Towing Restrictions on Oceanographic Research Vessels

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Jensen Maritime Consultants, Inc.
A Crowley Company
JMC History

• 1961 JMC founded (formerly B.F. Jensen & Associates)
• 1981 – Norwegian Owners
• 1993 – JMC start buy-back
• 1998/1999 – 100% American Owned
• 2008 – Jensen becomes a Crowley Company

In the early days fishing vessels were the Firm’s “bread & butter”

Today, our projects include more complex design and engineering support for tugs, barges, research/passenger/cruise vessels, off-shore dredges, diving support vessels, dry cargo vessels, patrol and fire boats, and more.
Presentation Outline:

• Introduction
• Towing Stability Criteria applicable to ORV’s
  • Derivation of 46 CFR 173.095(b) and it’s suitability to this application.
  • JMC suggestion for an alternative towline pull criteria for ORV’s.
Introduction

- Although weight handling gear and lifting equipment play a significant role in the mission of ORV’s NO explicit guidance exists from the Coast Guard or regulatory bodies on the evaluation of towing for ORV’s.
- Analysis of an ORV’s suitability for towing must by logical interpretation of the regulations employ rules designed for the evaluation of tugboats.
Applicable Towing Stability Criteria for both Inspected and Uninspected ORV’s

INSPECTED ORV’s:
- These are Motor Vessels >= 300GT, and Non-self-propelled vessels >= 100GT.
- Regulated under CFR Title 46 Chapter I, Subchapter U – Oceanographic Research Vessels:
  - By Reference 46 CFR 189.55-5(c) invokes 46 CFR Subchapter S:
    - “Subdivision and Stability. Plans required by part 170 of this chapter.”
- 46 CFR Subchapter S, Subpart E – Towing
  - 173.090 General
    - This subpart applies to each vessel that is equipped for towing.
Applicable Towing Stability Criteria for both Inspected and Uninspected ORV’s (Con’t)

UNINSPECTED ORV:

- Regulated under Title 46 CFR Subchapter C – Uninspected Vessel
  - No towing restrictions
- If however the vessel is Load Lined, and the assigning authority is the ABS our experience has been that 46 CFR Subchapter S, Subpart E – Towing is invoked.
Subpart E – Towing

173.095(b):

\[ GM_{REQ} \geq \frac{(N)(P \times D)^{2/3}}{K\Delta(f/B)}(s)(h) \]  

1

- \( N \) = Number of Props
- \( P \) = Shaft Power per Shaft [HP]
- \( D \) = Propeller Diameter [ft]
- \( s \) = The fraction of the propeller intercepted by the rudder.
- \( h \) = Vertical distance from propeller shaft centerline at ruder to towing bitts. [ft]
- \( \Delta \) = Displacement [LT]
- \( f \) = Minimum Freeboard along the length of the vessel [ft]
- \( B \) = Molded beam. [ft]
- \( K \) = 38 [English units]
Derivation of 46 CFR173.095(b)

\[ KG = \frac{\sum (w_i \times kg_i)}{\Delta} \]

Therefore,

\[ \Delta \times GG' = w_i \times d_i = \text{applied moment} \quad (\text{HM}) \]

\[ GG' = \frac{w_i d_i}{\Delta} = \frac{HM}{\Delta} \]

\[ \tan(\phi) = \frac{GG'}{GM} = \frac{HM}{\Delta GM} \]

Re arranging,

\[ GM = \frac{HM}{\Delta \tan(\phi)} \quad (2) \]
Derivation of 46 CFR173.095(b) Con’t

\[ HM = N \times \frac{(P \times D)^{2/3}}{K} \times (s) \times (h) \]

\[ \tan (\phi) = \frac{f}{\frac{1}{2} B} \]

\[ \tan (\phi) = 2 \left( \frac{f}{B} \right) \]

Therefore,

\[ GM = \frac{HM}{\Delta \tan (\phi)} = \frac{(N)(P \times D)^{2/3}(s)(h)}{2 \times K \left( \frac{f}{B} \right)} \]  

(3)
Suggested alternative towline pull criteria for ORV’s

\[ GM_{REQ'd} = \frac{(BS)(h)}{2\Delta\left(\frac{f}{B}\right)} \]  

(4)

BS = Breaking Strength of the towline [LT]
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