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KC-10A CARGO SYSTEM MOCK-UP TEST, (U)
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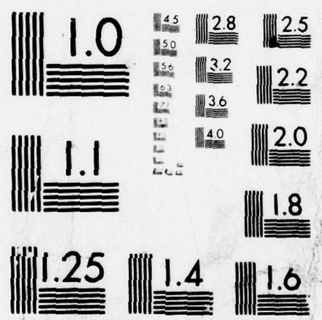

MICROCOPY RESOLUTION TEST CHART
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(6) KC-10A CARGO SYSTEM MOCK-UP TEST,

(11) 22 Aug 79

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116 400

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FOREWORD

This report of a test performed on the KC-10A cargo system mock-up is submitted in accordance with Data Item number DI-T-3718/M (Sequence No. A02D) under USAF contract number F33700-78-C-0001 for the KC-10 program. The test was conducted on June 18, 19 and 20, 1979, at Long Beach, Calif., by the Douglas Aircraft Co., McDonnell Douglas Corp., 3855 Lakewood Blvd., Long Beach, Calif. 90846.

Three USAF personnel witnessed the first 2 days of testing and two of them remained for the final 1/2 day. On June 18 and 19, the following were present:

Capt. Robt. I. Marx, ASD/YTT Flt Test MGr., KC-10
SMSgt. Willie J. Lorenz, AFALD/YT/MACSO Loadmaster
SMSgt. Steve K. Johnson, AFTEC/TEZ Loadmaster

One June 20, Capt. Marx and Sgt. Lorenz were present.

ABSTRACT

A test was conducted on the KC-10A Cargo Handling System Mock-Up to evaluate the performance of the current design of the powered roller system.

The test consisted of running a total of 246 load/unload cycles with various weights loaded on the pallets. Of these load/unload cycles, 135 were single HCU-6/E pallets and the remaining 111 were coupled HCU-6/E pallets (2 in train). These cycles simulate over 2 years of KC-10A palletized cargo operations.

The powered roller system functioned very well for the entire spectrum of loads. Single and coupled pallets were loaded laterally or rotated in the doorway easily. This test demonstrated that the system meets or exceeds its design requirements.

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LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

The main cabin cargo handling system consists (in-part) of a powered roller system, which provides lateral on-loading/offloading of cargo and capability for rotating over-length cargo through the cargo doorway.

Paragraph 1051BH of the Statement of Work (SOW), dated 30 September 1977, states that: "Tests shall be initiated on the cargo loading system mock-up to evaluate control system operation and system capability to rotate overlength loads and to move coupled pallets".

A cargo loading system mock-up was built as a development tool to demonstrate the ability of the powered rollers to move and rotate single and coupled pallets; the electrical circuitry of the system; and to develop operation techniques for training and cargo loading manual inputs.

Through the development phase, the cargo loading system mock-up was modified and changed to insure that the best combination of designs were evaluated.

1.1 TEST OBJECTIVE

The primary objective of this test was to evaluate the performance of the current design of the powered roller system. The test plan was derived using the Mission Profiles of Appendix II of the SOW to simulate real life conditions. The secondary objective of this test was to evaluate the effect of reorientation of two powered rollers as outlined in Review Item (RI) C101 submitted by USAF during the Furnishings and Equipment Critical Design Review (CDR) on 14 March 1979.

1.2 DESCRIPTION OF CARGO HANDLING SYSTEM MOCK-UP

The KC-10 Cargo System Mock-up used in this test/demonstration is shown in Figure 1 and by two overview photographs, Figures 2 and 3.

The mock-up consists of simulated loader and the KC-10A cargo handling system from fuselage stations 625 to 960 (approximately). Details of the mock-up include:

1) Loader Simulation
   To simulate the bed of a USAF 40K loader, cylindrical rollers were used adjacent to the aircraft door and the guide rails were spaced at 108.5 inches. The guide rails were flared open at the end as on the 40K loader.
2) Airplane Simulation
   a) The cargo door sill conveyor assembly was simulated by a row of cylindrical rollers and an aft door jamb protector bracket (production part). These items were installed at the doorway area.
   b) Production omni-directional rollers were mounted on plywood simulating the KC-10A omni-directional conveyor assemblies.
   c) Eight powered rollers were installed in cutouts in the plywood. Locations are identical to the KC-10A system. The roller assemblies had prior usage during the development phase of the mock-up, but each roller shell had new tread on it for this test/demonstration. In Figure 4, the new tread can be seen as well as the aluminum alloy rings on the ends of the roller. The end rings are a production change which has been made to protect the tread from gouging by the latch detends on the edges of the HCU-6/E cargo pallets.
   d) The left-hand guide rail was positioned at X = +108.69, simulating the 27 pallet arrangement.
   e) The right-hand guide rail was positioned at X = -88.69. The guide rail has notches cut in it to simulate the individual segments of rails located in the omni-directional area of the KC-10A cargo handling system (Refer to Figure 3).
   f) A production type pendant control was used for this test/demonstration. The pendant is located at the forward edge of the simulated cargo door area.

1.3 DESCRIPTION OF TEST ARTICLES

Two HCU-6/E cargo pallets manufactured by the Brownline Division of Brooks and Perkins, Inc. were used for the test. "Flight test" weights were loaded on the HCU-6/E pallets to simulate the various weights of pallets.

A Douglas design pallet coupler was used to couple the HCU-6/E pallets together. This coupler is described in Paragraph 3.0 of this report.

1.4 CARGO SYSTEM MOCK-UP TEST PLAN

A test plan, based on the following, was developed to evaluate the performance of the powered roller system.

Mission profiles discussed in Appendix II of the SOW were used to determine the number and character of single and coupled pallet loads that would be carried aboard the KC-10A during its 20 year life span. This pallet study is found in Appendix C.

The equivelent of two years of service was considered sufficient to evaluate the powered roller system.

A total of 246 load/unload cycles were run, with pallets weight between 2000 and 10,000 pounds. A load cycle is defined as the movement of a pallet load from the "loader" into the "airplane" and back out to the "loader". The first 236 cycles simulated the 2 years of projected KC-10 service and the remaining 10 cycles were run with powered rollers numbers 4 and 5 rotated 90° clockwise to evaluate the effects this arrangement would have on pallet handling capabilities (Reference RI C101).

The following chart lists the sequence of events in the mock-up test/demonstration.

SEQUENCE OF ACTIVITY - CARGO SYSTEM MOCK-UP TEST				
TEST RUN	PALLET CONFIG.	PALLET LOAD 1000'S LB.	PALLET EXCURSION*	CYCLES**
1	Single	5	To RS	45
2	Single	10	To RS	5
3	Single	5	To LS	45
4	Single	10	To LS	5
5	Single	5	Rotate To LS	20
6	Single	10	Rotate To LS	5
7	Coupled 108" Side	6/6	To RS	10
8	Coupled 108" Side	2/2	To RS	75
9	Coupled 108" Side	2/4	Rotate To LS	10
10	Coupled 88" Side	2/4	Rotate To RS	10
11	Coupled 108" Side	4/6	Rotate To LS	3
12	Coupled 88" Side	4/6	Rotate To LS	3
			SUBTOTAL	236
	FOR RUNS 13-21, POWERED ROLLERS 4 & 5 WERE ROTATED 90° CLOCKWISE (REF. FIG'S. 21 & 22).			
13	Coupled 88" Side	4/4.2	Rotate To RS	1
14	Coupled 108" Side	4/4.2	Rotate To LS	1
15	Coupled 108" Side	4/4.2	To RS	1
16	Single	5	To RS	1
17	Single	5	To LS	2
18	Single	5	Rotate To LS	1
19	Single	5	To RS	1
20	Single	10	To RS	1
21	Single	10	Rotate To LS	1
			TOTAL	246

* RS = Right side channel of pallets in airplane; LS = Left side.

** One cycle is movement of pallet from loader into airplane and back out to loader.

2.0 SINGLE PALLET OPERATION

A total of 125 load cycles was run with single pallets having loads of 5000 or 10,000 lb., 100 cycles being straight lateral translations, simulating loading into a 25 pallet all-cargo configuration as shown in Figure 5, and 25 load cycles were rotated on entry and exit simulating loading the left-hand side of a 27 pallet all-cargo configuration.

After the first 10 cycles, a cut apporximately 0.6 in. long appeared on the tread of one roller (see Figure 6) but it did not increase during the remainder of the entire test.

Figure 7 shows a chip in the tread of roller No. 5 that was discovered after the first 48 cycles, the last 3 cycles at a 10,000-lb. load. Figure 8 shows that a pallet being offloaded may not be misaligned or it won't enter the loader's guide rails easily. In Figure 9, a pallet is in the process of rotation, and Figure 10, a chamfer on the end ring of a roller occured when the edge of a pallet was positioned on the edge of the roller. In Figure 11, a pallet was positioned so that one of its latch detents was against the door jamb protector bracket to determine if a hook-up would occur. The remedy for this condition is to pull the pallet away from the bracket by use of the powered rollers.

After 122 load cycles, it was noticed that roller No. 4 would not raise up when energized to drive toward the right side. The frame of the roller was bent (Figure 14) so that the erection mechanism was misaligned. The problem was corrected by replacing the frame. Simultaneously it was noticed that roller No's 4, 5 and 2 were missing one bolt each in the attachment pattern to their metal mounting plates, and at all 8 powered rollers many of the wood screws attaching the mounting plates to the wooden flooring were loose or missing. The omission of bolts and wood screws can be seen in Figure 4, 6, and 7 and is traceable to modifications made during prior development work done on the mock-up. All missing attachments were installed, and no further difficulties were experienced with roller operations.

Basically, the powered roller system performed this portion of the test well in moving the single pallet laterally in the aircraft or rotating in the doorway area.

3.0 COUPLED PALLET OPERATION

A total of 111 load cycles was run with coupled pallets having total loads of 4000 to 12,000 lb. for the pair of pallets. The first 85 load cycles were straight lateral translations into the airplane, and the last 26 were rotated on entry and exit. The pallets that were rotated were coupled on either the 88 inch or 108 inch dimension.

Figure 12 shows coupled pallets being loaded and Figure 13 is a close-up of the pallet coupler. This coupler provides a 1-inch space between pallets as is standard in the KC-10A Cargo Handling System. Two couplers are required to couple two pallets. No loose parts or tools are required for attachment of the couplers. In Figure 15, a pair of coupled pallets has been rotated to the right side channel in the airplane.

In Figure 16, some scuffing on the end ring of roller No. 5 is seen, and the tread chip first shown in Figure 7 is enlarged to approximately 0.7 in. long, 0.5 in wide, and 0.15 deep at the deepest point. This was observed after 230 load cycles including 20 cycles rotating coupled pallets and 25 cycles rotating single pallets.

Figures 17, 18, 19, 20 are views of all the powered rollers, taken in pairs, showing the condition of the rollers at the completion of 236 load cycles.

The powered roller system performed this portion of the test very well. Lateral movement of coupled pallets was accomplished easily and the rotation was positive.

4.0 OPERATION WITH TWO POWERED ROLLERS ROTATED 90° (RI C101)

Powered roller No's 4 and 5 were rotated 90° clockwise to a longitudinal drive fixed position in order to evaluate the function of the roller system in this configuration, refer to RI C101 generated during the Furnishing and Equipment CDR. Figure 21 shows this arrangement and Figure 22 is an overview photo.

In general, this arrangement produced a considerable amount of unwanted pallet rotation, especially on single pallets moving toward the airplane door from the airplane's right side. A 5000-lb. pallet rotated approximately 30° on entry toward the right side and 75° on exit. A 10,000-lb. pallet rotated approximately 20° on entry, and on exit was rotated 45° by the time it got to the airplane centerline (similar to Figure 24). Since 86% of the anticipated pallet loads in KC-10A operations do not require rotation, the unwanted pallet rotation associated with this mixed arrangement is very undesireable. Rotating single or coupled pallets to the left side worked quite well except for final adjustments. Figure 23 shows a pallet position on the left side with no more alignment by powered rollers possible.

In this arrangement the operator must handle more complex switching operations in rotating pallets because he must handle power controls in 4 directions instread of 2.

Aft translation produced by rollers 4 and 5 was an assist, although it did tend to produce some rotation because the point at which power is applied is eccentric to the pallet.

5.0 SUMMARY AND CONCLUSIONS

The basic powered roller system design performed very well for the entire spectrum of loads. Lateral onloading/offloading of single and coupled pallets were accomplished easily and effectively. Rotation of single and coupled pallets was positive and easy to control. The operator's pendant control techniques were easily learned and applied. This test demonstrated that the powered roller system meets or exceeds its design requirements.

Wear, tear, or tread gouging on the powered rollers was not sufficient to be considered disabling damage. All rollers were functioning normally at the completion of testing. The bent frame on roller No. 4 (causing a 50% loss of function) was traceable to loose attachment of the rollers to the mock-up flooring.

Roller tread wear was negligible, measuring .000 to .020 in. on the radius, considering that the testing simulated 2 years of KC-10A palletized cargo operation.

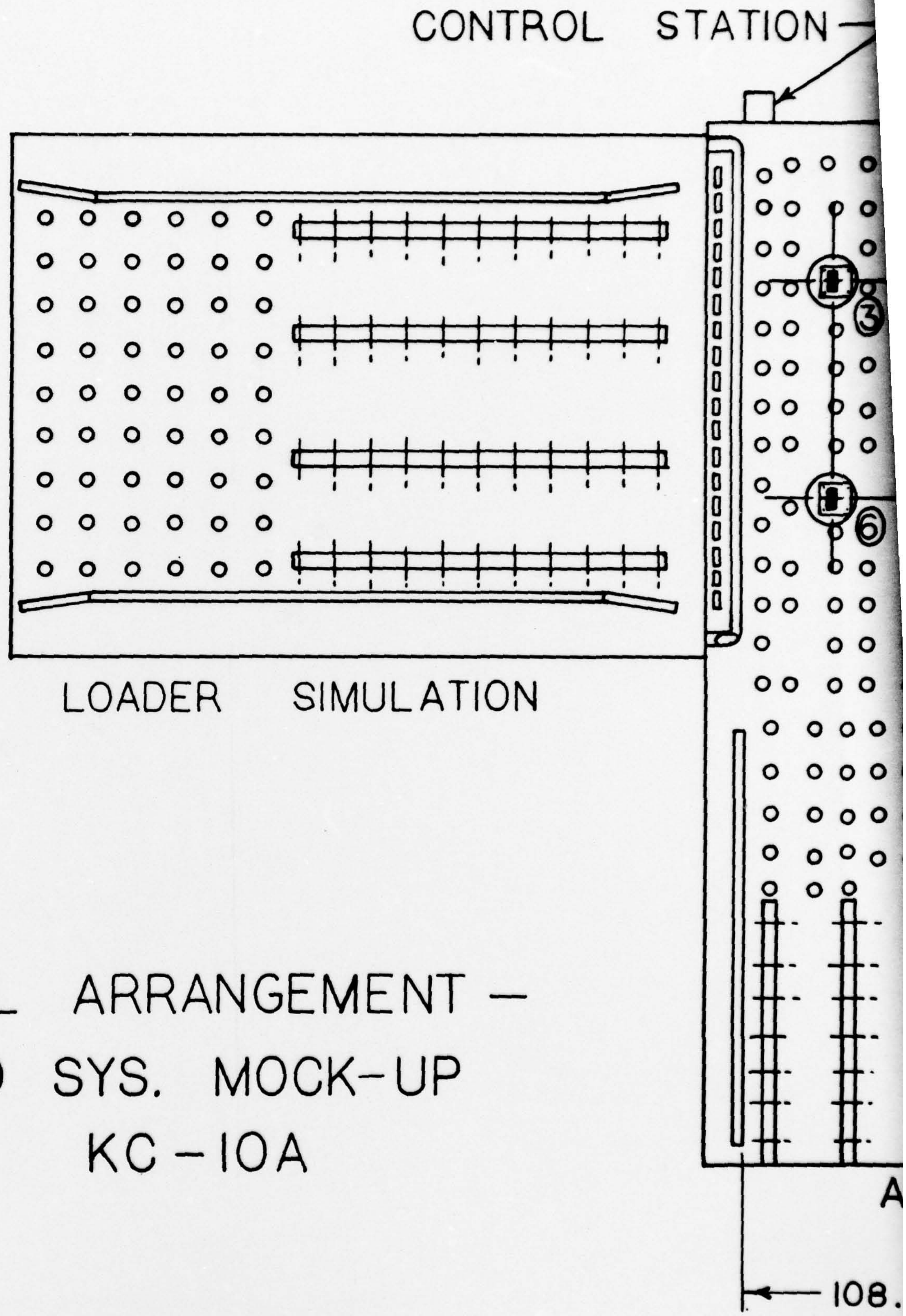
In addition, this test demonstrated that rotating two rollers 90^{o}, as indicated in RI C101, created unwanted pallet rotation when moving pallets in/out of the aircraft and complicated the operator's control procedures.

During the development phase concern was expressed about the wear on the bottom surface of the HCU-6/E pallets when rotating through the cargo door. Upon the completion of this test, photographs were taken of the bottom surface of one of the pallets and a close-up of one corner, see Figures 25 and 26. The photographs show that there are numerous marks and small indentations over the bottom surface, but no serious damage. The other pallet used in the test looked the same.

These HCU-6/E pallets have been at the Long Beach facility for approximately eight years. They were first used on the DC-8 Power Pack Shuttle mock-up, through the development phase of the KC-10A mock-up, and then for the 2-year simulated KC-10A palletized cargo operation.

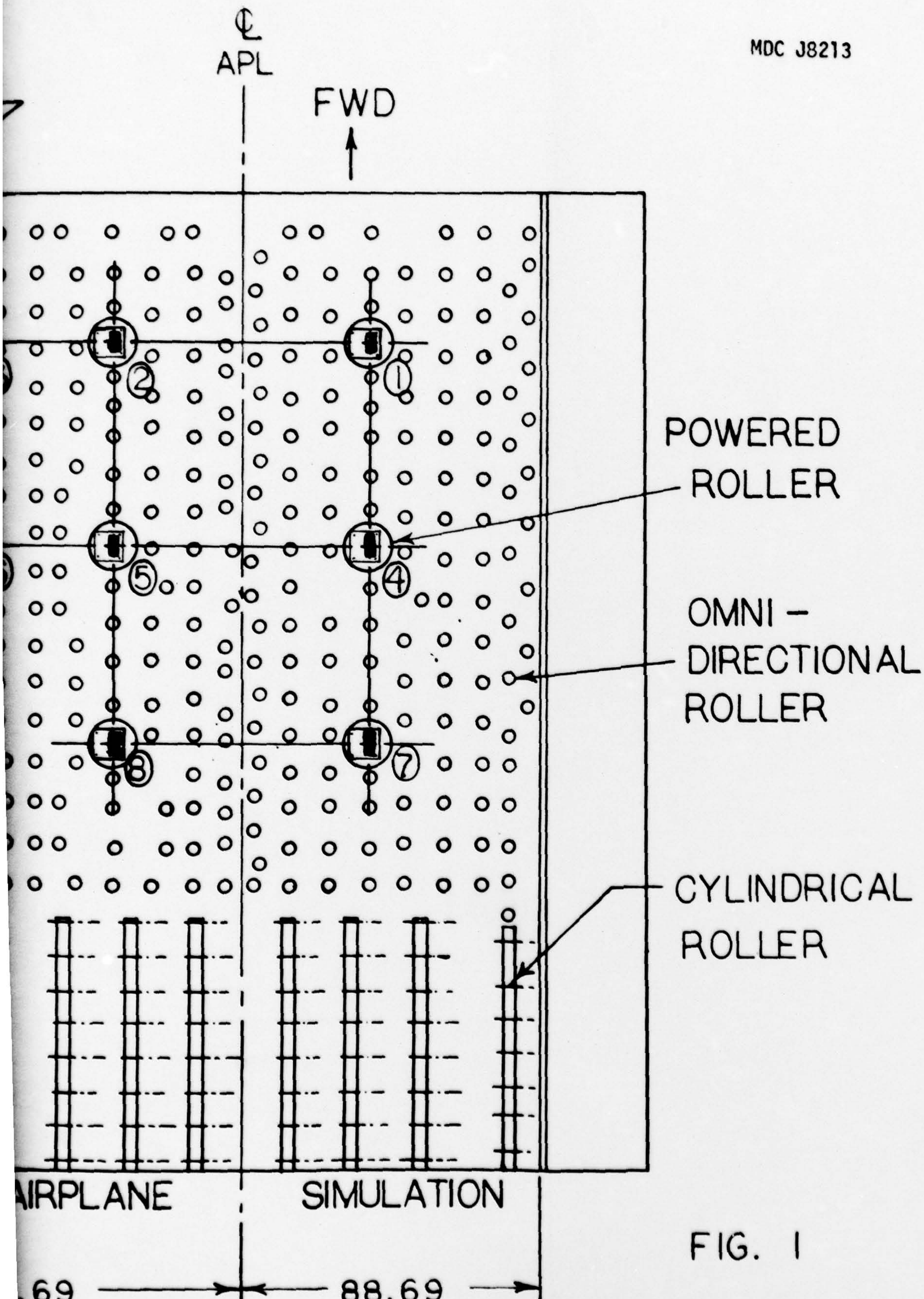
There is one area that should be noted. During this test a sharp edge was found on the lower corner of the pallet latch detents, as seen in Figure 13. This edge condition may have been produced by displacing and cold working the material during pallet movements on various mock-up operations, and may be the cause of roller tread damage and end ring wear that occured during the early testing.

APPENDIX A
FIGURES AND PHOTOGRAPHS
OF CARGO MOCK-UP TEST



GENERAL ARRANGEMENT —
CARGO SYS. MOCK-UP
KC-10A

1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APL
FWD
1
2
4
5
7
8
POWERED ROLLER
OMNI-DIRECTIONAL ROLLER
CYLINDRICAL ROLLER
AIRPLANE
SIMULATION
.69
88.69

FIG. 1

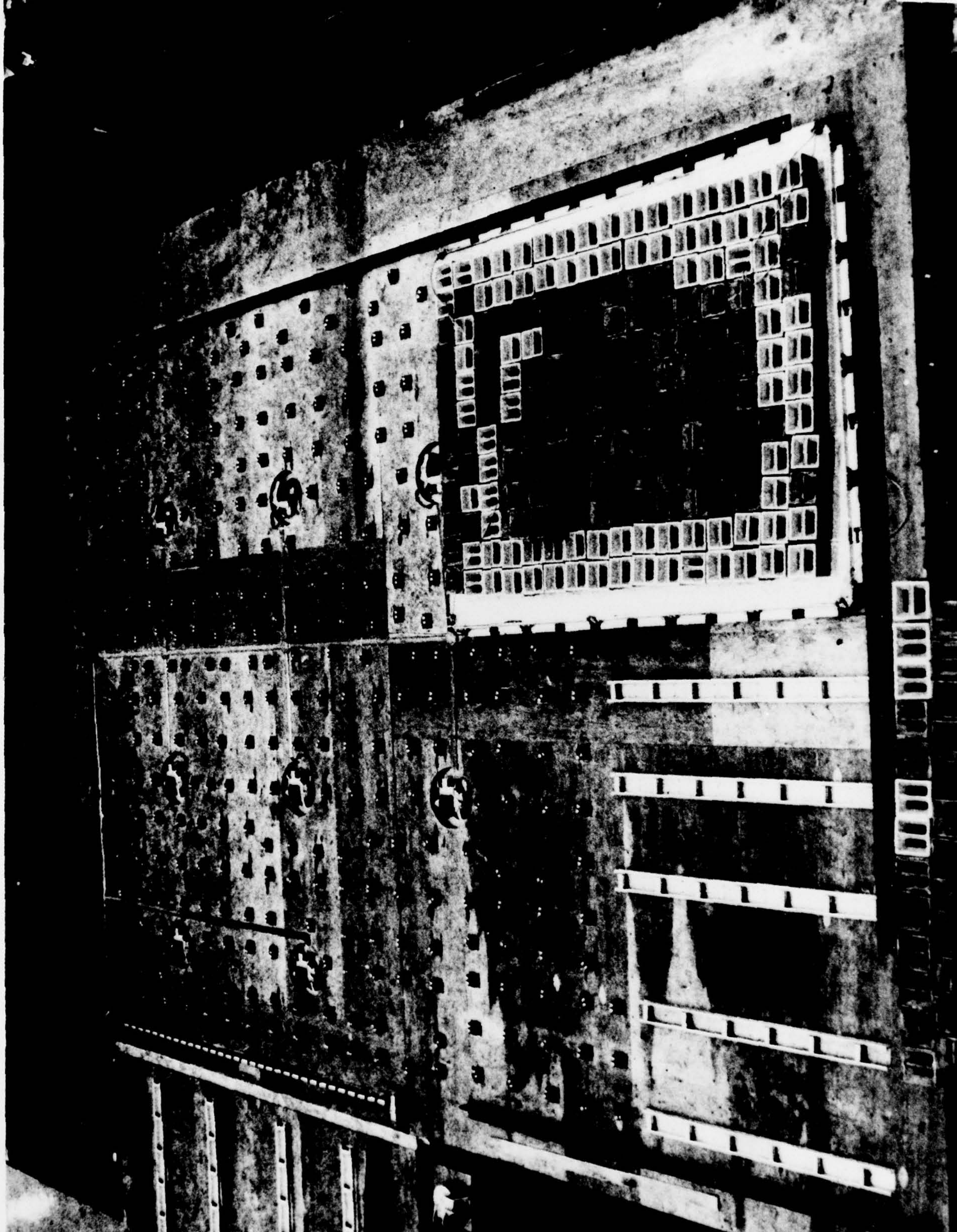

FIGURE 2. OVERVIEW LOOKING FORWARD - DOWN

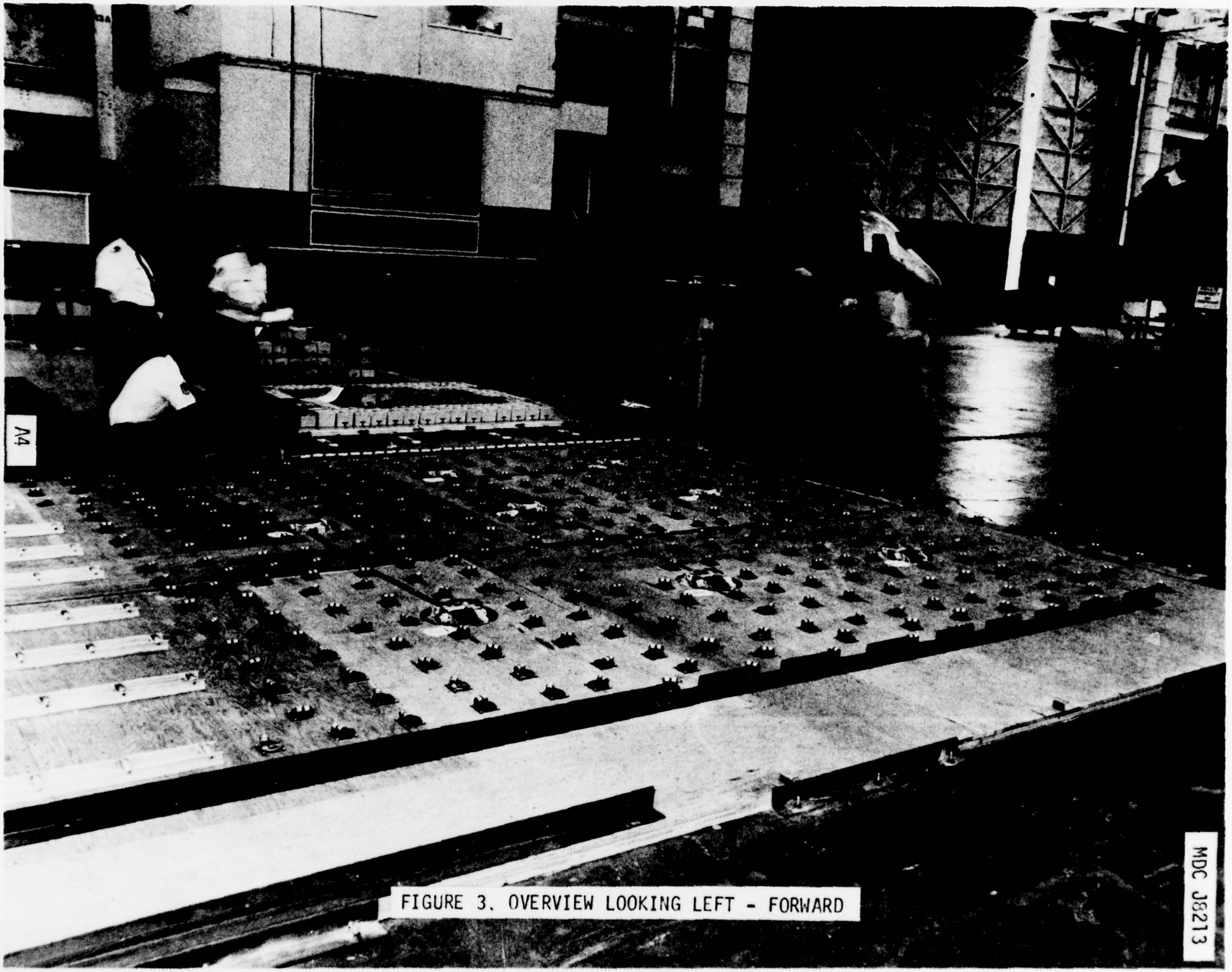

FIGURE 3. OVERVIEW LOOKING LEFT - FORWARD

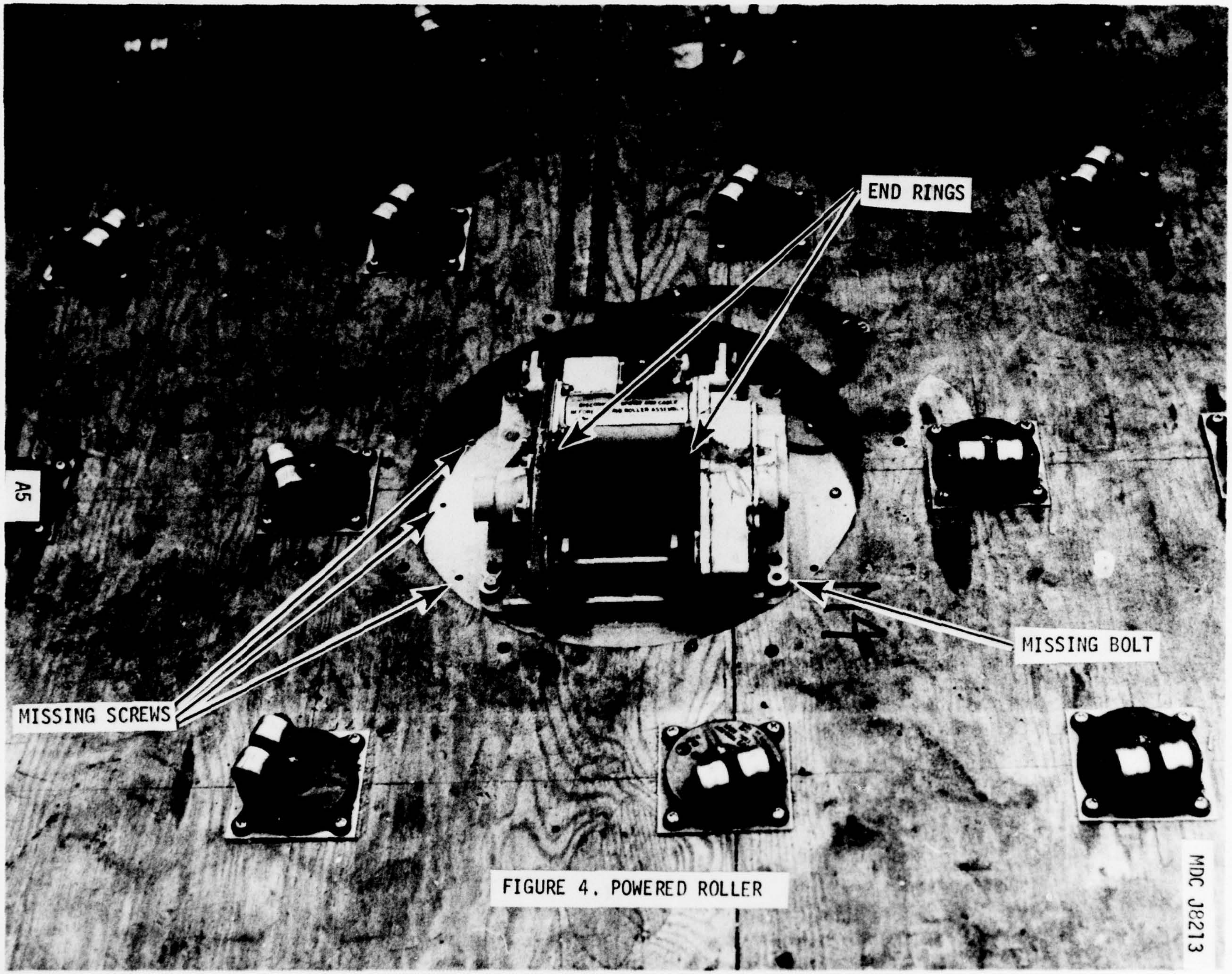

FIGURE 4. POWERED ROLLER

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FIGURE 5, PALLET IN RIGHT SIDE CHANNEL

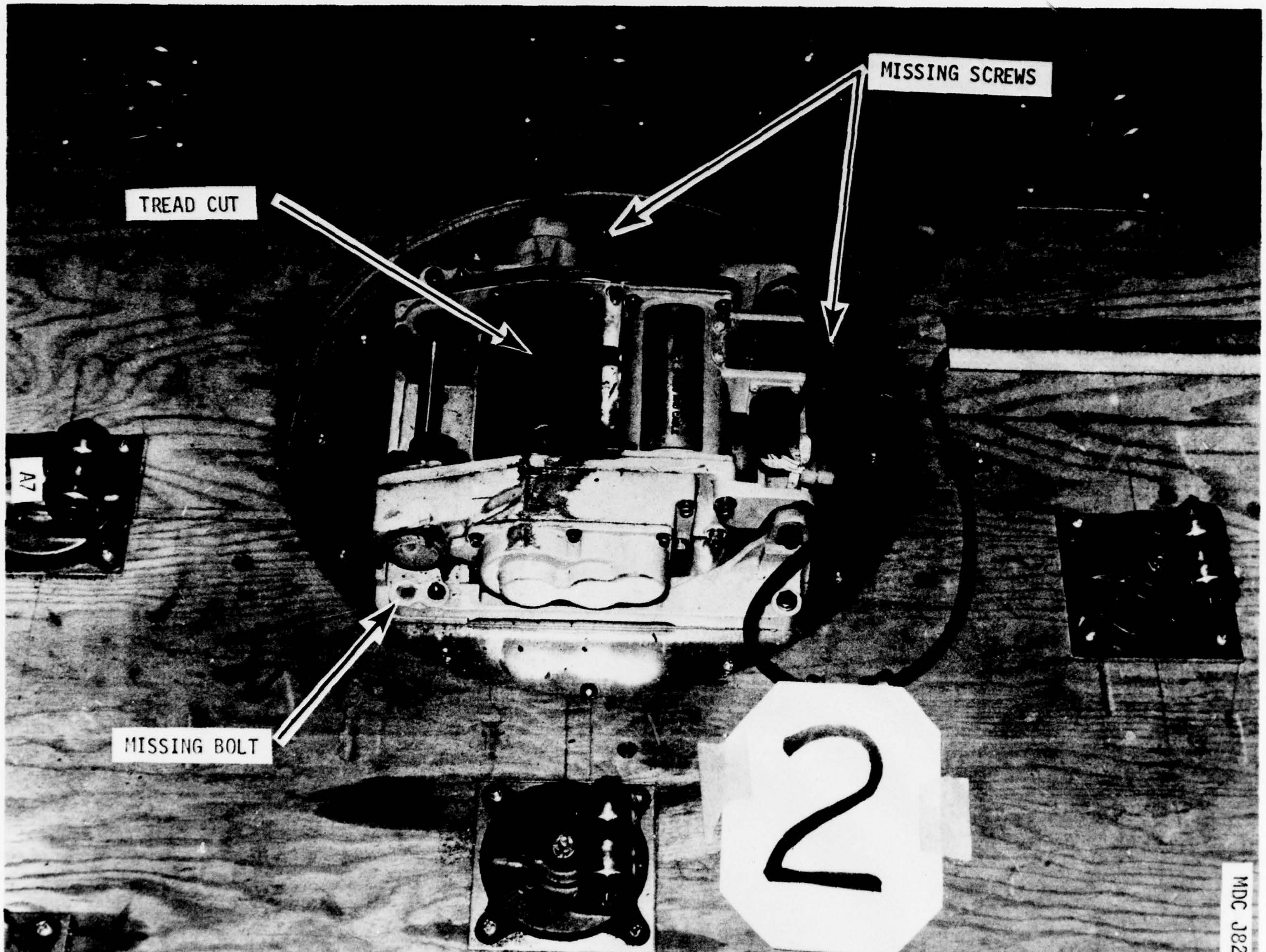

FIGURE 6, TREAD CUT ON POWERED ROLLER

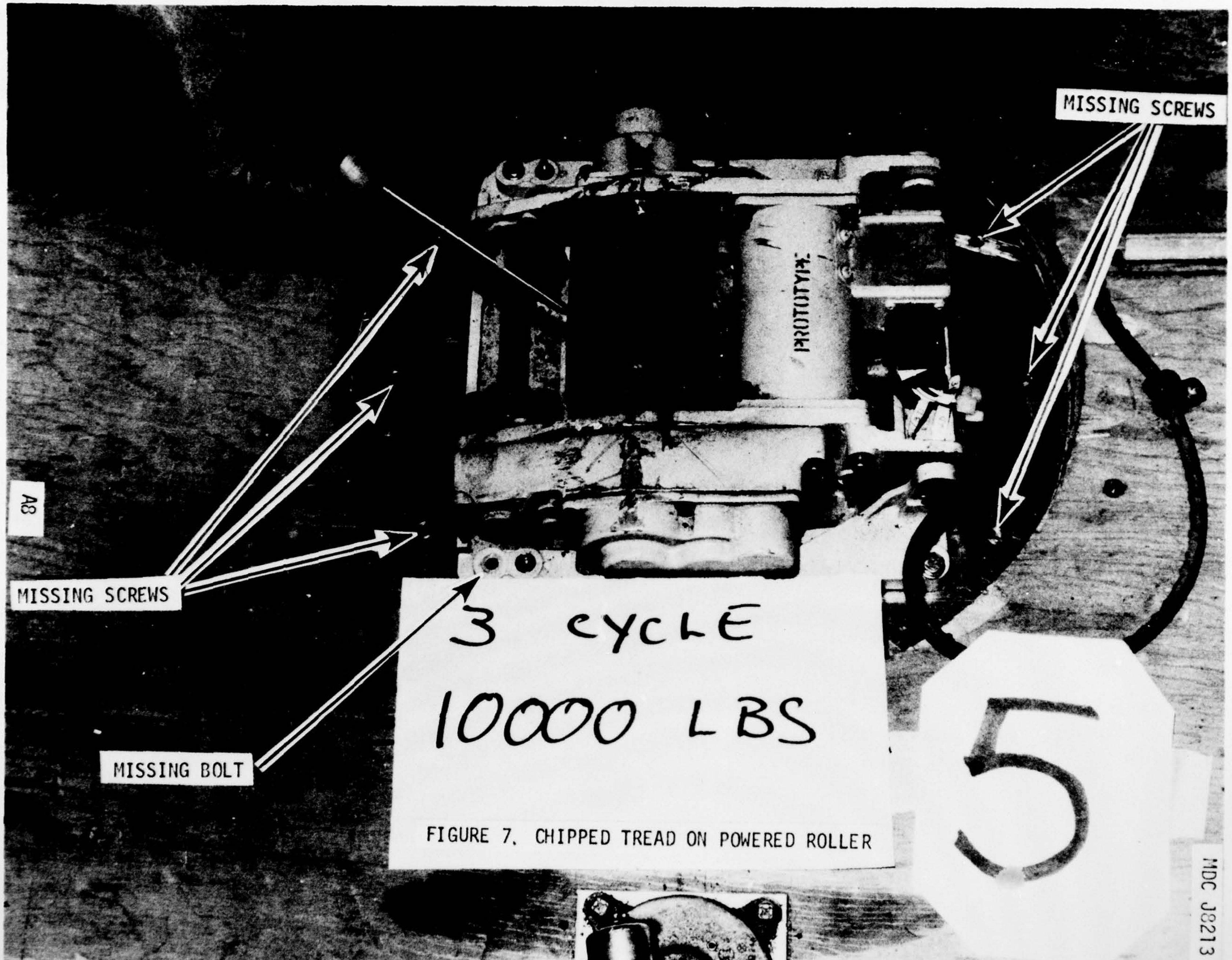

FIGURE 7. CHIPPED TREAD ON POWERED ROLLER

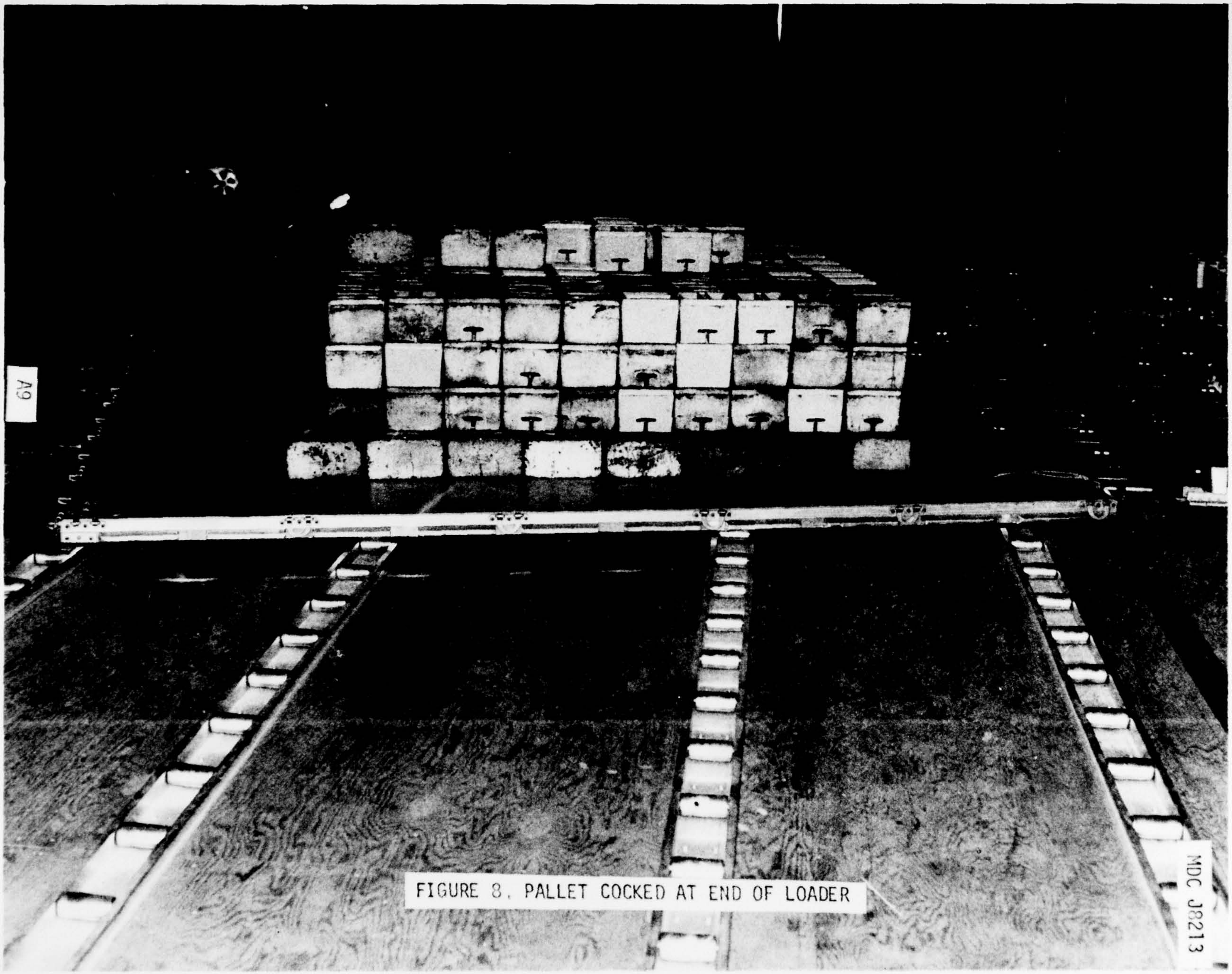

FIGURE 8. PALLET COCKED AT END OF LOADER

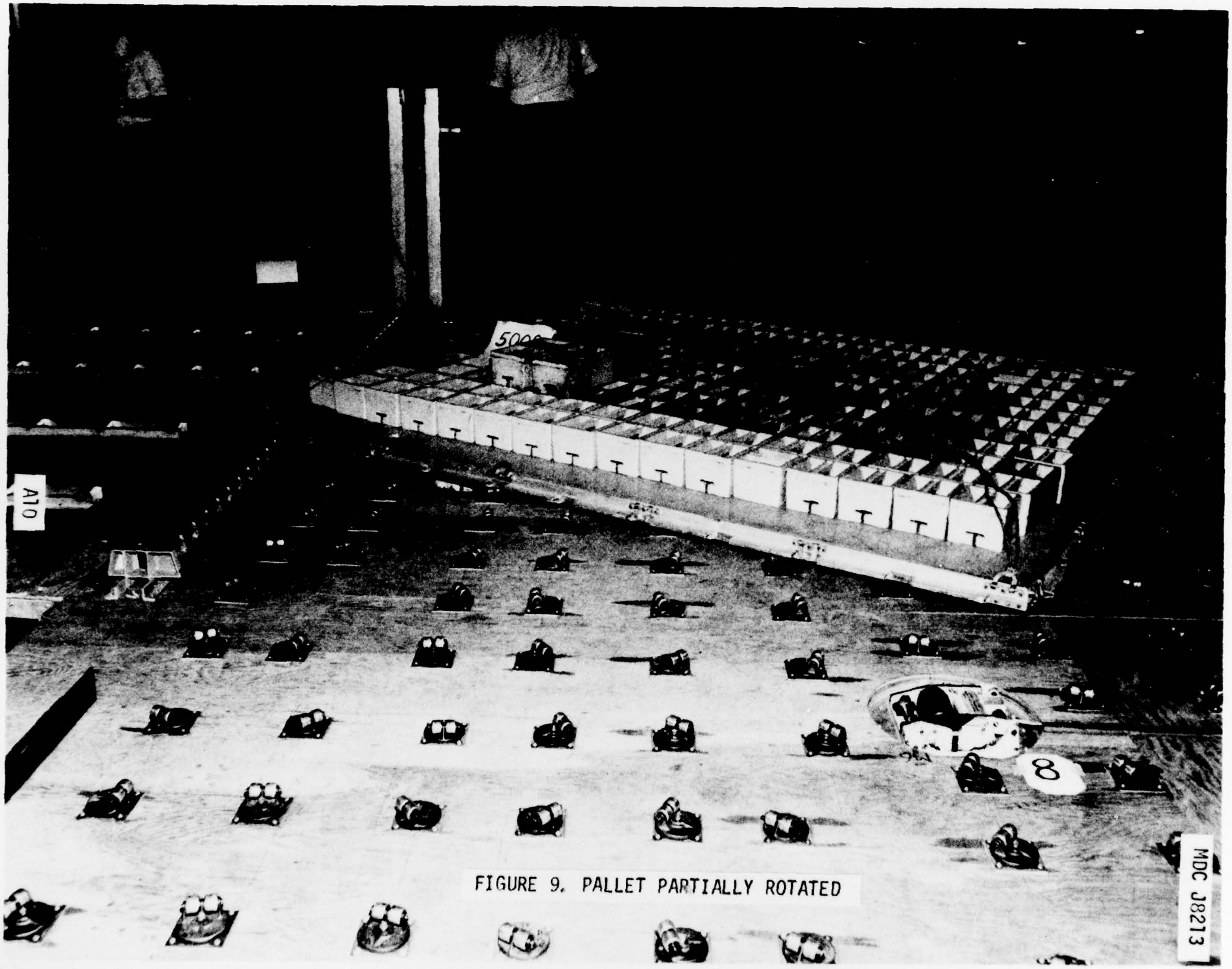

FIGURE 9. PALLET PARTIALLY ROTATED

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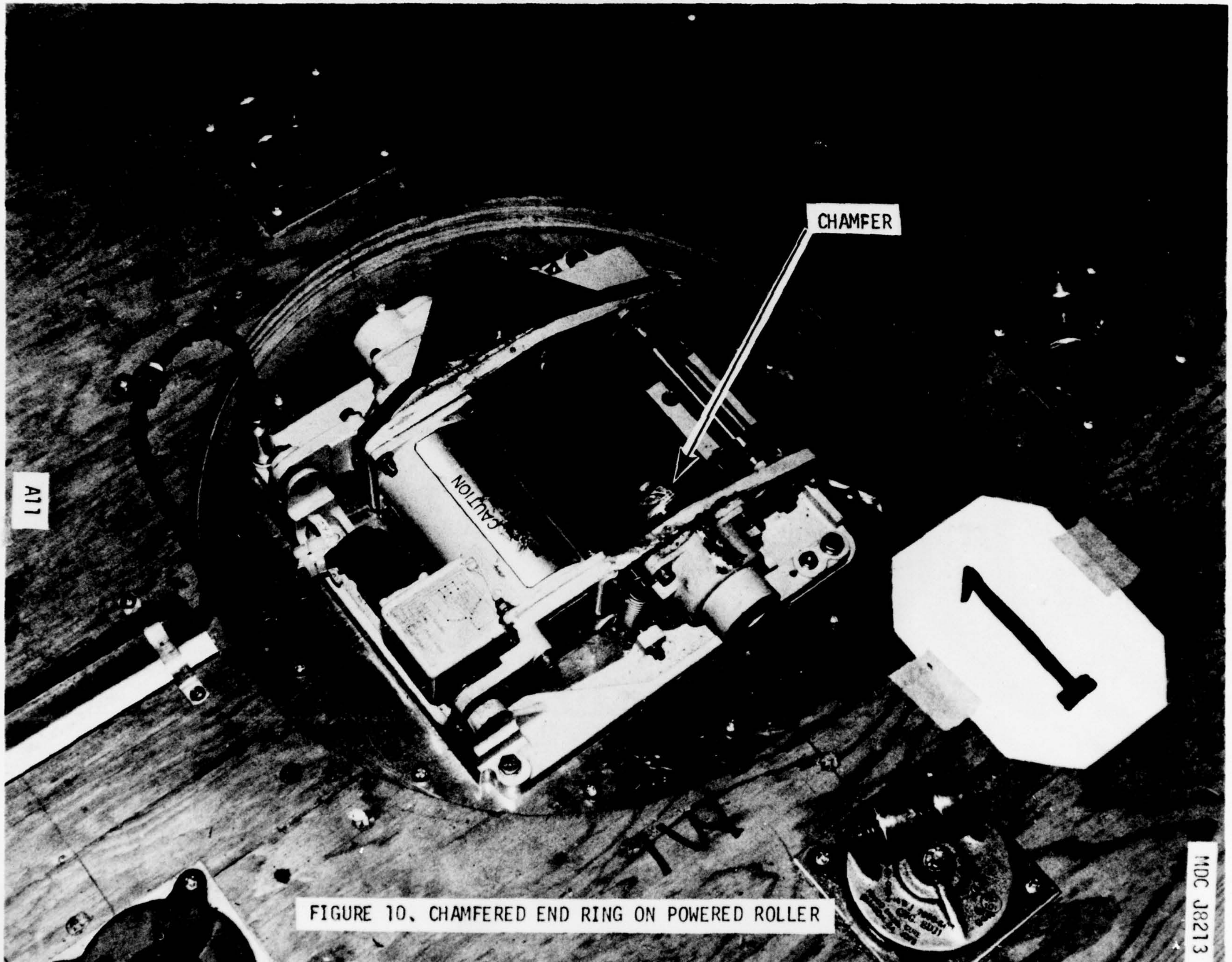

FIGURE 10. CHAMFERED END RING ON POWERED ROLLER

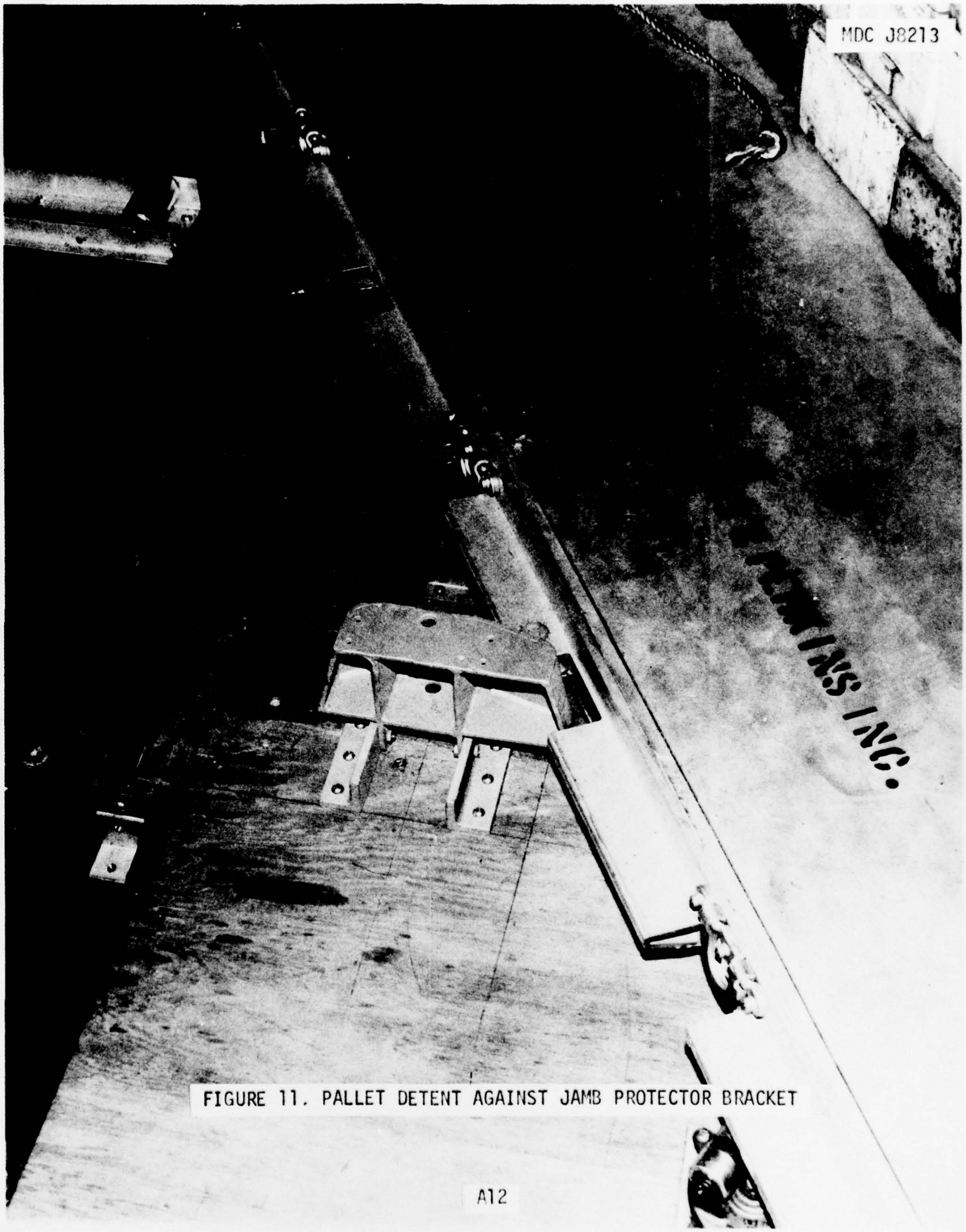

FIGURE 11. PALLET DETENT AGAINST JAMB PROTECTOR BRACKET

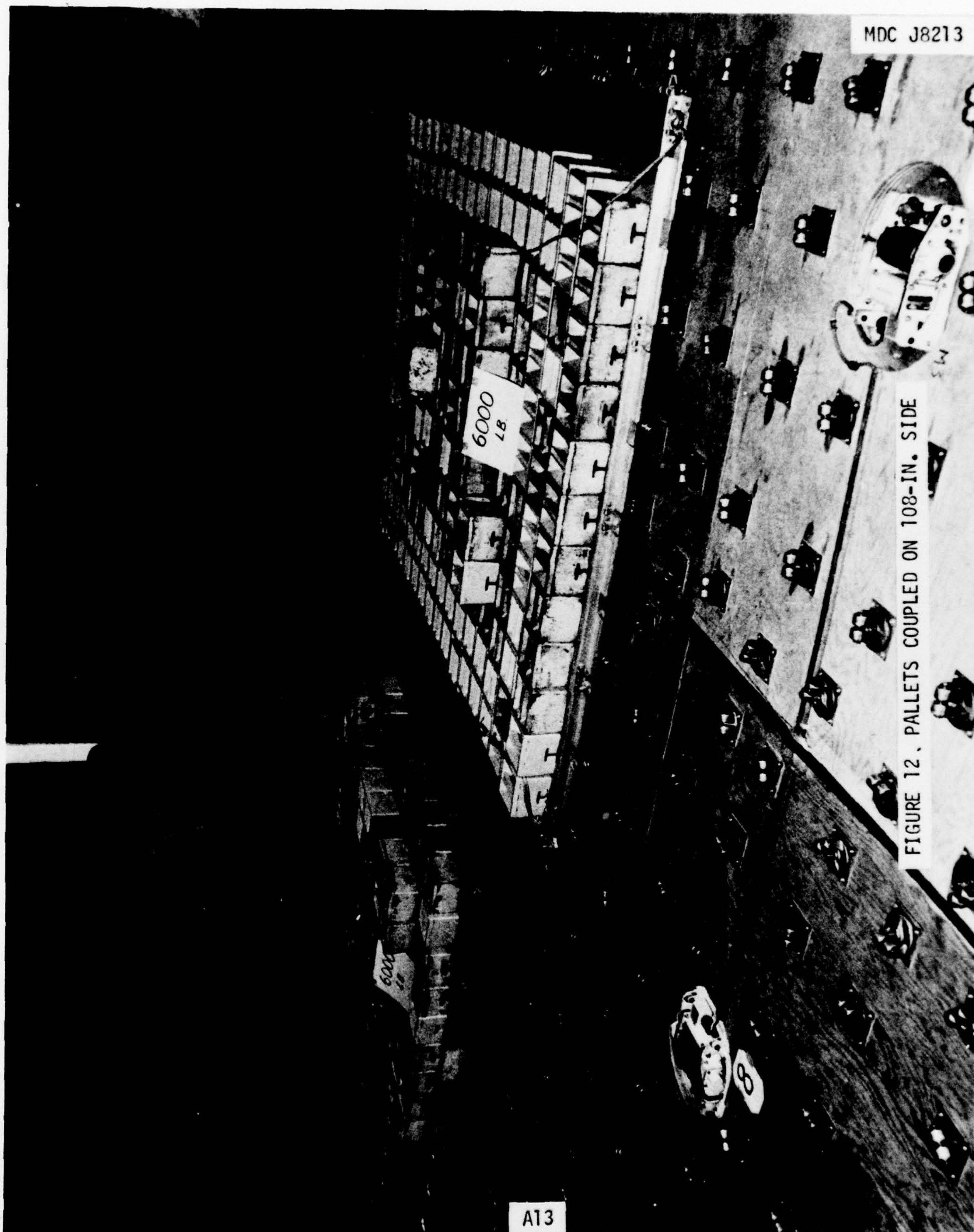

FIGURE 12. PALLETS COUPLED ON 108-IN. SIDE

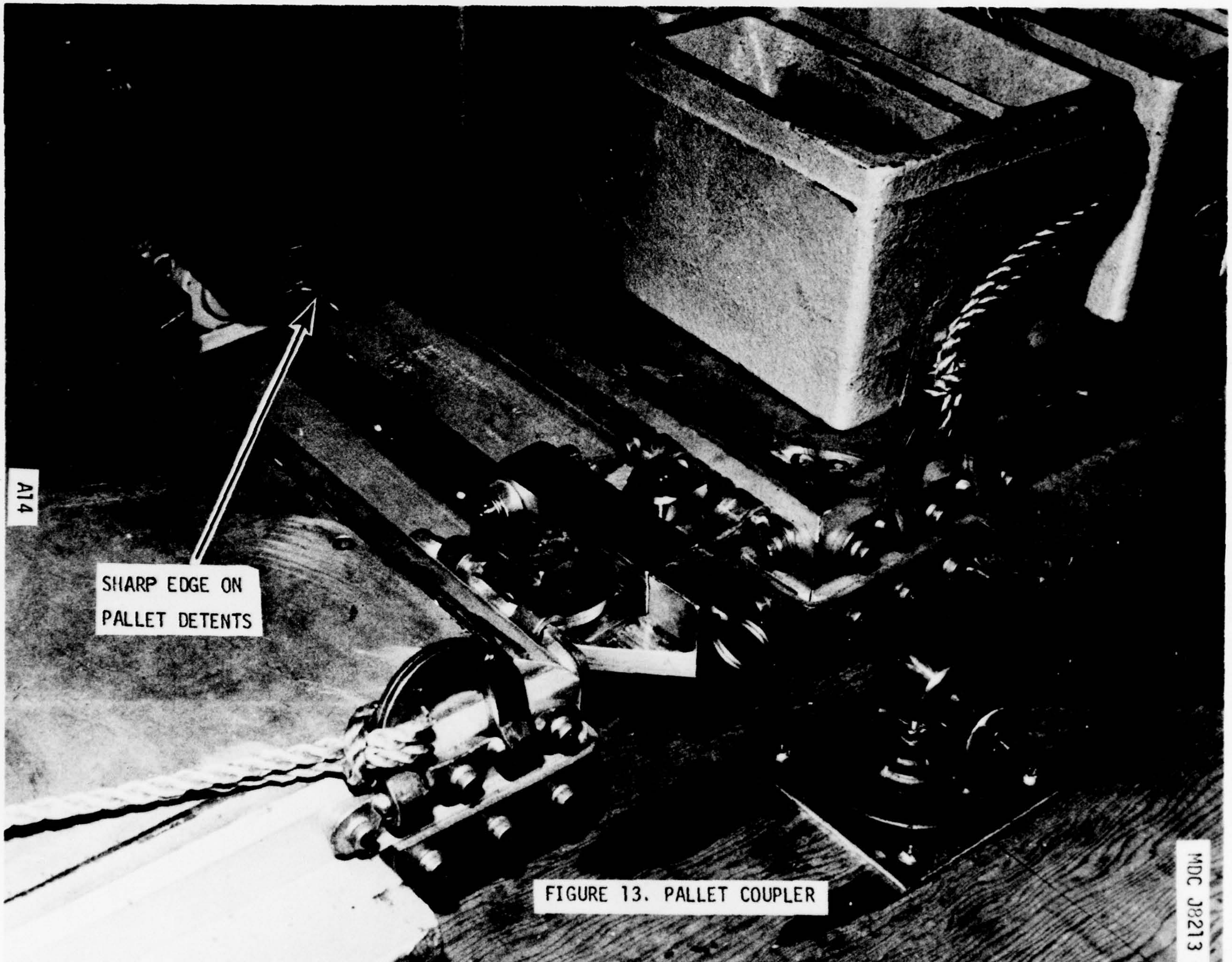

FIGURE 13. PALLET COUPLER

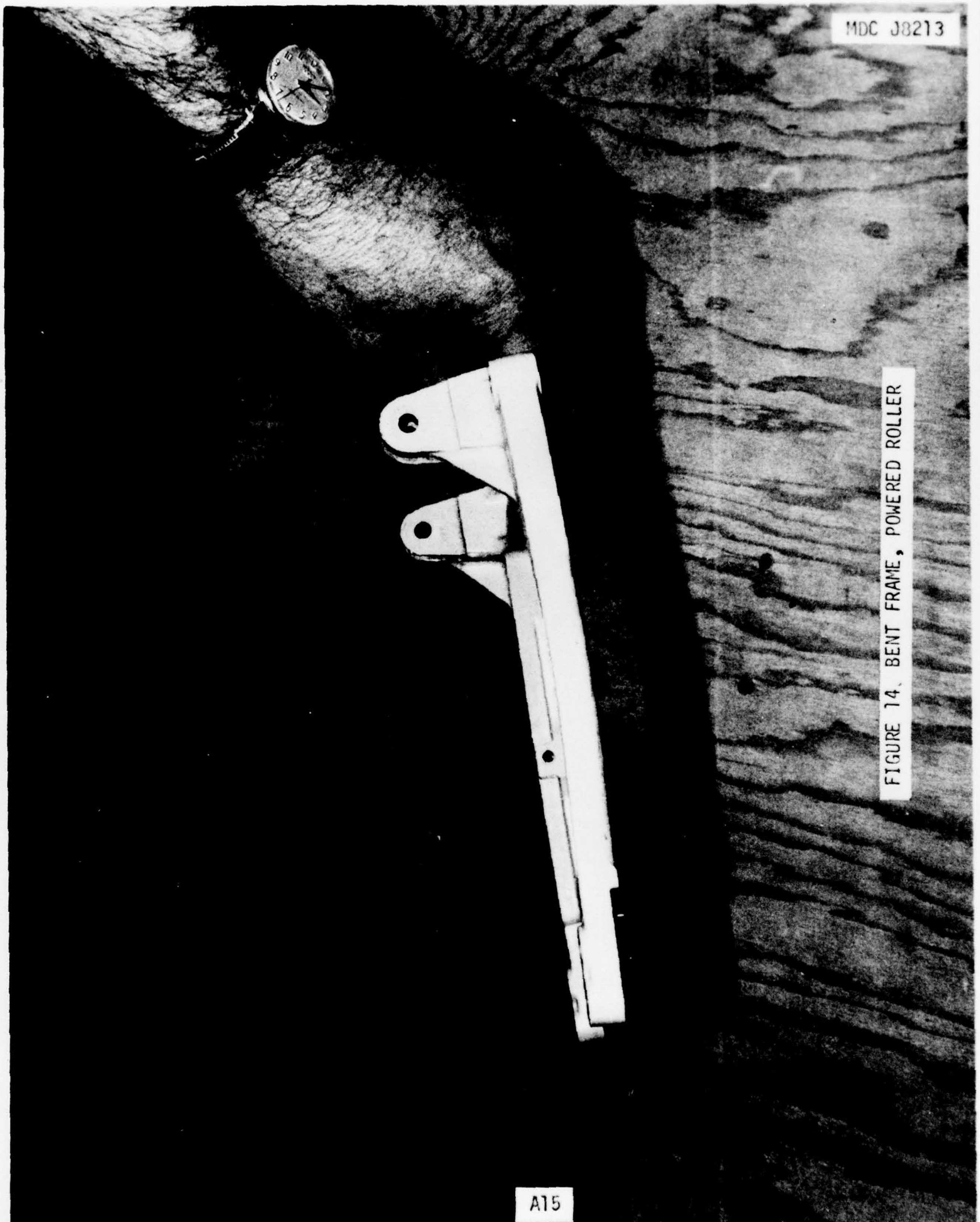

FIGURE 14. BENT FRAME, POWERED ROLLER

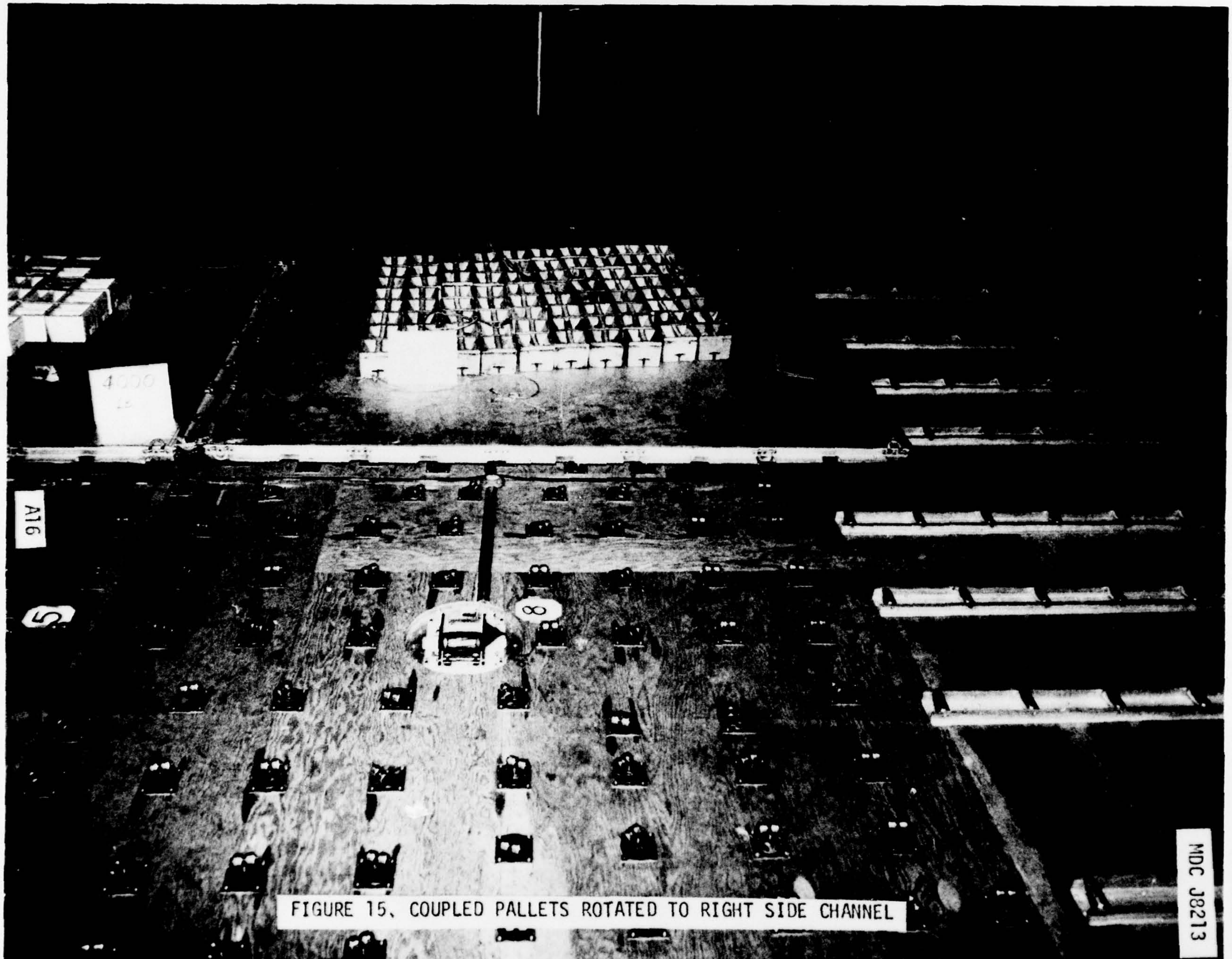

FIGURE 15. COUPLED PALLETS ROTATED TO RIGHT SIDE CHANNEL

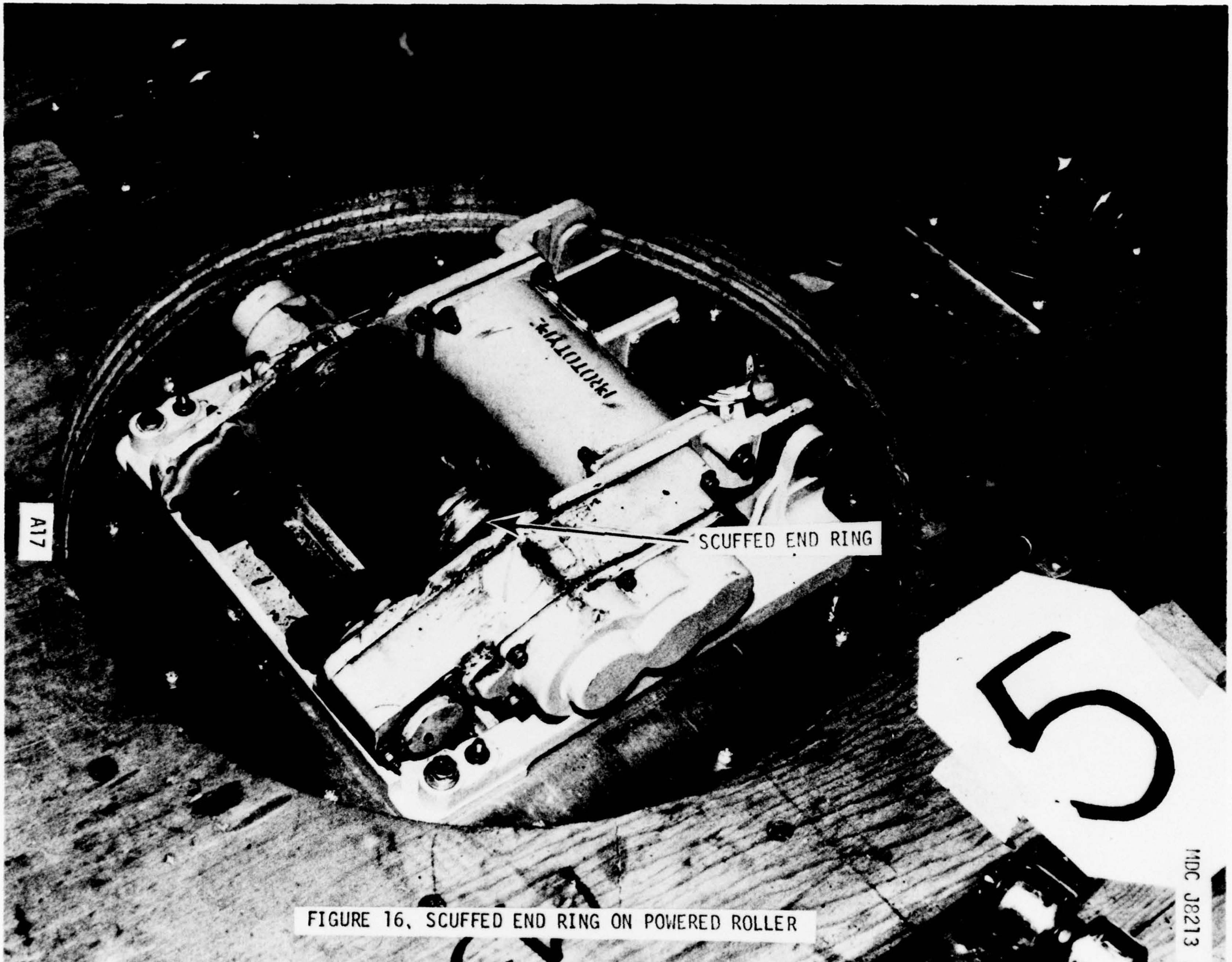

FIGURE 16. SCUFFED END RING ON POWERED ROLLER

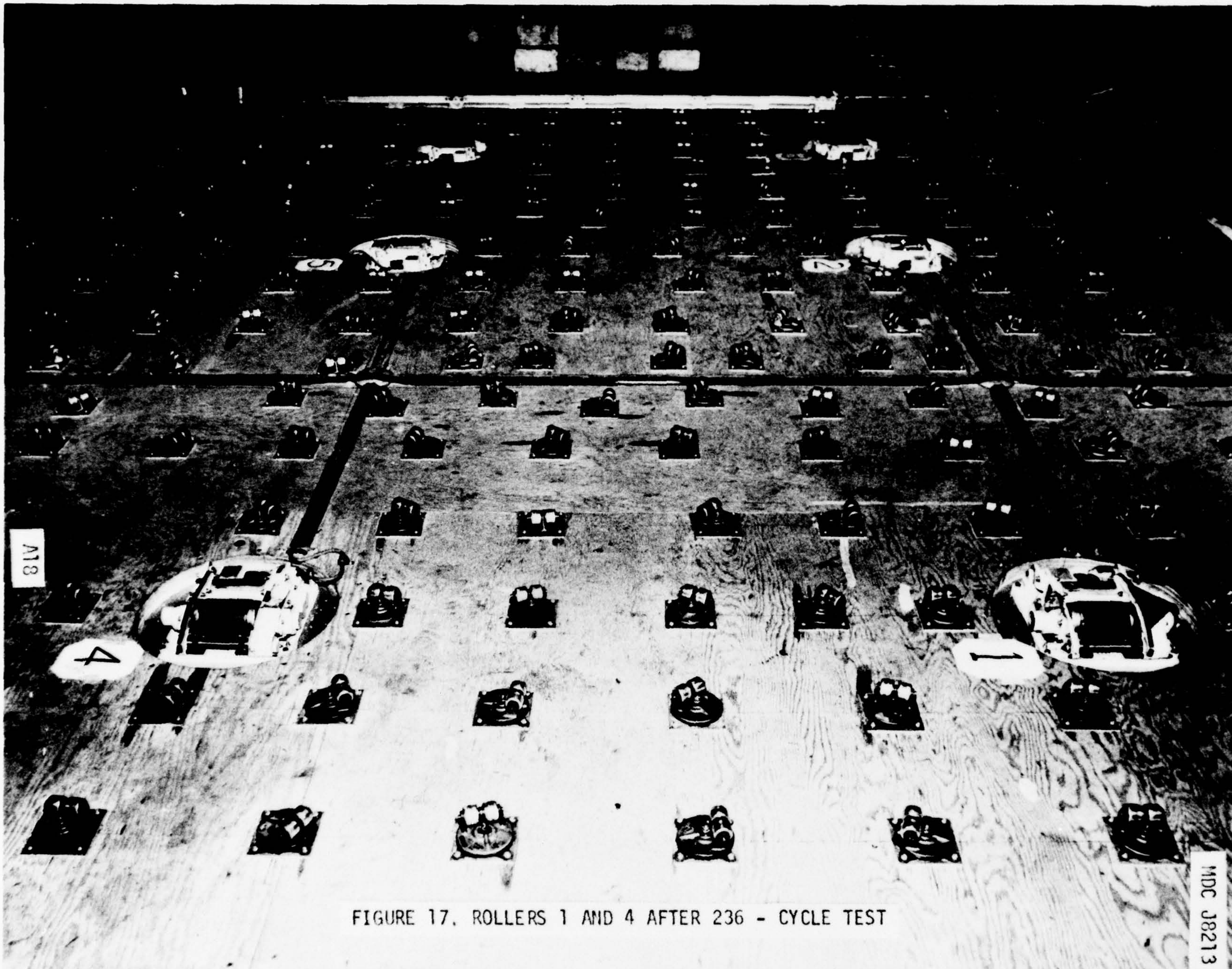

FIGURE 17. ROLLERS 1 AND 4 AFTER 236 - CYCLE TEST

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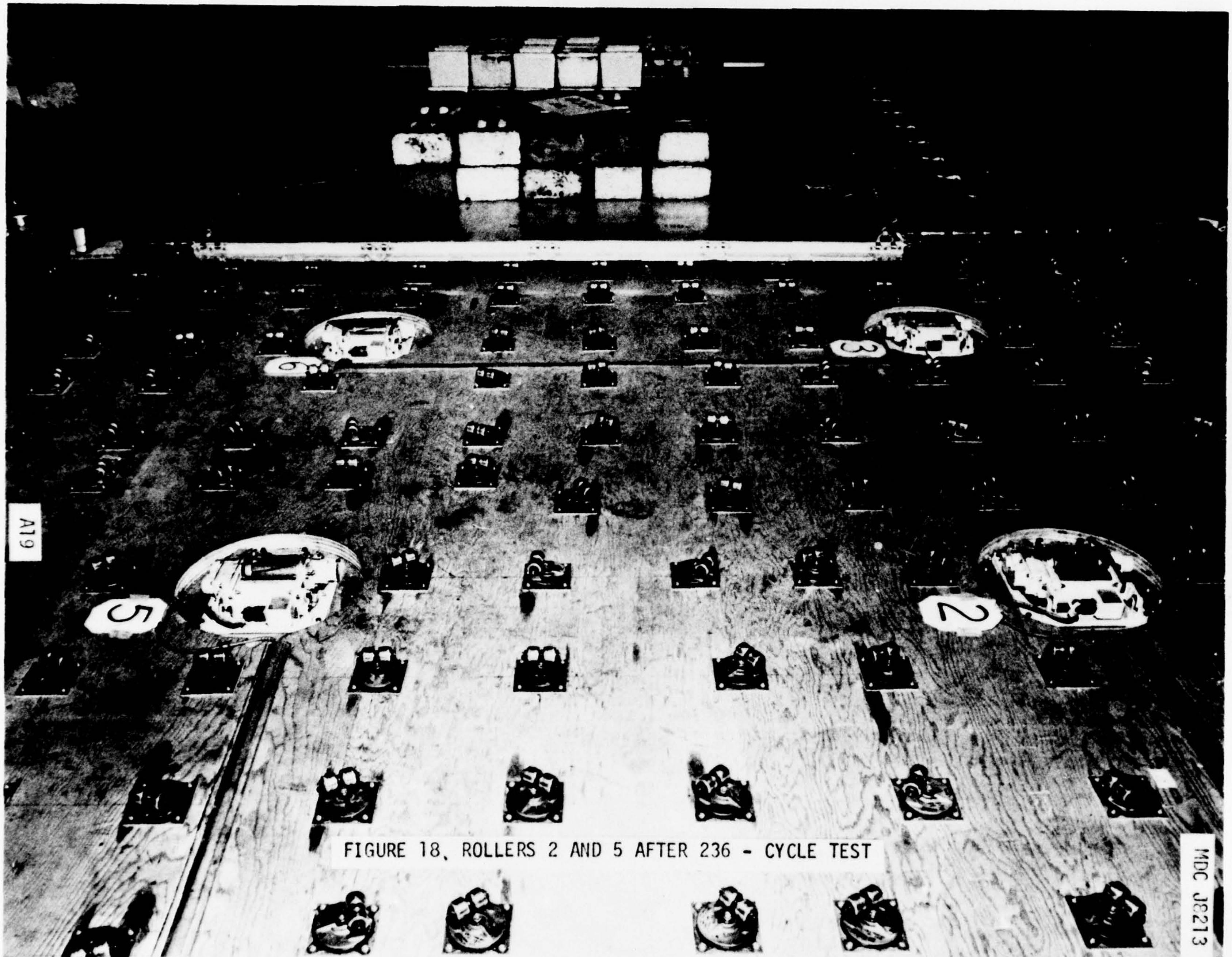


FIGURE 18, ROLLERS 2 AND 5 AFTER 236 - CYCLE TEST

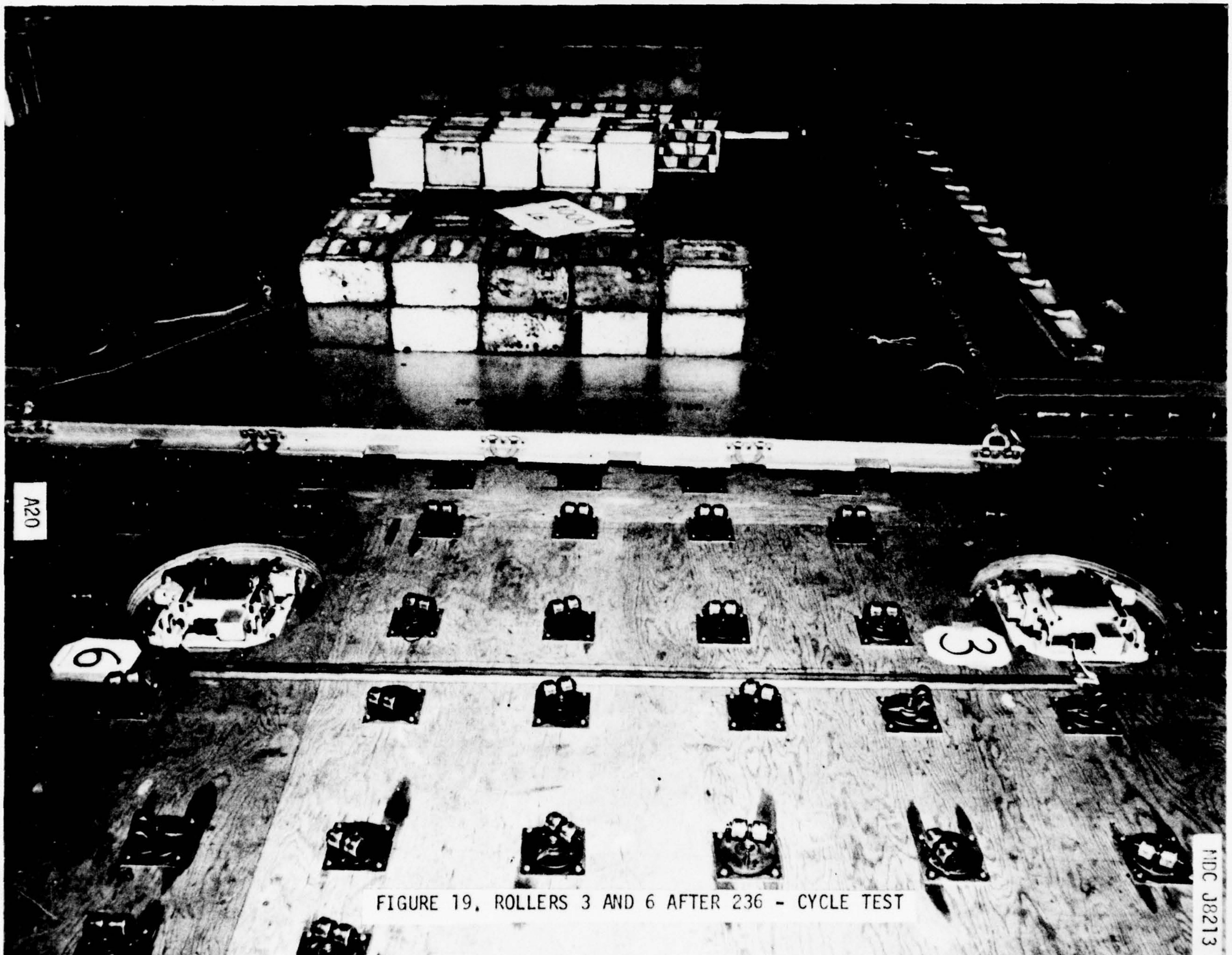
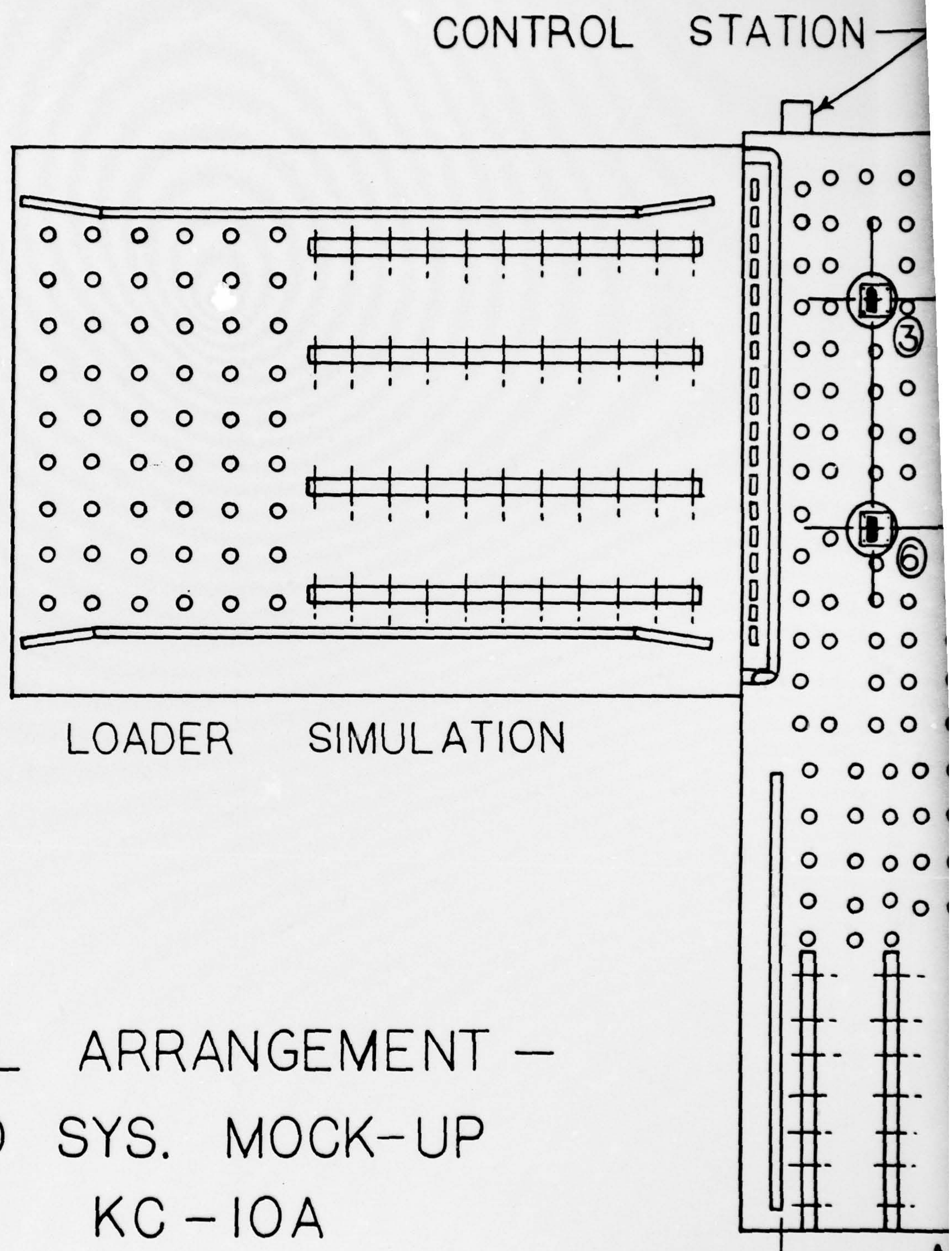


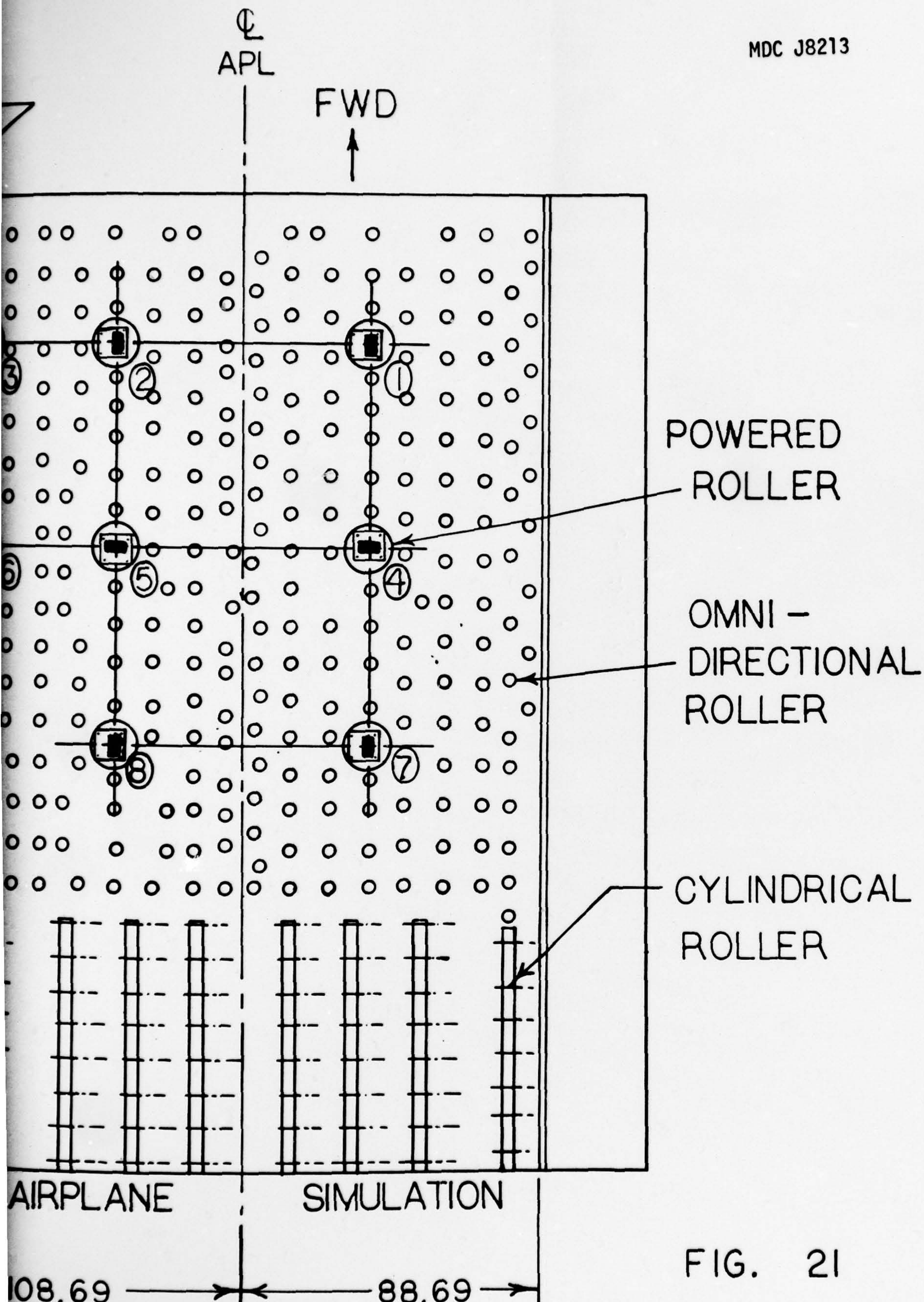
FIGURE 19. ROLLERS 3 AND 6 AFTER 236 - CYCLE TEST

FIGURE 20, ROLLERS 7 AND 8 AFTER 236 - CYCLE TEST



GENERAL ARRANGEMENT –
CARGO SYS. MOCK-UP
KC-10A

ROLLERS 4 AND 5 ROTATED 90° CW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APL
FWD
1
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4
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6
7
8
POWERED
ROLLER
OMNI-
DIRECTIONAL
ROLLER
CYLINDRICAL
ROLLER
AIRPLANE
SIMULATION
108.69
88.69

FIG. 21

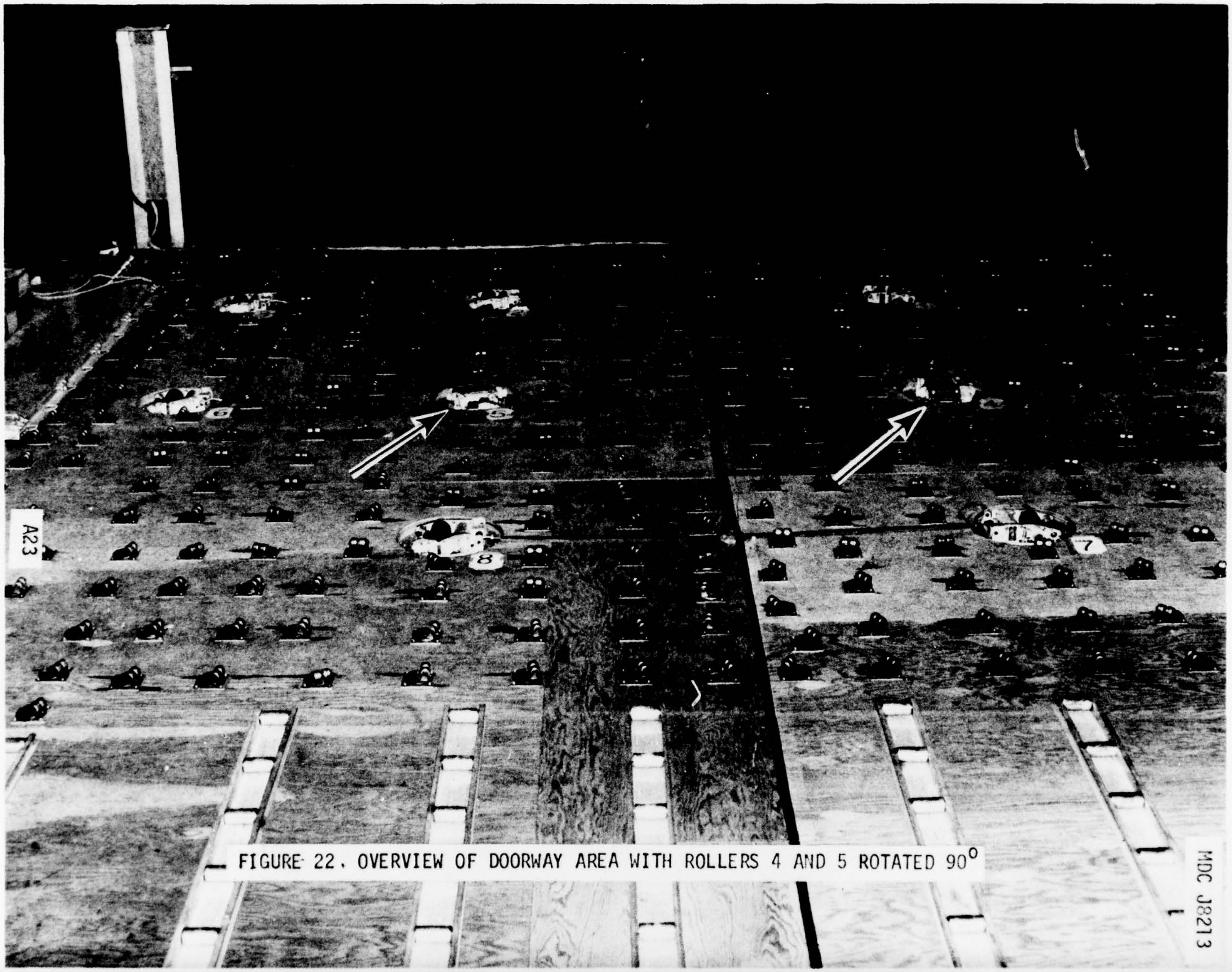


FIGURE 22. OVERVIEW OF DOORWAY AREA WITH ROLLERS 4 AND 5 ROTATED 90°

FIGURE 23. PALLET ROTATED TO LEFT SIDE CHANNEL

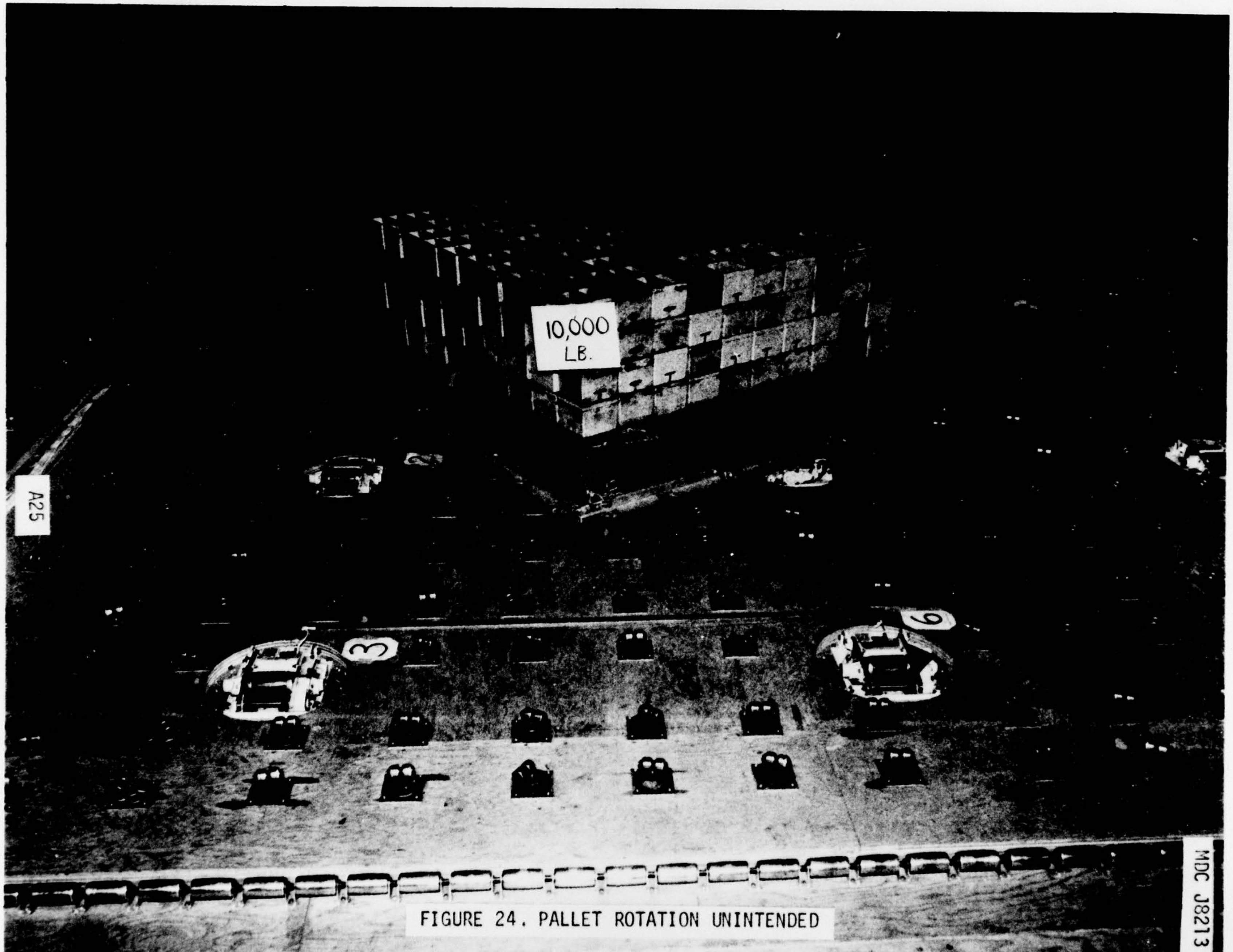


FIGURE 24. PALLET ROTATION UNINTENDED

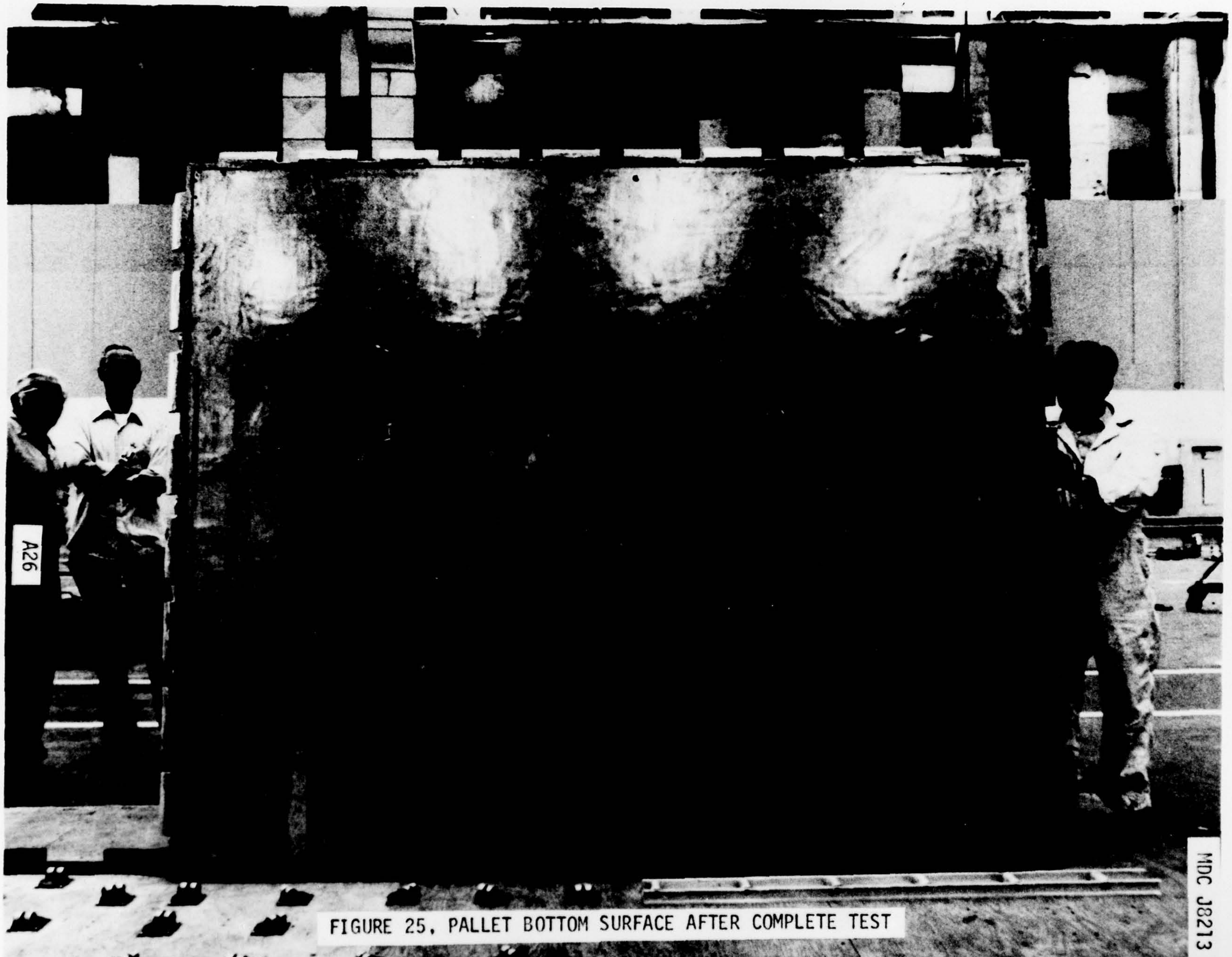


FIGURE 25. PALLET BOTTOM SURFACE AFTER COMPLETE TEST

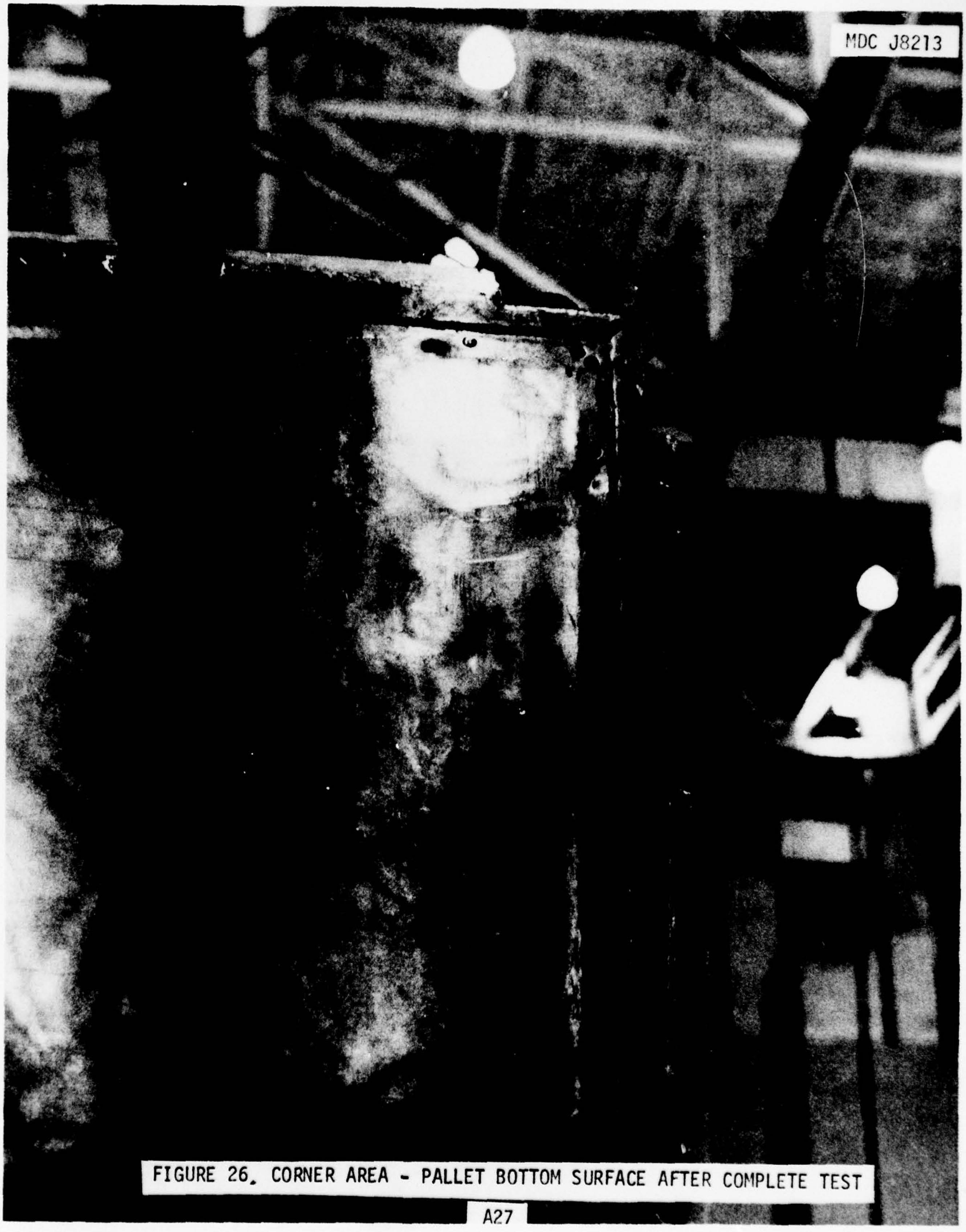


FIGURE 26. CORNER AREA - PALLET BOTTOM SURFACE AFTER COMPLETE TEST

APPENDIX B
WORKSHEETS OF CARGO
MOCK-UP TEST

KC-10 CARGO SYS
MOCK-UP TEST

(JUNE 18, '79):

TEST RUN	PALLET CONFIG.	PALLET LOAD, LB.	CYCLES	
1 R.S	SINGLE	5000	45	LATERAL TRACKING SOMETIMES DRIFTS
				AT 10 CYCLES, PHOTO #2 ROLLER AT 27 " " " " (SCRUB MAR
2 R.S	SINGLE	10,000	5	AT 3 CYC, PHOTO #5 ROLLER
3 L.S	SINGLE	5000	45	AT 11 CYC, PHOTO # "
4 L.S	"	10000	5	
5 L.S. ROTATED	SINGLE	5000	20	PHOTO - PALLET PARTIALLY ROTATED
6 L.S. ROTATED	"	10000	5	2ND CYCLE: #4 ROLLER PUSHED OFF OF CAM. #4 AND #2 HAD ONE INSTL BOLT MISSING. ALL ROLLERS WERE MISSING WOOD SCREWS ATTACHING MOUNTING PLATE TO PLYWOOD. #4 HAD BENT FRAME; WOULD NOT ERECT WHEN DRIVEN TO R.S. FRAME REPLACED.
7 R.S.	COUPLED	6000/6000	10	COUPLED ON 108" EDGE. NO ROTATION. GOOD TRACKING. VERY LITTLE MANUAL ASSIST
(JUNE 19, '79):				
8 R.S	COUPLED	2000/2000	75	" " " "
				AFTER 24 CYC, PHOTO PAIRS OF ROLLERS AT COMPLETION, NO CHANGE IN CONDITION OF ROLLERS.
9 L.S. ROTATED	COUPLED	2000/4000	10	COUPLED ON 108" EDGE; ROTATE TO L.S.
10 R.S. ROTATED	COUPLED	2000/4000	10	COUPLED ON 88" EDGE; ROTATE TO R.H. #5 ROLLER LOST CHIP OF TREAD — APPROX $\frac{11}{16} \times \frac{9}{16}$, $\frac{5}{32}$ DEEP AT DEEPEST POI
11 L.S. ROTATED	COUPLED	4000/6000	3	COUPLED ON 108" SIDE; ROTATE TO L.S.
12 L.S. ROTATED	COUPLED	4000/6000	3	COUPLED ON 88" SIDE; ROTATE TO L.S.

PHOTO 8 ROLLERS, 2 ROLLERS PER PHOTO.
ROTATED ROLLERS 4 & 5; TAKE O'ALL PHOTOS.

WORKSHEET
30-103V (9-43)

KC-10 CARGO SYS MOCK-UP TEST

MDC J8213

(JUNE 20, '79)

ROLLERS 4 & 5 ROTATED 90° CW

TEST RUN	PALLET CONFIG.	PALLET LOAD, LB	CYCLES	
13 R.S. ROTATE	COUPLED	4000/4200	1	COUPLED ON 88" SIDE; ROTATE TO R.S. REQUIRED CONSIDERABLE MANUAL
				ASSIST. NOT AS WORKABLE AS ORIGINAL ROLLER ARRANGE'T.
14 L.S. ROTATE	COUPLED	4000/4200	1	COUPLED ON 108" SIDE; ROTATE TO L.S. APPROX. SAME DEGREE OF DIFFICULTY AS
				ORIG'L ROLLER LAYOUT, EXCEPT THAT MORE SWITCHING DEXTERITY REQ'D OF
				OPERATOR. ROLLER 5 WAS GOUGED — 2 CIRCUMFERENTIAL GOUGES.
15 R.S.	COUPLED	4000/4200	1	COUPLED 108" SIDE. TO R.S., NO ROTAT'N ON EXIT FROM AIRPLANE, R.S. END
				ROTATED FWD. NEEDED MANUAL RE-ALIGN ON DOORWAY
16 R.S.	SINGLE	5000	1	NO ROTATION INTENDED. APPROX. 30° ROTATION GOING IN, 75° ON EXIT. MANUAL ASSIST
17 L.S.	"	5000	2	NO ROTATION INTENDED. APPROX. 10° ROTATION ON EXIT.
18 L.S. ROTATED	"	5000	1	GOOD ROTATION, BUT CONTROL IS INADEQUATE
19 R.S.	"	5000	1	AFT TRANSLATION BY ROLLER #4. PRODUCES SLOW ROTATION CCW
20 R.S.	"	10,000	1	STRAIGHT IN, BUT ROTATED 20° CW BEFORE R.S. RAIL CONTACTED.
				45° ROTATION ON EXIT AT TIME PALLET GOT TO ℄ AIRPLANE. PHOTO
21 L.S. ROTATE	SINGLE	10,000	1	GOOD ROTATION BUT INADEQUATE CONTROL. NO ACCURACY OF POSITION.
				PHOTO
	PHOTO ROLLERS 1	THRU 6		
		TOTAL 246 CYCLES		
				TREAD WEAR WAS MEASURED ON SEVERAL ROLLERS AND FOUND
				TO BE WITHIN .000 AND .020 IN.

APPENDIX C
KC-10A PALLET STUDY

KC-10A PALLET STUDY

1.0 PROBLEM

Determine a spectrum of pallet loads single and coupled, that are likely to be carried aboard the KC-10A during it's 20 year life span. These data will be utilized for the testing of the Cargo Loading Modkup. The objective is to simulate representative cargo operations on the Cargo Loading Mockup to evaluate wear on the powered rollers.

2.0 STUDY APPROACH

The primary mission of the KC-10A is as a tanker aircraft. The accommodation for cargo is considered secondary but an important role.

To determine the number and character of single and coupled pallet loads carried during the KC-10A life time, the following must be known:

1. Type of cargo mission to be flown.
2. Number of cargo missions by type of mission over the 20 year life span.
3. Type of cargo carried on these missions.
4. Determine from the type of cargo the number of single and coupled pallets required for airlift.
5. Determine the approximate weight of these single and coupled pallets.

3.0 STUDY APPROACH AND ASSUMPTIONS

The following assumptions were used in this study:

3.1 TYPE OF CARGO MISSIONS

The only information available for the type of mission the KC-10A will be flying is defined by the mission profiles described in the Statement of Work Appendix II. Although it has been recommended that these mission profiles be only used for Life-Cycle costs, the objectives of this study are to determine the wearability of the powered rollers. Therefore, these mission profiles are applicable for this study. Attachment I of this study contains these KC-10A mission profiles.

Three of the ten mission profiles are defined as cargo carrying mission: Mission number 2-TAF DEPLOYMENT/REDEPLOYMENT with 33,756 pounds ACL (allowable cabin load) available, Mission number 3-CARGO TRAINING with 76,000 pounds ACL available, and Mission number 5-CONTINGENCY CARGO with 171,508 pounds of ACL available.

3.2 NUMBER OF CARGO MISSIONS

USAF letter number YT(78-1-8) dated 1 March 1978 indicated that the ATCA annual basic utilization rate was 540 hours per aircraft with the potential surges and contingencies raising the rate to 1200 hours per year per aircraft. This letter is attached as Attachment 2 of this study.

The 540 hour utilization rate is assummed to be peace time and the 1200 hour rate as surge (wartime) rate.

The following assumption is made - During the 20 year time span the KC-10A will fly 5 years at the surge rate (1200 hr/year) and 15 years at the peace-time rate (540 hr/year).

Table 1 was derived to show the total number of missions by profile over the 20 years.

Results indicate that 213 missions (flights) for profile No. 2 would be flown during the 20 years. This was derived as follows:

Peace time —

81 flights/year X 10% flights are profile #2 X 15 years = 122 flights

Surge —

181 flights/year X 10% flights are profile #2 X 5 years = 91 flights

Total flights = 122 + 91 = 213

TABLE I

ATCA MISSION PROFILES

MISSION NUMBER	MISSION PROFILE	FLIGHT TIME (HOURS)	GROUND TIME (HOURS)	PERCENT FLOWN	CARGO MISSIONS ACL AVAILABLE	TOTAL PEACE-TIME MISSIONS FOR 15 YEARS	TOTAL SURGE MISSIONS FOR 5 YEARS	TOTAL MISSIONS FOR 20 YEARS
1	TAF EMPLOYMENT	7.10	.58	2	-	24	18	42
2	TAF DEPLOYMENT/REDEPLOYMENT	7.33	.58	10	33,756 lb	122	91	213
3	CARGO TRAINING	4.73	.58	1	76,000 lb	12	9	21
4	MAC LONG HAUL AND/OR TRAINING	5.5	.58	30	-	366	272	638
5	CONTINGENCY CARGO	11.62	.58	1	171,508 lb	12	9	21
6	B-52 TRAINING	5.80	.58	6	-	73	54	127
7	B-52 CONTINGENCY (TWO B-52S)	6.82	.58	1	-	12	9	21
8	FIGHTER TRAINING (LOW ALT. 160-220)	5.97	.58	1	-	12	9	21
9	FIGHTER TRAINING (MED. ALT. 260-310)	6.97	.58	40	-	488	362	850
10	FIGHTER TRAINING (MED ALT 260-310) & KC-10A REFUELING TRAINING	8.50	.58	8	-	98	72	170
TOTALS PER 100 FLIGHTS		663	58	100				
YEAR TOTALS BASED ON 540 FLIGHT HOURS PER YEAR		540	47	81.4				
YEAR TOTALS BASED ON 1200 FLIGHT HOURS PER YEAR		1200	105	181				
			TOTAL NUMBER OF FLIGHTS OVER 20 YEARS			1219	905	2124

Using the same formula for profiles No. 3 and 5, except using 1%, results in a total of 21 flights each.

3.3 TYPE OF CARGO CARRIED BY MISSION PROFILE

Mission profile Number 2 is defined as a TAF (Tactical Air Force) Deployment/Redeployment. This mission envolves the deployment of a fighter/interceptor squadron including the squadron's support equipment. The KC-10A will refuel aircraft as well as carry cargo. The available ACL is 33,756 pounds. The F-15 squadron has been selected for this mission profile.

Mission profile Number 3 is defined as a Cargo Training mission. This mission is assumed to be a normal channel cargo operation transporting palletized cargo from one Air Force base to another. The palletized cargo includes single and coupled pallets. Available ACL is 76,000 pounds.

Mission profile number 5 is defined as a contingency cargo mission. This mission is assumed to be an emergency cargo mission, such as the resupply of ammunition. Available ACL is 171,598 pounds.

3.4 DETERMINE PALLET REQUIREMENTS FOR THE THREE CARGO MISSION PROFILES

This section determines the number of pallets that will be loaded aboard the KC-10A for each type of mission profile during the 20 years.

3.4.1 TAF Deployment/Redeployment Mission Profile

The F-15 squadron's support equipment consist of 198 single items weighing 573,367 lbs. Attachment 3 contains the list of these 198 items sorted by NSN (National Stock Number).

An assumption was made that all equipment would be pre-loaded on 463L pallets before loading into the KC-10A.

Each item on the list was reviewed to determine if a single or double pallet was required for loading. When possible small items were grouped together on a single pallet. However, a complete study to utilize all of the stacking surface on the pallet was not done. The 198 items results in requiring 94 single pallets and 84 coupled pallets.

A number of items which are loaded on coupled pallets are too long for loading across the aircraft and must be rotated through the cargo door. Figure 1 shows the maximum length of cargo, versus height, that can be loaded without rotation. This figure represents the maximum contours for 463L pallets in the KC-10A. The six inch clearance rule was used to determine if rotation was required.

Table II lists the 18 items which must be rotated through the cargo door. The first 5 items in the table are towbars, which are very long, but weigh only 415 pounds each. These items can be loaded manually rather than using the powered roller systems.

For the F15 squadron the total pallet requirements are:

94 - SINGLE PALLETS
84 - COUPLED PALLETS:
- 66 - NO ROTATION REQUIRED
- 13 - ROTATION REQUIRED
- 5 - MANUAL ROTATION

These single and coupled pallets represent 262 pallet position for loading in the KC-10A (94 + (84 X 2) = 262).

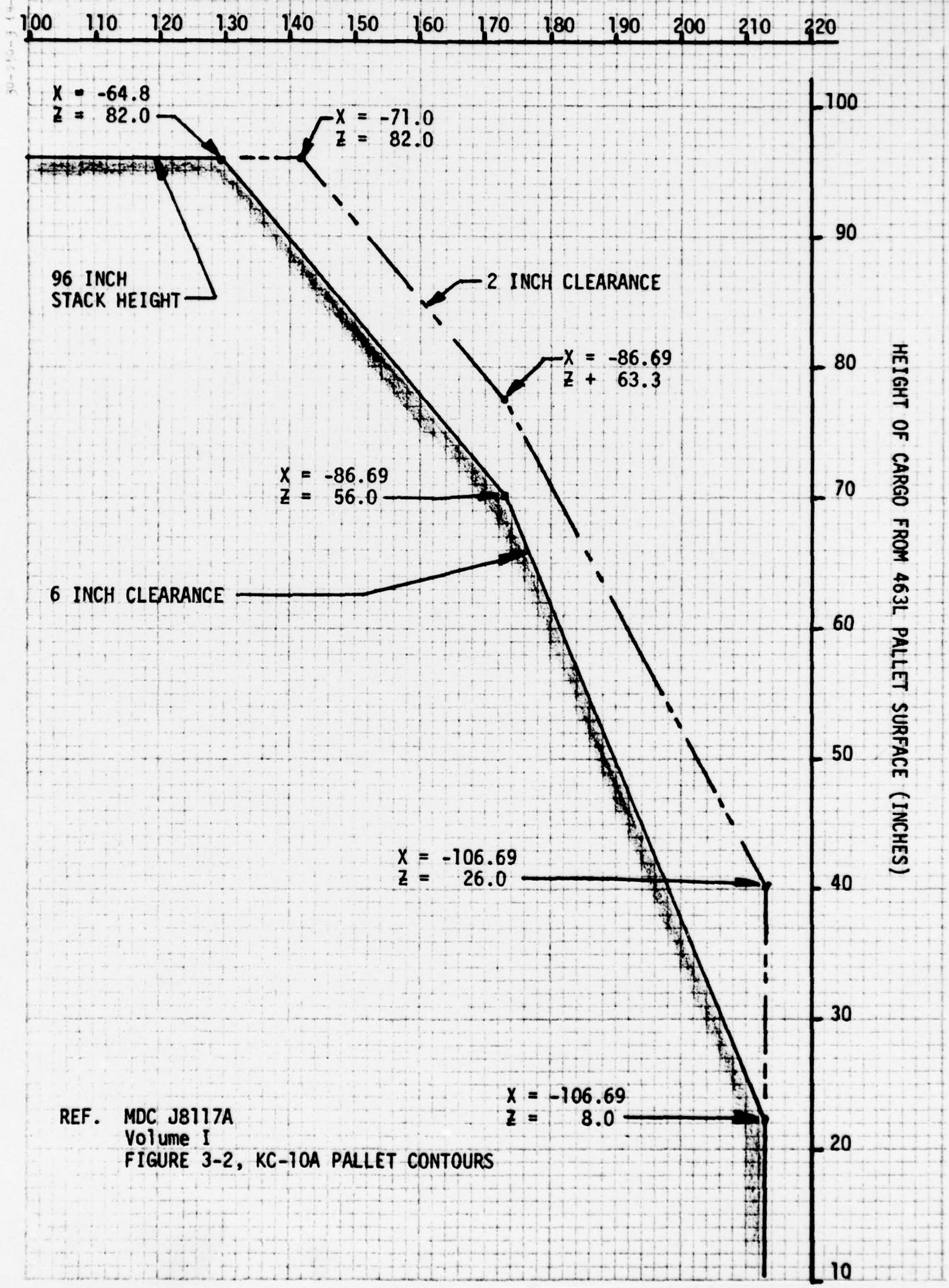
The configuration of the KC-10A during a TAF deployment/redeployment will either be the 23 pallet/20 passenger mixed configuration or the 27 pallet all cargo configuration. The total number of KC-10A's required to carry the 262 pallet positions are:

23 Pallet System:

$$\frac{262}{23} = 11.4 \text{ or } 12 \text{ KC-10's}$$

FIGURE I

MAXIMUM LENGTH OF CARGO LOADABLE WITHOUT ROTATION (INCHES)
(LOADED SYMMETRICALLY ABOUT CENTERLINE)



REF. MDC J8117A
Volume I
FIGURE 3-2, KC-10A PALLET CONTOURS

TABLE II - F15 SQUADRON

ITEMS WHICH REQUIRE ROTATION THROUGH THE CARGO DOOR

NO.	NSN	NOMENCLATURE	L	W	H	WT
S009	1730-00-640-8080	TOWBAR A/C	296	57	30	415
S031	1730-00-640-8080	TOWBAR A/C	296	57	30	415
S032	1730-00-640-8080	TOWBAR A/C	296	57	30	415
T016	1730-00-640-8080	TOWBAR A/C	296	57	30	415
T197	1730-00-640-8080	TOWBAR A/C	296	57	30	415
E301	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T026	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T027	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T028	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T029	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T030	1740-00-713-5908	TRL 3000 W/F15 ENG	216	60	89	4360
T303	1740-00-713-5908	TRL 3000 W/O ENG	152	58	89	1360
T019	1740-00-713-5908	TRL 3000 W/O ENG	152	58	89	1360
S043	2330-L0-021-3648	TANK DOLLY	228	88	47	863
S044	2330-L0-021-3648	TANK DOLLY	228	88	47	863
T214	4920-00-438-3812	M37 THRUST TRL	201	64	85	5490
T215	4920-00-438-3812	M37 FUEL TK TLR	192	97	96	5360
T184	3990-00-820-9890	463L PALLET TRAIN	176	108	84	9910

DIMENSIONS IN INCHES AND WEIGHT IN POUNDS

27 Pallet System:

$$\frac{262}{27} = 9.7 \text{ or } 10 \text{ KC-10's}$$

However, the limiting factor for carring the TAF support equipment is ACL,

$$\frac{573{,}367 \text{ (lb.) total weight of items}}{33{,}756 \text{ lb. ACL}} = 16.9 \text{ or } 17 \text{ KC-10's}$$

To determine the average number of pallets per KC-10, divide the total number of pallets type by the total number of KC-10's required to carry the equipment.

Single Pallets = 94

$$\frac{94}{17} = 5.53 \text{ Pallets/KC-10}$$

Coupled Pallets (no rotation required)

$$\frac{66}{17} = 3.88 \text{ Pallets/KC-10}$$

Coupled Pallets (rotation required)

$$\frac{13}{17} = 0.76 \text{ Pallets/KC-10}$$

Coupled Pallets (manual rotation)

$$\frac{5}{17} = 0.29 \text{ Pallets/KC-10}$$

To determine the total number of pallets by loading configuration that will be loaded during the 20 year life span, multiply the pallets by the total number of sorties each KC-10 will experience during the 20 years. The total number of sortie/KC-10 is 213 for the 20 years.

This results in the following:

TAF DEPLOYMENT/REDEPLOYMENT MISSION PROFILE

Total number of single pallets = 213 X 5.53 = 1178

Total number of coupled pallets (no rotation) = 213 X 3.88 = 826

Total number of coupled pallets (rotation required) = 213 X 0.76 = 162

Total number of coupled pallets (manual rotation) = 213 X 0.29 = 62

3.4.2 Cargo Training Mission Profile

This mission involves the accommodation of 463L pallets in a normal cargo operation. The preloaded 463L pallets assigned to the nine types of fighter/interceptor squadrons were used to represent the 463L pallet world.

These are 442 pallets listed in the nine squadrons, 18 of these pallets are coupled pallets or 4% of the total.

The configuration of the KC-10A for a cargo training mission is assumed to be the 23 pallet system (delivery configuration).

The total number of coupled pallets per aircraft is 4% of 23 pallets or 0.92 coupled pallets/KC-10. The total number of single pallets is 23 X 96% = 21.08 pallets/KC-10.

The KC-10 will fly 21 cargo training missions during its 20 year life span. Therefore the total number of pallets loaded will be:

Coupled Pallets:

21 X 0.92 = 19 pallets/KC-10A

Single Pallets:

21 X 21.08 = 444 pallets/KC-10A

3.4.3 Contingency Cargo Mission Profile

This mission involves the carring of ammunition loaded on single 463L pallets.

The KC-10A pallet configuration will be the 27 pallet all cargo configuration where 11 pallets must be rotated 90 degrees for loading on the left side of the aircraft and 16 pallets require no rotation.

Total number of pallets loaded in the 21 KC-10's during the 20 years are:

Single Pallets (rotation required):
21 X 11 = 231 pallets/KC-10A

Single Pallets (no rotation):
21 X 16 = 336 pallets/KC-10A

3.4.4 Determine Approximate Weight of Pallets

SINGLE PALLETS (NO ROTATION)
Figure 2 show a distribution of 463L pallet net weight from a previous Douglas study. The pallet weights range from 300 pounds to 9700 pounds with the average net weights at 4661 pounds. When adding the tare weight of 354 pounds (nets and pallet) to these values, the average weight is 5,015 pounds and the minimum weight 6.54 pounds and 10,054 pounds maximum weight. The weight distribution between 1000 and 8500 pounds is fairly uniform.

For test purposes for the cargo loading mockup, the weights selected for a single pallet are 90% at 5,000 pounds and 10% at 10,000 pounds. These values represent higher weights in comparison to distribution represented in Figure 2, but simplify testing setup. These values will be used for single pallets where no rotation is required.

SINGLE PALLETS (ROTATION REQUIRED)
The single pallets selected are loaded with ammunition. Douglas conducted a CRAD study in 1975 which investigated Army ammunition resupply characteristics. From this study, it was estimated that 25% of the pallets would weigh approximately 10,000 pounds and the remaining 75%,5000 pounds.

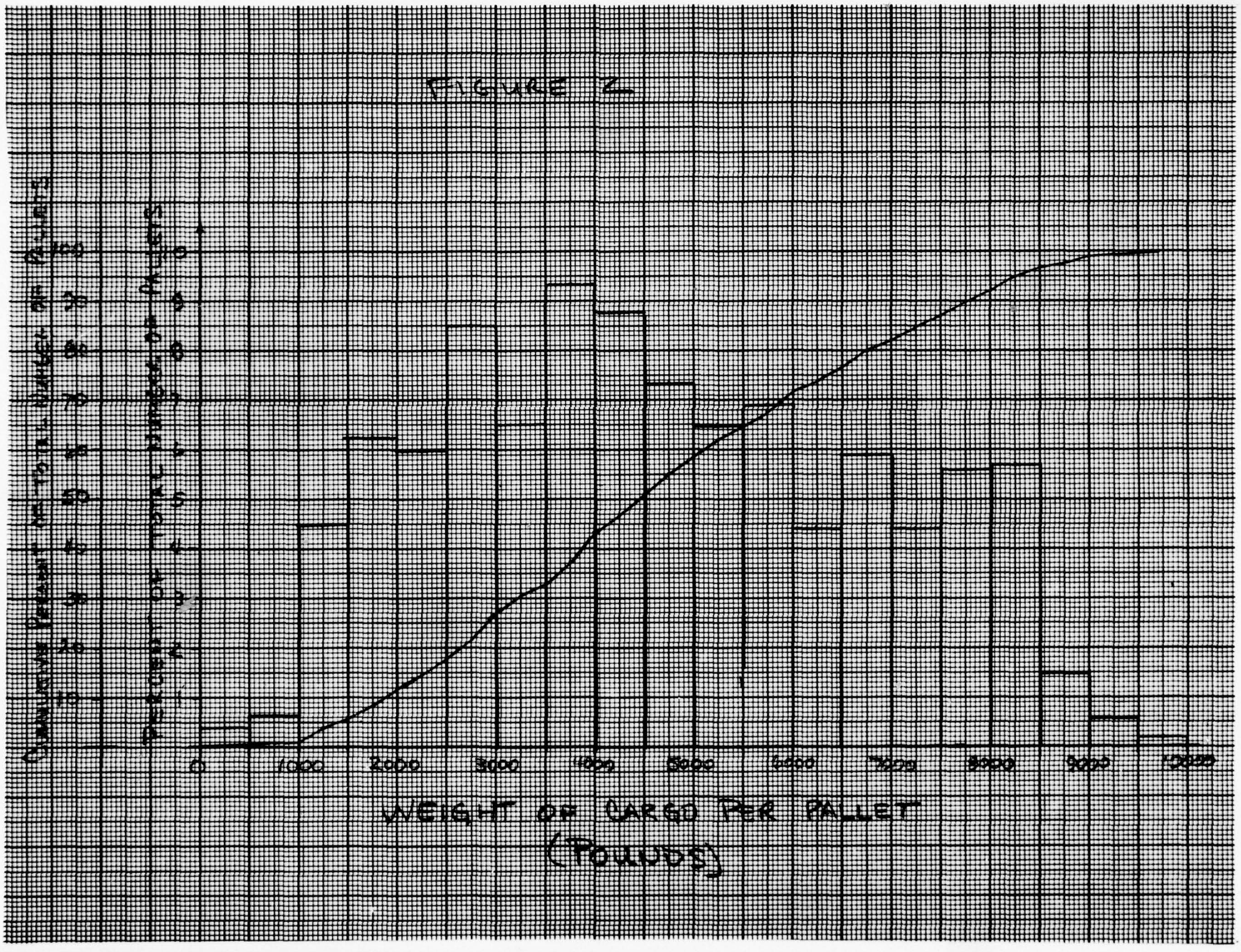


FIGURE 2
CUMULATIVE PERCENT OF TOTAL NUMBER OF PALLETS
10
20
30
40
50
60
70
80
90
100
PERCENT OF TOTAL NUMBER OF PALLETS
1
2
3
4
5
6
7
8
9
10
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
WEIGHT OF CARGO PER PALLET
(POUNDS)

COUPLED PALLETS (NO ROTATION)

Coupled pallets are used to accommodate wheeled vehicles and equipment. Reviewing the weights of the items, which are not rotated, the weights for 10% of the pallets is 12,000 pounds (6000 pounds per pallet) and 4000 pounds (2000 pounds per pallet) for the remaining 90%.

COUPLED PALLETS (ROTATION REQUIRED)

Coupled pallets which require rotation consist primarily of aircraft engines on transportation trailers. The weight of these items are not evenly distributed on the coupled pallets. The weights have been estimated to be 6000 pounds (4000/2000 pounds) for 80% of the pallets and 10,000 pounds (6000/4000 pounds) for 20% of the pallets. These weights apply for coupling on the 88 or 108 inch dimension of the pallet.

3.5 SUMMARY OF PALLET LOADING REQUIREMENT FOR THE KC-10A DURING 20 YEARS

Table III list the summary of pallet loadings for the three mission profiles over a 20 year time span for each KC-10A. Included are the estimated weights for the pallets.

TABLE III

SUMMARY - PALLET STUDY

TOTAL NUMBER OF PALLET LOADING OVER A 20 YEAR SPAN (ASSUMED 5 YEARS AT THE SURGE RATE OF 1200 FLIGHT HOURS/YEAR AND 15 YEARS AT THE PEACE TIME RATE OF 540 FLIGHT HOURS/YEAR)

	MISSION #2 TAF DEPLOYMENT/ REDEPLOYMENT*	MISSION #3 CARGO TRAINING	MISSION #5 CONTINGENCY CARGO	TOTAL
SINGLE PALLETS NO ROTATION REQUIRED 90% @ 5000 LB., 10% @ 10,000 LB.	1178	444	336	1958
SINGLE PALLETS ROTATION REQUIRED 75% @ 5000 LB., 25% @ 10,000 LB.	-	-	231	231
COUPLED PALLETS 108 INCH DIMENSION NO ROTATION REQUIRED 90% @ 4000 LB. (2K/2K), 10% @ 12,000 LB. (6K/6K)	826	19	-	845
COUPLED PALLETS ROTATION REQUIRED				162
- 108 INCH DIMENSION 80% @ 6000 LB. (2K/4K), 20% @ 10,000 LB. (4K/6K)	81	-	-	
- 88 INCH DIMENSION 80% @ 6000 LB. (2K/4K), 20% @ 10,000 LB. (4K/6K)	81	-	-	
COUPLED PALLETS MANUAL ROTATION (415 LB. TOWBAR)	62	-	-	62

* ASSUMES TAF DEPLOYMENT EQUIPMENT IS PREPALLETIZED AND NOT LOADED ON A PALLET SUBFLOOR.

9/7/78

MEMORANDUM

MDC J8213
Attachment 1

TO: C. W. Andrews, C1-251

FROM: R. D. Dangaran, C1-253

SUBJECT: KC-10A MISSION PROFILES

COPIES:
K. Akamatsu, Avionics
F. G. Appleby, Project
K. M. Carpenter, Electrical
R. L. Clepper, Structures
D. L. Gibler, Project
J. J. Heffernan, Acoustics
R. W. Howard, Environmental
G. W. Johnson, Maintainability
R. E. McConnelly, ARB
W. L. Miles, Human Factors
O. J. Minnich, Interiors
J. A. Riccobono, Mechanical
G. A. Schlanert, Project
H. F. Winchester, Power Plant

Attached is a copy of the ten basic KC-10A mission profiles described in the Statement of Work Appendix II. The revised mission profile number 9R and the modified mission profile number 9A are also included. Mission profile number 9A describes the hose and reel refueling method to be used in the reliability allocations, assessments and analysis report.

These profiles describe operational characteristics that can be used in establishing design criteria and reliability analysis requirements. Timing of some events and the amount of time required to checkout and/or stow the refueling equipment were estimated based on the best available information at the time.

Comments and/or corrections to these profiles are solicited.

R. D. Dangaran

R. D. Dangaran
KC-10A Reliability & Safety

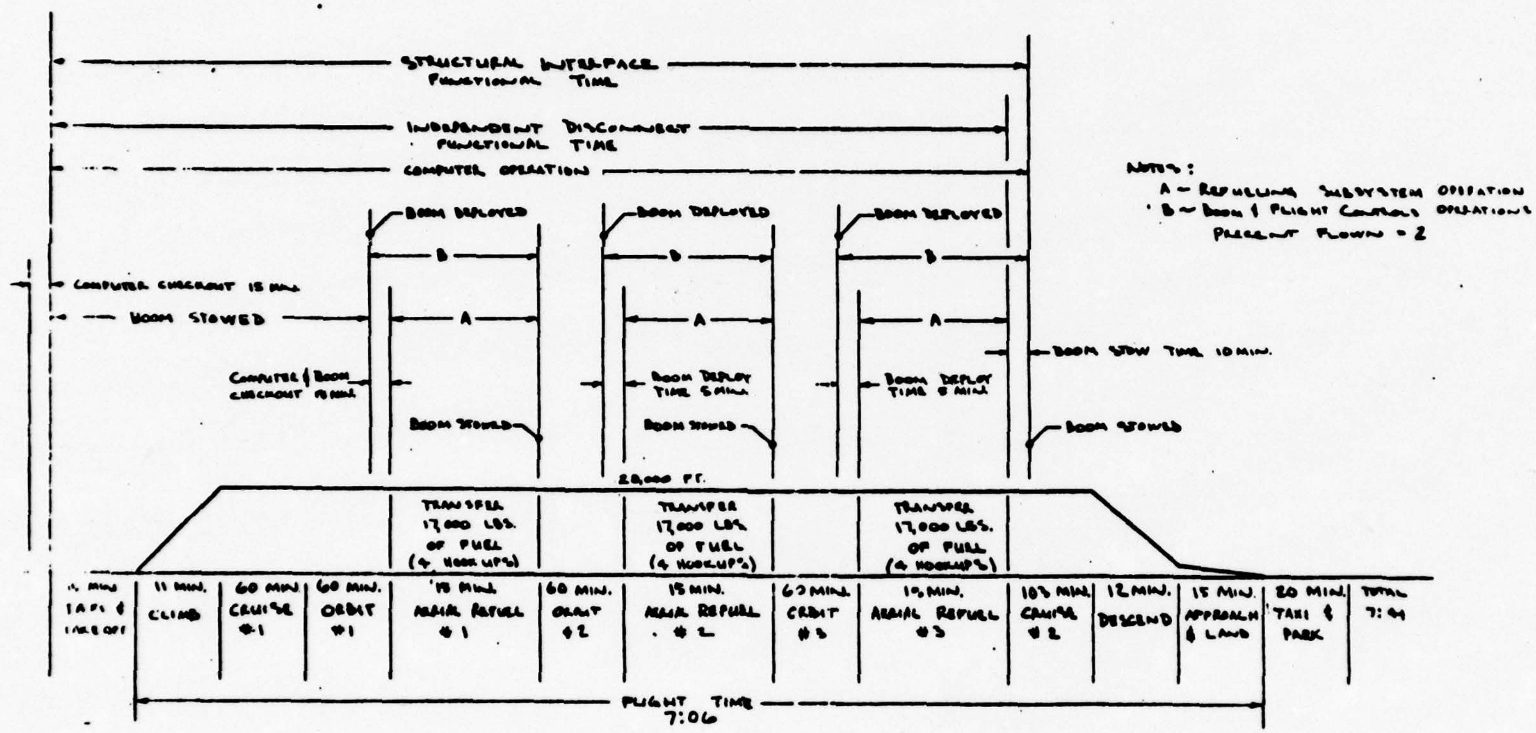
yd

attach.

9/7/78

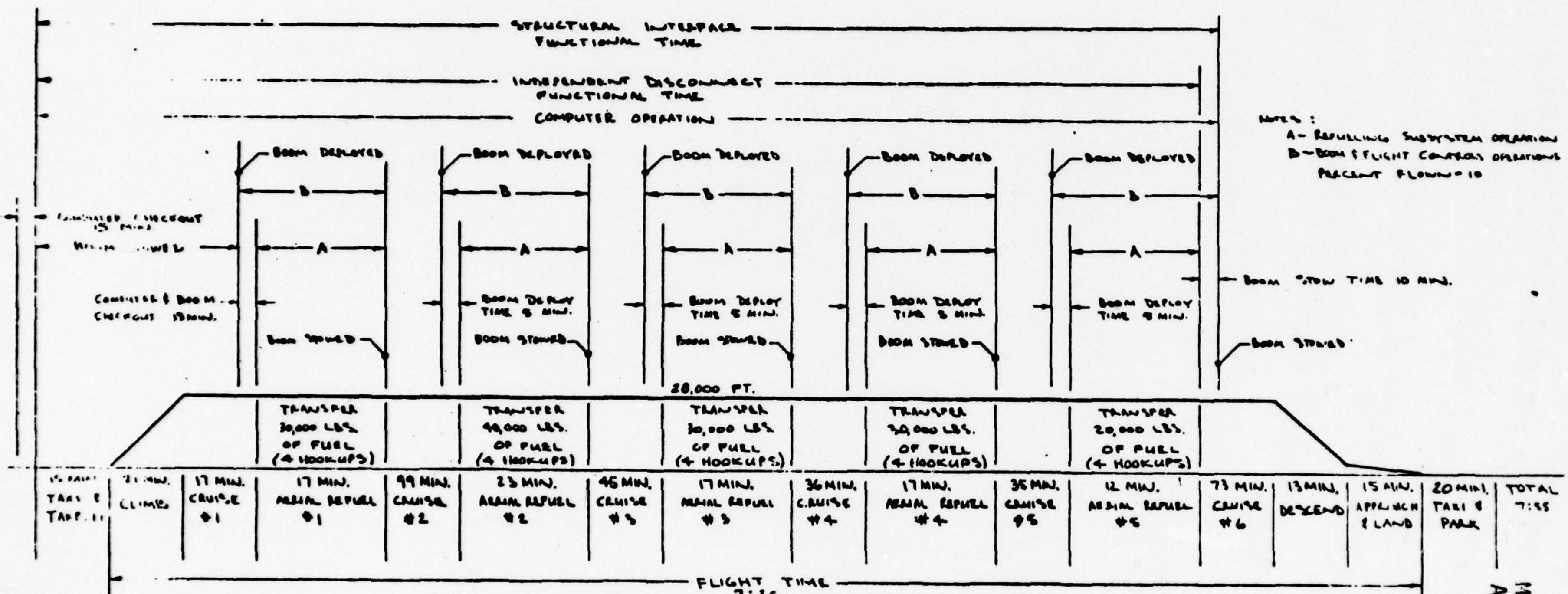
MISSION NUMBER	MISSION PROFILE	FLIGHT TIME (HOURS)	GROUND TIME (HOURS)	PERCENT FLOWN	NO. OF TOUCH & GO LANDINGS	NO. OF BOOM HOOKUPS	NO. OF UARRSI HOOKUPS	NO. OF HOSE HOOKUPS	FUEL OFFLOAD (POUNDS)	FUEL ONLOAD (POUNDS)	NO. OF BOOM DEPLOYMENTS (CYCLES)	NO. OF HOSE DEPLOYMENTS (CYCLES)	FUEL TRANSFER ONLOADING TIME (HOURS)	FUEL TRANSFER OFFLOADING TIME (HOURS)	*BOOM COMPUTER OPERATING TIME (HOURS)	BOOM FLT. CONT. OPERATING TIME (HOURS)	INDEPENDENT DISC. OPERATING TIME (HOURS)	STRUCTURAL INTERFACE TIME (HOURS)
1	TAC EMPLOYMENT	7.10	.58	2	0	12	0	0	51,000	0	3	0	0	.75	5.60	1.33	5.18	5.35
2	TAC DEPLOYMENT/ REDEPLOYMENT	7.33	.58	10	0	20	0	0	150,000	0	5	0	0	1.43	6.32	2.18	5.90	6.07
3	CARGO TRAINING	4.73	.58	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	MAC LONG HAUL AND/OR TRAINING	5.50	.58	30	5	3	0	0	95,000	0	1	0	0	.47	2.62	.88	2.20	2.37
5	CONTINGENCY CARGO	11.62	.58	1	0	0	1	0	0	136,418	0	0	.28	0	0	0	0	0
6	B-52 TRAINING	5.80	.58	6	3	12	0	0	50,000	0	2	0	0	1.50	4.10	2.00	3.68	3.85
7	B-52 CONTINGENCY TWO B-52s	6.82	.58	1	0	2	0	0	140,000	0	1	0	0	1.08	4.12	1.50	3.70	3.87
8	FIGHTER TRAINING (LOW ALTITUDE 160-220)	5.97	.58	1	3	24	0	0	80,000	0	2	0	0	1.50	4.20	2.00	3.78	3.95
9	FIGHTER TRAINING (MED. ALTITUDE 260-310)	6.97	.58	40	5	48	0	0	160,000	0	2	0	0	2.00	4.75	2.50	4.33	4.50
10	FIGHTER TRAINING (MED ALTITUDE 260-310) & KC-10A REFUELING TRAINING	8.50	.58	8	5	48	6	0	160,000	80,000	2	0	.75	2.00	4.73	2.50	4.32	4.48
TOTALS PER 100 FLIGHTS		663	58	100	411	2716	49	0	12652 K	776,418	197	0	6.28	137	414	180	320	389
YEAR TOTALS BASED ON 540 FLIGHT HOURS PER YEAR		540	47	81	335	2212	40	0	10305 K	632,377	160	0	5.11	112	337	152	261	317
	RELIABILITY MODIFIED MISSIONS																	
9R	FIGHTER TRAINING (BOOM) (MED. ALTITUDE 260-310)	6.97	.58	38.8	5	48	0	0	160,000	0	2	0	0	2.00	4.75	2.50	4.33	4.50
9A	FIGHTER TRAINING (HOSE) (MED ALTITUDE 260-310)	6.97	.58	1.2	5	0	0	43	120,000 (EST.)	0	0	2	0	2.00	0	0	0	4.50

* INCLUDES 15 MINUTES GROUND CHECKOUT TIME



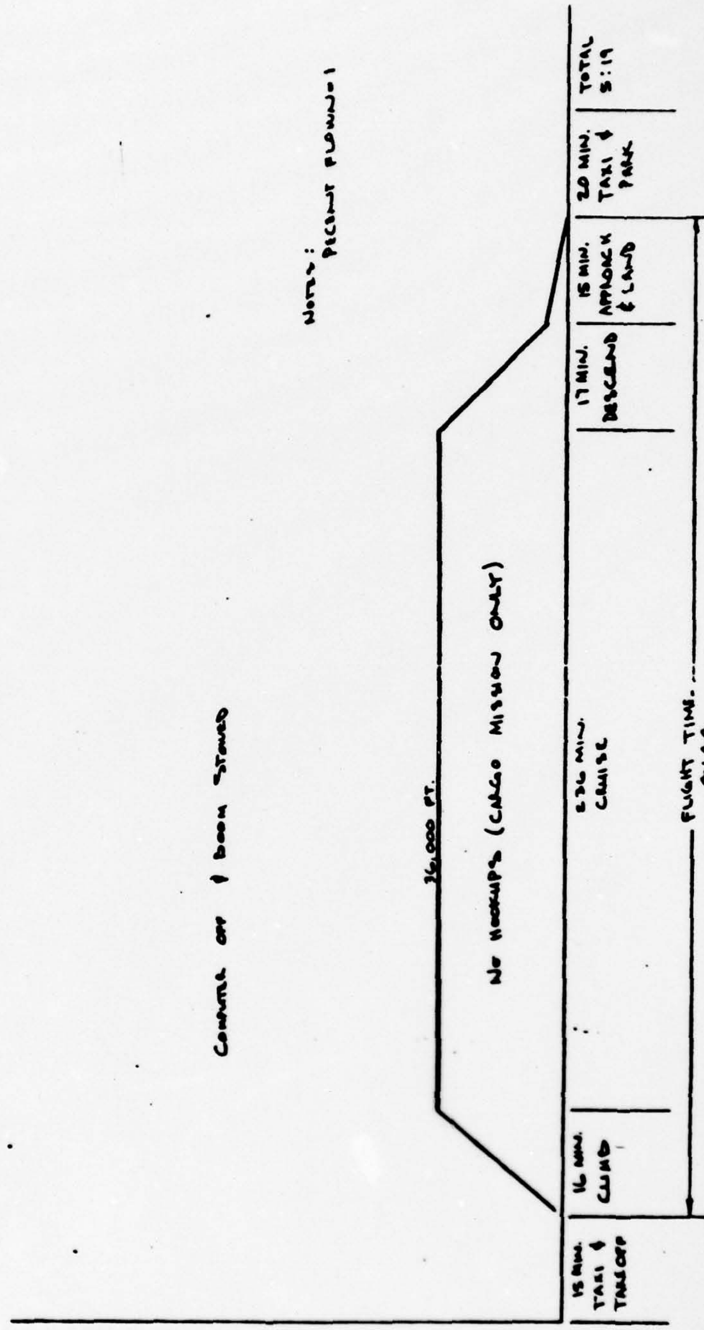
MISSION PROFILE NUMBER 1

TAC EMPLOYMENT



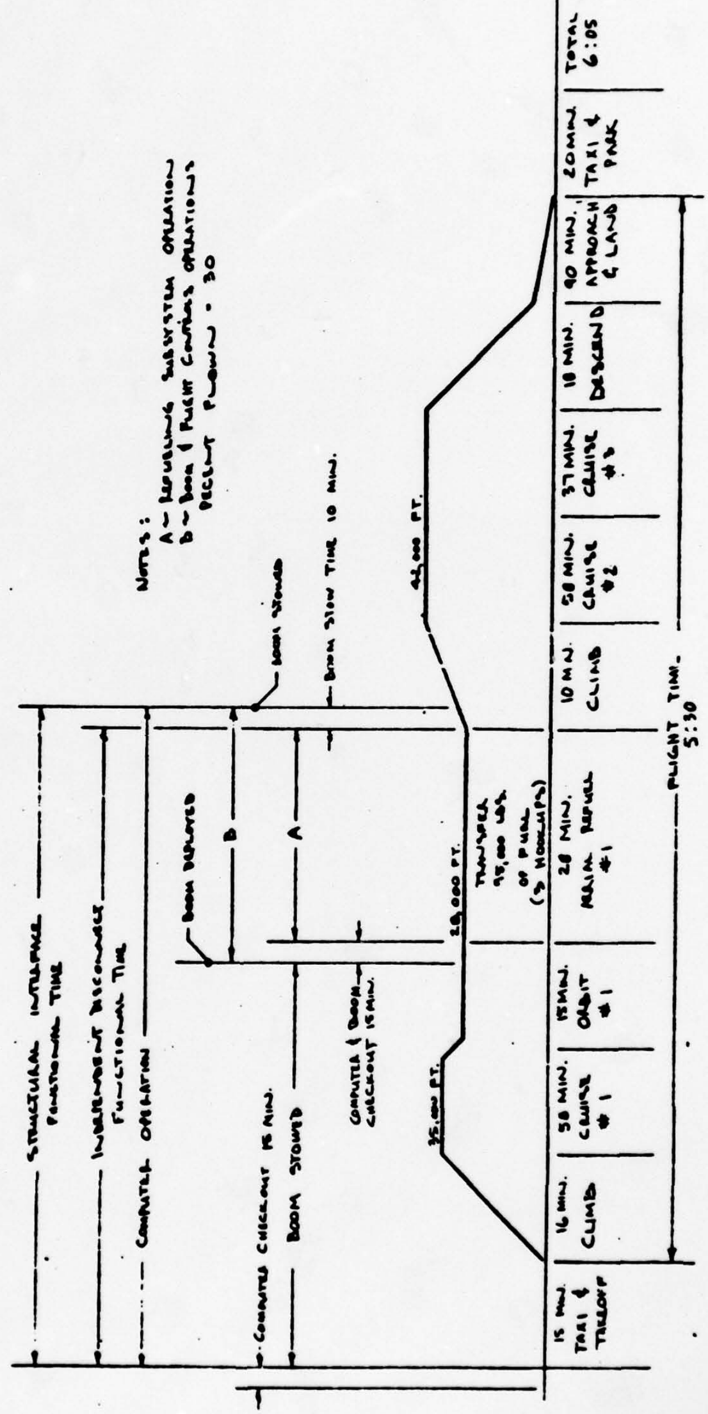
MISSION PROFILE NUMBER 2

TAC DEPLOYMENT / REDEPLOYMENT

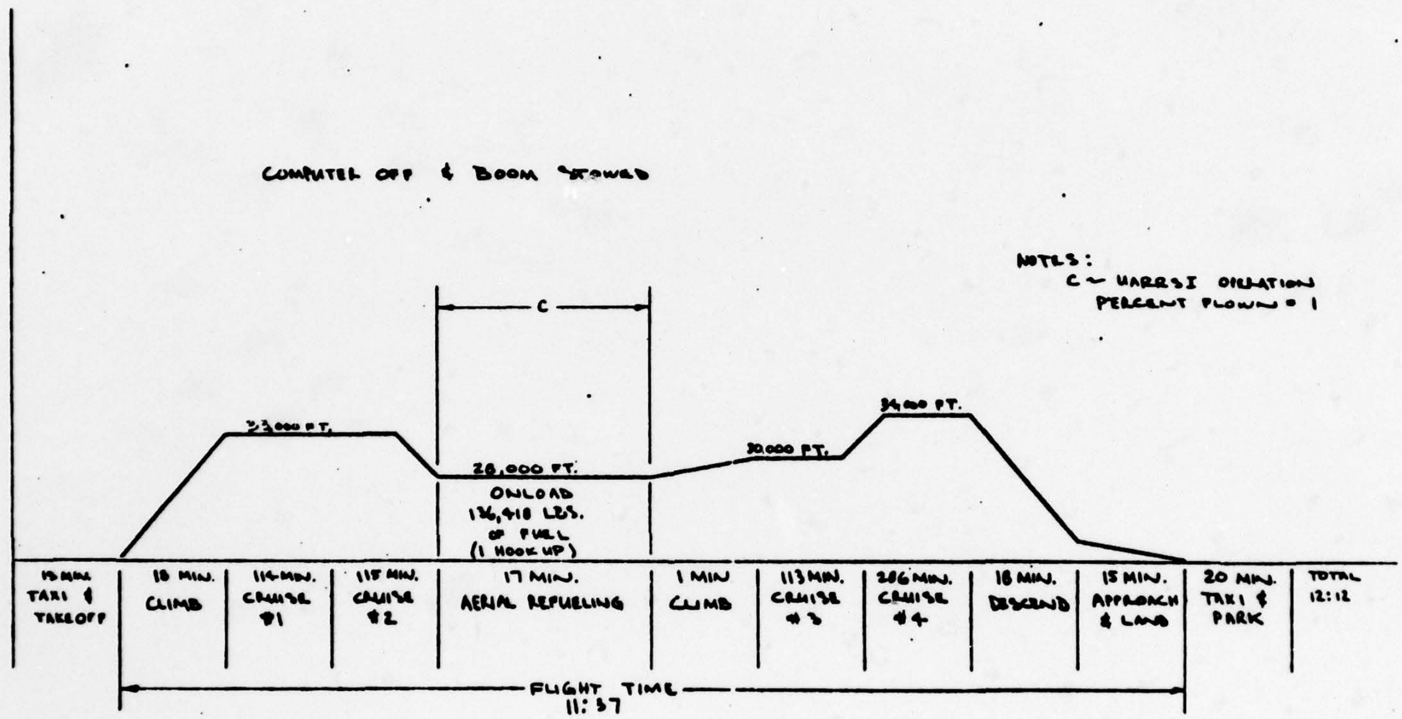


MISSION PROFILE NUMBER 3

CARGO TRAINING

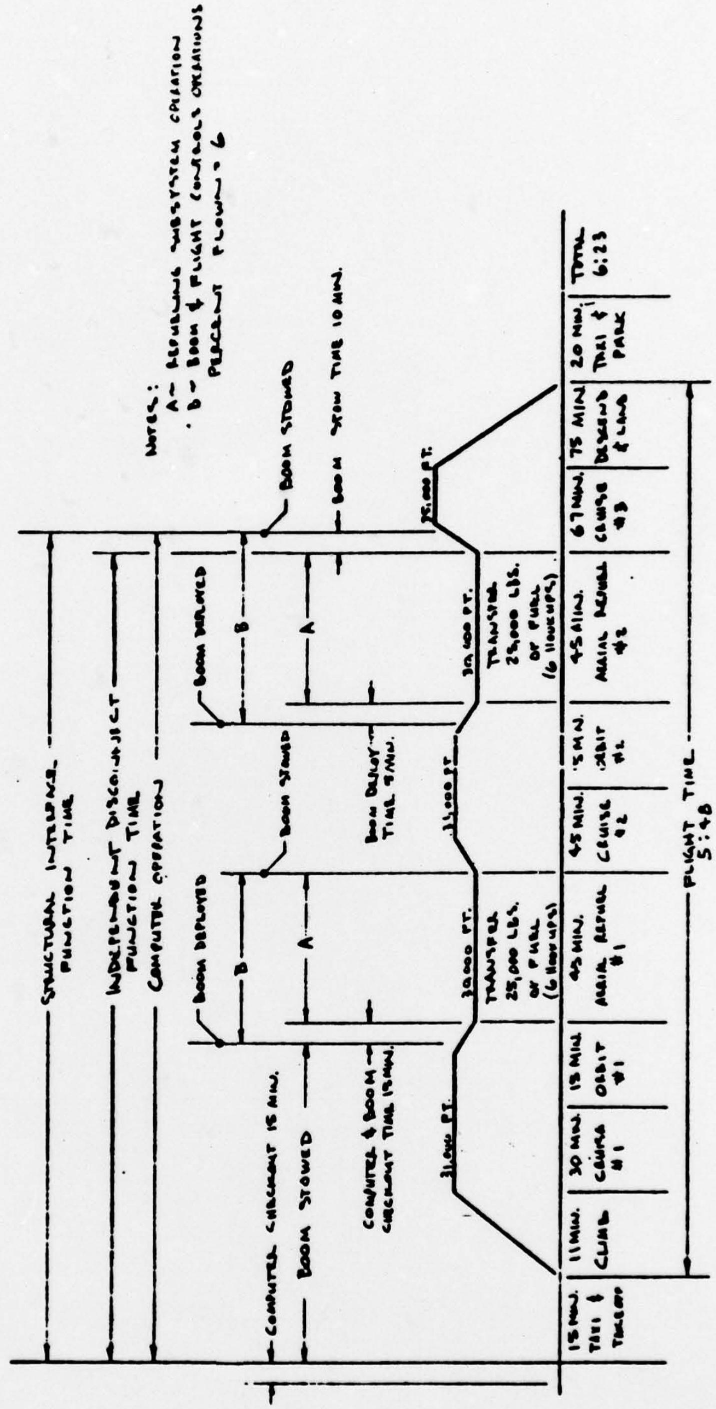


MISSION PROFILE NUMBER 4
MAC LONG HAUL AND/OR TRAINING



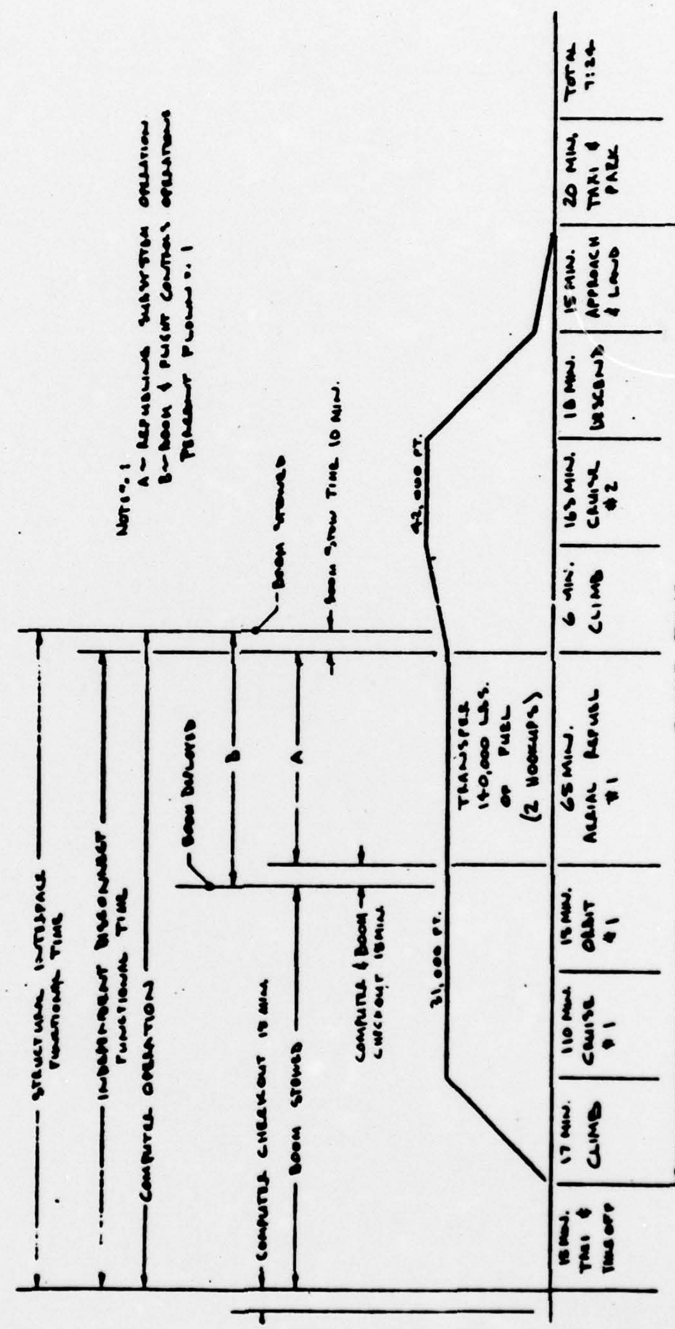
MISSION PROFILE NUMBER 5

CONTINGENCY CARGO



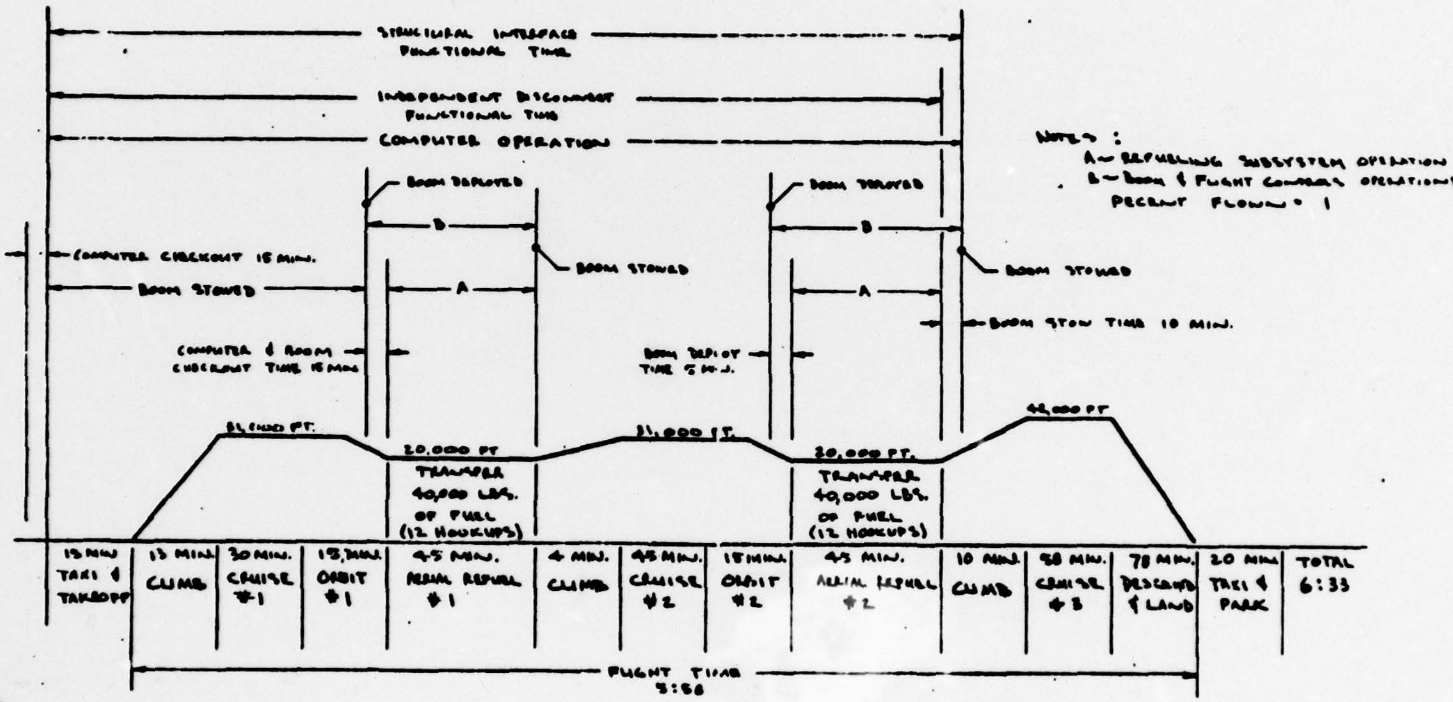
MISSION PROFILE NUMBER 6

B-52 TRAINING



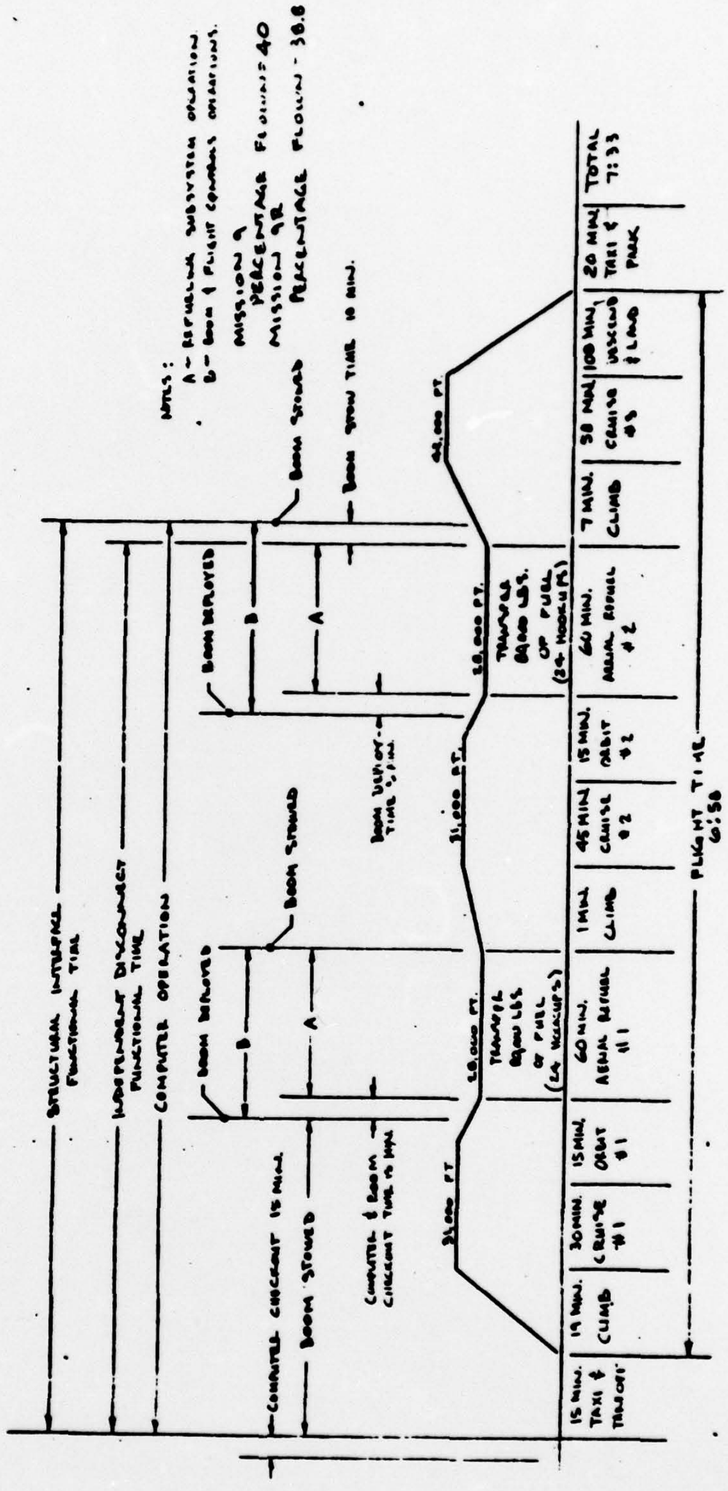
MISSION PROFILE NUMBER 7

B-52 CONTINGENCY (TWO B-52's)

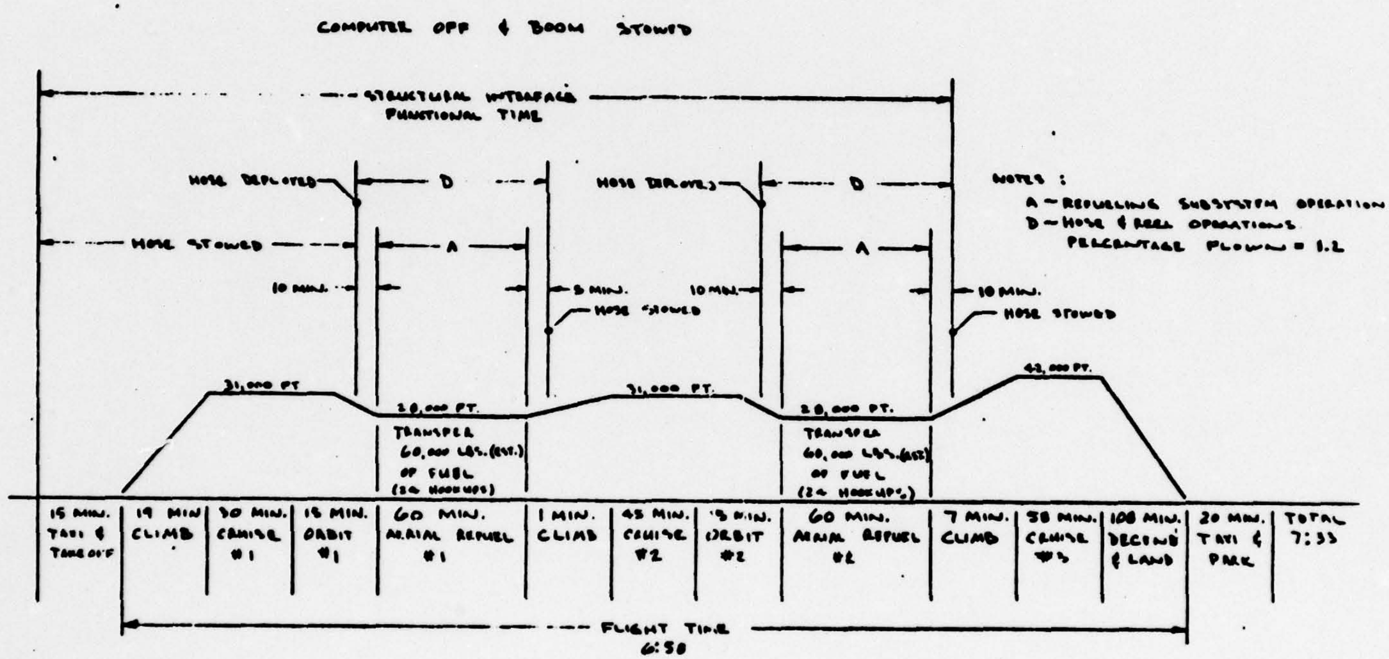


MISSION PROFILE NUMBER 8

FIGHTER TRAINING (LOW ALTITUDE 160-220)

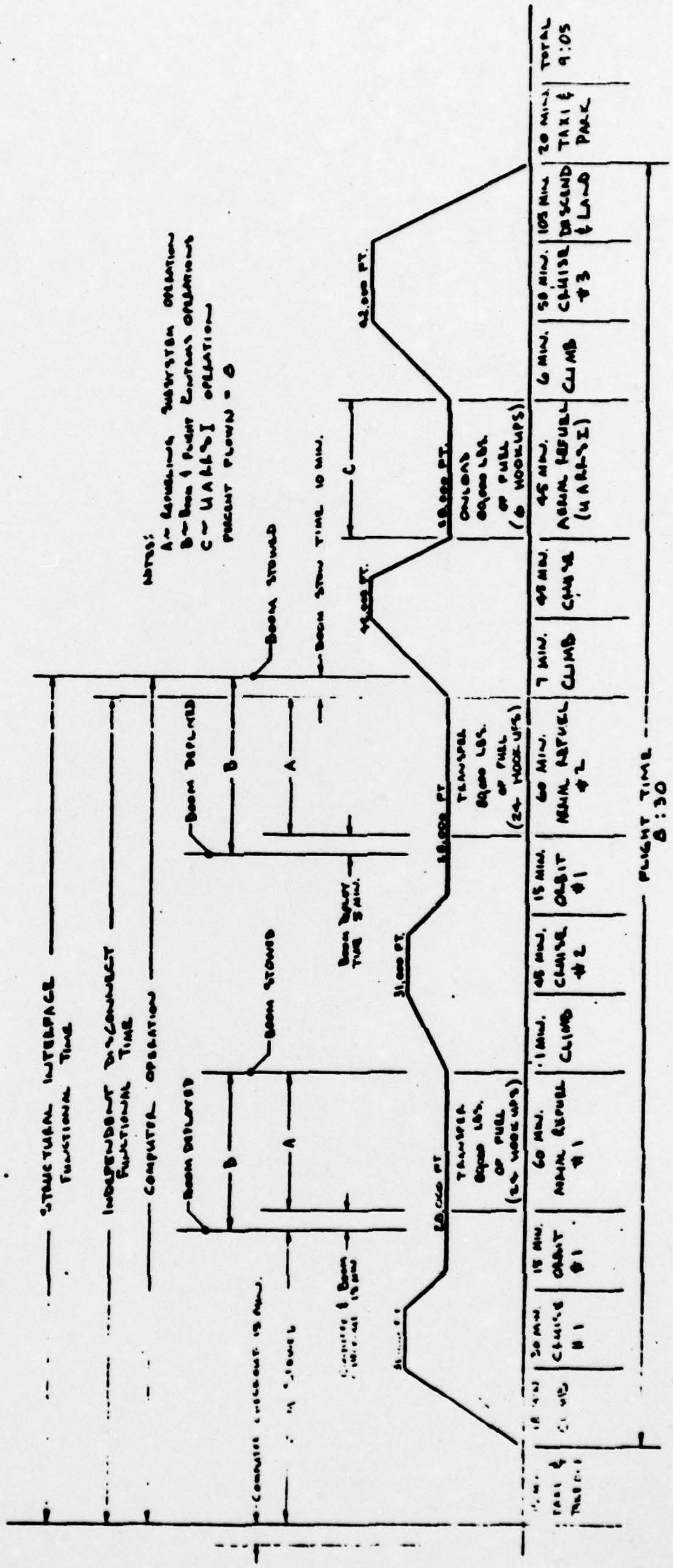


MISSION PROFILE NUMBER 9
FIGHTER TRAINING (MED ALTITUDE 260-310)



MISSION PROFILE NUMBER 9A

FIGHTER TRAINING (MED ALTITUDE 260-310)



MISSION PROFILE NUMBER 10
FIGHTER TRAINING & KC-10A REFUELING TRAINING
(MED ALTITUDE 260-310)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE ACQUISITION LOGISTICS DIVISION (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

11 MAR 1978

REPLY TO ATTN OF: YT (78-1-8)

CORRESPONDENCE
RECD MAR 10 ... AM

SUBJECT: ATCA Utilization Rate

CONTROL C1-304

End. 1 8 MAR 78
from: Naval Plant Rep. Office
To Douglas Aircraft Co., Long Beach, Calif.
For: Action indicated
☒ Information
☐ Action
☐ Reply Prior To

C. A. KJELLAND
By direction

TO: NAVPRO

Douglas Aircraft Company
Attn: Mr. G. D. Staffieri
Mail Station C1-241 (35-33)
3855 Lakewood Boulevard
Long Beach, California 90846

IN TURN

1. Per your request at the ATCA system review, 8 February 1978, the following information is provided.

2. Current Air Force planning is for an annual basic utilization rate of 540 hours per aircraft, plus surges and contingencies which may raise this rate to 1200 hours per year. Mission distribution shall be as specified in the statement of work, Appendix II. This planned utilization rate, however, shall not effect the specification requirement for a boom with a structural life of at least 30,000 hours (Ref ATCA Specification, Paragraph 03-80.01.00).

THOMAS E. BAHAN
Dep Prgm Mgr for Business
Dep for Advanced Tanker/Cargo Aircraft

RECEIVED
MAR 13 1978
ATCA
PROGRAM

RECEIVED
MAR 13 1978
RECEIVED
C1-250

CORRESPONDENCE CONTROL C1-303

Activity	Reply	Action	Comp	Info
Engineering				
Product Support				
Program C...				
...				✓
Contracts				✓
Quality ...				
...				✓
...				✓

01006

S = SINGLE PALLET
C = COUPLED PALLET

FIGHTER SQUADRON EQUIPMENT LISTING,NOV75

DATA SORTED BY NSN(MAJOR)AND SQUADRON TYPE(MINOR)

NO.	NAT'NL STOCK NO.	NOMENCLATURE	WEIGHT	CUBE	LEN	WTH	HGT	SQDN
S040	- - -	PALLET WOOD	894	15	48	40	14	F15 } S
T252	- - -	BOX WOOD	12	0	20	12	6	F15 } S
T253	- - -	BOX WOOD	15	0	15	9	12	F15 } S
T254	- - -	BOX WOOD	50	2	27	12	12	F15 } S
T255	- - -	BOX WOOD	50	0	14	11	9	F15 } S
E107	1730-00-003-9567	LADDER ACFT	40	22	109	19	19	F15 } S
E107	1730-00-003-9567	LADDER ACFT	40	22	109	19	19	F15 } S
T093	1730-00-011-8713	LOADER MOB AMU	1172	238	121	63	54	F15 - C
T095	1730-00-011-8713	LOADER MOB AMU	1172	238	121	63	54	F15 - C
T096	1730-00-011-8713	LOADER MOB AMU	1172	238	121	63	54	F15 - C
T097	1730-00-011-8713	LOADER MOB AMU	1172	238	121	63	54	F15 - C
T188	1730-00-013-6815	SKATE WHEEL	1850	37	102	30	21	F15 } S
T189	1730-00-013-6815	SKATE WHEEL	1850	37	102	30	21	F15 } S
S030	1730-00-192-4065	LIFT MJ-1	4294	231	148	52	52	F15 - C
T101	1730-00-192-4065	MJ1	4294	231	148	52	52	F15 - C
T102	1730-00-192-4065	MJ1	4294	231	148	52	52	F15 - C
E302	1730-00-294-3397	TRL 4000	3938	312	152	79	45	F15 - C
T037	1730-00-294-3397	TRL 4000	3938	312	152	79	45	F15 - C
T038	1730-00-294-3397	TRL 4000	3938	312	152	79	45	F15 - C
T010	1730-00-390-5618	MAINT STD B1	1180	372	132	58	84	F15 - C
T011	1730-00-390-5618	MAINT STD B1	1180	372	132	58	84	F15 - C
T013	1730-00-390-5618	MAINT STD B1	1180	372	132	58	84	F15 - C
T004	1730-00-390-5618	B1 STD	1180	372	132	58	84	F15 - C
T006	1730-00-390-5618	B1 STD	1180	372	132	58	84	F15 - C
S005	1730-00-465-7050	LIFT MHU-83 A/U	6850	333	189	71	43	F15 - C
T132	1730-00-465-7050	MHU-83A/E	6850	333	189	71	43	F15 - C
T131	1730-00-465-7050	MHU-83A/E	6850	333	189	71	43	F15 - C
S003	1730-00-606-5391	LIFT MJ-1	4257	231	148	52	52	F15 - C
S004	1730-00-606-5391	LIFT MJ-1	4257	231	148	52	52	F15 - C
T001	1730-00-606-5391	LIFT MJ-1	4257	231	148	52	52	F15 - C
T004	1730-00-606-5391	LIFT MJ-1	4257	231	148	52	52	F15 - C
T038	1730-00-606-5391	MJ1	4257	231	148	52	52	F15 - C
T071	1730-00-606-5391	MJ-1	4257	231	148	52	52	F15 - C
T241	1730-00-606-5391	MJ1	4220	231	148	52	52	F15 - C
S009	1730-00-640-8080	TOWBAR ACFT MD1	415	292	296	57	30	F15 - C
S051	1730-00-640-8080	TOWBAR ACFT MD1	415	292	296	57	30	F15 - C
S052	1730-00-640-8080	TOWBAR ACFT MD1	415	292	296	57	30	F15 - C
T026	1730-00-640-8080	TOWBAR ACFT MD1	415	292	296	57	30	F15 - C
T197	1730-00-640-8080	TOWBAR UNIVERS	415	292	296	57	30	F15 - C
T020	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T021	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T022	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T0[illegible]	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T0[illegible]	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T062	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T090	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T091	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T092	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T219	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S
T220	1730-00-781-2670	JACK HYD TRI	680	65	45	45	56	F15 } S

SUBTOTAL: 99,977

FIGHTER SQUADRON EQUIPMENT LIST, NOV 7_

DATA SORTED BY NSN(MAJOR) AND SQUADRON TYPE(MINOR)

NO.	NAT'NL STOCK NO.	NOMENCLATURE	WEIGHT	CUBE	LEN	WTH	HGT	SQDN
D221	1730-00-781-2610	JACK HYD TRI	660	65	45	45	56	F15)
S010	1740-00-580-7990	MB-4 COLEMAN	10610	770	162	79	104	F15-C
S033	1740-00-580-7990	MB-4 COLEMAN	10610	770	162	79	104	F15-C
S042	1740-00-580-7990	MB-4 COLEMAN	10610	770	162	79	104	F15-C
T236	1740-00-580-7990	MB-4 COLEMAN	10700	716	162	79	97	F15-C
T237	1740-00-580-7990	MB-4 COLEMAN	10700	716	162	79	97	F15-C
T233	1740-00-580-7990	MB-4 COLEMAN	10700	716	162	79	97	F15-C
S001	1740-00-689-2616	TRL MHU-12	6355	576	129	84	92	F15-C
S00[illegible]	1740-00-689-2616	TRL MHU-12	5280	470	129	84	75	F15-C
T007	1740-00-689-2616	TRL MHU-12M	5523	595	129	84	95	F15-C
T012	1740-00-689-2616	TRL MHU-12	3650	363	129	84	58	F15-C
T023	1740-00-689-2616	TRL MHU-12M	2232	545	129	84	67	F15-C
T024	1740-00-689-2616	TRL MHU-12M	1825	181	129	84	29	F15-C
T100	1740-00-689-2616	TRL MHU-12	3676	533	129	84	65	F15-C
T243	1740-00-689-2616	TRL MHU-12	1825	181	129	84	29	F15-C
E301	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
E305	1740-00-713-5908	TRL 3000	1360	454	152	58	89	F15-C
T019	1740-00-713-5908	TRL 3000	1360	454	152	58	89	F15-C
T026	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
T027	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
T0[illegible]9	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
T029	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
T030	1740-00-713-5908	TRL 3000 W/F15 ENG	4360	667	216	60	89	F15-C
S043	2330-00-021-3648	TANK DOLLY	863	545	228	88	47	F15-C
S044	2330-00-021-3648	TANK DOLLY	863	545	228	88	47	F15-C
S0[illegible]	2420-00-411-9920	TRACTOR AGE	5285	724	148	89	95	F15-C
T03[illegible]	2420-00-411-9920	TRACTOR AGE	5220	724	148	89	95	F15-C
T0[illegible]	2420-00-411-9920	TRACTOR AGE	5220	724	148	89	95	F15-C
S0[illegible]	3655-00-014-6208	TANK STORE LOX	1113	66	90	50	34	F15-S
T052	3655-00-014-6208	TANK STOR LOX	1113	66	90	50	34	F15-S
T070	3655-00-014-6208	TANK STOR LOX	1113	66	90	50	34	F15-S
E134	3655-00-111-3600	TRL NITRO SERV	2500	185	114	64	44	F15-C
E204	3655-00-111-3600	TRL NITRO SERV	2500	185	114	64	44	F15-C
T191	3655-00-111-3600	TRL NITROGEN	2500	185	114	64	44	F15-C
T180	3655-00-534-0504	TRK ASSY NITRO	420	39	33	35	59	F15 } S
T194	3655-00-614-0002	TRUCK ASSY OXY	420	39	33	35	59	F15 } S
S007	3655-00-702-8014	TRL NITRO SERV	1800	146	116	56	39	F15-C
T14[illegible]	3920-00-165-4155	TRAILER F-2	900	346	132	51	89	F15-C
T120	39[illegible]-00-[illegible]-[illegible]143	CRANE FLOOR	600	205	194	61	30	F15-C
E102	3990-00-820-9696	463L PALLET	2618	396	88	108	72	F15-S
E1[illegible]	3990-00-820-9696	463L PALLET	875	374	88	108	68	F15-S
E202	3990-00-820-9696	463L PALLET	2540	396	88	108	72	F15-S
S034	3990-00-820-9696	463L PALLET	3889	330	88	108	60	F15-S
S041	3990-00-820-9696	463L PALLET	4694	374	88	108	68	F15-S
T00[illegible]	3990-00-820-9696	463L PALLET	4517	495	88	108	90	F15-S
T0[illegible]	3990-00-820-9696	463L PALLET	2250	379	88	108	69	F15-S
T014	3990-00-820-9696	463L PALLET	3823	385	88	108	70	F15-S
T0[illegible]	3990-00-820-9696	463L PALLET	3614	495	88	108	90	F15-S
T0[illegible]	3990-00-820-9696	463L PALLET	3002	385	88	108	70	F15-S
T[illegible]	3990-00-820-9696	463L PALLET	2040	286	88	108	52	F15-S

SUB TOTALS 190,548

FIGHTER SQUADRON EQUIPMENT LISTING,NOV78

DATA SORTED BY NSN(MAJOR)AND SQUADRON TYPE(MINOR)

NO.	NAT'NL STOCK NO.	NOMENCLATURE		WEIGHT	CUBE	LEN	WTH	HGT	SQDN
T121	3990-00-820-9896	463L PALLET		3178	440	88	108	60	F15-S
T182	3990-00-820-9896	463L PALLET		4556	385	88	108	70	F15-S
T183	3990-00-820-9896	463L PALLET		4462	462	88	108	84	F15-S
T184	3990-00-820-9896	463L PALLET	TRAIN(2)	9910	924	176	106	64	F15-C
T185	3990-00-820-9896	463L PALLET		3363	440	88	108	80	F15-S
T186	3990-00-820-9896	463L PALLET		4130	440	88	108	80	F15-S
T187	3990-00-820-9896	463L PALLET		4468	440	88	108	60	F15-S
T193	3990-00-820-9896	463L PALLET		3120	495	88	108	90	F15-S
T195	3990-00-820-9896	463L PALLET		3785	440	88	108	80	F15-S
T196	3990-00-820-9896	463L PALLET		3606	365	88	108	70	F15-S
T198	3990-00-820-9896	463L PALLET		2775	385	88	108	70	F15-S
T199	3990-00-820-9896	463L PALLET		2775	385	88	108	70	F15-S
T200	3990-00-820-9896	463L PALLET		7576	440	88	108	80	F15-S
T201	3990-00-820-9896	463L PALLET		7007	440	88	108	80	F15-S
T202	3990-00-820-9896	463L PALLET		3447	401	88	108	73	F15-S
T203	3990-00-820-9896	463L PALLET		4310	440	88	108	80	F15-S
T204	3990-00-820-9896	463L PALLET		4339	495	88	108	90	F15-S
T205	3990-00-820-9896	463L PALLET		7922	385	88	108	70	F15-S
T206	3990-00-820-9896	463L PALLET		4108	539	88	108	98	F15-S
T207	3990-00-820-9896	463L PALLET		4499	533	88	108	97	F15-S
T208	3990-00-820-9896	463L PALLET		2944	561	88	108	102	F15-S
T209	3990-00-820-9896	463L PALLET		7985	561	88	108	102	F15-S
T210	3990-00-820-9896	463L PALLET		6978	561	88	108	102	F15-S
T211	3990-00-820-9896	463L PALLET		4724	528	38	108	96	F15-S
T212	3990-00-820-9896	463L PALLET		2904	385	88	108	70	F15-S
T216	3990-00-820-9896	463L PALLET		1740	475	88	108	66	F15-S
T217	3990-00-820-9896	463L PALLET		3029	379	86	108	69	F15-S
T228	3990-00-820-9896	463L PALLET		2579	440	88	108	80	F15-S
T231	3990-00-820-9896	463L PALLET		4377	440	88	108	80	F15-S
T242	3990-00-820-9896	463L PALLET		6025	440	88	108	80	F15-S
T245	3990-00-820-9896	463L PALLET		3157	374	88	108	68	F15-S
S018	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
S021	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
S025	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
S027	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
T140	4120-00-303-3064	AM32C-10B		1330	299	100	70	69	F15-S
T165	4120-00-303-3064	AM32C-10B		1330	294	100	70	69	F15-S
T105	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
T108	4120-00-303-3064	AM32C-10B		1330	279	100	70	69	F15-S
T230	4310-00-289-8249	MC-1A AIR COMP		1750	150	80	65	50	F15-S
T192	4310-00-331-6810	COMPRESSOR MB-1		1700	166	101	62	46	F15-S
S014	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
S015	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
S020	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T081	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T076	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T077	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T239	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T240	4310-00-547-3741	COMPRESSOR MC2A		867	121	89	59	40	F15-S
T181	4520-00-859-5426	HEATER HDU-13/M		1300	79	66	42	48	F15-S

SUB TOTAL: 162,306

FIGHTER SQUADRON EQUIPMENT LISTING,NOV76

DATA SORTED BY NSN(MAJOR)AND SQUADRON TYPE(MINOR)

NO.	NAT'NL STOCK NO.	NOMENCLATURE	WEIGHT	CUBE	LEN	WTH	HGT	SQDN
E1[illegible]6	4910-00-595-5394	HYD FILL UNIT	320	27	48	30	33	F15 } S
E2[illegible]	4910-00-595-5394	HYD FILL UNIT	320	27	48	30	33	F15 } S
S02[illegible]	4910-00-595-5394	HYD FILL UNIT	320	27	48	30	33	F15 - S
T094	4920-00-347-9455	AF/M32T-1 TEST	3181	198	102	60	56	F15 - S
T[illegible]13	4920-00-458-3812	M37 CONTROL TRL	4610	385	117	64	89	F15 - C
T214	4920-00-458-3812	451 THRUST TRL	5490	632	201	64	65	F15 - C
T215	4920-00-458-3812	M37 FUEL TK TRL	5360	1034	192	97	96	F15 - C
T222	4920-00-476-2250	TRAILER TEST	1360	454	152	58	89	F15 - C
T031	4920-00-880-5994	TTU-228/E-A	5500	310	118	66	69	F15 - C
T041	4920-00-880-5994	TTU-228/E-1A	5500	310	118	66	69	F15 - C
T072	4920-00-880-5994	TTU-228/E-1A	5500	310	118	66	69	F15 - C
T074	4920-00-880-5994	TTU-228/E-1A	5500	310	118	66	69	F15 - C
T122	4920-01-029-7470	TARGET ASSY	300	223	69	69	61	F15 - S
E1[illegible]	4930-00-761-9591	OIL SERV UNIT	115	9	31	18	30	F15 } S
E[illegible]	4930-00-761-9591	OIL SERV UNIT	115	9	31	18	30	F15 } S
S008	4930-00-761-9591	OIL SERV UNIT	115	9	31	18	30	F15 } S
S036	4930-00-761-9591	OIL SERV UNIT	115	9	31	18	30	F15 } S
T01[illegible]	4935-00-794-0254	HYD TEST CART-6	215	54	70	45	30	F15 } S
T024	4935-00-794-0254	HYD TEST CART-6	215	54	70	45	30	F15 } S
T033	4935-00-794-0254	HYD TEST CART-6	215	54	70	45	30	F15 - S
E304	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
S017	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
S019	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
S024	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
S029	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T003	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T042	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T043	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T044	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T0[illegible]	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T07[illegible]	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T099	6115-00-420-8486	AM32A-60A	3700	301	120	63	69	F15 - C
T015	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T017	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T083	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T084	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T079	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T0[illegible]	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T087	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
T088	6230-00-752-2082	NF2 LITEALL	2170	340	108	69	79	F15 - S
S011	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
S012	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
S013	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
S016	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
S022	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
S023	6230-00-877-9172	NF2 LITEALL	2170	340	108	69	79	F15 - S
E[illegible]	7125-00-872-1285	BIN CARGO	800	88	33	68	68	F15 } S
S0[illegible]	7125-00-872-1285	BIN CARGO	590	88	68	33	68	F15 } S

SUBTOTAL 120,536

GRAND TOTAL = 573,367 LB

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Powered Rollers; Rotating Cargo Pallets; Cargo Systems, Aircraft

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A test was conducted on the KC-10A Cargo Handling System Mock-Up to evaluate the performance of the current design of the powered roller system.

The test consisted of running a total of 246 load/unload cycles with various weights loaded on the pallets. Of these load/unload cycles, 135 were single HCU-6/E pallets and the remaining 111 were coupled HCU-6/E pallets (2 in train). These cycles simulate over 2 years of KC-10A palletized cargo operations.

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Block 20 (Continued)

The powered roller system functioned very well for the entire spectrum of loads. Single and coupled pallets were loaded laterally or rotated in the doorway easily. This test demonstrated that the system meets or exceeds its design requirements.