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DEVELOPMENT OF A CORROSION CONTROL TOUCH-UP KIT
FOR INDIVIDUAL AIRCRAFT

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WORK UNIT 52

A Corrosion Control Touch-up Kit was developed in order to provide fleet activities with equipment and materials to counteract corrosion on aircraft surfaces as soon as detected, thus providing a means whereby aircraft may remain in service until the next scheduled PAR. The kit described herein is considered satisfactory by the fleet and the Naval Air Systems Command.

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SUMMARY

INTRODUCTION

Carrier-based aircraft present serious problems of corrosion arising from the environments encountered during deployment. The severity and frequency of this corrosion has hitherto resulted in high maintenance costs and frequent unscheduled withdrawal of aircraft from service.

Inasmuch as corrosion is a progressive function, it has been reasoned that the adverse effects could be minimized by treating small areas of corrosion as soon as detected. This would be performed as a "First Aid" measure aboard the carrier with the plane "in situ" on the carrier deck.

A previous attempt to implement this concept had resulted in the assembly of all necessary materials and equipment into a transportable kit which consisted of five separate units containing the necessary chemical materials in one and five gallon containers together with such additional materials and equipment indicated for this type of operation. This proved to be heavy, cumbersome and inconvenient for use under the conditions afloat.

These shortcomings were recognized by the Naval Air Systems Command and were brought out at a paint conference held at the Naval Air Engineering Center on 30 September 1965, at which time, the Aeronautical Materials Laboratory (currently the Aero Materials Department) undertook the development of a hand-portable kit containing all necessary materials and equipment and suitable for "on-the-spot" treatment of small corroded areas.

SUMMARY OF RESULTS

Approximately one hundred (100) hand portable kits containing all the materials and equipment considered necessary for treating small areas of corrosion on carrier-based aircraft by squadron personnel were assembled by the AML and were consigned in lots of fifty units each to the COMNAVAIRPAC and to the BUWEPS FLTREADREPLANT for evaluation by deployed squadrons.

The comments and criticisms received from the various squadrons were carefully analyzed and were reflected in a second series of approximately one hundred kits which were consigned as before. It was generally conceded by the responding squadrons that these modified kits were suitable for the purpose intended. Two relatively minor suggestions for further improvement were noted and were included in a prototype unit which will be the basis for a specification governing future commercial production.

CONCLUSIONS

The reactions of fleet personnel to the use of the corrosion control kit herein described under actual service conditions have led to the following conclusions:

(a) The use of the kit by squadron personnel provides an effective means of combating corrosion in its early stages on carrier-based aircraft without interference with operating schedules.

(b) The portability of the kit and completeness of its contents permit necessary corrosion control to be performed on any aircraft without removing it from its parked position on the carrier deck.

(c) The contents of the kit are reduced to a minimum number of items of the simplest functions commensurate with effectiveness for their intended purpose, thus permitting adequate use by squadron personnel with a minimum of training.

(d) The timely use of the kit will result in appreciable monetary savings during periodic overhaul procedures and will reduce the frequency of unscheduled servicing due to corrosion.

RECOMMENDATIONS

Inasmuch as the effectiveness of the corrosion control kit has been established by use of the limited number of kits evaluated by certain carrier-based squadrons, it is recommended that the following steps be taken to implement its use when accepted as a fleet-wide routine function:

(a) All kit replacement items be carried in Navy stock in the sizes and types of containers contained in the kit.

(b) The effectiveness of the kit be maintained by applying all pertinent changes in aircraft maintenance and overhaul to the contents and instructions of the kit.

TABLE OF CONTENTS

	<u>PAGE</u>
<u>Summary</u>	
Introduction.....	iii
Summary of Results.....	iii
Conclusions.....	iii, iv
Recommendations.....	iv
<u>List of Figures</u>	vi
<u>Discussion</u>	1, 2
<u>References</u>	3
<u>Acknowledgement</u>	4
<u>Tables</u>	
1 - List of Items.....	5
2 - Directions.....	6
3 - Kit Items.....	7, 8, 9
4 - Directions of Use of Corrosion Kit.....	10, 11, 12

LIST OF FIGURES

Figure

1	Early Version of Corrosion Control Kit - One of 200 Units Submitted to Fleet for Evaluation - Exterior View.....	13
2	Early Version of Corrosion Control Kit - One of 200 Units Submitted to Fleet for Evaluation - Interior View.....	14
3	High Impact Resistant Container Used for Prototype Kit.....	15
4	Interior View of Prototype Kit Showing Fabric Cover in Place..	16
5	Interior View of Prototype Kit - Fabric Cover Removed.....	17

DISCUSSION

The desirability of treating corroded areas of exterior aircraft surfaces in their earliest detectable stages has long been recognized as an effective means of reducing maintenance costs and preventing withdrawal of aircraft from service due to serious corrosion problems.

Early attempts to treat small areas of corrosion on carrier-based aircraft while deployed resulted in the assembly of all necessary materials and equipment in kit form. These, however, proved neither practical nor desirable due to their weight and cumbersomeness. The possibilities of a self-contained hand-portable kit which could be used to treat aircraft in their parked positions on carrier decks was discussed at a paint conference held at the NAEC on 30 September 1965, at which time, the AML (currently AMD) undertook the development of a kit which would eliminate the objectionable features of the earlier exhibits.

A trial kit which embodied all features considered appropriate for its intended purpose was assembled by the AML and was described in the reference (a) memorandum prior to its presentation at a Corrosion Control Conference held at the Naval Air Station, North Island during the week of 29 November 1965. The complete kit which included seventeen items, was contained in a metal box measuring 18" x 12" x 12" and weighed fifteen pounds. It was generally conceded by the conferees that evaluation of this kit by squadron personnel under actual conditions of use was indicated.

Reference (b) dated 13 January 1966 established WEPTASK FAE 32005/200-1/FO120505, PAN 17 (currently AIRTASK No. FO120505, Work Unit #52) which authorized the evaluation of corrosion control touch-up kits, the work to be conducted in three separate phases as follows:

Phase I - to be completed by 1 March 1966, to assemble 201 touch-up kits for consignment to COMNAVAIRPAC (100 units); BUWEPFLTREADREPLANT (100 units), and NAVAIRTECHTRACEN, Memphis (1 unit for training purposes).

Phase II - to be completed by 1 September 1966, the completion of field evaluation.

Phase III - to be completed by 1 November 1966, the availability of a specification.

Inasmuch as many of the component items necessitated outside procurement and since the metal boxes used as containers required considerable modification to adapt them to this purpose, it was decided to furnish the kits on two separate occasions. Consequently, one hundred and one kits as shown in Figures 1 and 2 were assembled at the AMD in February-March 1966 and forwarded to COMNAVAIRPAC (50 units); BUWEPFLTREADREPLANT (50 units) and to NAVAIRTECHTRACEN, Memphis (one unit for training purposes). A list of component items and instructions were included in each kit, Tables 1 and 2.

In June 1966, a three-man corrosion control team organized by NASCREPLANT visited the Mediterranean area to witness the actual "on-the-spot" use of the touch-up kits. The effectiveness, conditions of use, opinions of squadron personnel and other pertinent matters listed in the reference (c) memorandum were carefully noted for future consideration as a basis for improvement.

NADC-MA-6731

The additional kits required to complete Phase I of reference (b) were assembled and forwarded to COMNAVAIRPAC (50 units) and to BUWEPFLTREADREPLANT (50 units) in December 1966.

During the early part of 1967, reports of the evaluation of the kits forwarded in accordance with Phase I were received from the various fleet activities. The comments, criticisms, and suggestions contained were examined for recurrence, practicality, pertinence and correlation with the observations made during the Mediterranean trip. The data compiled therefrom completed Phase II of the assignment.

In March-April 1967, a second trip was made to the Mediterranean area by the three-man corrosion control team in order to inspect shore-based corrosion control facilities; review corrosion control materials and instructions; consider the mid-deployment inspection concept, and to investigate other corrosion control items of general interest to gain experience and recommend action. In general, it was found that the kit was being used to advantage and was being favorably received by the squadron personnel. Details of this trip, including comments, ideas, and observations are set forth in the reference (d) memorandum.

At an aircraft corrosion control standardization conference held on 15-16 May 1967 at the NASC, Washington, D. C., the final version of the items to be contained in the kit was decided. It was also agreed that the container should be plastic in lieu of metal and that all corners should be rounded. It was established that AML (AMD) would prepare a prototype kit having the agreed configuration and would provide technical specification requirements and that WESO would be authorized to prepare a specification and maintain liaison with the ASO.

Subsequent to the above conference, the reference (e) letter was received which modified the action covered by the foregoing. This modification required that small non-metallic circular brushes for cleaning drain holes be included and also a maskant material for use in conjunction with the paint strippers which would perform satisfactorily under the environmental conditions of its use.

In August 1967, tests were conducted to find satisfactory replacements for the flammable solvents, butanol and aliphatic naphtha, used prior to the surface treatment. A substitute procedure, which made use of a Scotchbrite pad saturated with specification MIL-C-22543 water emulsion cleaner (diluted 1:9 with water) to remove superficial corrosion followed by a water rinse prior to surface treatment, was found to be effective.

A prototype of the final experimental kit which incorporated the recommendations of the May 1967 meeting and the foregoing modifications was assembled as illustrated in Figures 3, 4 and 5 and contained a list of items (Table 3) and instructions for use (Table 4). Details of this prototype provide the technical data upon which the specification will be prepared by WESO.

NADC-MA-6731

REFERENCES

- (a) NAEC AML memorandum M-411-AJK:1bg (6090) dated 23 Nov 1965, "Corrosion Control Touch-Up Kit for Individual Aircraft; Materials and Processes for"
- (b) NWSA FAE 3221/6:JPL dated 13 Jan 1966
- (c) NAEC AML memorandum M-411-AJK:1bg (7599) dated 14 Jul 1966, "Aircraft Anti-Corrosion Visit to the Mediterranean; report of"
- (d) NAEC AML memorandum M-411-AJK:1bg (9556) dated 11 May 1967, "Corrosion Review Team Visit to the Mediterranean; report of"
- (e) NASC ltr AIR 52031C SG/117 to AMD dated 29 Aug 1967

NADC-MA-6731

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To Mrs. Mary Wilson for her technical contributions on all matters involving paint systems; and

To the various personnel of other branches within AMD for their technical contributions.

NADC-MA-6731

TABLE 1

LIST OF ITEMS

- 1 - Marking Pencil
- 2 - Masking Compound
- 3 - Goggles
- 4 - Swatches
- 5 - Gloves, Protective, Throwaway
- 6 - Paint Remover, For Enamels, Acrylic Nitrocellulose and Cellulose Nitrate
Paint Systems (MIL-R-8633A)
- 7 - Paint Remover, for Specification Epoxy Paint Systems (MIL-R-81294)
- 7A - Paint Remover for Difficult-To-Remove Epoxies (Pennsalt 732)
- 8 - Brush, for Applying Paint Remover (Located on Naphtha Can)
- 9 - Scraper
- 10 - Waterless Cleaner, MIL-C-22550
- 11 - Water Emulsion Cleaner, MIL-C-22543
- 12 - Naphtha
- 13 - Abrasive Paper, "Tri-M-Ite 400"
- 14 - Abrasive Pad, MIL-A-9962
- 15 - Brush for Applying Surface Treatment Compound
- 16 - Surface Treatment Compound, MIL-C-5541
- 17 - Primer, AML P-180
- 18 - Topcoat, White, Spray Can AML P95K
- 19 - Topcoat, Gray, Spray Can AML P95K
- 20 - Waterless Hand Cleaner, P-H-31A

NADC-MA-6731

TABLE 2

DIRECTIONS

STEP

- 1 - Inspect entire aircraft paint surface for blisters, scratches, cracks, flaking, etc. and encircle area with marking pencil (Item 1).
- 2 - Apply continuous ribbon of masking compound (Item 2) around encircled area to form a dam, which should be high enough to contain paint stripper within area.
- 3 - Put on goggles (Item 3) and gloves (Item 5).
- 4 - Apply paint stripper (items 6 or 7 depending on paint to be removed) with brush (Item 8) by dabbing. The encircled area must be entirely covered with a liberal coating. Care must be taken to prevent paint remover from coming in contact with paint outside this area.
- 5 - After about 1 hour, remove the loosened paint, stripper, and masking compound with scraper (Item 9) by scraping toward the center of the encircled area. If paint is not completely removed, repeat Steps 2, 4 and 5.
- 6 - Clean the area using water emulsion cleaner (Item 11) and swatches (Item 4) followed by water rinse and allow to dry. If no water is available, waterless cleaner (Item 10) may be used for this entire step.
- 7 - Remove all traces of residue and corrosion with abrasive pad (Item 14) moistened with naphtha (Item 12).
- 8 - Smooth off entire area and surrounding paint edges with abrasive paper (Item 13).
- 9 - Wipe off area with swatch (Item 4) saturated with naphtha (Item 12) and allow to dry.
- 10 - Brush chemical treatment compound, MIL-C-5541, (Item 16) on bare metal using brush (Item 15). Continue brushing for one minute. Wait 5 minutes, then rinse off with water and allow to dry. If no water is available, allow compound to dry and quickly wipe off any residue with naphtha (Item 12).
- 11 - Apply thin, even coat of primer (Item 17) to chemically treated metal area using brush contained in can. Allow to dry for at least 2 hours.
- 12 - Apply proper color top coat (Item 18 or Item 19) to entire area, feathering out beyond sanded paint margin. Allow to dry for 30 minutes and apply additional coats as necessary, allowing 30 minutes between coats.

NADC-MA-6731

TABLE 3

KIT ITEMS

<u>Item No.</u>	<u>Total No. to be Included in Kit</u>	<u>Name and Size (Where applicable)</u>	<u>Specification</u>	<u>Stock No.</u>	<u>Possible Supplier</u>
1	1	Safety goggles	GG-G-531a	GSA 4240-276-7343	Fisher Scientific Company Chicago, Illinois
2	1 roll	Gloves, polyethylene, disposable, hardguard, wrist length (medium size)	---	---	
3	1	Marking pencil		7520-223-6672	
4	2	AK-10 Maskant Material			Cee Bee Chemical Company 9520 E. Ceebee Drive Downey, California
5	1	Masking tape 2"	MIL-T-21595	9G-7510-266-6710	
6	1	Pipe hanger		DISC 796369Z5340-184-1713	
7	1	Bottle, polyethylene with delivery tube (1 liter capacity)			Fisher Scientific Company Chicago, Illinois
8	3	Acid brush		9G-7920-514-2417	
9	1	Paint remover (1 pint-flat can)	MIL-R-81294		
10	1	Micarta scraper 2½" x 6" x 1/16"			Westinghouse Electric Company New York City, New York (fabricated to size)

NADC-MA-6731

TABLE 3

<u>Item No.</u>	<u>Total No. to be Included in Kit</u>	<u>Name and Size (Where applicable)</u>	<u>Specification</u>	<u>Stock No.</u>	<u>Possible Supplier</u>
11	1 box	Kemwipes, disposable wipers, type 900S		FSN 7920-721-8884	
12	1 box	Bag, polyethylene non-perforated 6" x 6"		8105-837-7754	
13	1	Tooth brush		8530-290-2920	
14	1	Water emulsion cleaner flat can (1 pint-flat can)	MIL-C-22543		B&B Chemical Company Miami, Florida
15	3 pads	Abrasive pad (very fine)	MIL-A-9962	9G-7920-753-5242	
16	8 sheets	Abrasive cloth, aluminum oxide wet or dry, No. 320	P-C-451 Type 1, Class 2	9Z-5350-246-0330	
17	1 box	Pipe cleaner (36 in a box)			Dill's Pipe Cleaners U. S. Tobacco Company New York, New York
18	2	Brush, nylon, touchup 1" width		90-8020-263-3866	
19	1	Surface treatment and compound, premixed Alodine 1200 in polyethylene container (1 pint)			Amchem Products, Inc. Ambler, Pa.
20	1	Dow No. 19 in polyethylene container (1 pint)			Dow Chemical Company Midland, Michigan

NADC-MA-6731

TABLE 3

<u>Item No.</u>	<u>Total No. to be Included in Kit</u>	<u>Name and Size (Where applicable)</u>	<u>Specification</u>	<u>Stock No.</u>	<u>Possible Supplier</u>
21	2 pints	Primer, epoxy polyamide 1 pint - component I and 1 pint - component II	MIL-P-23377B		
22	10	Paper cups with lid (6 ounces)		7350-903-8141	
23	1	MIL-L-81352 lacquer, acrylic insignia white in 16 oz. aerosol containers			Sprayon Products, Inc. Cleveland, Ohio
24	1	MIL-L-81352 lacquer, acrylic light gull gray in 16 oz. aerosol containers			Sprayon Products, Inc. Cleveland, Ohio
25	1	Flashlight, gooseneck type	MIL-F-6502B		
26	1	Mirror, inspection 1-11/16" x 2-9/16" x 16 1/2"		5120-618-6902	
27	1	Preservative compound in 16 oz. aerosol container	MIL-C-16173, Grade IV		Sprayon Products, Inc. Cleveland, Ohio
28	1	Compound, corrosion preventive, water displacing, ultra thin film (16 oz. aerosol container)		RM8030-938-1947- G600	
29	2	Sealant in two compartment plastic cartridge kit		8030-753-5006	
30	1	Spatula (hard rubber or micarta) 1" x 6" x 3/16"			Fisher Scientific Company Chicago, Illinois

TABLE 4

DIRECTIONS FOR USE OF CORROSION KIT

CONTENTS

- I - Marking areas of corrosion
 - II - Removal of paint
 - III - Corrosion removal
 - IV - Cleaning
 - V - Application of chemical film
 - VI - Application of sealant
 - VII - Painting
 - VIII - Preservative compounds
-

I. Marking areas of corrosion - If areas exhibiting corrosion and/or paint failure are found during daily inspection, they should be encircled with the marking pencil (Item 3). The gooseneck flashlight (Item 25) and the Inspection Mirror (Item 26) are intended to facilitate inspection.

II. Removal of paint - (Method (a) or Method (b) may be used as considered advantageous).

(a) Abrasion - The paint within the encircled area may be removed by rubbing with either the Abrasive Pad (Item 15) or the Abrasive Cloth (Item 16). Surrounding paint edges are "feathered in" about 1" back from touch-up area.

(b) Paint Stripper - CAUTION: When paint stripper (Item 9) is used, avoid seepage into faying surfaces, fastener holes and plastic parts by proper masking. Avoid contact with skin. Read instructions on label. Wear safety goggles (Item 1) and gloves (Item 2). Point can away from body while opening and put cloth over cap to catch spray.

(1) Masking prior to application of paint stripper - (Method (a) or Method (b) may be chosen at the discretion of user).

(a) Masking Tape (Item 5) - Protect faying edges, fastener holes, plastic parts with masking tape, torn off to the appropriate size. Mask around area to be stripped and on lower edge construct a "lip" extending about $\frac{1}{2}$ " from surface to catch paint stripper drippage.

(b) Maskant Material (Item 4) - Squeeze sufficient maskant material (Item 4) on areas to be protected and around encircled area to form a dam which should be high enough to contain paint stripper within the area.

TABLE 4

(2) Application of paint stripper - Apply paint stripper (Item 9) by dabbing (not brushing) with the brush (Item 8). The encircled area must be entirely covered with paint stripper.

(3) Removal of paint stripper (within 30 minutes) - After paint has lifted (if epoxy) or softened (if acrylic), remove the loosened paint, stripper and maskant compound with scraper (Item 10) by working the maskant into the paint stripper, and scraping toward the center of the encircled area. Place these residues in a disposable bag (Item 12). All residues must be completely removed by using Item 11 wiping cloth. Rinse with water using bottle (Item 7).

(4) If all paint has not been removed, allow to dry, and repeat steps b(1), b(2), and b(3).

III. Corrosion removal - Remove superficial corrosion by light rubbing with an abrasive pad moistened with water emulsion cleaner (Item 14). If more severe corrosion is noted, rinse the area with water and temporarily treat with preservative compound (Item 27) as described below for subsequent work below decks as described in Section 4 of the 509 Manual. If not done previously, edges of adjacent paint film should now be "feathered in" using abrasive cloth (Item 16).

IV. Cleaning - Flood the entire area to be treated with the water emulsion cleaner (Item 14) diluted 1 part cleaner to 9 parts water before use. Allow it to remain on the surface for at least 5 minutes, then flush with water using the bottle (Item 7). If droplets of water form on the surface, retreat with the diluted water emulsion cleaner (Item 14) until a "water break-free surface" is obtained.

V. Application of chemical film - CAUTION: Wear safety goggles (Item 1) and gloves (Item 2).

Mask the area to be treated with masking tape (Item 5), in order to prevent staining of adjacent paint area. On lower edge, construct lip with tape in order to prevent dripping. The surface being treated must be kept clean and not touched with fingers, etc. Do not use maskant material (Item 4) since the greasy film will interfere with subsequent paint adhesion.

Aluminum surfaces - Apply Alodine 1200 (Item 19) using nylon brush (Item 18).

Magnesium surfaces - Shake Dow No. 19 (Item 20) thoroughly and apply with nylon brush (Item 18).

Allow surface treatment (Items 19 and 20) to remain on surface until a uniform light brown color is obtained.. If surface treatment does not uniformly wet the surface, rinse off and repeat cleaning, Step IV. Rinse chemical film with water using the bottle (Item 7) and allow to dry for one hour before proceeding to the next step. Do not touch or wipe with a cloth.

TABLE 4

VI. Application of sealant - Apply sealant (Item 29) on non-removable fastener heads. Mix the components thoroughly before use. Apply two parallel strips of masking tape (Item 5), one on each side of the fastener heads and $\frac{1}{2}$ " away from the heads. The purpose of the tape is to control sealant thickness. Extrude the sealant into the center of the taped area. Smooth with scraper (Item 10). Remove tape. Painting can be accomplished immediately, if desired.

VII. Painting

Application of primer - Mix one volume Component I (stir first) with one volume Component II (i.e. 1 oz. to 1 oz.) epoxy polyamide primer (Item 21). Use paper cups (Item 22) as paint containers. Stir well with spatula (Item 30), cover with lid and allow to stand one hour before use. Stir well before use and brush on with brush (Item 18). Discard unused mixed primer.

Allow primer to dry 2 to 3 hours before application of topcoat. One hour may be sufficient if temperature and humidity conditions are ideal.

Application of topcoat - Shake aerosol containers of topcoat in appropriate color (Items 23 or 24) well before use. Use 12" to 18" away from surface. Apply thin dry film (to prevent running) and allow to air dry 30 minutes between subsequent coats. Use only enough topcoat to get hiding.

VIII. Preservative compounds - Corrosion preventive compound, MIL-C-81309 (Item 28), is a temporary preservative that also displaces water from recesses. It can be used on any surface for short term protection and reapplied when necessary. In areas subject to abrasion, rain or salt water where a more durable protective film is desired, the MIL-C-16173, Grade IV (Item 27), should be sprayed over the MIL-C-81309 (Item 28). The MIL-C-16173, Grade IV preservative (Item 27) may be used alone on any surface known not to contain entrapped water. NOTE: Use the pipe cleaners (Item 17) to clean out drain holes.

NADC-MA-6731

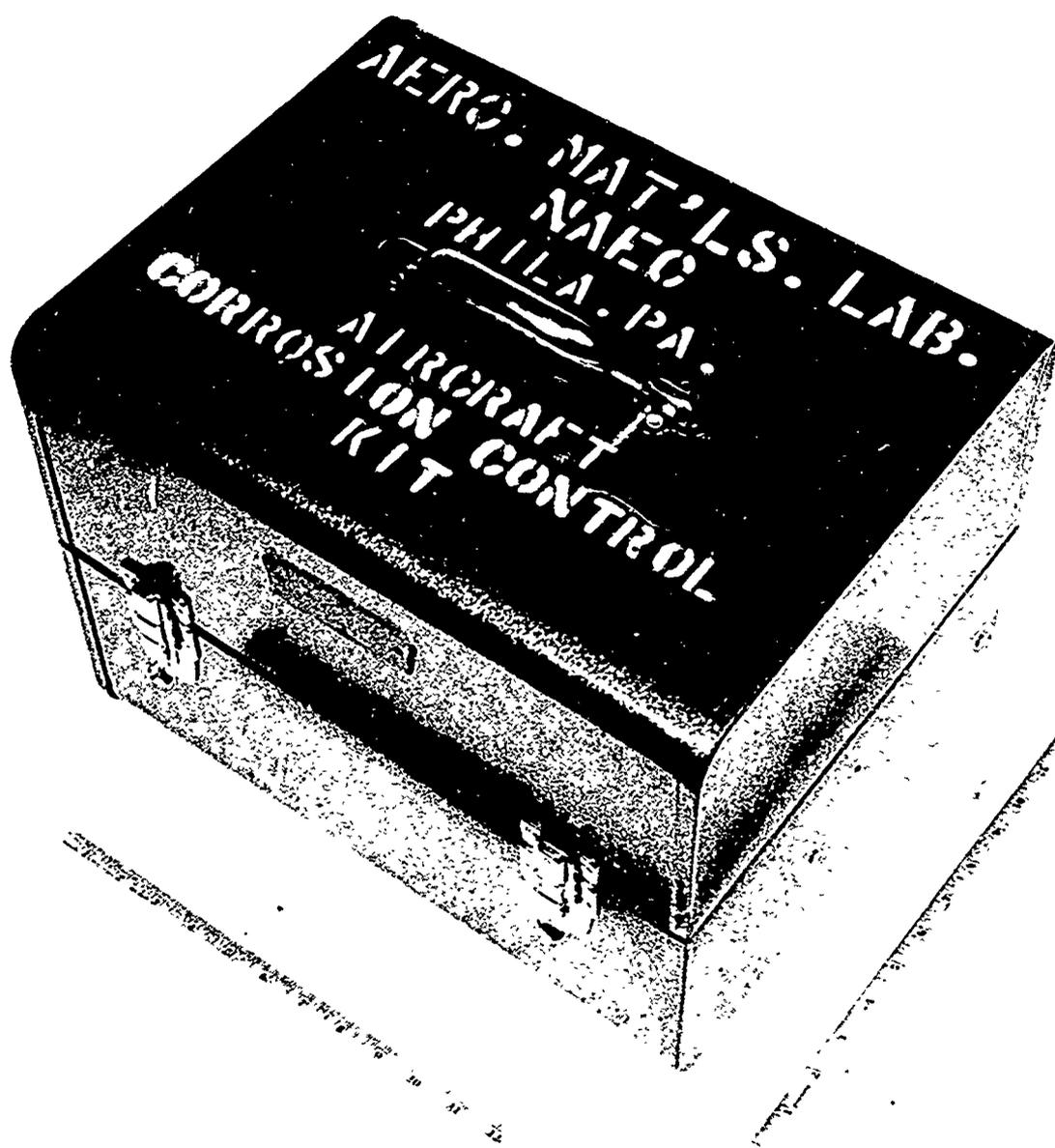


FIGURE 1 - EARLY VERSION OF CORROSION CONTROL KIT - ONE OF 200 UNITS SUBMITTED TO FLEET FOR EVALUATION - EXTERIOR VIEW

NADC-MA-6731

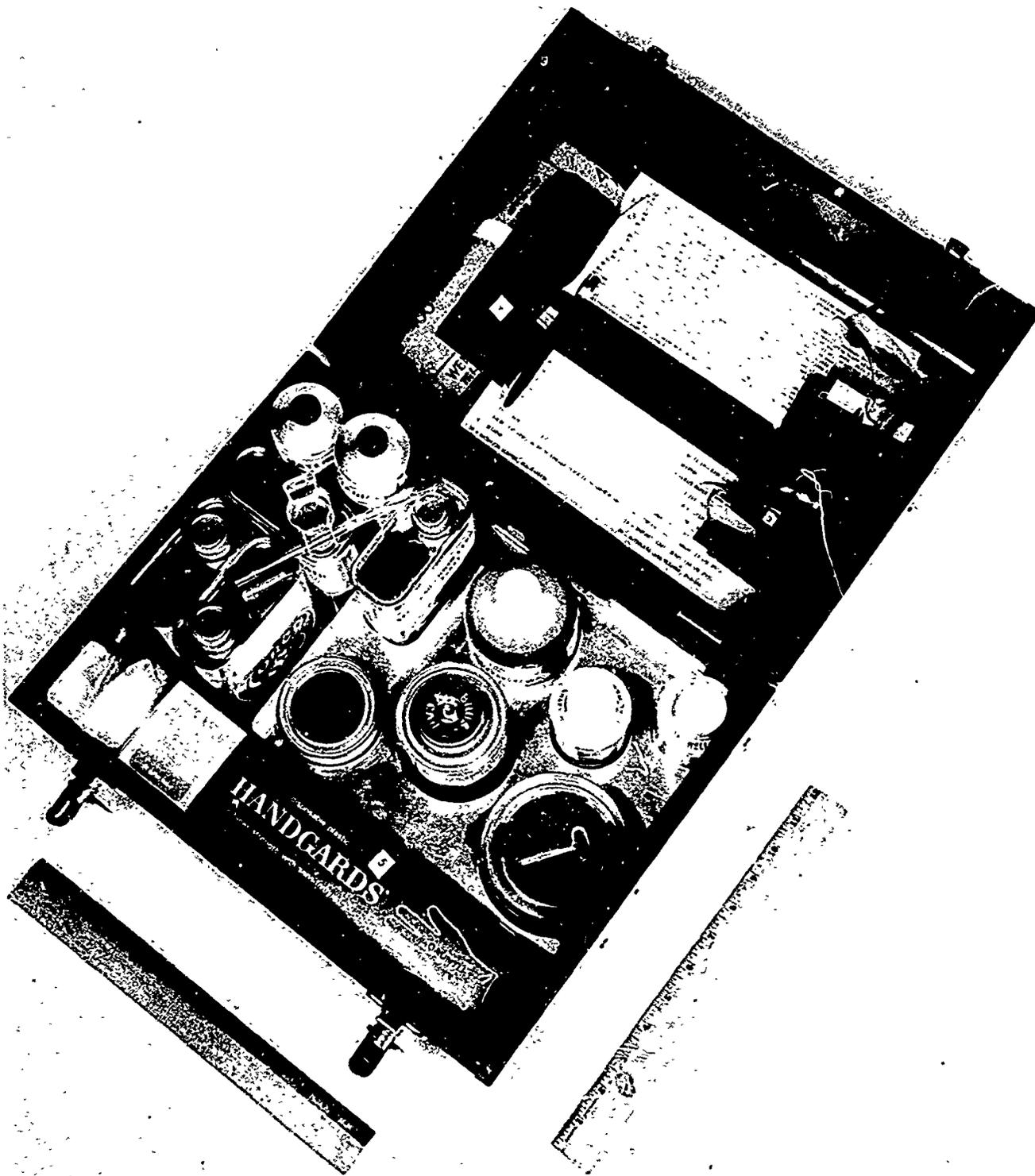


FIGURE 2 - EARLY VERSION OF CORROSION CONTROL KIT - ONE OF 200 UNITS SUBMITTED TO FLEET FOR EVALUATION - INTERIOR VIEW

NADC-MA-6731

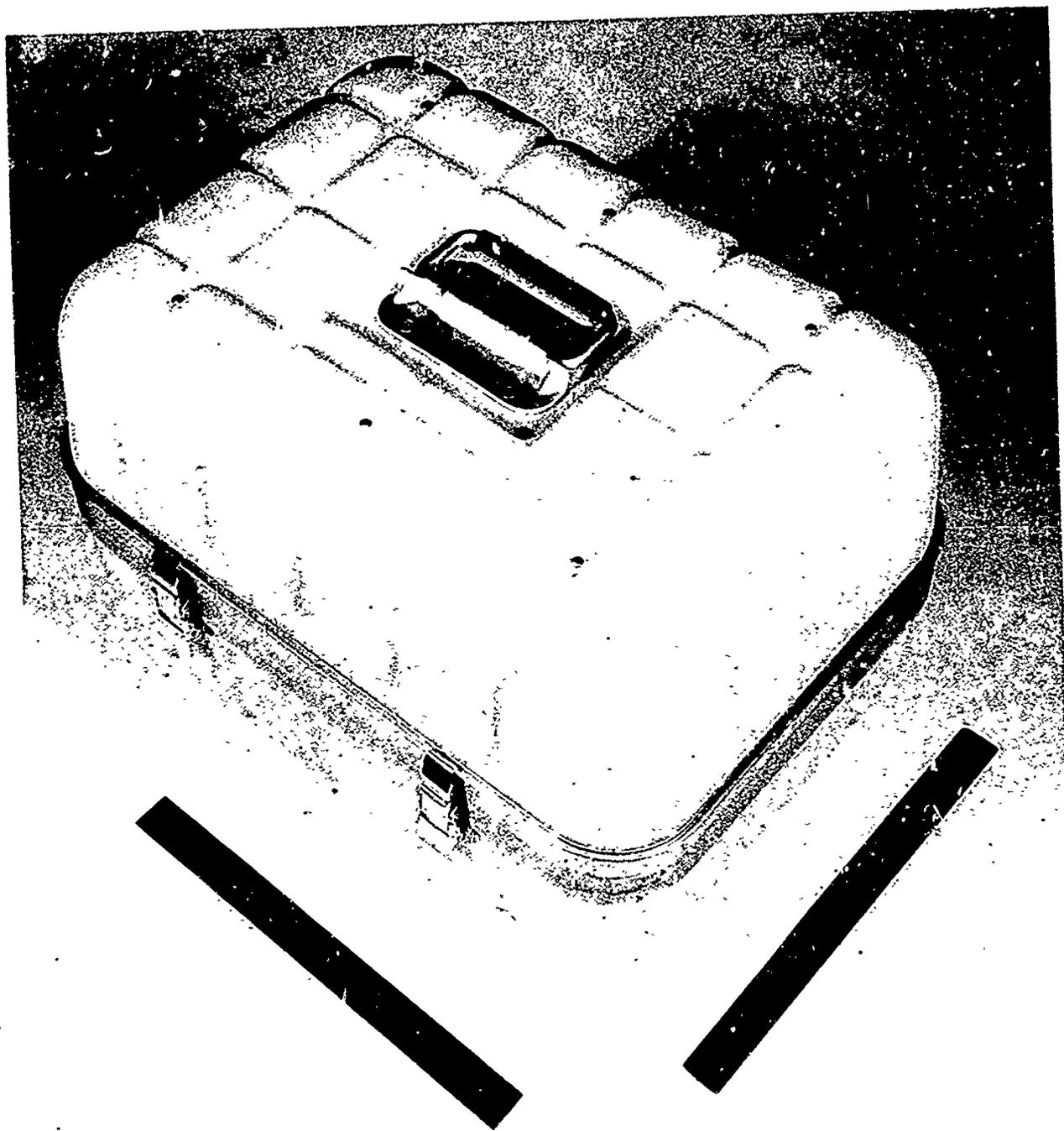


FIGURE 3 - HIGH IMPACT RESISTANT CONTAINER USED FOR PROTOTYPE KIT

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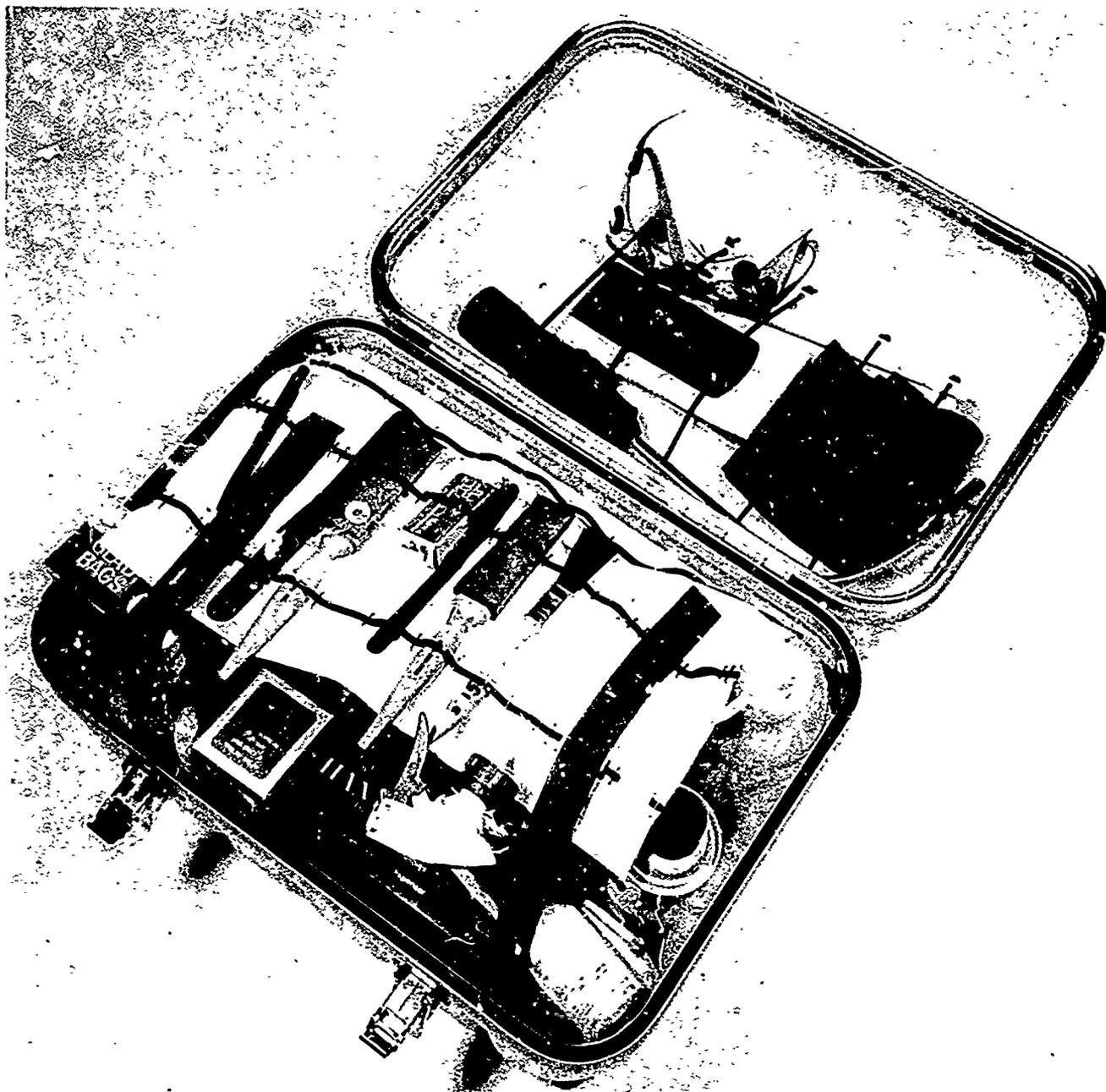


FIGURE 4 - INTERIOR VIEW OF PROTOTYPE KIT SHOWING FABRIC COVER IN PLACE

NADC-MA-6731

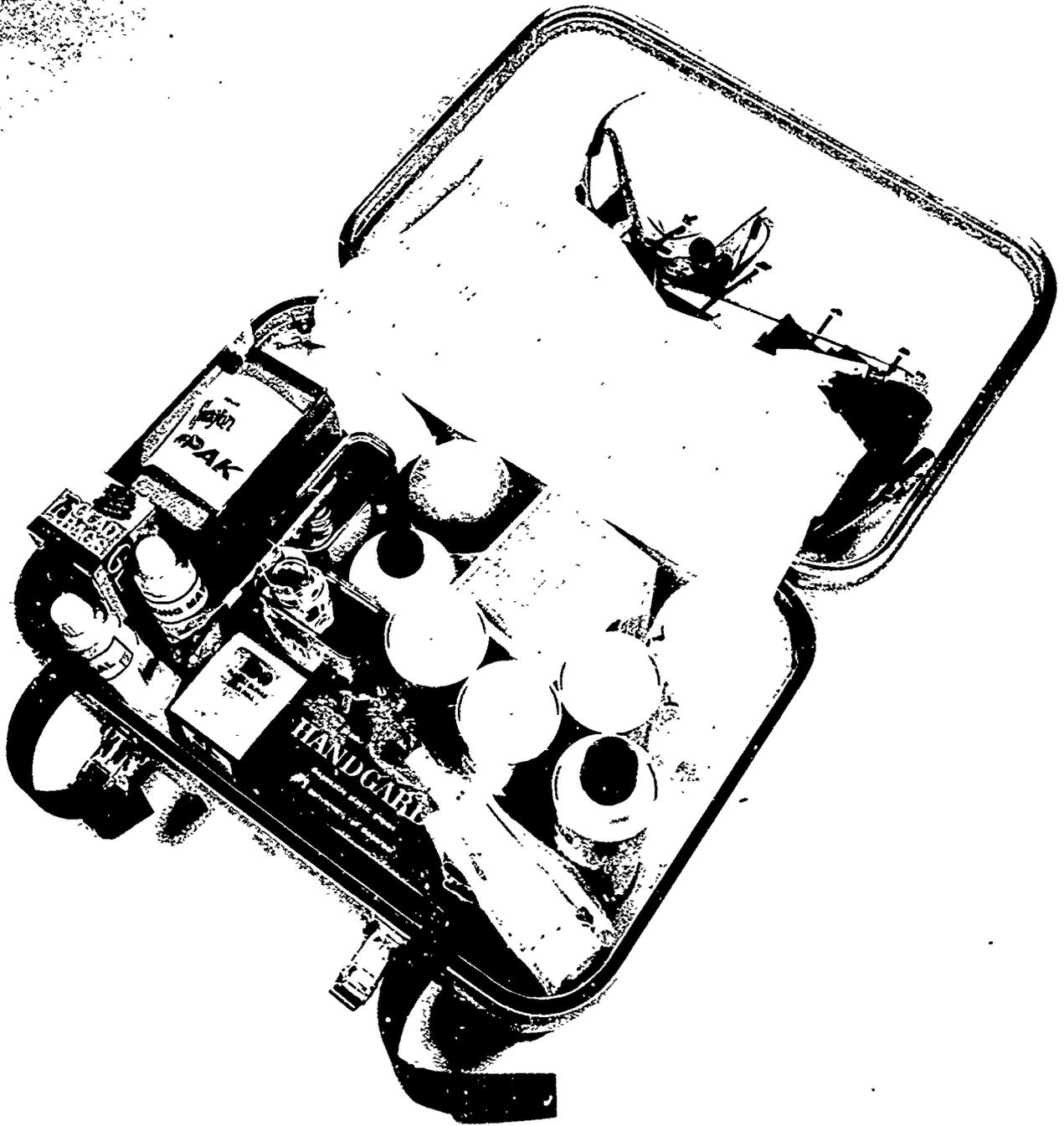


FIGURE 5 - INTERIOR VIEW OF PROTOTYPE KIT - FABRIC COVER REMOVED

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13. ABSTRACT A Corrosion Control Touch-Up Kit was developed in order to provide fleet activities with equipment and materials to counteract corrosion on aircraft surfaces as soon as detected, thus providing a means whereby aircraft may remain in service until the next scheduled PAR. The kit described herein is considered satisfactory by the fleet and the Naval Air Systems Command.			

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