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PRELIMINARY EXPLOSIVES OPERATION PLAN & PROCEDURE

FOR THE DEPLOYMENT OF THE:

EX-HOYT S. VANDENBERG



LOCATED IN:

KEY WEST, FLORIDA

PREPARED AT THE REQUEST OF:

THE CITY OF KEY WEST C/O REEFMAKERS™
1274 NORTH CHURCH STREET, MOORESTOWN, NEW JERSEY 08057

PREPARED:

APRIL 15, 2009

This Preliminary Explosives Operation Plan & Procedure has been generated as a living document at the request of REEFMAKERS™. A final Plan reflecting actual explosives types and quantities will be generated following test blasts to be performed in Key West, Florida.

I. DESCRIPTION OF VESSEL AND PROJECT

The Ex-Hoyt S. Vandenberg (the Vessel) is a former United States Navy/USAF vessel that has been procured and prepared for deployment (sinking) as an artificial reef. Refer to the Deployment Plan: *Ex-Hoyt S. Vandenberg* prepared by REEFMAKERS™ on behalf of the City of Key West (hereinafter referred to as "the Deployment Plan") for technical details about the vessel and its deployment.

II. CDI'S SCOPE OF WORK ON THE PROJECT

Perform design of, selected preparations for and the explosives creation of forty-six (46) flooding holes evenly distributed on the Port and Starboard sides of the vessel on the Tank Top and First Platform elevations below water line per the Deployment Plan. For deck details and flooding hole locations, refer to Drawings No. SPL-1 and PPL-1 of the USAF Vessel Vandenberg preparation drawings prepared by REEFMAKERS™.

III. REVIEW OF VESSEL CONDITIONS

- A. Each flooding hole location has been tested to determine actual hull thickness to permit CDI to determine the appropriate linear shaped (flex linear) charges needed to sever the hull steel with certainty.
- B. The actual steel used in the hull has been tested to determine its exact metallurgical makeup and the likely response of the steel to the shaped charges specified for the hull thickness at each flooding hole location. These tests revealed that the steel is far more ductile than currently available mild rolled steel plate (A-36 plate) available for test blast operations. This ductility diminishes the effectiveness of linear shaped charges and CDI has determined that additional test blasts will be required. This procedure is referred to under the Test Blast Section IX of this document.

IV. GENERAL BLASTING PROCEDURE

Each of the forty-six (46) flooding holes will be created by assembling four (4) linear shaped charges to form a square. The ends of these shaped charges are MITRE-cut on a 45° angle for a "picture frame" type corner.

CDI has designed and fabricated steel corner braces into which contiguous shaped charges will be inserted and secured to create rigid corners in a square position.

The shaped charge frame will be supported on custom design standoffs which will ensure maintenance of the precise standoff distance between the linear shaped charge and the hull steel for creation of the penetrating plasma jet which will isolate the hull section to be removed for creation of the flooding hole.

The shaped charge frames will be bolted to the hull to ensure correct location and configuration up until the time of detonation.

Once the vessel is anchored at the offshore deployment point, an initiation harness will be attached to the four (4) shaped charges in the frame and a plate "displacement charge" for simultaneous initiation.

All flooding holes in the same section of the vessel (same deck between adjacent bulk heads) will

be explosively created instantaneously with a detonating cord loop. Adjacent sections will be separated by millisecond connectors.

V. SAFETY OF OPERATIONS ON BOARD

REEFMAKERS™, as the Owner's representative, will ensure coordination of contractors on this multi-contractor project and all personnel working on board will comply with a vessel and project-specific safety plan.

Lighting, ventilation, fall protection and fire prevention on board will be the responsibility of REEFMAKERS™ and their selected vessel preparation subcontractor.

CDI's Standard Explosives Handling Guidelines (reference Exhibit A) and Torch-Cutting and Welding Safety Program (reference Exhibit B) to reflect CDI's general safety procedures are attached. CDI will adopt any project-specific modifications required to our general safety plans.

VI. PREPARATION OF VESSEL FOR EXPLOSIVES PLACEMENT

Refer to the Deployment Plan for structural modifications, strip-out and environmental remediation operations performed in Norfolk before the vessel was towed to Key West.

Following arrival of the vessel in Key West, general procedures to be used in preparation for explosives placement are as follows:

- A. Venting holes for ventilation and egress of air during deployment will be cut through decks and bulk-heads as specified by REEFMAKERS™ in the deployment design.
- B. All flooding hole locations will be marked by REEFMAKERS™' deployment design representative.
- C. Selected portions of ribs, which interfere with flooding hole locations, will be removed using oxy-propane torch-cutting methods. Raised welds and other surface anomalies will be removed to create a smooth interior hull surface for shaped charge frame placement.
- D. Bolts will be welded, head down, 90° normal to the interior hull surface, at locations specified by CDI around each flooding hole location.
- E. Paint and excess rust will be removed along proposed linear shaped charge cut-lines around flooding hole perimeters.
- F. Openings will be created in transverse waterproof bulk-heads on the Tank Top and First Platform levels to permit installation of CDI's non-el initiation system and efficient flooding of the vessel.

VII. QUANTITY & TYPE OF EXPLOSIVES

The following types and preliminary quantities of explosives to be used are detailed in Exhibit E, attached. Actual quantities will be determined following test blasts in Key West.

- A. Copper-clad linear shaped charges (1,200 and 2,000 grain per foot), manufactured by Accurate Energetic Systems (Accurate), will be used as the primary steel-cutting charge. Total net weight of RDX explosives is 131.36 lbs. Final quantity to be determined by final test shot in Key West.
- B. 80-grain Petro-Explo, Inc. detonating cord. Approximately 11.43 lbs. of PETN is contained in this product. Final quantity to be determined by final test shot.

- C. Up to 18.75 lbs. of C-4 (from Accurate) will be utilized to ensure asymmetrical displacement of hull plate segments to break any "stickers" after severance by steel-cutting explosives charges. Final quantity to be determined by final test shot.
- D. Up to 44 lbs. of NG-based, Austin Powder X-Gel, 1 ¼" x 8" sticks may be used, in concert with C-4, as hull plate displacement charges. Final quantity to be determined by final test shot.
- E. Up to 40 lbs. of C1.5 PETN-based sheet explosives manufactured by Donovan Commercial Industries will be used to facilitate initiation of shaped charge explosives. Final quantity to be determined by final test shot.
- F. 50-grain, 25-grain and 18-grain Dyno Nobel detonating cord will be used to initiate the non-el system. Up to 17.64 lbs. of PETN is contained in the detonating cord to be used. Final quantity to be determined by final test shot.
- G. 100 MS non-electric detonators (manufactured by Dyno Nobel) will be used to initiate linear shaped charges in the cutting frames. Less than 0.5 lbs. of explosives will be used in this product. Final quantity to be determined by final test shot.
- H. 9 MS non-electric surface connectors will be used to keep down the maximum weight of explosives per delay. Less than 0.5 lbs. of explosives will be used in this product. Final quantity to be determined by final test shot.
- I. P-3 boosters manufactured by Accurate to create individual initiation lines. Up to 0.5 lbs. of explosives will be used in this product. Final quantity to be determined by final test shot.

NOTES:

1. Technical Data Sheets and Material Safety Data Sheets (MSDS) for the above energetic products are attached as Exhibit C.
2. The quantities shown above are "maximum quantities" in each category. Test shots against Vandenberg hull plates in Key West will determine the final quantities of individual products "in combination with one another" to achieve maximum results. Final quantities will be provided to appropriate agencies in the Blast Record to be kept by CDI's Florida-licensed blaster in charge.

VIII. EXPLOSIVES HANDLING OPERATIONS AND PROCEDURES

- A. All explosives handling during frame assembly transportation and frame placement will be coordinated with the Monroe County, Florida Sheriff's Department, the Key West Police and Fire Departments, and will be conducted in accordance with applicable local, State and Federal Regulations.
- B. Explosives Frame Assembly

The assembly of the linear shaped charge frames will take place at the Sheriff's Department bunker adjacent to the Airport on Key West. No initiation device will be attached to these LSC frames until the frames have been placed within the vessel on the inside face of the hull and the vessel has been anchored at the deployment point.

IX. TEST BLAST

Field testing of the Vandenberg hull at the W-3 Shipyard in Norfolk was inconclusive save to demonstrate that the steel was more ductile than the testing equipment employed by Si-Tech Testing Labs was able to indentify because the hull steel was below the range of their equipment.

Test blasts were conducted by CDI at its test facility in Baltimore, Maryland on Friday, April 10, 2009, using the appropriate shaped charges against available A-36 plate to simulate cutting frame conditions. The tests went as planned to the extent performed at this stage.

A coupon of steel from the Vandenberg hull was tested using Brinell and Rockwell tests in Si-Tech's lab and the hull steel was found to be even more ductile than data on an old A-7 mild rolled steel plate.

In order to **ensure** that the shaped charge explosives stored in Key West will effectively sever the plate actually used in the Vandenberg hull, it will be necessary to remove plate sections from the Vandenberg in Key West for such tests. These hull plates could not be removed prior to the Ocean tow from Norfolk to Key West due to Marine insurance limitations on such hull modification.

CDI has arranged with Detective Sargeant Bobby Randolph of the Monroe County Sheriff's Department to conduct explosive tests against actual hull plate sections at the test range to be specified by Det. Sgt. Randolph. Such tests will provide the final conclusive data, as respects the efficacy of the intended program. These test blasts will be conducted immediately prior to the start of explosives frame fabrication at the Monroe County bunker.

X. INITIATION SYSTEM/SEQUENCE

- ◆ Each of the four (4) linear explosives charges placed by CDI in each cutting frame will be independently initiated by a multiply redundant non-electric system containing 80 grain per foot detonating cord with P-3 boosters containing 12 grains of RDX.
- ◆ The use of this non-electric system is much safer than electric initiation systems as there is no concern for radio frequency hazards and a greatly reduced concern for extraneous electricity hazards. This is particularly important on a steel vessel on the water in south Florida during thunderstorm season.
- ◆ All hull cutting frames (between transverse bulk-heads on a given deck) will be initiated instantaneously with a redundant loop of detonating cord.
- ◆ Redundant 9 MS non-el surface connectors will create a delay between deck compartments to minimize the high frequency energy from the shaped charges which will pass through the hull into the water. Any reduction in energy passed into the water mitigates the risk to marine life.
- ◆ All systems will be designed and assembled in accordance with guidelines suggested by the manufacturer and the Institute of Makers of Explosives (IME). The entire system will be checked by CDI a minimum of four (4) times prior to detonation.

Initiation of the main detonation harness will be completed by using a non-el starter line/blasting cap configuration which will be attached to the trunk line of the initiation system thirty (30) minutes prior to the deployment. The non-el blasting caps will be initiated with a non-el starter or its technical equivalent.

XI. EXPLOSIVES TRANSPORT

Many of the products have already been delivered by DOT-approved commercial carrier to the City of Key West and have been held in storage by Monroe County Sheriff's Department.

Additional explosives products will be delivered to the Monroe County bunker in CDI's DOT-approved explosives vehicle following close coordination of such deliveries with Monroe County Sheriff's and the City of Key West's Police Department. CDI's vehicle is equipped with IME-compliant compartments for the co-transport of 1.4 and 1.1D products.

Once the explosives frames have been assembled, they will be transported in CDI's DOT-approved vehicle from the bunker to the vessel. Such transport, to be coordinated closely with regulatory agencies, is currently envisioned to take place during early morning hours before traffic exposes the vehicle to increased risk. CDI's vehicle will be escorted front and back by Police or Sheriff's vehicles which will be running without lights or siren to avoid undue distraction to motorists.

A risk assessment indicates that the greatest hazard in the legal transport of explosives is in the "duration" that the explosives transport vehicle is on the road. To mitigate that risk and subject to the capacity of CDI's DOT-approved vehicle (as compared to the limited explosives transport capabilities of the Monroe County Sheriff's Department), CDI will endeavor all explosives to be used in the final loading operations (as determined by test shots in Key West), to the vessel in a single trip. If the bulk of the assembled shaped charge frames preclude transport in a single trip, additional trips will be arranged with appropriate authorities.

XII. EXPLOSIVES DISPOSITION AND SAFETY ON BOARD THE VESSEL

There is approximately 250' from the edge of the vessel at the pier to the closest occupied dwelling (the old Navy warehouse is not considered "occupied"). The attached American Table of Distances (July 1991, Exhibit D) defines quantities of explosives that may be stored in individual magazines on both barricaded and un-barricaded basis.

- ◆ The explosives brought to the vessel daily are considered "in process" for loading purposes, rather than a "storage condition."
- ◆ Once the explosives are on board and are separated from the adjacent occupied structures, the equivalent of a "barricaded condition" is created given the relatively small quantities of explosives involved and the ability of the vessel's hull to contain explosives energy.
- ◆ Once placed throughout the length of the vessel, the structures are not prone to sympathetic or mass detonation.

In consideration of the above bullets, CDI believes it is appropriate to pursue the most conservative procedure with regard to explosives on board the vessel. Following the most conservative guidelines in Exhibit D, CDI will separate the explosives on board the vessel to maintain less than 30 lbs. of explosives in any one location where sympathetic or mass detonation might occur. Separation of explosives will be consistent with the barricaded distances shown on that Exhibit with separations including interim bulk-heads in the vessel for further safety.

Open flames will be kept 50' from direct line of sight from or access to explosives. With the approval of CDI's Florida-licensed blaster of record, separation of hot work from explosives by bulk-heads and decks will serve to effectively modify the hot work limitation as respects proximity to loaded explosives.

Prior to delivery of explosives to the vessel, security, firefighting and related matters will be agreed upon between CDI, Key West Police Department, Key West Fire Department, Monroe County Sheriff's Department and other agencies with jurisdiction.

Pressurized salt water lines are spaced periodically along the pier and appropriate firefighting plans/procedures will be developed by REEFMAKERS™ and their vessel preparation subcontractor in concert with CDI's Florida-licensed blaster in charge. A detailed fires safety program will be developed by the appropriate agencies with input from CDI prior to the delivery of explosives to the vessel.

XIII. SECURITY

- A. The Monroe County Sheriff's Hazmat Bunker adjacent to the Key West Airport is already controlled under locally approved security conditions. Explosives will be handled at the bunker during standard working hours and the bunker will be locked during non-working hours.
- B. During explosives transport from the bunker to the vessel, the DOT-compliant transport vehicle will be escorted forward and behind with Police or Sheriff's vehicles.
- C. While explosives are on the vessel at the pier, security will be provided during non-working hours by a combination of agencies for landside and waterside purposes. Refer to the Deployment Plan for details.

No security personnel will be permitted "on the vessel" during non-working hours once explosives are on board. Once the fire watch has been completed following any hot work conducted at appropriate distances from explosives on board, all personnel will leave the vessel until CDI returns for work the following work day.

- D. Refer to the Deployment Plan for security during the tow from Key West to the deployment point.

XIV. COORDINATION OF EXPLOSIVES OPERATIONS DURING DEPLOYMENT

Refer to the Deployment Plan for coordination of CDI's explosives operations with all agencies/stakeholders involved with the deployment.

XV. OPERATIONS FOLLOWING EXPLOSIVES DEPLOYMENT

After the charges are detonated to create the flooding holes, the vessel is expected to sink in a controlled fashion per REEFMAKER'S™ design.

A. Clearance Dive

CDI will, along with the Monroe County Sheriff's Department, conduct training of otherwise qualified clearance divers to perform the explosives clearance dive on the Vandenberg following deployment.

Approximately five (5) minutes following the sinking of the Vandenberg, a team of properly qualified divers will be released by CDI to dive on the vessel. If the vessel comes to rest on its keel, according to the Deployment Plan and REEFMAKER'S™ design, these divers will swim the Port and Starboard sides of the vessel to visually count the number of flooding holes created by explosives operations. If the number of holes counted matches the number of cutting frames detonated, an "All Clear" will be given by CDI in accordance with State and Federal regulations.

If the vessel comes to rest in a fashion where the holes cannot be visually counted through an outside dive, a penetration dive will be performed with appropriately qualified personnel to

determine whether all cutting frames have performed per CDI's design. If such a penetration dive confirms that all charges have detonated per CDI's design, an "All Clear" will be given by CDI in accordance with State and Federal regulations.

B. Handling of Misfires

In the event of a misfire, where undetonated explosives are discovered by the clearance divers, OSHA Regulations per 29 CFR 1926.911 will be adhered to as follows:

1. The Blaster-In-Charge, who is an "OSHA Competent Person," shall advise REEFMAKRES™ of the proper safeguards for excluding all employees or persons from the danger zone. This will be accomplished by having a security cordon of appropriate size around the deployment site remain in place to keep vessels/divers at a safe distance. The security perimeter may be reduced from the original security perimeter during the deployment on the basis of further discussions between CDI and the appropriate authorities.
2. No other work shall be done except that necessary to remove the hazard of the misfire and only those employees necessary to do the work shall remain in the danger zone. The removal of any undetonated explosives shall be performed by the clearance divers trained/authorized by CDI for such operations.
3. Personnel not involved with the handling of the misfire shall be kept outside of the area until the misfire has been dealt with in accordance with CDI's directions.
4. Any undetonated explosives retrieved will be transferred to the Monroe County Sheriff's launch for transport by their EOD representative and a representative of CDI to CDI's DOT-compliant vehicle parked at the pier. CDI's truck will be escorted from the pier to the Monroe County Sheriff's bunker adjacent to the Airport where the misfired explosives will be stored pending further disposition in accordance with applicable regulations.

C. Recovery of Cameras from the Vandenberg

Qualified divers may, with the approval of CDI and Mr. Bob Smith, lead Dive Master, retrieve cameras from the Vandenberg when such operations and considered safe.

D. Setting out Mooring Boys

Qualified divers may, with the approval of CDI and Mr. Bob Smith, lead Dive Master, set out mooring boys at the Vandenberg site when such operations and considered safe.

E. All Clear

An "All Clear" notice will be issued by CDI once the Vandenberg deployment site has been determined to be compliant with applicable post-blasting State and Federal regulations.