NATIONAL RADIO ASTRONOMY OBSERVATORY
Socorro, New Mexico

VLBA Antenna Memo Series No.68

St. Croix VLBA Antenna Painting and Surface Preparation Requirements

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1.0 Executive Summary

A detailed inspection of the St. Croix VLBA antenna was conducted on January 31, 2006 and February 1, 2006. The results of this inspection are detailed in the St. Croix Corrosion Report, VLBA Antenna Memo Series No. 62. This report states that the paint system on the St. Croix antenna has been compromised and corrosion is consuming the steel at a rapid rate. If left unchecked the St. Croix antenna structure would suffer a critical failure due to corrosion in less than five years.

The only way to check this corrosion is to restore the antenna's coating system. Funding for coating maintenance became available. Maintenance has been scheduled to occur beginning September 10, 2007 to December 10, 2007. The surface area of the structural steel is estimated to be between 50 and 60 thousand square feet.

The St. Croix antenna was originally painted with a three-coat inorganic zinc/epoxy/epoxy coating system. This system is no longer protecting the steel because the paint was not applied properly initially; the paint was damaged during antenna assembly and maintenance; and the epoxy paint layers have thinned from UV light degradation. In a seacoast environment, this type of coating system would have an expected lifetime of approximately 14 years [24]. The antenna was painted in 1992, and therefore its expected lifetime has been exceeded. Considering all of the above factors, as much of the old paint as possible should be stripped off and the antenna recoated instead of conducting spot repairs and then over-coating the antenna.

The majority of the money and time will be spent cleaning the steel and creating/restoring the rough surface needed for coating adhesion. Proper surface preparation is critical to the long-term success of any coating. There are two common methods of surface preparation that would be acceptable for the St Croix antenna's marine environment. These are abrasive blast cleaning and ultra-high pressure waterjetting (UHP). Although it might be more costly, UHP waterjetting is the preferred surface preparation method for St. Croix. This method will remove the soluble salts in the lap joints and bolted connections where crevice corrosion is consuming the steel. UHP waterjetting also does not use an abrasive that could damage bearings and other sensitive equipment.

The antenna truss webbing consists of numerous structural members. Access to the faces of these members is hindered by the adjacent structure. This will make it difficult to achieve a high quality of surface preparation. Therefore, a coating that will give good adhesion on the inevitable inferiorly prepared surfaces should be selected. Since there are so many sharp edged structural members, the coating system should also have good edge retention properties. In summary, a surface tolerant coating system with exceptional edge retention properties must be chosen. The choice of topcoat is not as important because its function is only to protect the barrier coats from UV radiation.

In a marine environment it is necessary to ensure that significant flash rust or chlorides cannot accumulate on the prepared surface before the paint is applied. Therefore, instead of preparing the entire surface and then going back and painting, the structure will have to be prepared and painted in smaller sections.

Typical coating systems that are being considered are listed below.

Stripe Coat – organic zinc or surface tolerant epoxy mastic
A stripe coat of the primer will be applied by brush at the bolted joints, welds, sharp edges and corners where corrosion is likely to occur before the rest of the primer is sprayed on.

Prime coat - organic zinc or surface tolerant epoxy mastic
A polyurethane joint sealant must be applied at the lap joints and crevices on the structure before the intermediate coat is applied.

Intermediate coat - epoxy mastic or polysiloxane without topcoat
The intermediate coat should also be striped in at the bolted connections and high corrosion areas before the complete coat is sprayed on.

Topcoat – urethane, acrylic or acrylic polysiloxane

Another part of this job is to repair or replace the parts of the antenna that are badly corroded. All corroded bolts will be replaced with hot dipped galvanized bolts.

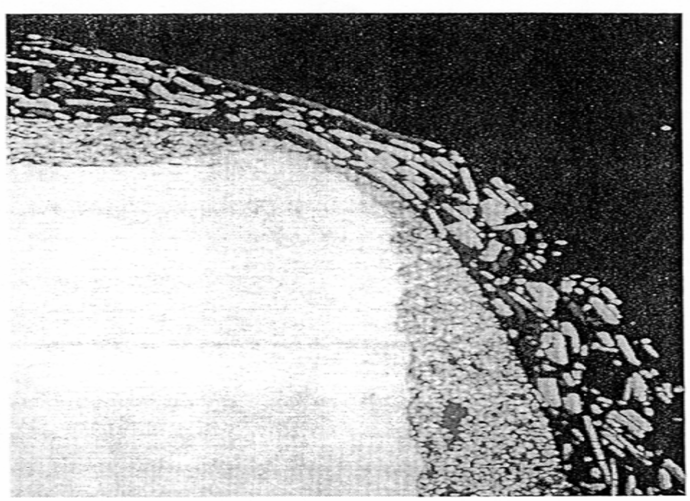
The walkways and gratings are exposed to abrasion and mechanical damage during antenna maintenance. This mechanical damage has compromised the coating system and some areas of the grating are experiencing severe corrosion. Due to the complicated geometry of the grating, it would by very costly and time consuming to prepare the surface and repaint the walkways. Therefore, the severely corroded grating will be replaced with hot dipped galvanized grating.

2.0 Corrosion

The picture below shows that corrosion is occurring on the edges of the structural members and at the bolted lap joint connections.

2.1 Edge Corrosion

The sharp edges of structural members are subject to corrosion for two reasons. The first is that the coating at the edges is prone to damage during shipping, assembly and maintenance of the structure. The second reason is that the coatings shrink and pull away from sharp edges during the curing process. The photograph below is a side view of a Micaceous Iron Oxide (MIO) filled epoxy product applied over a zinc primer. The photograph clearly shows both the zinc primer and the epoxy thickness narrowing over the sharp corner.



2.2 Crevice Corrosion

The most corrosion on the structure is occurring where the structural members are bolted together. These bolted connections have lots of edges so they are susceptible to the edge problems as described above. In addition, crevice corrosion is also a major problem at these connections. Crevice corrosion occurs in the pockets that form when pieces of metal are held together in a lap joint, under washers or between a bolt and a nut. There are two types of crevice corrosion. The first occurs when an area of low oxygen concentration inside the crevice causes the inside surfaces to become anodic to the surface outside the crevice. A second form of crevice corrosion occurs when corrosive elements inside the crevice, such as salts and moisture, create a build-up of corrosion products. The interior of the crevice becomes a cathode and the exterior of the crevice shows severe corrosion because it becomes the anode. Severe pitting and loss of structural strength can occur from this concentrated form of corrosion. See Figure 1.

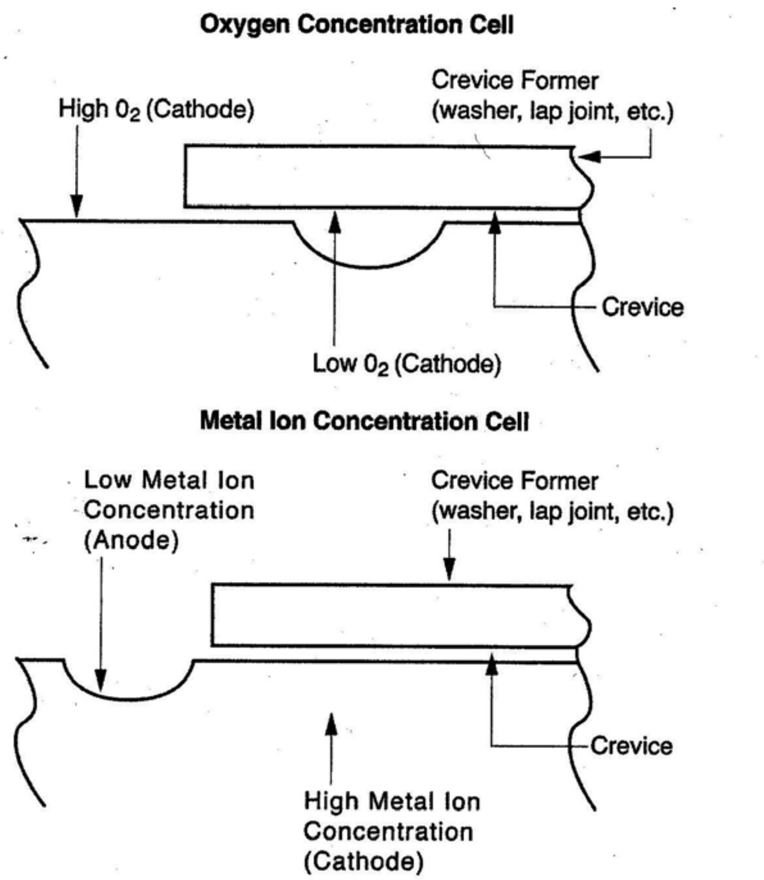


FIGURE 1 Concentration cell corrosion. Top: Oxygen concentration cell. Bottom: Metal ion concentration cell. Courtesy of SSPC: The Society for Protective Coatings; 4th Edition, *Good Painting Practice, SSPC Painting Manual,* Volume 1.

Our inspections at St. Croix indicate that most of the corrosion is taking place outside of the crevices indicating the metal ion concentration cell type crevice corrosion.

2.3 Exfoliation Corrosion

The picture below shows a flake of steel that was removed from the underside of a steel beam in the box section of the antenna.

The steel is beginning to swell and disintegrate and flakes off in layers. This form of corrosion is called exfoliation. Exfoliation is a form of layer corrosion which starts at the edge, proceeds within the body of the material in paths parallel to the rolling direction of the steel. The corrosion formed is greater in volume than the metal it replaced, and the layers of steel are forced apart.

2.4 Corrosion on Flat Surfaces

The next photograph shows rust beginning to bleed through the paint along the surfaces of some of the structural members. This indicates that the paint system may be approaching the end of its life. The coatings may have chalked to the point where there is insufficient thickness to adequately protect the steel. Some of this bleeding may also be due to osmotic blistering of the original paint system due to the presence of chlorides under the paint.

3.0 Original Coating System

3.1 Existing Coating System

The individual components of the St. Croix antenna were fabricated in Texas. The fabricator applied 3 mills DFT (Dry Film Thickness) of a High Ratio Zinc Silicate Primer (Inorganic Coatings Inc, IC531) and 4-6 mills DFT of the first coat of epoxy (Inorganic Coatings Inc, A26). The structural components were then shipped to St Croix and painted with 4-6 mills DFT of a third coat of epoxy (Inorganic Coatings P26T) after assembly. The three coat Inorganic Zinc/Epoxy/Epoxy system should have had an overall thickness of 11-15 mils.

One weakness with the original paint system is that the system lacks the topcoat needed to protect the epoxy from UV exposure. Epoxies break down and chalk when exposed to UV light. Therefore, they are usually combined with Polyurethane, acrylic, and other topcoat formulations. This chalking decreases the paint film thickness over time.

Another problem with the original paint specification was that a stripe coat was not specified. In a severe environment, a coat of paint is usually brushed onto edges and welds before the full coat is applied to the entire surface. The stripe coat builds up the paint thickness on the edges thus giving extra protection to the areas of the structure where corrosion is likely to occur.

The IC 531 primer calls for a minimum surface prep of Nace No. 3/SSPC SP 6 “Commercial Blast” in mild environments and Nace No. 2/SSPC SP 10 “ Near White Metal Blast” in severe environments. After a thorough search through old VLBA files, it could not be determined which of these blast profiles was originally provided for the St Croix antenna.

3.2 Initial Adhesion Problems

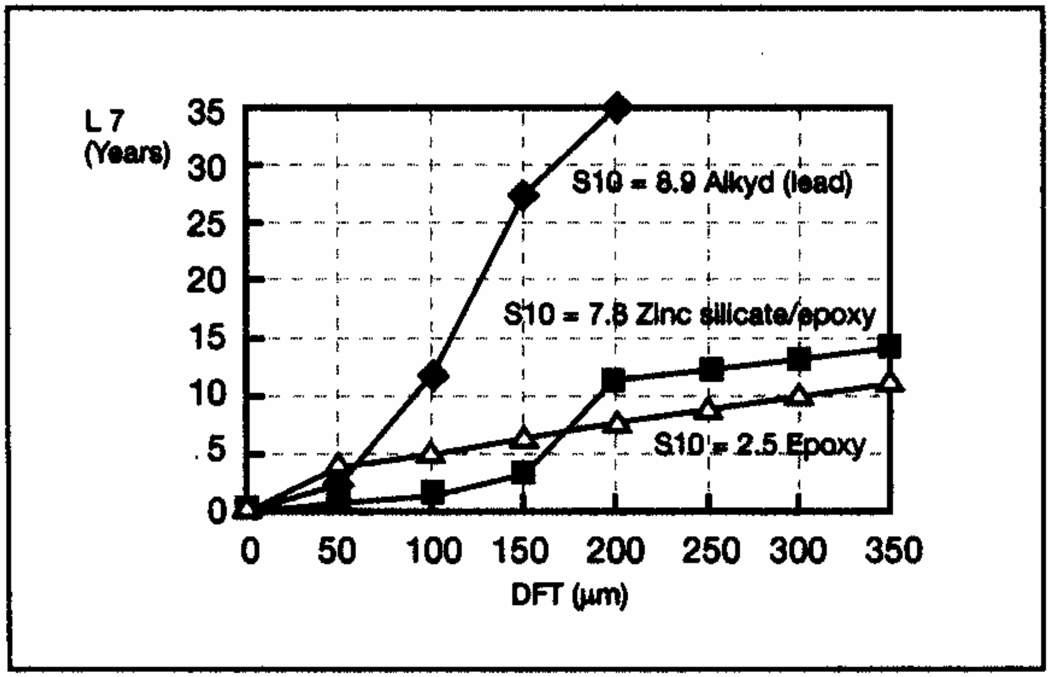
There were initial problems with the paint on the St. Croix and Hancock VLBA antennas. A consulting firm (KTA-Tator) was hired to perform a warranty inspection on the Hancock antenna. The paint failures on the St. Croix antenna were identical to the Hancock antenna. Both antennas were painted by the same paint contractor with the zinc/epoxy/epoxy paint system. Kirk Shields of KTA-Tator prepared a report for the Hancock Antenna in September of 1993 [1].

The consultant’s field investigation of the antenna structure identified numerous areas of poor workmanship. The dry film thickness of the structure had excessive thicknesses of the field applied finish coat. There was disbonding between the finish and intermediate coats and disbonding of the entire coating system from the steel substrate. The disbonding of the entire coating system from the steel substrate was attributed to surface contaminants remaining from the fabrication process. The disbonding between the finish and intermediate coats was attributed to exceeding the recoat window of the epoxy. Since epoxy coatings break down under UV exposure, a recoat window or time exists in which subsequent topcoats can be applied without additional surface roughening and expected to adhere.

3.3 Expected Paint Service Life

The effectiveness of coating systems as barriers to corrosion deteriorates with time. Eventually, their adhesion to the substrate becomes compromised. Cracks in the barrier layers develop, allowing the corrosive environment free access to the now unprotected substrate. The onset of corrosion at the substrate/coating interface further undercuts the coating layers, causing them to spall off and progressively expose more of the steel surface to further corrosion.

Coating condition is assessed as the percentage of coating breakdown over a large area. Repainting is usually initiated when a coating system reaches rust grade 7 (0.3 percent area rusted) according to ASTM D 610 or, at worst rust grade 5.5 (1.8 percent area rusted) [26].



The above graph compares the time to reach rust grade 7 for 3 coating systems in a seacoast environment [24]. The St. Croix antennas Zinc Silicate/Epoxy system was specified to have a Dry Film Thickness (DFT) of 275-375 µm. According to the chart, this represents an L7 life of 13 – 14 years. The antenna was built in 1992 and is now 15 years old.

4.0 New Coating System

4.1 Strip and Repaint or Overcoat

The worst of the corrosion is occurring at the bolted joints. The antenna is going to need significant rehabilitation at the bolted structural connections. This includes replacement of the severely corroded nuts and bolts, removal of all existing paint, soluble salts, rust, and restoring the rough surface profile which is required for good coating adhesion.

On the remainder of the antenna, between 1 and 2% of the paint area is experiencing corrosion. It would be possible to grit blast and prime only the corroded areas and then overcoat the antenna. This would require that the existing coating be sanded to a featheredge adjacent to the damaged area. The existing coating would also have to be cleaned and brush blasted as the recoat window of the epoxy has been greatly exceeded. Brush blasting is a method of surface preparation in which an abrasive blast stream is applied to a surface from a distance of 4 feet or more. This method both cleans and lightly abrades the surface. A risk from brush blasting is that if the epoxy coating has become brittle with age, the impact from the abrasive may cause it to fracture. These fractures may not be large enough to be seen, but they could destroy the barrier properties of the coating.

Another problem with overcoating is that stress can build up within the protective coating layers. This can lead to subsequent interlayer coating failure (spalling) or, more seriously, to bond failure at the primer/steel interface. Also, if any rust is left under the paint, it continues to attack the structure. The rust then swells causing the paint to crack. Once the paint cracks, the corrosion begins consuming the steel at an intensified rate.

In the past, NRAO has hired contractors to spot repair the paint system. Spot repairs were also performed with limited success during the maintenance visits by NRAO personnel. In both cases, adequate time and resources were not available to properly prepare the surface before painting. Unless these maintenance coats are removed, the doubly overcoated areas would exceed the recommended maximum paint thickness and would probably disbond the poorly adhered maintenance coat.

Considering that the paint system on the antenna was not initially applied correctly and has surpassed its expected lifetime, and the problems from overcoating, it is clear that as much of the old paint as possible should be stripped off before the antenna is recoated.

4.2 Coating System Selection

The offshore oil industry has done abundant research in the use of coatings for corrosion protection on steel structures. Offshore platforms are exposed to salt spray, ultra violet sunlight and the constant movement and flexing of substrates. Maintenance on offshore structures is also very expensive, so the coating systems must be designed to require very little maintenance. “Offshore oil platforms traditionally used a four-coat system made of a inorganic zinc-rich epoxy primer, 2 high-build epoxy mid-coats and either a polyurethane or an acrylic epoxy topcoat. For this system, time to first major paint maintenance was taken at 10 years with a further 3 to 4 major paint repair campaigns being scheduled thereafter for the remainder of the projected field life of 20 years. More recently offshore platforms are using thermal-sprayed aluminum (TSA) systems, a zinc-rich primer/polysiloxane topcoat system. For the TSA systems, only superficial maintenance would be expected over the 20 year life. The polysiloxane system is expected to be no better or worse than the traditional four-coat system.” [7]

Since the St. Croix coating requirements are similar to offshore oil platform requirements, it follows that similar coating system should be used but since the coating will be field applied under less than ideal conditions, some modifications will have to be made. Under field conditions it is much harder to control the ambient conditions, spraying distance and dry film thickness than in a shop environment. It is better to use a less capable coating system than a high performance system that is incorrectly applied.

The antenna structure was not designed with coating maintenance in mind. The structure has several back-to-back angles, lap joints, skip welds and sharp edges where high surface preparation quality requirements will be hard to or impossible to achieve. Coating performance is proportional to the degree of surface preparation. A high standard of surface preparation should be sought but a surface tolerant coating that will give good adhesion on the inevitable inferiorly prepared surfaces should also be used. Since there are so many sharp cornered structural shapes, we must also choose a coating system with superior edge retention. In summary, a surface tolerant, user-friendly coating system with exceptional edge retention properties must be chosen. The choice of topcoat is not as important because its function is only to protect the barrier coats from UV radiation.

Each layer of the paint system must be compatible with the others. Each layer of coating should have equal, if not greater, tensile strength and rigidity than the layer above it. Each layer must also be able to wet the surface of the layer that was applied before it. Otherwise, there will not be good intercoat adhesion.

Details of individual coating systems and their suitability to the St. Croix antenna are discussed in Appendix A. This document will be presented to the technical service representative from major paint suppliers and with their help, the appropriate coating system formulation will be selected.

A typical coating system may be as follows:
<u>Prime coat</u> – organic zinc or surface tolerant epoxy mastic
<u>Intermediate coat</u> – epoxy mastic or polysiloxane without topcoat
<u>Topcoat</u> – polyurethane, acrylic or acrylic polysiloxane

4.3 Coating System Application

In a marine environment, it is necessary to apply the prime coat the same day the surface is prepared so significant flash rust or chlorides cannot accumulate on the surface. However, it is usually more efficient to waterjet a few days at a time and then return and sweep the area just before it is primed. This means that the structure will need to be blow dried with oil free compressed air before it can be painted. Compressed air should be blown directly into the lap joints and bolted connections to ensure that they are completely dry before painting.

Isolated areas where there is inadequate surface profile should be hand tool prepped. All galvanized bolts and surfaces should be treated with Galvaprep or equivalent per manufacturer's instruction before the prime coat is applied.

The surface should be spot checked for soluble salts before coatings are applied. The coating should not be applied if the soluble salts exceed the paint manufacturer's recommendations.

A stripe coat of the primer should be applied by brush at the bolted joints, welds, sharp edges and corners where corrosion is likely to occur before the rest of the primer is sprayed on.

A polyurethane joint sealant shall be applied at the lap joints and crevices on the structure before the intermediate coat is applied.

The intermediate coat should also be striped in at the bolted connections and high corrosion areas before the complete coat is sprayed on.

In order to avoid the delamination problem that occurred when the antenna was first painted, all paint coats must be applied during the specified recoat windows.

5.0 Surface Preparation

Proper surface preparation is critical to the long-term success of any coating. There are two common methods of surface preparation that would be acceptable for the St. Croix antenna's marine environment. These are abrasive blast cleaning and ultrahigh pressure waterjetting (UHP). Although it might be more costly, UHP waterjetting is the preferred surface preparation method for the St. Croix antenna because this method will remove the soluble salts in the lap joints and bolted connections where crevice corrosion exists. UHP waterjetting also does not use an abrasive that could damage bearings and other sensitive equipment.

5.1 Abrasive blast cleaning

Abrasive blast cleaning is the traditional method of surface preparation. In marine environments, near white metal abrasive blast quality (SSPC-SP 10/NACE No. 2) is often considered to be the minimum degree of surface preparation acceptable. Near white metal blast cleaning is a standard of abrasive blast cleaning which requires the removal of almost all of the coating and surface contamination from the steel substrate. In effect, the standard allows what is referred to as shadows to remain on the surface, but little else.

The primary benefits of abrasive blasting are its high productivity rate (lower cost) and its ability to create the rough surface or anchor profile required for good coating adhesion. Abrasive blasters use 4 to 10 pounds of abrasive per square foot. Therefore, between one and three hundred tons of abrasive would be needed for the St. Croix project. Antenna machinery such as bearings and gearboxes would have to be carefully protected from this abrasive.

Abrasive blasting may not do an adequate job of removing the residual chlorides from the structure. Salts on steel surfaces absorb moisture and cause osmotic blistering of the coating. Unless these salts are removed to an adequate level during surface preparation, problems will arise with the newly applied coating system. Therefore, if we sandblast the antenna, we should also pressure wash the surface with Chlor-rid or a similar product to remove the residual salts.

5.2 Ultra-high Pressure Waterjetting (UHP)

Surface preparation with UHP waterjets involves water pressurized up to 40,000 psi to remove the old coatings and corrosion products. In marine environments, very thorough cleaning (SSPC-SP 12/Nace No. 5 WJ-2) is often considered to be the minimum degree of UHP surface preparation acceptable. A WJ-2 surface shall be cleaned to a matte finish which when viewed without magnification, is free of all visible contaminants except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter. The staining or tightly adherent matter is limited to 5% of the surface.

UHP waterjetting requires more equipment and time than abrasive blasting and, therefore, can be more expensive. UHP waterjetting cannot generate a surface profile, although it can clean back to and refresh an existing profile. Since the St Croix antenna was initially sand blasted, UHP waterjetting should be able to restore this profile. There are two advantages to UHP waterjetting. The first is that there is no abrasive that could damage bearings and other sensitive equipment. The second is that UHP waterjetting does an excellent job of removing soluble salts. This will be particularly advantageous at the lap joints and bolted connections where crevice corrosion exists.

There may be another advantage to using UHP waterjetting. There is some evidence to suggest that UHP waterjetting may leave some of the original inorganic zinc primer intact. The photograph below shows a ship ballast tank which was cleaned by UHP waterjetting. This ballast tank was initially primed with an inorganic zinc primer. The inorganic zinc primer chemically bonded to the substrate so that it could not be removed by the waterjetting. The photograph also shows that the inorganic zinc primer was sacrificially consumed on the edges and where the original topcoat was compromised.

Because of these advantages, UHP waterjetting is the preferred method of surface preparation for the St. Croix antenna.

6.0 Bibliography

[1] Shields, Kirk, Warranty Inspection on Radio Antenna Located in Hancock, New Hampshire, KTA-Tator, Inc., Report # JN C2247, September 1993

[2] Depaiva, Mario and Martins, Joao, An Edge Retentive Coating Solution Based On A Tolerant, Solvent-Free Epoxy System, PCE, June 2002

[3] Vincent, Louis, The Protective Coatings Users Handbook, NACE International, 2004

[4] Fairhurst, D., The Basics of Corrosion, PCE, July 1997

[5] Cunningham, Tony, Marine Coating Inspection, NACE, August 2004

[6] Brown, Thomas, Designing Protective Coating systems For Offshore Oil and Gas Platforms, Ameron International, 2004

[7] Swidzinski, M.A.M., Offshore Protection: Painting For a 20 Year Life, JPCL, May 2004

[8] Salome, Fred, Personal Conversations, ACA Corrosion Technologist

[9] Wood, William A. Jr., What You Should Know About Applying Zinc-Rich Primers, JCPL, July 2005

[10] Byrnes, Geoffrey B., How to Avoid Specifying Delamination, JCPL, August 2001

[11] Smith, William, Preparing Galvanized Steel for Epoxy Topcoating, JCPL, February 2002

[12] Makepeace, Desmond and Krzywicki, John, Surface Preparation for Galvanized Steel to Be Painted, JCPL, June 2005

[13] Fischer, Karl P., A Review of Offshore Experiences with Bolts and Fasteners, NACE Paper #03017, Corrosion 2003

[14] NACE Standard RP0176-2003, Corrosion Control of Steel Fixed Offshore Structures Associated with Petroleum Production

[15] SSPC-TR 4, Preparation of Protective Coating Specifications for Atmospheric Service

[16] Negrey, R. P., Inspection and Interpretation Using Nace No. 5/SSPC SP-12, Corrosion 2000, Paper #00615

[17] Schmid, Richard F., Ultrahigh-Pressure Waterjetting Comes Of Age For Surface Preparation – Its Time To Get The Salts Off The Work, NACE Paper #594, Corrosion 97

[18] Dupuy, Richard, Ultra-High-Pressure Watterjetting for Maintenance Coating Applications, JCPL, July 2001

[19] Momber, A.W., Effects of Surface Preparation Methods on Adhesion of Organic Coatings to Steel Substrates, JCPL, November 2004

[20] Kronborg, Peter, Fundamentals of Waterjetting and Priming Steel Surfaces on Ships, PCE, March 1999

[21] Compiled by Corrosion Management Staff, UHP Waterjetting Update, Corrosion Management, November 2003

[22] Kuljian, Gordon and Holmes, Brenda, U.S. Navy Experience with Waterjetting, PCE, February 1998

[23] Frenzel, Lydia and Chauviere, Monica, The Whole Truth Of Standards And Specifications For Water In Surface Preparation, NACE Paper #596, Corrosion 97

[24] Adamson, Neil P., Performance of Coating Systems Using Numerical Life Prediction, JPCL-PMC, July 1998

[25] Perkins, Paul, Guidelines for Establishing a Bridge Painting Program, JCPL, October 2003

[26] Adamson, N, Silalabi, L, Morris, P., Gaging the Service Life of Aged Alkyds, Problem Solving Forum, JPCL, July 1997

Appendix A. Details of Individual Coatings

Thermal Sprayed Coatings

Thermal sprayed coatings would provide the best and longest lasting solution of all the coatings. Thermal spraying involves simultaneously melting and blowing of metallic particles onto the surface. This process requires a blast-cleaned surface of exceptional quality and profile. It would not be possible or cost effective to use this process on the entire antenna. However, this system could be used to provide extra protection for problem areas on the structure.

Inorganic Zinc Primers

An inorganic zinc silicate primer was used as a shop primer when the telescope was first put into service. The primary advantage of a zinc primer is that this type of coating will arrest rust creep, or undercutting of the coatings surrounding the damaged area, and confine corrosion to the point of the damage. Inorganic zinc primers provide optimum galvanic protection for steel substrates but in a maintenance scenario it is usually not possible to achieve the high degree of surface preparation and favorable ambient conditions for proper application. Therefore inorganic zinc primers are rarely used as maintenance primers. Since it will not be feasible to reapply an inorganic zinc coating in St. Croix, it would be to our advantage to use a method of surface preparation that leaves this primer intact on the St. Croix antenna.

Organic Zinc Primers

Organic zinc epoxy primers will not provide the same level of service as inorganic zincs but they are more tolerant to compromised surface preparation and ambient weather conditions. Provided the zinc loading of the formula is sufficient ("A zinc pigment greater than 80% by weight in the dried film would be considered as a minimum for good cathodic protection properties"[6].), an organic zinc primer would be a good candidate for the St Croix antenna. Since a highly loaded zinc primer can be harder to apply correctly than other primers, its use should discussed with the selected coatings manufacturer and paint contractor.

High Build Epoxy Coatings

Epoxy coatings generally provide protection to substrates by forming a barrier to the environment and essentially keeping the electrolyte necessary for corrosion at bay. Minimum film thicknesses are normally obtained in one or two coats, but two coats are typical in offshore applications to ensure a high level of protection and a minimum amount of film defects such as pinholes and holidays. Epoxies can be applied over a zinc rich primer or used in direct to metal applications.

Inert fillers such as aluminum flakes and micaceous iron oxide can be added to the epoxy resin. These platelet-like pigments create a labyrinth like path through the epoxy thereby increasing its barrier properties. Epoxy coatings with these pigments are called epoxy mastics.

One drawback of epoxy coatings is their poor resistance to ultra violet from sunlight. This leads to an erosion of the coatings film thickness, reducing the barrier protection of the system. Topcoats are generally required that have a high resistance to UV.

Polyurethane Topcoats

Polyurethane finish coats are generally acknowledged as providing optimum resistance to UV and high degrees of flexibility and chemical resistance. Polyurethane finishes offer no real anticorrosive or barrier protection to the substrate but they do provide a high level of protection to the integrity of the coatings system. These coatings are usually used as a protective coating for epoxy intermediate coats.

Epoxy/Polysiloxane Topcoats

Polysiloxane coatings technology permits the availability of ultra high performance by the combination of the barrier protection and durability properties of a high build epoxy with UV resistance. “A three-coat system consisting of zinc/epoxy/epoxy-polysiloxane rivals the performance achieved with a typical four coat zinc/epoxy/epoxy/polyurethane system [6]”. There has been limited success with epoxy/polysiloxane at the VLA. It was found that if there was not adequate surface profile, the high internal curing stress that occurs in polysiloxane caused the primer to disbond from the substrate. If adequate surface preparation quality can be achieved, an epoxy/polysiloxane system could be a viable technology for the St Croix antenna.

Acrylic Topcoats

Fred Salome [8] suggested that we use an acrylic (Latex) topcoat that would be easy for the site technicians to maintain. This would be a single part paint that could easily be brushed onto areas where the original topcoat has been damaged. Mr Salome’s suggestion to use a very easy to maintain topcoat has merit because the first line of defense is the site technicians who are electronics specialists and not painters.

Acrylics have exceptional resistance to UV rays and excellent long-term flexibility. However, they are susceptible to washing off when subjected to rain within a few hours after application and they cure slowly during high relative humidity conditions.

Acrylic Polysiloxane Topcoats

Acrylic modified siloxane finish coats are also available that will provide UV resistance similar to that achieved with polyurethane topcoats but they do not have the anticorrosive advantages of a high build epoxy-polysiloxane. These are available as single component materials and are well suited for routine maintenance. A sample of this paint has been requested so that it can be evaluated as to whether it suffers from the same high curing stress problem as the epoxy polysiloxane.