# Magneto-Optic Imaging Inspection of Selected Corrosion Specimens


July 1992

DOT/FAA/CT-TN92/20

Document is on file at the Technical Center Library, Atlantic City International Airport, N.J. 08405



U.S. Department of Transportation
**Federal Aviation Administration**

Technical Center
Atlantic City International Airport, N.J. 08405

NOTICE

Technical Report Documentation Page

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| DOT/FAA/CT-TN/92/20 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| MAGNETO-OPTIC IMAGING OF SELECTED CORROSION SPECIMENS | July 1992 |
| | 6. Performing Organization Code<br>DTS-75 |
| 7. Author(s)<br>Stephen N. Bobo | 8. Performing Organization Report No.<br>DOT-VNTSC-FA1H2-92 |
| 9. Performing Organization Name and Address<br>U.S. Department of transportation<br>Research and Special Programs Administration<br>Volpe National Transportation Systems Center<br>Cambridge, MA 02142-1093 | 10. Work Unit No. (TRAIS)<br><br>11. Contract or Grant No. |
| 12. Sponsoring Agency Name and Address<br>U.S. Department of Transportation<br>Federal Aviation Administration<br>Technical Center<br>Atlantic City International Airport, NJ 08405 | 13. Type of Report and Period Covered<br>Technical Note<br><br>14. Sponsoring Agency Code<br>ACD-220 |

15. Supplementary Notes

Technical Center Project Manager: Chris C. Seher ACD-220

16. Abstract

A feasibility demonstration was conducted at the facilities of Physical Research Instrumentation Company (PRI) in Redmond, Washington. The purpose of the demonstration was to compare the effectiveness of the PRI Model 301-1 magneto-optic imaging (MOI) system with conventional eddy current methods of detecting corrosion in aircraft test panels, previously identified by eddy current scanning. The study indicated that MOI may not be able to detect gradual differences in thinning that are less than 10 percent of base metal thickness. Also, with MOI, it appears to be more difficult to provide quantitative estimates of residual thickness than is the case with eddy current scanning. On the other hand, MOI visualization of the extent of corrosion is simple and free of the labor intensive point-by-point mapping, which is required by eddy current scanning.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Nondestructive Evaluation<br>Shearography, Inspection<br>Aging Aircraft<br>Aircraft Inspection | Document is on file at the Technical Center Library, Atlantic City International Airport, New Jersey 08405 |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | 23 | |

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

## TABLE OF CONTENTS



### FIGURES



### TABLES

## INTRODUCTION

Corrosion is difficult to detect with existing techniques, particularly in combination with moisture entrapment. Magneto optic imaging (MOI) was identified as a potential candidate nondestructive inspection technique which might be more reliable than currently mandated eddy current inspection techniques, and might also reduce the inspection time and associated costs. In order to evaluate MOI, the Volpe National Transportation Center, under FAA Technical Center sponsorship, conducted a joint feasibility demonstration of MOI with Boeing and Physical Research Instruments (PRI).

Magneto-optic imaging depends on the ability of certain materials to rotate the plane of polarization of light in the presence of a magnetic field. This (Faraday) effect is used to detect perturbations in the magnetic field produced by passing an alternating current in a thin planar foil of doped yttrium iron garnet. When the foil is placed near the surface of a metallic test object, eddy currents are produced which modify the magnetic field in the foil. When defects or other obstructions, such as rivets or holes, divert the otherwise uniform flow of electric current near the surface of the test piece, magnetic fields perpendicular to the surface of the test piece are produced which can be imaged in real time by an appropriately designed optical system.

## THE TEST PANELS

Six test panels were provided by Boeing. The panels, taken from actual aircraft, measured approximately 6 by 18 inches with thickness of 0.040 inch. Each panel contained at least one row of flush rivets which attached plates of varying sizes (representing internal structure) to the back of the panel. Figure 1 shows examples of several panels with notations indicating corrosion detected by MOI.

A previous eddy current inspection by certified Boeing technicians identified numerous sites of corrosion on the panels in depths equal or greater than 10 percent of the total thickness (the current limit for removal of a panel from the aircraft). These sites were marked by Boeing on transparent panel overlays which were not made available prior to the MOI inspection.

## INSPECTION PROCEDURE

The inspection was performed by PRI personnel in accordance with a procedure jointly prepared by Boeing, PRI, and the FAA Technical Center (see Appendix A). The front face (side opposite the corrosion) of each panel was painted with semigloss paint, and the rear face of each panel was marked with an indelible serial number. Pairs of panels were then taped together in order to conceal the presence of corrosion. In some cases, material containing various metals was introduced in the two-panel sandwich. Magnetic material, such as a steel rivet, near the test piece perturbs the magnetic field and distorts the magneto-optic image. (A similar effect is introduced by magnetic material in the case of eddy current scanning.) The extent of corrosion was recorded on each panel surface, using an erasable marker. Personnel were requested to use the marker to circumscribe corrosion having a depth of 10 percent or greater of panel thickness, and to estimate and mark whether its depth was 10 percent, 20 percent, or 30 percent and greater (Figure 1).

Two employees of PRI inspected the panels in sequence, and the results were then compared with the transparent overlays provided by Boeing. Inspection time was recorded.

## COVERAGE

Previous eddy current inspection of the panels covered areas near the rows of rivets, but not (according to Boeing personnel) necessarily the remainder of the panel, whereas the MOI instrument, having a coverage of about 15 square inches, could easily sweep the entire area of the panel. Indeed, the best technique in using the MOI instrument was to move it slowly over the panel, since the motion aided in discrimination and observation of details in the panel.

## INSTRUMENTATION

The Model 301-1 MOI instrument in operation on a test panel is shown in Figure 2.

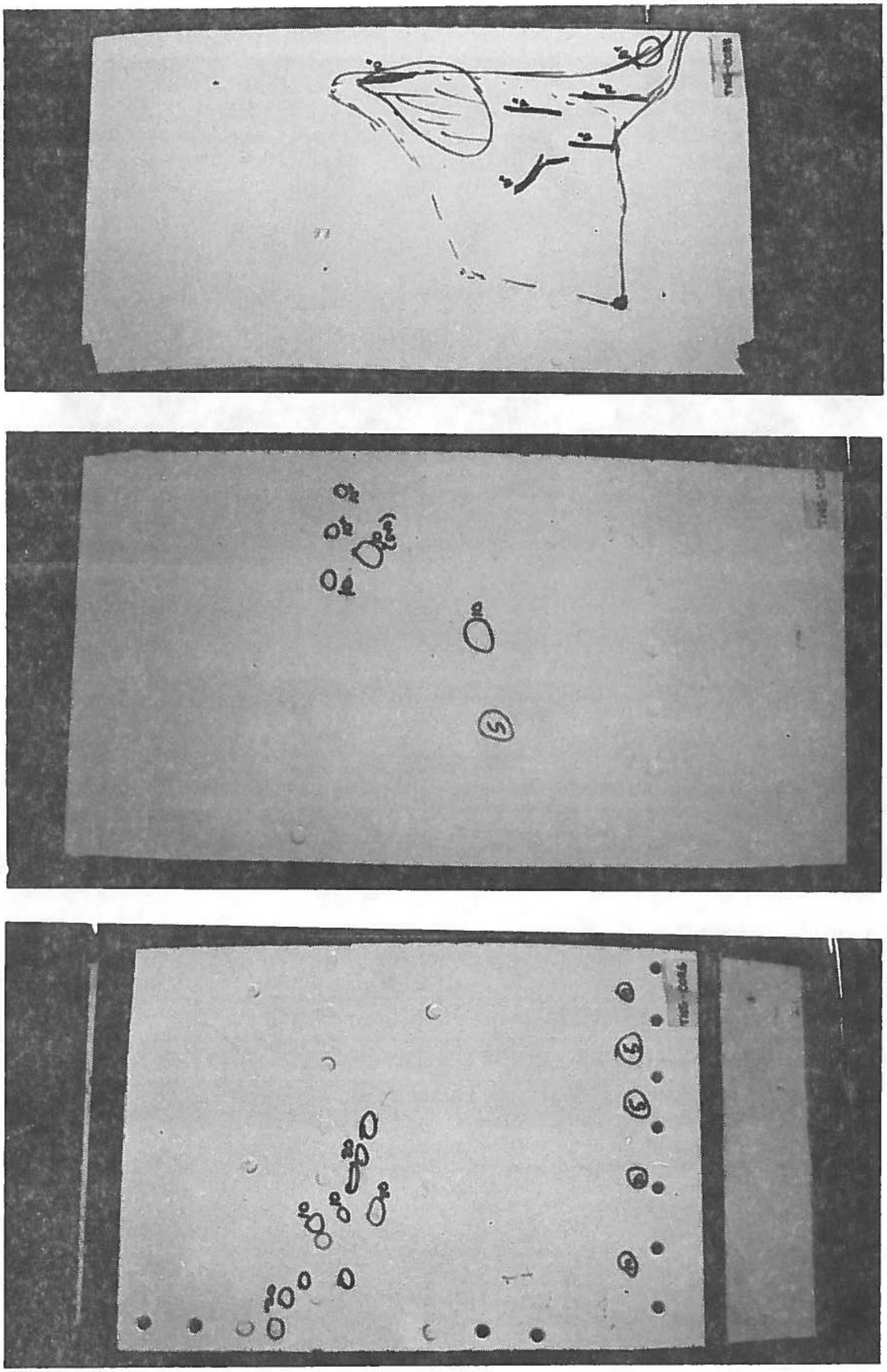


**Figure 1** Examples of test panels containing subsurface corrosion, detected by MOI.

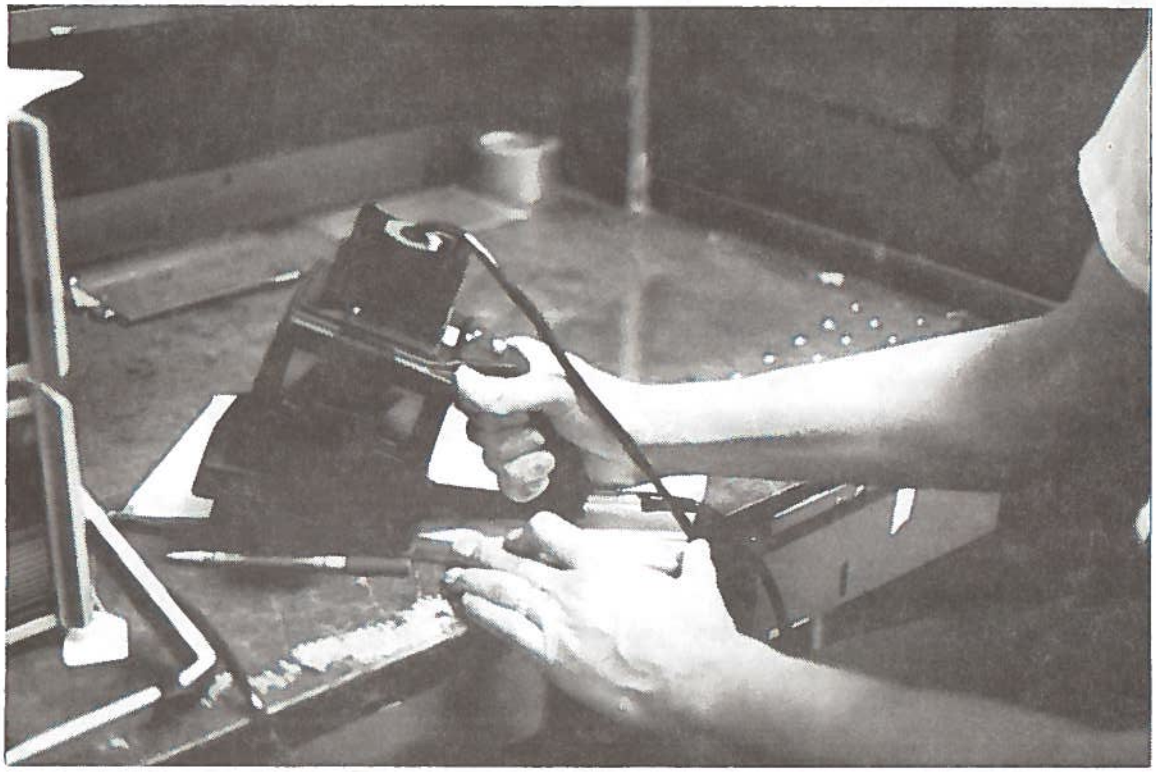


**Figure 2** Model 301-1 in operation on a test panel.

## RESULTS

Table 1 presents a summary of the inspection data. Individual data were collected and tabulated by Boeing personnel (Appendix B). Since the panels are used in ongoing training and classroom activities, details of the corrosion and the overlays indicating corrosion sites were retained by Boeing.

Table 1. Comparison of MOI and Eddy Current (EC)

| Corrosion Depth | 10% | 20% | 30% | Time |
|---|---|---|---|---|
| Sites Detected by EC | 14 | 11 | 8 | * |
| Sites Detected by MOI** | 6.5 | 10 | 7 | 25 min |

* Time not available, Boeing indicates similar time expended.
** Average of two inspections.

## INSPECTION TIME

The time required for inspection of the six panels probably does not relate to the time required for inspection of a complete aircraft because of human factors considerations. However, MOI inspection for corrosion appears to be inherently faster than eddy current scanning, since the coverage of the MOI scanner is many times that of a single eddy current probe. Moreover, the MOI image is enhanced by motion over the area being inspected. Thus, the inspector is motivated to move the scanner to enhance the image, and coverage is thereby increased.

## CONCLUSIONS

The study indicated that MOI using current procedures is slightly poorer in detecting differences in thinning less than 10 percent of base metal thickness than eddy current methods. On the other hand, visualization of the extent of corrosion is simple and free of the labor intensive point-by-point mapping required by eddy current scanning. Both, PRI's and Boeing's comments are presented in the appendices.

# APPENDIX A

# PROCEDURE FOR MOI CORROSION INSPECTION

## PROCEDURE FOR MAGNETO-OPTIC/EDDY CURRENT IMAGING INSPECTION FOR CORROSION IN SKIN PANELS OF AIRCRAFT

1. <u>Purpose</u>

   A. To find and make an estimate of corrosion of 10 percent or more in the aluminum outer skin at the faying surface of structures with two layers. This procedure uses a Magneto-Optic/Eddy Current Imager (MOI) with a video display. The calibration details are given for clad 2024-T3 or -T4 and clad 7075-T6 aluminum alloys which have an outer skin thickness between 0.032 and 0.125 inches.

   <u>Note</u>: Differences in the conductivity or the thickness between the reference standard and the airplane skin, separation between skins, intergranular cracking related to corrosion, and paint may cause changes in the MOI response. Thus, this procedure cannot be used to give, with precision, the depth of corrosion, or to look for local material losses of less than 10 percent.

2. <u>Equipment</u>

   A. To do this procedure, it will be necessary to use a PRI Instrumentation MOI model 301-1 or equivalent.

   B. Boeing Reference Standard 127-XXX or 127A-XXX shall be used. Refer to Detail I and Detail II.

   C. Appropriate shim material used in conjunction with the Reference Standards to represent paint layers.

3. <u>Instrument Calibration</u>

   A. Find the appropriate thickness of the outer skin of the airplane in the region to be inspected. Refer to the applicable service bulletin or skin drawings to find the appropriate thickness of the outer skin of the airplane.

   B. Make a selection of the necessary Reference Standard from Table 1.

   C. If the area of the inspection is painted, place a non-conductive shim having the same thickness as the paint over the reference standard. The nonconductive shim must be within plus or minus 0.003 inch of the actual paint thickness. The image may be degraded but must still be able to distinguish the 10 percent change in thickness of the reference standard.

   D. Place the MOI Imaging Head on the reference standard over the areas representing material loss. If using reference standard 127A-XXX, place the Imaging Head over the area where there is secondary structure. Make sure that the bottom surface of the Image Head is in even contact with the surface of the reference standard.

   E. Select the frequency within the suggested range according to Table I which gives the best contrast for the simulated corrosion areas of the chosen reference standard. Adjust the bias control setting to give the best contrast and definition of the image of the simulated corrosion. For thicker materials where the images may be weaker, scan the Imaging Head while making adjustments, rather than holding it in a stationary position. Figure 1 has an image of a flat-bottomed hole. Note how the image shows only portions of the edges of the hole and the slot.

   F. Scan the Imaging Head over the surface of the reference standard to ensure that 10 percent variations in thickness can be observed. Ensure that 20 and 30 percent variations in thickness can be observed. Note that images of simulated corrosion move as the Imaging Head is scanned.

   G. Scan the reference standard at progressively higher frequency settings, and note the frequencies at which the images of the different thinned areas disappear.

   H. The maximum percent of material corrosion loss is related to the lowest frequency at which the image disappears. Refer to Table 2 for an estimate of maximum material loss.

WARNING: IF THE FREQUENCY SETTING IS TOO LOW, A BRIGHT LINE ON A DARKER BACKGROUND WHICH IS CENTERED ON THE IMAGE AREA, WILL APPEAR (see Figure 2b). THIS IS NOT AN IMAGE OF CORROSION, AND GENERALLY DOES NOT MOVE WHEN THE IMAGING HEAD IS SCANNED. THE FREQUENCY MUST BE INCREASED UNTIL THIS FEATURE IS MINIMIZED OR ELIMINATED. WHEN LOWER FREQUENCIES ARE USED, IMAGES OF THE SUBSTRUCTURE MAY BECOME VISIBLE. HOWEVER, THE REGULAR PATTERN EXHIBITED BY THIS SUBSTRUCTURE EASILY DISTINGUISHES IT FROM THE GENERALLY IRREGULAR CORROSION IMAGES.

4. Inspection Procedure

A. Calibrate the instrument in accordance with Section 3.

B. Place the Imaging Head on the skin to be inspected in an area where there is second layer structure and no apparent corrosion.

C. Use the procedure indicated in Paragraph 3.C. to adjust the bias control setting to give the best contrast and definition of the image of the simulated corrosion. It is quite helpful and beneficial to scan the Imaging Head while making the adjustments, rather than holding it in a stationary position. The image without corrosion should consist of a bright background with random dark lines distributed approximately uniformly over the image area (see Figure 2a). This is the condition of highest sensitivity to corrosion.

D. Place the Imaging Head on adjacent area where the skin is a single layer. If the image shows a bright line down the center region as described in the WARNING above, it will be necessary to raise the eddy current frequency. Check the reference standard and the location on the airplane to determine the appropriate frequency for the actual thickness (refer to Table 1).

E. Place the properly adjusted Imaging Head on the skin and slowly scan it toward the area to be inspected for corrosion. Any region showing a generally darker image than the image seen when no corrosion is present could be an indication of corrosion. Figure 3a is an actual corrosion image. Note how the corroded region gives a diffuse "area" type image, while the flat-bottomed hole (in Figure 1) gives sharper "edge" type images. The bias level setting should be re-adjusted for optimum contrast as per the appropriate reference standard. Note again, that corrosion images move as the imaging head is moved.

F. If suspect areas show corrosion-like images (See paragraph 4.E.), confirmation is required. This involves two steps: first, turn the eddy current frequency control to the "OFF" position and determine if the image persists. If the image persists, it is not an indication of corrosion, and may be due to magnetized steel fasteners or other local magnetic fields. Any images that are only present when the eddy current excitation is on are an indication of possible corrosion. Refer to paragraph 3.H. to estimate the percent of material loss.

5. Inspection Results

A. Refer to the applicable service bulletin for the corrosion limits.

B. This procedure may not be reliable in finding material losses less than 10 percent.

C. An area of possible corrosion which does not give an indication of corrosion of the faying surface of the second skin should be investigated for possible corrosion of the second layer. Depending on the depth (see Table 1) this might be detected at lower frequencies using the MOI.

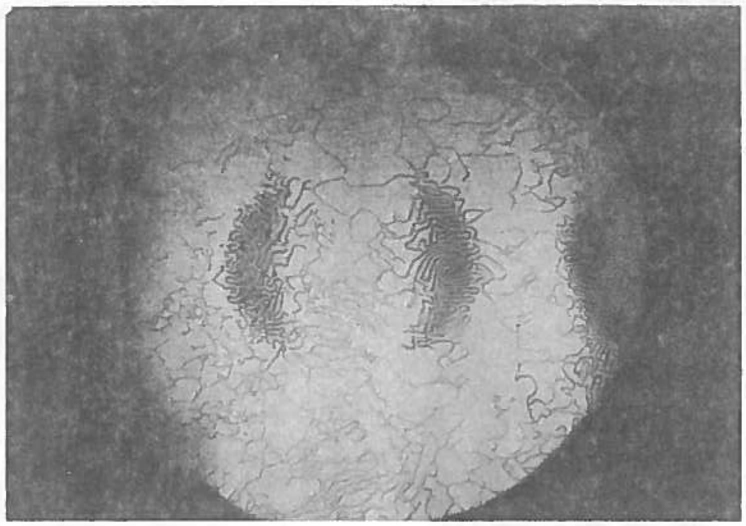
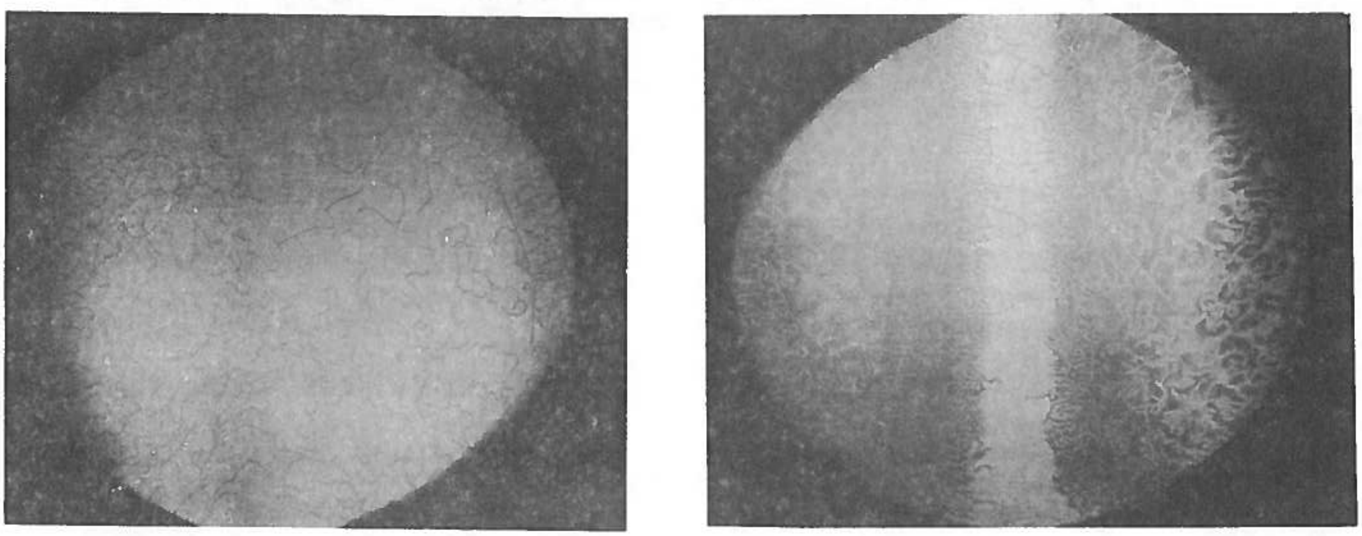
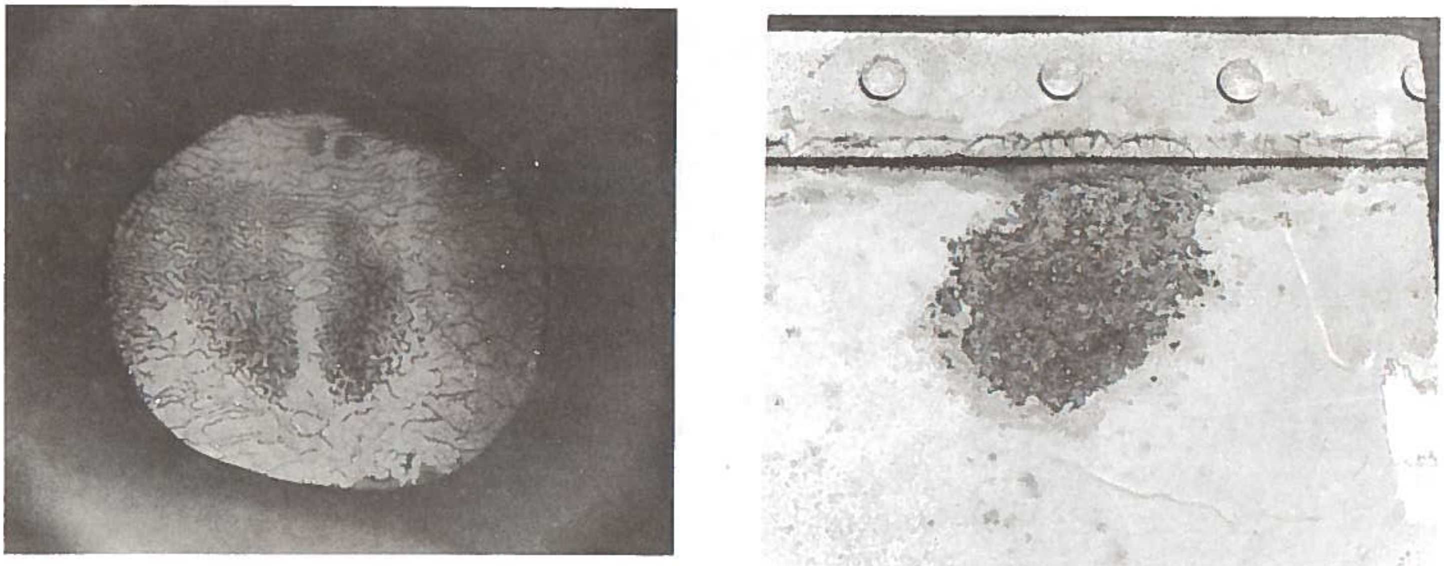


Figure 1. Image of Boeing Reference Standard 127-XXX. Note how the flat-bottomed hole gives a sharper "edge" type image, while a real corroded image gives a diffuse "area" type image.



a. b.

Figure 2. The appearance of the image for a correct and typical setup condition for corrosion, shown in the figure on the left, and the appearance of the image when the frequency is set too low, shown on the right. The dark side bands are a result of too deep a penetration of the eddy current excitation.



a. b.

Figure 3. An image of corrosion, left, in an aluminum panel removed from an older airplane, right. The image is bookmatched or mirrored from the actual photo of the corrosion because it was obtained from the opposite side of the panel.

TABLE I

| Airplane Outer Skin Thickness | Reference Standard Number *(1) | Instrument Test Frequency Range KHz |
|---|---|---|
| 0.032 - 0.034 | 127 - 0.032<br>127A - 0.032 | 1.6 - 12.8 KHz |
| 0.034 - 0.038 | 127 - 0.036<br>127A - 0.036 | 1.6 - 12.8 |
| 0.038 - 0.045 | 127 - 0.040<br>127A - 0.040 | 1.6 - 6.4 |
| 0.045 - 0.056 | 127 - 0.050<br>127A - 0.050 | 1.6 - 6.4 |
| 0.056 - 0.068 | 127 - 0.063<br>127 - 0.063 | 1.6 - 6.4 |
| 0.068 - 0.076 | 127 - 0.072<br>127A - 0.072 | 1.6 - 6.4 |
| 0.076 - 0.085 | 127 - 0.080<br>127A - 0.080 | 1.6 - 3.2 |
| 0.085 - 0.095 | 127 - 0.090<br>127A - 0.090 | 1.6 - 3.2 |
| 0.095 - 0.105 | 127 - 0.100<br>127A - 0.100 | 1.6 - 3.2 |
| 0.105 - 0.118 | 127 - 0.110<br>127A - 0.110 | 1.6 - 3.2 |
| 0.118 - 0.125 | 127 - 0.125<br>127A - 0.125 | 1.6 - 3.2 |

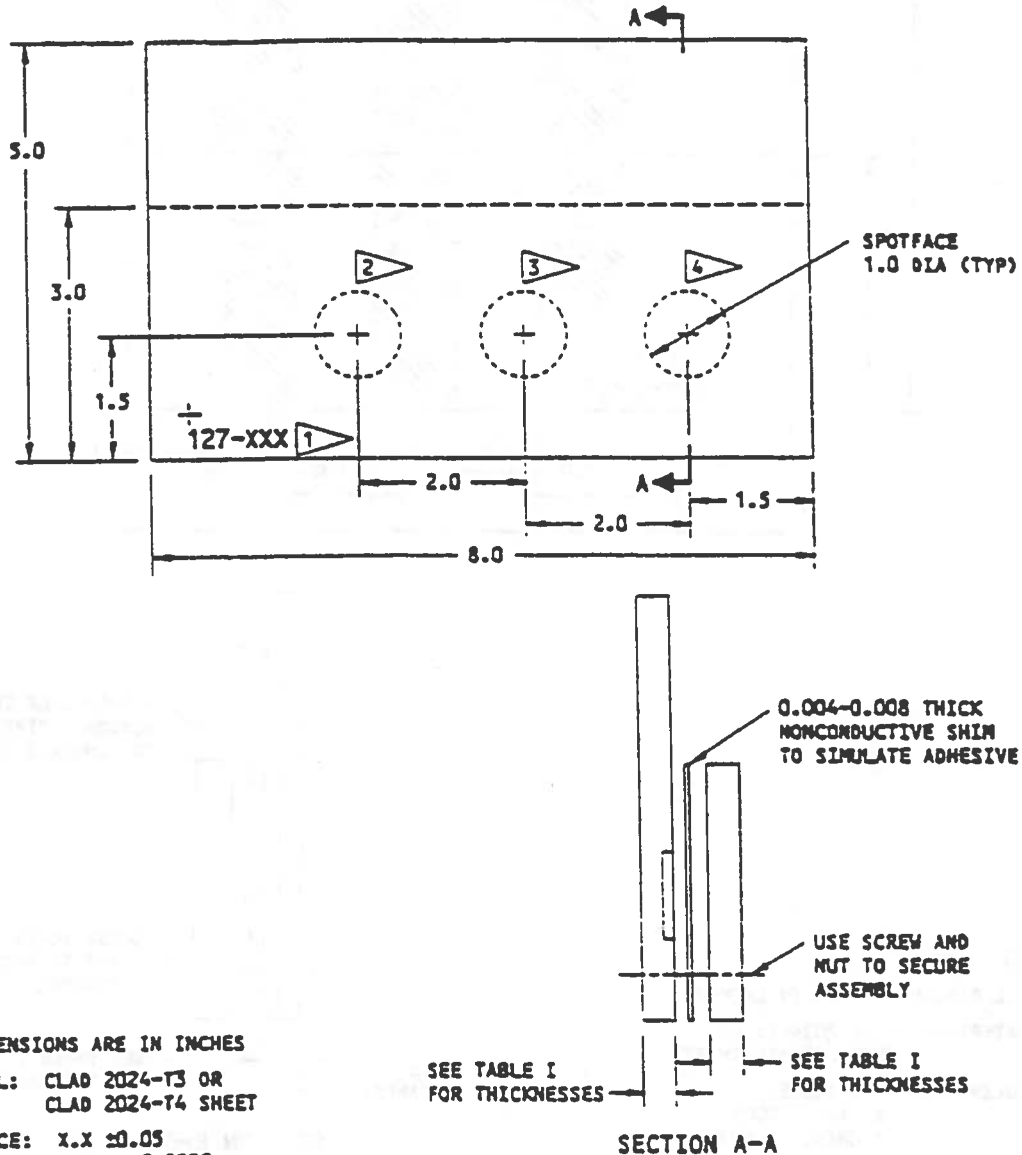
*(1) Dash number indicates the reference standard thickness in inches.

TABLE II

| Skin Thickness | 10% | 20% | 30+% |
|---|---|---|---|
| 0.032 - 0.034 | 51.2 KHz | 51.2 KHz | 102.4 KHz |
| 0.034 - 0.038 | 25.6 KHz | 51.2 KHz | 51.2 KHZ |
| 0.038 - 0.045 | 25.6 KHz | 25.6 KHz | 51.2 KHz |
| 0.045 - 0.056 | 12.8 KHz | 25.6 KHz | 25.6 KHz |
| 0.056 - 0.068 | 12.8 KHz | 12.8 KHz | 25.6 KHz |
| 0.068 - 0.076 | 6.4 KHz | 12.8 KHz | 12.8 KHz |
| 0.076 - 0.085 | 6.4 KHz | 6.4 KHz | 12.8 KHz |
| 0.085 - 0.095 | 6.4 KHz | 6.4 KHz | 6.4 KHz |
| 0.095 - 0.105 | 3.2 KHz | 6.4 KHz | 6.4 KHz |
| 0.105 - 0.125 | 3.2 KHz | 3.2 KHz | 6.4 KHz |

**How to use this table:**

1. Find the appropriate skin thickness range.
2. Determine the lowest frequency setting at which the corrosion image disappears.
3. Match the frequency setting to the appropriate material loss column.

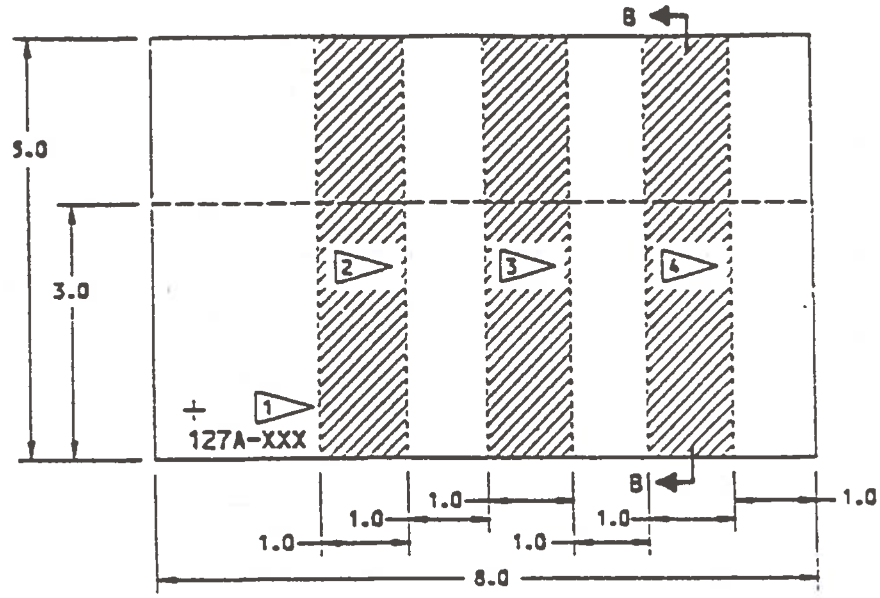


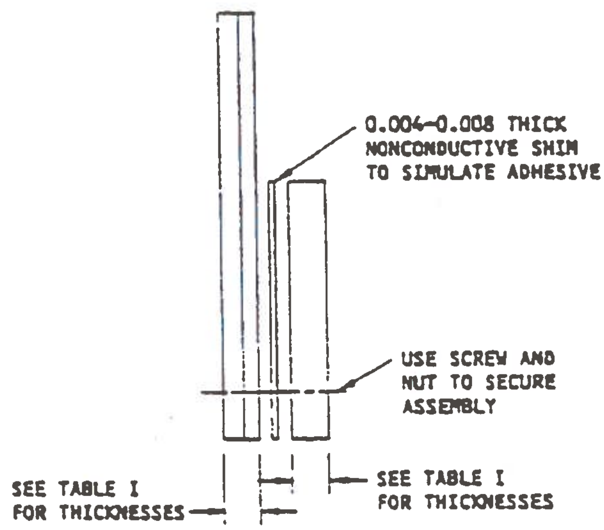

NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: CLAD 2024-T3 OR
  CLAD 2024-T4 SHEET
- TOLERANCE: X.X ±0.05
  X.XXX ±0.0005
  SPOTFACE DEPTH ±0.001
- SPOTFACE TO A SURFACE FINISH OF 64 RHR OR BETTER

1. ETCH OR STEEL STAMP WITH 127-XXX ON BOTH SKINS OF THE REFERENCE STANDARD. SEE TABLE I FOR REFERENCE STANDARD PART NUMBER IDENTIFICATION
2. THE DEPTH OF THE SPOTFACE IS 10 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD
3. THE DEPTH OF THE SPOTFACE IS 20 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD
4. THE DEPTH OF THE SPOTFACE IS 30 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD

CORROSION REFERENCE STANDARD 127-XXX
DETAIL I
Corrosion Loss in Aluminum Skins (Meter Display)
Figure 5 (Sheet 6)




NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: CLAD 2024-T3 OR
  CLAD 2024-T4 SHEET
- TOLERANCE: X.X ±0.05
  X.XXX ±0.0005
  MACHINING DEPTH ±0.001
- MILL OR GRIND TO A SURFACE FINISH OF 64 RHR OR BETTER

1 ETCH OR STEEL STAMP WITH 127-XXX ON BOTH SKINS OF THE REFERENCE STANDARD. SEE TABLE I FOR REFERENCE STANDARD PART NUMBER IDENTIFICATION

2 THE DEPTH OF THE MACHINING IS 10 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD

3 THE DEPTH OF THE MACHINING IS 20 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD

4 THE DEPTH OF THE MACHINING IS 30 PERCENT OF THE ACTUAL THICKNESS OF THE OUTER SKIN OF THE REFERENCE STANDARD

CORROSION REFERENCE STANDARD 127A-XXX
DETAIL II
Corrosion Loss in Aluminum Skins (Meter Display)
Figure 5 (Sheet 7)

# APPENDIX B

Letter, Boeing to VNTSC: Summary of Magneto Optic Imager Corrosion Detection Evaluation of February 6, 1992.

Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

BOEING

February 12, 1992
6-4701-68-087

Mr. S. Bobo
DOTS 75
DOT UNTSC
Kendall Square
Cambridge, MA 02142

Subject: Summary of Magneto Optic Imager Corrosion Detection Evaluation of February 6, 1992.

Dear Mr. Bobo:

On February 6, 1992, a blind test was performed to estimate the potential of the Magneto Optic Imager (MOI) to detect corrosion. The test was performed at the Physical Research Instruments Inc. (PRI), Kirkland office using a procedure written by PRI and using the MOI 301-1 supplied by PRI. The MOI model 301-1 has greater current induction and lower frequency capabilities for improved corrosion detection as compared to the MOI model 301 that is currently on the market.

Boeing supplied the test panels that were cut from corroded aircraft skins. The panels were painted and taped back to back so that visual clues to the presence of corrosion were minimized.

Two personnel from PRI independently inspected the test panels while being observed by FAA and Boeing personnel. The results are summarized in the following table where the number of corroded areas mapped out by the MOI inspectors are compared to those mapped out by eddy current.

| Percent Corrosion Loss | 10% | 20% | 30% |
|---|---|---|---|
| Areas Detected by EC | 14 | 11 | 8 |
| *Areas Detected By MOI | 6.5 | 10 | 7 |

*Average of two inspectors

The quantification of corrosion severity by the MOI is not refelected in the results. That is if an area of 20% corrosion was mapped by an MOI inspector and labeled as 10% or 30% corrosion full credit for the detection of 20% corrosion was given. It was observed that the quantification of corrosion with the MOI was very

BOEING 1916 1991 75 YEARS

BOEING

judgmental with one inspector over estimating the corrosion severity and the other under estimating the corrosion severity. It was further observed that while the MOI did well at detecting the areas with 20% or 30% corrosion loss the MOI detected only about half of the areas with 10% corrosion loss. Corrosion at the 10% to 20% level that covered a relatively large area (1/2 inch in diameter of greater) was not detected. False calls were not a problem with the MOI except when subsurface structure with fastener holes was present. Both inspectors confused the image created by the subsurface fastener holes for corrosion.

In summary the MOI did well at detecting sharply defined corrosion. Areas of broad shallow corrosion loss were not detected. Subsurface features were difficult to distinguish from corrosion and the quantification of the degree of corrosion was poor.

Sincerely,

**QUALITY ASSURANCE RESEARCH AND DEVELOPMENT**

M. C. Hutchinson

M. C. Hutchinson
Org. A-2621 M/S 9R-58
(206) 393-7407

cjc
cc: A. Broz
D. Galella
W. Lankelis
E. Schafer
C. Sear
W. Shih
R. Whealy

# APPENDIX C

## Letter, PRI to VNTSC: Response to comments on MOI Corrosion Detection Evaluation

PRI Instrumentation
An affiliate of Physical Research, Inc.
25500 Hawthorne Boulevard, Suite 2300
Torrance, California 90505-6828

Office: (213) 791-1774
Fax: (213) 375-4334

17 February 1992

U.S. Dept. of Transportation
Dr. Steve Bobo
Kendall Square
MC: DTS-75
Cambridge, MA 02142

Subject: Response to comments on MOI Corrosion Detection Evaluation

Dear Steve:

I am writing in response to the letter that Mike Hutchinson wrote to you concerning the blind tests of the MOI on corrosion samples held on 6 February 1992 at the PRI Instrumentation Kirkland offices. I have also spoken to Mike directly to obtain clarification of a few points. The following are my observations/comments of the letter.

First, the procedure written by PRI closely followed the Boeing procedure for LFEC inspection for corrosion and was only intended as a Draft Procedure. Based on the test evaluation the procedure would be modified as required.

The "Standard" for comparison was based on an eddy current (EC) probe evaluation of the corrosion sample and not on actual characterization of the sample. This may not be a fair or correct way of interpreting the MOI results. Furthermore, the EC probe was only applied to the region of the rivets, whereas the MOI was scanned over the entire test specimen. The MOI detected areas of corrosion in the regions that were not scanned by the EC probe and these were not included in the evaluation.

The principal criticisms of the MOI were the following:

1) Areas of broad, shallow corrosion loss were not detected.
2) Subsurface features were difficult to distinguish from corrosion.
3) Quantification of the degree of corrosion was poor.

It is generally true that the MOI is not sensitive to shallow taper in the material since the images are formed due to measurable disruptions of the eddy current flow induced in the material. We have not yet determined how small a disruption is detectable. Generally, any significant pitting type of corrosion will contain enough irregularities to produce an image, but a more systematic study is needed to quantify what is significant. Additional *well-characterized* samples should be tested with the MOI.

It is not clear that the features detected were representative of those in an actual airplane. Subsurface features within the aircraft structure should be recognizable with experience and we believe that this problem can be mitigated with adequate training. Subsurface structures should have sufficient regularities to be recognizable.

Since the depth of penetration of eddy currents at a given frequency is really an exponentially decaying function, it is difficult to estimate the depth of corrosion with great accuracy. The MOI does not measure phase information, only amplitude.

We believe that the MOI can greatly simplify the detection of corrosion and other subsurface defects that are within its depth of penetration range due to its ease of use and speed. Quantification of the severity of corrosion is only approximate, but once the area is defined by the MOI, other means can be used to determine severity of corrosion. Sensitivity to shallow corrosion must be further quantified with characterized samples.

I believe the overall impression was that the MOI performed reasonably well on the blind test and showed very good potential for being able to inspect large areas very rapidly for corrosion. Furthermore, the training required to be proficient with the MOI is much less than that required with other NDE instruments.

Please call if you have any other comments.

Sincerely,

W.C.L. Shih
President

CC:

A. Broz, FAA
D. Galella, FAA
M. Hutchinson, Boeing
W. Lankelis, Boeing
E. Schafer, Boeing
C. Seher, FAA



☆U.S. GOVERNMENT PRINTING OFFICE: 1992 - 704-078/60171