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**SURVEY, DESIGN AND TRAINING FOR THE
STABILIZATION OF WWII HISTORIC
FEATURES, OBJECTS AND MONUMENTS
ON WAKE ATOLL**

September 2010

by

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For: RFQ# WI 10-084
“Wake Island Cultural Resource Restoration Consulting”
Chugach Support Services, Inc.

A consultant’s report provided to:

TEC, Inc.
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The preservation of the objects that are found is a necessary duty of the finder. To disclose things only to destroy them, when a more skillful or patient worker might have added them to the world’s treasures, is a hideous fault. –W.M. Flinders Petrie

SECTION 1: SCOPE OF WORK FULFILLED BY THIS PROJECT / LIMITS

This report is the final submittal in fulfillment, as far as possible (see “Limits” below), of the *Scope of Work* for the following project:

Chugach Support Services, Inc.
1082 Makepono St., Honolulu, Hawaii 96819
808-842-4390

RFQ# WI 10-084
“Wake Island Cultural Resource Restoration Consulting”

Scope of Work (abbreviated):

- Visit Wake Island to provide technical restoration/preservation guidance of the World War II artifacts.
- Provide guidance to comply with the *Wake Island Cultural Resources update and Management Recommendations*, dated August 14, 2008 and assistance while on the island restoring those artifacts with the Chugach, Inc. environmental manager and staff.
- Provide consulting services on restoring/preserving Wake Island historical artifacts in complying with Federal, Air Force and National Historic Preservation Act (NHPA).
- Onsite presentations or briefing (synopsis of report) to the Environmental Manager prior to departing Wake Island.
- After on-site visit, a final report shall be developed and will include the following:
 - (a) Artifact List that can be restored in-house using our Environmental Manager and staff and include step-by-step guidance on restoring artifacts.
 - (b) Artifact List that must be restored/preserved using specialty services. Give details why specialty services are needed and provide scope of work and estimated cost for the work.
 - (c) General Federal, Air Force and any NHPA requirements in restoring/preserving the artifacts.
 - (d) Types of equipment, materials and supplies that will be needed to self-perform the work on-house.

Limits:

The enormous number and the diversity of complex conditions of the historic features, objects and monuments on Wake Atoll would require the production of a large volume instruction manual or textbook to provide “step-by-step guidance on restoring artifacts” that the *Scope of Work* required. This would be a work very many months, even a year in production at substantial cost. The work needed for even stabilization, let alone “restoring” of the features and items on Wake Atoll is extensive and normally the work of specialists in the concrete repair industry.

Much of the work stabilizing the deteriorating concrete features, which are by far the largest population of historic items of complex condition, would normally require the expertise of the developed concrete repair industry and their specialized equipment. Special tools, materials and knowledge of their use, and seasoned judgment are all

needed to perform optimum work. This report certainly can not provide comparable information and training of these skills to base operating support (BOS) personnel.

The discovery of the true condition of these ferro-concrete structures during this first inspection visit, and the realization that the tools needed for stabilization work were not available on Wake Atoll to demonstrate to BOS the necessary stabilization techniques, prevented an evaluation of the capability of BOS personnel to tackle various tasks. Thus, the production of lists of features or items that BOS can stabilize and a list of those others need to deal with can not be fully produced. First, BOS supervisors will need to attempt the recommendations made in this report on some of the concrete structures and metal items and determine what can reasonably be expected to be undertaken by BOS personnel. There are structures, such as the substantially important Japanese ferro-concrete bunker used by Rear Admiral Sakaibara as his command post (WK32), that definitely will require specialists in historic structure preservation. Not only is the amount of time this structure requires probably well beyond what BOS personnel in place can provide, the nature of the work requires specialists in historic preservation and structural stabilization.

This is not to say that BOS can not undertake needed stabilization tasks. Using the specified tools, materials and methods set forth in this report, BOS is encouraged to begin work, as much to meet the urgency of need as to provide the lowest cost services. There is much work BOS personnel can perform. But BOS supervisors will need to determine the extent of personnel capabilities as these attempts progress. It is expected that further professional involvement will be needed to perform some of the stabilization tasks optimally, or even to be present during initial attempts to guide decision-making in methods.

This is also not to diminish the capabilities of BOS personnel. What BOS has, at the very least, that outside expertise does not have, is the experience and knowledge of how best to bring equipment to so many remote structures. That task alone, getting the needed materials and equipment to the sites is an initial hurdle and outside advisors such as those producing this report are not capable of identifying where and how this access work can be accomplished.

While some of the needed stabilization materials were brought to the atoll for this project, the lack of specialized equipment, principally grout injection pumps, power sources and grout injection nozzles, prevented any training of BOS personnel during the project. Also, the considerable preparation, access, and set-up times for any worthwhile work were too great to be accomplished during the two-week project visit. Short of a follow-up project for training when all needed equipment and larger quantities of materials have been brought to the atoll, BOS supervisors will have to take on the responsibility of directing work, guiding decision-making, and evaluating the achievement of effective and non-harmful (from both historic preservation and structural perspectives) work.

Important Photographic Documentation for Disappearing Historic Features:

In place of the expected training in stabilization techniques that could not be accomplished, an emphasis was made on undertaking thorough documentation of the nature and scale of the needed work through as complete a photographic survey (digital images and High-Definition video clips) as possible. It was considered important to do so as the team had the equipment on the atoll and also the time to seek out every feature possible that had been previously identified in surveys. This project documentation not only shows to others the scale and complexity of the preservation needs on the atoll, it also should very clearly show the urgency of need for a large commitment of attention.

This documentation should also prove to be historically important. Many of the features are about to be lost completely and the last major documentation appears to have been about ten years ago during the work for the *Cultural Resources Management Plan* (CRMP). That report stated the dire situation correctly as follows:

"The Wake Island NHL is in serious trouble. Resources are decaying at an alarming rate and the atoll's residents and visitors are not receiving proper education on how to care for cultural resources and the benefits these resources provide. If improvements are not made to protect the cultural resources and comply with NHPA Section 110 procedures, it is doubtful the NHL will contain any intact and meaningful cultural resources within the next 20 years."

The documentation using High Definition video, though limited, is unique. The documentation of all features on the atoll could have been made complete but secure areas around Peacock Point were closed to our team at the time of visit. Because of the great number of features and the speed at which they had to be found and documented, and also the limited time to identify the images and label them, a few errors may have been made in the process.

Newly Documented Finds:

During this documentation, two ferro-concrete structures that seem to not have been found, or else not previously recorded, were discovered and documented. These have been named WK61 and WK62 following the system of nomenclature used in the 2000 *Cultural Resources Management Plan* (CRMP) and explained elsewhere in this report.

A Fact-Finding Project:

While there were goals in the *Scope of Work* that were intended to produce immediate expertise for stabilization action, this, it turned out, was not quite achievable due to the discovered volume and complexity of problems and the need for special equipment. The project turned out to be more of a fact-finding mission that accomplished an establishment of what is needed for stabilization on a larger scale. While some stabilization tasks can begin immediately using BOS personnel once additional material quantities and specialized equipment are procured and delivered to the atoll, optimal

preservation of the body of historic features will require another step and involvement of professional expertise to achieve that goal.

SECTION 2: SUMMARY OF THE CONTEXT OF THIS PROJECT

Summary of National Historic Landmark Protection

“Wake Island” or properly “Wake Atoll” has been designated a National Historic Landmark.

A National Historic Landmark (NHL) is a building, site, structure, object, or district, that is officially recognized by the United States government for its historical significance. Out of more than 80,000 places on the National Register of Historic Places only about 2,430 are NHLs.

NHLs are designated by the United States Secretary of the Interior because they are:

1. Sites where events of national historical significance occurred (e.g.: Wake Island);
2. Places where prominent persons lived or worked;
3. Icons of ideals that shaped the nation;
4. Outstanding examples of design or construction;
5. Places characterizing a way of life; or
6. Archeological sites able to yield information (e.g.: Wake Island).

National Historic Landmark Program: NHL Database, National Park Service. Entry for Wake Island:

The database entry contains the following information:

Pacific Ocean, U.S. Minor Islands
County of Wake Island.

National Register Number: 85002726
Resource type: Building.
The threat level was *Watch* in 2004.
Certified Local Government: NO

Statement of Significance (as of its designation - September 16, 1985):

Wake Island became a symbol of hope for Americans when its defense force repulsed Japanese attacks shortly after Pearl Harbor. When Japanese forces captured Wake later, in December 1941, this removed a threat to their line of defense from Tokyo to the Marshall Islands. The Landmark includes World War II-related resources on Peale, Wilkes, and Wake Islands, the three islands in the coral atoll that comprise Wake.

The Air force has completed a *Cultural Resources Management Plan* which is now available for comment. The Air Force has vacated the atoll and is negotiating transfer of the base to the Army.

Recommendation/Change since last report:

The historic resources will still need to be maintained by any owner and until that authority is clear, the resources will continue to deteriorate. Recent investigations suggest level of deterioration is at its highest percentage. Immediate actions should be taken to impede further deterioration and loss of cultural heritage. It is also suggested that threat level of Wake Island be increased to Priority due to level of deterioration and occurrence of archaeological sites able to yield information.

Summary of the Cultural Resources Management Plan (CRMP) of May 2000

The *Cultural Resources Management Plan* (CRMP) was produced to integrate the preservation and enhancement of Wake Island National Historic Landmark (NHL) with the mission of the Wake Island Airfield, which primarily functions as a United States Department of Defense (DoD) facility. The CRMP was produced by Foothill Engineering Consultants, Inc. (FEC) of Golden, Colorado, and prepared under Contract Number F41624-95-D-8004, Delivery Order 18 with the Air Force Center for Environmental Excellence (AFCEE), Brooks Air Force Base (AFB), Texas. AFCEE was requested to prepare the CRMP by the 15th Civil Engineering Squadron (CES)/Environmental Restoration Element (CEVP), Hickam AFB, Hawaii, which is responsible for environmental programs at Wake Island Airfield.

Tasks involved in producing the CRMP included surveying, describing, and mapping as many historic features as possible on Wake Atoll, with an emphasis on Peale and Wilkes islands; performing a document review; and integrating this information into the CRMP. The fieldwork was performed in July-August 1999, October-November 1999, and February-March 2000.

Two objectives of the CRMP were to ensure that the missions of the tenant organizations did not adversely impact cultural resources within the Wake Island NHL (Thompson 1984), and the cultural resources management program does not impair the missions of

island tenant organizations. A third objective was to provide guidelines to stop or impede the deterioration of the more significant and unique cultural resources on the atoll.

The final decision of the CRMP is as follows:

"The Wake Island NHL is in serious trouble. Resources are decaying at an alarming rate and the atoll's residents and visitors are not receiving proper education on how to care for cultural resources and the benefits these resources provide. If improvements are not made to protect the cultural resources and comply with NHPA Section 110 procedures, it is doubtful the NHL will contain any intact and meaningful cultural resources within the next 20 years."-May 2000

Updated Integrated Cultural Resources Management Plan (ICRMP) February 2008

(Not made available to consultant)

General Inspection of Historic Resources April 2008

(Not made available to consultant)

Wake Island Cultural Resources Update and Management Recommendations of August 14, 2008

The performance of the current 2010 "Survey, Design and Training" project reported here met some of the recommendations in the *Wake Island Cultural Resources Update and Management Recommendations* of August 14, 2008. The *Wake Island Cultural Resources Update and Management Recommendations* identified actions proposed for implementation in fiscal years 2009 and beyond as funding becomes available.

Quoting from the *Wake Island Cultural Resources Update and Management Recommendations*:

"Chugach Support Services, Inc. (CSSI) is the Base Operating Support contractor for the 15th Air Wing operations at Wake Island, and, as such CSSI has certain responsibilities regarding protection and maintenance of certain specified features of the Wake Island National Historic Landmark (NHL). As directed by the Air Force (15 CES/CEVP at Hickham AAFB), CSSI may also be tasked with efforts to document, evaluate, and preserve historic features throughout the NHL, and to enhance opportunities for appreciation of the historic features for the Wake Island residents and visitors."

"A draft updated Integrated Cultural Resources Management Plan (ICRMP) for Wake Island Airfield was completed in February 2008, a portion of which

identified the most critical needs for historic preservation actions on Wake Island.”

“At the direction of the Air Force, CSSI began implementing recommendations in the ICRMP in FY2008. The following actions are proposed for implementation in the FY2009 and following years as funding becomes available.”

The actions proposed for implementation in the *Wake Island Cultural Resources Update and Management Recommendations* that seem to have been partially or fully satisfied by this 2010 “Survey, Design and Training” project are:

3. Conservation of Monuments and Metal Artifacts

“A qualified conservator will be retained to provide a plan for stabilization and preservation of the 8-inch Singapore gun, the 5-inch gun on Wilkes Island, and metals artifacts in outdoor settings on Wake Island. The conservator will define methods and materials to be used in stabilization and preservation. The prescribed materials will be purchased, and the stabilization will be accomplished, as much as appropriate, by on-island BOS personnel. The conservator will also provide define (sic) methods and materials for cleaning and otherwise protecting and restoring the WWII monuments located near the terminal building. The conservator will also provide guidance on stabilization and preservation of metal artifacts in the museum collection. This action will address multiple CSSI requirements, including maintenance of the monuments and outdoor artifacts”.

6. Stabilization and Preservation of Japanese Concrete Structures

“A multi-year implementation plan will be prepared for the stabilization and preservation of selected structures that are representative of the types of Japanese concrete structures dating from WWII. The plan will primarily be prepared by a structural engineer with extensive experience in reinforced concrete historic structures. The plan will include task descriptions, cost estimates, and priorities for addressing structure stabilization, so that these projects can be budgeted and accomplished in the following years. The selected structures will be recorded to standards of the Historic American Building Survey/Historic American Engineering Record (HABS/HAER) in FY 2009, prior to any stabilization or preservation efforts. This action will be undertaken in recognition that stabilization and preservation of all of the large number of WWII concrete structures is not feasible, and that most of these structures will continue to deteriorate. Documentation to HABS/HAER standards will make representative examples of these structures available to the American public who are unlikely to ever have an opportunity to visit Wake. Documentation also addresses the Air

Force's responsibilities under Section 110 of the National Historic Preservation Act".

SECTION 3: SYSTEM OF IDENTIFYING STRUCTURES FOR THIS REPORT / ABOUT THE IMAGE AND VIDEO FILES

IMPORTANT: Structures Identification (ID) System

The system of identifying structures on Wake Island NHL in this report utilizes the previous system used to create the CRMP in 2000. This system is based off of GIS survey and was most beneficial to our own reporting. Using the previous system of naming is meant to eliminate confusion upon further investigations of Wake atoll.

Structures were designated during the initial CRMP survey in 2000 with a two letter beginning code followed by the number, starting with one (1), to designate the order in which they were found. "WL" in the coded designation refers to Wilkes Island, while "WK" refers to Wake Island, and "PI" to Peale Island.

The previous study designated 6 landmarks on Wilkes Island, 60 landmarks on Wake Island, and 35 landmarks on Peale Island. Any new discoveries have been named in continuation of this numbering system (such as WK61 and WK62, newly discovered and so named during this project).

There were also a number of historic features recorded by PHRI in 1989 in association with archaeological monitoring activities conducted during construction of the Starbird Launch Complex. These features are designated with the numbers "690" followed by the order in which they were discovered. These features range in number from 690-1 to 690-31. These numbers were used in this report only for reference. There have been no new additions to this system of designation.

For the "690" features we have added an island prefix, "WK" or "WL" to the file name to sort them by their two locations.

About the Video Files:

The video files provided right from the camera in .MOV format are High Definition (HD) video (1920x1080 pixels / 1080p) and should be processed into other formats for viewing on a computer. For computers with other than very powerful processors, the files will not play back adequately.

As far as we know, this is the first time video documentation has been made of some of these features. Much of the video documents interior views.

SECTION 4: COMMENTS ON SELECTED INDIVIDUAL ITEMS

The following descriptions of some of the most important historical items provide an overview of the types of features, objects and monuments found on Wake Atoll. Many of the structures described in this list are types represented in numerous examples on the islands. Where appropriate, comments on interpretative value and potential archaeological remains are made.

WL01 *Coral Rubble Mound and 3 Inch Anti-Aircraft Gun:*



Located in the south-central end of Wilkes Island, southwest of the jet fuel tank farm, this cluster includes a 4 meter high coral rubble mound that was used as a defensive measure against anti-aircraft, as well as a 3-inch anti-aircraft (AA) gun. Several pieces of wood protruding vertically at the northeast edge on the depression may indicate a collapsed entrance. The 3-inch AA gun lies on the base of the mound on the northeast side (see video files). It has been mentioned that the gun was actually dragged in from a previous location closer to Kuku Point, and does not belong to the gun emplacement associated with the coral mound. The 3-inch AA gun would have high interpretive value if transported to another, more accessible location. We recommend that this gun be mounted on the emplacement located in cluster WK61-690-14. If the emplacement at this location were removed and cleaned, the coral mound rebuilt with the addition of a concrete pad on its top, and the emplacement mounted to the pad with the 3-inch AA gun in place, this historic structure would hold very high interpretive potential for visitors to

the Wake Island Terminal. The barrel of this gun has been cut off and is missing. It is recommended that a steel replica barrel be made, even though lacking in historical accuracy, and welded in place, to convey at a distance an approximation of the gun's original profile.

WL02 *Concrete Foundation, Gun Emplacement, Concrete Bunker, Artillery Shell Boxes, and Trenches:*



Located on Wilkes Island to the northwest of the submarine channel and gravel pit, this cluster includes the remains of a Japanese concrete foundation, 3-inch AA gun emplacement, a concrete bunker and a series of well-crafted trenches. The concrete foundation has bolts that extend upward from the lip at regular intervals but no superstructure exists. The gun emplacement contains two concrete artillery shell boxes on the top edge which are unique to the atoll. They were lined with wood. The emplacement also displays a large crater that seems to be the remnants of a 50-100 lb bomb which would have destroyed the original structure. It has been determined that any remains of the 3-inch gun or revetments were taken as scrap metal during salvage operations in the 1960's. The series of Japanese trenches throughout the cluster, some up to 1.5 meters in height, are in excellent condition and hold great potential to interpret Japanese defensive fortifications as well as a very high potential for archaeological remains. Vegetation should be removed from the entirety of the structures, detailed mapping conducted, and annual upkeep should be undertaken to keep the site void of modern trash and free of vandalism. Archaeological investigations should ensue.

WL04***Destroyed Ferro-Concrete Pillbox:***

Located on the northwestern shore of Wilkes Island, this Japanese pillbox has deteriorated to the point of total loss. The structure now consists of two fragments lying directly on the waterline at high tide. While there is nothing left to preserve, this feature should stand as an example to what will eventually happen to all such features remaining on the atoll without the help of preservation methods. The interpretive value has been lost and the archaeological potential is low due to wave action.



Located on the lagoon shore on the southeastern portion of Wilkes Island, POW Rock is a large coral boulder just at the waterline which bears the inscription "98 US P.W. 5-10-43".

Several stories exist today which aim to solve the question as to how this inscription was created and under what circumstances. The inscription was undoubtedly carved by one of the 98 civilian prisoners of war who were retained on the island after the remainder were removed to prison camps in China and Japan. These contractors remained on Wake atoll due to their skill as heavy machine operators (with the exception of one doctor who volunteered to stay and care for the others). The Japanese forced these prisoners to build defenses such as the ferro-concrete pillboxes and aircraft revetments. Only months after the above date, the 98 were executed under orders from Japanese Rear Admiral Sakaibara, who was later hanged for his war crime.

The most popular story, although highly unlikely, is that during this execution, one of the civilian contractors escaped. The contractor was missing for several days, which in this time he chiseled the inscription located on POW Rock. He was later found and personally beheaded by Admiral Sakaibara with a samurai sword.

This story does not hold true for several reasons, the most obvious being the date of the inscription occurring months before the supposed escape. Another reason being the

delicate skill and time-consuming depths of the cutting in which the inscription was made. It seems unlikely that an escaped prisoner would have the tools and time to make such an inscription, all while trying to remain hidden from his captors. While this story brings to heart similar stories of American morale and dedication to the cause, it is far from plausible. It is more likely that the inscription was made by a group of contractors designated to remove something that previously existed on another nearby coral boulder, WL6 (U.S.S. Nitro Rock). Personal correspondence with local Wake contractor personnel suggests that at one time, U.S.S. Nitro Rock had been mounted with a plaque dedicating the arrival of Pan American Airlines to Wake Atoll. It has been suggested that this plaque, and a large portion of the coral boulder, was forcibly removed (on order of the Japanese) by American POW's during their imprisonment on Wake. This activity would have garnered the contractors the means to chisel the inscription on the nearby POW Rock. There is little archaeological potential at this feature; however the interpretive potential is very high. The rock's inscription is a poignant reminder of the historic events which occurred at Wake Atoll.

WL06 *U.S.S. Nitro Rock:*



Located on the lagoon shore on the southeastern portion of Wilkes Island, 50 meters to the southeast of WL5, this feature is a large coral boulder with graffiti inscribed into the rock. The oldest graffiti on the rock commemorates the 1935 visit of the U.S.S. Nitro and is dated "3-9-35". This is likely the oldest historic feature still extant on the island. There have been numerous additions to the graffiti on this feature in the forthcoming years,

including a similar inscription to the one on WL5 but reading "5.8.43 98 US PW". This inscription, we believe, lends credence to the above hypothesis as to the scribes of WL5.

WL07 (WL-690.27) *Heavily Deteriorated Japanese Ferro-Concrete Pillbox:*



Formerly designated by PHRI as 690-27, this ferro-concrete pillbox located northwest of the submarine channel on Wilkes Island is in perhaps the worst state of degradation of any of the existing structures on Wake Atoll. With this being said, the structure holds high interpretive potential and is still worth conserving. As with all of the defensive structures constructed between the years 1941-1945 by the Japanese on Wake Atoll, this concrete structure was built with a coral aggregate mixed with sea water. The use of ocean water heavily amplified the inclusion of chlorides, which has led to the vast corrosion of rebar in these structures. The feature should be maintained with the appropriate designated conservation materials and methods discussed in this report.

WL08 (WL-690.26) *Japanese Ferro-Concrete Pillbox:*



Formerly designated by PHRI as 690-26, this ferro-concrete pillbox located northwest of the submarine channel on Wilkes Island near Kuku Point holds high interpretive potential and should be conserved. As with all of the defensive structures constructed between the years 1941-1945 by the Japanese on Wake Atoll, this concrete structure was built with a coral aggregate mixed with sea water. The use of ocean water heavily amplified the inclusion of chlorides, which has led to the vast corrosion of rebar in these structures. The feature should be maintained with the appropriate designated conservation materials and methods discussed in this report.

WL09 (WL-690.25) *Japanese Ferro-Concrete Bunker:*



Formerly designated by PHRI as 690-25, this ferro-concrete bunker is situated above the beach on the south side of Wilkes Island. This low lying feature is almost entirely encompassed by coral wash, burying most of the structure. There is evidence of a square entryway on the southwest face of the bunker. The feature should be completely excavated to reveal the interior and should be maintained with the appropriate designated conservation materials and methods discussed in this report.

American Magazines:

Located on Wake Island behind the modern terminal, these four ferro-concrete American-built igloo-type ammunition magazines represent the only permanent defensive fortifications American forces were able to construct prior to the outbreak of war in December 1941. All four are of similar reinforced concrete construction measuring 15 meters x 7.5 m x 4.5 m. Each magazine has been covered with mounded coral rubble and sand to help camouflage and protect the feature. The design of these four magazines appears to match standardized Army and Navy design from 1928. After the civilian hospital was destroyed by Japanese bombs on December 9, 1941, Commander Cunningham ordered that two of the reinforced magazines be cleared of ammunition and converted into hospitals to afford the patients better protection. Each hospital could hold 21 beds and was given electricity by means of gasoline generators (Urwin 1997). All of these structures are in good condition and little work other than vegetation removal and

the application of the appropriate designated conservation materials and methods discussed in this report are necessary. These features hold high interpretive value as they are the only representation of American defenses on Wake Atoll.

Marine Defenders Memorial:

This memorial, located east of Elrod Drive behind the modern terminal, was constructed in 1965 to commemorate the Marines who defended Wake Island against the Japanese attack in 1941. The upkeep of this memorial is extremely important as it is one of the features most seen by visitors to Wake Atoll. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.

WK07 ***Guam Memorial:***



This memorial, located east of Elrod Drive behind the modern terminal, was constructed in 1990 to commemorate the citizens from Guam who were on Wake Island at the time of the Japanese attack in December 1941. The upkeep of this memorial is extremely important as it is one of the features most seen by visitors to Wake Atoll. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.

WK08 *Morrison Knudson Memorial:*



This memorial, located east of Elrod Drive behind the modern terminal, was constructed in 1988 to commemorate the civilian employees of the Morrison Knudson Company who were constructing the naval base at the time of the attack and helped in the defense of the island. The upkeep of this memorial is extremely important as it is one of the features most seen by visitors to Wake Atoll. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.

WK09***Japanese Memorial:***

This memorial, located east of Elrod Drive behind the modern terminal, was constructed in 1957 (with an engraved stone added in 1966; Hitchcock 1996) to commemorate the Japanese Soldiers who perished on Wake Island in the years between 1941-1945. The upkeep of this memorial is extremely important as it is one of the features most seen by visitors to Wake Atoll. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.

WK14 *Painted U.S. 3-inch Anti-Aircraft Gun:*



This static display, located in front of the modern terminal, is one of two U.S. 3-inch anti-aircraft guns located on Wake Atoll (the other, WK15, is located at the entrance to the downtown area) which has been painted gray to slow corrosion. The paint coating system did not adequately protect the metal and corrosion continues. The upkeep of this memorial is extremely important as it is one of the features most seen by visitors to Wake Atoll. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.



This feature, located on the northeast point of Wake Island near the downtown area and the burned bridge, is composed of a Japanese ferro-concrete bunker used by Rear Admiral Sakaibara as his command post. Drawings from a 1946 report, conducted by the United States Strategic Bombing Survey, indicate that the structure was once two stories high. Today only the second story is visible and accessible. Parts of halls or tunnel entrances on the east and west ends of the second story have been removed leaving only the central portion of the second story intact but buried, and the entire structure is tilted around 15 degrees to the northeast. Gun emplacements and observation posts that are visible in the 1946 drawings are now gone.

The interior of the structure has features of interest. The two side entrances to the extant second story have barriers that create a zig-zag maze that would slow an enemy entrant and also only permits single-file entry. The ferro-concrete walls are covered with distinctive, 1 x 6-inch, cedar lap paneling, painted light green with a lead carbonate-based paint and laid horizontally over planks (1.75 in. or 4.5 cm thick) of compressed cork. Around a half of this planking remains. Cork was a common insulation used for Japanese submarines during WWII. The use of cork in this structure has been suggested to be a defense against either humidity or sound. The interior planking is heavily garnished with graffiti dating back decades. The interior structure shows signs of increased spalling over the past 10 years. The treatment of this structure requires several important procedures. To treat the interior for corrosion, all cedar lap paneling must be labeled and removed to

treat the hidden concrete with the migrating corrosion inhibitor and then replaced. The entire structure also needs to be leveled on the northeast side, built up with coral debitage, and a barrier wall built between the structure and the lagoon to protect from erosion. This feature should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.

CAUTION: The paint on the cedar planks within the structure is powdering and is easily transferred to hands and clothing. The paint contains lead (probably lead carbonate) and is toxic. Access to this structure should be barred and warning signage placed.

WK36 *Japanese Blockhouse:*



This structure, located on the northeast end of Wake Island adjacent to the billets and behind the Drifter's Reef Bar, is a good example of an American built, Japanese ferro-concrete blockhouse. Measuring 7.6 m in length and 6.9 m in width, this structure is half-octagonal in shape and has three gun ports. The south wall is straight, with the entrance in the center of the wall. Directly inside the entrance is a concrete wall; one must step to the left or to the right to go around this wall to access the area with the gun ports. This structure shows moderate amounts of spalling which can be fixed using methods described in this report. All vegetation and debris should be removed from the structure and it should be maintained with the appropriate designated conservation materials and methods discussed in this report to prevent future deterioration.



This complex of features contains a blockhouse with observation post, a 5-inch gun mount, coral rubble mounds with rifle pits, and an array of other defensive features. Previously designated as Feature J, the blockhouse and adjacent connected observation post is of the same general design as WK36 with three gun ports. Coral rubble that has been graded flat lies atop the blockhouse. There is an entryway into the lower level of the observation post on the west side of the structure. Also, there is an entryway from above into the connecting tunnel from a point in between the observation post and the blockhouse. The interior of the feature reveals heavily spalled walls and ceilings that create an obvious hazard to visitors. The entire inside should be cleaned of debris, treated with the migrating corrosion inhibitor, certain areas patched with mortar, and vegetation removed. This structure holds very high interpretive potential as a Japanese defensive position. The nearby 5-inch gun mount has been discussed earlier when describing plans for the 3-inch AA gun located on Wilkes Island. The corresponding rifle pits and defensive features should all be cleared of vegetation and trash debitage.

PI01***Japanese Barracks Complex:***

This cluster of features, located in the southeastern portion of Peale Island, is comprised of a concrete foundation belonging to barracks, a water cistern, fire-brick cooking ovens, and an underground chamber or bin located northwest of the ovens. The site has high archaeological potential as well as high interpretive value. The features should be investigated with archaeological excavation and thoroughly mapped. Any discovered artifacts should be kept for the new museum. All vegetation should be removed from the site and thorough analysis of the coral berm revetments surrounding the features is necessary to determine if interior structures exist.

PI02

Japanese Baths, Cisterns, and Kitchen Area:



This cluster of features, located in the center of the southern tip of Peale Island, consists of the remains of cisterns, a kitchen area, and baths used by the Japanese officers during their occupation of Wake Atoll. Only the well-made concrete foundations of most of these structures exists. There is a moderate scatter of artifacts including Japanese beer bottles and colored glass fragments. The site should be investigated through archaeological excavation and any discovered artifacts should be kept for the new museum. All vegetation should be removed from the site.



This concrete foundation, located on the south side of Peale Road, southeast of the Coast Guard station, is part of the remains of the U.S. Naval Air Station and the location of a 1978 Japanese cremation. This foundation consists of a large concrete slab with concrete walls extending 1.65 m above the floor. The concrete used in construction of this foundation was finely made using coral sand and gravel aggregate. There are at least four doorways or entries to this structure. Several floor drains are visible where vegetation is cleared. According to Hitchcock (1996, 2010), the remains of 954 Japanese soldiers were cremated here before being returned to Japan in 1978. Bullet holes are present in the walls and the walls are collapsing in several areas. No roof or superstructure is present. Vegetation should be cleared from this area and the migrating corrosion inhibitor should be used on all surfaces to prevent further corrosion.

PI19***8-inch Gun:***

This feature, located in the northwest portion of Peale Island, consists of an 8-inch gun and several coral mounds, depressions, and coral cobble features. The 8-inch (200 mm) coastal defense gun is the commanding artifact on this island. The gun is in its original mounted position overlooking the ocean side of the island, and could be pivoted for aiming at targets at sea. A ladder provides access to a cavity under the gun, presumably for maintenance or operation, and may also access a possible tunnel connecting it to an adjacent coral rubble mound. The gun is in a rapidly deteriorating state due to long exposure to humid climate and ocean weather. The logistics of conserving this important piece are detailed within this report.

This gun may represent one of the 12 8-inch, quick-firing guns produced by Vickers company which were purchased legally from England in 1905 by the Japanese for use against the Russians (Alexander 1993). Alternately, the gun may be a Japanese copy of the Vickers type gun, as the Japanese are known to have copied designs from foreign gun manufacturers during World War II (Denfeld 1981).

PI20***Seaplane Ramp and Parking Area:***

This feature is the seaplane parking area and ramp located on the lagoon side of central Peale Island. The feature consists of a narrow ramp leading up from the lagoon into the parking area itself. Both the ramp and parking area are made of concrete and encompass

3.7 acres. Several bomb craters have been patched with cement. Some have reported that this feature is associated with the Pan American Airways seaplane facility (Jackson 1996). However, it seems more likely that this feature was constructed as part of the U.S. Naval Air Station that was under construction at the time of the initial Japanese attack in December 1941 (CRMP 2000). Pan Am typically only docked one seaplane at a time in Wake's lagoon and would not have needed such a large area to house seaplanes. Also, an aerial photograph of Peale Island taken May 25, 1941 shows that the seaplane parking area had not yet been built at this time. This feature should be kept clear of vegetation and sprayed with the migrating corrosion inhibitor to prevent further corrosion.

PI28 *10-4-42 Blockhouse:*



Located in the northwestern portion of Peale Island, this cluster is a large defensive bunker complex containing ten features including a ferro-concrete blockhouse. This blockhouse is partitioned into three rooms by concrete walls on the inside. Each has a gun port overlooking to the ocean. The gun ports are 60 cm tall and 2 m wide on the outside, but narrow to only 1 m wide on the inside. The structure is cracked and starting to spall off in several places. There is an inscription, the date "10-4-42", carved in the cement at the northwest corner of the structure. As of 1999 this corner was still intact, but has since spalled off. Additional inscriptions are inscribed in the concrete on the southwest corner. These inscriptions are faint, but appear to be Japanese characters. This feature should be cleared of debris, mortared where necessary, and sprayed with the migrating corrosion

inhibitor. The "10-4-42" inscription is a vital part of this structure and should be reattached immediately.

SECTION 5: SAMPLE MATERIALS DELIVERED FOR THIS PROJECT

Materials that seemed at the outset to be useful for the stabilization of the structures, monuments and artifacts were selected and delivered to Wake Island for this 2010 project, based initially on only an evaluation of needs from examining photographs of features and items. Quantities purchased and delivered were based on proportioning within the very limited budget of the project. The application of these materials, if they proved useful, were to be demonstrated during the project to Chugach BOS personnel.

During the course of the on-island survey, it was found that each of the materials was, indeed, essential, although lower cost substitutes could be utilized. However, the convenience of these packaged materials and the ease of procurement of most of them from stock in Hawaii and delivery to Hickham AFB could outweigh their higher cost.

Key Materials and Purposes

<u>Material</u>	<u>Purpose</u>
Ship-2-Shore Industrial Liquid Corrosion Control Systems	Metals corrosion (stop and prevent). Surface application to steel and aluminum.

This coating has extensive use in the Canadian maritime industry and one of its principal uses is for coating anchor chain and ship bilge tanks and other steel surfaces that can not be protected with paint-type coatings. It is a very effective dielectric barrier that prevents corrosion by its complete inability to pass electrons and by excluding oxygen and moisture from the metal. It is effective for iron, steel and aluminum. The liquid is a light brown translucent and dries to a hard waxy film that does not transfer. In sunlight and heat, thin applications tend to eventually turn white. This can be removed with additional application of the material. The material is not widely known nor used in the United States and currently has no U.S. distributor.

Application can be by brush, spray or immersion. The liquid should be liberally applied to all steel and aluminum, saturating existing corrosion. It will not be appropriate nor effective on steel so severely corroded that there is no steel left – with only corrosion remaining (iron oxide minerals) as is the case with most of the material of the Peale Island 8 in. gun (PI19). The coating will protect for years and reapplications can be made directly over old coatings. Removal, when necessary, can be accomplished with a hot water pressure washer or use of soap and water.

The coating should also be used on corrosion to penetrate to, and protect, good steel under the corrosion where paint is desirable for its color but can not penetrate and protect.

An example of its use prior to painting would be complex surfaces of the anti-aircraft guns (WK14) located at the air terminal and at the entrance to the housing area. After application and penetration, and after the Ship-2-Shore has hardened, it can then be painted over along with the rest of these guns. Simply painting over the corrosion on these corroded parts of the gun will leave access to oxygen and the steel will continue to corrode under the paint. Paint adheres well enough to dry Ship-2-Shore films in places where handling and foot wear is not present.

MCI-2020

Cortec Corporation

Migrating corrosion inhibitor (MCI) liquid for steel rebar within concrete.

This is a liquid to be sprayed onto exterior surfaces of steel reinforced concrete. A corrosion inhibiting chemical in the liquid will migrate through corrosion of typical densities at a rate of about 1 cm/day (varies with concrete density). It stops corrosion of reinforcing steel by migrating through existing corrosion and forming a single molecular barrier on the surface of the remaining steel under the corrosion. This chemical, in a different packaged form from Cortec Corporation, should also be used in all fresh concrete for new construction in high chloride environments such as Wake Island to prevent corrosion of reinforcing steel. MCI-2020 should be sprayed onto all reinforced concrete surfaces on Wake Island, certainly on all historic structures where it is suspected that reinforcing steel has not yet completely corroded, but also on all newer concrete such as used in the monuments and utilitarian structures. It is useless to apply it to concrete containing totally corroded reinforcing steel.

MCI-2023

Cortec Corporation

Passivating grout for coating exposed rebar but also for application at Wake as a convenient injection grout behind spalls.

This product is a cementitious grout (cement and silica sand and other ingredients with a liquid binder) with the addition of Cortec Corporation's Migrating Corrosion Inhibitor (MCI).

The primary (1) intended application of this product on the historic features on Wake Atoll is as a conveniently available grout for injection. In most cases in this application, the MCI component would play no role. Other cementitious grouts could be used in its place for injection to fill voids between spalled concrete and inner concrete and, hopefully, provide some adhesion of the spalled concrete to sound material in walls and ceilings. Because it is a high quality grout (ignoring the MCI component) and kept in stock at a retailer in Honolulu (Bonded Products Co.) who will deliver it to Hickham AFB, it is a convenient product to procure. That convenience may outweigh its higher cost over plain cementitious grouts available elsewhere.

Note that this bagged product has an approximate 6 month shelf life and probably less in the high humidity of Wake Atoll. Therefore, the ability to maintain small stocks on the

atoll and replenish easily and quickly when needed from retail stock in Honolulu may be an important feature.

A secondary (2) intended application of the MCI-2023 passivating grout does take advantage of the Cortec MCI component. There is exposed reinforcing steel on many of the historic structures where a core of good steel remains under the corrosion. MCI-2023 should be used to quickly coat and protect what remains of the steel, leaving considerations over whether to patch over the good steel for later deliberations. Patching losses of original coral concrete and covering the corroding rebar has appearance issues as in many cases such patching will present largely new surfaces to view, which may be undesirable, rather than original material, even though deteriorated. Decisions on whether to patch losses of original concrete will require deliberations on ethics and case-by-case decisions. Meanwhile, MCI-2023 can be used to protect the original and exposed steel and its color will aid in hiding the corrosion as the color will visually be closer to the original concrete than brown corrosion.

The third (3) application of the grout which does utilize the MCI component is for grout embedding of new steel rebar used as heavy and deep pins to hold large pieces of spalled concrete in place. Here, the MCI component allows the use of conventional steel rebar or other steel rods and avoids the high cost of using stainless steel.

MCI-2702 Cortec Corporation Patching mortar (overhead and vertical) containing migrating corrosion inhibitor.

For the stabilization work on historic concrete structures on Wake Atoll, patching of concrete losses is not, at present, planned. This is partly due to time restraints and also due to ethical issues of restoring original surfaces with new material. Instead, a good quality patching mortar such as MCI-2702 will be needed to fill the sides of spalls on walls and ceilings before grout injection to prevent the leakage of grout. In this application, the added MCI component has no benefit. But like the MCI-2023 passivating grout, the convenience of having this high quality product cement patching material in stock at a Honolulu building supply retailer (Bonded Products Co.) makes it an initial good choice. In time, other patching mortars may be considered.

M238 Cortec Corporation MCI additive intended to alter Ship-2-Shore corrosion inhibiting properties.

This product which allows customer addition of the Cortec Corporation Migrating Corrosion Inhibitor (MCI) to petroleum based liquids is included as an additive to Ship-2-Shore to enhance its corrosion prevention properties and may make recoating less frequently necessary. Its effectiveness or its necessity has not been tested however, and is recommended solely on the basis of chance improvement in corrosion prevention.

Typical dosing is 4% V/V of M238 to another liquid. For simplicity, a 3% dosing can be achieved by adding 21 oz. (1/6 gal.) of M238 to each of the six 20 liter pails (each 676 oz. volume) of Ship-2-Shore if the container head room allows this addition.

Material Quantities Initially Delivered and Unit Costs

Ship-2-Shore Industrial	(6) 20 liter pails	\$300.00 ea.
MCI-2020	(4) 5 gal. pails	\$510.00 ea.
MCI-2023	(6) 26.5 lb bags + 11 lb. pails resin	\$78.00 ea.
MCI-2702	(4) 50 lb bags	\$70.50 ea.
M238	(1) gallon pail	\$21.00 ea.

Future Materials Order Placements

Future orders for these sample materials should be placed with the following:

Ship-2-Shore

Liquid Corrosion Control Systems
(No current U.S. retailer available)
Terry Laing (owner)
Box 48205 Victoria, BC
Canada V8Z 7H6
250-477-7325
tlaingtlaing@hotmail.com

Possible future U.S. retailer:
Richard or Linda Moran
Corrosion Cops
94-463 Alapine Street
Waipahu, HI 96797
808-676-1963
www.corrosioncops.com

MCI-2020 **MCI 2023** **MCI-2702**

Bonded Products, Honolulu, HI
Contact: Lauren Farias
808-832-1151
(Will deliver to Hickham AFB)

M238

Matthew S. Drew, Technical Sales Representative
Cortec Corporation

4119 White Bear Parkway
St. Paul, MN 55110
651-429-1100 – Ext. 19

SECTION 6: ADDITIONAL SPECIAL MATERIALS AND EQUIPMENT ESSENTIAL FOR THE STABILIZATION WORK

Essential procedures for the stabilization of spalling concrete, a deterioration common on Wake Atoll from corroding reinforcing steel, is injection of cementitious bonding grout into voids and the pinning of spalling concrete to sound material. Both require the following special materials and equipment. Because these materials and equipment were not available on the atoll during the work of this project, the methods of stabilization could not adequately be demonstrated. These tools and materials will be essential for any and all stabilization work on the ferro-concrete structures.

Portable Power Sources

The “essential” equipment identified below requires portable power sources (fueled compressors and electric generators) capable of being placed in working proximity of every concrete structure to be stabilized. Only BOS can evaluate if this remote placement would be possible. “Essential” is applicable to achieving optimal stabilization work. In situations where such power sources can not be brought to within working distance of a structure, less than optimal stabilization work is still possible to achieve using only manual tools and possibly battery powered tools identified below. The lack of portable power equipment largely limits work to manual pumping of grout, with inability to wash out joints with pressurized water, and inability to drill for the placement of large pins. This pretty much leaves only the possibility of manual pumping of grout into voids which is likely to be incompletely effective as a bonding method.

Grout Injection Pump

Grout injection into cracked, spalled and otherwise deteriorating concrete and masonry walls, floors, roof tops and ceilings is a specialized industry and the equipment to force grout and other forms of cement and polymer slurries into voids is mostly large, powerful and very expensive. Often, such machinery is truck mounted. But such work on the Wake islands requires small scale pumps to reach remote areas as well as for low cost work. A few small grout pumps are available in both powered (electrically and pneumatically) models and in manual models. A manual pump would only be recommended for sites where power sources can not be brought to within working distance.

BOS will need to determine if compressed air power can be brought within the working proximity of every historic concrete structure to be stabilized. This may be in the form of large fueled compressors or smaller electrical generator driven compressors minimally

capable of 100 psi at 15 cfm. Electrical generators are highly desirable and almost essential at the work sites also for powering grout mixers, electric hammer drills and rotary hammers.

For stabilization grout injection pumps on the Wake islands, we recommend at the outset the products offered by the following:

ChemGrout, Inc.
PO Box 1140
805 E. 31st Street
LaGrange Park, IL 60526
Phone: 708-354-7112
Fax: 708-354-3881
Email: info@chemgrout.com
Website: www.chemgrout.com

CG-050M (5 gal. hopper, 2-3 GPM, 200 PSI, manual):



CG-050 (5 gal. hopper, 2-3 GPM, 225 PSI, air powered):



CG030 (15-30 gal. hopper, 12-16 GPM, 300-400 PSI, air powered):



The pneumatic model CG-050 seems to be sufficient for the slow placement of grout. Placement of grout in the stabilization work on Wake islands is expected to be naturally and necessarily slow and in small volume batches at a time due to (1) the strategic work of drilling multiple injection ports, (2) strategic containment mortaring to stop leakage, (3) deliberative decision-making on placement strategies, and (4) rapid cure rates and dehydration in the local heat.

Injection Nozzles, etc.

Injection nozzles are needed to place into drilled ports to deliver the grout slurry to voids behind spalled concrete. Nozzles have to fit tightly to overcome back pressure of the slurry and keep the slurry under pressure within voids to cause it to disperse as far into the voids as possible. Pressure fit tapered nozzles are the most simple. A nozzle such as the ChemGrout, Inc. “DrivePacker” illustrated below may be the most appropriate for the tasks on the Wake structures.



ChemGrout Inc. DrivePacker

Grout Mixers

Cementitious grout could be mixed in small quantities manually in mortar tubs with a hoe but an electric mixer is highly recommended even for small quantities to develop uniform and free-flowing properties, as well as to speed production and reduce labor. Though fluid, grout is tough to mix and a powerful mortar mixer is needed for even small quantities of 5 gallons. A specialty grout mixer is recommended, such as the 1 HP electric mixer offered by ChemGrout or similar mixers by others.

If grout is mixed too thinly, two things will go wrong: (1) the grout will shrink in the void on curing, and (2) the solids will fall out of suspension either in the mixing container or in the void.



ChemGrout Hand Held 1 HP Electric Grout Mixer

Masonry Pins

Stabilizing spalling concrete caused by the pressure of corrosion forming on internal reinforcing steel requires a dual approach.

For one (1), detached concrete needs to be re-adhered to a base of sound material by injection of an adhesive into the voids between detaching material and sound material. This adhesive is commonly polymer modified cement/sand mixtures and that is what is recommended for the conditions on structures on Wake Atoll. However, because the voids behind detached concrete on the Wake ferro-concrete structures are full of loose material, are dirty, and have weak interfaces, grout is likely to achieve only a weak bond, if it achieves any bond at all.

But grout also functions (2) as a gap filler that allows the pressure of drilling and driving anchors pins to hold detached concrete in place. Pins will be the principal means of

preventing future loss of detaching concrete from spalling surfaces on the 100 or so historic concrete structures on the islands.

Stainless pins are recommended. For most circumstances, long and thin stainless steel pins will be appropriate and ones having self-anchoring, mechanical gripping properties will be preferred to those requiring grout embedding. Thousands of these seem likely to be needed in lengths varying 12 inches to 36 inches.

Large “chunks” or thick “sheets” of detaching concrete will require heavier and longer pins that would be grouted into oversized drilled holes. Here, mild steel rod or even standard ½ in. concrete reinforcing steel bars can be used if the grout used for embedding is Cortec Corporation’s MCI-2023 with the MCI corrosion inhibitor.

For self-anchoring pins we recommend for conditions of the Wake structures those made by the following:

HELIFIX Inc.

DryFix



Dry mechanical pinning and remedial tying system

Reno Fricano, Vice President, North American Sales
630-707-7000 (Chicago, IL)

Our local distribution:
10325 State Route 43
Suite N
Streetsboro
OH 44241
USA

Toll Free 888-992-9989
Tel: 330-562-2647
Fax: 330-562-2657

Battery Powered Hammer Drill and Battery Powered Rotary Hammer

Installation of the DryFix stainless steel pins requires both an electric hammer drill (3-jaw-chuck type) for drilling pilot holes for the pins and a rotary hammer (SDS type chuck) for driving the pins.

These conventional tools are probably already owned by BOS. But for structures that are located where bringing power sources to the site would be difficult, it may be possible to perform drilling and driving of the Helifix DryFix pins using new battery-powered

hammer drills and battery-powered SDS bit rotary hammers now available from Hilti. A nearby 12 volt vehicle would enable keeping back-up batteries in recharged and ready state during drilling and pinning operations.

It is not known if these new battery powered tools would have the power to perform this drilling and pinning work. They would have to be purchased and tested.

For drilling, the following model would be appropriate: Hilti TE 4-A18 18V battery powered

For driving with an SDS chuck, the following model may be appropriate: Hilti TE 7-A.

Hilti, Inc.
800-879-8000
www.us.hilti.com

Penetrating Epoxy and Coatings

Steel that has corroded completely and has essentially reverted back to iron ores can not benefit from corrosion control coatings such as Ship-2-Shore or Cortec Corporation's Migrating Corrosion Inhibitor. Instead, these steel structures require penetrating "consolidation" with a hardening resin principally to strengthen them. Such complete reversion to iron minerals in the corrosion process typically is in the form of leafy layers of iron ore that are weak.

Two examples of this complete loss to corrosion are:

1. Peale Island 8 in. Gun (PI19).



2. Remains of a Machine Gun near the Planned Museum Building.



The recommended penetrant and consolidant would be one of two low viscosity 2-part 100% solids industrial epoxies:

PPG Amerlock Sealer

Sherwin Williams Macropoxy 920 Pre-Prime.

In the case of the 8 in. Peale Island Gun, and possibly the machine gun, the entire structure would receive a thorough penetrating treatment (repeated until fully saturated) followed by a protective overcoat of a resin colored a uniform color, perhaps a dark brown. This overcoating is needed to provide protection of the epoxy from ultraviolet light to which it is sensitive.

A suitable overcoatings would be one of the relatively new and very durable silicone-modified epoxy coatings such as:

PPG/Ameron PSX 700 Engineered Siloxane.

SECTION 7: TRAINING OF BASE OPERATION SUPPORT PERSONNEL / COST PROJECTIONS OF STABILIZATION WORK

It was not possible to demonstrate important stabilization procedures during a training session for BOS personnel because, as explained elsewhere above, essential tools were not available. Instead, the materials brought to the site were introduced and stabilization of spalling concrete and treating corroding steel were explained at the blockhouse (WK36) near the housing area.



Robert Lodge introducing the essential stabilization materials to BOS personnel at the training session.

What was said had to be translated to many of the BOS personnel from English into (presumably) one of the Philippine languages of the BOS workers. Because of the specialized terminologies and complexities of materials and tools applications for complex condition problems, it seems doubtful that a full understanding of stabilization procedures was transferred.

Now that all materials and tools necessary to perform stabilization tasks have been determined, it may be useful to procure these and conduct training sessions and pilot stabilization projects. This may be necessary to identify deviations in methods and materials that may be needed.



Robert Lodge demonstrating to BOS personnel how to locate voids that need grout injection and/or pinning.



Robert Lodge at the Japanese blockhouse (WK36) explaining the preliminary procedures necessary prior to grout injection and pinning. Here, he explains how available openings to voids such as this side crack can be used for pressure-washing out debris. Then, such openings need to be sealed with mortar to prevent grout loss under the pressure of injection. Finally, the strategies for drilling injection ports for grout and drilling for pins were explained, including the use of mechanical anchor pins and grouted pins.

While all basic materials and procedures for stabilization of steel and aluminum artifacts and for stabilization of concrete structures were explained, lacking the right tools these materials and procedures were not able to be tested for any needed changes, nor could decision-making be experienced in the process of working with the wide variety of concrete deterioration conditions.

Cost Projections

It was expected that in this single two-week visit stabilization procedures could be determined, demonstrated and cost estimates produced. That turned out to be unrealistic. The initial visit accomplished a survey of condition and identifications of materials tools and methods to perform stabilization but since not all necessary materials and tools could have been identified in advance of the visit and procured for the time of the visit, it was impossible to begin stabilization work in those two weeks of this first visit.

Cost projections for stabilization work can only be produced after trial attempts at using these tools and materials in pilot stabilization efforts. This will reveal the time of effort and consumption of materials.

Cost projections will also be dependent on the government's selection of features to be preserved from the 100 or so on the atoll.