



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 19, 2022

Group Chair's Factual Report

SEARCH AND RECOVERY

DCA21FA174

Attachment 8 - EGI Final Report
(51 pages)

TRANSAIR FLIGHT 810, BOEING 737-275C
FAA REGISTRATION N810TA
PROJECT FINAL REPORT



TRANSAIR FLIGHT 810
BOEING 737-257 RECOVERY
🇺🇸 OAHU, HAWAII. 2021 🇺🇸

08 February 2022

Submitted To:
Matthew Teeuwen
Assistant Vice President
AIG Aerospace
1175 Peachtree Street, NE, Suite 1000
Atlanta, Georgia, 30361

Submitted By:
Eclipse Group, Inc.
1997 Annapolis Exchange Parkway
Suite 300
Annapolis, MD 21401
Ph.: 410.533.3041
Fax: 410.972.4701
www.eclipse.us.com

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.

Table of Contents

INTRODUCTION	4
FINAL REPORT OBJECTIVES	4
RECOVERY OBJECTIVES - (NTSB ACCIDENT NUMBER DCA21FA174).....	4
REPORT RECIPIENTS	4
PROJECT BACKGROUND	5
RECOVERY OBJECTIVES.....	6
NTSB.....	6
STATE OF HAWAII, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	6
PROJECT PARTICIPANTS	6
STATE OF HAWAII STATE EMERGENCY RESPONSE COMMISSION (SERC) / LOCAL FEDERAL AGENCIES	7
<u>HAWAII DEPARTMENT OF HEALTH (DOH)</u>	<u>7</u>
<u>HAWAII DIVISION OF AQUATIC RESOURCES (DAR).....</u>	<u>7</u>
<u>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA).....</u>	<u>7</u>
<u>UNITED STATES COAST GUARD (USCG)</u>	<u>7</u>
<u>HAWAII DEPARTMENT OF TRANSPORTATION.....</u>	<u>8</u>
PERIOD OF PERFORMANCE.....	8
OPERATIONS AREA (OPAREA).....	8
PROJECT ASSET DESCRIPTION	8
ROV SUPPORT VESSEL - RV BOLD HORIZON (BH)	8
<i>WORKING DECK</i>	<i>9</i>
<i>VESSEL POSITIONING, ENDURANCE AND EFFICIENCY</i>	<i>9</i>
<i>VESSEL HABITABILITY</i>	<i>9</i>
EGI REMOTE OPERATED VEHICLES (ROV)	10
<i>SURVEY POSITIONING, TRACKING AND DATA ACQUISITION</i>	<i>10</i>
DERRICK BARGE SALTA VERDE (DBSV).....	11
<i>VESSEL POSITIONING</i>	<i>11</i>
TUG, SHIRLEY C	12
OSRV SENTRY	12
PRE-PLANNING	13
RECOVERY EVALUATION	13
TARGET POSITIONS	16
COCKPIT & MAIN BODY DISTANCE SEPARATION	18
ANTICIPATED WEIGHTS OF WRECKAGE	18
ENVIRONMENTAL CONDITIONS.....	19
REGIONAL AND STATE STAKE HOLDERS ENGAGEMENT	19
HAWAIIAN DEPARTMENT OF AQUATIC RESOURCES (DAR) / NOAA AND EPA	19
UNITED STATES COAST GUARD (USCG).....	20
ASSET JUSTIFICATIONS.....	20
PREPARATIONS.....	22
RV BOLD HORIZON	22
DERRICK BARGE SALTA VERDE	22
RIGGING	23
WEATHER MITIGATION.....	24
OPERATIONAL APPROACH.....	24



OPERATION HIGHLIGHTS	27
TIMELINE SUMMARY	29
PROJECT TIME LINE	33
PROJECT REPORTING	34
SITUATION DAILY REPORTS (SITREPS)	34
OPERATIONAL RESULTS	34
TECHNICAL OBJECTIVES	34
TECHNICAL RESULTS	34
ENVIRONMENTAL PROTECTIVE OBJECTIVES	35
ENVIRONMENTAL PROTECTIVE RESULTS	35
LESSONS LEARNED.....	35
APPENDIX I.....	38
ENVIRONMENTAL SITREPS	38

INTRODUCTION

Eclipse Group Inc. (EGI), under contract to AIG Aerospace, was tasked with the recovery of the ditched aircraft, TransAir Flight 810, a Boeing 737-275C off the coast of Oahu, Hawaii. The recovery objectives were the fuselage, engines and associated debris.

This effort was performed over a period of 21-days and was successfully completed on November 02, 2021. Operations concluded with the delivery of the entire aircraft fuselage, engines and other associated wreckage to Kalealoa Barbers Point Harbor, Oahu, Hawaii.

EGI provided vessel, ROV and subsea navigation services in the form of EGI's Research Vessel R/V "BOLD HORIZON" (BH), Derrick Barge "D/B SALTA VERDE" (DBSV), Barge assist Tug "SHIRLEY C", GP-50 Remote Operated Vehicle (ROV) and all personnel required for the operation of this equipment.

The Client Representative, Lone Star Retrieval, independently contracted Pacific Environmental Corporation (PENCO) for capture and clean up of potential petroleum products released during the salvage and American Marine Inc. for pier side logistical support.

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 DCA21FA174)

All items identified by the NTSB essential to the investigation during the course of the operations.

- ⇒ Specific items identified for recovery include the following:
 - Aircraft cockpit
 - Main fuselage – to include:
 - Flight data recorders
 - Internal Cargo Containers
 - Engines
 - Thrust Reversers
 - Ground Proximity Warning Computer
 - Removal of misc. wreckage to include:
 - Forward landing gear
 - Separated Aircraft components
 - Cargo containers
 - Airplane debris, sheet metal etc.

REPORT RECIPIENTS

Distribution of this report by Eclipse group is limited to National Transportation Safety Board (NTSB), AIG Aerospace, and AIG's designated representative, Lone Star Retrieval.

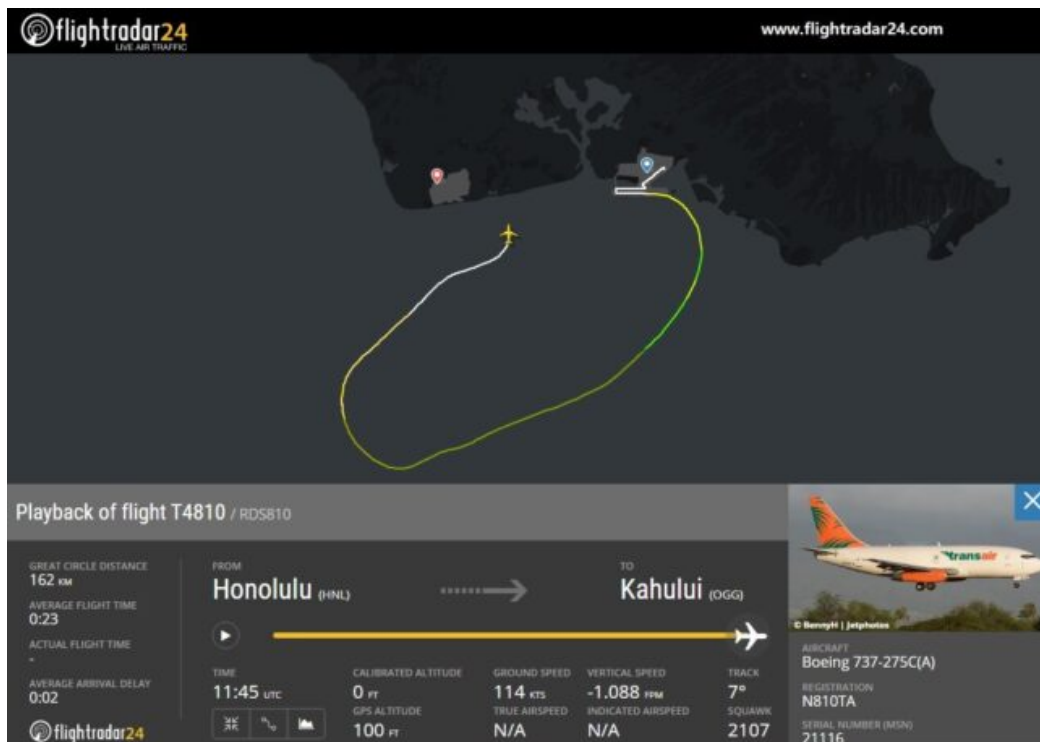
PROJECT BACKGROUND

TransAir Flight 810, a Boeing 737-275C, Operated by Rhoades Aviation, departed from Honolulu's Daniel K. Inouye International Airport (HNL) in route to Kahului International Airport (OGG), Kahului, Hawaii on July 2, 2021. The aircraft was registered as N810TA and was operating under 14 Code of Federal Regulations Part 121 as a cargo flight.

At the time of departure, the aircraft was loaded with 2,000 gallons / 14,000 lbs. of fuel and 19,897 lbs. of cargo, identified as pharmaceuticals, tires, and other miscellaneous cargo. Communications between the flight 810 and tower, during the climb-out stated the aircraft had lost all power from its left engine.. The crew then reported the aircraft started to lose power from the right engine. The aircraft attempted to return to the airport while the tower alerted emergency ground services.

The aircraft continued to loose both power and altitude and was diverted to the closer Kalaeloa Airport. At approximately 0145 local time the airplane ditched into the Pacific Ocean south of the island of Oahu, approximately two nautical miles south of the Kalaeloa Airport in an area known as Mamala Bay. The only occupants at the time of the accident were the two pilots who were able to exit the aircraft through the cockpit windows and were subsequently rescued by the US Coast Guard. Aircraft floating debris including miscellaneous cargo was recovered at the site immediately after the ditching

The NTSB initiated an investigation into the loss of the aircraft and conducted a search and subsequent survey of the debris field utilizing a remote operated vehicle (ROV). The ROV located all major components of the aircraft including cargo containers, which had been ejected at the time of the accident. The debris field area was approximately 700 ft. long by 100 ft. wide with seafloor depths ranging from 360 – 420 feet seawater (FSW).



RECOVERY OBJECTIVES

NTSB

Congress charges the NTSB with the directive of investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation -- railroad, highway, marine and pipeline -- and issuing safety recommendations aimed at preventing future accidents.

This particular accident did not involve the loss of life but still represented a serious accident. The NTSB led this investigation with the objective of recovering all relevant components from the aircraft to establish the probable cause or causes of failure that precipitated this accident.

This accident was unusual given that the downed aircraft was relatively intact, having broken into two major sections, offering a unique opportunity to understand inherent failure points in this particular situation for this aircraft type.

NTSB objectives included documentation of entire aircraft remains, the recovery of the flight data recorder, cockpit voice recorder, enhanced ground proximity warning system (EGPWS) computer, both engines with their fuel controllers, and documentation of the cockpit switch positions.

STATE OF HAWAII, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

The aircraft was loaded with 2,000 gallons of jet fuel and carried general cargo that included pharmaceutical supplies at the time of the accident.

The State of Hawaii and the National Oceanic and Atmospheric Administration (NOAA) Fish and Wildlife Service (FWS) alarmed by the presence of fuel and pharmaceuticals in the vicinity of protected habitats and the potential environmental impact, required the removal of the aircraft to eliminate the potential contamination by residual jet fuel and other fluids.

EGI's recovery met all goals by locating all of the components required by the NTSB for the on-going investigation and the removal of the pharmaceuticals and wing fuel tanks from the sea bottom.

PROJECT PARTICIPANTS

EGI provided an experienced vessel and subsea recovery team for this effort with significant experience in aircraft recovery. EGI's team also included Ms. Darla White, a highly regarded Hawaii based marine biologist, to address environmental reporting on indigenous flora and fauna status at the recovery site and to report her observations to the State of Hawaii EPA and NOAA.

The National Transportation Safety Board (NTSB) team included an Investigator In Charge (IIC) on shore and two NTSB representatives on-board the recovery vessel. The NTSB team provided advice and directed the recovery of items of importance to the investigation. Boeing also provided a technical team both onshore and aboard the vessel to assist with technical details in the investigation.

AIG's on-site representative was Mr. Richard Ball, principle for Lone Star Retrievals. Mr. Ball was present to monitor recovery efforts, advise as necessary, and to coordinate the transfer to shore, then arrange for disposal of the wreckage.

Lone Star Retrieval contracted the services of Pacific Environmental Corporation (PENCO), an emergency response cleanup responder to assist in hazardous waste mitigation. PENCO reported directly to Lone Star Retrieval.

A representative from the U.S. Navy Office of Supervisor of Salvage (SUPSALV), Mr. Brian Blake, was present during the recovery of the forward section of airplane as an observer but also provided peer review with respect to recovering the wing and tail section methodology.

STATE OF HAWAII STATE EMERGENCY RESPONSE COMMISSION (SERC) / LOCAL FEDERAL AGENCIES

All aspects of the recovery were discussed, reviewed, approved and monitored by the State of Hawaii SERC comprised by Department of Health (DOH), Department of Aquatic Resources (DAR), National Oceanic and Atmospheric Administration (NOAA) and the United States Coast Guard (USCG). Representatives of these departments are identified as the following:¹

HAWAII DEPARTMENT OF HEALTH (DOH)

Liz Galvez

Emergency Preparedness & Response Coordinator

HAWAII DIVISION OF AQUATIC RESOURCES (DAR)

Brian Neilson

DAR Administrator

Ryan Jenkinson

DAR Protected Species Lead

David Gulko

DAR Coral Biologist and Lead for this operation at DAR

Cathy Gewecke

DAR Permitting Specialist

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

Danielle Jayewardene

Marine Natural Resources Management Specialist

Ron Dean

NOAA Pacific Islands Regional Office (PIRO) in Honolulu
Branch Chief at NMFS Office of Protected Resources

UNITED STATES COAST GUARD (USCG)

LCDR Joshua Williams

Waterways Management, Chief

LCDR Jay Hodges

Emergency Management and Readiness

¹ It is recognized that there are many individuals who are active parties to and critical to this effort and any omission is strictly unintentional.

Bradley Lindsey, BMC
Waterways Management

HAWAII DEPARTMENT OF TRANSPORTATION

Peter Pillone
Harbor Master

PERIOD OF PERFORMANCE

- September 30 through November 23, 2021
- This included transit times from vessel homeports to the operations area and back to homeport at the completion of the operation.

OPERATIONS AREA (OPAREA)

- Mamala Bay, Oahu, Hawaii
- The NTSB coordinated with the FAA and USCG to close surrounding waters (1 NM) and airspace from October 8 through November 6, 2021.

PROJECT ASSET DESCRIPTION

ROV SUPPORT VESSEL - RV BOLD HORIZON (BH)



Figure 8. M/V 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,
 - 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 handling 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.

EGI REMOTE OPERATED VEHICLES (ROV)



EGI is providing the GP-50 ROV (A second vehicle is also provided as back-up) 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. The 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 video is 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 II 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.

DERRICK BARGE SALTA VERDE (DBSV)



Figure12. Derrick Barge Salta Verde (DBSV)

Curtin Maritime Corporation (CM), based in Long Beach has been contracted by EGI to provide heavy lift assets for this recovery.

CM provided the 200 Ton, 185 ft. LOA, 50 ft. beam, US Flagged, Jones Act compliant, United States Coast Guard (USCG) documented and American Bureau of Shipping (ABS) classed / inspected 4-point DERRICK BARGE SALTA VERDE (DBSV).² This vessel provides the lift capability and deck space for the recovery of the aircraft to deck and delivery to Barbers Point Harbor.

The DBSV deck equipment includes the following:

- Clyde Frame 7 Five Drum 2,000' of 1 1/8" Winch and Anchor System
- MD-97 Water Fall Recovery Winch with a drum pulling power of 195,000 lbs.
- Manfred: Manitwoc 4600 Series III Crane with a maximum lift capability of 270,000 lbs.
- Multiple pneumatic tuggers place around the deck
- Rigging and Welding Shop

VESSEL POSITIONING

The DBSV will be towed to site, positioned and tended by a Curtis Maritime tug identified below for the duration of the operation. Once in place it is held in position by a 4-point anchor spread.

² The NTSB has also worked previously with this vessel for the recovery of the Dive Boat Conception in Santa Barbara, California.

TUG, SHIRLEY C

Figure 14. Loadline Tug Shirley C

The 120 ft. CURTIN Loadline Tug Shirley C will transport the DBSV from Long Beach, tend the anchors, and provide a safety vessel for the barge occupants.

OSRV SENTRY

Figure 15. Photo of OSRV SENTRY

AIG will provide the PENCO Oil Spill Response Vessel (OSRV) SENTRY. The MV SENTRY is a 100 ft. LOA offshore supply ship that has been modified for the collection and containment oil resulting from

spills. The ship's crew stands a round-the-clock watch to provide visiting tank ships with a quick-response capability in the event of an oil spill.

PRE-PLANNING

RECOVERY EVALUATION

An initial site survey was performed by a local ROV company – SEA Engineering Inc. under the direction of the NTSB. The ROV and vessel used, while small, achieved good results and were able to locate and map the extents of the debris field and the respective positions of major aircraft debris.

The Boeing 737 had performed a controlled, low-speed ditching onto the surface of the ocean. By design, both engines broke free from their respective wing pylons. The cockpit / forward section of the fuselage separated from the aft section at the leading edge of the wings. It was found that the forward wing spar failed during the impact. The aircraft carried one pallet and six cargo cans, four remained in place, and two were ejected from the aircraft.

The NTSB provided the results of the survey as well as ROV video and images to all prospective contractors for planning and bidding purposes. Example images of the key recovery objects and a table and charts with their relative positions and distances are provided below.





TARGET POSITIONS

Target Name	X	Y	Latitude	Longitude	Depth (Ft)	Video time
Tail Section (with Main Wings)	601212.42	2353304.38	21° 16' 43.2873" N	158° 01' 27.6581" W		7/7/2021 16:45:36
Aft of Tail Section	601236.97	2353292.74	21° 16' 42.9038" N	158° 01' 26.8086" W	363	7/7/2021 16:56:41
Forward of Tail Section	601203.03	2353317.23	21° 16' 43.707" N	158° 01' 27.9811" W	340	7/7/2021 17:01:06
APU	601111.13	2353168.36	21° 16' 38.8839" N	158° 01' 31.2017" W	366	7/8/2021 9:19:12
Engines	601111.84	2353172.94	21° 16' 39.0325" N	158° 01' 31.176" W	366	7/8/2021 9:21:30
Nose Landing Gear	601115.93	2353177.83	21 °16' 39.1909" N	158° 01' 31.0332" W	354.5	7/8/2021 9:29:28
Forward of Cockpit Section	601122.79	2353184.31	21° 16' 39.4002" N	158° 01' 30.7938" W	363.5	7/8/2021 9:33:16
Aft of Cockpit Section	601135.39	2353198.86	21° 16' 39.871" N	158° 01' 30.3533" W	364	7/8/2021 9:36:25
Thrust Reverser Engine 1	601154.04	2353136.19	21° 16' 37.829" N	158° 01' 29.7198" W	437	7/8/2021 9:58:48
Inlet Guide Vane	601160.42	2353123.46	21° 16' 37.4135" N	158° 01' 29.5009" W	440	7/8/2021 10:06:15
Tires	601202.36	2353202.37	21° 16' 39.9715" N	158° 01' 28.029" W	432	7/8/2021 10:24:50
FedEx Cargo Can (SAA 34562 FX)	601158.96	2353256.42	21 °16' 41.7382" N	158° 01' 29.5234" W	341	7/8/2021 10:36:19
TransAir Cargo Can (SAA 4054 TXHA)	601154.91	2353244.99	21° 16' 41.3671" N	158° 01' 29.6662" W	345	7/8/2021 10:39:18
Keel Beam	601087.2	2353202.52	21° 16' 40" N	158° 01' 32.0246" W	350	7/8/2021 13:52:59

X and Y coordinates are UTM North Zone 4 meters. Depth is from ROV pressure sensor.

In the following chart, the distance between the Inlet Guide Vane and Forward of Tail Section is 0.11 nm (648 ft). The direction of travel was lower left to upper right (arrow) and the tail was floating when the Coast Guard arrived.



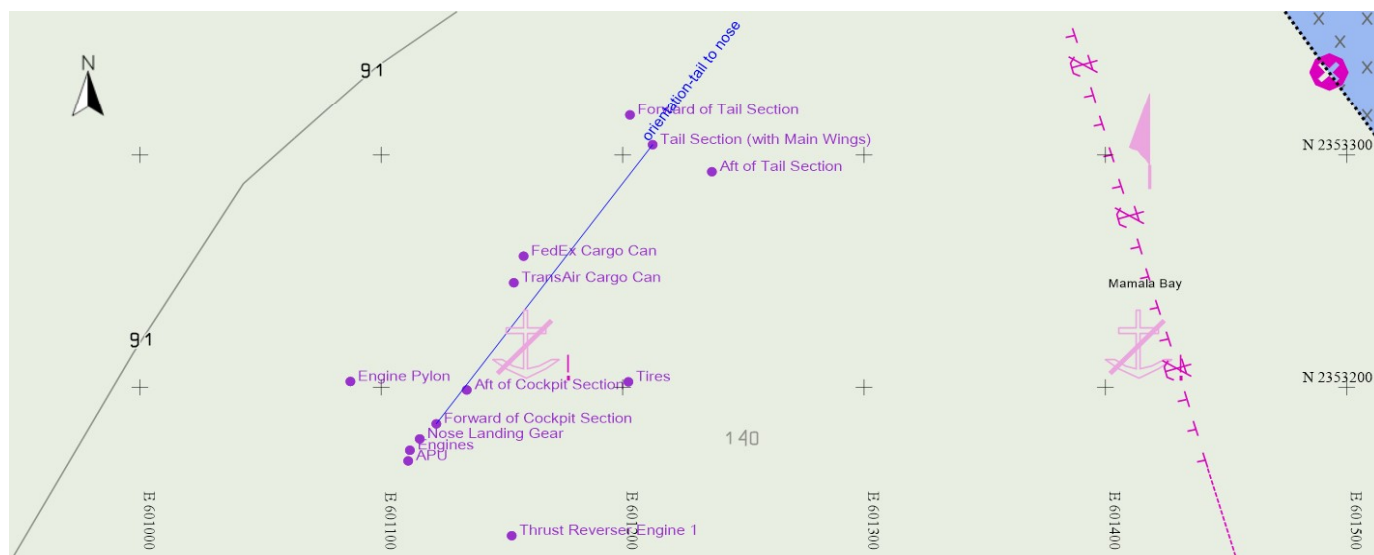
Figure 5. Relative locations of debris determined by survey ROV.

Note the following corrections:

- The part marked Engine Pylon was subsequently found to be the Keel Beam.
- The part marked APU was subsequently found to be an air conditioning pack
- The part marked Thrust Reverser Engine 1 is not confirmed to be from that engine.

COCKPIT & MAIN BODY DISTANCE SEPARATION

name (target from-to)	layer	sol e	sol n	eol e	eol n	dist(ft)	dist(m)	bearing(deg)
orientation-tail to nose (1 to 7)	SURVEYLINES	601212.42	2353304.38	601122.79	2353184.31	491.58	149.83	216.74



Upon award of the recovery contract, EGI developed a recovery plan in collaboration with the NTSB and Lone Star Retrieval based on the site survey and available information. The Boeing Company also provided “subject matter experts” to assist in planning. This technical review evaluated structural integrity, anticipated weights, centers of gravity of the larger sections and placement of recovery rigging to minimize the potential for further breakup of the wreckage. A significant amount of time was spent in the pre-planning phase evaluating worst-case scenarios and alternate rigging plans.

ANTICIPATED WEIGHTS OF WRECKAGE

TARGET WEIGHTS OF INDIVIDUAL PIECES	NOMINAL WEIGHT IN TONS	WORST CASE WEIGHT IN TONS	NOTES
LEFT WING (85000*.5028/2/2000)	10.69	21.25	21.25 Tons for worst case scenario assumes (1) tanks full of water (2) loss of tail lift so tail weight is divided between the wings
RIGHT WING (85000*.5028/2/2000)	10.69	21.25	21.25 Tons for worst case scenario assumes (1) tanks full of water (2) loss of tail lift so tail weight is divided between the wings
TAIL (49.72%)	21.12	31.81	NOTES: 1) Worst case of 31.81 assumes failure of basket lift at one wing. 2) The 21.12 ton weight should be the load on the whip line when the wings are aboard the barge as the cargo containers above water level drain.
AFT SECTION, TOTAL		42.5	NOTES: 1) Shown suspended in level attitude and fully supported by crane, which is not the intended method of recovery. 2) Fuel tank draining reduces this to 22 tons total as water drains from wings. 3)
COCKPIT WINDOWS (64%)	4.9	7.7	Worst assumes total failure of either lift point
REAR OF FWD FUSELAGE SECTION (36%)	2.8	7.7	Worst assumes total failure of either lift point
FORWARD FUSELAGE, TOTAL		7.7	

ENVIRONMENTAL CONDITIONS

The crash site is located on the southern side of Oahu. This location had environmental characteristics that included warm water with excellent visibility, hard but uneven seafloor with a relatively steep grade sloping away from the island.

The seabed is defined as pavement, primarily lava rock with little sediment covering; the wreckage was resting unobstructed on this hard layer. The lack of sediment also provided for exceptional water clarity estimated at a distance of 80' to 100' of visibility. These two factors significantly improved the ease and safety of the operation, reducing the risk of entanglement by the ROV with the wreckage and recovery rigging.

Significant waves and swells are a common characteristic of the Hawaiian Islands and were present for this operation. Sea states were a critical factor in planning operations; the anticipated weight of the tail section was estimated at 95,000 lbs. The surface area of the aircraft pushing against the surrounding water induced by wave and swell conditions produces a potentially dangerous condition called dynamic loading / snap loading which would be magnified by a factor of 3-times actual weight depending on sea states which can lead to catastrophic failure of the crane, rigging or the aircraft.

Our target for commencing operations was September 15th. Due to delays in contract review, signing and then rigging procurement, the commencement of operation was delayed to October 12th. Historically the winds and swells increase to unworkable levels by mid to late November so speed of recovery was a of critical importance. The heaviest lifts required nearly perfect sea states, and careful planning was required. EGI incorporated long-range subscription weather reporting services, which became one of the single most important tools for this operation.

REGIONAL AND STATE STAKE HOLDERS ENGAGEMENT

The aircraft was located within 12-nautical miles of the coast of Hawaii. Any activity occurring within state waters required the approval of the state.

HAWAIIAN DEPARTMENT OF AQUATIC RESOURCES (DAR) / NOAA AND EPA

Protection of natural resources is of vital importance. The State of Hawaii places a top priority on the protection of the natural resources of the Hawaiian Islands and the surrounding ocean. These resources are of vital resource to both the natural and economic health of the State. Approval for this operation needed to be obtained from the Department of Aquatic Resources (DAR), NOAA and the EPA. The State of Hawaii had two objectives:

- 1) Removal of the aircraft to protect state natural resources
- 2) Insure any removal effort did not adversely impact these same resources.

EGI balanced operational requirement to achieve these objectives and addressed this requirement by retaining Ms. Darla White, MSc. a highly regarded Hawaii based Marine Field Ecologist for the establishment and the implementation of Best Management Practices (BMP) for the protected species related environmental monitoring requirements and BMP implementation in the event of animal interaction with operations. Ms. White also served as the Protected Species Observer (PSO) during all recovery operations. As the PSO, she ensured all parties are were knowledgeable of the BMPs, recording

observation data, and summarizing the observations into a report upon completion of the recovery operation and to report such findings to the State of Hawaii.

EGI opened dialog with these agencies early into the planning process so that an understanding could be established of their policies and requirements to be able to operate within 2 nautical miles of Oahu. EGI engaged the services of a local marine scientist who had established relationships with the agency leadership. Through ongoing dialog EGI was able to address concerns, establishment of rules of the road and reporting requirements.

UNITED STATES COAST GUARD (USCG)

EGI contacted the United States Coast Guard for the same purposes and to understand any local requirements and to request approval for marine operations.

Upon arrival in Hawaii and prior to the commencement of operations, EGI met in-person with each of these groups to provide the opportunity for follow-up questions and resolution of any outstanding concerns.

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.

EGI responded to this time element by considering options for both a dive support vessel and heavy lift assets that were immediately available and in close geographic proximity to the mishap. The OPAREA was located off Hawaii in the Pacific with rapidly degrading weather approaching in the winter months. Arriving on scene as quickly as possible was our most important objective.

The crash site was within two nautical miles of the shore and eight nautical miles from Barbers Point, Hawaii. Barbers Point was designated as the port that would receive the wreckage. Close proximity to these two points allowed us to consider assets that might not otherwise be appropriate for an operation further out at sea.

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 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 and investigative 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

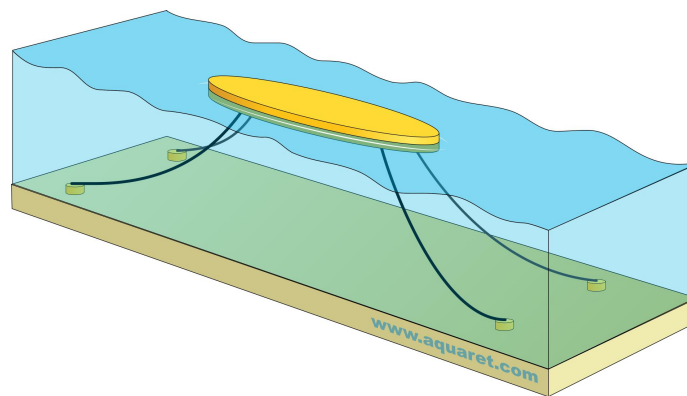
It was determined that a single vessel solution was not appropriate for this operation. A vessel with adequate lift capability and deck area for all of the required equipment was not geographically available and would require unacceptable delay in time at higher cost to relocate from areas further away such as the Gulf of Mexico. Barge assets were considered the best alternative to supporting the lifting and deck requirement. Operating the ROV from the barge was explored, however based on past experience this was not considered a suitable option, the debris field was relatively long and the ROV would be based on a platform with limited maneuvering capability to shift around the debris field and it was determined that a second ROV support vessel would provide greater flexibility.

When considering other 3rd party options, the time and cost to transport, mobilize and transit to station individual components, i.e. the ROV, vessel and additional support equipment was considered a significant trade-off versus the benefit of utilizing an asset that was already mobilized and was considered the best option for ROV operations.

EGI maintains a company owned, fully mobilized ROV support vessel, the RV BOLD HORIZON, which is home ported in San Diego, CA. This vessel was 10-days sail from the crash location and offered everything needed for this recovery in addition to sufficient accommodations for the investigators and operations team.

For our heavy lifts it was determined that a derrick barge was the logical solution, EGI reviewed available options. Again factors that were considered were availability and location.

Trade-offs with utilizing a barge included lack of accommodations to support the number of operations personnel required. Having the investigation team taxi from shore locations was not considered due to logistical issues, safety and cost. Bold Horizon offered the advantage of being able to accommodate the investigative team.



EGI considered several subcontractors to provide the heavy lift asset. There was one company with suitable assets in Hawaii. As a competing bidder for this project, they were unwilling to provide an offer to Eclipse.

EGI, however, identified a suitable asset from Curtin Marine, a service provider with whom EGI has an exiting relationship. The vessel utilized a four-point anchor - The method of anchoring a vessel such as the DBSV by locating four anchors on the sea bottom. Once the four anchors are in place the barge can shift locations by moving in and out on the individual anchor lines. A tug or other boat maneuvers the anchors into the respective positions and the approximate locations can be seen on the water surface by noting the locations of buoys over the anchors.

The asset was available immediately and the contractor had local knowledge of Hawaii having worked there in the past. These factors were determined to be benefits. The trade-offs identified were the following:

- The asset was smaller than desired and was located in California requiring it to be towed to Hawaii
- Utilizing a barge include the need to be placed on a 4-point more which would require time to set anchors and had implications related to seabed disturbance

PREPARATIONS

Upon award and during contract negotiations, preparations commenced and project specific equipment was acquired for the operation. A general list of major items included:

RV BOLD HORIZON

- Additional rigging
- Recovery Baskets
- Rental Air Tuggers
- Compressor to operate the air tuggers
- Spare Generator
- Hydraulic hole saw
- Additional Spares

DERRICK BARGE SALTA VERDE

- 2" Lift wire
- Rigging
- Water Fall Lift Winch
- Fairlead
- Additional Air tuggers
- Dunnage

Due to the protracted nature of the negotiations, some of the high dollar items were not ordered until negotiations were completed. Due to time constraints some items were air shipped to Hawaii to meet the ships rather than delay sailing with these items included

- Additional Rigging
- High volume air compressor
- ROV Spares

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 95,000 lbs. Potential dynamic loading was then estimate to determine the safe working loads of the tail section rigging. The safety factor used for any single piece of rigging for this lift was established at 1.5 SWL or 154,000 lbs. for any single piece of rigging for the aft section lift.

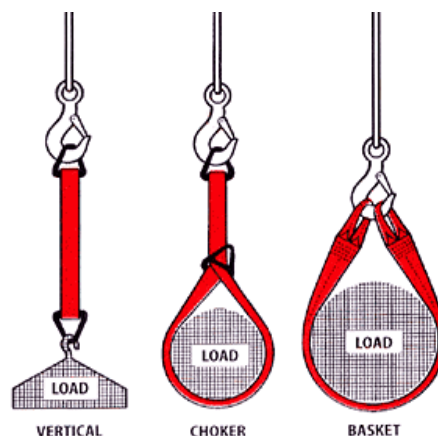
The net effect was that the planned lift of the tail utilized a three-point / leg rigging arrangement, any one of the three points / legs of our lift was capable of supporting the entire static load. The limiting factor was the ability of the crane to pick the aircraft with dynamic loading with entrained water through the air-water interface, for this phase of the recovery environmental planning became a critical factor.

The approach to minimize this potential issue was to rig the aircraft such that it lifted at approximately a 45° upward angle of attack, keeping the wings and the heaviest part of the aircraft as close to the crane as possible at an angle that minimized the surface area on which the sea states could act upon.

By lifting the aircraft in this manner, the aft end of the aircraft remained in the water at the air/water interface allowing the aircraft to shed water and weight as it was lifted in incremental steps through the air/water interface onto the barge.

To provide a further level of safety, a maximum target weight limit was established. Once the maximum target weight was reached, the lift was halted to allow water to drain from the aircraft until the weight dropped below this number and the lift was resumed. The highest surge load observed was 90,000 lbs. during this evolution. The final dry weight of the aircraft was approximately 60,000 lbs. after recovery.

Using a combination of thru frame ROV lifts and or the use of the ship's J-Leg davit would accomplish lifting of the smaller wreckage and baskets with an air tugger. Pieces that were small enough would be placed into a salvage basket to optimize the collection of debris. Wreckage by nature is irregular in shape. The larger pieces are strapped with either synthetic or steel straps, with the objective of insuring that the wreckage cannot slip out of the strap.



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>

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 wind, 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:

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OPERATIONAL APPROACH

The coordination of the arrival of vessels, support equipment and personnel were key elements in the management of this project. Efficient use of these resources in the face of progressively deteriorating sea states and the onset of winter would have a profound impact on the success and the overall cost of the operation

It was understood from the onset that the Bold Horizon was able to make the voyage from CA to Hawaii more quickly than the Salta Verde by four (4) days. The Salta Verde, upon arrival would require at least two-days to prepare its equipment for operations.

EGI used this six (6) day timeline difference to its benefit. Prior to arrival of the barge at the crash site, It had been agreed that EGI would perform an environmental survey of proposed anchor locations and to establish the conditions at the site both before and after the operation to provide a quantifiable impact study

report on the evaluation and monitoring of the salvage efforts on the seabed and surrounding marine life to both State and federal agencies.

While the Salta Verde was in transit and then preparing for operations, EGI would perform these environmental surveys and then pre-rigging large debris making the most efficient use of time upon arrival of the barge. A general workflow was established and is provided below:

1. On arrival, an in-person meeting / review of operations will be conducted with representative(s) of Coast Guard, Hawaiian Natural Resource, NOAA, Port Officials, and PENCO. The vessels may undergo an invasive species hull inspection using the state provided ROV.
2. BH will transit to the OPAREA at the earliest time allowed. The vessel will shift into operations starting with an initial bottom survey of the debris area and proposed anchor sites. Upon completion of survey, recovery baskets will be deployed in the highest debris concentration areas in accordance with NOAA species protection guidelines.
3. The aircraft engines will be rigged and recovered to the Bold Horizon for eventual delivery to port
4. BH ROV will pre-rig the major fuselage and cockpit to the degree possible prior to the arrival of the DBSV. The forward fuselage will have a cable through the cockpit windows and another beneath the rear of the section.
5. The aft main section will have two lifting points, the first being two basket loops with one under each wing, coming to a common point above the fuselage. Then the ROV will pass a line under the tail and if sea-states allow, the BH will temporarily lift the aft section to allow two straps to be deployed beneath the aft fuselage, under the pressure bulkhead and ahead of the aft doors.³ Each section would be rigged with two lifting points.

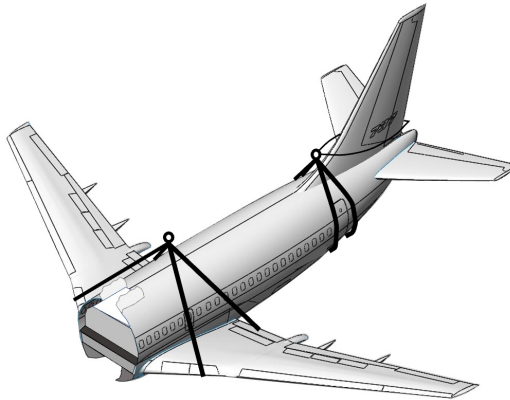
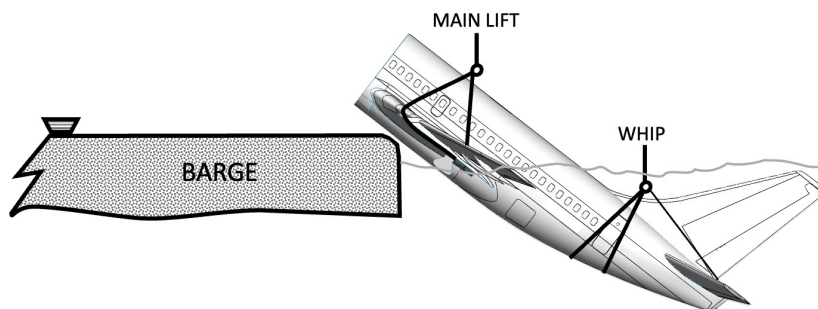


Figure 1. Aft fuselage after rear straps is passed beneath fuselage.

6. BH and ROV will fill debris baskets and recover as much as possible pending arrival of DBSV.
7. BH and ROV will record placement of DBSV anchors as part of the ongoing effort to document pre and post disturbance of the seabed.
8. The forward fuselage will be recovered and placed on the DBSV deckhouse, which has the deck load capability and suitability for this purpose for later offload in port.

9. PENCO is responsible for capture of oil &/or fuel and will be on call from beginning of operations. The PENCO Oil Spill Response Vessel (OSRV, 100 ft.) SENTRY will be on site prior to moving the wings to prevent fuel from reaching shore.
10. The main lift will be from a barge waterfall-style anchor winch to the basket haul rigging, which has been passing under the wings. A second line from the main master link will be attached to the pair of straps beneath the aft fuselage. The fuselage will be raised at a tail low angle, minimizing the load on the crane both during the in-water lift and during the air-water interface lift to deck.
11. Two tugger lines from two separate tuggers oriented fore and aft of the barge will be attached to the wing tips to stabilize the load during all aspects of the recovery operations. These tuggers will also insure that the aircraft does not spin in the water column and to correctly orientate the aircraft during the air-water interface lift.
12. Once the aircraft has arrived at the air-water interface, the barge will perform a load transfer from the waterfall winch to the crane main and whip lines. A pre-installed stinger attached to the master link will be for this transfer.
13. The rate of lifting will be slow through the air-water interface as water drains from the fuselage. The load during the lift will be monitored by the ROV and by use of the crane load cell to insure loading on the crane does not exceed safe working loads.
14. The front section will be brought aboard and the crane will support the rear as tugger winches laterally move the airplane into place.



15. Once the aircraft is onboard, secured and stabilized the CVR and FDR will be recovered and moved to shore as soon as possible.⁴ If needed a secured gangway will be utilized to allow safe access to the after door and access to the interior of the aircraft.
16. PENCO personnel will board DBSV to drain airplane fuel tanks into a 6,000 ISO tank, which they will provide.⁵
17. The tug will move DBSV to Barbers Point, probably to Pier 7. The BH with the ROV camera will remain on site to record bottom conditions, to include possible disruption where anchors had been placed.
18. Lone Star Retrieval (LSR) will have transportation waiting for the DBSV to unload debris at the pier.

⁴ The NTSB is to supply containers and transportation.

⁵ Note that an absorbent cofferdam will surround the airplane on deck and due to dihedral the cofferdam does not need to reach the wing tips. The wing tips are higher than the center so any remaining water/fuel mixture will be near the fuselage.

19. PENCO to remove the ISO tank with the water/fuel mix from DBSV and clean spilled fuel from barge as required.
20. End operations, load engines for return to California, conduct exit discussions. BH and DBSV depart.

OPERATION HIGHLIGHTS

The Bold Horizon arrived on location on October 12th, 5-days prior to the DBSV to perform the barge anchor and sewage pipeline outfall site surveys. The 1st day onsite proved too rough to dive however the vessel remained on location to monitor the weather. It is common to have weather and sea states that follow a pattern tied with the sun and moon which cause the seas to calm during a period of 24-hour cycle. This proved to be the case; the seas calmed after midnight and then rose again in the early afternoon.

The recovery team was able to dive early on the second day and survey the proposed anchor positions and performed a survey of the sewage outfall. With this task completed the next step was to shift to recovery operations. The ROV and EGI's vessel the Bold Horizon were then tasked with the recovery of smaller debris and the placement of recovery baskets in high-debris density locations. These baskets were to be loaded as time allowed or for the immediate recovery of any high priority items

The 1st priority for recovery were the aircraft engines and associated components to include the thrust reversers. This was accomplished via ROV thru frame lifts to the air water interface then transfers to the vessel crane at the surface to the deck of the ship. Initially synthetic straps were used to rig the engines, these are lighter and easier for the ROV to manipulate however the engines had sharp edges that cut and caused the straps to fail during the lift. At that time the decision was made to switch to wire straps. Once both engines were onboard they were transferred to the Port of Honolulu. During this initial round of lifts the forward landing gear was also recovered.

On the morning of October 17th, the Bold Horizon proceeded to the Port of Honolulu for the offload of the engines. The navigation team traveled to the DBSV at Barber's Point to install a repeater navigation and video system that allows the BH to share its subsea navigation system and ROV video with the DBSV to assist with operations.

Weather reporting indicated that the sea states started to lay down the afternoon of the October 19th with optimal weather October 20-22 for the recovery of the cockpit and tail section. The plan for the next 96-hours is for the DBSV to head to the site the morning of the 18th over the cockpit, the BH will then rig the cockpit and for the DBSV to perform the lift to deck the 19th. Upon completion the BH will attach the recovery rigging to the tail section for recovery immediately after with the goal of both lifts being completed by the morning of the 22nd.

The barge was set up on anchors by 1300 on the 18th and the ROV commenced rigging the cockpit to the barge winch wire. For safety with two vessels working within 100' of each other, the operation was ceased once daylight started to fade.

Operations resumed the morning of the 19th and rigging was completed by mid-afternoon. The barge was repositioned for the lift and the BH moved off location to allow the barge to freely operate and recovery operations commenced. At this time a problem with the barge winch was discovered resulting in excessive

overheating and recovery operation ceased. It was decided to cease operations for the day while the winch issue was resolved.

Operation resumed again the morning of the 20th, the DBSV winch operated correctly and the cockpit was recovered to deck by 11:00 in the morning. The NTSB team was onboard the barge to secure the cockpit. In the operational planning, the cockpit was to be moved to the upper deck of the barge to make space for the tail section, however late in the project the decision was made to place a containment tank onboard for the purpose of pumping residual fuel out of the wings. This tank did not allow for the movement of the cockpit to this area. The decision was made to send the barge back into port to offload the cockpit, the afternoon of the 20th and for the barge to be back on location the morning of the 21st.

Several hours later the operations team was informed by the 3rd party shore logistics company that there would be no shore support available to offload the cockpit until the morning of the 22nd effectively using up the weather window available for the recovery of the tail section. The earliest forecasted weather that potentially might be suitable for the recovery of the tail was seven (7) days away.

The barge was instructed to offload the wreckage as planned at Barber's Point, then to remain there until instructed to return to the crash site at the next available weather window.

From October 20th until October 25th the Bold Horizon shifted to pre-rigging the tail and site clearance, which is the process of recovering non-essential wreckage from the seafloor to restore the seabed to as pre-crash condition as reasonably possible. On the 25th the BH returned to port to offload garbage, take on provisions, swap out a faulty compressor and to perform a hull inspection. During the evening of the 22nd it was suspected that the BH had touched bottom and an inspection was performed to insure that no damage had been sustained.

An optimal weather window was identified on the 29th and 30th of October with the weather progressively improving on the 27th and 28th. The barge was instructed to head to the crash location on the 26th to set anchors and be ready to make the connection with the tail section. The barge was required to rig the wing slings, which occurred on the 27th and 28th. At the end of the day on the 28th tension was taken on the aircraft and 40,000 lbs. of tension was observed while setting the rigging into the wings. Operations were concluded for the day and instructions were given for the Penco remediation vessel to be on location at 08:00 the following morning.

The morning of the 30th the ROV placed a tugger line from the barge onto one of the wings of the aircraft to stabilize and keep the aircraft from rotating in the water column. One final check was made and the barge started recovery of the aircraft. The aircraft was recovered to deck at 10:30. The barge proceeded to secure the load and pull anchors. The NTSB team then transferred to the DBSV for the ride to Barber's Point to remove any residual fuel and recover the FDR and CVR.

Once the DBSV was clear of the area the Bold Horizon proceeded to perform a site clearance of the tail section location and recovered baskets. Operations were resumed the morning of the 31st and the Bold Horizon performed post anchor site surveys at the 10 anchor locations and a post survey of the sewage line outfall. Operations were formally concluded at 14:45 and the Bold Horizon returned to the Port of Honolulu for demobilization.

TIMELINE SUMMARY

DATE	DAY	BOLD HORIZON OPERATIONS	SALTA VERDE OPERATIONS	BH DAYS ⁶	DBSV DAYS ⁷
SEPTEMBER					
09/30	THURS	BH UNDERWAY		01	
OCTOBER					
10/01	Fri	BH Transit		02	00
10/02	Sat	BH Transit		03	01
10/03	Sun	BH Transit	DBSV Underway	04	02
10/04	Mon	BH Transit	DBSV Transit	05	03
10/05	Tue	BH Transit	DBSV Transit	06	04
10/06	Wed	BH Transit	DBSV Transit	07	05
10/07	Thurs	BH Transit EGI Project Team Arrives	DBSV Transit	08	06
10/08	Fri	BH Transit Meet local officials to review environmental and other plans and implementation.	DBSV Transit	09	07
10/09	Sat	BH Transit EGI Operations team travels to Hawaii	DBSV Transit	10	08
10/10	Sun	BH Transit /Arrives Operations team Embarks Prepping for operations	DBSV Transit	00	09
10/11	Mon	00:00 – Standing by at Pier 29, Honolulu prepping for operations 24:00 – Standing by for departure and weather	DBSV Transit	00	10
10/12	Tues	06:00 - Standby for departure 09:30 – Sea states are high, decision made to standby on location and watch the weather	DBSV Transit	01	11
10/13	Wed	00:00- Standby near location waiting on weather 08:25 – Dive #1 Trim and ballast test 09:30 - Trim and Ballast test complete 09:55 – Survey of cable location and pre-anchor surveys 13:45 – Recovered due to marginal sea states, heading to anchorage	DBSV Transit	02	12
10/14	Thurs	00:00 - Standing by at anchor 02:37 – Underway to work site 04:22 – ROV Deployed for pre-anchor surveys 12:01 – Survey's completed, prepping for basket deployment 13:05 – Basket deployed 14:40 – ROV rigging up forward landing gear 15:03 – Nose gear on deck, standing down for weather	DBSV Transit Arrives Barber's Point	03	00

⁶ BH - Bold Horizon Day Count

⁷ DBSV – Derrick Barge Salta Verde Day Count

10/15	Fri	00:00 – Standing by on weather 03:45 – Setting for basket deployment 04:10 – Changed dive plan for pre-anchor survey due to new location 04:48 – ROV deployed 05:13 – ROV recovered due to telemetry failure 12:00 – Trouble Shooting Issue 16:30 – Issue traced to a bad motor which was replaced 17:50 – ROV Pre-dove and ready to go. Waiting on weather	Prep for operations	04	00
10/16	Sat	04:32 – ROV deployed for engine recovery 05:07 – #2 Engine rigged and start recovery 08:40 – Recovery Strap is cut and engine is back on bottom 09:30 – ROV re-rigged and back at engines 11:20 – Engine #2 with out thrust reverser is on deck 12:31 – ROV at Engine #1 14:40 – Straps slip and Engine #1 is back on bottom 16:09 – ROV Re-rigging Engine #1 17:40 – Engine #1 on deck Standing by on weather	Prep for operations	05	00
10/17	Sun	00:00 – WOW running weather patterns 03:06 – Onsite for cowl recovery 05:16 – Inlet guide vane recovered to deck 08:55 – Both engine cowls recovered to deck 09:05 – Bold starts transit to PENCO dock for offload of engines, engine parts and other wreckage 10:30 – Alongside PENCO dock, Pier 14, Port of Honolulu 11:00 – Start offload, 64 dock personnel present 14:00 – Survey team meet with Barge team to install video telemetry system onboard the DBSV 18:00 – Standby at PENCO Pier	00:00 – Standing by at Barber's Point 14:00 – Survey team meet with Barge team to install video telemetry system onboard the DBSV	06	01
10/18	Mon	00:00 – Bold standing by at PENCO Pier 06:00 – Prepping for operations 11:50 – Departed PENCO pier for job site 15:00 – Anchors positioned and Bold Surveying them in 15:54 – ROV on water starting rigging of Cockpit, Plan is to attached and recover to the barge in the AM 18:00 – forward cockpit sling is rigged and choked, aft sling is staged in the AM	00:00 – DBSV Preparing for departure to the job site 12:45 – DBSV deploying anchors 15:00 Anchors deployed and ready for operations	07	02
10/19	Tue	00:00 – WOW 06:00 – Getting setup within DBSV anchor pattern 06:52 – Continue to rigging cockpit 15:42 – Rigging completed	00:00 – DBSV on location over Cockpit 10:40 – Deployed Lift line next to Cockpit 16:02 – Slack winch recovery line is taken up 16:12 – DBSV reporting winch	08	03

		16:12 – DBSV winch has issues, decision made to stand down for the day while issues are resolved and recommence with recovery at 1 st light	transmission issues, attempting to resolve. 17:30 - DBSV reports issue is identified and will work to insure they are ready at 1 st light		
10/20	Wed	05:00 – ROV onsite attaching barge lift winch to cockpit 08:30 – ROV moves off to observe, barge commences lift 08:35 - Cockpit off bottom 08:40 – ROV recovered and Bold standing off during recovery 10:50 – Cockpit recovered to deck, standing by for investigation team 14:38 Decision made to send DBSV to Offload the cockpit and to be back in the field by AM for tail rigging and recovery 14:40 – ROV Back at tail section to install additional rigging on tail section continue with bottom debris clearance	00:00 - DBSV on location over Cockpit 08:30 – Cockpit lift commences 10:50 – Cockpit is recovered to deck, NTSB team onboard 13:00 – Team is back onboard the Bold, DBSV recovering anchors 14:38 - Decision made to send DBSV to Offload the cockpit and to be back in the field by AM for tail rigging 17:00 – Barge along side, informed that Subcontractor American Marine is unable to organize the offload of the cockpit until 10/22 indicating a shortage of personnel and equipment to perform a single pick is the issue – This effectively blows our weather window for the tail recovery	09	04
10/21	Thurs	05:00 – ROV onsite pre-rigging tail section 13:11 - Tail basket rigging completed 13:20 – ROV continues site clearance Notable recoveries include both port and starboard thrust reversers	Standby at pier – Waiting for subcontractor to offload the tail	10	05
10/22	Fri	05:45 – ROV onsite performing site clearance Notable recoveries include APU and keel beam 16:21 – Water Taxi transfers customer and SUPSALV off the vessel	Standby at pier – Subcontractor arrives with 36 personnel, two porta-potties, two forklifts, one crane, truck for offload. Weather will not allow for the recovery of the tails, barge instructed to stay in port	11	06
10/23	Sat	05:30 – ROV onsite performing site clearance	Standby at pier	12	07
10/24	Sun	05:30 – ROV onsite performing site clearance 12:30 – Weather is up, heading to Barber's Point and the DBSV, will discharge wreckage onto the DBSV 14:07 – Along Side, Meeting with Barge Master 15:48 – Offload completed 18:07 – Departed Barber's Point, headed out to location to run weather patterns until sea subside	Standby at pier 14:07 – Start offload from the Bold Horizon onto the DBSV 15:48 – Offload completed	13	08
10/25	Mon	05:00 - ROV onsite performing site clearance 20:03 – Bold returns to Honolulu Pier 29 for provisioning	Standby at pier	14	09
10/26	Tues	Standby at pier, to offload trash, take on water and groceries, swap out faulty compressor and perform hull inspection	Standby at pier	15	10
10/27	Wed	00:00 – Standby at Pier 29 Honolulu 06:00 – Standby while DBSV establishes anchor spread 13:00 - Depart for crash site 14:40 - Arrive on site, survey in the anchor locations 15:52 - ROV in water loading baskets	06:00 – DBSV departs Barber's Point for crash site 13:00 – DBS has anchor spread out, Standby	16	11

10/28	Thurs	ROV in-water through out day pre-rigging tail section	06:00 - DBSV in position over aircraft 07:50 - Meeting onboard DBSV with operations team to review rigging plan	17	12
10/29	Fri	06:00 - ROV in water rigging tail section 09:30 - Rigging attached to barge winch wire 11:33 - Re-positioning Barge 12:23 - 40K of tension taken on winch wire, wire slacked off for recovery in the am 13:10 - ROV continues to perform site clearance	06:00 - DBSV on site over tail section 12:23 - All rigging in-place and tested Barge standing by for weather window in the am for final pick	18	13
10/30	Sat	06:24 - ROV attaches tugger line from barge to control aircraft attitude during ascent 08:31 Commence start of recovery at Aircraft visible from surface ROV recovered to deck 10:30 Aircraft on deck 11:42 - Standing by while barge pulls anchors 15:15 - ROV conducting site clearance of tail location 16:12 - Loading baskets with wreckage	06:00 - DBSV standing by for ROV, PENCO Vessel on location 08:31 - DBSV commences start of recovery at 10:00 - DBSV transfers load from recovery winch to crane 10:30 Aircraft on deck 11:42 Standing by while barge pulls anchors 13:50 - NTSB Personnel transfer to DBSV, all anchors recovered and heading to Barber's Point 16:08 - Entered port, maneuvering to come along side 17:30 - DBSV at pier 7, Booms deployed	19	14
10/31	Sun	06:00 - FEDEX cargo container recovered 09:40 - ROV Conducts post survey of 10 anchor locations, Inspects sewage outfall 14:45 - ROV concludes site surveys 17:00 - Bold Horizon concludes operations and returns to Honolulu port	1) DBSV to Pier 7 at Kalaeloa Harbor 2) PENCO removes ISO tank and Hazmat Offload Wreckage	20	15
NOVEMBER					
11/01	Mon	Prep for departure	Prep for departure	00	00
11/02	Tues	Prep for departure	Prep for departure	00	00
11/03	Wed	Prep for departure	Prep for departure	00	00
11/04	Thurs	Underway for home	Underway for home	1	1

PROJECT TIME LINE

One hundred and twenty two (122) days was the amount of time taken from the date of the initial accident to the successful conclusion of recovery operations.

The first table below outlines the significant events. The second table following the first provides a more granulated summary of each day's accomplishments.

DATE	OP DAY	PROJECT DAY	DESCRIPTION
7/02	0	0	Aircraft Ditches
7/07	0	5	NTSB Performs survey of crash site
7/09	0	7	NTSB Issues a request for proposals
7/26	0	24	EGI Submits proposal
8/06	0	35	EGI Awarded Contract
8/16	0	45	Contract Submitted to AIG
9/16	0	76	Contract Executed
9/30	0	90	Bold Horizon Departs San Diego
10/02	0	92	DBSV Departs Long Beach
10/07	0	97	Project Team Arrives Honolulu
10/08	0	98	Project Team Meets with USCG, DAR, NOAA
10/09	0	99	Operations Team arrives
10/10	1	100	Bold Horizon Arrives Honolulu
10/11	2	101	Prep for operations
10/12	1	102	Operations
10/13	2	103	Operations
10/14	3	104	Operations
10/15	4	105	Operations
10/16	5	106	Operations
10/17	6	107	Operations
10/18	7	108	Operations
10/19	8	109	Operations
10/20	9	110	Operations
10/21	10	111	Operations
10/22	11	112	Operations
10/23	12	113	Operations
10/24	13	114	Operations
10/25	14	115	Operations
10/26	15	116	Operations
10/27	16	117	Operations
10/28	17	118	Operations
10/29	18	119	Operations
10/30	19	120	Operations
10/31	20	121	Operations
11/01	21	122	Offload
11/02	22	123	Prep for home
11/03	23	124	Prep for home
11/04	1	125	Departure
11/23	19	144	Demob

PROJECT REPORTING

SITUATION DAILY REPORTS (SITREPS)

During operations, two types of daily situational reports were provided to stakeholders to summarize daily events, accomplishments, issues encountered and remedies.

This operation had two sets of stakeholders with two different objectives. The Investigative stakeholders primary interest was technical in nature as it related to the investigation and the local stakeholders who's interested laid with any environmental events

The Technical Operational SITREP was provided to the NTSB, USCG and AIG, providing specific daily events related to physical recovery operations.

An Environmental Operations SITREP was provided to the State of Hawaii, Fish and Wildlife Services and NOAA. This report contained the same recovery information as the technical report but also provided specific reporting and observations on daily events as they related to protected species and general marine life. These reports have been included with this report.

OPERATIONAL RESULTS

Period of Performance

Eclipse Group proposed an 11-day at-sea operation in the project plan submitted to the NTSB and Client however At-Sea operations ultimately lasted 21-days, a 30% increase in time and cost. This schedule overrun was directly linked to adverse sea states and shore side logistical delays.

TECHNICAL OBJECTIVES

Primary Objectives

- | | |
|--|-----------|
| • Recovery of both engines and associated components - | Completed |
| • Recovery of the Cockpit - | Completed |
| • Recovery of Flight Data Recorder (FDR) and Voice Data Recorder (VDR) | Completed |
| • Recovery of the EGPWS Computer | Completed |

Secondary Objectives

- | | |
|---|-----------|
| • Removal of the main body of the aircraft | Completed |
| • Removal of smaller debris | Completed |
| • Removal of two separated cargo containers | Partial |

TECHNICAL RESULTS

All primary and secondary objectives were accomplished with the following exceptions, the gearboxes for the engines were contained in magnesium housing, which had disintegrated due to prolonged exposure to seawater and were subsequently unrecoverable. The second cargo container identified during the initial search and survey was not located or recovered, a search of the surrounding area both visually and with the ROV obstacle avoidance sonar did not locate this piece. Both video and navigational data of this search have been retained. Due to time constraints and schedule overruns the EGI project manager made the decision to discontinue the search.

ENVIRONMENTAL PROTECTIVE OBJECTIVES

Primary Objectives

- Minimize and mitigate any discharge of jet fuel or petroleum products
- Take all reasonable measures to insure the safety of marine life during operations
- Minimize the impact on corals and living rock at the anchor locations
- Document the impact that was observed during operation both from the wreckage and recovery operations
- Avoid impacting or damaging man made infrastructure in the form of a sewage outfall
- To not disturb or harass any protected species which might enter the area of operations

ENVIRONMENTAL PROTECTIVE RESULTS

- All environmental objectives were achieved

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

This recovery had a greater number of challenges than what is normally encountered. These included the following:

- **Contracting** – The ability to construct contract mechanisms that provided equal, fair and reasonable protections to both the customer and contractor
- **Technical** - Relative size and weight of the aircraft
- **Environmental** – Operating in a geographic area known to present sea state challenges
- **Wildlife conservation** – The protection of public lands, and responsible practices that conserve wild life populations.
- **Competing Interests** - There were a larger than normal number of stakeholders with competing interests

ISSUE #1
CONTRACTING:
An excessive amount of time was required to negotiate the recovery contract. The responsible party was in actuality a collection of insurance companies and some of the standard clauses did not fit well with a consortium of responsible parties which potentially jeopardized the mission by pushing the start of the operation into progressively worsening weather
RESOLUTION:
Establish Non-binding Master Service agreements with these entities to minimize or eliminate delays of this nature

ISSUE #2
CONTRACTING:
The Contracting Party refused to provide equal indemnification for pollution risks. EGI asked for indemnification from any pollution that might emanate from the aircraft and offered indemnification to the customer for any pollution that might emanate from EGI provided vessels and equipment. The customer took the position that they did not own the aircraft and could not offer this protection. This impasse resulted in negotiating delays and jeopardized the conclusion of negotiations
RESOLUTION:
Against EGI's legal counsel's advise, EGI accepted the client's position on the following premises: 1) Both the State and Federal regulatory bodies understood and accepted the risks associated with this recovery 2) This acceptance was based on the environmental protection measures that the client had committed to provide which included an on-site skimmer vessel with associated oil booms and equipment. 3) EGI considered the risk of a significant event as minimal and its belief that most if not all of the jet fuel had already been released from the aircraft immediately after the accident
ISSUE: #3
TECHNICAL - ROV OPERATIONS / WEATHER:
Upon arriving at the location the weather was not conducive for diving operations.
RESOLUTION:
Project Assets remained on location to observe the daily weather cycle. It was determined that the higher sea states starting around mid to late afternoon resulting in conditions that were too rough for diving operations. EGI modified its dive plan to take advantage of calmer seas from approximately 04:00 until 17:00 everyday
ISSUE: #4
BARGE OPERATIONS / WEATHER:
Heavy lifts could only be performed in nearly perfect sea states and only during daylight hours to maximize visibility of the lifts given the anticipated weights and loads expected and the potentially fragile state of the wreckage
RESOLUTION:
EGI positioned the barge in port during periods that were not conducive for safe operations or during periods that did not require the barge. EGI monitored its subscription daily 7-Day forecast and was able to pre-plan our heavier lifts to coincide with favorable weather conditions. While the barge was in-port the Bold Horizon pre-rigged wreckage to maximize the available time for the barge during good weather. Advantages to this approach included keeping the crash location open for the Bold Horizon to maneuver within the debris field and to minimize fuel burn and cost.

ISSUE: #5
ENVIRONMENTAL / LOCATION:
The crash site was located within a marine sanctuary and no-anchor zone
RESOLUTION:
EGI engaged with stakeholders early to address concerns and reporting requirements, EGI agreed to perform a pre-disturbance survey of all areas of concern and to then perform a post disturbance survey to provide quantifiable reporting of the impact that this operation had on the sanctuary

ISSUE: #6
Environmental / LOCATION:
The crash site bordered Military restricted unexploded ordinance disposal site
RESOLUTION:
Through contacts at the Supervisor of Salvage (SUPSALV) permission was obtained to work within this restricted waterway. Further, the Navy ceased activity within this area for the duration of operations

Environmental / LOCATION:
ISSUE: #7
The crash site was located in close proximity to an aging sewage outfall
RESOLUTION:
EGI performed an as-laid survey of this pipeline confirming its location on our onboard navigational system; insured that none of the proposed anchor locations would endanger the pipeline. At the conclusion of the operation, a Post operational survey was performed to confirm that the pipeline was not damaged or impacted by the operations in anyway

ISSUE: #8
LOGISTICAL SUPPORT ISSUES:
The ability to offload wreckage in port was at significant costly. Costs included port charges for storage of wreckage and the cost of the required stevedores for off load from the vessel deck to the pier side by approved port personnel.
RESOLUTION:
EGI did not anticipate that it would not be able to offload wreckage at irregular intervals, as it has been able to do in the past on other recoveries. If EGI were ever called upon to perform another recovery in Hawaii, EGI would provide a flat barge into the operation so that wreckage could be offloaded between the recovery assets and the barge without involving the port until the conclusion of the operation, this would significantly reduce cost, complexity and complications
COMMENTS:
An inappropriate number of personnel and equipment were brought in to perform offloading operation. By EGI's count there were close to 67 people at the pier to offload the engines, and another 37 to offload the cockpit of the aircraft and an unknown number for the main body of the aircraft. While EGI was not responsible for pier side operations, if called upon to perform this function, EGI would work to ensure that this aspect was performed efficiently and cost effectively

APPENDIX I

ENVIRONMENTAL SITREPS

OCTOBER 8, Friday

Darla White joined the team from her home in Maui. The EGI and NTSB held an organizational meeting at the Ala Moana Hotel, followed by meetings with the Coast Guard and combined environmental/wildlife representatives of the State and NOAA. The team inspected the crates American Marine is assembling to transport the engines, then went on to inspect a Boeing 737-200 “sistership” of the one to be recovered.

At the EGI/NTSB meeting, IIC Lorenda Ward related that a press conference is to be held at 10am Saturday with Peter Knudsen of the NTSB Public Affairs. In subsequent meetings with the Coast Guard, State, and NOAA, members of those groups said that they would this to their PA representatives.

The following items were discussed at the Coast Guard meeting:

- Debris currently being held at the Coast Guard will be transferred to the NTSB.
- The Coast Guard is issuing a Notice To Mariners to prohibit boats within a mile of the operation, effective 10/9/2021-11/6/2021.
- The Coast Guard will be available to send a boat to bring in the flight recorders when available. IIC Ward will take custody of them from Clint Crookshanks after removal from the wreckage, so there will be no transfer of custody.
- The USCG Command Center 24/7 telephone number is 808-842-2600 and the Coast Guard always monitors marine radio Channel 16. The email is d14-smb-sechono-sechonolulu@uscg.mil
- The operational SITREP will be provided to the Command email on a daily basis.
- The Coast Guard asked to be informed before lifts are performed for the major two sections of the airplane and may elect to have a boat standing by in case of onlookers breaching the restricted area.
- The prevailing current is to the SW and away from the island but the operation is to file an NRC report for any visible oil sheen seen no matter how small.
- All noted surrounding underwater features, including the pipeline and mooring about two miles away, a small reef, etc.
- The Coast Guard would appreciate knowing the operation communication channels.

The following items were discussed at the environmental/wildlife protection meeting:

Dave Gulko led with a series of questions, which were discussed and answered, which included:

- Anchor placement in relation to the reef and other resources.
- The need for pre and post operation video about where the anchors were placed. He expressed appreciation for the effort being taken to minimize bottom damage.
- The initial lift will not drag the wreckage along the bottom to create further damage.
- A lengthy discussion was had regarding the medical cargo. While the operation knows of no opioids, all agreed that whatever is in the containers, getting the cargo out of the ocean as fast as possible is desired, as well as trying to capture anything which gets loose during the recovery.
- Darla White is to provide daily natural resource situation reports and they are providing Ms White with the contact information for law enforcement if needed.

- The team was able to meet the PENCO group when checking on the construction of the engine boxes.

Representatives of EGI, NTSB, Boeing, LSR, and PENCO met at the Transair hangar to observe a sister ship and made the following observations:

- The FDR is 12" to the right of the roof crown and the rear is in line with the center of the L2 door. The FDR measured 21" x 8" x 5"
- The front face of the CVR was located 46" aft of the rear cargo door and the box measured 14" x 5" x 5"
- There are 20" between windows and each window measured 10" x 14". The interior floor is 31" below the bottom of the windows.
- The aft edge of the forward cargo can is at the center of the 3rd window aft of the emergency exit.
- The group GPWS computer is likely still attached to the rack in the bottom of the nose section.
- Methods of rigging the rear of the cockpit section were discussed.
- Contingency ideas about rigging the main section were discussed.

OCTOBER 9, Saturday

Crew continues to arrive. Preparations with agent for arrival of BOLD HORIZON. Those not on the boat stayed at the Ala Moana hotel.

OCTOBER 10, Sunday

The Bold Horizon arrived at 07:30 am and began to transition from the sea transit to be ready for ROV operations. Fuel bunkering required limiting the number of people aboard.

OCTOBER 11, Monday

Further ship preparations, provisioning, and grocery shopping. The arriving crew was able to move aboard and a crew briefing was held in the evening. Team leaders traveled by car to Barbers Point Port to survey where the Bold Horizon and Salta Verde would come to port.

OCTOBER 12, Tuesday

Dawn boarding of NTSB, Boeing, and Lone Star Retrieval representatives. The BOLD departed Honolulu and weather prevented ROV operations, including the intended survey of barge anchor sites.

Once on board and with the initial report for Tuesday, two situation reports were generated daily, one pertaining to vessel and ROV operations and one about environmental and marine life aspects.⁸⁸

OCTOBER 12, Tuesday

ENVIRONMENTAL SITUATION REPORT

- No environmental report due to no dives having been conducted.

OCTOBER 13, Wednesday

ENVIRONMENTAL SITUATION REPORT

- Proposed barge anchor point 4 (NE point) - ROV
- We started by investigating the eastern most edge of the zone near the military exclusion zone boundary in approximately 52 m depth, and 62 m to the east of the proposed anchor site 4.
- The eastern side of the boundary was steeply sloped.
- Within our exploration zone (west side of boundary) we encountered a cone-shaped burrow approximately 1 m in diameter and an estimated 20-25 cm high with what looked like soft-textured filaments lining a small (~15 cm) crater on top at the entrance, very much like a cinder cone. Based on its size, it may be a crustacean burrow.
- A dark cluster, possibly algae or basalt, was visible amidst a largely sand/sediment area and we were heading toward it to investigate when we had to bring the ROV to the surface.
- The limited area that we were able to survey was low complexity (< 0.5 m).
- Time on the bottom was less than 10 minutes.

OCTOBER 14, Thursday

ENVIRONMENTAL SITUATION REPORT

Surveys of proposed barge anchor locations. Each GPS coordinate was given a 25 m radius buffer zone to survey for sand patches ideal for anchoring, and sensitive habitat features to be avoided. Each proposed anchor 'zone' was surveyed in an east-west transect pattern, from south to north, with exception of the first one (anchor 4), which was thoroughly covered but in a haphazard pattern.

Dive 1: Anchor Point 4 (NE) 0420 hours; approximately 62 m depth

- We dropped southwest of the proposed anchor point 4 zone and found a number of pipe lengths (n~10) from 2-5' long at 63.1m (photo and fix captured)
- Habitat is of very low complexity (< 0.25m), consisting on sparse rubble with pavement. There appears to be a thin layer of sand/soft sediment over pavement/hard bottom in the sediment areas.
- Occasional sea stars - cushion (n=1) and purple velvet (n=4) observed.
- The NW quadrant of anchor 4 zone is the sandiest area; 50-60 m depth.

Moved to investigate sewage outfall pipe at 1517 hours. The pipe had numerous leaks in it - several visible holes with plumes coming off the side of it that were visible in the sonar. The holes that we investigated are

⁸⁸ Operations SITREPS prepared by Robert Swaim and Environmental SITREPS prepared by Darla White. Distribution by Robert Swaim.

on the video recording. The pipe is in approximately 55 m depth. We took at least two photos of different leaking holes in the pipe, but not of the sonar which elucidated the plumes along a greater length than our field of view.

Dive 2: Anchor Point 3 (NW) 0550 hours, approximately 50 m depth; winds 17 knots

- Deployed approximately 50 m south of the drop zone (25 m radius boundary) - pretty sandy here.
- Ran east/west transects from south to north.
- Southern edge of the zone is mostly sand with occasional pavement areas.
- Area is mostly sand with small rock rubble areas (see screen shots) and very low complexity overall (less than 0.25). The southern half of quadrant is good sandy spot.
- Around the gps point are small rocky spots with cca and small gold features; the surrounding area is soft sediment with short algal growth. I need to look at the photos to get a better look at the gold-colored objects.
- Organisms observed included three sea stars with large discs and 5 arms slender pointed arms were observed (dark from our perspective). There were several round mounds/burrows approximately 8in diameter (screenshots). There were several clusters of small sponges (possibly *Spirastrealla vagabunda*) and a variety of crustose coralline algae and a couple of very small hard substrate/rock areas with echinoderms present (e.g. sea stars/ cucumber).
- There is a tire partially buried in sand on the western boundary of the survey zone.
- In the northern half of the zone there are small and sparse rocky bits. The area appears to have more pavement with shallow sediment or at least more dark material on the surface (could be algae or darker sediments). We observed a couple of small rock features and occasional echinoderms (cucumbers and sea stars with the large central disc and slender pointed arms), and a couple of small bright golden features that were possibly a sponge or feather worm; also red algae (i.e. possibly *Amansia*; *Halymenia*). The upper boundary of the zone had a couple of small rocky features that we took screen shots of. Mostly sandy.

Dive 3: Anchor Point 2 (SW) 0744 hours, 140 m depth, give or take a few meters

Arriving on site - southern rim of the zone 0754 hours.

- Southern part of this zone is fairly steeply sloped
- Possibly small Halimeda and small gold objects - see screen shots; occasional burrows about 6-8 inches across; one urchin - no ID (flew by too fast). Gold objects might be feather duster worms of some variety, about the size of a quarter or half dollar; up close (within 2m) they have an oval configuration, like an eye or a mouth with gold on the outside and orange on the inside
- Looks sandy/soft sediments with very low relief; slight slope and then more slope. Took a representative screen shot.
- East side is sloped - not sharply - enough that we have to keep asking for scope; still very low relief (basically flat) soft sediment.
- Patterns in the northern half of the circle appear more like pavement with shallow sediment on top. Small algae (?) on surface of sediments; patchy distribution.
- Slope runs down to the east; east edge of circle is about 148 m.

Dive 4: Anchor Point 1 (SE) 1032 hours. Approximately 160 m depth.

- Inside the critical habitat area, south of the artificial reef area

- First landing & screenshot on boundary east of point. Sand, not deep. We barely made a puff upon touch down. It was pretty soft and made shallow footprints. ROV is 5000 lbs.
- Slope at southern edge of the zone.
- We found hard debris just south of the zone; rectangular block and round pipe; screenshot and gps taken; approx.. 160m depth; concrete pipe (fix & pic) approx.. 3' diameter; encrusting algae and a couple of white spine urchins.
- More hard debris in SW boundary area; fix& pic; rectangular concrete; inside of anchor zone.
- Habitat: Moderate slope; very low relief; soft sediment, presumably over pavement. Pipe that we found is pretty much on tip of it. SE boundary is a pretty good slope & difficult to see but appears largely the same low complexity soft sediment 155 m depth.
- Video is better on the E to W transect due to slope direction.
- More hard debris (two lengths of pipe in tandem) along the eastern side of the zone just north of center (pic & fix).
- Found two more sea stars, the same species with the large central disc and thin, pointy arms.
- The northern end of this appears to have thicker sediment based on a series of depressions that give the impression of sediment depth. Top edge of the zone is 155m depth.
- This appears to be a good anchor zone.

Dive 5: Set basket 1 on the bottom (leave closed) and retrieve front landing gear, 1320 hours.

Approximately 100 m depth

Basket was set on target location near the cockpit/nose of the aircraft. The basket is closed securely. The area is moderately sloped with very low complexity, and small oblong basalt (?) formations, almost like large oblong nodules, and sediment.

The nose landing gear was located, a new gps fix marked at 103 m depth. The ROV pilots worked to secure a strap around one of the tires, which was facing up. The section was vertically lifted to the surface by the ROV. No sensitive habitat was observed in the area thus far.

OCTOBER 15, Friday

ENVIRONMENTAL SITUATION REPORT

Surveys of proposed tug anchor location. The GPS coordinate was given a 25 m radius buffer zone to survey for sand patches ideal for anchoring, and sensitive habitat features to be avoided. Each proposed anchor 'zone' was surveyed in an east-west transect pattern,

Dive 1 (7): Anchor Point 5 (Tug) 0455 hours; approximately 19 m depth On site 0505 hours

- The ROV started the survey at the north end of the zone due to prevailing winds and currents.
- Just north of the zone is a sand patch.
- The ROV lost power and returned to the surface for maintenance after approximately 10 minutes of survey time. Dives were cancelled for the remainder of the day.
- The site was deemed too shallow to survey with the ROV.
- Below is a representative photo of the substrate that was observed. The area observed was very low complexity with hard substrate encrusted with predominately algae (CCA, Halimeda, and turf). Sea stars are present.

OCTOBER 16, Saturday

ENVIRONMENTAL SITUATION REPORT

- Operations commenced at 0430 hours and concluded at 1740 hours. Two of the engines were recovered.
- Depth was 105 m. The substrate is sloped with very low relief (< 0.25 m); pavement and sediment. The initial landing attracted some opelu and the lights attracted plankton, but it was uneventful otherwise. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation.

OCTOBER 17, Sunday

ENVIRONMENTAL SITUATION REPORT

- Targeted retrieval of engine-associated parts.
- Operations commenced at 0300 hours and concluded at 0900 hours. The nose cowlings (n=2) and one inlet guide vein were recovered.
- No oil is associated with these components and no sheen was detected on the surface. Additionally, no oil, fuel, or sheen was detected upon retrieval of either engine.
- Depth was approximately 110 m. The substrate is sloped with very low relief (< 0.25 m); pavement and sediment. A brown stingray (*Bathytoshia lata*) passed through the area but did not linger. One trumpetfish (*Aulostomus chinensis*) investigated the ROV. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation.
- The ship arrived at the dock at 1020 hours to offload the recovered pieces.
- The barge has arrived and plans to set anchors tomorrow. The anchor site survey and recommendations were sent to the barge team and they have confirmed receipt. Steve Saint Amour will be meeting with the barge lead today.
- The ship will stay in port until tomorrow morning.
- One of two orange inlet cowl on deck

OCTOBER 18, Monday

ENVIRONMENTAL SITUATION REPORT

- Targeted rigging of the cockpit for retrieval.
- The Bold Horizon left port approximately 1130 hours to return to the site. The barge DB Salta Verde and tug Shirley C were on site setting anchors. Due to the anchor configuration and similar lengths of the Salta Verde and Bold Horizon, operations for the larger aircraft pieces will only proceed during daylight hours.
- ROV operations commenced at 1500 hours and concluded at 1700 hours. The ROV successfully rigged the front of the cockpit for lift and after examining the aft portion of the wreckage, returned to the ship for a longer length of pole. This front portion of the plane broke off just in front of the wings. The rigging was placed at the site and will continue in the morning.
- Depth was approximately 110 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.

OCTOBER 19, Tuesday

ENVIRONMENTAL SITUATION REPORT

- Targeted rigging of the cockpit for retrieval.
- Due to the anchor configuration and similar lengths of the Salta Verde and Bold Horizon, operations for the larger aircraft pieces will only proceed during daylight hours.
- ROV operations commenced at 0600 hours and concluded at 1630 hours. The ROV successfully rigged the front portion of the aircraft. The barge winch had maintenance issue and needed repair before lifting the piece. Operations will resume in the morning. The Bold Horizon ROV will rig the larger portion of the fuselage including the wings and tail all day tomorrow.
- Depth was approximately 110 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.

OCTOBER 20, Wednesday

ENVIRONMENTAL SITUATION REPORT

- Objective: retrieve the forward section of the plane and rig the aft section; deploy another basket.
- Due to the anchor configuration and similar lengths of the Salta Verde and Bold Horizon, operations for the larger aircraft pieces will only proceed during daylight hours.
- ROV operations commenced at 0600 hours. The ROV attached the rigging to the barge wench. The ROV stayed on site to get a visual on the lift and to ensure that the rigging was secure around the section for a successful extraction. The ROV returned to the ship. Several experts moved over to the barge (via the tug) to observe the plane section as it was brought onto the barge. This group included NTSB, Navy salvage, the project manager, and the insurance representative. A small boat of Navy personnel arrived for the retrieval and joined the barge as well. The team returned to the Bold Horizon after documenting the salvage.
- The retrieval was successful. This section of the plane was missing the bottom section below the cargo deck. The bottom section of the plane had apparently been sheared away, to the surprise of all, during the crash and its current location is unknown. It is not with the rest of the debris.
- Due to the size of the section, the barge made the decision to offload it on the dock today. The tug proceeded to bring the anchors in so that the ROV could resume rigging the aft section of the plane and deploy another basket.
- The barge is having difficulty getting permissions to unload at this time. We are not sure when they will be able to. The NTSB is working to figure out permissions. Any assistance anyone on this thread could provide would be greatly appreciated. The ROV plans to continue rigging the aft section in the morning.
- The sea state was excellent today and we hope it holds. There is a strong storm brewing in the northeast Pacific.
- Depth was approximately 110 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.
- Survey video showed that little structure remained below the level of the reinforced cargo floor. Further, the nose landing gear (NLG) structure had separated and loose avionics were scattered on

the sea bed. Substantial structure remained of the reinforced floor structure, reinforced frame of the main deck cargo door, and nearly complete fuselage structure above the floor level.

- Recovery began with the ROV using a pole to with an attached 5/8” steel cable from the right cockpit window through the left. The cable had a loop at each end and one end was passed through the other (choked).⁹
- A second cable was passed from beneath the aft left corner of the cargo floor to where the aft edge of the lower cargo door had been. The cable also had a loop at each end and was then brought up as a basket lift above the mid-fuselage. The forward and aft cables were then brought together to the lift cable from the waterfall (anchor) winch on the DBSV. The forward fuselage was lifted on October 20 at about 08:36 am. (NAV screen time) The left side of the section was downward and the ROV showed that there was essentially no structure remaining beneath the main deck floor.
- The Shirley C was used to transfer EGI and LSR personnel to the DBSV as the forward section was lifted and the forward fuselage was placed on the deck of the barge at about 10:45 am. The section had to be rotated, was briefly inspected by the NTSB, and then placed on the bottom to secure it for transfer.
- The DBSV was then shifted southward and the BH brought in from the north to conduct a survey of the large wing/tail section. This video was used that evening to discuss how the center wing section had substantially less remaining structure than previously known.

OCTOBER 21, Thursday

ENVIRONMENTAL SITUATION REPORT

- Objective: rig up the aft section of the plane for extraction and retrieve two engine thrust reversers.
- The DB Salta Verde is at Barber's Point and it is anticipated that the barge will begin offloading tomorrow morning at 0700 hours and then return to the wreckage site to set anchor, which will take most of the day.
- ROV operations commenced at 0630. The ROV successfully rigged the aft section and then retrieved the remaining two engine reverse thrusters. The thrusters were brought aboard the deck of the Bold Horizon. Operations were completed at 1930 hours. The first lift included at least five small yellow-orange fish (likely anthias) that didn't make it. There was also a very small/light patchy sheen (~1m² aggregated) left on the surface of the water that dissipated within about three minutes. The last lift was completed after dark and hung off the side of the ship for a few minutes as it was transferred to the crane. The activity attracted a couple of larger fish, one of which was gray and either a small shark or large jack and the other was described to likely be a barred knifejaw (angelfish shape with dark bars) by crew on deck during ops and closer to the fish than I was. They left as soon as the crane started to pull the part out of the water. No sheen was detected.
- The sea state was excellent today but conditions are changing. It is anticipated that the next weather window for the large section of the plane will be next week. Stay tuned for updates.
- Depth was approximately 110 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.

OCTOBER 22, Friday

⁹ Cables are visible in the photos taken on the DBSV.

ENVIRONMENTAL SITUATION REPORT

- Objective: pick up remaining debris and put smaller wreckage in baskets
- The DB Salta Verde will stay at Barber's Point until Monday and then return to the wreckage site to set anchor, which will take most of the day. The weather window is anticipated to be Tuesday/Wednesday for the larger piece of the aircraft. The Bold Horizon will collect debris in the interim.
- ROV operations commenced at 0630 and ended at 1630. The ROV successfully brought aboard several of the larger pieces and spent the day collecting smaller debris and filling the baskets. There are three baskets on the bottom. No sheen was detected when the larger parts were lifted to the deck.
- Depth was approximately 115 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.

OCTOBER 23, Saturday

ENVIRONMENTAL SITUATION REPORT

- Objective: pick up remaining debris and put smaller wreckage in baskets
- The DB Salta Verde will stay at Barber's Point until Monday and then return to the wreckage site to set anchor, which will take most of the day. The weather window is a moving target for the larger piece of the aircraft. The Bold Horizon will collect debris in the interim using the ROV to fill the baskets.
- ROV operations commenced at 0630 and ended at 1800. The ROV spent the day collecting smaller debris and filling the baskets. A number of electronic boxes of interest to the NTSB were recovered and more to be collected tomorrow. This wreckage is likely from the underside of the cockpit where the avionics and electronics live. One basket was lifted and emptied and returned to the bottom. One basket is on deck full. There was a lot of small debris that escaped the baskets as they were lifted from the water. It appeared to be small bits of paint and foam and pieces of wreckage small enough to fit through the basket walls.
- Average depth was approximately 115 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.
- Other fish observations of interest this past few days includes another brown sting ray and a gray-colored shark reported by one of the ROV pilots with the dorsal fin out of the water, likely a Galapagos or a gray reef shark based on the description. There are a number of trumpet fish (*Aulostomus chinensis*) that are very curious about the ROV and are seen frequently. The bridled triggerfish (*Sufflamen fraenatum*) has taken interest in the operation, and bandit angelfish (*Apothemichthys arcuatus*) are occasionally seen in pairs.
- I have reached out to Brian Greene about the following species: What I believe is the orange margin butterflyfish (*Prognathodes basabei*; endemic) is the most commonly fish seen. I thought it was the pennant butterfly fish (*Heniochus diphreutes*) at first but it does not have the characteristic long dorsal streamer and generally looks a little different; it does have the rayed dorsal 'crown' that *Prognathodes* has. There is an aggregation of a damselfish species that I am not familiar with that are medium to large for the family with a light body and dark at the posterior edge and caudal fin.

There is also a goatfish species that appears different from those in shallower waters. It has two long thick dark stripes on the upper half of the body and appears white otherwise, and possibly a dark spot on the caudal fin. The ambient light during the day makes it challenging to discern colors. I have not seen them during dark ops when the lights really help. And there was a really cute little bubble-faced nocturnal red fish the size of an Apogon spp. but wider of face that escaped a piece of debris that we had just picked up. It looked right into the camera for a few seconds.

OCTOBER 24, Sunday

ENVIRONMENTAL SITUATION REPORT

- Objective: pick up remaining debris and put smaller wreckage in baskets; offload wreckage at Barber's Point Harbor.
- ROV operations commenced at 0600 and ended at 1230. The Bold Horizon continued the collection of debris using the ROV to fill the baskets. The focus has been on the electronic boxes (first priority) and smaller debris to fill the basket. The basket was retrieved with the lid secure (they all have been). Again, small debris filtered through the walls of the basket at the surface with the same apparent paint chips, foam, and small debris, as well as some sediment and rust.
- Average depth was approximately 115 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far. The baskets have been securely closed and the cables taught during deployment and retrieval.
- The Bold Horizon departed the harbor at sunset (approximately 6pm) a monk seal was spotted off the starboard side by the project manager. I was sitting on the port side of the bridge at the time and he came to get me but it was in our wake at that point. It was low light but he is certain that it was a seal with its head out of the water watching the boat pass. No identifying markings were noted. I estimate that the sighting was approximately one mile (or less) southwest of Ko'olina. The good news is that it was not in the vicinity of the project.
- The Bold Horizon sailed west toward Ka'ena Point for calmer seas for the evening, and will return to the project site at first light.

OCTOBER 25, Monday

ENVIRONMENTAL SITUATION REPORT

- Objective: pick up electronic debris and put larger wreckage in baskets
- ROV operations commenced at 0630 and ended at 1630. The Bold Horizon continued the collection of debris using the ROV to fill the baskets. The focus has been on the electronics and now larger debris to fill the basket.
- Average depth was approximately 115 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far.
- The Bold Horizon will be docked at Pier 29 tonight to exchange personnel, inspect the hull, and take the necessary steps to report the ship's contact with the substrate.

OCTOBER 26, Tuesday

ENVIRONMENTAL SITUATION REPORT

- None, due to spending the day in Port of Honolulu.

OCTOBER 27, Wednesday

ENVIRONMENTAL SITUATION REPORT

- The Bold Horizon was at the dock at Pier 29 all day on Monday, October 26th. A summary of events regarding the ship's contact with the substrate was sent out separately.
- Objectives today: position the barge over the site and set anchor; deploy a basket; inspect the existing rigging on the tail section; pick up debris
- The barge DB Salta Verde and tug Shirley C commenced setting anchor around the wreckage site in the early morning hours.
- The Bold Horizon left Honolulu Harbor at 1300 to collect the barge anchor location points, set out another basket, and examined the rigging that was left on the tail of the aircraft previously. All went smoothly. The ROV came across what appears to be a 4x4" wood beam that is not part of this accident and has likely been there a while. More debris from the plane was collected in the basket.
- Examination of the forward opening of the fuselage shows the cargo container filling nearly the entire space. Apparently, they are made to fit the shape of the aircraft. Where the floor is bent upward at the bottom, there is a very small space where the canister is bent upward. From the front it appears that there would not be any room for a monk seal or turtle to enter. The cargo door is open at the aft end of the aircraft, though we have not had a good visual on it.
- Tomorrow the goal is to continue with rigging the forward section of the aircraft. The ROV team will transfer to the barge to lay out the rigging and coordinate with the barge team. The ROV team will then rig the fuselage and connect it to the barge crane and do a test lift to see how heavy this plane actually is. Current estimates put it at 94,000 lbs.
- A note about the barge anchorages:
We surveyed the proposed barge anchor sites at the onset of this project to enable a visual assessment of the anchor impacts. The barge does have the ability to anchor on a particular target point, however, due to prevailing wind, wave, and currents and the reality of positioning the barge in the best orientation for these lifts, the two anchor sets have not been on the proposed/surveyed sites (Figure 1). The new plan is to survey all actual anchor locations and the surrounding areas to get a representative sample of the habitat.

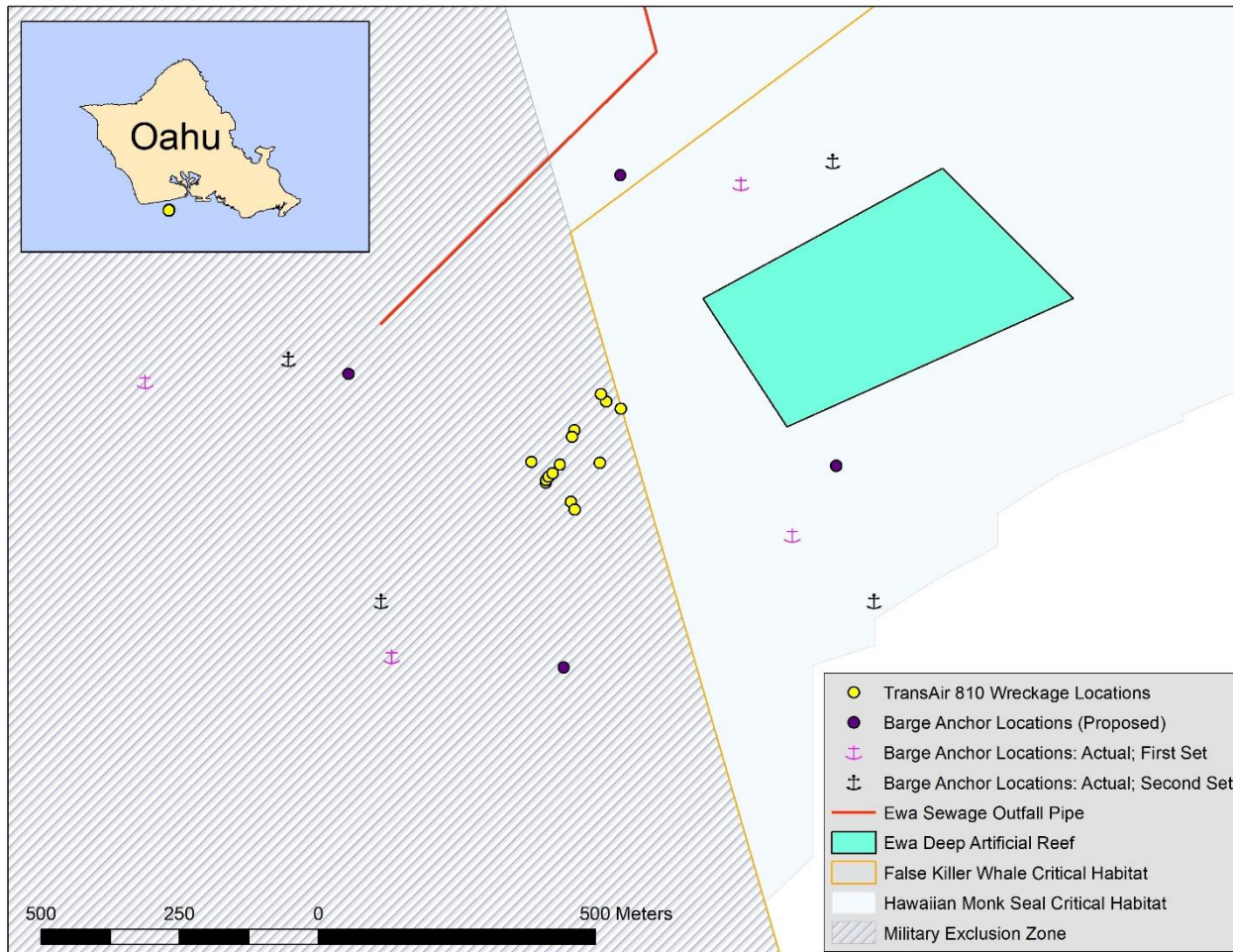


Figure 1. Barge proposed and actual anchor locations.

OCTOBER 28, Thursday

ENVIRONMENTAL SITUATION REPORT

- Objectives today: rig the wings and forward section; attach to barge; test lift
- The ROV team transferred to the DB Salta Verde to lay out the rigging and coordinate with their team around 0600 this morning. They were back in time for breakfast.
- ROV ops commenced approximately 0900 and ended at 1700. The operating depth was approximately 100 m. They successfully rigged both wings and the front of the aircraft. The only remaining rigging is the strap that goes between the front and aft rigging and to cinch it, which will continue first thing tomorrow morning.
- A small group of dolphins (n= 6 - 8) were sighted approximately 400 m off the bow. This is the first sighting during operating hours. They meandered very slowly by the port side of the ship, catching an occasional small swell/wave. One gave a tail slap. They slowly meandered toward the stern of the ship and then disappeared. It is my guess that they dove down to investigate the activities but I was unable to find them again afterward and they were not visible on the ROV cameras. They did not venture between the ship and the barge at the surface.

- A hose on the left seven-function manipulator arm of the ROV was damaged at approximately 1500 hours on a piece of jagged metal from the wreckage and released approximately one pint of hydraulic fluid. The ROV was brought immediately to the surface for maintenance. The part was replaced and the ROV returned to the water at 1530 hours. The hydraulic fluid used is biodegradable and has been tested on shrimp reproductivity and viability of offspring. It passed the Antarctic Commission's requirements for Eclipse's last operation there.

OCTOBER 29, Friday

ENVIRONMENTAL SITUATION REPORT

- Objectives today: finish rigging the plane (last bit), cinch, test lift, fill baskets
- ROV ops commenced approximately 0600 and ended at 1745 hours. They successfully rigged the remaining strap to the aircraft. They were able to cinch it, and the test lift was a success. The ROV commenced filling the baskets with debris, and brought one basket to the ship. Additionally, two larger pieces of wreckage were lifted on the wench, which was some of the forward 'belly' skin. The basket contained a box that was apparently liberated from a shipping container (Figure 1). It will not be opened on the ship but will be taken to the dock with the other wreckage for the NTSB investigation.
- Figure 1. Box of cargo had been found at 100.8 m depth and recovered. The straps were in tact and the box was still closed.
- Average depth was approximately 110 m. No ESA-listed species were sighted, and no habitat of concern was disturbed during the operation. No drop-offs or areas of habitat complexity have been observed in any of the operations thus far. The baskets have been securely closed and the cables taught during deployment and retrieval.
- There was a lot of small debris that escaped the basket as it was lifted from the water. Again, it appeared to be small bits of paint and foam and pieces of wreckage small enough to fit through the basket walls. The aircraft belly sections also shed some smaller loose bits upon retrieval. Three fishes came up in the basket this time. Steve put them back in the water.
- The big lift is scheduled for tomorrow morning. If all goes as planned, that is, if it stays in one piece, the barge will pull anchor and head back to Barber's Point Harbor with the NTSB folks. Wreckage removal will continue, and survey of the anchor sites will commence.
- There was a lobster on one piece of wreckage today. It abandoned its claim and escaped before the piece was lifted away. And the resident brown stingray made appearances again. I was able to confirm that *Heniochus diphreutes* is also a resident of these depths. I hope to get better photos of the other species when we survey the anchor sites.