

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Washington, D.C. 20594

March 25, 2004

Vehicle Performance Factual

ACCIDENT

NTSB Number:	DCA04MM015
Description:	Capsizing of small passenger ferry
Location:	Northwest Harbor, Baltimore, Maryland
Date:	March 6, 2004
Time:	~1600 EST
Vessel:	M/V Lady D, fully enclosed pontoon boat
Operator:	Seaport Taxi (Living Classrooms Foundation)

SUMMARY

On March 6, 2004, at about 1600 Eastern Standard Time, the M/V Lady D small passenger vessel (MD8246BC), a 36 foot long by 8 foot wide fully enclosed pontoon boat built by Susquehannah Santee, capsized in reported squall-like conditions shortly after embarking on its journey. The commercial water taxi voyage was on the return leg of its periodic passenger circuit between Ft. McHenry National Monument and Fells Point, Inner Harbor, an approximately 15 minute one-way voyage. The two crewmembers and 20 of 23 passengers were rescued shortly after the accident. Five passengers onboard were fatally injured and one passenger was hospitalized in critical condition. The majority of the vessel cabin sidewall structure, the complete canopy structure, and 1 of 2 passenger benches separated from the vessel hull at some point subsequent to the capsize event and prior to completion of the vessel recovery operation.

The vehicle performance investigator joined the investigation on March 10 and commenced on-scene documentation of the vessel origin, course, capsize location, course during the drift and rescue period, and tow back to the pier of origin. On scene vehicle performance activities were concluded on March 14, 2004.

1.0 Photographic and Video Evidence

Photographic and video evidence were collected to support reconstruction of the accident timeline and vessel position. Available image data are described in Sections 1.1 and 1.2. A composite summary of image data used to support the timeline and position reconstruction is presented in Figure 1.

Figure 1: Photographic evidence, ordered in time, sequenced left to right, top to bottom. The likeness of a passenger was removed in the second row, third image.



1.1 Photographic Evidence

Photographic evidence was obtained from 3 witnesses with digital cameras and several images published on the internet. The available photographic evidence is summarized in Table 1. The time offset is a calculated value for each camera that represents the device lead or lag compared to an atomic-based clock reference time and date (reported by a handheld global positioning system device). The time offset was defined by comparing device time and date values, corrected for local time offsets, to known reference time and date values. No part of the third image in the second row of Figure 1 that was used as the basis for facts was removed or altered; instead, the deletion removed the likeness of a passenger.

Table 1: Photographic Evidence

Source	Media	Number of Pictures	Time Encoded	Time Offset	Comment
Passenger (Canon EOS digital rebel camera)	digital image	10	Yes	0 sec (+/- 1 sec)	1. Prior to capsizing event 2. Time reported consistent with GMT basis
USNR Petty Officer (Sony Cybershot digital camera)	digital image	18	Yes	+64 min, 13 sec (+/- 3 sec)	1. Following capsizing event 2. Time does not reflect daylight savings time offset
Baltimore City Fire Department (digital camera)	digital image	1	No	unknown	1. Following capsizing event, Navy LCM8 arrival, and fire rescue boat arrival on scene 2. Reported to be taken at about 16:15
Internet (Baltimore Sun and Yahoo)	digital image	4	No	unknown	1. Following capsizing and rescue events 2. Document water taxi tow operation

1.2 Video Evidence

Video evidence from one U.S. Navy Reserve witness with a JVC model GR-D30U digital video camera and Baltimore television station WJZ, Channel 13 were obtained. Requests to obtain copies of known footage from a second Baltimore television station were denied. U.S. Coast Guard helicopter video was not available for the timeframe of interest.

A summary of the video evidence gathered to support the investigation is presented in Table 2. As before, the time offset is a calculated value that represents the difference in time between the given witness video camera time setting and the reference time measured from an atomic-based clock, adjusted to local time. Table 3

documents the recorded camera time, date, and content information for each segment of the U.S. Navy Reserve video.

Table 2: Video Evidence

Source	Media	Segments	Time Encoded	Time Offset	Comment
USNR Petty Officer (digital video camera)	DV tape	11	yes	-1 year, 68 days, 9 hours, 39 min., 1 sec.	1. Following capsized event
Baltimore WJZ television (channel 13)	VHS tape	1 (previously recorded)	yes	unknown	1. Following capsized and rescue events 2. Documents water taxi tow operation

Table 3: U.S. Navy Reserve Video Camera Segment Data

Segment	Date	Start Time	End Time	Duration	Comment
1	12/29/2002	6:38:09	6:39:49	1:40:06	Fire pier area; small fire rescue boat and 2 large fire boats tied up; rainbow in background.
2	12/29/2002	6:40:22	6:40:27	0:05:04	Static image of ground.
3	12/29/2002	6:41:02	6:41:13	0:11:25	Fire pier area & personnel looking from fire dock staging area across channel (between pier 1 and cement plant).
4	12/29/2002	6:41:17	6:41:38	0:21:08	Fire pier area & personnel looking from fire dock staging area across channel (between pier 1 and cement plant); weather clear and sunny, visible rainbow.
5	12/29/2002	6:43:36	6:46:31	2:54:16	Fire rescue boat transfers child victim to shore; View of ITB mobile tanker cited in USNR witness statement; Water taxi heading southeasterly past fire pier (Captains S. and G.); Fire boat 1 and second fire rescue boat tied up at fire pier.
6	12/29/2002	6:51:00	6:51:26	0:26:07	Fire pier staging area, looking toward Naval Reserve Center from fire house; witnesses appear to be focused on area in channel at or slightly north of cement plant.

Table 3 (Continued): U.S. Navy Reserve Video Camera Segment Data

Segment	Date	Start Time	End Time	Duration	Comment
7	12/29/2002	6:51:34	6:52:12	0:38:25	Fire dock staging area, looking toward Naval Reserve Center from area in front of fire house; U.S. Army Corp of Engineers vessel tied up.
8	12/29/2002	6:54:59	6:55:29	0:30:16	NRC personnel on shore with green tanker in background.
9	12/29/2002	6:57:13	6:57:46	0:33:21	Adult victim transferred to shore via stretcher near fire pier.
10	12/29/2002	7:00:04	7:02:31	2:27:11	LCM8 (ACU2-27) vessel arrives at NRC pier; Green tanker in background.
11	12/29/2002	7:04:59	7:05:51	0:52:08	NRC pier & personnel.

1.3 Aerial Imagery

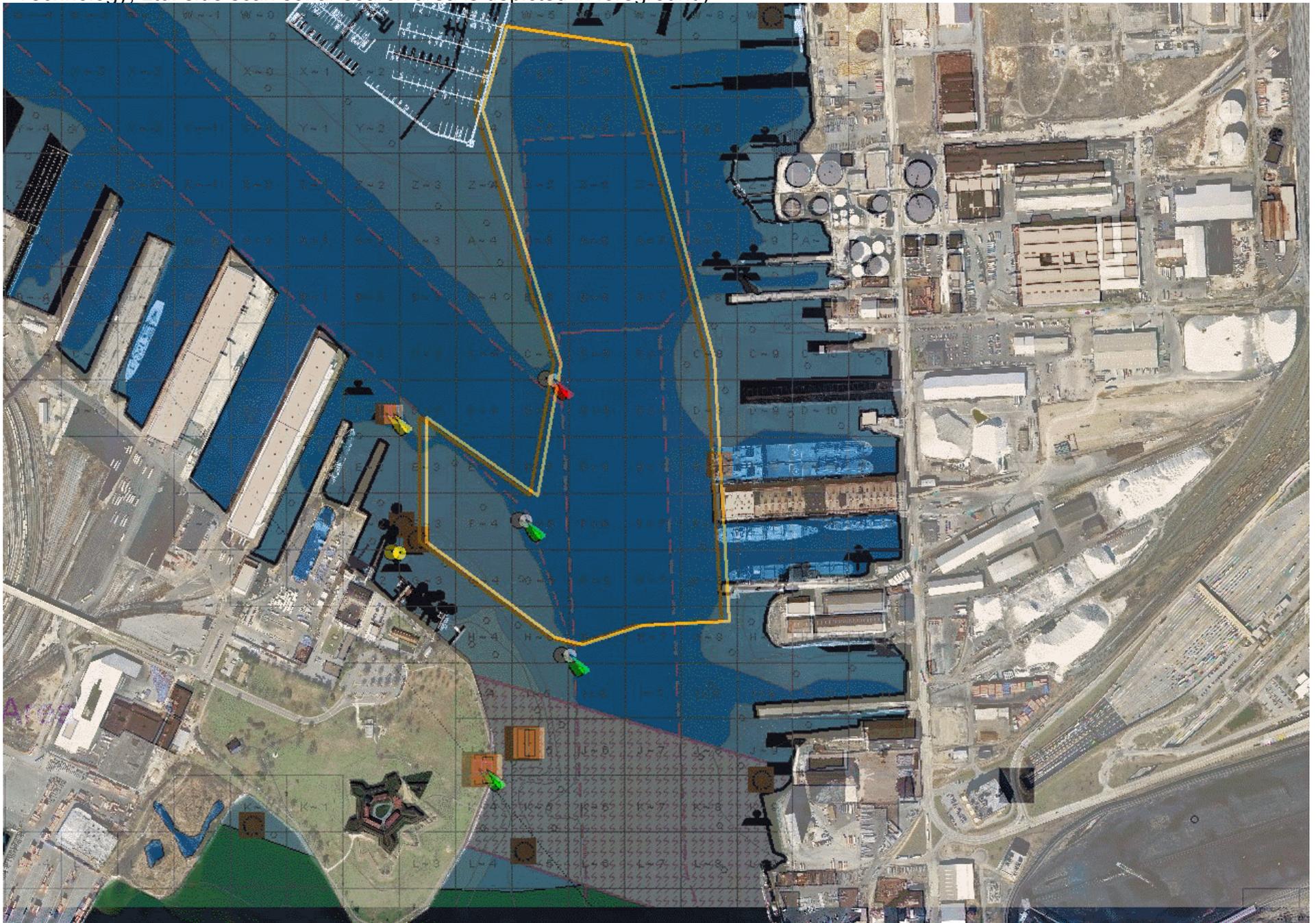
The Baltimore City Mayor's Office provided a March 2002 aerial image of the Baltimore Harbor region and a snapshot of the digital model used to support the on-scene recovery operations. The March 2002 aerial image was overlaid on the digital snapshot to construct Figure 2. An early estimate of the Marine Sonic Technology, Ltd. side scan sonar search area is depicted by the polygon in the foreground (see Section 5.0 and Figure 5 for additional details).

Efforts to obtain more recent aerial information from the U.S. Geological Survey via Microsoft TerraServer and Florida International University's TerraFly were limited by the data age (1974). Mapquest and Maptech Mapserver provided no data for the Baltimore harbor area. An updated aerial was expected to be available by the end of 2004 and can be requested through the Enterprise Geographic Information Services Group, Mayor's Office of Information Technology, Baltimore City Mayor's Office.

2.0 Responding Vessel Time and Position Data

Position and time data from each vessel that played a critical response role during the first two hours following the accident were requested from each agency or operator that participated in the rescue and/or recovery activities. In each case, the operator was requested to verify whether their boat(s) or any personnel on board were equipped with a GPS unit, if the unit was active, and if the recorded waypoint or track log still existed.

Figure 2: March 2002 aerial image overlaid on Baltimore City Mayor's Office electronic database (approximate Marine Sonic Technology, Ltd. side scan sonar search area is depicted in foreground)



The Baltimore City Fire Department reported negative results for the small fire rescue boat, but provided two position fixes from the large fire boat. No associated time data were recorded. The U.S. Navy Reserve reported that no data were recorded by the GPS unit onboard the LCM8 vessel. The Baltimore City Police Department marine unit, Maryland Natural Resources Police, and U.S. Coast Guard all reported negative results to the data request. Deckelman Towing provided GPS data from the vessel (MD2329BC) used to tow the water taxi back to the fire dock on the evening of March 6, 2004. The water taxi tow course was defined by data extracted from a Furuno model GP-1650W GPS plotter (S/N 3474-2004).

3.0 Environmental Conditions

Weather, tide, current, and harbor condition evidence were gathered to define the environmental conditions present at the time of the accident.

3.1 Weather Data

The NTSB meteorology specialist provided time and position data for the storm cell track closest to the accident site in the approximately one hour time frame bounding the event. Table 4 summarizes the time, range, and azimuth data from the KLWX radar for NS SL storm cell identification number 12. The antenna was located at N38.97528, W77.47806, at an elevation of 369 feet MSL. A regional view of these data is presented in Figure 3. A close up view of the Baltimore Harbor and the Patapsco River area is shown in Figure 4.

Table 4: Storm Cell 12 Time and Position Data

Sample #	Hours	Minutes	Seconds	Azimuth (° true)	Range (nm)
1	15	8	34	0.7	21.5
2	15	14	22	19.7	24.4
3	15	20	10	29	25.3
4	15	25	58	38.5	27.1
5	15	31	46	46.1	29
6	15	37	35	52	32.7
7	15	43	22	56	35.5
8	15	49	11	61.9	38.4
9	15	55	0	66.5	41.9
10	16	0	48	69.8	46.4
11	16	5	50	72.1	50
12	16	10	51	74.1	53
13	16	15	51	-	-

Figure 3: Cell 12 storm track (blue dashed line) and National Weather Service small craft advisory region (black solid line)

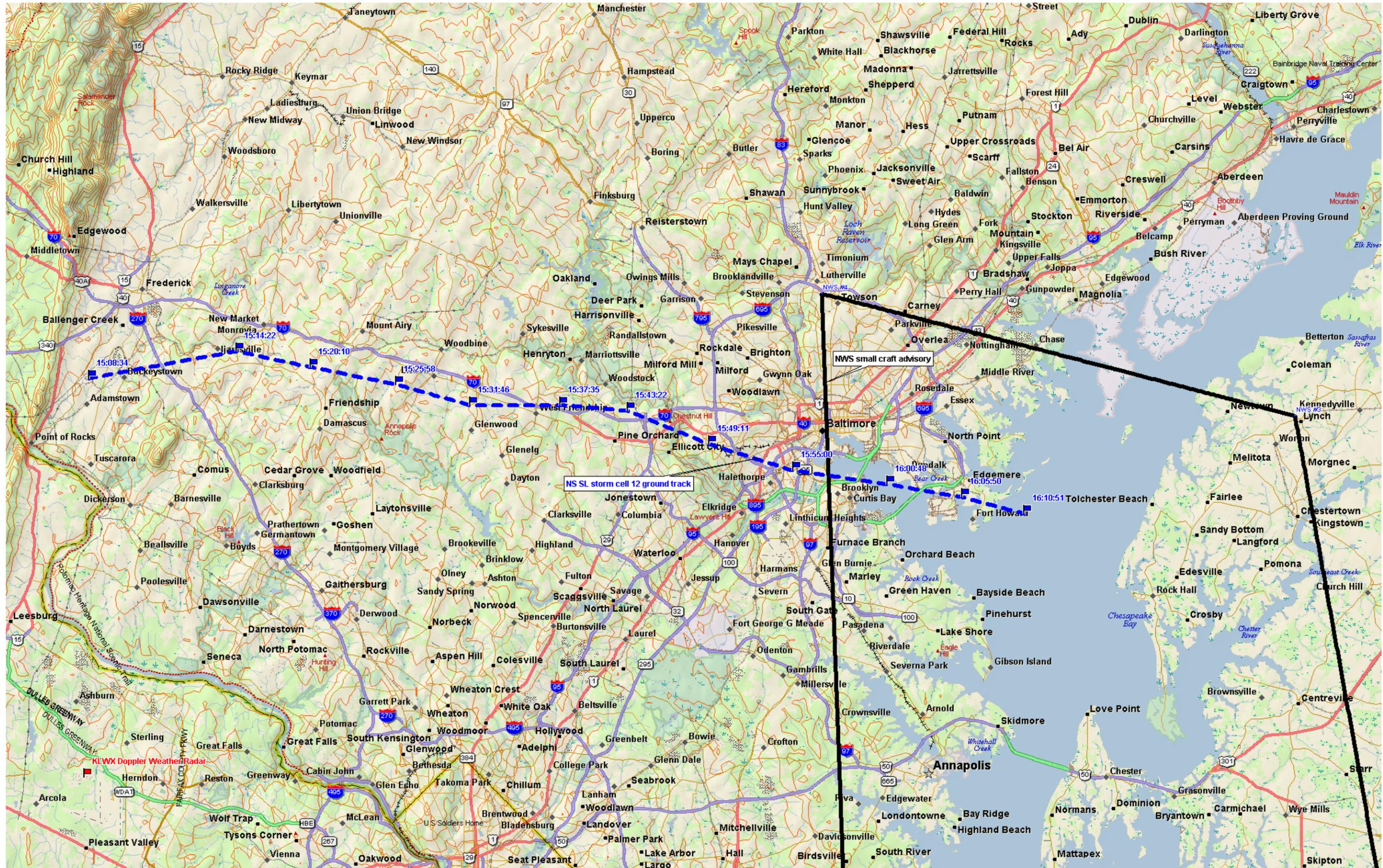
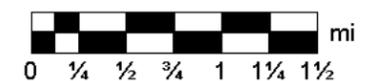
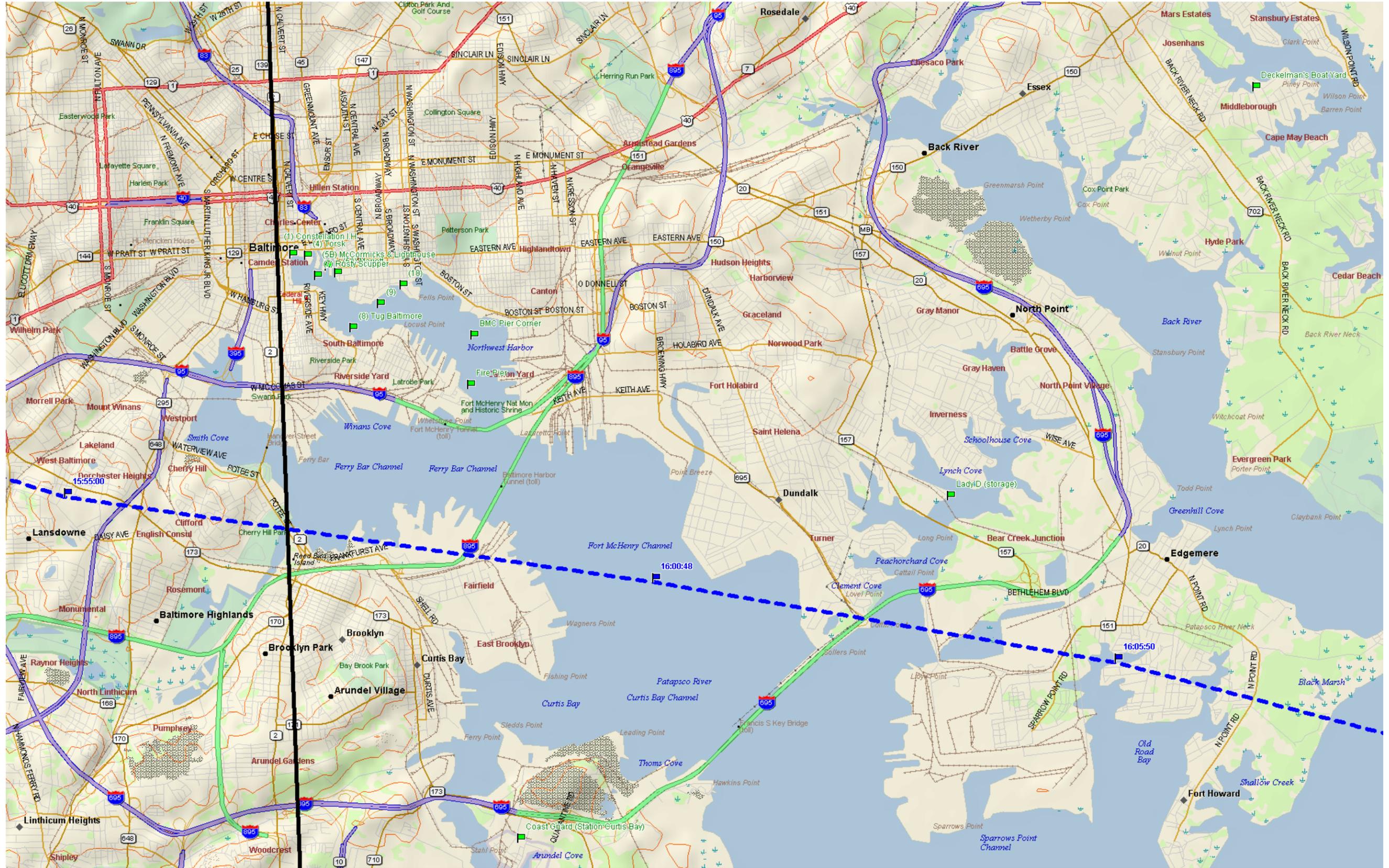


Figure 4: Overview of Baltimore Harbor and Patapsco River, including the Inner Harbor area, Ft. McHenry, the Francis S. Key Bridge, U.S. Coast Guard Station Curtis Bay, and the cell 12 storm track (blue dashed line).



3.2 Tide Data

The tide at Ft. McHenry at 16:00 on March 6, 2004 was recorded at 0.2 meters and rising toward the high water level of 0.4 meters at approximately 6:55 PM. Tide levels on the day of the accident are documented in Table 5

Table 5: Tide Data, March 6, 2004

Time	Height above datum (meters)	Tide Level
10:10 AM	0.1	decreasing
10:20 AM	0.0	datum
...	0.0	datum
2:30 PM	0.0	datum
2:40 PM	0.1	increasing
2:50 PM	0.1	increasing
3:00 PM	0.1	increasing
3:10 PM	0.1	increasing
3:20 PM	0.1	increasing
3:30 PM	0.1	increasing
3:40 PM	0.2	increasing
3:50 PM	0.2	increasing
4:00 PM	0.2	increasing
4:10 PM	0.2	increasing
4:20 PM	0.2	increasing
4:30 PM	0.2	increasing
4:40 PM	0.2	increasing
4:50 PM	0.3	increasing
5:00 PM	0.3	increasing
5:10 PM	0.3	increasing
5:20 PM	0.3	increasing
5:30 PM	0.3	increasing
5:40 PM	0.3	increasing
5:50 PM	0.3	increasing
6:00 PM	0.3	increasing
6:10 PM	0.3	increasing
6:20 PM	0.3	increasing
6:30 PM	0.3	increasing
6:40 PM	0.4	high tide
6:50 PM	0.4	high tide
7:00 PM	0.4	high tide
7:10 PM	0.4	high tide
7:20 PM	0.3	decreasing
7:30 PM	0.3	decreasing

3.3 Current and Harbor Conditions

The tide based current was reported to be weak and variable in the Baltimore harbor (0.2 to 0.3 knots) at 16:00 on March 6, 2004. The tide based current at Baltimore Harbor approach (off Sandy Point) was reported to be 0.81 knots (flood direction) with a maximum current of 0.9 knots (flood direction) at 17:05.

A U.S. Coast Guard vessel participating in the search and rescue operations reported at 17:44 that debris in Baltimore Harbor in the vicinity of the accident was drifting 112 degrees at 2.4 knots.

The BCFD fire rescue boat first responders estimated swell heights of 3 to 4 feet in the harbor at the time of the accident with a water temperature of about 41° Fahrenheit. The Baltimore City Police Department (BCPD) marine unit first responders reported white-capped sea swells of about 3 to 5 feet near the turning basin. Visibility in the water during dive operations was reported to range from 18 to 20 inches near the surface, deteriorating to 6 to 8 inches near the harbor bottom. The main channel depth was approximately 50 to 60 feet.

4.0 Witness Evidence

Witness information regarding the position (and in certain cases associated time) of the water taxi following the capsizing event is summarized in Table 6.

Table 6: Summary of Witnesses Evidence Related to Vessel Time and Position

Witness	Organization	Position and/or Time Evidence
Witness S	U.S. Navy Reserve Senior Chief	<ol style="list-style-type: none"> 1. Pilot of U.S. Navy LCM8 vessel 2. Intercept course to passengers in water 3. LCM8 initial on-scene heading 4. LCM8 heading change 5. Location when LCM8 attempted to upright Lady D 6. Drift course 7. Return course
Witness N	U.S. Navy Reserve Petty Officer	<ol style="list-style-type: none"> 1. Photographer on board LCM8 2. LCM8 intercept approach, time on scene 3. LCM8 return and arrival timeframe
Witness R	BCFD	<ol style="list-style-type: none"> 1. Pilot of large fire boat 2. Initial on scene position
Witness H	Maryland Pilots Association	<ol style="list-style-type: none"> 1. Chesapeake Terminal, harbor pilot on Asian Emperor 2. Witnessed port side of LCM8 with BCFD and U.S. Coast Guard boat on scene ~16:26-16:31
Witness K	U.S. Navy Reserve Petty Officer	<ol style="list-style-type: none"> 1. Documented shore activities 2. BCFD fire rescue boat arrival time 3. Water taxi search response 4. LCM8 arrival time

Certain witness information was defined in terms of bearings from reference vessels. As a result, vessel reference dimensions were documented. The integrated tug barge (ITB) *Mobile* was berthed at the Apex oil terminal at the time of the accident. According to U.S. Coast Guard records, the *Mobile*, IMO 8001206, VIN CG000660, call sign KXDB, was built in 1984, is flagged in the United States, and measured 691 feet in length.

Work to reconstruct position and bearing information from photographic evidence included a survey of a ship identified to be the *Asphalt Star* in the same berth position on March 18, 2004 as that previously occupied by the *Mobile* on March 6, 2004. The *Asphalt Star*, IMO 9127693, VIN 9127693, call sign SVVF, was built in 1996, is flagged in Greece, and measured 598 feet 9 inches in length.

5.0 Side Scan Sonar Data

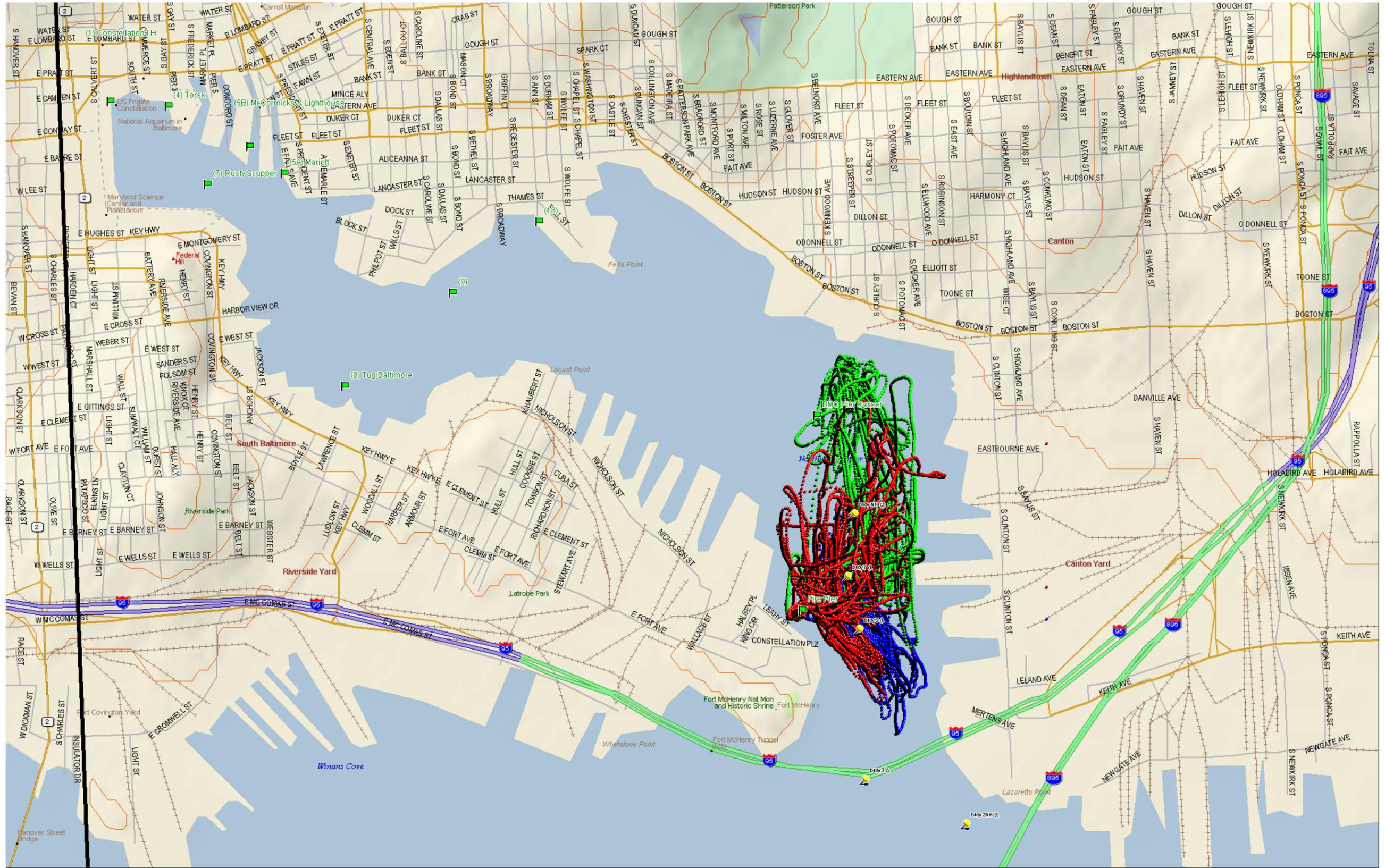
Side scan sonar data were collected by two independent commercial entities that donated the use of their equipment and personnel to support the Baltimore City Fire Department (BCFD) victim recovery operations. The two teams mapped the harbor floor and identified targets of interest using dimensional information representative of the missing victims. The side scan sonar imagery gathered by each team independently identified the location of the accident vessel canopy on Friday, March 12, 2004. The available side scan sonar data are summarized in Table 7 and a portion of the Marine Sonic Technology, Ltd. data are plotted in Figure 5.

A basic side scan sonar system consists of a boat, a GPS unit, a computer processor, a cable for electronic transmission and towing, and a subsurface towfish that transmits acoustic energy and receives reflected returns. A computer processes the GPS and sonar data and presents the information in near real time to the sonar operator in the form of a scrolling, position-encoded, graphical image. The shadows, size, and shape of image features are analyzed by the operator to identify targets of interest. Image data are also archived for subsequent analysis. In general, the use of higher acoustic frequencies improves image resolution at the expense of narrower scan distances.

Table 7: Side Scan Sonar Data

Source	Media	Days On Scene	Comment
Marine Sonic Technology, Ltd. ("Centurion" Sea Scan PC splash proof computer with 600 kHz towfish)	digital images and tabulated files	8	1. Identified accident vessel canopy 2. Provided large area side scan sonar coverage in direct support of Tyco Decisive ROV and BCFD dive operations throughout the victim recovery period
Northrup Grumman Corporation Electronic Systems (AN/AQS-14A towed search sonar system)	digital images	2	1. Identified accident vessel canopy 2. Scanned the Northwest Harbor area from the Inner Harbor to the Key Bridge and communicated targets of interest

Figure 5: Marine Sonic Technology, Ltd side scan sonar search tracks. (blue circles: March 8, 2004; green circles: March 9, 2004; red circles: March 10, 2004)



6.0 ROV Video of Water Taxi Canopy

Once the Marine Sonic side scan sonar team located the Lady D canopy, it was inspected in its resting position on the harbor floor with a remotely operated vehicle (ROV) equipped with a video camera. SeaTrepid, Inc. donated the use of its VideoRay ROV and complementary tripod mounted sonar equipment and expertise to support the BCFD victim recovery operation.

The VideoRay ROV received steering commands from the operator and communicated video images to a computer processor on the boat by means of an umbilical cable. A sonar operator directed the position and course of the ROV. The sonar station consisted of a computer processor that received signals from a sonar device temporarily stationed on the harbor floor, tethered by a second umbilical cable. The video recording that documents the water taxi canopy ROV inspection was provided to the BCFD.

7.0 Ship-Based ROV Operations

Side scan sonar data targets of interest were prioritized and subsequently used as an initial location for ship-based ROV search activities. Tyco Telecommunications donated the use of their cable laying and maintenance ship, the *Tyco Decisive*, in support of the BCFD victim recovery operations. The ship was equipped with a propulsion control system capable of maintaining the vessel at a fixed position based on differential GPS signals. A deep sea ROV equipped with a commercial high-resolution phased-array sonar¹ was launched from the ship and used to positively identify targets of interest. The ROV umbilical cord provided a reference point for recovery divers to transit to and from the harbor floor and ROV lighting provided directional reference for dive activities at target locations. Select target of interest and ROV search location data were provided by Tyco Telecommunications.

8.0 Accident Timeline

Significant events related to the accident voyage, vessel capsized, passenger rescue, passenger recovery, and vessel recovery are summarized in Table 8 as a function of local time. Shaded colors were used to simplify information source identification.

Table 8: Accident Timeline

Time	Position	Source	Event Description
~10:30		National Weather Service	Small craft advisory issued; winds 15 to 20 knots.
13:04:12	Fells Point	Passenger A digital camera	Passenger locates Fells Point water taxi dock.
14:16:03	Fells Point	Passenger A digital camera	Passenger group approaches Lady D, which is in the process of boarding passengers.
14:29:42	BCFD fire pier	Passenger A digital camera	Passenger group arrives at BCFD fire pier near Ft. McHenry National Monument, via the Lady D.

¹ A Dual-Frequency Identification Sonar (DIDSON) was flown in to assist recovery operations due to poor harbor bottom visibility conditions.

Time	Position	Source	Event Description
15:15:31	Ft. McHenry	Passenger A digital camera	Weather deteriorating; dark clouds visible; wind-driven flag.
15:41	BCFD fire pier	Passenger B cellular phone log	Call to Rochester, NY (2 minutes).
15:43	BCFD fire pier	Passenger B cellular phone log	Call to Lewisville, TX (2 minutes).
15:43:59	Ft. McHenry	Passenger A digital camera	Passenger panoramic image #1 of parade ground area.
15:44:14	Ft. McHenry	Passenger A digital camera	Passenger panoramic image #2 of parade ground area captures approaching cloud front in top, right-hand-side horizon view.
15:44:19	Ft. McHenry	Passenger A digital camera	Passenger panoramic image #3 of parade ground area confirms approaching cloud front in horizon view.
~15:45	BCFD fire pier	Seaport Taxi captain	Lady D arrives at BCFD fire pier with 2 crewmembers and no passengers.
15:48	Ft. McHenry	Passenger B cellular phone log	Call to Lewisville, TX (1 minute; call reported to originate 4-5 minutes prior to boarding.)
15:48:11	Ft. McHenry grounds	Passenger A digital camera	Passenger location (image #1) on approach to BCFD fire pier, near Ft. McHenry National Monument.
15:48:19	Ft. McHenry grounds	Passenger A digital camera	Passenger location (image #2) on approach to BCFD fire pier, near Ft. McHenry National Monument.
~15:52	BCFD fire pier	Given fact	Lady D boards passengers. (Accident voyage included 2 crewmembers and 23 passengers, fully loaded. Four passengers were left behind at Ft. McHenry with the Seaport Taxi fort coordinator because of the vessel passenger limitation.)
~15:52	Northwest Harbor and Ft. McHenry	Passenger and shore witnesses	Weather deteriorated rapidly (rain, increased wind, lightning) shortly after departure.
~15:53	Northwest Harbor	Seaport Taxi witness	Senior captain on water communicates via VHF channel 71 radio to 4 other in service company vessels, recommending that they tie up at a safe place until the deteriorating weather passes.
15:53+	Northwest Harbor	Seaport Taxi witness	Company office manager overhears senior captain communication and checks Doppler radar image on National Weather Service internet web site.
15:53+	Northwest Harbor	Seaport Taxi witness	Company office manager concludes and reports on VHF channel 71 that the heaviest precipitation will likely not affect the Inner Harbor.
15:53+	Northwest Harbor	Seaport Taxi witnesses	Other captains of Seaport Taxi vessels divert or tie up to ride out the severe weather.
15:53+	Northwest Harbor	Seaport Taxi witness	Senior captain on water calls the Lady D, inquiring whether or not it has left Ft. McHenry.
15:53+	Northwest Harbor	Seaport Taxi witness	Captain of Lady D reports that the Lady D had already departed, bound for Fells Point.
15:53+	Northwest Harbor	Seaport Taxi witness	Senior captain suggests the Lady D divert to Baltimore Marine Center or Henderson's Dock.
15:53+	Northwest Harbor	Seaport Taxi witness	Captain of Lady D tells the senior captain that diverting "was an excellent idea."
15:54:46	Northwest Harbor, West Channel	Passenger A digital camera	Lady D accident voyage underway; Fells Point on horizon in camera field of view. Vessel heading estimated to be about 74° true.

Time	Position	Source	Event Description
15:54:57	Northwest Harbor, West Channel	Passenger A digital camera	Lady D accident voyage underway; water tower on horizon and area north of Pier 1 in camera field of view. Vessel heading estimated to be about 130° true.
~15:55	U.S. Navy Reserve Center dock area	USNR Command Master Chief and Senior Chief	2 USNR witnesses observe Lady D position and bearing in Northwest Harbor with respect to ITB Mobile (green tanker tied up at the Apex oil terminal) and the red-green-red channel buoy (buoy NH).
~15:58	Northwest Harbor	Given fact	Lady D capsizes. (Passenger A reported capsize event occurred within about 1 minute of the last photograph taken during the voyage, placing the capsize event at ~15:56.)
~15:58	U.S. Navy Reserve Center dock area	USNR Command Master Chief and Senior Chief	2 USNR witnesses observe Lady D position between the red-green-red channel buoy (buoy NH) and the ITB Mobile, moving left to right across their field of view, turn to port, heel, and capsize.
~15:58	U.S. Navy Reserve Center dock area (1201 Halsey Place, Baltimore, MD)	USNR Senior Chief	USNR witness calls 911 on cellular telephone immediately after witnessing capsize event. (Senior Chief later stated that Lady D capsized to port.)
~15:58	U.S. Navy Reserve Center (1201 Halsey Place, Baltimore, MD)	USNR Command Master Chief	USNR witness calls 911 on landline telephone shortly after witnessing capsize event. (Command Master Chief, later stated that Lady D capsized to starboard; did not observe Lady D heel to one side or other prior; was watching it the whole time.)
15:58	U.S. Navy Reserve Center	USNR Chief phone log	USNR person engaged in a call that originated at 15:56, of approximately 2 minutes duration, is interrupted by report of vessel capsizing.
15:58:15		BCPD incident history detail	BCPD incident history detail initiated for Lady D accident as a result of USNR landline call.
15:58:52		BCPD incident history detail	USNR witness notified BCPD that water taxi turned over near Ft. McHenry via cellular telephone call.
15:59:54		BCFD incident history detail	BCFD incident history detail initiated for Lady D accident.
16:01+	BCFD fire house, second floor	BCFD marine pilot	BCFD marine pilot observes overturned boat.
16:01+	BCFD fire house	BCFD marine pilot	BCFD marine pilot informs BCFD dispatcher on first floor of firehouse.
16:01:46		BCFD incident history detail	BCFD entry documents report of "...OVER BOAT ..." from police clerk #1342.
16:02:55		BCPD incident history detail	Witness notified BCPD that water taxi turned over near Ft. McHenry.
~16:03	U.S. Navy Reserve Center	USNR Senior Chief	USNR personnel board LCM8-27. (19 persons, assembled from an ad hoc crew, hurriedly man the boat and depart within 5 minutes of the accident.)
16:03:06	Northwest Harbor	BCFD incident history detail	BCFD dispatches large fire boat (FB1, "Mayor J. Harold Grady"), fire rescue boat #1 (FRB1), and numerous shore-based assets.
16:04:34	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 underway with water taxi and victims in sight.

Time	Position	Source	Event Description
16:05		National Weather Service	National Weather Service issues special marine warning: "Mariners can expect wind gusts to near 50 kt...high waves...dangerous lightning and heavy downpours. Boaters should seek safe harbor immediately until this storm passes. Mariners should seek safe harbor immediately."
16:05:05	Northwest Harbor	BCFD incident history detail	BCFD FRB1 indicated it was responding. (2 crewmembers reported on initial response.)
16:05:08	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 records overturned water taxi and victims near pier 1 (image #1).
16:05:24	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 approaches overturned water taxi and victims near pier 1 (image #2).
16:05:39	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 approaches overturned water taxi and victims near pier 1 (image #3).
16:05:44	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 on scene after traveling approximately 1/3 n.m. between USNR pier and Lady D position off pier 1. (Limited to a maximum speed of 12 knots, travel time is estimated to be 2.5 minutes.)
16:05:44	Northwest Harbor	BCFD incident history detail	BCFD FB1 indicated it was responding.
16:05+	Northwest Harbor	Seaport Taxi witness	Seaport Taxi fort coordinator calls Seaport Taxi, notices unusual activity. (Heard sirens in vicinity of Ft. McHenry, but did not witness accident.)
16:05+	Northwest Harbor	Seaport Taxi witness	Senior captain on water and Seaport Taxi office manager call Lady D. Crew of Lady D does not answer on VHF-FM channel 71, UHF walkie-talkie, or cellular telephone.
16:05+	Northwest Harbor	Seaport Taxi witness	Senior captain on the water disembarks passengers at Fells Point. (Intends to get underway to look for Lady D.)
16:05+	Northwest Harbor	Seaport Taxi witness	Senior captain on the water instructed to pick up fleet captain at Henderson's Marina.
16:06:00	Northwest Harbor	BCFD incident history detail	BCFD shore based assets begin arriving at the fire pier.
~16:06	Northwest Harbor	USNR Senior Chief	USNR LCM8-27 begins passenger rescue operations.
16:06:52	Northwest Harbor	BCFD incident history detail	BCFD FRB1 reported "overturned pontoon boat." (FRB1 likely on scene at this time)
16:08:09	Northwest Harbor	BCFD incident history detail	BCFD FRB1 reported "at least 1 unaccounted for."
~16:10	Outside fire house between Ft. McHenry pier and BCFD fire pier	BCFD digital camera	USNR LCM8-27 and BCFD FRB1 on scene. (LCM8-27 boat had lowered bow ramp to facilitate victim rescue.)
16:10:13	Northwest Harbor	BCFD incident history detail	BCFD FRB1 reported "overturned water taxi."
16:11	Northwest Harbor	USNR Chief cellular phone log	Call of 1 minute duration from USNR LCM8-27 vessel to Naval Reserve Center.
16:12:22	Northwest Harbor	BCFD incident history detail	BCFD FRB1 reported "people trapped."

Time	Position	Source	Event Description
16:16		U.S. Coast Guard	Sea taxi overturned in the area of Seagirt Marine Terminal. Overheard BCFD on channel 16. Initially reported near Fells Point. CBS (Station Curtis Bay) advised 272005 underway en route incident location.
16:17		U.S. Coast Guard	Seaport Taxi "Eagle" called Coast Guard and BCPD marine boat and reported "an overturned taxi at Fells Point."
16:17+		U.S. Coast Guard	U.S. Coast Guard SAR (search and rescue) alarm activated.
~16:17	Northwest Harbor	USNR Senior Chief	USNR LCM8-27 uses ramp to partially lift Lady D out of water. Three victims float free of Lady D.
16:17+	Northwest Harbor	USNR Petty Officer	USNR LCM8-27 rescues adult female victim. (USNR personnel begin administering CPR.)
16:17+	Northwest Harbor	USNR Petty Officer	USNR LCM8-27 rescues child victim. (USNR personnel begin administering CPR.)
16:17+		BCPD	BCPD recovers 1 adult female victim, 1 rescuer in water. (Transferred victim to BCFD EMS unit waiting at 3100 block of Boston Street, located northeast of the BCFD fire pier on the opposite side of the Northwest Harbor.)
16:18:44	BCFD fire pier	USNR Petty Officer digital video camera	FB1 and FB2 at fire pier.
16:18:54		BCPD incident history detail	Report of marine units still getting people out of water.
16:21:27		BCPD incident history detail	BCFD request for BCPD police boat to respond. Police boat already at location.
16:21:54	Northwest Harbor	BCFD incident history detail	BCFD FB1 indicated it was on scene.
16:22		U.S. Coast Guard	Contacted BCFD dispatch. (BCFD advised they had two BCFD boats, 1 Army Corp of Engineers boat, actually the USNR LCM8, and 1 BCPD boat.)
~16:22	Northwest Harbor	BCFD incident history detail	BCFD dispatches additional medical units.
16:22:29		BCPD incident history detail	Marine units request medic to meet them at their headquarters (3201 Boston St.).
16:22:37	BCFD fire pier	USNR Petty Officer digital video camera	FRB1 approaches fire pier with child victim. (USNR person administered CPR en route. FB1 no longer at fire pier.)
~16:23	BCFD fire pier	BCFD	FRB1 transfers child victim to shore.
16:23:38	BCFD fire pier	USNR Petty Officer digital video camera	FRB1 casts off to return to scene. (Child victim is hand carried to EMS unit on shore.)
16:24		U.S. Coast Guard	CG 272005 advised BCPD have recovered 2 persons in water.
16:25	Northwest Harbor	USNR Chief cellular phone log	Call of 1 minute duration from USNR LCM8-27 vessel to Naval Reserve Center.
16:25		U.S. Coast Guard	CG 272005 boat underway, en route to Fells Point.
16:25:10	BCFD fire pier	USNR Petty Officer digital video camera	Seaport water taxi passes fire pier on its way to scene/search area.
16:25:24	Northwest Harbor	BCFD incident history detail	BCFD FRB1 on backup status.
16:26:00		BCPD incident history detail	Request for BCPD to lead way to MD shock trauma.

Time	Position	Source	Event Description
16:26		U.S. Coast Guard	Seaport vessel 10 advised total count when vessel left the pier was 25 persons (2 crew and 23 passengers).
16:31:25	Northwest Harbor	BCFD incident history detail	BCFD FRB1 indicated it was on scene.
~16:32	Northwest Harbor	BCFD	FRB1 receives adult female victim from USNR LCM8-27 for transport to shore EMS unit. (USNR person administers CPR en route.)
~16:32	Northwest Harbor	Maryland harbor pilot	Observed USNR LCM8-27 and BCFD/BCPD boat located between Ft. McHenry and Lazaretto Point. (Reported weather front blew over in about 10 minutes; estimated peak gusts to be about 60 knots based on wind/water interaction.)
16:33	Northwest Harbor	USNR Chief cellular phone log	Call of 1 minute duration from USNR LCM8-27 vessel to Naval Reserve Center.
~16:33	Northwest Harbor	USNR Senior Chief	USNR LCM8-27 transferred on scene operation over to BCFD FB1 boat near Lehigh Cement and prepared to return to USNR pier. (USNR spent 25 to 30 minutes on scene according to LCM8-27 pilot.)
16:35:48	Northwest Harbor	USNR Petty Officer digital camera	USNR LCM8-27 underway back to USNR pier. (Fells Point in background.)
16:36:41	BCFD fire pier	USNR Petty Officer digital video camera	Adult female victim arrives on shore in basket via FRB1 and is rushed via gurney to waiting EMS unit.
16:37		U.S. Coast Guard	CG 272005 boat on scene.
16:38:10	USNR pier	USNR Petty Officer digital camera	USNR LCM8-27 approaching USNR pier.
16:39:05	USNR pier	USNR Petty Officer digital video camera	USNR LCM8-27 arrives at USNR pier with 16-19 victims.
16:39:10	Hospital	BCFD	Medic 5 ambulance arrives at hospital.
16:39:24		BCPD incident history detail	Trooper 1 helicopter gives an ETA of 10 minutes.
16:40		U.S. Coast Guard	CG 272005 boat records position of 39 15.68N, 076 34.39W near Lehigh Cement.
16:41:07		BCFD incident history detail	BCFD battalion chief reported "a total of 25 people on board."
16:42		U.S. Coast Guard	CG 272005 boat records communication between Sector Baltimore and CBS ... (24 persons in water, 1 confirmed injury on the fire boat, CPR was conducted.)
16:46		U.S. Coast Guard	Trooper 1 en route for search.
16:47:02		BCFD incident history detail	BCFD battalion chief requested (BCPD) to "have Trooper 1 do a sweep with the thermal imaging camera."
16:48		U.S. Coast Guard	CG 272005 boat notified CBS of 4 persons injured and reported divers on scene.
16:48:34		BCFD	Medic 21 ambulance reported transporting to hospital.
16:49		U.S. Coast Guard	CG 212047 boat underway.
16:52		U.S. Coast Guard	BCFD requested sonar search from Coast Guard. Advised not capable.
16:52:34		BCFD	Medic 1 ambulance reported transporting to hospital.

Time	Position	Source	Event Description
16:57		U.S. Coast Guard	CG 212047 boat on scene.
16:57:48		BCFD	Medic 1 ambulance arrived at hospital.
17:00		U.S. Coast Guard	CG 212047 reported "debris from overturned taxi is drifting southeast."
17:02		U.S. Coast Guard	CG 212047 advised debris drifting southeast at approximately 2.4 knots.
17:03:24		BCFD incident history detail	BCFD chief of fire department on scene.
17:06		U.S. Coast Guard	Contacted Seaport vessel 10 (Seaport fleet captain. Advised the capsized vessel captain and load gate personnel confirm 25 persons onboard when vessel left the dock.)
17:11		U.S. Coast Guard	Updated position on the vessel 39 15.30N, 076 33.80W.
17:14		U.S. Coast Guard	CG 212047 boat reported "winds have picked up to 20-30 knots."
17:15:51		BCPD incident history detail	Bayview requests BCPD to respond to emergency room related to victim fatality.
17:16		U.S. Coast Guard	CG 212047 boat reported "position of the overturned taxi 39 15.30N, 076 33.80W."
17:24		U.S. Coast Guard	Sector Baltimore calls BCFD FB1 with negative results.
17:24		U.S. Coast Guard	Trooper 1 on scene.
17:25		U.S. Coast Guard	CG 272005 boat reported "air unit on scene (Trooper 1 Helo)."
17:25		U.S. Coast Guard	Baltimore City requesting more assets from U.S. Coast Guard. Advised SECBALT would find what assets and helo's available and call back.
17:26:17		BCPD incident history detail	Report of victim fatality and identity.
17:29		U.S. Coast Guard	CG 212047 boat reported "commencing shoreline search at Seagirt (marine terminal)."
17:36:50		WJZ 13 News video	Tow operator began Lady D tow operation. (Origin was at BCFD FB1 position southeast of Lazaretto Point in Patapsco River.)
17:43		U.S. Coast Guard	Sea tow advised they are towing Sea taxi to their pier. (BCFD fire pier at Ft. McHenry.)
17:44		U.S. Coast Guard	Advised drift is 112 at 2.4 knots.
17:51		U.S. Coast Guard	CG 212047 boat reported "drop datum with strobe for sunset."
17:52		U.S. Coast Guard	Maryland Natural Resources Police advising they have 4 vessels en route.
17:57		U.S. Coast Guard	Survival matrix ran, advised 2.7 hours survival.
18:03:17		WJZ 13 News video	News anchor reported 21 people "survivors" have been found/recovered. (Cited BCFD as information source.)
18:04		U.S. Coast Guard	Trooper 1 still on scene searching.
18:11		U.S. Coast Guard	Sector Baltimore notified CG 272005 boat "Helo 25 en route."
18:12		U.S. Coast Guard	CG 272005 boat reported "two helo's on scene (Fox and Helo 1). Two BCPD boats (217 and 269), BCFD FRB1, FRB2, and FB1 on scene."
18:12:24		BCPD incident history detail	Report that Natural Resources Police advised and responding.
18:13		U.S. Coast Guard	HH6527 has 50 minute ETA.
18:18		U.S. Coast Guard	Baltimore Harbor closed to all traffic north of Key Bridge.

Time	Position	Source	Event Description
18:21:48		WJZ 13 News video	Tow operator with Lady D in tow, positioned between Ft. McHenry and Lazaretto Point.
18:29:50		WJZ 13 News video	Tow operator with Lady D in tow approached BCFD fire pier (tow destination).
18:32		U.S. Coast Guard	All traffic at Key Bridge north stopped.
18:32:37		WJZ 13 News video	News anchor reported recovery operations have commenced (as opposed to rescue operations; cited BCFD as information source.)
18:32:57		WJZ 13 News video	Reporter cited BCPD as information source for report of 1 confirmed adult fatality.
18:39		U.S. Coast Guard	Attempting to contact BCFD incident command.
18:43		U.S. Coast Guard	Corp of Engineers underway with another vessel.
18:45		U.S. Coast Guard	BCFD incident command advised they will call SECBALT land line for scene coordination briefing.
18:47		U.S. Coast Guard	CG 272005 boat reported "position off the USNS Comfort looking for persons in water."
18:53		U.S. Coast Guard	CG 41359 boat underway.
18:54		U.S. Coast Guard	Talked to BCFD incident command. (BCFD advised they had 2 fire boats, 1 with divers, 2 police boats, 1 Army Corp. boat.)
18:59		U.S. Coast Guard	NTSB en route to scene.
19:16		U.S. Coast Guard	CG 41359 boat position Ft. McHenry.
19:27		U.S. Coast Guard	CG 212047 boat reported "datum has drifted 1 mile south to the mouth of Colgate Creek."
19:37:02		BCPD incident history detail	Report of Red Cross on way to assist.
March 6, 2004		BCFD	One rescued adult female passenger died.
March 7, 2004; 20:56:06		BCFD incident history detail	BCFD suspended SAR operations. (3 victims remained to be recovered).
March 8, 2004		BCFD	One rescued adult female passenger died.
March 13, 2004		BCFD	BCFD located 1 deceased adult female passenger.
March 14, 2004		BCFD	BCFD located and recovered 1 adult male and 1 child deceased passenger.
March 15, 2004		BCFD	BCFD located and recovered 1 deceased female passenger.
March 2004			One rescued child passenger remained hospitalized.

8.0 Vessel Heading

The accident vessel heading and approximate position were calculated based on 2 passenger photographs taken during the Lady D accident voyage. Baltimore Harbor horizon evidence captured in the photographs was used to establish the camera bearing and vessel hull measurements defined the passenger cabin dimensions. The camera position was determined from the reconstructed passenger seating arrangement.

Calculated heading data based on camera bearings of 11° and 93.6° true are documented in Figure 6. The 11 second time separation between the 2 photographs was used to estimate the corresponding vessel position plotted in Figure 7.

9.0 Baltimore Harbor Diagram

The accident vessel origin, calculated position and heading data, estimated capsized location, USNR LCM8-27 vessel rescue contact, drift down course, and tow back path are depicted in Figure 7. Time, position, and bearing information derived from witness statements, photographs, video camera footage, and GPS evidence were first plotted in the Topo USA environment. The composite image that resulted was subsequently overlaid on a Baltimore Northwest Harbor marine chart to construct Figure 7.

Significant events (position and/or time) are noted in black text with a white background. Bearing data are represented by straight lines (yellow or red). Circular areas depict reported or estimated water taxi positions. The large, light green, shaded circle represents the probable vessel capsized location. The tow vessel's approach path to the accident vessel is represented by the red dotted line and the accident vessel tow path is defined by the blue dotted line. Large yellow dots represent nominal channel buoy locations. The blue dashed line in the lower portion of Figure 7 identifies the path of NS SL storm cell identification number 12.

With respect to victim recovery operations, red dots denote targets of interest identified by side scan sonar operations. The *Tyco Decisive* search grid is illustrated by the large green square, with ship-based ROV detailed search locations shown by the small yellow dots. Victim recovery locations are denoted by the yellow squares. The vessel canopy and starboard passenger bench locations are identified by the green stars. The side scan sonar search areas were plotted on a day-by-day basis, but not shown here because these data obscure other data of interest in a two-dimensional presentation.

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Figure 6: Vessel heading estimates based on 2 passenger photographs taken during the Lady D accident voyage, reconstructed passenger cabin dimensions, and known passenger seating arrangement.

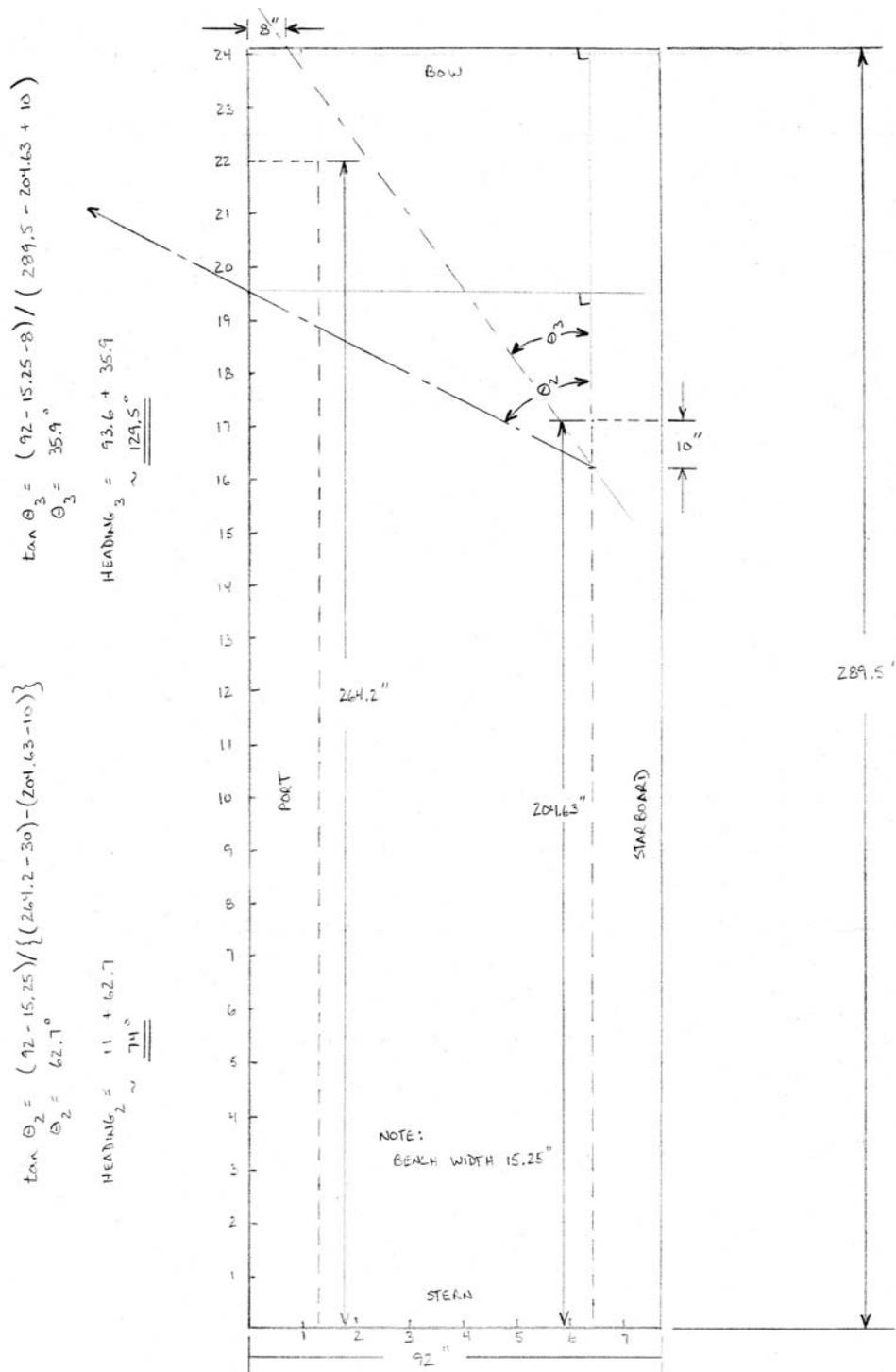


Figure 7: Composite overlay of accident, rescue, and recovery data. The last known vessel position and heading data place the Lady D in the small circular area north of Ft. McHenry, heading 129.5° true (shaded dark blue, 200 foot radius). The estimated capsizelocation is depicted by the large circular area to the northeast (shaded yellow, 400 foot radius).

