

Regulatory Framework for Liftboats Stability and Load Lines

SEACOR POWER MBI Briefing

Naval Architecture Division
Office of Design and Engineering Standards
United States Coast Guard

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Briefing Overview

- Witness Professional Background
- CG Organizational Structure
- U.S. Regulations Applicable to Liftboats
- U.S. and international IMO standards
- Wind Load Calculation
- Critical Axis
- Ongoing Research
- Regulatory development process

Image Source: <https://www.rivieramm.com/news-content-hub/news-content-hub/seacor-bsp-marine-gains-full-control-of-liftboat-jv-58619>



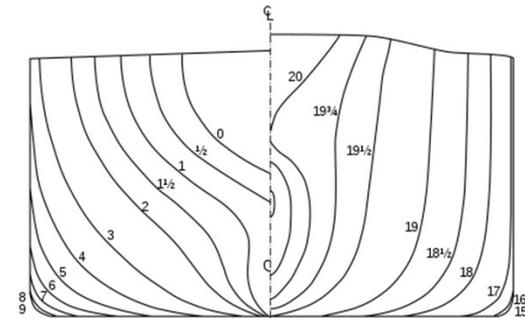
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Professional Background

Naval Architect – 39 years experience

- Education
- Experience

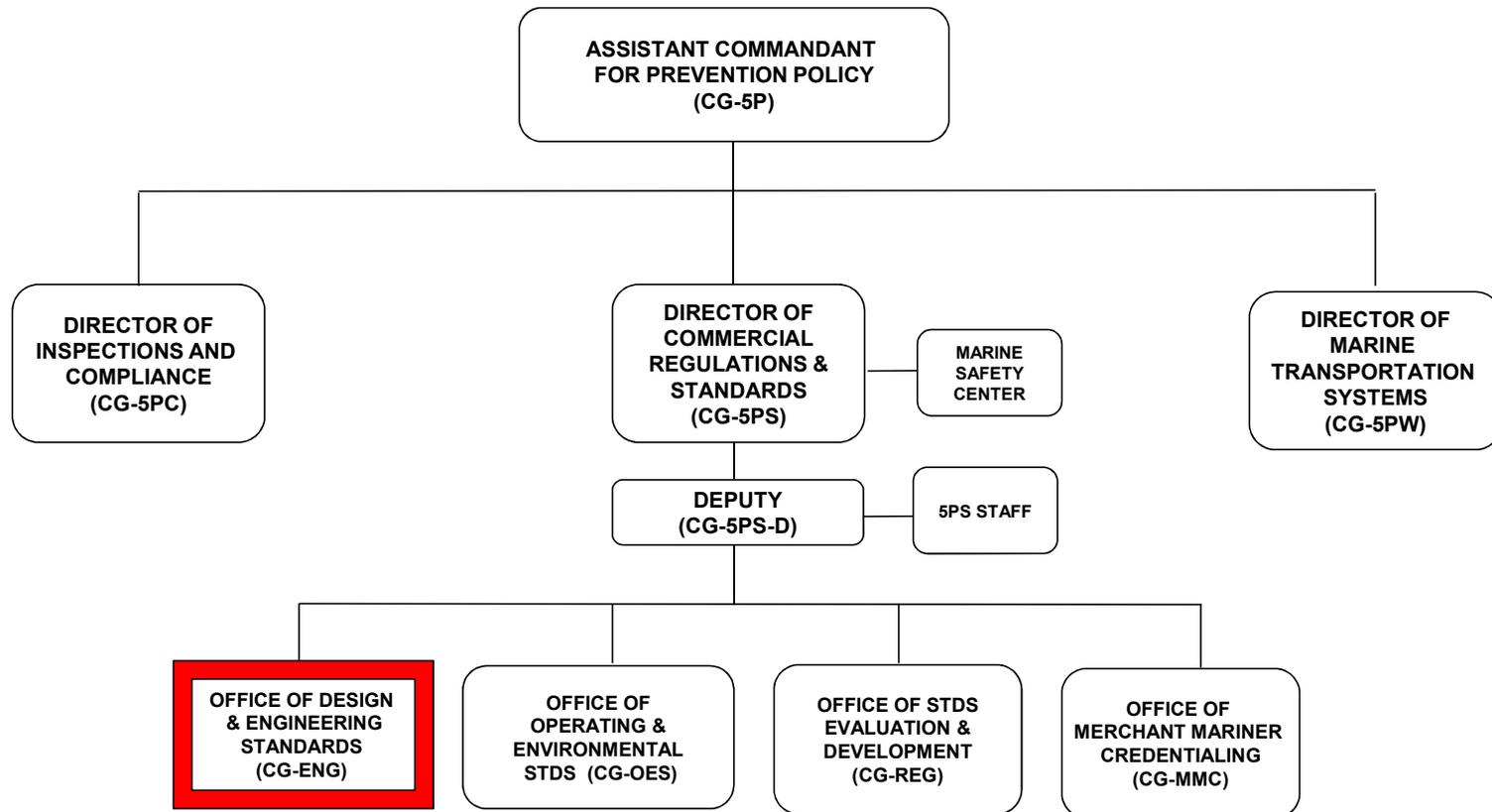


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CG-ENG Organization



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U.S. Regulations applicable to Liftboats: Inspection, Stability & Load Lines

46 CFR Subchapter L:
Offshore Supply
Vessels

46 CFR Subchapter S:
Subdivision and
Stability

46 CFR Subchapter E:
Load Lines

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U.S. Regulations applicable to Liftboats *(con't)*

46 CFR Subchapter L, Offshore Supply Vessels

- Certificate of Inspection (COI)
- Special provisions for liftboats (Part 134)
- Restricted & unrestricted service options
- Structural standards
- Operating manual

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U.S. Regulations applicable to Liftboats *(con't)*

46 CFR Subchapter S, Subdivision & Stability

- Special provisions for liftboats (Part 174, Subpart H)
- Restricted & unrestricted service options
- Afloat stability-Restricted service
 - Intact
 - Damage
- Elevated stability

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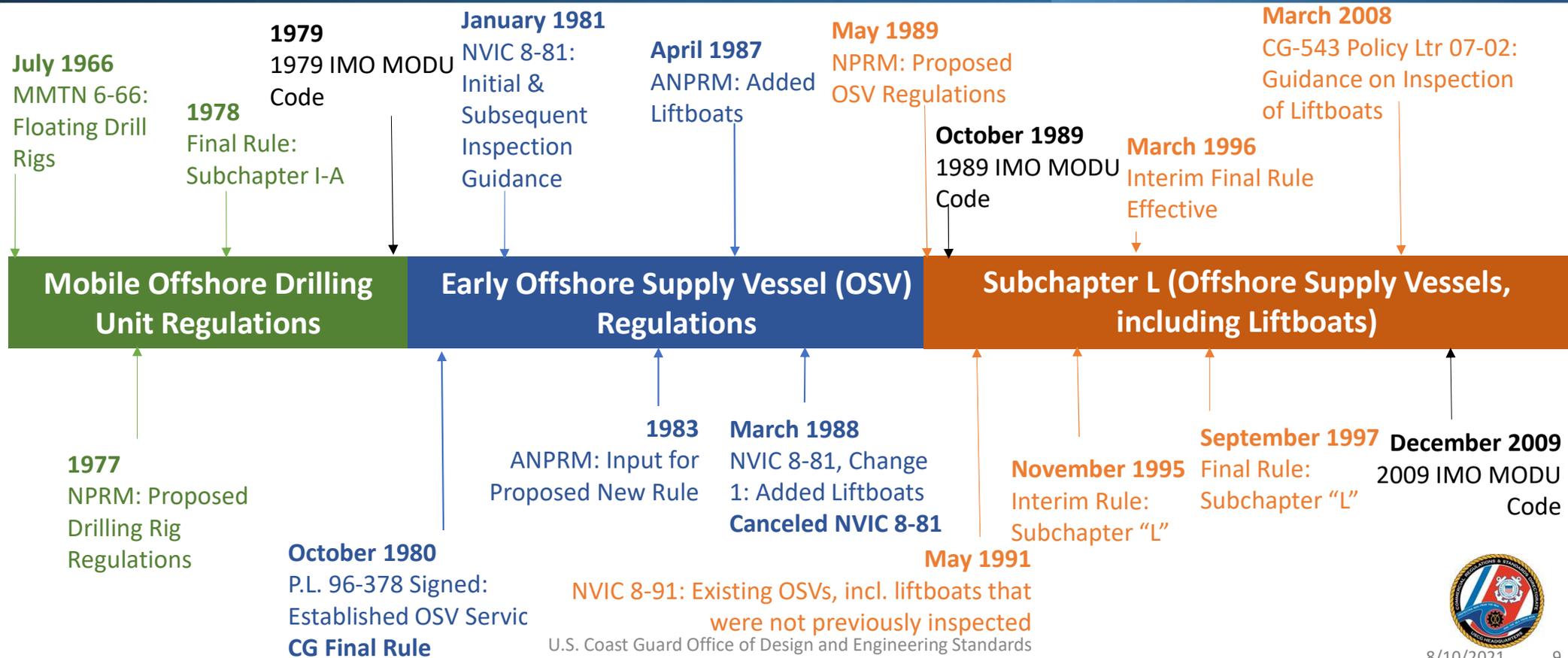
U.S. Regulations applicable to Liftboats *(con't)*

46 CFR Subchapter E, Load Lines (LL)

- LL purpose: To ensure seaworthiness of the intact (undamaged) vessel
- LL required if 79 ft or longer, and operating outside the Boundary Line
- Unrestricted LL—
 - Normal freeboard calculation + bow height
- Restricted LL—
 - Bow height waived for 12-hour location restriction
- Restriction noted on LL certificate



History of MODU, OSV, and Liftboat Regulations



Brief History of the International Maritime Organization (IMO)

1948: Inter-Governmental Maritime Consultative Organization (IMCO) established

1958: The IMO Convention entered into force

Purpose

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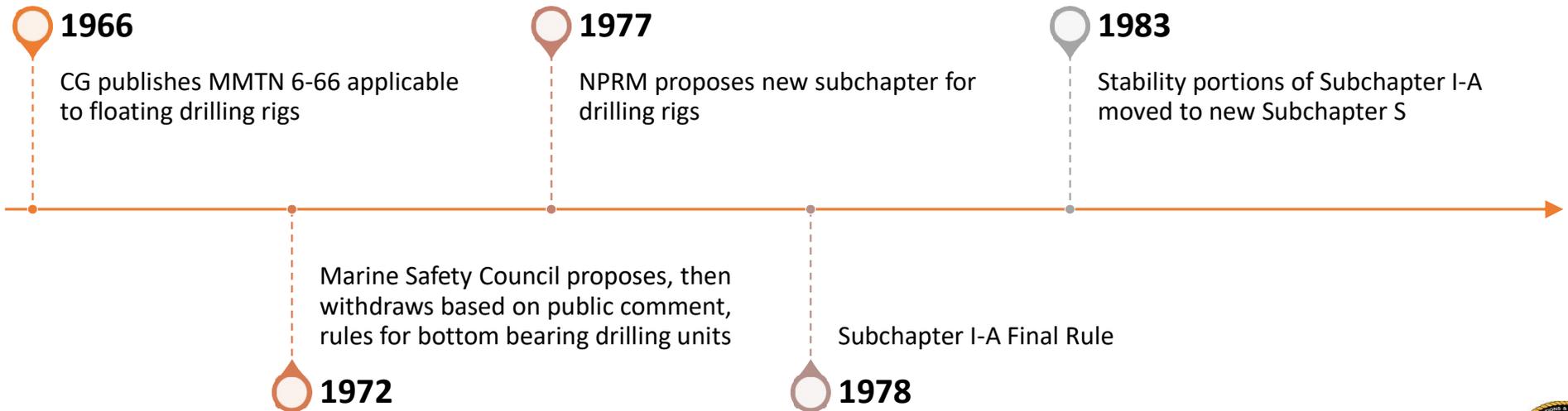
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History of the IMO MODU Code

- 1969-1974: IMCO is developing safety requirements for drilling rigs and production platforms, but numerous other issues take higher priority
- Eventually, IMCO decides to issue a non-mandatory code (the 1979 MODU Code) to facilitate international movement and consistency
- Later amendments result in the 1989 MODU Code and 2009 MODU Code
- Criteria for stability, subdivision and the operating manual remain essentially unchanged since the '79 MODU Code



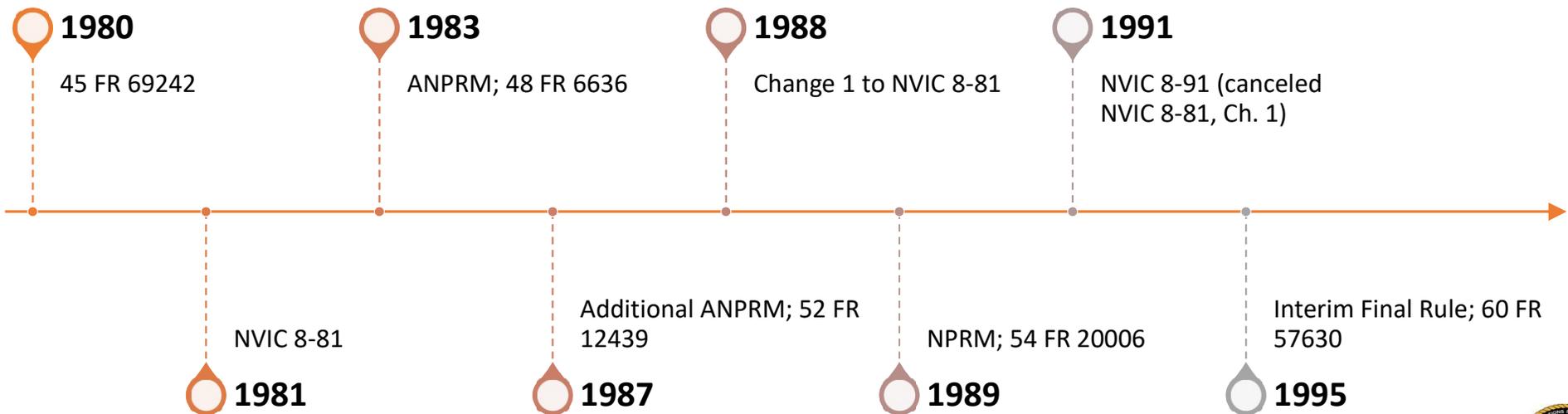
History of U.S. MODU Regulations



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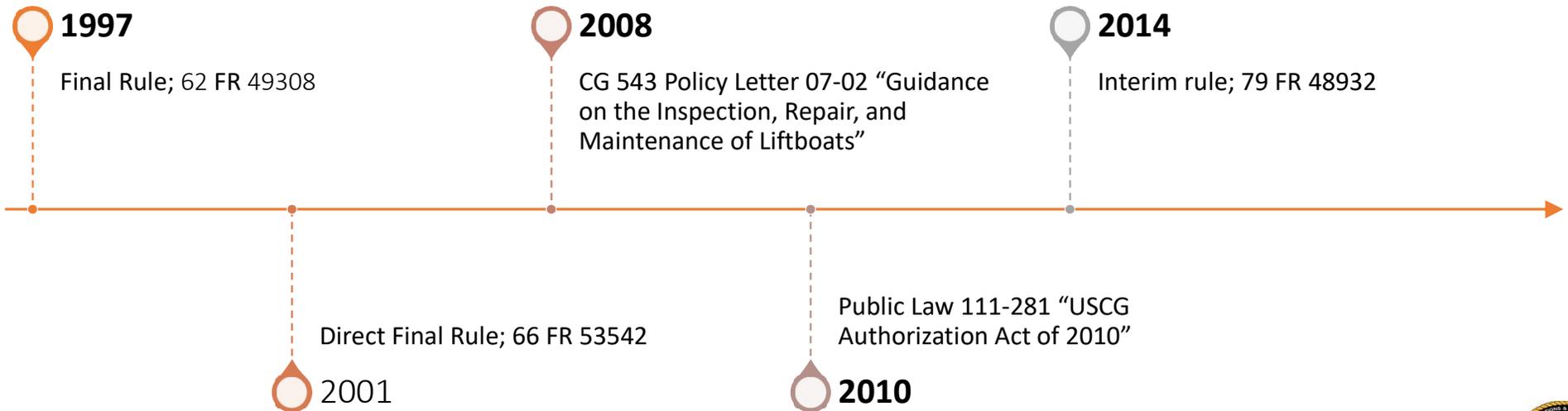
History of U.S. Liftboat Regulations



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History of U.S. Liftboat Regulations, (con't)



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IMO Stability Instruments

- SOLAS II-1 [and II-2]
 - Part B-1: Stability
 - Part B-2: Subdivision, watertight and weathertight integrity
 - Part B-4: Stability management
- MODU Codes (1979, 1989, 2009)
 - Non-mandatory
 - Stability requirements (Chapter 3) substantially the same for all 3 Codes
- 2008 IS Code
 - Mandatory requirements – righting lever properties and severe wind and roll → Part A (from 1 July 2010; invoked by SOLAS reg. II-1/5 & LLPROT reg. 1(3))
 - Recommended design criteria – MODUs → Part B/§2.6

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CFR vs. IMO MODU Code Stability Standards

Intact Criteria	MODU Code	Unrestricted Liftboat	Restricted Liftboat
Metacentric height	No requirement	2 inches	1 foot at each leg position
Righting Arm	Positive for all angles from upright to second intercept		Positive 10° from 1 st intercept
Righting Energy	Area under righting moment curve 40% greater than area under heeling moment curve		Same, AND 5 ft-deg energy between intercepts
Heeling wind speed	70 knots normal operating; 100 knots severe storm		60 knots normal operating; 70 knots severe storm
Limited operation wind speed	50 knots normal operating	No limited option	
Severe Storm	Change from normal to severe storm op mode within time consistent w/conditions	Change from normal to severe storm condition within maximum time specified in operating manual	Must remain w/in 12 hours of harbor of safe refuge or area where liftboat may be jacked up and meet 100 knot on-bottom stability requirement
Heel calculation axis	Most critical	Not specified	Not specified

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CFR vs. IMO MODU Code Stability Standards *(con't)*

Damaged Criteria	MODU Code	Unrestricted Liftboat	Restricted liftboat
Flooding Standard	Any 1 compartment within 1.5m horizontal extent at any vertical location; no less than 3m between bulkheads	All compartments within 5 feet (1.5m) of adjacent watertight bulkheads, bottom shell, and uppermost continuous deck	Each compartment with 30 inches (760mm) of the hull, excluding the bottom, between two adjacent watertight bulkheads and uppermost continuous deck
Wind heel after damage	50 knot wind from <i>any direction</i> after damage with no downflooding opening below the final waterline	50 knot wind after damage with no downflooding opening below the final waterline	
Range of Stability after Damage	Greater than 7° + 1.5 x static angle after damage or 10°, whichever is higher	No requirement	
Downflooding points	Openings submerged when inclined not fitted with closing appliances	Openings not able to be rapidly made watertight	First opening that cannot be closed watertight and through which downflooding may occur



NVIC 3-97: Delegation of Coast Guard Stability Review Authorities to ABS

- Authorizes ABS to conduct stability reviews on behalf of the Coast Guard for any U.S. flagged vessel with the exception of certain novel craft
- ABS issues the stability letter
- Coast Guard conducts oversight of ABS stability reviews

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Wind Load Calculation

- Method for calculation of wind forces and moments:
- Basis: Bernoulli's equation (ideal fluid), Pressure $P = \frac{1}{2} * \rho * V^2$
- Actual wind force calculation assumes sustained (steady) wind
- Shape factors, C_s
- Process: Assess force on a specific area with similar shape and height – the “Block method”
- MMTN 6-66 (13 July 1966) equation: $P = 0.004 V^2 C_h C_s$
(0.004 factor includes a gustiness factor)

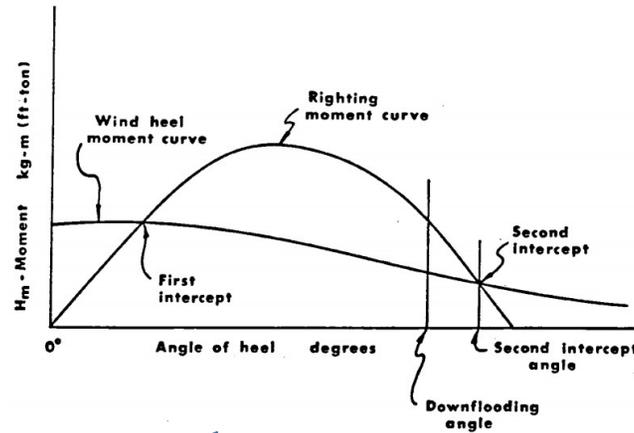
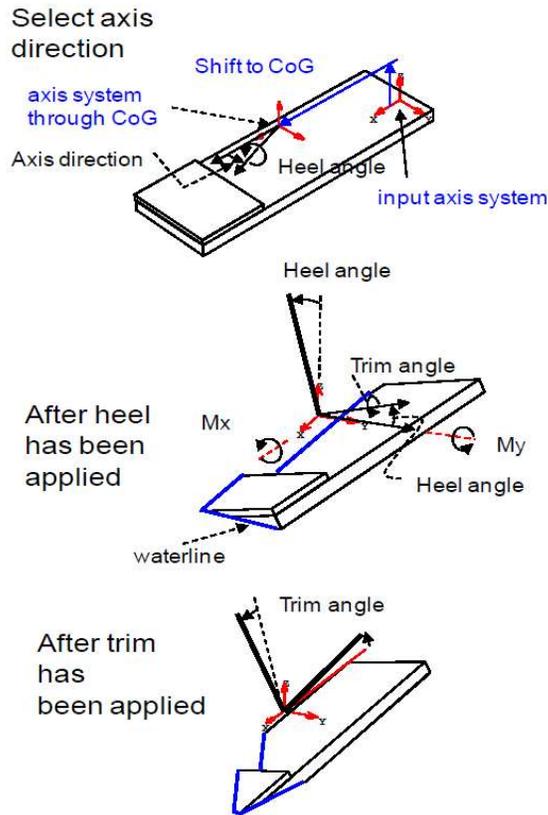


Wind Load Calculation, continued

- Wind gradients from studies by National Bureau of Standards, ASCE, ABS 1968 MODU rules, and other 1960s professional sources
- Alternative intact stability criteria:
- Wind tunnel tests for wind loads acceptable under MODU Code 3.2.8
- Not allowed in CFR;
only available as “Equivalent” per §125.170 & §108.105

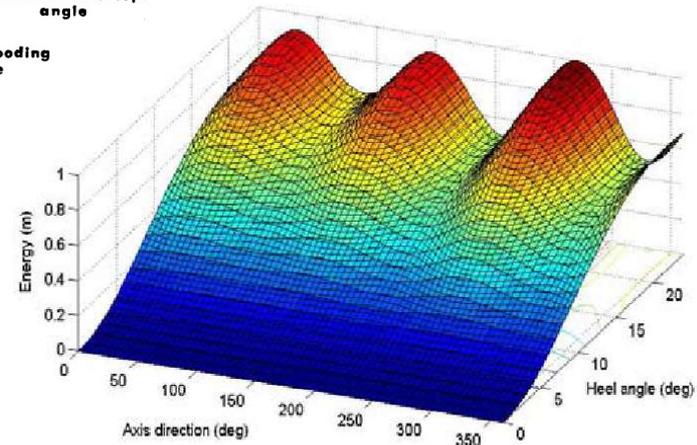


Critical Axis



Images from van Santen, J. (2009). The use of energy build up to identify the most critical heeling axis direction for stability calculations for floating offshore structures. *10th International Conference on Stability of Ships and Ocean Vehicles*, 65-76, and 46 CFR 174.045

Or



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Current Liftboat Stability Research

- Stability characteristics of non-traditional hull shaped vessels is an area of interest to CG-ENG.
- CG Research and Development Center FY22 study

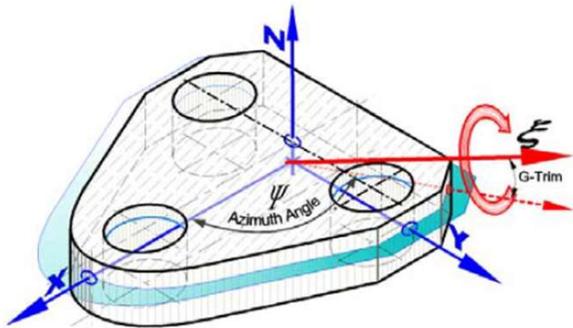


Image from Breuer, et al. (2009) *Steepest Descent Method, Resolving an Old Problem*

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Regulatory Development Process

Need for a Regulation established:

- Statutory requirement;
- Program need (Reg Project Proposal (RPP)); or
- Petitions from stakeholder population



Administrative Procedure Act (5 USC §551 et seq. (1946)):

- Regulatory Project Team
- Advance Notice of Proposed Rule Making
- Notice of Proposed Rule Making
- Public comment periods (established parameters)
- Analysis/review
- Agency and Department clearance
- Final rule



Thank you

Questions

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