



MAR - 6 2014

MEMORANDUM FOR: CAPT Greg Stump, Commanding Officer, Sector San Francisco.

FROM: Robert Schwemmer,
 Regional West Coast Maritime Heritage Coordinator
 Lisa Symons,
 Damage Assessment and Resource Protection Coordinator
 James Delgado,
 Director of Maritime Heritage

SUBJECT: Sonar Data Site Characterization MV *Fernstream*

REF: USCG-NOAA MOA-2009-20/7848

General Background

Three recent surveys of opportunity in 2013, allowed for a more detailed assessment of the wreck of *Fernstream*, a RULET target classified as a High/Medium Risk, and the highest ranked potentially polluting wreck in U.S. Coast Guard District 11. The original assessment notes

“For the Worst Case Discharge, *Fernstream* scores High with 15 points; for the Most Probable Discharge (10% of the Worst Case volume), *Fernstream* scores Medium with 13 points. Given these scores, and higher level of data certainty, NOAA recommends that this site be reflected within the Area Contingency Plans and be considered for further assessment to determine vessel condition, amount of oil onboard, and feasibility of oil removal action. At a minimum an active monitoring program should be implemented.”

Table 1. *Original* summary matrix for the vessel risk factors for the *Fernstream*

Vessel Risk Factors		Data Quality Score	Comments	Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Low	Maximum of 12,500 bbl, not reported to be leaking	Med
	A2: Oil Type	Medium	Bunker oil is diesel oil, a Group II oil type	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	No fire was reported	
	C2: Oil on Water	Low	No oil was known to have been reported on the water	
	D1: Nature of Casualty	High	Collision	
	D2: Structural Breakup	High	The vessel remains in one contiguous piece	
Archaeological Assessment	Archaeological Assessment	Low	The best sinking assessment still comes from the U.S. Coast Guard Marine Board of Investigation so a detailed assessment was not prepared	Not Scored
Operational Factors	Wreck Orientation	Medium	Believed to be on one side	Not Scored
	Depth	High	150 ft	
	Visual or Remote Sensing Confirmation of Site Condition	High	Location is known and charted	
	Other Hazardous Materials Onboard	High	No	
	Munitions Onboard	High	No	
	Gravesite (Civilian/Military)	High	No	
Historical Protection Eligibility (NHPA/SMCA)	Medium	Possibly NHPA		



Navigation Response Team 6 (NRT6) from NOAA's Office of Coast Survey conducted multi-beam sonar operations on the *Fernstream* site in May 2013; this was followed by side-scan sonar in October and further, detailed 3D scans using a Coda Octopus Echoscope with the San Francisco Police Department's Marine Unit in November 2013. Working with the data from all three surveys, we have characterized the site for the first time, conducting the archaeological assessment previously not possible, due to a lack of information. Based on this new data and characterization, we recommend a revised scoring for this wreck.

General Observations/Archaeological Assessment

The shipwreck of *Fernstream* as observed from the multi-beam and side-scan sonar data recorded in 2013, Figures 5-6, confirms that the shipwreck sits upright with the forecastle, partial remains of the stern-house and bridge-house, as well as the forward and after mast house structures all visible (Coda Octopus 2013). Figures 4-13 indicate that the hull has suffered from catastrophic collapse of the bridge-house structure, has a severe breach in the steel hull on the starboard side forward of the bridge-house, masts and booms, king posts have all collapsed onto the main deck or possibly shelter deck, and the port side of the wreck is buried deep in sediment. The stern is the highest remaining structure above seafloor, but also in a state of collapse. The shipwreck appears to be listing to port in the bow. At the starboard breach in the hull forward of the bridge-house structure, the bow is no longer in longitudinal alignment with the after part of the hull to the stern. (NOAA 2013). Outside the wreck, the starboard side of the hull shows evidence of scouring of sediment, more prominently in the bow, a typical occurrence with shipwrecks and due to their position on the seafloor in prevailing currents.

Fernstream as designed had nine designated sections between frames with multiple deep tanks that could be utilized to carry bunker fuel as noted in Figures 1-3. The total capacity of these tanks totaled 2,615.6 Oil Tons @ 38 C.F.; 18,925 NUCOS Volume (bbls) and 794,829 NUCOS Volume (gals) with the assumption that oil tones equals metric tons (tonnes) of Diesel, as noted in Figure 1. (Stout 2013). No records or interviews with crewmen of *Fernstream* at the time of loss have determined which deep tanks carried bunker fuel or other lubricants. This volume is higher than the previous assessment.

In reviewing the ship's plans, No. 3 deep tank(s) hold; positioned forward of the machinery space has the tallest deep tank profile above the ship's keel (MMG 2013). The United Coast Casualty Report states: "The vessels collided at an angle of about 20 degrees. The port bow and stem of the *Hawaiian Rancher* first came in contact with the port side of the *Fernstream* just abaft the bridge, damaging the lifeboat and superstructure. It penetrated the hull at the after part of the engine room, damaging the watertight bulkhead to No. 4 hold. The bow of the *Hawaiian Rancher* withdrew from the hole in the *Fernstream* within a few seconds" (USCG 1953). The collision impact zone of *Fernstream* is far aft of the No. 3 deep tank(s) hold on the port side of the vessel, but *Hawaiian Rancher*'s bow may have impacted deep tanks No. 5 between bulkheads No. 3 and No. 4, deep tanks No. 6 aft of bulkhead No. 4. The sonar imagery (Figures 5-6) clearly shows that the port side of the ship's outer hull at the collision zone is buried deep under tons of sediment. Submerged reconnaissance with a remotely operated vehicle (ROV) would not yield useful site characterization data for this region of the shipwreck.

On the starboard side of the shipwreck where the No. 3 deep tank(s) are located, the sonar imagery (Figures 5-6) reveals a severe breach in the hull. Although not related to the collision impact zone, a catastrophic event has caused a major break in the hull, possibly when the freighter impacted the seafloor, was weakened by the collision, or 61 years of degradation of a steel-hull vessel in a saltwater environment caused the hull to collapse on itself. There is a high probability the No. 3 deep tank(s) has also succumbed to the elements or has been impacted by the collapse of the bridge-house structure.

Conclusions and Updated Risk Assessment

Although an ROV survey may provide some further characterization data, the limited visibility and currents approaching this break in the hull with a tethered vehicle would risk the loss of the ROV. The only possible access to the lower deep tanks would be from the starboard side of the wreck where the sediment has scoured out. Although some observations might be made on the condition of the steel hull, access with an ROV near the lowest part of the vessel is highly unlikely.

The surveys provide information that allows NOAA to update the Vessel Risk Factors used for determining potential pollution risk. NOAA ran a revised Pollution Risk Factor assessment and the Pollution Potential score for the vessel remains medium given that it is not possible to state that the vessel lost all of its bunkers at the time of the casualty.

Based on the detailed sonar data, the state of hull degradation and superstructure collapse of the wreck of MV *Fernstream* has reduced the structural integrity of the vessel to where much of it is open to the sea and not likely to hold significant amounts of oil. Strong currents and an active deposition of silt as a result of offshore sediment movement, calculated over a 12 day period of observation to be $59334 \times 10^4 \text{ m}^3 \pm 4 \times 10^3 \text{ m}^3$ of movement offshore (Wayman 2005) are reflected in the site's characteristics, notably the burial of substantial portions of the vessel's interior, this suggests that although the vessel most likely still contains some diesel bunker fuel and oil lubricants, it is likely trapped beneath the sediments in areas inaccessible to ROV survey.

The scoring of the Fernstream Pollution Potential Factors does not change as noted on Table 2 on the next page. The NOAA recommendation now changes to inclusion within the Area Contingency Plan and active monitoring based on the results of the three surveys of opportunity.

Table 2. Revised summary matrix for the vessel risk factors for the *Fernstream*

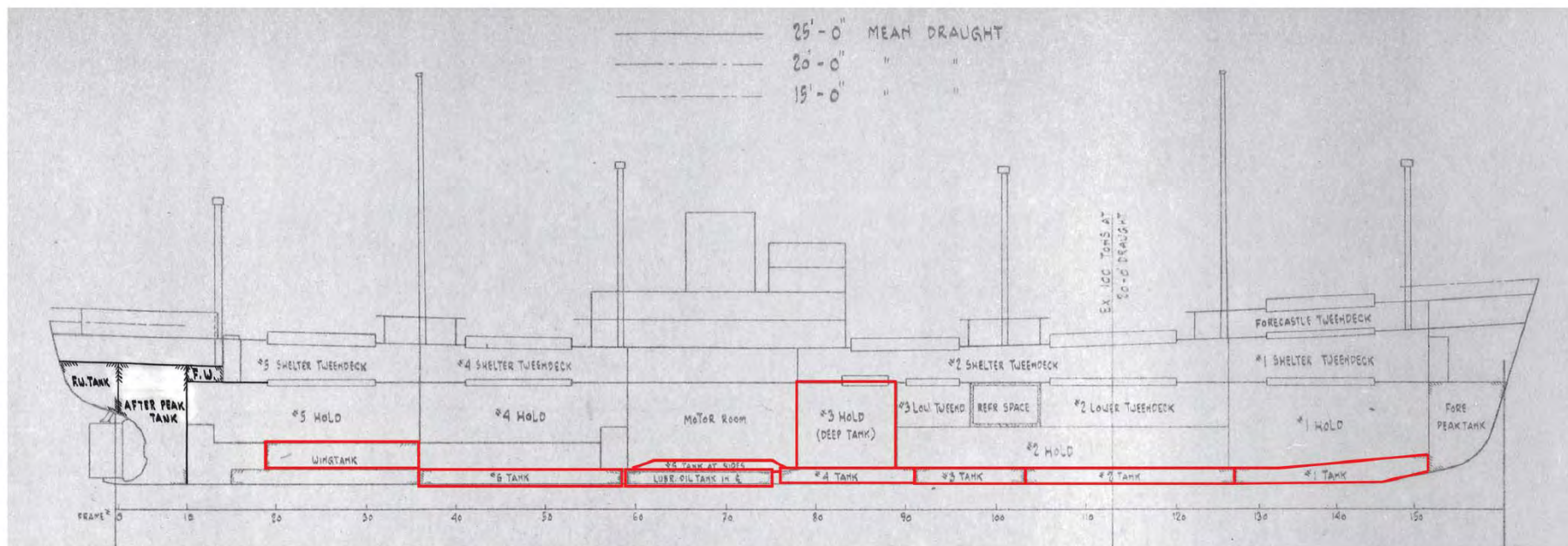
Vessel Risk Factors		Data Quality Score	Comments	Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	High	Maximum of 18,925 bbl, not reported to be leaking	Med
	A2: Oil Type	Medium	Bunker oil is diesel oil, a Group II oil type	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	No fire was reported	
	C2: Oil on Water	High	Oil was reported on the water at the time of the collision	
	D1: Nature of Casualty	High	Collision	
	D2: Structural Breakup	High	The vessel is in two pieces	
Archaeological Assessment	Archaeological Assessment	High	Recent sonar surveys reflect significantly reduced structural integrity, with significant sedimentation covering any remaining tanks on the port side.	Not Scored
Operational Factors	Wreck Orientation	High	Ships sits upright, with the bow listing to port	Not Scored
	Depth	High	150 ft	
	Visual or Remote Sensing Confirmation of Site Condition	High	Location is known and charted, 3 surveys 2013	
	Other Hazardous Materials Onboard	High	No	
	Munitions Onboard	High	No	
	Gravesite (Civilian/Military)	High	No	
	Historical Protection Eligibility (NHPA/SMCA)	Medium	Possibly NHPA	

References

Coda Octopus, November 2013, With San Francisco Police Department Marine Unit
 MMG, 2013, Maritime Museum of Gothenburg
 NOAA May and October, 2013, Office of Coast Survey NRT6 Survey Team
 NOAA, March 2013. Screening Level Risk Assessment Package *Fernstream*
 Stout, Jordan, 2013, NOAA Emergency Response Division, provided estimated deep tank capacity calculations based on historic records of similarly designed vessels and report tank capacities listed in ships plans.
 USCG, 1953. United States Coast Guard Casualty Report of the collision between MV *Fernstream* and SS *Hawaiian Rancher*, Washington DC, 8 May 1953
 Wayman, King, 2005. Bedform Migration and Sediment Transport Rates in the Mouth of San Francisco Bay. California State University, Monterey Bay.

Dist: District 11
 Sector San Francisco
 USCG-MER
 NPFC
 ORR
 ONMS

Deep Tanks Designated to Carry Bunker Fuel & Lube Oil



EFFECT ON DRAUGHT DUE TO FILLING TANK		SALT WATER TANK 38 C F		TANK CAPACITIES		OIL TONS @ 38 C F		If "Oil Tons" equals metric tons (tonnes) of Diesel			
FORWARD	AFT	M ³	COMPARTMENT	FRAME NO	M ³	Oil Tons @ 38 C F	Tank Capacities	M ³	Oil Tons @ 38 C F	NUCOS volume (bbls)*	NUCOS volume (gals)*
+ 8"	- 4 3/4"	63.0	FORE PEAK TANK	52 - 57	63.0	63.0	Fore Peak Tank	63.0	N/A		
+ 10 1/4"	- 5 3/8"	96.1	#1 TANK	107 - 182	95.2	88.5	#1 Tank	95.2	88.5	640	26,880
+ 1'-5 3/8"	- 6 1/8"	235.0	#2	163 - 187	233.2	216.6	#2 Tank	233.2	216.6	1,567	65,814
+ 8 3/4"	- 6 5/8"	173.0	#3	91 - 103	171.4	158.4	#3 Tank	171.4	158.4	1,146	48,132
+ 7 3/8"	- 3 1/8"	228.1	#4	76 - 91	225.8	208.6	#4 Tank	225.8	208.6	1,509	63,378
+ 3 1/8"	+ 10 3/4"	310.0	#5	66 - 76	307.6	286.1	#5 Tank	307.6	286.1	2,070	86,940
- 4 7/8"	+ 1'-4 1/4"	264.2	#6	56 - 59/60	261.8	243.4	#6 Tank	261.8	243.4	1,761	73,962
+ 3'-3 1/8"	+ 1'-4 3/4"	1219.8	DEEP TANK	78 - 89	1200.0	1112.6	Deep Tank	1,200.0	1,112.6	8,051	338,121
- 1'-3"	+ 2'-4 3/8"	327.2	WING TANK	13/14 - 36	324.3	301.4	Wing Tank	324.3	301.4	2,181	91,602
- 3'-3 3/4"	+ 6"	53.2	DRINKING WATER TANK	10 - 14	52.7	N/A	Drinking Water Tank	52.7	N/A		
- 1'-5 3/4"	+ 2'-2 1/4"	224.1	AFTER PEAK TANK	8 - 10	222.0	N/A	After Peak Tank	222.0	N/A		
- 5 3/4"	+ 8 1/4"	65.7	F.W. TANK IN STERN	67 - 73	65.0	N/A	FW Tank in Stern	65.0	N/A		
TRIM GIVEN FOR A MEAN DRAUGHT OF 20'-0"							TOTALS	3,222.0	2,615.6	18,925	794,829

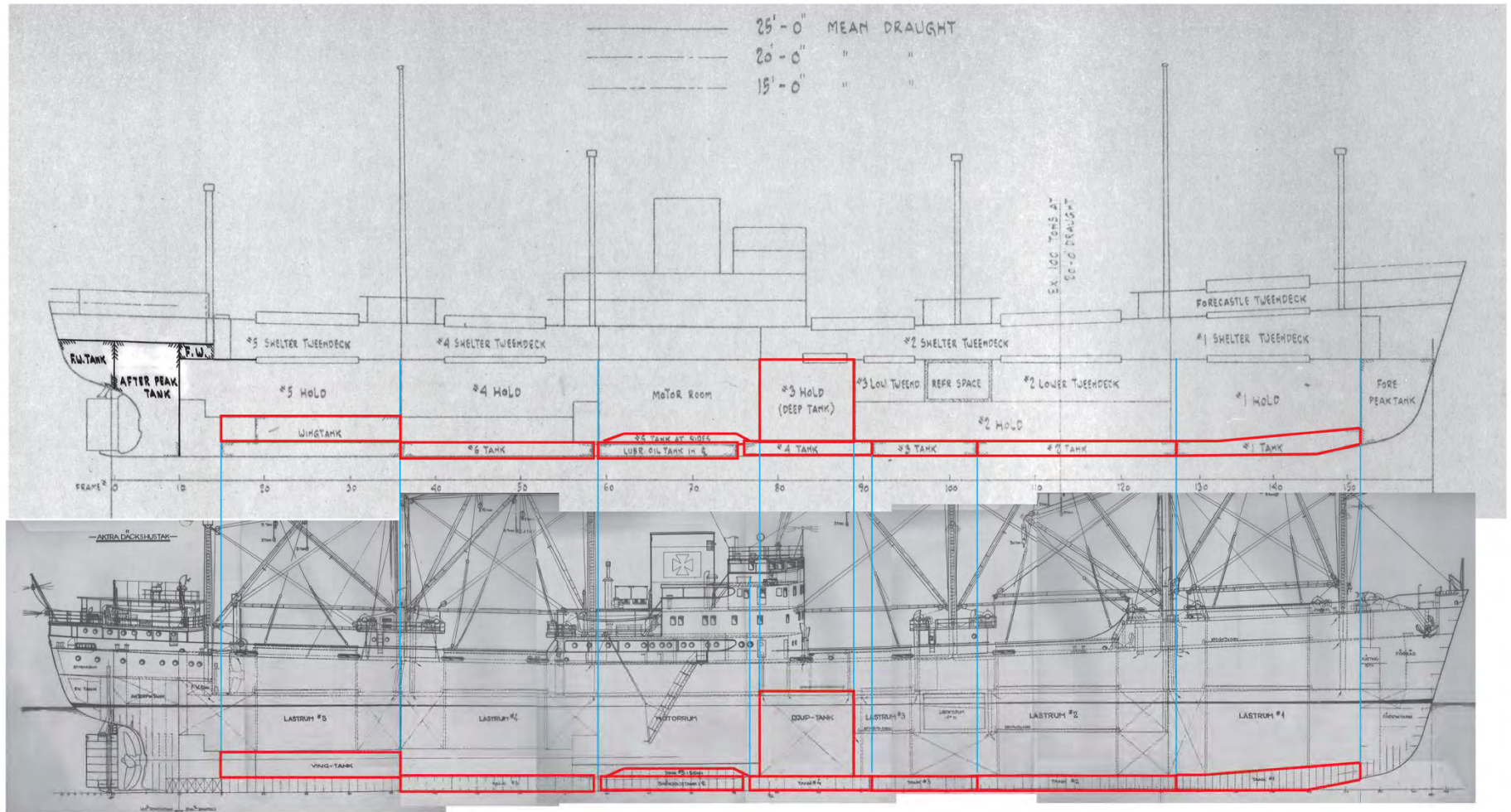
Last modified 07/01/2013

Tanks highlights drawn by Robert Schwemmer, NOAA Office of National Marine Sanctuaries
 Tank capacities provided by Jordan Stout, NOAA Emergency Response Division
 Ships plans courtesy of Maritime Museum of Gothenburg



Deep Tanks Designated to Carry Bunker Fuel & Lube Oil

MV *FERNSTREAM*
FIGURE 2



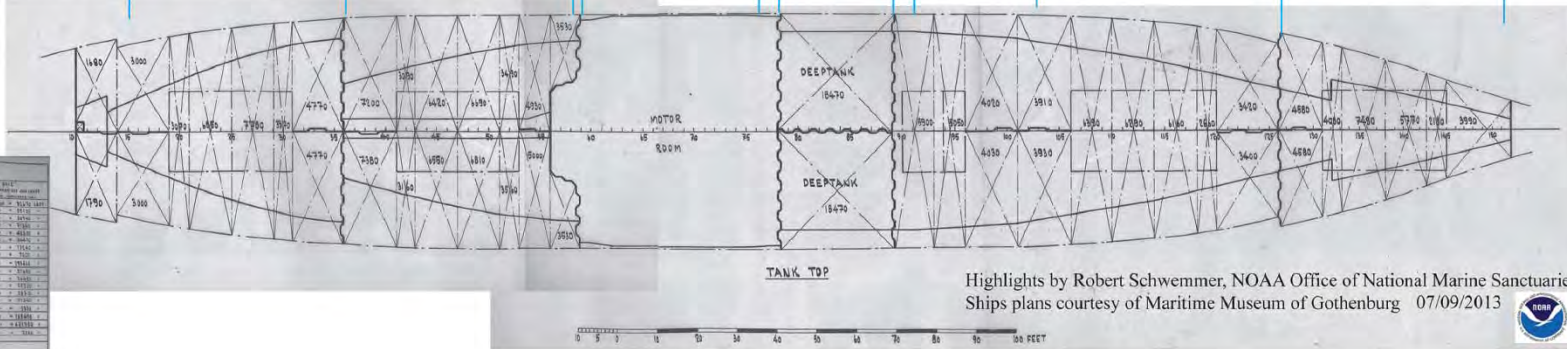
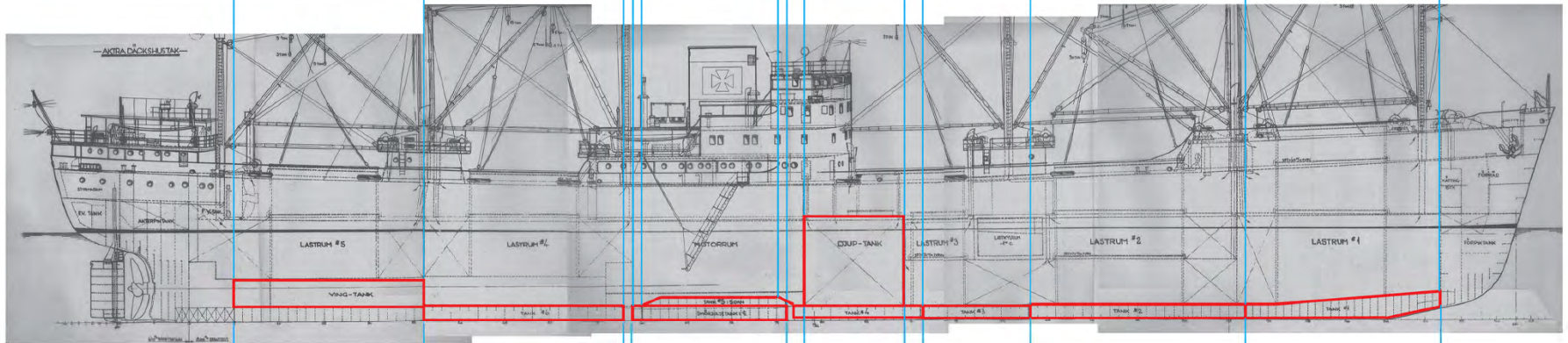
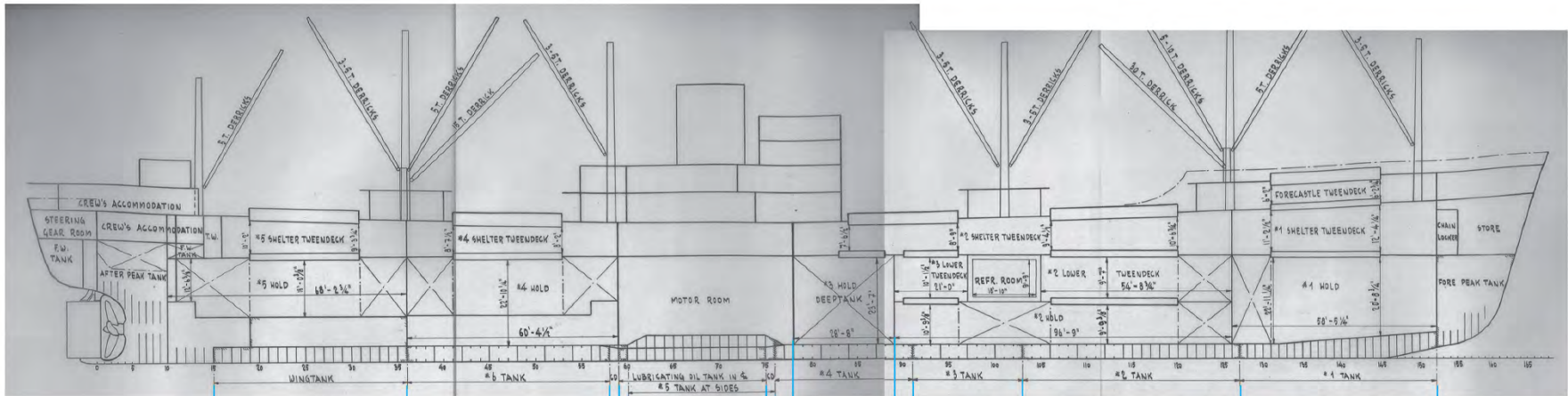
Last modified 07/01/2013

Tanks highlights and mosaic by Robert Schwemmer, NOAA Office of National Marine Sanctuaries
Ships plans courtesy of Maritime Museum of Gothenburg



Deep Tanks Designated to Carry Bunker Fuel & Lube Oil

MV FERNSTREAM
FIGURE 3

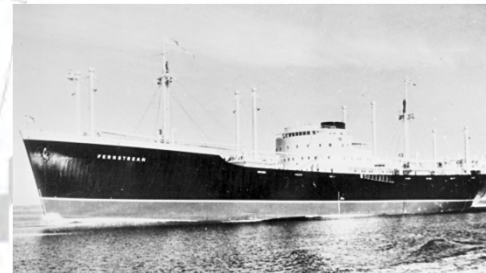
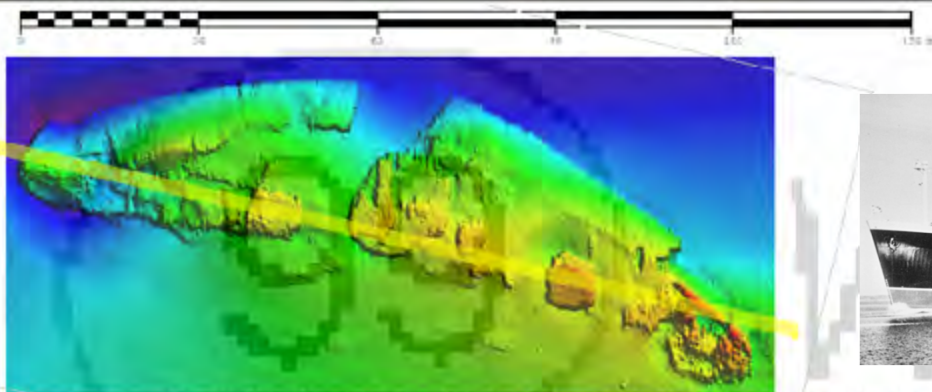


DIMENSIONS OF VESSEL (IN FEET)	
LENGTH OVERALL	148.0
LENGTH BETWEEN PERPENDICULARS	128.0
BREADTH	30.0
DEPTH	12.0
DRAG	1.5
DISPLACEMENT	1,500
NET TONNAGE	1,000
GROSS TONNAGE	1,500
REGISTERED TONNAGE	1,000
WEIGHT	15,000
WEIGHT OF HULL	10,000
WEIGHT OF MACHINERY	5,000
WEIGHT OF EQUIPMENT	1,000
WEIGHT OF SUPPLIES	500
WEIGHT OF PASSENGERS	100
WEIGHT OF CREW	50
WEIGHT OF PASSENGER BAGGAGE	100
WEIGHT OF CREW BAGGAGE	50
WEIGHT OF PASSENGER AND CREW BAGGAGE	150
WEIGHT OF PASSENGER AND CREW BAGGAGE AND SUPPLIES	200
WEIGHT OF PASSENGER AND CREW BAGGAGE AND SUPPLIES AND EQUIPMENT	250
WEIGHT OF PASSENGER AND CREW BAGGAGE AND SUPPLIES AND EQUIPMENT AND MACHINERY	300
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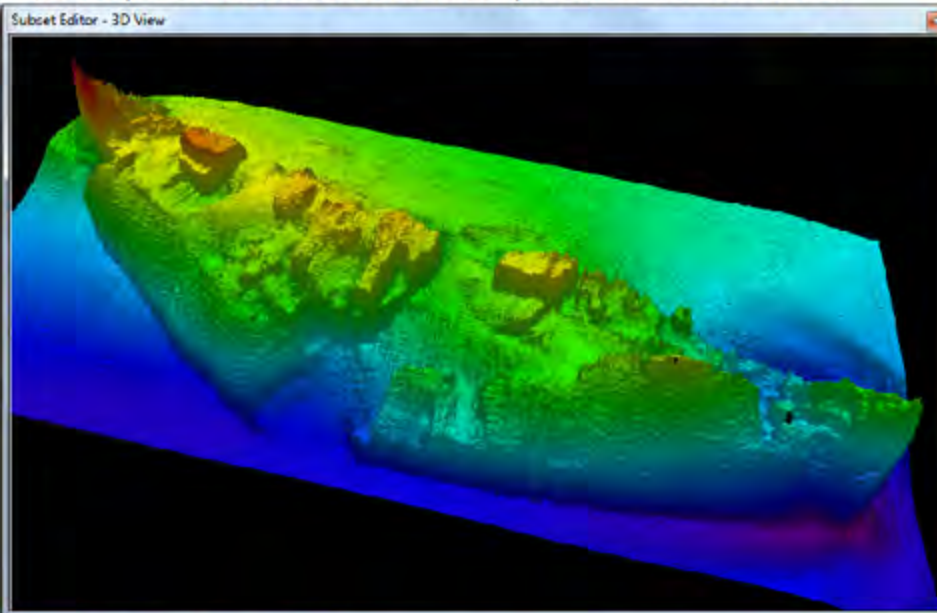
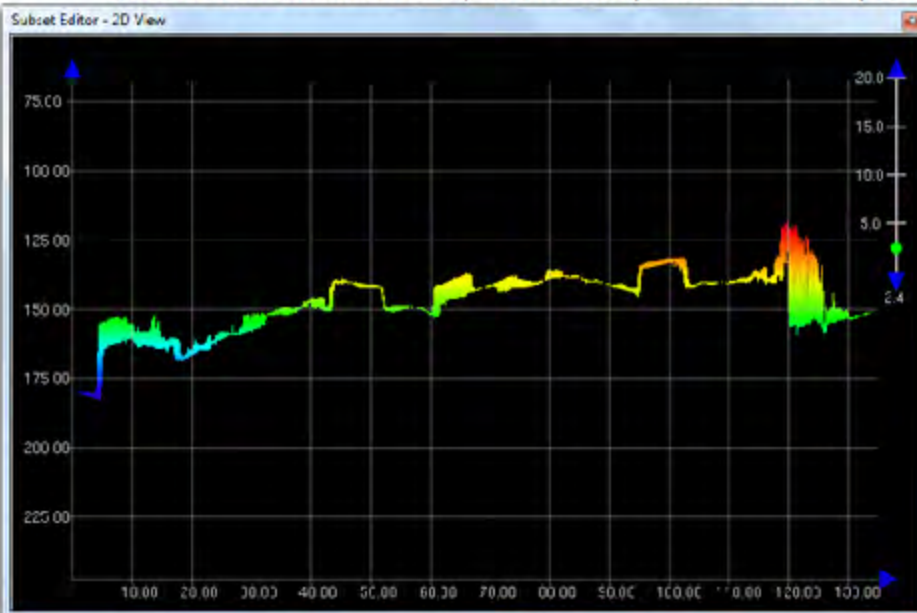
Highlights by Robert Schwemmer, NOAA Office of National Marine Sanctuaries
Ships plans courtesy of Maritime Museum of Gothenburg 07/09/2013



MV *FERNSTREAM*
FIGURE 4



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 116 FEET



Chartlet
1 of 8

WRECK *FERNSTREAM*, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION

Preliminary data subject to office review. Soundings corrected using preliminary observed tides.
Data reflects state of sea floor in existence on day and at time the survey was conducted.

This chartlet has been corrected through
Notice to Mariners dated 5/11/2013
NOT FOR NAVIGATION



NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Project: NRT-6 Response
Survey: Wreck Fernstream Development
State: California
Locality: San Francisco Bay
Sub-locality: East of the Golden Gate Bridge
Survey Scale: 1:10,000

Sounding Units: Feet
Sounding Datum: MLLW
Horizontal Datum: NAD 83
Chart Number: 18650
Chart Edition: 56, Sep./2009
NOS Ref:

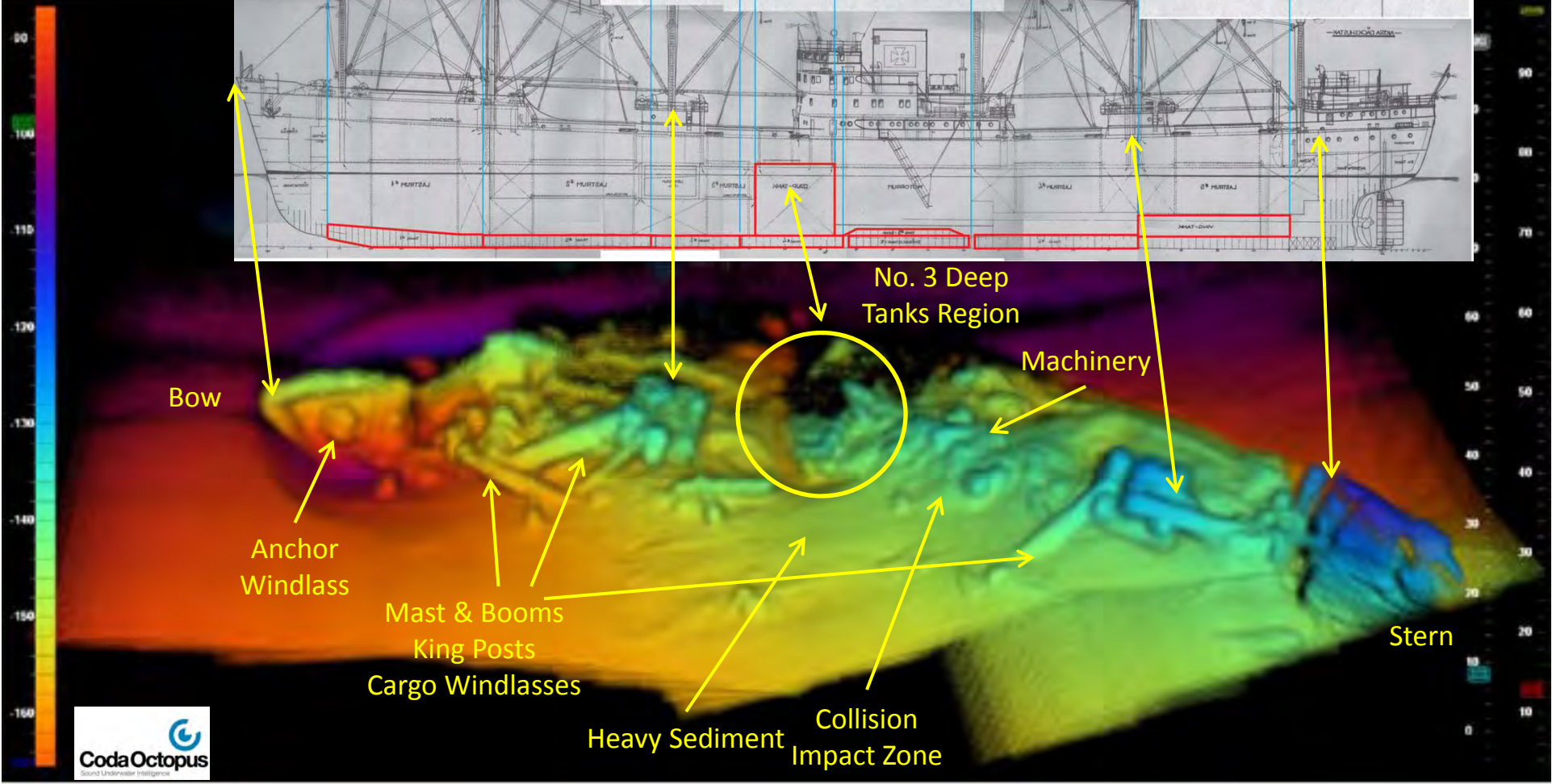
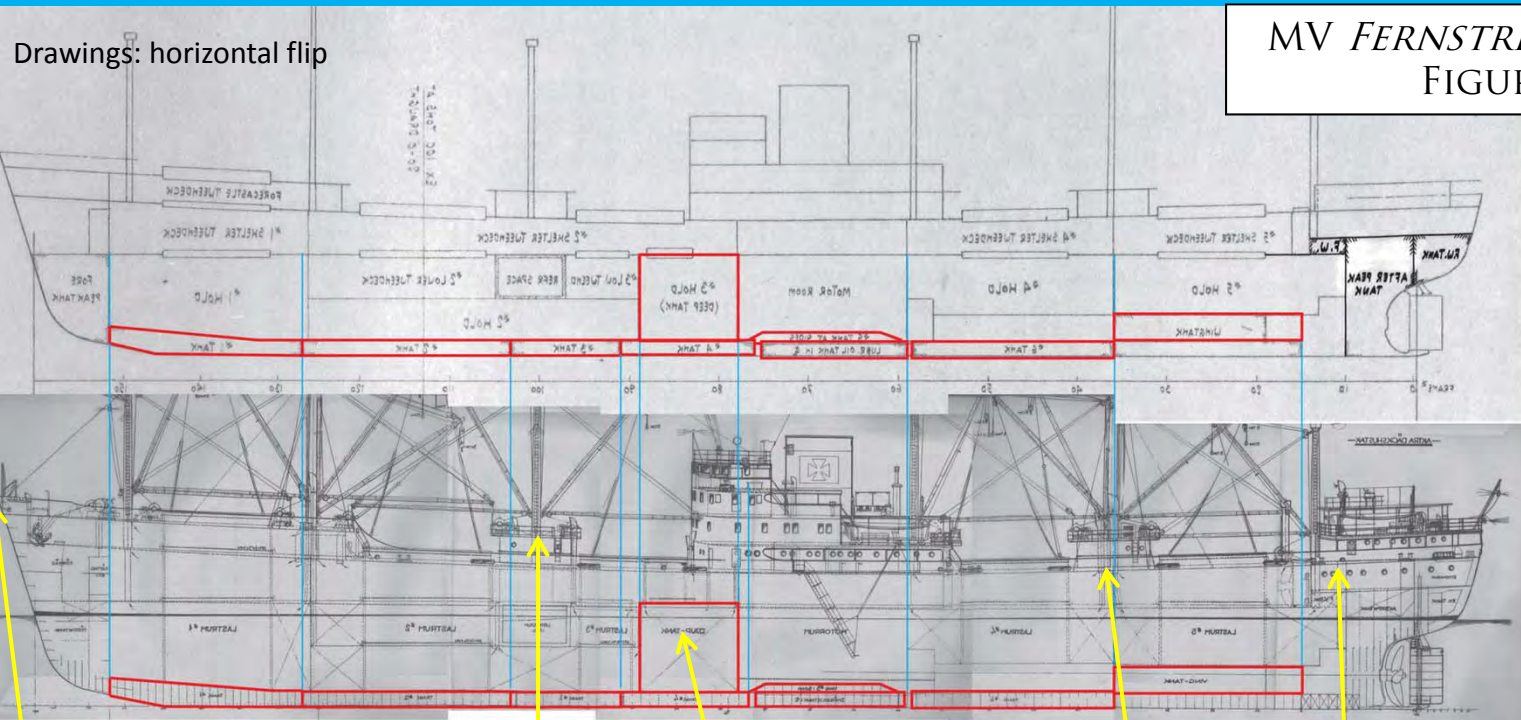
NOAA NRT-6
Laura Pagano, Team Lead
Ian Colvert
Edmund Wernicke

Survey Date: July 8, 2013



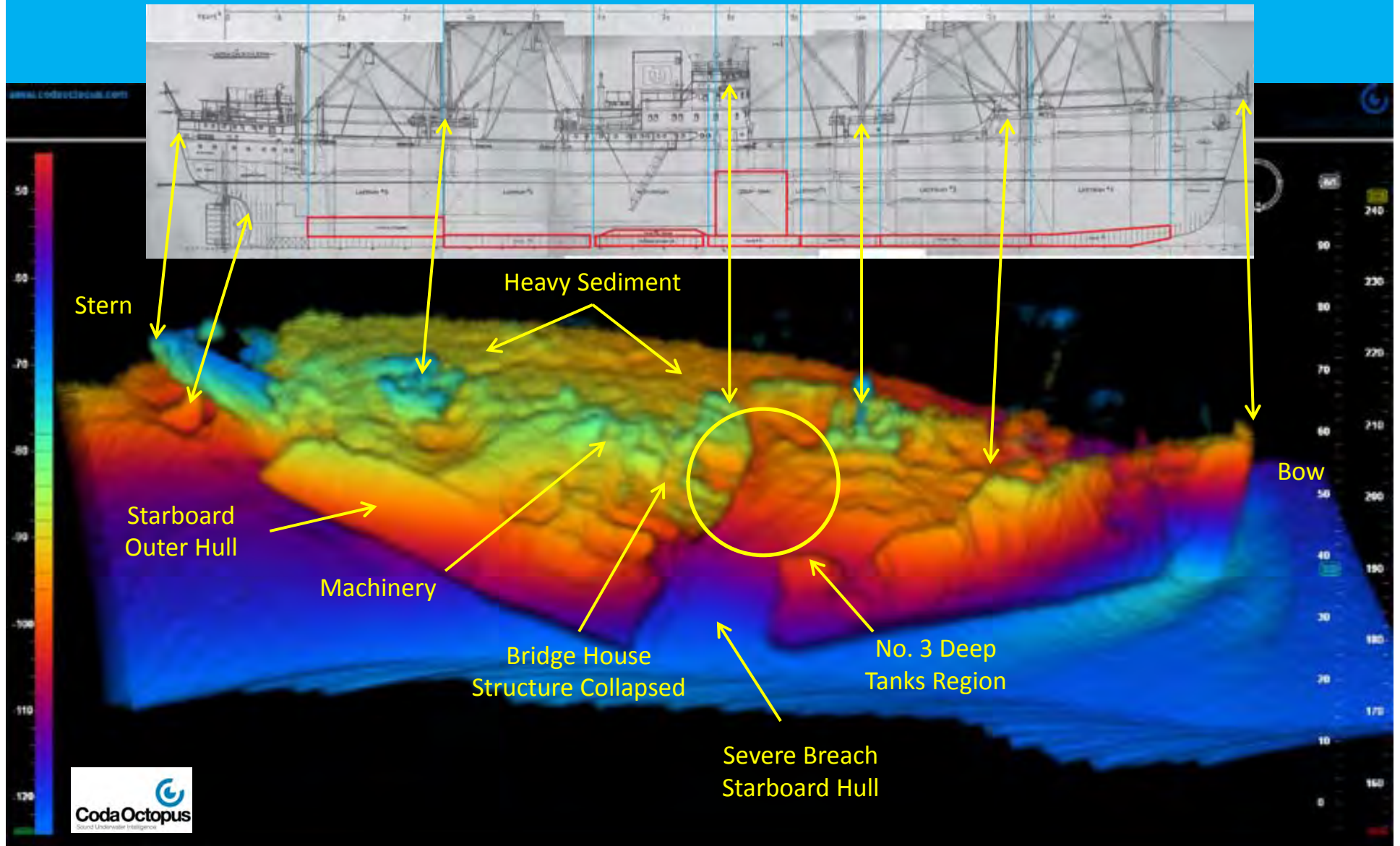
NOAA OFFICE OF NATIONAL MARINE SANCTUARIES

MV *FERNSTREAM*
FIGURE 5



Looking North

MV *FERNSTREAM*
FIGURE 6

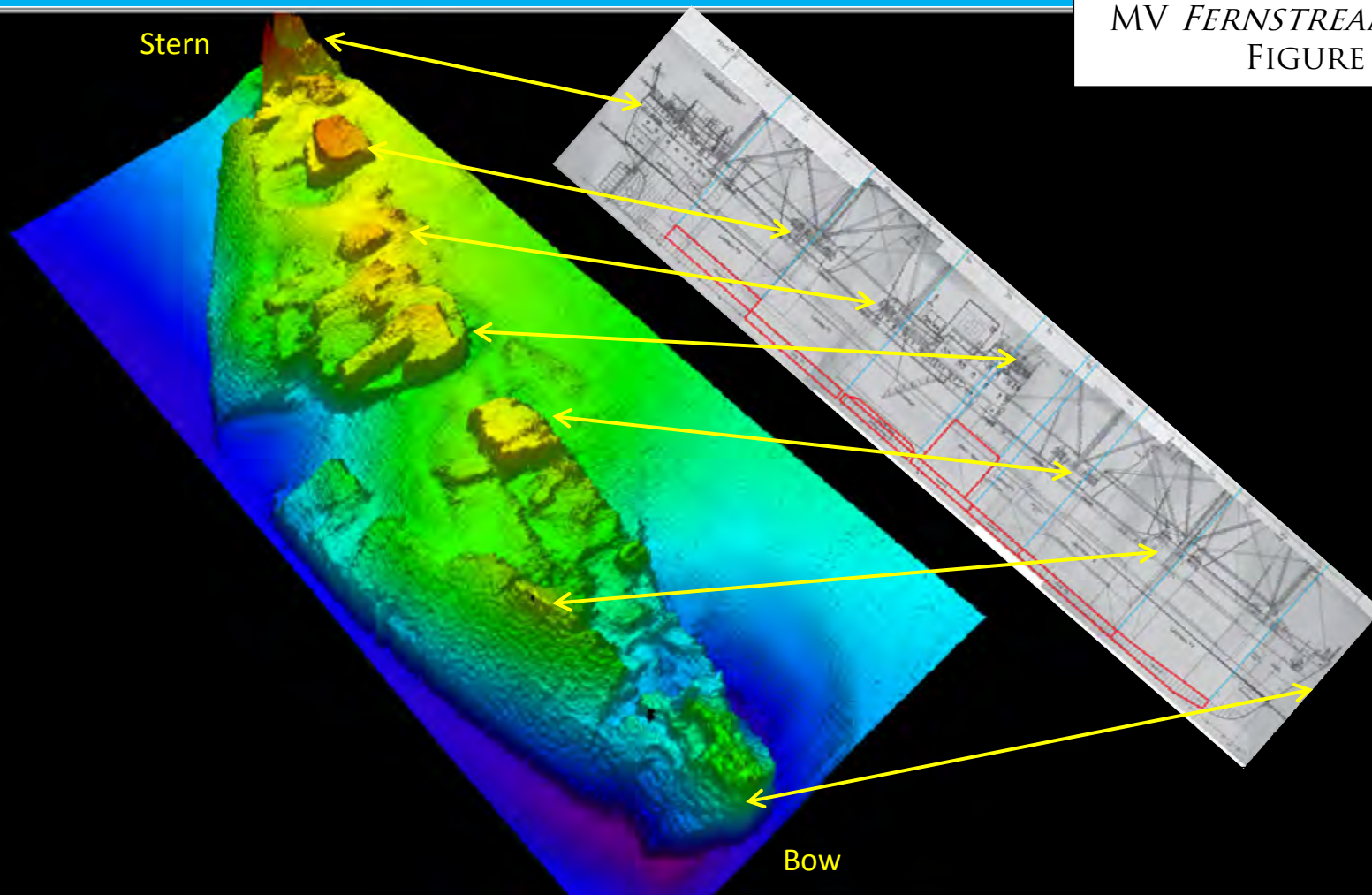


Looking South



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MV *FERNSTREAM*
FIGURE 7



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 116 FEET

Chartlet
6 of 8

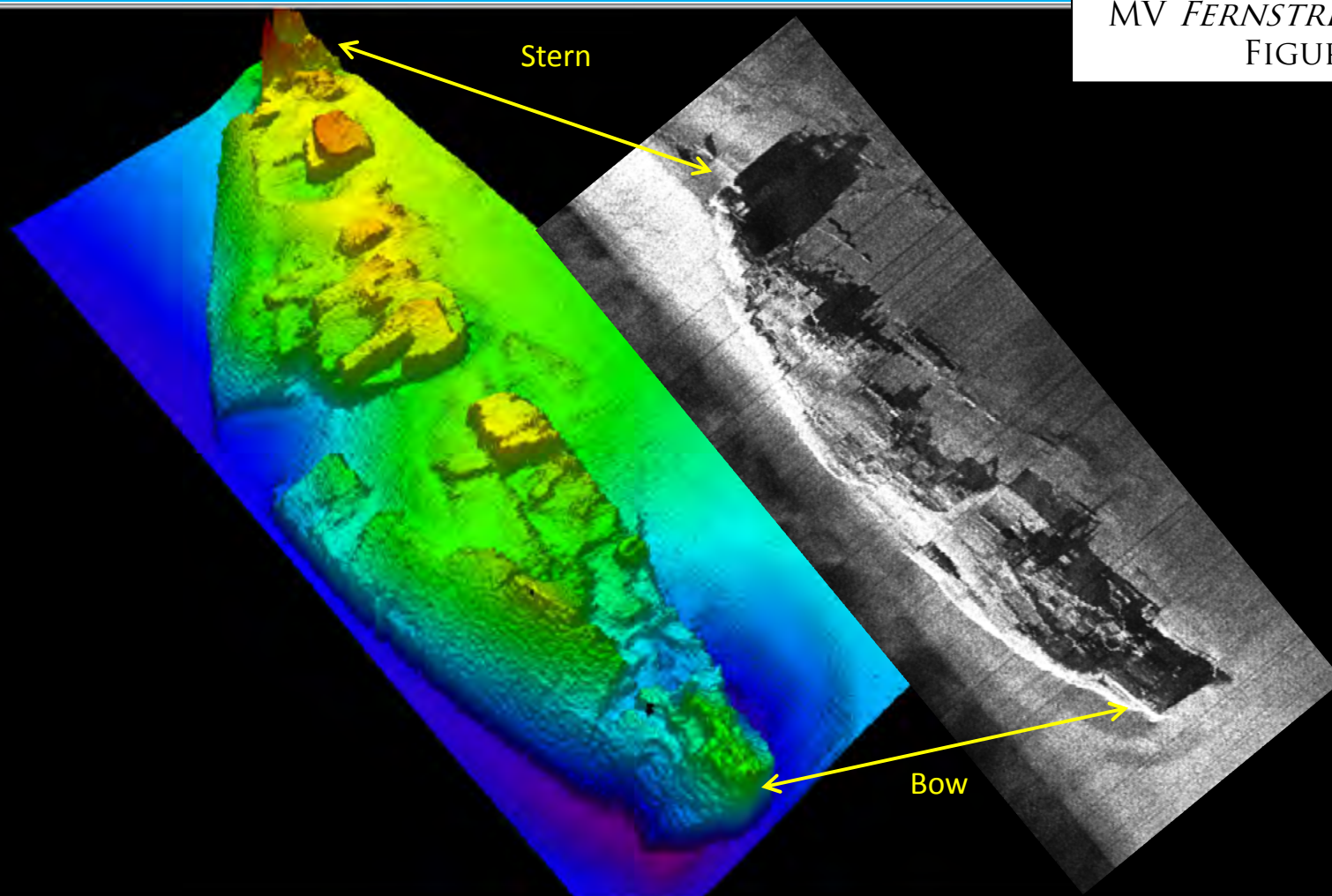
WRECK *FERNSTREAM*, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION

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	<p>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL OCEAN SERVICE</p>	<p>Project: NRT-6 Response Survey: Wreck Fernstream Development State: California Locality: San Francisco Bay Sub-locality: East of the Golden Gate Bridge Survey Scale: 1:10,000</p>	<p>Sounding Units: Feet Sounding Datum: MLLW Horizontal Datum: NAD 83 Chart Number: 18650 Chart Edition: 56, Sep./2009 NOS Ref:</p>	<p>NOAA NRT-6 Laura Pagano, Team Lead Ian Colvert Edmund Wernicke Survey Date: July 8, 2013</p>
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MV *FERNSTREAM*
FIGURE 8



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 116 FEET

Chartlet
6 of 8

WRECK *FERNSTREAM*, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION

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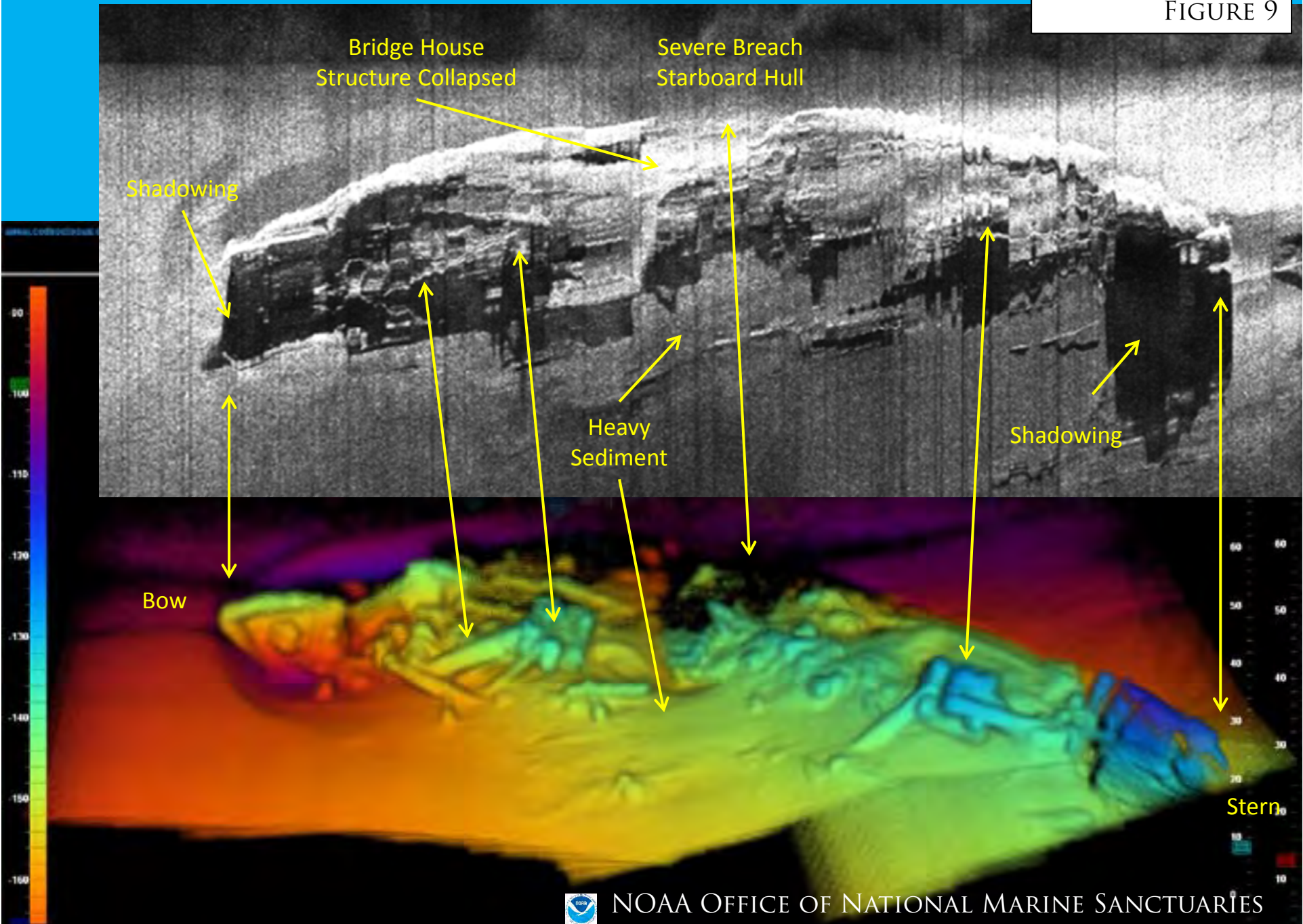
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Survey: Wreck Fernstream Development
State: California
Locality: San Francisco Bay
Sub-locality: East of the Golden Gate Bridge
Survey Scale: 1:10,000

Sounding Units: Feet
Sounding Datum: MLLW
Horizontal Datum: NAD 83
Chart Number: 18650
Chart Edition: 56, Sep./2009
NOS Ref:

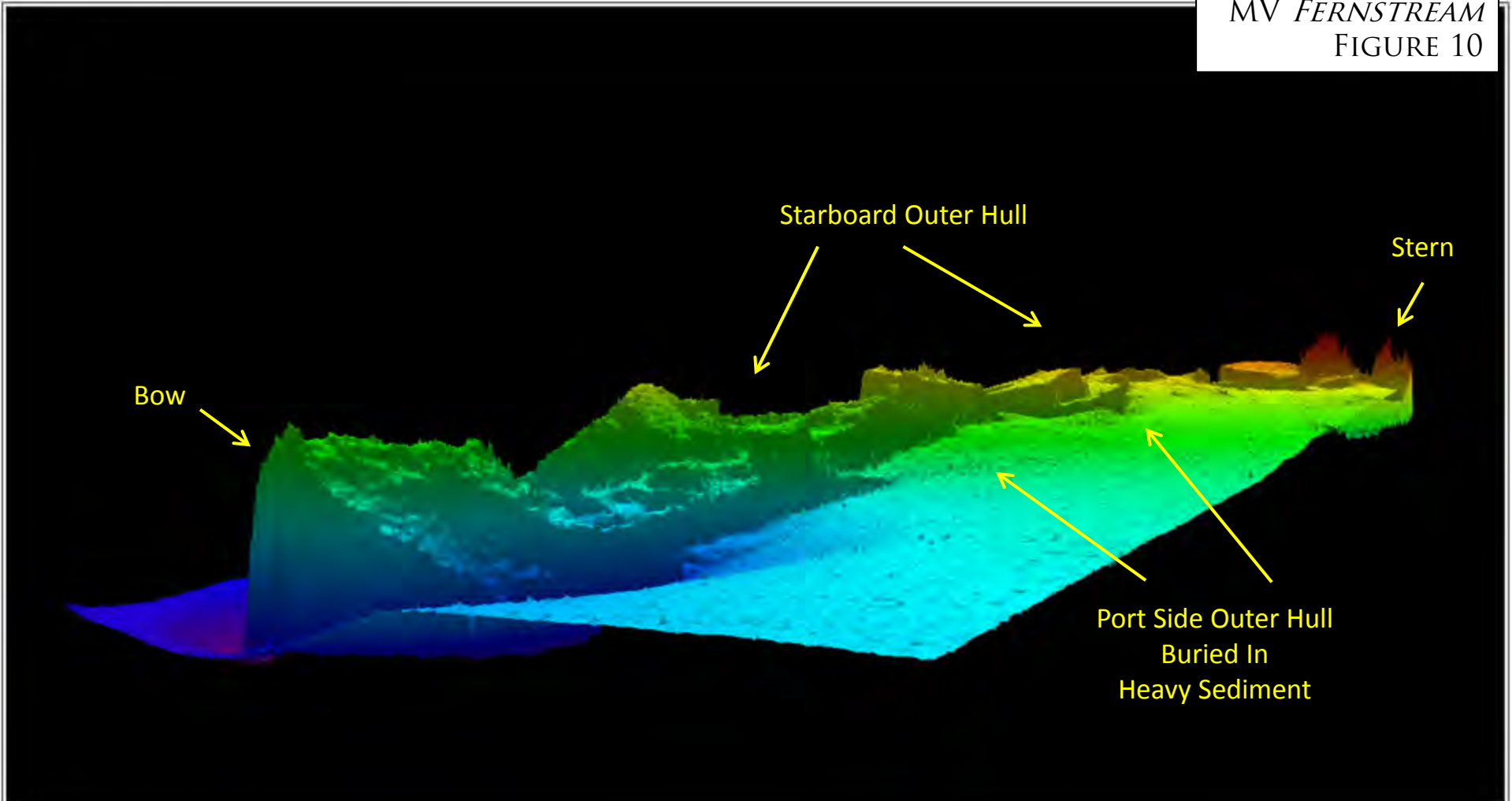
NOAA NRT-6
Laura Pagano, Team Lead
Ian Colvert
Edmund Wernicke
Survey Date: July 8, 2013



MV *FERNSTREAM*
FIGURE 9



MV *FERNSTREAM*
FIGURE 10



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 116 FEET

Chartlet
3 of 8

WRECK *FERNSTREAM*, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION

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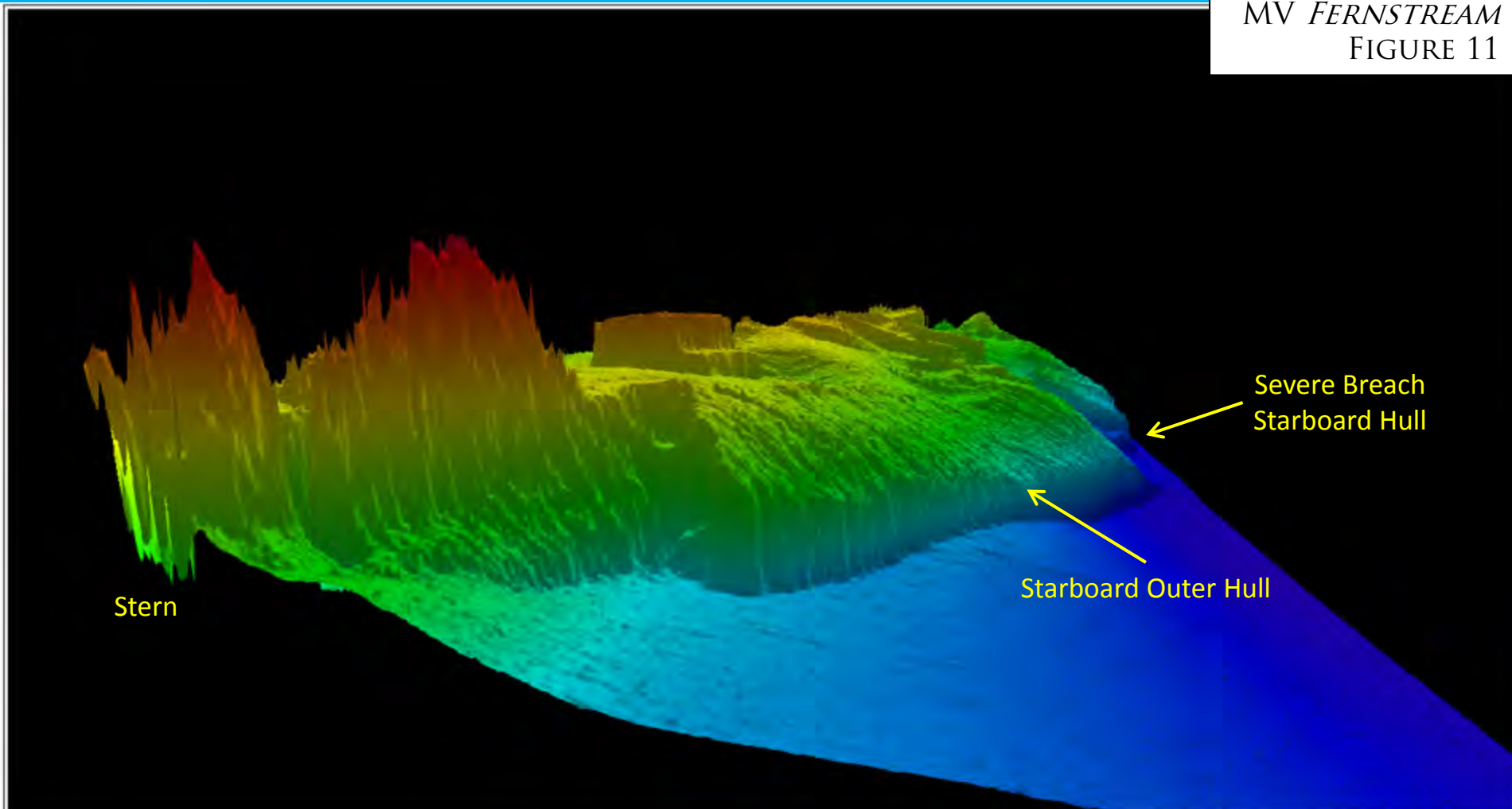
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Survey: Wreck Fernstream Development
State: California
Locality: San Francisco Bay
Sub-locality: East of the Golden Gate Bridge
Survey Scale: 1:10,000

Sounding Units: Feet
Sounding Datum: MLLW
Horizontal Datum: NAD 83
Chart Number: 18650
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NOS Ref:

NOAA NRT-6
Laura Pagano, Team Lead
Ian Colvert
Edmund Wernicke
Survey Date: July 8, 2013



MV *FERNSTREAM*
FIGURE 11



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 116 FEET

Chartlet
5 of 8

WRECK FERNSTREAM, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION

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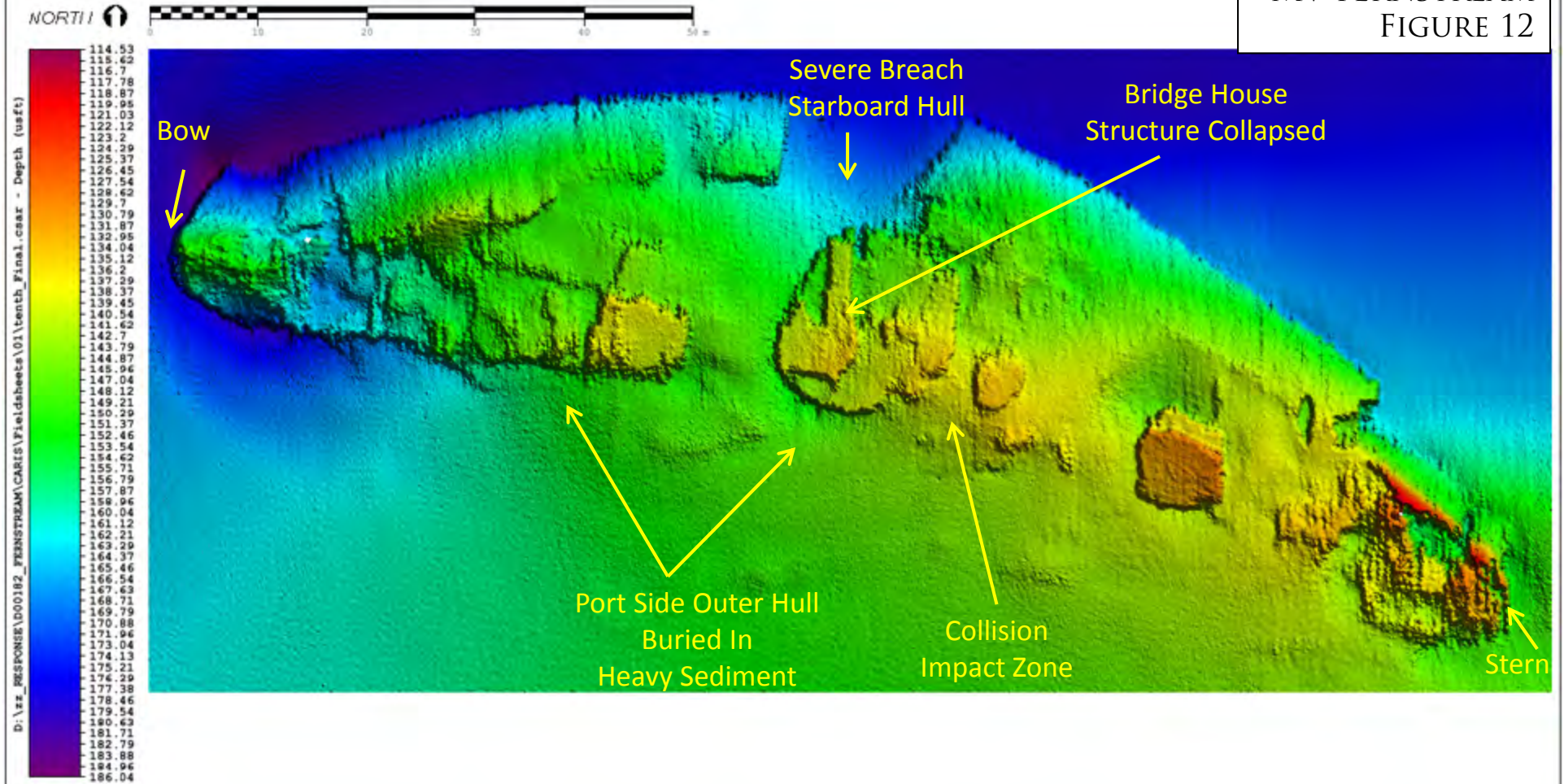
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Project: NRT-6 Response
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Survey Date: July 8, 2013

MV *FERNSTREAM*
FIGURE 12



WRECK LOCATION: 37-49-11.96N, 122-27-32.56W | LENGTH: 415 FEET | BEAM: 100 FEET | HEIGHT ABOVE BOTTOM: 46 FEET | SHOALEST DEPTH: 114 FEET

Chartlet 8 of 8 **WRECK FERNSTREAM, EASTBOUND SAN FRANCISCO TRAFFIC LANE, 0.1 METER RESOLUTION** This chartlet has been corrected through Notice to Mariners dated 5/11/2013 **NOT FOR NAVIGATION**

Preliminary data subject to office review. Soundings corrected using preliminary observed tides.
Data reflects state of sea floor in existence on day and at time the survey was conducted.

	<p>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL OCEAN SERVICE</p>	<p>Project: NRT-6 Response Survey: Wreck Fernstream Development State: California Locality: San Francisco Bay Sub-locality: East of the Golden Gate Bridge Survey Scale: 1:10,000</p>	<p>Sounding Units: Feet Sounding Datum: MLLW Horizontal Datum: NAD 83 Chart Number: 18650 Chart Edition: 56, Sep./2009 NOS Ref:</p>	<p>NOAA NRT-6 Laura Pagano, Team Lead Ian Colvert Edmund Wernicke Survey Date: July 8, 2013</p>
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MV *FERNSTREAM*
FIGURE 13

