UNITED STATES COAST GUARD

INVESTIGATION INTO THE CIRCUMSTANCES
SURROUNDING THE SINKING OF THE

F/V PATRIOT

14 NAUTICAL MILES OFF THE COAST OF GLOUCESTER, MA
ON JANUARY 3, 2009 WITH THE LOSS OF TWO
CREWMEMBERS

U.S. Department of Homeland Security

United States Coast Guard

Commandant
United States Coast Guard

2100 Second Street, S.W. STOP 7581
Washington, DC 20593-0001
Staff Symbol: CG-545
Phone: (202) 372-1030
Fax: (202) 372-1904

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SINKING AND LOSS OF TWO CREW MEMBERS ABOARD THE COMMERCIAL FISHING VESSEL PATRIOT 14 NAUTICAL MILES EAST OF GLOUCESTER, MA IN STELLWAGEN BANK ON JANUARY 3, 2009

ACTION BY THE COMMANDANT

The record and the report of this Investigation convened to investigate the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments.

ACTION ON RECOMMENDATIONS

Recommendation 1: Recommend that 46 U.S.C. 3301, *Vessels subject to inspection*, be amended to include commercial fishing vessels.

Action: We concur with this recommendation. We believe that inspection and certification of commercial fishing industry vessels would improve the level of safety of the vessels and for those who work on them. We have long sought the legislative authority to bring fishing vessels under an inspection regime. In one of our more comprehensive attempts, we requested the legislative authority to implement an inspection and certification scheme for commercial fishing vessels based on a 1992 Report to Congress for the Inspection of Commercial Fishing Industry Vessels. That request, as with several others preceding it, was not granted. In our latest attempt, using data collected since 1992, we are developing a revised legislative change proposal asking Congress for the authority to implement an inspection and certification scheme for commercial fishing industry vessels. In the interim, we note the current version of the Coast Guard Authorization Act for 2010 (HR 3619), passed by the House of Representatives on 23 October, 2009, includes provisions for mandatory fishing vessel safety examinations every two years and issuance of certificates of compliance for fishing industry vessels. While these examinations would not be as detailed in scope as an inspection for certification, it would increase our ability above the existing voluntary examination program.

Recommendation 2: Recommend a re-evaluation of the applicability of 46 C.F.R. 28 Subpart E, *Stability*, be conducted and that this applicability be amended to include commercial fishing vessels less than 79 feet in length.

Action: We concur with this recommendation. The Commercial Fishing Industry Vessel Safety Advisory Committee (CFIVSAC) has also recommended that the stability requirements in 46 CFR Part 28 be extended to commercial fishing vessels less than 79 feet in length. We are including this as part of a current regulatory project revising 46 CFR Part 28.

Recommendation 3: Recommend a requirement for commercial fishing vessels to be equipped with tracking equipment. Optimally, recommend the development of a system that would combine the capabilities of Automatic Information System and Vessel Monitoring System.

Action: We concur with this recommendation. We agree that the ideal situation would be to have all commercial fishing vessels fitted with a universal transponder that combines the attributes of the Vessel Monitoring System (VMS) with the capabilities of the Automatic Identification System (AIS). However, this would be difficult to achieve as the two systems serve very different purposes, employ different communications paths, and are mandated by different Federal agencies.

Instead, we are proposing to expand AIS requirements beyond Vessel Traffic Service (VTS) areas to all U.S. navigable waters and to expand the applicability to all commercial vessels, including fishing vessels, of 65 feet or more in length. A Notice of Proposed Rulemaking (NPRM) was published on December 16, 2008.

With the existing VMS in place and the anticipated change to AIS requirements in progress, we will have expanded electronic tracking of commercial fishing vessels. As such, we believe it is unnecessary to reengineer the two systems and reissue carriage requirements in order to track fishing vessels offshore.

Recommendation 4: Recommend the language of the regulation for Emergency Position Indicating Radio Beacons (EPIRBs) on commercial fishing industry vessels be amended to state that EPIRBs shall be installed in accordance with manufacturer's instructions.

Action: We concur with the intent of this recommendation. While the installation of the Emergency Position Indicating Radio Beacon (EPIRB) was not identified as a latent unsafe condition or determined to be a causal factor in this incident, we do believe this topic is important enough to warrant discussion. Manufacturer guidelines provide general information on proper installation of the device and suggestions on locations so that the EPIRB will float free and activate in an emergency. However, given the nearly unlimited differences in arrangements and layouts on fishing vessels, the most appropriate installation may or may not be in complete accordance with the manufacturer's general guidelines and recommendations. As such, an owner should not be forced to install an EPIRB in accordance with the manufacturer's guidelines if a better arrangement is possible. Under 46 CFR 25.26-5 it is the responsibility of the owner to ensure that the EPIRB is properly installed in a manner so that it will float-free if the vessel sinks. To assist the owner, we have published and distributed information on EPIRB installation and testing, which is available online at http://homeport.uscg.mil. As an additional check, our fishing vessel safety examiners inspect EPIRB installations during dockside safety examinations to ensure they are installed so that they will function as required. For these reasons, the existing performance-based requirement is preferred over a prescriptive requirement.

Recommendation 5: Recommend the Commercial Fishing Vessel Safety (CFVS) program change its criteria for the issuance of a CFVS decal to require/include a stability test. To facilitate a cost effective testing procedure for the mariner, recommend the development of a simplified stability test for commercial fishing vessels.

Action: We partially concur with this recommendation. Currently, commercial fishing vessels 79 feet or more in length, with their keel laid or at a similar stage of construction or having undergone a major conversion started on or after September 15, 1991, are already required to comply with the stability requirements in 46 CFR Part 28 Subpart E, in order to satisfactorily complete a voluntary dockside examination and receive a Commercial Fishing Vessel Safety (CFVS) Decal. Extending stability requirements to vessels less than 79 feet will be proposed as part of an on-going regulatory project. If adopted, the same compliance requirements regarding stability would apply to commercial fishing vessels less than 79 feet in length in order for them to receive a CFVS Decal. As such, we do not believe a change in criteria for the issuance of an examination decal is necessary.

[redacted]

KEVIN S. COOK
Rear Admiral, U.S. Coast Guard
Director of Prevention Policy

TABLE OF CONTENTS

			Page
	SUMMARY		3
Section 1	**FINDINGS OF FACT**		4
	1.1	Vessel, general data	4
	1.2	Vessel, layout of cargo and tank arrangement	5
	1.3	Vessel, personnel	5
	1.4	Vessel, modifications	6
	1.5	Vessel, lifesaving equipment	7
	1.6	Vessel, freeing ports	9
	1.7	Vessel, condition and survey	9
	1.8	Roll dampening paravanes (birds)	10
	1.9	Watertight doors and hatches	10
	1.10	Dewatering systems and flooding alarms	11
	1.11	Fire/burglar alarm system	11
	1.12	Weather	12
	1.13	Vessel traffic	12
	1.14	Wreck site encroachment	13
	1.15	Previous trips of the F/V PATRIOT	14
	1.16	Underwater survey of the F/V PATRIOT	14
	1.17	NOAA Passive Acoustic Buoys	22
	1.18	Marine Safety Center stability analysis	26
	1.19	Autopsy results	26
	1.20	Search & Rescue (SAR)	27
	1.21	Life raft	28
	1.22	EPIRB	29
	1.23	Survival suit	30
	1.24	Trawl doors and block analysis	30
	1.25	Inspection of the Tug GULF SERVICE and Barge ENERGY 11103	31
	1.26	Tow line inspection	32
	1.27	Tug video analysis	33
	1.28	Global Positioning System	34
	1.29	Proposed salvage operation	34
Section 2	**TIMELINE**		35
	2.1	Timeline of key events	35
Section 3	**ANALYSIS**		37
	3.1	Capsizing/ Stability	37
	3.2	Human Error	41
	3.3	Deployment of the lifesaving equipment	42
	3.4	Ship Strike/ Collision	43

TABLE OF CONTENTS CONTINUED

			Page
Section 4	**CONCLUSIONS**		45
	4.1	Conclusion: Capsizing/ Stability	45
	4.2	Conclusion: Ship Strike/ Collision	45
	4.3	Conclusion: Life Saving Equipment	45
	4.4	Conclusion: Human Error	45
Section 5	**RECOMMENDATIONS**		46
	5.1	Amend 46 United State Code	46
	5.2	Re-evaluate need for stability requirements	46
	5.3	Development of new tracking equipment	46
	5.4	Amend EPIRB regulations for commercial fishing vessels	46
	5.5	Change the criteria for the issuance of Commercial Fishing Vessel Safety Decals to include stability test	46
Section 6	**ENCLOSURES**		47
	6.1	Evidence index	47

SUMMARY

On January 3, 2009, the F/V PATRIOT sank, resulting in the drowning death of the two crew members onboard. The casualty occurred while the vessel was underway on a fishing voyage approximately 14 nautical miles (nm) east of Gloucester, MA in Stellwagen Bank. The U.S. Coast Guard conducted a Marine Casualty Investigation into this incident. The purpose of the investigation was to uncover the cause of the incident, document the events, and initiate the necessary corrective actions in an effort to prevent future casualties. The Coast Guard also performed a complete review of the Coast Guard's Search and Rescue (SAR) response; the SAR review results can be found in the SAR Final Action Memorandum, Evidence Control #131.

On the evening of January 2, 2009, the F/V PATRIOT departed Gloucester, MA for Stellwagen Bank on a routine fishing trip with a master and one crew member onboard. On January 3, 2009, at approximately 1:35 a.m., the master's wife/vessel's co-owner, contacted Coast Guard Station Gloucester and reported that she received notification that a fire alarm on the F/V PATRIOT was received by the alarm service. This was the first notification to the Coast Guard of any potential distress on board the F/V PATRIOT. The Coast Guard did not receive any distress calls or signals from the F/V PATRIOT.

A Coast Guard rescue helicopter from Air Station Cape Cod, the first Coast Guard asset on scene, detected and homed in on an EPIRB homing signal, located a debris field, and sighted the body of the deckhand. The deckhand's body was recovered by the Coast Guard Cutter (CGC) FLYINGFISH. Later that day, the rescue helicopter located and retrieved the body of the master. Neither the master nor deckhand was wearing survival suits or life jackets when their bodies were recovered.

The Coast Guard rescue helicopter crew observed the EPIRB's flashing strobe while searching for the F/V PATRIOT's crew; however, their immediate priority was to locate any potential survivors. The EPIRB was never recovered. The liferaft was recovered by a Good Samaritan vessel that assisted in the search and rescue efforts. The liferaft was found in an inflated condition, but the canopy was not fully opened/erect due to being tangled in multiple lines.

The F/V PATRIOT's location was confirmed in approximately 100 feet of water and its condition was documented by a Remote Operated Vehicle (ROV) and commercial underwater cameras. The vessel is lying on its starboard side with the fishing nets in a retrieved position. No significant damage to the hull or superstructure has been noted on the areas of the vessel visible.

The Coast Guard used the ROV and commercial dive video footage, the Marine Safety Center modeling study, and the U.S. Navy Commander Undersea Surveillance analysis of underwater acoustic data to explore the possibility of a collision, capsize/loss of stability, or flooding as the cause of the loss of the F/V PATRIOT. The Coast Guard attributes the vessel's loss to a rapid event, most likely a capsizing, that did not allow the crew time to respond or access lifesaving gear.

Section 1 - FINDINGS OF FACT

1.1 Vessel, General Data

Name:	PATRIOT
Owner:	S. & M. Fisheries, Inc.
Official Number:	1055291
Gross Tons:	69
Length:	62 feet
Breadth:	18 feet 5 inches
Depth:	9 feet
Hull Design:	Offshore, western rigged dragger
Hull Material:	Steel; 3/8 inch bottom; 5/16 inch sides
Propulsion:	Single Detroit diesel (12 V 71) 345 hp
Fuel Capacity:	7,000 gallons (approximately)
Build Date:	1997, Beaufort, North Carolina
Flag:	United States

Figure 1: Picture of the F/V PATRIOT as the F/V DANIELLE MARIE prior to sale and name change.

1.2 Vessel, Layout of Cargo and Tank Arrangement

Below the main weather deck, the internal hull was constructed with four transverse bulkheads which divided the vessel into five water-tight compartments:

1. Forepeak (the water-tight door from the engine room leading to the forepeak was removed, leaving an open doorway)
2. Engine room with port and starboard fuel tanks
3. Fish Hold (the fish hold was an open space with wooden slats to separate the space into pens)
4. Water tank
5. Lazarette

Above the main deck, there were four main areas:

1. Pilothouse
2. Galley and dining area
3. Crew living spaces (2 bunk beds to sleep 4 persons; head)
4. Engineer's storage area and aft operating station

Concrete permanent ballast was added between all frames in the bilge from the forepeak to the lazarette.

TANK	MAX Capacity	EST Capacity At Time of Incident
01 Fuel oil port	3500 gallons	3200 gallons
02 Fuel oil starboard	3500 gallons	3200 gallons
Hydraulic tank	30 gallons	30 gallons
Unused Water Tank	Unknown	0
Fish tank/hold	Unknown	6 tons ice

Table 1: PATRIOT Tank Capacities

1.3 Vessel, Personnel

At the time of the incident, the F/V PATRIOT was manned with two of the three crew members: the master and deckhand.

Crewmember:	Matteo Russo	*Time on vessel:*	<1 Year
DOB:	[redacted]	*Time in industry:*	20+ Years
Position on vessel:	Master	*Status:*	Deceased
Crewmember:	Giovanni "John" Orlando	*Time on vessel:*	<1 Year
DOB:	[redacted]	*Time in industry:*	20+ Years
Position on vessel:	Deckhand	*Status:*	Deceased

Figure 2: Flicker.com photo of Matteo Russo and John Orlando onboard the F/V PATRIOT

A third crewmember, [redacted] was employed by Matteo Russo to serve as the F/V PATRIOT's engineer but could not get underway on the night of January 2nd due to a family obligation. Mr. Russo decided to get underway without Mr. [redacted] and he and Mr. Orlando would have had to fulfill Mr[redacted] duties while underway. Mr. [redacted] duties included checking and maintaining machinery operations, equalizing the port and starboard fuel tanks by means of a crossover valve that allowed the fuel in each tank to maintain equal levels for stability of the F/V PATRIOT, and assisting both Mr. Orlando and Mr. Russo on deck as needed. It was not a regular occurrence for the vessel to get underway with only a master and a deckhand; however, the vessel had completed several voyages with two crewmembers as recently as August of 2008.

1.4 Vessel, Modifications

The F/V PATRIOT was built in 1997 by Gerry T. Smith, Inc. of North Carolina. The vessel was constructed originally to be a shrimper, without plans or blueprints.

Mr.[redacted] purchased the vessel from Mr. [redacted] and subsequently modified the vessel to be a dragger. These modifications included:

- Replacing the long shrimping outriggers with smaller outriggers used only for deploying the paravanes to buffer the vessel's rolling.
- The original boom was shortened.
- A single, large winch on deck was replaced with two smaller winches.
- Two net reels were added to the vessel: one behind the superstructure and one at the stern. This modification included adding framework to support the net reels' weight.
- Installing a gallows frame on the stern.

- Cutting a ramp into the stern.
- Adding two sheets of steel to the pilothouse overhang to protect fisherman from the weather.

Mr. [redacted] purchased the vessel in 2005 and made the following modifications:

- Replacing two deck winches with 550 lbs H12 winches. The H12 winches were half the size of the old ones.
- Cutting one foot off both flanges on the forward net reel.
- Replacing the aft net reel with a smaller one. Mr. [redacted] estimates that the new reel weighed half as much as the original.

On January 28, 2008 the American Bureau of Shipping conducted tonnage calculations on the F/V PATRIOT.

Mr. Matteo Russo purchased the F/V PATRIOT on March 18, 2008. Mr. Russo made the following modifications:

- Two winches were mounted on the top of the superstructure. They were not rigged for operation at the time of the incident.
- A pull-master winch was installed on the main deck weighing approximately 400 pounds.
- A conveyer belt was added to the main deck on the port side.
- Radios and electronic equipment were added or replaced.
- A hydraulic steering system was installed with a 30 gallon reservoir.
- A 3.5 ft x 3 ft aft operational control room replaced a shower stall.

Neither the F/V PATRIOT's builder nor any of the owners conducted a stability test on the vessel. A deadweight survey was never conducted.

1.5 Vessel, Lifesaving Equipment

The F/V PATRIOT's inflatable life raft was a Zodiac 4-person self-inflatable life raft and was stowed on the upper deck behind the pilothouse. It was secured to the vessel by a hydrostatic release unit and designed to automatically release at approximately 13 feet of depth.

EQUIPMENT	NOTES
(1) Zodiac 4 person inflatable life raft	Inspected September 2008 Hydrostatic release exp 08/09 Deployed, but not as designed (See Section 1.21)
(1) EPIRB category 1 (406 MHz) (Emergency Position Indicating Radio Beacon)	Battery expiration: Unknown Registration # ADCD0805AC40C01 Stored in a float-free box Deployed as designed; Did not transmit properly (See Section 1.22)
(5) Survival suits	One suit located in the wheel house and the other four located in the aft head. (See Sections 1.7 and 1.23)
(4) Type 1 Personal Floatation Devices (PFD) (Lifejackets)	By the USCG boarding report of November 12, 2008, there were 4 PFDs on board. No deficiencies were noted
(1) Ocean Service DISTRESS 363 signal kit	(3) Smoke Flares (6) Hand Held Flares (3) Parachute Flares Inspected by the Coast Guard on November 12, 2008 and were found to be in serviceable condition.
(5 to 9) VHF-FM Radios	Voyager Marine Electronics connected four radios on the bridge and one in the aft control station. Two of the radios on the bridge were coded and a single side band was on the bridge. The engineer believed there to be 8 to 9 VHF radios on board and working.
(1) 24 inch Life ring	Inspected by the Coast Guard on November 12, 2008 and found to be in serviceable condition.
(1) Spare EPIRB category (406 MHz)	Possibly stored in the bunkroom

Table 2: Lifesaving Equipment carried on board the F/V PATRIOT

The F/V PATRIOT had one, registered Category 1[1] EPIRB (406 MHz) stored in a float-free box on the upper deck behind the pilothouse. [redacted] stated that Matteo Russo kept a second Category 1 EPIRB (406 MHz) in the crew berthing area.

[1] A Category 1 EPIRB broadcasts both a 121.5 MHz and 406 MHz signal and is designed to deploy automatically.

Both Matteo Russo and Giovanni Orlando had cell phones with them on January 2, 2009. Though it is unknown if they had a signal at the time of the casualty, Matteo Russo received a call from [redacted] at 10:50 p.m. This phone call lasted 20 minutes.

Figure 3: Storage locations of EPRIB and life raft

1.6 Vessel, Freeing Ports

The F/V PATRIOT had six freeing ports: three on each side. According to [redacted], the four aft freeing ports had adjustable doors. There were two additional freeing ports forward of the working deck. The deck freeing ports cleared water well. As a part of the crew's fish sorting, the freeing port openings would be partially closed so that undersized fish would be released through the opening. The approximate size of the freeing ports is 14 inches by 10 inches. Photographs show two smaller drainage ports on the port side below the pilot house. A reasonable assumption can be made regarding identical drainage ports on the starboard side.

1.7 Vessel, Condition and Survey

In July 2007, the F/V PATRIOT (then F/V DANIELLE MARIE) was hauled out/dry-docked for regular maintenance. During the vessel's haul out, zincs were replaced, the hull bottom was pressure washed, and a transducer was installed.

Marine Safety Consultants, Inc. conducted a Condition and Value Survey on the F/V PATRIOT (then F/V DANIELLE MARIE) in February 15, 2008 prior to Matteo Russo's purchase of the vessel. This visual survey was done at dockside, and no equipment or machinery was operated or tested. The surveyor generally found the fishing vessel to be in good condition and made 11 recommendations to be completed including freeing up dogs on watertight doors, replacing gaskets on watertight doors and fittings as required,

testing all bilge alarms, adding chain guards to all net drum drives, and having all mechanical and electrical systems inspected by certified mechanics.

Coast Guard Commercial Fishing Vessel Examiners conducted a voluntary inspection of the F/V PATRIOT on July 31, 2008; no deficiencies were found and a fishing vessel safety examination decal was issued.

In November 2008, Coast Guard Commercial Fishing Vessel Examiners observed the F/V PATRIOT listing approximately 15-20 degrees to its starboard side while at the dock. A crew member onboard stated that while taking on fuel, the valves were not aligned correctly to allow the tanks to fill at an equal level.

The F/V PATRIOT was boarded by the Coast Guard Cutter (CGC) HAMMERHEAD on November 12, 2008; no deficiencies were found.

1.8 Roll-Dampening Paravanes ("Birds")[2]

Roll-dampening paravanes were fitted to the F/V PATRIOT on the port and starboard outriggers. Underwater footage shows that the outrigger cables were loose, indicating that the outriggers were deployed and in use at the time of the incident with both paravanes in the "up" position so they would not drag through the water. There was no evidence that the paravanes became fouled.

1.9 Watertight Doors and Hatches

There were three pilothouse watertight doors: one on the starboard side of the forward operating station, one on the port side of the forward operating station, and one centered on the rear of the pilothouse. The forepeak, fish hold, and lazarette had watertight hatches. The engine room hatch was not watertight.

All doors and hatches were inspected during the Coast Guard dockside examination and provided good watertight integrity.

The position of the doors at the time of the casualty is unknown. The open doors may have been left in the open/un-dogged position by the crew during fishing operations, used to abandon ship, been left open during an emergent response when the master rushed to aid the deckhand, or may have sprung open due to air pressure as the vessel sank. However, ROV video footage shows that the forward port side and the rear pilothouse watertight doors were open and that the starboard door is closed (See Section 1.16). This footage also shows that the engine room (non-watertight) and fish hold hatches were open and that the lazarette and forepeak hatches were shut.

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[2] ***NOTE:** Roll-dampening paravanes (commonly referred to as "birds") are lowered into the water via port and starboard outriggers while the vessel is underway. When dragged through the water, each paravane exerts a downward force by the diving effect of its fin. This balanced downward pulling force at the end of each outrigger makes the moving vessel more resistant to heeling forces and dampens the rolling movement.

Figure 4: ROV photo of the port side pilothouse watertight door open

1.10 Dewatering systems and Flooding Alarms

The F/V PATRIOT had two, fixed dewatering systems onboard on January 2, 2009. The first system consisted of Direct Current (DC) 32V Rule type pumps in the engine room, lazarette, and fish hold. These pumps were controlled by switches in the pilothouse.

A second, dewatering system located in the starboard, aft corner of the engine room consisted of a Pacer 2" centrifugal pump powered by an Alternating Current (AC) 3hp motor. This pump had pick-ups for the engine room, fish hold, lazarette, and a seacock directly underneath the pump. Each suction line was fitted with a check valve to prevent back flooding at the connection to a common manifold. This pump was primarily used as a wash down pump and discharged to a hose located on the starboard side of the pilothouse on deck. This pump would be run continually in the winter as a wash down pump, discharging seawater to prevent the lines from freezing.

The bilge electronic alarm system consisted of float switches in the fish hold, engine room and lazarette.

1.11 Fire/Burglar Alarm System

On May 27, 2008, a burglar and fire alarm monitored by Wayne Alarm Systems, Inc. was installed on the F/V PATRIOT. According to Wayne Alarm Services, Inc., two smoke detectors and two motion detectors were transferred from Matteo Russo's old vessel, the F/V JOSEPHINE to the F/V PATRIOT. The only new equipment installed was a Global System for Mobile (GSM) radio that broadcasts over the cell phone network. The smoke detectors that were installed on the F/V PATRIOT were System Sensor model 2WT-B with a thermal sensor. The thermal sensor alarms at 135° Fahrenheit. The location of the mounted smoke and motion detectors could not be confirmed.

1.12 Weather

Weather data at the time of the casualty is based on two NOAA weather buoys located within 10 nm from the wreck site, interviews with the crew of the M/V GATEWAY ENDEAVOR, and observations made by Coast Guard assets on scene. All information confirms that the wind was 15–20 knots from the west-northwest (270° to 280°), air temperature was 32° F, and water temperature was 42° F. Wave height was 2–3 feet and the M/V GATEWAY ENDEAVOR observed visibility at 6-8 nm. No icing was noted by any on-scene vessel.

1.13 Vessel Traffic

Coast Guard Investigating Officers analyzed data from the Automatic Identification System (AIS), Vessel Monitoring System (VMS), and foreign vessel arrival data to determine what vessels were within 12 nautical miles (nm) of the F/V PATRIOT's final position at 12:30 a.m. Both the AIS and VMS systems use the Global Positioning System (GPS) to generate positions. All GPS systems are set to atomic clocks at the GPS ground stations and satellites and are identical. VMS transmits every 30 minutes or hourly depending on the type of fishing the vessel is engaged in. At the time of the casualty, the F/V PATRIOT's VMS was transmitting hourly. A position transmitted from a VMS unit with GPS is accurate up to 100 meters; a VMS unit without GPS is accurate up to 300 meters.

Figure 5 shows the positions of all nearby vessels between 11:30 p.m. on January 2nd and 1:30 a.m. on January 3rd. The F/V STORMY WEATHER, F/V JULIE ANN II, and F/V LISA ANN II were all either fishing, hove to, or anchored approximately 11 nm to the northwest. The M/V GATEWAY ENDEAVOR, a support vessel that stays at the Northeast Gateway Deepwater Port, stayed hove to throughout this period until getting underway to assist with the SAR efforts at 4:00 a.m. The Tug GULF SERVICE, towing the Barge ENERGY 11103 approximately 1,300 feet astern, transited through the immediate area and passed within approximately 2.5 nm of the F/V PATRIOT at 12:01 a.m.

The white line in Figure 5 is the Tug GULF SERVICE's track line traveling at 8-8.3 knots. At 12:30 a.m., the Tug GULF SERVICE's AIS position was over 4 nm south-south west of the F/V PATRIOT's last VMS position and continuing south. Because of the Tug GULF SERVICE and Barge ENERGY 11103's close proximity to the F/V PATRIOT on January 2, 2009, USCG Investigators boarded the vessel in Piney Point, MD (See Section 1.25).

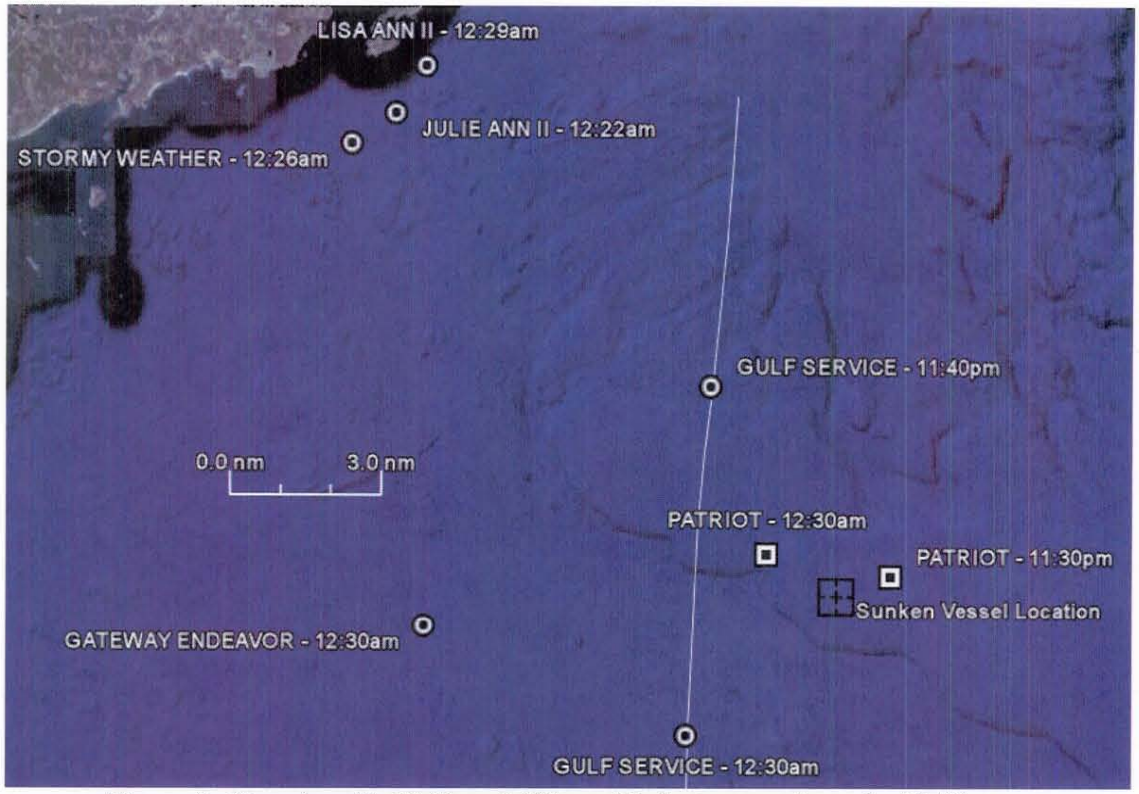

Figure 5: Vessels with VMS and AIS enabled at approximately 12:30 a.m.

On April 28, 2010, U.S. Navy Commander Undersea Surveillance completed examination of that night's recordings of NOAA underwater passive acoustic sonar buoys. This analysis confirmed both the approximate locations of the F/V PATRIOT and the Tug GULF SERVICE's transit south as shown by VMS and AIS. The U.S. Navy confirmed that there was no vessel in the immediate vicinity of the F/V PATRIOT when she sank at approximately 1:15 on January 3, 2009 (See Section 1.17).

1.14 Wreck site encroachment

On January 4, 2009 at approximately 12:00 p.m., Mr. [redacted] set out fishing gear from the F/V RHIANNON RAE II on the Middle Bank at Stellwagen Bank. Mr. [redacted] had not been at Stellwagen Bank the previous day and at this time was unaware of the F/V PATRIOT casualty. While fishing, Mr. Fernandes usually follows tracks that he has saved on a Global Positioning System (GPS) plotter. At approximately, 1:30 p.m. the gear from the F/V RHIANNON RAE II became entangled on a large underwater obstruction. Mr. [redacted] tried for an hour steaming from different directions to untangle his gear from the object. He then hauled back approximately 300 feet of wire, bringing the F/V RHIANNON RAE II closer to the object. The starboard wire then parted leaving the F/V RHIANNON RAE II hanging off the object on its port wire. The port wire also parted soon after, leaving the F/V RHIANNON RAE II's entire fishing net assembly on the F/V PATRIOT. This included the F/V RHIANNON RAE II's fishing net, ground cables, and both doors.

The extent of the damage this caused to the F/V PATRIOT is unknown. ROV and dive footage shows one of the F/V RHIANNON RAE II's ground cables wrapped under the

F/V PATRIOT's stern and around the rudder and propeller. The other door and cable seems to be caught on the starboard paravane. This cable passes underneath the wreck at the middle of the working deck (See Figure 12).

1.15 Previous Trips of the F/V PATRIOT

During December of 2008, the F/V PATRIOT completed 7 trips total with each trip visiting the same section of Stellwagen Bank where the wreck was later located. These trips varied in duration with 2 trips lasting less than 10 hours, 4 trips lasting slightly longer than 24 hours, and one multiday trip lasting 3 days, 8 hours. These trips reveal that the vessel often got underway at night with 4 trips starting soon after midnight and 2 trips starting between 3:30 p.m. and 6:30 p.m. Only 1 trip during December started during daylight hours at approximately 8:30 a.m.

Interviews with both the former owner and with a crewmember of the F/V PATRIOT that served as the ship's engineer revealed that the vessel would transit out from port with an engine speed of over 1700 RPM. Vessel Monitoring System (VMS) data for previous trips revealed that the F/V PATRIOT speed could be as high as 8.5 knots at these times. Upon reaching a fishing ground, the crew would reduce engine speed to 600 – 650 RPM or idle, take the propeller out of gear, and engage the Power Take Off (PTO) that powered the vessel's deck gear hydraulics. It would take approximately 10 minutes to deploy the fishing gear. The crew would then disengage the PTO, reengage the propeller, and actively fish. While dragging her nets, the F/V PATRIOT's engine speed was usually 1400-1500 RPM and her speed was approximately 3.0 knots or less. The F/V PATRIOT would drag until her nets were full, taking approximately 3 hours or less. To recover the nets, the crew would disengage the propeller and reengage the PTO to operate the deck hydraulics. During the haul back, the crew would periodically engage the propeller to maintain forward momentum. After the fish were on deck, the crew would either redeploy the gear or transit to a new location.

NOAA Passive Acoustic Buoys recorded these previous trips and these recordings were provided to the U.S. Navy Commander Undersea Surveillance (CUS) for analysis (See Section 1.17). CUS analysts were able to identify the F/V PATRIOT's acoustic signature, determine engine speed, and detect an auxiliary alternating current (AC) motor noise on every trip. Interviews with crewmembers and examination of engine room photos have determined that this AC motor was a wash down pump that the crew would continuously run to prevent the system from freezing.

1.16 Underwater Survey of the F/V PATRIOT

Throughout the course of this investigation, the Coast Guard either conducted or participated in several underwater surveys of the F/V PATRIOT's wreck site. These included two surveys using side scan sonar, one survey using a Coast Guard Remote Operated Vehicle (ROV) and one dive survey.

On January 16, 2009, Massachusetts State Police along with one USCG Investigator surveyed the wreck location using a towed, side scan sonar array. Rough sea conditions prevented clear sonar shots from being taken. A second side scan sonar survey was

conducted on January 23, 2009 by a Marine Surveyor from Rockport, MA hired by the family of the deceased crewmembers. This survey collected high resolution sonar images of the wreck site (See Figure 6). The surveyor was also able to take photos of the wreck using a simple, underwater camera and confirmed the wreck as that of the F/V PATRIOT.

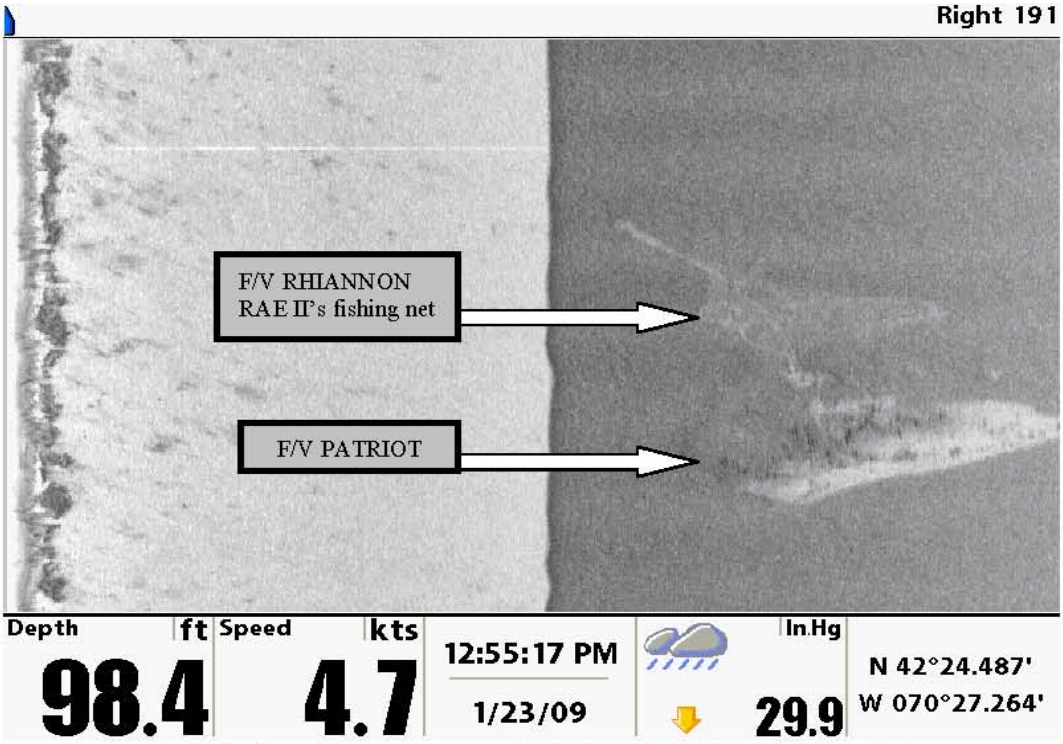

Figure 6: Side Scan Sonar image of F/V RHIANNON RAE II's fishing net hooked on the F/V PATRIOT

On January 30, 2009, Sector Boston, Marine Safety and Security Team (MSST) Boston and MSST Seattle commenced a Remote Operated Vehicle (ROV) operation to visually survey the F/V PATRIOT using the CGC JUNIPER as a platform. Because of the ROV's small size and maneuverability, Coast Guard personnel were able to photograph much of the wreck including inside the pilot house, inside the engine room, and underneath the starboard bow and starboard bilge keel. This operation collected approximately 7 hours of underwater video footage of the wreck.

Family and friends of the deceased commissioned a dive survey conducted on February 10, 2009 in the presence of a Coast Guard Investigator. Commercial divers documented the F/V PATRIOT using both video and photography and also recovered the F/V PATRIOT's GPS (See Section 1.28) and the liferaft's hydrostatic release (See Section 1.21). In the following months, family sponsored dives were conducted by commercial divers where items from the F/V PATRIOT wreck were brought to the surface. Among these items were a 10 ton block, the F/V PATRIOT's computer, and the ship's wheel. Coast Guard Investigators were not present for these dives.

All surveys conducted on the F/V PATRIOT reveal that the vessel is lying on its starboard side in approximately 100 feet of water. Dive and ROV surveys documented

most of the vessel including the pilothouse, the engine room, the bunkroom, and sections of the starboard hull visible to the ROV. These surveys were not able to document an approximately 5 foot tall section of the external starboard hull from the front of the pilothouse to the stern which were unavailable for observation. These surveys established the following:

- The overall condition of the wreck appears to be good with no apparent breaches or insets on the hull.
- Fishing gear from the F/V RHIANNON RAE is wrapped around the wreck of the F/V PATRIOT (See Section 1.14 and Figures 11, 12, 13, and 14).
- The F/V PATRIOT's nets are stowed on their reel. The cod end of the net on the forward net reel is attached to the raised boom. The cod end is empty and drifting. The cod end does not appear to have been tied off to the gallows frame.
- The forward net appears to have jumped off its drum and entangled around the drum's axle on the port side (See Figure 15). The washdown hose is also entangled in the net (See Figure 16).
- The F/V PATRIOT's outriggers are "up" as they would be in port. However the cable spools that deploy the outriggers are "birdnested" indicating that the outriggers were likely down at the time of the casualty.
- In the pilothouse, the ROV found that the throttle and clutch were in the "idle" position, the autopilot was in standby mode, and that the rudder indicator was 15° to port. This matches the observed position of the F/V PATRIOT's rudder.
- No footage shows any signs of a fire or smoke inside of the vessel.

The underwater surveys of the vessel also reveal paint scrapes and damage to the wreck in several locations. Observed damage includes:

- Paint scrapes along the port side of the hull, including a heavy scrape on both sides of the bow (See Figure 8).
- A slight bend in the top of rudder (See Figure 14).
- The top of the pilot house shows significant scrapes and damage, including a bent radar stand and a sheered antenna (See Figure 9).
- The starboard block on the gallows frame has a significant bend in it and the wire running through it is parted (See Section 1.24)

The paint scrape damage could have been caused by the F/V RHIANNON RAE's fishing gear or by some event relating to the casualty.

Figure 7: ROV Photo of the F/V PATRIOT's starboard bow

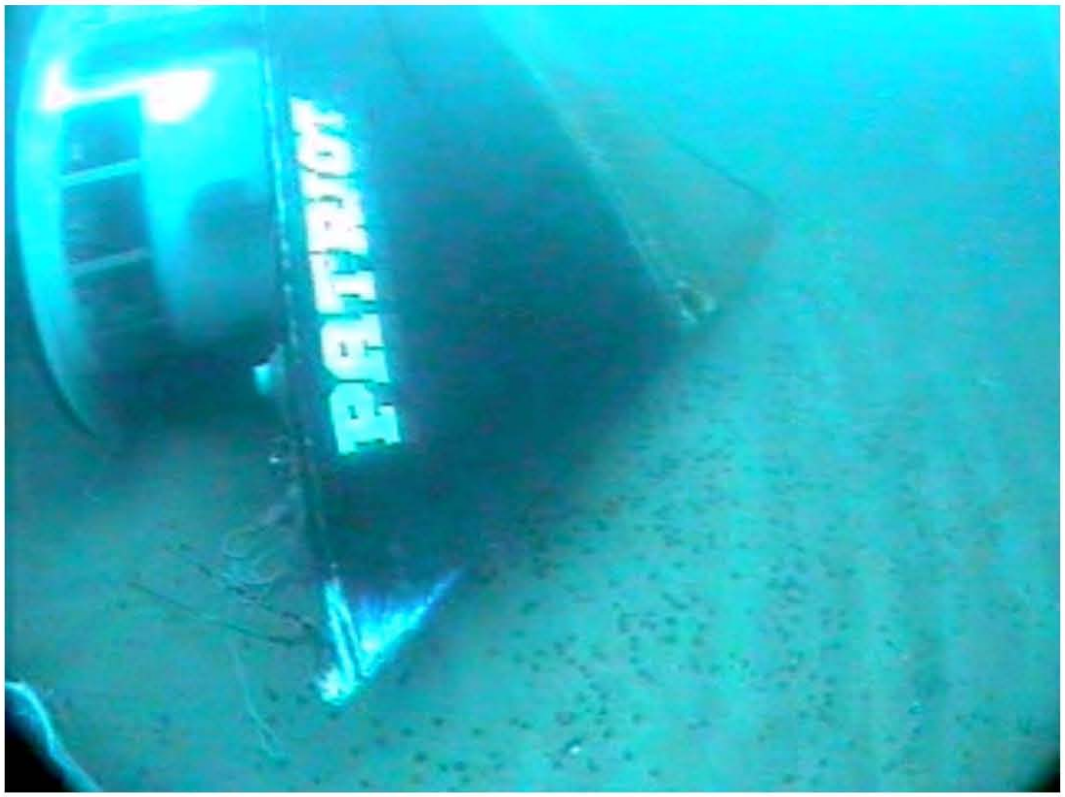

Figure 8: ROV photo of the F/V PATRIOT resting orientation

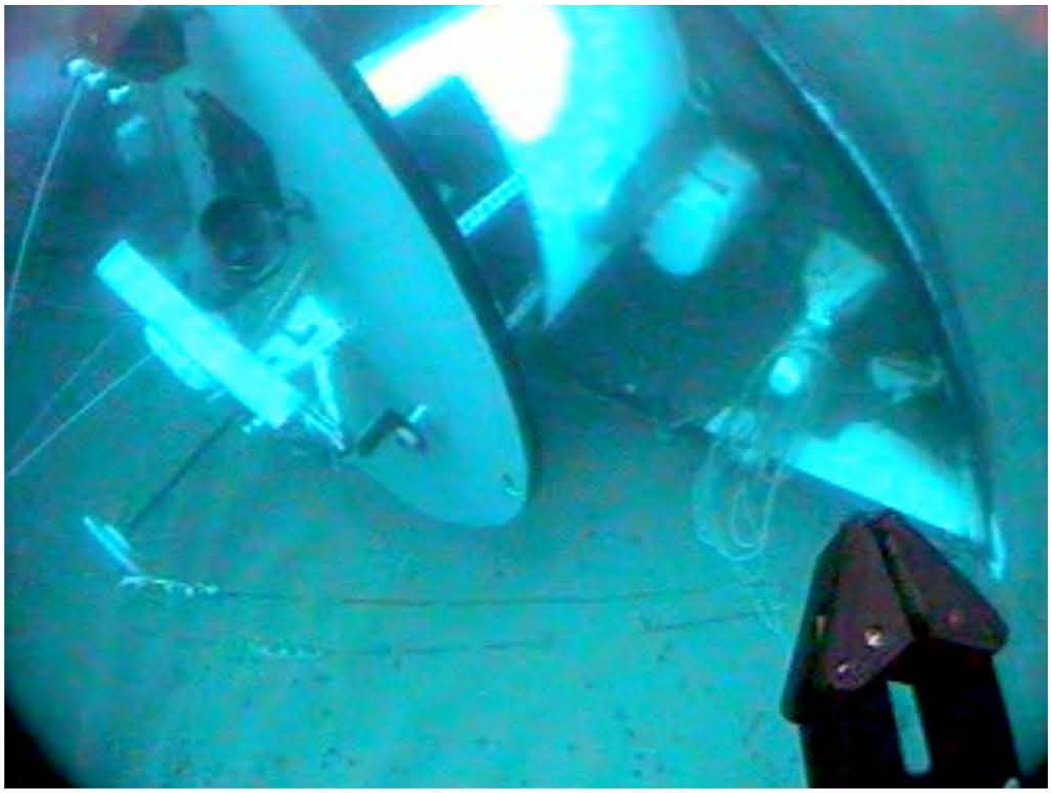

Figure 9: ROV photo of the pilothouse from above

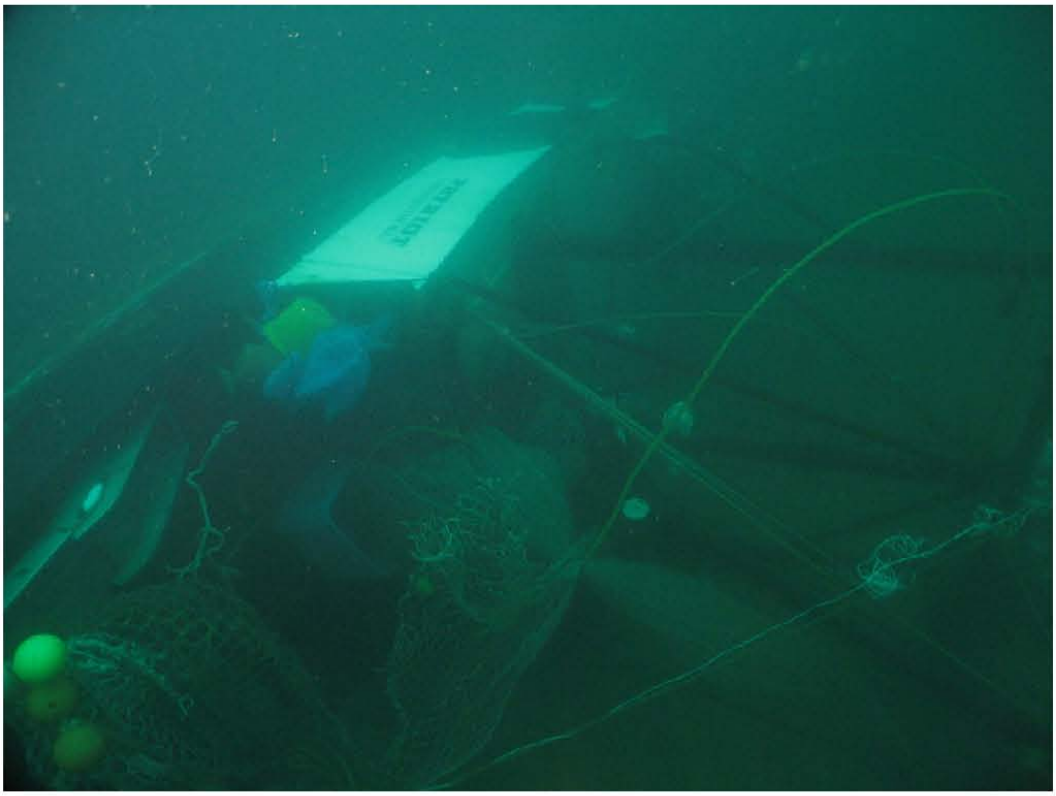

Figure 10: Dive photo of the F/V PATRIOT port aft

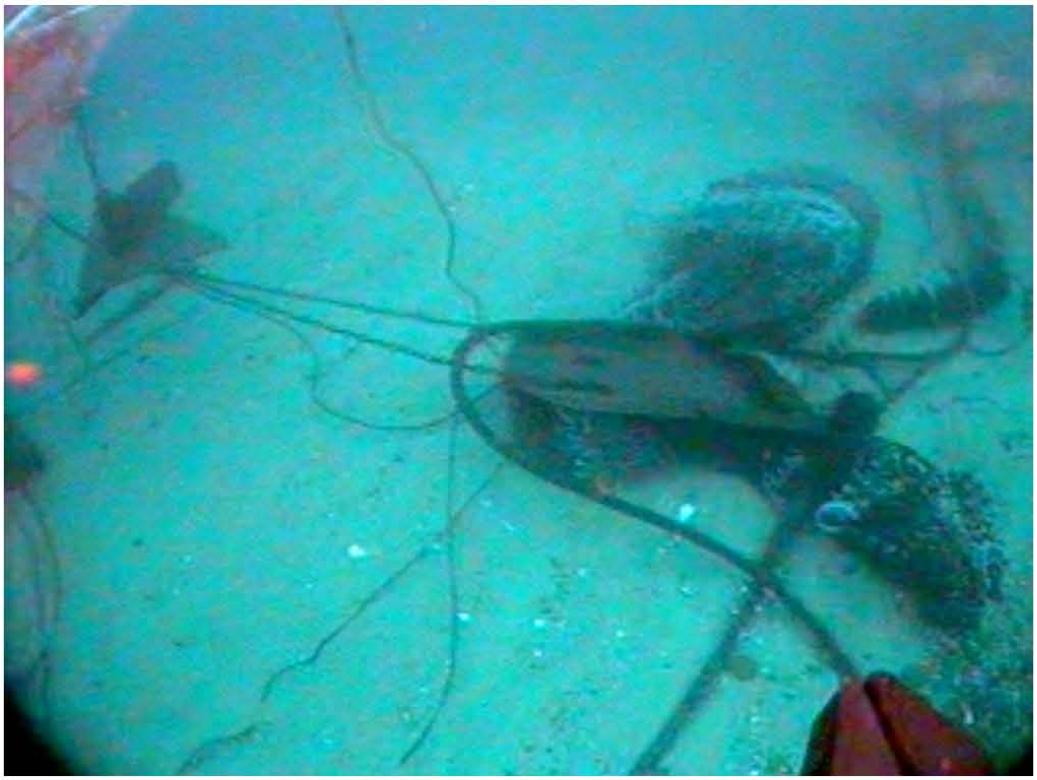

Figure 11: ROV photo of a trawl door from the F/V RHIANNON RAE II

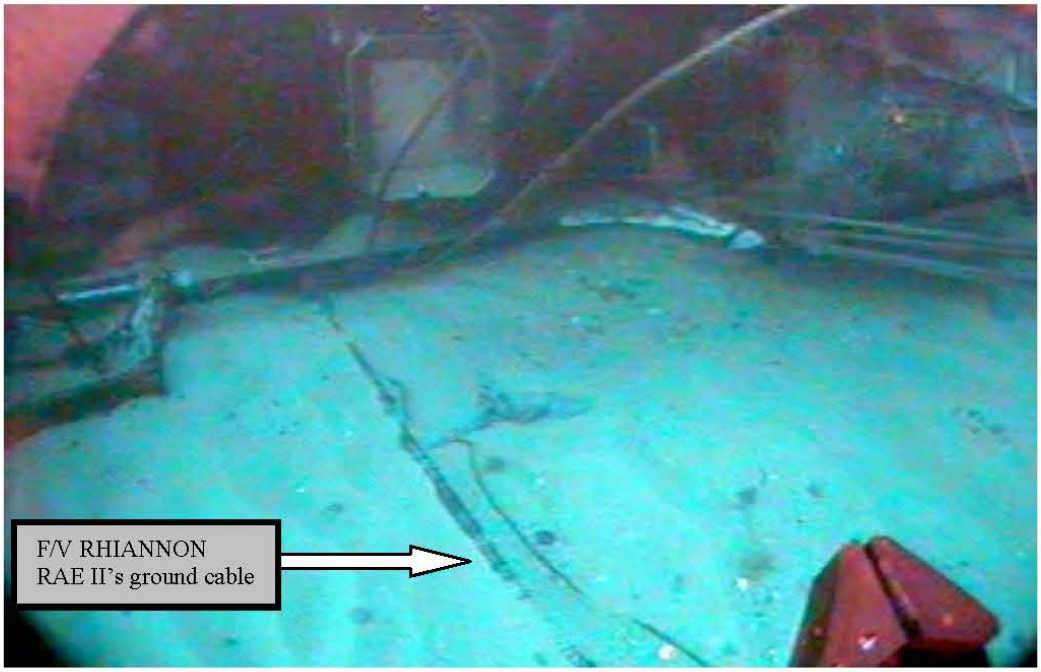

Figure 12: ROV Photo of F/V RHIANNON RAE II's fishing gear ground cable under the F/V PATRIOT

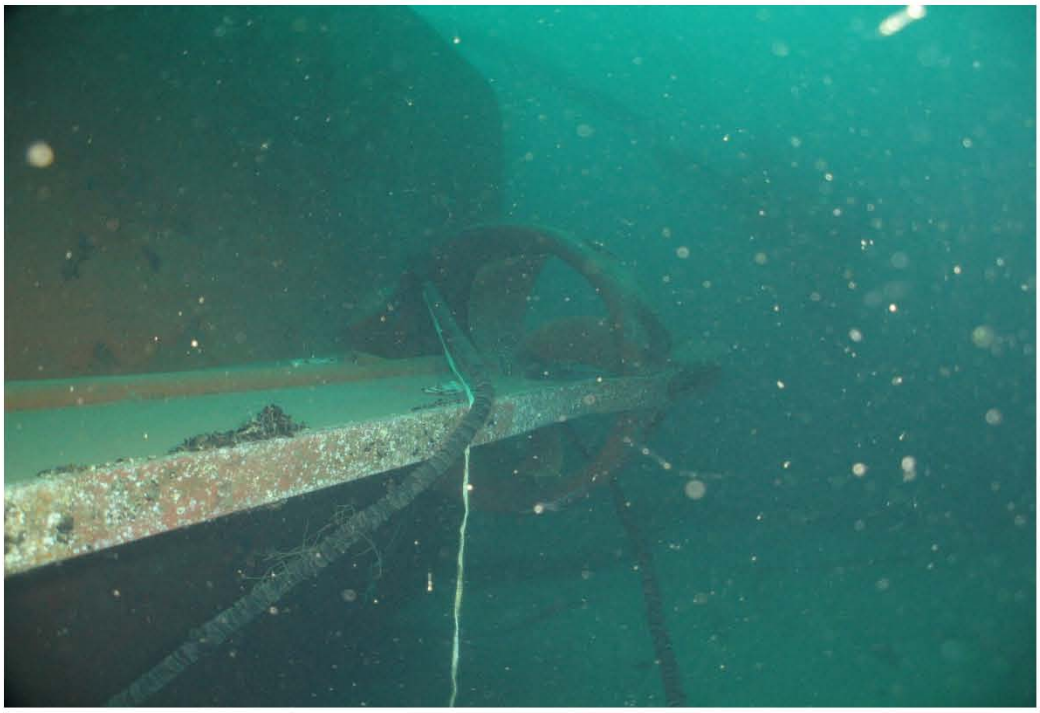

Figure 13: ROV Photo of F/V RHIANNON RAE II's fishing gear ground cable looped on the F/V PATRIOT's propeller

Figure 14: ROV photo of F/V RHIANNON RAE II's fishing gear ground cable and F/V PATRIOT's life raft painter line looped on the F/V PATRIOT's slightly bent rudder

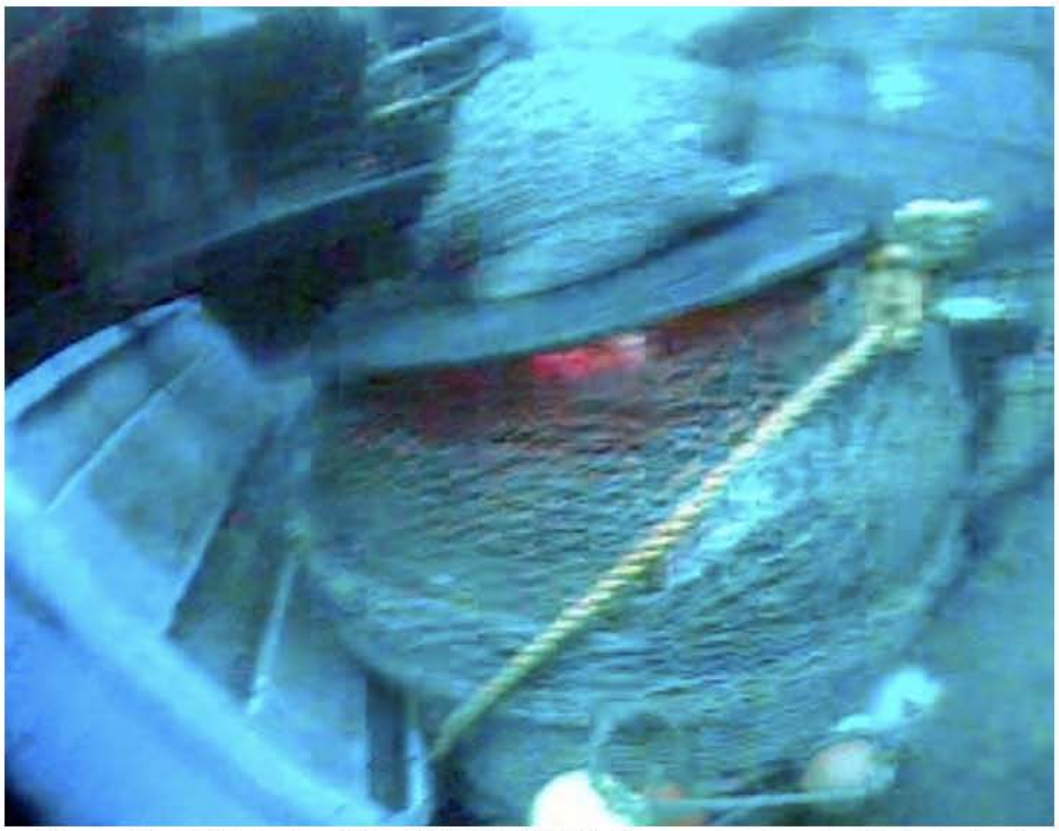

Figure 15:ROV photo of the F/V PATRIOT's forward net reel with fouled net

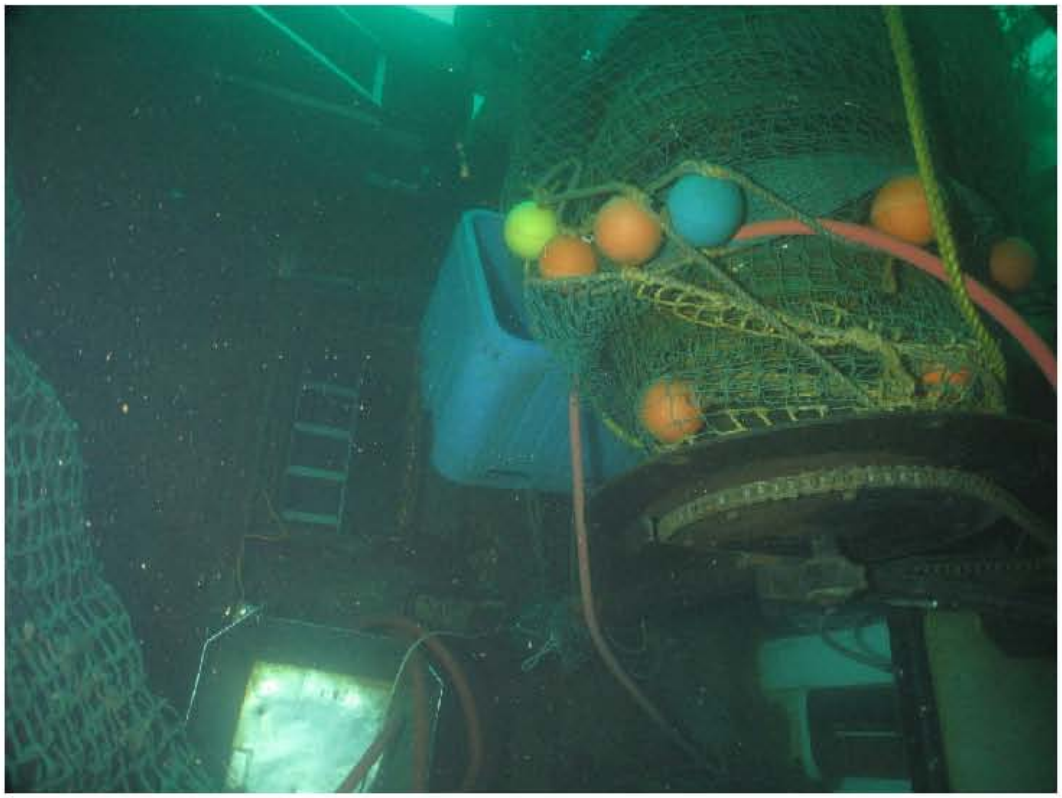

Figure 16: Dive photo of washdown hose entangled in the forward net reel

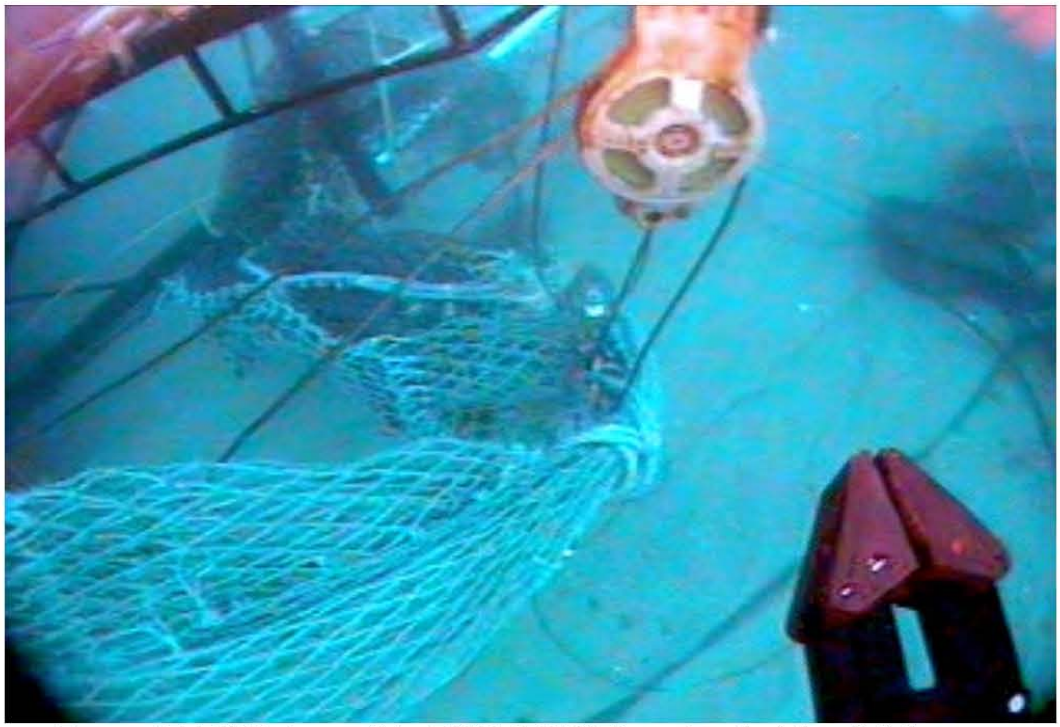

Figure 17: ROV photo of the F/V PATRIOT's cod end of the aft fishing net

1.17 NOAA Passive Acoustic Buoys

On February 9, 2010, Coast Guard Sector Boston received underwater, audio recordings from NOAA researchers for the night of January 2-3, 2009. The recordings were received by 19 separate passive, acoustic buoys called Marine Autonomous Recording Units (MARU) fabricated by Cornell Bioacoustics Research Program in Ithaca, NY. These MARU buoys were deployed underwater in a hexagonal pattern throughout Massachusetts Bay and are intended to record and track the vocal sounds of marine mammals. Four of the nineteen buoys recorded no sounds on the night of January 2 due to a malfunction. Eight functional MARU buoys were located within 10 nautical miles of the F/V PATRIOT's wreck location with two of these functional buoys located within 5 nautical miles. The closest buoy to the wreck site is MARU buoy 4 located at 42° 23.770' N by 70° 29.667' W, approx. 2 nm south west of the wreck site (See Figure 18).

The acoustic data provided by these buoys consists of 15 minute long individual data files that contain a separate channel for each buoy's information. The time stamps on these files are calibrated to GPS time at the beginning and end of a three month deployment. These buoys were deployed from October 11, 2008 to January 21, 2009. According to Cornell researchers the time deviation between these files and GPS standard time would be at most a few seconds.

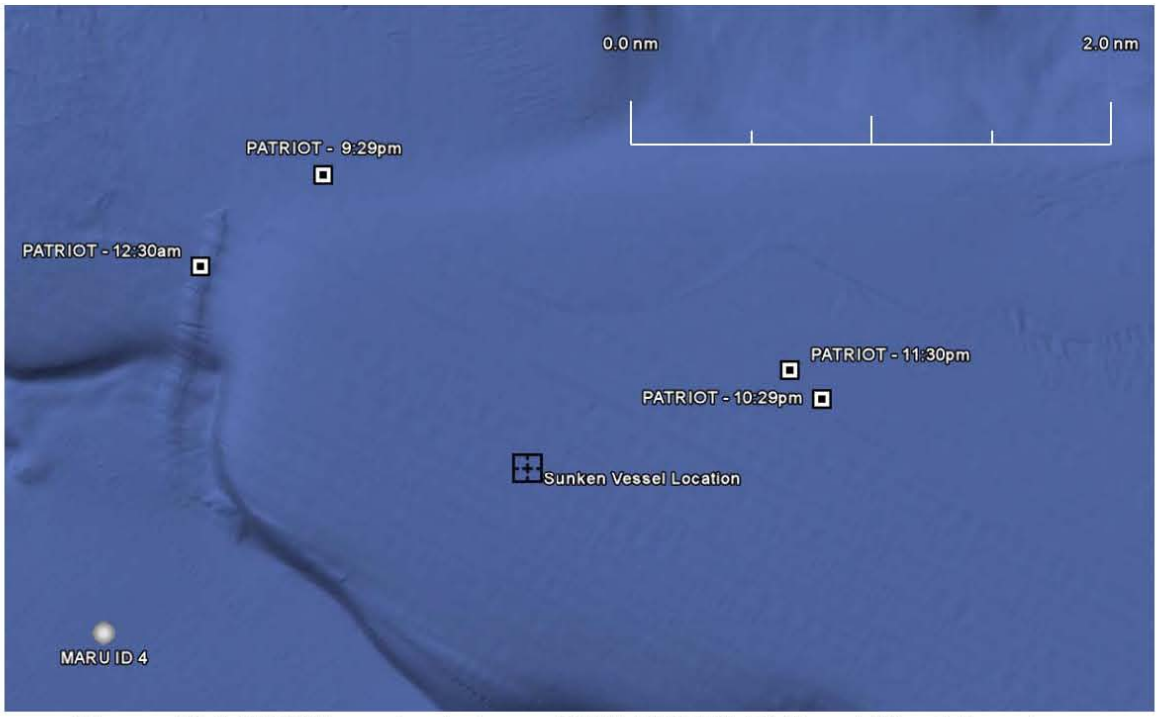

Figure 18: MARU Buoy 4 relative to F/V PATRIOT VMS and Wreck locations.

Analysis of the closest buoys to the wreck location revealed 3 sounds of interest to the investigation. A first, loud sound lasting 2.5 seconds, designated as Aural Transient Event (ATE) 1, is first detected by Buoy 4 at 12:07:12 a.m. and then by every other functional buoy. A second, moderately loud sound, designated as ATE 2, lasting less than one second is first recorded by buoy 4 at 1:12:33 a.m. and then is recorded by buoys 5, 12, and 13. A third, faint sound, designated as ATE 3, lasting less than 3 seconds is recorded at 1:20:20 a.m. by buoy 4 only.

Coast Guard Sector Boston Investigators provided these files to the U.S. Navy Commander Undersea Surveillance (CUS) for analysis and received the Navy's final report on April 28, 2010. In addition to the three louder sounds detected earlier, CUS analysts were able to detect both the Tug GULF SERVICE's and F/V PATRIOT's diesel engine sounds through much of the night, accurately determine the engine's revolutions per minute (RPM) for each vessel, and detect several other sounds from the F/V PATRIOT that night.

Table 3 contains a chart showing the F/V PATRIOT's engine RPMs for the entire night from approximately 11:17 p.m. on January 2, 2009 to after ATE 3 at 1:20 a.m. on January 3, 2009. According to CUS analysts, the Tug GULF SERVICE Engine speed stayed at a constant 708 RPM throughout the night as she transited south (See Section 1.13).

CUS analysts also detected an Alternating Current (AC) Auxiliary Motor from the F/V PATRIOT starting at 8:53 p.m. on January 2, 2009. This motor runs at approx 3400 RPM until 1:06:11 a.m. on January 3, 2009 when it slows by 18 RPM over the next 3 minutes and 29 seconds. Starting at 1:09:40 a.m., this AC auxiliary motor increases by 41 RPM until its acoustics are lost simultaneously with ATE 2 at 1:12:31 a.m. This motor's

acoustics are identical to one heard on the F/V PATRIOT's December trips (See Section 1.15).

ATE 1:

The U.S. Navy Commander Undersea Surveillance (CUS) analysis of ATE 1 found that the event is made up of a series of individual sounds. The first sound in this series had "the aural characteristics of a metal on metal impact noise." This sound is followed by at least 12 short pulses in groups of three at regular interval of 9.60 pulses per second. This matches the rotational rate of the Tug GULF SERVICE's propeller as she transited through the area at this time (See Section 1.13).

Time Difference On Arrival (TDOA)[3] analysis conducted by Cornell University placed ATE 1's location at 42° 25' 1.2"N by 70° 31' 1.9"W, approximately .3 nautical miles from the Tug GULF SERVICE's AIS position at 12:07 a.m. Both Tug GULF SERVICE and F/V PATRIOT engine RPM's remain at a constant speed throughout this event.

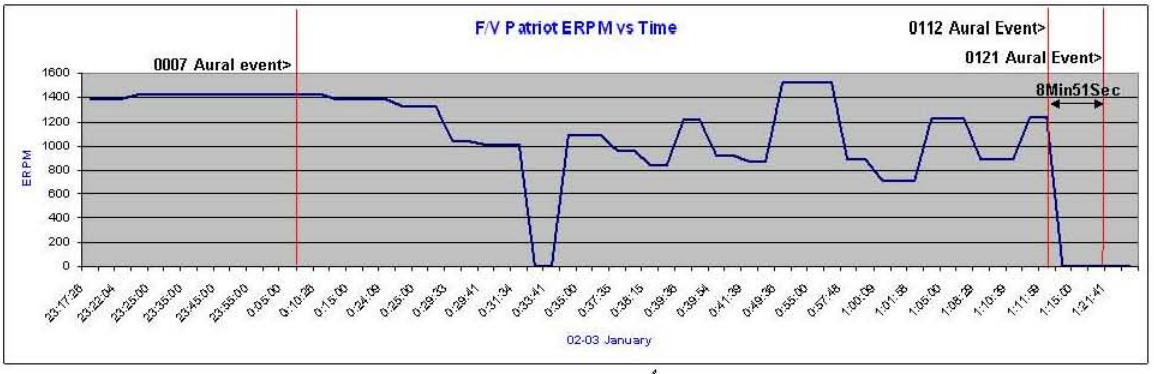

Table 3: F/V PATRIOT Engine RPM vs Time[4] with a red line corresponding to each Aural Transient Event.

ATE 2:

CUS analysis of ATE 2 describes this event as resembling a metallic thud lasting less than 1 second. Because the F/V PATRIOT's engine one minute before ATE 2 and the AC motor sounds cease simultaneously, CUS analysts determined that the sound originated from the F/V PATRIOT. TDOA[4] analysis conducted by Cornell University placed ATE 2's location at 42° 25' 20.6" N by 70° 28' 16.0" W approximately 1 nm NW of the F/V PATRIOT wreck location. CUS Analysts detected no other vessels in the immediate vicinity at this time.

Immediately after ATE 2, Navy analysts detected a "broadband noise" with an irregularly increasing frequency throughout the event, consistent with a void filling up with water. This "broadband noise" is heard from 1:12:34 a.m. to 1:15:39 a.m. and ATE 3 occurs approximately 6 minutes after this broadband sound ends.

[3] TDOA Analysis has a 1 – 5 nautical mile error radius.
[4] On this chart, an RPM reading of "0" means engine noises quieted to a level undetectable and not necessarily that the engine was shut down.

ATE 3:

Analysts described ATE 3 a series of 7 irregular, quiet sounds lasting 2 seconds total with the final and loudest sound having a hollow metallic quality. Because ATE 3 is only heard on Buoy 4, TDOA analysis was not possible. No further sounds associated with the F/V PATRIOT are heard by any buoys after this.

TIME/DATE	RECORDED SOUND
7:15 p.m.: 02JAN2009	F/V PATRIOT engine noises first detected by Acoustic Buoy 11. F/V PATRIOT diesel engine speed 1716 RPM.
8:50 p.m.: 02JAN2009	F/V PATRIOT diesel engine drops to non-detectable range for approx. 11 minutes.
8:53 p.m.: 02JAN2009	An Alternating Current (AC) auxiliary motor detected by Acoustic Buoy 4. This motor's speed stays constant at approx. 3400RPM.
9:01 p.m.: 02JAN2009	F/V PATRIOT diesel engine speed increases to 1014 RPM. It remains between 1000 and 1500 RPM for the next 3 hours
12:07:12 a.m.: 03JAN2009	Acoustic Buoy 4 records a series of loud events designated as Aural Transient Event (ATE) 1 with a 3 second duration.
12:29:33 a.m.: 03JAN2009	F/V PATRIOT begins a period of frequent diesel engine speed changing until 1:12 a.m.
1:01:59 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increases to 1233 RPM for 6 min. 30 sec. CUS analysts detect "aperiodic loading" on the engine.
1:06:11a.m.: 03JAN2009	The AC Auxiliary motor detected begins a gradual, continuous RPM decrease over the next 3 min. 29 sec. (3400 – 3382 RPM)
1:09:40 a.m.: 03JAN2009	The AC Auxiliary motor detected begins a gradual, continuous RPM increase over the next 2 min. 51 sec. (3382 – 3423 RPM)
1:10:40 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increases to 1242 RPM for 1 min 20 sec. CUS analysts detect "aperiodic loading" on the engine.
1:12:00 a.m.: 03JAN2009	Loss of acoustics on F/V PATRIOT diesel engine.
1:12:22 a.m.: 03JAN2009	An almost inaudible "pop" is heard on buoy 4.
1:12:31 a.m.: 03JAN2009	Acoustic Buoy 4 records a moderately loud event designated as ATE 2 less than one second in duration. The AC Auxiliary motor acoustic are lost simultaneously with this event.
1:12:34 a.m.: 03JAN2009	An almost inaudible "pop" is heard on buoy 4.
1:12:34 a.m.: 03JAN2009	Acoustic Buoy 4 begins detecting a broadband noise.
1:15:39 a.m.: 03JAN2009	Loss of Broadband noise.
1:21:22 a.m.: 03JAN2009	Acoustic Buoy 4 records a series of quiet events designated as ATE 3 with a 2 second duration.

Table 4: Timeline of Acoustic Recordings

1.18 Marine Safety Center Stability Analysis

The USCG Marine Safety Center (MSC) completed its evaluation of the F/V PATRIOT's stability on November 20, 2009. This analysis was based on information gathered from family, crewmembers, and former owners. Because no stability test, inclining experiment, or even deadweight survey had ever been conducted on the F/V PATRIOT, investigators were unable to provide MSC with an estimated displacement or center of gravity. However, the MSC was able to acquire from the American Bureau of Shipping (ABS) tonnage measurements that allowed for some vessel modeling to be performed. The MSC's modeling provided some insights into the probable stability characteristics of F/V PATRIOT.

With the limited evidence available, MSC was able to create a rough computer model of the F/V PATRIOT and assessed nine different loading scenarios for possible catastrophic changes to stability. This analysis determined that a combination of uneven fuel load, a raised cod end, and water on deck could have brought the vessel close to capsize. But again, this is a rough analysis based on estimates gathered during the investigation and cannot be considered a conclusive cause of the vessel's sinking.

MSC also evaluated flooding scenarios as part of its analysis and determined that unrestricted flooding into the fish hold would have "resulted in down flooding into the engine room and inevitable sinking." Similarly, a flooded engine room would have resulted in down flooding into the fish hold. MSC also evaluated the affect flooding into the lazarette space and found that this flooding by itself would not sink the F/V PATRIOT. According to the MSC, complete flooding of either the fish hold or engine room would sink the vessel.

1.19 Autopsy Results

The bodies of Matteo Russo and Giovanni "John" Orlando were taken to the office of the Chief Medical Examiner (ME) of Boston, Massachusetts. The ME conducted an autopsy on both bodies on January 5, 2009. The official cause of death of both crew members was "drowning" over an interval listed as "seconds." The ME could not specify the number of "seconds," but did state that the drowning would have taken less than ten minutes to cause death. The ME noted that neither body had the signs of a long water immersion or hypothermia, indicating that both men had died before they experienced severe hypothermia.

The ME found that both bodies were in good condition without any signs of major trauma. John Orlando had abrasions on his face around his left eye. Matteo Russo had abrasions on his chest and abdominal region and a bruise on his left leg. The ME later stated that none of these injuries could have caused death and that it is impossible to know when the injuries occurred.

The ME's office conducted post-mortem drug testing on both bodies. Matteo Russo tested [redacted] for alcohol [redacted]

[redacted]

John Orlando tested [redacted] for drugs and alcohol.

1.20 Search and Rescue (SAR) [6]

The initial notification that the F/V PATRIOT was in trouble came at 1:15 a.m. on January 3, 2009 when Wayne Alarms Systems received a signal that the fire alarm had activated on the vessel. This began a notification chain that included the family and Gloucester Fire Department. The Coast Guard received its first notification at 1:35 a.m. By 2:30 a.m., the Coast Guard obtained the F/V PATRIOT's last known VMS location and launched a Coast Guard rescue helicopter at 4:42 a.m., with surface assets concurrently steaming to the last VMS position. Vessels searching on scene included the CGC FLYINGFISH, a Coast Guard 47' Motor Life Boat, a Coast Guard rescue helicopter HH60J, the M/V GATEWAY ENDEAVOR, F/V HARVEST MOON, and F/V PADRE PIO.

The CG HH60J detected and homed in on a 121.5 MHz signal from an EPIRB. Following this signal, the helicopter crew sighted the EPIRB strobe at 5:12 a.m. in the middle of a debris field. The crew of CG HH60J noted that the EPIRB was yellow and that the debris field contained such items as plastic buckets, an ice chest, papers, and wooden boards. All assets focused on finding survivors and did not recover the EPIRB. The CG HH60J spotted the life raft at 6:08 a.m. and an oil slick at 6:42 a.m. The liferaft was later recovered by the M/V GATEWAY ENDEAVOR.

The Coast Guard rescue helicopter spotted the first person, later determined to be John Orlando, face down in the water at 5:17 a.m. and the CGC FLYINGFISH responded with an Emergency Medical Technician (EMT). The HH-60J spotted the second person, later determined to be Matteo Russo, face down in the water at 12:14 p.m. and recovered the body. In both cases, the EMT on scene, after consultation with a flight surgeon, made the determination not to begin resuscitation efforts because the bodies were showing signs of rigor mortis.

Figure 19 represents the Global Positioning System (GPS) positions based on logs and records from Coast Guard and Good Samaritan assets on scene, the F/V PATRIOT's VMS system, and the location of the wreck determined on January 23, 2009. Individual GPS systems have margins of error that differ by brand; usually these errors are less than 50 meters. For the purpose of this investigation, all positions are assumed to have a 0.1 nm error radius to compensate for this.

[5] Turkowski, Lance, and Bonfiglio eds., Drug Information Handbook for Advanced Practice Nursing. (Hudson, OH: Lexicomp, 2008) 1242.

[6] For greater detail on SAR operations, See SAR Final Action Memo: Evidence Control #131

Figure 19: Locations and times of items found during search and rescue.

1.21 Life Raft

The M/V GATEWAY ENDEAVOR recovered the life raft on January 3, 2009 at approximately 6:15 a.m. The mate on board stated that the raft was inflated, the sea anchor deployed, but the canopy had been "restricted by the straps" and had not deployed properly. However, the life raft did inflate enough that survivors could have used it.

The life raft was examined by a third-party Zodiac certified technician. The examination revealed several deficiencies in the packing and maintenance of the life raft. Inside the life raft was a "rat's nest" of the equipment including the rainwater collector, the spare sea anchor, pressure relief caps and other items. The spare sea anchor is required to be stowed in the equipment bag or connected to the inner lifeline with rubber bands; it appeared that the sea anchor was not packed using either method. The technician felt this tangle could have prevented the canopy from properly deploying.

There is other evidence that the life raft was improperly maintained. The main flotation chamber had not been repaired in accordance with manufacturer requirements; someone repaired the lights with unapproved parts; and, at the time of the examination, the lights were inoperable. The hand pump was not in working condition. The life raft had last been maintained in November of 2008 by Westerbeke Marine.

The most unusual aspect of the life raft is the complete separation of the starboard painter line from the life raft itself. The nylon stitching completely ripped out, which would have required a force in excess of 1750 lbs. The weak link on the hydrostatic release would have failed at approximately 500 lbs; however it appears to be intact. The technician stated in his report that it was possible that "the starboard outer lifeline became entangled on something which would have ripped off the lifeline." Both the ROV and dive video

footage showed the painter wrapped around the mast, out riggers, and rigging and that the painter never became tight on the weak link. The starboard painter connection either failed below the manufacturer rating due to a defect or an unknown force was exerted on the connection in excess of 1750 lbs.

Following the technician's life raft examination, Coast Guard life raft inspectors conducted a life raft servicing facility audit at Westerbeke Marine in Boston, MA. The inspectors audited Westerbeke's records, technician's certifications, inspected the servicing facility and equipment, and witnessed the technicians' service and repacking of a Zodiac life raft. The audit concluded that the facility, equipment and technicians were in compliance with applicable laws, regulations, and life raft manufacture's requirements.

1.22 EPIRB

The F/V PATRIOT had a single Category 1 EPIRB registered to it. [redacted] stated that Matteo Russo kept a second Category 1 EPIRB in his bunkroom. Category 1 EPIRB's are designed to float and be automatically activated by water. They transmit two signals: one at 406 MHz and another at 121.5 MHz. The 406 MHz transmission alerts NOAA's National Mission Control Center (NMCC) via the COSPAS-SARSAT and GEOSAR satellites. This signal has registration information encoded that allows NOAA and the Coast Guard to contact owners and begin search and rescue efforts. After two satellite passes, a 406 MHz signal allows NOAA to triangulate the EPIRB's location within 2 – 5 km.

A Category 1 EPIRB also transmits a 121.5 MHz signal for local Search and Rescue assets to home in on. At the time of the casualty, satellites still monitored for 121.5 MHZ signals, but the NMCC relies on the 406 MHz signal for first alerts and position information. Monitoring for 121.5 MHz signals stopped on February 1, 2009. These signals have no information encoded to indicate the vessel the EPIRB is associated with; however, the NMCC can roughly determine a position from a 121.5 MHz signal.[7]

During the Search and Rescue (SAR) response[8], the Coast Guard HH60J helicopter on scene homed in on a 121.5 MHz EPIRB signal and sighted a yellow EPIRB in the water. This EPIRB was not recovered because all SAR assets were focused on finding the crew members and leaving the EPIRB afloat provided rescuers a datum to track drift.

This left only the signals received by NOAA's National Mission Control Center for interpretation. NMCC received the "first alert" 121.5 MHz signal (Site 20418) at 4:30 a.m. on January 3rd. NMCC received this signal for 73 hours until 5:00 a.m. on January 6th. NMCC received a second 121.5 MHz signal (Site 20507) at 9:43 a.m. on January 3, but this signal broadcasted for only 2.3 hours. It is impossible to know which vessel's EPIRB they came from since the 121.5 MHz signals are not encoded with registration information. Three days later, the NMCC received a third EPIRB signal, this one at 406 MHz (Site 47587), at 3:49 a.m. on January 6th with the F/V PATRIOT's registration encoded. The NMCC received this signal for only one satellite alert and was unable to

[7] The 121.5 MHz signal derived position can be off by as much as 25 km.
[8] For greater detail on SAR operations, See SAR Final Action Memo: Evidence Control #131

record any information on its location. According to the manufacturer, these erratic signals could have been caused by a weak battery.

1.23 Survival Suit

In July 2009, lifeguards on Marconi Beach near Wellfleet, MA found a survival suit stored in a survival suit bag from the F/V PATRIOT. The F/V PATRIOT's engineer verified the survival suit belonged to Matteo Russo. The suit was stowed correctly in its bag, was undamaged, and appeared that no one had tried to access it.

1.24 Trawl Doors and Block Analysis

The vessel was equipped with two 1200 pound steel trawl doors stored inboard the aft bulwark. The trawl doors are designed to flow through the water at an angle causing them to spread away from each other, opening the net horizontally. The trawl doors are attached to the boat by trawl warps (cables). During haul-back operations, the trawl doors were clipped to the gallows frame in preparation for the next pay-out of fishing gear.

Underwater ROV footage shows the port side trawl door tight to the block and flipped upside down. The port door's wire rope is tightly under strain and in a straight line going back to the winch. The starboard side door was found lying in the sand below the gallows frame with its wire rope both parted and frayed, and its starboard block bent and deformed (See Figures 20 and 21). Neither door is still clipped to the gallows frame.

The family of the deceased crewmembers recovered the starboard block, and it was subsequently examined by Coast Guard Marine Inspectors on September 22,

Figure 20: ROV photo of the port 10 ton block and door.

Figure 21: ROV photo of the starboard 10 ton block and frayed wire rope

2009. The Inspectors noted damage that included a deflection of the sheave guard and a misalignment of the pulley. Divers had cut the attachment ring off to remove the block from the wreck. The Coast Guard purchased an identical block and sent it to Detroit Testing Laboratory, Inc (DTL) in Warren, Michigan to conduct destructive testing. DTL determined that, depending on the angle that the force was applied, it would take between 4,066 and 5,591 lbs of force to create damage similar to that of the starboard block on the F/V PATRIOT.

1.25 Inspection of the Tug GULF SERVICE and Barge ENERGY 11103

On January 7, 2009 at 9:45 p.m., the Tug GULF SERVICE and barge ENERGY 11103 arrived at the NuStar Piney Point Oil Terminal in Piney Point, MD. Coast Guard Investigators and Inspectors from Sector Baltimore met the Tug GULF SERVICE as she docked and immediately examined the tug and barge's hull from the shore and from a Coast Guard 26' Trailerable Aids to Navigation Boat (TANB) using spotlights. There were no visible scrapes or gouges on the tug or barge consistent with a collision with a smaller, steel-hulled vessel. The ENERGY 11103 was carrying 209 bbl. of #6 fuel oil on board when she was examined and had a draft of 14'. The draft of the barge ENERGY 11103 was 14' 6" when she departed Searsport, ME on January 2, 2009 and transited through Massachusetts Bay. After the USCG examination at Piney Point, approximately 100,000 bbl of #6 oil was loaded onto the Barge. Further photo documentation was taken during daylight hours after loading onto ENERGY 11103 had commenced.

Figure 22: Tug GULF SERVICE in drydock

Sector Baltimore Investigators conducted interviews with the crewmembers of both the barge and tug. The Tug GULF SERVICE has a self-contained security video system that records digital images from three interior cameras and three exterior cameras. One exterior camera faces forward and is mounted on the pilothouse. The remaining two cameras face aft to monitor the barge with one aimed to port and one to starboard. The Sector Baltimore Investigators made DVD copies of the Tug's DVR. These videos show no images of the F/V PATRIOT (See Section 1.27). The Coast Guard collected the towing cable as evidence and a National Transportation Safety Board (NTSB) metallurgist later examined it (See Section 1.26).

Coast Guard Investigators and Inspectors from Marine Safety Unit (MSU) Morgan City, LA attended a dry docking of the Tug GULF SERVICE on December 17, 2009 and of the barge ENERGY 11103 on December 28, 2009 in Morgan City, LA. This was the tug and barge's first dry docking since prior to January 3, 2009. No evidence of a collision was noted on the hull of either vessel.

1.26 Tow Line Inspection

A National Transportation Safety Board (NTSB) metallurgist analyzed a Coast Guard subpoenaed tow cable off the Tug GULF SERVICE. The tow cable was approximately 2,000 feet long and 2-inches in diameter. The cable consisted of six strands, each consisting of 36 wires, each at a nominal diameter of 0.1122 inch.

NTSB's factual report on the condition of the towing wire noted the following exceptions to the general condition:

- Approximately 136 feet from the Tug end, the cable had been crushed inwards. The report indicated that the crushed zone was "approximately 12-inches with more severe crushing in the center 4-inches, consistent with the cable being highly loaded and in contact with a cylindrical object, such as a bollard."
- Approximately 535 feet from the Tug end of the tow cable, "the cable surface had been painted a pale blue color."
- Beginning approximately 700 feet from the Tug end, 6 sections of broken wires were observed protruding from the tow cable. Utilizing a 5X magnifier, examination of the fractures on the protruding ends of the wires "revealed mechanical damage that had obliterated the finer features but the cup and cone features, consistent with an overload event, were still evident."

The NTSB report indicates that the condition of the tow line is consistent with typical towing operations.

1.27 Tug Video Analysis

The Tug GULF SERVICE had 6 cameras onboard (3 cameras in the engine room and 3 mounted on the upper bridge):

- Camera #1 documented the Tug GULF SERVICE's engine room
- Camera #2 documented the Tug GULF SERVICE's forward view
- Camera #3 documented the Tug GULF SERVICE's starboard aft view
- Camera #4 documented the Tug GULF SERVICE's port aft view
- Camera #5 documented the Tug GULF SERVICE's engine room
- Camera #6 documented the Tug GULF SERVICE's engine room

All 6 cameras saved their files to a single Digital Video Recorder (DVR). Sector Boston Investigators viewed the camera video footage revealed that no other vessels were recorded by the cameras during the Tug GULF SERVICE's transit through Massachusetts Bay. Investigators did notice that at approximately 6:30 a.m. on January 3, 2009 an object entangled on the tow cable becomes visible as both the sun rises and the GULF SERVICE shortens its tow for transit through the Cape Cod Canal. This object is visible for the entire canal transit and disappears into the water as the tow is lengthened and the cable's catenary enters the water. The object appears to be a white foam lobster float with a red flag suspended upside down. Crewmembers interviewed on January 8, 2009 stated that they remembered seeing lobster pots on the cable when it was shortened that day. This object is not believed to have any connection to the F/V PATRIOT.

Coast Guard Investigative Service (CGIS) Computer Forensic Analysts cloned the DVR hard drives and examined the clone hard drive for evidence of tampering. CGIS completed this analysis on January 12, 2010 and determined that no signs of tampering or alteration of the hard drives existed.

1.28 Global Positioning System (GPS)

On February 10, 2009, on behalf of the family and former owner, a commercial diver recovered the Global Positioning System (GPS) system, a Northstar 951x, from the wreck of the F/V PATRIOT. Sector Boston Investigators delivered the GPS the next day for analysis to its manufacturer, Navico. Navico technicians dried, cleaned, and reassembled the GPS but were unable to extract any information. The technician stated that the on-board memory required a constant current to hold the data and this model GPS had a "watch" battery to maintain current when the GPS was powered down. It is probable that the battery discharged as seawater shorted the GPS, erasing any data in the device when the F/V PATRIOT sank.

Navico returned the GPS to the Coast Guard on March 9, 2009 and Sector Boston returned the unit to the family on July 13, 2009. Sometime between February 11, 2009 and July 13, 2009, a small, non-recordable data chip containing local chart information was misplaced at the Navico facility. The Coast Guard purchased and delivered a new, non-recordable data chart chip to the wife of the deceased master.

1.29 Proposed Salvage Operation

The Coast Guard determined that the wreck of the F/V PATRIOT did not pose significant harm to the environment or to navigation to justify either requiring the vessel's salvage as funded by the owner or the federal government. The family of the deceased crewmembers explored salvaging the vessel and contracted RDA Construction Corporation. On July 1, 2009, the family members determined that a safe salvage of the vessel was too expensive to attempt after the Coast Guard required additional safety measures.

On August 8, 2009, the safety zone around the F/V PATRIOT wreck site that had been in effect since January 4, 2009 was allowed to expire by the Captain of the Port of Boston. This wreck was included in the NOAA chart updates beginning in March 2009 and published in Local Notice to Mariner 08/09.

Section 2 – TIMELINE

2.1 Timeline of Key Events[9]

TIME/DATE	EVENT
6:36 p.m.: 02JAN2009	Initial activation of the VMS unit aboard the F/V PATRIOT. The vessel was underway soon after this position report.
7:15:41 p.m.: 02JAN2009	F/V PATRIOT diesel engine noises first detected by Acoustic Buoy 11. F/V PATRIOT Diesel Engine speed a constant 1716 RPM for next 1 hour, 35min.
8:29 p.m.: 02JAN2009	VMS report of vessel location, 42° 28.55'N, 70° 30.00'W. F/V PATRIOT is approx. 3nm NW of Stellwagen Bank.
8:50:28 p.m.: 02JAN2009	F/V PATRIOT diesel engine drops to non-detectable range for next 10 min. Probable time F/V PATRIOT deploys fishing gear.
8:53:00 p.m.: 02JAN2009	An Alternating Current (AC) auxiliary motor detected by Acoustic Buoy 4. This motor's speed stays constant at approx. 3400RPM.
9:01:25 p.m.: 02JAN2009	F/V PATRIOT diesel engine speed increases to 1014 RPM and maintains 1000 to 1500 RPM for next 3 hour, 28 min. Probable time the F/V PATRIOT begins actively fishing.
9:29 p.m.: 02JAN2009	VMS report of vessel location, 42° 25.68'N, 70° 28.43'W. F/V PATRIOT is located at NW corner of Stellwagen Bank.
10:29 p.m.: 02JAN2009	VMS report of vessel location, 42° 24.75'N, 70° 25.62'W. F/V PATRIOT is located on Stellwagen Bank.
10:50 p.m.: 02JAN2009	Matteo Russo receives call on cell phone from [redacted]. Call lasts 20 minutes.
11:30 p.m.: 02JAN2009	VMS report of vessel location, 42° 24.87'N, 70° 25.80'W. F/V PATRIOT is located on Stellwagen Bank.
11:50 p.m.: 02JAN2009	Tug GULF SERVICE enters vicinity of F/V PATRIOT. Tug GULF SERVICE located 42° 27.20'N, 70° 30.82'W and transiting south at > 8 kts.
12:07:12 a.m.: 03JAN2009	Acoustic Buoy 4 records a series of loud events designated as ATE1. U.S. Navy Analysis associates this sound with the Tug GULF SERVICE's propeller.
12:10 p.m.: 02JAN2009	Tug GULF SERVICE departs vicinity of F/V PATRIOT. Tug GULF SERVICE location 42° 24.53'N, 70° 31.08'W and transiting south at > 8 kts.
12:29 a.m.: 03JAN2009	F/V PATRIOT begins a period of frequent diesel engine speed changing. Probable time the F/V PATRIOT begins recovering her fishing gear.
12:30 a.m.: 03JAN2009	Last VMS report of vessel location, 42° 25.30'N, 70° 29.12'W. F/V PATRIOT is located near the Western tip of Stellwagen Bank.
1:01:59 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increases to 1233 RPM for 6 min. 30 sec. CUS analysts detect "aperiodic loading" on the engine.
1:06:11a.m.: 03JAN2009	The AC Auxiliary motor detected begins a gradual, continuous RPM decrease over the next 3 min. 29 sec. (3400 – 3382 RPM)
1:09:40 a.m.: 03JAN2009	The AC auxiliary motor detected begins a gradual, continuous RPM increase over the next 2 min. 51 sec. (3382 – 3423 RPM)

[9] For greater detail on SAR operations, See SAR Final Action Memo: Evidence Control #131

TIME/DATE	EVENT
1:10:40 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increase to 1242 RPM for 1 min. 20 sec. CUS analysts detect "aperiodic loading" on the engine.
1:12:00 a.m.: 03JAN2009	Loss of acoustics of F/V PATRIOT diesel engine by Acoustic Buoy 4.
1:12:22 a.m.: 03JAN2009	An almost inaudible "pop" is heard by Acoustic Buoy 4.
1:12:31a.m.: 03JAN2009	Acoustic Buoy 4 records a moderately loud event designated as ATE 2 less than one second in duration. Probable time of F/V PATRIOT Marine Casualty.
1:12:34 a.m.: 03JAN2009	An almost inaudible "pop" is heard by Acoustic Buoy 4.
1:12:34 a.m.: 03JAN2009	Acoustic Buoy 4 first detects a broadband noise heard for approx. 3 minutes. U.S. Navy Analysis associates this sound with a void filling up with water.
1:15:39 a.m.: 03JAN2009	Loss of acoustics of broad band noise by Acoustic Buoy 4.
1:15:52 a.m.: 03JAN2009	Wayne Alarm Systems receives a fire alarm signal from the F/V PATRIOT.[10]
1:21:22 a.m.: 03JAN2009	Acoustic Buoy 4 records a series of quiet events designated as ATE 3 with a 2 second duration. Probable time F/V PATRIOT impacts ocean bottom.
1:30 a.m.: 03JAN2009	The VMS system should have but did not receive a position for the F/V PATRIOT by this time.
4:30 a.m.: 03JAN2009	NOAA National Mission Control Center first detects a 121.5 MHz EPIRB signal (Site 20418).
5:12 a.m.: 03JAN2009	U.S. Coast Guard Air Station Cape Cod HH-60J helicopter homes in on a 121.5 MHz signal and spots a strobe light in the water.
5:17 a.m.: 03JAN2009	U.S. Coast Guard Air Station Cape Cod HH-60J helicopter locates the body of John Orlando from the F/V PATRIOT face down in the water.
5:28 a.m.: 03JAN2009	The crew of a small boat launched from the CGC FLYINGFISH recovers the body of John Orlando.
6:00 a.m.: 03JAN2009	The M/V GATEWAY ENDEAVOR recovers a life raft reported by U.S. Coast Guard Air Station Cape Cod HH-60J. No personnel were onboard.
9:43 a.m.: 03JAN2009	NOAA National Mission Control Center detects a second 121.5 MHz EPIRB signal (Site 20507).
12:14 p.m.: 03JAN2009	U.S. Coast Guard Air Station Cape Cod HH-60J locates the body of Matteo Russo. A rescue swimmer was deployed from the helicopter to recover the body.
3:49 p.m.: 06JAN2009	NOAA National Mission Control Center detects a 406 MHz EPIRB signal (Site 47587) with registration number MS0707SM encoded. This is the EPIRB registered to the F/V PATRIOT.
4:59 p.m.: 06JAN2009	NOAA National Mission Control Center detects the last 121.5 MHz EPIRB signal. No EPIRB was recovered.

[10] Wayne Alarm Systems and the NOAA Acoustic Buoys use different, unsynchronized time scales and cannot be directly compared with one another.

Section 3 - ANALYSIS

The Coast Guard examined several scenarios as cause of the F/V PATRIOT's sinking including collision, fire, flooding, and loss of stability. Though the exact cause of the sinking of the F/V PATRIOT cannot be determined as there were no survivors and no eye witnesses, a preponderance of evidence exists pointing towards a capsize resulting from a loss of stability.

Ancillary to the investigation, the Coast Guard also analyzed the effectiveness of the lifesaving equipment on board the F/V PATRIOT and the possibility of this casualty resulting from a collision.

3.1 ANALYSIS: Capsizing / Stability

The Coast Guard examined a vessel capsize as a potential cause of the sinking of the F/V PATRIOT. A rapid capsizing is supported given the speed of the event as shown by NOAA Acoustic recordings, the apparent ejection of the crew into the water without time to take any emergency actions, and the condition of the wreck. The section below entitled "Stability" discusses the possible cause of this capsize. The section below entitled "Haul Back" discusses problems the crew may have experienced with the F/V PATRIOT's retrieval of gear.

Table 5 shows events associated with the F/V PATRIOT starting at approx. 1:00 a.m. on January 3, 2009. Navy Commander Undersea Surveillance (CUS) analysts state that the Alternating Current (AC) auxiliary motor speed decrease at 1:06:11 a.m. is the first unusual event that night compared with previous trips. This AC auxiliary motor speed stayed constant at approx. 3400 RPM from 8:53 p.m. before decreasing by 18 RPM at 1:06:11 a.m. for 3 minutes and 21 seconds. At 1:09:40 a.m., the AC motor's speed increased by 41 RPM for 2 minutes and 51 seconds before being lost simultaneously with Aural Transient Event (ATE) 2 at 1:12:31 a.m. The significance of this increase is unknown but may be related to conditions on deck (See Haul back section below).

After 1:00 a.m., there were two final diesel engine speed increases detected from the F/V PATRIOT. The F/V PATRIOT's diesel engine speed increased to 1233 RPM at 1:06:11 a.m. and to 1242 RPM at 1:10:40 a.m. before stopping altogether at 1:12:00 a.m. (See Table 5). CUS analysts detected "aperiodic loading and unloading on the engine" during both periods, possibly indicating that the crew were engaging the F/V PATRIOT's hydraulics or transmission. The loss of diesel engine noise is followed by a "pop" at 1:12:22 a.m., ATE 2 at 1:12:31 a.m., and then a broadband noise at 1:12:34 a.m. that CUS analysts associate with a void filling with water (See Section 1.17).

TIME/DATE	EVENT
1:01:59 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increases to 1233 RPM for 6 min. 30 sec. CUS analysts detect "aperiodic loading" on the engine.
1:06:11 a.m.: 03JAN2009	The AC auxiliary motor detected begins a gradual, continuous RPM decrease over the next 3 min. 29 sec. (3400 – 3382 RPM)
1:09:40 a.m.: 03JAN2009	The AC auxiliary motor detected begins a gradual, continuous RPM increase over the next 2 min. 51 sec.
1:10:40 a.m.: 03JAN2009	F/V PATRIOT diesel engine speed increase to 1242 RPM for 1 min. 20 sec. CUS analysts detect "aperiodic loading" on the engine.
1:12:00 a.m.: 03JAN2009	Loss of acoustics of F/V PATRIOT diesel engine by Acoustic Buoy 4.
1:12:22 a.m.: 03JAN2009	An almost inaudible "pop" is heard by Acoustic Buoy 4.
1:12:31 a.m.: 03JAN2009	Acoustic Buoy 4 records a moderately loud event designated as ATE 2 less than one second in duration. The AC auxiliary motor acoustic are lost simultaneously with this event. Probable time of F/V PATRIOT Marine Casualty and when both crewmembers enter the water.
1:12:34 a.m.: 03JAN2009	An almost inaudible "pop" is heard by Acoustic Buoy 4.
1:12:34 a.m.: 03JAN2009	Acoustic Buoy 4 first detects a broadband noise heard for approx. 3 minutes. US Navy Analysis associates this sound with a void filling up with water.
1:15:39 a.m.: 03JAN2009	Loss of acoustics of broad band noise by Acoustic Buoy 4.
1:15:52 a.m.: 03JAN2009	Wayne Alarm Systems receives a fire alarm signal from the F/V PATRIOT[11].
1:21:22 a.m.: 03JAN2009	Acoustic Buoy 4 records a series of quiet events designated as ATE 3 with a 2 second duration. Probable time F/V PATRIOT impacts ocean bottom.
1:25 a.m.: 03JAN2009	Probable time of death of both crewmembers.

Table 5: Timeline of Events

It is possible the crew increased the engine speed from 1:10:40 a.m. to 1:12:00 to lift the cod end off the deck using a hydraulic winch and the F/V PATRIOT's boom. While this could not by itself compromise the vessel's stability, it may have worsened an already existing stability condition (See Stability Section below). The crew may have reacted to the worsening situation by reducing the diesel engine speed to idle at 1:12:00 a.m. This hypothetical roll would have continued until, by 1:12:31 a.m., the F/V PATRIOT had completely lain over on her side. The recorded sound designated as ATE 2 possibly consists of falling equipment or the outboard outrigger falling over. At 1:12:34 a.m., water begins pouring into the open engine room and fish hold hatches. This flooding possibly activated the F/V PATRIOT's fire alarm whose signal was received by Wayne

[11] Wayne Alarm Systems and the NOAA Acoustic Buoys use different, unsynchronized time scales and cannot be directly compared with one another.

Alarm Systems at 1:15 a.m.[12] The engine room and fish hold finished flooding at 1:15:39 a.m. and the F/V PATRIOT reached the sea floor at 1:21:22 a.m.

According to the coroner's report, both crewmembers died from drowning with the event taking less than 10 minutes to cause death. Assuming they entered the water between ATE 2 at 1:12 a.m. and when the F/V PATRIOT finished flooding at 1:15 a.m., the death of both crewmembers most likely occurred by 1:25 a.m. (See Section 1.19)

A fast capsize event with a duration of less than 2 minutes is consistent with other evidence gathered during the investigation. The deceased crewmembers were recovered with no lifesaving equipment donned indicating that the crew was likely ejected from the vessel. Matteo Russo's survival suit was recovered on Cape Cod still in its storage bag. No call for help was ever recorded. (See Sections 1.19, 1.20, and 1.23)

STABILITY

Stability testing is not required for commercial fishing vessels less than 79' in length. A stability test had never been conducted on the F/V PATRIOT; therefore the stability of the F/V PATRIOT on the morning of January 3, 2009 is unknown. Evidence gathered from interviews of vessels on scene and from two nearby weather buoys show that icing was not an issue. Weather recorded on scene shows the F/V PATRIOT would have experienced 17-knot winds with 2.5 to 3 foot waves (See Section 1.12).

The two previous owners and Matteo Russo had made significant modifications to the F/V PATRIOT. Prior to the 2007 survey, concrete had been added to the F/V PATRIOT's bilge from the forepeak to the lazarette as ballast, indicating that stability had been a concern in the past. These alterations may have affected stability characteristics of the vessel, but because no stability test, inclining experiment, or deadweight survey had ever been conducted on the F/V PATRIOT, it is impossible to know to what extent (See Section 1.4).

The F/V PATRIOT was fishing that night and, though it is impossible to know how much fish was on board when the casualty occurred, the weight of the fish may have contributed to the vessel capsizing. ROV footage reveals that the cod end of the net was lifted high by the boom (See Section 1.16). According to NOAA NMFS, the F/V PATRIOT could have legally caught as much as 2,800 lbs of fish from various species onboard. The third crewmember revealed that the vessel had approximately six tons of ice in the fish hold upon departure from Gloucester.

The F/V PATRIOT also had as much as 6,400 gallons of diesel on board on January 2, 2009 distributed between two tanks; one to port, one to starboard. If the crew had not balanced these two tanks: properly, it is possible that one tank had as much as 600 gallons or 4,290 pounds more in one tank than the other (See Section 1.2). Another possible source of instability is the two trawl doors. Underwater footage reveals that the port door's wire has pulled the door tight to its block by the winch. The starboard door's

[12] Wayne Alarm Systems and the NOAA Acoustic Buoys use different, unsynchronized time scales and cannot be directly compared with one another.

wire is parted and frayed and its block bent. Neither door is clipped to the gallows frame, allowing each 1,200 lbs door to swing on its block (See Section 1.24).

This information was given to the Coast Guard Marine Safety Center (MSC) who attempted to create a computer model of the F/V PATRIOT to assess the vessel's stability. Because no stability test, inclining experiment, or even deadweight survey had ever been conducted on the F/V PATRIOT, MSC was unable to accurately quantify the F/V PATRIOT's stability characteristics. MSC was able to create a rough model to assess different loading scenarios. This analysis determined that a combination of factors such as an uneven fuel load, a raised cod end, and water on deck could have brought the vessel close to capsize. MSC also assessed the effect of down flooding into an open fish hold or engine room hatch and determined that either would have resulted in an inevitable sinking, closely matching the events recorded by Acoustic Buoy 4 (See Section 1.18).

HAUL BACK

Examination of evidence shows that the F/V PATRIOT's crew may have experienced difficulty while retrieving the vessel's fishing gear. This evidence includes the vessel's engine speed that night and the condition of the vessel's deck gear as revealed by underwater survey of the vessel.

According to engine speeds provided by CUS analysts, the F/V PATRIOT probably began hauling back her fishing gear at 12:29 a.m. Both CUS and interviews with the crewmember and family members establish that a typical haul back took approximately 20 minutes start to finish. Table 6 shows the F/V PATRIOT's engine speed from 11:17 p.m. on January 2 through 1:21 a.m. on January 3. The frequent engine speed changes from 12:29 a.m. onward indicate the engaging and disengaging of the F/V PATRIOT's hydraulic system. This means it took the F/V PATRIOT approx. 42 minutes to haul back her gear that night (See Section 1.17).

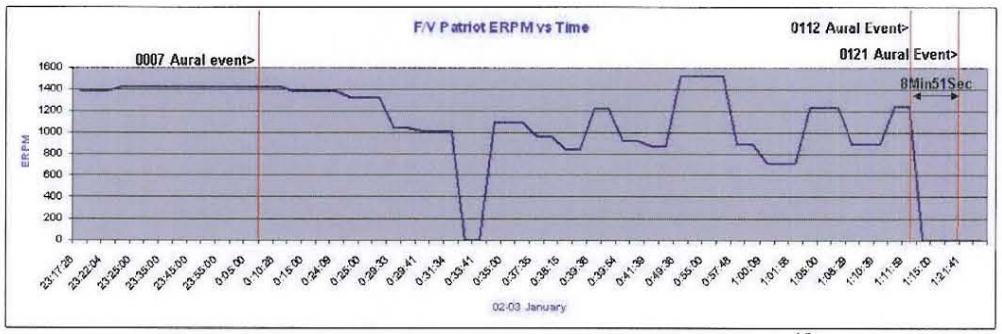

Table 6: F/V PATRIOT engine RPM versus time[13]

Video footage from both ROV and dive surveys of the wreck site reveal other signs of difficulty with the haul back. Underwater footage reveals that there is an unknown quantity of net that had come off the forward reel presumably while the net was being hauled in. The net is wrapped tightly around the axle outside the port flange of the forward reel, possibly jamming the net reel. The underwater surveys also show that the

[13] On this chart, an RPM reading of "0" means engine noises quieted to a level undetectable and not necessarily that the engine was shut down.

F/V PATRIOT's wash down hose had become entangled in this same net reel (See Section 1.16 and Figures 15 and 16).

This entangled wash down hose may explain the speed decrease of the AC auxiliary motor on board the F/V PATRIOT at 1:06:11 a.m. and its subsequent increase at 1:09:40 a.m. (See Table 5). Interviews with a former owner and crewmembers of the F/V PATRIOT established that the AC auxiliary motor heard by CUS analysts is likely the vessel's wash down pump (See Section 1.15). It is possible that the wash down hose became entangled in the net reel at 1:06:11 a.m. CUS analysts state that the F/V PATRIOT's diesel engine speed at this time was 1233 RPM with "aperiodic loading" on the engine, indicating that the crew may have been operating the vessel hydraulics including the forward net reel. This hose entanglement would have increased the wash down pump's flow resistance and caused the AC motor's speed to decrease. The diesel engine speed decreases at 1:08:29 a.m. and at 1:09:40 a.m., the AC motor speed begins to increase again. This 1:09:40 a.m. increase may have been the crew diverting system's flow or a hose/ connection bursting, relieving pressure and resistance on the wash down pump. This loss of resistance would cause the motor speed to increase from 1:09:40 a.m. to when the AC motor noise was lost at 1:12:34 a.m.

Another haul back problem revealed by underwater footage is the condition of both trawl doors as seen in the underwater video footage. The port door's wire has pulled the door tight to its block. The starboard door's wire is frayed and its block bent. Neither door is clipped to the gallows frame, allowing each 1,200 lbs door to swing on its block (See Section 1.24).

These haul back abnormalities could not have solely caused the F/V PATRIOT's sinking; however they may have distracted the crew from a developing dangerous situation.

3.2 ANALYSIS: Human Error

Human Error always plays a role in the causal analysis of accidents but in this case, with no surviving witnesses, any actions and decisions taken by either crewmember that contributed to the sinking of the F/V PATRIOT are unknown. There are three known errors made that possibly contributed to this Marine Casualty: 1) the decision to get underway late at night, 2) the decision to get underway with only 2 out of 3 crewmembers, [redacted]

Crewmembers activated the F/V PATRIOT's VMS system at 6:36 p.m. on January 2, 2009 and were underway soon after that. While the F/V PATRIOT often departed to fish at this time (See Section 1.15), there were no other vessels detected on VMS or AIS at Stellwagen Bank that night (See Section 1.13). A "Good Samaritan" vessel in the area could have aided in notification and response to an emerging casualty.

Though the F/V PATRIOT had gotten underway previously with 2 out of 3 crewmembers, being short a crewmember may have contributed to this marine casualty. The third crewmember's duties included checking and maintaining machinery operations, equalizing the port and starboard fuel tanks by means of a crossover valve that allowed

the fuel in each tank to maintain equal levels for stability of the F/V PATRIOT, and assisting on deck as needed (See Section 1.3). The remaining two crewmembers would have had to fulfill these responsibilities in addition to their own and may have been distracted from an emerging problem on board.

[redacted]

3.3 ANALYSIS: Deployment of the lifesaving equipment

During the search and rescue effort and afterward, as equipment floated up from the wreck, Coast Guard investigators recovered and examined several pieces of the F/V PATRIOT's lifesaving equipment. These included the life raft and a survival suit.

LIFE RAFT

Examinations of the life raft by Coast Guard Inspectors and a Zodiac certified technician determined that several deficiencies existed in how the life raft was packed (See section 1.21). It is possible the deficiencies could have contributed to the canopy not fully deploying.

Though the starboard life raft painter probably entangled on the wreck preventing the functioning of the hydrostatic release, the nylon stitching on the painter line connection failed causing the raft and the line to separate and the raft to reach the surface. This separation would require a force in excess of 1750 lbs, a much greater force than the upward buoyancy of the raft would create. This means either that the connection point failed at a much lower strength than its rating or that an unknown force in excess of 1750 lbs was exerted on the raft (See Section 1.21).

The January 20, 2009 ROV footage shows a ratchet strap surrounding the life raft cradle. This may have interfered with the hydrostatic release. This footage also showed that the painter line was entangled around the rigging, the outriggers, and, possibly, the propeller and rudder. On February 10, 2009, a diver examined and recovered the hydrostatic release. The hydrostatic release had engaged and the diver stated that the ratchet strap had not blocked the blade or restricted the painter line. It is very possible that the painter became caught on the rigging, outriggers, or masts and this prevented the sea painter from being cut.

EPIRB

The Coast Guard rescue helicopter crew observed the EPIRB's flashing strobe while conducting searches for the F/V PATRIOT's crew; however, their immediate priority was to locate any potential survivors and therefore did not recover the EPIRB. Without an EPIRB to analyze, the signals received by NOAA's National Mission Control Center (NMCC) can only be interpreted. NMCC received 3 EPIRB signals associated with the F/V PATRIOT: two 121.5 MHz signals the day of the response and one 406 MHz signal three days later. Only the 406MHz signal received on January 6, 2009 was confirmed to be one registered to the F/V PATRIOT (See section 1.22).

The F/V PATRIOT possibly had two EPIRBs onboard, one registered to the F/V PATRIOT and an older one registered to the F/V JOSEPHINE. Because the first 121.5 MHz signal and the 406 MHz signal both terminated within 1.5 hours of each other, it is most probable that both signals came from the F/V PATRIOT's registered EPIRB. The second 121.5 MHz transmission only transmitted for 3 hours and is possibly from the older EPIRB.

Both EPIRBs should have transmitted on both 121.5 MHz and 406 MHz. Because the EPIRB was not recovered, it is impossible to know the exact cause of the malfunction but the manufacturer stated a weak battery could disable the 406 MHz transmitter and cause the erratic signals received after this casualty.

3.4 ANALYSIS: Ship Strike/Collision

The Coast Guard examined a collision as a potential cause of the sinking of the F/V PATRIOT. However, AIS, VMS, and sonar data confirm that no vessels were in the immediate vicinity of the F/V PATRIOT at the probable time of the casualty between 1:12 a.m. and 1:21 a.m. The two closest vessels to the F/V PATRIOT at 1:12 a.m. were the M/V GATEWAY ENDEAVOR, over 8 nm to the west, and the Tug GULF SERVICE towing Barge ENERGY 11103 over 9 nm to the south (See Sections 1.13 and 1.17).

An examination of underwater video footage reveals no visible damage on the F/V PATRIOT consistent with a high impact collision. The windows are intact, the keel coolers are unbroken, and the outriggers are lying in the up position. The F/V RHIANNON RAE II hooked its net on the F/V PATRIOT on January 4, 2009 and this explains much of the paint scrapes and minor damage present (See Section 1.14). There are paint scrapes on the hull, pilothouse, and outriggers. An unknown object sheared a deck flood light off the top of the pilothouse and damaged the radar. A 10 ton block on the starboard gallows frame has been damaged, most likely concurrent with the parting of the cable that had run through it. However, none of this damage specifically indicates a collision between the F/V PATRIOT and another vessel (See Section 1.16).

The Coast Guard also examined the possibility that a collision occurred between 11:50 p.m. and 12:10 a.m. as the Tug GULF SERVICE towing Barge ENERGY 11103 transited through the area 1.5 nm west of Stellwagen Bank. At 12:07 a.m., Acoustic Buoy 4 recorded a loud series of sounds lasting 2 seconds designated as ATE 1. The Coast Guard provided these recordings to the U.S. Navy Commander Undersea Surveillance (CUS) for analysis. CUS determined this sound originated from the Tug GULF SERVICE's propellers and gives the sound's possible origin as a propeller either cavitating or encountering an object. However, CUS was also able to detect and analyze both vessel's engine plant and machinery noises for this period and neither vessel shows any change at all during this period: Tug GULF SERVICE's engine speed remains at approx. 700 RPM and the F/V PATRIOT's remain at approx. 1400 RPM at least 20 minutes after ATE 1. The F/V PATRIOT's engine speed continues to match the parameters of a typical fishing trip for over an hour until 1:12 a.m. (See Sections 1.15 and 1.17)

Furthermore, the F/V PATRIOT's performance while trawling would have prevented her from entering the path of the Tug GULF SERVICE. According to both interviews with a crewmember and a former owner and the VMS data for previous trips, the F/V PATRIOT could transit no more than 3.0 knots with her nets deployed. F/V PATRIOT engine speed data provided by CUS shows that the F/V PATRIOT finished deploying her fishing gear at 9:01 p.m. and began hauling it back at 12:29 a.m. At 12:00 a.m., the F/V PATRIOT would have been at most 1.5 nm from her 11:30 p.m. VMS position and over 2.0 nm east of the Tug GULF SERVICE. The F/V PATRIOT would have had to make at least 6.5 knots to reach the Tug GULF SERVICE's path (See Sections 1.13, 1.15, and 1.17). The Tug GULF SERVICE continued south and was 3.5 nm south of the F/V PATRIOT's 12:30 a.m. VMS position (See Figure 23).

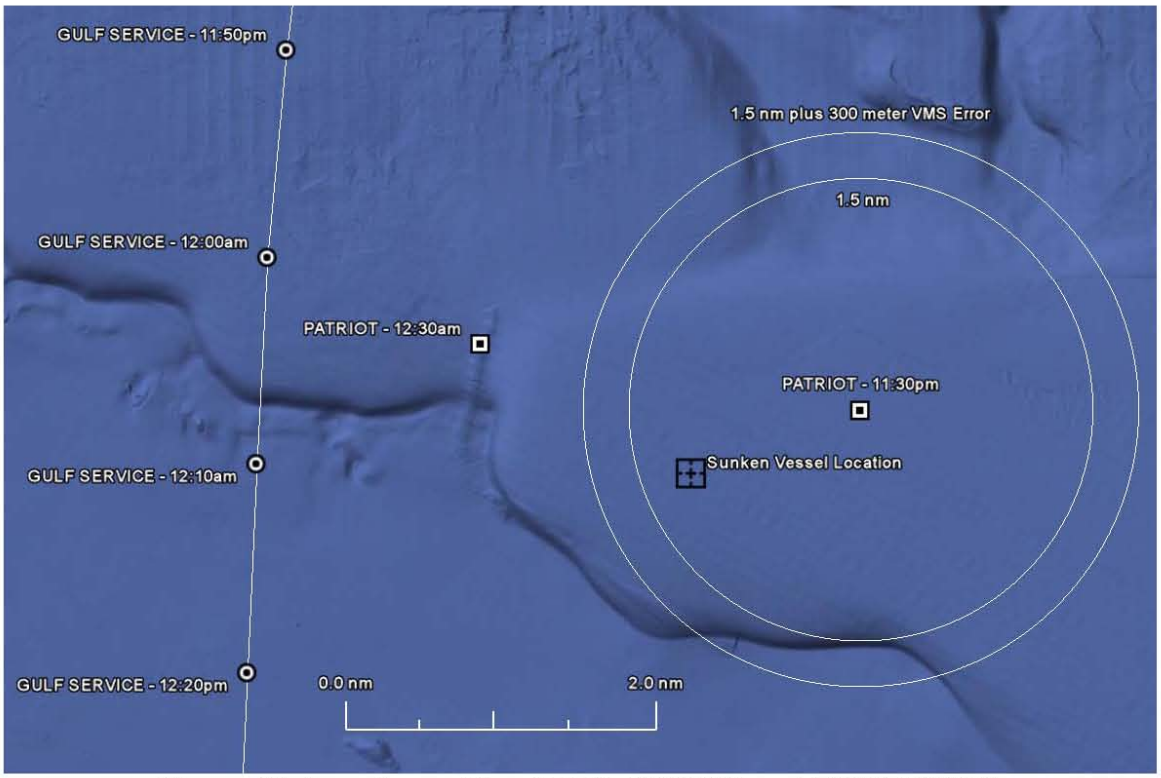

Figure 23: Locations of Tug GULF SERVICE and F/V PATRIOT between 11:30 p.m. and 12:30 a.m. The white circle is a 1.5nm range marker from the F/V PATRIOT's 11:30 position.

During this investigation, the Coast Guard examined the hull of the Tug GULF SERVICE and Barge ENERGY 11103 both in and out of water, had the Tug GULF SERVICE's towline examined by a NTSB metallurgist, and had Tug GULF SERVICE's security camera digital recorder evaluated by a Computer Forensic Analyst. These examinations revealed no evidence of a collision (See Sections 1.25, 1.26, and 1.27).

Section 4 - CONCLUSIONS

4.1 Conclusion: Capsizing / Stability

The F/V PATRIOT most likely capsized at 1:12 a.m. on January 3, 2009 leading to rapid down flooding through her open fish hold and engine room hatches and, subsequently, the vessel's sinking. Both crewmembers most likely entered the water between 1:12 a.m. and 1:15 a.m. and had drowned by 1:25 a.m. The cause of this capsize was possibly a stability failure created by a combination of factors and initiated by the lifting of the cod end of the net off the deck.

4.2 Conclusion: Ship Strike/Collision

Based on evidence that there were no vessels in the vicinity of the F/V PATRIOT between 1:12 and 1:21, the Coast Guard believes that the F/V PATRIOT did not sink due to collision.

4.3 Conclusion: Life Saving Equipment

The life raft deployed, but the painter, because it became entangled on the wreck, never became tight on either the hydrostatic release or the weak link. The starboard painter attachment point failed and allowed the raft to reach the surface. The canopy of the raft did not deploy because several lines and painters held it down. This would not have prevented a survivor from pulling himself up onto the raft and was not a factor in the two crewmember's deaths.

The F/V PATRIOT's EPIRB did not function properly and transmit a 406 MHz signal until January 6, 2009. A 406 MHz signal has encoded registration data and gives the NMCC a much more accurate position to send search and rescue (SAR) assets to.

4.4 Conclusion: Human Error

It is impossible to know the crew's final actions on board the F/V PATRIOT and how those decisions may have affected the casualty itself. However getting underway late at night, getting underway shorthanded, [redacted]

Section 5 - RECOMMENDATIONS

5.1 Amend 46 United State Code

Recommend that 46 U.S.C. 3301, *Vessels subject to inspection*, be amended to include commercial fishing vessels.

5.2 Re-evaluation of stability applicability

Recommend a re-evaluation of the applicability of 46 C.F.R. 28 Subpart E, *Stability*, be conducted and that this applicability be amended to include commercial fishing vessels less than 79 feet in length.

5.3 Development of new tracking equipment

Recommend a requirement for commercial fishing vessels to be equipped with tracking equipment. Optimally, recommend the development of a system that would combine the capabilities of Automatic Information System and Vessel Monitoring System.

5.4 Amend EPIRB regulations for commercial fishing vessels

Recommend the language of the regulation for Emergency Position Indicating Radio Beacons (EPIRBs) on commercial fishing industry vessels be amended to state that EPIRBs shall be installed in accordance with manufacturer's instructions.

5.5 Change the criteria for the issuance of Commercial Fishing Vessel Safety Decals to include a stability test

Recommend the Commercial Fishing Vessel Safety (CFVS) program change its criteria for the issuance of a CFVS decal to require/include a stability test. To facilitate a cost effective testing procedure for the mariner, recommend the development of a simplified stability test for commercial fishing vessels.