

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



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OPERATIONAL FACTORS/HUMAN PERFORMANCE

Night Ground Handling Observation at Kahului Airport

February 21, 2024

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A. OPERATIONAL FACTORS/HUMAN PERFORMANCE GROUP IN ATTENDANCE¹

Ops Group Chair	Shawn Etcher Operational Factors National Transportation Safety Board
HP Group Chair	William Bramble Human Performance National Transportation Safety Board
Subject Matter Expert	Robert "Rocky" Stone Operational Factors National Transportation Safety Board
Group Member	Edwin "Eddie" Miller FAA AVP-110
Group Member	Ryan Iwasaki Boeing Air Safety

B. SUMMARY

On November 30, 2023, about 0614 Hawaii standard time (HST), a Boeing 717-200, N494HA, sustained minor damage when it was involved in an incident after pushback and while taxiing for departure at Kahului Airport (OGG), Maui, Hawaii. The 119 passengers and crew onboard were uninjured. One ramp agent sustained minor injuries. The flight was operating as a Title 14 Code of Federal Regulations Part 121 scheduled domestic passenger flight from OGG to Daniel K. Inouye International Airport (HNL), Honolulu, Hawaii.

The flight crew reported that during push back from the gate, they received clearance from the tug² driver to start the engines. The number one (left) engine was successfully started, the brakes set, and the ground crew was instructed to disconnect the tow bar. While waiting for load closeout and an air route traffic control clearance, the number two (right) engine was successfully started, and the ground crew was released to disconnect the headset and nose landing gear bypass pin. The captain recalled that he confirmed the pin had been disconnected, the after-start checklist was completed, and a taxi clearance was received from ATC. The taxi commenced followed by an unusual motion as the airplane impacted the tug.

¹ Group members from Hawaiian Airlines, nor ALPA could attend do to other priorities.

² For this report "tug," "tractor," and "tow" are synonymous and could be interchanged.

The operator reported that after push back, the escort disconnected the tow bar from the airplane, the tug driver repositioned the tug on the left side of the cockpit, and the escort attached the towbar to the rear of the tug. After the tug driver received clearance from the flight crew, the escort disconnected the nose landing gear bypass pin and communication cable from the airplane. The escort displayed the pin to the flight crew but did not see a response. The tug driver and escort waited for an acknowledgement. The tug driver sounded the vehicle's horn and tossed her gloves above her head to attract the crew's attention. The airplane's taxi light came on and the airplane began to move forward. The tug driver tried to drive out of the way of the taxiing airplane and the escort left on foot. The left main landing gear impacted the tow bar and the left wing impacted the tug cab. The tug cab collapsed, injuring, and trapping the driver. Airport fire and rescue extricated the driver who was transported to a local hospital for treatment. Post accident examination of the airplane revealed minor damage to the left wing.

NTSB assigned specialists in the following areas to investigate the incident: operations, human performance, cockpit voice recorder (CVR), and flight data recorder (FDR). The Federal Aviation Administration (FAA), Hawaiian Airlines, The Boeing Company, and the Air Line Pilots Association (ALPA) were parties to the investigation. The FDR and the CVR were removed from the airplane and shipped to the NTSB's Vehicle Recorder Laboratory in Washington, DC, for download of data.

C. DETAILS OF THE EXAMINATION

A B717 night ground handling observation took place at OGG from 1930 to 2230 on February 20, 2024. The operations and human performance group chair plus some of the operations group observed a B717 arriving at OGG gate 17, including the arrival, marshalling, chocking, and deplaning of the airplane. Next, the group observed loading of that airplane, pushback, and taxi out for departure 24 minutes after it had arrived.

A tug was in the ramp area at gate 17. A ramp agent entered its cab and turned on its engine. A pair of headlights illuminated. A yellow rotating beacon installed in the aft center portion of the cab's roof illuminated and began to flash. When the beacon switch was selected to OFF, the beacon was not illuminated. A group member asked several ramp agents if they had ever intentionally turned the beacon switch off, and they said no. They said that the beacon switch remained ON so the beacon would automatically illuminate whenever the tug ignition switch was turned. Several ramp agents were asked if they had ever inadvertently turned the beacon switch off, perhaps due to its proximity to adjacent switches. None recalled doing so.

Investigators sounded the tug's horn and measured its volume from 10 ft away using a sound meter app called "Noise" on an Apple Watch version 10.3.1. The loudness of the horn was measured at 103 to 110 db.



Figure 1: Exterior view of front of tug.

The NTSB human performance specialist entered the tug cab and documented driver controls. A horn button was located on the tip of a wand that extended outboard from the left side of the steering column.



Figure 2: Tug steering wheel and wand with horn button.

A cluster of pushbutton switches on the dashboard to the right of the steering column controlled the amber beacon, windshield wipers, headlights, and front and

rear headlights. Each switch was labeled with an icon, and each switch, except for the rear windshield wiper switch, was illuminated by a blue internal light. When a switch was selected ON a green dot also illuminated in the center of the switch.

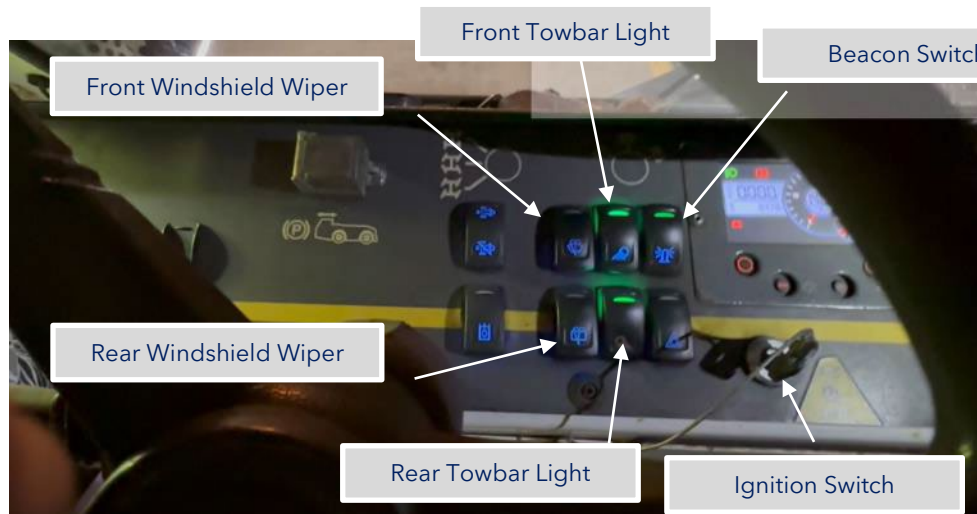


Figure 3: Tug dashboard switch cluster.

A ramp agent connected a towbar between the front of the tug and the nose gear of the airplane. The ramp agent connected opposite ends of a communication cable between the tug and a panel on the left lower left side of the airplane's nose. A dome light inside the cockpit of the airplane was selected ON.



Figure 4: Tug connected to airplane by towbar and communications cable.

Red and green navigation lights were illuminated on the airplane's left and right wingtips, respectively. Amber anticollision beacons were flashing on the top and

bottom of its fuselage. Logo lights illuminated the airline logo on the sides of the tail of the airplane. Lights on top of each wing illuminated the sides of the fuselage.



Figure 5: Exemplar B717 exterior lighting during pushback.

A ramp agent positioned himself near each wingtip to serve as a “wing walkers.” Each carried a pair of lighted wands.



Figure 6: Wing walker using lighted wands.

When the tug driver finished pushing the airplane back, the wing walker on the airplane’s left side (captain’s side) walked toward the nose of the airplane, transitioned to the role of “escort”, and disconnected the towbar from the tug while the wing walker on the right side walked to the nose of the airplane, around the front of the tug, and then walked back to the gate area.



Figure 7: Escort disconnecting towbar from tug.

The tug driver backed the tug up about 3-5 ft while the escort disconnected the towbar from the nose gear of the airplane.



Figure 8: Escort disconnecting towbar from airplane.

The tug driver then backed up a few more ft before driving the tug forward and to the right, positioning it near the captain's side of the airplane, close to the nose of the airplane. The escort connected the towbar to the rear of the tug. The rotating amber beacon on the roof of the tug continued flashing.



Figure 9: Tug repositioned on the left side of the cockpit.

The escort positioned himself below the cockpit in front of the nose gear and monitored the tug driver.



Figure 10: Escort awaiting signal from flight crew via tug driver.

The ramp agent appeared to acknowledge the tug driver with his hand, then removed the nosewheel bypass pin from the nose gear and the communication cable from the side of the fuselage. The escort coiled the cable in his hands and placed it in the tug cab on the passenger side.



Figure 11: Escort disconnecting communication cable.

The tug driver drove back to the ramp area as the tug's amber beacon continued to flash. The ramp agent walked about 40 ft from the cockpit and 45 degrees left of center from the captain's point of view, and turned the wand he was holding to flashlight mode. He then faced the cockpit with his arms held straight overhead with the nose pin ribbon and flashlight in his hands and the flashlight illuminating the ribbon. A cockpit crewmember was seen moving his hands around inside the cockpit (illuminated by the dome light).



Figure 12: Escort displaying pin to flight crew as tug departs the area.

The escort turned away from the airplane and walked to the ramp area. After about one minute, the flight crew began to taxi the airplane. The cockpit dome light remained illuminated. The tug driver parked at the gate.

Another airplane arrived from HNL and parked at the gate. Its passengers were deplaned, the aircraft was to remain overnight (RON). Following the removal of the baggage from the cargo and all passengers and flight crew deplaned, the tug was connected to the tow bar and the group observed the connection of the tow bar. With the towbar connected, the distance from the tug's windshield to the nose of the airplane was about 8 ft.

The group observed the connection of the communication cable to the airplane. The communication cable was a coiled cord. When attached to the airplane the cable sagged downward. Measured along the curve, the cable was a length of about 18 ft. The ground crew estimated that when fully extended, the cable would be over 25 ft in length. The group did not fully extend the cord to measure it, but the group later observed that when the tug was backed up for disconnection of the tow bar, the cable was stretched to a length of about 25 ft. It was still coiled and it appeared that it could extend more if needed.

Two members of the ops and HP group (Group 1, consisting of Stone and Bramble) entered the cockpit to observe a pushback. Two ground service linemen were seated in the pilot seats to apply brakes if needed during the pushback. The other three members of the ops group (Group 2 consisting of Miller, Iwasaki, and Etcher) remained on the ramp. One sat in the tug during the pushback. The others stood nearby.

1.0 Group 1's Observations

Group 1 waited in the front passenger seating row while the airplane was pushed back. When aircraft motion stopped and the parking brake was set, group 1 relocated to the cockpit area. The tug's flashing amber beacon was visible and highly salient directly in front of the airplane when viewed from the captain's seat position.



Figure 13: Tug directly in front of the airplane.

The tug backed up during the towbar removal process, at which time its headlights were visible and bright.



Figure 14: Tug after backing up during towbar removal. (Headlights of tug in photo.)

The tug repositioned to the captain's side of the airplane about 13 horizontal ft from the side of the airplane. Its headlights were no longer visible.

The HP investigator, who was 6'4" tall, sat in the captain's seat and adjusted the seat height so his eye reference point was parallel with the top of the glareshield and

he adjust the seat's fore-aft position so the yoke and rudder pedals were in a comfortable position.



Figure 15: Eye reference point for human performance specialist seated in captain's seat (vehicle shown is a golf cart).

When the HP investigator looked to the left, the tug's amber beacon was seen slightly forward of the center post in the captain's side window, approximately 45 to 50 degrees left of the investigator's center of view when looking straight ahead. Because it was bright and flashing, the beacon was highly salient in the investigator's peripheral field of view. This made the tug's presence quite noticeable. When the beacon was off, the tug's presence was much less noticeable.



Figure 16: Tug positioned 13 ft from the airplane with amber beacon illuminated.

A member of the operations and human performance group stood on the opposite side of the tug and held his arms above his head as if he was holding the nosewheel bypass pin. When the tug's beacon on, he was illuminated by the flashing light. With the beacon off, he was a low contrast target, and spotting him required a more focused visual search.



Figure 17: Tug with amber beacon off and FAA investigator simulating a display of the nosewheel steering bypass pin, with no illumination.

When a lighted wand was turned on in flashlight mode and held between the group member's outstretched arms, his presence was much more noticeable.



Figure 18: FAA investigator simulating display of nosewheel steering bypass pin with ribbon illuminated by a handheld flashlight.

The HP investigator noted the presence of bright stadium lights in the gate area that were pointed toward the airplane and many small scratches in the captain's side

window that made outside objects more difficult to see and caused veiling luminance around bright points of light.



Figure 19: Stadium lights illuminated facing the ramp area.

The HP investigator lowered his head to look at the MCDU³ and then turned his head to the left. Most of the tug was no longer visible because it was obscured by the aircraft structure (the sill of the captain's side window), and the group member standing on the other side of the tug was adjacent to the window frame.

³ Multifunction Control and Display Unit



Figure 20: View of tug with investigator's head lowered and rotated left.

The tug was repositioned about 5 ft away from the side of the airplane. This made it less visible from the reference eye point.

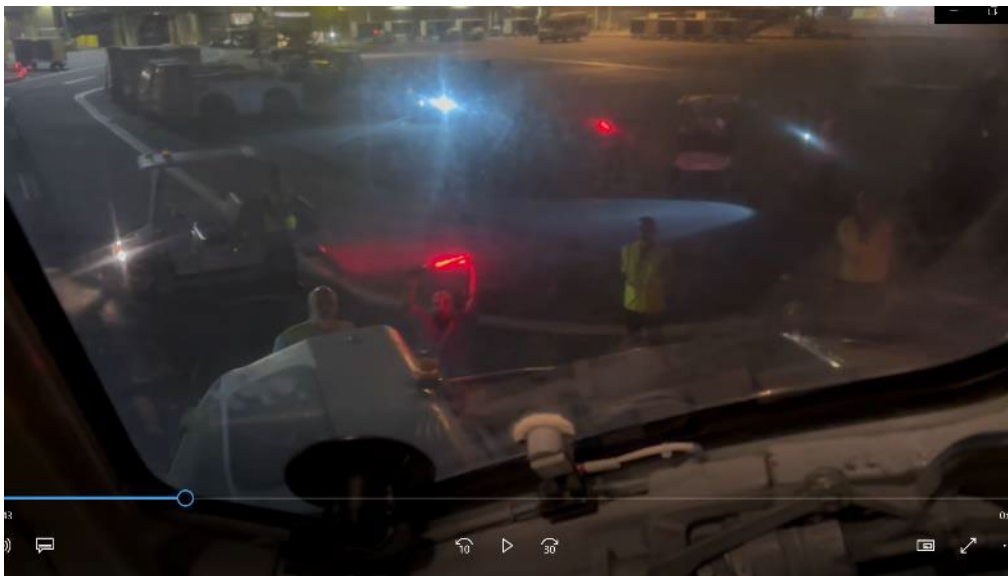


Figure 21: View of tug from reference eye point with tug positioned 5 ft from the side of the airplane.

Next, group 1 observed a pushback from the ground. Figure 22 shows the tug positioned 13 ft from the airplane.



Figure 22: Tug positioned 13 ft from the airplane.

Group 1 observed the cockpit from the point of view of a ramp agent standing on the opposite side of the tug displaying a pin (figure 23). The cockpit was illuminated with the cockpit dome light. In the photograph an operational factors group member is seated in the left (captain) seat and leaning forward approximately 3 inches, when measured from seat back. Another operational factors investigator is standing in the cockpit in close proximity to the jumpseat location and can be seen in the 2nd cockpit window from the right.



Figure 23: View of cockpit from point of view of ramp agent standing and displaying pin on the opposite side of the tug.

Next, the tug was repositioned 5 ft from the airplane.



Figure 24: Tug positioned 5 ft from the side of the airplane.

Next, Group 1 observed the view of the cockpit of a ramp agent standing on the opposite side of the tug, with the tug positioned 5 ft from the airplane. In figure 25, an operational factors group member seated in the left (captain's) seat was leaning forward approximately 14 inches as measured from the seat back.



Figure 25: View of cockpit from the perspective of ramp agent displaying pin while standing on the opposite side of the tug. Tug remained 5 ft from the airplane.

2.0 Group 2's Observations

During the pushback from the viewpoint of the tug seats the wing walkers with lighted ones could clearly be seen. Once the airplane was stopped on the spot in close proximity to where the event occurred, the tug was disconnected from the tow bar and placed in a position 15 ft from the left side fuselage and at a point about 70° from the captain's seating position. The HP GC was observed changing positions with the line service personnel in the left seat. From the ground position, with the cockpit dome light illuminated, the HP investigator was clearly recognized from the ramp. The cockpit

personnel photographed and documented the view from the cockpit with the tug light illuminated.

Subsequently, the tug light was turned to the off position, and documented from the cockpit. The tug was then moved to a position 5 ft from the left side of the fuselage. The view from the cockpit was documented with the tug light both illuminated and off. Additionally, the gear pin was held up over one ground personnel's head that was similar in height as the event wing walker. The pin and flag were held over his head with both lighted wand illuminating it and the light wand turned off.

Additionally, the ops group ground crew documented what could be seen in the cockpit from the ramp position in front of the airplane. About 20 ft in front of the nose gear the personnel could see the top of the cockpit crew's heads that were seated in the pilot seats. Additionally, from about 30 ft in front of the nose the ground personnel could clearly see from about pilot chest height up to and included their faces and top of their heads. The faces were clearly visible from the ramp with the dome light illuminated.

With the concurrence of the cockpit crew the tug was re-attached to the towbar using the rear attach point and pulled into the gate. The jet bridge was reattached to the plane and the ops group ground crew and HP group chair switched positions. The airplane was then pushed back to a close proximity to the first position. The documentation for the second group was done similar to that of the first crew.

The cockpit crew observed the tug in position on the left side of the airplane and could see the yellow beacon on top of the tug clearly from the pilot seat based on various seat height positions. When the beacon light was turned off the tug could still be seen however it was not as apparent but still observable. The group also noted that there was a film on the windows that were similar to delamination however, it could be wiped off with a bare finger and was outside the cockpit window. The line service personnel informed the cockpit crew that it was a salt accumulation. They further advised that the windows are cleaned upon crew request. The salt accumulation did slightly hinder the visibility but the tug was still observed. However, it should be noted that a stenograph sized notebook was placed on the EFB holder attached to the sidewall of the airplane near each pilot's side window. The visibility out that side window was considerably reduced.

The tug was then moved to within 5 ft of the fuselage. As before the cockpit crew could see the tug clearly with the beacon being illuminated however, when it was turned off it was a greater challenge to see. When the notebook was placed at the point where the EFB would be attached in the portrait position the tug was visible but not as clear and required the person seated in the pilot seat to adjust in their seat to see the tug.

Additionally, it was noted that the ground ops group members were seen from the cockpit when in front of the airplane but then as they started walking towards the nose they could not be seen as the glare shield and nose of the airplane blocked the view. Also the group member seated in the right seat reported they could not see the tug nor the wing walker on the left side from their seated position.

The tug was then reconnected to the airplane and was towed back to the gate and secured for the evening.

3.0 Gate Security Camera Video

The investigative team requested security camera video from the Hawaii State Airports Division, Kahului Airport manager at the time of the event. During the night observation the team requested the same gate security video recording, in order to be able to see side by side comparison in similar conditions. It should be noted that although similar night conditions, during the night observation there was no rain in the vicinity as there was at the time of the event. The video camera was mounted in the vicinity of gate 17. The security video for the night observation captured both pushbacks from gate 17. The screen shots below are from the first pushback and are similar to the video coverage of the second pushback. It should also be noted that during both recordings the airplane's beacon, both top and bottom, were illuminated; however, the screen capture did not show that. Additionally, the jet bridge position in the security video obtained from the night observation on February 20, 2024 approximates where it was placed on the event pushback. However, it is likely that the jet bridge position and/or the airplane's position following the pushback may not be in the exact location as they were during the time of the event. It should also be noted that at the time of the event pushback the ramp was wet and reflective. At the time of the night observation the ramp was dry.

Figure 26 was a recording of the event pushback, in the screen shot you can see the wing walker on the left side of the airplane (in red circle) with the right illuminated wand held in the vertical position and the left illuminated wand held in a nearly horizontal position.

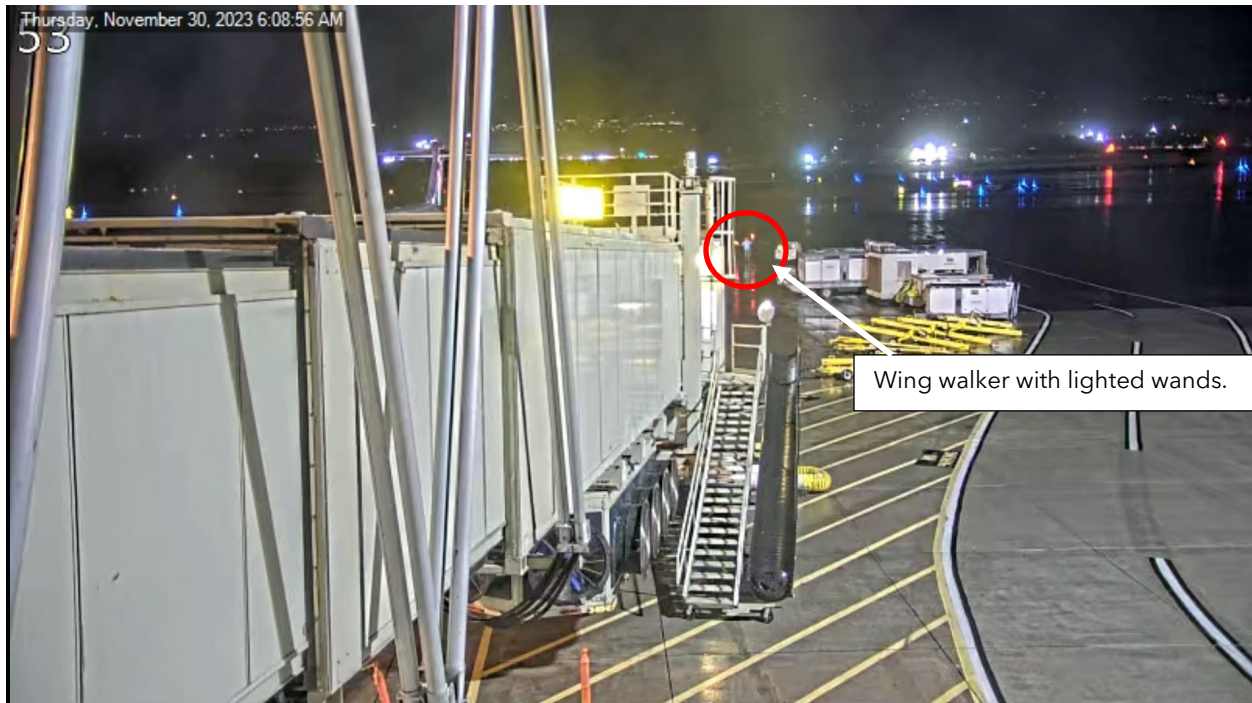


Figure 26: Screen shot during pushback on November 30, 2023. Wing walker with lighted wands visible.

Figure 27 was a recording of the night observation conducted on February 20, 2024. In that screenshot you can see the wing walker on the left side of the airplane with lighted wands (in white circle) with the right illuminated wand held in a nearly horizontal position and the left illuminated wand held in the a near vertical position.

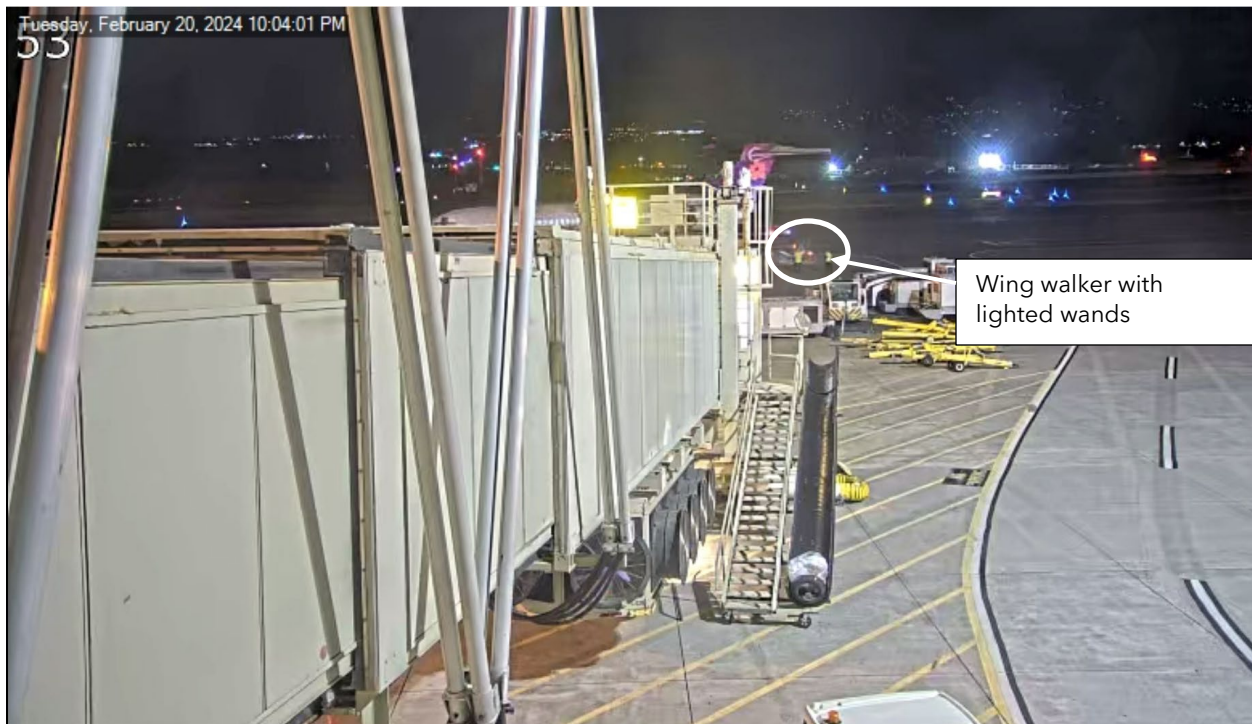


Figure 27: Screen shot during pushback on February 20, 2024. Wing walker with lighted wands visible.

Figure 28 was a screen shot of a recording of the event pushback. The screen shot was after the airplane came to a stop following the pushback from gate 17. Although the tug (in red circle) is partially obscured by the ladder cage on the right side of the jet bridge, there was no visual indication on the recording of a yellow beacon on top of the tug being illuminated.

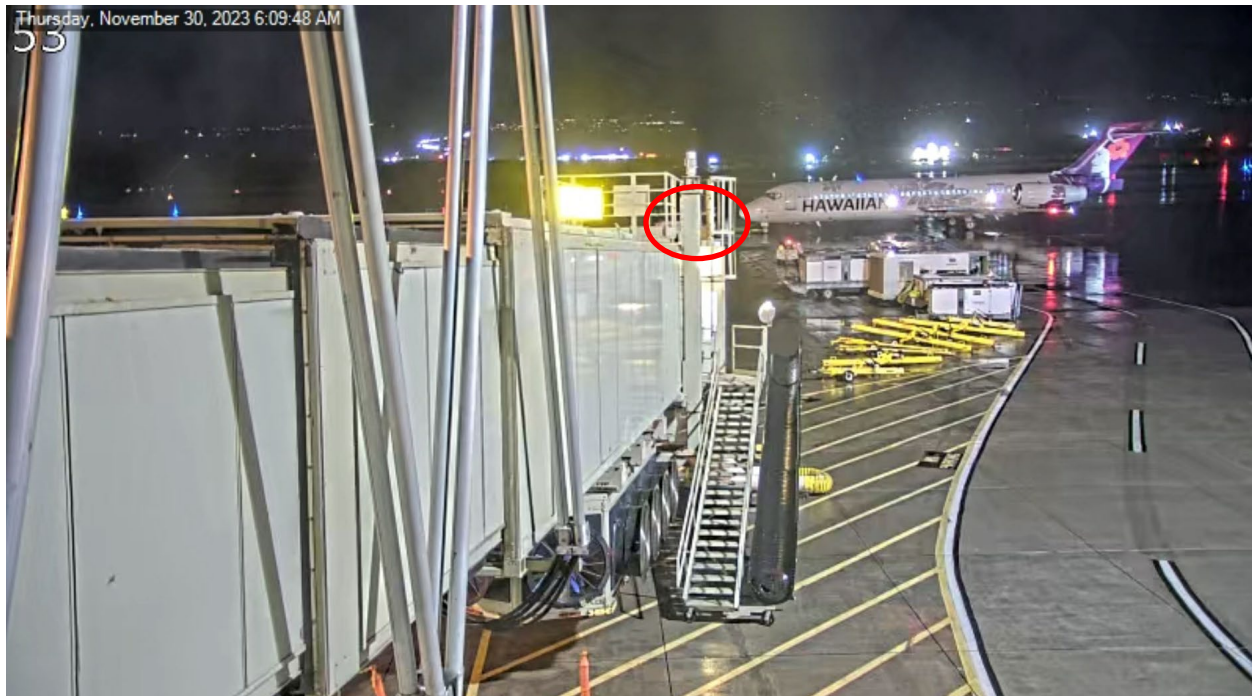


Figure 28: Screen shot after pushback and airplane stopped on November 30, 2023.

Figure 29 was a screen shot from security video recorded on February 20, 2024. The screen shot was captured after the airplane was stopped following pushback from gate 17. In that screen shot you can visually acquire the tug yellow beacon light. Additionally, the screen shot captured a golf cart's beacon, which was also being used during the night observations. Both lights are labeled in the figure.

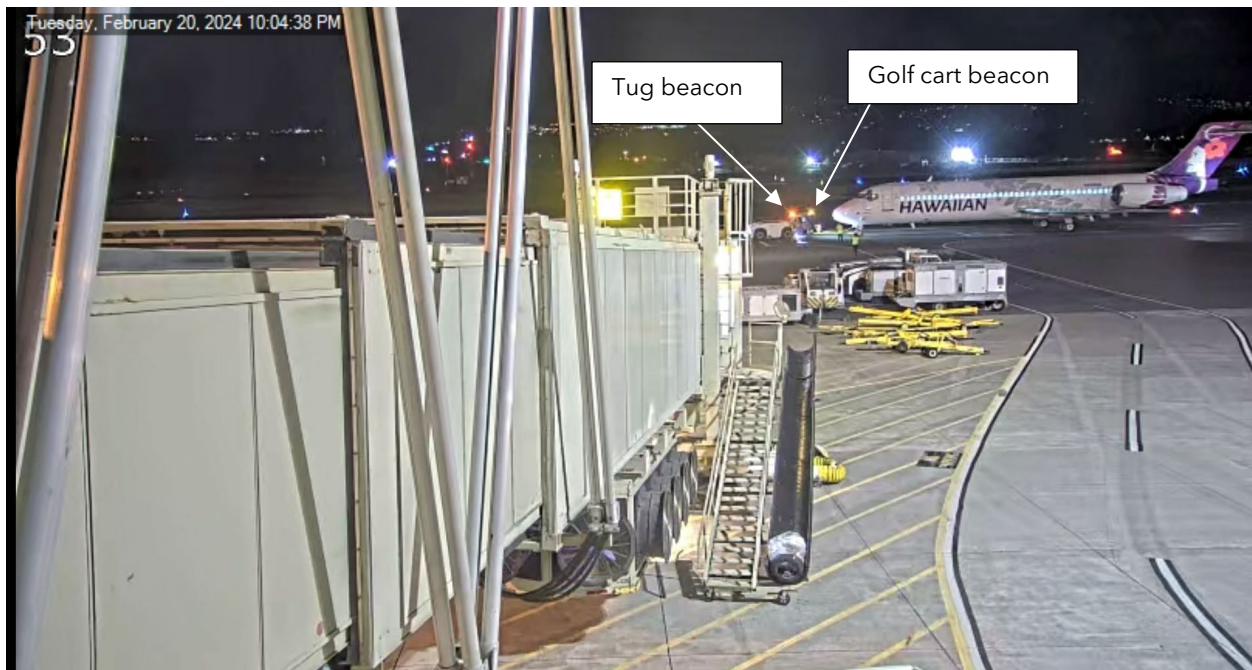


Figure 29: Screen shot after pushback and airplane stopped on February 20, 2024.

Figure 30 was a screen shot obtained from the security video recording of the event pushback. The screen shot captures the tug being positioned of the left side of the airplane's nose. In the screen shot, the tug's headlights (in red circle) are illuminated.

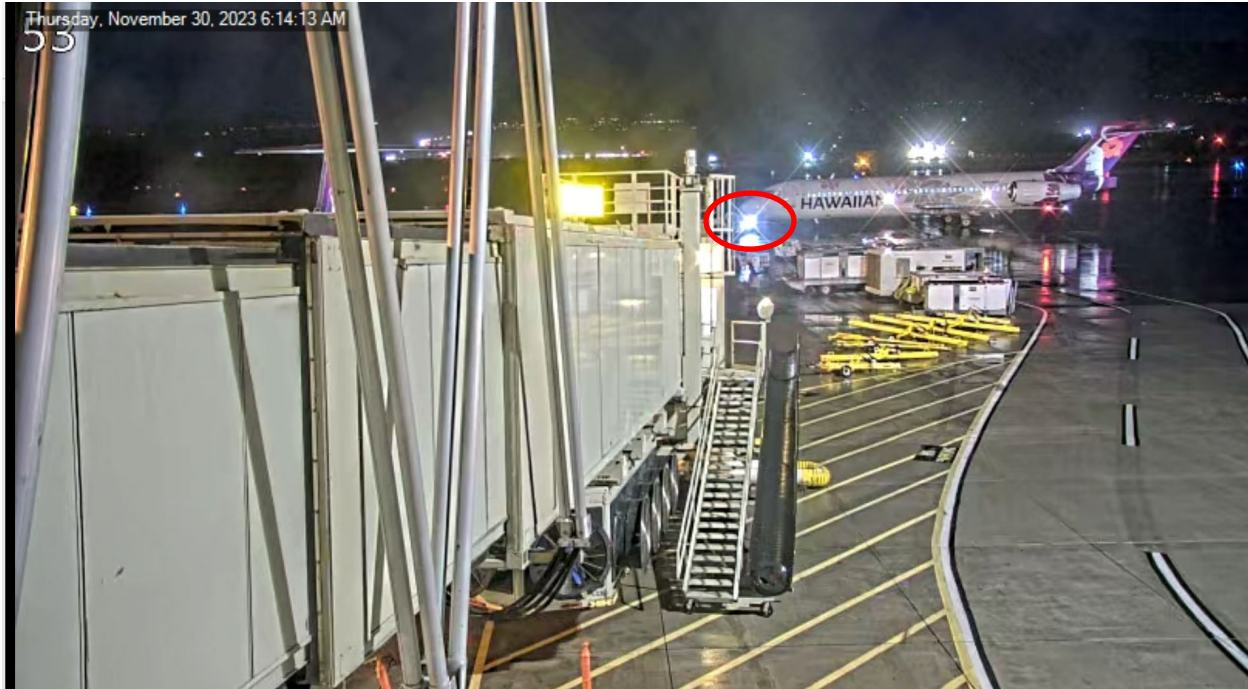


Figure 30: Screen shot after towbar disconnected from airplane on November 30, 2023.

Figure 31 was a screen shot of the security camera video recording that occurred on February 20, 2024. In that screen shot the tug's yellow beacon is illuminated as indicated by the white arrow.

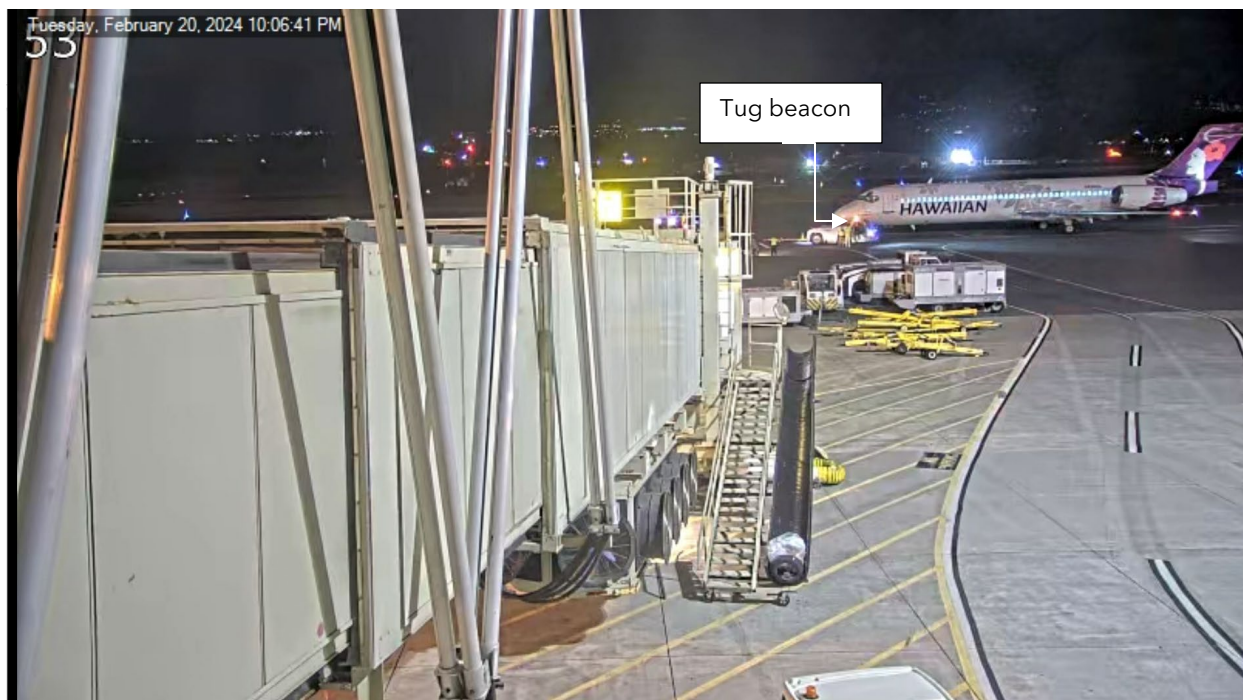


Figure 31: Screen shot after tug placed approximately 10 ft from airplane on February 20, 2024.