UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

University-National Oceanographic Laboratory System

Research Vessel Operators Council

Summary Report

of the

1985 Annual Meeting

Sessions held at

Moss Landing Marine Laboratories, Moss Landing, California

Navy Postgraduate School, Monterey, California

Monterey Marine Aquarium, Monterey, California

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VI B. Bruce Adee - University of Washington

VI C. Scott Davis - United States Coast Guard

VI D. Load Line - Jim Graf - American Bureau of Shipping

Summary Report of the 1985 Annual RVOC Meeting
Monterey, California
25-27 September 1985

Welcoming Remarks

Dr. John Martin, Director, Moss Landing Marine Laboratory welcomed the RVOC to the Monterey Bay area and to the Moss Landing facility.

The meeting was called to order by Chairperson E.R. "Dolly" Dieter, University of Alaska. The meeting loosely followed the Agenda (Appendix I). Registered attendees are listed in Appendix II.

Old Business

A motion was made, seconded and passed to accept the minutes of the 1984 meeting. Several items of old business were discussed.

Fire fighting tapes - Bill Barbee confirmed that UNOLS will in the near future buy a set of the Texas A&M fire fighting tapes for use of the RVOC members.

Winch report status - There was no information about whether or not the winch report would be revised or updated.

Computer maintenance program - Rodney Lay of Rodney Lay & Associates provided the RVOC members an opportunity to see a maintenance management computer program designed by his company. The program was written as a management tool, specifically for UNOLS-size ships.

RVOC newsletter - The memberships confirmed their desire to continue with the RVOC newsletter and offered suggestions on how to get more articles into the publication.

Radio license status for NSF owned vessels - Institutions needing a renewal of their radio license should not expect an automatic renewal but should submit an application to the FCC for a new license.

Foreign clearance manual - John McMillan and Bill Barbee reported that a UNOLS foreign clearance manual authored by Lee Stevens was in the final stage of review and would be published and distributed in the near future.

Foreign clearance post cruise obligations - A discussion was held concerning the responsibility of follow up action for post cruise obligations on foreign clearance. The membership felt strongly that delinquent scientists should be reminded of their obligation by the State Department and that if reports were not forthcoming their Director should be notified. A list of those scientist delinquent on Post Cruise obligations has been prepared by the State Department, and scientists and operating institutions are being notified. Failure to provide U.S. State Department with required post cruise reports could prevent other ship users from clearance to sail in waters where reports are outstanding.

NEW BUSINESS

Radio Technical Commission for Maritime Service Membership (RTCM) - A discussion was held as to whether or not each RVOC member should consider being a member in RTCM. It was concluded that since Ken Palfrey was already a member he would pass necessary information to the memberships through the newsletter. A survey will be completed by several members concerning the transmission of data via radio. This will be compiled by John McMillan and forwarded to Keller and Heckman for use at the 1987 World Administrative Radio Conference for the Mobile Services.

Physical & Medical standards for crew members - Jim Williams brought up the need for a set of physical standards for crew members. Discussion followed concluding that the subject was broad enough for a workshop at the 1986 meeting.

Navy Ocean Clearance requirements - A brief discussion was held concerning problems with notifying the Navy and the Defense Mapping Agency when deploying instruments or working in certain defense-controlled ocean areas. Because of the complexity of the problem an ad hoc Committee of Jim Williams, Dick Edwards and Jack Bash was formed to investigate the scope of the problem and report to the membership via the January `86 newsletter.

AGENCY REPORTS

National Science Foundation

John McMillan presented the 1986 budget, as follows:

FY 1986 NSF/OCE BUDGET

$ Million

Budget	Actual FY 84	Current Plan FY 85	Request FY 86
OSRS	55.09	58.16	59.94
OFS	32.89	34.91	36.79
ODP	26.29	27.60	28.85
TOTAL	114.27	120.67	125.58

Office of Naval Research

Keith Kaulum discussed the 1986 ONR budget for research vessels. Keith also discussed the progress of the Navy's initiative to build a new research vessel. Two institutions will be competitively selected for follow-on design work. One will be selected to build and operate the vessel. Wes Lovaas discussed the DOD instrumentation program.

UNOLS

Bill Barbee, Executive Secretary, UNOLS reported that the UNOLS Safety Standards have been approved and would be distributed in the near future. He also discussed the scope of the UNOLS contract with Medical Advisory System. He also noted that funds requested for 1986 ship operations exceeded by about $6 million funds available, and that lay-ups would likely be necessary in 1986.

U.S. State Department

Tom Cocke gave an update of foreign clearance problems with Mexico, Brazil, Soviet Union, Trinidad/Tobago and Venezuela. These countries have turned down clearances in the past year and require close compliance with their stated requirements especially lead-time requirements. He also stated that the State Department will be responsible for the monitoring of post cruise obligations. Notice to Research Vessel Operators #61, and #68 are included as Appendix III.

Commander Naval Oceanographic Command

Richard Martino reminded the members again of the need to report surface and subsurface obstacles to: Defense Mapping Agency Hydrographic/Topographic Center - Mr. Steven Hall, Chief, Notice to Mariners Branch, Attention: HNNM, Washington, D.C. 20315 Telephone (202) 227-3146 or AUTOVON 287-3146. He also recommended operators of the Navy's weather forecasting and ships routing service.

SPECIAL REPORTS

Safety Standards

Tex Treadwell reported that the Safety Standards were finally approved by UNOLS. A standing review committee will update the standards periodically. Input should be submitted ASAP.

User's Manual

Ken Palfrey provided a status of the fleet's user manuals (Appendix IV). Most institutional manuals are up to date and in good shape. Members were reminded that copies of their institutions manual are to be distributed to all UNOLS institutions.

IMCO Update

Jon Leiby was not present and there was no IMCO update.

Shared Use Equipment/Marine Technicians

Bill Mitchell reported on the May 1985 Marine Technicians meeting. The consensus was that the May meeting on shared use equipment and marine techs was too general in scope and did not resolve problems. The membership felt that another meeting is in order and that this meeting should include only those persons immediately concerned or responsible for marine techs and should address specific problems rather than be an open forum.

OSPREY

Don Newman told the membership that NSF was not supporting the conversion of OSPREY but that the University of Southern California was proceeding with the conversion on a limited basis.

Louisiana Consortium

Steve Rabalais gave a presentation on the new research vessel PELICAN at the Louisiana Universities Marine Center (LUMCON) and progress on their new facility.

UNOLS Fleet Replacement Plan

Bob Dinsmore was not present so there was no update on the Fleet Replacement Plan. Bob did however send a copy of the RFP for Engineering Study of the KNORR/MELVILLE Propulsion System which is included as Appendix V.

The second day's session was held at the Navy Postgraduate School:

Dr. Chris Mooers, Chairman, Department of Oceanography, NPS welcomed workshop members to NPS and gave a brief description of the department.

Vessel STABILITY WORKSHOP

The Stability Workshop was held on the second day of the annual RVOC meeting-- Thursday, 26 September. Speakers included Mr. Duane Laible, The Glosten Associates, Professor Bruce Adee, Chairman of the Ocean Engineering Program/University of Washington, Lt. Scott Davis, US Coast Guard and Mr. James Graf, American Bureau of Shipping. Professor Gene Allmendinger served as the Workshop's moderator. Professor Adee participated through the Sea Grant Program of the University of Alaska.

The objectives of the Workshop were two-fold--1) to raise research vessel operators' level of awareness of stability criteria and the critical necessity for meeting these criteria under various operating conditions and 2) to provide input to the review and possible alteration of the Stability Section of the UNOLS Safety Standards. In meeting these objectives, principal subjects discussed by one or more speakers included:

1. basic fundamentals of stability including use of the "inclining experiment" and "sallying ship" procedures.

2. the need for inclining experiments to be conducted when significant changes occur in the magnitude and/or location of "light ships" weights of vessels.

3. the need for accurate information concerning the magnitude and location of "dead weight" items (tankage, scientific loads, etc.) in various operating conditions.

4. a review of stability criteria in use including weather criteria and dynamic criteria (Rahola and IMO righting energy criteria).

5. U.S. Coast Guard stability requirements for inspected and uninspected oceanographic research vessels.

6. the adverse effects on stability of fishing vessels of poor to hazardous loading conditions, icing, water on decks, following/quartering seas, towing of under water gear and hard turns.

7. details of load line assignments and surveys (initial, annual and condition) by ABS for inspected research vessels and uninspected research vessels making international voyages.

8. the need for clear, concise stability in formation on board ship to enable the master to readily ascertain vessel's stability in all conditions of loading.

9. shipboard use of PCs as tools for rapid analyses of vessel stability conditions.

10. the need for keeping stability booklets up to date as valid bases for stability analyses.

Attachments to these minutes contain details of the above subjects.

The Workshop's "open discussions" and "follow-up discussion" on 27 September brought forth the following major points.

1. The Workshop succeeded in raising the level of awareness of stability considerations. It was felt that information embodied in this increased awareness should be conveyed to masters and other pertinent operating personnel by those attending the Workshop. The preparation of special material on stability for ship-board use was not considered necessary.

2. It was felt that stability information pertinent to scientists should be conveyed via statements in the RVOC and UNOLS newsletters. Dolly Dieter asked Gene Allmendinger to prepare these statements.

3. The use of on-board PCs to aid in analyzing vessel stability should be promoted.

4. U.S. Coast Guard Circular 5-85 for fishing vessels is considered to be an excellent document. However, the speakers were undecided regarding its applicability in providing quidelines for inspected and uninspected (greater than 79'long) research vessels.

5. The need for stability guidelines for uninspected research vessels (less than 79' long) was recognized. However, the only guidelines emerging from the Workshop was the caution that stability criteria for these vessels should be more stringent than IMO criteria.

Presentations by Duane H. Laible, The Glosten Associates, Inc., Bruce Adee, Ocean Engineering, University of Washington, Scott E. Davis, U.S. Coast Guard and Jim Graf, American Bureau of Shipping are Appendix VI A.-D.

NAVY WEATHER

Commander Davies gave a talk on the Navy's ability to provide ship routing and weather information to the UNOLS fleet.

Business Meeting Wrap-up, held at Monterey Bay Aquarium.

The following locations were offered for the 1986 meeting: University of Delaware, Lewes Delaware; University of New Hampshire, Durham, New Hampshire; Skidaway, Savannah, Georgia; Florida Institute of Oceanography, St. Petersburg, Florida.

Jack Bash was re-elected for a two year term as secretary.

Suggestions for topics of discussion and workshops for the 1986 meeting were as follows:

(1) Presentation on Cranes, A-Frames and Hydraulics
(2) USCG tonnage requirements
(3) Health screening for seaman
(4) Clearance for submarine areas
(5) KEVLAR cable use

Wes Lovaas reported that a new printing was needed for the Winch and Wire "Green Book" and that a new chapter on KEVLAR would be added. It was recommended that several corrections were needed to the basic book before republishing.

Jim Williams reported that their new 9/16" cable from McWhite did not pass the torque test.

RESEARCH VESSEL OPERATORS' COUNCIL

1985 Annual Meeting
Moss Landing Marine Laboratory
Moss Landing, California
25-27 September 1985

FINAL AGENDA

25 SEPTEMBER 1985 - 0830

Moss Landing Marine Laboratory
Seminar Room
7711 Sandholdt Road
Moss Landing

Registration/Coffee/Doughnuts

Welcoming Remarks

Dr. John Martin, Director, Moss Landing Marine Laboratory

Old Business

Minutes of 1984 Annual RVOC Meeting - Dolly Dieter, Chairperson

Fire fighting tapes

Winch report - status

Computer stability program designed by Rodney Lay & Associates

RVOC newsletter - Jack Bash, Secretary

Status of radio license for NSF owned vessels

Status of foreign clearance manual

Foreign clearance post cruise obligations

New Business

1986 RVOC meeting topics

1986 workshop topics

Letter from world administrative radio conference

Other topics

Agency Representatives Reports

- National Science Foundation - Budget Outlook; John McMillan
- Office of Naval Research - Budget Outlook; Keith Kaulum
- University National Oceanographic Laboratory Systems - Report from UNOLS; Capt. Bill Barbee
- U.S. State Department - Update on foreign clearance; Tom Cocke
- Commander Naval Oceanography Command - Highlight availability of weather forecasting for RVOC; Richard Martino

Special Reports

- Safety Standards - Update; Tex Treadwell - Texas A & M University
- User's Manual - Update; Ken Palfrey - Oregon State University
- IMCO - Update; Jonathan Leiby - Woods Hole Oceanographic Institute
- Shared Use Equipment/Marine Technicians - Update of May 1985 meeting; Bill Mitchell - University of Texas
- OSPREY - Update on conversion; Don Newman - University of Southern California
- Louisiana Consortium - Update; Steve Rabalais - Louisiana University Marine Consortium
- UNOLS Fleet Replacement Plan and Ship Design Study - Update; Capt. Bob Dinsmore - Woods Hole Oceanographic Institute

Tour of Moss Landing Marine Laboratory - 1600-1700

26 SEPTEMBER 1985 - 0800

Navy Postgraduate School
Ingersol Hall (behind the library)
Room 271
Monterey

Coffee/Fruit

Welcoming Remarks

0815-0830 Dr. Chris Moores, Chairman - Department of Oceanography

Workshop - Vessel Stability

0830-0845 Introduction; Gene Allmendinger - University of New Hampshire

0845-0945 Intact Stability; Duane Liable - The Glosten Associates

0945-1045 Stability Considerations; Bruce Adee - Department of Ocean Engineering, University of Washington

26 SEPTEMBER 1985 CONTINUED

1045-1100 Coffee Break

1100-1200 Stability for Research Vessels; Lt. Scott Davis - United States Coast Guard

1200-1330 Lunch

1330-1430 Stability and Load Line; Jim Graf - American Bureau of Shipping

1430-1600 Question and Answer Session; Gene Allmendinger

1600 - ?? Tour Fleet Numerical Facility and Navy Postgraduate School

27 SEPTEMBER 1985 - 0900

Monterey Bay Aquarium
Ocean View Conference Room
886 Cannery Row
Monterey

Coffee/Doughnuts

Scheduled Topics and Activities

0900-1230 Wrap up of business meeting

Suggestions for 1986 annual meeting: location and agenda items (Please have suggestions ready.)

Election of secretary - two year term

1230-1400 Lunch

1400 Tour of Monterey Aquarium - $6/person

Social Activities

24 September 1985 (Tuesday)

1800 No host get together in the main lounge at Ramada Inn.

25 September 1985 (Wednesday)

1800 Cocktail party hosted by John Martin, Director, Moss Landing Marine Laboratory. Everyone is on their own for dinner.

26 September 1985 (Thursday)

1830-1930 No host cocktail hour at Mission Ranch, 26270 Deloris, Carmel.

1930 No host dinner at Mission Ranch. Cost is $12.50/person.

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United States Department of State

Bureau of Oceans and International Environmental and Scientific Affairs

Washington, D.C. 20520

September 12, 1985

NOTICE TO RESEARCH VESSEL OPERATORS # 61 (Revision 5)

SUBJECT: Claimed Maritime Jurisdictions

The purpose of the following table is to provide research institutions and federal agencies with guidance on maritime claims of foreign nations. The listing does not necessarily reflect acceptance or recognition by the United States Government of the claims or of the countries. Additionally, it is likely that certain countries will change or expand their claims beyond the limits contained in this list. Researchers are advised to consult with this office when any research is planned off foreign coasts.

Users of this table should recognize the limit of the application of these data. More specific information, such as claimed baselines negotiated or claimed boundaries with neighboring states, etc., should be obtained for precise interpretative analysis.

Extended territorial sea, fishing, or economic zones may be interpreted by the coastal state as including jurisdiction over marine scientific or fisheries research. However, unless a claim is explicitly stated in the national law of that state the claim will not appear in the table. Researchers should consult this office for guidance as necessary.

Questions or updates on these lists should be directed to:

Tom Cocke
Office of Marine Science
and Technology Affairs
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Washington, D.C. 20520
Telephone (202) 632-0789

TABLE 1

SUMMARY OF OCEAN CLAIMS OF THE WORLD'S NATIONS (September 1, 1985)
(Distances in nautical miles)

	Territorial Sea	Contiguous Zone	Exclusive Fisheries	Continental Shelf	Economic Zone	Third UN Convention on the Law of the Sea Signed (X= 10Dec.82)	Ratified
Albania	15	-	-	-	-	-	-
Algeria	12	-	-	-	-	X +	-
Angola	20	-	200	-	-	X +	-
Antigua and Barbuda	12	24	-	-	200	2-7-83	-
Argentina	200	-	-	200m/E	-	10-5-84	-
Australia	3	12	200	200m/E	-	X	-
The Bahamas	3	-	200	200m/E	-	X	7-29-83
Bahrain	3	-	-	CS	-	X	-
Bangladesh	12	18	-	CM	200	X	-
Barbados	12	-	-	-	200	X	-
Belgium	3	-	200(B)	CS	-	12-05-84	-
Belize	3	-	-	-	-	X	8-13-83
Benin	200	-	-	-	-	8-30-83	-
Brazil	200	-	-	200m/E	-	X +	-
Brunei	12	-	200(B)	-	-	12-05-84	-
Bulgaria	12	-	-	-	-	X	-
Burma	12	24	-	CM/200	200	X	-
Cambodia	12	24	-	200	200	7-01-83	-
Cameroon	50	-	-	CS	-	X	-
Canada	12	-	200	200m/E	-	X	-
Cape Verde	12	-	-	-	200	X +	-
Chile	3	-	200	200	-	X +	-
China	12	-	-	-	-	X	-
Colombia	12	-	-	200m/E	200	X	-
Comoros	12	-	-	-	200	12-06-84	-
Congo	200	-	-	-	-	X	-
Costa Rica	12	-	-	200	200	X +	-

Notes at end of table.

SUMMARY OF OCEAN CLAIMS OF THE WORLD'S NATIONS (September 1, 1985)
(Distances in nautical miles)

	Territorial Sea	Contiguous Zone	Exclusive Fisheries	Continental Shelf	Economic Zone	Third UN Convention on the Law of the Sea Signed (X= 10Dec.82)	Ratified
Cuba	12	–	–	200m	200	X +	8-15-84
Cyprus	12	–	–	200m/E	–	X	–
Denmark	3	4	200	200m/E	–	X	–
Djibouti	12	24	–	–	200	X	–
Dominica	12	24	–	–	200	3-28-33	–
Dominican Republic	6	24	–	CM/200	200	X	–
Ecuador	200	–	–	200m	–	–	–
Egypt	12	18	–	200m/E	200	X	3-26-83 ++
El Salvador	200	–	–	–	–	12-05-84	–
Equatorial Guinea	12	–	–	–	–	1-30-84	–
Ethiopia	12	–	–	–	–	X	–
Fiji	12	–	–	200m/E	200	X	12-10-82
Finland	4	–	12	200m/E	–	X +	–
France	12	–	–	200m/E	200	X +	–
Gabon	100	–	150	–	–	X	–
The Gambia	200	–	–	CS	–	X	5-22-84
Germany (GDR)	12	–	200(B)	200m/E	–	X +	–
Germany (FRG)	3	–	200	200m/E	–	–	–
Ghana	200	–	–	100f/E	–	X	6-07-83
Greece	6	–	–	200m/E	–	X +	–
Grenada	12	–	–	–	200	X	–
Guatemala	12	–	–	CS	200	7-08-83	–
Guinea	12	–	–	–	200	–	–
Guinea-Bissau	12	–	–	–	200	X	–
Guyana	12	–	200	CM/200	–	X	–
Haiti	12	24	–	E	200	X	–
Honduras	12	24	–	200m/E	200	X	–
Iceland	12	–	–	CM/200	200	X	–
India	12	24	–	CM/200	200	X	–
Indonesia	12	–	–	E	200	X	–
Iran	12	–	50(B)	CS	–	X +	–

Notes at end of table.

SUMMARY OF OCEAN CLAIMS OF THE WORLD'S NATIONS (September 1, 1985)
(Distances in nautical miles)

	Territorial Sea	Contiguous Zone	Exclusive Fisheries	Continental Shelf	Economic Zone	Third UN Convention on the Law of the Sea Signed (X= 10Dec.82)	Ratified
Iraq	12	-	-	CS	-	X +	-
Ireland	3	-	200	-	-	X	-
Israel	6	-	-	E	-	-	-
Italy	12	-	-	200m/E	-	12-07-84 +	-
Ivory Coast	12	-	-	200m	200	X	3-26-84
Jamaica	12	-	-	-	-	X	3-21-83
Japan	12/3	-	200	-	-	2-07-83	-
Jordan	3	-	-	-	-	-	-
Kenya	12	-	-	-	200	X	-
Kiribati	12	-	200	-	-	-	-
Korea (North)	12	-	-	-	200	X	-
Korea (South)	12/3	-	12	-	-	3-14-83	-
Kuwait	12	-	-	CS	-	X	-
Lebanon	12	-	-	-	-	12-07-84	-
Liberia	200	-	-	200m/E	-	X	-
Libya	12	-	-	-	-	12-03-84	-
Madagascar	50	-	-	150	150	2-25-83	-
Malaysia	12	-	200	200m/E	-	X	-
Maldives	S	S	S	S	S	X	-
Malta	12	24	25	200m/E	-	X	-
Mauritania	70	-	-	CM/200	200	X	-
Mauritius	12	-	-	CM/200	200	X	-
Mexico	12	-	-	-	200	X	3-18-83
Monaco	12	-	-	-	-	X	-
Morocco	12	24	-	200m/E	200	X	-
Mozambique	12	-	-	-	200	X	-
Nauru	12	-	-	-	200	X	-
Netherlands	12	12	200	-	-	X	-
New Zealand	12	-	-	CM/200	200	X	-
Nicaragua	200	-	-	200m	-	12-09-84	-

SUMMARY OF OCEAN CLAIMS OF THE WORLD'S NATIONS (September 1, 1985)
(Distances in nautical miles)

	Territorial Sea	Contiguous Zone	Exclusive Fisheries	Continental Shelf	Economic Zone	Third UN Convention on the Law of the Sea Signed (X= 10Dec.82)	Ratified
Nigeria	30	–	–	200m/E	200	X	–
Norway	4	10	–	200m/E	200	X	–
Oman	12	–	–	200m/E	200	7-01-83 +	–
Pakistan	12	24	–	CM/200	200	X	–
Panama	200	–	–	–	–	X	–
Papua New Guinea	12	–	–	200m/E	200	X	–
Peru	200	–	–	200	–	–	–
Philippines	S	–	–	E	200	X +	5-22-84++
Poland	12	–	200	–	–	X	–
Portugal	12	–	–	200m/E	200	X	–
Qatar	3	–	B	CS	–	11-27-84	–
Romania	12	–	–	200m/E	–	X +	–
Saint Christopher and Nevis	12	24	–	–	200	12-07-84	–
Saint Lucia	3	–	12	–	–	X	–
Saint Vincent and the Grenadines	3	–	12	–	–	X	–
Sao Tome and Principe	12	–	–	–	200	7-12-83	–
Saudi Arabia	12	18	–	CS	–	12-07-84	–
Senegal	12	–	200	CM/200	–	X	10-25-84
Seychelles	12	–	–	CM/200	200	X	–
Sierra Leone	200	–	–	–	–	X	–
Singapore	3	–	B	–	–	X	–
Solomon Islands	12	–	–	–	200	X	–
Somalia	200	–	–	–	–	X	–
South Africa	12	–	200	200m/E	–	12-05-84	–
Soviet Union	12	–	–	200m/E	200	X +	–
Spain	12	–	–	–	200	12-04-84	–
Sri Lanka	12	24	–	CM/200	200	X	–

Notes at end of table.

SUMMARY OF OCEAN CLAIMS OF THE WORLD'S NATIONS (September 1, 1985)
(Distances in nautical miles)

	Territorial Sea	Contiguous Zone	Exclusive Fisheries	Continental Shelf	Economic Zone	Third UN Convention on the Law of the Sea Signed (X= 10Dec.82)	Ratified
Sudan	12	18	-	200m/E	-	X +	-
Suriname	12	-	-	-	200	X	-
Sweden	12	-	200	200m/E	-	X +	-
Syria	35	-	-	200m/E	-	-	-
Tanzania	50	-	-	-	-	X	-
Thailand	12	-	-	200m/E	200	X	-
Togo	30	-	-	-	200	X	-
Tonga	12	-	-	200m/E	200	-	-
Trinidad and Tobago	12	-	200	200m/E	-	X	-
Tunisia	12	-	-	-	-	X	-
Turkey	6/12	-	-	-	-	-	-
Tuvalu	12	-	-	-	200	X	-
(Ukrainian SSR)	12	-	-	200m/E	200	X +	-
United Arab Emirates	3/12	-	-	B	B	X	-
United Kingdom	3	-	200	200m/E	-	-	-
United States	3	12	-	200m	200	-	-
Uruguay	200	-	-	200m/E	-	X +	-
Vanuatu	12	24	-	CM/200	200	X	-
Venezuela	12	15	-	200m/E	200	-	-
Vietnam	12	24	-	CM/200	200	X	-
Western Samoa	12	-	-	-	200	9-28-84	-
Yemen (Aden)	12	24	-	CM/200	200	X	-
Yemen (Sanaa)	12	18	-	200m	-	X +	-
Yugoslavia	12	-	-	200m/E	-	X	-
Zaire	12	-	200	-	-	8-22-83	-

Abbreviations:
- CS -Continental Shelf,not specific.
- CM -Continental Margin.
- E -Depth of Exploitation.
- S -Special Claims
- \+ -Declarations made at the time of signature of the Convention.
- of ratification of the Convention.

B-Defined by its bilateral maritime boundaries or by an equidistant line.
m-Meters (depth).
f-Fathoms (depth).

United States Department of State

Bureau of Oceans and International Environmental and Scientific Affairs

Washington, D.C. 20520

September 16, 1985

NOTICE TO RESEARCH VESSEL OPERATORS #68

SUBJECT: Advance Notice Requirements for Foreign Research Clearance Requests

It is important to assure that marine scientific research clearance requests meet coastal state lead-time requirements, which may vary. All requests should be submitted in accordance with NTRVO #67 and should reach the Office of Marine Science and Technology Affairs (OMS) at least one month earlier than the stated prior notice requirements of the coastal state, in order to allow time for OMS handling, forwarding of documents to Embassy, and Embassy preparation of the diplomatic note. The following are required lead times (including one month for handling) for various coastal states:

7 months

Argentina	Iceland	Mexico
Australia	India	Portugal
Brazil	Indonesia	Soviet Union
Chile	Italy	Spain

5 months	4 months	
Ecuador	Colombia	Oman
Peru	Honduras	Panama
Venezuela	Morocco	United Kingdom

2 months

Canada

All other requests should reach the Department of State no later than 3 months prior to the start of research.

Although it is recommended that all requests be submitted to the Department of State the following countries have stated that requests must be submitted through official channels:

Brazil	Mexico
Canada	Morocco
Greece	Soviet Union
India	

Please contact me if you have any questions:

Research Vessel Clearance Officer
Office of Marine Science and Technology Affairs
OES/OMS Rm 5801
U.S. Department of State
Washington, D.C. 20520
Tel: 202/632-0789

W. T. Cocke

W. Thomas Cocke
Office of Marine Science
and Technology Affairs

RVOC ANNUAL MEETING
Moss Landing Marine Laboratories

25 September 1985

USER MANUALS - UNOLS STATUS*

R/V ALPHA HELIX	12/84
R/V BLUE FIN	5/84
R/V CAYUSE	1985
R/V JERE A. CHASE	1/6/82
R/V CAPE HATTERAS	1984 (2nd edition)
R/V CAPE HENLOPEN	7/81
R/V ENDEAVOR	1985
R/V GYRE	1984 (revision)
R/V LAURENTIAN	undated
**R/V MELVILLE	7/83
**R/V NEW HORIZON	1/84 (revision)
**R/V THOMAS WASHINGTON	6/1/84 (draft)
R/V THOMAS G. THOMPSON	11/84
R/V RIDGLEY WARFIELD	2/84
R/V KNORR	1985
R/V OCEANUS	1985
R/V WECOMA	1985 (revision)
RSMAS - in one volume	10/84
R/V COLUMBUS ISELIN	
R/V CAPE FLORIDA	
R/V CALANUS	
AGOR's - NAVOCEANO	7/20/81 (chg. 1)

*Based on copies received by Ken Palfrey, OSU.

**SIO also publishes a "Chief Scientist Manual" providing rules and procedures vs. features and capabilities contained in individual "Vessel Handbook" - not reviewed.

NOTE

Based on a Winter 1981-82 review of then existing user manuals, the UNOLS Advisory Council made the following recommendations:

1. All UNOLS institutions should develop, maintain and provide a dated users manual for their publically supported facilities. This should be provided chief scientists well before embarkation.

2. UNOLS user manuals should contain descriptions of:

   a. The characteristics and configuration of the vessel - including deck layout diagrams, winch wire and J-A frame type and position, communication and navigation equipment;

   b. Available technical support groups and instrumentation - including capabilities, instrument make, model and age, and procedures and costs for using these facilities;

   c. Policies for living aboard - including policies on bunking, meals, courtesy, alcohol and drugs, drills, safety, etc.;

   d. Chief scientist responsibilities - including relationship to Captain and crew, clearances, scientific personnel, customs and reporting; and

   e. Request and report forms - including either instructions or a model that explains the type of information required on each section of the form;

   f. Add names and or offices of institution representatives for specific information;

   g. Perhaps an easier way of keeping a manual up-to-date would be to have a removable page with telephone numbers and addresses.

   h. Publications should be dated.

R. P. Dinsmore
9/11/85

D R A F T

REQUEST FOR PROPOSALS

ENGINEERING STUDY FOR REFIT OF

MAIN PROPULSION SYSTEM OF AGOR-14 CLASS

The Woods Hole Oceanographic Institution hereby invites proposals from qualified naval architects and engineers for the purpose of undertaking an engineering study of the modification or replacement of the propulsion system of the AGOR-14 Class oceanographic research vessels KNORR and MELVILLE.

1. GENERAL INFORMATION

For convenience, the Woods Hole Oceanographic Institution is hereinafter referred to as "Woods Hole" and the successful offeror is hereinafter referred to as the "Contractor." A proposal conference will not be held. Inquiries concerning this RFP should be directed as follows:

For contractual matters:

Purchasing Manager
Woods Hole Oceanographic Institution
Telephone Extension - 2372

For operational and technical matters:

Manager of Operations
Woods Hole Oceanographic Institution
Telephone Extension - 2736

2. DESCRIPTION OF AGOR-15

Description of AGOR-15 (AGOR-14 similar but not identical)

The Research Vessel KNORR was designed and built under the direction of the Supervisor of Shipbuilding, Naval Ship Systems Command by the Defoe Shipbuilding Corporation of Bay City, Michigan. The vessel was launched in 1968 and delivered to Woods Hole Oceanographic Institution on April 15, 1970. The ship (Fig. 1) was designed as a general purpose oceanographic research vessel. A summary of current data is:

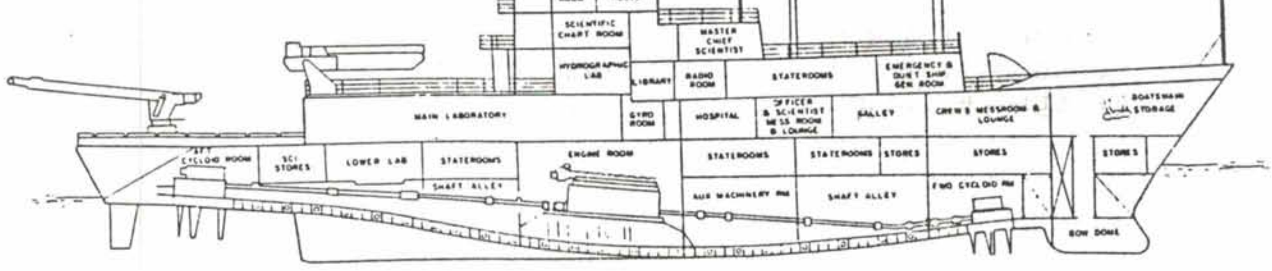
Built:	1969
Length:	245' LOA (75 m)
Beam:	46' (14 m)
Draft:	16' (4.8 m)
Gross Tonnage:	1,806 tons
Displacement:	1,915 L tons
Crew:	24
Scientific Personnel:	24
Main Engine:	One Enterprise DMR diesel engine; 2,500 HP
Propulsion:	Cycloidal propellers forward and aft (J. M. Voith Model 32G and 24E)

Ownership:
Title held by U S Navy; operated under contract with ONR by WHOI

Speed:		
Cruising	-	10.0 knots
Full	-	12.0 knots
Minimum	-	Dead Slow
Endurance:		45 Days
Range:		10,000 miles
Fuel Capacity:		110,100 gals.
Laboratories:		
Wet	-	400 sq. ft.
Dry (3)	-	3,000 sq. ft.

Ships Service Generators:
Two 300 KVA, Enterprise diesel DSM-36 generators

Attachment A (Booklet of General Plans) further describes the ships.



KNORR - Inboard Profile

Figure 1

3. BACKGROUND

The AGOR-14 Class was conceived in 1965 as a new design of research vessel over its predecessors AGOR's 3 to 13. Those ships all were variations of the basic AGOR-3 design; each sub class modified to meet new and changing requirements. Finally, the list of proposed modifications became so great that the AGOR-3 design could not be changed sufficiently to accommodate them. Accordingly, it was decided to make the AGOR-14 the lead ship of an entirely new class. The basic requirements which affected the propulsion system were:

- Cruising speed of 12 knots or greater
- 10,000-mile endurance at 12 knots
- 28,000 pounds tow pull at 8 knots
- Change and maintain heading and speed from zero to full speed for extended periods
- Hold the ship broadside against a 35,000 lb. lateral force
- Ice strengthening

Open deck space and flexibility for accommodating scientific outfitting were the chief forces in the basic arrangements. That this requirement has been successfully met can be attested to by the sole use of these ships in seagoing programs where they and no others can fulfill the needs.

Maneuverability and position keeping were defined as maintaining position against a 40-knot beam wind and a one-knot beam current (35,000 lb. force). Almost alone this requirement drove the selection of the propulsion system resulting in the use of two Voith-Schneider cycloidal propellers, one aft-2,000 HP (Mod 32G) and one forward-1,000 HP (Mod 24E). Operational experience has demonstrated that the ships do possess exceptional maneuverability, probably unsurpassed among all research ships. However, this has been accompanied by high failure rates and maintenance costs.

The speed and endurance requirement was set at 12 knots and 10,000 miles respectively. Under normal operating conditions, 12 knots has not been achievable as a regular cruising (or even full) speed.

Other than to meet the maneuverability criteria, the requirement for the main propulsion plant was simplicity. This resulted in a single, large, low speed diesel engine to drive both aft and forward cycloids. The machinery arrangement is shown in Figure 2. The lengthy shafting, clutches, couplings, and other novel arrangements make questionable whether simplicity actually has been achieved.

Desired quiet ship requirements have not been met in the AGOR-14 class. Quite the contrary, these ships have a reputation for noisiness. Scientific echo sounding from the hull is virtually impossible. The noise problem has appeared to be so related to the propulsion system that no serious effort has been mounted to identify or correct it.

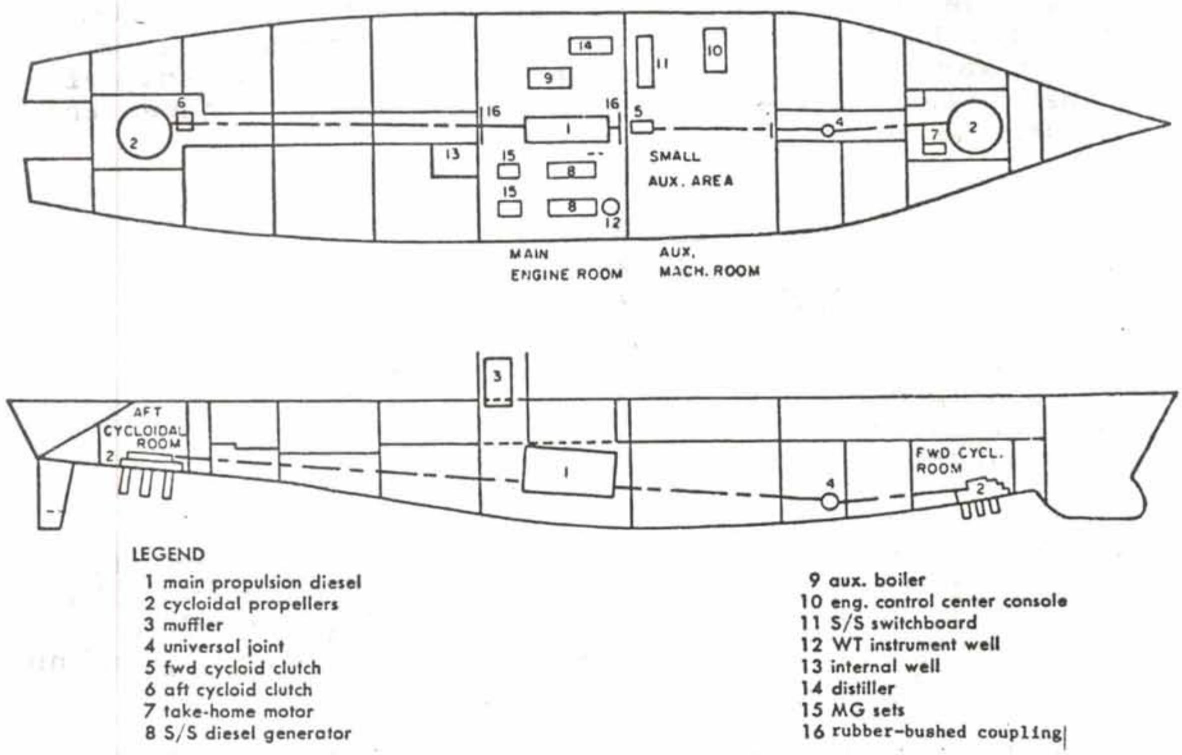


Figure 2

MELVILLE (AGOR-14) and KNORR (AGOR-15) were completed in 1969 and 1970 respectively. They are sister ships but not twins. Their differences reflect certain preferences or "options" on the part of the operating institutions (Item 1, above). These options were an intended feature of the individual ships' designs. In other aspects, particularly propulsion machinery, their construction trials and subsequent operating histories have been so alike that a problem evident on one is certain to be followed by the same problem on the other.

From the outset the ships were beset with maintenance problems chiefly associated with the drive train and propulsion system. These ranged from vibrations, alignments, gears, seals, and more recently, a massive failure in the aft cycloid itself. The high maintenance costs and time lost are a matter of record. The ships are now 15 years old and have demonstrated that the problems encountered are beyond the "debugging" stage. If a full service life (30-40 years) is to be achieved, a major engineering refit is required.

Attachments B and C further describe the design policy and evaluation.

4. ENGINEERING STUDY PLAN

a. The purpose of the contract engineering study is to examine, evaluate, and report on several alternatives for modifying and/or replacing the propulsion system of the AGOR-14 Class. This is to be accomplished by a recognized naval engineering firm selected on a competitive basis. It is proposed that this study be at a level of effort of about 900 man-hours and take not longer than three months for completion.

b. Alternatives for changes in the propulsion system shall include the following:

1) Conversion to conventional single or twin screw propulsion retaining one or none of the existing cycloid propellers.

2) Convert to "Z"-drive or other trainable drive system.

3) Retain cycloidal drive replacing all components where required in order to relieve existing problems.

4) Other alternatives which may be suggested or recommended by the Contractor.

Each alternative shall include the feasibility for replacing the existing single engine system with a modern diesel-electric plant with unattended engine room capability.

c. The goal for each alternative shall be to provide a propulsion system capable of meeting the redefined scientific and operational requirements, Section 5 below, and to achieve a low maintenance, low operating cost capability having an extended service life of at least 20 years.

d. The contract report shall include the folowing completed items delivered at the end of the Study:

1) Technical discussion of each alternative evaluated and the feasibility for meeting mission requirements including maneuverability, station keeping, speed, and related noise, and

2) Preliminary arrangement plan for each alternative along with:

3) Estimated weight changes and impact on stability and load line regulations,

4) Estimates of speed, power, and fuel consumption,

5) Estimated costs, and

6) Contractors recommendations and reasons therefor.

Where, and if, hull form changes are indicated, the effect on sea keeping shall be stated.

e. It is likely that one alternative resulting from the proposed study might be more suitable for one operator than the other. Therefore, the possibility of differing modifications to each ship should not be disregarded during the course of the Study. Only two ships of this Class were constructed and no compelling reason exists why they should remain in Class.

f. The contractor shall be furnished with a set of plans and specifications of the ship(s) and other available reports which are pertinent to the subject.

g. The contractor shall visit Woods Hole and/or Scripps Institution of Oceanography, La Jolla, CA, at the start of the Study and consult with operating personnel. At that time a meeting will be held with a Review Group from Woods Hole and Scripps Institution for the purpose of discussing and updating the scientific mission requirements (Section 5 a) and other matters. If possible, the contractor shall visit one or both of the ships.

h. The contractor shall consult with the Review Group from Woods Hole and Scripps Institution midway through the Study and present a progress report. At the completion of the Study the contractor shall make a presentation to the Review Group of all deliverables including his recommendations.

i. All designs, arrangements, and calculations resulting from the Contractor's Study shall become the property of the Office of Naval Research.

5. SCIENTIFIC AND OPERATIONAL REQUIREMENTS

a. The oceanographic mission requirements from 1965 have been updated and revised for the purpose of best meeting projected oceanographic requirements at sea. The following tentative requirements shall apply for the purposes of this Study:

1) Speed: 14 knots maximum sustainable speed.

2) Endurance: 10,000 miles at 12 knots cruising speed.

3) Tow Pull: 10,000 lbs. at 6 knots
25,000 lbs. at 2.5 knots

4) Speed Control: Continuous speed control or increments not greater than 0.1 knot (0-6 knots) and 0.2 knot (6-14 knots).

5) Ice Strengthening: ABS Class C, but this should not dictate the choice of a propulsion system.

6) Acoustics: Ship should be as quiet as possible for hull mounted echo sounding and towed multi-channel seismics arrays. Design targét is precision echo sounding at 3.5 and 12 kHz and SEA BEAM to depths of 6,000 m and acoustic doppler profiling at frequencies between 50-300 kHz; up to and including maximum sustained speed.

7) Dynamic Positioning: Depths to 6,000 m in wind speed 35 knots, SS-5 and 3-knot current, at best heading, using GPS and/or bottom transponders. Max excursion of 150 ft.

8) Precision Trackline: Maintain slow speed (2 knots mean speed) track under controlled conditions (GPS and/or bottom transponders in depths to 6,000 m) in wind speed 35 knots, SS-5 and 3-knot current. +/- 0.1 knot speed control along track. Maximum lateral excursion 150 ft.

9) Payload: Provide for deck and hold loading of not less than 90 tons total in addition to regular scientific outfit.

10) Electric Load: Provide for auxiliary electric power about 50% more than now available.

b. These requirements will be discussed and may be updated at a meeting with the Woods Hole/Scripps Institution Review Group at the time of the Study (Section 4 g).

c. Alternatives which, in the opinion of the Contractor, do not meet these requirements should be reported in the technical report (4 d-1 above).

6. RADIATED NOISE

In order to acquire data and information involved with possible alternatives, Woods Hole will conduct a brief study using expert consultants for the testing and evaluation of the radiated noise. A copy of the Noise Study Report will be furnished to Contractor as a guide for his evaluations.

7. SELECTION OF CONTRACTOR

a. Contractor selection will be based on the manner in which the responses demonstrate understanding of the problems and their possible solutions; the numbers and caliber of personnel to be assigned; proposed cost; the overall quality of the proposal; and other factors.

b. Woods Hole reserves the right to negotiate with any offeror and to reject, as Woods Hole interest may warrant, any and all proposals received and to waive any informality in connection therewith.

c. A contract award may be made without discussion of proposals received; therefore, should be submitted initially on the most favorable terms (from a price and technical standpoint) which the offeror can submit.

d. Proposals must be based upon this RFP package, and to be responsive it must contain a firm-fixed-price proposal to accomplish the Study in accordance with the terms herein and which offers a completion date that is not in excess of ninety (90) calendar days from the date of contract execution.

8. SUBMISSION OF PROPOSALS

a. Proposals must be submitted in four (4) copies and must be received at Woods Hole on or before thirty (30) calendar days from the date of issuance of this RFP.

b. Each proposal must be supported by cost estimates indicating man-hours, salary scales, travel, G & A, and other costs upon which the offerors' proposal is based.

c. Late proposals will not be considered unless Woods Hole determines that such action would not unduly delay the procurement and would be in the best interest of Woods Hole.

9. INCURRING COSTS

Woods Hole will not reimburse recipients of this RFP for costs incurred in preparation of their proposal.

10. NEWS RELEASES

News releases pertaining to this procurement shall not be made prior to Woods Hole approval, and then only in coordination with the issuing office.

WOODS HOLE OCEANOGRAPHIC INSTITUTION

By: ------------------------------------
Purchasing Manager

Attachments

A - Copy of Booklet of General Plans, AGOR-15
B - AGOR-14 Class Evaluation, NSEC, Nov. 1970
C - "New Concepts Applied to Research Ship Design"; Reed, Sarchin & Leiby, May 1968

Presentation to the 1985 Research Vessel Operation Council
Monterey, California - September 26, 1985

INTACT STABILITY

by Duane H. Laible, The Glosten Associates, Inc.

Introduction

Intact stability is a measure of a vessel's ability to return to the upright - the desirable position. Stability is defined as "the resistance to sudden change," and as you know the forces acting on a ship at sea are not only changeable, but can be upsetting.

You, as vessel operators, are charged with assuring yourselves that your vessels meet applicable stability criteria, and more importantly that adequate stability is maintained. This latter point is the primary responsibility of the master, but you play an important part in ensuring safe departures and providing the master with the information needed to maintain the vessel in a safe condition throughout the voyage.

Our focus will be on assessing the capabilities of a vessel in terms of intact stability. We will consider the most important factors in that assessment; regulatory guides available to us; practical techniques and tools to make the assessments; and finally the instructions or recommendations to the operator that will maximize his or her chances to operate the vessel in the safest way.

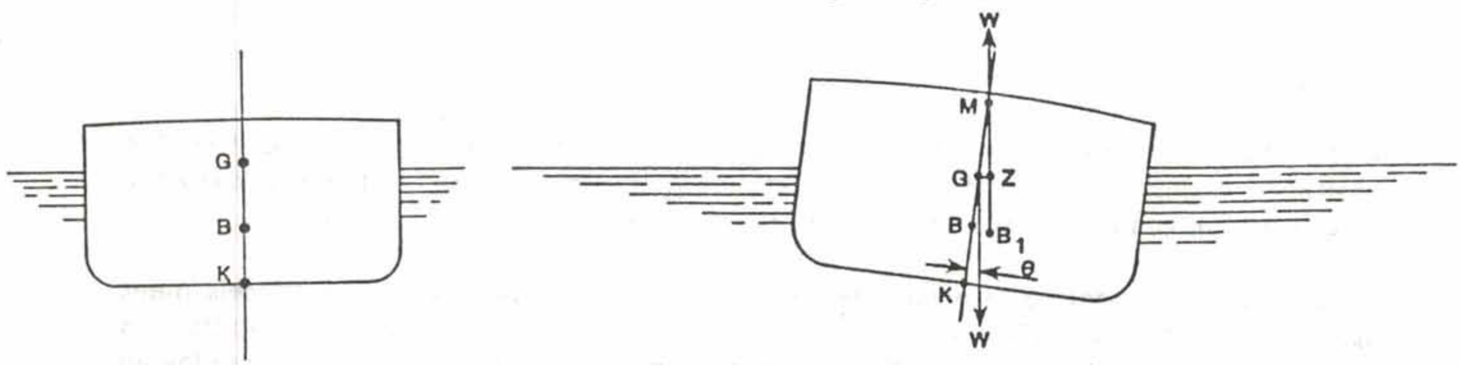
Our approach will be to discuss the subject of intact stability under the following topic headings:

Reference
Regulations (Criteria)
Reporting
Recommendations

Reference

Reference in the broad sense is the information we use to frame the subject. What are the important factors affecting stability; what factors are those that we can effectively control in a given existing vessel; and what type of information do we need to identify the variables?

A vessel afloat in still water is acted upon by two forces. A gravitational force equal to the weight or displacement (Δ) of the ship acts vertically downward through the center of gravity, G, of the vessel. A buoyant force acts vertically upward through the geometric center, B, of the underwater volume of the ship. These two forces are equal in magnitude which may be denoted by W.



GZ = GM x sin θ

GM = KB + BM - KG - f.s. correction

Figure 1

If the ship is to remain at rest, G and B must lie in the same vertical line. No general statement can be made, however, regarding their longitudinal distances from amidships (LCG and LCB) or their heights above the basline (KG and KB). Note that at a given displacement and trim, the location of B depends solely upon the shape of the underwater body of the ship. The location of G, on the other hand, is dependent upon the distribution of weight in the ship and is, within limits, under the control of the operating personnel when loading the vessel.

Assume that the vessel is caused to heel to a small angle θ by an externally applied force. As the vessel heels, the shape of the underwater volume changes and B, always staying at the geometric center of that volume, moves to a new position, B_1. G, however, whose location is dependent only upon the distribution of weights in the ship, remains stationary. The two equal but opposite forces, W, now act vertically through G and B_1. Since they no longer act in the same straight line, they result in a moment tending to return the vessel to the upright. As shown in the sketch:

RIGHTING MOMENT = (W) x (GZ)

Observe that the vertical through B_1 intersects the centerline of the ship at M and that GZ = (GM) x (sin θ). Now it is a peculiar fact that for small angles of inclination (up to about seven degrees), M does not change appreciably its location in the ship, and therefore the moment tending to right the ship when heeled to small angles is conveniently written:

$$\text{RIGHTING MOMENT} = (W) \times (GM) \times (\sin \theta)$$

This, then, is the significance of that much discussed characteristic, GM, or metacentric height. The larger this quantity, the greater is the tendency for the vessel to return to the vertical, or the more stable it is.

The position of M depends upon that of B and consequently upon the shape of the ship. Therefore, the only method available to operating personnel to increase GM, and hence the stability of the ship, is to lower G. This explains the advantages of keeping topside weights to a minimum and adding ballast low in the ship. Some indication of the magnitude of the GM may be obtained from observation of the period of roll. A quick roll, while uncomfortable, indicates a large GM, good stability. On the other hand, a slow "sluggish" roll gives warning of deficient stability and a small GM.

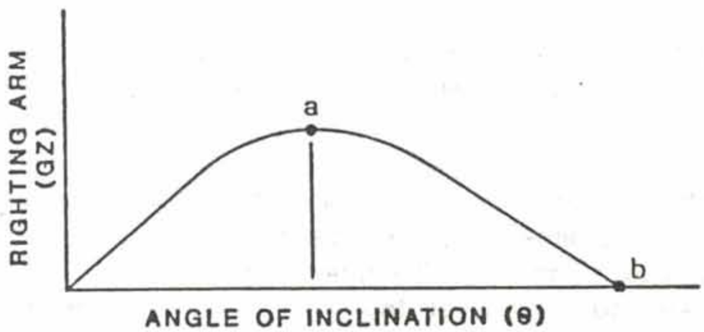
If KG should be greater than KM, that is, if G should lie above M, GM would be negative. The resulting moment would tend to capsize the ship, the vessel would be unstable. Depending upon its shape, the vessel would "loll" over to an angle at which it would gain equilibrium, or it might even capsize. A negative GM is, of course, highly undesirable as the vessel would at best be unmanageable.

For many years GM-based criteria alone were used to evaluate stability, since GM is relatively easy to calculate and the measure takes into account the principal factors affecting stability.

The U. S. Coast Guard wind heel criterion, which is applicable to research vessels, requires a particular value of GM for a vessel at a particular draft. Without arguing the merits of the criterion, it can be seen that if a required GM is to be met at a given load condition, the only variable we can control is the center of gravity - since the location of the metacenter is determined by the hull shape.

GM is useful in finding equilibrium heel angles when the applied heeling moment or upsetting forces can be clearly defined. A variety of criteria have been developed for special vessels such as tugs, vessels lifting weights over the side, and passenger ships subject to passengers congregating at the rail, and others.

Because GM is valid at only small angles of heel, methods for the direct calculation of GZ at large angles of heel were developed and criteria evolved using GZ as a measure. The value of GZ, or the "righting arm" as it is commonly called, can only be determined by a calculation based upon the shape of the ship and the value of KG. The lower G is in the ship, however, or the smaller KG, the larger is GZ. These values plotted against the angle of heel form a "stability curve".



a = point of maximum righting arm

b = range of stability

Figure 2

Among other things, this curve shows the angle "a" at which the tendency of the vessel to return to the upright is a maximum and the angle "b" at which this tendency vanishes. If heeled past the latter angle the vessel will capsize. The angle "b" is known as the "range of stability".

One more point will complete this brief discussion of the stability of ships. If a tank is "slack", that is, somewhere between empty and full, the liquid it contains has a detrimental effect on stability due to its tendency to flow to the low side when the vessel is heeled. This results in a movement of G toward the low side of the vessel reducing GZ and hence the righting moment. Purely because it simplifies calculation, this reduction in righting moment is attributed to a "virtual" rise in G or decrease in GM. This is the so-called "free surface effect" which points to the importance of having as few tanks slack at any time as is practical. The effect is greater in wide tanks than in narrow ones. For this reason the fuel and water tanks in ships are usually subdivided longitudinally.

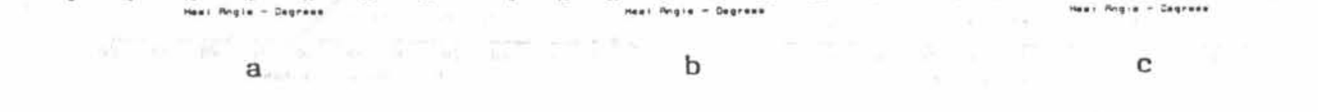
This discussion of some of the basic principles of stability is made to let us examine those things we can alter or control. For GM based criteria we have two choices -

increase GM available or reduce GM required. The former is generally the only avenue available in a given vessel; but at times there is some hope in the latter, for example by reducing windage.

As was stated before, this leads to the obvious and well known conclusion that the most direct way to increase GM is to reduce KG and to minimize free surface.

The other elements of the equation can be modified, but generally not in a way that the operator can control. You all have seen vessels that are so deficient in stability that sponsons have been added. Sponsons increase the waterplane inertia, thus raising the metacenter, and can also raise the center of buoyancy. Other forms of radical surgery, usually with a burning torch, can be done so as to remove parts high in a vessel, thereby lowering KG.

The GZ curve at large angles of heel depends, as was stated, on the location of the center of gravity also, but more importantly on the amount and disposition of the buoyant elements immersed as the vessel rolls to large angles. This can be seen from the shape of the GZ curve for several example vessels.



a b c

Figure 3

Again, with an existing vessel, one has little control over the shape of a righting arm curve, but draft has a strong influence on righting arm curve, and that is within your control. The following figure shows the righting arm curve for the same KG, but at two different drafts for a vessel.

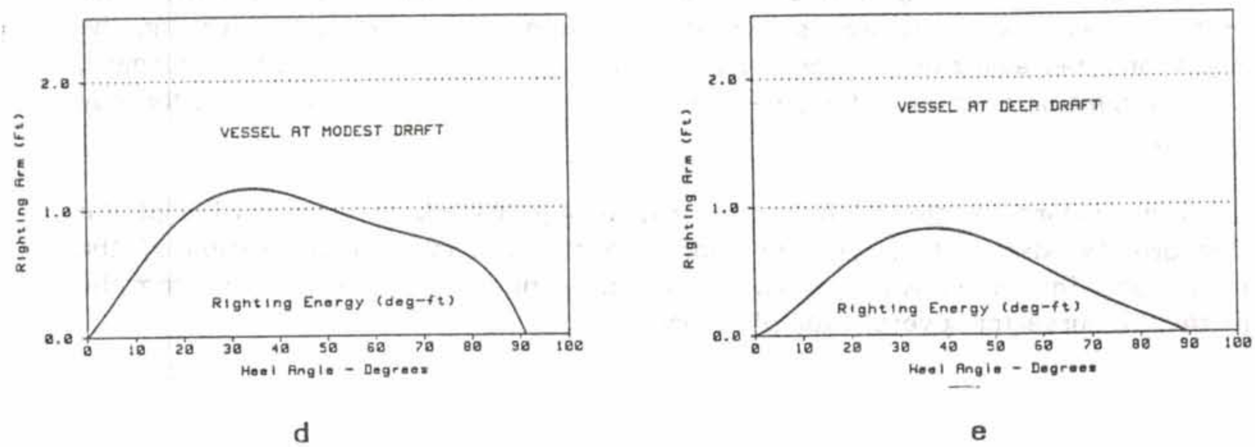


Figure 4

Another factor is the inclusion of superstructure buoyancy in the calculation of the righting arm. If the deckhouse is structurally sound and if it can be made effectively watertight, then it can be included in the calculation. The figure below shows the effect of a superstructure addition.

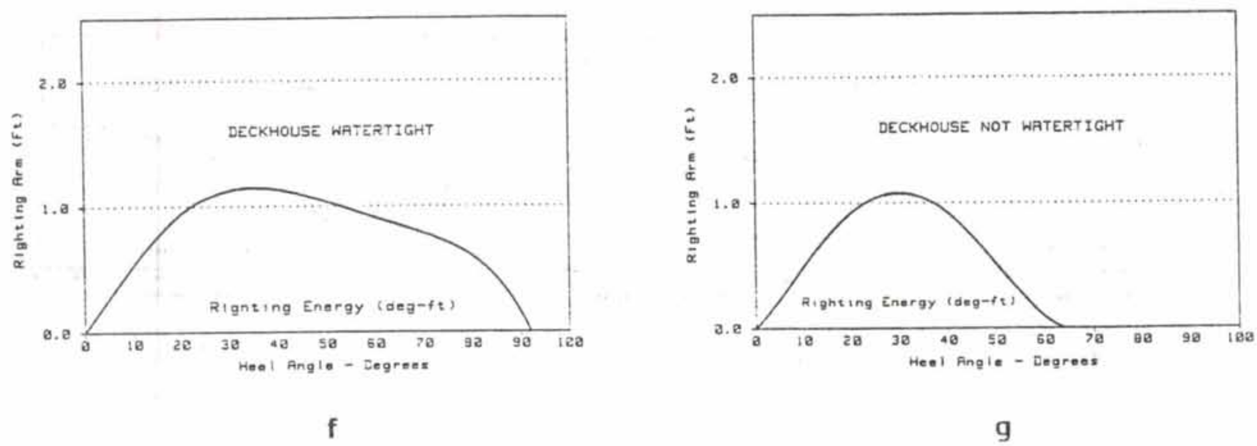


Figure 5

These figures demonstrate that you should be aware of what elements are included in the calculation of GZ for your vessels, so that these volumes can be maintained tight.

Regulation

Subchapter S of the Coast Guard rules details the criteria that apply to research vessels. Figure 6 shows the righting energy criterion in graphical form. The criterion requires a minimum value of the righting arm at 30 degrees, and certain areas under the curve to 30 degrees and 40 degrees or to the angle at which downflooding occurs. These measures ensure a minimum level of righting energy so that the ship may successfully resist the forces of the sea.

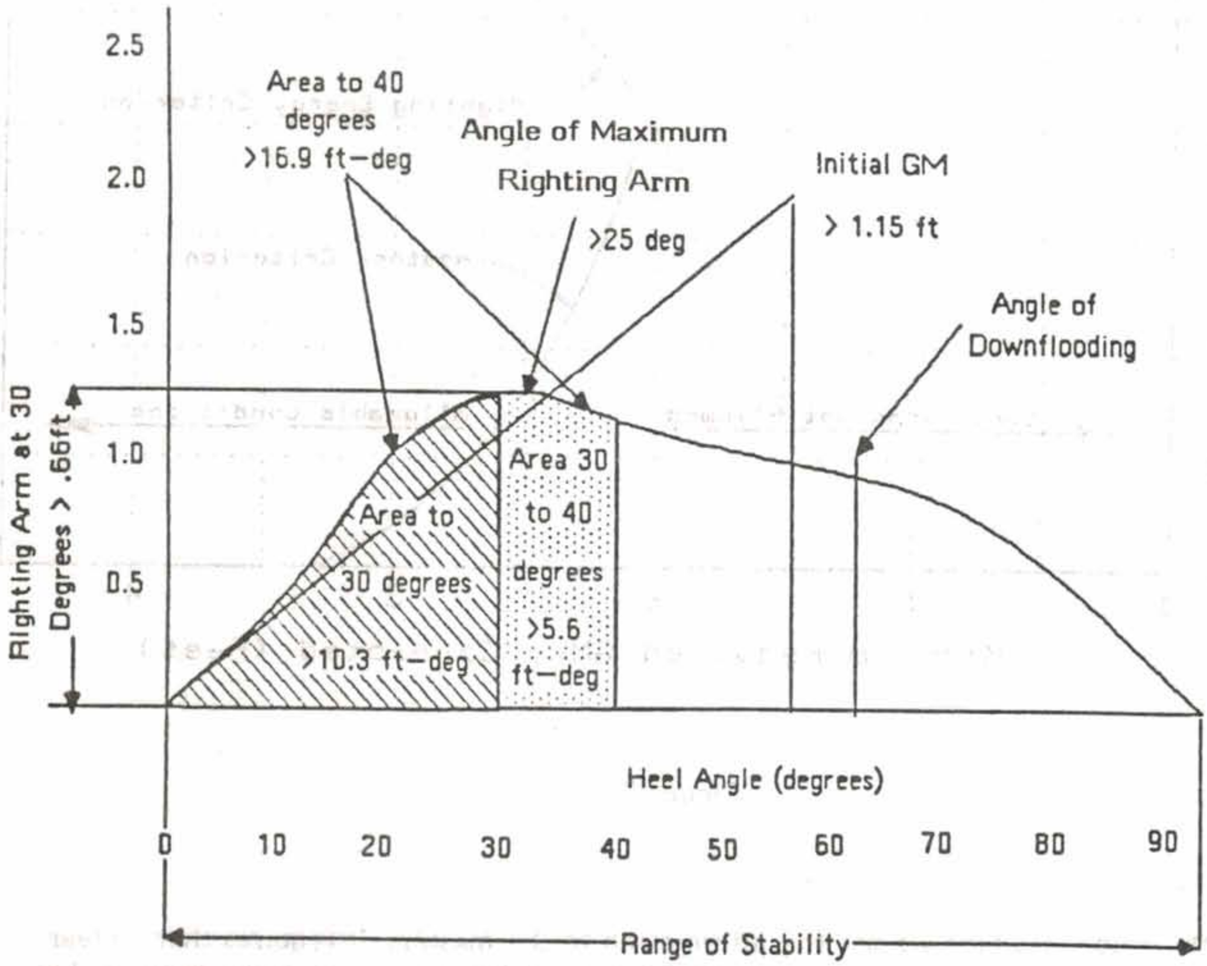


Figure 6

However, both the wind heel and the righting energy criteria are stylized calculations. They are not direct calculations that apply to definable events. But, as a statistical measure, they give us some assurance that vessels will survive if they meet the criteria and are similar to the vessels that form the statistical base.

After analyzing a ship in a wide variety of load conditions, the GM required to meet the criteria at a given draft is plotted. Actual load conditions can then be compared with the "required" curve.

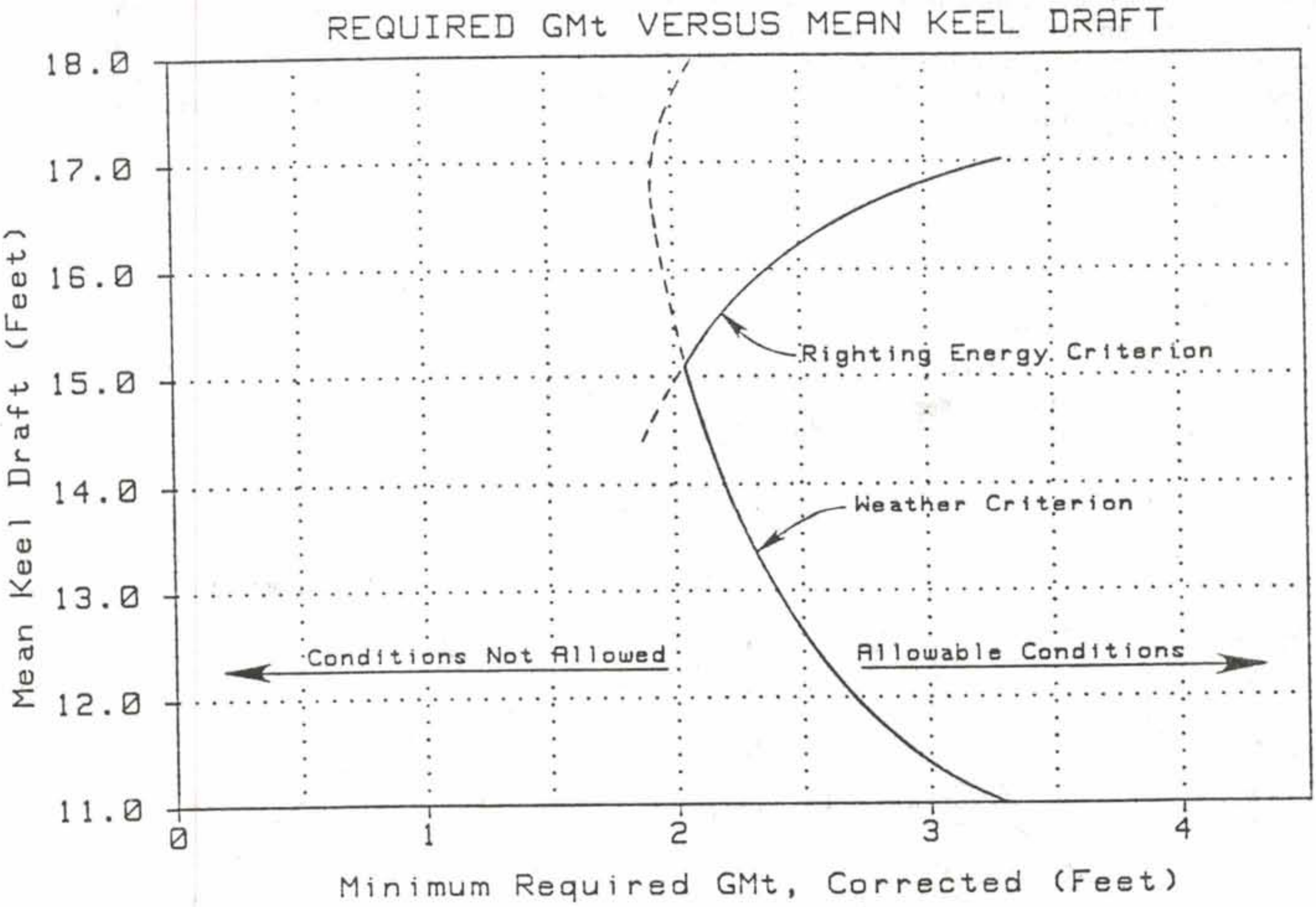


Figure 7

Reporting

This is the stage at which we get the information to the master. It requires that a clear definition of the vessel be presented, and that a straightforward way to keep track of the conditions be provided.

From the foregoing can be seen that the items we can control that assure adequate stability are weight, the location of the center of gravity and downflooding angle (we could also include assurance that all of the elements included in reserve buoyancy are actually effective -- that is, that the hull and superstructure are watertight). But we can only control them if we have good information on where we began.

This begins with an inclining experiment that is designed to establish the weight or displacement and establish the vertical center of gravity of the vessel in a condition without any variable load. This is the light-ship weight and KG. From that base, deadweight is added to arrive at operating conditions.

This concept is so simple and elementary that it seems impossible for any confusion to result. I can tell you that is not the case, particularly for research vessels that have a variety of elements that could be either light-ship or deadweight. To avoid confusion, the bookkeeping journal, what we call the trim and stability booklet, must have a clear description of all assumptions.

Another reason for needing good data is that the items we are seeking to control are relatively small. The following tabulation, for a vessel the size of the ALPHA HELIX, makes this point.

Total displacement	600 LT	KG	13.4 feet above baseline
Total deadweight	168 LT	KG	8.7 feet above baseline
Light-ship weight	432 LT	KG	15.3 feet above baseline

But of 168 LT of deadweight, only about 20 LT are truly discretionary, since the remainder are fuel, fresh water, stores, crew and effects, and other relatively fixed items. Thus a little over 3 percent of the weight is the part that the scientists really have available. This is particularly true of small vessels, but even in large vessels such as MELVILLE and KNORR, the truly discretionary payload is small.

Thus we must provide the master with a clear description of all the items that go not only into the variable weights, but also make up the light-ship weight.

Another factor that needs to be considered is that all vessels seem to grow heavier throughout their lives and sometimes the discretionary payload can disappear. For example:

1. Ever-increasing accumulation of spare parts. Have you looked in the engineer's store lately to see how many "almost good or almost broken" items are being kept because they might need them sometime.

2. Additional equipment is added in both the laboratory and the machinery spaces. (Electronics is a prime example.)

3. Specific voyage outfit that seems to become permanent.

4. Paint.

5. Minor modifications.

In principle, growth is recorded when major changes occur, because a new inclining experiment is conducted. But, even if no major change is made, re-evaluations at 5- to 7-year intervals may be a good idea.

The foregoing is particularly important for vessels that are likely to have relief masters or vessels that are likely to re-stage at foreign ports.

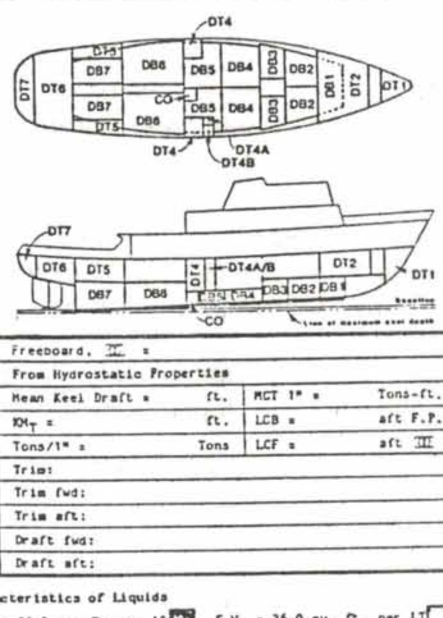
Recommendations

The U. S. Coast Guard requires, and common sense dictates, that the master have available all the information necessary to properly evaluate the stability of the vessel. Differing backgrounds and training lead to varying expectations about the material a master may need. However, it is my opinion that the booklet must give all of the data, and if done carefully, it will be useful regardless of the skill level of the users.

From our experience we have found that tabular forms, while necessary, are made much more useful by the inclusion of figures that give the operator a quick visual check of the condition of the vessel. For small vessels, this can be done on one page. For larger vessels, summary sheets of the principal variables such as fuel, etc. can be constructed, and then the summary sheet can have a drawing along with the tabulation. The following figure, from the ALPHA HELIX trim and stability booklet, seems to work quite well.

R.V. "ALPHA HELIX" Trim & Stability Conditions	%	Weight	VCG	V. Mom.	LCG	L. Mom.	F.S. Corr.
Crew, Staff & Effects			20.0		33.0		
Refr. Stores & Dry Provs.			13.8		41.4		
Scientific Stores							
Outfit			12.6		92.9		
D.B. Tank No. 1					23.0		
D.B. Tank No. 2 (P&S)					31.5		
D.B. Tank No. 3 (P&S)					40.1		
D.B. Tank No. 4 (P&S)					50.4		
D.B. Tank No. 5 (P&S)					61.9		
D.B. Tank No. 6 (P&S)					77.0		
D.B. Tank No. 7 (P&S)					94.5		
Deep Tank No. 1 (Fore Peak)					2.5		
Deep Tank No. 2					18.7		
Deep Tank No. 4A L.O.					61.0		
Deep Tank No. 4B L.O.					61.0		
Deep Tank No. 4 (P&S)					65.0		
Deep Tank No. 5 (P&S)					95.8		
Deep Tank No. 6					109.5		
Deep Tank No. 7 (After Peak)					118.0		
Contaminated Oil Tank					66.0		
Total Deadweight							
Light Ship Weight							
Total Displacement							

Condition No. ________



Freeboard, [illegible] =	
From Hydrostatic Properties	
Mean Keel Draft = ft.	MCT 1" = Tons-ft.
KM_T = ft.	LCB = aft F.P.
Tons/1" = Tons	LCF = aft [illegible]
Trim:	
Trim fwd:	
Trim aft:	
Draft fwd:	
Draft aft:	

Notes
1. Weights are in long tons.
2. VCGs are measured from baseline.
3. LCGs are measured from fore peak (Fr. 0).

KM_T		LCB		
GM (Uncorrected)		Lever		Fwd Aft
FS (Correction)				
GM (Corrected)				

Characteristics of Liquids

D.O. = 41.3 cu. ft. per LT

L.O. = 39.0 cu. ft. per LT

F.W. = 36.0 cu. ft. per LT

S.W. = 35.0 cu. ft. per LT

Figure 8

There are other things that can be done to minimize confusion and to assist the master so that we encourage reliable monitoring of the stability of the vessel. Some thoughts in this regard are as follows:

- Provide weights of all the gear that is loaded. You can do this by having containers run over truck scales, or even weighed with a dynamometer as gear is stowed. Many scientists have packages they routinely use, and the weight of those should be recorded and provided as part of the voyage plan.

- Before departure a burn-out sequence can be established and the stability can be checked for each case. This is something that is, again, very valuable for smaller vessels.

- Provide instructions for the scientific party regarding the rules for use of hatches, doors and other openings at sea. This will ensure that the assumptions in the calculations are not violated.

- Review the trim and stability book with your operating crew. Find out what features are cumbersome or unclear. Correct those. Remember, most of these books were prepared to meet minimum regulatory requirements, oftentimes under the pressure of extreme deadlines, so the objective of "clear communication" was not always a high priority.

- Provide the master with information about some of the other serious impacts on stability that can occur during operations -- such as influence of excessive trim, stability loss in following seas, icing, effect of water on deck. I believe those will be covered in other discussions here. However, I should note that the U. S. Coast Guard has just published Navigation and Vessel Inspection Circular 5-85, Proposed Voluntary Stability Standards for Uninspected Commercial Fishing Vessels that is an excellent summary of concerns about stability. It is directed at fishermen, but applies equally well to many of the vessels in this fleet.

In closing, we should note that the advent of the computer has provided the opportunity to "mechanize" trim and stability booklets. In large ships that have strength limitations in addition to the usual stability constraints this is very common practice. Numerous computer programs are available. We have acquired several of these, but find them generally not very useful for small vessels.

The main limitation in the programs that we have seen is that they have no graphics and they clearly have much information that is irrelevant.

Since the objective is to encourage the use of the program, and to do at high speed all of the calculations required by a trim and stability booklet, we feel that any computerized program should have graphical presentations that are as good as the best paper booklets. We hear a lot about "user-friendly" programs. What that means to me is understanding the needs of the user and designing the program to fill them. I believe the essence of the need is to give the master and you a tool that encourages its use. We all know that stability is important. The goal is to take the steps necessary to know that the stability is adequate -- that means doing the arithmetic.

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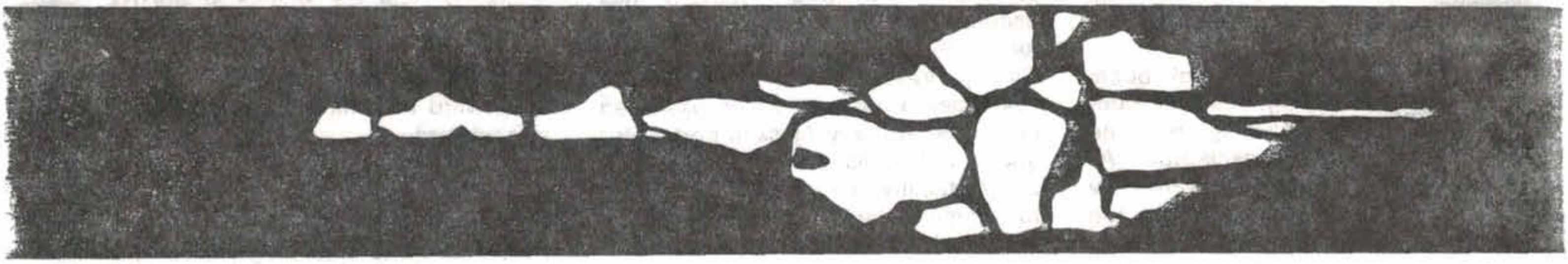
ALASKA Seas and Coasts

A Newsletter for the Alaska Commercial Fishing Industry



Gravity and buoyancy in balance =

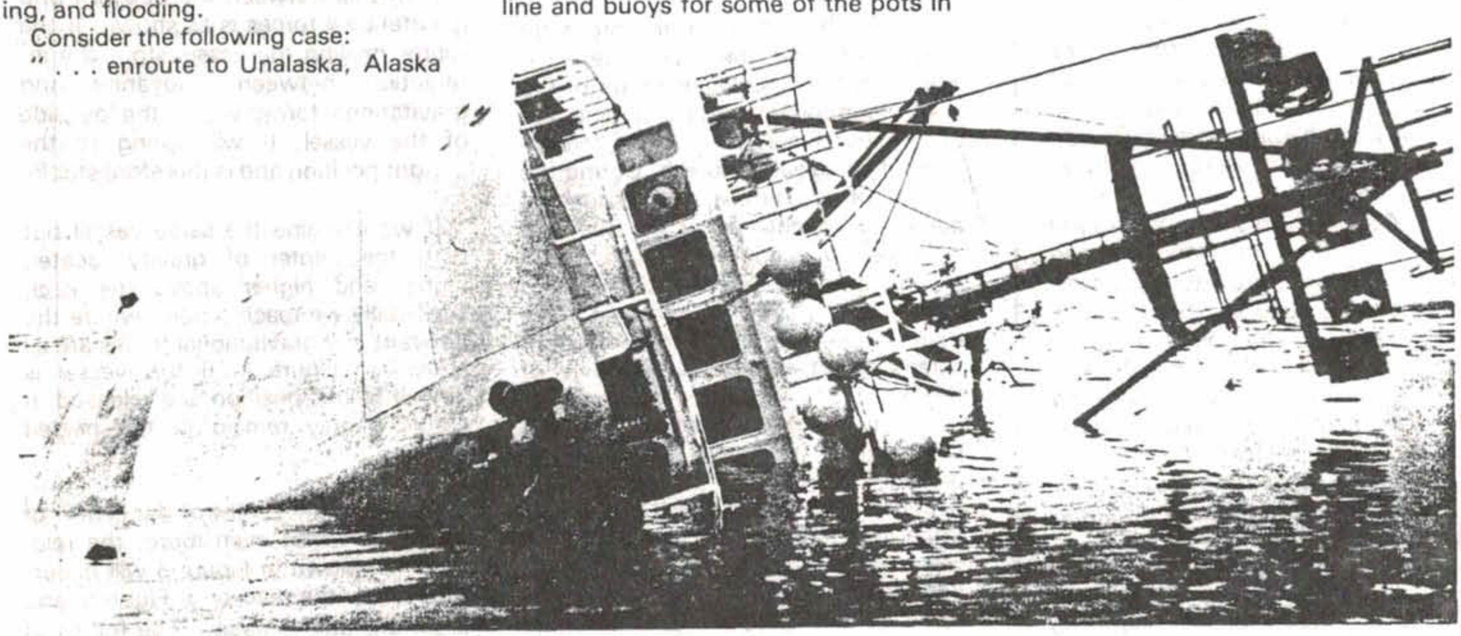
Vessel Stability

by
Bruce Adee
Director of Ocean Engineering
University of Washington

Danger and difficult conditions are part of a fisherman's life. When accidents involving the loss of vessel stability occur, the danger becomes extreme. The Coast Guard lists 85 deaths from fishing vessel casualties during fiscal 1978. Of these 85 deaths, 77 are attributed to foundering, capsizing, and flooding.

Consider the following case:

". . . enroute to Unalaska, Alaska from Tacoma, Washington with a deck load of 60 crab pots (600 pounds each) in 2½ tiers, plus 18 crab pots in the forward tank and 17 crab pots in the aft tank. The forward tank was also full of water. All fuel tanks were full (about 10,000 gallons) prior to departure, as were the fresh water tanks. There were line and buoys for some of the pots in the lazarette. The weather was good, with little or no wind and waves. With no warning, the vessel began to list to port and trim by the stern. The master looked aft from the pilot house as soon as he realized the rapid change of the condition of the vessel and noticed



Lurking in the back of every fisherman's mind is the possibility of losing his vessel. In this era of high pressure crab and salmon seasons of short duration one of the greatest concerns must be loss of vessel stability, whether it is caused by icing, overloading, or flooding.

Photo by Norm Holm, Kodiak Marine Surveyors.

that the stern was already under water, and water, fuel and air were blowing out the lazarette hatch. He had checked the lazarette hatch prior to loading and it was bolted closed (8 to 12 bolts). The vessel continued to sink by the port stern and the crew abandoned ship and boarded a life raft. The entire process took from two to five minutes.*

If you believe that only crab boats are prone to capsizing, then consider the purse seiner retrieving its seine near Cherry Point, Washington. At first it appeared that there were only about 100 salmon in the net. As the drum continued to reel in the net it slowed and eventually stopped. It then appeared that there were 300 fish in the net, so the double block was used to help haul the net.

"As the winch took a strain the boat dropped off a swell, causing the entire net full of fish to come aboard the stern of the vessel in one rapid motion. As the fish came over the roller drum on the stern, the boat rolled to starboard and the entire load of approximately 700 fish shifted to the starboard side, causing a severe list."

** Storch, R. L., "Alaskan King Crab Boat Casualties," Marine Technology, Vol. 15, No. 1, January 1978.*

This article is an outgrowth of a recent series of workshops on vessel stability and alarm systems held at various locations around the state of Alaska. A workbook will be published which goes into the subject of vessel stability in more depth.

Also in the planning stages are several complete stability analyses of a number of typical vessels in various fisheries. For this program only a small number of vessels can be tested initially, but anyone interested in participating should contact Professor Adee at 326 Mechanical Engineering Building, Mail Stop FU-10, University of Washington, Seattle, WA 98195.

The author wishes to acknowledge the support provided to the Fishing Vessel Safety Center by the Alaska Sea Grant Program and the National Marine Fisheries Service.

In a few minutes the vessel rolled to 90 degrees and sank about 15 minutes after the initial list. "No distress signals were broadcast because of the lack of time."*

These accidents, although they may appear to be unusual cases, are fairly common. The tragic pattern has become far too familiar. To help reduce this type of accident, we at the Fishing Vessel Safety Center have developed a program which has been presented at many Alaskan ports. Our goal is to help fishermen better understand stability. This article is intended to augment the presentations already made in Alaskan ports.

Fundamental Principles of Stability

A vessel's stability or the lack of it results from the interplay of two forces: gravity and buoyancy. The gravity force, or weight of the vessel, acts downward perpendicular to the sea surface. In equilibrium this is just balanced by the buoyant force of the water. When weight is added to the vessel it sinks further into the water. Once again a new equilibrium position is found where the buoyant force and weight just balance. What do you suppose would happen if you add more weight aft? The same thing except the buoyant force required to balance the weight would also have to come from the stern. As a result the vessel sinks further into the water and trims by the stern.

Each of the two important forces are distributed over the hull. The total weight of the vessel is made up of the many component parts including the hull, joiner work, fuel, water, equipment, fishing gear, and fish. During the design of the vessel, the weight of each component part of the hull may be carefully accounted for to determine the total weight and the point where this weight is centered. The point where the weight may be considered to act is the center of gravity of the boat.

The buoyant force which supports the boat is produced by the water pressure against the hull. Long ago, Archemides showed that this pressure force was equal to the weight of the water displaced by the underwater portion of the hull. While in reality this force is distributed over the entire underwater portion of the hull, we may simplify this and consider it equivalent to a single buoyant force acting at the geometric center of the underwater portion of the hull.

** U.S. Coast Guard casualty number 16732/136-79.*

An equilibrium condition is shown in Figure 1, with the points labeled G and B representing the centers of gravity and buoyancy, respectively. The arrows drawn through these points represent the weight of the vessel acting downward and the buoyant force acting upward.

If this equilibrium condition is disturbed, for instance, the vessel is heeled to some angle, then there is a change in the underwater shape of the hull. The vessel has the same weight, so the displacement remains the same, but because the underwater shape has changed, the center of buoyancy will move. In this case the shift in volume is illustrated in Figure 2. Volume is gained on the low side of the hull and lost on the upper side. As a result the center of buoyancy moves toward the low side. Since no weight was shifted, the center of gravity remains in the same position.

When the vessel is heeled over from the original upright equilibrium, three results are possible. The first is illustrated in Figure 3. In this case, the height of the center of gravity above the keel is small enough so that the relationship between the buoyant and gravitational forces is as shown. If the forces heeling the vessel stop, the interaction between buoyancy and gravitational forces will lift the low side of the vessel. It will spring to the upright position and is therefore stable.

If we examine the same vessel but with the center of gravity located higher and higher above the keel, eventually we reach a point where the buoyant and gravitational forces are as shown in Figure 4. If this vessel is heeled to this position and released, it would simply remain in the heeled position.

Finally, if the height of the center of gravity is raised even more, the relationship shown in Figure 5 will occur. This is just the reverse of Figure 3 and is an unstable situation. The forces of gravity and buoyancy will act to heel the vessel to a larger angle if it is released. This situation is always to be avoided.

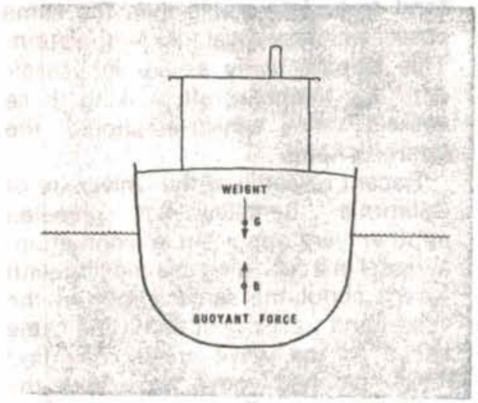


Figure 1. Fishing vessel in equilibrium

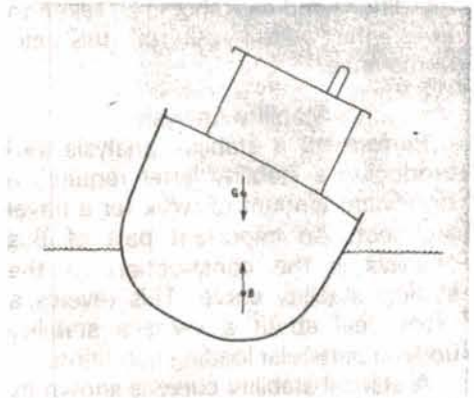


Figure 4. Neutrally stable fishing vessel in equilibrium at an angle of heel.

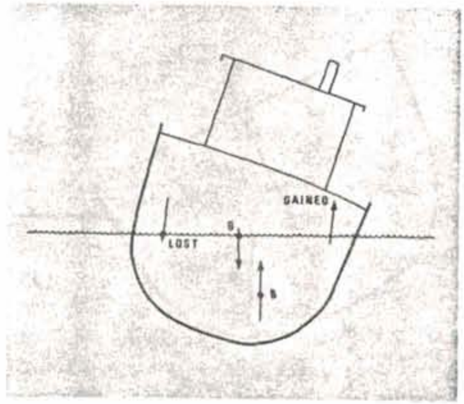


Figure 2. Change in underwater volume as vessel heels

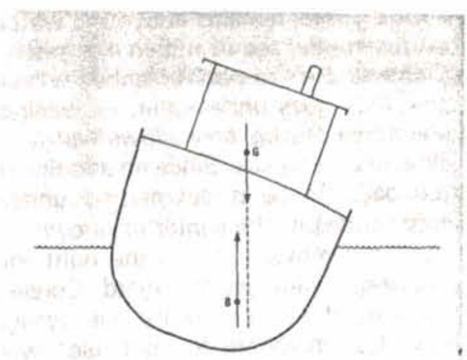


Figure 5. Unstable fishing vessel.

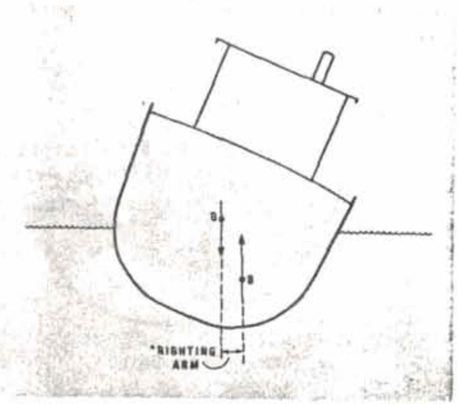


Figure 3. Stable fishing vessel.

** A measure of the forces acting to bring the boat back into an upright position.*

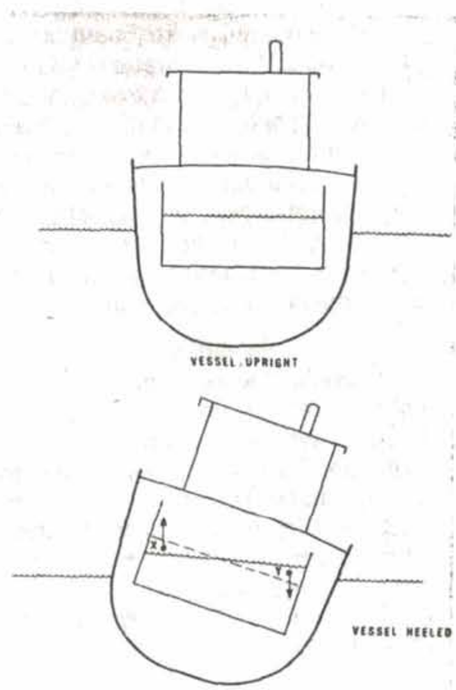


Figure 6. Effect of a free surface.

Factors Affecting Stability

The most important factor affecting the stability of a vessel is the height of the center of gravity above the keel. While the naval architect will make a careful estimate of this before construction to insure stability once the vessel is delivered, it is up to the master to insure that the center of gravity remains below a point where the vessel will be unsafe. Remember that deck loads, radar masts, or any weights added high on the vessel will increase the height of the center of gravity. There is no exception to the rule that raising the height of the center of gravity decreases a vessel's stability.

In northern waters, there is the danger of encountering icing conditions. Under these circumstances there may be a rapid buildup of ice on the exposed structure and gear on the vessel. This will have the same effect as adding weight high on the vessel, leading to a reduction in stability. Under icing conditions the safe load that a vessel may carry will be reduced from that under non-icing conditions.

Free Surface

When a tank containing liquid is not completely filled, the liquid is free to move about in the tank as the vessel heels. The presence of this free surface always decreases the vessel's stability.

To see the "free-surface" effect, look at Figure 6, which shows a vessel with a partly-filled tank first in the upright and then in a heeled position. The total amount of liquid in the tank does not change, but in the heeled position, the water surface in the tank remains parallel to the sea surface and the water shifts in the tank. This shift requires that the liquid which was within the triangular-shaped area labeled X in the upright condition is shifted to the triangular-shaped area labeled Y when the vessel heels. Redistributing the liquid within the tank is equivalent to taking some weight away on the left and adding it on the right. These forces are represented by arrows in Figure 6 and have the effect of tipping the vessel further to the side to which it is heeled.

It is obviously important to vessel stability to keep tanks and fish holds pressed up or empty. Free-surface alarms should be installed to let you know when you have free surface to contend with.

The free surface effect occurs with any cargo which is free to shift from side to side. This includes fish, iced fish, sand, grain, and many others. Bin boards properly installed in the hold will help to reduce the destabilizing effect of shifting fish.

Flooding

Related to the problem of free surface is the problem of vessel flooding. Recently, many vessels have been lost

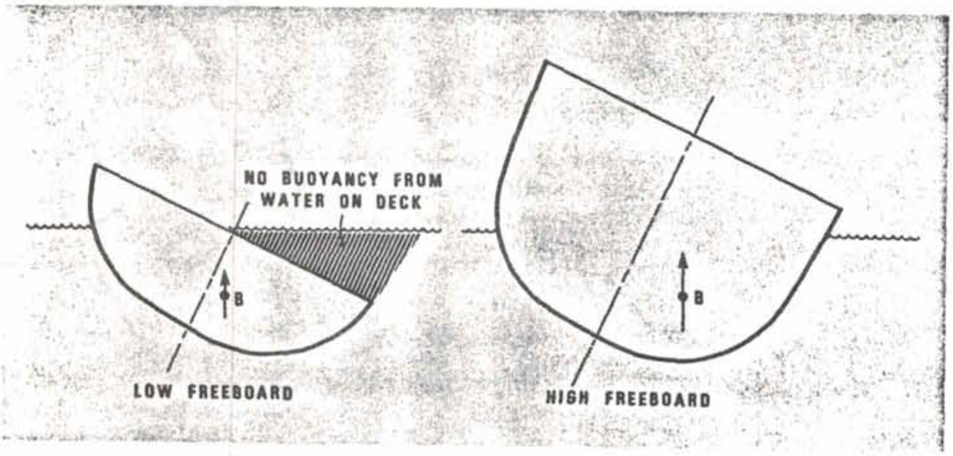


Figure 7. Effect of freeboard on stability.

because the lazarette has flooded and the skipper has not realized there was a problem until it was too late. Lazarette flooding is most severe in vessels with a broad stern and low freeboard aft. In many vessels, if the lazarette is flooded there may be no way to prevent capsizing. Every skipper should be sure there is an operational water level alarm and a way to pump out the lazarette on his vessel. Careful periodic inspection of the drain line from the lazarette to insure that it is not clogged is also an important maintenance procedure.*

Freeboard

A vessel's freeboard may have an important effect on its stability. In Figure 7, two vessels with similar hull shapes and beams are shown heeled to the same angle. The vessel on the right has greater freeboard and so the deck of this vessel remains above the water surface under the condition illustrated. Once an angle of heel is reached where the deck goes underwater, increasing the angle of heel only allows water to flow onto the deck. Since no additional enclosed space is submerged under this condition, the center of buoyancy does not move as far to the right for the vessel with less freeboard. Consequently, the tendency for the vessel with less freeboard to right itself will generally be less.

There are two mitigating factors which must be considered when a decision is made concerning the amount of freeboard. For similar vessels, the vessel with higher freeboard will have a higher center of gravity and the vessel will also be more affected by strong beam winds, since it provides a greater "sail" area to the wind.

Stability analyses have shown that vessels which have a large initial trim by the stern (stern down) generally tend to be less stable than the same vessel with less initial trim by the stern. This is particularly severe in vessels with low freeboard aft, making these vessels more sensitive should the lazarette flood.

Recent research at the University of California, Berkeley has revealed another very important phenomenon: a vessel in a following sea moving with waves about the same length as the vessel and traveling at about the same speed as the wave crests may find itself "perched" on a wave with the crest amidships. For most modern fishing vessels the stability of the vessel may be drastically reduced under these conditions and care should be taken to keep the vessel out of this circumstance.

Stability Analysis

Performing a stability analysis and producing a stability letter requires a significant amount of work for a naval architect. An important part of this analysis is the construction of the statical stability curve. This reveals a great deal about a vessel's stability under a particular loading condition.

A statical stability curve is shown in Figure 8. On the vertical axis the righting arm is the horizontal distance between the arrow representing weight pointing downward through the center of buoyancy only (see Figure 3). This curve reveals a great deal about the vessel's stability under a specific loading condition. (The curve is different for each different loading condition). The initial steepness or slope determines how the vessel responds at small angles of heel. The steeper the curve for small angles the more the vessel wants to spring back to the upright condition. The location of the peak (labeled P in Figure 8) is very important. The higher the peak the more stable the vessel, but it is also important to have the peak at as large an angle as possible. This will help the vessel maintain stability even when heeled over to a large angle.

The point where the curve crosses the horizontal axis (labeled L in Figure 8) is also very important. It should occur at as large an angle as possible. When the vessel is heeled to an angle greater than the angle at point L, it will capsize.

Finally, the area under the curve is important. It is related to the energy it takes to capsize a vessel and should be large enough to prevent the vessel

(Continued on Page 7)

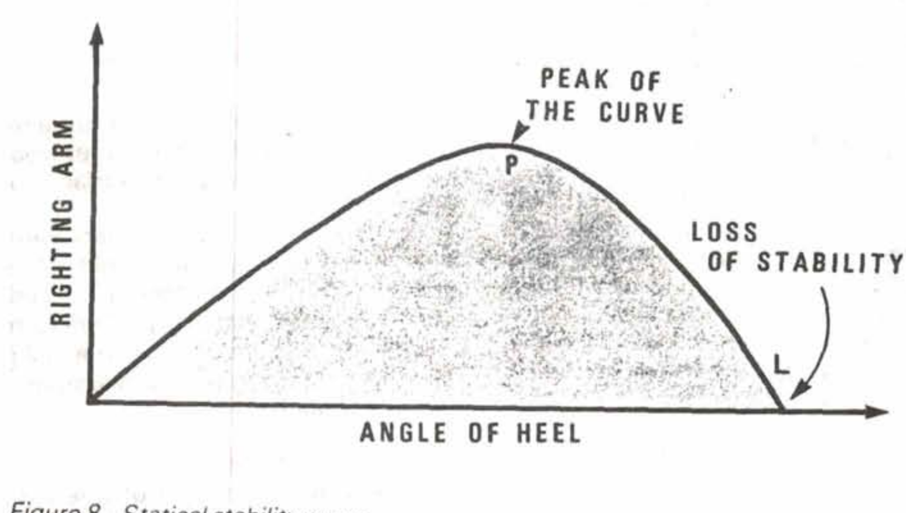


Figure 8. Statical stability curve.

* *See Alaska Seas and Coasts, Vol. 7, No. 4, "The Lazarette—Keep it Empty, Keep it Clean."*

from being rocked to large angles by relatively small forces.

In performing a stability analysis, the naval architect will use standards developed by the Intergovernmental Maritime Consultative Organization (IMCO) to determine the safe loadings under various conditions. Although no formal required standards exist for U.S. fishing vessels, the IMCO criteria provide excellent guidelines for larger vessels.

Statical Stability and Vessel Dynamics

At this point the reader might ask, "Why not design the vessel with extremely large statical stability?" The reason is that a vessel which is too stable might not be seakindly. The natural period of roll is directly related to level of stability. A vessel which is too stable will want to spring back to the upright too quickly. A less stable vessel will have a slower roll or longer roll period. As with most design problems, a careful compromise must be reached to produce both a stable and a comfortable vessel.

PRESENTATION TO

RESEARCH VESSEL OPERATORS' COUNCIL

Scott Davis, Lt. USCG

Hello, my name is Scott Davis, and I am a Lieutenant in the Coast Guard. I went to the Coast Guard Academy and graduated in 1976. My first duty assignment was in Astoria, Oregon aboard the Coast Guard Cutter YOCONA. My next tour took me down South to New Orleans, Louisiana in the merchant marine technical office where I spent 3 years in the hull structures and stability section. Then in 1981 I went back to school at the University of Michigan for 2 years concentrating my studies in naval architecture with an emphasis on structures. Following school I came to my current assignment in the merchant marine technical office in Alameda. I currently serve as the Hull Section Chief and am responsible for all structural and stability reviews that come through our office.

The merchant marine technical offices serve as technical advisors to the local inspection offices of which our office covers from Southern California north to Alaska and west to Honolulu and the Far East. As many of you may already know the technical offices are being consolidated into a single office which is in the conception stages currently in our headquarters office. The most likely location for the new Marine Safety Center as it has been labeled is in the Washington, D.C. metropolitan area.

When I first started my research for this presentation on the stability for research vessels I accumulated some very interesting statistics. I generated a list of research vessel casualties since 1980. In that 5 year span there were a total of 55 casualties investigated by the Coast Guard with a monetary loss of over 10 million dollars. Of these 55 casualties; 13 collisions; 13 material failures; 11 groundings; 9 fires; 4 floodings; and 5 others (steering, weather damages, etc.). Note that none were solely related to the vessel's intact stability or the lack there of! From this observation one could infer that one of two things; 1) that the operators of research vessels as a general rule are a group of conscientious, knowledgeable operators who consistently maintain their vessels in a safe, seaworthy, and stable state, or 2) on the other hand the Coast Guard stability criteria is doing as intended by ensuring that the vessel's are stable in all intended operations. Actually the truth is probably some combination of the two. However these statistics further point out that of the 55 casualties 5 were completely lost and an additional 32 had their seaworthiness affected by the casualty. This emphasizes the continued need for investigating the stability of research vessels.

The Coast Guard stability requirements as they relate to Research Vessels are essentially split into two categories. First, motor driven research vessels of 300 gross tons and over and steam ships longer than 65 feet are inspected vessels under Title 46 subchapter U, which is contained in parts 188 through 196. These vessels must comply with all of the inspection requirements contained in these parts of title 46. The stability requirements appropriate for these vessels is contained in Title 46 Subchapter S, which are the recently published stability regulations. That is not to say that the requirements are new just that Subchapter S which contains the stability requirements for all vessels was published in November of 1983. The stability requirements for all oceanographic vessels inspected under subchapter U (or those vessels of 300 G.T. or more) and barges of less than 300 G.T. are summarized as follows:

1) Weather Criteria (46 CFR 170.170)
   - an empirically based formula for required GM
   - based on exposed wind area (a static criteria)
   - intent; to show adequate intact stability to resist wind heeling moment

2) Dynamic Criteria (46 CFR 170.173)
   - derived from the IMO standard
   - based on righting energy (uses the area under a righting arm curve)
   - uses free trim/constant trimming moment
   - intent; to demonstrate measure of righting capability

3) Subdivision and Damage Stability Requirements (46 CFR 173.075, 080,085)
   - subdivision same as that for passenger vessels with less than 400 pass.
   - damage stability also taken from passenger vessel section
   - intent; to show survivability

4) Towline Pull Criteria (46 CFR 173.095)
   - if vessel will engage in towing off of the stern (usually not governing)
   - if tow over the side superimpose heeling arm curve on R.A. curve
   - residual righting energy must then be used in dynamic criteria (See 46 CFR PART 173 Subpart B)

I think I can safely say that the majority of the research vessels fall into the second category of being uninspected. The Coast Guard investigates the stability of these vessels if they require a loadline assignment. There are, however, no established stability requirements in the regulations for uninspected oceanographic research vessels. Based upon guidance received from Coast Guard Headquarters in 1975 the following stability requirements are the minimum standards applicable to these vessels:

1) Weather Criteria - same as above

2) Dynamic Criteria (vessel must comply with one of the two standards)
   - 46 CFR 170.173 - IMO standard same as before (encourage this standard)
   - 15 foot-degree criteria, what was once called Rahola

3) Towline Pull Criteria - same as above

Note that for uninspected R/V's there is no requirement for subdivision or damage stability.

The Coast Guard requires that the Master's of both inspected and uninspected oceanographic research vessels be supplied with sufficient information to operate the vessel in a safe and stable condition and in accordance with the applicable regulations. For inspected vessels the applicable section of the regulations is 46 CFR 170 Subpart D, and for uninspected vessels getting loadlines the requirement is found in the 46 CFR Subchapter E part 42. Certainly the information necessary to accomplish this will vary depending on the vessel type, size, and operations. The presentation of the stability information to the Master can be accomplished in two ways:

1) First, and usually preferable, is when sufficient information to enable the Master to operate the vessel in compliance with the applicable regulations can reasonably be placed on the Certificate of Inspection, Loadline Certificate, or the Stability Letter. The stability/operating restrictions in this case are simple and limited in number. The method used by the naval architect in this case is to generate a set of worst case loading conditions which reflect the anticipated range of operations (usually constituted by a full load condition with 100, 50, and 10 percent consumables on board). In these conditions a free surface correction associated with the largest pair or centerline tank of each type of liquid should be assumed, plus tankage should be loaded in the highest tanks. If ballast will be carried, the free surface moment associated with the largest ballast tank pair or centerline tank should be included. If these conditions comply with all applicable requirements then the worst cases have been considered and the only loading restriction with regard to tankage is to carry no more than one pair or centerline tank of each type of consumable liquid slack at any one time. Certainly we will all agree that this is a conservative approach with an associated loss in cargo carrying capacity in trade for simple and limited restrictions on the vessels operations.

2) The second method used to present the Master with the necessary stability/operating information is to generate a Trim and Stability Booklet for the vessel. This procedure is usually used because the conservative approach just described is too restrictive or because of a desire to have increased flexibility in their operations or a need for specific guidance on vessel idiosyncrasies. In this case the naval architect must generate a booklet that complies with the format specified in 46 CFR 170.110. In essence the booklet must supply the Master with a rapid and simple means for assessing the vessels stability. In contrast to the first method this procedure generally requires that the Master investigate the stability of the vessel prior to it's departure by calculating the particulars of the vessel as loaded. Therefore, it is necessary that the booklet contain at the minimum information necessary to calculate the vessel's characteristics. The following is a list of items indicative of the information necessary in a Trim and Stability Booklet:

- a general description of the vessel, including lightship
- instructions on the use of booklet
- general arrangement plans showing compartmentation, closures, vents, etc.
- hydrostatic curves or tables
- capacity plan showing capacities and vertical and longitudinal centers
- tank sounding tables w/capacities, centers, and fsc
- loading restrictions (max KG or min GM curves)
- examples of loading conditions
- a rapid and simple means for evaluating other loading conditions
- brief description of the stability calc's done including assumptions
- general precautions regarding unintentional flooding
- table of contents and index
- guidance concerning cross flooding if applicable
- amount and location of fixed ballast if applicable
- discussion of amount and sequence of ballasting

That, in essence, covers the stability information required by the Coast Guard for Oceanographic Research Vessels. The segments of this information applicable to a particular research vessel is dependent upon the vessel's size and operations. What I'd like to do now, in finishing up, is point out several areas of potential stability problems. These areas are based on our experience with research vessels and vessel stability in general.

1) Vessels over time have a tendency to grow. This is often times very applicable when discussing research vessels because the equipment carried may vary extensively depending on each trips' intended operation. Our guidance in this respect is cautionary stressing that is is very important to know what items are included in lightship. This is especially true for research vessels where electronic equipment, computers, specialized equipment (A-frames, towing gear, winches, etc.) may or may not be included in lightship.

2) The addition of weight, in itself, may prove detrimental to a vessels stability but certainly equally, if not more important, is the location of the weight additions/removals. (high weight additions - bad, low weight removals - bad, etc.)

3) The next big area of concern is the state of the tankage. specifically what order should the consumable tanks be burned-off, and the free surface moment associated with slack tanks. From strictly a stability standpoint consumable tanks should be burned-off in the order of highest to lowest tanks. Often trim considerations may preclude this sequence. Prudent seamanship would demand that slack tanks be kept to a minimum and cross connections between port and starboard tanks be kept closed at all times. In the same light bilges should always be kept at minimum levels. Discuss briefly the results from the Tug Eagle case and the drastic effects the tank arrangements had on the vessels stability.

4) Last is just a precautionary note concerning towing. It is common place for research vessels to be engaged in towing operations both over the side and off of the transom. The Master should be aware that the trimming and heeling moments induced by these tows can have a detrimental effect on the vessel's overall stability.

In closing I'd like to thank you for this opportunity to come and talk with you. It is unfortunate that the Coast Guard's stability requirements are often considered confusing at best, if not total magic. I hope that I've been able to clear some of the bureaucratic fog in that regard. Thank you!

OCEANOGRAPHIC RESEARCH VESSELS
SUMMARY OF COAST GUARD STABILITY REQUIREMENTS

FOR OCEANOGRAPHIC RESEARCH VESSELS INSPECTED UNDER SUBCHAPTER U (I.E., THOSE OVER 300 G.T.) PLUS BARGES LESS THAN 300 G.T.:

1. WEATHER CRITERIA (46 CFR 170.170)

   In all operating conditions, the minimum required GM is determined from the formula contained in the specified section.

2. DYNAMIC CRITERIA (46 CFR 170.173)

   For each loading condition the vessel must be shown by design calculations to comply with the dynamic stability requirements contained therein.

3. SUBDIVISION AND DAMAGE STABILITY REQUIREMENTS (46 CFR 173.075, 173.080, 173.085)

   Again, for each loading condition the vessel must demonstrate sufficient intact stability and subdivision to comply with the designated sections of title 46.

FOR UNINSPECTED OCEANOGRAPHIC RESEARCH VESSELS:

1. WEATHER CRITERIA (46 CFR 170.170) as above.

2. DYNAMIC CRITERIA

   For each loading condition the dynamic stability of the vessel must be assessed using either A. or B.

   A. Righting Energy Criteria

      1. In all operating conditions, the area under the righting arm curve must equal 15 foot-degrees to the least of the following angles:

         a. 40 degrees
         b. the angle of maximum righting arm
         c. the angle of downflooding

      The righting arm curve is based upon the KG after correction for free surface.

      2. The angle of downflooding shall not be less than 20 degrees, and the angle of vanishing stability shall not be less than 40 degrees.

   B. Intact Stability criteria of 46 CFR 170.173 as above.

APPENDIX VI-D

PRESENTATION TO

RESEARCH VESSEL OPERATORS COUNCIL

James Graf
American Bureau of Shipping

LOAD LINES - General Application

To provide a minimum level of safety based on statistical data and prior experience.

1930 LLC - Approved stability data was not a req'mt
1966 ICLL - Fine tuning of 1930 convention
More draft large ships, less draft small ships

APPLICATION - LL req'd for all vessels undertaking an International Voyage Except:

1) Warships
2) New ships less than 79' in length
3) Existing ships less than 150 G.T.
4) Pleasure yachts
5) Fishing vessels

US REGS. DOMESTIC VOYAGES

*6) Uninspected motor oceanographic research vessels less than 300 G.T.

Function of ABS - Since 1929 has been the load line assigning authority on behalf of the USCG.

-CLASSED AND UNCLASSED SHIPS-

SURVEYS - Initial & Periodical

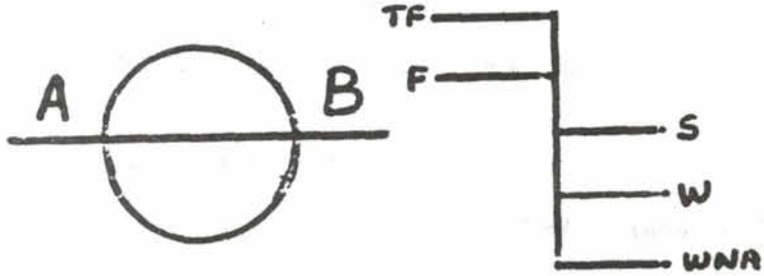
INITIAL SURVEY - Plan approval, completion of "survey for load lines," Form LL-11 inspection etc. Provisional and full term load line certs.

ANNUAL LOAD LINE INSPECTION (ALLI) - Visual examination afloat 3 months either way of anniversary date. Endorsing LL Cert.

CONDITION SURVEY LL RENEWAL - Req'd every 4 or 5 years depending on ship's age.

- Drydocking req'd
- More thorough internal and external examination.
- Gaugings may be req'd

LOAD LINE CALC. - Determining The Summer Load Draft



TYPES OF SHIPS - Type "A" Versus Type "B"

TABULAR FBD - Tables of FBD values for a STD. Ship based on length.

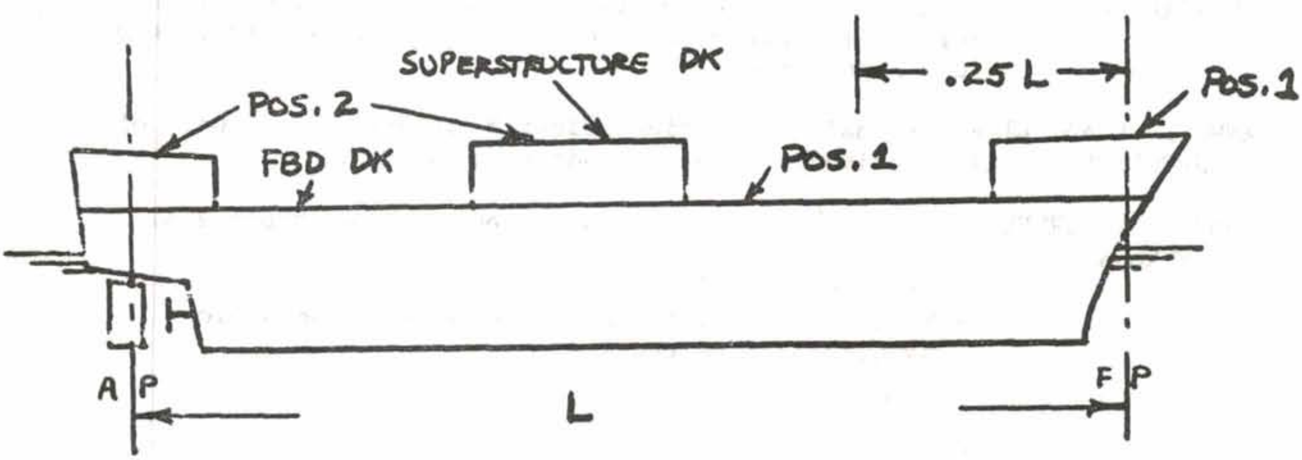
CORRECTIONS - Block Coefficient
Min. Superstructure - Type "B" ¦Resist
Depth Correction - L/D Ratio ¦Extreme
Superstructure Correction - ¦Rolling
Sheer Correction
Bow Height Check
Misc. - Lost Buoyancy Penalty
Scantling Draft
Stability Draft

Density and Seasonal Allowances

CONDITIONS OF ASSIGNMENT

Four Primary Concerns:

1) Strength - Adequate for intended service & assigned draft.
2) Stability " " " " " " "
3) Protect The Ship - Protect openings, through the outer boundary of the ship, from the elements.
4) Protect The Crew - in the necessary work of the ship.



- Watertight Integrity of the Shell
- Weathertight Integrity of the FBD DK and Above

REQUIREMENTS BASED ON:

1) Minimum vs. Increased FBD
2) Location - FBD DK vs. Superstructure DK
   - Position 1 vs. Position 2

CONDITIONS OF ASSIGNMENT - Continued

HULL PENETRATIONS

-Cargo Side Ports
-Scuppers, Inlets & OVBD. Discharges

DECK PENETRATIONS

-Hatch Covers & Coamings
-Mach. Sp. Openings
-Manholes & Access Hatches
-Ventilators
-Airpipes

BULKHEAD PENETRATIONS

-Doors & Sills*
-Side Scuttles & Deadlights

OTHER

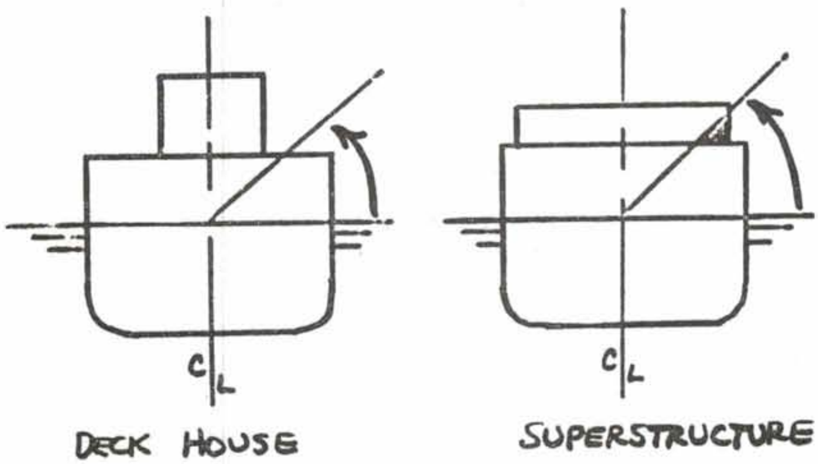
-Freeing Ports*
-Crew Protection*

*Problem Areas For Research Vessels

DECK HOUSE VS. SUPERSTRUCTURE

Superstructure: Weathertight Dk Structure that extends from side to side, within 0.04B of the ships side.

Credit is given up to 1 STD. Height (5.9' - 7.5')



RESERVE BUOYANCE-
Location is Important

Resist Extreme Rolling!

PLAN VIEW DECK STRUCTURE ON FBD DECK