

# **MARINE DRAFT SURVEYING**



**McDONALD MARINE SURVEYS INC.  
DRAFT & CARGO SURVEYING**

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Marine Surveyor

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**Presentation to:**

**Society of Accredited Marine Surveyors**

**Annual Conference and Educational Symposia**

Delta Chelsea Hotel, Toronto, Ontario, Canada

October 29, 2004, 11:15 a.m.–12:15 p.m.

# My Background

- Over 20 years experience loading ships and doing draft surveys.
- Master Mariner Certification.
- Lifted over 10 million tons.
- Surveyed over 1 million tons of cargo on behalf of clients.
- Member of the Society of Accredited Marine Surveyors.
- Member of the Company of Master Mariners of Canada.

# Your background ?

- Your Expectations
- Questions you would like answered?

# Today's Presentation Summary

- Marine Draft Survey definition and theory
- Draft survey process
- Equipment used
- Sample of a draft survey report
- Human aspects
- Adding value for your client: How to ensure your clients always gets more then they pay for
- Questions and discussion

# Marine Draft Survey definition and theory

- MARINE DRAFT SURVEYING is the science of determining the weight of cargo, by comparing the displacement of water by a ship with and without that cargo.
- Before and after survey
- Based on Archimedes' Principle.
- Volume and density must be known.

# Draft survey process

- Observe all draft marks and density of water.
- Apply corrections as needed for perpendicular offset, list, deformation.
- Arrive at mean draft to enter hydrostatic tables.
- Extract displacement tonnage from hydrostatics.
- Apply corrections for trim and density.
- Subtract all deductibles.
- Repeat above in light and loaded condition.
- Arrive at NET displacement for light and loaded.
- The difference in net displacement equals cargo loaded or discharged.

# Equipment used

- Hydrometer
- Steel sounding tape
- Water finding paste
- Boat available to read inaccessible draft marks
- High power flashlight
- Binoculars for reading draft marks
- Laptop computer or calculator
- Draft survey software

# Sample Draft Survey Report

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### SAMPLE DRAFT SURVEY REPORT

VESSEL: MV CANADIANA  
PORT: TORONTO, CANADA

DATE: September 21, 2012  
FILE #: C 1221

	<u>LIGHT</u> meters	<u>LOADED</u> meters						
1(a) Draft For'd Corrected to Fwd. Perpendicular	4.1480	8.0828						
(b) Draft Aft Corrected to Aft Perpendicular	6.3560	7.9954						
(c) Draft Fore & Aft Mean $a+b / 2$	5.2520	8.0391						
2 (a) Draft Amidships Port	5.0600	8.0850						
(b) Draft Amidships Starboard	5.2050	7.9900						
(c) Draft Amidships Mean	5.1325	8.0375						
3 Mean of Means $(1c + 2c) / 2$	5.1923	8.0383						
4 $1/4$ Mean Corrected for Deformation $(2c+3) / 2$	5.1624	8.0379						
5 Displacement in SALT WATER (metric tonnes)	19,686.600	31,430.180						
6 Correction for Trim	<table><thead><tr><th>Light</th><th>Loaded</th></tr></thead><tbody><tr><td>2.1m stern</td><td>.09 m head</td></tr><tr><td>-222.761</td><td>4.269</td></tr></tbody></table>	Light	Loaded	2.1m stern	.09 m head	-222.761	4.269	4.269
Light	Loaded							
2.1m stern	.09 m head							
-222.761	4.269							
7 Displacement Corrected for Trim	19,463.839	31,434.449						
8 Density Correction	1.000	1.000						
9 Displ. Corrected for Density	18,989.112	30,667.756						
10 Total Consumables, Stores etc.,	-11199.19	-483.850						
(a) Fuel Oil	<table><thead><tr><th>Light</th><th>Loaded</th></tr></thead><tbody><tr><td>253.14</td><td>285.55 MT</td></tr></tbody></table>	Light	Loaded	253.14	285.55 MT	285.55 MT		
Light	Loaded							
253.14	285.55 MT							
(b) Fresh Water	147.50	72.80 MT						
(c) Ballast	10736.30	62.80 MT						
(d) Diesel Oil	9.45	9.90 MT						
(e) Lube Oil	32.20	32.20 MT						
(f) Other: Sludge and E.R. Bilge	20.60	20.60 MT						
Total (metric tonnes)	11199.19	483.85 MT						
<u>Net Displacement (metric tonnes)</u>	7,789.922	30,183.906						

Cargo Discharged GOLD BARS IN BULK Metric Tonnes 22,393.985

Long Tons 22,040.294

Short (net) Tons 24,685.136

#### REMARKS:

Good survey conditions. Cargo discharged from Holds 1, 2, 3 4. Vessel took fresh water at dock.

WITHOUT PREJUDICE

signed  
Captain and/or First Officer  
MV CANADIANA

signed  
D. McDonald  
for McDONALD MARINE SURVEYS INC.



# Human aspects

- Enjoy working with numbers
- Physically fit, lots of climbing. May have to go into small boat to read Draft marks.
- Flexible with your sleep, ships run 24/7
- Good eyesight, lots of small print to read
- Ability to deal effectively with ship's crew

# Adding value for your client:

Ensuring your clients always gets more than what they pay for:

- Be meticulous in observations and calculations
- Ensure the vessel is prepared for survey
- Get all required data and allow vessel to start loading/discharging ASAP
- At departure, have all your data prepared so final survey is done without delay
- Issue report immediately upon completion, with laptop computer and portable printer.
- Be available for other survey work while at the vessel, if needed on short notice.

The following diagram demonstrates some of the corrections that are applied to observed draught marks before calculating a mean draught, during the marine draft survey process

**CORRECTION TO PERPENDICULARS**

AP = After perpendicular  
 FP = For'd perpendicular  
 LBP = Length between perpendiculars

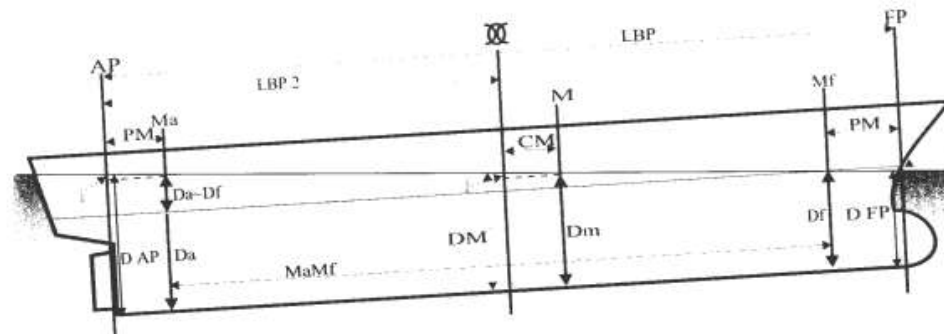
Ma = Draught marks aft  
 Mf = Draught marks for'd  
 M = Draught marks midships

D AP = Draught at after perpendicular  
 D FP = Draught at for'd perpendicular  
 D M = Draught at midships

Da = Observed draught aft  
 Corrected for list or heel  
 Df = Observed draught for'd  
 Corrected for list or heel  
 Dm = Observed draught midships  
 Corrected for list or heel

PM = Displacement of marks from perpendiculars for'd and aft  
 CM = Displacement of midships marks from midships  
 MaMf = Distance between draught marks  
 Da-Df = Difference between observed draughts for'd and aft,  
 i.e. Apparent trim

i = Correction to observed draughts for'd and aft for draught at perpendiculars  
 j = Correction to midships draught for draught midships



# TERMS USED IN DRAFT SURVEYING

- **DISPLACEMENT:** the mass of water displaced by the ship. It represents the total weight of the ship and is calculated by: volume of displacement x density of the water.
- **LIGHT DISPLACEMENT:** the displacement of the ship when all her equipment plus engine room spares and with water in the boilers to working level. Also referred to as Lightship or Lightweight.
- **DRAFT:** the distance from the bottom of the keel to the waterline. Sometimes spelt DRAUGHT.
- **Aft Draft:** the distance from the bottom of the keel to the water line on the aft perpendicular when the ship is upright.
- **Midship Draft:** the distance from the bottom of the keel to the waterline at a position midway between the perpendiculars.

# Terms (cont'd)

- **DEADWEIGHT:** the difference between the light and loaded displacement. It is the carrying capacity of the ship and includes the weight of cargo, ballast, fuel, water, stores, crew and effects.
- **AFT PERPENDICULAR (AP):** a perpendicular drawn to the waterline at the point where the aft side of the stern post meets the summer load line. Where no stern post is fitted, it is taken as the center line of the rudder stock.
- **FORWARD PERPENDICULAR:** a perpendicular drawn to the waterline at the point where the foreside of the stem meets the summer load line.
- **LENGTH BETWEEN PERPENDICULARS (LBP):** distance from forward perpendicular to the aft perpendicular.

# Terms (cont'd)

- **TRIM:** the difference between the forward and aft draft.
- **APPARENT TRIM:** the difference between the drafts observed at the forward and aft draught marks.
- **TRUE TRIM:** The difference between the draft measured at the forward and aft perpendiculars
- **RELATIVE DENSITY(RD):** The ratio of the weight of a substance to the weight of an equal volume of fresh water at a given temperature  
RD of Fresh Water 1.000 at 4 degrees C.  
RD of Salt Water 1.025 at 4 degrees C.
- **CENTRE OF FLOATATION:** The centroid of the the waterplane area. It is the point about which the ship trims, heels and lists.

# Sources of information on Draft Surveying

- Draught Surveying, A manual for Marine Surveyors and Ship's Officers, by W.J. Dibble and P. Mitchell
- Merchant Ship Stability, By H.J. Pursey
- Stability and Trim for The Ship's Officer,  
by William L. George

## Websites of interest:

- <http://unece-draughtsurvey.ath.cx/abstract.php>

Website of the United Nations, describing standards for draft surveying.

- <http://www.marinesurvey.org>

Website of the Society of Accredited Marine Surveyors.

PHOTOGRAPHS

Scroll down





MIDSHIP DRAFT MARKS BY DAY f  
meters



Midship draft marks by  
night

READING  
OUTBOARD  
DRAFT MARKS  
BY DAY



A photograph showing the lower portion of a large blue ship's hull. The ship is positioned in choppy, blue water. In the foreground, there is a yellow concrete barrier. The text "Fwd draft marks choppy water" is overlaid in white at the bottom of the image. The ship's hull has some markings, including a red "MARIN" logo at the top and a vertical scale of draft marks on the side. The background shows a distant shoreline with trees and buildings under a blue sky with light clouds.

Fwd draft marks choppy water

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