

VIKING AIR DHC-6-400 TWIN OTTER
FAA REGISTRATION: N153QS
NTSB ACCIDENT NO: WPR23LA192
PROJECT FINAL REPORT



DATE: March 06, 2023

Submitted To:
Richard Ball
Lone Star Retrieval (LSR)



Submitted By:
Eclipse Group, Inc.



NOTE: It is a violation of Federal Regulation 49 CFR Part 831.13 for any party other than the NTSB to release any information about wreckage or the accident. This includes any photos, sketches, written descriptions, or statements.

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INTRODUCTION

Eclipse Group Inc. (EGI), under contract to Lone Star Retrieval, has been tasked with the search and recovery of a Viking Air DHC-6-400, a Twin Otter aircraft with two souls aboard. The subject aircraft, tail number N153QS, impacted the surface of the Pacific Ocean about 54 km west of the Half Moon Bay Airport (HAF). The objectives of our operations were to search and recover as much wreckage as possible that could potentially aid NTSB in a crash investigation.

This effort was scheduled to be performed over a period of 39 days inclusive of mobilization / demobilization, transit to and from the site, and an estimated onsite period of up to 18 days. Scheduling conflicts, complicated by adverse weather, impacted the initial search necessitating a staged approach. The operations were broken into 4 separate phases:

- Phase 1: Initial Search
- Phase 2: Expanded Search
- Phase 3: Target Identification
- Phase 4: Recovery

Operations were concluded on November 05, 2023, with the successful recovery and delivery of the starboard wing and engine to Port of Astoria, Oregon.

EGI provided vessel, ROV and subsea navigation services in the form of EGI's R/V "BOLD HORIZON (BH), M/V "SWIFT RESPONDER" (Swift), GP-50 Remote Operated Vehicle (ROV) and all personnel required for the operation of these assets.

FINAL REPORT OBJECTIVES

The report objective is to provide a factual summary of this recovery that includes the following elements:

- Pre-job assumptions and preparations
- Local conditions encountered during the operation
- General operational timeline
- Description of operational results
- Lessons learned

RECOVERY OBJECTIVES - (NTSB ACCIDENT NUMBER: WPR23LA192)

The stated recovery objectives to aid NTSB in the investigation were the following:

- Main fuselage
- Both wings / engines
- Fuel bladders (3)
- Pilot / Co-pilot

REPORT RECIPIENTS

Distribution of this report by Eclipse group is limited to the following:

- Lone Star Retrieval (LSR)
- Global Aerospace, Inc.
- National Transportation Safety Board (NTSB)

PROJECT BACKGROUND

A Viking Air Ltd. DHC-6-400 Twin Otter, tail number N153QS, departed Santa Rosa, California on a scheduled transpacific ferry flight on May 20, 2023. The subject aircraft suffered an inflight emergency resulting in the aircraft impacting the surface of the Pacific Ocean, approximately 30 miles west of Half Moon Bay, California.

The aircraft was equipped with an additional three (3) fuel bladder ferry tank system. A presumed equipment malfunction resulted in the aircraft being unable to transfer fuel from the auxiliary to the main system, resulting in fuel starvation and loss of power in both engines. The aircraft had two (2) souls onboard, a pilot and a co-pilot, who both suffered fatal injuries during the accident.

NTSB Preliminary Report:

"On May 20, 2023, at about 1400 Pacific daylight time, a de Havilland DHC-6-400, N153QS, was substantially damaged when it impacted the Pacific Ocean near Half Moon Bay, California. The pilot and 1 passenger were fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations (CFR) Part 91 ferry flight.

The U.S. Coast Guard responded to the accident site. The operator reported that the airplane had a ferry tank system installed and 540 gallons of fuel was added for the transpacific flight. The airplane's amphibious floats were removed for the flight. The flight departed the Charles M Schulz-Sonoma County Airport (STS), Santa Rosa, California, and was destined for Daniel K Inouye International Airport (HNL), Honolulu, Hawaii. After departure, satellite flight tracking data showed the airplane on a southwest heading over the ocean at an altitude of about 15,500 ft mean sea level (msl). About 4 hours into the flight, the crew contacted ATC and reported that they were having a problem transferring fuel from the ferry tanks and that they intended to return. About 356 miles from the California coast, the flight track reversed course to the northeast, towards STS.

*At 1145 time, the flight crew reported that they lost fuel pressure and an engine. The last few minutes of the data shows an altitude drop from about 3,600 to about 240 ft msl. The last track data point was about 33 miles off the California coast. The U.S. Coast guard responded to the scene minutes after the accident. The examination of the wreckage in the water revealed that the fuselage was inverted, and the wings and engines separated from the airplane. The horizontal stabilizer remained partially attached to the empennage and the forward fuselage had impact damage. Occupant and wreckage recovery was not performed."*¹

¹ NTSB WPR23LA192 Preliminary Report

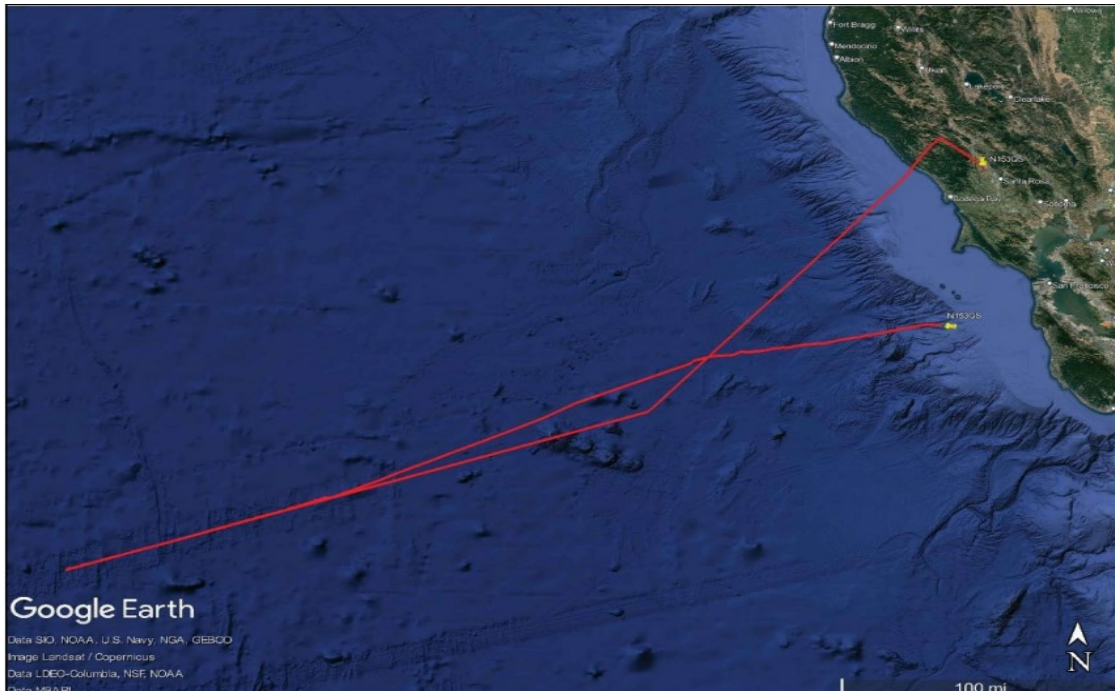


Figure #1. Screenshot of N153QS Flight Track.²

ECLIPSE GROUP INC. (EGI) RECOVERY OBJECTIVES

The objective of EGI's operations was to locate and recover all components of the aircraft to establish the probable cause or causes of equipment failure that precipitated this accident.

PROJECT PARTICIPANTS

- National Transportation Safety Board (NTSB)
- United States Coast Guard (USCG)
- National Oceanic and Atmospheric Association (NOAA)
- Lone Star Retrieval (LSR)
- Eclipse Group Inc. (EGI)

PARTICIPANT INVOLVEMENT & RESPONSE

NATIONAL TRANSPORTATION SAFETY BOARD (NTSB)

The National Transportation Safety Board (NTSB) is leading the investigation of N153QS. The NTSB is responsible for investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation to include railroad, highway, marine and pipeline and issuing safety recommendations aimed at preventing future accidents.

UNITED STATES COAST GUARD (USCG)

The United States Coast Guard (USCG) was alerted to the emergency and deployed a helicopter which spotted the aircraft upside down and partially submerged approximately 40 miles west of Half Moon Bay Airport (HAF). A USCG rescue swimmer was deployed and observed both of the airplane's occupants in the cockpit, unresponsive. The swimmer made a limited attempt to recover the bodies, which was

² Screenshot of N153QS Flight Track from NTSB WPR23LA192 Preliminary Report

unsuccessful. Further efforts were terminated out of safety concerns for the swimmer. The bodies remained strapped into the aircraft. Photos from the responding helicopter show that both wings / engines and the front of the aircraft were separated.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The aircraft was loaded with 1,000 gallons of aviation fuel and represented a risk to indigenous marine life. NOAA and the Fish and Wildlife Service (FWS), alarmed by the presence of fuel within a marine sanctuary for protected habitats required further investigation of potential environmental impact which might include the potential removal of the aircraft to eliminate contamination by residual jet fuel.

It is known that there were three fuel bladders secured in the main compartment. One bladder was subsequently located on the beach at Half Moon Bay. It is unknown if the remaining two bladders are still onboard the aircraft.

The aircraft initially remained on the surface due to the buoyancy of the fuel in the bladders and air pockets trapped in the main fuel tanks. As the bladders either floated free of the aircraft or emptied due to tears, the aircraft sank to the seabed. A large volume of fuel was observed on the ocean surface indicating that one or more of the bladders and fuel tanks had been compromised.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

The EPA is responsible for protecting people and the environment from significant health risks, sponsors and conducts research, and develops and enforces environmental regulations. The EPA works to ensure that contaminated lands and toxic sites are cleaned up properly and revitalized under federal law.

LONE STAR RETRIEVAL (LSR)

LSR representative Mr. Richard Ball, under contract to Global Aerospace Inc., supported on-site and virtually. Mr. Ball was present to monitor search and recovery efforts, advise as necessary, and to coordinate the transfer to shore, then arrange for disposal of the wreckage.

ECLIPSE GROUP INC. (EGI)

EGI was the appointed search and recovery contractor by LSR.

PERIOD OF PERFORMANCE

- June 20, 2023, through November 5, 2023
- This included all four phases, mobilizations, transit times to and from vessel homeports and the operations area, demobilizations and offloading of recovered wreckage.

OPERATIONS AREA (OPAREA)

- Approximately 40 miles off the coast of San Francisco, California
- The crash-site is within San Francisco's vessel traffic separation scheme
 - Coordination with San Francisco's Vessel Traffic Service was required to operate in the area
- The crash-site is within the Monterey Bay National Marine Sanctuary
 - Coordination with NOAA and EPA was required to operate in the area

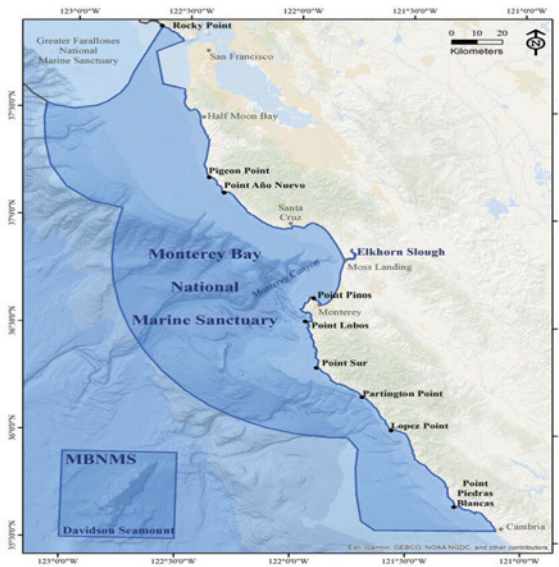


Figure #2. Monterey Bay National Marine Sanctuary³

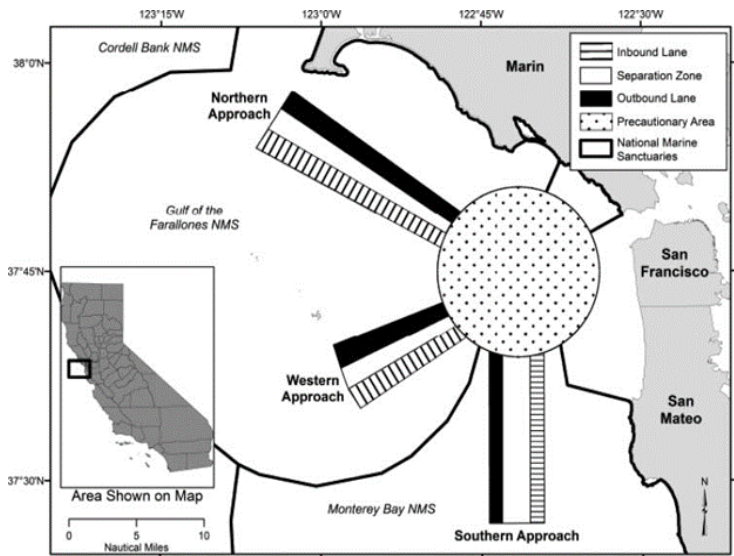


Figure #3. San Francisco Vessel Separation Scheme⁴

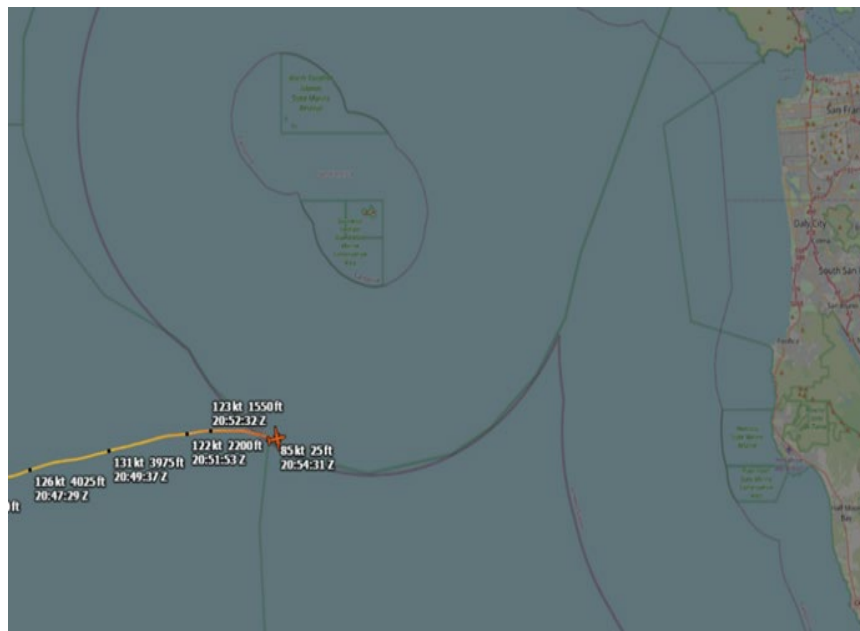


Figure #4. ADS-B Flight Track Relative to the Separation Scheme⁵

³ Screenshot from https://www.researchgate.net/figure/Monterey-Bay-National-Marine-Sanctuary-Monterey-Bay-National-Marine-Sanctuary-MBNMS-is_fig1_337424836

⁴ Vessel Separation Scheme, from https://www.researchgate.net/figure/Study-area-Map-of-the-study-region-including-the-Traffic-Separation-Scheme-TSS-and_fig1_286510830 [accessed 08 Feb, 2024]

⁵ Screenshot from *The tragic twin otter aircraft accident off the California coast: Something terrible went wrong*. Aviation Law Group, <https://www.aviationlawgroup.com/the-tragic-twin-otter-aircraft-accident-off-the-california-coast-something-terrible-went-wrong/>, [accessed 01 Feb, 2024] Note: Image displays the plane's location between the western and southern approaches

SEARCH AREA RATIONALE

A 6nm circular search area was established based on positions reported by the USCG, an emergency response consultancy company – FireFly, and the NTSB. NOAA was consulted and permission was requested to search this area and was approved. Upon completion of EGI’s initial search, it is believed the aircraft wreckage is towards the southeastern portion of the 6nm circle search area. The search area is illustrated below with the rational for this determination.

- Aircraft was reported to still be at the surface when the USCG departed the location; but was “already starting to break-up”
- Photographic evidence taken by the USCG suggest a slowly submerging aircraft
- Assume some amount of drift before submersion
- Seascape chop conditions were reported by several parties to be moderate to unsafe for operations in the days following the accident
- All drift models indicated the probability that the floating wreckage drift prediction was either a South, Southeast, or predominately East/Northeast drift
- None of the drift models indicated a predominantly Western or Northwestern drifting pattern

Initial Hypothesis: N153QS submerged after a relatively short amount of drift, and the recommended sub-surface search area is illustrated in the larger polygon (soft white L-shaped area), with a smaller 6 nm radius circle in the center (yellow) designated as a suggested priority zone.

Subsequent Hypothesis: EGI believes the plane wreckage is towards the southeast of the priority search zone. This is depicted with a yellow square within the 6nm circle. (Could extend outside the circle)

Soft white polygon: suggested total search area
 Yellow circle: suggested priority search area

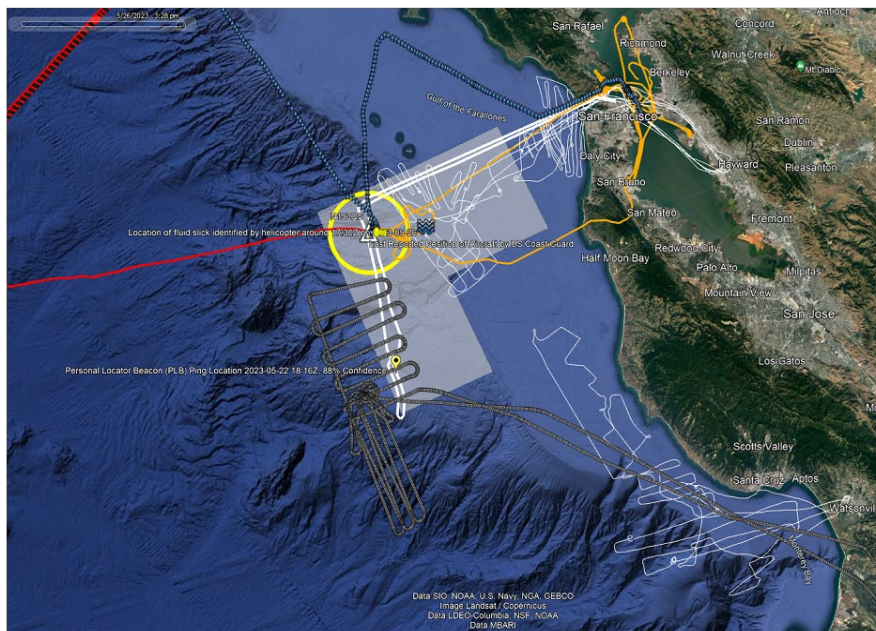


Figure #5. EGI’s Twin Otter Search Area

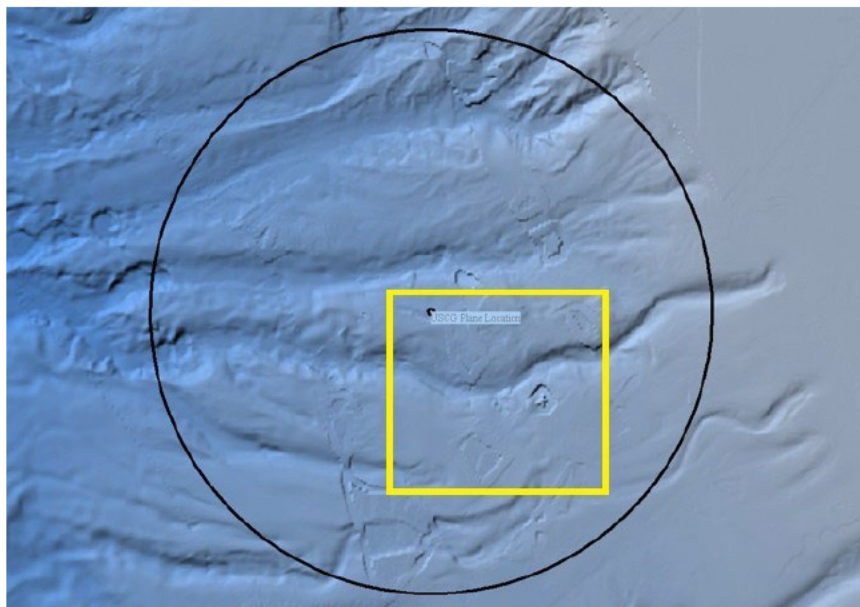


Figure #6. EGI's Assumed Twin Otter Wreckage Location

KEY LOCATIONS

DESCRIPTION	DATE	LATITUDE	LONGITUDE
Center point of suggested priority search area	2023-06-27	37.520833	-123.116944
Last position report from aircraft	2023-05-20	37.522	-123.119
Last known location of the aircraft - USCG	2023-05-20	37.520833	-123.116944
Last Personal Locator Beacon (PLB) ping location	2023-05-22	37.201944	- 123.034722
Location of a large petroleum substance slick	2023-05-26	37.523056	- 122.964722

ASSUMPTIONS

EGI reviewed the available information and concurred with the rational for this search area. This area bordered a shelf that drops off to approximately 3,000 meters. All areas within the search area are approximately 1,400 meters or less, which was a factor in the choice of search assets.

The ocean current as stated above would push the aircraft along the ledge or back toward shore and shallower water.

EGI believes that the last Personal Locator Beacon (PLB) ping location on the day of the crash indicates that it had separated from the aircraft and personnel and was able to travel further and faster than the aircraft due to wind and sea state conditions and is outside of the probability area for the aircraft.

ENVIRONMENTAL CONDITIONS

The crash site is located off Half Moon Bay, south of the entrance to San Francisco Harbor. This location had environmental characteristics that included hard geological features and sediment covering the bottom. There are ravines running through the search area from east to west, which presents challenging bottom conditions. Significant waves and swells are a common characteristic of this area and were present for this operation.

PRE-PLANNING

ASSET JUSTIFICATIONS

Response time is a critical element in aviation investigation. Important evidence may be compromised or lost due to extended exposure / immersion in seawater. Arriving on scene as quickly as possible was our most important objective.

EGI evaluated project assets using following factors:

- Availability of the asset
- Suitability of the asset for the task
- Suitability of the asset for the expected weather conditions
- Geographic proximity of the asset to the project location
- Cost

It is always EGI's primary objective to provide the best technical solution to achieve the desired results at the lowest cost.

The fundamental requirement was to provide a vessel or vessels that could support the following activities:

- Capable of completing a sidescan sonar grid pattern search
- Capable of supporting the installation and operation of an ROV
- Sufficient deck space to support ancillary equipment, i.e. recovery winches, recovery baskets
- Adequate accommodations for the operations personnel
- Adequate load handling equipment i.e. cranes, A-Frames winches to support small wreckage & basket recovery
- Load handling capability to support the lifting of the largest / heaviest anticipated sections of the aircraft
- Sufficient deck space to place these recovered sections of aircraft

When considering 3rd party options, EGI determined the time/cost to transport, mobilize and transit to station individual 3rd party components and additional support equipment weren't necessary as we prepared to utilize both company-owned vessels, as both vessels offered all capabilities and necessities required to complete this operation. EGI determined a smaller vessel (Bold Horizon) would be sufficient in completing search operations while a larger vessel (Swift Responder) would be used as an ROV support vessel for the recovery operations.

PREPARATIONS

Upon completion of contract negotiations and award preparations commenced. Project specific equipment was prepared for the operation. A general list of items included:

- Additional rigging
- Spare Generator
- Recovery Baskets
- Additional Spares
- GP-50
- GP-Mini

PROJECT ASSET DESCRIPTION**ROV SUPPORT VESSEL – RV BOLD HORIZON (BH)**

Figure #7. EGI's Bold Horizon

The BH is a purpose-built, US Flagged, Jones Act compliant, United States Coast Guard (USCG) documented and American Bureau of Shipping (ABS) classed / inspected vessel. The BH has numerous features and capabilities not typically found on similarly sized vessels. Important discriminators include the abundance of interior and exterior deck spaces to support various missions' requirements.

WORKING DECK

The BH has an open main deck area of 2,000 sq. ft. with a minimum loading capacity of 800 pounds per square foot. The deck is equipped with 1"-8 x 24" x 24" O/C deck sockets rated at 5,000 lbs. each.

The vessel is equipped with a variety of load handling equipment including:

- One (1) Nautilus 3400 – 051 telescoping pedestal deck crane located on the starboard aft quarter. The maximum boom extension is 70' and is able to reach most areas of the vessel. The crane capacities are 15,000lbs SWL at 15 ft. extension and 4,000 lbs. at 70 ft.
- One (1) hydraulically operated 12-ton SWL stern A-Frame
- Vertical clearance of 21 feet 7 inches between the cross member and deck and Horizontal clearance of 14 feet between legs and cross member
- Starboard mounted J-Frame for side deployments with a SWL of 9,800 lbs.
- In addition to the load handing equipment the vessel carries two winches and one capstan for client use

VESSEL POSITIONING, ENDURANCE AND EFFICIENCY

The BH is equipped with two (2) variable pitch propellers and bow thruster capable of precision station keeping. This vessel is fuel efficient with a low maximum fuel burn rate of 1,000 gallons per day, giving the vessel an endurance of up to 40-days and a maximum range of 9,600 miles.

The RV Bold Horizon routinely conducts projects where station keeping is a critical component of the mission. With the trawl winch operating off the stern through the 12t A-frame, the vessel/crew maintain high proficiency in holding a tight watch circle during science or ROV missions.

VESSEL HABITABILITY

The BH provides ample accommodations for charterers and crew combined. All cabins are either single or double bunk staterooms, a number of cabins have attached shared bathrooms with additional public shower and bathrooms facilities located on all decks. All interior spaces are environmentally controlled.

ROV SUPPORT VESSEL – MV SWIFT RESPONDER (SWIFT)



Figure #8. EGI's Swift Responder

WORKING DECK

The main and mezzanine / Helipad decks provide a total available deck space of 3,360 square feet for project equipment. The vessel has a boat ramp located on the port stern for auxiliary vessels. Deck equipment includes:

- Two (2) ea. UMOG 20T telescoping cranes with a maximum extension of 60 feet
- One (1) 20T Dynacon articulating A-Frame with Winch
- Fully Instrumented Dynacon Trawl Winch supporting 9/16" wire through the A-Frame (Over 8 Tons of lift capability)
- Three (3) Deck Winches
- One (1) McElroy MC-21 Towing Capstan
- Breakout distribution panel for vessel positioning and numerous 220 and 440 VAC, 3 phase outlets mounted at convenient points around the deck for client data and equipment power requirements.

The deck was designed with an integrated “Peck & Hale” sockets system organized in a 48” grid pattern. Deck cargo capacity is 600 long tons and decking strength of 10,000 lbs. per square foot. These features provide versatility and allow for rapid, cost-effective installation of client project equipment.

VESSEL POSITIONING, ENDURANCE AND EFFICIENCY

The Swift Responder is equipped with two (2) fixed pitch propellers and bow thruster capable of precision station keeping. This vessel is fuel efficient with a low maximum fuel burn rate of less than 2,500 gallons per day. General performance data includes:

- Cruising Speed of 12 knots at 80% HP
- Endurance of 25 days at a continuous 12 knots
- Range of 7,200 nautical miles at 12 knots
- Draft of 13’

VESSEL HABITABILITY

The Swift Responder has the capability to support 38 passengers and crew in a range of large single, double- and eight-man staterooms. Several cabins have attached shared shower / bathrooms with additional public shower and bathrooms facilities located on all decks.

The Swift has a conference room, operations center, and a large client lounge. The galley onboard can host up to 22 people. An 800 square foot science laboratory and separate locker room are located adjacent to the main deck and are intended for client use. All interior spaces are environmentally controlled.

EDGE TECH SIDESCAN SONAR

The EdgeTech 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System is a combination frequency modulated (FM) dual-frequency side scan sonar and a high-resolution FM sub-bottom profiler that uses EdgeTech’s proprietary Full Spectrum “chirp” technologies to simultaneously generate both longer-ranged high-resolution side scan imagery and high-resolution cross-sectional sub-bottom imagery of the seabed at deeper penetrations than conventional continuous wave (CW) systems.

The 2000-DSS Combined Side Scan Sonar and Sub-Bottom Profiling System is dual-frequency configurations for the side scan sonar: 100/400 kHz. The 2000-DSS uses a high frequency, 2–16 kHz sub-bottom sonar for higher resolution sub-bottom imaging in water depths up to 2000 meters.

The two side scan frequencies and the sub-bottom frequency are transmitted simultaneously as linearly swept wideband high-energy acoustic pulses (also called “chirp pulses”) over a full spectrum frequency range. The received echoes are processed into high signal-to-noise (SNR) images, which can be directly displayed as shades of gray or color on a computer monitor and printed on a continuous feed thermal printer. The data can also be stored in real-time onto a large capacity hard drive and archived onto a DVD.

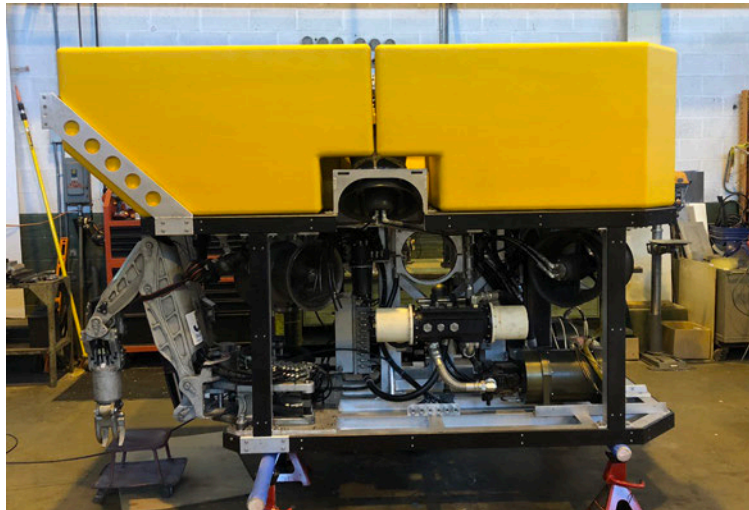
**EGI REMOTE OPERATED VEHICLES (ROV)
GP-50**

Figure #9. EGI's GP-50

EGI is providing the GP-50 ROV (A second vehicle is also provided as back-up, aka GP-Mini) as the host vehicle for this operation. The GP-50 is an EGI designed vehicle and is a continuation and advancement on previous EGI Deep-water vehicle systems. The ROV is purpose built for deep-water operations to a depth of 6,000 meters. Design considerations included an emphasis on reliability, flexibility, and low cost of repair.

System architecture focuses on simplicity in design, ensuring reliability yet allowing for the integration of various sensors and work packages to accomplish a wide range of missions. Technical simplicity, reliability and adaptability delivers low risk of performance and best price value to our customers.

The vehicle is equipped with two manipulators, load releases and tooling ports allowing it to perform the work required for this scope of work. Data recording is achieved with a video suite consisting of standard definition (SD), High Definition (HD), low light cameras and lighting to ensure high quality image recording. All videos are recorded using the Digital Edge EdgeDVR-1HD-4SD System. When used with the precision USBL subsea navigation system, ROV position, depth and other critical information would be overlaid onto the video and stored.

SURVEY POSITIONING, TRACKING AND DATA ACQUISITION

Surface / Sub surface tracking will be achieved by utilizing Sonardyne Ranger II Ultra Short Base Line (USBL) system with beacons to track the ROV position on the seafloor. This information will be provided to the QINSy Integrated Navigation system for tracking and data collection.

The Sonardyne Ranger 2 USBL is a precision, survey- grade Ultra-Short Base Line (USBL) acoustic positioning system designed for Dynamic Positioning (DP) reference and for ROV/towfish tracking operations, primarily for construction and survey use. Ranger 2 can track up to ten targets simultaneously to ranges of greater than 6,000 meters. QINSy (Quality Integrated Navigation System) is a hydrographic data acquisition, navigation, and processing software package. The suite of applications can be used for various types of surveys, ranging from simple single beam surveys up to complex offshore construction works. QINSy is well suited to these types of linear surveys, whether the inspection sensors are mounted on the surface vessel itself or on ROVs, or other subsurface vehicles.

WEATHER MITIGATION

All vessels and equipment are designed and maintained to operate in open ocean with the conditions that typically may be expected in an open environment. EGI uses established limits for weather conditions, as shown below. EGI vessels are required to continuously monitor weather and the company subscribes to the weather reporting service DTN, <https://www.dtn.com>

The typical service includes twice daily weather reports with a seven-day forecast. EGI establishes weather parameters, which the DTN identifies and flags with both predicted winds, swell and wave heights with a color-coding system to indicate where these states fall with-in EGI's established parameters. EGI also utilizes other local, publicly available weather reporting sources to include NOAA, and "Windy" as an example. These weather reports will be transmitted daily to all vessels. Example of our report is shown below:

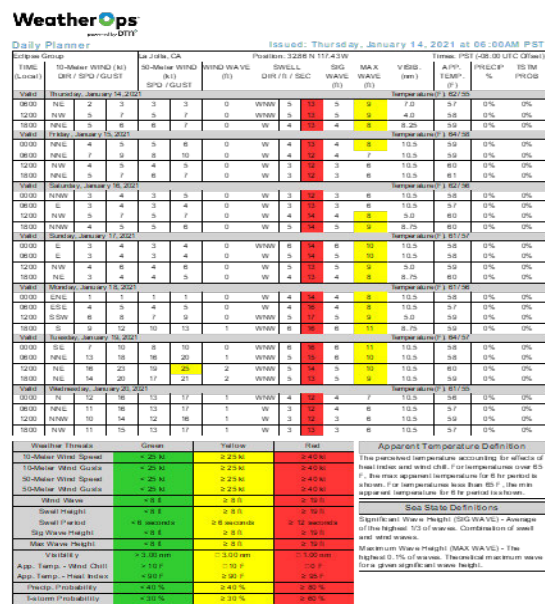


Figure #10. Example of weather report

ANTICIPATED WEIGHTS OF WRECKAGE

TARGET WEIGHTS OF INDIVIDUAL PIECES	NOMINAL WEIGHT	NOTES
MAX TAKE OFF WEIGHT	12,500 lbs.	This is total weight of aircraft (dry) for comparison purposes
MAX WEIGHT (FERRY FLIGHT EXCEPTION)	17,500 lbs.	140% of normal max weight
FUEL BLADDER #1*	2,380 lbs.	350 Gal @ 6.8 lbs. per gallon
FUEL BLADDER #2	2,380 lbs.	350 Gal @ 6.8 lbs. per gallon
FUEL BLADDER #3	2,380 lbs.	350 Gal @ 6.8 lbs. per gallon
WING / ENGINE (STARBOARD)	4,850 lbs.	390 Gal @ 8.5 lbs. per gallon (seawater)
WING / ENGINE (PORT)	4,850 lbs.	390 Gal @ 8.5 lbs. per gallon (seawater)
AFT FUSELAGE	4,500 lbs.	"Worst-case" weight of Aft section
FWD FUSELAGE DEBRIS	500 lbs.	Damaged on impact
- One bladder is known to be no-longer on the aircraft - The aircraft was over max take-off weight (exceptions up to 140% for ferry-flight) - Weights are based on incomplete information and are assumptions only		

RIGGING

During operational planning, estimated maximum static and dynamic weights with entrained water were evaluated, assumptions based on our proposed working sea state parameters to establish a base line maximum load. The maximum static weight was estimated to be around 4,850lbs. Potential dynamic loading was then estimated to determine the safe working loads of the heaviest possible lifts. It was known that both wings, and the engines were detached from the fuselage, which would suggest the fuselage, or the wings (with engines attached) would be the heaviest section of the aircraft.

EGI's plan was to utilize a series of different recovery and rigging strategies for each individual item to be recovered during the recovery. Given the sea-state and depth of the operation, the ROV utilized choker hitches around the wing on both sides of the engine, with a third around the engine itself. The compression of the choker hitch and increased tension would tighten down more securely and provide greater control of the load. All objects being recovered would be lifted by using a combination of thru-frame ROV lifts. Once an item is rigged and ready to be lifted for recovery, the ROV would attach itself to the load and the operations team would start to recover the ROV. When the ROV reaches the surface, the operations team would then transfer the load to the vessel's deck crane to be lifted from the water to the vessel's deck.



Choker Hitch

Figure #11. Choker hitch⁶

⁶Photo from: <https://www.mazzellacompanies.com/learning-center/what-is-best-sling-hitch-vertical-basket-choker-bridle/>

SEARCH AND RECOVERY EFFORTS

This operation was broken into 4 separate phases due to unfavorable sea-states and asset availability. The 1st and 2nd phases were the search phases, and the 3rd and 4th phases were the recovery phases. During the searching phases, EGI opted to focus the search efforts on the center and east of the last known positions running north / south lines on the assumption that the aircraft drifted, and the wreckage would be at a location southeast of the last known position. The search was performed using a high-pass approach at a lower frequency to provide an optimal swath or coverage of 500 meters per side of the sidescan. Reciprocal lines were run to give 100% coverage of the nadir that is present under the sidescan. An example of a nadir is provided below. By running overlapping lines the area not seen within the nadir is covered.

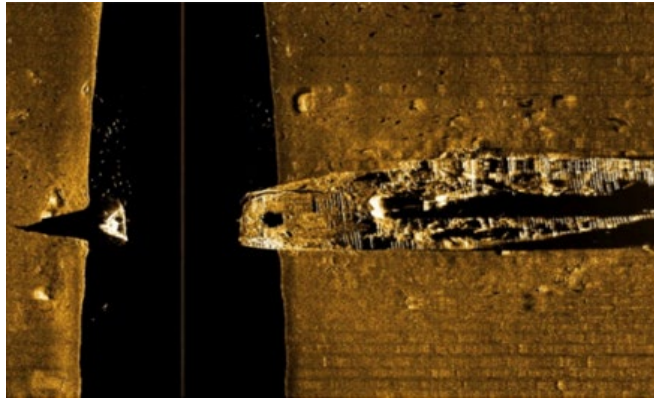


Figure #12. Example of a Nadir

Once a target of interest is identified, a “low-pass” at a higher frequency is performed to obtain a high resolution of the target. If the aircraft is identified, multiple lines are run over the target to image it from multiple directions, which better defines the position on bottom.

OPERATION OVERVIEW

The initial search (Phase 1) was performed by the Bold Horizon conducting sidescan sonar search grid lines, June 24, 2023, through June 26, 2023. The continued search (Phase 2) resumed on July 26, 2023, and lasted until August 3, 2023. For the initial recovery effort (Phase 3), the Bold Horizon returned to the crash-site with EGI’s ROV team to investigate potential targets on August 8, 2023, until August 13, 2023. Finally, the wing and engine recovery (Phase 4) was performed by the Swift Responder on October 29, 2023.

PHASE 1: THE INITIAL SEARCH

Operations started on June 24th at 03:15 and continued until 12:40 on June 26th. The initial search was performed by running “racetrack turns” to try and maximize turn efficiency. This produced two main data groups (shown below in orange). The data in the middle of the circle was run at a heading NNW (340 degrees), whereas the eastern side of the circle was run at a heading SSE (160 degrees). This pattern is best to collect data by running groups of the same direction. Two data gaps became present in the NE quadrant of the circle because the operations team encountered a 200m “wall” that came up very quickly. This is an example of the difficulties of flying in and out of the steep terrain. Water depths encountered ranged from 600 meters to 1200 meters as anticipated. A total of 38.77% of the priority search area was covered during this time, however, operations were suspended due to increasingly poor weather which endangered the sidescan system. The aircraft was not located during this period.

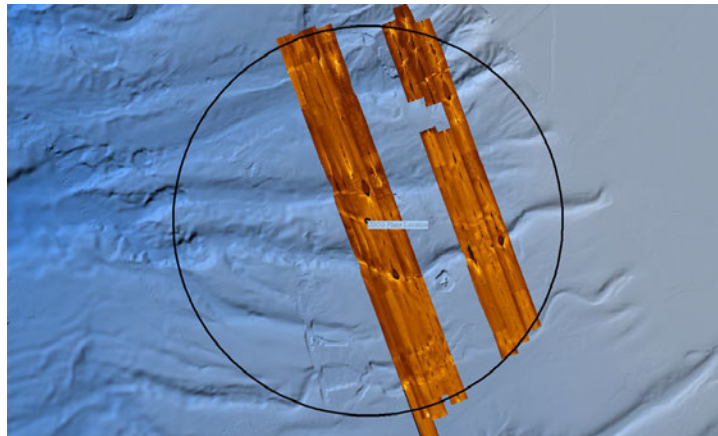


Figure #13. Initial Search Area Progress

INITIAL SEARCH PROGRESS

Date	Description	Distance Searched	Accumulative Search	Distance Remaining	Total Percentage Covered
6/24	Search Day 1	64.40km	64.40km	367.49km	14.91%
6/25	Search Day 2	84.41km	149.81km	282.08km	34.69%
6/26	Search Day 3	17.65 km	167.46km	264.43km	38.77%

PHASE 2: THE CONTINUED SEARCH

Operations resumed at 21:00 on July 26th and lasted until 03:00 on August 3rd. The Bold Horizon returned to the search location and the survey team focused their search efforts towards the southeastern portion of the 6nm circle priority search area. The survey team believed the aircraft wreckage was within this area due to an amount of potential target hits they were receiving on sonar. The survey team covered 100% of the new priority search grid (shown below as square box within southeastern quadrant) and had numerous targets of interest that would require the ROV to further investigate. The Bold Horizon then transited to San Francisco to mobilize the ROV crew to inspect the potential targets.

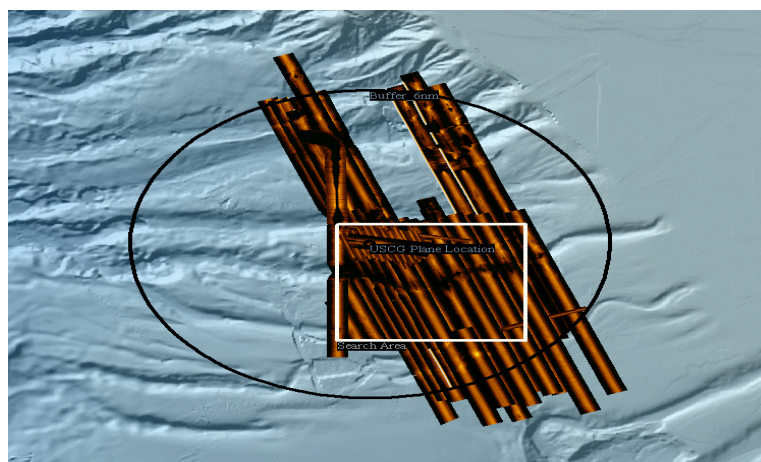
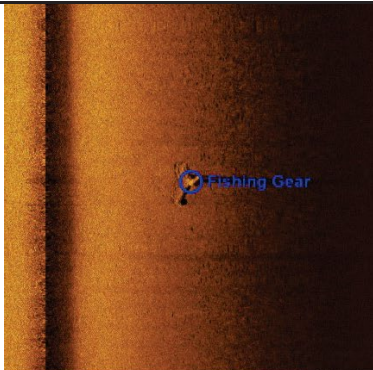
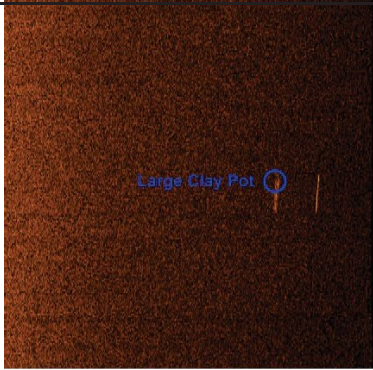
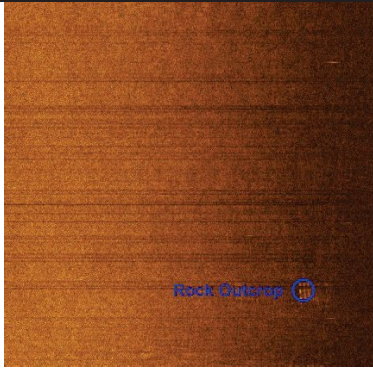


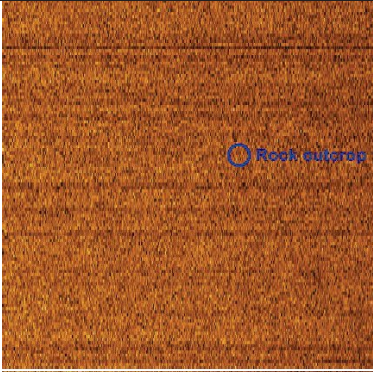
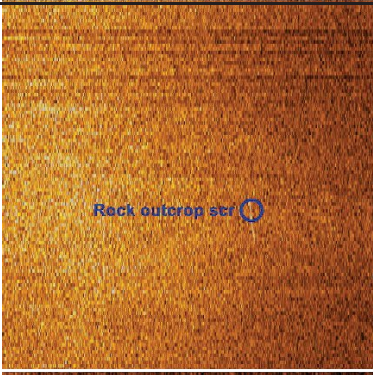
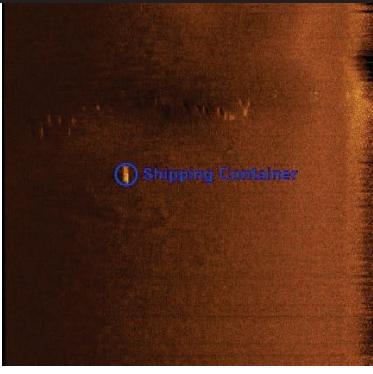
Figure #14. Updated Priority Search Area Progress

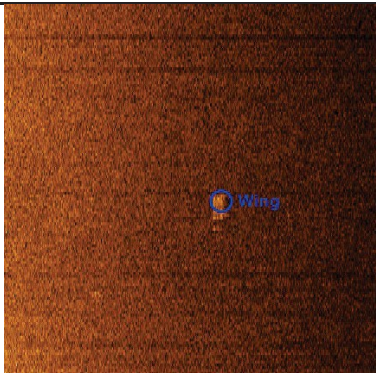
PHASE 3: INITIAL RECOVERY EFFORT

The ROV team mobilized in San Francisco and joined the Bold Horizon to inspect all targets of interest. These diving operations lasted from 00:20 on August 9, 2023, until August 13, 2023, at 17:05. During this phase, the sonar targets were identified (as shown below) as the twin otter's starboard wing and engine, fishing gear, a U.S based shipping container, pottery, rock piles and other geological foundations. After inspection of all sonar hits, the ROV began rigging the wing / engine for recovery. The operations concluded due to other scheduled job obligations.

TARGETS

Target Image	Target Info	User Entered Info
	Fishing Gear - Sonar Time at Target: 7/28/2023 6:58:20 PM - Click Position 37.4723023607 -123.0279761363 (WGS84) (X) 497526.27 (Y) 4147268.87 (Projected) - Map Projection: EPSG:26910 - Acoustic Source File: HMB_209_0500_1822.jsf - Ping Number: 23826 - Range to target: 46.88 Meters - Fish Height: 15.53 Meters - Heading: 175.600 Degrees - Course Made Good: 160.604 Degrees - Event Number: (-1) - Line Name: HMB_209_0500_1822 - Water Depth: 496.03 Meters	Dimensions and Attributes - Target Width: 4.20 Meters - Target Height: 7.02 Meters - Target Length: 11.71 Meters - Target Shadow: 38.65 Meters - Mag Anomaly: N/A - Avoidance Area: N/A - Classification1: N/A - Classification2: N/A - Area: N/A - Block: N/A - Description: N/A
	Large Clay Pot - Sonar Time at Target: 8/2/2023 11:52:02 AM - Click Position 37.5269339012 -123.1203485472 (WGS84) (X) 489366.20 (Y) 4153336.27 (Projected) - Map Projection: EPSG:26910 - Acoustic Source File: HMB_214_1517_1132.jsf - Ping Number: 1594827 - Range to target: 102.25 Meters - Fish Height: 16.79 Meters - Heading: 322.390 Degrees - Course Made Good: 339.742 Degrees - Event Number: (-1) - Line Name: HMB_214_1517_1132 - Water Depth: 909.36 Meters	Dimensions and Attributes - Target Width: 0.92 Meters - Target Height: 0.20 Meters - Target Length: 8.73 Meters - Target Shadow: 1.22 Meters - Mag Anomaly: N/A - Avoidance Area: N/A - Classification1: N/A - Classification2: N/A - Area: N/A - Block: N/A - Description: N/A
	Rock Outcrop - Sonar Time at Target: 6/26/2023 6:27:28 PM - Click Position 37.4840733510 -123.0238912592 (WGS84) (X) 497887.80 (Y) 4148574.67 (Projected) - Map Projection: EPSG:26910 - Acoustic Source File: HalfMoonBay_SSS_20230626_Line41.002.jsf - Ping Number: 116253 - Range to target: 423.27 Meters - Fish Height: 56.33 Meters - Heading: 147.890 Degrees - Course Made Good: 159.950 Degrees - Event Number: (-1) - Line Name: HalfMoonBay_SSS_20230626_Line41.002 - Water Depth: 412.09 Meters	Dimensions and Attributes - Target Width: 2.50 Meters - Target Height: 0.00 Meters - Target Length: 19.39 Meters - Target Shadow: 0.00 Meters - Mag Anomaly: N/A - Avoidance Area: N/A - Classification1: N/A - Classification2: N/A - Area: N/A - Block: N/A - Description: N/A

	Rock Outcrop • Sonar Time at Target: 7/28/2023 6:33:17 PM • Click Position 37.4898030410 -123.0351935227 (WGS84) (X) 496888.82 (Y) 4149210.65 (Projected) • Map Projection: EPSG:32610 • Acoustic Source File: HMB_209_0500_1822.jsf • Ping Number: 15197 • Range to target: 29.12 Meters • Fish Height: 15.38 Meters • Heading: 173.890 Degrees • Course Made Good: 160.201 Degrees • Event Number: (-1) • Line Name: HMB_209_0500_1822 • Water Depth: 490.24 Meters	Dimensions and Attributes • Target Width: 1.28 Meters • Target Height: 0.57 Meters • Target Length: 5.91 Meters • Target Shadow: 1.02 Meters • Mag Anomaly: N/A • Avoidance Area: N/A • Classification1: N/A • Classification2: N/A • Area: N/A • Block: N/A • Description: N/A
	Rock Outcrop • Sonar Time at Target: 6/25/2023 6:32:14 PM • Click Position 37.5200139187 -123.1149645963 (WGS84) (X) 489840.98 (Y) 4152567.95 (Projected) • Map Projection: EPSG:26910 • Acoustic Source File: HalfMoonBaySSS_20230625_Line26.001.jsf • Ping Number: 179533 • Range to target: 135.70 Meters • Fish Height: 72.59 Meters • Heading: 321.690 Degrees • Course Made Good: 340.257 Degrees • Event Number: (-1) • Line Name: HalfMoonBay_SSS_20230625_Line26.001 • Water Depth: 727.16 Meters	Dimensions and Attributes • Target Width: 0.55 Meters • Target Height: 0.00 Meters • Target Length: 14.26 Meters • Target Shadow: 0.00 Meters • Mag Anomaly: N/A • Avoidance Area: N/A • Classification1: N/A • Classification2: N/A • Area: N/A • Block: N/A • Description: N/A
	Rocks and Misc Debris • Sonar Time at Target: 8/3/2023 6:43:50 AM • Click Position 37.5247514729 -123.1270680664 (WGS84) (X) 488772.15 (Y) 4153094.92 (Projected) • Map Projection: EPSG:26910 • Acoustic Source File: HMB_215_1521_0626.jsf • Ping Number: 1961992 • Range to target: 51.81 Meters • Fish Height: 14.58 Meters • Heading: 324.500 Degrees • Course Made Good: 340.086 Degrees • Event Number: (-1) • Line Name: HMB_215_1521_0626 • Water Depth: 907.30 Meters	Dimensions and Attributes • Target Width: 0.93 Meters • Target Height: 0.40 Meters • Target Length: 4.04 Meters • Target Shadow: 1.46 Meters • Mag Anomaly: N/A • Avoidance Area: N/A • Classification1: N/A • Classification2: N/A • Area: N/A • Block: N/A • Description: N/A
	Shipping Container • Sonar Time at Target: 6/26/2023 5:03:54 PM • Click Position 37.5557395281 -123.0477922269 (WGS84) (X) 495778.78 (Y) 4156526.33 (Projected) • Map Projection: EPSG:26910 • Acoustic Source File: HalfMoonBay_SSS_20230626_Line41.001.jsf • Ping Number: 109027 • Range to target: 334.46 Meters • Fish Height: 50.22 Meters • Heading: 146.790 Degrees • Course Made Good: 159.282 Degrees • Event Number: (-1) • Line Name: HalfMoonBay_SSS_20230626_Line41.001 • Water Depth: 606.12 Meters	Dimensions and Attributes • Target Width: 6.31 Meters • Target Height: 2.72 Meters • Target Length: 22.57 Meters • Target Shadow: 19.16 Meters • Mag Anomaly: N/A • Avoidance Area: N/A • Classification1: N/A • Classification2: N/A • Area: N/A • Block: N/A • Description: N/A

	Starboard Wing / Engine • Sonar Time at Target: 7/27/2023 9:35:12 AM • Click Position 37.5221937842 -123.0973649870 (WGS84) (X) 491396.45 (Y) 4152808.04 (Projected) • Map Projection: EPSG:26910 • Acoustic Source File: HMB_209_0115_0918.jsf • Ping Number: 30413 • Range to target: 195.28 Meters • Fish Height: 62.67 Meters • Heading: 149.600 Degrees • Course Made Good: 158.782 Degrees • Event Number: (-1) • Line Name: HMB_209_0115_0918 • Water Depth: 631.22 Meters	Dimensions and Attributes • Target Width: 5.70 Meters • Target Height: 0.96 Meters • Target Length: 11.12 Meters • Target Shadow: 3.05 Meters • Mag Anomaly: N/A • Avoidance Area: N/A • Classification1: N/A • Classification2: N/A • Area: N/A • Block: N/A • Description: N/A
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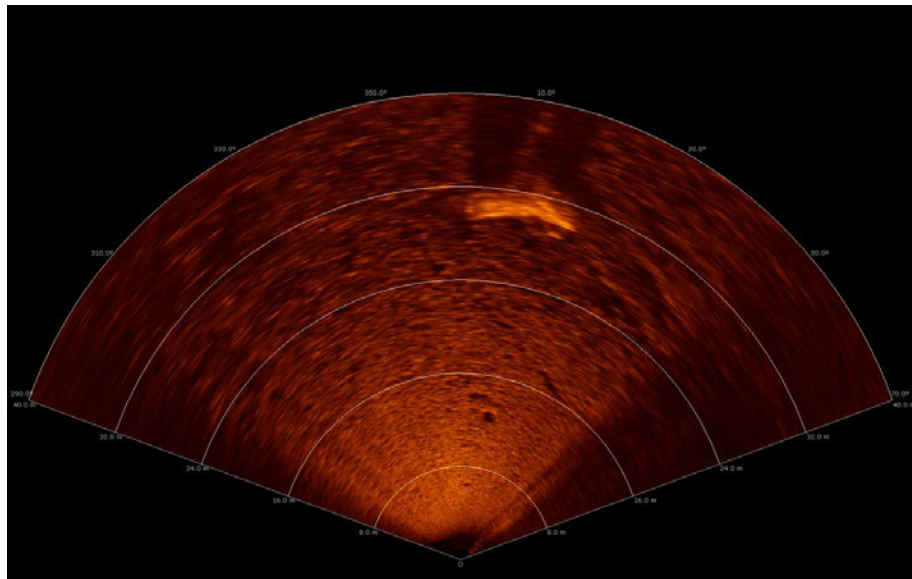


Figure #15. Wing and Engine Sonar

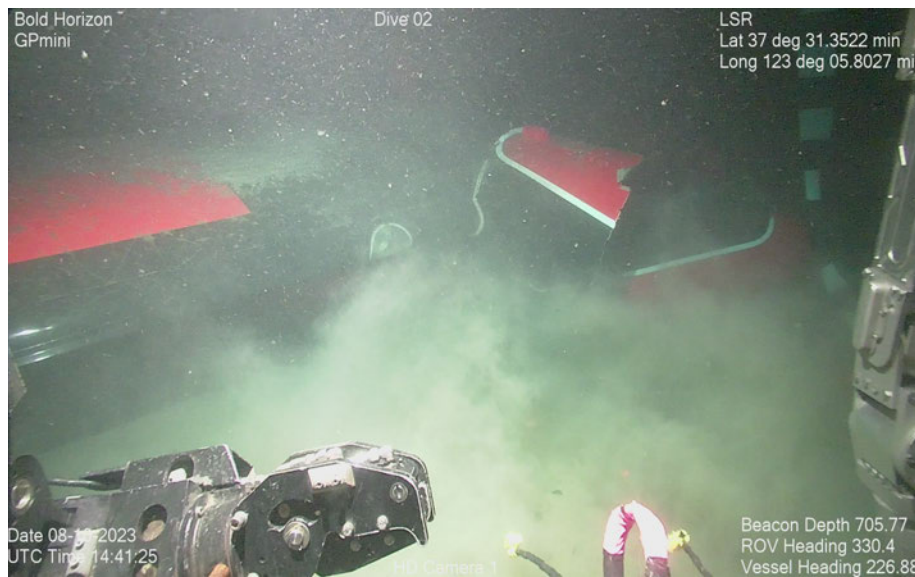


Figure #16. Wing and Engine Inspection (1)

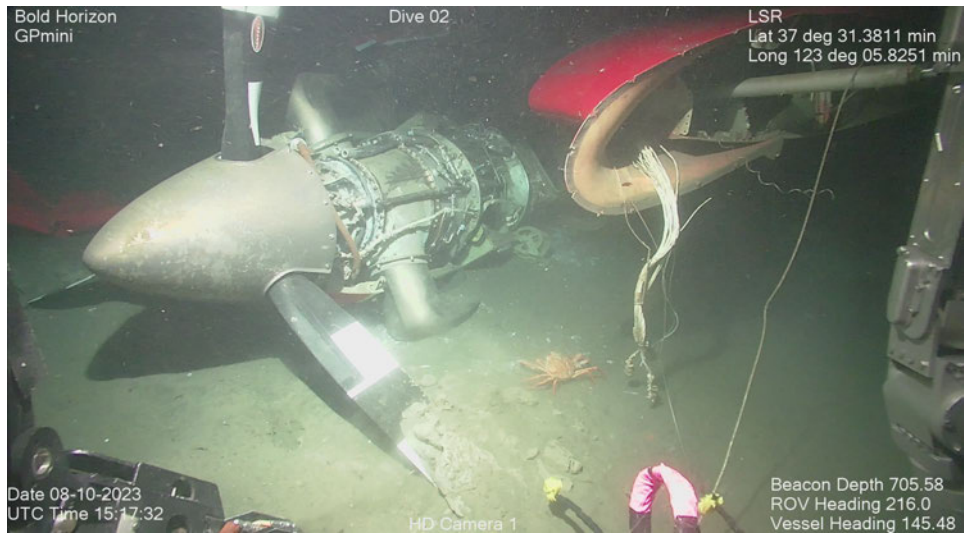


Figure #17. Wing and Engine Inspection (2)

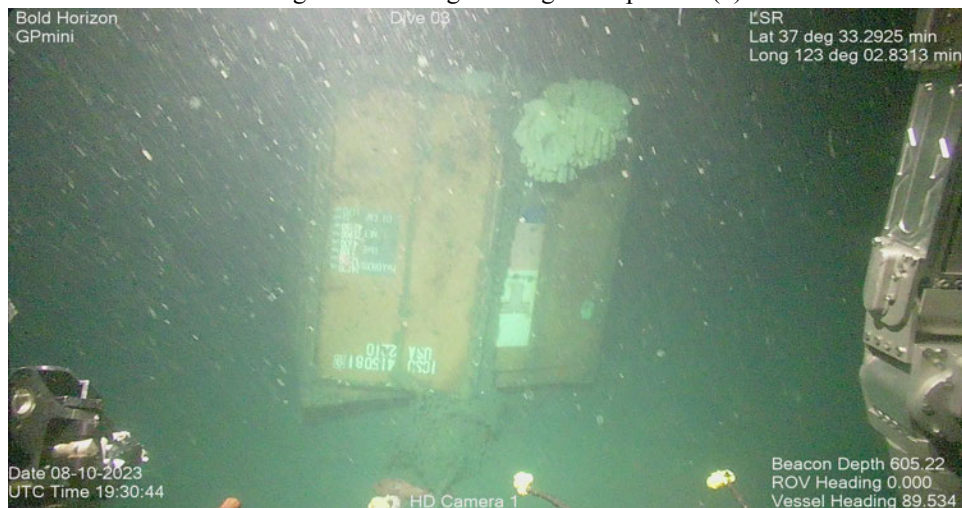


Figure #18. Shipping Container

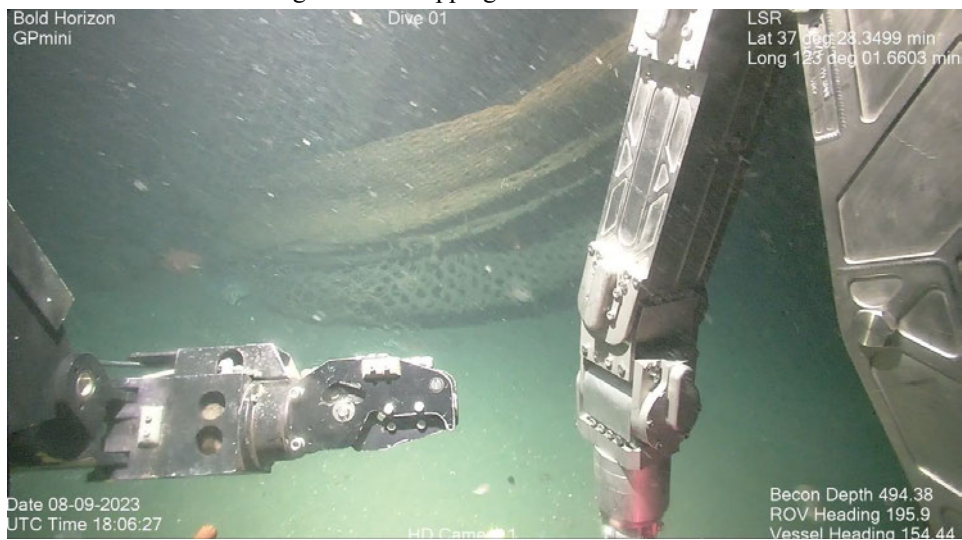


Figure #19. Fishing Debris



Figure #20. Large Clay Pot

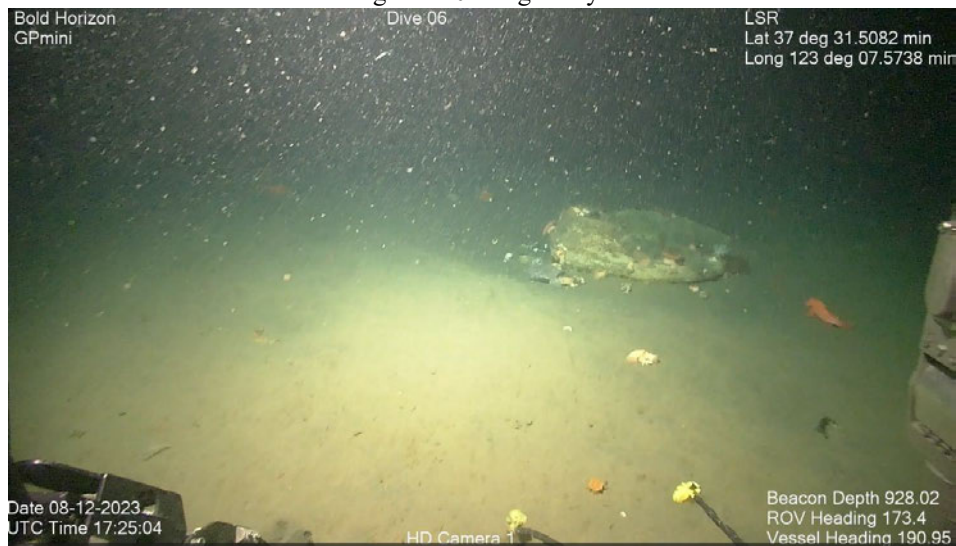


Figure #21. Large Rock

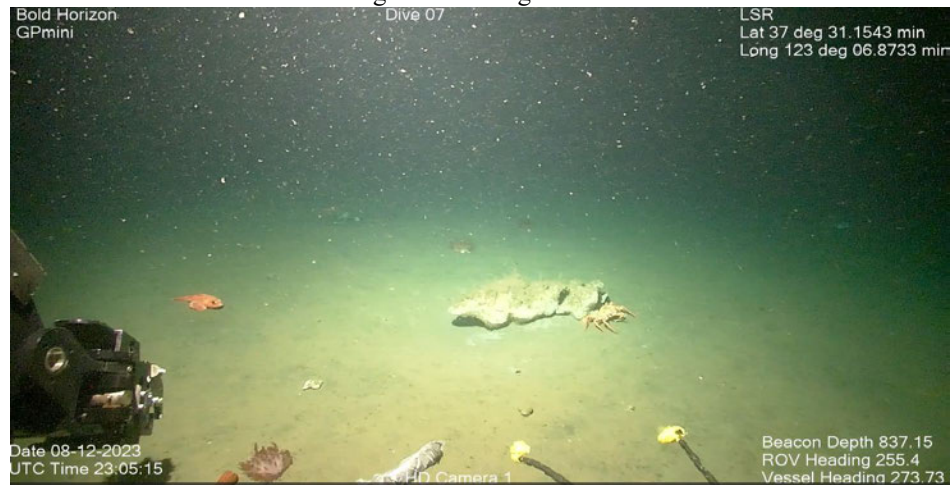


Figure #22. Small Rock



Figure #23. Rock Pile

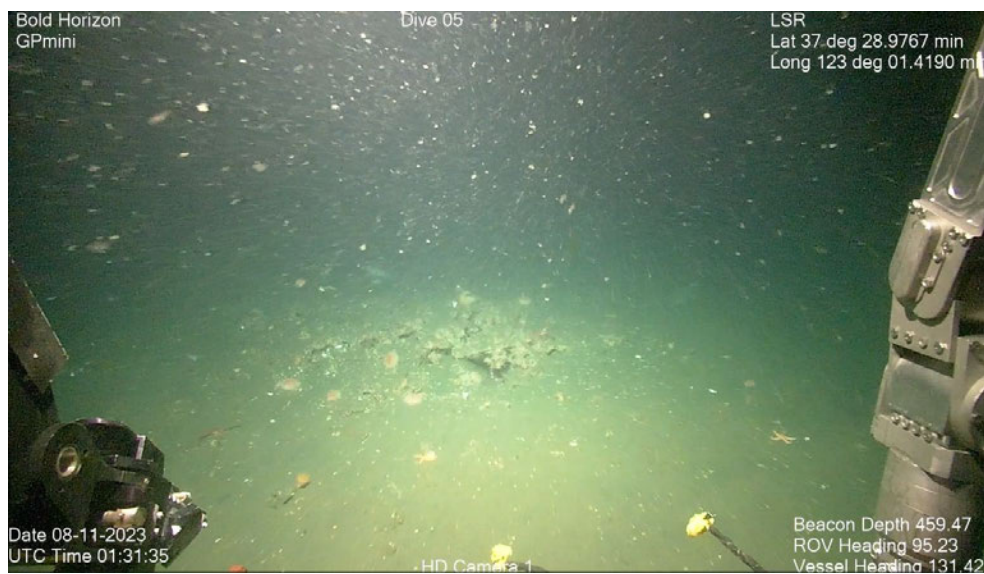


Figure #24. Rock Pile 2

PHASE 4: TWIN OTTER WING & ENGINE RECOVERY

Since EGI's Swift Responder had just completed an aircraft recovery off the coast of San Clemente Island, CA, the vessel was already properly mobilized for an aircraft recovery, it was decided to utilize the vessel to complete the twin otter wing and engine recovery. After 2 days of transit, the recovery operation was completed within five (5) hours on October 29, 2023. The wing and engine were pre-rigged up from the Bold Horizon's previous evolution, so upon arrival at the wreck site, operations began to ensure the wing and engine were still rigged properly to ensure for a successful recovery. After making minor adjustments, the wing and engine were successfully recovered and secured onboard the vessel by 20:05.



Figure #25. Twin Otter Wing Recovery



Figure #26. Twin Otter Engine Recovery

OPERATIONAL SUMMARY

N153QS crashed into the Pacific Ocean at around 14:15 on May 20, 2023. The USCG was alerted and deployed a helicopter that spotted the aircraft upside down and partially submerged approximately 40 miles west of Half Moon Bay. A USCG rescue swimmer observed both of the plane's occupants were still strapped in the cockpit, unresponsive. The swimmer made a limited attempt to recover the pilot's bodies, however, was unsuccessful. Further efforts were terminated due to safety concerns to the rescue swimmer.

Eclipse Group Inc. was awarded the contract to begin search efforts. After analyzing the gathered data to include, the aircraft's last position report (gathered from the aircraft's ADS-B data), the last known location per the USCG, last personal locator beacon (PLB) position, location of the large fuel slick and ocean current conditions, EGI was able to make assumptions with possible drift models to predict either a South/Southeastern or East/Northeastern drifting pattern. EGI established a 6nm circle which became known as the priority searching area that was within a larger, L-shaped polygon potential search area.

EGI mobilized the Bold Horizon starting on June 20, 2023, and was underway to begin the search by 06:00 June 22. After nearly 2 full days of transit, the Bold Horizon arrived on-site around 03:20 on June 24. Search operations began and lasted until 12:40 on June 26 due to increasing sea-states. During this search, the survey team was performing "racetrack turns" by running lines NNW at around 340 degrees and to the SSE at around 160 degrees. The total area covered during this time was 38.77% of the priority search area. The Bold Horizon left the crash-site when operations were announced to be suspended and arrived at the Port of San Diego at 07:42 on June 28 to begin demobilization.

After nearly a month, EGI began to mobilize their assets again to continue the search on July 22, 2023. The Bold Horizon was again underway by 19:15 on July 24. The vessel arrived at the search location at 20:30 on July 26 and immediately resumed search operations by 21:00. During the previous search it was clear that running lines north/south within the terrain's canyons presented data gaps. EGI began running lines east/west which would fill the data gaps and provide more data. During the continued search, the survey crew began using a pinger which assisted by being more efficient with data collection. On July 27th, around 08:30, the crew lost contact with the towfish which caused operations to be momentarily halted for repairs. This issue was fixed and sidescan operations resumed by 17:00. At around 14:00 on July 28th, the survey team located a target of interest and noted its position. The next day the survey team performed another pass near the target, and the crew believed it was part of the plane. Sidescan and pinging search operations continued to gather data of the area until operations ceased at 01:35 on August 3rd. The Bold Horizon left the crash-site on 03:00 August 3rd and was underway to San Francisco to prepare for ROV operations. On August 4th demobilization of the sidescan equipment and mobilization of the ROV equipment commenced.

The Bold Horizon finished mobilizing the ROV team / equipment and departed San Francisco on August 8 at around 19:45 and arrived on location at 00:20 August 9. ROV operations started at 09:27 August 9th, with the task of inspecting potential targets within "Area Bravo". During the first dive, the target of interest appeared to be fishing debris; folded up fishing nets and rope. The crew recovered the ROV to prepare to inspect another potential target site.

Operations resumed the next morning (August 10) at 06:16 with dive #2. The task was to inspect the potential target at "Area Bravo 115". Upon inspection, the ROV located what appeared to be the starboard wing and engine of the Twin Otter aircraft at a depth of 705m. The ROV inspected the wing / engine and surrounding

area and noted they believed the engine was not structurally attached to the plane. After further inspection, the ROV recovered to reposition. At 09:52, the Bold Horizon had moved locations to “Area Delta” to begin dive #3. During this dive, the ROV inspected another larger target, which appeared to be an upside-down shipping container (corner numbers: ICSO415081, USA 2210).

The team recovered the ROV and moved to “Area Charlie #1” at 13:50 and “Area Charlie #2” at 17:20. The ROV completed dives #4 and #5 at these locations, however, the targets of interest were just hard geology. On August 11, the decision was made to continue search operations due to other potential targets matching or being similar to that of previously found geology. The crew began running survey lines with USBL tracking for the remainder of the day. On August 12, ROV operations resumed in the area just west of the last ADS-B location to inspect potential targets. During dive #6, the ROV confirmed a target as a geology pile and another target as “a large clay pot”. The ROV was recovered, and the vessel moved to area “Scripps”, and located another pile of geology. The Bold Horizon moved back to “Area Bravo” to revisit the wing / engine to begin a rigging attempt. At 18:45, the ROV began dive #8 and by 21:40, the wing and engine were successfully rigged up utilizing choker hitches around the engine, and each end of the wing with 3 separate rigging straps. The rigging plan was to lift the wing with a slight tilt (45–60-degree), as this would allow seawater to slowly exit the wing as it is lifted above the surface during recovery. The decision was made to postpone the recovery of the wing / engine due to increasing sea-states and overall length of the wing. EGI planned to return to the crash site with the Swift Responder to complete the recovery at a later date.

Late developing information indicated that the aircraft was equipped with a Ducaine pinger with 60 day battery, operating at 37.5kHz. The sonardyne Ranger 2 USBL has a feature that allows it to listen for a discreet frequency. All parties agreed that an attempt would be made to localize the beacon utilizing the USBL and track lines would be developed and executed. On August 13, the Bold Horizon continued running tracking patterns until 16:45. The USBL was then recovered, and the Bold Horizon departed the twin otter search location.

Operations resumed on October 27, 2023, with mobilization of the Swift Responder in the Port of San Diego. The Swift Responder departed the port for the Twin Otter crash-site by 11:00 on October 27, and arrived at 15:10 on October 29. ROV operations began shortly after 15:30 with the task of adjusting the rigging performed in August. By 18:10, rigging adjustments were complete and at 18:16 the twin otter wing and engine recovery commenced. At 19:02, the load was transferred to the deck crane and ROV was on deck. When the wing / engine was lifted out of the water, the team noticed that during the recovery, the engine’s propeller had separated from the engine. The starboard wing and engine of N153QS had been successfully recovered and was secured on deck at 20:05. The Swift Responder departed the crash-site at 22:00, underway for Astoria, Oregon for demobilization and wreckage delivery. The vessel arrived in Oregon on November 1st at 11:00. On November 5th at 15:00, the twin otter’s starboard wing and engine were successfully loaded onto a freight for delivery to the client and completed the search and recovery operations, for now.

TIMELINE SUMMARY

DATE	DAY	BOLD HORIZON OPERATIONS
MAY		
20-May	SAT	14:00- N153QS crashes approximately 33 miles off the coast of Half Moon Bay, California 14:30- Coast Guard arrives; plane inverted with both wing and engines detached
JUNE		
20-Jun	TUES	MOB
21-Jun	WED	MOB
22-Jun	THURS	06:00- Bold Horizon underway for Twin Otter search location
23-Jun	FRI	Transit
24-Jun	SAT	03:20- BH arrives at search location (37 24.60N 123 04.4W, Begin sidescan search operations. 23:59- Covered 64.4km of search area, 367.49km remaining to search. 14.91% completed.
25-Jun	SUN	Continued sidescan operations, completed 4 lines within search area; 2 in west half and 2 in eastern half of primary search area 23:59- Covered 84.41km of search area, 149.81km in total, 282.08km remaining to search. 34.69% completed.
26-Jun	MON	Continued sidescan operations, completed 6 lines and one partial rerun on a possible target that was nonconclusive (weather is marginal for work) 12:00- Covered 17.65km of search area, 167.46km in total, 264.43km remaining to search. 38.77% completed. 12:40- Search terminated due to increasing and sustained weather conditions, BH Departs Twin Otter search location, underway for Port of San Diego
27-Jun	TUES	Transit
28-Jun	WED	07:42- BH arrives Port of San Diego, DEMOB
JULY		
22-Jul	SAT	MOB
23-Jul	SUN	MOB
24-Jul	MON	19:15- Bold Horizon underway for Twin Otter search location
25-Jul	TUES	Transit
26-Jul	WED	Transit 20:30- BH arrives at search location 21:00- Begin sidescan search operations
27-Jul	THURS	Continued sidescan operations 08:30- Lost contact of towfish during 3rd line, halt to operations for repairs 17:00- Towfish repaired, resume sidescan search operations
28-Jul	FRI	Continued sidescan operations 14:00- Survey team located target of interest

29-Jul	SAT	Continued sidescan operations 07:30- Winch drum malfunction 09:00- Winch drum operational, continue sidescan search operations 14:40- Survey team performed another pass near target of interest, believed to be part of plane
30-Jul	SUN	Continued sidescan operations
31-Jul	MON	Continued sidescan operations
AUGUST		
1-Aug	TUES	Continued sidescan operations
2-Aug	WED	Continued sidescan operations
3-Aug	THURS	01:35- Ceased survey operations, 100% of new priority zone covered 02:00- Sonar on deck and secure 03:00- BH underway to San Francisco 09:30- BH arrived and secured to Pier 30, Embarcadero, San Francisco, CA
4-Aug	FRI	08:45- Shift to Pier 94 for Tetrattech offload 11:45- Shift to Pier 30 DEMOB sidescan equipment
5-Aug	SAT	PREP / MOB for ROV Operations
6-Aug	SUN	PREP / MOB for ROV Operations
7-Aug	MON	PREP / MOB for ROV Operations
8-Aug	TUES	19:45- Bold Horizon underway for Twin Otter search location
9-Aug	WED	00:20- BH arrives on location 09:27- ROV in water, Begin ROV Operations, Begin Dive #1, area bravo 11:06- ROV identifies target as fishing debris, ROV recovers 11:52- ROV on deck, End of Dive #1 15:07- U/W to new position—Bravo search site 17:40- On site, prep ROV for launch 18:30- Operations halted for equipment maintenance

10-Aug	THURS	06:16- ROV in water, Begin Dive #2, area "Bravo 115" 07:28- ROV locates what appears to be a wing with engine/prop attached, depth 705m. 07:30- Confirmed ROV team has found Twin Otter Starboard wing 08:06- Engine confirmed not structurally attached 08:56- ROV recovery 09:40- ROV on deck, End of Dive #2 09:52- BH moving to area "Delta" 11:49- ROV off deck, Begin Dive #3 12:30- ROV investigates target, target appears to be shipping container. Corner numbers: ICSO 415081, USA 2210; container is upside down 13:09- ROV recovery 13:42- ROV on deck, End of Dive #3 13:50- BH moving to area "Charlie#1" 15:55- ROV off deck, Begin Dive #4 16:30- ROV inspects target, appears to be rock pile 16:40- ROV recovery 17:10- ROV on deck, End of Dive #4 17:20- BH moving to area "Charlie#2" 17:57- ROV off deck, Begin Dive #5 18:28- ROV inspects target, appears to be rock pile, begin ROV recovery 19:05- ROV on deck, End of Dive #5 19:30- BH moving to area "Bravo", Begin Search Operations 23:59- BH running survey lines / operating tracking patterns with pinger
11-Aug	FRI	00:00- BH cont. running survey lines / operating tracking patterns with pinger 04:00- Running survey lines - USBL Tracking
12-Aug	SAT	07:40- BH moving to area west of last ADS-B location to inspect targets 08:55- ROV off deck, Begin Dive #6 10:26- ROV confirms target is a rock pile 11:27- ROV identifies target as large pottery 11:32- ROV recovery 12:22- ROV on deck, End of Dive #6 13:12- BH moving to area "Scripps" 14:27- ROV launch canceled to make repairs 15:13- ROV repaired, ROV off deck, Begin Dive #7 16:05- ROV identifies target as rock pile 17:12- ROV on deck, End of Dive #7 17:15- BH moving to area "Bravo" to begin rigging wing / engine 18:45- ROV off deck, Begin Dive #8 21:40- ROV rigged engine and one end of wing 21:42- ROV recovery 22:31- ROV on deck, End of Dive #8, ROV suffered damage to stern on recovery 23:00- Begin running tracking patterns with pinger
13-Aug	SUN	00:00- Running tracking patterns with pinger 04:00- Running survey lines (340°/160°) with USBL tracking 16:45- Crew recovers USBL transducer 17:05- Ops complete, BH underway
14-Aug	MON	Transit
15-Aug	TUES	Transit

16-Aug	WED	07:00- BH arrives Port of San Diego DEMOB
OCTOBER		
27-Oct	FRI	08:00- Swift Responder mobilizes for Twin Otter wing recovery upon delivery of recovered Lear Jet wreckage at Port of San Diego 11:00- Swift Responder departs San Diego, underway for Twin Otter Crash Site
28-Oct	SAT	Transit
29-Oct	SUN	15:10- Swift Responder arrives at Twin Otter crash site 15:35- ROV off deck, Begin Dive #1, Task: Twin Otter wing recovery attempt 16:30- ROV adjusting / finishing previous rigging on wing 18:10- ROV completes rigging wing / engine 18:16- ROV begins to recover with wing / engine 19:02- ROV on deck, End of Dive #1 20:05- Wing / Engine on deck / successfully recovered, propeller lost during recovery 22:00- Swift Responder underway for Astoria, OR
30-Oct	MON	Transit
31-Oct	TUES	Transit
NOVEMBER		
1-Nov	WED	Transit 11:00- Swift Responder arrives at Port of Astoria, OR
2-Nov	THURS	08:00- DEMOB ROV equipment
3-Nov	FRI	DEMOB
4-Nov	SAT	DEMOB
5-Nov	SUN	15:00- Twin Otter wing / engine loaded onto freight for client

PROJECT TIMELINE

169 days was the amount of time taken from the date of the initial accident to the successful conclusion of recovery operations.

DATE	OP DAY	PROJECT DAY	DESCRIPTION
20-May		0	N153QS Crashes into Pacific Ocean near Half Moon Bay, California
19-Jun		30	Search team arrives in San Diego
20-Jun	1	31	Search equipment arrives, mobilization starts
21-Jun	2	32	Mobilization cont.
22-Jun	3	33	BH underway for Twin Otter search location
23-Jun	4	34	Transit
24-Jun	5	35	BH arrives to search location, Towfish Sidescan Operations begin, 64.4km covered (14.91% complete)
25-Jun	6	36	Towfish Sidescan Operations, 84.41km of search area covered today, 149.81km of search area covered in total (34.69% complete)
26-Jun	7	37	Towfish Sidescan Operations, 17.65km of search area covered today, 167.46km of search area covered in total (38.77% complete)
27-Jun	8	38	Vessel in transit to San Diego
28-Jun	9	39	BH arrives in San Diego, Start Demobilization

22-Jul	10	63	MOB
23-Jul	11	64	MOB
24-Jul	12	65	BH underway for Twin Otter search location
25-Jul	13	66	Transit
26-Jul	14	67	BH arrives to search locations, Operations begin
27-Jul	15	68	Towfish Sidescan Operations
28-Jul	16	69	Towfish Sidescan Operations
29-Jul	17	70	Towfish Sidescan Operations
30-Jul	18	71	Towfish Sidescan Operations
31-Jul	19	72	Towfish Sidescan Operations
1-Aug	20	73	Towfish Sidescan Operations
2-Aug	21	74	Towfish Sidescan Operations
3-Aug	22	75	Towfish Sidescan Operations, Begin Transit
4-Aug	23	76	BH Arrives at Pier 30, The Embarcadero, San Francisco, CA, DEMOB Sidescan
5-Aug	24	77	MOB / Prep for ROV ops
6-Aug	25	78	MOB / Prep for ROV ops
7-Aug	26	79	MOB / Prep for ROV ops
8-Aug	27	80	BH underway for Twin Otter search location
9-Aug	28	81	BH arrives to search locations, ROV Operations begin, ROV locates Starboard Wing/Engine
10-Aug	29	82	ROV & Survey Operations
11-Aug	30	83	ROV & Survey Operations
12-Aug	31	84	ROV Operations
13-Aug	32	85	Survey Operations, Ops complete for now
14-Aug	33	86	Transit
15-Aug		87	Transit
16-Aug	34	88	BH Arrives at Port of San Diego
26-Oct		159	Swift Responder Mobilizes
27-Oct	35	160	Swift Responder departs San Diego for Twin Otter Recovery
28-Oct	36	161	Transit
29-Oct	37	162	ROV Operations / Recovered Twin Otter Wing / Engine, Propeller lost during recovery
30-Oct		163	Transit
31-Oct		164	Transit
1-Nov		165	Swift Responder arrives at Port of Astoria, OR, Begin DEMOB
2-Nov	38	166	DEMOB
3-Nov		167	DEMOB
4-Nov		168	DEMOB
5-Nov	39	169	Recovered Twin Otter wreckage loaded onto freight for client

OPERATIONAL RESULTS

Eclipse Group proposed a 5-day-at-sea operation in the project plan submitted to the NTSB and Lone Star Retrieval, however, at-sea operations ultimately lasted 18 days, a 277% increase in time and cost. This schedule overrun was directly linked to adverse sea states. EGI was able to locate and recover the starboard wing and engine, however, the rest of the plane is still yet to be found.

PROJECT REPORTING

SITUATION DAILY REPORTS (SITREPS)

During operations, daily situational reports were provided to investigative stakeholders (NTSB) and to the client (Lone Star Retrievals) to summarize daily events, accomplishments, issues encountered and remedies. These SITREPS are located at the end of this report.

LESSONS LEARNED

EGI has performed an objective review of this recovery operation with the goal of capturing the following factors:

- Project aspects that can be improved for future operations
- Operation aspects that met expectations and should be replicated for future recoveries

Identification of unique issues that arose during the operation and how these issues were resolved or mitigated

ISSUE #1
Due to drastic changes in terrain and depth, during survey ops the team would hit a wall and require additional passes to successfully capture sonar imaging along the continental shelf's slope.
Solution #1
Began running survey lines East / West instead of North / South to compensate / fill data gaps.

ISSUE #2
Weather was marginal for work, causing operations to be suspended.
Solution #2
Operations resumed when more favorable sea-states were present.

APPENDIX I ROV DIVE LOGS

BOLD HORIZON ROV LOGS

Dive #1	Date	Time (UTC)	Log Entry
	Aug-09-2023	16:31	ROV off deck, Begin Dive #1; Task: survey work area
		17:09	ROV on bottom—depth 495 meters
		18:03	ROV on location—begin site survey
		18:06	ROV inspect large target—appears to be fishing debris (net and tackle)
		18:15	ROV begin recovery to surface
		18:52	ROV on deck End of Dive #1
Dive #2	Date	Time (UTC)	Log Entry
	Aug-10-2023	13:05	ROV pre-dive checks complete
		13:16	ROV off deck, Begin Dive #2; Task: Survey Bravo 115 Location
		14:06	ROV at seabed, depth 694M (beacon depth), Winch 752m out
		14:28	ROV near Bravo 115, appears to be a wing at latitude 37° 31.350' N, longitude 123° 05.800' W—wing appears to have engine with prop attached, depth 705 msw.
		14:45	ROV begins inspection of wing and surrounding seabed. "STBD Wing"- Snap photos taken on DVR
		15:06	Engine confirmed NOT structurally attached
		15:13	Inspection of other side of prop / engine - photos taken
		15:20	Inspecting seabed around wing location
		15:56	ROV begin recovery to surface for transit to next location
		16:40	ROV on deck, End of Dive #2
			Notes: Found starboard wing & engine attached to wing Wing and engine are right-side up Traction winch level-wind working correctly—magnetic sensor replaced 08/08/2023 Replaced Yaw hose fitting for ISE arm Rigging in place on porch (of ROV)
Dive #3	Date	Time (UTC)	Log Entry
	Aug-10-2023	18:45	Vessel on location (Area Delta), pre-dive checks complete
		18:47	ROV off deck, Begin Dive #3, DVR started
		18:56	ROV depth 60m, Sonardyne gets beacon position; winch paying out at 25 meters per minute, slowing to 20m / min; trouble starting M3, shut off PHINS, restart network
		19:24	ROV on bottom, depth 605m, winch at 617m out
		19:28	Target in front of M3, range = 12m

		19:30	Target is an ISO container: corner numbers ICSO 415081, USA 2210; container is upside down
		19:44	Moving toward second target, range 200m, bearing bearing 210° Area Delta 2
		20:02	ROV depth 612m, winch 637m out
		20:06	Set up for ROV sector search, no sonar targets within 75m range near Delta 2
		20:09	ROV off bottom
		20:42	ROV on deck, End of Dive #3
Dive #4	Date	Time (UTC)	Log Entry
	Aug-10-2023	22:55	ROV pre-dive checks complete
		22:57	ROV off deck, Begin Dive #4; Task: Charlie 1 Inspection
		23:26	ROV at seabed, depth 486m
		23:30	ROV at first sonar target, geological only; position: latitude 37° 29.404' N, 123° 02.109' W
		23:40	ROV begin recovery to deck
		0:12	ROV on deck, End of Dive #4
Dive #5	Date	Time (UTC)	Log Entry
	Aug-11-2023	0:55	ROV off deck, Begin Dive #5; Task: Charlie 2 Inspection
		1:21	ROV on seabed, depth 458m
		1:28	ROV inspecting sonar targets; appear to be rock piles; position: latitude 37° 28.968' N, 123° 01.412' W.
		1:30	ROV begin recovery
		2:05	ROV on deck, End of Dive #5
			Notes: Replaced USB extension to monitors due to glitching Installed door jamb strap and turnbuckle for CV Broke aft port aluminum frame member during launch (poor welds)
Dive #6	Date	Time (UTC)	Log Entry
	Aug-11-2023	15:45	Pre-dive checks complete
		15:55	ROV off deck, Begin Dive #6; Task: Survey small debris field at impact site; position: latitude 37° 31.415' N, 123° 07.024' W.
		18:32	ROV at seabed, Depth 928m
		17:26	Found rock, position: latitude 37° 31.507' N, 123° 07.570' W.
		18:27	Found pottery, position: latitude 37° 31.647' N, 123° 07.024' W.
		18:32	ROV begin recovery
		19:01	ROV on deck, End of Dive #6

Dive #7	Date	Time (UTC)	Log Entry
	Aug-11-2023	22:12	ROV off deck, Begin Dive #7; Task: Survey debris at Area "Scripps", position: 37° 31.155' N, 123° 06.896' W.
		22:54	ROV at seabed, depth 834m
		23:05	ROV at sonar target, observed rocks; position: latitude 37° 31.115' N, 123° 06.916' W.
		23:12	ROV begin transit to Bravo 115, wing location
		23:25	ROV begin recovery to deck
	Aug-12-2023	0:09	ROV on surface
		0:12	ROV on deck, End of Dive #7
Dive #8	Date	Time (UTC)	Log Entry
	Aug-12-2023	1:45	ROV off deck, Begin Dive #8; Task: Wing / Engine rig up for recovery at Area: Bravo 115, position: latitude 37° 31.305' N, 123° 05.813' W.
		2:24	ROV at seabed, depth 708m
		2:28	ROV at twin otter wing, commence rigging with slings
		4:40	ROV rigged engine, one end of wing; To be finished next dive.
		4:42	ROV off bottom for recovery
		5:19	ROV on surface
		5:31	ROV on deck, End of Dive #8; Damage to stern bumper on recovery
			Notes: Repairs made to ROV bumpers and frame Troubleshooting subsea network issues; network limited to 100mb/s, needs 1 Gb/s for optimal performance Network bottle shows signs of corrosion when disassembled

SWIFT RESPONDER ROV LOGS

Dive #1	Date	Time (UTC)	Log Entry
	Oct-29-2023	13:29	Pre-dive complete SAT
		15:34	ROV off deck, Begin Dive #1; Task: Twin Otter Wing / Engine recovery, Area: Bravo 115
		16:20	ROV on bottom
		16:25	ROV at site
		16:30	Begin rigging wing / engine
		18:10	Finished rigging last sling
		18:16	ROV begins ascent with rigging attached (Begin wing recovery)
		19:00	ROV on surface
		19:02	ROV on deck, End of Dive #1
		20:05	Wing / Engine on deck
			Notes: Propeller has detached from engine during recovery

APPENDIX II VESSEL SITREPS

Date/Time:	06-21-2023 / 0700 LT
Position:	Moored at Crosby Street pier
Status:	Making Preparations for Twin Otter Search Project – Continue with vessel crewing efforts - Provisioning
Wx Orbs:	Wind: n/a , Seas: n/a, Skies: n/a, Barro Pressure : n/a Swell Direction : n/a
Schedule:	June 22nd – Depart for Twin Otter search location at 0600 hrs June 23rd - Transit to Location June 24th - Arrive at location ETA 0600 hrs
Crew :	M. McCabe, T. Drummond, N. belt, M. Cascade, H. Ducharme, J. Purdy, I. Berger, J. Berger, Balaam Bernaldez, (9 crew onboard)
Deck:	San Diego Hydraulics has begun work on winch drum ,Expected completion date 6/26/23
Eng Rm:	SME turbo seals are installed. Testing was conducted(No load on engine) June 20th – Results OK – Further checking with engine under load upon departure.

Date/Time:	06-24-2023 / 0630 LT
Position:	37 24.60N 123 04.4 W Twin Otter wk location
Status:	0320 hrs - Arrived at location begin operations
Wx Orbs:	Wind: NW at 12 kts , Seas: SE at 3/5 ft, Skies: overcast, Barro Pressure 1011 Swell Direction : Pushing to SE
Schedule:	June 24th – to June 28th SIdescan operations
Crew :	M. McCabe, T. Drummond, N. belt, M. Cascade, H. Ducharme, J. Purdy, I. Berger, J. Berger, Balaam Bernaldez, James McCary (10 crew onboard) + 1 Eclipse Tech - Zeth Mogk
Client:	1 - Richard Ball
SIdescan:	5 – Nolan Walker, Griff Jones, Paul Jubinski, Kevin Beck, Grace Smythe
Deck:	San Diego Hydraulics has begun work on winch drum ,Expected completion date 6/26/23
Galley:	Ice maker has lost its compressor – need to replace as soon as possible – sourcing now – UPDATE
	Chief got the Ice machine to work but is on last leg
Eng Rm:	No New issues

Date/Time:	06-25-2023 / 0630 LT
Position:	37 25.90N 123 00.6W Twin Otter wk location
Status:	Continue side scan operations at location – Have completed 4 lines thus far – 2 in the west half at center @ 2 In eastern half of search area about to start 5th line
Wx Orbs:	Wind: NW at 12 kts , Seas: SE at 3/5 ft, Skies: overcast, Barro Pressure: 1011, Swell Direction : Pushing to SE
Schedule:	June 24th – to June 28th Side scan operations
Crew :	M. McCabe, T. Drummond, N. belt, M. Cascade, H. Ducharme, J. Purdy, I. Berger, J. Berger, Balaam Bernaldez, James McCary (10 crew onboard) + 1 Eclipse Tech - Zeth Mogk
Client:	1 - Richard Ball
Sidescan:	5 – Nolan Walker, Griff Jones, Paul Jubinski, Kevin Beck, Grace Smythe
Deck:	San Diego Hydraulics has begun work on winch drum ,Expected completion date 6/26/23
Galley:	Ice maker has lost its compressor – need to replace as soon as possible – sourcing now – UPDATE Chief got the Ice machine to work but is on last leg
Eng Rm:	No New issues – All equipment running well as intended

Date/Time:	06-26-2023 / 0800 LT
Position:	37 38.70N 123 06.2W Twin Otter wk location
Status:	Continue side scan operations at location – Have completed 6 lines and one partial rerun on a possible target which was non-conclusive.
Wx Orbs:	Wind: NW at 20kts , Seas: SE at 7/9 ft, Skies: overcast, Barro Pressure: 1011, Swell Direction : Pushing to SE - WEATHER IS MARGINAL FOR WORK
Schedule:	June 24th – to June 29th Side scan operations 26 – Check on status of Crane winch & Traction winch parts for install upon return to San Diego.
Crew :	M. McCabe, T. Drummond, N. belt, M. Cascade, H. Ducharme, J. Purdy, I. Berger, J. Berger, Balaam Bernaldez, James McCary (10 crew onboard) + 1 Eclipse Tech - Zeth Mogk
Client:	1 - Richard Ball
Sidescan:	5 – Nolan Walker, Griff Jones, Paul Jubinski, Kevin Beck, Grace Smythe
Deck:	San Diego Hydraulics has begun work on winch drum, Expected completion date 6/26/23
Galley:	Ice maker has lost its compressor – need to replace as soon as possible – sourcing now – UPDATE Chief got the Ice machine to work but is on last leg
Eng Rm:	No New issues – All equipment running well as intended

Date/Time:	06-27-2023 / 0700 LT
Position:	34 38.0 N 121 04.3 W 21 nm due west of point Arguello - E/R to San Diego
Status:	Departed Twin Otter work location @ 1240 hrs on 26 June 2023
Wx Orbs:	Wind: NW at 15/20 kts , Seas: SE at 6/8 ft, Skies: overcast, Barro Pressure: 1007, Swell Direction : Pushing to SE -
Schedule:	June 27/28 U/W to San Diego June 28 ETA for arrival at 0700 hrs – Crosby St Pier – Begin Demob – Disembark side scan crew - all trash off of vessel – vessel cleanup - Laundry Check on status of Winch for Crane – Possibly lube & Fuel (Date Not confirmed yet)
Crew :	M. McCabe, T. Drummond, N. belt, M. Cascade, H. Ducharme, J. Purdy, I. Berger, J. Berger, Balaam Bernaldez, James McCary (10 crew onboard) + 1 Eclipse Tech - Zeth Mogk
Client:	1 - Richard Ball
Sidescan:	5 – Nolan Walker, Griff Jones, Paul Jubinski, Kevin Beck, Grace Smythe
Deck:	San Diego Hydraulics has begun work on winch drum ,Expected completion date 6/26/23
Galley:	Icemaker has lost its compressor – need to replace as soon as possible – sourcing now – UPDATE Chief got the Ice machine to work but is on last leg
Eng Rm:	No New issues – All equipment running well as intended

Date/Time:	07-27-2023 / 0800 LT
Wx Obs:	Wind: NW @ 20-25 kts , Seas: NW 6-8 ft , Baro: 1012.0 mb , Visib: 4-6 NM
Position:	Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 340 deg
Status:	We arrived on location (San Francisco- West Traffic Separation Lanes) at 2030 Lt on July 26th a little slower then expected due to rough weather. We immediately deployed the towfish at 21:00pm and began our survey. We were running our 3rd line when we lost contact with the towfish this morning at 08:30am. The Client (Tetrattech) are repairing the towfish or they will swap out if necessary. We are standing by and ready to resume the survey as soon as towfish is ready. As far as I know the plane has not been located yet and we have many more lines to run before we complete the search grid.
Schedule:	July 25th: Underway to survey area July 26th: Began survey on arrival at location at 21:00pm on July 26th July 27th: Survey with side scan sonar continues. Towfish is currently on deck for repair after coming close to the bottom
Crew On:	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Client:	TetraTech 6 pax onboard
Deck:	Tugger winch sent to SD Hydraulics on July 20th (Ready for pickup on July 31st)
Job Equip:	Dynacon has gearbox problem
Eng Rm:	MSD under repair, Sink in # 8 Cabin not working, Toilet in Ch Mate Cabin not working, A/C chart rm & lounge not working

DATE 07-28-2023

Wx Obs: Wind: NW @ 15-25 kts , Seas: NW 6-8 ft , Baro: 1010.0 mb , Visib: 4-6 NM
Position: Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 160 deg
Status: The tow fish was repaired and we commenced survey ops at 17:00 pm (Thursday) July 27th. We are have run several lines with no other issues. The weather is holding up for now with increased sea state expected on Tuesday (Aug 1st).
Schedule:
 July 26th: Began survey on arrival at location at 21:00pm on July 26th
 July 27th: Survey with side scan sonar continues. Towfish is currently on deck for repair at 09:00am .Towfish operational at 17:00 pm
 July 28th: Continue to survey the grid , everything operational at this time.
Crew On : M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey: TetraTech (6 pers onboard)
Client: Lone Star Retrieval
Deck: Tugger winch sent to SD Hydraulics on July 20th (Ready for pickup on July 31st)
Job Equip: Dynacon has gearbox problem
Eng Rm: MSD under repair, Sink in # 8 Cabin not working, Toilet in Ch Mate Cabin not working, A/C chart rm & lounge not working

Date/Time: 07-29-2023 / 0800 LT

Wx Obs: Wind: NW @ 15-20 kts , Seas: NW 4-6 ft , Baro: 1010.5 mb , Visib: 4-6 NM
Position: Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 160 deg
Status: The survey team located a promising target yesterday afternoon. It looks like the plane in the photos but no one can be sure so we are making several more passes over the target this morning. The counter stop working on the winch drum at 07:30am this morning and while reeling in the cable we observed the cable becoming fouled on the drum at 07:45am. Currently the crew are busy getting the winch cable respooled correctly. We should be operational in the next hour and we will continue our survey.
Schedule:
 July 26th: Began survey on arrival at location at 21:00pm on July 26th
 July 27th: Survey with side scan sonar continues. Towfish is currently on deck for repair at 09:00am .Towfish operational at 17:00 pm
 July 28th: Continue to survey the grid . Found Promising target
 July 29th: Made a another pass over the target this morning. Currently ironing out problems with the winch and the counter.
Crew On : M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey: TetraTech (6 pers onboard)
Client: Lone Star Retrieval
Deck: Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip: Dynacon has gearbox problem
Eng Rm: MSD under repair, Sink in # 8 Cabin not working, Toilet in Ch Mate Cabin not working, A/C chart rm & lounge not working

Date/Time:	07-30-2023 / 1500 LT
Wx Obs:	Wind: NW @ 10-15 kts , Seas: NW 3-5 ft , Baro: 1012 mb , Visib: 6-8 NM
Position:	Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 340 deg
Status:	The survey team believes they have located the plane however we will continue to search the entire grid. The weather has been cooperating and does not deteriorate until Wednesday/Thursday of this week. The survey team thinks we will complete the survey area on Wednesday.
Schedule:	July 30th: Continue survey July 31st: Continue survey Aug 01st: Continue survey Aug 02nd: Continue survey , may complete the survey and get underway for San Francisco (waiting on confirmation)
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (6 pers onboard)
Client:	Lone Star Retrieval
Deck:	Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip:	Dynacon has gearbox problem
Eng Rm:	MSD under repair, Sink in # 8 Cabin not working, Toilet in Ch Mate Cabin not working, A/C chart rm & lounge not working
Crew:	A. Reed (AB) to return on Aug 03rd and L. Richardson (AB) to depart on Aug 03rd in San Francisco

Date/Time:	07-31-2023 / 1500 LT
Wx Obs:	Wind: NW @ 15-20 kts , Seas: NW 4-6 ft , Baro: 1009 mb , Visib: 6-8 NM
Position:	Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 340 deg
Status:	The survey continues. We had 7-9 ft seas last night and our grid pattern was east to west so not many people got any rest last night. There have been no new target sightings as of yet. We are continuing with our search.
Schedule:	July 28th: Continue to survey the grid . Found Promising target believed to be the plane July 29th: Made a another pass over the target this morning. Re-wrap cable on drum July 30th: Continue survey July 31st: Continue survey Aug 01st: Continue survey Aug 02nd: Continue survey , may get underway for San Francisco in the afternoon.
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (6 pers onboard)
Client:	Lone Star Retrieval
Deck:	Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip:	Dynacon has gearbox problem
Eng Rm:	MSD under repair, Sink in # 8 Cabin not working, Toilet in CM Cabin not working, A/C chart rm not working, Stbd Radar(X-Band) not working
Crew:	A. Reed (AB) to return on Aug 03rd and L. Richardson (AB) to depart on Aug 03rd in San Francisco

Date/Time:	08-02-2023 / 0800 LT
Wx Obs:	Wind: NW @ 10-15 kts , Seas: NW 3-5 ft , Baro: 1010 mb , Vis: 4-6 NM
Position:	Lat. 37 -deg 35.0' N / Long. 123- deg 07.3' W , SPD 3.0 kts , CSE 160 deg
Status:	The survey is going well. There have been no new targets spotted in the last 24 hours. We have had a few problems with the winch cable not spooling correctly on the drum due to level wind speed and weight of the towfish. The team has been quick to see the problem so there has been very little downtime. We will be going into port (SF) and tying up at Pier 32 on The Embarcadero. The ETA is 1800 LT today (Aug 2nd)
Schedule:	July 31st: Continue survey Aug 01st: Continue survey Aug 02nd: Complete Survey , Underway for San Francisco at 1500LT (ETA 1800 LT)
Crew On:	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt M.Cascade, L.Richardson, T.Drummond, S.Mogk (10 crew)
Survey:	TetraTech (6 pers onboard)
Client:	Lone Star Retrieval
Deck:	Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip:	Dynacon has gearbox problem (Wes to replace in San Francisco on Aug 3rd)
Eng Rm:	MSD under repair, Sink # 8 Cabin not working, Toilet - CM Cabin not working, A/C chart rm not working, Stbd Radar(X-Band) not working
Crew:	A. Reed (AB) to return on Aug 03rd and L. Richardson (AB) to depart on Aug 03rd in San Francisco

Date/Time:	08-03-2023 / 0800 LT
Wx Obs:	Wind: NW @ 10-15 kts , Seas: NW 3-5 ft , Baro: 1010 mb , Visib: 4-6 NM
Position:	Pier #30/32, Address: 599 The Embarcadero, San Francisco, CA
Status:	Moored at Pier #30/32, The Embarcadero, San Francisco, CA
Schedule:	Aug 03rd: Complete Survey at 03:00- Underway to San Francisco
Crew On:	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (6 pers onboard)
Client:	Lone Star Retrieval
Deck:	Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip:	Dynacon has gearbox problem (Wes to replace in San Francisco on Aug 3rd)
Eng Rm:	MSD under repair, Sink # 8 Cabin not working, Toilet - CM Cabin not working, A/C chart rm not working, Stbd Radar(X-Band) not working
Crew:	A. Reed (AB) to return on Aug 03rd and L. Richardson (AB) to depart on Aug 03rd in San Francisco

Date/Time:	08-04-2023 / 1200 LT
Wx Obs:	Wind: N/A, Seas: N/A, Baro: N/A, Vis: N/A
Position:	Pier #30/32, Address: 599 The Embarcadero, San Francisco, CA
Status:	08:45AM shifted berths this morning for Tetrattech winch offload. (Pier 94) At 11:45AM we were moored at (Pier #30/32)
Schedule:	Aug 03rd: Wes arrives with gear box, L. Richardson (AB) departs at 10:00AM and A. Reed (AB) arrives at 10:00AM Aug 04th: Shift berths for survey winch offload. All secure at Pier #30/32 San Francisco at 11:45AM (Wes Arrives) Aug 05th: ROV Crew Arrives
Crew On:	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, , M.Cascade, L.Richardson, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (4 pers onboard) > Mike Adkins departed at 05:00AM, Kevin Keck departed at 09:00AM
Client:	Lone Star Retrieval
Deck:	Tugger winch sent to SD Hydraulics on July 20th / Tugger winch repaired and ready for pickup July 28th
Job Equip:	Dynacon has gearbox problem (Wes to replace in San Francisco on Aug 3rd)
Eng Rm:	MSD under repair, Sink # 8 Cabin not working, Toilet - CM Cabin not working, A/C chart rm not working, Stbd Radar(X-Band) not working
Crew:	A. Reed (AB) to return on Aug 03rd and L. Richardson (AB) to depart on Aug 03rd in San Francisco

Date/Time:	08-05-2023 / 11:00 am LT
Wx Obs:	Wind: N/A , Seas:N/A, Baro: N/A , Visib: N/A
Forecast:	Weather forecast or sea state improving for ROV dive ops on Aug. 9th
Position:	Pier # 30/32, Address - 599 The Embarcadero, San Francisco, Ca
Status:	Dynacon Winch Repaired (Gearbox Installed) and ROV sheave hung on A-Frame
Schedule:	Aug 03rd: Complete Survey at 03:00 am- Arrive San Francisco at 09:00 am (Wes arrives with gearbox) Aug 03rd : L.Richardson (AB) departs at 10:00 am and A.Reed (AB) arrives at 10:00 am Aug 04th: Shift berths for survey winch offload. Dynacon Winch Repaired /Gearbox Installed Aug 05th : Install Sheave /move ROV into place./Connect umbilical to ROV/ Wash Down Boat/Clean Rooms/Garbage Offload
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (3 pers onboard) > Mike Adkins ,Paul Jublinski, Kevin Beck, Bill Langolf departed
Client:	Lone Star Retrieval
Deck:	Tugger winch repaired and ready for pickup .Containers purchased and ready for delivery with Shipped.com on Aug 12/15th
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet not working, A/C chart rm not working, Stbd Radar(X-Band) not working

Date/Time:	08-06-2023 / 08:00 am LT
Wx Obs:	Wind: N/A , Seas:N/A, Baro: N/A , Visib: N/A
Forecast:	Weather forecast - sea state improving for ROV dive ops on Aug. 9th
Position:	Pier # 30/32, Address - 599 The Embarcadero, San Francisco, Ca
Status:	Dynacon Repaired/ ROV crew arriving
Schedule:	Aug 03rd: Complete Survey at 03:00 am- Arrive San Francisco at 09:00 am (Wes arrives with gearbox) Aug 03rd : L.Richardson (AB) departs at 10:00 am and A.Reed (AB) arrives at 10:00 am Aug 04th: Shift berths for survey winch offload. Dynacon Winch Repaired /Gearbox Installed Aug 05th : Install Sheave /move ROV into place./Connect umbilical to ROV/ Wash Down
Boat/Clean Rooms/Garbage Offload	Aug 06th: Bill arrived with wooden crates/ Continue to demob Tetrattech
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , S.Mogk (10 crew)
Survey:	TetraTech (2 pers onboard) Chris Kenyon, Glenn Burnett
Client:	Lone Star Retrieval
Deck:	Tugger winch repaired and ready for pickup .Containers purchased and ready for delivery with Shipped.com on Aug 12/15th
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -part ordered, A/C bridge not working, Stbd Radar(X-Band) not working, keel cooler pump for ME has seal leak

Date/Time:	08-07-2023 / 12:00 pm LT
Wx Obs:	Wind: N/A , Seas:N/A, Baro: N/A , Visib: N/A
Forecast:	Weather improving offshore on Wednesday 8/9/23
Position:	Pier # 30/32, Address - 599 The Embarcadero, San Francisco, Ca
Status:	Testing ROV/ Routine Maintenance
Schedule:	Aug 04th: Shift berths San Francisco for survey winch offload. Dynacon Winch Repaired /Gearbox Installed Aug 05th : Install Sheave /Move ROV into place./Connect umbilical to ROV/ Wash Down
Boat/Clean Rooms/Garbage Offload	Aug 06th: Demob Tetrattech / Respool cable on Trawl Winch Aug 7th: Testing ROV/ Routine Maint. on ROV
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
Departing:	G.Loy,B.Stender departing today
Survey:	TetraTech Navigators -Chris Kenyon, Glenn Burnett / Eclipse Group Inc.-Tony Wass, Kyle Stimach, Rudy Schlepp, Steve Saintamour,S.Mogk (7 pers) Rob Craft arriving on Tuesday Aug 8th
Client:	Lone Star Retrieval (Richard Ball) arriving Tuesday, Aug 8th at 2400
Deck:	Tugger winch repaired and ready for pickup .Containers purchased & ready for delivery with Shipped.com on Aug 15th
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -parts on order, A/C parts on order, Stbd Radar(X-Band) not working.

Date/Time:	08-09-2023 / 08:00 am
Wx Obs:	Wind: 5-10 kts , Seas: 2-4 ft , Baro: 1011.0 , Visib: 4-6 nm
Forecast:	Weather is calm at the crash site location
Position:	Lat. 37 deg 28.3' N / Long. 123 deg 01.6' W
Status:	Preparing to dive the ROV at the op site
Schedule:	Aug 04th: Shift berths San Francisco for survey winch offload. Dynacon Winch Repaired /Gearbox Installed Aug 05th : Install Sheave /Move ROV into place./Connect umbilical to ROV/ Wash Down Boat/Clean Rooms/Garbage Offload Aug 06th: Demob Tetrattech / Respool cable on Trawl Winch Aug 07th: Testing ROV/ Routine Maint. on ROV Aug 08th: Preparing for departure. Underway at 19:45 pm for crash site Aug 09th: On location and preparing for ROV launch
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	TetraTech Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Craft
Client:	Lone Star Retrieval (Richard Ball) arrived on Aug 8th
Deck:	Tugger winch repaired and ready for pickup .Containers purchased & ready for delivery with Shipped.com on Aug 16th
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -parts on order, A/C parts on order, Stbd Radar(X-Band) not working.

Date/Time:	08-10-2023 / 08:00 am
Wx Obs:	Wind: 5-10 kts , Seas: 2-4 ft , Baro: 1010.0 , Visib: 4-6 nm
Forecast:	Weather is calm through Aug 11th at op site
Position:	Lat. 37 deg 28.3' N / Long. 123 deg 01.6' W
Status:	Dive ROV at 06:00 am this morning
Schedule:	Aug 08th: Preparing for departure / Underway at 19:45 pm for crash site Aug 09th: Launch ROV at Op site Alpha Aug 10th: Launch ROV at Op site Bravo
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	TetraTech Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Craft
Client:	Lone Star Retrieval (Richard Ball) onboard
Deck:	Tugger winch repaired and ready for pickup .Containers purchased & ready for delivery with Shipped.com on Aug 16th
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -parts on order, A/C parts on order, Stbd Radar(X-Band) not working

Date/Time:	08-11-2023 / 08:00 am
Wx Obs:	Wind: 5-10 kts , Seas: 2-4 ft , Baro: 1009.0 , Visib: 6-8 nm
Forecast:	Weather is calm through Aug 11th at op site
Position:	Lat. 37 deg 28.3' N / Long. 123 deg 01.6' W
Status:	Search Grid pattern with USBL (Ranger)
Schedule:	Aug 08th: Preparing for departure / Underway at 19:45 pm for crash site Aug 09th: Launch ROV at Op site Alpha Aug 10th: Launch ROV at Op site Bravo/Charlie Aug 11th: Run Grid Pattern and search with USBL Aug 12th: Transit to San Francisco for fuel in the morning
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	TetraTech Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Kraft
Client:	Lone Star Retrieval (Richard Ball) onboard
Mach:	Tugger winch repaired and ready for pickup at SDH
Containers:	Shipped.com delivering two containers on August 16th to TAMT
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -, Stbd Radar not working,

Date/Time:	08-12-2023 / 14:00 pm
Wx Obs:	Wind: 1-5 kts kts , Seas: 1-3 ft , Baro: 1017.0 , Visib: 6-8 nm
Forecast:	Weather is calm through Aug 14th at the op site
Position:	Lat. 37 deg 28.3' N / Long. 123 deg 01.6' W
Status:	Conducting dive operations at several different locations
Schedule:	Aug 08th: Preparing for departure / Underway at 19:45 pm for crash site Aug 09th: Launch ROV at Op site Alpha Aug 10th: Launch ROV at Op site Bravo/Charlie Aug 11th: Run Grid Pattern and search with USBL Aug 12th: Conduct dive operations Aug 13th: Conduct dive operations
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Kraft
Client:	Lone Star Retrieval (Richard Ball) onboard
Mach:	Tugger winch repaired and ready for pickup at SDH
Containers:	Shipped.com delivering two containers on August 16th to TAMT
Eng Rm:	MSD under repair, # 8 Cabin sink not working, CM Cabin- toilet -, Stbd Radar not working.

Date/Time:	08-13-2023 / 08:00 am
Wx Obs:	Wind: 1-5 kts kts , Seas: 2-4 ft , Baro: 1016.0 , Visib: 1 nm (Fog)
Position:	Lat. 37 deg 28.3' N / Long. 123 deg 01.6' W
Status:	Run survey lines with USBL (Ranger)
Schedule:	Aug 08th: Preparing for departure / Underway at 19:45 pm for crash site Aug 09th: Launch ROV at Op site Alpha Aug 10th: Launch ROV at Op site Bravo/Charlie Aug 11th: Run Grid Pattern and search with USBL Aug 12th: Conduct dive operations Aug 13th: Run survey lines with USBL, transit to SD op location
Crew On :	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Kraft
Client:	Lone Star Retrieval (Richard Ball) onboard
Mach:	Tugger winch repaired and ready for pickup at SDH
Containers:	Shipped.com delivering two containers on August 16th to TAMT
Eng Rm:	Repairs Needed- MSD under repair, # 8 Cabin sink ,CM Cabin toilet -, Stbd Radar not working

Date/Time:	08-14-2023 / 08:00 am
Wx Obs:	Wind: 1-5 kts kts , Seas: 2-3 ft , Baro: 1014.0 , Visib: 6-8 NM
Position:	Lat. 34 deg 58.0.3' N / Long. 121 deg 44.2' W
Status:	C/C - underway to Lear Jet Crash Site
Schedule:	Aug 11th: Run Grid Pattern and search with USBL for Twin Eng Otter Aug 12th: Conduct dive operations Aug 13th: Run survey lines with USBL, transit to ROV location Aug 14th: C/C transit to Sam Clemente Island Crash site
Crew:	M. McCabe, J.Martti, C.Petrone, D.Wood, J.Berger, N.Belt, A. Reed , M.Cascade, T.Drummond , (9 crew)
ROV Team:	Navigators -C.Kenyon, G.Burnett - EGI Rov team.-T.Wass, K. Stimach, R.Schlepp, S. Saintamour, S.Mogk, Rob Kraft
Client:	Lone Star Retrieval (Richard Ball) onboard
Mach:	Tugger winch repaired and ready for pickup at SDH
Containers:	Shipped.com delivering two containers on August 18th to TAMT
Eng Rm:	Repairs Needed- MSD under repair, # 8 Cabin sink ,CM Cabin toilet , Stbd Radar not working