



UNITED STATES COAST GUARD

**REPORT OF THE INVESTIGATION
INTO THE
AUTONOMOUS CRAFT VICAR 602 &
RECREATIONAL VESSEL ROWING SCULL
COLLISION AND TOTAL CONSTRUCTIVE LOSS
OF ROWING SCULL ON THE PATAPSCO RIVER
IN BALTIMORE, MD, ON AUGUST 07, 2024**



MISLE ACTIVITY NUMBER: 7989592

U.S. Department of
Homeland Security

United States
Coast Guard



Commandant
United States Coast Guard

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16732/IIA #7989592
04 March 2026

**COLLISION BETWEEN THE AUTONOMOUS VESSEL VICAR 602 (CG1848200) AND A
RECREATIONAL ROWING SCULL ON THE PATAPSCO RIVER IN BALTIMORE,
MARYLAND ON AUGUST 7, 2024**

ACTION BY THE COMMANDANT

The record and the report of the investigation completed for the subject casualty have been reviewed. The record and the report, including the findings of fact, analyses, conclusions, and recommendations, are approved subject to the following comments. This marine casualty investigation is closed.

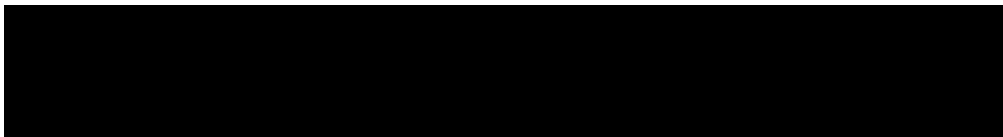
ACTION ON RECOMMENDATIONS

Recommendation 1: It is recommended that Coast Guard Headquarters promulgate guidance to clarify authorities and applicable standards for the governance of autonomous craft and/or vessels.

Action: I concur with this recommendation. The U.S. Coast Guard (USCG) is currently developing guidance to support field commands in the exercise of their authorities for autonomous and remote vessels. Additionally, the USCG is working to develop applicable standards for these types of vessels. However, the USCG's authority to regulate certain categories of vessels, such as small, non-commercial vessels, is currently limited by statute. In the interim until legislative changes and standards for autonomous and remote vessels can be implemented, the USCG continues to rely on local Captain of the Port authorities and discretion to ensure the safety of federal waterways.

Administrative Recommendation 1: It is recommended that a Findings of Concern be published to mitigate the risks associated with the contributing factors identified in the investigation.

Action: I concur with this recommendation. On January 27, 2026, [Findings of Concern 003-25 Safe Operation of Autonomous Vessels](#) was published by the USCG Office of Investigations & Casualty Analysis based on the findings from the investigation into the incident.



R. C. COMPHER
Captain, U.S. Coast Guard
Director of Inspections & Compliance (CG-5PC)



16732
November 24, 2025

**GLOBAL AUTONOMOUS RECONNAISSANCE CRAFT VICAR 602 &
RECREATIONAL VESSEL ROWING SCULL COLLISION AND TOTAL
CONSTRUCTIVE LOSS OF ROWING SCULL ON THE POTAPSCO RIVER IN
BALTIMORE, MD, ON AUGUST 07, 2024.**

ENDORSEMENT BY THE COMMANDER, COAST GUARD EAST DISTRICT

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved. It is recommended that this marine casualty investigation be closed.

ENDORSEMENT ON RECOMMENDATIONS

Safety Recommendation 8.1.1: It is recommended that Coast Guard Headquarters promulgate guidance to clarify authorities and applicable standards for the governance of autonomous craft and/or vessels.

Endorsement: Concur – I support the recommendation for Coast Guard Headquarters to promulgate guidance clarifying authorities and applicable standards for the governance of autonomous craft and/or vessels. As advancements in autonomous technology continue to evolve, it is imperative that the Coast Guard establish clear and consistent policies to address the unique challenges and opportunities presented by these emerging platforms. The Office of Prevention Policy (CG-5P) is uniquely positioned to take the lead in evaluating, analyzing, and providing comprehensive guidance for autonomous craft. With its focus on maritime safety, security, and environmental stewardship, CG-5P is well-equipped to ensure alignment with existing laws and regulations while enhancing operational oversight. Additionally, the Coast Guard should actively collaborate with the International Maritime Organization (IMO) to drive the development of standardized laws and regulations for autonomous craft at the global level. Such guidance and international cooperation will not only promote consistency across jurisdictions but also support the Coast Guard's mission to adapt to technological advancements while maintaining its unwavering commitment to safeguarding the nation's waterways.

Administrative Recommendation 8.2.1: It is recommended that a finding of concern be published to mitigate the risk associated with the contributing factors identified in the investigation.

Endorsement: Concur. I strongly support the recommendation to publish the findings of concern identified by Sector Maryland-National Capital Region to address the contributing

factors identified in the investigation. Taking this proactive step will help mitigate risks, enhance safety measures, and demonstrate a commitment to continuous improvement. By highlighting these concerns, we can foster greater awareness and drive meaningful action to prevent similar incidents in the future.



MATTHEW J. MESKUN
Captain, U.S. Coast Guard
Chief, Prevention Division

Enclosures: (1) Endorsement by the Officer in Charge, Marine Inspection
(2) Executive Summary
(3) Investigating Officer's Report



16732
October 17, 2025

**GLOBAL AUTONOMOUS RECONNAISSANCE CRAFT VICAR 602 &
RECREATIONAL VESSEL ROWING SCULL COLLISION AND TOTAL
CONSTRUCTIVE LOSS OF ROWING SCULL ON THE PATAPSCO RIVER IN
BALTIMORE, MD, ON AUGUST 07, 2024**

ENDORSEMENT BY THE OFFICER IN CHARGE, MARINE INSPECTION

The record and the report of the investigation convened for the subject casualty were reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved. It is recommended that this marine casualty investigation be closed.

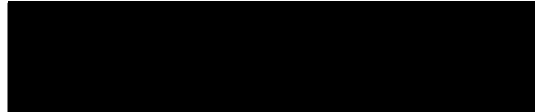
ENDORSEMENT ON RECOMMENDATIONS

Safety Recommendation 1: It is recommended that Coast Guard Headquarters promulgate guidance to clarify authorities and applicable standards for the governance of autonomous craft and/or vessels.

Endorsement 1: Concur with the safety recommendation proposed by the investigating officer.

Administrative Recommendation 1: It is recommended that a finding of concern be published to mitigate the risks associated with the contributing factors identified in the investigation.

Endorsement 1: Concur with the administrative recommendation.



PATRICK C. BURKETT
Captain, U.S. Coast Guard
Officer in Charge, Marine Inspection

Enclosures: (1) Executive Summary
(2) Investigating Officer's Report



16732
October 17, 2025

**GLOBAL AUTONOMOUS RECONNAISSANCE CRAFT VICAR 602 &
RECREATIONAL VESSEL ROWING SCULL COLLISION AND TOTAL
CONSTRUCTIVE LOSS OF ROWING SCULL ON THE PATAPSCO RIVER IN
BALTIMORE, MD, ON AUGUST 07, 2024**

INVESTIGATING OFFICER'S REPORT

1. Preliminary Statement

1.1. This marine casualty investigation was conducted, and this report was submitted in accordance with Title 46, Code of Federal Regulations (CFR), Subpart 4.07, and under the authority of Title 46, United States Code (USC) Chapter 63.

1.2. The Investigating Officer did not designate any individuals, organizations, or parties as a party-in-interest in accordance with 46 CFR Subsection 4.03-10.

1.3. The Coast Guard was the lead agency for all evidence collection activities involving this investigation. No other persons or organizations assisted in this investigation.

1.4. All times listed in this report are approximate and in Eastern Standard Time using a 24-hour format and are approximate.

2. Craft Involved in the Incident



Figure 1. Photograph of an unmanned Global Autonomous Reconnaissance Craft, trailered. This is not the photo of the VICAR 602 but of a similar hull and design. Obtained from Internet.

Official Name:	VICAR 602
Identification Number:	CG1848200 – Official Number (US)
Flag:	United States
Vessel Class/Type/Sub-Type	Miscellaneous
Build Year:	2024
Gross Tonnage:	2 GT
Length:	16 feet
Beam/Width:	10 feet
Draft/Depth:	1.5 feet
Main/Primary Propulsion: (Configuration/System Type, Ahead Horsepower)	Diesel Engine with sterndrive, (200 Ahead/Astern HP)
Owner:	Maritime Applied Physics Corporation Baltimore, Maryland USA
Operator:	Maritime Applied Physics Corporation Baltimore, Maryland USA



Figure 2. Photos of Rowing Scull (post collision) at Baltimore Community Rowing Facility. 07August 2024 Taken by Coast Guard Investigator.

Official Name:	N/A (unnamed)
Identification Number:	N/A (vessel exempt from state registration)
Flag:	United States
Vessel Class/Type/Sub-Type	Recreational/Rowing Scull
Build Year:	Unknown
Gross Tonnage:	<1 GT
Length:	27 feet
Beam/Width:	1-2 feet
Draft/Depth:	0.5 feet
Main/Primary Propulsion: (Configuration/System Type, Ahead Horsepower)	Self-Propelled
Owner:	██████████ Baltimore, Maryland USA

Operator:

Baltimore, Maryland USA

3. Record of Deceased, Missing, and Injured

There were no deceased, missing, or injured personnel as a result of this marine casualty.

4. Findings of Fact

4.1. The Incident:

4.1.1. On August 05, 2024, at 0600, Maritime Applied Physics Corporation (MAPC) began a 72-hour endurance test of the VICAR 602, a 16-foot diesel-powered, unmanned Global Autonomous Reconnaissance Craft (GARC), in the Middle Branch of the Patapsco River Baltimore, Maryland.

4.1.2. The VICAR 602 was operating on a 100-yard oval track line with two programmed waypoints (called a loitering pattern). When the VICAR 602 reached one waypoint, it would autonomously turn to port and navigate to the other waypoint. The VICAR 602 was making six knots.

4.1.3. Simultaneously, a MAPC 25-foot vessel, MD2590CR, was anchored northeast of VICAR 602's loitering pattern with its bow facing the test.

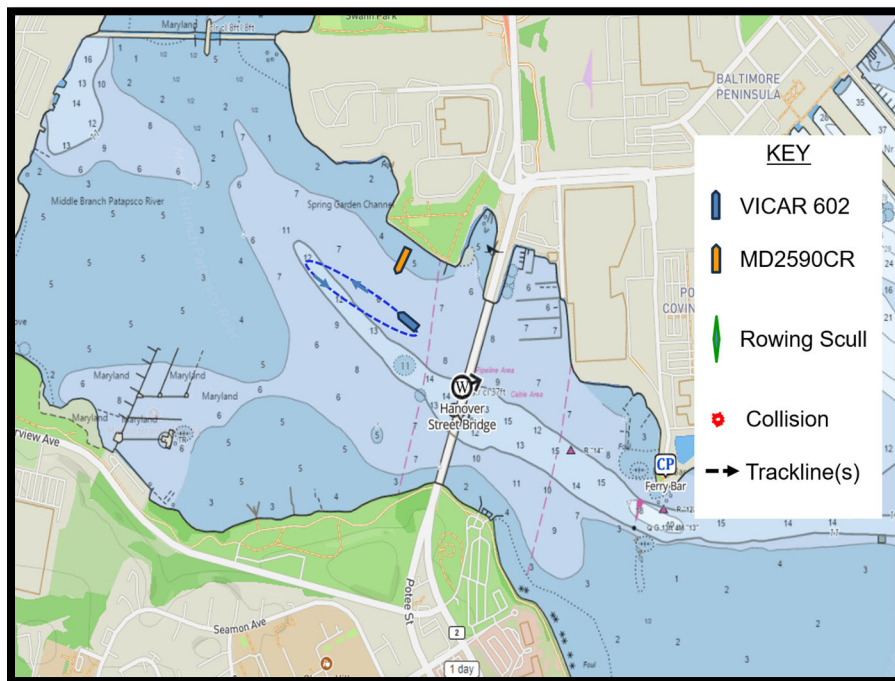


Figure 3. Approximate location and track line of VICAR 602 and anchored position of the MD2590CR. Image created by USCG.

4.1.4. The MD2590CR's crew was tasked with maintaining consistent visual confirmation of the test from the MD2590CR. The crew was capable of taking remote

control of the VICAR 602, to include executing an emergency stop of VICAR 602's propulsion, if necessary.

4.1.5. On August 07, 2024, at 0600 (48 hours into the 72 hour test), there was a crew change on the MD2590CR. The oncoming crew consisted of two total personnel: one technician and one intern.



Figure 4. Picture of MD2590CR moored at an unknown facility. Provided by MAPC.

4.1.6. At 0645, the operator of a single occupant rowing scull launched their vessel from the Baltimore Community Rowing dock and began a rowing workout in the Middle Branch of the Patapsco River. The operator of the rowing scull was facing aft while propelling the vessel forward at approximately six to seven knots during the workout.

4.1.7. At some point during the workout, the operator of the rowing scull altered their course and began heading west through the Hanover Bridge Span.

4.1.8. At 0757, the technician moved to the stern of the MD2590CR to use the restroom. At the same time, the intern relocated their chair from inside the cabin area to the bow for a better view of the VICAR 602's test.

4.1.9. At 0759, the operator of the rowing scull observed the MD2590CR and altered their course to port to avoid the MD2590CR off its starboard side.

4.1.10. The operator of the rowing scull then heard a motor, and turned their head, and observed a bow aspect of the VICAR 602 approaching the rowing scull and abandoned the rowing scull off its portside into the water.

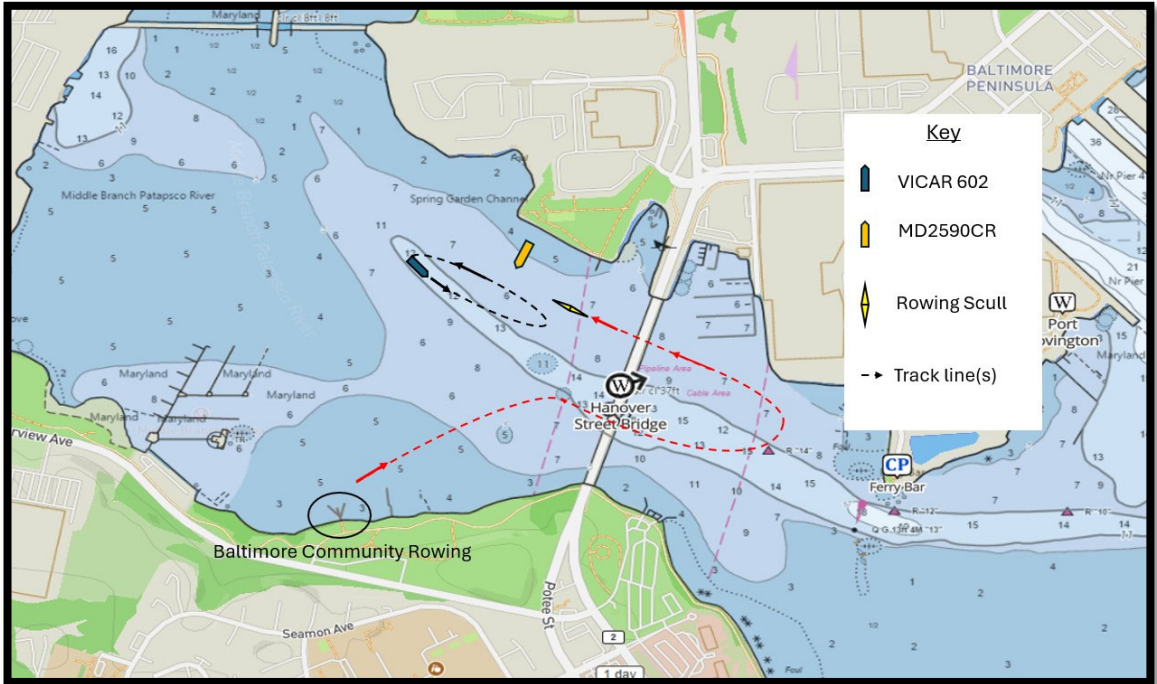


Figure 5. Approximate track line of Rowing Scull, departing from Baltimore Community Rowing and eventually heading west through the Hanover Bridge Span. Image created by USCG.

4.1.11. At 0800, the bow of the VICAR 602 collided with the starboard side of the rowing scull, splitting the vessel in half.

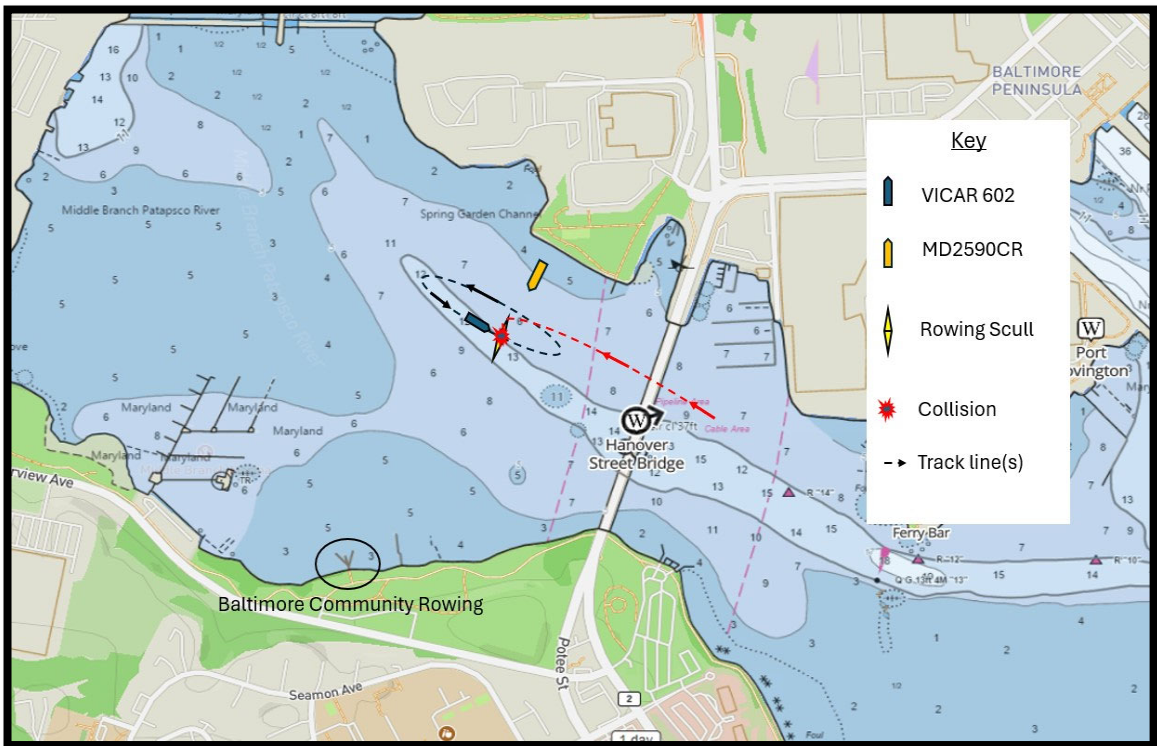


Figure 6. Approximate Location and Track line of VICAR 602, MD2590CR, and Rowing scull. Image created by USCG.

4.1.12. At 0801, the intern heard a scream and retrieved the controller for the VICAR 602 and brought the engine to neutral. The technician and intern then observed the damaged rowing scull and its operator in the water and attempted to help. The operator refused help and began swimming back towards Baltimore Community Rowing.



Figure 7. Rowing Scull in the Patapsco River after the collision. Photo taken by Baltimore Community Rowing.

4.1.13. At 0810, the operator of the rowing scull was retrieved from the water by a good Samaritan vessel crewed with members of Baltimore Community Rowing.

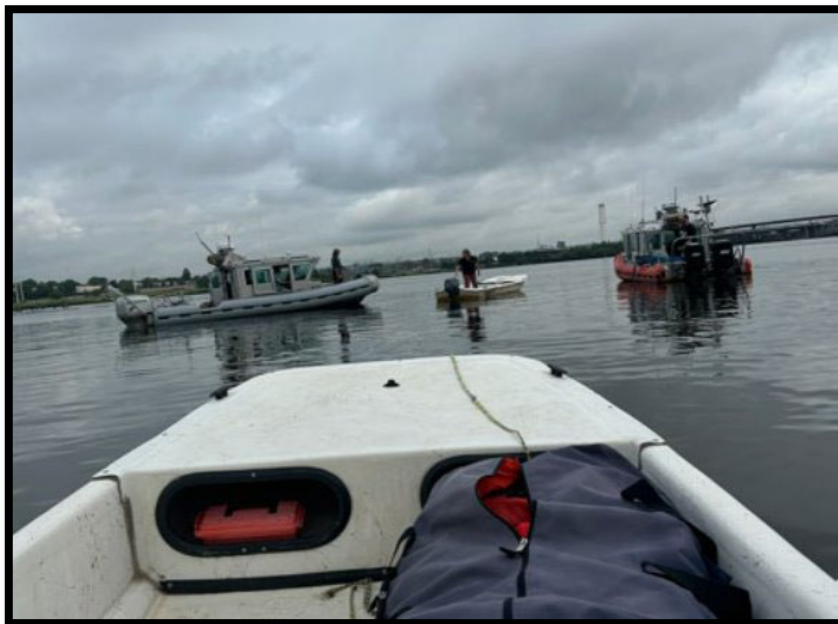


Figure 8. Members of Baltimore Community Rowing (center), MD2590CR (right), and another vessel from MAPC (left) responded to the scene to recover the rowing scull operator and the rowing scull from the water. Photo taken by Baltimore Community Rowing.

4.1.14. At 0820, a MAPC representative notified the Coast Guard of the casualty.

4.2. Additional/Supporting Information:

4.2.1. The VICAR 602 was owned and operated by MAPC and was in the pre-delivery phase for one of their GARC government contracts.

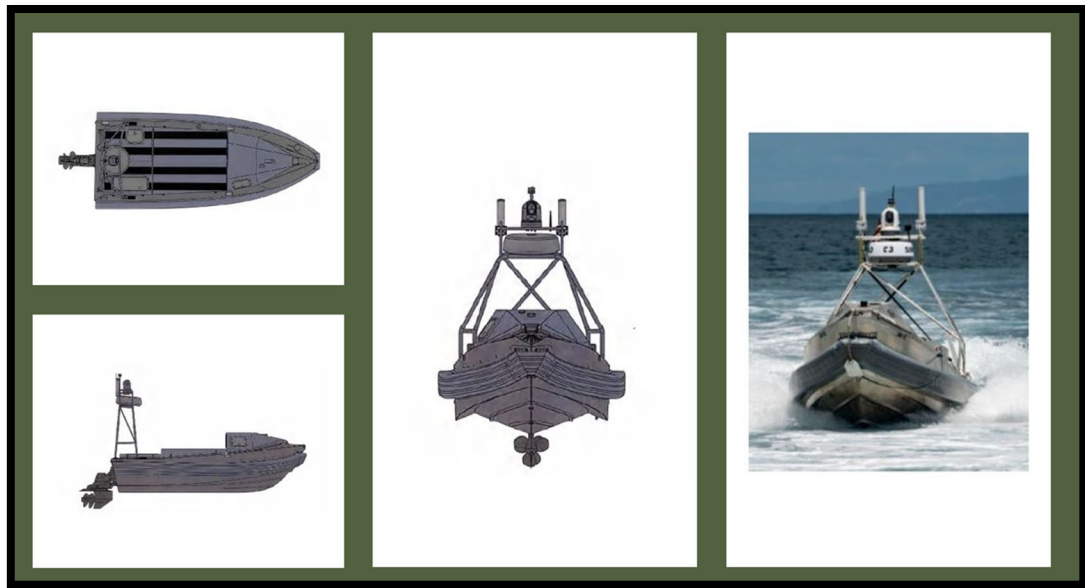


Figure 9. GARC Schematics. Obtained from MAPC.

4.2.2. The GARC command and control system consisted of modular, open architecture software and hardware component that handled propulsion, power distribution, autopilot, navigation sensors and other platform autonomy and payload control functions.

4.2.3. The GARC autonomy and control systems included: wireless handheld safety remote controller which operates on UHF band for Line of Sight (LOS) close quarters maneuvering; laptop-based mission planning & execution application for Beyond Line of Sight (BLOS) control in direct human-in-loop, way point control, and autonomous modes; and advanced perception and navigation autonomy options.



Figure 10. GARC Controller Configuration. Obtained from MAPC.

4.2.4. MAPC maintained a list of approved GARC operators who had gone through an internal training on how to remotely operate the GARC.

4.2.5. VICAR 602 was equipped with a collision avoidance system which, according to MAPC, was capable of complying with the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS) rules 13-17. MAPC did not provide a standard nor conformance to a standard to validate their assertion of compliance with COLREGS. The system had been intentionally disabled because the MD2590CR was moored within the detection area. MAPC's reason for disabling the collision avoidance system was that the proximity of the MD2590CR to the VICAR 602 would have disrupted the VICAR 602's 72-hour test. The craft could still be remotely operated and controlled using the LOS controller or BLOS computer from the MD2590CR, if needed.

4.2.6. A 72-hour endurance test of the VICAR 602 was scheduled on the Middle Branch of the Patapsco River with the MD2590CR on-scene to serve as an observation platform. The schedule onboard the MD2590CR consisted of three teams, each team consisting of three crewmembers, standing 8-hour shifts. During the time of the incident, the team was only crewed with two personnel, vice the original listed on the 72-hour endurance test plan. The technician was an approved GARC operator; however, the intern was not.

4.2.7. For planning purposes, MAPC identified four operational areas for GARC testing; however, the Middle Branch (where the incident occurred) had not been identified as an operational area. The Middle Branch had been chosen to conduct the 72-hour endurance test as MAPC believed it would be a quiet location to conduct said test. MAPC did not conduct any public outreach to notify the public that they would be conducting testing in the new area, prior to testing (Figure 11).

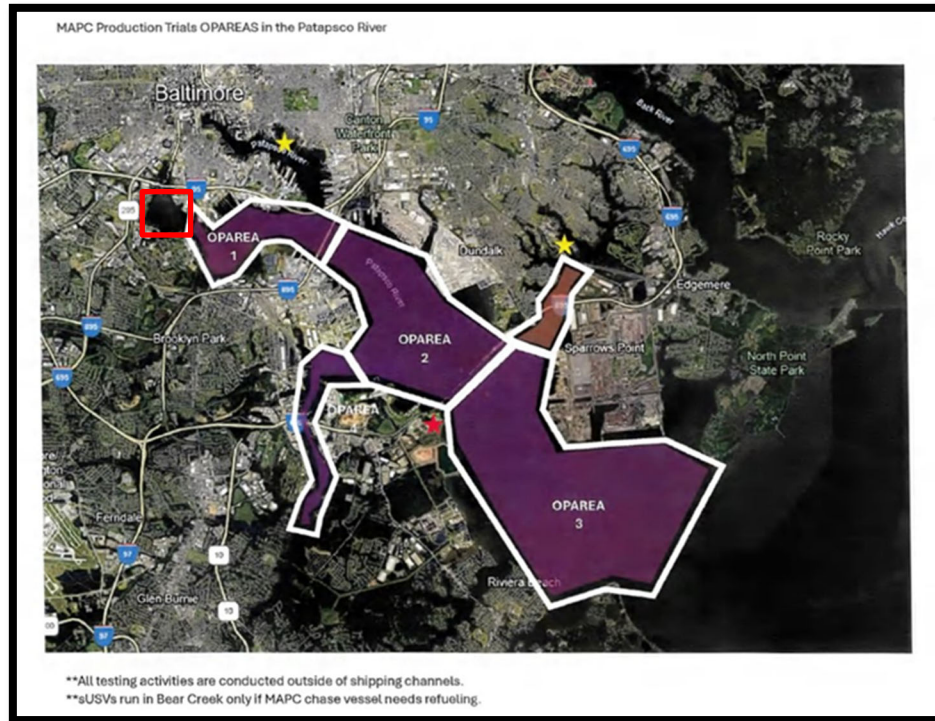


Figure 11. Middle Branch/testing area indicated by red square. Obtained from MAPC.

4.2.8. Baltimore Community Rowing had several publicly advertised rowing traffic patterns on the Middle Branch of the Patapsco River. The routes were posted on their public website.

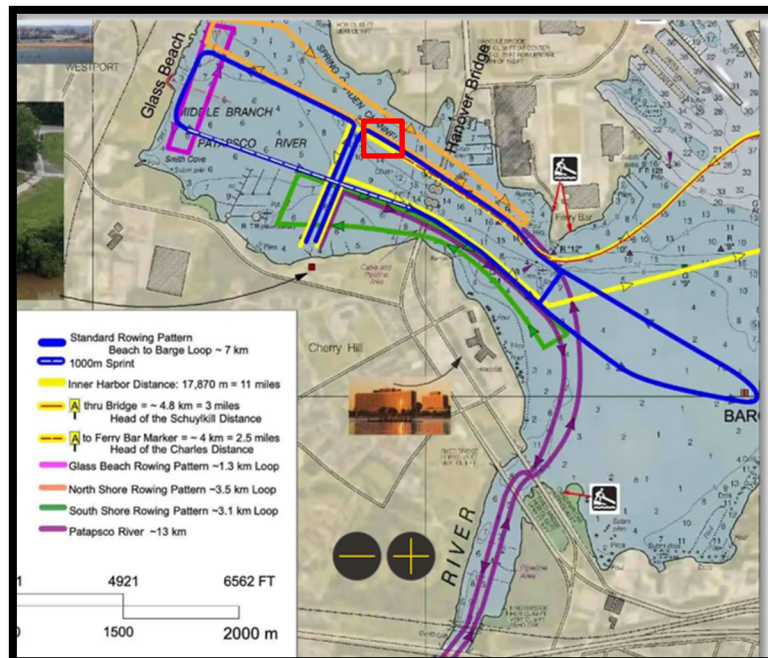


Figure 12. Baltimore Community Rowing traffic patterns. Red Square was the approximate location of the 72-hour test and collision. Obtained from Internet.

4.2.9. MAPC notified Sector Maryland-National Capital Region (NCR) in July 2023 of their plans for autonomous craft testing operations on the Patapsco River near Baltimore, MD. MAPC's brief included details about their testing procedures, predetermined testing locations, and communications plan. This included their providing testing schedules to Sector Maryland-NCR's Command Center and notifications if MAPC deviates from their provided schedule.

5. Analysis

5.1 Attention failure by test crew. During the ongoing 72-hour test, the technician moved to the stern of the MD2590CR to use the restroom. At the same time, the intern chose to relocate a chair from the cabin area to the bow for a better visual of the VICAR 602. This simultaneous decision resulted in both crew members being distracted. Had one crew remained focused on the test, the rowing scull may have been identified, and prompt action could have been taken to avoid the collision.

5.2 Failure of rowing scull operator to maintain proper lookout. The operator of the rowing scull was facing aft while propelling the vessel forward, a configuration that restricted their direct line of sight and hindered their ability to react promptly to potential collisions. Had the operator maintained a proper lookout, they might have been able to assess the situation fully and take timely action to avoid the collision.

5.3 Failure to adhere to planned crew requirements. In the company's 72-hour test procedure, the schedule for the MD2590CR originally called for a three person crew per eight-hour shift throughout the duration of the test; however, after the first 24 hours, a decision was made to reduce each team down to two. Had the company adhered to its original manning plan, the additional crew member may have prevented the collision.

5.4 Craft's collision avoidance system was disabled. The VICAR 602 was equipped with a programmed collision avoidance system which, according to MAPC, was capable of compliance with COLREGS rules 13-17, hazard and obstacle detection and avoidance. The system was intentionally disabled to facilitate the 72-hour test. Had the system been active and functioned as designed, it may have prevented the collision by following its claimed avoidance programming.

5.5 Failure to adhere to proposed testing location and procedures. In July 2023, Sector Maryland-NCR staff met with MAPC and received a briefing on GARC production and planned testing operations. MAPC outlined its intent to conduct tests within specified operational testing locations and provide test schedules to the Sector Command Center before conducting testing operations. Leading up to the 72-hour test and subsequent collision, no test schedules were provided to the Sector Command Center, nor was the test taking place in one of the pre-specified testing locations. Had the company provided the Coast Guard with the schedule and new testing location prior to the test, the Coast Guard may have been able to conduct an adequate risk assessment which identified the Middle Branch of the Patapsco River as a high traffic recreational rowing area and helped implement appropriate risk mitigation measures to avoid collisions.

6. Conclusions

6.1 Determination of Cause:

6.1.1. The initiating event for this casualty occurred when the VICAR 602 collided with the rowing scull. Causal factors leading to this event were:

6.1.2. The attention failure by test crew.

6.1.3. The failure of rowing scull operator to maintain proper lookout.

6.1.4. The failure to adhere to planned crew requirements.

6.1.5. The GARC's collision avoidance system was disabled.

6.1.6. The failure to adhere to proposed testing location and procedures.

6.2 Evidence of Act(s) or Violation(s) of Law by Any Coast Guard Credentialed Mariner Subject to Action Under 46 USC Chapter 77: There were no potential acts of misconduct, incompetence, negligence, unskillfulness, or violations of law by a credentialed mariner identified as part of this investigation.

6.3 Evidence of Act(s) or Violation(s) of Law by U.S. Coast Guard Personnel, or any other person: There were no potential acts of misconduct, incompetence, negligence, unskillfulness, or violations of law by Coast Guard employees or any other person that contributed to this casualty.

6.4 Evidence of Act(s) Subject to Civil Penalty: Negligent operations as defined 46 USC 2302(a) were considered in this case; however, were ultimately not alleged.

6.5 Evidence of Criminal Act(s): There were no potential violations of criminal law identified during the investigation.

6.6 Need for New or Amended U.S. Law or Regulation: This investigation identified no potential matters needing new or amended U.S. law or regulation.

6.7 Unsafe Actions or Conditions that Were Not Causal Factors.

6.7.1. At the time of the collision, the MD2590CR had two crew onboard, a technician and intern; however, only the technician was an approved GARC operator. When the technician went to use the restroom, the intern was left in control of the VICAR 602. Although the intern was ultimately able to stop the VICAR 602 after they heard a scream, the fact that an unqualified operator was left as the sole operator during a test was an unsafe condition.

6.7.2. In July 2023, Coast Guard representatives met with MAPC staff and received a brief on the company's production model and planned testing operations. Coast Guard policy WWM 01-20 *Policy Evaluation of Risk Posed by Novel Uses of the Marine Environment* requires the Coast Guard to identify associated risk with the proposed operations using the 5-Step Navigation Safety Risk Assessment (NSRA) and document

such novel uses in Marine Information for Safety and Law Enforcement (MISLE), a database system used by the Coast Guard. Following the collision, there were no records (physical or electronic) indicating that the Coast Guard used the NSRA tool or documented the MAPC operation in MISLE in accordance with the policy.

6.7.3. The Navigational Safety Advisory Council's (NAVSAC) Resolution 16-01 recommends that unmanned maritime systems (UMS) be configured with unique markings or other displays indicating they are unmanned. At the time of the collision the VICAR 602 was not configured with any of these indicators, thus vessel operators whom encountered the GARC would likely assume the GARC was manned and may have taken associated actions as per the rules of the road; resulting in certain undesired outcomes like a collision.

7. Actions Taken Since the Incident

7.1. On October 10, 2024, Sector Maryland-NCR staff attended MAPC facility in Baltimore, MD to discuss its autonomous craft operations within the Captain of the Port zone (details captured in MISLE Activity #8025723). In addition, a navigation safety risk assessment using CGTTP 3-71.7 was completed and added to the activity.

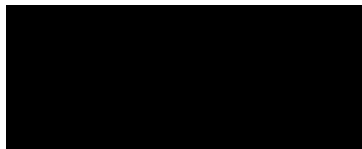
8. Recommendations

8.1. Safety Recommendation:

8.1.1. It is recommended that Coast Guard Headquarters promulgate guidance to clarify authorities and applicable standards for the governance of autonomous craft and/or vessels.

8.2. Administrative Recommendation:

8.2.1. It is recommended that a finding of concern be published to mitigate the risks associated with the contributing factors identified in the investigation.



Lieutenant, U.S. Coast Guard
Investigating Officer