving work. Should this be a model for safety training for all ocean-going scientists? Training could consist of a short CPR-type class that explicitly addresses safety issues arising during oceanographic cruises. This could tie in specifically with the chief scientists' responsibility for the safe execution of scientific operations. It would also separate the safety training issue in space and time from the activities of loading and getting underway on the actual cruise.

C. Safety inspections: Non-Navy owned UNOLS vessels currently undergo safety inspections once every two years. These are conducted by NSF Inspection, under the auspices of the Facilities Section (headed by Dick West). The inspections are contracted out to ABSTEC, a part of the American Bureau of Shipping. Navy-owned UNOLS vessels are inspected every three years by the Navy's Board of Inspection and Survey (INSURV). UNOLS is working to alternate the NSF and INSURV inspections on Navy-owned ships.

Based on the ABSTEC report of the 18 May 1995 inspection of R/V OCEANUS, the NSF/ABSTEC inspections are extraordinarily thorough. Integrity of hull, tanks, piping and electrical systems are examined, as well as operational condition of all machinery (engines, ventilation systems, pumps, hydraulics, booms, frames and winches). Safety gear and crew safety training are assessed; realistic fire and man-overboard drills are conducted. A sea trial is conducted to evaluate the ship's performance under demanding conditions. Condition and functionality of living and working quarters are evaluated. The technical services in support of scientific operations are evaluated in a general manner. Finally, a detailed list of recommendations is provided. The information in the inspection report is a useful summary of the ship's capabilities and weaknesses.

Ability of the crew to assist with scientific operations is not evaluated except through UNOLS cruise assessments. It is probably inappropriate to include such evaluations in an already lengthy inspection process that deals primarily with the integrity and safety of the ship as a platform. This issue is intimately related to the issue of crew turnover (below).

D. Crew experience and turnover: One of the major strengths of the UNOLS fleet is the experience and dedication of the ships' crews. This relates closely to safety issues: experience with the range of scientific operations performed on research vessels translates directly into increased safety and better science. While most UNOLS vessels have retained a stable cadre of experienced, highly trained crew members, a few have not. How can high rates of crew turnover be dealt with? Is there some means of training new crew members to deal specifically with the requirements of working on a research vessel? Should there be some crew turnover rate beyond which a ship is reviewed regarding inclusion in the UNOLS fleet? How is this type of information obtained and who would keep track of it?

RECOMMENDATIONS

1) Potential safety problems do exist, especially with regard to scientific operations. UNOLS should be involved in creating or revamping safety standards for science at sea.

2) A copy of the RVOC Safety Training Manual, Chapter 1: Research Party Supplement should be sent to each chief scientist well before each cruise. UNOLS should also prepare a guide to safety training for the scientific party. This should cover general shipboard safety training as well as training in procedures that may be unique to a particular cruise (e.g. coring operations, deployment and recovery of large gear).

3) Communications between the chief scientist and ship's captain (and other key personnel) should be open and frequent prior to the cruise. As the ship's captain and home institution are likely to be held responsible for activities and accidents on shipboard, institutions should devise a means of evaluating the preparedness of each scientific party before the cruise. UNOLS should be involved in designing this evaluation procedure.

4) Some level of crew stability should be required for inclusion in the UNOLS fleet. UNOLS should put forward specific recommendations on this issue, and consider the most effective way of tracking crew stability and experience. This may be a simple matter of looking at employment records during the inspections.