



**INCIDENT REPORT CONDUCTED UNDER THE AEGIS OF US
SAILING, THE BERMUDA RACE ORGANIZING COMMITTEE AND
THE CRUISING CLUB OF AMERICA**



Photo: Daniel Forster

The Sinking of the Yacht *Solution*, and the Rescue of her Crew by
United State Coast Guard July 2, 2024

Submitted February 12, 2025

Executive Summary

Bermuda Race Organizing Committee ("BROC"), The Cruising Club of America ("The CCA"), US Sailing Association ("US Sailing") jointly empaneled a review of the abandonment and sinking of the sailing vessel *Solution*, which was returning from the 2024 [Newport Bermuda Race](#), and subsequent rescue by the United States Coast Guard to determine lessons learned that would be of help to other sailors.

Solution was a 61-year old, well found, wooden 50-foot auxiliary sloop under command of her owner, Carter "Bink" Bacon with four experienced crew. One of the crew hit his head while below, eventually developed symptoms consistent with a concussion, and was confined to his bunk. About half way back from Bermuda while motor-sailing, the engine stopped operating, apparently due to a fouled fuel filter, and Bacon was unable to repair it.

The weather deteriorated, seas built, and the boat began to pound heavily. Bacon observed water rising in the bilge but was unable to determine its source; the bilge pumps were unable to stem the rise of water. He contacted his brother ashore who notified the USCG. Soon, a USCG plane arrived and dropped a pump. However, without an engine, with considerable water in the boat, and under the wind and sea conditions, Bacon was unable to recover the pump.

A USCG helicopter arrived on the scene and Bacon decided to accept rescue of all crew; they were hoisted into the helicopter and taken ashore without further injury.

Solution is believed to have sunk 69 hours after she was abandoned.

The review group recommends US Sailing's Safety at Sea training include protocols for employing a pump dropped from a USCG plane or helicopter and for rescue of crew by helicopter. The training should cover the essential communications and responsibilities of all participating parties. In most cases the USCG should have command of the procedures. The review group further recommends the persons-in-charge of vessels headed offshore have fuel tanks inspected periodically for debris accumulation and consider installing a duplex fuel filter system.

Introduction

The reasons for this review are to learn and communicate how to avoid similar incidents and, when they occur, how to deal with them, and to provide the review team's considered opinion on what was done well, what may or may not have mattered, and lessons learned, broader lessons learned to instruct other sailors in planning for and responding to similar situations, and recommendations for organizations for improving recreational boating safety through race regulations or safety at sea education.

Organizations requesting this review ("the Organizations") are Bermuda Race Organizing Committee, The Cruising Club of America, and the US Sailing Association.

The panels referred to the US Sailing and World Sailing guidelines for incident reports to determine lessons learned for the benefit of other offshore sailors—not to determine fault or the cause(s) for the incident.

For this report, the organizations asked that the abandonment of Solution and rescue of her crew (and also incidents involving Yacht *Alliance* and Yacht *Gunga Din*) be reviewed by a panel of experienced offshore sailors who would interview and gather pertinent material. Other panels were assigned to review the vessels' structural and communication concerns. The panels referred to the US Sailing and World Sailing guidelines for incident reports to determine lessons learned for the benefit of other offshore sailors—not to determine fault or the cause(s) for the incident.

Our review was designed to determine facts and lessons learned.

- How and when did it become apparent that the vessel was in danger?
- What actions were taken to safeguard the vessel and her crew?
- What went well? What lessons were learned?

Our review was not designed to, and does not, address causes of the flooding, accountability, or liability.

Procedure

The members of the review team were selected by the Organizations considering their past experience with safety at sea issues. Relevant biographical data are included in an Appendix.

The review included an interview of *Solution's* owner and skipper and reviews of reports, videos and other documents concerning the incident.

Findings

We were informed by two detailed reports from owner/skipper Carter Bacon, which are included in the Appendices, a detailed interview with owner/skipper Bacon, and subsequent discussions. The following is a summary of those reports, interviews and subsequent discussions.

Solution was a 61-year-old wooden sloop of seaworthy design that had been well maintained by her owner at a highly reputable boat yard. She had been sailed offshore extensively by her owner for decades including transatlantic. She was fitted with two large Rule pumps, rated at 2000 gallons per hour (gph) but, Bacon estimated, capable of 600 gph as installed, each with its own hose and through hull.

A planned weather briefing in Bermuda was canceled but Bacon reported "[our] regular navigator ... assisted us with up-to-the minute weather plots and sailing directions which he sent from his home by satellite phone text messages."

Bacon, a member of The Cruising Club of America, had owned and sailed *Solution* for over 20 years, including at least one transatlantic crossing, a cruise in Europe, one Newport Bermuda Race and one Marion Bermuda Race. Bacon had previously navigated his family's schooner to the Galàpagos via sextant and taffrail log. The crew consisted of Bacon's daughter, who had considerable offshore experience and a couple whom Bacon "did not know ... but had interviewed... on Zoom. They were companionable and helpful and turned out to be cool and competent when the chips were down...[one] had significant offshore experience as crew, [and was] very safety conscious."

On June 29, following her participation in the 2024 Newport Bermuda Race, *Solution* departed Bermuda, bound for Rockport, Maine.. "Up to the minute weather plots and sailing directions" were received by satellite phone text messages from shore.

On July 1, crew member Clive Crooks hit his head while below.

Early on July 2, about half way from Bermuda to Cape Cod, in "difficult sailing conditions, with confused seas," the engine failed, apparently due to a fouled fuel filter. Bacon felt that replacement of the filter under the conditions was not feasible and that *Solution* could proceed under sail until conditions improved or they reached safe harbor. He altered course for Cape Cod.

Clive Crooks developed a headache and became nauseous.

As *Solution* was propelled by a northerly meander and the wind veered into the north, conditions worsened and *Solution* encountered severe pounding, “the loudest and most bone-jarring I have ever experienced on any boat” according to Bacon. Thereafter, the seas had eased, and Bacon felt they had departed the Stream. Shortly, Bacon discovered water in the bilge, “the bilges were so full of water I could not detect if and where any water might be entering the boat.” The pumps could not keep up with the flooding.

Bacon called his brother on the satellite phone and asked him to contact the USCG which promptly launched a plane and helicopter. As instructed by the USCG, Bacon activated the EPIRB.

Shortly thereafter, yacht *Orion*, also returning from Bermuda, appeared on the scene, having been alerted by VHF traffic from *Solution* and the USCG airplane.

The USCG plane dropped a pump. But *Solution* was so full of water, and sea and wind conditions so adverse, that, without an engine, Bacon was not able to maneuver her under sail alone to pick up the pump.

A helicopter arrived and offered Bacon a choice: accept a second pump or abandon ship.

Bacon reported: “It was an easy but painful decision to abandon *Solution*. She was clearly sinking. ...Once the batteries were submerged there was no way to know whether or for how long they would continue to provide power to the electric pumps before shorting out. Even if we got the bigger pump aboard and it got ahead of the flooding, we would still have to make it 200 miles without a pump failure through heavy adverse winds and seas, which were not expected to abate until late on July 3. There was no hope of restarting the engine until we reached calm water which meant that the batteries could not be charged to power our pumps, assuming we could keep them from becoming submerged. I assumed we had hull damage and had no way to assess its extent or the increased rate of flooding that would result if we started to push the hull. If that wasn’t enough, there was a crewmember on board with a possible concussion. We had no choice but to go.” He also did not know whether the rate of flooding might increase or how long the batteries, at risk of being covered with water, would power the pumps.

The crew were instructed to jump one-by-one into the water where they were recovered by a rescue swimmer from the helicopter and safely evacuated. There were no further injuries.

Bacon reported that, in the heat of the evacuation, he did not attempt to scuttle *Solution*. It appears that *Solution* sank about 3 days after the abandonment.

Conclusions

1. The yacht and crew were appropriate for the passage.
2. Engine failure may have contributed to the loss as, with an engine:
 - a. *Solution* might have better weathered the conditions and avoided pounding
 - b. The batteries could have been charged and pumps kept running
 - c. The pump dropped by the USCG might have been recovered and used to stem the flooding.
 - d. However, it is unknown whether the pumps could have kept up with the flooding or whether the flooding might have become worse.
3. The engine apparently failed due to contamination in the fuel clogging the fuel filter. Having the fuel tank cleaned prior to going to sea might have avoided the engine failure. There was no reason to believe that fuel obtained in Bermuda contributed to the clogging of the filter.
4. Having a duplex fuel filter system, with a Y-valve, might have enabled restarting the engine (although the second filter might also have clogged).
5. The decision to abandon *Solution* and accept rescue by the USCG was, under the conditions, prudent and successful.
6. Once the USCG is asked to help, decisions by the skipper of the yacht may be subordinated.
7. Use of pumps dropped by the USCG may benefit from training in SAS seminars.
8. Clearly it is impossible to test abandon ship in real-life conditions, so these lessons learned are important to Safety at Sea seminars. Our looking at the lead-up situation (water in the boat in all three), actions taken and decisions made yields very valuable material for training and for study by individual sailors.

Recommendations

1. The review group recommends US Sailing's Safety at Sea courses include lessons for employing a pump dropped from a USCG plane or helicopter, and for rescue of crew by helicopter, if not already included. The training should cover the essential communications and responsibilities of all participating parties.
2. In most cases the USCG should have command of the procedures, after communicating the options the skipper has (if any).

3. The review group further recommends that persons-in-charge of vessels headed offshore have fuel tanks inspected periodically for debris accumulation and consider installing a duplex fuel filter system.
4. Finally, we recommend heeding Bacon's wise advice: "When you have good reason to believe the loss of your vessel is probable, do not delay in preparing for the worst, whether that means calling for outside help, or preparing to enter a life raft. Delay simply means allowing unknown factors a chance to make things worse and bring on a crisis."

Questions and comments may be addressed to:

USSailing, Richard York, Chair, Safety at Sea Committee: york.richardw@gmail.com

Bermuda Race Organizing Committee, Andrew Kallfelz, Chair: Chair@bermudarace.com

The Cruising Club of America, William Strassberg, MD, Chair, Safety & Seamanship Committee: baybones@gmail.com

Appendices

1. Relevant biographical data

Ernest Godshalk, CCA member and Fleet Captain, is past chair of The CCA's Safety and Seamanship Committee, past member of US Sailing's Safety at Sea Committee, and member of New York Yacht Club's Seamanship Committee. He has raced and cruised for 60 years in the US, Canada, Bermuda, Caribbean, transatlantic, Europe, and Asia, in recent decades aboard his 42 foot sailboat.

Sheila McCurdy has sailed over 125,000 offshore miles on all kinds of boats, including 10 transatlantic crossings and 20 Newport Bermuda Races. She has helped countless sailors prepare for safe offshore sailing through US Sailing training and safety at sea programs, and has been a Safety at Sea moderator and instructor for over 20 years. She was a sailing advisor to the U.S. Naval Academy for two decades. Sheila is a past commodore of the Cruising Club of America, and holds a Master of Marine Affairs degree from the University of Rhode Island and a 100-ton Merchant Marine license. She is a member of US Sailing's Safety at Sea Committee.

Ann Noble-Kiley is Director of the CCA's Offshore Safety at Sea Training in Bristol, RI. She is a member of the CCA Safety and Seamanship Committee and formerly sailed her Bermuda 40, Passport, along the eastern coast to Atlantic Canada and south to Bermuda and the Windward Islands. She recently spent 10 years sailing in Europe and in latitudes extending beyond the Arctic Circle. She holds a Yachtmaster and 100-ton Captains license.

William Strassberg, MD is Chair of the CCA Safety and Seamanship Committee. He is a member of the Ocean Cruising Club and has crossed the Atlantic and Pacific Oceans, sailed high latitudes over the Arctic Circle, and New Zealand and Cape Stewart to the south. He has published articles on Skippers, Leadership and Vessel Safety, and is editor of the CCA Essential Passage Guide to the Viking Route.

Richard York is the current Chair of US Sailing's Safety at Sea Committee. Member of the Seamanship and Safety Committee of the CCA. Also member of safety/seamanship committees at New York YC, and Storm Trysail Club. Owner of J/46 ARAGORN, with almost 70,000 sea miles commanding her. Circumnavigation westabout 2003-07. Many trips between the Leeward Islands and New England. Extensive cruising in New England and the Caribbean. Five Bermuda Races.

2. Memoranda by Bacon

The following was written by Carter Bacon, Owner and Captain of s/v Solution.

Solution was a 50-foot sloop, designed by K. Aage Nielsen and built by Paul Luke of East Boothbay, Maine, in 1963. She was expertly designed and solidly constructed for racing offshore in the North Atlantic, with 2 x 2 laminated 8 ply white oak frames, double planking of 7/8 mahogany over 3/8 cedar, bronze floor timbers and reinforcing members, and a plywood deck with fiberglass sheathing. She has been maintained since 2000 to the highest standards by Rockport Marine, and has undergone extensive replacement of structural members on numerous occasions whenever any questions as to her soundness were revealed by annual inspections.

I sailed *Solution*, with a crew of seven others, to Bermuda in the Newport to Bermuda race, which began on June 21. We arrived in Bermuda on June 25 after a fast, uneventful passage.

On June 29, I departed Bermuda at 3:00 pm with my daughter Libby for the return passage to *Solution's* home port of Rockport, Maine. We had two additional sailors aboard, Louise and Clive Crooks. I did not know them but had interviewed them on Zoom. They were companionable and helpful and turned out to be cool and competent when the chips were down. We planned to sail north using modern weather prediction and communications tools to navigate as efficiently as possible through the anticipated Gulf Stream currents and weather patterns. My regular navigator, Jim Gabriel, assisted us with up to the minute weather plots and sailing directions which he sent from his home by satellite phone text messages. At all times while on deck the crew wore harnesses with inflatable PFD's, and were tethered to jack lines or strong points.

Another vessel which had participated in the race, *Orion*, left at approximately the same time and was visible to us on AIS for the entire passage. On the morning of July 1, *Orion* hailed us on VHF channel 16 and the caller introduced himself as "Forrest," captain of *Orion's* return crew. He said they were heading for Boston, and said we should feel free to call on *Orion* for assistance at any time. I thanked him and offered the same.

The passage began with moderate southerly breezes, coming from directly behind us as we headed north. The wind was insufficient to give us the desired speed and we proceeded under power with the mainsail set, making about six knots. We were carrying a roller-furled genoa jib on our headstay, which we deployed from time to time with little effect. As of 7 pm on June 30, we were 150 miles north of Kitchen Shoals reef, having averaged six knots since our departure.

During the next three hours the southerly breeze freshened until we were able to shut off the engine. Over the same period we picked up a northerly "warm eddy" current of at least two knots. Our speed increased dramatically. We often hit ten knots and we had uninterrupted good

sailing under the mainsail alone for the next 24 hours. At 5 pm on July 1 we were 325 miles north of Kitchen Shoals, having covered 175 miles in the previous 22 hours for an average speed of almost eight knots.

At that time we were experiencing steady winds of more than 20 knots. We were still sailing with a full mainsail and had rolled out the genoa which was giving us added speed. The forecast indicated that winds would increase to 25 knots and then decrease and shift into the west over the next 12 hours, followed by increasing winds as we neared our planned exit from the Gulf Stream. Around 6 pm, as a precautionary measure, I put a double reef in

the mainsail and we rolled in the genoa, leaving only a small handkerchief rolled out for balance.

Clive and Louise went below at about 7 pm leaving Libby and me on watch. Once below, Clive slipped as the boat lurched and hit his head on a cabin handhold. He told Louise and me that he was OK. In hindsight, it appears that he suffered a concussion. He went to bed shortly after the fall.

The passage proceeded uneventfully, except for two hours of torrential rains, until early in the morning on July 2. By this time we had left the warm eddy and entered a northbound meander of the Gulf Stream, which gave us the continued benefit of a northerly current. After midnight, the strong winds which had been pushing us steadily northward abated somewhat and shifted from south to west, creating difficult sailing conditions, with confused seas. In response we started the engine, which gave us the power we needed to punch through the waves. I did not increase sail, expecting that strong winds would again materialize. The "ride" was uncomfortable. We bounced around, but there was no pounding and we continued to make good time because we were riding a favorable current at the edge of the Gulf Stream. Around 1 am I felt confident enough about the way the boat was behaving to go below. Clive and Louise came up to take a turn on watch, and Libby and I turned in. Clive said he felt OK, with only a slight headache.

At 3:30 am, after a few hours of motor-sailing, the engine shut down. The cause was probably sludge from the bottom of the fuel tank stirred up by all of the bouncing around. The engine started revving and slowing, a sign that its fuel supply was being choked off. It stopped on its own before it could be shut it down. In a calm harbor with no rolling I could replace the fuel filter and get the engine back on line in twenty minutes. In a choppy sea, getting the engine restarted would be an almost impossible challenge. It would have to

wait. We continued to sail without incident, although at a reduced speed now that we had lost the engine. At about 4:00 am I joined Clive on watch in the cockpit. Louise retired to the cabin.

I decided that we should head for Cape Cod, then 230 miles away, which was the closest shelter. This would take a day and a half off the time it would take us to get to a safe harbor. I did not think I had a realistic chance of getting the engine running and it would be only a matter of time before our batteries would run low if they could not be charged. It seemed dangerous to try to get all the way to Rockport.

As the morning progressed the wind continued to shift, as predicted, into the north. We were sailing close hauled on the port tack in an ever more easterly direction. At some point I tacked,

in order to put the boat on a westerly course towards Cape Cod. This course would also take us out of the Gulf Stream which promised to become more turbulent as the wind increased. I hoped we would get a favorable shift at some point that would allow us to fetch the Pollock Rip Channel into Nantucket Sound without tacking. I also considered sailing directly to Newport if we could not fetch the Cape.

After the sun rose, I set up the inner headstay and set a "staysail" (small jib) on that stay, providing *Solution* with a balanced sail profile that served the boat well in a wide range of wind conditions. Clive was on the helm during these operations, which consumed at least half an hour. He steered well, keeping the boat reasonably level and avoiding crashing seas, so that I could work on the pitching foredeck. Once the staysail was set, Clive retired to the cabin and Libby joined me on watch. It was around 6 am.

Shortly after Clive retired, Louise popped her head up through the companionway to tell me that Clive was nauseous and appeared to have a concussion, but he was conscious,

calm and cheerful. Louise had him tucked into his bunk and was caring for him. She was cool, collected and all business. Clive was in good hands. The wind was increasing. I concentrated on trying to steer around the worst of the waves.

By 7 am, the wind had increased substantially. The current was running fast (almost four knots) indicating that we were near the northern "wall," or boundary, of the Stream, where the current runs the fastest. The waves coming from the north were being "stacked up" by the southerly current. As we ascended a wave, *Solution* would occasionally come down hard, with a loud bang, rather than the easy landing we are accustomed to. This meant she was landing more on her side than on her bottom. Two of these "bangs," which came sometime before 7:30 am, were the loudest and most bone-jarring I have ever experienced on any boat. I now believe that these hard landings opened a seam in *Solution's* hull.

Suddenly, shortly after the last, and largest, of our hard landings, we were in calmer seas. Our instruments indicated that we had exited the Gulf Stream. The waves were still large and turbulent but they were spaced out to their normal distance and we were sailing fast upwind with easy motion under a double reefed main and small staysail. However, the wind was also rising, to a steady 26 knots, with gusts to 30. The boat was heeled way over and I felt there was too much pressure on the rig. I dropped the mainsail, the boat's angle of heel decreased, and we were sailing comfortably and with plenty of speed with just a staysail (a small jib), something *Solution* had done on a number of previous passages in similar conditions. We were just fetching Cape Cod.

After dropping the main and sailing for a few minutes under the staysail alone, I felt confident enough about our sailing situation to hand the helm over to Libby and go below to check on Clive and Louise. It was a little after 8 am.

Clive and Louise were secure in their pilot berths, but the cabin looked like a bomb had hit. All kinds of gear and clothing crammed the floor of the cabin where it had fallen during the time spent battling the waves. I heard water sloshing below the floorboards. I opened the engine compartment at the rear of the cabin and could see that the water was quite deep in the bilges. I was not too concerned at first because the automatic bilge pump had been off, so I turned it on, expecting that the water would be pumped out in less than ten minutes (based on many previous experiences).

I quickly picked up the cabin sufficiently to remove any hazards. I was then able to lift the floorboards around the cabin and check all the through-hull fittings that admitted sea water for various purposes. These all appeared in proper order with hoses attached. However, the bilges were so full of water I could not detect if and where any water might be entering the boat.

Then I went back to the engine compartment to check on the pumping progress. The water had risen, not fallen, in spite of the high-capacity pump. As I watched, our emergency pump, located just above the primary pump, was activated when the water level reached its float switch, but the level kept rising, although at a slower rate because we now had two large pumps going. I do not recall the exact capacity of these pumps, but they could each pump hundreds of gallons per hour, a number that seemed astounding to me when I installed them several years ago. I checked to make sure they were both running and then began a second search for the source of such a large leak. By then there was no way to even guess where the water was coming in. All of the bilge was under water and water was coming over the leeward floorboards when we rolled. It could have been coming from anywhere.

I was out of options. At 8:36, I called my brother Wells, an experienced pilot and sailor, on the Iridium satellite phone (which worked like a charm! What a relief!). I told him the situation and asked him to notify the Coast Guard and take charge of all communications. Minutes later he called back with a phone number to a CG officer. I called the number and was advised that an airplane and helicopter were being dispatched from Cape Cod, 200 miles away. The officer directed me to activate *Solution's* EPIRB beacon. I did so at about 9:00 am and placed the unit in a cup holder in the cockpit. I did not secure it to the boat.

After speaking with the Coast Guard I tried calling *Orion*, the vessel that had been sailing near us since we left Bermuda, but got no response. Later in the morning *Orion* heard the radio chatter and broke in, offering to come to our aid. The CG pilot in charge thanked them for the offer and asked them to stand by. I then called them and thanked them for their concern. They had not heard my earlier call because they were busy on deck. Two hours later, as I was making the decision to abandon *Solution*, *Orion* appeared on the horizon.

The plane arrived around 10:00 am and dropped the pump in the water near us. It had a 400-foot floating rope attached which should have made it easy for us to sail close to it, pick up the rope and reel in the pump container. However, when I tried to maneuver close to the rope I found the boat unresponsive. We sailed right over the rope and then spent an hour trying to maneuver back to it in the high winds and large waves. *Solution* was so sluggish she would not come up to the wind for a tack. Each time I wanted to change directions I had to jibe, losing any windward distance I might have gained. Later, I realized that we were so full of water that the kind of steering required was impossible because the boat was so sluggish.

After we spent more than an hour or more trying to retrieve the pump, the CG pilot who was flying circles overhead radioed to say that the helicopter would arrive soon, that it was at its maximum distance from base and carried only enough fuel to stay overhead for 50 minutes. He advised us that our choices were to abandon *Solution* or allow the helicopter to deliver a second pump directly onto our deck. There was not enough time to do both. It was my choice.

It was an easy but painful decision to abandon *Solution*. She was clearly sinking. I estimated that the water was rising an inch every ten minutes and it was now completely covering the floorboards, with 8 inches to go before it covered the main batteries located beneath the lower bunks in the main cabin. This could be two to six hours away. Once the batteries were submerged there was no way to know whether or for how long they would continue to provide power to the electric pumps before shorting out. Even if we got the bigger pump aboard and it got ahead of the flooding, we would still have to make it 200 miles without a pump failure through heavy adverse winds and seas, which were not expected to abate until late on July 3. There was no hope of restarting the engine until we reached calm water which meant that the batteries could not be charged to power our pumps, assuming we could keep them from becoming submerged. I assumed we had hull damage and had no way to assess its extent or the increased rate of flooding that would result if we started to push the hull. If that wasn't enough, there was a crewmember on board with a possible concussion. We had no choice but to go. I told the CG pilot we would be ready to move immediately when the helicopter arrived.

When the helicopter arrived, the pilot directed me to turn 180 degrees and place the boat on an easterly course. After making this turn, the staysail was backed, with the sheet pulling from the windward side. The boat moved along steadily at 1-3 knots, without any further need for steering, allowing the helicopter pilot to gauge his approach.

The actual rescue was at once dramatic and anti-climactic. Each of us jumped in the water in turn. A frogman was lowered, harnessed up the "victim" and the pair was hoisted 80 feet to the helicopter. I had watched this so many times on TV that there was nothing surprising except the tight grip of the harness. The competence and coordination of the CG crew was, not surprisingly, as close to perfection as humans get. The process was repeated four times and the pilot headed for Cape Cod at approximately 12:15 pm.

Although Clive was suffering from a possible concussion, he had no problem getting into his safety gear, coming up on deck, jumping over the side and ascending to the helicopter. As soon as he was aboard, CG personnel examined him and performed various tests while in radio contact with a physician.

LOSS OF SOLUTION

Re: Analysis of Information regarding location of vessel following abandonment

Carter Bacon, August 3, 2024

Solution was abandoned at approximately 1615 GMT on July 2. When last seen she was afloat, headed in a southeasterly direction, with staysail sheeted to windward. Wind was from the north at 25 – 30 knots.

Solution was leaking badly. Her two high capacity bilge pumps were operating, but the water level inside the boat was rising and was just over the level of the cabin sole. It was a matter of time before she filled with water and sank. The question is "How much time?"

Discussion of Rate of Flooding

A starting point for trying to estimate the rate of flooding would be to try to estimate how much water was being pumped out and then estimate how long the boat would have taken to fill with water if the bilge pumps were not operating. The pumps were Rule high-capacity pumps installed c. 2010. They were advertised (as I recall) at 1500 gallons per hour. The small print says they pump between 300 and 2000 gallons per hour depending

on how far they must lift the water and how much hose is involved. Solution's pumps were located four feet below the high point in the discharge system and each pump had a dedicated hose 15 feet long. I would guess that the two pumps were actually moving a total of a few hundred gallons per hour, say 600. If that was the case, assuming (1) that the boat was filling at the rate of 600 gallons per hour, and (2) the boat had a volume of 18,000 gallons (both conservative estimates), it would have taken 30 hours to fill completely once the pumps stopped.

My own guess at the time of abandonment, standing in the cabin and watching the water rise (while both pumps were operating), was that it would have filled more quickly than that, but I no longer think that is the case after doing some back of the envelope calculations. I had not taken into account the fact that the water was still only filling the narrowest part of the boat when we abandoned her, so the rate of flooding, based on vertical distance, would have slowed significantly as the water rose. Of course, assuming the hull had been damaged there is no way to know how the leaking may have slowed or speeded up over time as pressures on the hull increased or decreased depending on the sea state.

Battery Considerations

A significant element of uncertainty is how long the batteries lasted. Solution's main bilge pump was powered by her so called "house" batteries, which consisted of eight 6-volt deep cycle batteries, linked in pairs to form four 12-volt batteries. The system was located in the main cabin beneath the starboard and port settees. The tops of the batteries would have been covered with water once the water level had risen to eight or nine inches above the cabin sole.

These batteries were only two years old. The system had a rated capacity of 900 "amp hours", which means that, in theory, the batteries could provide 1 ampere of power for 900 straight hours. In practice, this number is far more than what you can actually get out of a battery. However, even at say, 450 AH, the batteries could have powered the main bilge pump (which drew approximately 6 amps) for 70+ hours, or three days.

The emergency bilge pump, located just above the primary pump, was powered by the engine starting battery. This was to insure that, in case one battery bank were to fail, there would still be at least one pump attached to a good battery. The starting battery was rated at 250-amp hours. Assuming it could have provided 125-amp hours of service and the

secondary pump also drew 6 AH, the battery would have lasted 20 hours. The battery was located in the machinery space. The top of the battery was approximately four inches above the level of the cabin sole or three inches above the water level at the time of abandonment.

This discussion begs the question of how long the batteries would have provided power once they were under water. Batteries do not instantly cease to work when submerged. There are plenty of stories of people witnessing submerged car lights still operating long after the car has fallen off a bridge or been run into a river. The water is a conductor so as soon as the battery terminals are submerged, the water acts like a "short," conducting current between the two terminals and running down the battery. The most that can be said for purposes of guessing when Solution sank is that the rate at which the batteries were being run down would have increased once they were submerged.

My guess: The main bilge pump operated for 60 hours. The emergency bilge pump operated for 20 hours.

Post-Abandonment wanderings of Solution

Four sources of information regarding the vessel's post-abandonment whereabouts have been identified:

- AIS Signals: Last signal: 1342 GMT July 4.
- Iridium Satphone Signals: last signal 1311 GMT July 5.
- Apple laptop finder: last signal July 2, time not specified.
- EPIRB: last signal: estimated time: 0237 GMT July 4.

For the reasons noted below, the EPIRB and laptop information is not helpful.

Iridium Satphone Signals

I purchased an Iridium "Go!" satellite phone for the 2022 Bermuda race and return and had it on board for the '24 race and return. Although a portable device, the phone was temporarily connected to a rail-mounted external antenna which provided excellent reception while at sea. The phone was plugged into the boat's "house" 12-volt electrical system to ensure that it was always fully charged. It also contained a battery which would have provided significant additional power once the boat batteries were depleted.

I purchased a service plan for the phone from Predictwind (which also provides weather data via a data connection) which came with "unlimited data." This means that the phone is

always connected to one or more satellites, enabling fast connections. It also means that the location of the phone is being tracked by Predictwind which records the boat's position every hour, with occasional lapses and errors. Their website states that the tracking data is saved for nine months.

Predictwind provided a tracking map showing the location of Solution from the beginning of the Bermuda Race on June 21 until July 5 at 1311 GMT when the data ceased to be broadcast. I have commented on this data in a separate memorandum. The data is generally consistent with the AIS data discussed below.

AIS Data

Like most vessels that venture offshore, and per Bermuda Race requirements, Solution was equipped with an Automatic Identification System (AIS) which constantly broadcasts Solution's position and ID information through its VHF radio whenever the radio is on. The data is monitored by a government agency but access to the data is only available through private vendors.

Through a Google search I contacted SpireGlobal.com which advertised that it could provide AIS tracking data. I spoke with sales rep, "Jimmy" who said my request for less than a week's worth of data for a single vessel was so small he would provide it without charge. He sent me a map indicating Solution's course after we abandoned her, showing that the last AIS signal was received on July 4 at 1342 GMT. The position given, 037-41.06N 067-19.8W, is consistent with the position of Solution at that time shown on the Predictwind chart.

EPIRB

I switched on Solution's Emergency Position Indicating Radio Beacon (EPIRB) at 1300 GMT pursuant to instructions from the USCG. I placed the unit in a cupholder in the cockpit and did not think to tie it onto the boat.

The Coast Guard was unable to provide much in the way of helpful information. I could not get any time data. My only information is this statement from the commander of the CG station which is responsible for maintaining the data: "The first position we had for the EPIRB was 38-48N 067-32.4W and the last was 37-41.06N 067-19.8W. That is all the information I was able to obtain."

I turned the EPIRB on at 1300 GMT on July 2. The starting position given by the CG is consistent with the Predictwind position report for 1310. The ending position, 37 41.06N 67 19.8W, is consistent with the Predictwind position report for 0800 GMT on July 4.

According to the SARSAT website (<https://www.sarsat.noaa.gov/emergency-406-beacons/>) an EPIRB is expected to broadcast for up to 48 hours. It appears that Solution's EPIRB fell well short of this standard. Now that I have seen the AIS and Predictwind data, which indicate that Solution was still afloat after the EPIRB stopped broadcasting, the EPIRB information is of little or no additional help.

Find my iPhone

On July 8 at 0447 GMT, before I received the Predictwind, EPIRB and AIS information, I tried to locate my laptop (which I had left aboard Solution) through the Apple system that locates personal devices. The website indicated that the device's last known whereabouts was on July 2, 305 miles southwest of my home in Cambridge, Mass. But no exact position was given and there is no way to tell at what time on Jul 2 the laptop was no longer visible. The laptop was on the chart table, which was 30 inches above the cabin sole. Based on the rate at which the boat was probably flooding, the water level could not have reached that level until July 4. Accordingly, the laptop's connection to the GPS system was lost for reasons that had nothing to do with Solution's loss; perhaps the battery died.

Conclusion

The Predictwind data seems most reliable. I believe Solution sank within an hour following her final position report at 1311 GMT on July 5, 69 hours after she was abandoned. Her speed had slowed to less than ½ knot, which means that her small staysail was unable to pull the boat through the water and she was just drifting with the current.

The batteries probably kept her pumps going for many hours after they were submerged, keeping the rate of flooding to a minimum. There would have been minimal pressure on the hull. Any leaks due to structural damage could have slowed considerably from the time when the boat was being pushed through turbulent seas.

The AIS had shut down 24 hours earlier. This stands to reason. The AIS module was located in a locker near the mast, about 14 inches above the cabin sole. Once the water reached the module it would have filled with water and its electronic controls would have shorted out immediately.

The satphone was located high on the bulkhead in the aft stateroom, no more than six inches below the deck. Assuming it had power, it would have been able to send signals until it was submerged, which would not have happened until the boat was moments from sinking.