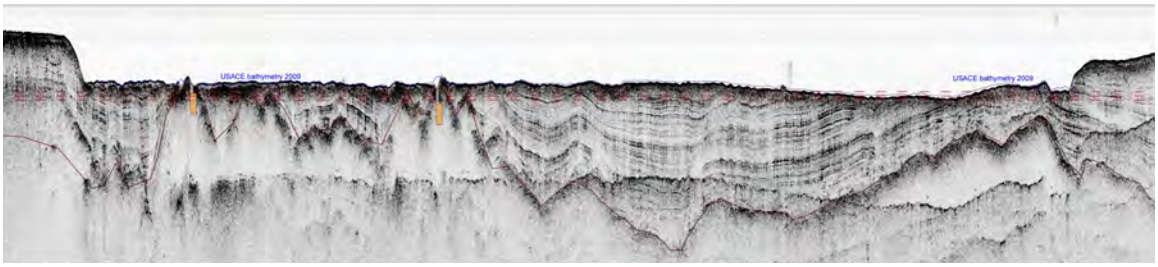
Department Of The Army
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

Contract #W912DS-12-D-0002, DB01
Marine Geophysical and Geological Investigation, Boston Harbor, Boston Massachusetts



Appendix I

June 15, 2015

e4sciences | Earthworks, LLC
27 Glen Road, North Entrance
Sandy Hook, Connecticut 06482
P.O. Box 178, Newtown, CT 06470
(203) 270-8100, Fax (203) 364-0480
www.e4sciences.com

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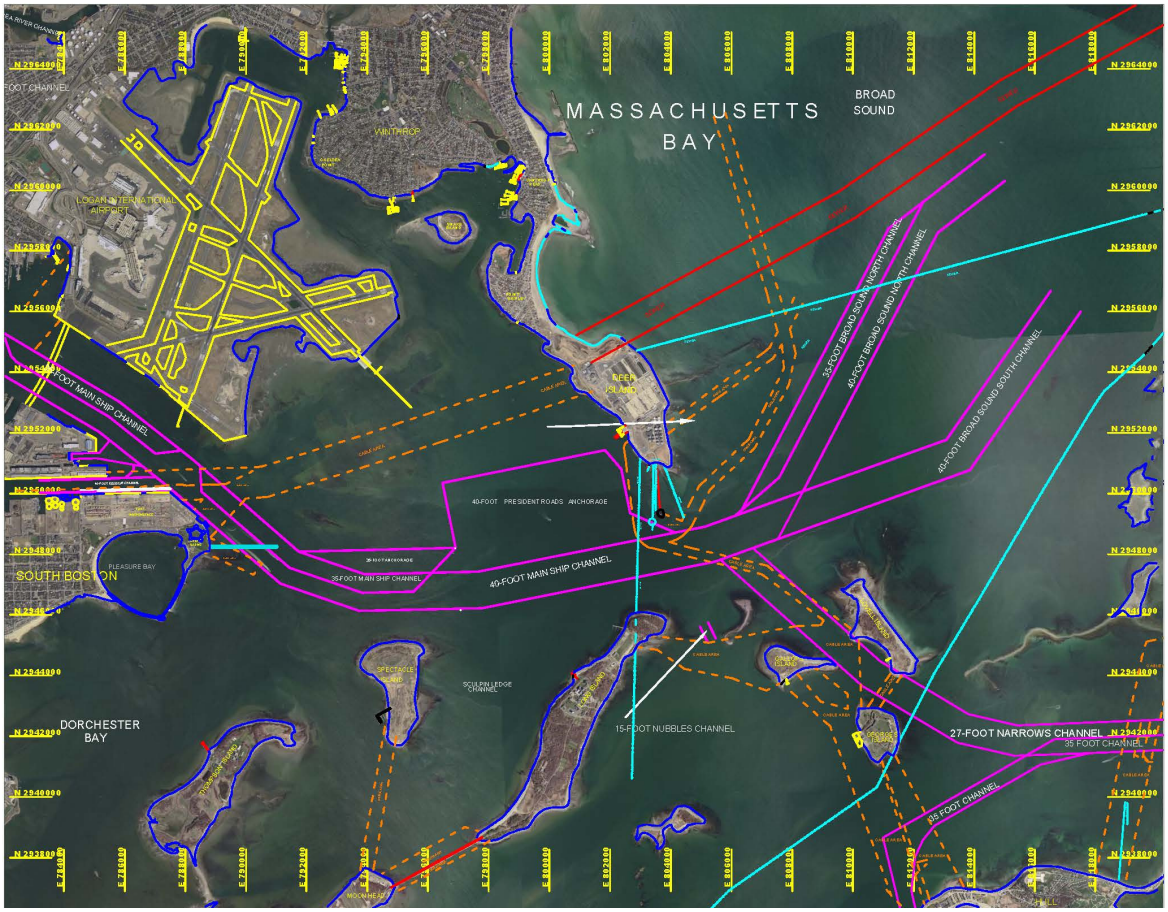
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742-2751

Contract W912DS-12-D-0002 Task Order DB-01
Work Plan: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston, MA



October 20, 2014

e4sciences | Earthworks, LLC
27 Glen Road, North Entrance
Sandy Hook, Connecticut 06482
P.O. Box 178, Newtown, CT 06470
(203) 270-8100, Fax (203)364-0480
www.e4sciences.com

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1. Introduction

The US Army Corps of Engineers New England District (NAE) is conducting a marine reflection seismic survey and subsurface drilling investigation in specific areas of the Federal navigation channels. These channels will be deepened to new authorized depths as the result of a Chief of Engineers report on improvement to Boston Harbor.

The objectives of the marine seismic reflection survey are to: 1) identify areas having materials that are not easily dredged (e.g. bedrock, cobbles, dense glacial till, hard pan), 2) delineate the volumes of rock/ledge materials that will require blasting versus those that can be removed by mechanical methods (e.g. glacial till, weathered and fractured rock), and 3) recommend areas for subsurface drilling investigations.

The objectives of the marine subsurface drilling investigation are to characterize sediment and collect bedrock cores to evaluate the density, strength, and other properties of bedrock and sediment and characterize those materials that will require blasting versus those that can be removed by mechanical methods. This is a high priority project for the District, and rock core borings are required as soon as feasible in order to facilitate coordination with regulatory agencies regarding blasting and to determine the appropriate removal methods in support of preparation of plans and specifications for a contract solicitation for dredging and rock removal as soon as possible.

e4sciences hereafter e4, is the prime contractor for the task order. e4 will manage the project, conduct the safety survey, the seismic survey, and coordinate the drilling, sampling and testing. e4 will also log the borings and describe the core.

Aquifer Drilling and Testing, hereafter ADT; Northstar Marine and Terrasense, LLC are e4's sub-contractors for the task order. Table 1 lists the subcontractors' addresses and roles in this task order. ADT will provide the drilling services and will be responsible for the drilling equipment. Northstar Marine will provide the marine vessels, boat captains and marine work platform for the drilling. Terrasense, LLC will conduct the geotechnical rock tests.

The Notice to Proceed received from NAE for the inspections is dated September 4, 2014.

Table 1. e4 subcontractors for tasks 5, 6 and 7.

Subcontractors	Role in task order DB-01
Aquifer Drilling and Testing 75 East 2nd Street Mineola, New York 11501	On site drilling services including all drilling equipment.
Northstar Marine 36 Clermont Drive Clermont, NJ 08210	On site vessels, vessel support including boat captains and drilling platform (liftboat LB Vision)
Terrasense, LLC 445 H Commerce Way, Totowa, NJ 07512	Off site geotechnical rock tests

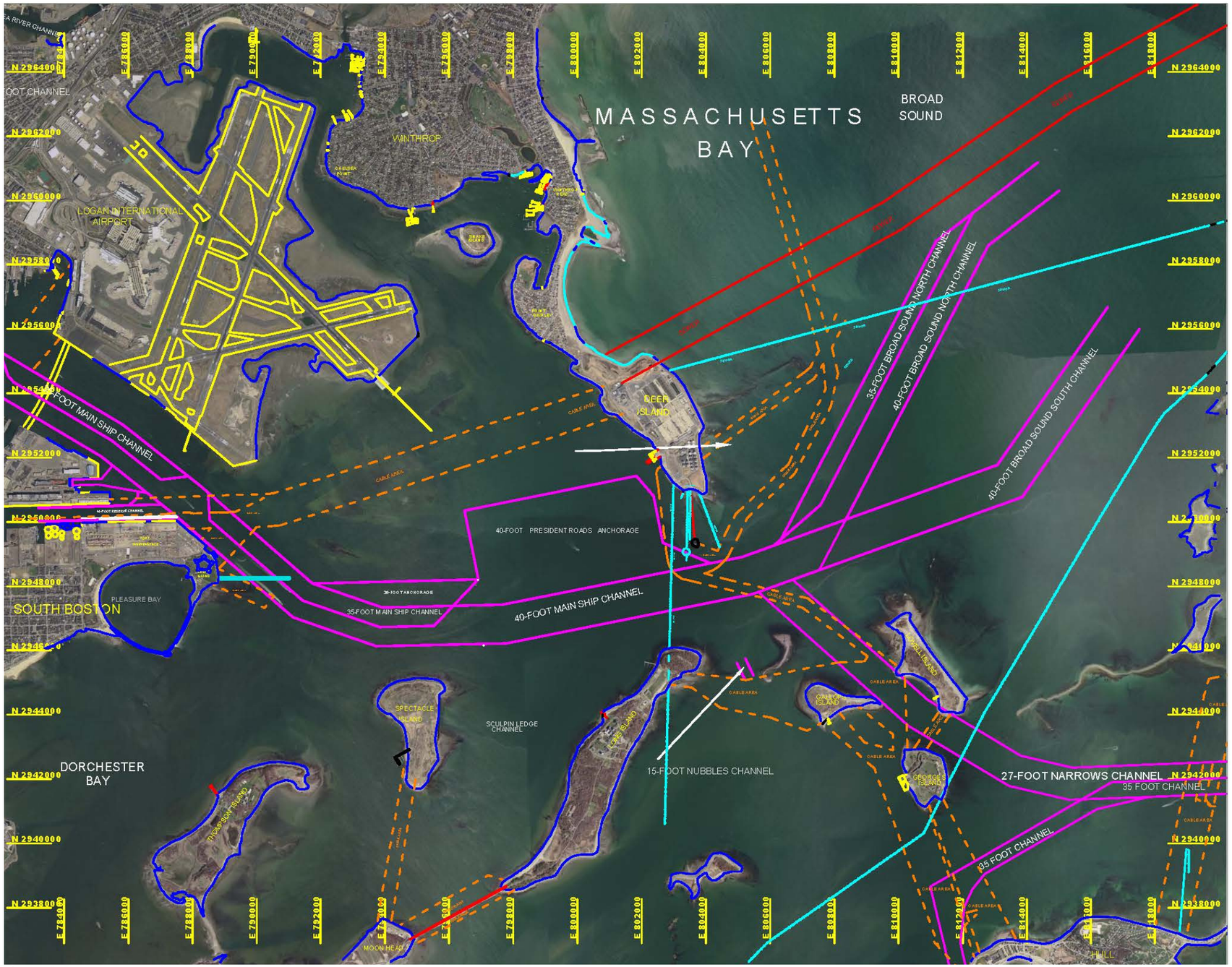


Figure 1. Location map of the Boston Harbor federal navigation channels..

2. Key Personnel

The Point of Contact, hereafter POC, for the USACE New England District, hereafter NAE, is Dr. Stephen S. Potts . The administrative POC for e4 is William Murphy. The POC for e4 during seismic survey operations is Matthew Art. The POC for e4 during drilling operations is W. Bruce Ward, chief geologist and inspector of the project. Contact information for key personnel is shown on Table 2. A list of team members is available in Table 3.

Table 2: Contact list.

	Name	Phone	email
NAE POC:	Dr. Stephen S. Potts	978-318-8452 (o)	Stephen.S.Potts@usace.army.mil
		734-904-0646(m)	
Alternate:	Mr. Peter Hugh	978-318-8452 (o)	Peter.Hugh@usace.army.mil
		978-844-7388 (m)	
Administrative POC	William (Bill) Murphy	203-270-8100 (o)	WFM3@e4sciences.com
		203-820-7320 (m)	
e4 survey POC	Matthew Art	203-270-8100 (o)	Matt.Art@e4sciences.com
		203-312-4943 (m)	
e4 drilling POC	W. Bruce Ward	203-270-8100 (o)	Bruce.Ward@e4sciences.com
		203-788-8103 (m)	
Alternate:	James Trotta	203-270-8100 (o)	James.Trotta@e4sciences.com
		914-774-5968 (m)	
U.S. Coast Guard POC	Craig Lapiejko	617-223-8351 (o)	
USCG Command Center	Duty officer	617-223-5757 (o)	
Boston Harbor Master	Sgt. Joe Cheevers	617-343-4721 (o)	
Alternate:	Harbor Master office	617-343-4721 (o)	

Table 3. List of project team members who will be on site during this project and their role for the project.

Team Disciplines	Name and Firm
Geophysical surveyor team leader, Health and Safety Officer, Geologist	Matthew Art, e4
Drilling team leader, geologist inspector, alternate Site Safety Officer	W. Bruce Ward, e4
Geologist inspector, and Site Safety Officer	James Trotta, e4
Geologist and navigation	Ian Nesbitt, e4
Geophysical survey team	William (Will) Murphy, e4
	Matthew Art, e4
	Ian Nesbitt, e4
	David Herron, e4
Time and Tide captain	James Cullinane, e4
Driller	Gustavo Suri (Lead Driller), ADT
Drilling support	To Be Determined, ADT
Liftboat captains	Collin Clement, Northstar Marine
	Herman Bechtler, Northstar Marine
	Christopher Cassel, Northstar Marine
Liftboat support	To Be Determined, Northstar Marine

Note: Additions or modifications to non-key personnel (e.g. deck hands) will be submitted to the NAE POC before drilling commences. Thereafter, changes will be delivered to NAE as they occur. An up-to-date list will be maintained on site. Personnel will have proof of required qualifications (e.g. captain license) on site.

The credentials of key personnel are reviewed below.

Matthew Art, e4sciences Director of Logistics
Matt has a BA in Geology from Williams College. He directed operations and logistics and construction for live nationally televised events for five years before joining e4sciences in 2006. He has participated in drilling projects and has participated in or led marine geophysical field surveys for the last seven years.

Matt has led water borne geophysical surveys from Boston Harbor to Jamaica to southern CA.
In 2010, Matt led the geophysical safety surveys for the borings in Boston Harbor and the borings in Weymouth Fore River Nantasket Roads channel.

Matt is e4sciences' Health and Safety Officer. He is Red Cross certified in first aid and CPR. He has completed the 10-hour OSHA construction safety course. Matt has a Safe Boating and Personal Watercraft License.

For this project Matt will lead the geophysical surveys.

- **Captain, e4sciences Time and Tide**
James Cullinane will be captain of the Time and Tide. He has been a boat captain for greater than 10 years. His credentials are in Appendix G.

Daniel Rosales, e4sciences Geophysicist
Daniel has a Geophysical Engineer degree from Universidad Simón Bolívar, Caracas, Venezuela. He has a MS and PhD in Geophysics from Stanford University. Daniel is an expert on wave theory and geophysical processing techniques particularly applied to high-resolution shallow seismic that is key to engineering and geotechnical projects. For the last seven years at e4 Daniel has been pioneering the application of advanced processing techniques to shallow seismic surveys for engineering applications including dredging rock. In 2010 he processed all the geophysical safety surveys. For this project Daniel will lead the seismic processing and contribute to the interpretation.

W. Bruce Ward, e4sciences Chief Geologist and Drilling Co-Inspector
Bruce has a BA in Geology from Franklin and Marshall College, and MS and PhD in Geology from the State University of New York at Stony Brook. He has been professionally describing rocks, sediment, cuttings and core for over 30 years. Over fifteen years ago he co-founded e4sciences with William Murphy.

In 2010, Bruce successfully lead the completion of thirteen borings in Boston Harbor and seven borings in Weymouth Fore River Nantasket Roads channel. Bruce's fifteen years of marine boring experience includes description and classification of bedrock core, visual soil classification methods of ASTM D 2488, and in the Unified Soil Classification System of ASTM D 2487.

Since 2000 e4 under Bruce's supervision has inspected over 800 marine sediment and rock probes, cores and borings. More than 400 of these were SPT and rotary core borings from a floating or raised platform using the general drilling procedures to be used for this project including rock coring in accordance with ASTM D 2113. Most (282) of the marine SPT and rock core borings were for the USACE-NAN. Most of these borings were for determining rock characteristics for dredging

In 2014 e4 has subcontracted ADT for at least 40 of the marine borings. Bruce Ward, James Trotta and Gus Suri have teamed up as inspectors and driller on 40 marine borings (Table 4).

Table 4. Recent e4 USACE-NAN marine boring projects with ADT and Northstar. Bruce Ward and/or James Trotta supervised and inspected the borings. Gus Suri drilled the borings on a Northstar liftboat.

e4 USACE Contract	Task Order	Year	Project title	Comment
#W912DS-12-D-0002	#0015	2014	Geophysical and Geotechnical investigation: Outfall design at Loch Arbour to Elberon, NJ under the Sandy Hook to Barnegat Beach Erosion Control Project	Borings offshore NJ on Northstar liftboat under Captain Clement, drilled by Suri, co-supervised and inspected by Trotta and Ward
#W912DS-12-D-0002	#0016	2014	Geotechnical and Geophysical investigation of Arthur Kill 4	Borings in AK4 channel on Northstar liftboat, drilled by Gus Suri. Supervised and inspected by Ward
#W912DS-12-D-0002	#0017	2014	Structural Investigation Bridge Piers and Shoreline Bulkheads for Arthur Kill 4	Borings near AK RR bridge in AK4 Channel, on Northstar liftboat under Captain Bechtler,drilled by Suri. Supervised and inspected by Trotta,

To date e4 has not had a major safety incident. This includes all drilling, boring and sampling projects that Bruce has supervised. Bruce is Red Cross certified in first aid and CPR. He will be retaking the 10-hour OSHA construction safety course before drilling starts. Course certificate will be in Appendix H. Bruce has a Safe Boating and Personal Watercraft License. Additionally, he has received training from Great Lakes Dredge and Dock Co. for working on marine platforms, and Metro North and NJ Transit safety training for working on railroad tracks. In 2014 he completed the 5-hour Houston Area Safety Council safety course and earned his confined space certification.

For this project Bruce will perform field inspection, develop field exploration logs, classify samples, perform quality control, record the daily operations of the drill crew, and perform other recording and coordination duties as required including a daily safety meeting.

James Trotta, e4sciences Senior Geologist and Drilling Co-Inspector
James has a BA in Geology from Williams College. He has been describing rocks, sediment, cuttings and core for 4 years. Since 2010 James has inspected over 100 marine sediment and rock borings. In 2010 James oversaw laboratory measurements of samples taken from Boston Harbor and Weymouth Fore River Nantasket Roads channel. James' training in marine boring experience includes description and classification of bedrock core, visual soil classification methods of ASTM D 2488, and in the Unified Soil Classification System of ASTM D 2487. James has supervised drilling on a Northstar liftboat (Table 4).

James is a former EMT-B, and he will be retaking the 10-hour OSHA construction safety course before drilling starts. Course certificate will be in Appendix H. James also has completed Houston Area Safety Council safety training for working in refineries, and Metro North safety training for working on railroad tracks.

For this project James will be the site safety officer, oversee all laboratory measurements, co-inspect the borings, develop field exploration logs, classify samples, perform quality control, record the daily operations of the drill crew, and perform other recording and coordination duties as required. He will lead daily safety meetings.

Gustavo Suri, ADT Lead Driller
Gus has over twenty-five years of experience in both land and marine borings. He has extensive experience with mud rotary drilled/driven casing, SPT sampling, undisturbed piston sampling,

rock coring (standard and wireline methods) and roller bit and wash boring methods throughout NJ and NY. He has worked with several drilling companies, including Warren George Inc. In the last year he has teamed up with e4, Bruce Ward and James Trotta for at least 40 SPT and rotary core borings from a Northstar liftboat. 20 of these were drilled for the USACE-NAN harbor-deepening project (Table 4). All of these collaborations have been completed within the planned schedule and within the budget.

He has a proven track record for excellent rock core recoveries even in conditions of broken and weathered rock. His drilling license number is 5163153767.

Captain, Northstar Marine Captain
Collin Clement, Herman Bechtler and Christopher Cassel will be captains of the Northstar Marine liftboat *LB Vision*. They will be rotated in for 2-week shifts. They all have over 10 years experience with liftboats. Their credentials are in Appendix G.

e4 has drilled with Herman Bechtler as captain in offshore Longbeach, NY and in Arthur Kill Channel (Table 4). e4 has drilled with Collin Clement as captain offshore NJ (Table 4). e4 has drilled with Christopher Cassel as captain in Arthur Kill Channel and offshore NJ (Table 4).

3. Project tasks

The e4sciences team will conduct the tasks and options presented in the NAE's Scope of Work, dated 06 August 2014. These are listed below.

Task 1 – Work Plan, Tidal Correction Plan (TCP), Accident Prevention Plan (APP), & Activity Hazard Analysis (AHA)
Task 2 – Seismic Survey Mobilization/demobilization
Task 3 – Seismic Reflection Survey
Task 4 – Report of Seismic Reflection Survey
Task 5 – Drilling Mobilization/Demobilization
Task 6 – Boston Harbor Borings

Option 3A – Sidescan Sonar Survey
Option 6A – Additional Borings
Option 6B – Additional Single Boring
Option 7 – Rock Mechanics Testing and Report
Option 8 – Boston Harbor Report of Explorations
Option 9 – Weather Delay (Multi-Executable)

Options 3A, 7, 8, and 9 were awarded at time of Notice to Proceed.

The location of the borings will depend on the results of the seismic survey. The drilling operations will commence as soon as feasible after the commencement of the seismic reflection survey. The order of borings will depend on sea conditions and vessel traffic. In the following section these tasks are discussed together.

3.1 Task 1- Work Plan, Tidal Correction Plan, Accident Prevention Plan and Activity Hazard Analysis

Task 1 covers preparation of this Work Plan, which summarizes the planned scope of services, schedules, milestones and methods to be followed for accomplishing the work. The Work Plan shall be submitted to the NAE for approval. The e4 POC shall provide weekly updates on the status of the work to NAE POC. During surveying and drilling e4 shall provide daily updates.

The tidal correction plan is in Appendix A. The Accident Prevention Plan (APP) is in Appendix B. e4sciences' Health and Safety Plan is in Appendix C. The Activity Hazard Analysis is in Appendix D. Work shall not proceed until the APP has been reviewed by the Corps Safety Manager and accepted by the Contracting Officer Representative.

3.2 Task 2- Seismic survey mobilization/demobilization

Seismic survey mobilization starts with moving e4's vessel the *Time and Tide* from Jersey City, NJ to Boston Harbor, MA. At the same time appropriate notifications will be made. This will include notification of the mariners and coordination with the Coast Guard and the Harbor Master.

During the geophysical survey, the *Time and Tide* will be moored at Constitution Marina located at 28 Constitution Rd, Boston. e4 personnel will embark and disembark the *Time and Tide* at Constitution Marina on a daily basis.

3.2.1 Notice to Mariners
e4 will coordinate with the U.S. Coast Guard to issue a "Notice to Mariners" regarding e4 operations. Notices to Mariner are in Appendix J. The U.S. Coast Guard point-of-contact for this project is Craig Lapiejko (Table 2). Before leaving the dock, e4 will update the Coast Guard Command Center duty officer on the location of the next survey site. The Coast Guard will then broadcast the location on marine channel 16. e4 will report back to Coast Guard Command Center duty officer at the end of each day.

e4 will review survey operations and safety issues with the Boston Harbor Master. The Federal Government is not required to hire police details and the following controls will be in place to assure public safety with regard to harbor navigation and recreational marine traffic. These include 1) notice to mariners, 2) daily Coast Guard contact, 3) presentation of proper shapes (signage), 4) captain will monitor channel 16 and will visually monitor traffic, and 5) crew will notify the captain immediately of any approaching vessel that may pose a traffic hazard. In an emergency, crew can sound a warning with a portable horn that will be kept in the work area. The captain will contact approaching commercial vessels via radio. When there is no radio response, as is expected for much of the recreational traffic, visual contact will be attempted and a horn will blow warning signals. When needed, the survey vessel can vacate the area quickly

e4 will coordinate the schedule around incoming/departing ship schedules including the LNG tankers and cruise ships, and any associated security requirements that may impact operations.

3.3 Task 3 – Seismic reflection survey

3.3.1 Sub-bottom seismology
e4 will acquire sub-bottom seismic cross sections throughout the channel. An Edgetech 512i will be utilized to acquire the data at a frequency range of 1-10 kHz. 1-10 kHz is the anticipated range required for optimal resolution. Frequency range may be adjusted to optimize depth penetration and resolution based on initial field testing at beginning of seismic survey. Survey lines will be parallel and perpendicular to the channel. Line spacing will be tighter where the channel is above grade.

The surveys will be geared to acquire high-quality data to at least -60ft MLLW. The sub-bottom reflection seismology are intended to provide cross sections of the sediment and rock strata. The reflection seismology also are intended to image and measure the depth of the top of cables and pipes and the thickness of the overburden.

If weather permits the geophysical surveys will start in the outer harbor and then proceed toward the inner harbor. Surveying is expected to run from 0600 to 1800 hours during the week days and on some Saturdays.

3.4 Task 3a – Sidescan sonar (optional)

This task was awarded at time of Notice to Proceed.

3.4.1 Sidescan orthosonographs
e4sciences will perform sidescan sonar surveys of the work area. The surveys will be run in lines not to exceed 100ft spacing. Surveys will be run in both directions, and at least 200% coverage will be obtained.

e4 will use an Edgetech 4125 at 540kHz and/or an Edgetech 4200 at 400kHz to produce orthosonographs™. The side-scan sonar transmits ultrasonic waves obliquely into the water and

measures the amplitude of the backscatter from the seafloor as a function of range. The reflectivity is a function of the seafloor roughness and the sediment acoustic properties. The e4-proprietary processing produces two independent orthosonographs™: one from the east and one from the west. Orthosonographs™ are seamless aerial-photograph-like images that are insonified from one direction only. These reflectivity images produce a high-definition picture of the structures on the seafloor. These images are also the best means to map debris on the seafloor.

The side-scan images produced 100% coverage with 200% redundancy and 400% overlap of the channel floor. The two independent orthosonographs™ insonified from two directions constitute the 200% redundancy. In fact, the data required to produce two images constitutes significantly greater overlap.

3.5 Task 4 – Seismic reflection report

3.5.1 Report

The mudline pick in the seismic profiles will be referenced to the USACE NAE multibeam bathymetry. The initial time-to-depth conversions will be based on ultrasonic measurements on the sediments and rocks. Note the ultrasonic measurements will be made on small core samples. The seismic (compressional–wave velocity) estimates are expected to be lower than the ultrasonic measurements to account for fractures in the underlying rock. Historical field and lab seismic velocity ranges from previous Boston Harbor investigations will also be used to guide seismic processing.

The acquired seismic profiles will be processed, interpreted, depth-migrated, and interpreted again. The migration and velocity determination is an iterative process. The best results on each of the profiles and cross lines may be reinterpreted with a range of estimated velocities. e4 selects the best velocities for each of the seismic intervals on the basis of the sharpest delineation on the strongest reflectors. The interpretation will focus on delineating (a) the sediment-rock interface, the top of rock, and (b) the determination of the elevation of obstructions. The error in the sub-bottom is expected to be ±0.5ft on the lines – including precision and corrections for the tide and datum. The uncertainty in the top of rock is expected to be ±1.0ft in the interpolated areas throughout the area of interest.

The orthosonographs will be integrated with the seismic cross sections. For example, it is common that submarine rock outcrops visible on orthosonographs confirm seismic imaging of rock strata intersection with the channel floor.

3.5.2 Proposed boring locations

Once a reach has been surveyed and the data processed a top-of-rock surface will be constructed with historic borings and the results of the geophysical surveys. Boring locations will be proposed to increase the resolution of the top of rock map. Borings may be proposed at rock peaks to characterize rock to be dredged. Borings will also be proposed where rock appears to be just at grade. Borings at such locations help define the area to be dredged in addition to further characterize rock at different depths. e4 will proposed up to 30 locations with the expectation of drilling 26. The proposed borings will be submitted to the NAE for review in groups of 4 to 12. This will permit drilling to commence before all of the geophysical surveys are complete.

3.6 Task 5 – Drilling mobilization/demobilization

Drilling mobilization starts with moving the liftboat, Northstar Marine *LB Vision,* from Jersey City, NJ to Boston Harbor, MA. At the same time appropriate notifications will be made. This

will include notification of the mariners; coordination with the Coast Guard, and the Harbor Master, and safety surveys to locate obstructions and other hazards.

LB Vision will be moored at Boston Harbor Ship Yard and Marina located at 256 Marginal St in east Boston. e4 personnel will embark and disembark the *LB Vision* at at Boston Harbor Ship Yard and Marina on a daily basis.

3.6.1 Notice to Mariners
e4 will coordinate with the U.S. Coast Guard to issue a "Notice to Mariners" regarding e4 operations. Notices to Mariner are in Appendix J. The U.S. Coast Guard point-of-contact for this project is Craig Lapiejko (Table 2). Before moving to a site, e4 will update the Coast Guard Command Center duty officer on the location of the next drill site. The Coast Guard will then broadcast the location on marine channel 16. e4 will report back to Coast Guard Command Center duty officer at the end of each day.

e4 will reviewed drilling operations and safety issues with the Boston Harbor Master. A police boat detail will not be hired because the Federal Government is not required to hire police details and the following controls will be in place to assure public safety with regard to harbor navigation and recreational marine traffic. These include 1) notice to mariners, 2) daily Coast Guard contact, 3) presentation of proper shapes (signage), 4) captain will monitor channel 16 and will visually monitor traffic, and 5) crew will notify the captain immediately of any approaching vessel that may pose a traffic hazard. If an emergency, crew can sound a warning with a portable horn that will be kept in the work area. The captain will contact approaching commercial vessels via radio. When there is no radio response, as is expected for much of the recreational traffic, visual contact will be attempted and a horn will blow warning signals. When needed, the support vessel will be able to leave the platform rapidly to help direct traffic away from the drilling platform.

e4 will coordinate the schedule around incoming/departing ship schedules including the LNG tankers and cruise ships, and any associated security requirements that may impact operations.

e4 has informed the Massachusetts Lobstermen's Association of the surveying and drilling activities. e4 placed notice in their monthly newspaper (Appendix J).

3.6.2. Utility notification
e4's team will contact Dig Safe, NSTAR, National Grid (Keyspan), Verizon, and Municipal Sewer and Water Departments to determine the location of utilities close to the drilling locations. The Dig Safe program will be notified prior to drilling, and drilling operations will not commence until the all clear has been given.

3.6.3. Safety Survey
The geophysical surveys will also act as safety surveys to determine locations of utilities and other potential obstacles. This survey will verify positions of utilities or other infrastructure on the channel floor where drilling will occur or where the drilling platform legs will be lowered. During the geophysical surveys e4 will examine the current condition of tide boards and potential locations for temporary tide boards for drilling if needed.

3.7 Task 6 - Boston Harbor borings

3.7.1 Drilling Plan
The geotechnical engineering services to be performed under this task are listed below, and described in greater detail in subsequent sections:

a. Drill and sample borings, and collect and log bedrock core. Save samples of all materials and deliver selected samples to Terrasense for rock mechanics testing.

b. Produce field logs of the borings (handwritten, typed and corrected), including drilling observations, photographs, boring coordinates and bottom elevations, and field classifications for all soils and rock encountered.

Twenty six (26) borings will be advanced in Boston Harbor at twenty six locations determined by the seismic survey results. The borings shall extend at least to an elevation -55 feet MLLW, with a minimum of 10 ft of rock cored at each location. The borings shall be labeled "FD14-B-R01" through "FD10-B-R26."

Site Conditions: Water depth in the area of the Boston Harbor borings is typically 40 feet, and the area is subject to a tidal range of about 9.5 feet.

Vertical Datum: The datum for this project is Mean Lower Low Water (MLLW) tidal datum (Tidal Epoch 1983-2001) and shall be the vertical datum from which all depths and elevations are measured. All records and submittals shall show the negative sign where elevations are referenced to MLLW. Where depths below MLLW are used, the negative sign shall be left off.

Measurements shall be made in feet, and tenths of feet.

3.7.2 Drilling Platform – Liftboat

Drilling rock from a floating platform such as a spud barge and achieving greater than 80% recovery while not artificially damaging the rock is difficult to achieve in Boston Harbor. This difficulty results from ocean swells and greater than 9.5-foot tides. When drilling on a rising tide it is difficult to maintain constant pressure on the drill bit. This can lead to mechanically damaged cores. Rate measurements can also be off because of inaccurate depth measurements during coring (core top and bottom can always be accurately measured). SPT borings during rapidly changing tides lead to sampling intervals either shorter or longer than the expected two-foot drive. This adds uncertainty to sample depths and blow-count data. Ocean swells that raise and lower a spud barge during drilling can be dangerous and can damage the drill rod and the rock.

To avoid these issues the drilling in this project will be conducted from a fixed marine plant that is the above the water. We will use a liftboat that will raise the drilling platform above the swells. The liftboat being used is the Northstar Marine *LB Vision*. Drilling from a liftboat greatly reduces problems during drilling, ensures more accurate depths, and reduces drilling induced breakage. The quality of recovered rock is closer to in situ conditions.

A 2014 marine survey of the liftboat will be conducted and submitted to USACE prior to commencement of borings.

3.7.3 Positioning on holes

e4 will position and set up the liftboat so that actual drilling locations are within 30 feet of the planned locations. This involves coordinating the physical placement of the drilling platform, timing with respect to weather and tides, and measuring the location and confirming that the bathymetry at the location is that of the targeted location. The liftboat will be positioned using a dGPS. This is monitored via a live map plot showing the vessel location and the target boring location. Each leg of the liftboat has sonar depth sensors to measure the depth beneath each leg. The legs are first lowered to the seafloor and then the platform rises on the legs above the sea.

The liftboat is required to maintain an air gap of at least five feet. The depth that the legs penetrate into the seafloor will be monitored by measuring the leg "stick up" above deck and the

deck-to-seafloor height. The liftboat will be moved if penetration is too deep to maintain the appropriate height. Leg penetration and air gap will be monitored during operations. The water depth of each leg and leg penetration will be recorded after set-up on each boring. This information will be noted on the drill logs.

Raising the platform into position will take about a half-hour and is best done in quiet seas and slack tide. Lowering the casing to the seafloor should also be done during slack tides if at all possible.

The drilling issues for the fixed platform include 1) confirming that the wellbore is above the targeted location, and 2) water depth measurements.

3.7.4 Sequence of borings

e4 will order, select, and drill the locations based on conditions such as rougher seas and difficult tides.

e4's team will complete the borings in sequence based on the difficulty of sea conditions, which will be determined as the boring locations are selected. If on a given day, the weather does not permit drilling at a scheduled location we will move to a secondary location. If none of those locations are drillable then we will discuss with the NAE to declare a weather day (see section 3.9). A decision may be made at the dock if conditions are clearly unworkable.

3.7.5 Measuring actual positions

The actual boring locations will be measured with a RTK dGPS system capable of sub-foot accuracy horizontal accuracy and a vertical accuracy of +/- 3 inches. The positions will be monitored using HydroPro. To verify location, four locations on the liftboat will be measured with the RTK dGPS: (a) one at the drill hole, and (b) one on each side of the platform centerline equidistance from the drill hole. The fourth will be on the platform centerline away from the drill rig. This redundancy is required to avoid disrupted GPS signals that may be caused by the the drill rig blocking GPS signals. Also, we will have measured the platform template.

3.7.6 Drilling

e4 shall provide all labor, materials, and equipment necessary to complete the specified subsurface explorations and sampling. e4 shall provide well maintained and calibrated drilling and sampling equipment, and a qualified crew and driller experienced in all phases of exploration drilling, sampling, and test methods for engineering purposes.

The core drilling will be conducted with ADT's 2005 CME-55LC/300 track mounted drill rig. The drill rig is setup with both a SPT autohammer and rope and cathead SPT hammer.

The rig will be positioned on the on the centerline of one end of liftboat. This is a typical set up for drilling off a barge or liftboat. The deck has guardrails along its edges. The drill rig will be driven onto the liftboat at Boston Harbor Ship Yard and Marina. The liftboat is self powered, with captains provided by Northstar Marine (see Appendix G for captain information). At the start of the day all personnel will board the liftboat at Boston Harbor Ship Yard and Marina. All personnel will board with appropriate personal protective equipment . The USCG will be notified before the liftboat leaves the dock. Drilling operations are planned to run from 0600 to 1800 hours during the week days and on some Saturdays.

Once the platform is raised on the location the captain will give a go ahead when it is safe to continue. The depth of penetration of the liftboat legs will be measured and the air gap will be determined. The inspector will then determine if all the location and bathymetry criteria are met

and drilling can commence. The driller will lower the 4-inch casing to just above the seafloor. The distance from the deck to the channel floor will be measured inside the casing using a weighted tape. This will be the final confirmation of the elevation of the drilling target. This will also give the inspector a first "feel" of the channel bottom. At forty to fifty feet it can be possible to distinguish among hard rocky bottom and sandy bottom and soft mud.

The casing will be left just above the bottom and a split spoon will be driven into channel bottom. The borings will be advanced using the Standard Penetration Testing (SPT) method (ASTM D 1586). The drill rig is setup with both a SPT autohammer and rope and cathead SPT hammer. The autohammer will be used in the most cases.

The NAE has requested a modification of the Standard Penetration Testing (SPT) method (ASTM D 1586). The NAE has requested using a 300-pound hammer, an 18-inch drop, and a 2.5-inch inside diameter split sampling spoon. This is due to the anticipated soil conditions. The heavier hammer will mean that the rock at refusal will require coring and help eliminate false refusals. In many cases weathered and broken rock that is too "soft" to core can produce false refusals when using the standard weights and spoon sizes.

Each split-spoon sample will be opened and laid out for examination. The length of both the in-place and washed-down sediment in the spoon will be measured. The amount of recovery of in-place sediment will be noted on the description logs.

Immediately upon opening the split spoon the sample will be photographed. Each split spoon sample will be photographed whole and measured. Then the sediment will be then cut in half and photographed again. Samples from each split spoon will be carefully placed into clearly labeled plastic jars. Jars and lids will be labeled with project name, boring number, sample number, split spoon depth, and number of blow counts required for advancing the split spoon. Visual descriptions shall follow ASTM D 2488. Conditions during drilling and characteristics of the sediments that effect drilling will be especially noted.

Bedrock shall be cored upon reaching refusal. First the casing will be driven down either to depth of the spoon or to refusal. If deemed necessary the casing will be spun into the top of the rock just enough to hold it in place and form a seal to prevent loss circulation. All attempts will be made to core the highest possible rock.

Rock coring shall be performed using an NQ-size wireline core barrel, in accordance with procedures in ASTM D 2113. Rock coring operations shall be conducted in a way to maintain integrity of core, minimize disturbance and breakage from coring operations, and maximize recovery. Only core bits in good shape will be used. The core will be photographed immediately upon extraction from the core barrel.

Description for cores will include the drill rate in minutes per foot. After the core is recovered, it will be carefully pieced together and photographed. Each core piece will be labeled (e.g., a, b, c etc.). The core will be described in detail with the following information included on each log:

1) Physical condition of bedrock (i.e. highly weathered, broken, highly fractured or sound)
2) Estimated depth of change from one physical condition to another
3) Rock Quality Designation (RQD) - The sum of the length of core segments four inches (4") in length or longer divided by the total length of the core run.
4) Fractures Per Foot (FPF) - The number of fractures in each linear foot of core.
5) Longest Core Segment (LCS) – the length of the longest core segment in each linear foot of core.

Minimum acceptable recovery: For each boring, a minimum of 80% core recovery is required. Borings with core recoveries of less than 80% shall be offset and re-drilled. If the second attempt also recovers less than 80%, then the boring will be accepted as complete, and no further attempts will be required.

Field Boring Logs: The drilling inspector shall keep detailed field logs of the borings. Logs shall be filled out on a daily basis such that each day of drilling activity is fully recorded at the end of work for that day. The field logs proposed by e4 are in Appendix F. Field boring logs shall have a minimum scale of one inch equals one foot, to allow sufficient room for material descriptions. Field logs shall be completely filled out in the field, at the time of drilling and sampling, with classifications, drilling observations, the start and finish clock times for each core run, drill times (minutes per ft), and drill fluid losses. Logs shall include at a minimum: dates, boring numbers, location, driller and inspector names, drilling details and methods used, and listed by depth, sample number, core run number, classifications (including ASTM descriptions, moisture levels, color, density, estimated percentage of major and minor components), strata breaks, blow count data for sample and casing drives, casing depths, sample recoveries, and other pertinent details of the drilling operations. The inspector shall also record coring bit type and condition. During rock coring the inspector shall record rig operations (down pressure, wash water pressure, core barrel rotation), coring rate (minutes per foot), and drilling observations (rough drilling, chatter, rod drops, drill fluid, etc.) and any drilling fluid loss, location and quantity. e4 shall record depth information on the boring logs so that the 0.0-foot depth coincides with the channel bottom; corrections for water depth, tidal fluctuations, and measurements in the field shall be performed to accomplish this. e4 shall record the clock time at the start of and completion of each core run, so that tide level can be determined from the nearest tide gauge, as a backup to other methods, to confirm water elevation at the time of drilling. All final elevations on the logs shall be in MLLW. All field logs and records shall be preserved in good reproducible condition and shall be available for examination by the NAE Representative throughout the fieldwork. Separate detailed field logs shall be made for each exploration.

Field submissions: Copies of the field boring logs shall be submitted to NAE on a weekly basis. In addition to the field logs, the inspector shall write a short narrative. The report will describe each day's activities as related to actions taken and work completed. These Progress Reports shall be submitted daily to NAE via e-mail. Copies of the daily written Progress Reports shall be included in the Report of Explorations.

Samples: e4 shall save and label representative samples of each material encountered while sampling. e4 shall supply all sample jars, labels, and core boxes required for the preservation of samples. Core boxes shall be constructed of lumber or plywood with operating latches and shall be labeled properly. Material shall be collected in 8oz. minimum plastic jars or in sufficient quantity to allow performance of subsequent laboratory soil tests, including grain size analysis and hydrometer tests. All jar samples shall have the boring and sample identification written on both the lid and a label on the side of the jar, using indelible ink pen or marker. All samples shall be delivered to Terrasense.

NAE oversight staff: NAE oversight staff will be able to access the work site to observe work. Government personnel will not impede or otherwise adversely impact progress and operations, and will board with the rest of the crew, stay for the day, and return at the end of the day. Government personnel will read the APP & Safety Plan, sign that they read it and will comply with it, and be covered by the Contractor's safety plan.

3.8 Task 6a – Additional borings to (optional)

If requested, e4sciences will perform 5 additional borings. This task is multi-executable up to 6 times as stated in Scope of Work. The additional borings will be performed in areas of special interest, to be decided based on the geophysical surveys, and will be discussed with the USACE prior to being performed.

3.9 Task 6b – Additional single boring (optional)

If requested, e4sciences will perform an additional boring. This task is multi-executable up to 6 times as stated in Scope of Work. Change The additional boring will be performed in an area of special interest, to be decided based on the geophysical surveys, and will be discussed with the USACE prior to being performed.

3.10 Task 7 – Rock mechanics testing and report (optional)

This task was awarded at time of contract award. The field inspector will assess bedrock cores for rock mechanics testing throughout the course of the drilling work. He will select intervals for testing during the field program. The planned tests are listed in Table 5.

Table 5. Rock mechanic tests to be performed on bedrock core from each boring in Boston Harbor.

Test	Number per core location	Total number of tests
Unconfined compressive strength w/ Young's Modulus (ASTM D7012, Method D, and ASTM D 3148; core preparation by ASTM D 4543)	1	26
Point load index (ASTM D 5731)	1	26
Splitting tensile strength (Brazilian)(ASTM D 3967)	1	26
Total hardness	1	26
Unit weight & classification	1	26
Petrographic analysis (ISRM procedures)	1	26
Acoustic velocity	1	26

The acoustic velocity measurements will be made in e4laboratories after coring. Velocity measurements will be made using Panametrics V114 1-MHz longitudinal-wave contact transducers, Panametrics 5058PR high-voltage pulser-receiver, and Tektronics TDS-210 digital storage oscilloscope.

Other measurements will be conducted by Terrasense, in Totowa NJ.

e4 will select proposed test intervals by submitting to the NAE images of core pieces and boring logs marked up with proposed test intervals. Once approval of the testing intervals is given, the samples will be sent to Terrasense. There will be regular communication between e4 and Terrasense to minimize delay in testing.

Core specimens subjected to testing shall be returned to the core box to the interval from which they came. Split core samples broken by strength testing shall be taped together and placed in a clear plastic bag, if necessary. Upon completion of testing, e4 will return all rock core boxes to the NAE core storage building at Devens, MA.

e4 will prepare a report for Boston Harbor borings. The report will present, tabulate, and summarize the rock mechanics testing results. The boring logs will be updated with the test results. In this report, e4 will use the findings from the testing to evaluate and make recommendations regarding rock removal methods required for each ledge location, specifically

whether the rock at each location requires blasting, or if it can be removed by other mechanical means (ripper, hydraulic percussive methods, such as a hoe ram, etc.).

3.11 Task 8 – Boston Harbor report of explorations (optional)

This task was awarded at time of contract award. e4 will prepare and submit a Report of Explorations, presenting and summarizing the field effort, and any deviations from the Work Plan. The report will include Weekly Safety Meeting logs, Daily Progress Reports, final checked boring logs, and a tabulation of actual (GPS surveyed) boring locations, elevations of channel bottom, depth drilled, completion depth and elevation of each boring location, length of rock cored, % recovery, RQDs, photographs of cores, a figure showing the actual boring locations, and any Optional tasks exercised.

The final submission will be submitted in both electronic and paper versions. The electronic version will be submitted on a computer compact disk (CD) and will include all drawings, tables, graphs, and text, as appropriate. The CD will be clearly labeled with the file name and description in an orderly fashion. The CD will include the individual electronic native files (Word, Excel, MicroStation, gINT, etc.) All text files will be created in Microsoft Word. In addition, an electronic version will be submitted as one consolidated file in PDF format (Adobe Acrobat, most current version), including scanned copies of the original field logs.

3.12 Task 9 – Weather day, multi-executable (optional)

This task was awarded at time of contract award. Weather Day Option includes the costs associated with marine plant and personnel in a non-working mode on a day due to weather conditions making it infeasible and/or unsafe to perform required work. All efforts will be made to keep weather days to a minimum.

One weather day option has been be exercised for the Boston Harbor borings and one for the Boston Harbor geophysical surveys. If weather days are not required, then they will be de-scoped, and contract will be reduced by the contract option amount not used. e4 shall telephone the NAE immediately when weather conditions prohibit work, to obtain approval for use of a Weather Day, and follow up with a submittal formally documenting the conditions when weather made water work unsafe and/or infeasible.

4. Deliverables

e4 plans to submit the following deliverables for this project:

- Draft Work Plan, (3 electronic & 3 hard copies);
- Tidal correction plan, (3 electronic & 3 hard copies);
- Accident Prevention Plan and AHA (3 electronic & 3 hard copies);
- Final Work Plan, (3 electronic & 3 hard copies)
- Final Tidal Correction Plan, (3 electronic & 3 hard copies)
- Final Accident Prevention Plan and AHA (3 electronic & 3 hard copies);
- Weekly safety reports;
- Daily activity reports with field logs;
- Project exposure report;
- Draft Boston Harbor report of Exploration (3 electronic & 3 hard copies);
- Final Boston Harbor report of Exploration (3 electronic & 3 hard copies);
- Draft Boston Harbor rock mechanics testing report (3 electronic & 3 hard copies);
- Final Boston Harbor rock mechanics testing report (3 electronic & 3 hard copies);
- Rock core secured in wooden boxes and soil/rock jar samples

All deliverables will be submitted to the NAE POC in the formats described in the USACE Scope of Work.

5. Coordination

All field activities and site visits, as appropriate for this project, shall be coordinated by telephone at least five days prior to actual commencement of work with Dr. Stephen Potts (978-318-8311(o), 734-904-0646 (m)) or, as an alternate, Mr. Peter Hugh (978-318-8452(o), 978-844-7388(m)). At a minimum, during the progress of the fieldwork, the inspector shall coordinate with NAE prior to the start of drilling work for each boring, at the completion of each boring, and when any difficulties or questions arise that require NAE input.

6. Quality Control Plan

e4 will perform independent quality control reviews prior to scheduled submissions. Each submittal will include a separate Quality Control Section indicating the quality control processes performed for the submittal together with an extent of compliance. This extent of compliance shall include the producer of the product, the original comment, who made the comment and its date, the comment response and where in the product changes, if any, were made. e4 will review the Final Report internally with a documented Independent Technical Review. Daniel Rosales will serve as the Quality Control Officer.

A more detailed description of the Quality Control Plan is attached in Appendix E.

7. Completion Schedule

The planned schedule for the work is presented in Table 6. Each task identified in the scope of work is listed.

Progress will be monitored using this schedule with the actual dates of submittal of deliverables, performance of the field inspections, ITR's, and out-briefs noted. The submittal of deliverables will establish milestones for the project. Every week, the schedule will be updated based on the progress of the work, modified as required, and submitted to the NAE POC. The scheduling of the drilling in relationship to sea conditions and weather may warrant minor revisions to the schedule.

The geophysical surveying is expected to take a minimum of thirty days. The plan is to survey from 0600 to 1800 hours during the week days and most Saturdays. During the geophysical survey, the *Time and Tide* will be moored at Constitution Marina located at 28 Constitution Rd, Boston. e4 personnel will embark and disembark the *Time and Tide* at Constitution Marina on a daily basis.

The drilling is expected to last at least twenty days. Drilling operations are planned to run from 0600 to 1800 hours during the week days and on some Saturdays. During the drilling operations *LB Vision* will be moored at Boston Harbor Ship Yard and Marina located at 256 Marginal St in east Boston. e4 personnel will embark and disembark the *LB Vision* at Boston Harbor Ship Yard and Marina on a daily basis.

Table 6. Proposed project milestones and dates. Updated 2014.10.20.

		Description	RFP schedule	Proposed start date
1	NTP	Notice to Proceed		2014.09.03
2	Task 1	Tidal plan, QC Plan		2014.09.26
3		Work plan draft, APP		2014.09.29
4		NAE comments	+14, calendar days	2014.10.03
5		Work plan final	Within 14 days of NAE comments	2014.10.21
6		Initial Coast Guard notification		2014.09.25
7		Contact Boston Harbor Lobsterman		2014.10.06
		Initial harbor master notification		2014.10.23
8	Task 2	Geophysical Mobilization	Within 14 days of NAE approval	2014.10.25
9		Time and Tide arrives in Boston		2014.10.30
10		Geophysical Demobilization		2014.12.05
11	Task 3	Seismic reflection survey	Within 14 days of NAE approval	2014.11.03
12	Task 3a	Side scan survey		2014.11.03
13	Task 4	Boring plan initial borings	Within 30 days of start	2014.11.07
14		NAE approval of initial borings		2014.11.14
15		Draft report geophysical survey	Within 14 days of seismic demob	2014.12.19
16		NAE comments	Within 14 days of receipt	2014.12.31
17		Final report geophysical survey	Within 14 days of NAE comments	2015.01.15
18	Task 5	Drilling Mobilization	Within 14 days of NAE approval	2014.11.07
19		Drilling Demobilization	Within 60 days of start	2014.12.19
20		Notice to Mariners		2014.10.31
21		Dig safe & utilities clearance		2014.11.07
22		Utilities		2014.11.07
23	Task 6	Drilling		2014.11.13
24		Complete drilling	Within 60 days of start	2014.12.19
25	Task 7	Rock mechanics testing		2014.11.20
26		Rock mechanics test & rippability report draft	Within 30 days of drilling demob	2014.01.15
27		NAE review	Within 14 days of receipt	2015.01.30
28		Rock mechanics test & rippability report final	Within 14 days of NAE comments	2015.02.15
29	Task 8	Report of explorations draft report	Within 14 days of drilling demob	2015.01.15
30		NAE review	Within 14 days of receipt	2015.01.30
31		Report of explorations final reports	Within 14 days of NAE comments	2015.02.15

Appendix A
Tidal Correction Plan

Tidal Correction Plan

The water level is constantly changing in the Boston Harbor. The tide range is over 9.5ft, and 2ft swells and waves are common. Historically, to determine accurate elevations of marine borings the water depths and accurate tides are needed. However, drilling from a fixed platform and using Real Time Kinematics differential Global Positioning System RTK dGPS the boring elevation can be accurately measured independently of water depths.

e4sciences will be drilling from a fixed platform provided by the liftboat LB Vision. The elevation of the deck will be measured and monitored using RTK dGPS. Drilling the borings from a raised liftboat (fixed platform) simplifies the process. The distance from the liftboat deck to channel bottom should not change during the drilling process as it does when one drills on a floating spud barge. Tidal corrections will still be made as a QA/QC step and a backup.

We will implement three methods for tracking elevations and tides throughout the drilling program. As standard practice all elevations will be measured in NAVD88 and then converted to MLLW (NAVD88 tidal epoch 1983-2001).

1. RTK Liftboat platform elevation. The elevation of the deck of the liftboat will be tied into MLLW (NAVD88 tidal epoch 1983-2001) using RTK dGPS. For the RTK e4 will use the GNNS service provider KeyNetGPS (http://www.keynetgps.com) that e4 used in the Boston Harbor in 2010. All measurements have a date and time in addition to the geographic position and elevation. The RTK measurement will be recorded continuously once the liftboat platform is set on site.

2. Relative elevations. The elevation of the platform above the sea surface will be measured every 10 minutes throughout the drilling. A tide gauge will be maintained on the jack-up rig to determine the variation of tides. This measurement shall be correlated with the NOAA Boston Harbor tidal station 8443970 (see next page for site details). This measurement also can be used to examine lag time between recorded tidal locations and the Boston Harbor tide station and the work site. This works especially well when one can record the slack tide time. Note that NOAA Boston Light tidal station #444162 MA has not been active since 2004.

The mudline elevation will also be correlated to the USACE-NAE multibeam bathymetry.

3. Near shore sites. We will place a tide gauge on the shore when the drilling location is near (~1000ft) of the shore. The gauge elevation will be tied into the local USGS or NOAA benchmarks. The tide gauge will record the water surface elevation at 10 minute intervals during the entire work process. Measurements made with RTK dGPS from the drilling platform, and from established tide stations will be correlated with these measurements.

The data will be recorded and plotted to evaluate uncertainty and estimate accuracy. These plots will be provided for each boring in an appendix.

Boston, Boston Harbor, Massachusetts
NOAA Station ID: 8443970
Latitude: 42° 21.3' N Longitude: 71° 3.1' W
http://tidesandcurrents.noaa.gov/stationhome.html?id=8443970

PUBLICATION DATE: 04/17/2003
NOAA Chart: 13272
USGS Quad: BOSTON SOUTH

T I D A L D A T U M S
Tidal datum at BOSTON, BOSTON HARBOR based on:
LENGTH OF SERIES: 19 Years
TIME PERIOD: January 1983 - December 2001
TIDAL EPOCH: 1983-2001
CONTROL TIDE STATION:

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in meters:
HIGHEST OBSERVED WATER LEVEL (02/07/1978) = 4.601
MEAN HIGHER HIGH WATER (MHHW) = 3.131
MEAN HIGH WATER (MHW) = 2.996
NORTH AMERICAN VERTICAL DATUM-1988 (NAVD) = 1.678
MEAN SEA LEVEL (MSL) = 1.585
MEAN TIDE LEVEL (MTL) = 1.550
MEAN LOW WATER (MLW) = 0.103
MEAN LOWER LOW WATER (MLLW) = 0.000
LOWEST OBSERVED WATER LEVEL (03/24/1940) = -1.135

ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 8443970 T.M.: 0 W
Name: BOSTON, BOSTON HARBOR, MA Units: Feet
Status: Accepted Epoch: 1983-2001

Datum	Value	Description
MHHW	13.80	Mean Higher-High Water
MHW	13.36	Mean High Water
DTL	8.66	Mean Diurnal Tide Level
MTL	8.61	Mean Tide Level
MSL	8.73	Mean Sea Level
MLW	3.86	Mean Low Water
MLLW	3.52	Mean Lower-Low Water
GT	10.27	Great Diurnal Range
MN	9.49	Mean Range of Tide
DHQ	0.44	Mean Diurnal High Water Inequality
DLQ	0.34	Mean Diurnal Low Water Inequality
HWI	3.74	Greenwich High Water Interval (in Hours)
LWI	9.93	Greenwich Low Water Interval (in Hours)
NAVD	9.03	North American Vertical Datum
Maximum	18.62	Highest Water Level on Station Datum
Max Date	19780207	Date Of Highest Water Level
Max Time	10:36	Time Of Highest Water Level
Minimum	-0.20	Lowest Water Level on Station Datum
Min Date	19400324	Date Of Lowest Water Level
Min Time	00:00	Time Of Lowest Water Level

Appendix B
Accident Prevention Plan

e4sciences | Earthworks, LLC

Accident Prevention Plan

Contract number: W912DS-12-D-0002, Task Order DB-01

Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston, Massachusetts

Prepared for:
US Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751

Prepared by:
e4sciences, LLC.
27 Glen Road
Sandy Hook, CT 06482
(203) 270-2800.

Draft: October 15, 2014

Table of Contents

i. Accident Prevention.

(a) The Contractor shall provide and maintain work environments and procedures which will—

(1) Safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;
(2) Avoid interruptions of Government operations and delays in project completion dates; and
(3) Control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall—

(1) Provide appropriate safety barricades, signs, and signal lights;
(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and
(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

1. SIGNATURE SHEET

a. Plan preparer

Matthew Art
e4sciences Safety Officer
(203) 270-8100 (o)
(203) 312-4943 (m)

James Trotta
e4sciences Site Safety Officer
(203) 270-8100 (o)
(914) 774-5968 (m)

b. Approved by

William F. Murphy III
e4sciences Principal
(203) 270-8100 (o)
(203) 820-7320 (m)

c. Plan concurrence

W. Bruce Ward
e4sciences Chief Geologist
(203) 270-8100 (o)
(203) 788-8103 (m)

2. BACKGROUND INFORMATION

a. Contractor:
e4sciences, LLC
27 Glen Road
Sandy Hook, CT 06482
(203) 270-8100

b. Contract number: W912DS-12-D-0002, Task Order DB-01

c. Project name: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston, Massachusetts

d. Project description: The US Army Corps of Engineers New England District (NAE) is conducting seismic surveys and subsurface explorations to collect bedrock cores to evaluate the density, strength and other properties of bedrock (ledge) in the Federal navigation channels (Figure B-1). The A/E shall complete a total of 26 borings. The location of these borings will be determined after acquisition of the seismic surveys.

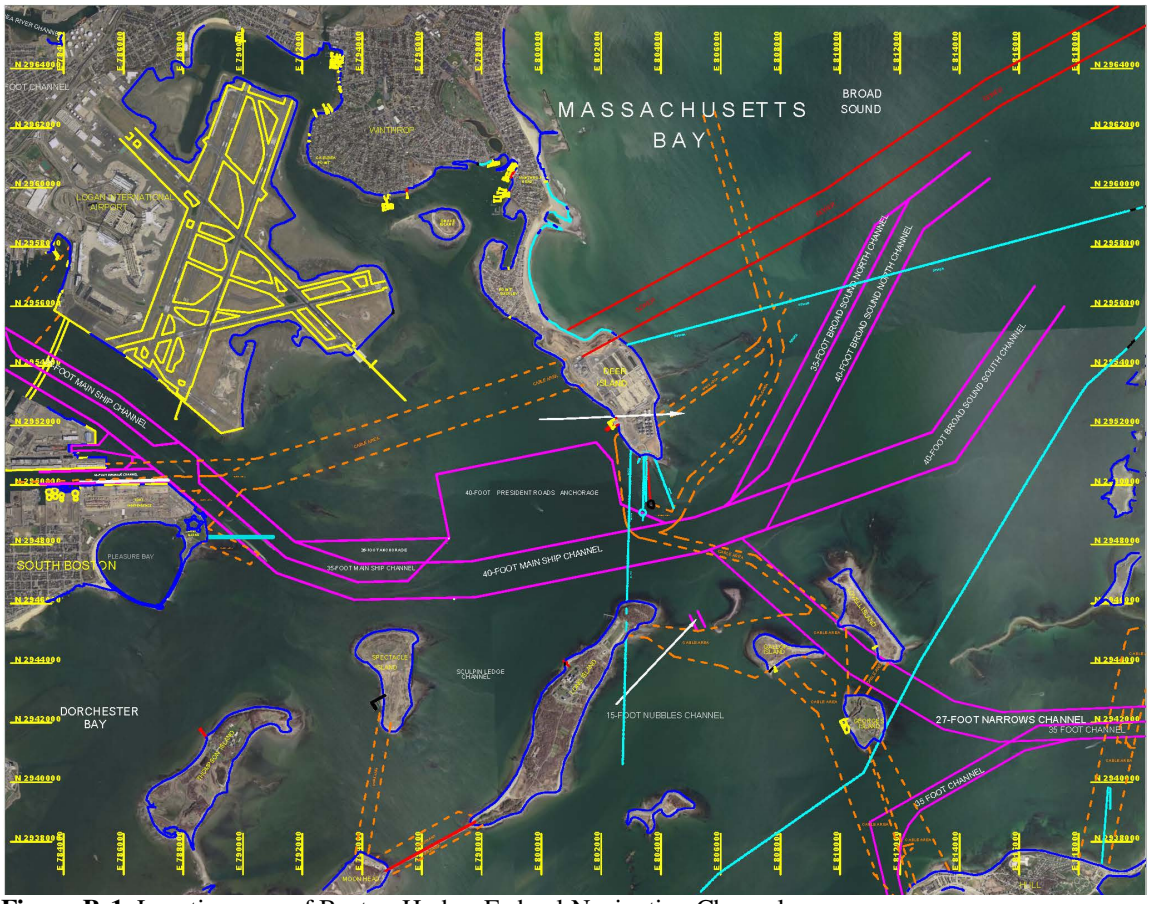


Figure B-1. Location map of Boston Harbor Federal Navigation Channels.

All work shall be performed in compliance with the Corps of Engineers Safety Manual, EM 385-1-1. Specific work shall include:

BASE:
Task 1 – Work Plan, Tidal Correction Plan, Accident Prevention Plan (APP), and Activity Hazard Analysis (AHA)
Task 2 – Seismic Survey Mobilization/Demobilization
Task 3 – Seismic Reflection Survey
Task 4 – Report of Seismic Reflection Survey
Task 5 – Drilling Mobilization/Demobilization
Task 6 – Boston Harbor Borings

OPTIONS:
Option 3A – Sidescan Sonar Survey
Option 6A – Additional Borings
Option 6B – Additional Single Boring
Option 7 – Rock Mechanics and Testing Report
Option 8 – Boston Harbor Report of Explorations
Option 9 – Weather Day (Multi-Executable)

Option 3A, Option 7, Option 8 and Option 9 were awarded at time of contract award.

e4 shall provide all labor, materials, parts, and equipment to conduct subsurface explorations to collect bedrock cores to evaluate the density, strength and other properties of isolated bedrock (ledge) high spots in the Federal navigation channels. All work shall be completed in accordance with Statement of Work (SOW) entitled "Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston, Massachusetts" dated 3 September 2014.

e. Contractor accident experience:
e4sciences has had no major accidents or injuries in its 16 years of operation.

f. Phases of work and hazardous activities requiring activity hazard analysis are listed below. See Activity Hazard Analysis in work plan Appendix D.

Driving
Mobilization of Equipment and Supplies on to Marine plant
Equipment Fueling/Greasing
Crane Operations
Cutting/Welding and Abrasion of Steel (torches/chop saws/ grinder)
Hand Tools (i.e. impact wrench, ratchets, screw drivers, etc.)
Locating Marine Plant on boring locations
Marine plant jack-up / jack-down
Drilling
Demobilization of Equipment and Supplies

3. STATEMENT OF SAFETY AND HEALTH POLICY

a. Ten Points

Safety first.

1. Safety officers are Matt Art for survey operations and James Trotta for drilling operations. Safety officers are responsible for the conduct of safe operations throughout the organization. Safety officers report to William Murphy, Principal and Safety Supervisor of e4sciences.
2. All employees and supervisors are responsible for their own safety and safety of colleagues and of operations conducted by e4sciences and their subcontractors, Aquifer Drilling and Testing (ADT), and Northstar Marine (Northstar).
3. Driving is the single most important opportunity for potential fatalities. Safe driving must be practiced at all times. The most dangerous driving is when returning from a job when tired and in the dark. The job is not complete until all personnel are home safely.
4. No alcohol may be consumed on the job and when traveling to or returning home from a job.
5. Advancing borings on and around water from marine plants require special care and operation by experienced personnel according to procedures further specified in this manual.
6. Operations will be conducted in accordance with the USACE EM 385-1-1 – Safety and Health Requirements Manual
7. Safety surveys are mandatory prior to all boring and coring procedures. Safety surveys include magnetometer, seismic, and side-scan sonar surveys as well as historical analysis and appropriate "dig safe" utility notifications.
8. All equipment configurations should be overbuilt with safety in mind.
9. With regard to PPE, head, eyes, hands, and feet are the most vulnerable.
10. All personnel must be aware of accident procedures and local emergency contact information at all times.

b. Safety Principles

e4sciences (e4) operates according to a set of principles stated above. e4 is in the business of reducing the clients risk. The first risk that a client faces is that one of our employees may have an accident. Therefore, safety comes first in all operations. All employees and sub-contractors are bound by the principles and requirements set forth in the APP and Health and Safety Plan (Appendix C).

e4 operations also depend on an expectation that preparation and prevention of mistakes and accidents is the key to successful operations. Mistakes and errors will happen, but preparation and prevention will minimize the outcome and minimize risk of injury.

In terms of safety, we emphasize safe driving as the single most important element. Second is personal physical safety and contact with heavy machinery with moving parts. Slips, trips and falls are the tertiary concern. Fourth are environmental concerns such as overhead objects and proximity to water.

Thoughts and concerns about safety require that each employee stop and consider the situation before acting on the next task. Safety concerns are reviewed at the beginning of each project and evaluated in hindsight after each project. The creation of good habits is a principle upon which we operate. Good habits are safe habits.

Each employee must work in the field in a pair with another employee as their buddy. Each is responsible for the safety of his or her buddy. At no time is any employee or sub-contractor to be out of voice or sight contact with his or her buddy.

For the complete Health and Safety Plan see Appendix D.

4. RESPONSIBILITIES AND LINES OF AUTHORITIES

e4 is ultimately responsible for the safety of its employees and sub contractors during survey and marine boring mobilization and operation.

a. Personnel responsible for safety at both corporate and project level are:

Project Personnel:
Director of Field Operations, Safety Officer, Geologist
Matthew B. Art – e4sciences – (203) 270-8100 (o), (203) 312-4943 (m)

Drilling Site Safety Supervisor, Geologist, Safety Officer
James Trotta – e4sciences – (203) 270-8100 (o), (914) 774-5968 (m)

Director of Field Operations
William F. Murphy IV – e4sciences – (203) 270-8100 (o), (203) 948-5250 (m)

Marine Plant Operator
David Morgan – Northstar Marine – (609) 675-8611 (m)

Lead Driller
Gustavo Suri – Aquifer Drilling and Testing – (516) 616-6026 (o), (908) 468-0325 (m)

Corporate Personnel:
Principal, Project Manager
William F. Murphy III – e4sciences – (203) 270-8100 (o), (203) 820-7320 (m)

a. Lines of authority:
No work shall be performed prior to an Activity Hazard Assessment conducted by the Drilling Supervisor or ranking Safety Officer. The Drilling Supervisor or Safety Officer is responsible for identifying all hazards (in conjunction with the tug captain, marine plant operator, and driller) and making and enforcing the recommended controls to such hazards. The Drilling supervisor or ranking Safety Officer is ultimately responsible for all decision making relative to safety.

5. SUBCONTRACTORS AND SUPPLIERS

a. Known sub-contractors and suppliers:

Company Name:	Aquifer Drilling and Testing
POC:	Steve Wolf
Address:	75 E 2nd Street. Mineola, NY 11501 (516) 616-6026 (o)

Company Name:	Northstar Marine
POC:	Dave Morgan
Address:	36 Clermont Drive Clermont, NJ 08210 (609) 263-6666 (o)

b. Means for controlling and coordinating sub-contractors:
It is the responsibility of e4 to review the APP, AHA and HASP with all subcontractors involved with subsurface explorations. All sub-contractors will operate under direct supervision of the drilling supervisor. The drilling supervisor or ranking Safety Officer is responsible for the safe operation of the marine plant.

c. Safety responsibilities of sub-contractors:
It is the responsibility of the ADT and Northstar employees to review and abide by the safety principles and procedures listed in the APP, AHA, and HASP as well as all safety and health requirements set forth in the USACE Safety and Health Requirements Manual EM 381-1-1, 15 September 2008. e4 will incorporate the discretion of the marine plant and driller into all safety related decisions. In the case that one of the responsible decision makers listed above is concerned for the safety of the operation, operation will cease until such concerns are resolved with certainty.

6. TRAINING

a. Safety indoctrination

To ensure a safe working environment each employee, team member, and sub-contractor will be indoctrinated according to e4 health and safety principles prior to the start of Subsurface Investigations. e4 Health and Safety Protocols are listed in Appendix C.

b. List of mandatory training and certifications:

All employees and sub-contractors are required to abide by the e4 Health and Safety protocols (Appendix C). e4 requires all sub-contractors to be licensed and certified as appropriate for their role in the project as required by federal and state regulations. Boat and liftboat operator documentation is in Appendix G.

c. Requirements for emergency response training:

All employees will be required to review and understand all emergency plans and procedures prior to drilling activity. Plans shall include escape procedures, routes of egress, critical marine plant operations, employee accounting following an emergency evacuation of the marine plant, rescue and medical duties, means of reporting emergencies, and persons to be contacted for information or clarification. Emergency telephone numbers and reporting instructions shall be posted in a visible and conspicuous location at the marine plant.

d. Requirements for supervisory and employee safety meetings:

Periodic safety meetings for supervisors and field personnel involved with subsurface explorations will take place prior to drilling and after a daily hindsight review of drilling operations. Prior to the commencement of drilling operations an Activity Hazard Analysis will be completed by the supervisors from e4, Northstar, and ADT. The results of this meeting, and the review from the previous day's drilling activity will be relayed to the employees in a safety briefing.

7. SAFETY AND HEALTH INSPECTION

a. Conduct of safety inspection:

The Drilling Supervisor or ranking safety officer will conduct a site safety and health pre-inspection survey prior to conducting any fieldwork. A Hazard Assessment form (Appendix C) will be completed and reviewed with all members of the drilling team prior to daily activity. It is the responsibility of the Drilling Supervisor and the ranking safety officer to identify and educate all team members of the hazards present and countermeasures (including required PPE and best practices) to avoid such hazards.

b. External inspections and certification:

Prior to subsurface investigation e4 will ensure that all marine plant vessels are currently inspected and approved for operation as a marine drilling platform. Prior to drilling operations and prior to spudding down in a navigation channel contact will be made with the USCG alerting activity and scheduled duration. Contact will be made with USCG upon completion of activity at any given location.

8. SAFETY AND HEALTH EXPECTATIONS, INCENTIVE PROGRAMS, AND COMPLIANCE

a. Written safety program goals, objectives, and accident experience goals for this contract:
The main safety objective of e4 is to reduce the exposure to health and safety risk. The goal is accident and injury free operation. e4 has advanced more than 500 borings without accident or injury. It is the goal of e4 to operate according to the rule and spirit of the APP and HASP.

b. Safety incentive programs:
Because e4 has stringent policies for adherence to safety principles, protocols, and procedures, it is in the best interest of every employee to follow these standards. e4 prides itself on accident and injury free operation.

c. Policies and procedures regarding noncompliance with safety requirements:
Team members not in compliance with every safety procedure and protocol will first be warned with corrective action with respect to a violation. Secondary infraction will result in member suspension from the drilling team.

d. Policies for holding managers and supervisors accountable for safety:
Managers and supervisors are the key to accident and injury free operation. All e4 managers and supervisors are highly experienced and indoctrinated with our safety principals and guidelines. In the event that a manager or supervisor fails to act within the spirit of these principles and guidelines appropriate disciplinary action will be taken.

9. ACCIDENT REPORTING

a. Exposure data:
All employees will sign in and out of the Job site prior to and after completion of daily activities. The Drilling Supervisor will report all hours to the e4 ranking safety officer. The hours will be verified and sent to the USACE POC, Stephen Potts, within 24 hours.

e4 will summarize on a monthly basis the total number of man-hours completed on-site (for the prime contractor and all subcontractors). e4 will submit this information electronically to the Safety and Occupational Health Office (sheila.harvey@usace.army.mil) on the 5th day of each month for work performed the previous month.

b. Accident investigation, reports and logs:
All accident reporting is the responsibility of the Quality Control Officer and Drilling Supervisor. All accident investigation and Reporting procedures are below and listed in the e4 Health and Safety Plan (Appendix C, Appendix III).

All accidents and near misses shall be investigated by the Contractor. All work-related recordable injuries, illnesses and property damage accidents (excluding on-the-road vehicle accidents), in which the property damage exceeds $2,000.00, shall be verbally reported to USACE within 4 hours of the incident. Serious accidents as described in EM 385-1-1 Section 01.D.02 shall be immediately reported to USACE. ENG Form 3394 shall be completed and submitted to USACE within five working days of the incident.

c. Immediate notification of major accidents:
The e4 ranking Safety Officer or Drilling Supervisor is responsible for reporting any accidents within 24 hours, unless stipulated below in section 8c. The report will be sent electronically to the USACE Chief of Safety, Sheila Harvey (978-318-8504, sheila.harvey@usace.army.mil). Preliminary findings may be communicated via telephone.

The following require immediate accident notification:
(1) A fatal injury;
(2) A permanent total disability;
(3) A permanent partial disability;
(4) The hospitalization of three or more people resulting from a single occurrence;
(5) Property damage of $2,000 or more.

10. MEDICAL SUPPORT

In the case of any serious or life threatening accident or injury requiring medical attention the USCG and Harbor Masters will be notified via VHF marine channel 16 (Emergency / Hailing).

In the case of minor injury, victims will be transported to the nearest safe harbor. Emergency responders will be notified with an address or nearest intersection to meet the victim for transport to the closest medical facility. USCG will be notified as appropriate.

Safe Harbor Location 1

USCG
427 Commercial Street
Boston, MA 02109
(617) 223-3212

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from USCG

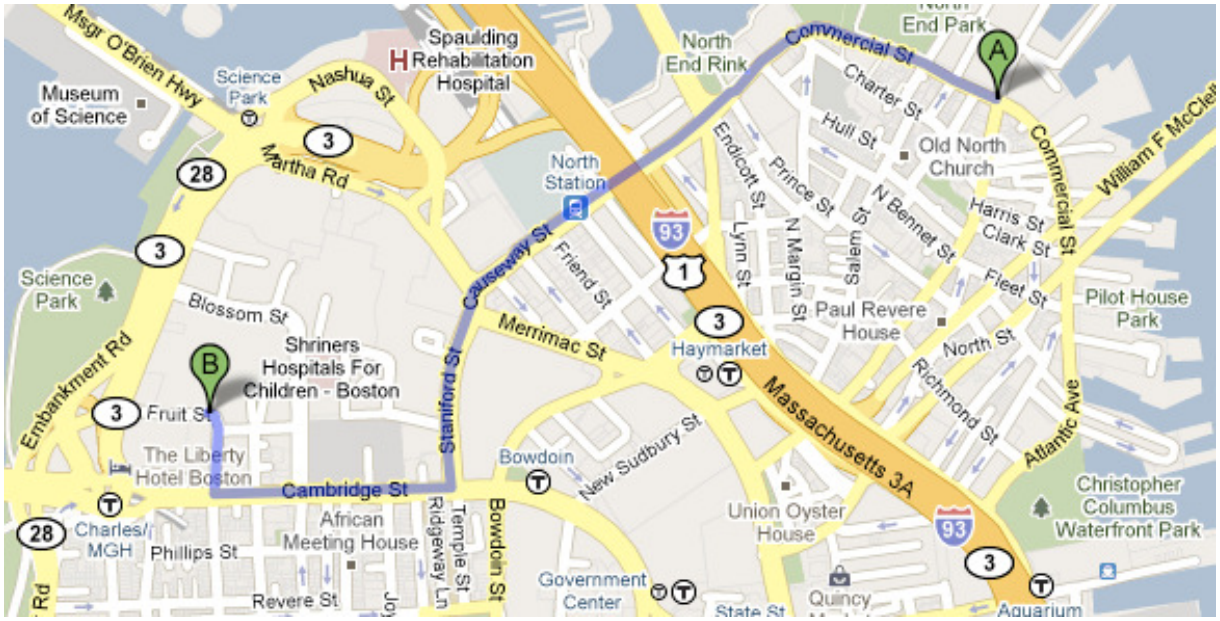
1.2 miles

Estimated transport time from USCG

3 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



Safe Harbor Location 2

Time and Tide mooring site

Constitution Marina
28 Constitution Rd
Boston, MA 02129
(617) 241-9640

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from mooring site

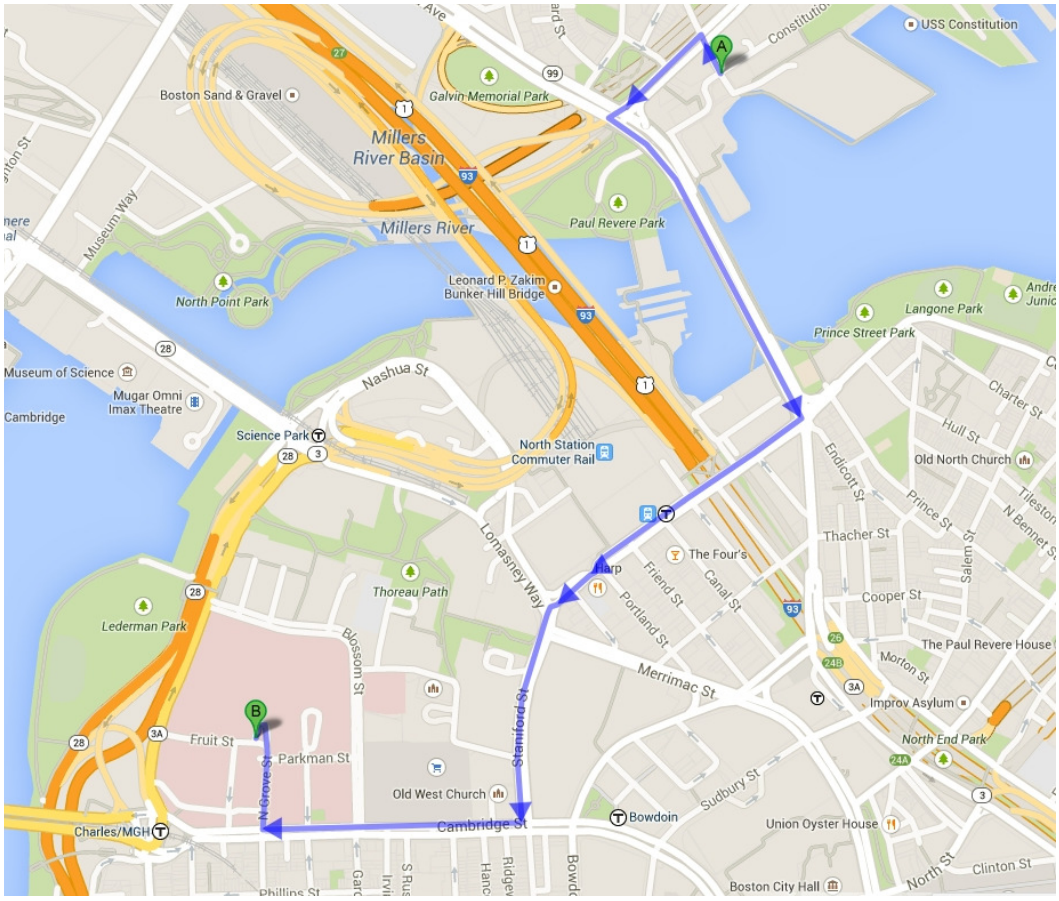
1.4 miles

Estimated transport time from mooring site

5 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



Safe Harbor Location 3

Liftboat mooring site

Boston Harbor Ship Yard and Marina
256 Marginal St,
Boston, MA 02128
(617) 561-1400

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from USCG

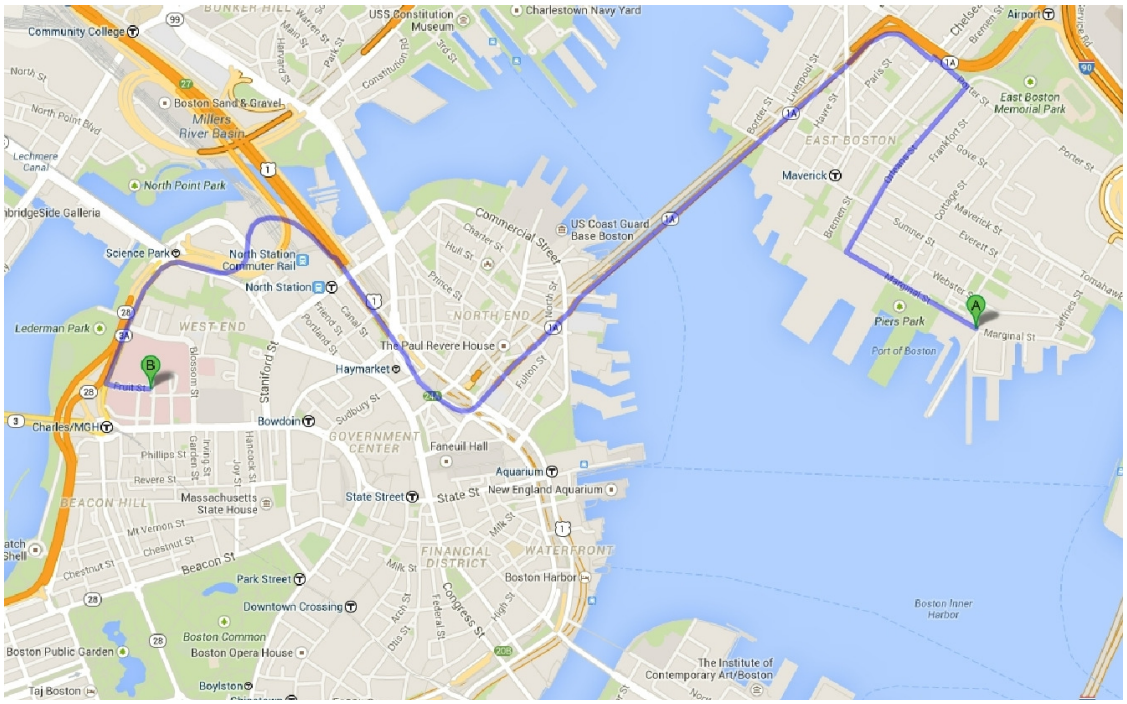
3.6 miles

Estimated transport time from USCG

9 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



11. PERSONAL PROTECTIVE EQUIPMENT

Requirements for PPE will be determined on a daily basis during the Activity Hazard Analysis meeting prior to embarkation. All PPE appropriate for marine plant operation and drilling will be readily available and immediately accessible at multiple stations on the marine plant. Items include, but are not limited to hard hats, eye protection, ear protection, hand protection (gloves), reflective vests and life vests. All vessels and platforms comprising the marine plant will comply with USCG safety regulations to the extent applicable.

12. PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL

e4sciences' Health and Safety Plan (Appendix C) highlights all protocols and procedures for risk identification, avoidance, and injury prevention. It is the responsibility of e4 to indoctrinate all employees and sub-contractors with respect to the rules and regulations of the Health and Safety Plan prior to conducting any subsurface investigation. All employees and drilling team members must be within visual and audible contact (radio or direct verbal) with the Drilling Supervisor or ranking safety officer. The Drilling Supervisor and ranking Safety Officer must have active communication with local emergency responders (USCG, 911, and local hospital telephone numbers).

a. Hazard communication program
   The ranking safety officer or Drilling Supervisor with respect to hazardous conditions shall brief all visitors to the marine plant, and the safety controls required. The ranking safety officer will provide any necessary PPE, and appropriate escort service for visitors to the marine plant.

b. Emergency response plans
   i. Procedures and tests
      Marine plant emergency plans and procedures will be reviewed with personnel and visitors to the site prior to embarkation or upon arrival to the marine plant. Plans shall include escape procedures and routes, critical marine plant operations, fire extinguisher locations, and rescue and medical duties.
   ii. Spill plans
      All employees will be instructed as to proper fueling techniques, prior to refueling any engines or generators. Spill absorbent materials will be readily accessible at any refueling location.
   iii. Firefighting plan
      During the pre-drilling AHA a list of major marine plant fire hazards, potential ignition sources, and firefighting equipment and locations thereof will be established. Good housekeeping protocols will be established. During the AHA emergency evacuation procedures will be established. The ranking Safety Officer or Drilling Supervisor will be responsible for briefing employees and emergency first responders on the hazards and the controls to hazards as well as good house keeping practices of the marine plant. The ranking Safety Officer or Drilling Supervisor shall be responsible for briefing personnel regarding individual responsibilities for various emergencies. Operators of the marine plant and vessels will be bound by USCG-approved fire plans, if applicable.
   iv. Posting of emergency telephone numbers
      A copy of the APP including emergency contact information will be kept on the marine plant at all times. Additionally local emergency contact information will be posted in a visible place on the marine drilling platform.

c. Health hazard control program
   Health hazards will be identified during AHA meetings prior to drilling activities. Machinery and operation of machinery and equipment hazards are expected to be the predominant form of hazard. Chemical hazards will be minimal, and are expected to include gasoline and diesel fuel. Drilling fluid is non-toxic marine approved drilling solution. All personnel will be made aware of necessary controls to hazards prior to commencing operation.

d. Hazardous energy control plan
Not applicable

e. Contingency plan for severe weather
If severe weather is forecasted, marine operations will not proceed until the marine plant operator, vessel captain, driller, and drilling supervisor or ranking safety officer deems weather suitable for safe operation. In the event that unexpected severe weather threatens safe operation, the marine plant will cease operation. Depending on the location and travel time to safe harbor, the marine plant will be relocated to the most suitable location, and personnel will be transported to a protected location.

f. Floating plant and marine activity
The floating plant shall be properly certified or inspected by the USCG or surveyors accredited by the National Association of Marine Surveyors or the Society of Accredited Marine Surveyors within the past calendar year. All captain and crew will be licensed and or documented by the USCG where required by federal and state regulation and have appropriate levels of experience to perform the duties assigned. Operators of the floating plant will coordinate operations with local ports and vessel traffic to ensure minimal delay to ship traffic and marine plant operation. Marine plant operation will be suspended if weather deems operation unsafe.

g. Personal protective equipment
Life vests, eye protection, ear protection, hand protection (gloves) and hard hats will be immediately available to all personnel on board the marine plant. All personnel must have appropriate protective footwear (boots) for a marine drilling platform. Active use of PPE shall be determined as part of the AHA by the ranking Safety Officer or Drilling Supervisor and as required by USACE and Federal and state regulation.

h. Plan for prevention of alcohol and drug abuse
Personnel are not permitted to use or be under the influence of alcohol, drugs, or any mind-altering substance while in transit to, or on the premises of the marine plant. If any personnel is found to be under the influence or in possession of alcohol, drugs, or any mind altering substances they will be immediately removed from the premises of the marine plant, and prohibited from further involvement with drilling operations. All e4 employees are subject to random drug screenings.

Appendix C
Health and Safety Plan

Health and Safety Plan

Contract number: W912DS-12-D-0002, Task Order DB-01

Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston, Massachusetts

Prepared for:
US Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751

Prepared by:
e4sciences
27 Glen Road
Sandy Hook, CT 06482
(203) 270-2800.

Updated: October 15, 2014

Table of Contents

1. Ten points

1. Safety first.

2. Safety officer is Matt Art, who is responsible for the conduct of safe operations throughout the organization:

   Cell: 203-312-4943
   Email: matt.art@e4sciences.com

   Safety Officer reports to William Murphy, Principal and Safety Supervisor of e4sciences | Earthworks:

   Cell: 203-820-7320
   Email: bill.murphy@e4sciences.com

3. All employees and supervisors are responsible for their own safety and safety of colleagues and of operations conducted by e4sciences | Earthworks.

4. Driving is the single most important opportunity for potential fatalities. Safe driving must be practiced at all times. The most dangerous driving is when returning from a job when tired and in the dark. The job is not complete until all personnel are home safely. No alcohol may be consumed on the job and when going to and returning home from a job.

5. The boat captain will be responsible for all safety decisions on the water. While e4sciences | Earthworks personnel maintain the prerogative to decide the safety of any task, the captain has final say with regard to marine safety. All Coast Guard regulations must be followed at all times.

6. Working in and around petroleum facilities requires special care and close collaboration with client personnel and procedures.

7. Safety surveys are mandatory prior to all boring and coring procedures. Safety surveys include magnetometer, seismic, and side-scan sonar surveys as well as historical analysis and appropriate “Dig-Safe” utility notifications.

8. All equipment configurations should be overbuilt with safety in mind.

9. With regard to Personal Protection Equipment (PPE), head, eyes, hands, and feet are the most vulnerable.

10. All personnel must be aware of accident procedures and local emergency contact information at all times.

2. Safety principles

e4sciences (e4) operates according to a set of principles stated in HASP Appendix I. e4 is in the business of reducing the clients risk. The first risk that a client faces is that one of our employees may have an accident. Therefore, safety comes first in all operations.

e4 operations also depend on an expectation that preparation and prevention of mistakes and accidents is the key to successful operations. Mistakes and errors will happen, but preparation and prevention will minimize the outcome and no one will suffer injury.

In terms of safety, we emphasize safe driving as the single most important element. Boating safety is second. Third is personal physical safety from cuts, falls, and contact with hazardous materials. Fourth are environmental concerns such as spills, fire, and explosions. Fifth, we are concerned about struck / caught in-between hazards because we handle, lift, and move moderately heavy equipment.

Thoughts and concerns about safety require that each employee stop and consider the situation before acting on the next task. Safety concerns are clearly discussed among employees before a project starts and evaluated in hindsight after each project. The creation of good habits is a principle upon which we operate. Good habits are safe habits.

Field crews consist of three people. Each employee must work in the field in a pair with another employee. Each is responsible for the safety of his or her mate.

3. Procedures

We do not operate heavy equipment. If there is ever a need for heavy equipment to be used, e4 will subcontract to a qualified licensed provider or operator.

Prior to leaving the dock the survey captain alerts the US Coast Guard Vessel Traffic Service (USCG-VTS) of all impending operations and location of survey. The captain alerts USCG-VTS of the timing and scope of all operation, and any impedance to normal operation. This check-in process takes place as the survey vessel leaves the homeport. The vessel remains in radio contact with USCG at all times. In Boston Harbor the primary channels are: (16) International distress, safety and hailing, (09) Alternate hailing, and (13) Internship navigation, draw bridges, and locks.

e4 coordinates survey operations with the property owners and operators in the vicinity of survey operations. e4 maintains safe distances from all vessel traffic. If the survey would impede commercial navigation, the survey is paused until the survey area is free and clear of traffic. The boat captain often requests a slow bell for surveying operations.

At all times during the survey the captain is in control of the boat and navigation. If navigation is deemed unsuitable for surveying it is the captain's responsibility to stop surveying. At all times the captain is in control of the ship. It is the responsibility of all hands on deck to provide extra eyes, alerting the captain to any hazards that the captain may or may not see.

During e4 surveys, employees always work in teams. The buddy system assures that there are always built in safety checks in the survey procedure.

If an accident were to occur

If an injury or emergency requiring medical assistance occurs then a member of the field crew will call 911. Then, e4 will call the EMS listed in Appendix II of this document (pg 25).

The greatest risks conducting marine borings are person overboard, slip, trip and fall hazards, and struck / caught in-between hazards.

4. Accident and injury prevention

e4 shall furnish to each of its employees, employment and a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees. Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued which are applicable to his own actions and conduct.

During coring and boring operations, e4 may encounter sediments containing amounts of hydrocarbons and heavy metals. Section 9 covers the procedures required for safe coring and handling of materials from cores and borings.

Dress Code

There is no formal dress code for e4 employees. All employees must, however, wear clothes suitable for the jobs being performed. Employees will be fully briefed by the Safety Officer before the start of a job regarding the project specific dress code. For drilling tasks long pants, and slip and crush resistant boots are required. Loose clothing that pose entanglement hazards with spinning and moving machine parts is prohibited.

Footwear

The most important protection is to wear the proper footwear for your work and environment. The shoes or boots should provide three major types of protection.

- The soles and heels should be slip-resistant
- The toe of the shoe should resist crushing injuries
- The shoe should support the ankle

The American National Standards Institute (ANSI) sets standards for shoes and boots. Chevron or cleat-designed soles are definitely the best for slippery situations because of the suction or squeezing action they provide. The softer soles are better for slippery hard flooring conditions; the harder, more rugged cleat-type sole is preferred for tough outdoor use. Leather covering the foot and ankle portion of the foot is preferred in most work environments. However, when working in wet environments or around chemicals, oils, greases or pesticides, boots made of polyvinyl chloride (PVC), a blend of PVC and polyurethane, or neoprene should be used.

Personal Protective Equipment

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

Where employees provide their own protective equipment, e4 shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

All personal protective equipment shall be of safe design and construction for the work to be performed.

e4 shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, e4 shall:

- Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment;

- Communicate selection decisions to each affected employee; and select PPE that properly fits each affected employee.
- e4 shall verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and which identifies the document as a certification of hazard assessment.
- Defective or damaged personal protective equipment shall not be used.

e4 shall provide training to each employee who is required by this section to use PPE. Each such employee shall be trained to know at least the following:

- When PPE is necessary;
- What PPE is necessary;
- How to properly don, doff, adjust, and wear PPE;
- The limitations of the PPE; and,
- The proper care, maintenance, useful life and disposal of the PPE.

Each affected employee shall demonstrate an understanding of the training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.

When e4 has reason to believe that any affected employee who has already been trained does not have the understanding and skill required, Earthworks shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete; or
- Changes in the types of PPE to be used render previous training obsolete; or
- Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

e4 shall verify that each affected employee has received and understood the required training through a written certification that contains the name of each employee trained, the date(s) of training, and that identifies the subject of the certification.

Eye and Face Protection

e4 shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

e4 shall ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) meeting the pertinent requirements of this section are acceptable.

e4 shall ensure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards wears eye protection that incorporates the prescription in its design, or wears eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

Hand Protection

e4 shall select and require employees to use appropriate hand protection when employees hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature

extremes.

e4 shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

Foot Protection

e4 shall ensure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards.

Head Protection

e4 shall ensure that each affected employee wears a protective helmet when working in areas where there is a potential for injury to the head from falling objects.

First Aid

All e4 employees have completed Red Cross CPR and First Aid training. First aid supplies are readily available at all times within the work area. When larger operations or multiple operations are being conducted at the same location, e4 will determine the need for additional first aid kits at the worksite, additional types of first aid equipment and supplies and additional quantities and types of supplies and equipment in the first aid kits.

Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

A first-aid kit and an eye wash station will be located on the marine platform in close proximity to the mobile drill rig.

Handling Materials

Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard. Permanent aisles and passageways shall be appropriately marked. e4 does not operate any heavy equipment.

Storage of material shall not create a hazard. Bags, containers, bundles, etc., stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse. Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage.

5. Hazards

A hazard is the potential for harm. In practical terms, a hazard often is associated with a condition or activity that, if left uncontrolled, can result in an injury or illness. Identifying hazards and eliminating or controlling them as early as possible will help prevent injuries and illnesses.

HAZARD COMMUNICATION PROGRAM

Introduction

It is the intention of e4 to comply fully in a prudent manner with all occupational safety and health standards/regulations.

This program has been established to provide guidelines for all employees, and for e4 to meet the requirements of the Hazard Communication Standard. The program applies to any hazardous chemical(s), which is known to be present on the premises, that employees may be exposed under normal conditions of use or in a foreseeable emergency. This written Hazard Communication Program will be available to all employees for review at all times.

Hazardous Chemicals List

e4 has established and will maintain a list of all the hazardous chemicals used on the premises. Matthew Art, Safety Officer will be made responsible for the maintenance of this list. During drilling in Boston Harbor Material Safety Data Sheets will be maintain on the liftboat for the chemicals being used for drilling and the liftboat including diesel, gas, lubricants.

Labeling of Hazardous Chemicals

Each container containing a hazardous chemical will be labeled with the identity and the appropriate hazard warning of the contents. In addition, those containers containing hazardous chemical(s) when received from a supplier or shipped to a customer will also have the name and address of the manufacturer or the responsible party. It is the responsibility of Matthew Art, Safety Officer to assure that the identity and the hazard warnings are placed on all containers that have been transferred from the original drum or container. Also, it is the responsibility of Matthew Art, Safety Officer to assure that the identity, the hazard warnings, and the name and address of the supplier are on the received/shipped container(s).

Material Safety Data Sheets (MSDS)

This MSDS file will contain an MSDS for every hazardous chemical used on the premises. These sheets will be available to employees at all times.

Information & Training

It is the policy of e4 to provide an information and training program to all employees with the implementation of this program, at the time of a new employee's initial assignment, and whenever a new hazard is introduced into the working place.
This information and training program will include:

- Any operation in employees' work areas where hazardous chemicals are present.
- Location and availability of the written hazard communication program, the list of hazardous chemicals and material safety data sheets.
- Means of detecting the presence or release of hazardous chemicals in the work area.
- Physical and health hazards of the chemicals in the area.
- Measures employees can take to protect themselves from these hazards.

- Explanation of the labeling system and the material safety data sheet.
- Emergency procedures.
- Details of the written hazard communication program developed by e4. It will be the responsibility of the Safety Officer, Matthew Art, to implement and maintain the information and training program.

Contractor Work

When it is necessary for an outside contractor to perform work at e4, it shall be the responsibility of Safety Officer, Matthew Art, to inform the contractor of the identity of any hazardous chemicals to which the contractor may be exposed. The procedure for informing the contractor will include the following:

- Making the hazardous chemicals inventory of any designated work area where contract work is being performed available to the contractor and advising the contractor of the labeling system.
- Making the MSDS's of the identified hazardous chemicals in a designated work area available to the contractor.
- Making the contractor aware of the appropriate protective measures taken by e4 employees in a designated work area. It is also the responsibility of Matthew Art, Safety Officer to determine if the contractor will be using any hazardous chemicals and, if so, to take appropriate actions to assure the protection of e4 employees.

Hazard of Non-routine Tasks

Prior to starting work on hazardous non-routine tasks, every affected employee will be given information by Safety Officer, Matthew Art, about the hazardous chemical(s) to which they may be exposed. Such information will include, but not be limited to specific hazards associated with the chemical(s), protective measures (i.e. personal protective equipment, work practices, engineering controls etc.) and emergency procedures.

6. Spill Prevention, Control, and Countermeasure

e4 only uses oil for motive power, and in small generators. e4 therefore is not legally bound to have a certified SPCC plan. However, e4 prevention, control, and counter measures are as follows:

Discharge Prevention and Control

- Fuel Transfer – All fuel transfer is limited to 2 gal per occurrence. All engines must be turned off and cooled before refueling.
    - Can-to-can transfer – Transferor must use a funnel, and have absorptive pad nearby in case of spillage. All can-to-can fuel transfer must take place in a containment tub. Transfer may not be attempted while the vessel is in motion.
    - Can-to-generator transfer – Transferor must use a funnel and have absorptive pads in place to absorb any spilled petroleum. Transfer may not be attempted while the vessel is in motion.
- Fuel Storage – All gas cans on board a vessel are limited to 5 gallons, or less. All gas cans are stored in a containment tub. The quantity of gas can contained fuel allowed on board a vessel is 20 gal.

Spill Remediation

- Cleanup – All spills must be absorbed into pads. Used pads are stored in watertight and airtight containers until properly disposed of. Any oil residue must be coated with absorptive material and swept into a water and airtight container. All surfaces are cleaned
- If spill overflows into water contact Coast Guard via marine channel 16.

7. Slip, Trip, and Fall

e4 approaches this subject by identifying and understanding how trip, slip, and fall accidents happen. We then minimize and eliminate slip, trip, and falling hazards.

Once per month, the Earthworks safety officer will inspect the safety of all operations.

Identifying Slip and Trip Hazards

Slips

Slips happen where there is too little friction or traction between the footwear and the walking surface. Common causes of slips are:

- wet or oily surfaces
- occasional spills
- weather hazards,
- loose, unanchored rugs or mats, and
- flooring or other walking surfaces that do not have same degree of traction in all areas.

Trips

Trips happen when your foot collides (strikes, hits) an object causing you to lose balance and, eventually fall. Common causes of tripping are:

- obstructed view
- poor lighting
- clutter in your way
- wrinkled carpeting
- uncovered cables
- bottom drawers not being closed
- uneven (steps, thresholds) walking surfaces.

Preventing slips, trips, and falls

Both slips and trips result from some kind of unintended or unexpected change in the contact between the feet and the ground or walking surface. Good housekeeping, quality of walking surfaces (flooring), selection of proper footwear, and appropriate pace of walking are critical for preventing fall accidents.

Good Housekeeping

Good housekeeping is the first and the most important (fundamental) level of preventing falls due to slips and trips. E4 takes the following measures to prevent falling hazards:

- Cleaning all spills immediately
- Marking spills and wet areas
- Mopping or sweeping debris from floors
- Removing obstacles from walkways and always keeping them free of clutter
- Securing (tacking, taping, etc.) mats, rugs and carpets that do not lay flat,
- Covering cables that cross walkways,
- Keeping working areas and walkways well lit,
- Replacing used light bulbs and faulty switches.
- Railings, guardrails or barriers will be in place around areas that present a fall hazard.

Good housekeeping practices, and preventive measures such as installation of sophisticated flooring, specialty footwear, and training on techniques of walking and safe falling effectively reduce the risk of injury in the workplace.

Footwear

In workplaces where floors may be oily or wet or where workers spend considerable time outdoors, prevention of fall accidents focuses on selecting proper footwear. Properly fitting footwear increases comfort and prevents fatigue that, in turn, improves safety for the employee.

Employee Responsibility

It is important to remember that safety is everybody business. It is e4's responsibility to provide safe work environment for all employees. It is the responsibility of e4 employees to act in the following manner to prevent slips, trips, and falls:

- Take your time and pay attention to where you are going.
- Adjust your stride to a pace that is suitable for the walking surface and the tasks you are doing.
- Walk with the feet pointed slightly outward.
- Make wide turns at corners.
- Change direction slowly
- Always using installed light sources that provide sufficient light for your tasks.
- Use a flashlight if you enter a dark room where there is no light.
- Ensure that things you are carrying or pushing do not prevent you from seeing any obstructions, spills, etc.
- Wear appropriate footwear with surface specific traction and job specific protection.

Identifying Elevated Falls

Generally, elevated falls are less frequent but more severe than same-level falls in the workplace. Elevated falls are falls from ladders, falls from vehicles and equipment, falls from loading docks, buildings and other structures. Railings or barriers will surround areas of the marine plant that present fall hazards.

Falls from Ladders

Ladders may be fixed or portable. They may be straight-, extension-, or stepladders and may be manufactured from wood, metal, plastic, or fiberglass. They can be light-, medium-, heavy-, or extra-heavy-duty. They can be two feet high (step-stools), 18 feet for extra-heavy-duty step-ladders, and 40 feet or longer for extension-type ladders.

The materials from which ladders are constructed have advantages and disadvantages in weight, durability, flexibility, conductivity, and strength. The intended use of the ladder should determine the type purchased, and only American National Standards Institute (ANSI) approved ladders shall be used. One major caution is that metal ladders should never be used in locations in which the ladder or its user could come into contact with electricity.

A ladder should be long enough so that when it rests against the upper support the user can work with waist no higher than the top rung of the ladder or above the rung at which the side-rails are resting against the upper support. This means that the top three rungs of a straight ladder or the top two steps of a stepladder should never be used for the feet.

The lower ends of the side rails should be equipped with slip-resistant pads, particularly if the ladder is to be used on hard surfaces. The same is true for the upper ends of the side rails if they are to rest against a surface.

Ladders should be set at, or as near to, a 4:1 angle as possible. That is, for each three or four feet of rise from the base to the upper resting edge of the ladder, the base should be one foot out from a vertical line from the upper resting edge of the ladder to the working surface. As an example, if a ladder is leaning against a ledge 20 feet off the ground, the base of the ladder should be five feet back from the wall. The base of the ladder must be firmly set so that there is no possibility of slippage or settling into soft ground. The resting edge of the ladder should have both side rails in contact with the structure it is against.

Ladders should be inspected before use: check for cracks, loose rungs, slivers, and sharp edges. Never paint ladders, as the paint can hide potentially dangerous conditions. Wooden ladders can be coated with linseed oil or an oil-based wood preservative to keep them from drying out and cracking. Allow ladders to dry thoroughly before using them or the rungs will be slippery.

The rungs and side rails of ladders must be kept free of oil, grease, and mud; they should be kept dry. Since the shoe has limited contact with the rung or step of a ladder, it is very important that both rungs and shoes have a high coefficient of friction (COF). Only shoes with heels should be worn when climbing ladders; users should be taught that the rung or step of the ladder should be just in front of the heel, under the arch of the foot. Stepping or standing on a ladder with the front part of the shoe is inviting a slip and fall. Always face the ladder when climbing or descending.

Another frequent cause of ladder-related injuries is attempting to reach too far left or right. When working on a ladder, the person's belt buckle should never extend beyond the side rails. Reaching further can cause the ladder to slide in the opposite direction. Tying the ladder to the structure supporting it can prevent this and is a recommended practice.

Workers should have both hands free to hold the ladder's side rails, not the rungs, when climbing or descending. Small tools may be carried in a tool belt, not in the hands; but a better choice is to raise tools and supplies with a rope. Never raise or lower power tools by the cord or while they are plugged into an electrical source.

Makeshift ladders, chairs, boxes, and barrels should never be used as substitutes for a ladder -- the risk is far too great.

Falls from Vehicles and Equipment

Whenever mounting or climbing on a vehicle or machine or vessel, have a good handhold before stepping up. Pulling yourself up reduces the force between your shoe and the step and reduces the danger of a slip. As with a ladder, the foot should be placed on the step or rung just in front of your heel, under the arch. Always face the vehicle or equipment when mounting and dismounting. When stepping down backward, step down on the ball of the foot; when stepping down forward, one lands on the heel, thus increasing the chances of falling, twisting an ankle or knee or suffering some other injury.

Practice the "Three-Point System." This system can significantly reduce the chances of injuring yourself through a slip or fall while climbing ladders or while entering or exiting a vehicle. The Three-Point System means that three of your four limbs are in contact with the ladder or vehicle at all times, either one hand and two feet, or two hands and one foot -- only one limb is in motion

at any one time.

Falls from Loading Docks

Loading docks and ramps are dangerous areas. They are frequently congested, heavy-traffic areas, and working and walking surfaces are often wet. Metal dock plates can wear smooth and become very slippery; in particular, the edge of a dock plate invites trips and falls.

Accidental backward steps can result in a fall from the dock. Portable railings, which can be easily removed from the edge of the dock, could prevent many dangerous falls. They are removed when a truck or tractor is at the dock, and replaced as soon as the truck or trailer leaves.

Proper housekeeping, well-designed traffic patterns and the use of abrasive, skid-resistant surface coatings will reduce the risk of slips, trips and falls.

Ramps and gangplanks have hazards similar to loading docks. The slopes should be as gradual as possible, as wide as possible, and as dry as possible. They should also have skid-resistant surfaces.

Falls on Stairs

Stairwells should be well lit, with sturdy handrails on both sides. Persons using the stairwell should have one hand free to be able to use the handrail.

All the steps should have the same rise and depth, with visible edges. They must be kept free of grease, oil, and obstacles that could cause slips and trips. Whenever possible, avoid carrying heavy or bulky objects which obscure your vision and/or require the use of both hands. Carry smaller, lighter loads and make more trips, or obtain help with the load.

Fall Protective Devices

Workers at high elevations, such as on ladders, platforms, or catwalks, should be protected from falling by some kind of fall protective device. This can be a protective cage, a lifeline, lanyard, safety belt or harness; there are numerous devices on the market. The system should provide maximum protection, but it also should be reasonably comfortable and not restrict a worker's necessary work activity. Suppliers of safety equipment can provide information on the correct system for your workplace and should provide instruction on its safe use.

Signs and Stripping

Safety signs to remind people of slip, trip and fall hazards are certainly always helpful, particularly where hazards cannot be removed or corrected. Such signs should be changed frequently.

Yellow stripping to identify walking and working areas are most effective if their meaning is enforced. Striped areas should mean that no object should be placed in these areas. Dropped and spilled materials should be removed immediately.

Learning How to Fall

Naturally, the goal is not to slip, trip, and fall; however, the possibility of a fall still exists. There are correct ways to fall, however, the recommended procedures are:

- Tuck your chin in, turn your head, and throw an arm up. It is better-to land on your

arm than on your head.

- While falling, twist or roll your body to the side. It is better to land on your buttocks and side than on your back.
- Keep your wrists, elbows and knees bent. Do not try to break the fall with your hands or elbows. When falling, the objective is to have as many square inches of your body contact the surface as possible, thus, spreading out the impact of the fall.

8. On Water Safety

United States Coast Guard (USCG) requirements

All vessels that e4 employees work on comply with all USCG requirements. Each employee shall be trained and licensed for safe boating. The captain alerts USCG VTS of all operations prior to leaving the dock for survey operations. The vessel remains in radio contact until it returns to the dock or checks-out of USCG VTS jurisdiction. All hands outside of the cabin will don Type I or Type III PFD's. If harnesses are deemed necessary by the captain or safety officer, they must be worn.

Rules of the waterways

All e4 employees have been certified in watercraft safety and the rules of navigation.

Impedances to vessel navigation

Navigation safety is the foremost concern when surveying. If there are any visible, or known submerged navigational hazard, the survey path will move to avoid any hazard. It is the responsibility of all hands on deck to provide extra eyes for identifying any hazards that the captain may or may not see.

Man overboard

A man overboard is one of the most serious safety concerns when working on the water. Best safety practices will be followed to reduce the chances of having a person overboard. Railings or barriers will surround areas of the marine plant that present fall hazards. Each person will be assigned a buddy to keep track of each other's whereabouts when on the marine plant or vessel. All personnel outside of the cabin will wear Type I or Type III PFD's. A life ring and life line will be kept on the vessels and the marine plant in close reach to the work area.

In the event of a person overboard the following procedures will be followed. The person first to see the person over board will yell "man overboard" and point to the man overboard. That person's job will be to keep visual contact of the person overboard. A flotation device will be thrown toward the person overboard.

If underway the captain will mark the GPS position. Floatable objects will be tossed over to mark a trail to the first sighting and to give an indication to how the currents are moving. The vessel will be slowed down and carefully turned and then will proceed to the person in the water. If at all possible the vessel will approach the person in the water from downwind and/or down current so that the wind and/or current will move the person toward the vessel.

Upon reaching the person the captain will kill the engines. Retrieve the person from the lowest point of the vessel.

9. Geophysical Measurements & Coring

Safety Survey

Prior to any coring, drilling, or any other measurement in which contact is made with the subsurface, e4 conducts a safety survey to check for cables, pipelines, or any other hazards to subsurface investigation. Prior to any coring, drilling, or sampling e4 notifies utility companies via the appropriate "one-call" agency.

Electricity and water

All conductive instruments and equipment used on board vessels is grounded in the water via a ground rod or other suitable grounding device.

Towing Equipment

Equipment towed from the survey vessel is both the responsibility of the equipment operator and the survey captain. The survey captain is responsible for traffic and navigation. The equipment operator is responsible for the equipment and the interaction with the physical environment. The depth at which equipment is towed depends on the function of the instrument. Safety is always the determining factor for selecting appropriate tow depth.

Towed equipment includes, but is not limited to:

- Sub-bottom profiler
- Side scan sonar
- Magnetometer
- Boomer seismic source
- Air gun seismic source
- Resistivity
- Seismic streamer

Mounted Equipment

e4 side scan sonar is primarily used in a fixed position on the bow of a vessel. The depth at which the instrument is mounted is water-depth dependent. The determination of depth is a function of bathymetry, water depth, and range (area) of survey line. We always err on the side of safety, we do not put our equipment or personnel in harms way.

Pneumatic Source

Pressurized nitrogen is used for the pneumatic source because it is an inert gas. All couplings, lines, and hoses for gas lines are inspected prior to connection. All pressure is released prior to disconnection. The air gun is only fired when it is in the water and a safe distance from personnel and other equipment.

Working around oil and gas

Surveys near any petroleum storage facility are conducted using the regulations and guidelines of the facility.

Drilling and Coring

All coring will take place using appropriate levels of PPE. If it is reasonably assumed that there is any contamination of sediment then the following actions will be taken. Hand, face, and eye protection will be worn commensurate with the level of contamination expected in the sediment. MSDS of suspected contaminants are consulted, studied, and regulations are followed.

A safety survey must be conducted before any coring. Additionally, a reasonable historical analysis including "one-call" procedures must be conducted to identify fiber optic cables as well as pipelines and electrical cables.

Cables and Pipelines

All cables and pipelines are to be treated as if they are active. No coring or drilling will be attempted within 50 feet of any cables or pipelines.

9. Transit safety

e4 limits the number of cars on the road to the absolute minimum. All drivers shall take a defensive driving course every three years.

10. Training and Safety Education

Employee training is required prior to any operation of equipment or fieldwork. Training is integrated within the education of new employees, and new methods or procedures for making geophysical measurements. Both training and education are core e4 principles (see HASP Appendix I).

HASP Appendix I – e4sciences Principles

e4sciences

Science in service to engineering
Measure twice, cut once
Preparation and honor

Spirit

Client success
Client value
Client centric
Safety first
Minimize client risk
Lump sum, fixed price
Spirit of scope of work
First class service
Best in class
Exceed expectations

Principles of operations

"If anything can go wrong, it will." – Edward A. Murphy

1. Be prepared
2. Safety first and always
3. Perfect good habits
4. Do not procrastinate
5. Results are always the central issue
6. Automate QA/QC, maintain efficiency
7. Checklists for equipment, procedures, & data
8. Mistakes will happen; scientists are human
9. Machines break down
10. Redundancy anticipates unexpected
11. Prevent and remediate mistakes in real time
12. Learn from mistakes, prepare for next time
13. Quantify precision with repeatability
14. Command files for data entry
15. Record navigation with command files
16. Duplicate data on separate media
17. Archive final data and results
18. Clean always

"By doubting, we come to inquire and by inquiry we arrive at the truth." – Peter Abelard

19. Vigorously debate the alternatives to find the best path to results
20. Internal education, evaluation, and communication must be continual

"Confront the brutal facts of your current reality, and retain unwavering faith that you will prevail in the end." – The Stockdale Paradox

21. When preparation is complete, do it
22. Be persistent

Internal self-consistency (precision) is secondary to correlation of independent data (accuracy).

23. Tie into benchmarks
24. Borings must be absolutely honored
25. Map all results
26. Stay close to data
27. Each step must be checked independently
28. If you can, make redundant measurements
29. Re-evaluate assumptions in hindsight

The objective is to deliver valuable and self-evident products to our client on time and for a fixed price.

30. Timeliness
31. Focus, avoid distractions
32. Processing and interpretation require some care, preparation, and dedication as the fieldwork
33. Science is the discipline, service is the product
34. Teamwork requires sublimation of eccentricities
35. Communicate daily

Implement new methods if and only if the new technique performs equivalently or better than the existing standard practice.

36. Standard practice based on repetition
37. Careful implementation
38. Rely on good habits
39. Adaptations must be conservative
40. Resist impulsive change

It is never about you.

“Serious presentations rise and fall on the quality, relevance, and integrity of the content.” – Edward Tufte

Simplify.

41. Reduce the clients risk
42. Visualize your client’s success and yours will follow
43. Reduce client safety factor
44. Stay in touch
45. Communicate consistently in short bursts
46. Make a project easy and pleasurable for the client
47. Little considerations make a big difference
48. No detail is too small to consider
49. Do not burden client with unnecessary detail
50. Clean design and appearance imply value
51. Design expresses function and efficiency
52. Simplicity speaks for itself
53. Representations must be self evident

54. Design should reflect the natural system
55. Beauty always has value
56. Understate the content
57. Always surprise in some way

HASP Appendix II - Emergency procedures

In the case of any serious or life threatening accident or injury requiring medical attention the USCG and Harbor Masters will be notified via VHF marine channel 16 (Emergency / Hailing).

In the case of minor injury, victims will be transported to the nearest safe harbor. Emergency responders will be notified with an address or nearest intersection to meet the victim for transport to the closest medical facility. USCG will be notified as appropriate.

Safe Harbor Location 1

USCG
427 Commercial Street
Boston, MA 02109
(617) 223-3212

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from USCG

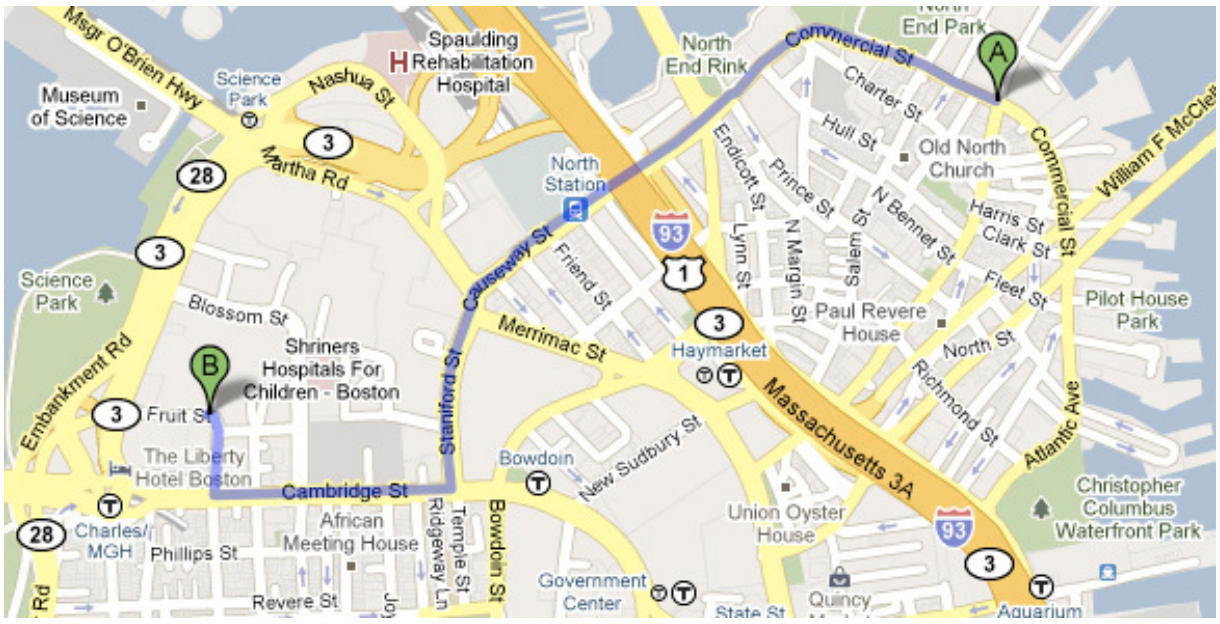
1.2 miles

Estimated transport time from USCG

3 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



Safe Harbor Location 2

Time and Tide mooring site

Constitution Marina
28 Constitution Rd
Boston, MA 02129
(617) 241-9640

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from mooring site

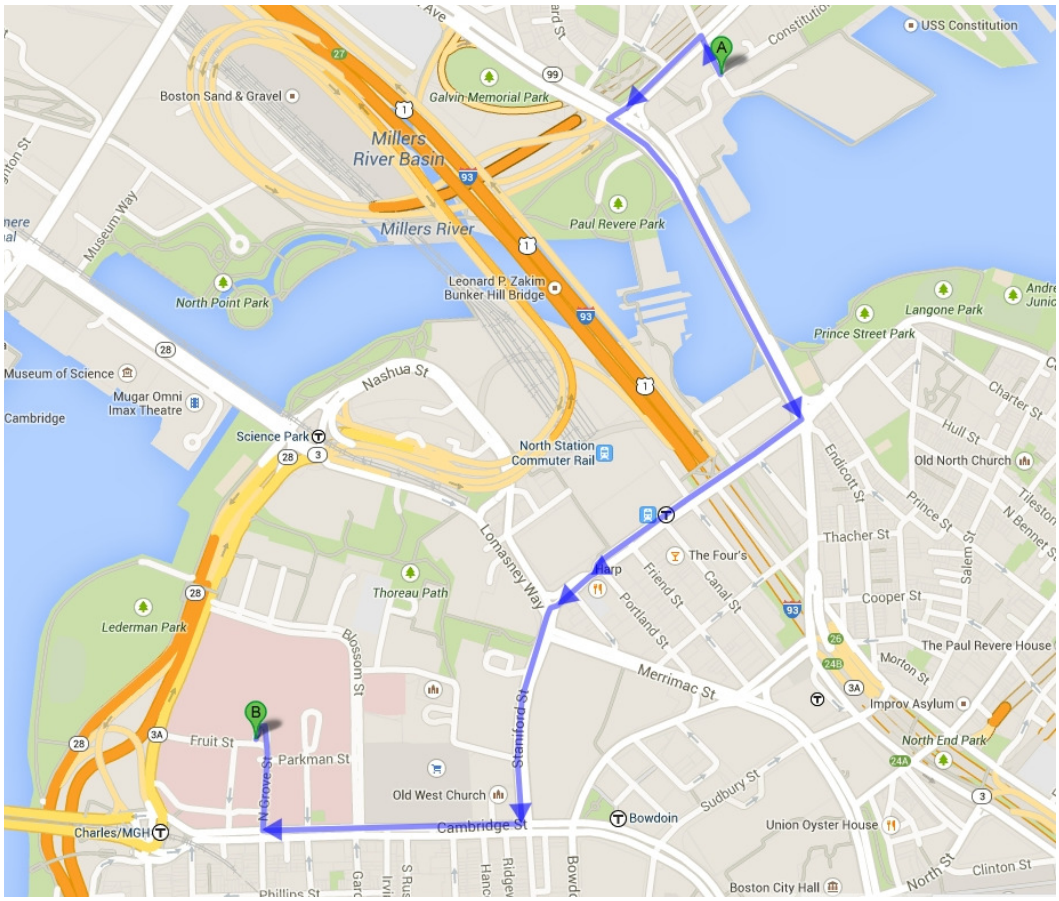
1.4 miles

Estimated transport time from mooring site

5 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



Safe Harbor Location 3

Liftboat mooring site

Boston Harbor Ship Yard and Marina
256 Marginal St,
Boston, MA 02128
(617) 561-1400

Nearest hospital

Massachusetts General Hospital
55 Fruit Street
Boston, MA 02113

Hospital distance from USCG

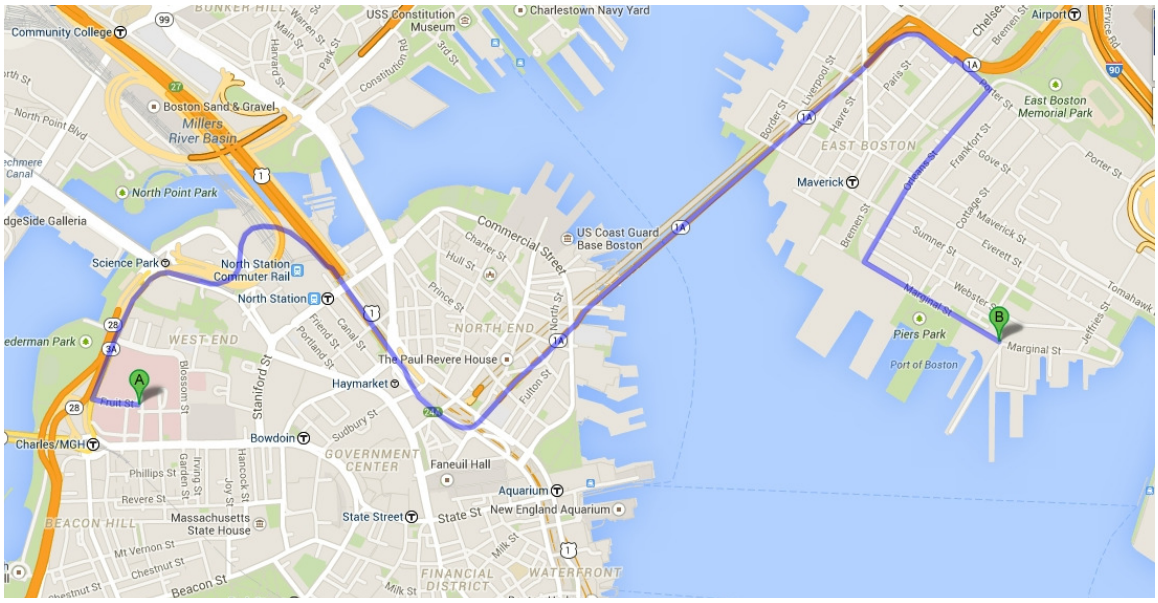
3.6 miles

Estimated transport time from USCG

9 minutes

Emergency response

911 & Coast Guard via VHF marine channel 16



HASP Appendix III – Safety accountability project review form

3. Specifications
   Was the project completed on time?

   _____

   Were there any problems?

   _____

   Were there any equipment failures?

   _____

   Were there any job failures?

   _____

   Were there any accidents?

   _____

   Were there any injuries?

   _____

2. Accident and job failure details
   If there were any accidents please provide a detailed account below.

   _____

   _____

   _____

   If there were any job failures please provide a detailed account below.

   _____

   _____

   If there were any injuries please provide a detailed account below.

   _____

   _____

3. Prevention from future failure / accidents including root-cause.
   In the space below, please provide the root cause of the failure / accidents and steps to prevent future failures / accidents.

   _____

   _____

   _____

HASP Appendix IV – Accident Investigation Procedure Form

Instructions for the Incident/Accident Investigation Form

Purpose of Form: Effective loss control efforts require documentation of incidents and accidents to determine hazards or problem areas, procedures, or systems and to perform trending. Thorough investigation is required to determine the facts surrounding events so that remedial action can be taken, if required. This form provides an outline of needed information. The document becomes a legal accounting of the facts surrounding the incident/accident.

A. Employee Data

Complete the top of the form with the identifying information and the date and time of the incident/accident. If a claim has been filed, complete the space for the claim number.

B. Incident Description

Attachment 1 contains benchmarked accident investigation procedures. Sufficient action is necessary to ensure that all facts surrounding the incident/accident are obtained so that effective loss control procedures can be established to protect against future incidents/accidents occurring. The form is developed to capture this information and to help the accident investigator come to reasonable conclusions concerning the events.

1. Where did the incident happen? – Go to the scene. Provide a visual image of the location of the incident. The reader should be able to visualize the area and the surrounding environment.
2. What was happening at the time of the incident? – Document the sequence of events leading up to the incident/accident. Include names of people interviewed and activities surrounding the event.
3. Describe any injury incurred, body parts and kind/s of injury/ies. – Thorough interview with the affected employee, determine what kinds of injuries were sustained and what body parts were involved.
4. What exactly caused the physical injury, or if an injury was avoided, what could have caused an injury? – What were the mechanics that caused the injury or could have caused an injury? Were procedures followed? Are the procedures faulty? Was equipment in good repair? Were there environmental hazards?

C. Investigation Results

5. After review of all facts, what was the hazardous condition, unsafe work practice or other root cause of the incident/ injury?

D. Corrective Action

6. What is recommended to help prevent this type of incident/accident from occurring again? Provide short term and long term corrective actions that will prevent or eliminate the hazardous condition, unsafe work practice, and root causes.

7. Who will be contacted concerning recommended action to ensure follow-up? Completion of this section ensures that the management staff involved knows that action has been taken to remedy the hazardous condition.

A. Employee Data					
Date of incident:			Time:		A.M/P.M.
Employee Name:					
Working Title:			Dept.		
Employee Contact #:	Hm.	.			
	Wk				
Supervisor Contact:					
	Wk				

B. Incident Description

Obtain written and/or recorded statements from injured employee. What happened? What caused the accident? What were the contributing factors? Reconstruct the sequence of events that led to the injury. Attach additional sheets if necessary. This document becomes a legal accounting of the facts surrounding the incident/accident. When documenting the facts, include answers to the following questions:

1. Where did the incident happen? Provide a full description of the surroundings of the location.
2. What was happening at the time of the incident? What were the events leading up to the incident?
3. What exactly caused the physical injury? What were the mechanics involved? Or, if a physical injury was avoided, what could have happened to cause an injury?
4. Describe any injury incurred by the employee, what body part/s and what kind/s of injury/ies. If there are no injuries, so state.

C. Incident Findings
After review of all facts, what was the hazardous condition, unsafe work practice or other root cause of the incident/ injury?
D. Corrective Action
What is recommended to prevent this type of incident/accident from occurring again?
Actions taken to ensure recommendations are considered:
Signature of Accident Investigator **Date** **Time**

Internal Distribution:

Original: e4 Safety Supervisor

Copies: e4 Safety Officer
Employee's Supervisor
Director/Manager of Department or Section

ACCIDENT INVESTIGATION BEST PRACTICES

I. Fact-Finding

1. Emphasis is placed on gathering facts; not to place blame, or determine the cause of accident.
2. Inspect the accident site before any changes occur
3. Preserve essential and critical evidence
4. Take photographs and/or make sketches of the accident scene.
5. Interview the injured employee and witnesses as soon as possible after an accident. Record pre-accident conditions, the accident sequence, and post-accident conditions.
6. Document the location of injured employee, witnesses, machinery, equipment, energy sources, and hazardous materials.
7. Ask *who, what, when, where, why, and how* during interviews.
8. Re-interview injured employee and witnesses to resolve conflicting accounts of the accident.
9. Remain completely objective during interviews and in documentation – no opinions, just the facts.
10. Keep complete and accurate notes.

II. Interviews

1. Get preliminary statements from victims and witnesses as soon as possible.
2. Explain the purpose of the investigation (accident prevention) and put each witness at ease.
3. Let each witness speak freely and take notes without distracting the witness.
4. Record the exact words used by the witness to describe each observation.
5. Be sure that the witness understands each question.
6. Identify the witness completely (name, occupation, years of experience, phone number).
7. Supply each witness with a copy of his or her statement (signed statements are desirable).

III. Accident Reconstruction

1. Develop a sequence of events from the information obtained from the victims and witnesses.
2. Identify hazardous conditions present during the accident.
3. Identify unsafe work practices present during the accident.
4. Identify system issues that caused or contributed to the accident.
5. Determine root causes of the accident.
6. If discrepancies exist, seek assistance from professional accident investigator/reconstructionist.

IV. Investigation Reporting

1. Provide complete, thorough information about the accident (the *who, what, when, and where* data).
2. Describe the accident. Document the sequence of events of the accident. Identify the extent of damage to the employee and/or property.
3. Identify hazardous conditions and/or unsafe work practices for each event of the accident.
4. Identify the root cause of each hazardous condition or unsafe work practice.
5. Provide short-term and long-term corrective actions that prevent or eliminate the identified hazardous conditions, unsafe work practices, and root causes.
6. Describe the corrective actions recommended, the persons who are accountable for each corrective action, and the approximate time frame for correction.

V. Corrective Actions

1. Recommend immediate corrective actions to eliminate or reduce hazardous conditions and/or unsafe work practices.
2. Recommend long-term corrective actions that correct policies, programs, plans, processes, and/or procedures.
3. Recommend engineering controls, administrative controls, and/or personal protective equipment.
4. Estimate the cost to implement each immediate and long-term corrective action.
5. Develop an action plan for each corrective action.
6. Monitor implementation of the action plan to ensure appropriate corrective action is taken.

Appendix D
Activity Hazard Analysis

Activity Hazard Analysis

Principle Steps	Potential Hazards	Recommended Controls
Driving	Weather	• Defensive driving is mandatory in all travel by car or truck • Headlights must always be on for safety.
	Traffic	• Defensive driving is mandatory in all travel by car or truck
	Construction	• Defensive driving is mandatory in all travel by car or truck
Mobilization of Equipment and Supplies on to Marine plant	Slip/Trip/Falls	• Work areas and means of access shall be maintained safe and orderly. • Even terrain will be utilized as unloading areas. • Tripping and poor footing hazards will be repaired as they are discovered or clearly identified.
	Loading Drill Rig on marine plant	• Spotters will be used when backing up trucks and moving equipment. • Loading will be done using an adequate loading ramp. • Drill rig will be centered on the long axis (relative to port / starboard). • Weight capacity of the drilling platform is 100,000#; this limit will not be approached.
	Back Injuries	• Site personnel will be instructed on proper lifting techniques. • Mechanical devices will be utilized to reduce manual handling of materials. • Team lifting will be used if mechanical devices are not available.
	Dropped Objects	• Steel toe boots meeting ANSI Standard Z41 will be worn.
	Struck By/Against	• All machines will be equipped with backup alarms.
Equipment Fueling/Greasing	Fire	• All fuel tank/trucks shall be grounded and bonded during fueling operations. • Smoking and open flames are not permitted within 50 feet of fueling/greasing areas. • All equipment shall be equipped with 10-lb. ABC type fire extinguishers. • 10-lb. ABC type fire extinguishers shall be readily available during fuel/greasing operations. • The fuel tank filler pipe shall be located in such a position, or protected in such a manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.
	Chemical Exposure	• Protective clothing (i.e., chemical gloves and safety glasses) will be worn during fueling operations. • Skin will be rinsed with water if contact with hazardous material occurs.
	Eye Injury	• Safety glasses that meet ANSI Standard Z87 will be worn.

Principle Steps	Potential Hazards	Recommended Controls
Equipment Fueling/Greasing (continued)	Spills	• Spill and absorbent materials will be readily available. • Employees will be instructed as to proper fueling techniques. • Fuel nozzle and hose will be secured in holder after use. • Fuel caps will be secured after fueling operations. • Fuel tanks and equipment will be grounded and bonded during fueling operations.

Crane Operations	Rollovers	• Equipment shall be set-up on stable platform and maintained level.
		• Cribbing will be used when necessary.
		• Outriggers shall be extended per the manufacturer's specification during all rigging operations. If blocking is necessary under outriggers the following requirements will be met:
		  ○ The blocks shall have sufficient strength to prevent crushing, bending, or shear failure.
		  ○ The blocks shall have such thickness, width, and length as to completely support the outrigger pads and prevent shifting, toppling, or excessive settlement under loads.
		  ○ Blocking shall only be used under the outer bearing surface of the extended outrigger beam floats.
		• Equipment shall be equipped with seat belts.

	Back Injuries	• Site personnel will be instructed on proper lifting techniques. • Mechanical devices will be utilized to reduce manual handling of materials.
	Overhead Hazards	• All personnel will wear hard hats meeting ANSI Standard Z89.1. • All fiber/wire ropes, slings, chains will be rated for the load in which it is expected to lift. All lifting devices will be inspected at the beginning of each work shift. If defective items are found, they will be tagged and removed from service. • All marine plant personnel will stay clear of all suspended loads. • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. • All overhead hazards will be identified prior to commencing work operations. • All equipment will stay a minimum of 15 feet from energized electrical lines (50kV). This distance will increase 4.0 inches for each 1kV above 50kV.
	Slip/Trip/Falls	• Work areas and means of access shall be maintained safe and orderly. • Even terrain will be utilized for loading/unloading areas. • Tripping and poor footing hazards will be repaired as they are discovered or clearly identified. • Handholds and steps will be provided for easy access to the car or cab of the crane. • All walking surfaces of the crane shall have anti-skid surfaces.

Principle Steps	Potential Hazards	Recommended Controls
Crane Operations (continued)	Dropped Objects	• Steel toe boots meeting ANSI Standard Z41 will be worn. • Ground personnel will be instructed to stay clear of suspended loads. • Personnel will be instructed on proper rigging procedures.
	Fire	• All equipment shall be equipped with 10-lb. ABC type fire extinguishers. • 10-lb. ABC type fire extinguishers shall be readily available.
	Noise	• All equipment will be equipped with manufacturers required mufflers. • Noise monitoring will be conducted. • Hearing protection will be provided with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs will be worn).
	Flying Objects/Debris	• Safety glasses meeting ANSI Standard Z87 will be worn. • All windows of the crane cab shall be made of safety glass or equivalent.
	Struck By/Against	• Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm. • Accessible areas within the swing radius of the rear of the rotating super-structure of a crane, either permanently or temporarily mounted, shall be barricaded to prevent an employee from being struck or crushed by the crane. • Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded. • Cranes shall be equipped with side mirrors to allow for visibility. • When practical and when their use does not create a hazard, tag lines shall be used to control loads. o Tag lines shall be suitable diameter with the appropriate size and number of hooks attached. o Tag lines shall be used on grid iron main frames at two points to aid in control and direction of suspended loads. • Adequate clearance shall be maintained between moving and rotating structures of fixed objects to allow the passage of employees the crane and without harm. • Accessible areas within the swing radius of the rear of the rotating super-structure of a crane, either permanently or temporarily mounted, shall be barricaded to prevent an employee from being struck or crushed by the crane. • Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded. • Cranes shall be equipped with side mirrors to allow for visibility.

Principle Steps	Potential Hazards	Recommended Controls

Crane Operations (continued)	Struck By/Against (continued)	• When practical and when their use does not create a hazard, tag lines shall be used to control loads.
		  ○ Tag lines shall be suitable diameter with the appropriate size and number of hooks attached.
		  ○ Tag lines shall be used on grid iron main frames at two points to aid in control and direction of suspended loads.
		• Cranes shall not be operated when wind speeds at the top of the crane approach the maximum wind velocity recommendations of the manufacture.
		• Cranes shall not be operated in weather conditions where visibility of the operator is obstructed.
		• Telescopic boom cranes shall be equipped with an anti-two block device to stop the load hoisting function before the load block or load contacts the boom tip and to prevent damage to the hoist rope or other machine components when extending the boom.
		• A boom angle or radius indicator shall be provided within the operator's view.
		• The lift and swing path will be maintained clear of obstructions. Adequate clearnance will be maintained from electrical/overhead hazards.
		• All personnel will maintain a safe distance from the crane swing radius and the counter weight.
		• A stadard signal system will be established. In situations where the operator cannot see the load, audio (radio) communication will be utilized.
		• Proper rigging procedures will be reviewed.
		• The crane will not be left unattended with a load on the crane.

	Overhead Hazards	• All personnel will wear hard hats meeting ANSI Standard Z89.1. • All ropes will be rated for the load in which it is expected to lift. All ropes will be inspected at the beginning of each work shift. • All ground personnel will stay clear of all suspended loads.
Hand Tools (i.e. impact wrench, ratchets, screw drivers, etc.)	Slip/Trip/Falls	• Tools will be kept in storage when not in use. • Work areas and means of access will be maintained safe and orderly. • Other obstructions will be marked, identified or barricaded. • Tripping or poor footing hazards will be repaired as they are discovered or will be clearly identified. • Personnel will clear walkways of equipment and materials.
	Dropped Objects	• Steel toe boots meeting ANSI Standard Z41 will be worn.
	Overhead Hazards	• All personnel are required to wear hardhat meeting ANSI Standard Z89.1.
	Sharp Objects	• Cut resistant work gloves will be worn. • All hand and power tools will be maintained in safe condition. • First aid kits will be available by the work area. • Caps will be placed on the protruding ends of rebar.

Principle Steps	Potential Hazards	Recommended Controls
Hand Tools (continued)	Electrocution	• Ground fault circuit interrupters will be used. • Cords will be kept off of and out of wet areas unless they are approved submersible type. • Cords will be inspected prior to each use for damage. Damaged equipment will be tagged and taken out of service.
	Fire	• Smoking will not be allowed in the work area. • 10-lb. ABC type fire extinguishers shall be readily available.
	Noise	• All equipment will be equipped with manufacturers required mufflers. • Noise monitoring will be conducted. • Hearing protection will be provided which have a noise reduction rating capable of maintaining personal exposure less than 85 dBA (ear muffs or plugs will be worn).
Cutting/Welding and Abrasion of Steel (torches/chop saws/ grinder)	Fire	• 10-lb. ABC type fire extinguisher will be located adjacent to the work area. • Smoking will not be allowed in the work area. • Hot work permits will be required for all cutting, welding, open flame, and flame/spark-producing equipment. • A fire watch will be assigned to watch for dangerous sparks in the areas during hot work operations. • After completion of hot work, the fire watch will be maintained for 30 minutes. • All requirements outlined in EM 385-1-1, Section 10 and 29 CFR 1926 Subpart J will be followed.
	Dermal Burns	• Protective equipment will be worn to prevent burns from hot slag.
	Flying Objects and Debris	• Safety goggles (the appropriate type of eye protection for the task will be chosen) meeting ANSI Standard Z87 will be worn.
	Back Injuries	• Site personnel will be instructed on proper lifting techniques. • Mechanical devices will be utilized to reduce manual material handling. • Team lifting will be utilized in lieu of mechanical devices.
	Inhalation Hazards	• If cutting, welding or grinding metal causing a hazardous atmosphere to occur the appropriate respiratory protection for the operation will be worn.
	Electrocution	• Ground fault circuit interrupters will be used. • Cords will be kept off of and out of wet areas unless they are approved submersible type. • Cords will be inspected prior to each use for damage. Damaged equipment will be tagged and taken out of service.

Principle Steps	Potential Hazards	Recommended Controls
Cutting/welding and Abrasion of Steel (continued)	Overhead Hazards	• All personnel are required to wear hard hats meeting ANSI Standard Z89.1. • All slings, chains and ropes will be rated for the load in which it is expected to lift. • All ground personnel will stay clear of suspended loads.
	Flying Objects/Debris	• All personnel are required to wear safety goggles meeting ANSI Standard Z87. • A portable eye wash station will be located near the work area.
	Sharp Objects	• Cut resistant work gloves will be worn. • Tools will be maintained in safe working condition. • First aid kits will be readily available. • Guards will be kept in place while using tools.
	Slips/Trips/Falls	• Work areas and means of access shall be maintained safe and orderly. • Even terrain will be utilized for equipment use. • Obstructions will be marked, identified or barricaded. • Tripping and poor footing hazards will be repaired as they are discovered or will be clearly identified. • Wet surfaces will be marked and identified.
Locating Marine Plant (Liftboat) on boring locations	Weather	• Marine radio forecasts and warnings will be monitored. • In the case of expected severe weather drilling operations will be postponed, or relocated to protected areas.
	Swells	• If swells are greater than 2 feet no hydraulic operation (raising or lowering) of the Liftboat platform will occur.
	Ship wakes	• Captain will request slow bell for all oncoming traffic
	Rough seas	• If swells are greater than 2 feet no hydraulic operation (raising or lowering) of the Liftboat platform will occur. • Marine radio forecasts and warnings will be monitored.
	Vessel Traffic	• All activity will be coordinated with local operators and mariners. • Captain will request slow bell for all oncoming traffic.
	Man Overboard	• Railings or barriers will surround areas of the marine plant that present fall hazards. • Personnel will wear Type I or Type III PFD's. • A life ring, life line, long boat hook will be kept on marine plant and vessels. • Site personnel will be instructed on man-overboard procedures. • Buddy system will be implemented.

Principle Steps	Potential Hazards	Recommended Controls
Locating Marine Plant (Liftboat) on boring locations (continued)	High winds	• Marine radio forecasts and warnings will be monitored. • In the case of expected severe weather drilling operations will be postponed, or relocated to protected areas.
Marine Plant lift up and down	Swells	• If swells are greater than 2 feet no hydraulic operation (raising or lowering) of the Liftboat platform will occur.
	Ship wakes	• Captain will request slow bell for all oncoming traffic
	Rough seas	• If swells are greater than 2 feet no hydraulic operation (raising or lowering) of the Liftboat platform will occur. • Marine radio forecasts and warnings will be monitored
	Vessel traffic	• All activity will be coordinated with local operators and mariners. • Captain will request slow bell for all oncoming traffic
	Machinery	• Qualified and experienced personnel will conduct operation of machinery. • All non-operational employees must maintain safe distances from mechanical operation.
	Slips, trips and falls	• Work areas and means of access shall be maintained safe and orderly. • Even terrain will be utilized for equipment use. • Obstructions will be marked, identified or barricaded. • Tripping and poor footing hazards will be repaired as they are discovered or will be clearly identified. • Wet surfaces will be marked and identified.
	Ladders	• Proper angling of ladders (4:1). • Proper anchoring of ladders • Three points of attachment to ladders by personnel.
	Fires	• 10-lb. ABC type fire extinguisher will be located adjacent to the work area.
	Fuel spills	• Spill and absorbent materials will be readily available. • Employees will be instructed as to proper fueling techniques. • Fuel nozzle and hose will be secured in holder after use. • Fuel caps will be secured after fueling operations. • Fuel tanks and equipment will be grounded and bonded during fueling operations.
	Cuts	• Sharp objects will be identified and clearly marked • Proper use of PPE is required.

Principle Steps	Potential Hazards	Recommended Controls
Marine Plant lift up and down (Continued)	Pinch points	• Pinch points will be identified and clearly marked. • Proper use of PPE is required.
	Man Overboard	• Railings or barriers will surround areas of the marine plant that present fall hazards. • Personnel will wear Type I or Type III PFD's. • A life ring, life line, long boat hook will be kept on marine plant and vessels. • Site personnel will be instructed on man-overboard procedures. • Buddy system will be implemented.
	High Winds	• Limit elevated drilling equipment.
Drilling	Heavy Rain	• Pause drilling operation
	Lightning	• Pause drilling operation
	Rough seas	• If rough seas affect the stability of the marine plant drilling operation will be paused.
	Overhead objects	• Experienced operators will control suspended loads • Proper use of PPE is required
	Machinery	• Qualified and experienced personnel will conduct operation of machinery. • All non-operational employees must maintain safe distances from mechanical operation.
	Slips, trips and falls	• Work areas and means of access shall be maintained safe and orderly. • Even terrain will be utilized for equipment use. • Obstructions will be marked, identified or barricaded. • Tripping and poor footing hazards will be repaired as they are discovered or will be clearly identified. • Wet surfaces will be marked and identified.
	Fuel spills	• Spill and absorbent materials will be readily available. • Employees will be instructed as to proper fueling techniques. • Fuel nozzle and hose will be secured in holder after use. • Fuel caps will be secured after fueling operations. • Fuel tanks and equipment will be grounded and bonded during fueling operations.
	Cuts	• Sharp objects will be identified and clearly marked • Proper use of PPE is required.
	Pinch points	• Pinch points will be identified and clearly marked. • Proper use of PPE is required.

Principle Steps	Potential Hazards	Recommended Controls
Drilling (continued)	Man Overboard	• Railings or barriers will surround areas of the marine plant that present fall hazards. • Personnel will don Type I or Type III PFD's • A life ring, life line, long boat hook will be kept on marine plant and vessels. • Site personnel will be instructed on man-overboard procedures. • Buddy system.
	Back Injuries	• Site personnel will be instructed on proper lifting techniques. • Mechanical devices will be utilized to reduce manual handling of materials. • Team lifting will be used if mechanical devices are not available.
Demobilization of Equipment and Supplies	Dropped Objects	• Steel toe boots meeting ANSI Standard Z41 will be worn.
	Overhead Hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. • All overhead hazards will be clearly identified. Equipment will maintain a minimum 15-foot clearance from 50kV sources. For lines greater than 50kV a minimum of 15 feet plus 4.0 inches for each 1kV above 50kV will be maintained.
	Eye Injury	• Safety glasses that meet ANSI Standard Z87 will be worn.
	Struck By/Against	• Personnel will understand and review hand signals. • All machines will be equipped with backup alarms.

Equipment To Be Used	Inspection Requirements	Training Requirements
Liftboat	Marine survey prior to use.	Qualified and experienced personnel will operate machinery.
Mobile drill	Initial inspection will be conducted prior to use.	Qualified and experienced personnel will operate machinery.
Liftboat Crane	Initial inspection will be conducted prior to use. Crane Load Test will be performed. Hoisting Certification Record Required. Naval Architectural Analysis for a crane on a floating platform. EM 385-1-1, Section 16.L.02	Ground personnel will be trained on proper crane signals outlined in EM-385-1-1, Figure 8-8. Crane only used when liftboat is jacked up.
Fire Extinguishers	Monthly inspections will be performed.	Personnel will be given instructions on proper use of fire extinguishers.
PPE (steel-toed boots, hard hats, safety glasses, safety goggles, gloves and ear plugs or ear muffs).	An initial inspection of each lot of PPE will be performed.	Personnel will be given training on proper donning and doffing procedures.
First Aid Kits	Daily safety and weekly inspections will be performed.	Personnel with first aid and CPR will be identified. Blood borne pathogen training will be reviewed with CPR and first aid trained employees
Diesel Fuel/Oil and Other Potentially Hazardous Materials	Daily safety inspection of storage and use areas will be conducted.	Hazard communication training will be given.
Spill Control Materials	Daily safety inspections of spill control materials will be conducted.	Personnel will be given training on how to respond to spilled materials.
Chains, Slings or Wire/Fiber Ropes	Inspections prior to each use will be conducted.	Personnel will be trained on proper use of chains, slings and ropes.
Safety Cans	Daily safety inspections of storage and use areas will be performed.	Use and storage procedures will be reviewed.
Hand Tools	Monthly inspections will be performed.	Personnel will be instructed on proper use of hand tools.
Torches/Welders/Grinders	Monthly inspections will be performed.	Proficiency training for users will be given.

Equipment To Be Used	Inspection Requirements	Training Requirements
Electric Tools	Monthly inspections will be performed.	Proficiency training for users will be given.
Chop Saw	Monthly inspections will be performed.	Proficiency training for users will be given
GFCIs	Monthly inspections will be performed.	Personnel will be instructed on proper use of GFCIs.
Extension Cords	Monthly inspections will be performed.	Personnel will be instructed on proper use of extension cords.
Ladders	Monthly inspections will be performed.	Personnel will be instructed on proper use of extension cords.

Appendix E
Quality Control Plan

QA/QC Plan

The importance of the accuracy and completeness of the Boston Harbor ledge characterization cannot be overstated. The QA/QC process is a series of checks and balances that maximize accuracy and completeness of the following:

a) measured and observed data
b) entry of the measured data onto graphic sections and into databases
c) reference frame for the observed data
d) plotting of the data
e) reporting of the data
f) archival of the data

The QA/QC process begins with a series of daily habits and protocols that govern the observation, processing, interpretation, and reporting of data. The Independent Technical Review (ITR) does not replace QA/QC. The ITR is a post-report review that cannot undo inaccuracies and omissions in the observations, measurements, and input of data. The key proposition is that "we all make mistakes all the time and the QA/QC process is there to catch the mistakes before they propagate."

A primary step in all procedures is that multiple sources of data are constantly being combined in a single reference frame. Daniel Rosales will be the quality control officer (QCO). He will continually review the combination of these data.

1. Qualifications and training

All members of the team are qualified geologists, scientists, engineers, drillers, and captains with a minimum of four years experience in description, drilling practice, and/or geo-referenced electronic data gathering. All are familiar with surface and subsurface measurements, safety procedures, teamwork, surveying benchmarks, observing and recording boring data, vertical and horizontal datum, map making, digital photography, event recording, objective description, note taking, and data backups. All personnel have been trained with the following behaviors as requisite:

a) Preparation – review pre-inspection package, review of project documents including the Work Plan, Health and Safety Plan, and QA/QC Plan. Complete and thorough boring inspection and interpretation depends on complete and thorough preparation, context and an understanding of the interrelation of rock properties to field inspection to ensure that nothing is omitted;
b) Historical knowledge – familiarize one's self with historical drawings and other documentation obtained from the USACE; the appropriate maps and Boston Harbor geological references appropriate for respective disciplines;
c) Practice & calibration – members of the e4 team have all worked together on the liftboat. The team will walk through the location procedures to improve coordination and to determine potential difficulties before deployment of the liftboat;
d) Anticipation – foresee difficulties and eliminate surprises before drilling, including preparing a Activity Hazard Analyses;
e) Redundancy – all data, observations, and interpretation must have back-check and backup data;

f) Communications – the protocol for communications and reporting as described in the Scope of Work and the Work Plan will be followed.

2. Benchmarks and hypotheses

Prior to the field inspection, the team will meet, review, and debate the following data: key members of the e4 team will walk through the location procedures to improve coordination and to determine potential difficulties before deployment of the liftboat.

a) Operations and maintenance manuals
b) Aerial photographs and historical drawings
c) Chain of custody for historical document electronic reproduction
d) Coordinate systems and datum
e) Tie-ins to local benchmarks
f) Three-dimensional terrain model of the system
g) Hard copies of data to be used in the field inspection
h) Checklists for each system
i) Checklists for equipment and inspection procedures
j) Data backup and transportation
k) Backup note taking procedures
l) Define naming conventions for all types of recorded data
m) CAD/GIS drawings
n) Experience with the event-based recording

This meeting will prepare the team to cover all of the expected phenomena at the site. The team will try to anticipate the unexpected and criticize the planned procedures in order to eliminate surprise and omissions. Nomenclature and numbering systems will be reviewed. The Team Leader will conduct the meeting, and the Quality Control Officer will observe. This step is important so that the fieldwork will not be repeated. The preparation must be complete.

3. Independent and redundant data in single reference frame

The fundamental practice of the e4 team is to acquire:

a) Redundant data;
b) More data than is defined in scope of work; and,
c) Compile all data; and,
d) Plot data in a single reference frame

All data will be duplicated at the end of every day. The redundant data copies shall be divided up among the crew and transported in separate vehicles.

4. Independent Technical Review

The QCO will review the Draft Report with a technical editor before the report is passed to e4sciences professionals not directly involved in the field work to perform an Independent Technical Review (ITR). The ITR will be performed by Salvatore Triano (PE), Stanley Boc (PG) and Josephine Durand (PhD).

Appendix F
Boring Logs

Field Boring Log

US Army Corps of Engineers®
New England District

FD14-__

e4sciences | Earthworks, LLC

Easting
Northing
NAD83 Massachusetts State Plane feet

North Ship Channel
Boston Harbor

described by

boring completed on

Driller _____

Driller helper _____

Distance from barge floor to water

Starting Water depth Time Tide

Ending Water depth Time Tide

Depth of channel floor
Total depth
Thickness of sediment
Number of core runs
Core type

Notes

Depth below mudline (feet)	Elevation MLLW USACE* (feet)	Unified Soil Classification	Description field description& notes per split spoon or core run	Sample type	Sample interval	Recovery (feet)	Blow counts (blows/6")	Soil sample	Drill rate (minute/feet)	Casing Intervals CoreRQD**	Casing blows Core LCS**	Core FPF**
0			elevation of channel floor =									
1												
2												
3												
4												
5												

* MLLW = Mean Lower Low Water (NAVD88; Tidal epoch 1983-2001)

** RQD = Rock Quality Description; LCS = Longest Core Segment; FPF = Fractures Per Foot

US Army Corps of Engineers®
New England District

continued

FD10-B-R

e4sciences | Earthworks, LLC

Easting
Northing
NAD83 Massachusetts State Plane feet

North Ship Channel
Boston Harbor

described by

boring completed on

Depth below mudline (feet)	Elevation MLLW USACE* (feet)		Unified Soil Classification		Description field description& notes per split spoon or core run	Sample type	Sample interval	Recovery (feet)	Blow counts (blows/6")	Soil sample	Drill rate (minute/feet)	Casing Intervals CoreRQD**	Casing blows Core LCS**	Core FPF**

* MLLW = Mean Lower Low Water (NAVD88; Tidal epoch 1983-2001)

** RQD = Rock Quality Description; LCS = Longest Core Segment; FPF = Fractures Per Foot

Final Boring Log
& Core Image

Boston Harbor Ledge Characterization
USACE Contract number: W 912 DS-09-D-0001, Task Order DB-01

US Army Corps of Engineers®
New England District

e4sciences | Earthworks, LLC

boring FD10-B-R06

Easting 790,745.4'
Northing 2,948,071.6'
NAD83 Massachusetts State Plane feet
*Elevations relative to Mean Lower Low Water (MLLW) NAVD88; Tidal epoch 1983-2001

Main Ship Channel
Boston Harbor

boring completed on June 9, 2010

Channel floor elevation = -39.7' MLLW
Boring bottom elevation = -48.5' MLLW
Total depth below channel floor = 8.8'

Top of all rock elevation = -39.7' MLLW
Rock refusal elevation = -39.9' MLLW
Number of rock core runs = 3

Rock encountered: Cambridge Argillite
Thickness of sediment = 0.0'

drilled by J. I. w/ T. T., CMI Subsurface Investigations, Inc.
drilled from a jack up platform, Nx core, rotary drill, 3" split spoon

described by W.B.Ward w/ R. Nolen-Hoeksema, e4sciences|Earthworks

Key

Sediment/soils: Black silt; Clay; Silt; Sand; Gravel; Sand & gravel; Silt, sand & gravel; Clay & gravel

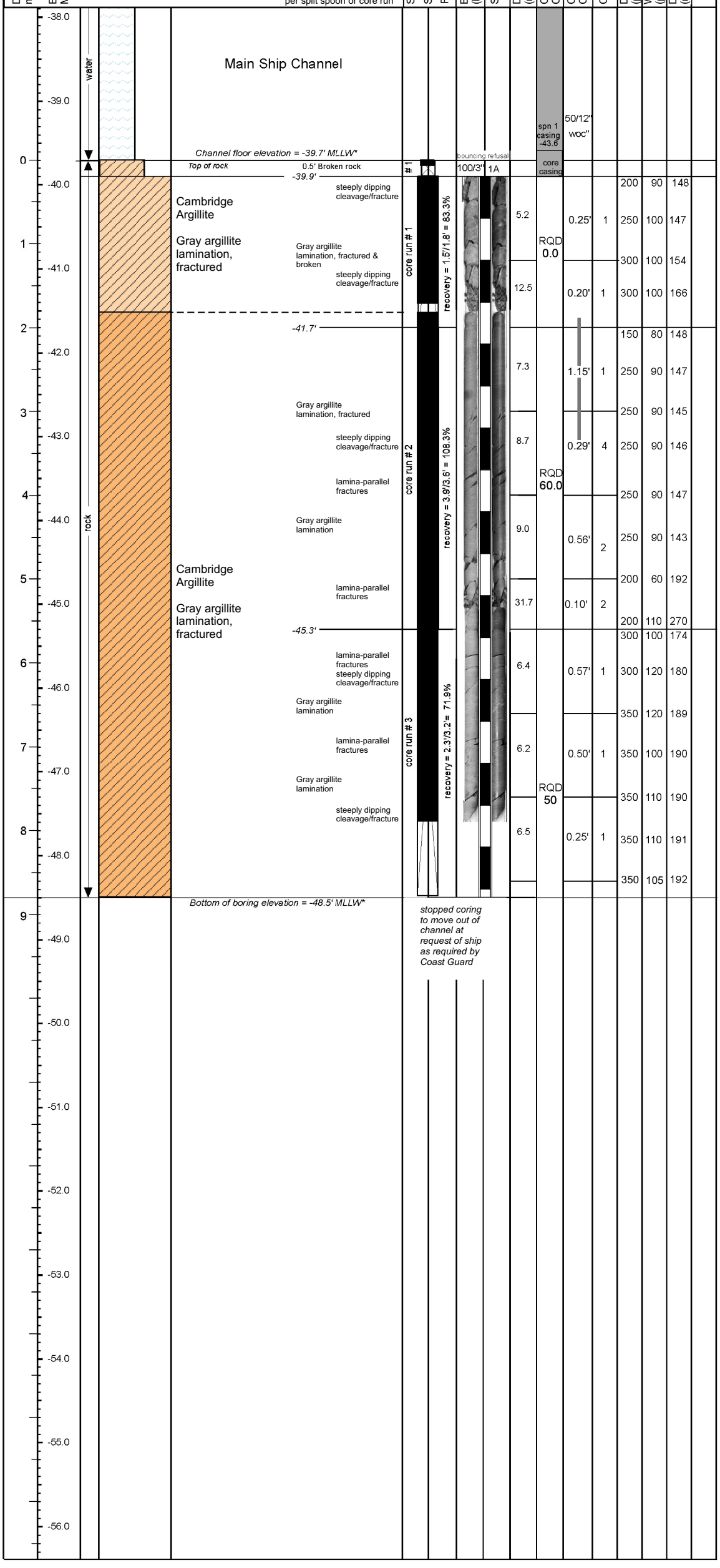
Rock: Mafic igneous rock with RQD < 50; Mafic igneous rock with RQD >50; Hornfels & contact-metmorphic altered argillite with RQD < 50; Hornfels & contact-metmorphic altered argillite RQD >50; Argillite with RQD < 50; Argillite with RQD >50

Geological Formations

Holocene	Black silt, Marine silt, Marine sands, Marine gravels
Pleistocene	Glacial marine clays & silts, Glacial till silt sand & gravels
Jurassic	Mafic igneous dikes & sills
Neoproterzoic to Cambrian	Cambridge Argillite

Blow-count abbreviations
wor = weight of rod
woh = weight of hammer
woc = weight of casing

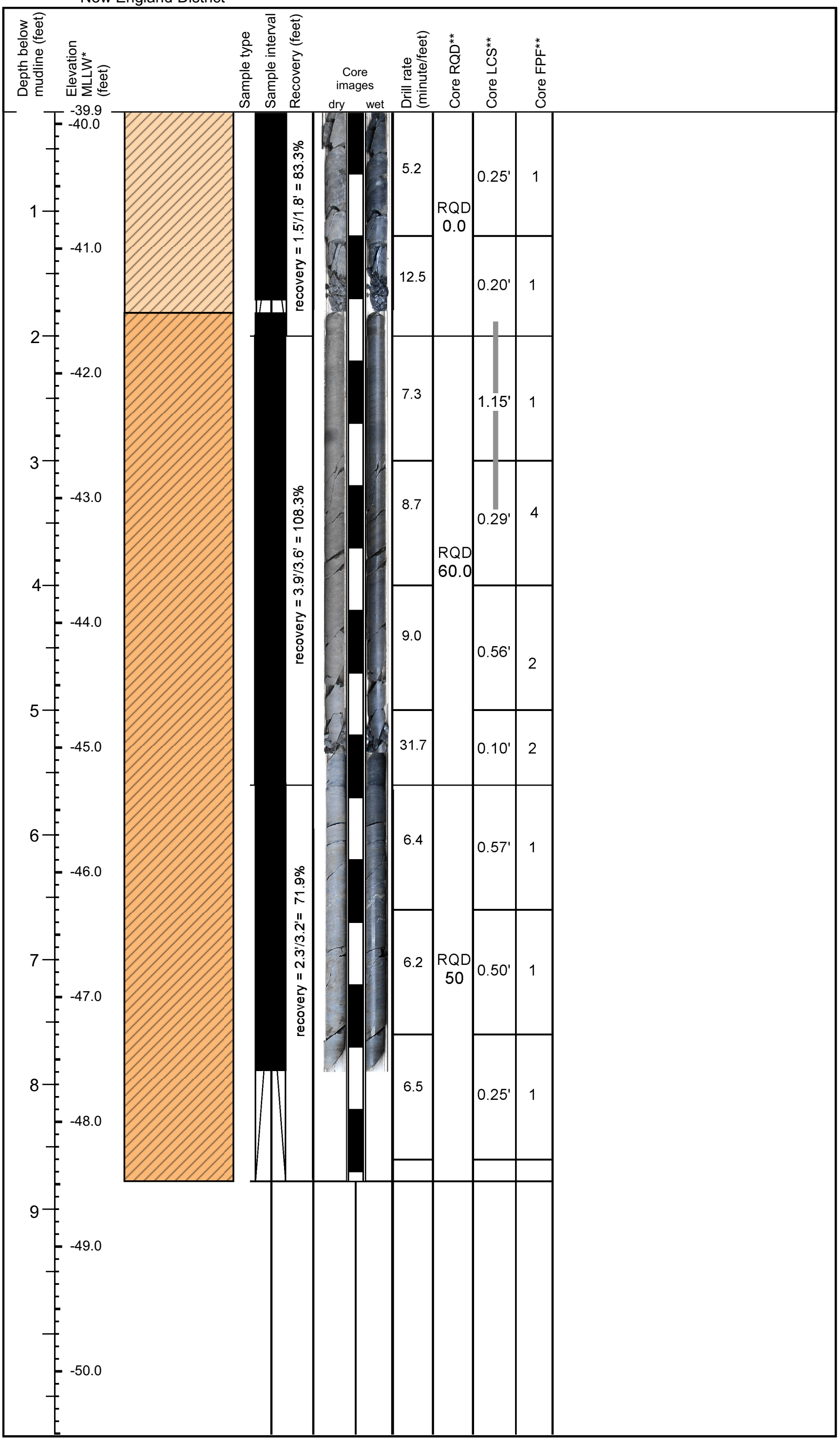
Rock-core description
**RQD = Rock Quality Description
**LCS = Longest Core Segment within foot interval
**FPF = Fractures Per Foot



US Army Corps of Engineers®
New England District

boring FD10-B-R06
core images

e4sciences | Earthworks, LLC



Appendix G
Captain Credentials

Collin Clement
Liftboat Captain
Northstar Marine

This credential has been issued under the provisions of the International Convention on Standards of Training Certification on Watchkeeping for Seafarers 1978, as amended.

The lawful holder of this Credential as endorsed below, is entitled under Title 46 (Shipping) U.S. Code to serve in the capacity or capacities specified, subject to any limitations indicated.

The Government of the United States of America certifies that

COLLIN HUGH CLEMENT JR

has been duly qualified in accordance with the provisions of regulation(s)

II/4; VI/2; II/3

Of the above Convention, as amended, and has been found competent to perform the following functions, at the levels specified, subject to any limitation indicated until 08-SEP-2014.

Ref Num 2524489 Serial Num 000028046

4

GLOBAL
TRAINING & ENVIRONMENTAL
API RP 2D
CRANE OPERATOR
operator class: A
expires: September 10, 2013
Collin Clement
INSTRUCTOR: S Nightingale

CAPACITY	LIMITATIONS APPLYING (IF ANY)
Master	Limited to vessels of not more than 100 Gross Register Tons (Domestic Tonnage). Valid for near coastal voyages only.
Officer in charge of a navigational watch (Mate)	Limited to vessels of not more than 200 Gross Registered Tons (Domestic Tonnage), 500 Gross Tons (ITC Tonnage). Valid for near coastal voyages only.
Rating forming part of a navigational watch (Able Seaman - Unlimited)	
Proficient in the use of survival craft(Lifeboatman)	Limited to service on vessels not equipped with lifeboats.

Ref Num 2524489 Serial Num 000028046

5

TWIC™
CLEMENT, COLLIN H
Expires 14FEB2014
Transportation Worker Identification Credential

2005 Guidelines
COMMUNITY & WORKPLACE CERTIFICATION
Collin Clement
Has Successfully Completed CPRTodayl Inc. Training Course In
Basic Life Support
Adult CPR, Child CPR & Infant CPR
76357290-5139 Certification Number
May 2012 Expiration Date
Regina Bennett Instructor
This individual has successfully met evaluation objectives consistent with ECC/ILCOR/AHA and nationally-recognized cognitive assessment guidelines and CPRTodayl Inc. Terms & Conditions

THE MARITIME CONSORTIUM, INC.
This card certifies that the named party is a member in good standing of The Maritime Consortium and is in full compliance with the U.S. Coast Guard Drug Testing Regulations (46 CFR Part 16 and 49 CFR Part 40)
Collin Clement
Northstar Marine, Inc.
MID# 45550
Mbr Exp 12/31/2011
Please keep this card on your person at all times.
See reverse for Maritime contact information.

LET IT BE KNOWN THAT
Collin Clement
Has Successfully Completed CPRTodayl Inc. Training Course In
BASIC FIRST AID
31344750-2826 Certification Number
May 2012 Expiration Date
Trevor R. Karas Instructor
This individual has successfully met evaluation objectives consistent with ECC/ILCOR/AHA and nationally-recognized cognitive assessment guidelines and CPRTodayl Inc. Terms & Conditions

NORTHSTAR MARINE, INC.
NORTHSTAR MARINE / SEATOW CAPE MAY
CERTIFICATE OF TRAINING 8 HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER OSHA 29 CFR 1910.120 (e) (8)
In recognition of successful completion of the above course of study conducted at Clermont, NJ
Date: 25 March 2011
Collin Clement
0099
8 HR REF

Certificate of Completion

J. Schneider and Associates, Ltd. certifies that

Collin Clement

has successfully completed all the requirements for

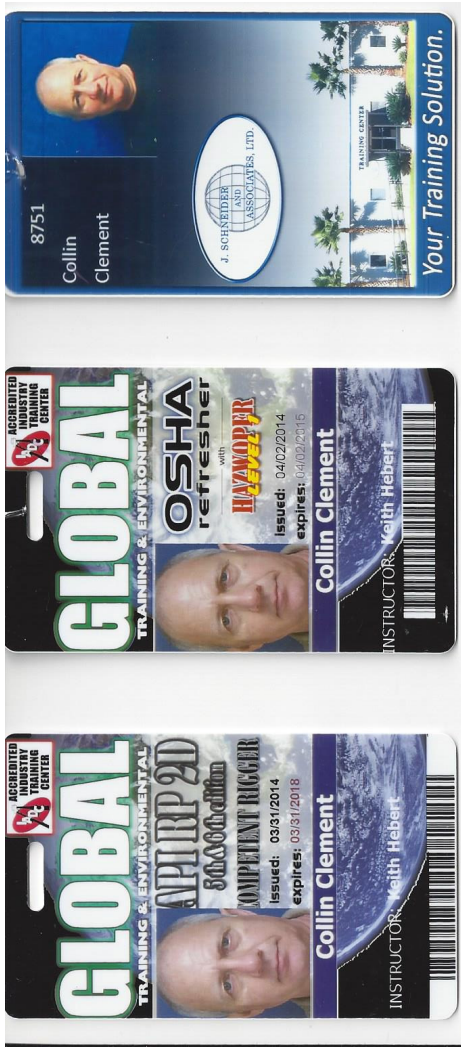
Crane - API - U

in accordance with Title 30 CFR 250.108, API RP 2D & Spec 2C (Current Editions), ANSI/ASME B30.
API - U

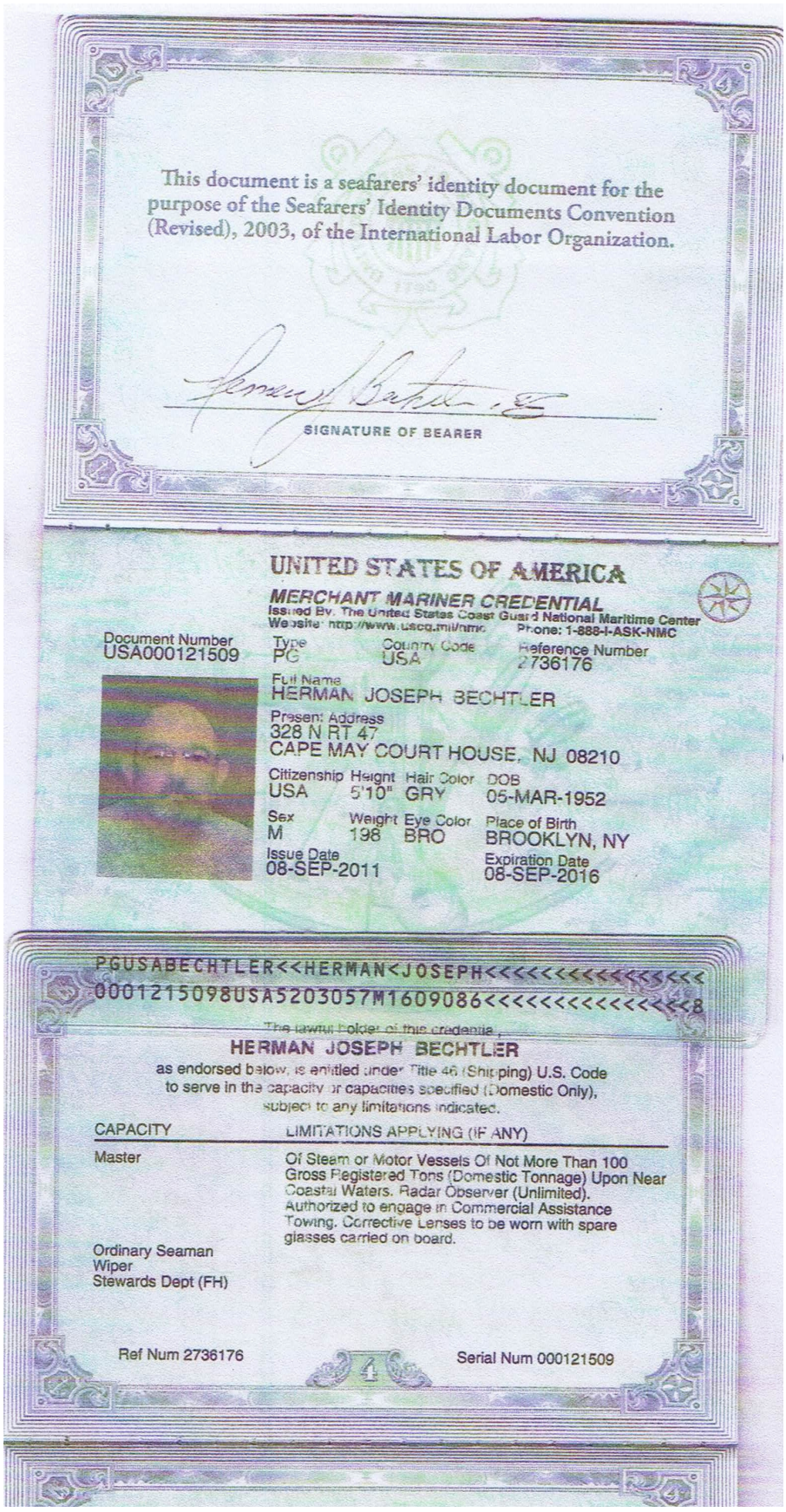
Course Completion Date:
4/1/2014

Instructor

J. SCHNEIDER AND ASSOCIATES, LTD.



Herman Bechtler
Liftboat Captain
Northstar Marine



This document is a seafarers' identity document for the purpose of the Seafarers' Identity Documents Convention (Revised), 2003, of the International Labor Organization.

SIGNATURE OF BEARER

UNITED STATES OF AMERICA

MERCHANT MARINER CREDENTIAL

Issued By: The United States Coast Guard National Maritime Center
Website: http://www.uscg.mil/nmc Phone: 1-888-I-ASK-NMC

Document Number
USA000121509

Type
PG

Country Code
USA

Reference Number
2736176

Full Name
HERMAN JOSEPH BECHTLER

Present Address
328 N RT 47
CAPE MAY COURT HOUSE, NJ 08210

Citizenship	Height	Hair Color	DOB
USA	5'10"	GRY	05-MAR-1952

Sex	Weight	Eye Color	Place of Birth
M	198	BRO	BROOKLYN, NY

Issue Date
08-SEP-2011

Expiration Date
08-SEP-2016

PGUSABECHTLER<<HERMAN<JOSEPH<<<<<<<<<<<<<<<<<<<<<<<<

000121509 8USA5203057M1609086<<<<<<<<<<<<<<<8

The lawful holder of this credential,

HERMAN JOSEPH BECHTLER

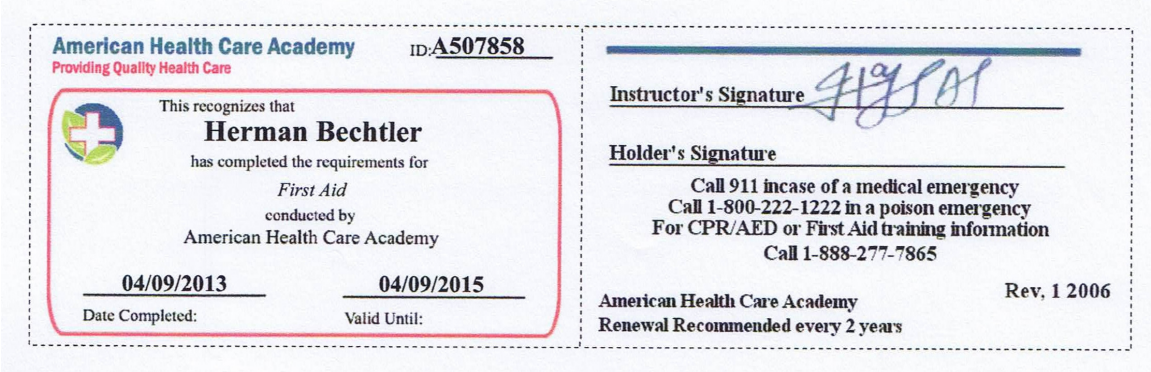
as endorsed below, is entitled under Title 46 (Shipping) U.S. Code to serve in the capacity or capacities specified (Domestic Only), subject to any limitations indicated.

CAPACITY	LIMITATIONS APPLYING (IF ANY)
Master	Of Steam or Motor Vessels Of Not More Than 100 Gross Registered Tons (Domestic Tonnage) Upon Near Coastal Waters. Radar Observer (Unlimited). Authorized to engage in Commercial Assistance Towing. Corrective Lenses to be worn with spare glasses carried on board.
Ordinary Seaman Wiper Stewards Dept (FH)	

Ref Num 2736176

4

Serial Num 000121509



American Health Care Academy
Providing Quality Health Care

ID: A507858

This recognizes that

Herman Bechtler

has completed the requirements for

First Aid

conducted by

American Health Care Academy

04/09/2013 — Date Completed:

04/09/2015 — Valid Until:

Instructor's Signature

Holder's Signature

Call 911 incase of a medical emergency
Call 1-800-222-1222 in a poison emergency
For CPR/AED or First Aid training information
Call 1-888-277-7865

American Health Care Academy
Renewal Recommended every 2 years

Rev, 1 2006

Christopher Stanley Cassel
Liftboat Captain
Northstar Marine

This document is a seafarers' identity document for the purpose of the Seafarers' Identity Documents Convention (Revised), 2003, of the International Labor Organization.

SIGNATURE OF BEARER

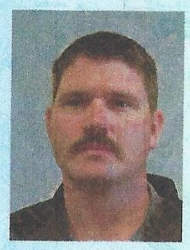
UNITED STATES OF AMERICA

MERCHANT MARINER CREDENTIAL

Issued By: The United States Coast Guard National Maritime Center
Website: http://www.uscg.mil/nmc Phone: 1-888-I-ASK-NMC

Document Number: USA000219588

Type	Country Code	Reference Number
PG	USA	3512894



Full Name
CHRISTOPHER STANLEY CASSEL

Present Address
304 WILLOW DRIVE
ERMA, NJ 08204

Citizenship	Height	Hair Color	DOB
USA	6'01"	BRO	11-SEP-1967

Sex	Weight	Eye Color	Place of Birth
M	279	GRN	MCKEES ROCKS, PA

Issue Date	Expiration Date
29-OCT-2013	29-OCT-2018

PGUSACASSEL<<CHRISTOPHER<STANLEY<<<<<<<<<<<<
0002195883USA6709110M1810297<<<<<<<<<<<<<<2

5

4

Ref Num 3512894 Serial Num 00021958B

JEFFREY P. NOVOTNY, CAPT, USCG

Master — Of Steam or Motor Vessels Of Not More Than 100 Gross Registered Tons (Domestic Tonnage) Upon Near Coastal Waters. Authorized to engage in Commercial Assistance Towing.

CAPACITY — LIMITATIONS APPLYING (IF ANY)

CHRISTOPHER STANLEY CASSEL as endorsed below, is entitled under Title 46 (Shipping) U.S. Code to serve in the capacity or capacities specified (National Only), subject to any limitations indicated.

The lawful holder of this credential.

American Health Care Academy™
We Provide Quality Health Care

A507769

This recognizes that

Christopher Cassel

has completed the requirements for

FIRST AID

conducted by

American Health Care Academy

2013-04-09	2015-04-09
Date Completed	Valid Until

Instructor Signature 4/9/08

Holder's Signature

Call 911 in case of a medical emergency
Call 1-800-222-1222 in a poison emergency
For CPR/AED or First Aid training information
call 1-888-277-7865

American Health Care Academy
Renewal Recommended every 2 years

Rev. 1 201

American Health Care Academy™
We Provide Quality Health Care

A507720

This recognizes that

Christopher Cassel

has completed the requirements for

ADULT, CHILD, INFANT CPR/AED

conducted by

American Health Care Academy

2013-04-09	2015-04-09
Date Completed	Valid Until

Instructor Signature 4/9/08

Holder's Signature

Call 911 in case of a medical emergency
Call 1-800-222-1222 in a poison emergency
For CPR/AED or First Aid training information
call 1-888-277-7865

American Health Care Academy
Renewal Recommended every 2 years

Rev. 1 201

James Joseph Cullinane
Time and Tide Captain
e4sciences

UNITED STATES OF AMERICA

MERCHANT MARINER CREDENTIAL

Issued By: The United States Coast Guard National Maritime Center
Website: http://www.uscg.mil/nmc Phone: 1-888-I-ASK-NMC

Document Number	Type	Country Code	Reference Number
USA000098819	PG	USA	1943810

Full Name
JAMES JOSEPH CULLINANE

Present Address
12 DEER MEADOW ROAD
EAST HARWICH, MA 02645-2239

Citizenship	Height	Hair Color	DOB
USA	5'08"	GRY	06-AUG-1954

Sex	Weight	Eye Color	Place of Birth
M	180	BLU	BOSTON, MA

Issue Date	Expiration Date
31-MAR-2011	31-MAR-2016

PGUSACULLINANE<<JAMES<JOSEPH<<<<<<<<<<<<<<<<
0000988193USA5408069M1603316<<<<<<<<<<<<<<<2

The lawful holder of this credential,
JAMES JOSEPH CULLINANE
as endorsed below, is entitled under Title 46 (Shipping) U.S. Code to serve in the capacity or capacities specified (Domestic Only), subject to any limitations indicated.

CAPACITY	LIMITATIONS APPLYING (IF ANY)
Master	Of Steam or Motor Vessels Of Not More Than 100 Gross Registered Tons (Domestic Tonnage) Upon Near Coastal Waters. Authorized to engage in Commercial Assistance Towing.

Anthony S. Lloyd

ANTHONY S. LLOYD, CAPT, USCG

Ref Num 1943810 Serial Num 000098819

4

Appendix H
Liftboat Documentation
& Inspection Surveys

LB Vision Equipment Data sheets
Northstar Marine

NORTHSTAR
ENVIRONMENTAL & MARINE SERVICES
Est. 1990

L/B Vision

EQUIPMENT DATA SHEET

ITEM	DESCRIPTION	DETAILS	REMARKS
1	**Type of Vessel**	Lift Boat	
2	**Manufacturer** **Name** **Model**	 Bollinger Class 105	 ***Vessel re-built*** 2009 - 2010 **Ø 24" x 95ft legs**
3	**Official no.**	626734	
4	**Principle Dimensions**	LOA 70' BOA 39' Moulded Depth: 8' Draft: 6 ft. Fully Loaded Elev. depth: 72' Max.* Work area: 864 ft^2 2 x 10" Dia. Drill Holes	 Incl. Pads & 6 new side tanks 65Ft offshore - max. * Excl. Stowage area 16 x 36 ft x ½"drill pad.
	Tonnage	90 GRT	

5	**Propulsion Engines**	2 x 6 cyl. marine diesels	Conventional drive ***New*** John Deere - 6125 AFM - 400 HP each. Tier 2
	Transmissions	2x Twin Disc	***New*** MG5114
6	**Standard Equipment**		
	Generators	2 x 40Kw Diesels	New John Deere – 4.5L. Tier 3
	Safety	Exceeds requirements	Coast Guard
	Nav. instruments	1 Radar, D.sounders	***All new - 2010***
	Ground tackle	CQR anchor	250 lb
	Lifting equipment	10 T Crane – 2 winches	40ft reach (max)
	Pumps	3 x S/W pumps	Fire & G.l services
	Positioning	DGPS (Hemisphere)	Satellite Compass
	Life raft	8 man	
	Manlift	Billy Pugh	
	Other	Nav. Comp. / weather/, speed/ AIS/ Tilt Alarm.	Sat Com's. available ***All new 2010***
7	**Further Details**		
	Hull Type	Mono Hull, weather deck	Flat bottom, raking ends &
	Material	Steel	Side tanks
8	**Accommodation**		
		8 berths in 4 Cabins	***Complete re-fit 2010***
		Head with shower & basin Washer/dryer	Zero Disch. Head & Urinal Tank for grey water
9	**General**		
	Hydraulics PTO	2 sets, 3 bank pumps	***All new,*** with deck utility
	3 Ph. Power	240V, 3Ph	connection available
	1 Ph Power	220/110v avail. on deck	As above (+/- 30Kw)
	Compressed air	Available on deck	90 psi/ 13CFM
	Potable water	3 x 500g Tanks	
	Ext. Fuel Tanks		3000 - 6000g possible
	Pre-load Tanks	Port & Stb	
	Drill holes	2 x Ø10" - through deck	
	Foredeck - Stiffening for drilling, CPT etc.	16' x 36' Doubler plate	Alumacraft MV 2072
	Tender	20ft Alum. 25Hp	
	Galley	Includes stove, microwave & refrigerator / freezer	
	Other:	Water maker ready	
		Provisions made for extend. wheelhouse & crew accommodation	Plans & space available

LB Vision October 2014 Inspection Report
Northstar Marine

MEYERROSE AND CO., INC.

MARINE SURVEYORS – CONSULTANTS
138 SOUTH FIRST STREET – SUITE 110
LINDENHURST, NY 11757-4923
TEL 631-225-3641 FAX 631-225-3642
WEB meyerrosemarinesurveyors.com
EMAIL rmeyerrose@optonline.net

Richard Meyerrose, Jr.
Marine Surveyor - President
TVIB certified AWO RCP auditor
Cell: 516-658-9059

Jason R. Meyerrose
Marine Surveyor – Vice President
Cell: 516-592-9198

29 October 2014 FILE NUMBER: M-8788

INSPECTION REPORT
ACCOUNT: NORTHSTAR MARINE, INC.
VESSEL: **"L/B VISION"**

This is to certify that on 23 October 2014 the undersigned Marine Surveyor, at the request of Mr. Dave Morgan, Northstar Marine, Inc., without prejudice and for interested parties, did carry out a Condition and Suitability for service inspection survey of the vessel **"L/B VISION"**, as the vessel lay jackup up at the Reynolds Shipyard, Staten Island, New York.

VESSEL PARTICULARS

1. Name: "L/B VISION", ex "R/V RUSSELL W. PETERSON".
2. Owners: Northstar Marine, Inc.
3. Registered Dimensions: 60.0'L x 24.0'B x 7.5'D.
4. Official No.: 626734 – 90 GRT / 72 NRT.
5. Built: 1980 by Bollinger Machine Shop, LA, hull # 132.
6. Inspected or Classed Vessel: No. Has valid Certificate of Documentation.
7. Construction: All welded steel.
8. Configuration: Rectangular, having flat deck, straight sides, similar flat raked ends and flat bottom. One sponson each side in after half length. Fitted with three spuds for jacking unit out of the water. One level deckhouse on deck outfitted with living accommodations. One pilothouse atop deckhouse with helm station. Three compartment hull, with complete complement of machinery and systems in the main compartment.
9. Compartmentation: Three compartments formed by (2) transverse steel bulkheads. The respective sponsons are divided in to fuel and ballast compartments.
10. Utilization: Vessel is utilized for waterfront projects in protected waters that require a stationary platform

VESSEL DESCRIPTION

The subject vessel is a conventional configuration and all welded steel construction, single skin, self-propelled deck barge, configured and outfitted as a lift boat.

A fixed steel sponson is fitted each side of the hull in the after half length, level at deck and protruding below the hull bottom, which are utilized for ballast and fuel storage. The main deck is extended over the hull, out to the width of the sponsons and spudwells, with a toerail fitted.

The three spudwells are respectfully mounted to the hull at port and starboard sides in the forward half length and centerline aft. The frames extend to about 8’ above the deck, with four hydraulically driven gear boxes mounted on each spudwell tower.

Three 95’ x 24” diameter steel spuds are utilized, each fitted with ratchet bars. Each side spud is fitted with an 8’ x 8’ x 1” stiffened plate foot, which were renewed at the end of Yr. 2013. The after spud is fitted with a 20’ x 7’ box neutral buoyant pad foot.

The main deck is fitted with perimeter fixed two tier safety rails, with gates, closed with chains.

The main deck is fitted with a complement of bitts and cleats. An hydraulically driven pedestal mounted rotating crane with 30’ main boom and 10’ fixed jib boom is mounted on deck forward starboard, with a current certificate #14050801 dated 5/18/2014, maximum load rating 19,450 #. The crane is only used when the hull is elevated.

To port, forward of the deckhouse is a raised fixed frame with an approx. 18’ aluminum workboat with 40 HP Yamaha outboard motor.

In way the working deck area are two x 10” drill holes, each consisting of Schedule 80 pipe (located in way the Forward Rake compartment).

There is a complement of large floodlights fitted around the vessel.

Again, forward of the deckhouse, are two large intake ventilators, each with electrically driven blower and weather covers. Adjacent are two cowls for air exhaust, plus, an emergency escape hatch from the engine room.

The forward side of the deckhouse is fitted with two watertight doors, one in to the deckhouse and one to the engine room, with a third watertight door aft side in to the deckhouse. All doors are fitted on raised sills. Also located forward side is a stairway with nonskid treads and safety handrails up to the deckhouse roof, shore power connection and fire station.

Continuing on main deck, there is a ring buoy located at each corner, each with lanyard, plus, there are two other ring buoys on board, one fitted with an emergency float light. A Jacobs ladder is fitted each side of the deck, and a donut lift is stowed at the port rail.

A single level deckhouse is located on deck in aft half length, and is arranged and fitted with accommodation spaces as follows. The port half of the house is the main salon, fitted with a table with padded bench seating forward port, and galley along port side including a refrigerator / freezer, cabinets and 4 burner electric stove with oven, and microwave oven above. To aft is a sink with pressure hot/cold water service with cabinets. Inboard is a work table, water cooler, passage way to bunk rooms, and entertainment center forward.

Working to inboard is the toilet locker with sink in passageway, then four x 2 bunk staterooms, two forward and two aft. A clothes washer and dryer is provided.

The deckhouse is attractively finished, clean and in excellent condition. The deckhouse is HVAC climate controlled. There is one general service breaker panel to forward.

Portable fire extinguishers are located in the deckhouse, including a fire axe, and watergel heat shield.

PILOTHOUSE

The pilothouse is also attractively finished with weathertight access door each side and windows all around. On the exterior are fitted protected night light bulb fixtures, hailer speakers, fixed ladder aft side to roof, (1) small freezer unit.

There is a wide eyebrow on three sides. Atop is a light mast with lights and day shapes, complement of navigation lights and complement of electronic antennas.

The consol is fitted with:

1 – ComNav steering lever.
2 – sets two lever throttle and clutch controllers.
2 – John Deere panels.

1 – computer/monitor with Coastal Explorer chart system (repeater in deckhouse), plus, complement of paper charts and assorted required publications.
1 – Garmin GPS map 492.
3 – Furuno LS-4100 echo sounders (port-starboard-aft).
1 – ComNav 1001 autopilot.
1 – hand held magnetic compass.
3 – ICOM IC-M422 VHF radiotelephones.
1- Furuno radar.
1 – Standard Horizon loudhailer VLH-300.
1 – rudder angle indicator.
3 – lever leg controllers.
1 – Tilt alarm panel; Murphy alarm for spud feet; clutch controllers for leg PTO; Murphy tank and bilge alarms; steering pump controller; bilge pump controller panel; (2) general service electrical breaker panels (12VDC and 110VAC).

MACHINERY AND SYSTEMS

Located inside the engine room companionway are controllers for the fire pump; ventilation; general service pump; and remote fuel shutoff.

The engine room and machinery – systems are reasonably clean with no oil leaks or water in the bilges. Inverted steel channel coolers for the main engines are located on the bottom plating.

Main propulsion is provide by two John Deere model 6125AFM75-125L diesel engines which drive through Twin Disc model MG 51145C marine reversing and reduction gears. Each main engine drives hydraulics off the forward ends. Guards are fitted over moving parts. Engines are battery electric started and fresh water cooled through the referenced internal keel coolers.

Auxiliary power is provided by two John Deere model 4025T280 diesel engines, each driving a 65 KW AC generator. Engines are battery electric started and radiator water cooled.

Auxiliary systems include:

Hydraulic system for legs including reservoir tank.
1 – electro-hydraulic steering system.
Potable water system.
Fixed and submersible bilge pumps.
2 – electrically driven fuel transfer pumps.
Fire pump system, for both when hull is in water and when elevated.
Ballast pump system (used to set the feet by pumping in ballast water).
Generator/shore power electrical panel and (2) general service electrical panels.

At forward bulkhead are shelving racks for storage.

Entry to the forward and aft rake compartments are via a watertight type door at the forward bulkhead and aft bulkhead, which must be closed and secured at all times when underway. Access to the sponsons are via bolted cover hatches on the hull sides.

The Forward Rake compartment is well painted, clean and dry. There are two nonintegral potable water tanks against the transverse bulkhead, each approx. 535 gallons.

The Aft Rake compartment is well painted, clean and dry. There are two steel tanks at the transverse bulkhead, one for waste oil and one for sewerage, each approx. 730 gallons capacity. There are two rudder posts with steering gear attached to the rudder stocks.

Each sponson is divided for ballast and fuel. Fuel capacity at each sponson is 1143 gallons.

Additional tankage includes: 636 gallon fuel oil day tank; 586 gallon potable water tank; 450 gallon hydraulic tank and 180 gallon lube oil tank, in the engine room.

The vessel is fitted with a normal complement of fixed fire stations with hose and nozzles; portable fire extinguishers; and safety equipment, including ring buoys fitted with lanyard and float light, and axe.

CONDITIONS

Overall condition of the vessel is considered to be satisfactory/good for age and past services, including obvious upgrading and ongoing maintenance and repair program.

Overall hull paint coatings and appearance are satisfactory. All machinery and equipment is in good condition.

RECOMMENDATIONS

1. Vessel to be operated when under way and when elevated according to good marine practices and the various stability details.

2. Any large gear and equipment (non vessel equipment) to be suitable secured whenever vessel is underway.

CONCLUSION

The subject vessel is intended to be utilized in protected waters with winds less than 30 knots and seas less than 5’ when underway, resultant of stability calculations carried out in January 2014 based upon a 40,000 pound deck load and not more than 75% fuel.

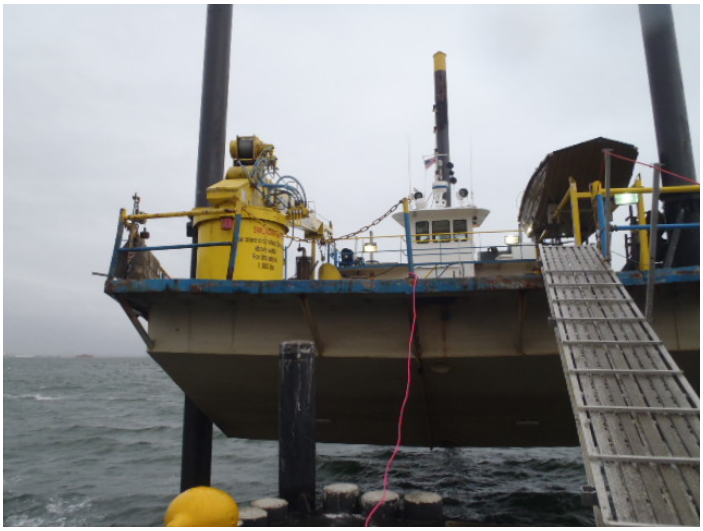
As far as may be ascertained from my examination of the subject vessel, machinery and equipment while in jacked up mode, it is the opinion of the undersigned that the subject vessel is in satisfactory condition and is equipped for service according to applicable rules and regulations for operation and that the unit is well suited for its intended role and function as well as for its ability to perform its intended project function.

The above report is a statement of opinion made, signed, and submitted without prejudice to the rights and/or interests of whom it may concern.

Respectfully submitted,

Richard Meyerrose, Jr.
Marine Surveyor – President

Enc: Photographs
RM/



Starboard and forward views

Forward

Port

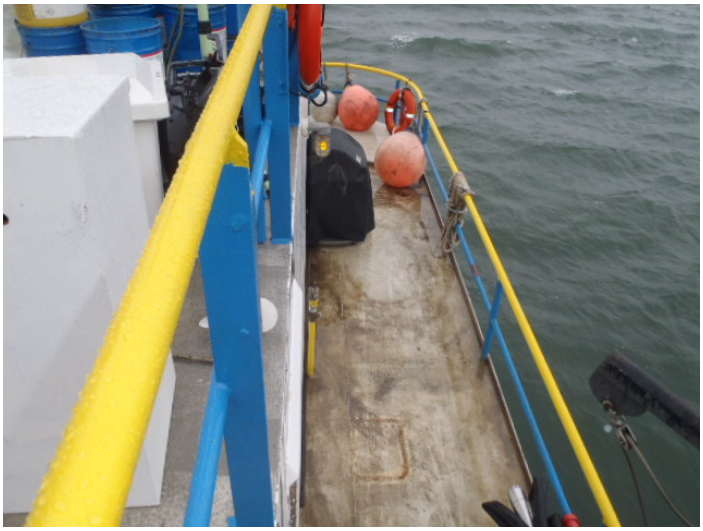
Atop deckhouse, looking forward, starboard

Deck mounted crane

Four hydraulic motors per leg

Pilothouse

Atop pilothouse



Port side, looking aft

Port side, looking forward

Portable pump unit

Starboard, looking forward

Starboard, looking aft

Port half of helm station

Starboard half of helm station

Chart table cabinet

Main salon views – starboard aft

Looking forward

Main salon – port

Looking aft

Two x 2 bunk staterooms

To aft

Toilet locker

Toilet sink in passageway

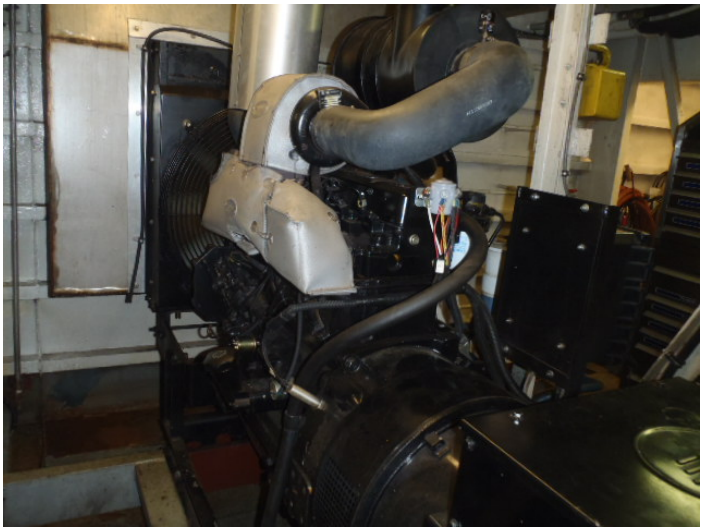
Forward two x 2 bunk stateroom

Clothes washer and dryer

Forward Rake compartment

Watertight door access

Engine room views




Typical, genset


Pump and sea water intake – hatch to side sponson

Potable water system


Fixed bilge suction – internal channel keel coolers – portable bilge pump


Typical, main engine propulsion


Electro hydraulic steering system


Main hydraulic system


General views


Main hydraulic system


Second genset

Compressor unit and water p[ump


Generator panel and general service breaker boxes

Aft Rake compartment

9. M-8788 CONDITION & SUITABILITY SURVEY, **“L/B VISION”** 10/23/2014 rmjr

LB Vision 2014 Stability Survey Report
Northstar Marine

Stability test and analysis for the L/B Vision, official number 626734

Prepared by: Blancke Marine Services Inc.
17 Wood St.
Woodberry, NJ 08096

A stability test was conducted on the L/B Vision on January 23, 2014. This experiment was conducted in Jersey City in the Morris Canal. This experiment was conducted in accordance with ASTM Standard F 1321.

As a result of this test the following lightship characteristics have been established for this vessel:

Displacement:	181.66 long tons
Vertical center of gravity:	16.22 feet above baseline
Longitudinal center of gravity:	33.61 feet aft of forepeak (Station 0)

This vessel is an un-inspected lift/work boat. It is not classed nor is it inspected by any governmental entity. This vessel is intended to be used on protected waters only.

Based on the vessel characteristics listed, the stability of the vessel was evaluated for transit modes only. Load conditions evaluated were full load with cargo (75% fuel), mid-load with cargo and burned-out with cargo. Additional load cases evaluated dealt with no deck load, offshore transits at 95% and 85% fuel. Specifics of all these load cases can be found in the load case section of the report.

Criteria for evaluation were taken from relative sections of ABS Rules for lift boats and USCG Rules for lift boat stability. It must be remembered that these rules apply to larger, inspected, lift boats that are in use and transit in exposed conditions. Even the most relative USCG rules apply to "Restricted Service" routes. These restricted routes are still offshore but within twelve hours of transit to a Harbor of Safe Refuge.

It must be emphasized that this vessel was only evaluated for intact stability in a transit mode. There was no evaluation of the structural adequacy of the vessel. The vessel was not evaluated in a damaged stability mode nor was it evaluated in the elevated mode of operation. This vessel is of such a size that damaged stability criteria may in fact never be able to be met. The owner's representative, Mr. Dave Morgan has stated that he, or a consultant, will evaluate the stability and suitability of the craft in the elevated mode with software that he has familiarity with and has used in the past. He will be basing his evaluation on the vessel load characteristics listed above adjusted for the elevated condition.

As well the suitability in relation to stability and stability evaluation of the onboard crane will be evaluated under a separate cover. The owner's representative has stated that they only use the crane with very short outreach and very light loads in the displacement mode.

It should be noted that the stability criteria used in the analysis provides the following cautionary note: ***Compliance with the stability criteria does not ensure immunity against capsizing regardless of the circumstances or absolve the master from his responsibilities. Master should therefore exercise prudence and good seamanship having regard to the season of the year weather forecasts and the navigational zone.***

Operational constraints:

The vessel meets or exceeds current ABS Rules for Building and Classing Liftboats (2009) for vessels in restricted service with fuel limitations, and the jack-up legs lowered 10 feet, and wind speeds less than 30 knots and local seas less than 5 feet. Therefore this vessel is limited to protected waters for loaded operations and local transits or partially protected water transits that are no greater than 20 nautical miles from a harbor of safe refuge. This vessel is restricted to local transits in conditions with less than 30 knots of wind and less than 5 foot seas. This vessel must conduct restricted service transits with the jack up legs lowered 12-1/2 feet. The vessel is further limited to no greater than 75% fuel in the port and starboard wing fuel tanks. The vessel is limited to 40,000 pounds of deck cargo with a vertical center of gravity of 4 feet above the main deck.

This vessel cannot carry passengers for hire. This vessel may not carry cargo from port to port. The owner of the vessel does not intend this vessel to be US Coast Guard inspected. The owner of the vessel does not intend this vessel to be ABS classed.

During any transit any and all deck machinery related to work, any and all instrumentation portable containers or drilling equipment must be restrained from movement.

Modifications:

There are no modifications required for this vessel.

General suggestions:

(1) The stability of the vessel must be evaluated periodically by the operator throughout the voyage as fuel, water and stores are consumed. In addition it should be evaluated when the number of load items stored above the deck is changed.
(2) Any other significant changes in the loading of the vessel are also cause for evaluating the stability.
(3) The bilges should be pumped to a minimum content at all times.
(4) The operator should make every effort to determine the cause of any list of the vessel before taking corrective action.
(5) Beam seas should be avoided. Vessels of this nature in beam seas have a tendency to ship water more readily and are more subject to heavy rolling.

(6) Following seas should also be avoided. Vessels of this nature in following seas are more likely to become perched on a wave, in which case the stability of the vessel is decreased significantly. A vessel of this nature in following seas is also more subject to swamping and the loss of steering control.

(7) If the vessel encountered beam seas or following seas, course and/or speed change should be made change the relative direction and speed of the waves are recommended.

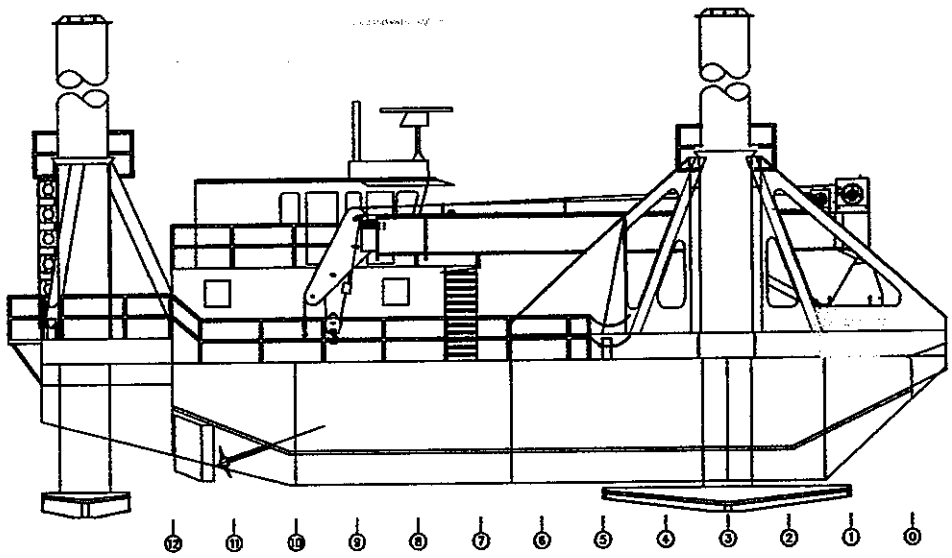
(8) Both equipment and other large weight should be properly stowed and placed as low as possible.

(9) All closing devices provided for vent pipes and access to compartments should be maintained in good watertight condition.

(10) Reliance on automatic fixed steering is dangerous, as this prevents speedy maneuvering which may be needed in bad weather.

(11) In all conditions of loading necessary care should be taken to maintain a seaworthy freeboard.

(12) Pay special attention to icing of the vessel and eliminate it by all possible means.



L/B VISION

ON - 626734

4 MARCH 2014

BLANCKE MARINE SERVICES INC.
17 WOOD STREET
WOODBURY, NEW JERSEY 08096
856-845-6399

L/B VISION

ON - 626734

4 MARCH 2014

INTACT STABILITY EVALUATION

ADDENDUM

Blancke Marine Services
17 Wood Street, Woodbury, New Jersey 08096
Tel (856)845-6399 Fax (856)845-6475

Vessel:	L/B VISION
Official Number:	626734
Load Condition:	6.26 tons of deck cargo on restricted routes @Mid Trip
Date:	03/03/14

Fuel:	50.00%	
Water:	50.00%	
Sewage:	50.00%	
CARGO MAIN DECK	40000	Pounds
Hydraulic oil	50.00%	
Waste Oil	50.00%	
Lube oil	50.00%	
Steering Gear fluid	50.00%	
Crew	3.00	

Item	Displacement L-tons	VCG ft abv BL	KG mom ft-LT	LCG ft aft REF "0"	LCG mom ft-LT	l/sg ft^4
Light Ship	181.66	16.22	2946.04	33.61	6106.29	NA
CARGO MAIN DECK	6.26	12.25	76.69	25.00	156.50	NA
CREW SECOND DECK	0.25	20.00	4.96	37.00	9.17	NA
Fresh Water Fwd Port	0.99	2.46	2.44	12.50	12.38	0.81
Fresh Water Fwd Starboard	0.99	2.46	2.44	12.50	12.38	0.81
Fresh Water Aft	1.09	1.27	1.38	17.50	19.08	1.14
Hydraulic oil	0.76	1.31	1.00	42.50	32.30	1.05
Fuel in Port Wing	5.08	0.97	4.93	45.02	228.70	3.00
Fuel in Stbd Wing	5.08	0.97	4.93	45.02	228.70	3.00
Fuel in Day Tank	1.07	2.16	2.31	17.50	18.73	0.99
Lube Oil	0.27	3.75	1.01	33.75	9.11	0.40
Sewage Aft	1.47	2.25	3.31	51.86	76.23	0.60
Waste Oil Aft	1.33	2.25	2.99	51.86	68.97	0.54
Steering Hydraulic Fluid	0.21	4.29	0.90	49.29	10.35	0.08
Lower Lift Legs 10 feet(33.19 Long Tons	0.00	-10.00	-331.98	0.00	0.00	0.00
Lower Aft Pad 10 Feet	0.00	-10.00	-25.36	0.00	0.00	0.00
Lower Fwd Pads (2) 10 Feet	0.00	-10.00	-38.43	0.00	0.00	0.00
Aft LEAD Ballast Stbd	0.00	0.00	0.00	0.00	0.00	0.00
Aft LEAD Ballast Port	0.00	0.00	0.00	0.00	0.00	0.00
Lead Ballast	0.00	0.00	0.00	0.00	0.00	NA
TOTALS	206.51	12.88	2659.54	33.84	6988.88	12.42
			12.88			
			0.06			
	Virtual KG=		12.94			

Blancke Marine Services
LIFTBOAT VISION
MID TRIP HYDROSTATICS

HYDROSTATIC PROPERTIES
Trim: Aft 0.32 deg., No Heel, VCG = 12.94

LCF Draft	Displacement Weight(LT)	Buoyancy-Ctr. LCB	VCB	Weight/ Inch	Moment/ LCF	Deg trim	KML	KMT
4.482	206.51	33.90a	2.27	4.21	33.05a	207.82	70.6	22.16

Distances in FEET.-------Specific Gravity = 1.025.----------Moment in Ft-LT.
Draft is from Baseline.

Blancke Marine Services
17 Wood Street, Woodbury, New Jersey 08096
Tel (856)845-6399 Fax (856)845-6475

Vessel:	L/B VISION
Official Number:	626734
Load Condition:	6.26 tons of deck cargo on restricted routes @Departure
Date:	03/03/14

Fuel:	75%	
Water:	100%	
Sewage:	10.00%	
CARGO MAIN DECK	40000	Pounds
Hydraulic oil	95%	
Waste Oil	10%	
Lube oil	95%	
Steering Gear fluid	95%	
Crew	3	

Item	- L-tons	VCG ft abv BL	KG mom ft-LT	LCG ft aft REF "0"	LCG mom ft-LT	l/sg ft^4
Light Ship	181.66	16.22	2946.04	33.61	6106.29	NA
CARGO MAIN DECK	6.26	12.25	76.69	25.00	156.50	NA
CREW SECOND DECK	0.25	20.00	4.96	37.00	9.17	NA
Fresh Water Fwd Port	1.98	3.50	6.93	12.50	24.75	0.00
Fresh Water Fwd Port	1.98	3.50	6.93	12.50	24.75	0.00
Fresh Water Aft	2.18	2.27	4.95	17.50	38.15	1.14
Hydraulic oil	1.43	1.98	2.83	42.50	60.78	1.05
Fuel in Port Wing	7.61	1.97	14.99	45.01	342.53	3.00
Fuel in Stbd Wing	7.61	1.97	14.99	45.01	342.53	3.00
Fuel in Day Tank	1.61	2.61	4.20	17.50	28.18	1.71
Lube oil	0.51	4.17	2.13	33.75	17.21	0.40
Sewage Aft	0.28	0.81	0.23	51.26	14.35	0.60
Waste Oil Aft	0.28	0.81	0.23	51.26	14.35	0.60
Steering Hydraulic Fluid	0.40	5.19	2.08	49.29	19.72	0.08
Lower Lift Legs 10 feet(33.19 Long To	0.00	-10.00	-331.98	0.00	0.00	0.00
Lower Aft Pad 10 Feet	0.00	-10.00	-25.36	0.00	0.00	0.00
Lower Fwd Pads (2) 10 Feet	0.00	-10.00	-38.43	0.00	0.00	0.00
Aft LEAD Ballast Stbd	0.00	0.00	0.00	0.00	0.00	0.00
Aft LEAD Ballast Port	0.00	0.00	0.00	0.00	0.00	0.00
Lead Ballast	0.00	0.00	0.00	0.00	0.00	NA
TOTALS	214.04	12.58	2692.39	33.63	7199.24	11.58
			12.58			
			0.05			
	Virtual KG=		12.63			

Blancke Marine Services
LIFTBOAT VISION
DEPARTURE HYDROSTATICS

HYDROSTATIC PROPERTIES
Trim: Aft 0.14 deg., No Heel, VCG = 12.63

LCF	Displacement	Buoyancy-Ctr.		Weight/	Moment/			
Draft	Weight(LT)	LCB	VCB	Inch	LCF	Deg trim	KML	KMT
4.630	214.04	33.65a	2.35	4.24	32.82a	214.45	70.0	21.62

Distances in FEET.-------Specific Gravity = 1.025.----------Moment in Ft-LT.
Draft is from Baseline.

Blancke Marine Services
17 Wood Street, Woodbury, New Jersey 08096
Tel (856)845-6399 Fax (856)845-6475

Vessel:	L/B VISION
Official Number:	626734
Load Condition:	6.26 tons of deck cargo on restricted routes @Burnout
Date:	03/03/14

Fuel:	10.00%	
Water:	10.00%	
Sewage:	95.00%	
CARGO MAIN DECK	40000	Pounds
Hydraulic oil	10.00%	
Waste Oil	10.00%	
Lube oil	10.00%	
Steering Gear fluid	10.00%	
Crew	3.00	

Item	Displacement L-tons	VCG ft abv BL	KG mom ft-LT	LCG ft aft REF "0"	LCG mom ft-LT	I/sg ft^4
Light Ship	181.66	16.22	2946.04	33.61	6106.29	NA
CARGO MAIN DECK	6.26	12.25	76.69	25.00	156.50	NA
CREW SECOND DECK	0.25	20.00	4.96	37.00	9.17	NA
Fresh Water Fwd Port	0.19	1.52	0.29	12.50	2.38	0.58
Fresh Water Fwd Starboard	0.19	1.52	0.29	12.50	2.38	0.58
Fresh Water Aft	0.23	0.48	0.11	17.50	4.03	1.14
Hydraulic oil	0.17	0.73	0.12	42.50	7.23	1.05
Fuel in Port Wing	1.07	-0.61	-0.65	45.10	48.26	3.00
Fuel in Stbd Wing	1.07	-0.61	-0.65	45.10	48.26	3.00
Fuel in Day Tank	0.22	1.38	0.30	17.50	3.85	2.86
Lube Oil	0.40	4.00	1.60	33.75	13.50	0.40
Sewage Aft	0.28	0.81	0.23	51.29	14.36	0.60
Waste Oil Aft	0.28	0.87	0.24	51.29	14.36	0.54
Steering Hydraulic Fluid	0.04	3.52	0.14	49.29	1.97	0.08
Lower Lift Legs 10 feet(33.19 Long Tor	0.00	-10.00	-331.98	0.00	0.00	0.00
Lower Aft Pad 10 Feet	0.00	-10.00	-25.36	0.00	0.00	0.00
Lower Fwd Pads (2) 10 Feet	0.00	-10.00	-38.43	0.00	0.00	0.00
Aft LEAD Ballast Stbd	0.00	0.00	0.00	0.00	0.00	0.00
Aft LEAD Ballast Port	0.00	0.00	0.00	0.00	0.00	0.00
Lead Ballast	0.00	0.00	0.00	0.00	0.00	NA
TOTALS	192.31	13.70	2633.93	33.45	6432.51	13.83
			13.70			
			0.07			
	Virtual KG=		13.77			

Blancke Marine Services
LIFTBOAT VISION
BURNOUT HYDROSTATICS

HYDROSTATIC PROPERTIES
Trim: Fwd 0.09 deg., No Heel, VCG = 13.77

LCF Draft	Displacement Weight(LT)	Buoyancy-Ctr. LCB	VCB	Weight/ Inch	Moment/ LCF	Deg trim	KML	KMT
4.201	192.31	33.43a	2.11	4.21	33.09a	205.91	75.1	23.45

Distances in FEET.-------Specific Gravity = 1.025.----------Moment in Ft-LT.
Draft is from Baseline.

Transit Stability Calculations

45-knot wind

NO GREATER THAN 20 MILES FROM A HARBOR OF SAFE REFUGE

GHS Rig Macro Library Version 13.50

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

INITIAL TRIM: 0.09f DRAFT: 4.63 FEET without wind at given VCG

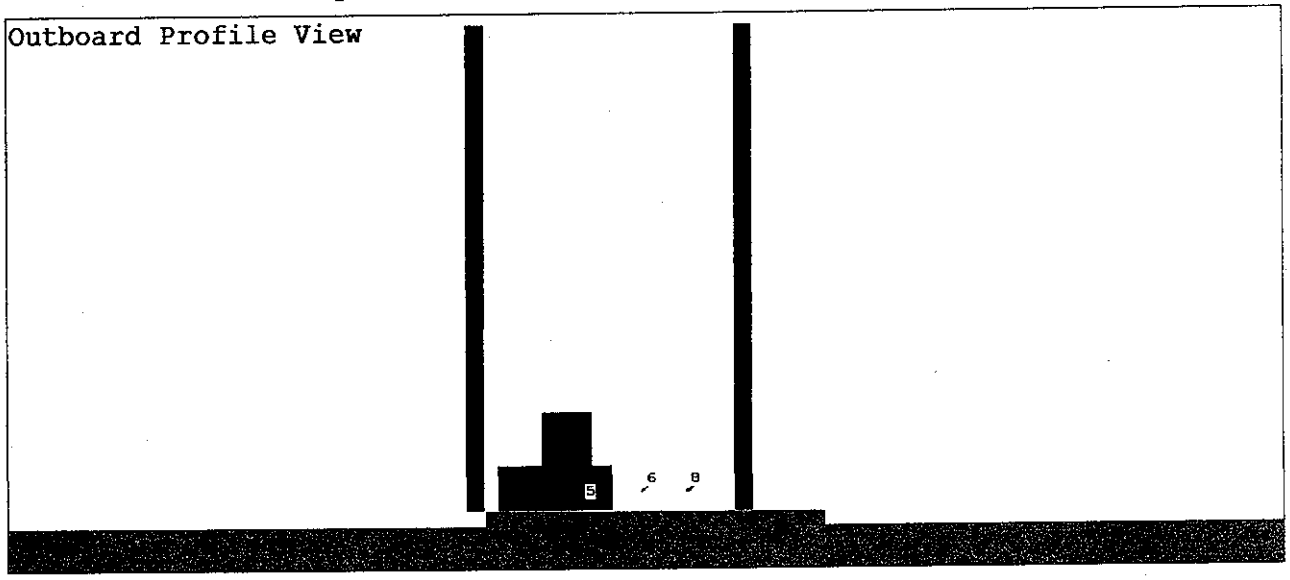
WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.679 @ 0.00, 4.589 @ 60.00a
Trim: Fwd 0.09/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		214.04	33.40a	0.00	12.63
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	214.04	33.39a	0.00	2.35
	Righting Arms:		0.00	0.00	

Part	SpGr	WPA	LCF	TCF	BML	BMT
Total Waterplane	**1.025**	**1788**	**32.70a**	**0.00**	**68.6**	**19.31**
		LT/Inch		**Ft-LT/in**	**GML**	**GMT**
		4.26		17.34	58.3	9.03

Distances in FEET.

Condition Graphic - Draft: 4.68 @ 0.00 , 4.59 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

INITIAL TRIM: 0.09f DRAFT: 4.63 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium		Attained Values			Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	5.23	-0.10	1.39	12.63	33.96	4.51	14
-40.0	5.25	-0.10	1.58	12.63	29.68	4.12	13
-35.0	5.27	-0.09	1.82	12.63	25.55	3.72	13
-30.0	5.27	-0.09	2.11	12.63	21.67	3.34	13
-25.0	5.26	-0.09	2.45	12.63	18.17	3.01	13
-20.0	5.25	-0.09	2.95	12.63	15.15	2.63	12
-15.0	5.20	-0.09	3.61	12.63	12.70	2.25	11
-10.0	5.09	-0.09	4.29	12.63	10.88	1.95	11
-5.0	4.90	-0.09	4.79	12.63	9.75	1.76	10
0.0	4.67	-0.09	3.50	12.63	9.03	2.26	11
5.0	4.42	-0.09	4.86	12.63	9.33	1.60	10
10.0	5.09	-0.09	-4.29	12.63	10.35	1.66	11
15.0	5.20	-0.09	-3.61	12.63	12.06	1.82	11
20.0	5.24	-0.09	-2.95	12.63	14.41	2.11	12
25.0	5.26	-0.09	-2.45	12.63	17.34	2.43	12
30.0	5.27	-0.09	-2.10	12.63	20.74	2.76	13
35.0	5.27	-0.09	-1.82	12.63	24.50	3.15	13
40.0	5.25	-0.10	-1.58	12.63	28.50	3.57	13
45.0	5.23	-0.10	-1.39	12.63	32.63	4.02	14

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 4.618 @ 0.00, 4.633 @ 60.00a
Trim: Fwd 0.42 deg., Heel: Stbd 4.98 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		214.04	33.40a	0.00	12.63
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	214.06	33.47a	1.69s	2.42
	Righting Arms (normal):		0.07a	0.79s	
	External Arms:		0.00	0.80s	
	Residual Righting Arms:		**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.153 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	167.08s
10.00s	171.28s
20.00s	163.30s
30.00s	144.24s
40.00s	119.36s
50.00s	93.09s
60.00s	68.03s
70.00s	48.02s
80.00s	34.37s
90.00s	28.53s
100.00s	30.78s
120.00s	35.71s
140.00s	36.88s
160.00s	27.60s
180.00s	167.08s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 4.98 deg heel **170.70**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

RESIDUAL RIGHTING ARMS vs HEEL ANGLE
LCG = 33.40a TCG = 0.00 VCG = 12.63

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height	
4.679	0.09f	0.01p	214.04	0.00	-0.784	0.00		
4.679	0.09f	0.00	214.07	0.00	-0.777	-0.01	6.11	(3)
4.645	0.26f	2.49s	214.04	0.00	-0.391	-1.46	4.01	(1)
4.601	0.42f	4.98s	214.04	0.00	0.000	-1.95	4.12	(1)
4.538	0.58f	7.48s	214.04	0.00	0.396	-1.45	4.65	(2)
4.457	0.70f	9.98s	214.06	0.00	0.755	-0.01	4.14	(2)
4.341	0.71f	12.48s	214.04	0.00	0.936	2.10	3.58	(2)
4.233	0.64f	14.59s	214.05	0.00	**0.982**	4.12	3.07	(2)
4.215	0.63f	14.98s	214.05	0.00	0.980	4.51	2.97	(2)
4.187	0.60f	15.61s	214.05	0.00	0.973	5.12	2.81	(2)
4.113	0.53f	17.48s	214.04	0.00	0.917	6.90	2.32	(2)
4.029	0.42f	19.98s	214.04	0.00	0.782	9.04	1.62	(2)
3.959	0.31f	22.48s	214.04	0.00	0.581	10.76	0.91	(2)
3.889	0.21f	24.98s	214.04	0.00	0.318	11.88	0.19	(2)
3.870	0.18f	25.62s	214.04	0.00	0.245	12.07	*-0.00*	(2)
3.810	0.10f	27.48s	214.04	0.00	0.010	12.31	*-0.53*	(2)
3.807	0.10f	27.56s	214.04	0.00	0.000	12.31	*-0.56*	(2)
3.720	0.01f	29.98s	214.04	0.00	-0.336	11.91	*-1.25*	(2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75
(3) Vent 2	FLOOD	24.16a	9.05	10.75

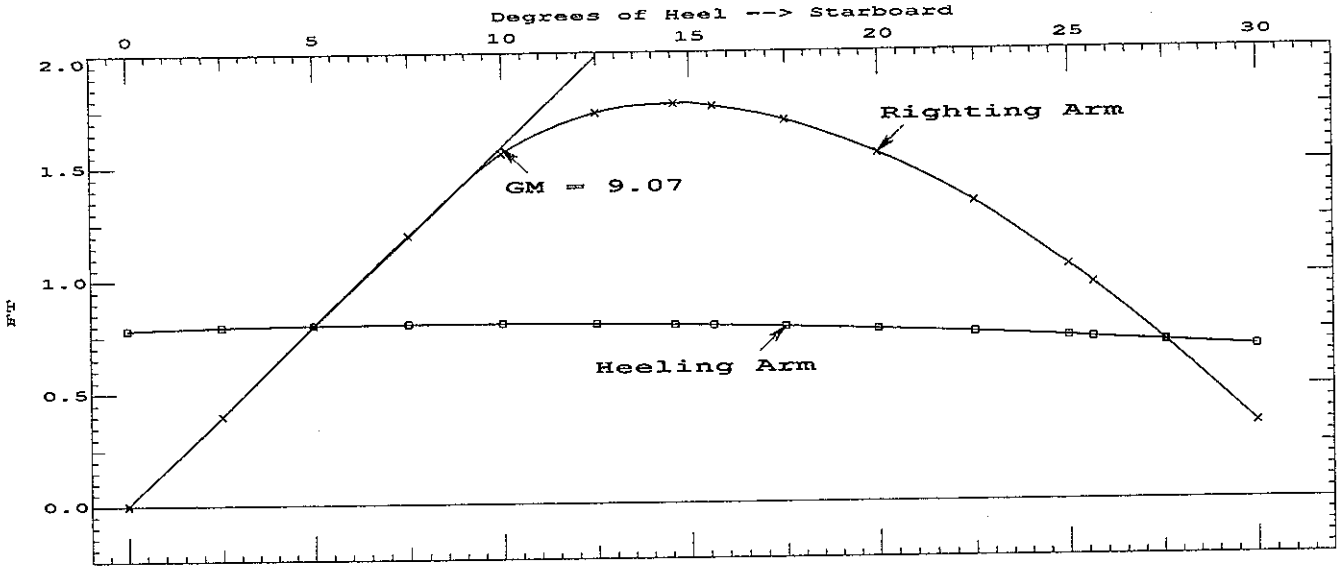
LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.07 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.604 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**4.98 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.00 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.243 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.243 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.573 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**22.57 P**

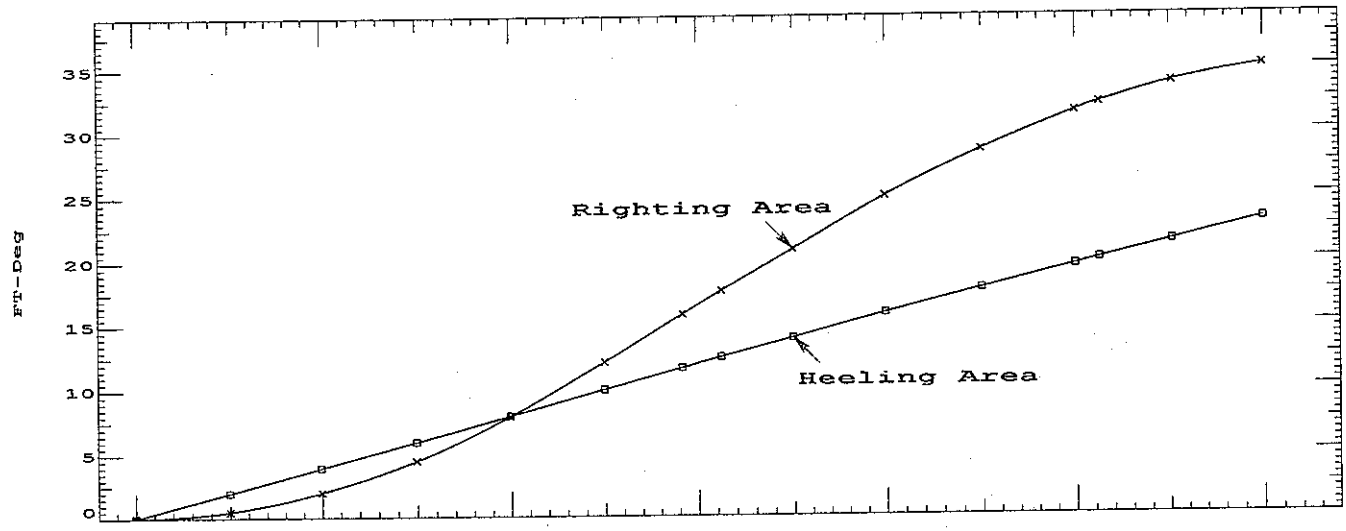
Relative angles measured from 4.981s

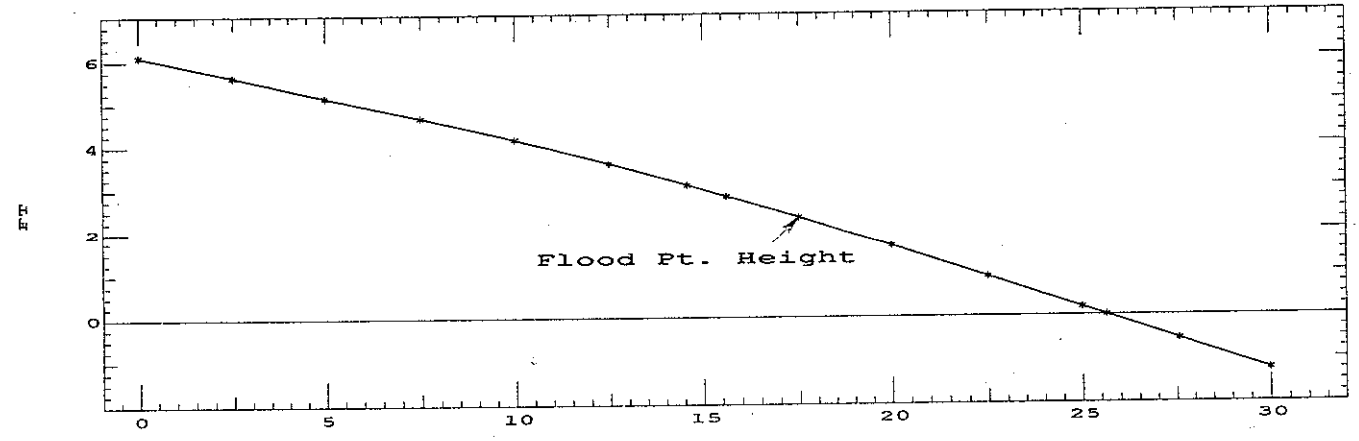
GM is derived from the RA curve.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

Inclination Axis rotated aft 5.00 degrees





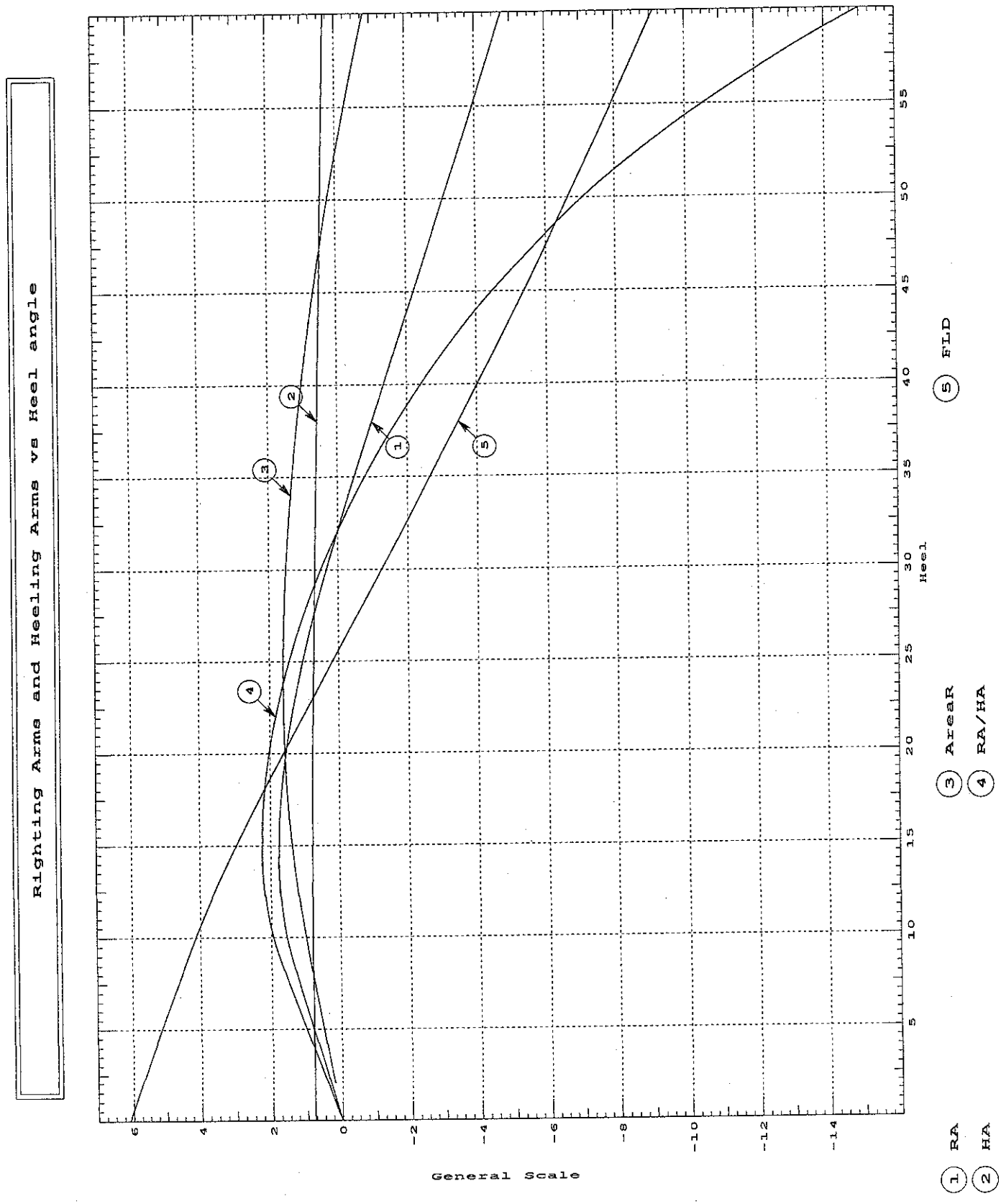


Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

Table of Righting Arms and Areas
Displacement: 214.05 LONG TONS VCG: 12.630
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.68	-0.09	0.00	0.00	0.78		0.01	6.11
4.65	-0.22	2.00	0.32	0.79	0.21	0.41	5.73
4.62	-0.36	4.00	0.64	0.80	0.41	0.81	5.34
4.58	-0.48	6.00	0.96	0.80	0.61	1.20	4.95
4.52	-0.61	8.00	1.28	0.80	0.81	1.60	4.55
4.45	-0.70	10.00	1.56	0.80	1.00	1.95	4.14
4.37	-0.71	12.00	1.71	0.80	1.18	2.14	3.69
4.26	-0.66	14.00	1.77	0.79	1.32	2.23	3.22
4.17	-0.59	16.00	1.75	0.78	1.43	2.23	2.71
4.09	-0.51	18.00	1.67	0.77	1.52	2.15	2.17
4.03	-0.42	20.00	1.54	0.76	1.57	2.02	1.62
3.97	-0.33	22.00	1.37	0.75	1.60	1.83	1.05
3.92	-0.25	24.00	1.16	0.73	1.61	1.58	0.47
3.86	-0.17	26.00	0.91	0.71	1.60	1.28	-0.11
3.79	-0.08	28.00	0.64	0.69	1.57	0.92	-0.68
3.72	-0.01	30.00	0.34	0.67	1.52	0.50	-1.25
3.65	0.05	32.00	0.02	0.65	1.45	0.03	-1.82
3.58	0.10	34.00	-0.31	0.63	1.36	-0.49	-2.37
3.50	0.13	36.00	-0.65	0.60	1.27	-1.07	-2.93
3.43	0.17	38.00	-0.99	0.58	1.15	-1.71	-3.48
3.35	0.20	40.00	-1.34	0.56	1.03	-2.40	-4.02
3.26	0.24	42.00	-1.69	0.53	0.89	-3.16	-4.56
3.17	0.28	44.00	-2.04	0.51	0.74	-4.00	-5.10
3.07	0.32	46.00	-2.39	0.48	0.58	-4.94	-5.63
2.96	0.37	48.00	-2.73	0.46	0.41	-5.96	-6.15
2.86	0.41	50.00	-3.08	0.43	0.23	-7.09	-6.66
2.75	0.44	52.00	-3.43	0.41	0.04	-8.34	-7.17
2.64	0.49	54.00	-3.77	0.39	-0.16	-9.73	-7.66
2.53	0.52	56.00	-4.11	0.36	-0.37	-11.35	-8.15
2.41	0.55	58.00	-4.44	0.34	-0.60	-13.09	-8.63
2.30	0.58	60.00	-4.77	0.32	-0.83	-15.02	-9.10

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

INITIAL TRIM: 0.09f DRAFT: 4.482 FEET without wind at given VCG

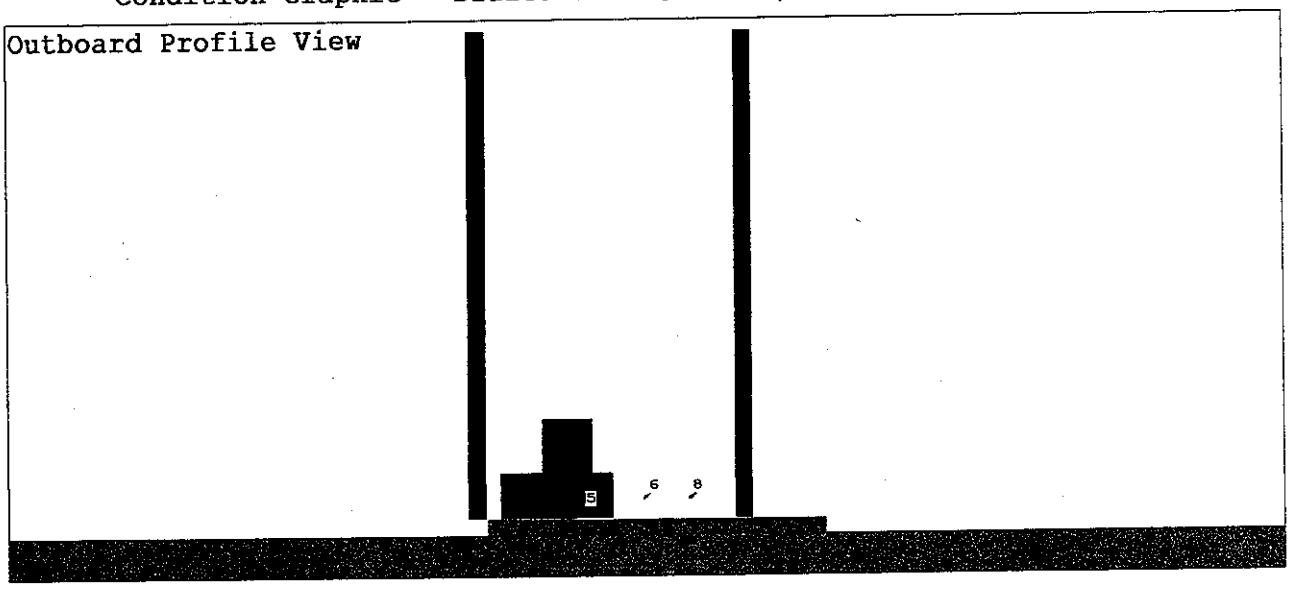
WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.531 @ 0.00, 4.441 @ 60.00a
Trim: Fwd 0.09/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		206.51	33.42a	0.00	12.94
	SpGr	Displ(LT)	LCB	TCB	VCB
HULL	1.025	206.51	33.41a	0.00	2.27
	Righting Arms:		0.00	0.00	

Part	SpGr	WPA	LCF	TCF	BML	BMT
Total Waterplane	**1.025**	**1781**	**32.83a**	**0.00**	**70.0**	**19.97**
		LT/Inch		Ft-LT/In	GML	GMT
		4.24		17.02	59.3	9.29

Distances in FEET.

Condition Graphic - Draft: 4.53 @ 0.00 , 4.44 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

INITIAL TRIM: 0.09f DRAFT: 4.482 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	5.09	-0.10	1.40	12.94	34.98	4.60	14
-40.0	5.11	-0.10	1.60	12.94	30.58	4.19	13
-35.0	5.12	-0.10	1.84	12.94	26.32	3.77	13
-30.0	5.13	-0.09	2.12	12.94	22.33	3.39	13
-25.0	5.12	-0.09	2.47	12.94	18.72	3.04	13
-20.0	5.10	-0.09	2.97	12.94	15.60	2.66	12
-15.0	5.06	-0.09	3.64	12.94	13.05	2.27	11
-10.0	4.95	-0.09	4.32	12.94	11.16	1.99	11
-5.0	4.75	-0.09	4.83	12.94	9.98	1.80	10
0.0	4.52	-0.09	3.54	12.94	9.29	2.32	11
5.0	4.26	-0.09	4.91	12.94	9.67	1.66	10
10.0	4.95	-0.09	-4.33	12.94	10.71	1.71	11
15.0	5.06	-0.09	-3.64	12.94	12.47	1.88	11
20.0	5.10	-0.09	-2.97	12.94	14.88	2.16	12
25.0	5.12	-0.09	-2.47	12.94	17.87	2.47	12
30.0	5.13	-0.09	-2.12	12.94	21.34	2.79	13
35.0	5.12	-0.10	-1.83	12.94	25.16	3.17	13
40.0	5.11	-0.10	-1.60	12.94	29.23	3.58	13
45.0	5.09	-0.10	-1.40	12.94	33.42	3.99	14

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

WEIGHT and DISPLACEMENT STATUS
Baseline draft: 4.463 @ 0.00, 4.488 @ 60.00a
Trim: Fwd 0.42 deg., Heel: Stbd 5.03 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		206.51	33.42a	0.00	12.94
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	206.50	33.50a	1.77s	2.34
		Righting Arms (normal):	0.07a	0.83s	
		External Arms:	0.00	0.83s	
		Residual Righting Arms:	**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.411 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	168.70s
10.00s	171.83s
20.00s	164.18s
30.00s	145.62s
40.00s	122.12s
50.00s	94.51s
60.00s	70.25s
70.00s	49.79s
80.00s	36.50s
90.00s	30.60s
100.00s	32.89s
120.00s	38.23s
140.00s	38.63s
160.00s	29.24s
180.00s	168.70s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.03 deg heel **171.62**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

RESIDUAL RIGHTING ARMS vs HEEL ANGLE
LCG = 33.42a TCG = 0.00 VCG = 12.94

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.531	0.09f	0.01p	206.52	0.00	-0.815	0.00	
4.495	0.25f	2.49s	206.51	0.00	-0.412	-1.53	4.15 (1)
4.473	0.34f	3.76s	206.51	0.00	-0.206	-1.93	4.21 (1)
4.446	0.42f	5.03s	206.51	0.00	0.000	-2.06	4.27 (1)
4.381	0.57f	7.53s	206.51	0.00	0.407	-1.55	4.79 (2)
4.302	0.71f	10.03s	206.51	0.00	0.796	-0.05	4.29 (2)
4.193	0.75f	12.53s	206.51	0.00	1.017	2.22	3.74 (2)
4.061	0.68f	15.03s	206.51	0.00	1.094	4.89	3.14 (2)
4.050	0.68f	15.24s	206.51	0.00	**1.094**	5.12	3.09 (2)
3.948	0.59f	17.53s	206.51	0.00	1.056	7.60	2.50 (2)
3.855	0.49f	20.03s	206.51	0.00	0.935	10.11	1.82 (2)
3.776	0.41f	22.53s	206.51	0.00	0.729	12.19	1.13 (2)
3.692	0.33f	25.03s	206.51	0.00	0.455	13.67	0.44 (2)
3.635	0.28f	26.61s	206.51	0.00	0.252	14.23	*-0.00* (2)
3.601	0.26f	27.53s	206.51	0.00	0.124	14.40	*-0.25* (2)
3.569	0.24f	28.39s	206.51	0.00	0.000	14.46	*-0.49* (2)
3.509	0.22f	30.03s	206.51	0.00	-0.246	14.26	*-0.94* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75

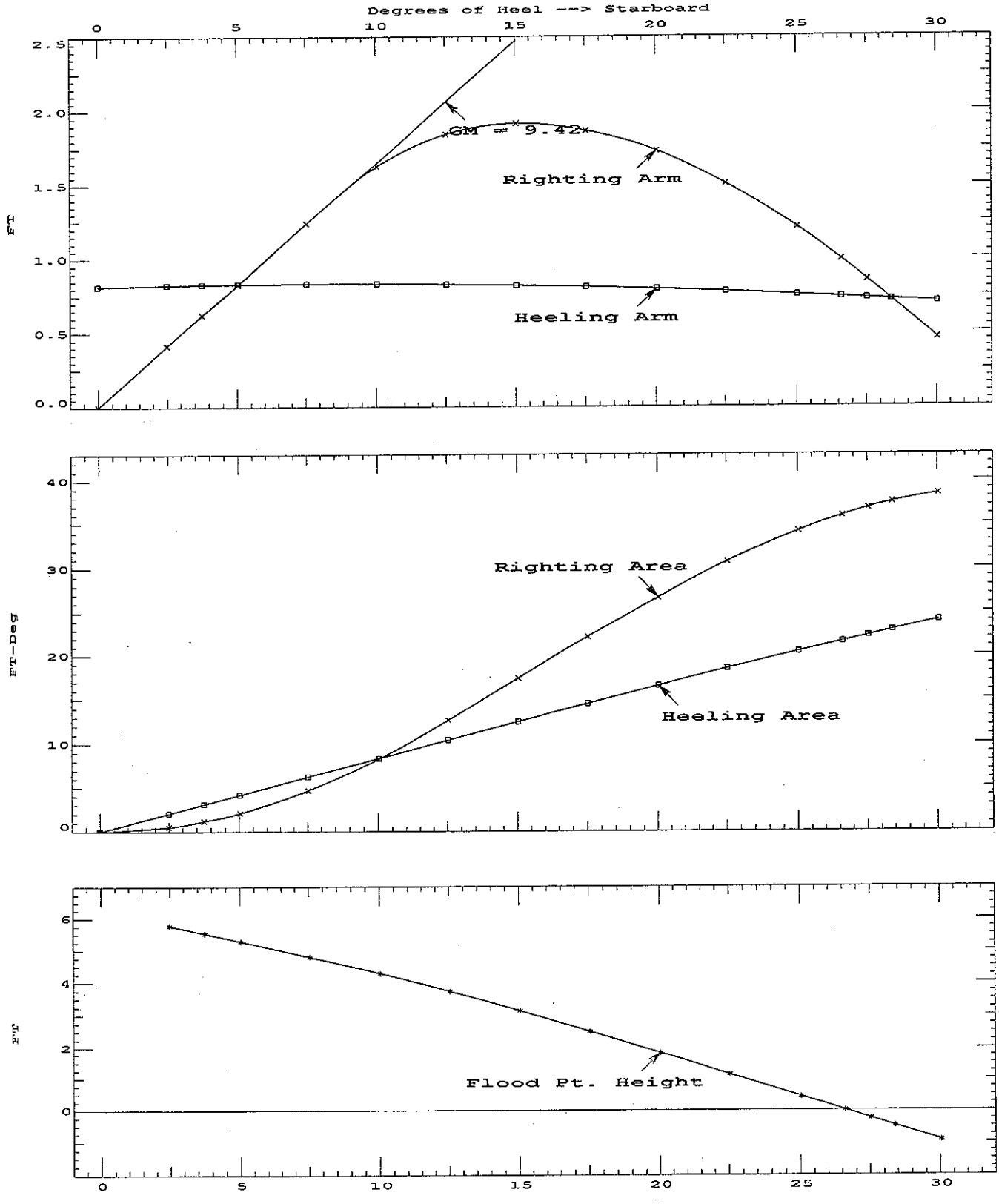
LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.42 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.660 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**5.03 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.05 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.336 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.334 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.613 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**23.36 P**

Relative angles measured from 5.032s

GM is derived from the RA curve.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Inclination Axis rotated aft 5.00 degrees



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Table of Righting Arms and Areas
Displacement: 206.51 LONG TONS VCG: 12.940
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.53	-0.09	0.00	0.00	0.82		0.00	6.25
4.50	-0.22	2.00	0.33	0.82	0.20	0.40	5.88
4.47	-0.35	4.00	0.66	0.83	0.40	0.80	5.49
4.42	-0.47	6.00	0.99	0.83	0.60	1.19	5.10
4.37	-0.60	8.00	1.32	0.83	0.80	1.58	4.70
4.30	-0.71	10.00	1.62	0.83	0.99	1.95	4.29
4.22	-0.75	12.00	1.81	0.83	1.17	2.19	3.86
4.12	-0.71	14.00	1.90	0.82	1.33	2.31	3.39
4.01	-0.65	16.00	1.91	0.82	1.45	2.34	2.90
3.93	-0.58	18.00	1.85	0.81	1.54	2.29	2.38
3.86	-0.50	20.00	1.73	0.80	1.61	2.18	1.83
3.79	-0.43	22.00	1.56	0.78	1.65	2.00	1.28
3.73	-0.36	24.00	1.34	0.77	1.67	1.75	0.72
3.66	-0.30	26.00	1.08	0.74	1.66	1.45	0.17
3.58	-0.25	28.00	0.78	0.73	1.64	1.08	-0.38
3.51	-0.22	30.00	0.46	0.71	1.59	0.66	-0.93
3.44	-0.21	32.00	0.13	0.68	1.53	0.19	-1.47
3.37	-0.20	34.00	-0.22	0.66	1.45	-0.33	-2.00
3.29	-0.20	36.00	-0.57	0.64	1.35	-0.89	-2.54
3.21	-0.18	38.00	-0.93	0.62	1.24	-1.50	-3.07
3.13	-0.19	40.00	-1.29	0.59	1.12	-2.18	-3.59
3.04	-0.18	42.00	-1.65	0.57	0.99	-2.92	-4.12
2.95	-0.17	44.00	-2.02	0.54	0.84	-3.73	-4.63
2.85	-0.17	46.00	-2.38	0.51	0.69	-4.68	-5.15
2.76	-0.16	48.00	-2.75	0.48	0.52	-5.68	-5.65
2.65	-0.15	50.00	-3.11	0.46	0.34	-6.79	-6.15
2.55	-0.14	52.00	-3.47	0.43	0.16	-8.01	-6.64
2.44	-0.13	54.00	-3.83	0.41	-0.04	-9.36	-7.12
2.33	-0.12	56.00	-4.18	0.38	-0.25	-10.86	-7.60
2.21	-0.11	58.00	-4.53	0.36	-0.47	-12.51	-8.06
2.09	-0.10	60.00	-4.88	0.34	-0.70	-14.34	-8.52

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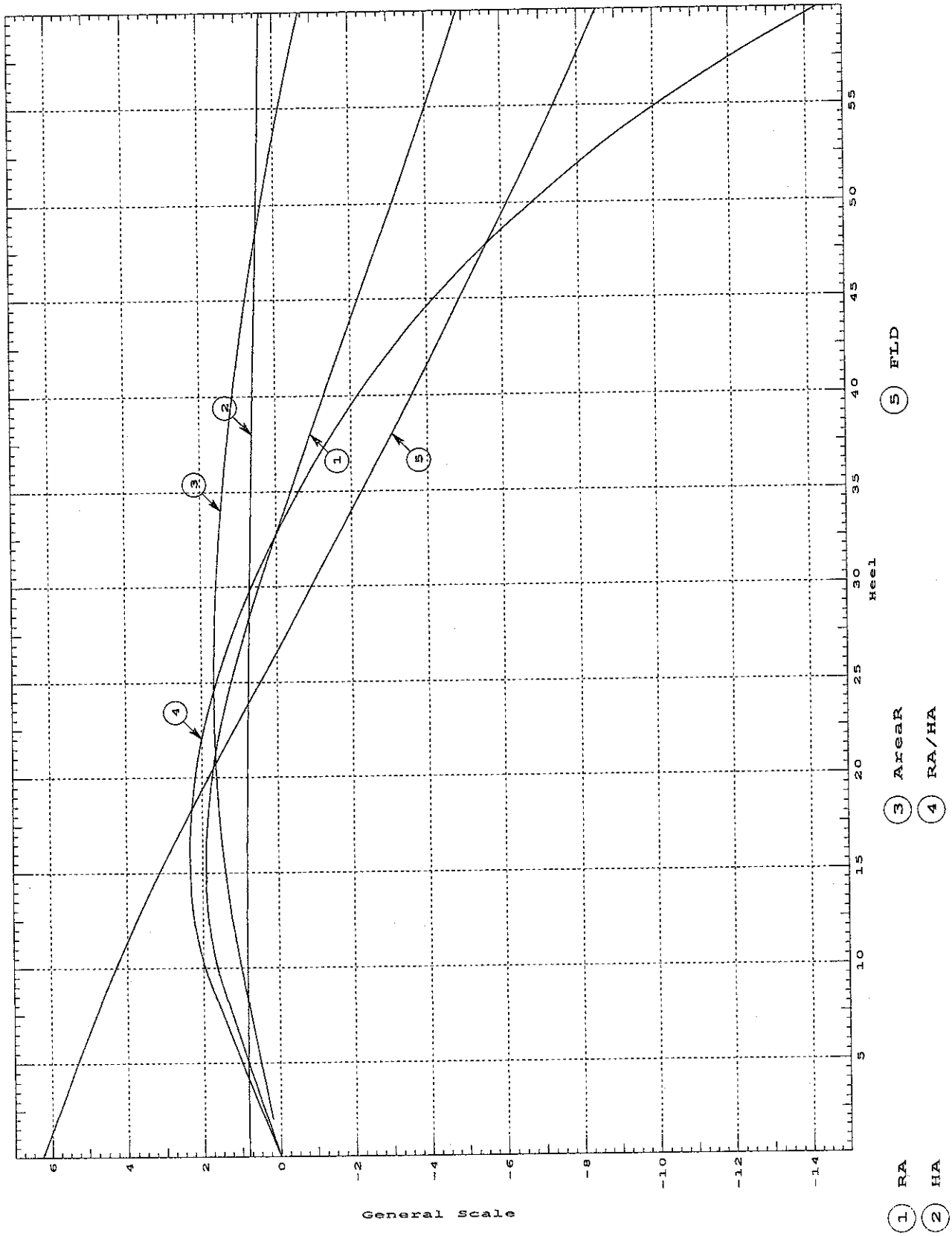
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Righting Arms and Heeling Arms vs Heel angle



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

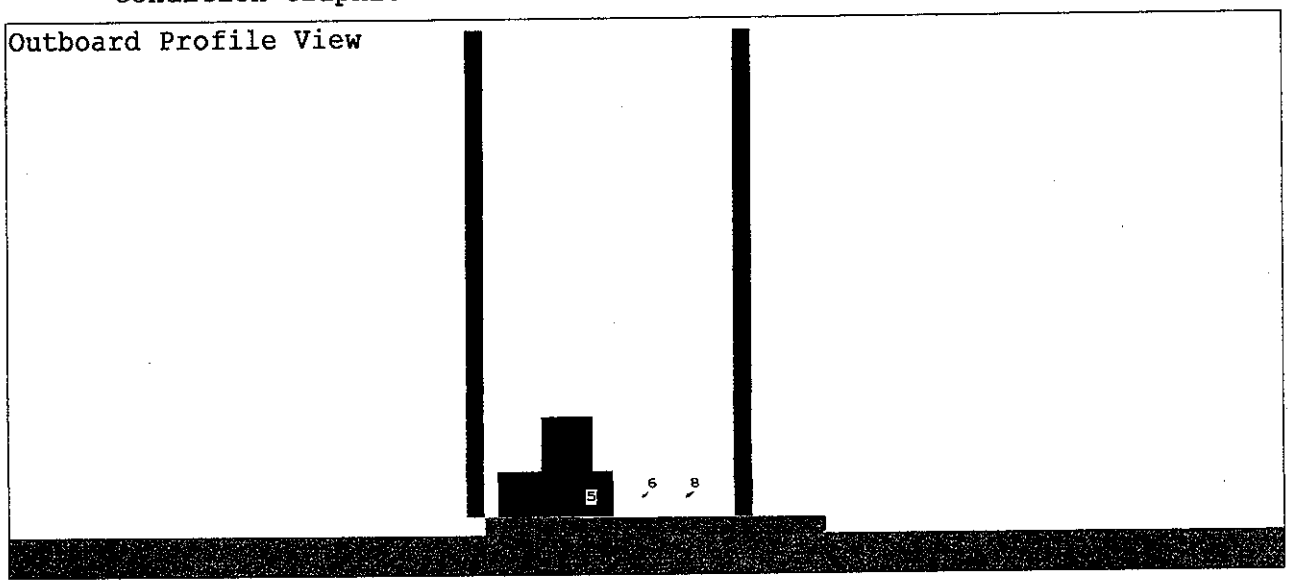
INITIAL TRIM: 0.09f DRAFT: 4.201 FEET without wind at given VCG

WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.251 @ 0.00, 4.161 @ 60.00a
Trim: Fwd 0.09/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG	
WEIGHT		192.29	33.46a	0.00	13.77	
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**	
HULL	1.025	192.29	33.44a	0.00	2.11	
	Righting Arms:		0.00	0.00		
Part	**SpGr**	**WPA**	**LCF**	**TCF**	**BML**	**BMT**
Total Waterplane	**1.025**	**1767**	**33.09a**	**0.00**	**73.0**	**21.34**
		LT/inch		**Ft-LT/In**	**GML**	**GMT**
		4.21		16.38	61.3	9.68

Distances in FEET.

Condition Graphic - Draft: 4.25 @ 0.00 , 4.16 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

INITIAL TRIM: 0.09f DRAFT: 4.201 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	4.83	-0.10	1.44	13.77	36.74	4.66	14
-40.0	4.85	-0.10	1.64	13.77	32.15	4.20	13
-35.0	4.86	-0.10	1.88	13.77	27.70	3.76	13
-30.0	4.87	-0.09	2.18	13.77	23.47	3.36	13
-25.0	4.86	-0.09	2.53	13.77	19.61	2.99	12
-20.0	4.84	-0.09	3.06	13.77	16.28	2.61	12
-15.0	4.79	-0.09	3.74	13.77	13.58	2.24	11
-10.0	4.68	-0.09	4.45	13.77	11.58	1.96	11
-5.0	4.48	-0.09	4.99	13.77	10.33	1.79	10
0.0	4.24	-0.09	3.66	13.77	9.68	2.30	11
5.0	3.97	-0.09	5.10	13.77	10.21	1.68	10
10.0	4.68	-0.09	-4.46	13.77	11.34	1.74	10
15.0	4.79	-0.09	-3.74	13.77	13.20	1.91	11
20.0	4.84	-0.09	-3.06	13.77	15.70	2.18	12
25.0	4.86	-0.09	-2.53	13.77	18.76	2.46	12
30.0	4.87	-0.09	-2.18	13.77	22.28	2.75	13
35.0	4.86	-0.10	-1.88	13.77	26.14	3.08	13
40.0	4.85	-0.10	-1.64	13.77	30.24	3.44	13
45.0	4.83	-0.10	-1.44	13.77	34.44	3.78	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 4.172 @ 0.00, 4.211 @ 60.00a
Trim: Fwd 0.42 deg., Heel: Stbd 5.21 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		192.29	33.46a	0.00	13.77
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	192.30	33.54a	1.96s	2.20
	Righting Arms (normal):		0.08a	0.89s	
	External Arms:		0.00	0.90s	
	Residual Righting Arms:		**0.08a**	**-0.00s**	

Distances in FEET.

GM = 9.744 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	169.78s
10.00s	172.94s
20.00s	165.70s
30.00s	148.45s
40.00s	124.84s
50.00s	98.43s
60.00s	74.33s
70.00s	54.26s
80.00s	41.53s
90.00s	34.59s
100.00s	36.99s
120.00s	42.77s
140.00s	43.30s
160.00s	31.17s
180.00s	169.78s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.21 deg heel **172.73**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 33.46a TCG = 0.00 VCG = 13.77

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.251	0.09f	0.01p	192.30	0.00	-0.883	0.00	
4.251	0.09f	0.00	192.32	0.00	-0.881	-0.01	6.53 (3)
4.211	0.25f	2.50s	192.29	0.00	-0.458	-1.68	4.43 (1)
4.185	0.33f	3.86s	192.29	0.00	-0.229	-2.15	4.50 (1)
4.156	0.42f	5.21s	192.29	0.00	0.000	-2.30	4.56 (1)
4.086	0.57f	7.71s	192.29	0.00	0.421	-1.78	5.04 (2)
4.013	0.73f	10.21s	192.29	0.00	0.838	-0.20	4.54 (2)
3.918	0.83f	12.71s	192.30	0.00	1.124	2.25	4.01 (2)
3.789	0.82f	15.21s	192.29	0.00	1.252	5.25	3.44 (2)
3.713	0.78f	16.62s	192.29	0.00	**1.271**	7.03	3.10 (2)
3.660	0.75f	17.71s	192.29	0.00	1.259	8.41	2.82 (2)
3.555	0.70f	20.21s	192.29	0.00	1.136	11.43	2.18 (2)
3.453	0.66f	22.71s	192.29	0.00	0.895	13.97	1.54 (2)
3.352	0.66f	25.21s	192.29	0.00	0.568	15.80	0.90 (2)
3.259	0.70f	27.71s	192.29	0.00	0.181	16.75	0.27 (2)
3.219	0.73f	28.81s	192.29	0.00	0.000	16.85	*-0.00* (2)
3.168	0.76f	30.21s	192.29	0.00	-0.237	16.68	*-0.35* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75
(3) Vent 2	FLOOD	24.16a	9.05	10.75

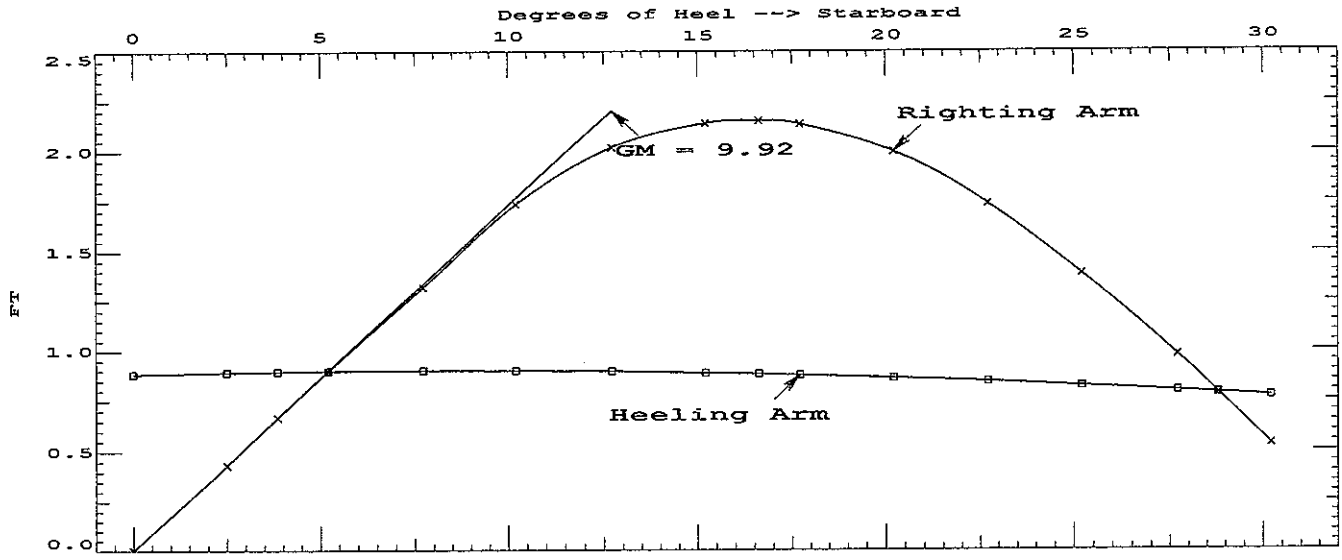
LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.92 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.672 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**5.21 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.23 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.444 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.413 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.636 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**23.60 P**

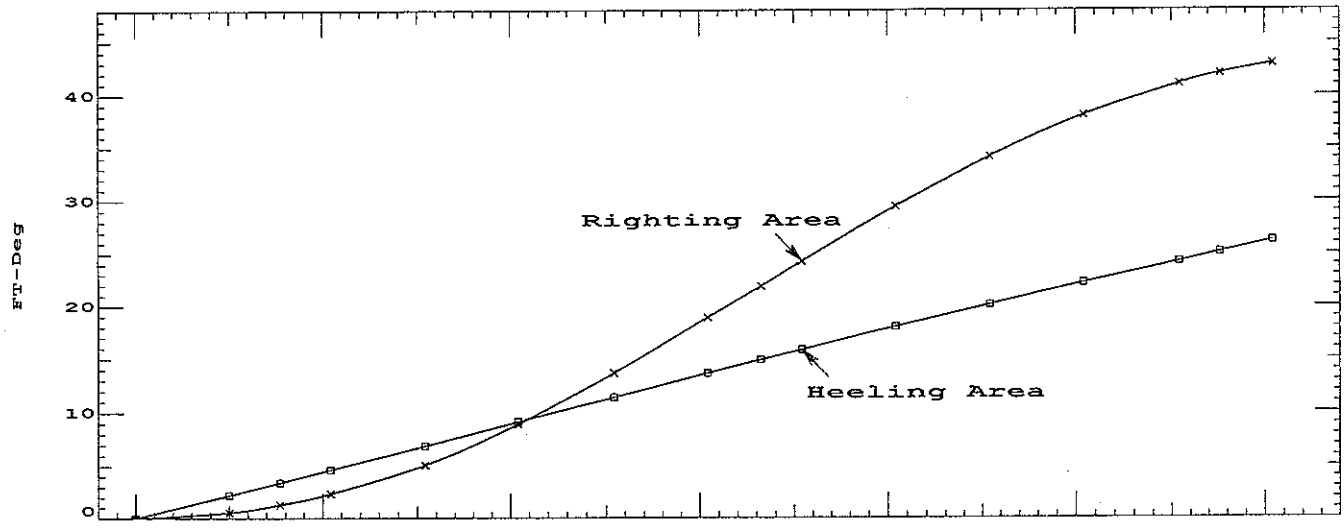
Relative angles measured from 5.215s

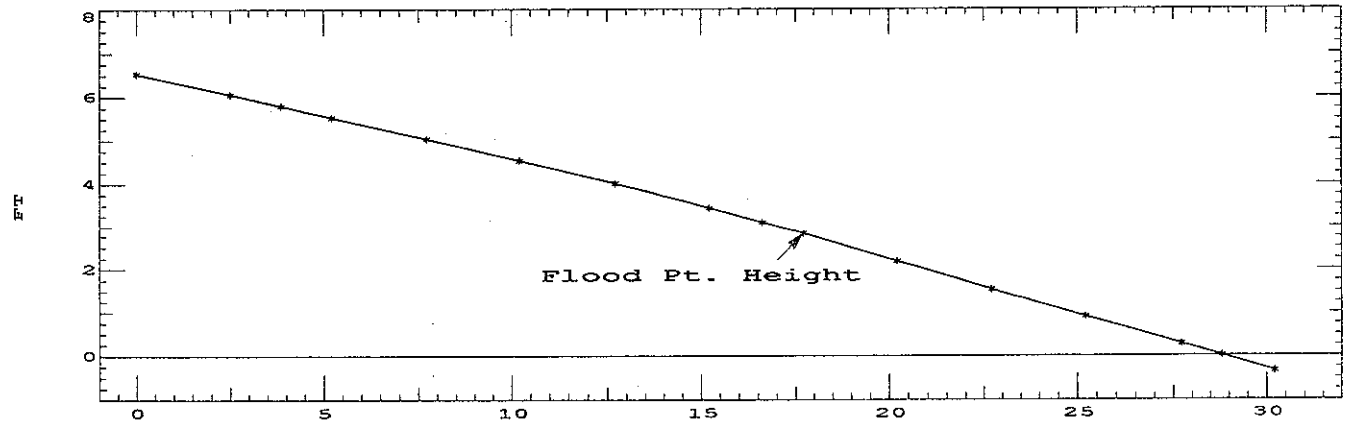
GM is derived from the RA curve.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

Inclination Axis rotated aft 5.00 degrees





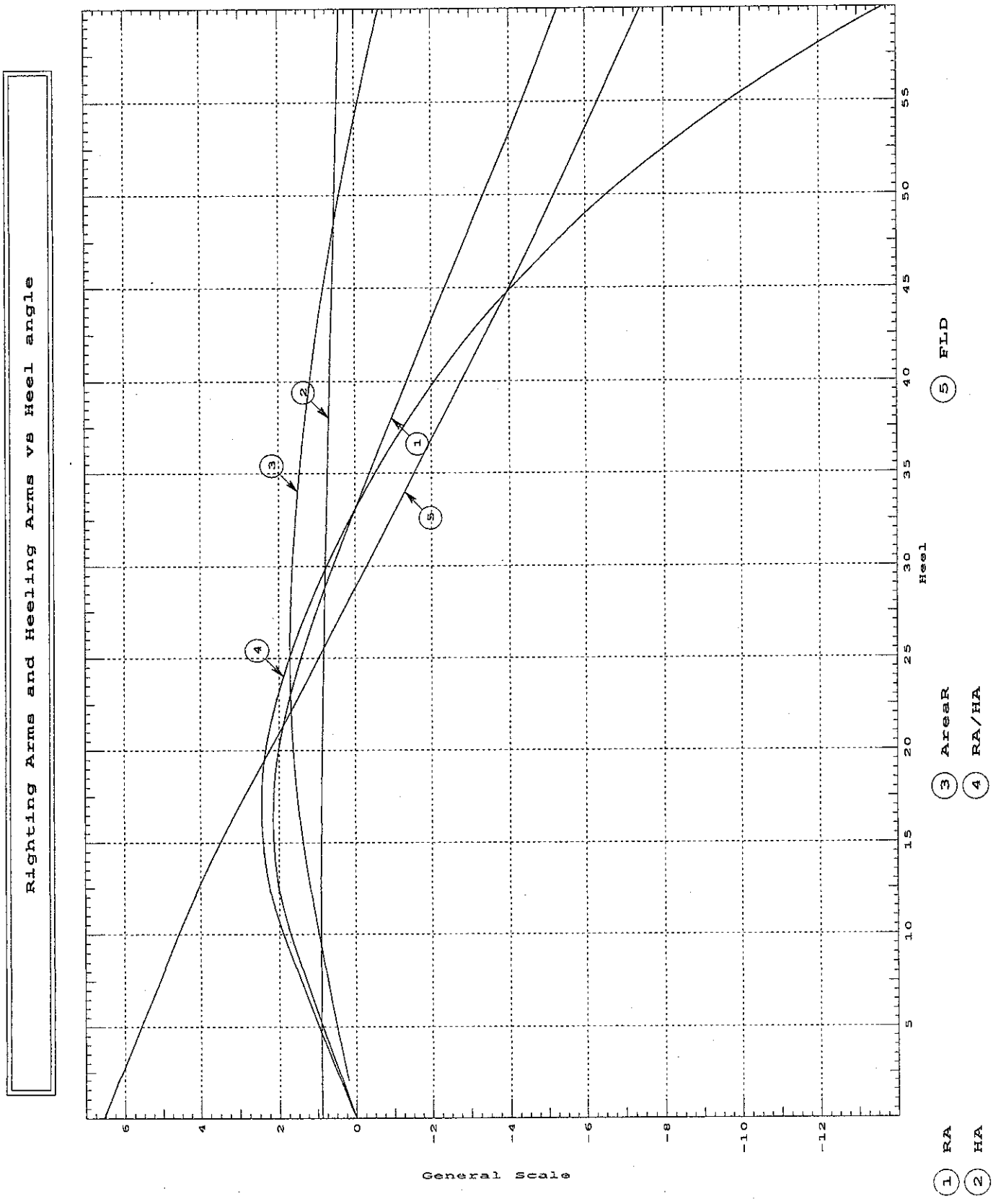


Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

Table of Righting Arms and Areas
Displacement: 192.30 LONG TONS VCG: 13.770
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.25	-0.09	0.00	0.00	0.88		0.00	6.53
4.22	-0.22	2.00	0.35	0.89	0.20	0.39	6.16
4.18	-0.34	4.00	0.69	0.90	0.39	0.77	5.77
4.13	-0.47	6.00	1.03	0.90	0.58	1.15	5.38
4.08	-0.59	8.00	1.37	0.90	0.77	1.52	4.98
4.02	-0.72	10.00	1.70	0.90	0.96	1.89	4.58
3.95	-0.81	12.00	1.96	0.90	1.14	2.19	4.16
3.85	-0.83	14.00	2.10	0.89	1.30	2.35	3.72
3.75	-0.80	16.00	2.15	0.88	1.44	2.44	3.25
3.65	-0.74	18.00	2.12	0.87	1.54	2.43	2.75
3.56	-0.70	20.00	2.01	0.86	1.63	2.34	2.24
3.48	-0.67	22.00	1.82	0.85	1.68	2.15	1.72
3.40	-0.66	24.00	1.57	0.83	1.71	1.88	1.21
3.32	-0.67	26.00	1.26	0.81	1.71	1.56	0.70
3.25	-0.71	28.00	0.93	0.79	1.69	1.17	0.20
3.18	-0.76	30.00	0.57	0.77	1.64	0.74	-0.30
3.10	-0.81	32.00	0.20	0.75	1.58	0.27	-0.80
3.02	-0.86	34.00	-0.18	0.73	1.50	-0.24	-1.30
2.95	-0.92	36.00	-0.56	0.70	1.41	-0.80	-1.79
2.87	-0.99	38.00	-0.96	0.67	1.30	-1.42	-2.29
2.79	-1.05	40.00	-1.35	0.65	1.18	-2.08	-2.78
2.71	-1.12	42.00	-1.75	0.62	1.04	-2.81	-3.27
2.62	-1.19	44.00	-2.15	0.60	0.90	-3.61	-3.75
2.54	-1.26	46.00	-2.55	0.57	0.74	-4.51	-4.23
2.45	-1.32	48.00	-2.95	0.54	0.57	-5.48	-4.71
2.36	-1.39	50.00	-3.35	0.51	0.40	-6.54	-5.18
2.26	-1.45	52.00	-3.74	0.49	0.21	-7.70	-5.64
2.16	-1.51	54.00	-4.13	0.46	0.01	-8.98	-6.09
2.06	-1.56	56.00	-4.52	0.43	-0.20	-10.42	-6.54
1.95	-1.60	58.00	-4.91	0.41	-0.41	-11.97	-6.98
1.83	-1.64	60.00	-5.29	0.39	-0.64	-13.67	-7.42

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

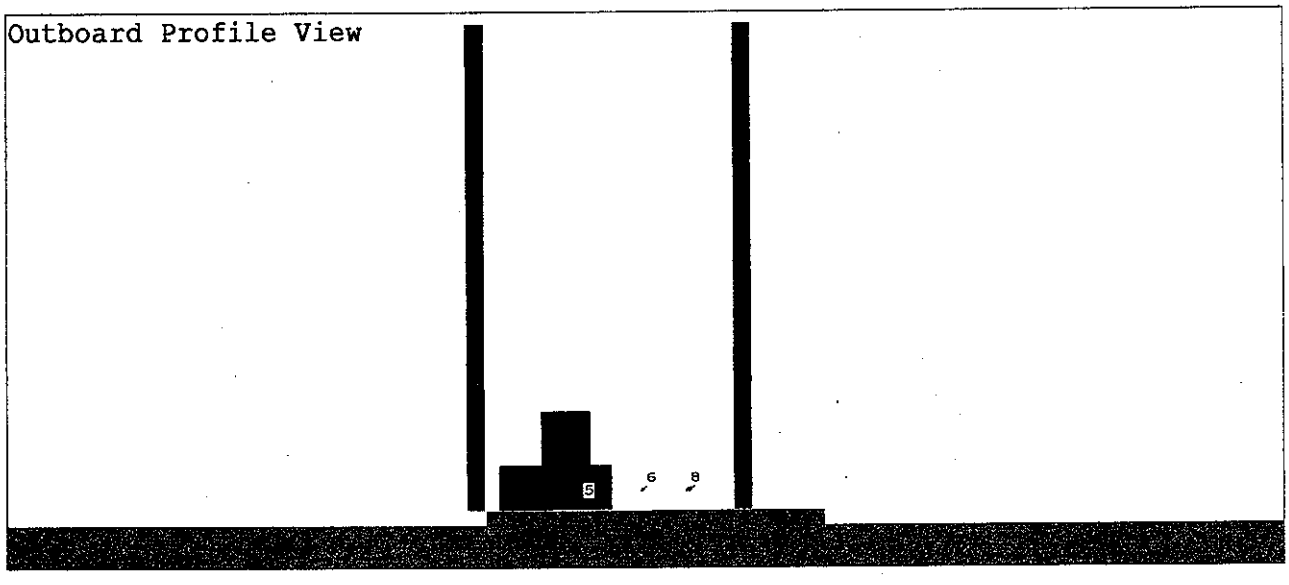
INITIAL TRIM: 0.14a DRAFT: 4.63 FEET without wind at given VCG

WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.554 @ 0.00, 4.694 @ 60.00a
Trim: Aft 0.14/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG	
WEIGHT		214.05	33.62a	0.00	12.63	
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**	
HULL	1.025	214.05	33.65a	0.00	2.35	
	Righting Arms:		0.00	0.00		
Part	**SpGr**	**WPA**	**LCF**	**TCF**	**BML**	**BMT**
Total Waterplane	**1.025**	**1782**	**32.81a**	**0.00**	**67.7**	**19.27**
		LT/Inch		**Ft-LT/in**	**GML**	**GMT**
		4.24		17.07	57.4	8.99

Distances in FEET.

Condition Graphic - Draft: 4.55 @ 0.00 , 4.69 @ 60.00a Heel: zero



Critical Points

cp1 Eroom Door	cp2 Vent 1	cp4 Vent 3	cp6 Vent 1	cp8 Vent 3
	cp3 Vent 2	cp5 Eroom Door	cp7 Vent 2	

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

INITIAL TRIM: 0.14a DRAFT: 4.63 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.96	0.16	-1.48	12.63	33.69	4.65	14
-40.0	3.93	0.16	-1.68	12.63	29.43	4.24	13
-35.0	3.91	0.15	-1.94	12.63	25.30	3.82	13
-30.0	3.90	0.15	-2.24	12.63	21.43	3.43	13
-25.0	3.91	0.14	-2.60	12.63	17.93	3.08	13
-20.0	3.93	0.14	-3.12	12.63	14.91	2.69	12
-15.0	3.97	0.14	-3.79	12.63	12.44	2.28	11
-10.0	4.09	0.14	-4.46	12.63	10.61	1.97	11
-5.0	4.29	0.13	-4.89	12.63	9.47	1.77	10
0.0	4.54	0.13	3.51	12.63	8.99	2.25	11
5.0	4.29	0.13	4.90	12.63	9.51	1.58	9
10.0	4.09	0.14	4.45	12.63	10.52	1.62	10
15.0	3.98	0.14	3.79	12.63	12.22	1.77	11
20.0	3.93	0.14	3.11	12.63	14.56	2.04	12
25.0	3.92	0.14	2.59	12.63	17.46	2.34	12
30.0	3.91	0.15	2.23	12.63	20.82	2.66	13
35.0	3.91	0.15	1.94	12.63	24.53	3.03	13
40.0	3.93	0.16	1.69	12.63	28.49	3.45	13
45.0	3.96	0.16	1.48	12.63	32.57	3.87	14

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 4.487 @ 0.00, 4.740 @ 60.00a
Trim: Fwd 0.20 deg., Heel: Stbd 5.02 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		214.05	33.62a	0.00	12.63
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	214.06	33.74a	1.69s	2.42
		Righting Arms (normal):	0.07a	0.79s	
		External Arms:	0.00	0.80s	
		Residual Righting Arms:	**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.127 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	167.08s
10.00s	171.28s
20.00s	163.30s
30.00s	144.24s
40.00s	119.36s
50.00s	93.09s
60.00s	68.03s
70.00s	48.02s
80.00s	34.37s
90.00s	28.53s
100.00s	30.78s
120.00s	35.71s
140.00s	36.88s
160.00s	27.60s
180.00s	167.08s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.02 deg heel **170.71**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE
LCG = 33.62a TCG = 0.00 VCG = 12.63

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height	
4.553	0.13a	0.00	214.04	0.00	-0.784	0.00	6.12	(2)
4.554	0.13a	0.01s	214.06	0.00	-0.779	-0.01	3.85	(1)
4.517	0.03f	2.51s	214.05	0.00	-0.392	-1.47	3.97	(1)
4.496	0.12f	3.76s	214.05	0.00	-0.196	-1.84	4.02	(1)
4.470	0.20f	5.02s	214.05	0.00	0.000	-1.96	4.08	(1)
4.404	0.35f	7.52s	214.05	0.00	0.395	-1.47	4.65	(2)
4.315	0.46f	10.02s	214.06	0.00	0.744	-0.04	4.14	(2)
4.189	0.43f	12.52s	214.05	0.00	0.913	2.03	3.57	(2)
4.067	0.34f	14.59s	214.05	0.00	**0.953**	3.97	3.07	(2)
4.043	0.31f	15.02s	214.05	0.00	0.952	4.37	2.96	(2)
3.916	0.17f	17.52s	214.05	0.00	0.886	6.69	2.31	(2)
3.806	0.01f	20.02s	214.05	0.00	0.749	8.75	1.61	(2)
3.703	0.16a	22.52s	214.05	0.00	0.548	10.38	0.90	(2)
3.593	0.34a	25.02s	214.05	0.00	0.287	11.43	0.18	(2)
3.564	0.38a	25.62s	214.05	0.00	0.215	11.58	*-0.00*	(2)
3.479	0.51a	27.33s	214.05	0.00	0.000	11.77	*-0.49*	(2)
3.469	0.52a	27.52s	214.05	0.00	-0.024	11.76	*-0.55*	(2)
3.333	0.71a	30.02s	214.05	0.00	-0.370	11.28	*-1.26*	(2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75

LIM	INTACT STABILITY CRITERION		Min/Max		Attained	
(1)	**GM Upright**	>	**0.16**	Ft	**9.27**	P
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.580**	P
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	deg	**5.02**	P
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	deg	**5.02**	P
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.208**	P
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.208**	P
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.553**	P
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	deg	**22.31**	P

Relative angles measured from 5.017s

GM is derived from the RA curve.

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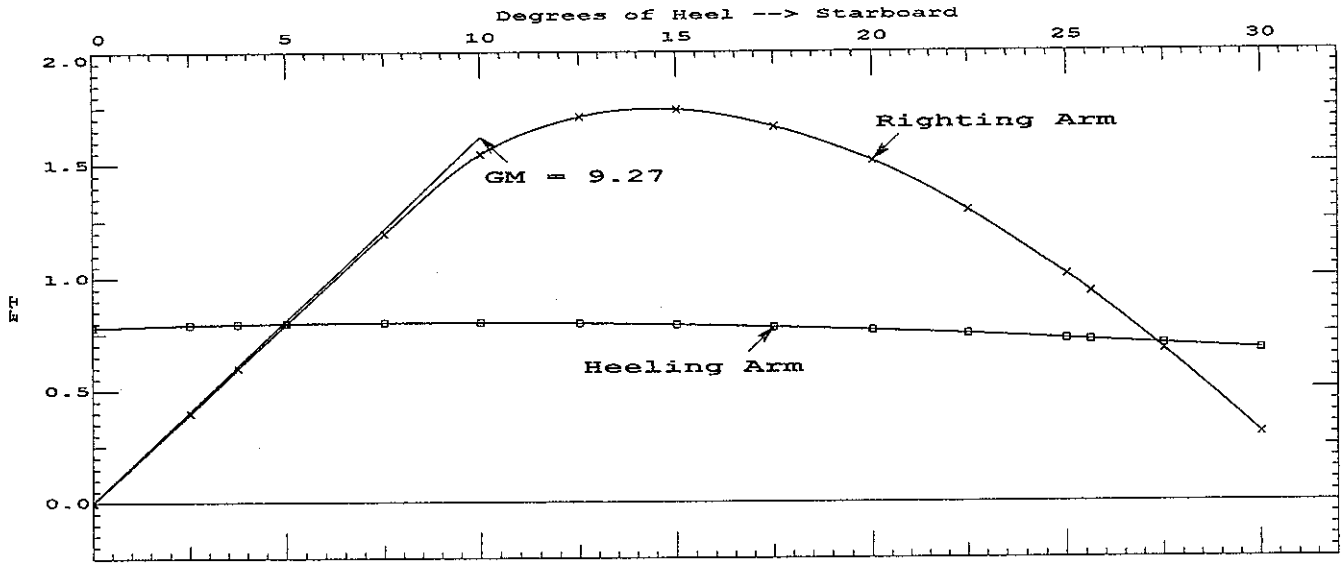
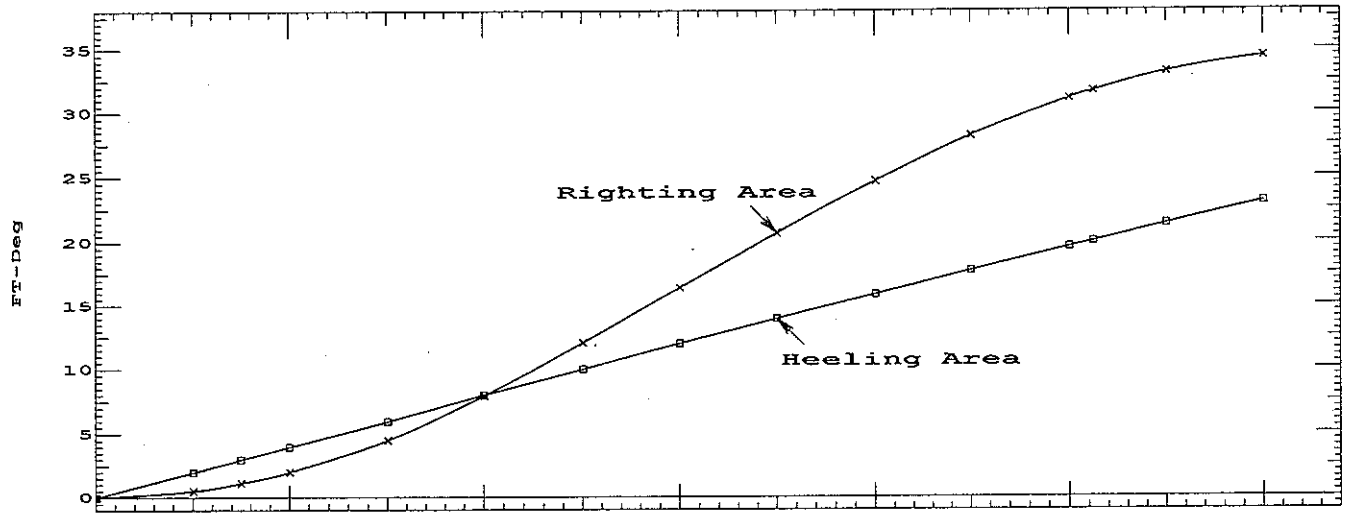
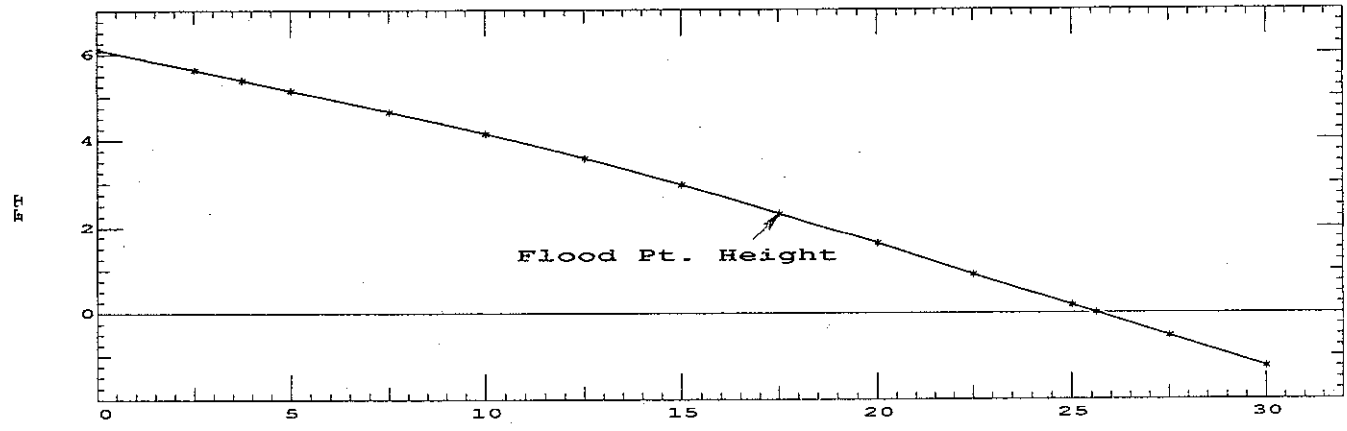
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

Inclination Axis rotated aft 5.00 degrees







Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

Table of Righting Arms and Areas
Displacement: 214.07 LONG TONS VCG: 12.630
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.55	0.13	0.00	-0.00	0.78		-0.00	6.12
4.52	0.00	2.00	0.32	0.79	0.20	0.40	5.74
4.49	-0.13	4.00	0.64	0.80	0.40	0.80	5.35
4.45	-0.26	6.00	0.95	0.80	0.60	1.19	4.95
4.39	-0.38	8.00	1.27	0.80	0.80	1.59	4.55
4.32	-0.46	10.00	1.54	0.80	0.99	1.93	4.14
4.22	-0.45	12.00	1.69	0.80	1.17	2.12	3.69
4.10	-0.37	14.00	1.74	0.79	1.31	2.20	3.22
3.99	-0.26	16.00	1.72	0.78	1.42	2.19	2.71
3.89	-0.14	18.00	1.64	0.77	1.50	2.11	2.18
3.81	-0.01	20.00	1.51	0.76	1.55	1.98	1.62
3.72	0.13	22.00	1.34	0.75	1.58	1.79	1.05
3.64	0.26	24.00	1.13	0.73	1.59	1.54	0.47
3.55	0.41	26.00	0.88	0.71	1.57	1.24	-0.11
3.44	0.56	28.00	0.60	0.69	1.54	0.87	-0.68
3.33	0.71	30.00	0.31	0.67	1.49	0.45	-1.26
3.22	0.85	32.00	-0.01	0.65	1.42	-0.02	-1.82
3.10	0.99	34.00	-0.34	0.63	1.33	-0.54	-2.38
2.98	1.12	36.00	-0.68	0.60	1.24	-1.12	-2.94
2.85	1.25	38.00	-1.02	0.58	1.12	-1.75	-3.49
2.72	1.38	40.00	-1.36	0.56	1.00	-2.44	-4.04
2.58	1.50	42.00	-1.71	0.53	0.86	-3.21	-4.58
2.45	1.63	44.00	-2.06	0.51	0.71	-4.04	-5.11
2.30	1.76	46.00	-2.41	0.48	0.55	-4.98	-5.64
2.15	1.89	48.00	-2.76	0.46	0.38	-6.01	-6.16
2.00	2.02	50.00	-3.10	0.43	0.20	-7.14	-6.68
1.85	2.14	52.00	-3.45	0.41	0.01	-8.39	-7.18
1.69	2.26	54.00	-3.79	0.39	-0.20	-9.78	-7.68
1.54	2.37	56.00	-4.13	0.36	-0.41	-11.41	-8.17
1.39	2.46	58.00	-4.46	0.34	-0.63	-13.14	-8.65
1.25	2.55	60.00	-4.79	0.32	-0.86	-15.07	-9.11

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LIFTBOAT VISION
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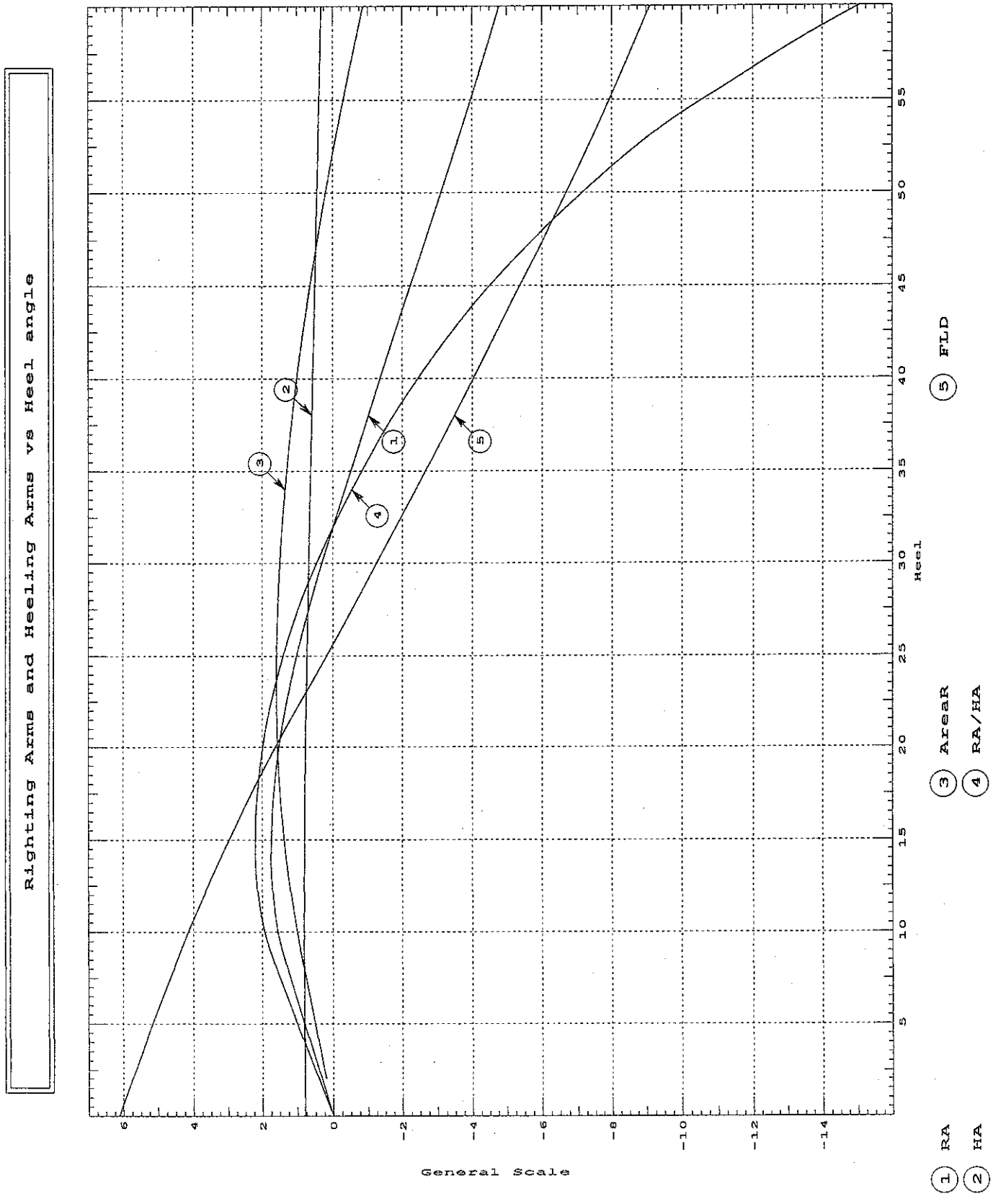
TRANSIT CONDITION
4.63-FEET Draft



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

INITIAL TRIM: 0.14a DRAFT: 4.482 FEET without wind at given VCG

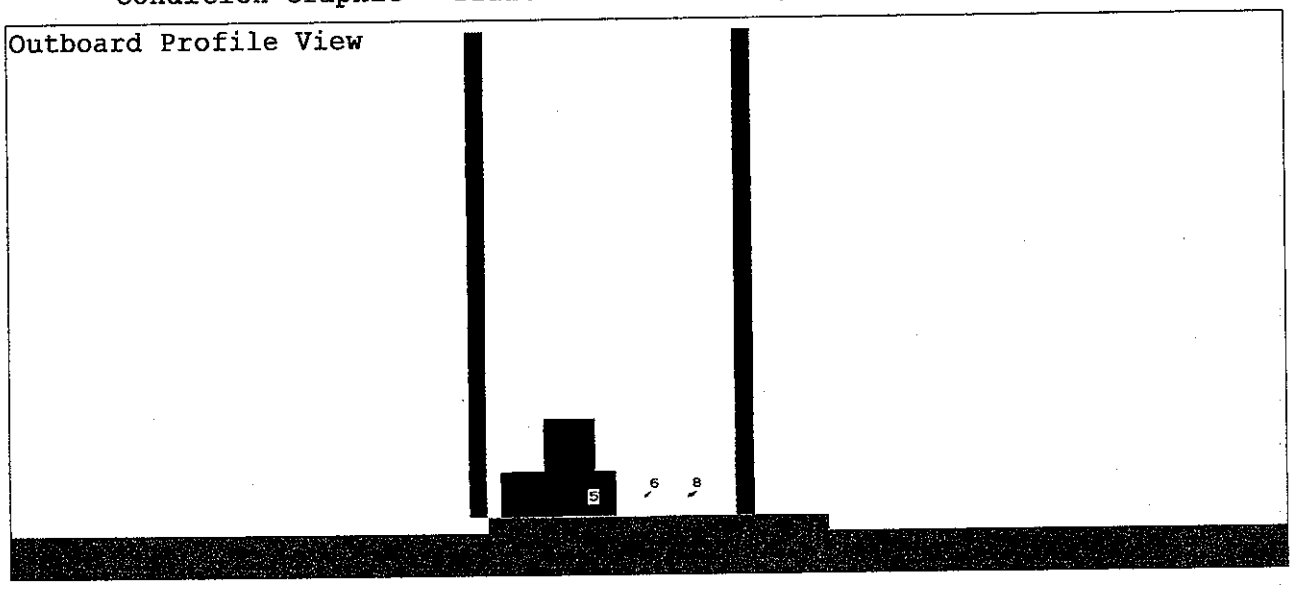
WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.405 @ 0.00, 4.545 @ 60.00a
Trim: Aft 0.14/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		206.51	33.65a	0.00	12.94
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	206.51	33.67a	0.00	2.27
	Righting Arms:		0.00	0.00	

Part	SpGr	WPA	LCF	TCF	BML	BMT
Total Waterplane	**1.025**	**1775**	**32.95a**	**0.00**	**69.1**	**19.92**
		LT/Inch		**Ft-LT/In**	**GML**	**GMT**
		4.22		16.76	58.4	9.25

Distances in FEET.

Condition Graphic - Draft: 4.41 @ 0.00 , 4.55 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

INITIAL TRIM: 0.14a DRAFT: 4.482 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.79	0.16	-1.53	12.94	34.71	4.73	14
-40.0	3.76	0.16	-1.73	12.94	30.34	4.30	13
-35.0	3.74	0.15	-1.99	12.94	26.10	3.87	13
-30.0	3.74	0.15	-2.29	12.94	22.13	3.47	13
-25.0	3.75	0.14	-2.65	12.94	18.54	3.11	13
-20.0	3.77	0.14	-3.18	12.94	15.43	2.71	12
-15.0	3.81	0.14	-3.86	12.94	12.91	2.31	11
-10.0	3.93	0.14	-4.51	12.94	11.03	2.01	11
-5.0	4.13	0.13	-4.96	12.94	9.81	1.81	10
0.0	4.39	0.13	3.55	12.94	9.25	2.31	11
5.0	4.13	0.13	4.95	12.94	9.74	1.64	10
10.0	3.93	0.14	4.52	12.94	10.79	1.67	10
15.0	3.81	0.14	3.85	12.94	12.54	1.82	11
20.0	3.77	0.14	3.18	12.94	14.94	2.09	12
25.0	3.75	0.14	2.65	12.94	17.90	2.39	12
30.0	3.74	0.15	2.30	12.94	21.32	2.69	13
35.0	3.75	0.15	1.99	12.94	25.10	3.06	13
40.0	3.76	0.16	1.73	12.94	29.12	3.45	13
45.0	3.79	0.16	1.52	12.94	33.24	3.85	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

WEIGHT and DISPLACEMENT STATUS
Baseline draft: 4.333 @ 0.00, 4.594 @ 60.00a
Trim: Fwd 0.19 deg., Heel: Stbd 5.07 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		206.51	33.65a	0.00	12.94
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	206.53	33.77a	1.77s	2.35
	Righting Arms (normal):		0.07a	0.83s	
	External Arms:		0.00	0.83s	
	Residual Righting Arms:		**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.395 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	168.70s
10.00s	171.83s
20.00s	164.18s
30.00s	145.62s
40.00s	122.12s
50.00s	94.51s
60.00s	70.25s
70.00s	49.79s
80.00s	36.50s
90.00s	30.60s
100.00s	32.89s
120.00s	38.23s
140.00s	38.63s
160.00s	29.24s
180.00s	168.70s

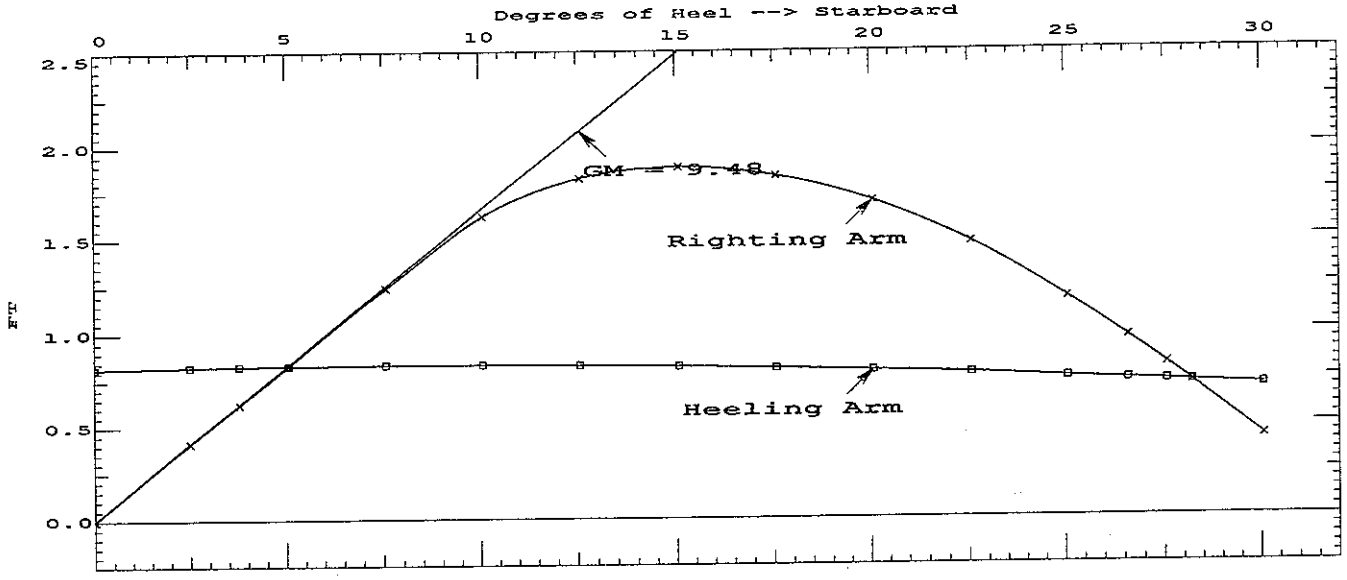
Angles in degrees Moments in Ft-LT

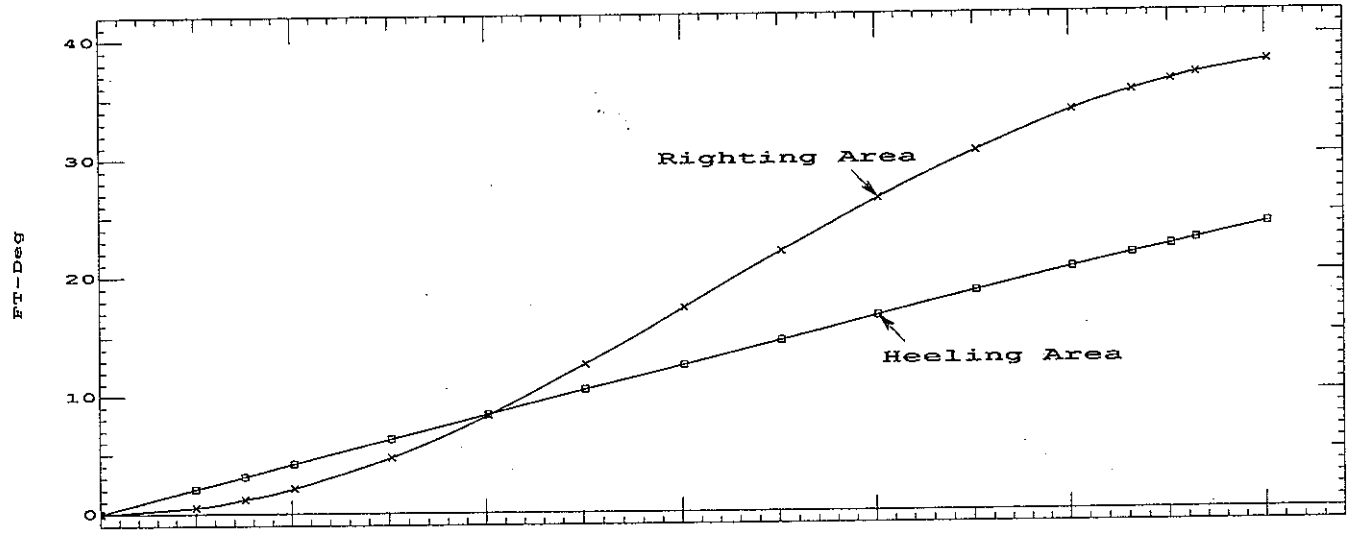
Interpolated moment to starboard for 5.07 deg heel **171.63**

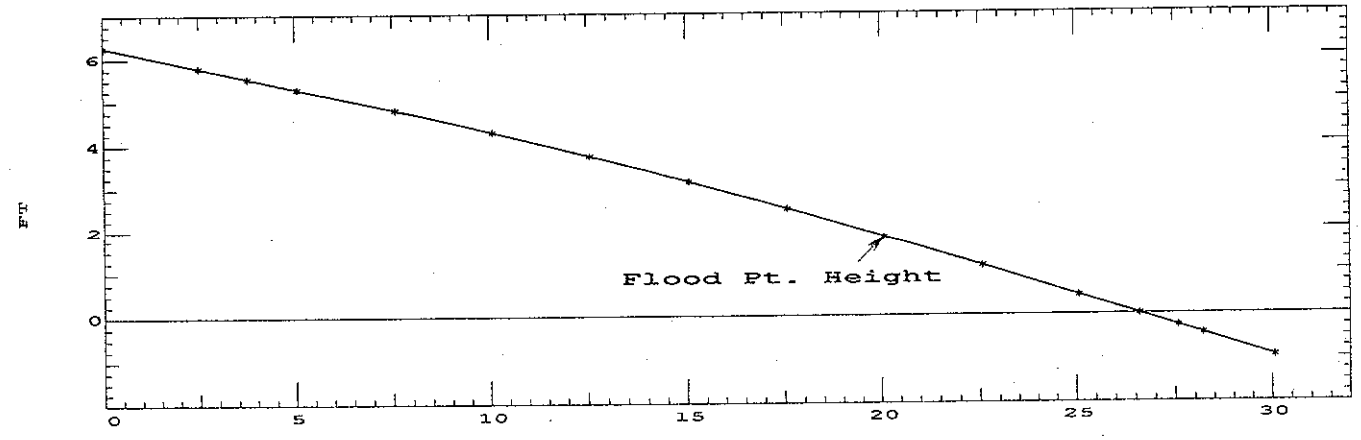
Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Inclination Axis rotated aft 5.00 degrees





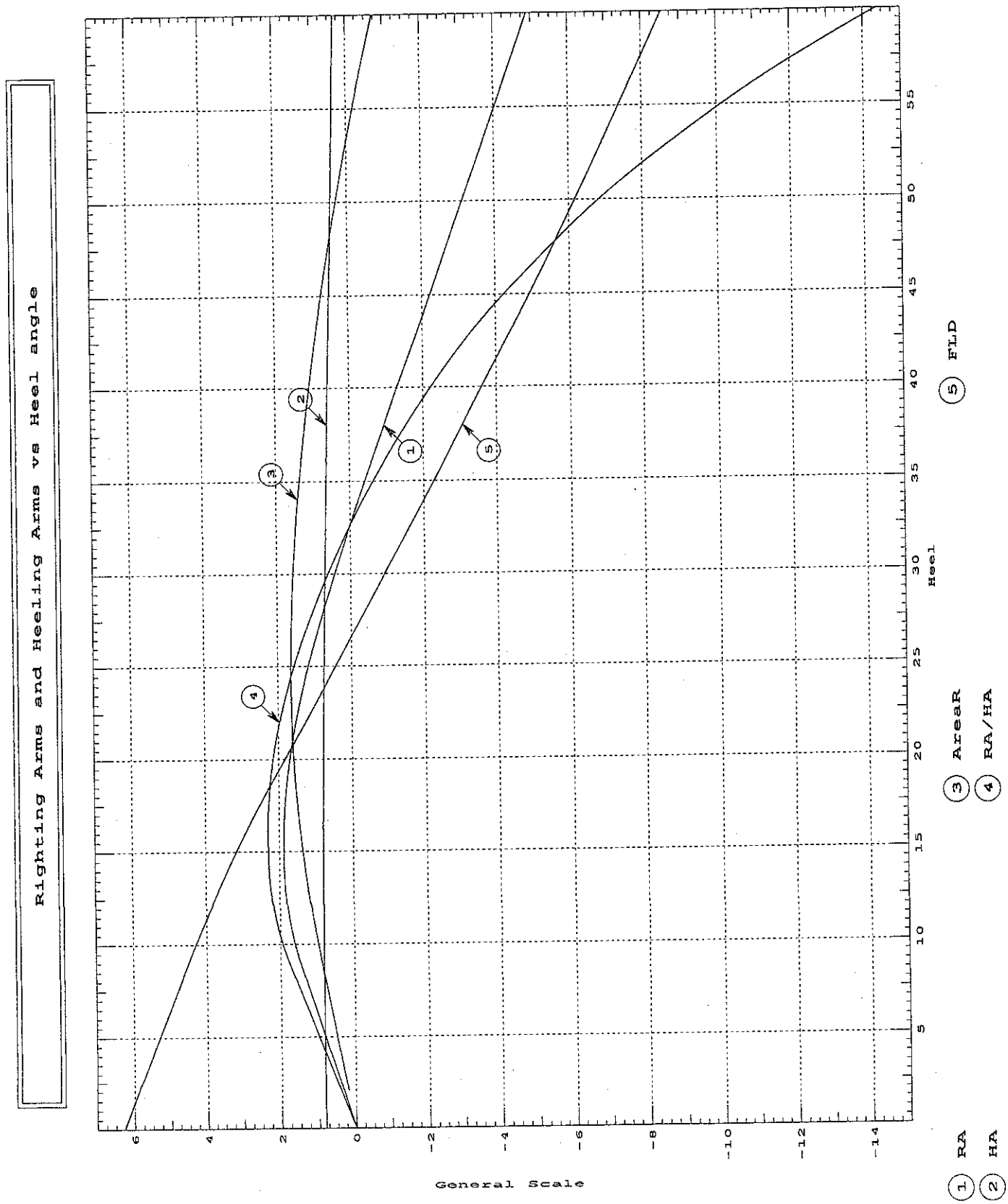


Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Table of Righting Arms and Areas
Displacement: 206.53 LONG TONS VCG: 12.940
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.41	0.13	0.00	-0.00	0.82		-0.00	6.27
4.37	0.01	2.00	0.33	0.82	0.20	0.40	5.89
4.34	-0.13	4.00	0.66	0.83	0.40	0.79	5.50
4.29	-0.25	6.00	0.98	0.83	0.59	1.18	5.10
4.23	-0.37	8.00	1.31	0.83	0.79	1.57	4.70
4.16	-0.47	10.00	1.61	0.83	0.99	1.94	4.30
4.07	-0.48	12.00	1.79	0.83	1.16	2.16	3.86
3.96	-0.43	14.00	1.87	0.82	1.31	2.28	3.39
3.84	-0.33	16.00	1.88	0.82	1.43	2.30	2.90
3.74	-0.22	18.00	1.82	0.81	1.53	2.25	2.38
3.64	-0.10	20.00	1.70	0.80	1.59	2.14	1.83
3.55	0.02	22.00	1.53	0.78	1.63	1.96	1.28
3.45	0.14	24.00	1.31	0.77	1.65	1.71	0.72
3.35	0.27	26.00	1.05	0.74	1.64	1.41	0.17
3.24	0.39	28.00	0.76	0.73	1.62	1.04	-0.39
3.12	0.50	30.00	0.44	0.71	1.57	0.62	-0.93
3.01	0.61	32.00	0.11	0.68	1.50	0.16	-1.48
2.89	0.70	34.00	-0.24	0.66	1.42	-0.36	-2.01
2.77	0.79	36.00	-0.59	0.64	1.33	-0.92	-2.55
2.64	0.88	38.00	-0.95	0.62	1.22	-1.54	-3.08
2.51	0.97	40.00	-1.31	0.59	1.10	-2.21	-3.61
2.38	1.07	42.00	-1.67	0.57	0.96	-2.95	-4.13
2.23	1.17	44.00	-2.04	0.54	0.82	-3.77	-4.65
2.09	1.27	46.00	-2.40	0.51	0.66	-4.72	-5.16
1.94	1.37	48.00	-2.77	0.48	0.49	-5.72	-5.67
1.79	1.47	50.00	-3.13	0.46	0.31	-6.83	-6.17
1.64	1.57	52.00	-3.49	0.43	0.13	-8.06	-6.66
1.48	1.66	54.00	-3.84	0.41	-0.07	-9.40	-7.14
1.33	1.75	56.00	-4.20	0.38	-0.28	-10.90	-7.62
1.18	1.83	58.00	-4.55	0.36	-0.50	-12.55	-8.08
1.03	1.89	60.00	-4.89	0.34	-0.73	-14.38	-8.54

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

INITIAL TRIM: 0.14a DRAFT: 4.201 FEET without wind at given VCG

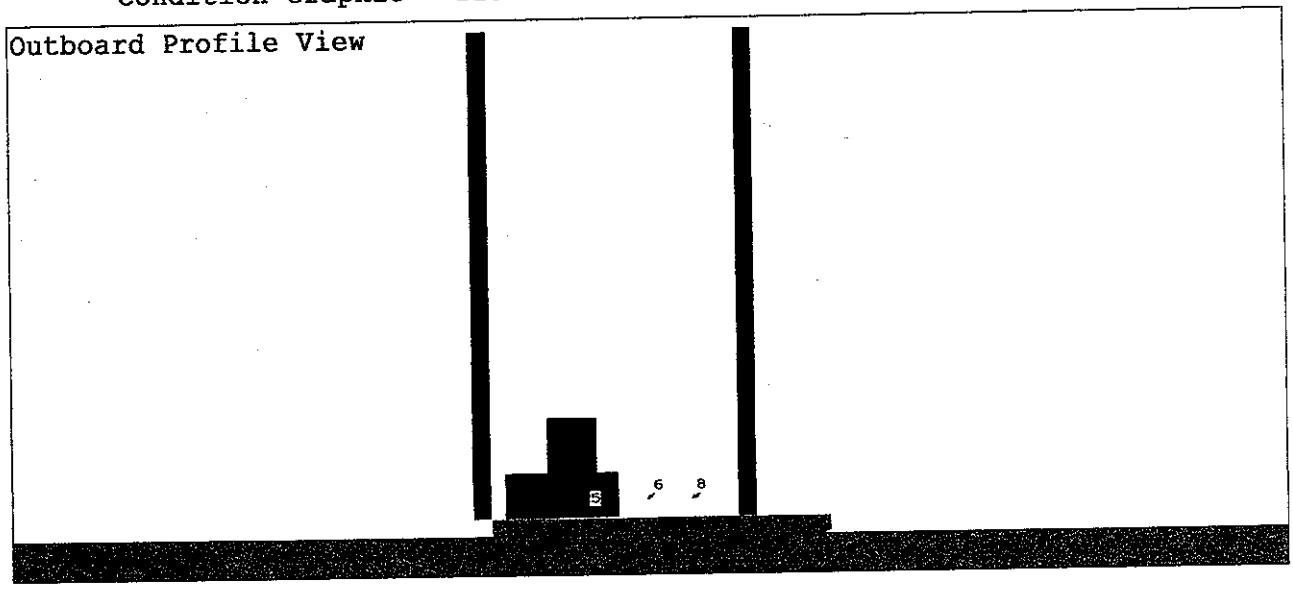
WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.124 @ 0.00, 4.264 @ 60.00a
Trim: Aft 0.14/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		192.29	33.69a	0.00	13.77
	SpGr	Displ(LT)	LCB	TCB	VCB
HULL	1.025	192.29	33.72a	0.00	2.11
	Righting Arms:		0.00	0.00	

Part	SpGr	WPA	LCF	TCF	BML	BMT
Total Waterplane	**1.025**	**1760**	**33.21a**	**0.00**	**72.0**	**21.30**
		LT/Inch		Ft-LT/In	GML	GMT
		4.19		16.12	60.4	9.64

Distances in FEET.

Condition Graphic - Draft: 4.12 @ 0.00 , 4.26 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

INITIAL TRIM: 0.14a DRAFT: 4.201 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.47	0.16	-1.60	13.77	36.51	4.77	14
-40.0	3.45	0.16	-1.81	13.77	31.86	4.30	13
-35.0	3.43	0.15	-2.08	13.77	27.35	3.85	13
-30.0	3.42	0.15	-2.39	13.77	23.14	3.44	13
-25.0	3.44	0.14	-2.77	13.77	19.34	3.06	13
-20.0	3.45	0.14	-3.31	13.77	16.07	2.67	12
-15.0	3.50	0.14	-4.01	13.77	13.42	2.27	11
-10.0	3.63	0.14	-4.70	13.77	11.47	1.99	11
-5.0	3.84	0.13	-5.14	13.77	10.28	1.80	10
0.0	4.11	0.13	3.68	13.77	9.64	2.29	11
5.0	3.84	0.13	5.14	13.77	10.23	1.66	10
10.0	3.63	0.14	4.70	13.77	11.32	1.70	10
15.0	3.50	0.14	4.01	13.77	13.11	1.86	11
20.0	3.45	0.14	3.31	13.77	15.53	2.11	12
25.0	3.44	0.14	2.77	13.77	18.50	2.38	12
30.0	3.42	0.15	2.39	13.77	21.94	2.65	13
35.0	3.43	0.15	2.08	13.77	25.73	2.97	13
40.0	3.45	0.16	1.81	13.77	29.78	3.31	13
45.0	3.47	0.16	1.59	13.77	34.03	3.64	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 4.042 @ 0.00, 4.316 @ 60.00a
Trim: Fwd 0.20 deg., Heel: Stbd 5.26 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		192.29	33.69a	0.00	13.77
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	192.31	33.82a	1.96s	2.20
	Righting Arms (normal):		0.08a	0.89s	
	External Arms:		0.00	0.90s	
	Residual Righting Arms:		**0.08a**	**-0.00s**	

Distances in FEET.

GM = 9.710 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	169.78s
10.00s	172.94s
20.00s	165.70s
30.00s	148.48s
40.00s	124.84s
50.00s	98.43s
60.00s	74.33s
70.00s	54.26s
80.00s	41.53s
90.00s	34.59s
100.00s	36.99s
120.00s	42.77s
140.00s	43.30s
160.00s	31.17s
180.00s	169.78s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.26 deg heel **172.74**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE
LCG = 33.69a TCG = 0.00 VCG = 13.77

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.124	0.13a	0.00	192.29	0.00	-0.885	0.00	6.55 (2)
4.124	0.13a	0.01s	192.29	0.00	-0.883	-0.01	4.28 (1)
4.085	0.03f	2.51s	192.32	0.00	-0.462	-1.69	4.39 (1)
4.057	0.11f	3.88s	192.29	0.00	-0.231	-2.17	4.46 (1)
4.025	0.20f	5.25s	192.29	0.00	0.000	-2.32	4.52 (1)
3.953	0.34f	7.75s	192.29	0.00	0.421	-1.80	5.04 (2)
3.874	0.49f	10.25s	192.29	0.00	0.838	-0.23	4.54 (2)
3.768	0.56f	12.75s	192.29	0.00	1.110	2.21	4.00 (2)
3.628	0.52f	15.25s	192.30	0.00	1.226	5.16	3.43 (2)
3.545	0.47f	16.59s	192.30	0.00	**1.243**	6.81	3.10 (2)
3.477	0.41f	17.75s	192.32	0.00	1.230	8.25	2.81 (2)
3.341	0.30f	20.25s	192.29	0.00	1.107	11.20	2.17 (2)
3.201	0.20f	22.75s	192.29	0.00	0.866	13.66	1.52 (2)
3.056	0.11f	25.25s	192.29	0.00	0.542	15.42	0.89 (2)
2.913	0.06f	27.75s	192.29	0.00	0.157	16.31	0.25 (2)
2.861	0.05f	28.71s	192.29	0.00	0.000	16.38	0.01 (2)
2.858	0.04f	28.77s	192.29	0.00	-0.010	16.38	*-0.00* (2)
2.775	0.03f	30.25s	192.29	0.00	-0.260	16.18	*-0.37* (2)
2.630	0.00	32.75s	192.29	0.00	-0.696	14.99	*-1.00* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75

LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.93 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.655 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**5.25 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.26 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.412 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.384 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.621 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**23.46 P**

Relative angles measured from 5.255s

GM is derived from the RA curve.

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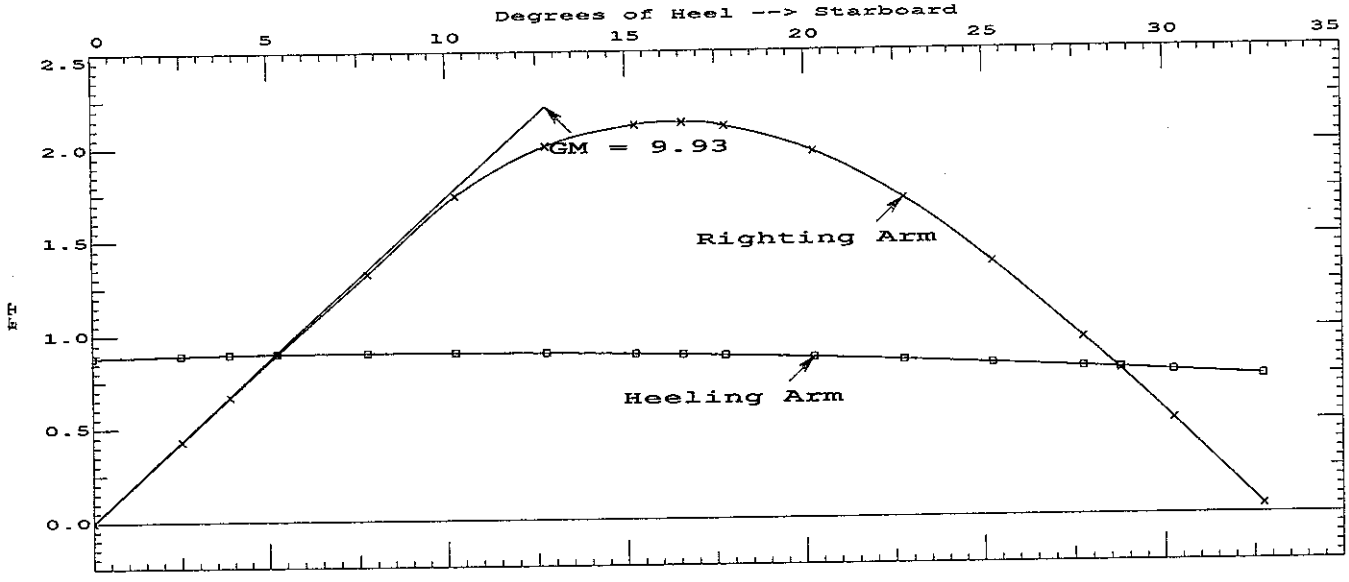
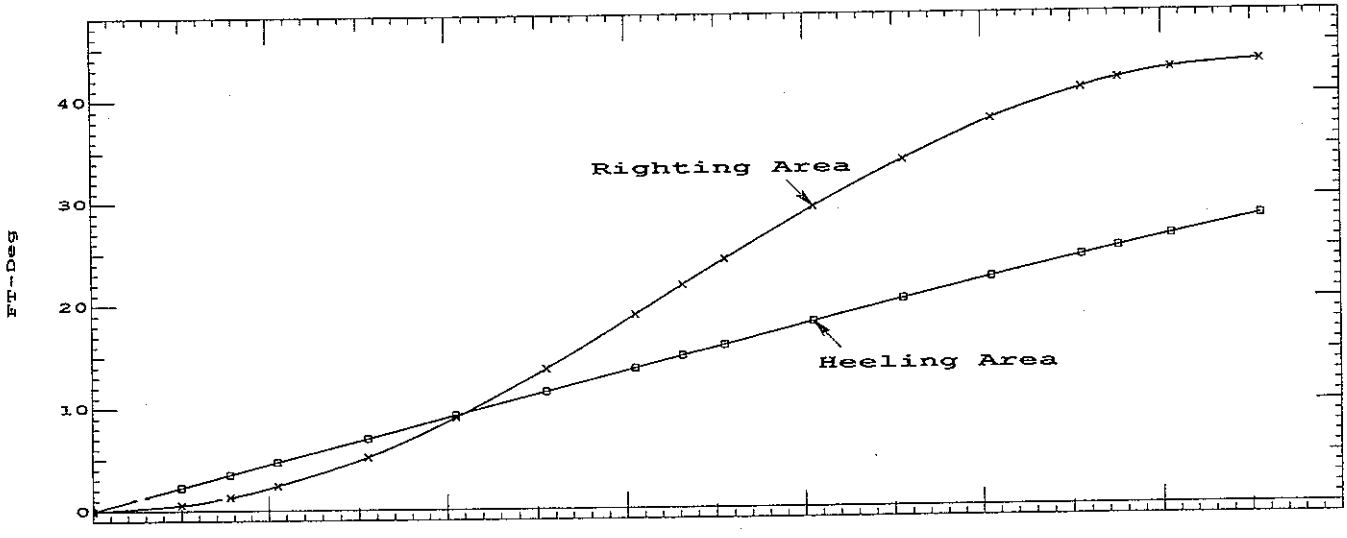
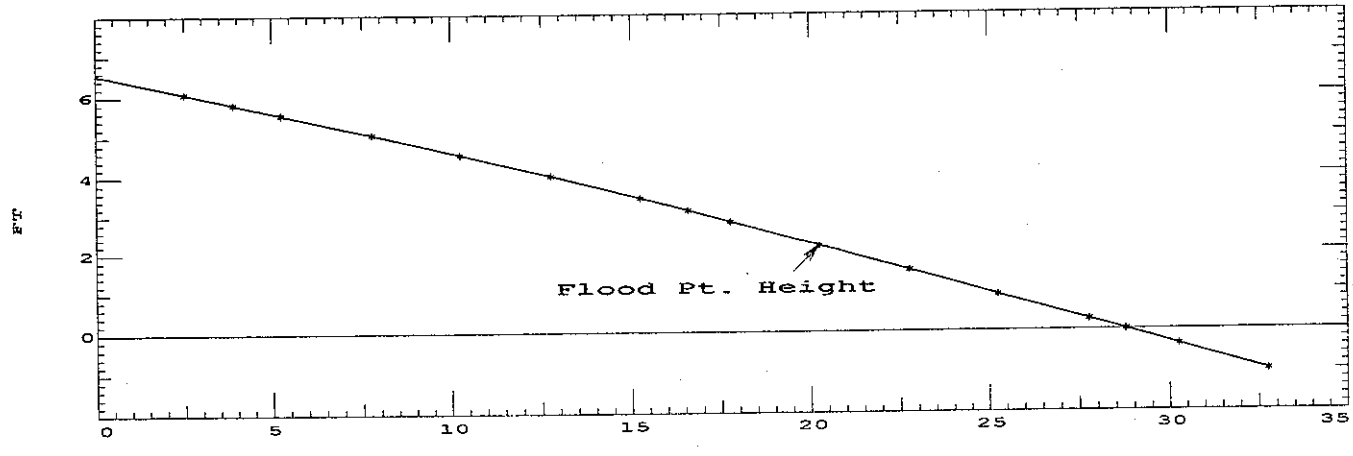
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

Inclination Axis rotated aft 5.00 degrees







Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

Table of Righting Arms and Areas
Displacement: 192.32 LONG TONS VCG: 13.770
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.12	0.13	0.00	-0.00	0.88		-0.00	6.55
4.09	0.00	2.00	0.34	0.89	0.19	0.39	6.17
4.05	-0.12	4.00	0.69	0.90	0.38	0.76	5.78
4.00	-0.24	6.00	1.02	0.90	0.57	1.14	5.39
3.95	-0.36	8.00	1.36	0.90	0.76	1.51	4.99
3.88	-0.48	10.00	1.70	0.90	0.95	1.89	4.59
3.80	-0.56	12.00	1.94	0.90	1.13	2.17	4.17
3.70	-0.56	14.00	2.07	0.89	1.29	2.33	3.72
3.58	-0.49	16.00	2.12	0.88	1.42	2.40	3.25
3.46	-0.40	18.00	2.10	0.87	1.53	2.40	2.75
3.36	-0.31	20.00	1.99	0.86	1.61	2.31	2.23
3.24	-0.23	22.00	1.80	0.85	1.66	2.12	1.72
3.13	-0.15	24.00	1.54	0.83	1.69	1.86	1.21
3.01	-0.09	26.00	1.24	0.81	1.69	1.53	0.70
2.90	-0.06	28.00	0.91	0.79	1.67	1.15	0.19
2.79	-0.03	30.00	0.56	0.77	1.62	0.72	-0.31
2.67	-0.01	32.00	0.19	0.75	1.56	0.25	-0.81
2.56	0.02	34.00	-0.19	0.73	1.48	-0.26	-1.31
2.43	0.04	36.00	-0.58	0.70	1.39	-0.83	-1.81
2.31	0.07	38.00	-0.97	0.67	1.28	-1.44	-2.30
2.18	0.10	40.00	-1.37	0.65	1.16	-2.10	-2.80
2.04	0.14	42.00	-1.76	0.62	1.02	-2.83	-3.29
1.91	0.16	44.00	-2.16	0.60	0.88	-3.63	-3.77
1.77	0.20	46.00	-2.56	0.57	0.72	-4.53	-4.25
1.63	0.23	48.00	-2.96	0.54	0.55	-5.50	-4.73
1.48	0.26	50.00	-3.36	0.51	0.38	-6.56	-5.20
1.34	0.29	52.00	-3.75	0.49	0.19	-7.73	-5.67
1.19	0.32	54.00	-4.15	0.46	-0.01	-9.01	-6.12
1.04	0.35	56.00	-4.53	0.43	-0.22	-10.44	-6.57
0.89	0.38	58.00	-4.92	0.41	-0.43	-12.00	-7.01
0.75	0.41	60.00	-5.30	0.39	-0.66	-13.70	-7.45

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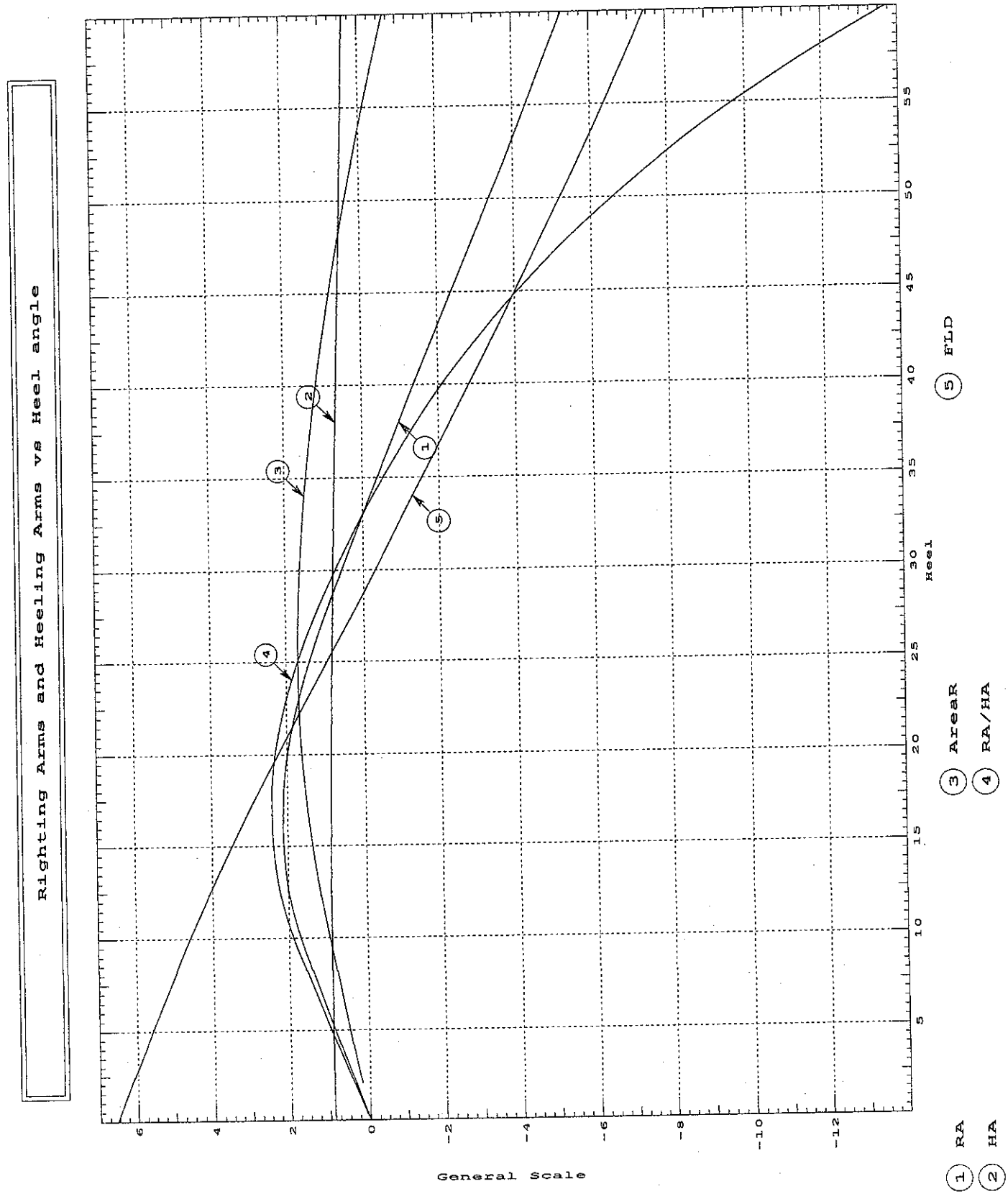
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft



Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

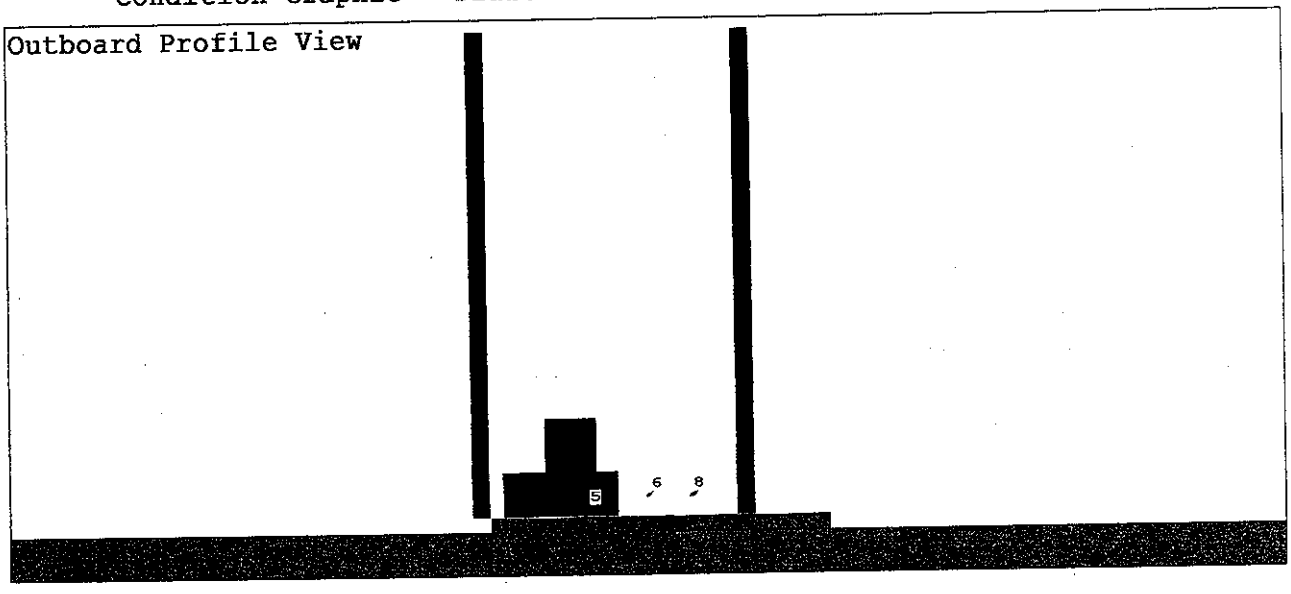
INITIAL TRIM: 0.32a DRAFT: 4.63 FEET without wind at given VCG

WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.455 @ 0.00, 4.775 @ 60.00a
Trim: Aft 0.32/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG	
WEIGHT		214.02	33.79a	0.00	12.63	
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**	
HULL	1.025	214.02	33.85a	0.00	2.35	
	Righting Arms:		0.00	0.00		
Part	**SpGr**	**WPA**	**LCF**	**TCF**	**BML**	**BMT**
Total Waterplane	**1.025**	**1777**	**32.90a**	**0.00**	**67.0**	**19.24**
		LT/Inch		**Ft-LT/In**	**GML**	**GMT**
		4.23		16.87	56.7	8.96

Distances in FEET.

Condition Graphic - Draft: 4.45 @ 0.00 , 4.77 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

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4.63-FEET Draft

INITIAL TRIM: 0.32a DRAFT: 4.63 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.84	0.38	-1.56	12.63	33.54	4.74	14
-40.0	3.81	0.36	-1.76	12.63	29.31	4.32	13
-35.0	3.79	0.35	-2.01	12.63	25.22	3.89	13
-30.0	3.79	0.34	-2.31	12.63	21.37	3.49	13
-25.0	3.80	0.33	-2.66	12.63	17.90	3.13	13
-20.0	3.82	0.32	-3.18	12.63	14.90	2.73	12
-15.0	3.87	0.31	-3.85	12.63	12.45	2.31	11
-10.0	3.98	0.31	-4.50	12.63	10.64	1.99	11
-5.0	4.18	0.31	-4.92	12.63	9.50	1.77	10
0.0	4.44	0.31	3.52	12.63	8.96	2.24	11
5.0	4.18	0.31	4.92	12.63	9.44	1.56	7
10.0	3.98	0.31	4.50	12.63	10.45	1.59	8
15.0	3.87	0.31	3.85	12.63	12.16	1.73	11
20.0	3.82	0.32	3.18	12.63	14.49	1.98	12
25.0	3.80	0.33	2.66	12.63	17.37	2.28	12
30.0	3.79	0.34	2.31	12.63	20.71	2.59	13
35.0	3.79	0.35	2.01	12.63	24.40	2.95	13
40.0	3.81	0.36	1.76	12.63	28.33	3.35	13
45.0	3.84	0.38	1.56	12.63	32.39	3.76	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 4.385 @ 0.00, 4.822 @ 60.00a
Trim: Fwd 0.02 deg., Heel: Stbd 5.04 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		214.02	33.79a	0.00	12.63
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	214.04	33.94a	1.70s	2.42
	Righting Arms (normal):		0.07a	0.79s	
	External Arms:		0.00	0.80s	
	Residual Righting Arms:		**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.115 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	167.08s
10.00s	171.28s
20.00s	163.30s
30.00s	144.24s
40.00s	119.36s
50.00s	93.09s
60.00s	68.07s
70.00s	47.81s
80.00s	34.41s
90.00s	28.54s
100.00s	30.81s
120.00s	35.84s
140.00s	36.88s
160.00s	27.60s
180.00s	167.08s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.04 deg heel **170.72**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

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RESIDUAL RIGHTING ARMS vs HEEL ANGLE
LCG = 33.79a TCG = 0.00 VCG = 12.63

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.454	0.31a	0.00	214.02	0.00	-0.786	0.00	6.12 (2)
4.455	0.30a	0.03s	214.03	0.00	-0.780	-0.02	3.81 (1)
4.417	0.14a	2.53s	214.04	0.00	-0.393	-1.49	3.93 (1)
4.395	0.06a	3.79s	214.02	0.00	-0.197	-1.86	3.99 (1)
4.368	0.02f	5.04s	214.02	0.00	0.000	-1.98	4.05 (1)
4.300	0.17f	7.54s	214.02	0.00	0.394	-1.49	4.65 (2)
4.205	0.26f	10.04s	214.02	0.00	0.735	-0.08	4.14 (2)
4.071	0.22f	12.54s	214.02	0.00	0.893	1.96	3.57 (2)
3.941	0.11f	14.58s	214.02	0.00	**0.929**	3.83	3.07 (2)
3.912	0.08f	15.04s	214.02	0.00	0.927	4.26	2.96 (2)
3.765	0.10a	17.54s	214.02	0.00	0.859	6.51	2.30 (2)
3.634	0.30a	20.04s	214.02	0.00	0.721	8.51	1.61 (2)
3.505	0.52a	22.54s	214.02	0.00	0.519	10.06	0.89 (2)
3.365	0.75a	25.04s	214.02	0.00	0.257	11.03	0.17 (2)
3.330	0.81a	25.63s	214.02	0.00	0.188	11.16	*-0.00* (2)
3.236	0.95a	27.12s	214.02	0.00	0.000	11.30	*-0.43* (2)
3.208	1.00a	27.54s	214.02	0.00	-0.055	11.29	*-0.55* (2)
3.036	1.25a	30.04s	214.02	0.00	-0.401	10.72	*-1.27* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75

LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.19 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.558 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**5.04 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.04 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.177 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.177 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.537 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**22.08 P**

Relative angles measured from 5.045s

GM is derived from the RA curve.

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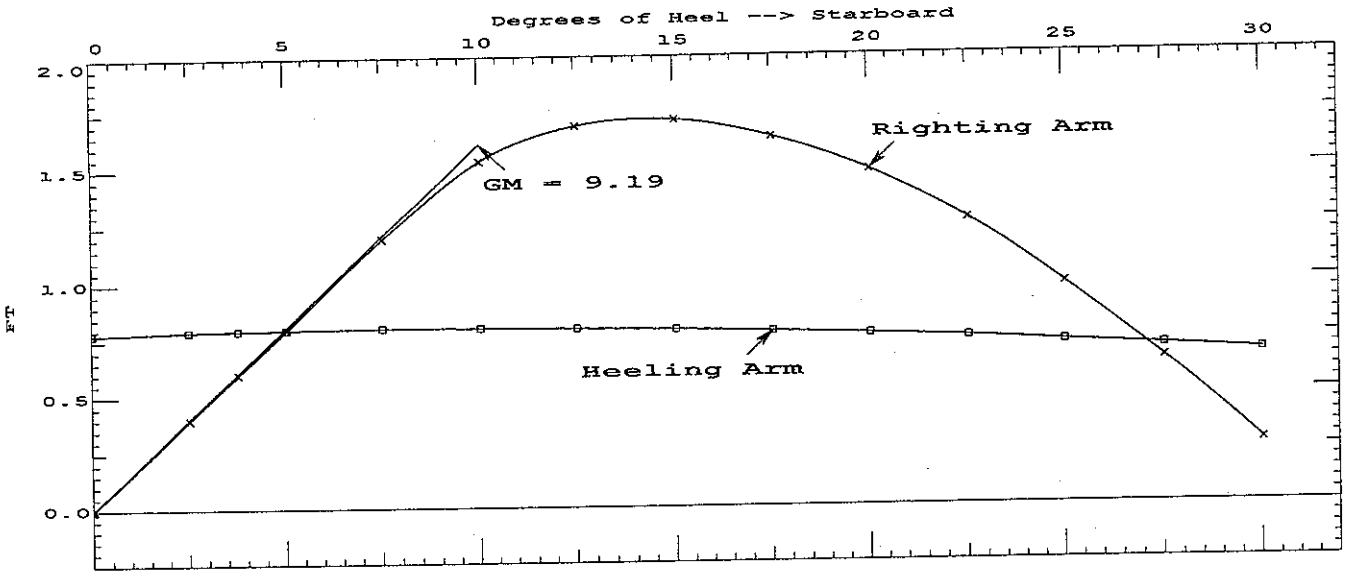
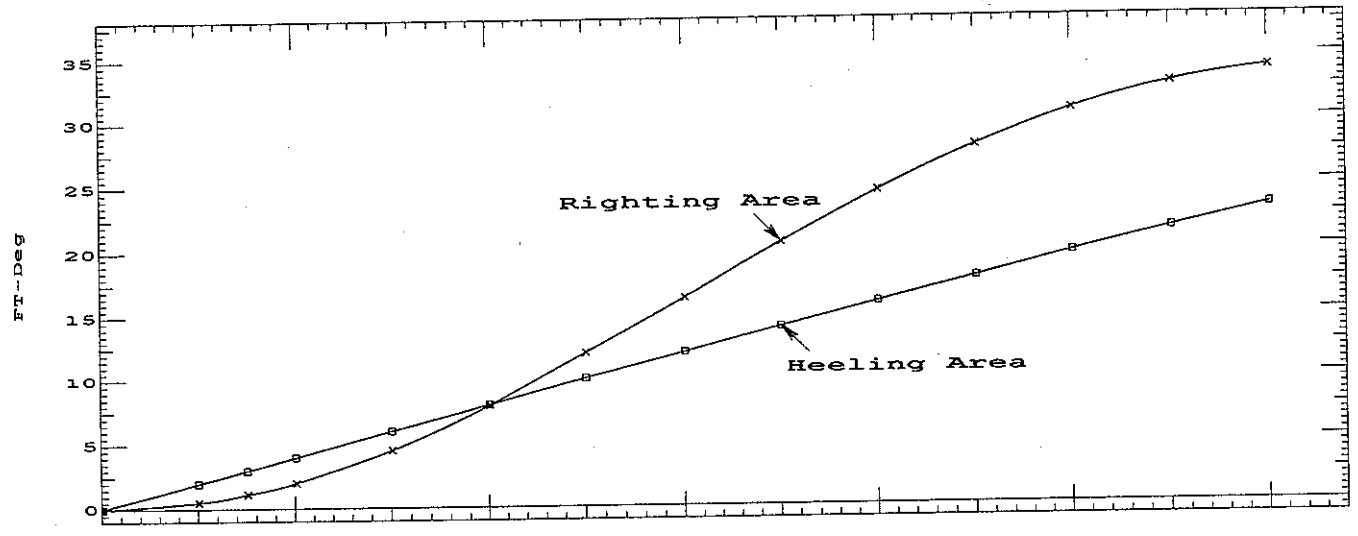
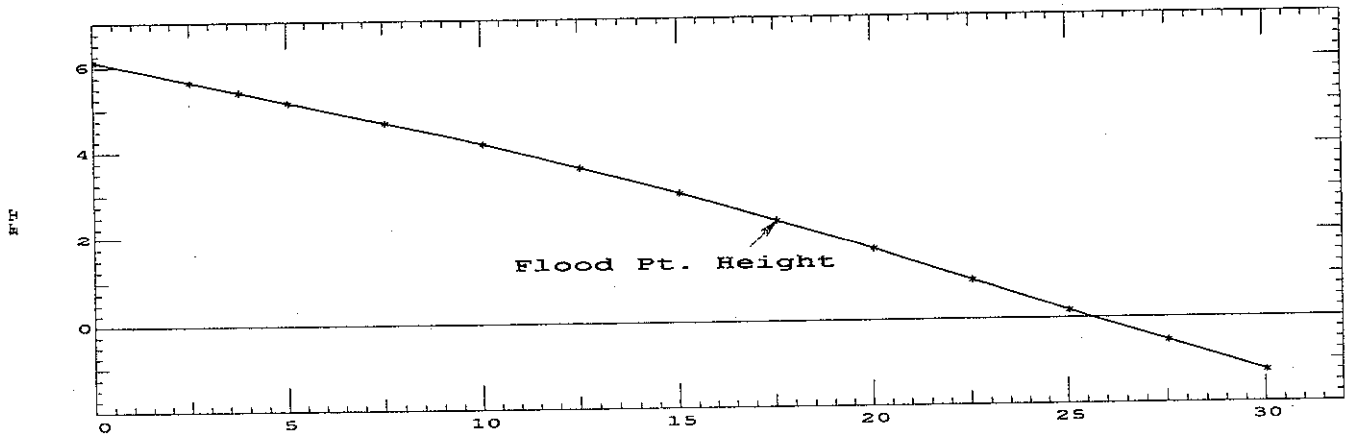
Inclination Axis rotated aft 5.00 degrees







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STABILITY CALCULATIONS
TRANSIT CONDITION
4.63-FEET Draft

Table of Righting Arms and Areas
Displacement: 214.02 LONG TONS VCG: 12.630
Heel axis: 5.0

Depth	Trim	Heel	RA	HA	AreaR	RA/HA	FLD
4.45	0.31	0.00	-0.01	0.78		-0.01	6.12
4.42	0.18	2.00	0.31	0.79	0.20	0.40	5.75
4.39	0.04	4.00	0.63	0.80	0.40	0.79	5.36
4.34	-0.08	6.00	0.95	0.80	0.60	1.19	4.96
4.29	-0.20	8.00	1.27	0.80	0.80	1.58	4.56
4.21	-0.27	10.00	1.53	0.80	0.99	1.91	4.15
4.10	-0.24	12.00	1.67	0.80	1.16	2.09	3.70
3.98	-0.15	14.00	1.72	0.79	1.30	2.17	3.22
3.85	-0.01	16.00	1.70	0.78	1.40	2.16	2.71
3.74	0.14	18.00	1.61	0.77	1.48	2.08	2.18
3.64	0.30	20.00	1.49	0.76	1.53	1.95	1.62
3.53	0.47	22.00	1.32	0.75	1.56	1.76	1.05
3.42	0.65	24.00	1.11	0.73	1.57	1.51	0.47
3.31	0.84	26.00	0.85	0.71	1.55	1.20	-0.11
3.18	1.04	28.00	0.58	0.69	1.52	0.83	-0.68
3.04	1.25	30.00	0.28	0.67	1.47	0.41	-1.26
2.89	1.45	32.00	-0.04	0.65	1.40	-0.06	-1.82
2.74	1.66	34.00	-0.36	0.63	1.31	-0.58	-2.38
2.58	1.86	36.00	-0.70	0.60	1.21	-1.16	-2.94
2.41	2.06	38.00	-1.04	0.58	1.10	-1.79	-3.50
2.25	2.26	40.00	-1.39	0.56	0.97	-2.49	-4.04
2.07	2.45	42.00	-1.74	0.53	0.83	-3.25	-4.58
1.90	2.65	44.00	-2.08	0.51	0.68	-4.09	-5.12
1.71	2.85	46.00	-2.43	0.48	0.52	-5.03	-5.65
1.53	3.05	48.00	-2.78	0.46	0.35	-6.06	-6.17
1.35	3.23	50.00	-3.13	0.43	0.17	-7.19	-6.68
1.16	3.42	52.00	-3.47	0.41	-0.02	-8.44	-7.19
0.98	3.59	54.00	-3.81	0.39	-0.23	-9.83	-7.68
0.80	3.75	56.00	-4.15	0.36	-0.44	-11.45	-8.17
0.63	3.89	58.00	-4.48	0.34	-0.66	-13.18	-8.65
0.46	4.01	60.00	-4.80	0.32	-0.90	-15.11	-9.11

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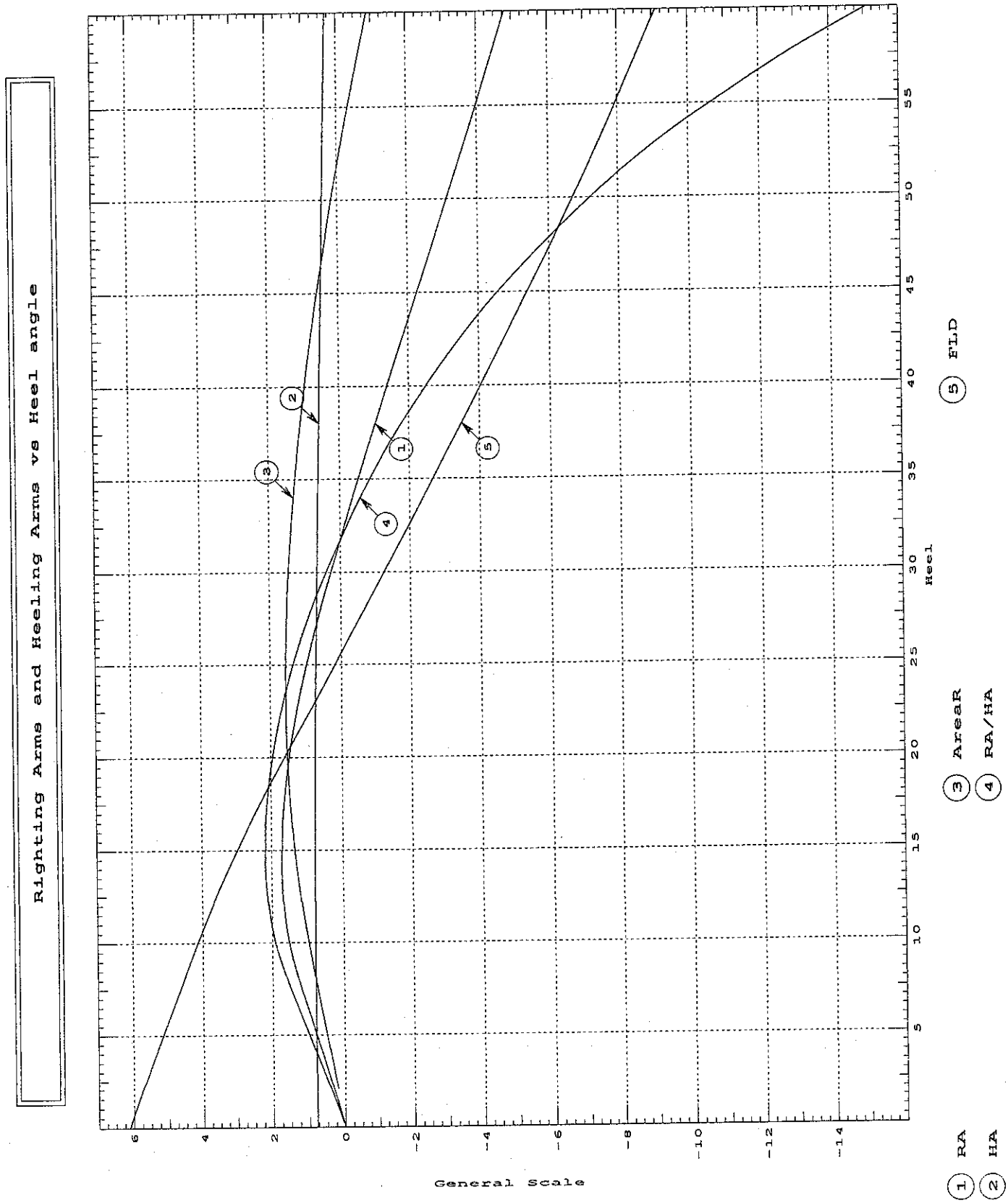

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LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

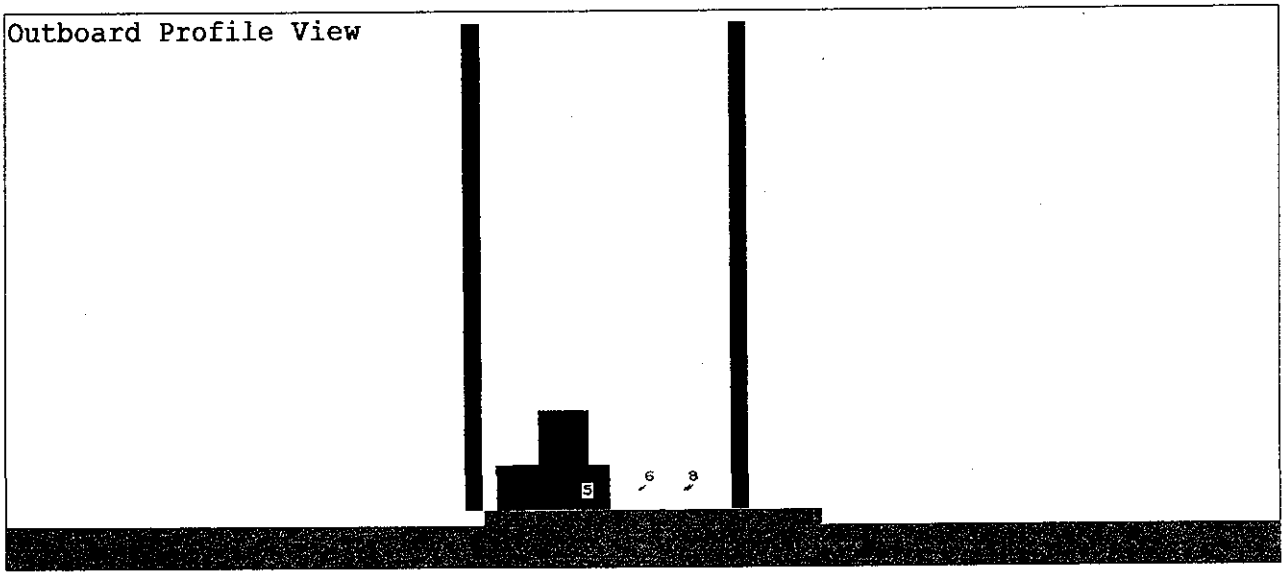
INITIAL TRIM: 0.32a DRAFT: 4.482 FEET without wind at given VCG

WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.306 @ 0.00, 4.626 @ 60.00a
Trim: Aft 0.32/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG	
WEIGHT		206.49	33.82a	0.00	12.94	
	SpGr	Displ(LT)	LCB	TCB	VCB	
HULL	1.025	206.49	33.88a	0.00	2.27	
	Righting Arms:		0.00	0.00		
Part	**SpGr**	**WPA**	**LCF**	**TCF**	**BML**	**BMT**
Total Waterplane	**1.025**	**1770**	**33.04a**	**0.00**	**68.4**	**19.89**
		LT/inch		Ft-LT/In	GML	GMT
		4.21		16.56	57.7	9.22

Distances in FEET.

Condition Graphic - Draft: 4.31 @ 0.00 , 4.63 @ 60.00a Heel: zero



Critical Points

cp1 Eroom Door	cp2 Vent 1	cp4 Vent 3	cp6 Vent 1	cp8 Vent 3
	cp3 Vent 2	cp5 Eroom Door	cp7 Vent 2	

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LIFTBOAT VISION
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4.482-FEET Draft

INITIAL TRIM: 0.32a DRAFT: 4.482 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.67	0.37	-1.60	12.94	34.53	4.83	14
-40.0	3.64	0.36	-1.81	12.94	30.19	4.38	13
-35.0	3.62	0.35	-2.06	12.94	25.99	3.94	13
-30.0	3.62	0.34	-2.37	12.94	22.05	3.54	13
-25.0	3.63	0.33	-2.72	12.94	18.50	3.16	13
-20.0	3.66	0.32	-3.24	12.94	15.43	2.75	12
-15.0	3.70	0.31	-3.91	12.94	12.86	2.34	11
-10.0	3.83	0.31	-4.56	12.94	10.96	2.03	11
-5.0	4.03	0.31	-4.99	12.94	9.78	1.81	10
0.0	4.29	0.31	3.56	12.94	9.22	2.30	11
5.0	4.03	0.31	4.98	12.94	9.70	1.62	10
10.0	3.83	0.31	4.57	12.94	10.76	1.64	10
15.0	3.70	0.31	3.91	12.94	12.51	1.78	11
20.0	3.66	0.32	3.24	12.94	14.90	2.04	12
25.0	3.63	0.33	2.72	12.94	17.84	2.33	12
30.0	3.62	0.34	2.37	12.94	21.23	2.62	13
35.0	3.62	0.35	2.06	12.94	24.96	2.97	13
40.0	3.64	0.36	1.81	12.94	28.91	3.35	13
45.0	3.67	0.37	1.60	12.94	32.99	3.74	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

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LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

WEIGHT and DISPLACEMENT STATUS
Baseline draft: 4.231 @ 0.00, 4.676 @ 60.00a
Trim: Fwd 0.02 deg., Heel: Stbd 5.10 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		206.49	33.82a	0.00	12.94
	SpGr	Displ(LT)	LCB	TCB	VCB
HULL	1.025	206.50	33.98a	1.77s	2.35
	Righting Arms (normal):		0.07a	0.83s	
	External Arms:		0.00	0.83s	
	Residual Righting Arms:		**0.07a**	**-0.00s**	

Distances in FEET.

GM = 9.377 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	168.70s
10.00s	171.83s
20.00s	164.18s
30.00s	145.66s
40.00s	122.13s
50.00s	94.52s
60.00s	70.47s
70.00s	49.80s
80.00s	36.54s
90.00s	30.60s
100.00s	32.93s
120.00s	38.22s
140.00s	38.64s
160.00s	29.24s
180.00s	168.70s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.10 deg heel **171.64**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 33.82a TCG = 0.00 VCG = 12.94

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.306	0.31a	0.00	206.48	0.00	-0.822	0.00	6.27 (2)
4.306	0.30a	0.03s	206.49	0.00	-0.817	-0.02	3.96 (1)
4.267	0.14a	2.53s	206.50	0.00	-0.415	-1.56	4.08 (1)
4.243	0.06a	3.81s	206.49	0.00	-0.208	-1.96	4.14 (1)
4.214	0.02f	5.10s	206.49	0.00	0.000	-2.10	4.20 (1)
4.143	0.16f	7.60s	206.49	0.00	0.406	-1.59	4.79 (2)
4.053	0.28f	10.10s	206.50	0.00	0.782	-0.10	4.28 (2)
3.924	0.27f	12.60s	206.49	0.00	0.979	2.10	3.73 (2)
3.766	0.15f	15.10s	206.49	0.00	1.042	4.65	3.13 (2)
3.759	0.14f	15.21s	206.49	0.00	**1.042**	4.76	3.10 (2)
3.610	0.02a	17.60s	206.52	0.00	0.998	7.23	2.48 (2)
3.469	0.21a	20.10s	206.49	0.00	0.876	9.59	1.81 (2)
3.326	0.41a	22.60s	206.49	0.00	0.668	11.52	1.11 (2)
3.170	0.62a	25.10s	206.49	0.00	0.392	12.84	0.42 (2)
3.071	0.75a	26.60s	206.49	0.00	0.199	13.29	*-0.00* (2)
3.001	0.84a	27.60s	206.49	0.00	0.062	13.42	*-0.28* (2)
2.970	0.88a	28.04s	206.49	0.00	0.000	13.43	*-0.40* (2)
2.820	1.06a	30.10s	206.49	0.00	-0.305	13.12	*-0.96* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

Critical Points		LCP	TCP	VCP
(1) Eroom Door	TIGHT	43.25a	3.00p	8.50
(2) Vent 1	FLOOD	32.33a	10.92	10.75

LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	Ft	**9.43 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.617 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	deg	**5.10 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	deg	**5.10 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.272 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.270 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.580 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	deg	**22.94 P**

Relative angles measured from 5.099s

GM is derived from the RA curve.

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TRANSIT CONDITION
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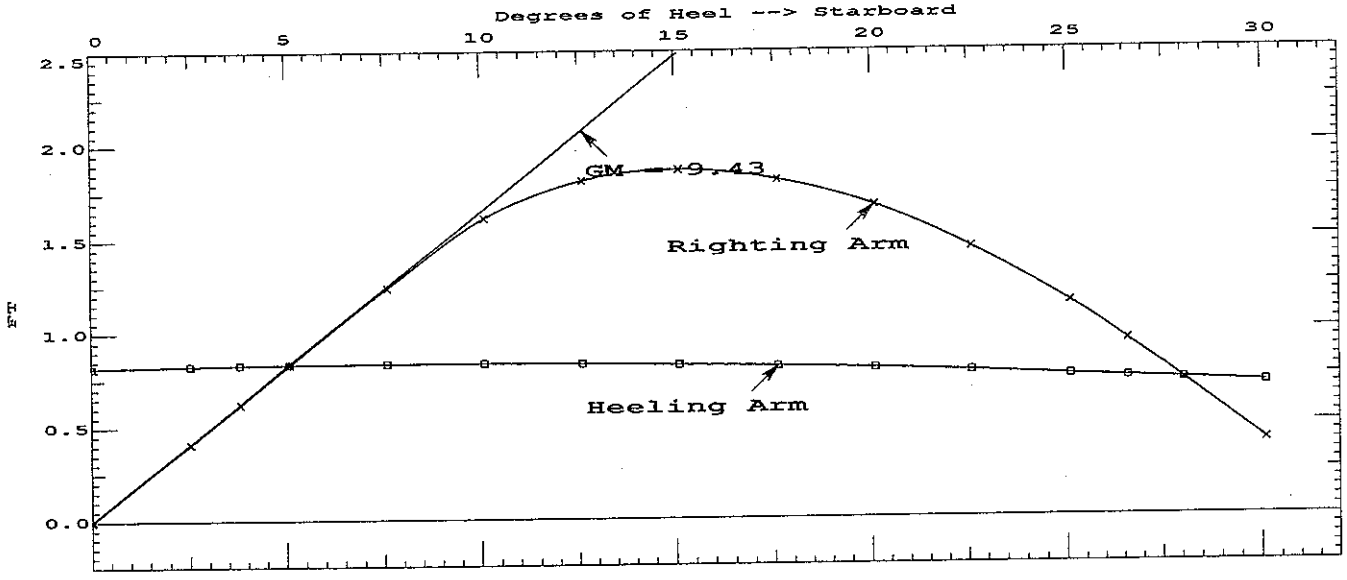
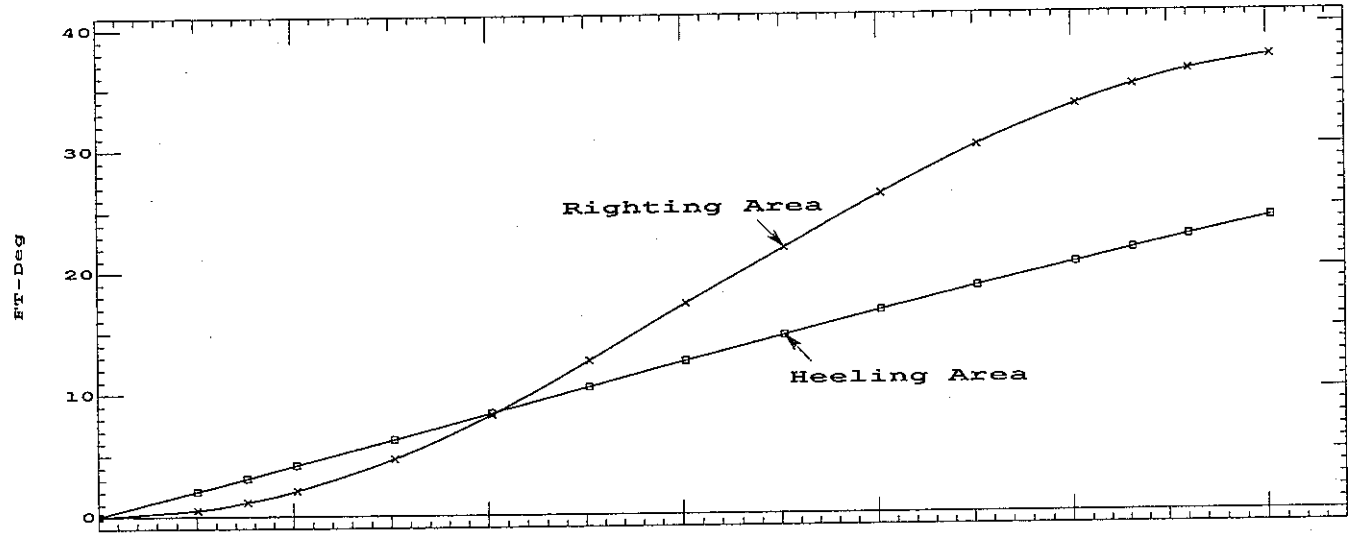
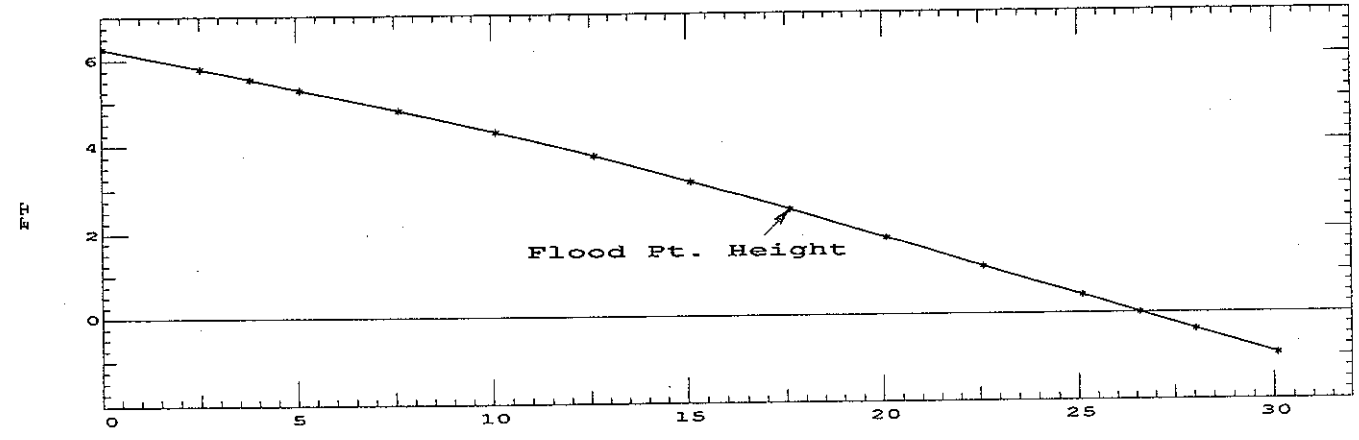
Inclination Axis rotated aft 5.00 degrees







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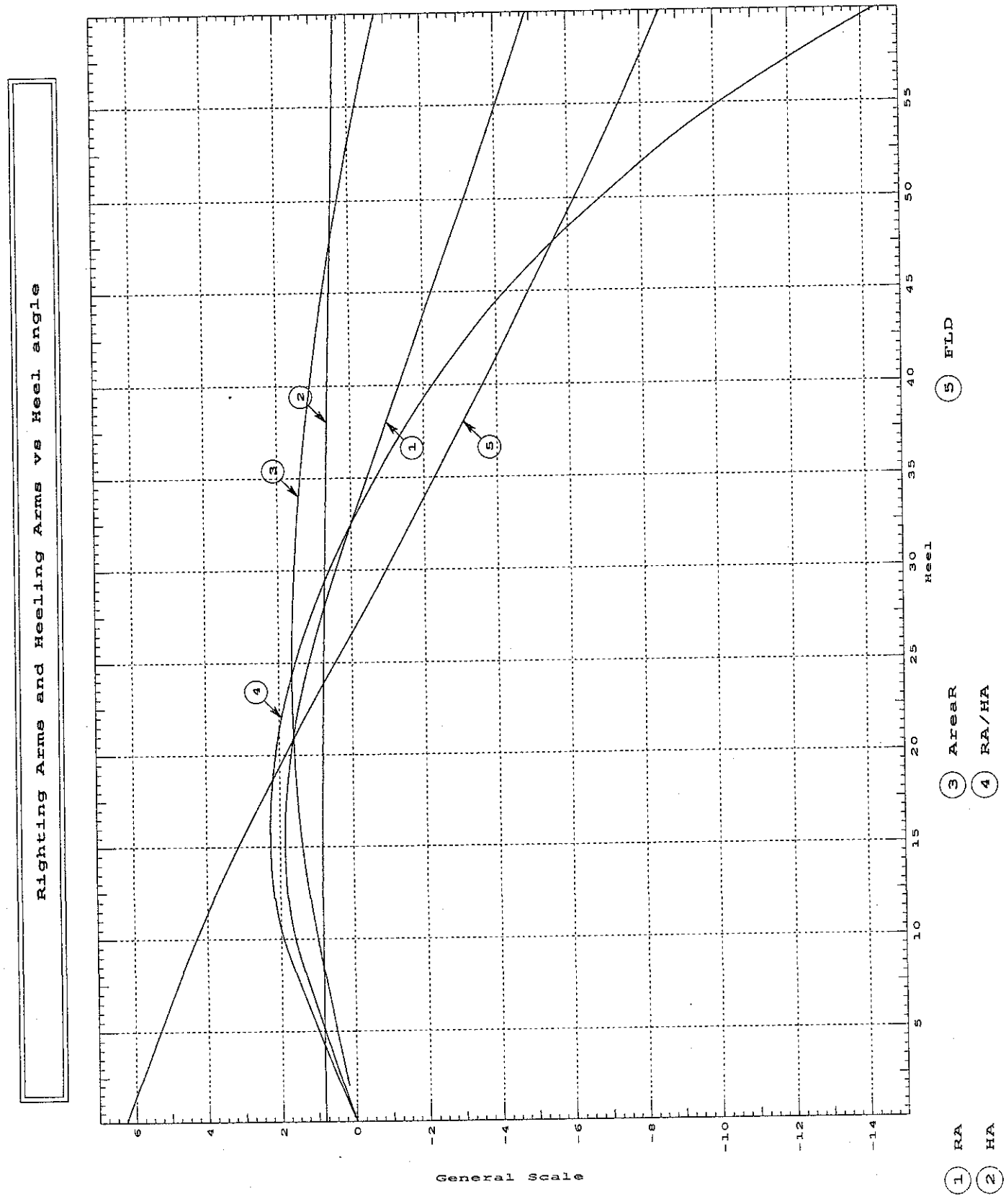
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft

Table of Righting Arms and Areas
Displacement: 206.49 LONG TONS VCG: 12.940
Heel axis: 5.0

Depth	Trim	Heel	RA		HAAreaR	RA/HA	FLD
4.31	0.31	0.00	-0.01	0.82		-0.01	6.27
4.28	0.17	2.00	0.33	0.82	0.19	0.39	5.89
4.24	0.05	4.00	0.65	0.83	0.39	0.78	5.50
4.19	-0.07	6.00	0.98	0.83	0.59	1.17	5.11
4.13	-0.19	8.00	1.31	0.83	0.79	1.57	4.71
4.06	-0.28	10.00	1.60	0.83	0.98	1.93	4.30
3.96	-0.28	12.00	1.77	0.83	1.16	2.14	3.86
3.84	-0.21	14.00	1.85	0.82	1.30	2.25	3.40
3.71	-0.09	16.00	1.85	0.82	1.42	2.27	2.90
3.59	0.05	18.00	1.79	0.81	1.51	2.22	2.38
3.47	0.20	20.00	1.68	0.80	1.58	2.11	1.83
3.36	0.36	22.00	1.51	0.78	1.61	1.93	1.28
3.24	0.53	24.00	1.28	0.77	1.63	1.68	0.72
3.11	0.70	26.00	1.02	0.74	1.62	1.37	0.17
2.97	0.88	28.00	0.73	0.73	1.59	1.01	-0.39
2.83	1.05	30.00	0.42	0.71	1.55	0.59	-0.94
2.68	1.22	32.00	0.08	0.68	1.48	0.12	-1.48
2.53	1.38	34.00	-0.26	0.66	1.40	-0.39	-2.02
2.37	1.53	36.00	-0.61	0.64	1.30	-0.96	-2.56
2.21	1.69	38.00	-0.97	0.62	1.19	-1.58	-3.09
2.04	1.85	40.00	-1.33	0.59	1.07	-2.25	-3.62
1.87	2.02	42.00	-1.69	0.57	0.94	-2.99	-4.14
1.69	2.19	44.00	-2.06	0.54	0.79	-3.81	-4.66
1.50	2.36	46.00	-2.42	0.51	0.63	-4.76	-5.17
1.32	2.53	48.00	-2.79	0.48	0.47	-5.77	-5.68
1.14	2.69	50.00	-3.15	0.46	0.29	-6.88	-6.18
0.95	2.85	52.00	-3.51	0.43	0.10	-8.10	-6.67
0.76	3.00	54.00	-3.86	0.41	-0.10	-9.44	-7.15
0.58	3.14	56.00	-4.21	0.39	-0.31	-10.92	-7.63
0.41	3.27	58.00	-4.56	0.36	-0.53	-12.56	-8.09
0.23	3.38	60.00	-4.91	0.34	-0.76	-14.37	-8.55

Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.482-FEET Draft



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LIFTBOAT VISION
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4.201-FEET Draft

INITIAL TRIM: 0.32a DRAFT: 4.201 FEET without wind at given VCG

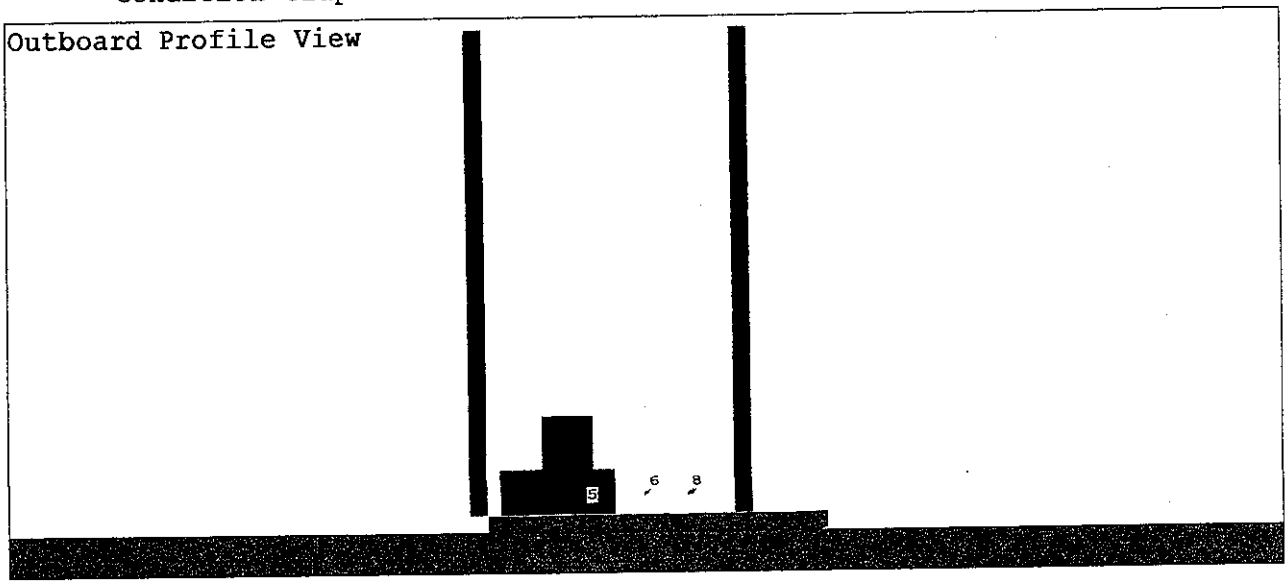
WEIGHT and DISPLACEMENT and WATERPLANE STATUS
Baseline draft: 4.023 @ 0.00, 4.343 @ 60.00a
Trim: Aft 0.32/60.00, Heel: zero

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		192.27	33.87a	0.00	13.77
	SpGr	Displ(LT)	LCB	TCB	VCB
HULL	1.025	192.27	33.93a	0.00	2.11
	Righting Arms:		0.00	0.00	

Part	SpGr	WPA	LCF	TCF	BML	BMT
Total Waterplane	**1.025**	**1756**	**33.29a**	**0.00**	**71.3**	**21.26**
		LT/Inch		Ft-LT/In	GML	GMT
		4.18		15.93	59.7	9.61

Distances in FEET.

Condition Graphic - Draft: 4.02 @ 0.00 , 4.34 @ 60.00a Heel: zero



Critical Points
cp1 Eroom Door
cp2 Vent 1
cp3 Vent 2
cp4 Vent 3
cp5 Eroom Door
cp6 Vent 1
cp7 Vent 2
cp8 Vent 3

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LIFTBOAT VISION
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4.201-FEET Draft

INITIAL TRIM: 0.32a DRAFT: 4.201 FEET with 45-knot wind at given VCG

Stability VS. AZIMUTH AXIS with Constant Trim

Azimuth	Origin	Equilibrium			Attained Values		Margin
Axis	Depth	Trim	Heel	VCG	GM	Aratio	Extras
-45.0	3.36	0.37	-1.67	13.77	36.15	4.86	14
-40.0	3.33	0.36	-1.88	13.77	31.52	4.38	13
-35.0	3.31	0.35	-2.14	13.77	27.06	3.92	13
-30.0	3.31	0.34	-2.46	13.77	22.89	3.50	13
-25.0	3.32	0.33	-2.83	13.77	19.14	3.11	13
-20.0	3.34	0.32	-3.38	13.77	15.92	2.71	12
-15.0	3.39	0.31	-4.07	13.77	13.33	2.30	11
-10.0	3.52	0.31	-4.75	13.77	11.43	2.00	11
-5.0	3.74	0.31	-5.18	13.77	10.26	1.80	10
0.0	4.01	0.31	3.69	13.77	9.61	2.29	11
5.0	3.74	0.31	5.18	13.77	10.17	1.64	10
10.0	3.52	0.31	4.75	13.77	11.23	1.68	10
15.0	3.39	0.31	4.07	13.77	12.98	1.82	11
20.0	3.34	0.32	3.38	13.77	15.35	2.06	12
25.0	3.32	0.33	2.83	13.77	18.28	2.32	12
30.0	3.31	0.34	2.46	13.77	21.70	2.58	13
35.0	3.31	0.35	2.14	13.77	25.54	2.89	13
40.0	3.33	0.36	1.88	13.77	29.63	3.21	13
45.0	3.36	0.37	1.67	13.77	33.87	3.55	13

Note: The trim was held constant while checking the given axes for least stability. This was done in order to avoid extreme trimming and capsizing in trim.

Units: Depth and VCG values are in FEET.
Azimuth Axis, Trim and Heel values are in degrees.
Trim and Heel are with respect to the axis of rotation (Azimuth Axis).

Equilibrium condition with wind and VCG as given.
The axis about which heel takes place is rotated 5.0 degrees azimuth.

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LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 3.939 @ 0.00, 4.397 @ 60.00a
Trim: Fwd 0.02 deg., Heel: Stbd 5.29 deg.
Inclination axis rotated Aft 5.00 degrees

Part		Weight(LT)	LCG	TCG	VCG
WEIGHT		192.27	33.87a	0.00	13.77
	SpGr	**Displ(LT)**	**LCB**	**TCB**	**VCB**
HULL	1.025	192.28	34.04a	1.97s	2.21
	Righting Arms (normal):		0.08a	0.89s	
	External Arms:		0.00	0.90s	
	Residual Righting Arms:		**0.08a**	**-0.00s**	

Distances in FEET.

GM = 9.688 (derived from righting-arm curve).

HEELING MOMENT specification

Heel Angle	Heeling Moment
0.00	169.78s
10.00s	172.94s
20.00s	165.70s
30.00s	148.46s
40.00s	124.84s
50.00s	98.43s
60.00s	74.34s
70.00s	54.29s
80.00s	41.57s
90.00s	34.59s
100.00s	36.99s
120.00s	42.87s
140.00s	43.30s
160.00s	31.17s
180.00s	169.78s

Angles in degrees Moments in Ft-LT

Interpolated moment to starboard for 5.29 deg heel **172.75**

Wind heeling moments calculated from geometry.
Wind shielding allowed between parts.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 33.87a TCG = 0.00 VCG = 13.77

Inclination axis rotated Aft 5.00 degrees

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	Area	Flood Pt Height
4.024	0.31a	0.00	192.27	0.00	-0.888	0.00	6.55 (2)
4.023	0.30a	0.03s	192.27	0.00	-0.883	-0.02	4.25 (1)
3.985	0.14a	2.53s	192.29	0.00	-0.464	-1.71	4.37 (1)
3.956	0.06a	3.91s	192.27	0.00	-0.231	-2.19	4.43 (1)
3.922	0.02f	5.29s	192.27	0.00	0.000	-2.35	4.49 (1)
3.849	0.17f	7.79s	192.27	0.00	0.422	-1.82	5.04 (2)
3.765	0.31f	10.29s	192.27	0.00	0.836	-0.25	4.54 (2)
3.650	0.36f	12.79s	192.25	0.00	1.098	2.17	4.00 (2)
3.502	0.30f	15.29s	192.27	0.00	1.206	5.08	3.42 (2)
3.418	0.23f	16.54s	192.27	0.00	**1.219**	6.60	3.12 (2)
3.334	0.15f	17.79s	192.27	0.00	1.206	8.11	2.80 (2)
3.175	0.00	20.29s	192.27	0.00	1.082	11.00	2.16 (2)
3.006	0.16a	22.79s	192.27	0.00	0.839	13.40	1.52 (2)
2.829	0.31a	25.29s	192.27	0.00	0.516	15.09	0.87 (2)
2.651	0.43a	27.79s	192.27	0.00	0.134	15.91	0.24 (2)
2.593	0.47a	28.61s	192.27	0.00	0.000	15.97	0.03 (2)
2.583	0.47a	28.74s	192.27	0.00	-0.023	15.97	*-0.00* (2)
2.472	0.54a	30.29s	192.27	0.00	-0.283	15.73	*-0.39* (2)
2.288	0.64a	32.79s	192.27	0.00	-0.719	14.49	*-1.01* (2)

Distances in FEET. Specific Gravity = 1.025. Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the heel moments from tabular input.

	Critical Points		LCP	TCP	VCP
(1)	Eroom Door	TIGHT	43.25a	3.00p	8.50
(2)	Vent 1	FLOOD	32.33a	10.92	10.75

LIM	INTACT STABILITY CRITERION		Min/Max		Attained
(1)	**GM Upright**	>	**0.16**	**Ft**	**9.90 P**
(2)	**Abs Ratio from abs 0 deg to RAzero or Flood**	>	**1.400**		**1.641 P**
(3)	**Absolute Angle at Equilibrium**	<	**15.00**	**deg**	**5.29 P**
(4)	**Inclination Angle at Equilibrium**	<	**15.00**	**deg**	**5.29 P**
(5)	**RA Ratio between Equilibrium and 20 deg**	>	**2.000**		**2.384 P**
(6)	**RA Ratio between Equilibrium and 10 deg**	>	**1.250**		**2.361 P**
(7)	**Absolute Area Ratio from abs 0 deg to 15**	>	**1.000**		**1.609 P**
(9)	**Angle from Equilibrium to RAzero**	>	**10.00**	**deg**	**23.32 P**

Relative angles measured from 5.287s

GM is derived from the RA curve.

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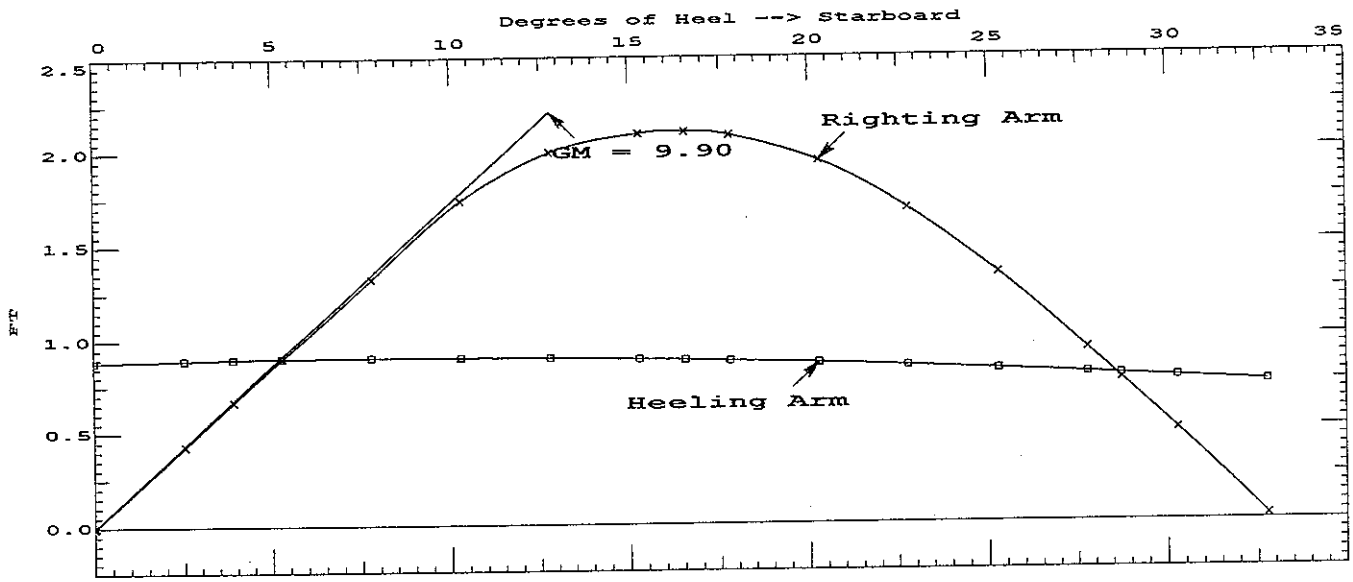
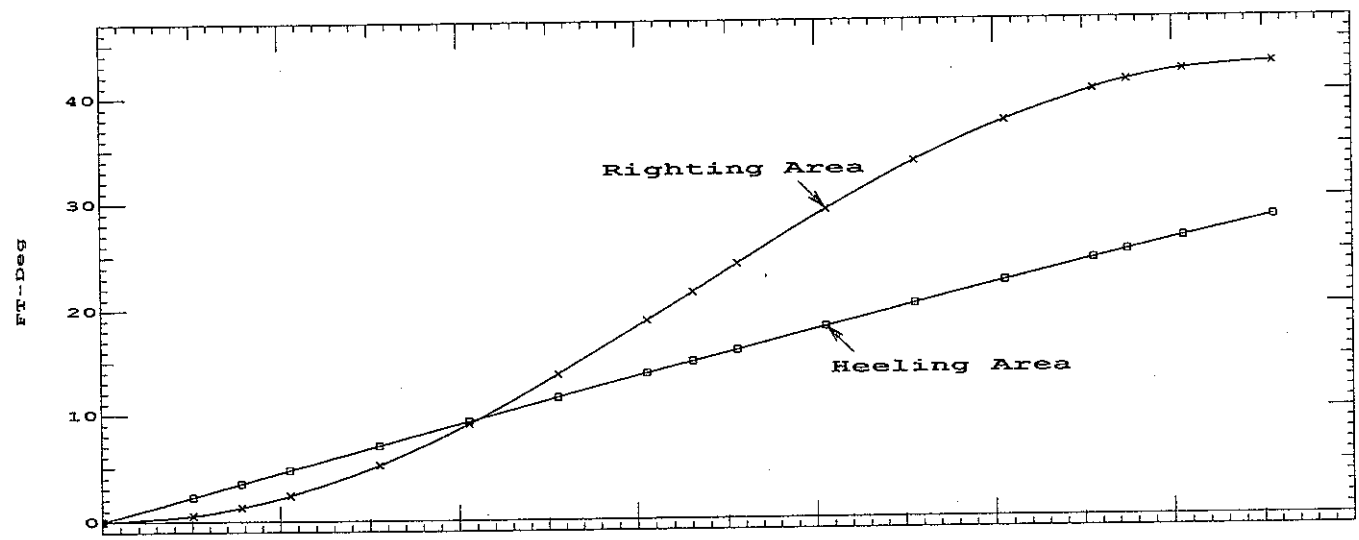
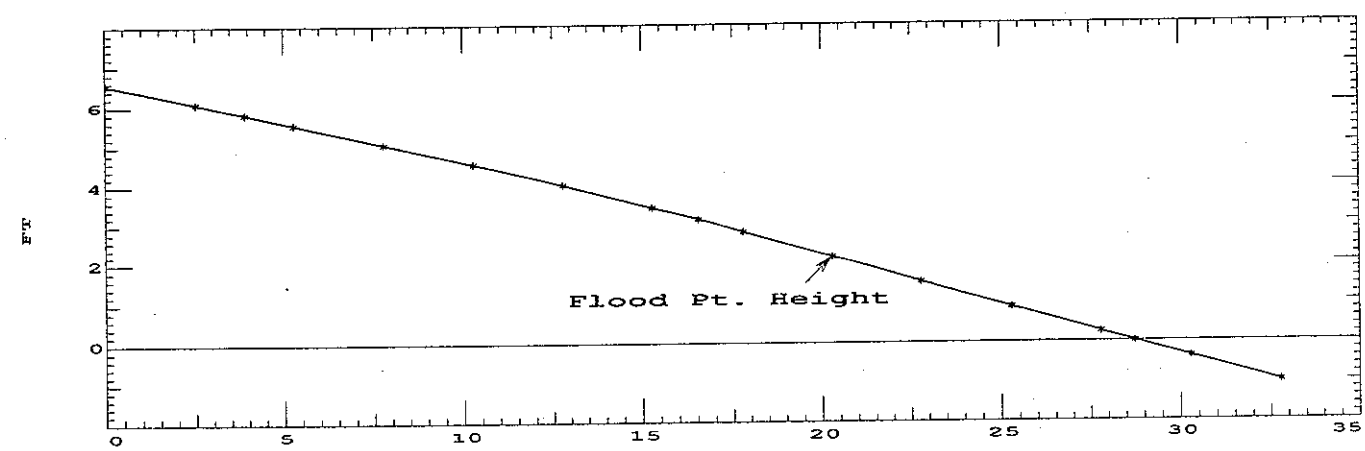
TRANSIT CONDITION
4.201-FEET Draft

Inclination Axis rotated aft 5.00 degrees







Blancke Marine Services
LIFTBOAT VISION
STABILITY CALCULATIONS
TRANSIT CONDITION
4.201-FEET Draft

Table of Righting Arms and Areas
Displacement: 192.27 LONG TONS VCG: 13.770
Heel axis: 5.0

Depth	Trim	Heel	RA	HA	AreaR	RA/HA	FLD
4.02	0.31	0.00	-0.01	0.88		-0.01	6.55
4.00	0.17	2.00	0.34	0.89	0.19	0.38	6.18
3.95	0.05	4.00	0.68	0.90	0.38	0.76	5.79
3.90	-0.06	6.00	1.02	0.90	0.57	1.13	5.39
3.84	-0.18	8.00	1.36	0.90	0.76	1.51	5.00
3.78	-0.30	10.00	1.69	0.90	0.95	1.88	4.59
3.69	-0.36	12.00	1.93	0.90	1.13	2.16	4.17
3.58	-0.34	14.00	2.06	0.89	1.28	2.31	3.72
3.46	-0.26	16.00	2.10	0.88	1.41	2.38	3.25
3.32	-0.14	18.00	2.07	0.87	1.52	2.37	2.75
3.19	-0.02	20.00	1.96	0.86	1.60	2.28	2.23
3.06	0.11	22.00	1.77	0.85	1.65	2.09	1.72
2.92	0.23	24.00	1.52	0.83	1.67	1.83	1.20
2.78	0.34	26.00	1.22	0.81	1.67	1.51	0.69
2.64	0.44	28.00	0.89	0.79	1.65	1.13	0.19
2.49	0.53	30.00	0.54	0.77	1.61	0.70	-0.32
2.35	0.61	32.00	0.17	0.75	1.54	0.23	-0.82
2.20	0.69	34.00	-0.21	0.73	1.46	-0.29	-1.32
2.04	0.78	36.00	-0.60	0.70	1.37	-0.85	-1.82
1.88	0.88	38.00	-0.99	0.68	1.26	-1.46	-2.31
1.71	0.97	40.00	-1.38	0.65	1.14	-2.13	-2.81
1.55	1.07	42.00	-1.78	0.62	1.00	-2.86	-3.30
1.37	1.17	44.00	-2.18	0.60	0.86	-3.66	-3.79
1.19	1.27	46.00	-2.58	0.57	0.70	-4.56	-4.27
1.01	1.38	48.00	-2.98	0.54	0.53	-5.53	-4.75
0.83	1.48	50.00	-3.37	0.51	0.36	-6.59	-5.22
0.65	1.58	52.00	-3.77	0.49	0.17	-7.76	-5.68
0.47	1.68	54.00	-4.16	0.46	-0.03	-9.04	-6.14
0.29	1.77	56.00	-4.55	0.43	-0.24	-10.47	-6.59
0.11	1.85	58.00	-4.93	0.41	-0.45	-12.02	-7.03
-0.06	1.92	60.00	-5.31	0.39	-0.68	-13.73	-7.46

Blancke Marine Services
LIFTBOAT VISION
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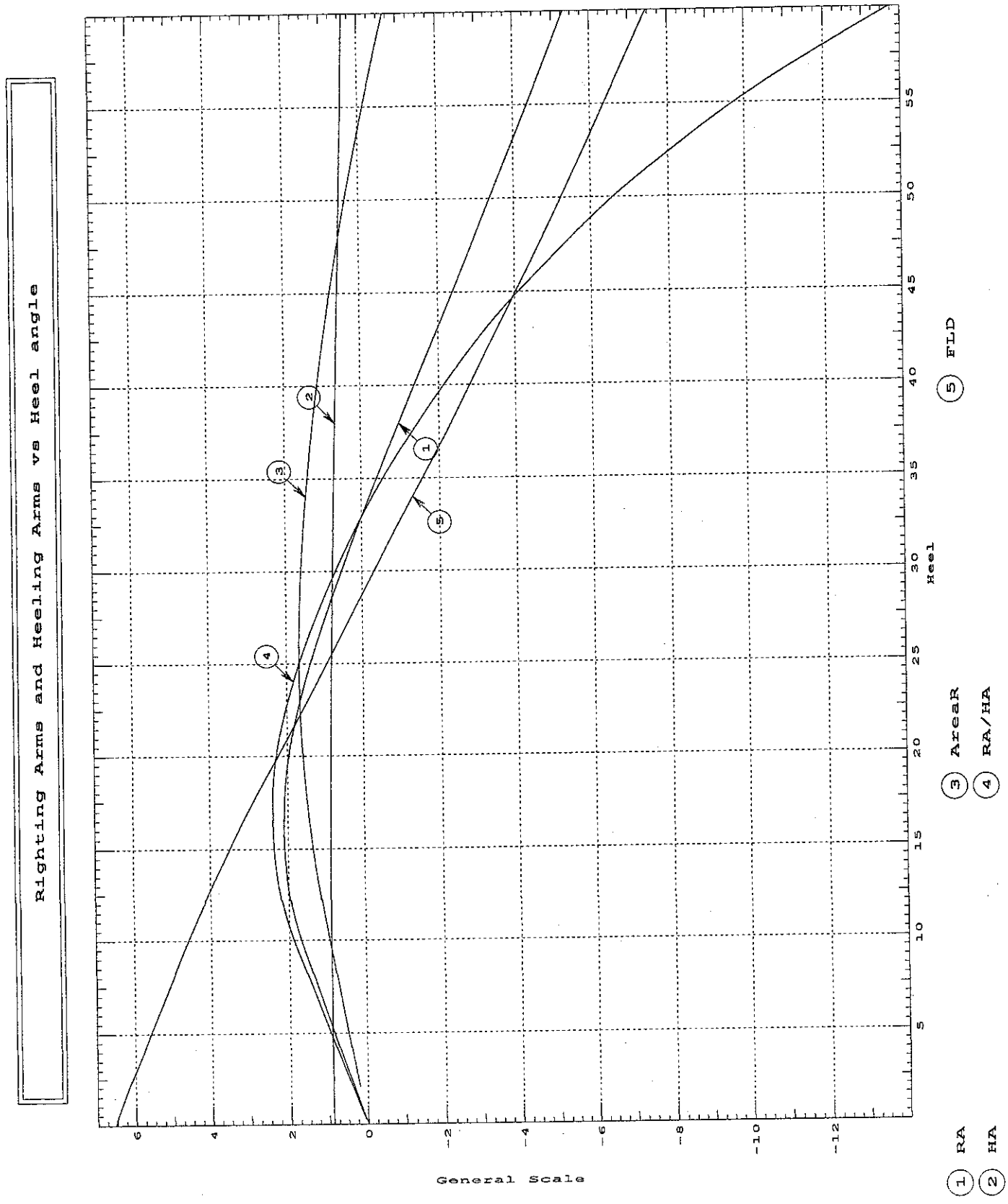


LB Vision 2014 Crane Inspection
Northstar Marine

Atlantic Crane Inspection Services
P.O. Box 747
Bensalem PA 19020
Office: (215) 639-2579
Fax: (215) 639-2316

Certificate Of Unit Test And/Or Examination On Crane, Derrick Or Other Material Handling Device.

Certificate Number: 14050801RH Unit Number: L/B Vision
Company Name: North Star Marina
Address: 36 Clermont Dr. Clermont NJ

Device: ✔ **Crane** _____ **Derrick** _____ **Other**

Location: A)_____ Remains at Worksite B)✔ Changes Worksite C)_____ on Barge

(If A or C Describe)_____

Manufacturer: EBI **Serial#**: Wolverine-1 **Model#**: C20-30

Type of Crane: Pedestal Crane **Maximum Rated Capacity**: 19,450lbs

Service Status at time of Survey: Lifting ✔ Other _____

Boom at time of Survey: Length: 30FT main 10'fixed jib Type: Hydraulic

Test Loads Applied

Radius	Proof Load	Rated Load	Outriggers	Boom Direction
30'	7700lbs	7000lbs	Barge Mount	Over Front

Description of Proof Load N/A

Basis for Assigned Load Ratings EBI C20-30 Load Chart

Remarks and/or Limitations Assigned 2nd Load Test done as for Model C10-30

30Ft. Radius 4400lbs Proof Load 4000lbs Rated Load -OutRiggers-Barge Mounted over front

I certify that on 05/08/14 the above device was ✔ (examined & tested) ___(examined) by the undersigned authorized representative who, in his opinion, said the unit ✔ (did) ___ (did not) meet the requirements of 1910.180 &1926.1400 B30.18

Ron Hughes
Authorized Representative
Today's Date 05/08/14

William Hottenstein
Signatory Authority

PERIODIC CRANE SAFETY INSPECTION REPORT

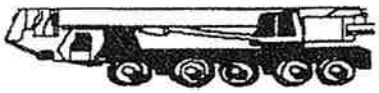
OFFICE: (215) 639-2579 FAX: (215) 639-2316

Unit #: L/B vision
S/N: Wolverine-1
Customer Name: Northstar marine
Make: EBI
Model: C20-30
Address:
Capacity: 19,450lbs
Max Boom: 30'main 10' fixed jib
Inspection Date: 5/8/14
Type of Crane: Pedestal
Job Site: Liberty harbor marina
Inspection #: 14050801rh
☑ Annual ☐ Monthly
Inspectors Signature:

	S	U	N/A
INFO/RECORDS			
Current Certification Posting			✓
Operator Instructions	✓		
Maintenance Records			✓
Hand Signal Charts	✓		
Proper load charts	✓		
Required Info/Warning Decals	✓		
SAFETY EQUIPMENT			
Warning Devices/Backup Alarms			✓
Safety & Machine Guards	✓		
Boom Angle Indicator	✓		
Boom Length Indicator			✓
Drum Rotation Indicator			✓
Fire Extinguishers	✓		
Anti-Two Block/Lock Out		✓	
Load Cells & Indicators (L.M.I.)			✓
Levels			✓
Operator Horn	✓		
CARRIER			
Steering	✓		
Brakes/Clutch			✓
Wheels & Tires			✓
Windows/Wipers	✓		
Steps & Handrail	✓		
Latches & Locks	✓		
Signal Horns/Alarms/Lights	✓		
Battery/Gauges/Charging System	✓		
Drivetrain	✓		
Suspension			✓
Hydraulic System:	✓		
Hoses/Pumps/Belts			✓
Coolant System:			✓
Hoses/Pumps/Belts			✓
Air System: Hoses/Pumps/Belts			✓
Outrigger System:			✓
Beams/Jacks/Locks/Pads/Pins			✓
Engine:	✓		
Fluid Levels	✓		
Leaks	✓		
Exhaust System	✓		

	S	U	N/A
CRAWLER CAR BODY			
Steering/Brakes/Locks			✓
Weldments			✓
Bolts			✓
Tracks/Tension			✓
Track Drive			✓
Drive Chain/Sprockets			✓
ROTATION ASSEMBLY			
Roller Path			✓
Rollers			✓
Motor	✓		
Gears/Guards	✓		
Brake	✓		
Lock	✓		
Bearings/Rotex	✓		
Bolts/Fasteners	✓		
UPPER WORKS			
Engine	✓		
Levels (Fluids)	✓		
Leaks	✓		
Belts/Hoses	✓		
Gauges	✓		
Battery/Charging System	✓		
Hydraulic System:	✓		
Hoses/Pumps/Belts	✓		
Coolant System:	✓		
Hoses/Pumps/Belts			✓
Air System:			✓
Hoses/Pumps/Belts/Tanks/Valves			✓
Counterweight:			✓
Bolts			✓
Latches			✓
Pins			✓
Cab			✓
Controls (Properly marked)	✓		
Function	✓		
Switches	✓		
Pedals			✓
Glass			✓
Exhaust System			✓
House Keeping			✓
Latches/Locks			✓
Lights			✓
Handles/Steps			✓
Extendable			✓

	S	U	N/A
HOIST SYSTEM			
Motors	✓		
Hydraulic System/Lines	✓		
Air System/Lines/Valves/tanks			✓
Brakes	✓		
Friction			✓
Locking Devices	✓		
Anchor System	✓		
Drums/Lagging	✓		
Reeving	✓		
BOOM (HYDRAULIC)			
Alignment	✓		
Cylinders	✓		
Pivot Points		✓	
Pins		✓	
Support Rollers	✓		
Wear Pads	✓		
Hoses & Reels	✓		
Welds & Connections	✓		
Sheaves	✓		
BOOM (LATTICE)			
Friction & Clutches			✓
Gears& Shafts			✓
Linkage & Pins			✓
Drums			✓
Brakes			✓
Boom Dogs (Pawl)			✓
Boom Cutoff			✓
Boom Stops			✓
Inner bail			✓
Outer Bail			✓
Gantry			✓
Main Chord			✓
Lacings			✓
Sheaves			✓
JIB & EXTENSIONS			
A-Frame & Main Chord	✓		
Lacings			✓
Pins & Connections	✓		
Sheaves	✓		
Jib Restraint			✓
Welds	✓		



Atlantic Crane Inspection Services
(215) 639-2579 Fax(215) 639-2316

CRANE INSPECTION & CERTIFICATION DEFICIENCY REPORT

Company Name Northstar marine Date: 5/8/14 Inspection #: 14050801rh

Unit#: L/B vision Manufacturer: EBI Model: C20-30 Serial# Wolverine-1

CODE	DEFICIENCY	DATE CORRECTED
U	Play in boom pivot pin that goes through turret (MONITOR)	
U	Play in boom cyl pin at turret (MONITOR)	
U	Two block not working on main hoist	
U	Label make, weight and cap on block	
	No other visible deficiencies found at time of inspection	
Note	Use specified wire rope recommended by manufacturer	

The above listed deficiencies denoted with the letter (U) shall be corrected and this report must be dated, signed and sent to Atlantic Crane Inspection Serices at the address listed above or fax to our office at 215-639-2316 and a certification and sticker will be issued. The above deficiencies denoted with the letter (R) are recommended and are not required to be corrected to achieve certification. However, those iteams should be corrected to improve equipment reliability and safety.

Signature of Inspection — Date: 5/8/14

The undersigned verifies the above listed deficiencies denoted with an (U) have been corrected.

Signature — Date

Atlantic Crane Inspection Services
(215) 639-2579 Fax(215) 639-2316

CRANE INSPECTION & CERTIFICATION DEFICIENCY REPORT

Company Name Northstar marine Date: 5/8/14 Inspection #: 14050801rh

Unit#: UB vision Manufacturer: EBI Model: C10-30 Serial# Wolverine-1

CODE	DEFICIENCY	DATE CORRECTED
U	Play in boom pivot pin that goes through turret (MONITOR)	ON GOING
U	Play in boom cyl pin at turret (MONITOR)	ON GOING.
U	Two block not working on main hoist	05/09/14
U	Label make, weight and cap on block	05/08/14 REFER RON
	No other visible deficiencies found at time of inspection	
Note	Use specified wire rope recommended by manufacturer	05/12/14.

The above listed deficiencies denoted with the letter (U) shall be corrected and this report must be dated, signed and sent to Atlantic Crane Inspection Serices at the address listed above or fax to our office at 215-639-2316 and a certification and sticker will be issued. The above deficiencies denoted with the letter (R) are recommended and are not required to be corrected to achieve certification. However, those iteams should be corrected to improve equipment reliability and safety.

Signature of Inspection — Date: 5/8/14

The undersigned verifies the above listed deficiencies denoted with an (U) have been corrected.

Signature — Date: 05/12/14

ATLANTIC CRANE INSPECTION SERVICES

LOAD TEST PERFORMANCE

OFFICE: (215) 639-2579 FAX: (215) 639-2316

Unit #: L/B vision
S/N: Wolverine-1
Customer Name: North Star
Make: EBI
Model: C20-30
Address:
Capacity: 19,450lbs
Max Boom: 30' main 10' fixed jib
Inspection Date: 5/8/14
Type of Crane: Pedestal crane
Job Site: Marina
Inspection #: 14050801rh

Service Status: N/A
Configuration: 3 parts on main 1 part on jib

Boom Length: 30' main
Angle: N/A
Jib: 10' fixed jib

Test Loads Applied, Functional (partial), Other: N/A

Radius	Proof Load	Rated Load	Outriggers	Boom Quadrant
30'	7,700lbs	7,000lbs	Barge mount	Over front

Description of Proof Loads: N/A

Basis for Load and Rating: Ebi c20-30 load chart

Remarks and or Limitations: Wire rope 1/2"

I certify that on the 8th day of May , 2014 the above described device was tested and examined by the undersigned; that said test and examination met with the requirements of the Division of Occupational Safety and Health (DQSH); that any deficiencies affecting the safe operation of the crane have been corrected prior to the of issuance of this certification. A copy of such Certificate(s) attesting to Annual and Quadrennial Certification shall be maintained in the crane or at the work site at all times.

This Test is for: Annual: ☑ Quadrennial: ☐ Other: ☐

Signature of the Inspector	Date 5/8/14
Signature	Date

ATLANTIC CRANE INSPECTION SERVICES

LOAD TEST PERFORMANCE

OFFICE: (215) 639-2579 FAX: (215) 639-2316

Unit #: L/B vision
S/N: Wolverine-1
Customer Name: North Star
Make: EBI
Model: C10-30
Address:
Capacity: 14,625lbs
Max Boom: 30' main 10' fixed jib
Inspection Date: 5/8/14
Type of Crane: Pedestal crane
Job Site: Marina
Inspection #: 1405080rh

Service Status: N/A
Configuration: 3 parts on main 1 part on jib
Boom Length: 30' main
Angle: N/A
Jib: 10' fixed jib

Test Loads Applied, Functional (partial), Other: N/A

Radius	Proof Load	Rated Load	Outriggers	Boom Quadrant
30'	4400lbs	4000lbs	Barge mount	Over front

Description of Proof Loads: N/A

Basis for Load and Rating: Ebi c10-30 load chart

Remarks and or Limitations: Wire rope 1/2"

I certify that on the 8th day of May , 2014 the above described device was tested and examined by the undersigned; that said test and examination met with the requirements of the Division of Occupational Safety and Health (DQSH); that any deficiencies affecting the safe operation of the crane have been corrected prior to the of issuance of this certification. A copy of such Certificate(s) attesting to Annual and Quadrennial Certification shall be maintained in the crane or at the work site at all times.

This Test is for: Annual: ☑ Quadrennial: ☐ Other: ☐

Signature of the Inspector 	Date 5/8/14
Signature	Date

Appendix I
OSHA 10-Hour Construction Course Certificates

Certificate of Completion

360training.com™

This Certifies That

James Trotta

is awarded this certificate for

OSHA 10 Hour Outreach Training Program - Construction

Credit Hours: 10.00

Completion Date: 11/18/2014

Marie Athey

Marie Athey, Trainer C 0026383 and G 0034871

"As an OSHA authorized trainer, I verify that I have conducted this OSHA outreach training class in accordance with OSHA Outreach Training Program requirements. I will document this class to my authorizing OSHA training organization. Upon successful review of my documentation, I will provide each student their completion card within 90 days of the end of the class."

360training.com • 13801 Burnet Rd., Suite 100 • Austin, TX 78727 • 888-360-TRNG • www.360training.com

Certificate of Completion

OSHAcampus.com™

powered by 360training.com

This Certifies That

William B Ward

is awarded this certificate for

OSHA - 10 Hour Construction Industry Outreach Training

Credit Hours: 10

Completion Date: 2010-04-15

William Bruce Ward

Student Signature

Michael Millsap

Michael Millsap, Trainer C 0034819 and G 0021414

AUTHORIZED IACET PROVIDER

360training.com, Inc. has been approved as an Authorized Provider by the International Association for Continuing Education and Training (IACET), 1760 Old Meadow Road, Suite 500, McLean, VA 22102; (703) 506-3275.

This certificate is proof of completion of your OSHA outreach course. In order to receive you official DOL card, you must complete the survey found in the end of course instructions. Your record must then be approved by your trainer and OSHA. Please allow 8-10 weeks for delivery.

360training.com ♦ 13801 North Mo pac, Suite 100 ♦ Austin, TX 78727 ♦ 888-360-TRNG ♦ www.360training.com

Appendix J
Notices

Homeland Security

U.S. COAST GUARD

First Coast Guard District

LNM Information Form

DATE: _____

NAME: _____

PHONE NUMBER: _____

EMAIL ADDRESS: _____

COMPANY NAME: _____

TYPE OF WORK: _____

_____

LOCATION WHERE WORK WILL BE DONE: _____

_____

LAT/LONG: (degrees, minutes, seconds & thousandths) _____

_____

BEGINNING/ENDING DATES: _____

HOURS OF OPERATION: _____

EQUIPMENT ON SCENE: _____

_____

RADIO FREQUENCY (IF USED): _____

Pease fax form two weeks before the work is to begin to: Mary Swanson @ 617-223-8291 or email: lnm@uscg.mil . The LNM (Local Notice to Mariners) can be found on the following website: http://www.navcen.uscg.gov

ATTENTION TO BOSTON HARBOR LOBSTERMEN:

The firm e4sciences LLC is under contract to the US Army Corps of Engineers to conduct geotechnical surveys and borings in the Federal Channels of Boston Harbor. The purpose of these borings is to characterize the rock and sediment for planning of the deepening project.

Each day that boring operations are being conducted vessel captains will contact the Coast Guard Command. The Coast Guard continually broadcasts a notice to mariners on marine channel 16 of the boring operations until contractor notifies the command that they have left the site. Notice of operations is also included in the Coast Guard's weekly Notice to Mariners.

e4sciences LLC will be conducting survey operations, followed shortly afterwards by drilling operations, in and around Boston Harbor likely starting before October 31st, and concluding before December 31st, 2014. Surveys will be conducted in, and outside of, the Main Ship Channel, Lower Reserved Channel, Reserved Turning Basin, President Roads Anchorage, and the Broad Sound North Channel. Survey operations will be conducted aboard the R/V *Time and Tide*, a 55ft white catamaran. Drilling operations will be conducted aboard the *L/B Vision,* a 75ft jack-up barge. Both of these vessels will be closely monitoring local marine traffic radio channels, and will broadcast their locations through AIS.

A more detailed schedule will be submitted to the Massachusetts and Boston Harbor Lobsterman Associations weekly. For more information contact James Trotta with e4sciences at 203.270.8100, or Beth Casoni with the Massachusetts Lobstermen's Association at 781.545.6984.

R/V Time and Tide


L/B Vision

Appendix K
QA/QC Comments and Responses

US Army Corps of Engineers®

New England District
696 Virginia Road
Concord, Massachusetts
01742-2751

SAFETY COMMENTS

Project Name: Boston Harbor Deep Draft Improvement PED Investigation
Location: Boston, MA

Date: 10/2/14
Reviewer: : Sheila Harvey
(see attached Memorandum)

Document Name: Work Plan: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston MA
Prepared By: e4Sciences, LLC (Contract#W912DS-12-D-0002, DB01)

No.	Ref. Section / Page	COMMENTS	Disposition
1.	Page B-12, Section 6b	Please include crane operator and boat operator certifications/Licenses	Included in Appendix G. Note only crane to be used is the one built on the liftboat
2.	Page B-15, Section 9a	Please include the following information in this section: The contractor must summarize on a monthly basis the total number of man-hours completed on-site (for the prime contractor and all subcontractors). Please submit this information electronically to the Safety and Occupational Health Office (sheila.harvey@usace.army.mil) on the 5th day of each month for work performed the previous month.	Included
3.	Page B-15, Section 9b	Please include the following Accident Reporting Requirements to this section: All accidents and near misses shall be investigated by the Contractor. All work-related recordable injuries, illnesses and property damage accidents (excluding on-the-road vehicle accidents), in which the property damage exceeds $2,000.00, shall be verbally reported to USACE within 4 hours of the incident. Serious accidents as described in EM 385-1-1 Section 01.D.02 shall be immediately reported to USACE. ENG Form 3394 shall be completed and submitted to USACE within five working days of the incident.	Included
4.	Page B-15, Section 9c:	USACE Safety Chief is Sheila Harvey, (978) 318-8504, sheila.harvey@usace.army.mil.	Added to text
5.		Please indicate where workers will embark and disembark the vessels on a daily basis. Will it be at the USCG location at 427 Commercial Street, Boston?	Added text Constitution Marina & Boston Harbor Ship Yard and Marina
6.		Please reference EM 385-1-1, Section 16.L.02 regarding the requirement for a Naval Architectural Analysis when placing a crane onto a floating barge.	Added to AHA Note only crane to be used is the one built on the liftboat and will be used only when boat is raised and not floating.

CENAE-SO DATE: 2 October 2014

MEMORANDUM FOR: Peter Hugh, Engineering Technical Lead

SUBJECT: Review Comments, Accident Prevention Plan/Health & Safety Plan/Activity Hazard Analyses, Marine Seismic Reflection Survey and Subsurface Investigation, Boston Harbor, Boston, Massachusetts

CONTRACT: W912DS-12-D-0002 Task Order DB-01

REVIEWER: Sheila Harvey

Rating C: The plan is accepted, except as noted. Resubmission is required.

APPENDIX B APP Comments:

1. Page B-12, Section 6b: Please include crane operator and boat operator certifications/Licenses.
2. Page B-15, Section 9a: Please include the following information in this section: The contractor must summarize on a monthly basis the total number of man-hours completed on-site (for the prime contractor and all subcontractors). Please submit this information electronically to the Safety and Occupational Health Office (sheila.harvey@usace.army.mil) on the 5th day of each month for work performed the previous month.
3. Page B-15, Section 9b: Please include the following Accident Reporting Requirements to this section: All accidents and near misses shall be investigated by the Contractor. All work-related recordable injuries, illnesses and property damage accidents (excluding on-the-road vehicle accidents), in which the property damage exceeds $2,000.00, shall be verbally reported to USACE within 4 hours of the incident. Serious accidents as described in EM 385-1-1 Section 01.D.02 shall be immediately reported to USACE. ENG Form 3394 shall be completed and submitted to USACE within five working days of the incident.
4. Page B-15, Section 9c: USACE Safety Chief is Sheila Harvey, (978) 318-8504, sheila.harvey@usace.army.mil.
5. Please indicate where workers will embark and disembark the vessels on a daily basis. Will it be at the USCG location at 427 Commercial Street, Boston?
6. Please reference EM 385-1-1, Section 16.L.02 regarding the requirement for a Naval Architectural Analysis when placing a crane onto a floating barge.

US Army Corps of Engineers ®

New England District
696 Virginia Road
Concord, Massachusetts
01742-2751

GEOLOGY REVIEW COMMENTS

Project Name: Boston Harbor Deep Draft Improvement PED Investigation
Date: 10/3/14
Location: Boston, MA
Reviewer: Stephen Potts
Document Name: Work Plan: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston MA
Prepared By: e4Sciences, LLC (Contract#W912DS-12-D-0002, DB01)

No.	Ref. Section / Page	COMMENTS	Disposition
1.	Table of Contents - Page 2	3.10, 3.11, and 3.12 are labeled incorrectly as 3.7, 3.8 and 3.9	Corrected
2.	1. Page 4	Label Figure 1 as Location Map	Corrected
3.	2. Page 5	Add mobile phone number for Stephen Potts (734-904-0646)	Added
4.	2. Page 5	Change "Matt has lead water.." to "Matt has led water.."	Corrected
5.	2. Page 6	For Bruce Ward - Change "USACE-NYD" to "USACE-NAN" or define "NYD"	Corrected
6.	2. Page 7	For James Trotta - Change "h" to "he"	Corrected
7.	2. Page 7	For Gustavo Suri - Change "USACE-NYD" to USACE-NAN" or define "NYD"	Corrected
8.	2. Page 7	Change verbs (developing, classifying, performing, recording, performing) to parallel structure with oversee and co-inspect (e.g. "developing" to "develop"	Corrected
9.	3. Page 8	Note that Options 3A, 7, 8, and 9 were awarded at time of Notice to Proceed	Added text
10.	3.1 Page 8	Capitalize "Prevention" in 3.1 Task 1.	Corrected
11.	3.2 Page 8	3.2.1 Notice to Mariners - Change "coordinated" to "coordinate"	Corrected
12.	3.2 Page 9	Add "the" before Boston Harbor Master, in first line.	Corrected
13.	3.3 Page 9	Change to "In an emergency,,"	Corrected
14.	3.3 Page 9	3.3.1 – Change "thought" to "throughout"	Corrected
15.	3.3 Page 9	Expand discussion of frequency range to indicate that 1-10 kHz is the anticipated range. Frequency range may be adjusted to optimize depth penetration and resolution based on initial field testing at beginning of seismic survey.	Added to text.
16.	3.3 Page 9	Change "may provide cross sections" and "may image and measure" to "will" or "are intended to…"	Changed to "are intended to"
17.	3.4 Page 9	3.4 Task 3a – Indicate that this task was awarded at time of Notice to Proceed	Added text.
18.	3.5 Page 10	3.5.1 Report – Indicate that historical field and lab seismic velocity ranges from previous Boston Harbor investigations will be used to guide to inform seismic processing.	Added text.
19.	3.5 Page 10	Add "with" to "rock strata intersection with the channel floor"	Added
20.	3.5 Page 10	Can "groups of 8 to 10" be expanded (e.g. "groups of 4 to 12") to allow for more flexibility?	Changed.
21.	3.6 Page 10	Add "the" before "Boston Harbor Master"	Corrected
22.	3.7 Page 12	3.7.2 Drilling Platform-Liftboat: Add statement that a 2014 marine survey of the liftboat will be conducted and submitted to USACE prior to commencement of borings.	Added text.
23.	3.7 Page 12	3.7.3 Positioning on holes – Can the water depth /length of each leg be recorded after set-up on each boring? This information can be noted on the drill logs.	Added text.

US Army Corps of Engineers ®

New England District
696 Virginia Road
Concord, Massachusetts
01742-2751

GEOLOGY REVIEW COMMENTS

Project Name: Boston Harbor Deep Draft Improvement PED Investigation
Date: 10/3/14
Location: Boston, MA
Reviewer: Stephen Potts
Document Name: Work Plan: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston MA
Prepared By: e4Sciences, LLC (Contract#W912DS-12-D-0002, DB01)

No.	Ref. Section / Page	COMMENTS	Disposition
24.	3.7 Page 12	3.7.5 Measuring and actual positions – reword "…GPS signals that may be caused the drill rigs…"	Reworded
25.	3.7 Page 13	3.7.6 Drilling – Add some details regarding the drill rig (e.g. make = CME, model = 850) and type of SPT hammer (e.g. autohammer, safety hammer, rope and cathead)	Added text.
26.	3.7 Page 13	Change "prevent loss circulation" to "prevent loss of circulation"	Corrected
27.	3.7 Page 13	Will NX-size core be sufficient? Would the use of NQ-size (wireline methods) significantly improve drilling production?	Yes, we intend to use wireline., text corrected
28.	3.7 Page 14	Proposed field log forms are acceptable. USACE field log forms are also acceptable.	Agreed. No action.
29.	3.7 Page 14	Add "a" to "inspector shall write a short narrative".	Corrected
30.	3.7 Page 14	Submit Progress Reports via e-mail. Remove "either by telephone".	Corrected
31.	3.8 Page 15	3.8 Task 6a – This task should be 5 additional borings, multi-executable up to 6 times as stated in Scope of Work.	Corrected
32.	3.9 Page 15	3.9 Task 6b – This task is multi-executable up to 6 times as stated in Scope of Work. Change "borings" to "boring".	Corrected
33.	3.10 Page 15	3.10 Task 7 – Indicate that this task was awarded at time of contract award.	Added text
34.	3.10 Page 15	Add space between e4 and laboratories	Correct spelling is without a space
35.	3.11 Page 16	3.11 Task 8 – Boston Harbor report. Change "3.11 Task 7" to "3.11 Task 8". Indicate that this task was awarded at time of contract award.	Corrected and added text
36.	3.12 Page 16	3.12 Task 9 – Weather day. Change "3.12 Task 8" to "3.12 Task 9". Indicate that this task was awarded at time of contract award.	Corrected and added text
37.	3.12 Page 16	Reword "All efforts will be made to keep weather days will be kept to a minimum"	Corrected
38.	3.12 Page 16	3.12 Task 9 – This task is multi-executable up to 15 times as stated in Scope of Work.	Added text.
39.	5. Page 18	Add mobile phone number for Stephen Potts (734-904-0646)	Added
40.	7. Page 20	Update schedule every week rather than every two weeks.	Changed text
41.	7. Page 20	Can the schedule also be depicted graphically using a Gantt Chart (e.g. Microsoft Project)?	Chart added
42.	7. Page 20	Add number and days of week that are anticipated to be work days for seismic survey and for liftboat drilling. Will work occur on Weekdays, Saturdays, and/or Sundays?	Added text. M-F some Saturdays 0600 to 1800
43.	7. Page 20	Add anticipated number of work hours per day and anticipated departure from, and return to, dock times for seismic survey and for liftboat drilling.	Added text.
44.	7. Page 20	Add anticipated location of docking facility for seismic survey and liftboat work.	Added text Constitution Marina & Boston Harbor Ship Yard and Marina
45.	Appendix B	Appendix B. Accident Prevention Plan	
46.	B-3	Table of Contents: Change B-6 to B-5 and B-7 to B-6	Corrected
47.	B-6	Remove "isolated" from bedrock (ledge) high spots	Changed text
48.	B-6	Change 27 to 26 borings.	Corrected

US Army Corps of Engineers ®

New England District
696 Virginia Road
Concord, Massachusetts
01742-2751

GEOLOGY REVIEW COMMENTS

Project Name: Boston Harbor Deep Draft Improvement PED Investigation
Date: 10/3/14
Location: Boston, MA
Reviewer: Stephen Potts
Document Name: Work Plan: Boston Harbor Marine Seismic Reflection Survey and Subsurface Investigation, Boston MA
Prepared By: e4Sciences, LLC (Contract#W912DS-12-D-0002, DB01)

No.	Ref. Section / Page	COMMENTS	Disposition
49.	B-7	Indicate that Option 3A, Option 7, Option 8 and Option 9 were awarded at time of contract award	Added text
50.	B-13	Change Appendix "C" to Appendix "D"	Corrected
51.	B-15	Change "Steven" to "Stephen"	Corrected
52.	B-17	Add hand protection (gloves)	Added text
53.	Appendix C	Appendix C. Health and Safety Plan	
54.	C-2	Change Contract number to :W912DS-12-D-0002 Task Order DB-01	Corrected
55.	C-3	Table of Contents: Change C-10 to C-11; C-12 to C-13; C-13 to C-14; C-18 to C-19; C-21 to C-20.	Corrected
56.	C-6	Change (pg 25) to C-27.	Corrected
57.	C-11	Hazardous Chemicals List – Shouldn't there be an MSDS book on the Liftboat? Aren't there standard chemicals being used during drilling or onboard that would require MSDSs? (e.g. diesel, gas, lubricants)	Yes. Corrected
58.	C-13	Reword "e4 does not throughput of any type…"	Corrected
59.	Appendix A	Appendix A. Tidal Correction Plan - Comments previously provided on September 29, 2014.	
60.	Page A-2/Paragraph 1	Spell out "RTK dGPS" on first use.	Corrected
61.	Page A-2/ Section 3.	Change "RTK GPS" to RTK dGPS"	Corrected
62.	Page A-2/ Section 2.	Add a statement or section indicating that all elevations and depths will be converted to MLLW and reported as MLLW.	Added text
63.	Page A-2/All Paragraphs	Change all "lift boat" and " lift-boat" to "liftboat". Liftboat is preferred. Refer to "American Bureau of Shipping – Guide for Building and Classing Liftboats," January and July 2014.	Corrected
64.	Page A-2/Section 1.	Add space after "…in 2010." And prior to "All measurements…" to separate the sentences.	Corrected
65.	Appendix E	Appendix E. Quality Control Plan - Comments previously provided on September 29, 2014.	
66.	Page D-2/Paragraph 4	Change "The Daniel Rosales…" to "Daniel Rosales"	Corrected
67.	Page D-2/ Section 1.	Change "engineer" to "engineers"	Corrected
68.	Page D-3/ Section 2.	Change "will vi will" to "will"	Corrected
69.	Page D-3/ Section 2.	Change all "lift boat" and " lift-boat" to "liftboat". Liftboat is preferred. Refer to "American Bureau of Shipping – Guide for Building and Classing Liftboats," January and July 2014.	Corrected
70.	Page D-3/ Section 4.	Identify who will perform Independent Technical Review	Added text