FINAL REPORT
FEBRUARY 1995

REPORT NO. 93-07

MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) ON LOAD AND ROLL PALLET (LRP) WITH SOFTWOOD DUNNAGE TRANSPORTABILITY TESTS

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A. C. McIntosh, Jr.

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The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the Office of the Project Manager, Ammunition Logistics (PM-AMMOLOG) to test the Load and Roll Pallet (LRP) for shipment of Multiple Launch Rocket System (MLRS) pods and Army Tactical Missile System (ATACMS) restrained with softwood dunnage. The dunnage provides a mechanism to center the loaded LRP when it is loaded into a 20-foot end-opening container and provides blocking to prevent lateral pallet movement while in transit. Softwood is replacing the original hardwood blocking and bracing (see USADACS Report No. EVT 12-90) as a cost-saving measure and due to the lack of universal availability of hardwood. This test sequence consists of rail impact, road hazard, road, washboard, and shipboard transportation simulation. The end-opening container with the LRP loaded with MLRS pods passed all tests with the softwood dunnage. This report contains the results of the tests conducted.

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REPORT NO. 93-07

MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) ON LOAD AND ROLL PALLET (LRP)
WITH SOFTWOOD DUNNAGE TRANSPORTABILITY TESTS

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was previously tasked by the Office of the Project Manager, Ammunition Logistics (PM-AMMOLOG) to test the Load and Roll Pallet (LRP) for shipment of Multiple Launch Rocket System (MLRS) pods and Army Tactical Missile System (ATACMS) (see USADACS Report No. EVT 12-90). The loading procedures required hardwood dunnage at the front of the 20-foot end-opening container to ensure alignment of the LRP when loaded into the container. Since hardwood is not universally available at all ammunition loading sites, and the cost of hardwood makes it expensive to use, softwood was tested to determine if it is an acceptable replacement.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to determine if softwood could be used to replace the hardwood dunnage used in shipping MLRS pods loaded on an LRP in a 20-foot end-opening container.

D. CONCLUSION. The intermodal shipping container safely retained the inert load of MLRS pods unitized on an LRP when subjected to the following tests: rail, road, and Shipboard Transportation Simulator (STS) tests.
E. **RECOMMENDATION.** The loading procedures for a unitized load of MLRS pods on an LRP shipped in a 20-foot end-opening container be approved for the transportation of MLRS pods with softwood dunnage.
PART 2
9-10 DECEMBER 1992

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PART 3

TEST PROCEDURES

A. RAIL IMPACT TEST. The test load or vehicle was positioned in/on a railcar. For containers, the loaded container was positioned on a container chassis and securely locked in place using the twist locks at each corner. The container chassis was secured to a railcar. Equipment needed to perform the test included the specimen (hammer) car, five empty railroad cars connected together to serve as the anvil, and a railroad locomotive. These anvil cars were positioned on a level section of track with air and hand brakes set and with the draft gear compressed. The locomotive unit pulled the specimen car several hundred yards away from the anvil cars, then pushed the specimen car toward the anvil at a predetermined speed, then disconnected from the specimen car approximately 50 yards away from the anvil cars, which allowed the specimen car to roll freely along the track until it struck the anvil. This constituted an impact. Impacting is accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The 4 and 6 mph impact speeds are approximate; the 8.1 mph speed is a minimum. Impact speeds were determined by using an electronic counter to measure the time required for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars.

B. ROAD HAZARD COURSE. Using a suitable truck/tractor or tactical vehicle, the vehicle/specimen of test method no. 1 was towed/driven over a hazard course two times at a speed of approximately 5 mph. The speed was increased or decreased, as appropriate, to produce the most violent load response.

C. ROAD TRIP. Using a suitable truck/tractor and trailer, or tactical vehicle, the tactical vehicle/specimen load was driven/towed for a total distance of at least 30 miles over a
ASSOCIATION OF AMERICAN RAILROADS (AAR)
STANDARD TEST PLAN

5 BUFFER CARS (ANVIL) WITH DRAFT GEAR
COMPRESSED AND AIR BRAKES IN A SET
POSITION
ANVIL CARS TOTAL WT 250,000 LBS (APPROX)

SPECIMEN CAR
IS RELEASED BY
SWITCH ENGINE TO
ATTAIN: IMPACT NO. 1 @ 4 MPH
IMPACT NO. 2 @ 6 MPH
IMPACT NO. 3 @ 8.1 MPH
THEN THE CAR IS REVERSED AND
RELEASED BY SWITCH ENGINE TO
ATTAIN: IMPACT NO 4. @ 8.1 MPH

FIGURE 1
combination of roads surfaced with gravel, concrete, and asphalt. The test route included curves, corners, railroad crossings, cattle guards, and stops and starts. The test vehicle traveled at the maximum speed suitable for the particular road being traversed, except as limited by legal restrictions. This step provided for the tactical vehicle/specimen load to be subjected to three full air brake stops while traveling in the forward direction and one in the reverse direction. The first three stops were at 5, 10, and 15 mph, while the stop in the reverse direction was at approximately 5 mph.

FIGURE 2
D. **Washboard Course.** Using a suitable truck/tractor, and/or tactical vehicle, the specimen was towed-driven over the washboard course at a speed which produced the most violent response in the particular test load (as indicated by the resonant frequency of the suspension system beneath the load).

![Diagram of washboard course with labels: START, WASHERBOARD COURSE, CONCRETE SURFACE, 26.5', 3/4, TYPICAL SECTION, FINISH.]

**FIGURE 3**

E. **Shipboard Transportation Simulator (STS).** The test load (specimen) was positioned onto the STS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instructions, the STS started oscillating at an amplitude of 30 inches plus 2 inches, either side of center and a frequency of 2 cycles per minute (30 seconds plus 2 seconds total roll period). This frequency was maintained for 15 minutes during which time the load was observed for apparent defects that could cause a safety hazard.
The frequency of oscillation was increased to 4 cycles per minute (15 seconds + 1 second roll period) and the apparatus operated for 2 hours. Inspection of the load did not indicate an impending failure; therefore, the frequency of oscillation was further increased to 5 cycles per minute (12 seconds plus 1 second cycle time), and the apparatus operated for 4 hours. The operation does not necessarily have to be continuous; however, no change or adjustments to the load or load restraints were permitted at any time during the test. The test load (specimen) cannot be removed from the apparatus, after once being set in place, until the test has been completed or is terminated.
PART 4
TEST RESULTS
RAIL IMPACT DATA

TEST NO. 1

DATE: 9 December 1992

TEST SPECIMEN: MLRS pods on an LRP in a 20-foot end-opening container on a TOFC.

TEST CAR NO.: TTX 251297
LT. WT.: 74,900 pounds

CHASSIS NO.: 5394
LT. WT.: 6,040 pounds

CONTAINER NO.: USAG 0602172
LT. WT.: 5,048 pounds

LRP
LT. WT.: 1,970 pounds

LADING AND DUNNAGE, MLRS (concrete filled) WT.: 21,800 pounds

TOTAL SPECIMEN WT.: 109,758 pounds

BUFFER CAR (5 CARS) WT.: 250,000 pounds

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<tr>
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<th>END STRUCK</th>
<th>(MPH)</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>1</td>
<td>Rear</td>
<td>4.69</td>
<td>No movement.</td>
</tr>
<tr>
<td>2</td>
<td>Rear</td>
<td>6.30</td>
<td>No movement.</td>
</tr>
<tr>
<td>3</td>
<td>Rear</td>
<td>8.43</td>
<td>No movement.</td>
</tr>
<tr>
<td>4</td>
<td>Rear</td>
<td>8.62</td>
<td>No movement.</td>
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</tbody>
</table>
ROAD TEST DATA

TEST NO. 2

DATE: 10 December 1992

TEST SPECIMEN: MLRS pods on an LRP in a 20-foot end-opening container on a TOFC.

PASS 1-A OVER FIRST SERIES OF TIES: 5.67 SEC 6.02 MPH
PASS 1-B OVER SECOND SERIES OF TIES: 6.12 SEC 5.35 MPH
REMARKS: No movement of LRP or MLRS pods.

PASS 2-A OVER FIRST SERIES OF TIES: 6.13 SEC 5.56 MPH
PASS 2-B OVER SECOND SERIES OF TIES: 6.31 SEC 5.19 MPH
REMARKS: No movement of LRP or MLRS pods.

30 MILE ROAD TEST: No movement of LRP or MLRS pods.

PASS 3-A OVER FIRST SERIES OF TIES: 5.53 SEC 6.13 MPH
PASS 3-B OVER SECOND SERIES OF TIES: 6.17 SEC 5.53 MPH
REMARKS: No movement of LRP or MLRS pods.

PASS 4-A OVER FIRST SERIES OF TIES: 6.22 SEC 5.48 MPH
PASS 4-B OVER SECOND SERIES OF TIES: 6.18 SEC 5.30 MPH
REMARKS: No movement of LRP or MLRS pods.

WASHBOARD COURSE: No physical damage to the LRP or MLRS pods.

SHIPBOARD TRANSPORTATION SIMULATOR (STS): No damage to the container, LRP, or MLRS pods.
PART 5

PHOTOGRAPH
AO317-SCN93-48-538. This photo shows the 20-foot end-opening container on a TOFC containing a load of MLRS pods on an LRP. Softwood dunnage was used to restrain the LRP in the container. No damage occurred during testing.
PART 6

DRAWING
MLRS

LOADING AND BRACING WITH LOAD AND ROLL PALLET (LRP) IN COMMERCIAL CONTAINERS OF ROCKET POD/CONTAINERS (RP/C) FOR MULTIPLE LAUNCH ROCKET SYSTEM, FOR SHIPMENT BY T/COFC CARRIER

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*LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS.

SEE GENERAL NOTE "P" ON PAGE 2.

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY MISSILE COMMAND

DRAFTSMAN

R. HAYNES

ENGINEER

G. WILLIS

APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

WILLIAM F. EMMETT

DECEMBER 1994

CLASS

19

DIVISION

48

DRAWING

8184

FILE

GM15RS3

PROJECT GM 820-89

DO NOT SCALE

APPROVED BY BUREAU OF EXPLOSIVES

DATE 1-4-95

D. H. EMERD
GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AUGMENTS TM 743-200-1 (CHAPTER 5).

B. THE SPECIFIED OUTLOADING PROCEDURES ARE APPLICABLE TO LOADS OF MULTIPLE LAUNCH ROCKET SYSTEM ROCKET POD/CONTAINERS (RPC/C) UTILIZING A LOAD AND ROLL PALLETS (LRP). SUBSEQUENT REFERENCE TO POD HEREIN MEANS THE RPC/C WITH ROCKET COMPONENTS NOTED. THE OUTLOADING PROCEDURES ARE ALSO APPLICABLE TO THE ARMY TACTICAL MISSILE SYSTEM (ATACMS) MISSILE LAUNCH POD ASSEMBLY (MLPA) OR OTHER SIMILARLY CONFIGURED ITEMS NOT EXCEEDING 22,000 POUNDS IN TOTAL LADING WEIGHT.


D. THE OUTLOADING PROCEDURES SPECIFIED HEREIN CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED PODS WHEN THEY ARE LOADED WITH AN ITEM WHICH IS IDENTIFIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED IN THE DRAWING TITLE.

E. THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20' LONG BY 8' WIDE BY 6'-4" HIGH END OPENING ISO CONTAINER WITH INSIDE DIMENSIONS OF 16'4" LONG BY 82" WIDE BY 86' HIGH (83' CLEAR HEIGHT) AND A MAXIMUM GROSS WEIGHT OF 52,510 POUNDS. THE LOAD IS FOR TRAILER-CONTAINER-ON-FLATCAR (T/COF) SHIPMENT, HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.

(continued at right)

MATERIAL SPECIFICATIONS

LUMBER - --- : SEE TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC ML-751.

NAILS - --- : SEE SPEC FF-N-105; COMMON.

STRAPPING, STEEL - --- : ASTM D3853; FLAT STRAPPING, TYPE I, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.

SEAL, STRAP - --- : ASTM D3893; CLASS H, FINISH A, B (GRADE 2) OR DOUBLE NOTCH TYPE, STYLE I, II, OR IV.

WEB STRAP - --- : ANSI ASME PIPING ASSEMBLY PART NO. ABS050-10 (AM-30-24-26089 OR EQUIVALENT).

WIRE, CARBON STEEL - --- : ANSI AB53; ANNEALED AT FINISH, BLACK OXIDE, FINISH .080" OIA, GRADE 1006 OR BETTER.

STAKE POCKET PROTECTOR - --- : COMMERCIAL GRADE.

ANTI-CHAFING MATERIAL - --- : FED SPEC PPP-F-320, TYPE SF, (SOLID FIBERBOARD), CLASS DOMESTIC, ALL GRADES.

LOAD AND ROLL PALLETS - --- : LOAD & ROLL INC DRAWING NO. 100-3121 AND PATENT NO. 4,834,000. CAPACITY 22,000 POUNDS.

LUMBER, LR P CLADDING - --- : FED SPEC ML-751; DOUGLAS FIR OR COMPARABLE LUMBER WITH STRAIGHT GRAIN AND FREE FROM MATERIAL DEFECTS.

PLYWOOD - --- : COMMERCIAL ITEM DESCRIPTION A-A-55057, TYPE A, CONSTRUCTION AND INDUSTRIAL PLYWOOD, INTERIOR WITH EXTERIOR OAK, GRADE C-D, IF SPECIFIED GRADE IS NOT AVAILABLE, A BETTER INTERIOR OR AN EXTERIOR GRADE MAY BE SUBSTITUTED.

F. WHEN LOADING THE PODS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE FORWARD BLOCKING ASSEMBLY). ADDITIONALLY, LATERAL VIBRATIONS TO THE LOAD ARE TO BE HELD TO A MINIMUM. EXCESSIVE BLOCK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE FILLER BLOCKS ON THE CORNER RETAINER PIECES. EACH ADDITIONAL PIECE TO THE FILLER BLOCK MUST BE APPROPRIATELY SIZED NAILS. ADDITIONALLY, THE THICKNESS OF THE FILLER BLOCKS MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE SIZE OF THE LOAD AND ROLL PALLETS ON THE CONTAINER INTERIOR LOADING SPACE.

G. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" THICK BY 5-1/2" WIDE.

H. WHEN STEEL STRAPPING IS SEATED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED TO SEAL THE JOINT WHEN A NOTCH-TYPE SEALER IS BEING USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER WITH TWO PAIR OF CHOMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP-TYPE SEALER IS BEING USED. REFER TO THE "STRAP JOINT A" AND "STRAP JOINT B" DETAILS ON PAGE 5 FOR GUIDANCE.

J. DIMENSIONS GIVEN FOR DUNNAGE PIECES OR ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY AND INSTALLATION INTO THE END OPENING CONTAINER.

K. MAXIMUM LOAD WEIGHT CRITERIA:

THE MAXIMUM LOAD WEIGHTS ARE CONTROLLED BY EQUIPMENT CAPABILITY FACTORS. ALTHOUGH THE HEAVIEST MAXIMUM LOADS ARE DETERMINED IN THE LOAD VIEWS, PROVISIONS ARE INCLUDED WITHIN THIS DRAWING SO THAT THE BASIC LOADS CAN BE ADJUSTED TO SATISFY A LESSER QUANTITY OF LADING UNITS. DEPENDING ON TRANSPORTATION ROUTING, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY "WEIGHT LIMITS" OF CERTAIN STATES. ALSO, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY OTHER RESTRICTIONS IMPOSED ON THE INTERMODAL CONTAINER SYSTEM.

L. REQUIREMENTS CITED WITHIN THE BUREAU OF EXPLOSIVES PAMPHLET APPLICABLE WHEN THE SHIPMENT MOVES BY TRAILER CONTAINER-ON-FLATCAR (T/COF). SPECIAL T/COF NOTES FOLLOW:

1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN T/COF SERVICE.

2. THE LOAD LIMIT OF A T/COF FLATCAR MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.

M. DURING INTRASTATE AND/OR INTERSTATE MOVES BY MOTOR CARRIERS, A PROPER CHASSIS OR MODIFIED FLATBED TRAILER MUST BE USED TO PRECLUDE VIOLATION OF ONE OR MORE "WEIGHT LIMITS" APPLICABLE TO THE STATE OR STATES INVOLVED.

N. THREE INCH (3") WIDE WEB CARGO STRAPS MAY BE USED IN LIEU OF THE 2" WIDE STEEL HOLD-DOWN STRAPS USED TO SECURE THE LADING TO THE LOAD AND ROLL PALLETS. EACH WEB CARGO STRAP ASSEMBLY MUST HAVE A MINIMUM LOAD RATING OF 9,000 POUNDS AND CONSIST OF A HEAVY CAPACITY RATCHET, 3-INCH WIDE POLYESTER WEBBING, A PAIR OF MOVABLE CORNER PROTECTORS, A FLAT HOOK ON EACH END, AND A KEEPER ON EACH FLAT HOOK. AN ACCEPTABLE WEATHER STRAP ASSEMBLY IS IDENTIFIED IN THE MATERIAL SPECIFICATIONS BELOW.

O. CONVERSION TO METRIC EQUIVALENTS, DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESS IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4 MM AND ONE POUND EQUALS 0.454 KG.

P. THE LOAD AND ROLL PALLETS IS A COMMERCIAL PRODUCT. FOR A SOURCE OF SUPPLY, CONTACT LOAD AND ROLL INC., 10100 KITY AVENUE, CHICAGO RIDGE, IL 60415. PHONE (708) 490-3370.

Q. PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS THE SIDEMILL, HAVE NOT BEEN SHOWN IN THE LOAD VIEWS FOR CLARITY PURPOSES.
SPECIAL HANDLING GUIDANCE

1. POD STACKING FOR OUTLOADING PURPOSES.
   A. THE UPPER POD SHOULD BE PLACED AS CLOSELY AS POSSIBLE IN VERTICAL ALIGNMENT WITH THE LOWER POD.
   B. WHEN STACKING THESE PODS, CARE MUST BE EXERCISED TO ENSURE THAT THE INTERLOCKING HOLES IN THE BOTTOM OF THE POD SKIDS ALIGN CORRECTLY WITH THE INTERLOCKING PINS ON THE TOP OF THE POD FRAME. THIS WILL PRECLUDE DAMAGE TO THE SKIDS AND ENSURE PROPER FUNCTIONING OF THE POD INTERLOCKS.

2. POD OR POD STACK HANDLING.
   NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED PODS. (2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.
   A. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR HANDLING THE DEPICTED PODS.
   B. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE PODS SHOULD BE HANDLED FROM A SIDE POSITION ONLY; CARE MUST BE EXERCISED WHEN INSERTING THE FORKS UNDER THE POD TO PREVENT DAMAGE TO THE PODS. ADDEDLY, THE FORK TINES SHOULD BE PLACED UNDER THE PODS STRONG AREAS; THAT IS, THE LATERAL FRAME MEMBERS/BUILD HEADS LOCATED NEAR THE LONGITUDINAL CENTER OF THE POD.

3. SEQUENTIAL CONTAINER LOADING.
   B. LOAD THE PODS OR POD STACKS BY FIRST INSERTING THE FAR SKIDS IN THE CENTER SKID RESTRAINT PANS ON THE LOAD AND ROLL PALLET, THEN LOADING THE NEAR SKIDS IN THE OUTSIDE SKID RESTRAINT PANS ON THE PALLET.
   C. APPLY THE STACK UNITIZING STRAP. NOTE: FIBERBOARD ANTI-CHAFING MATERIAL MUST BE INSTALLED UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE PODS.
   D. INSTALL THE CENTER FILL PIECES. POSITION THE CENTER FILL PIECES OF THE BOTTOM LAYER SO THAT THEY ARE SUPPORTED BY THE TOP OF THE FORK POCKET (TUNNEL) ON THE LOAD AND ROLL PALLET. POSITION THE CENTER FILL PIECES FOR THE TOP LAYER IN LINE WITH THOSE FOR THE BOTTOM LAYER. WIRE THE CENTER FILL PIECES TO THE POD FRAME.
   E. NEXT LOAD AND UNITIZE THE REMAINING PODS IN THE MANNER DETAILED IN PARAGRAPHS 3B AND 3C ABOVE.
   F. APPLY THE HOLD-DOWN STRAPS, POSITIONING FIBERBOARD ANTI-CHAFING MATERIAL UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE PODS. CAUTION: THE HOLD-DOWN STRAPS MUST BE INSTALLED WITH CARE SO AS NOT TO HAVE EDGE-TO-EDGE CONTACT WITH THE STACK UNITIZING STRAPS.

4. UNLOADING THE LOAD AND ROLL PALLET FROM THE END OPENING CONTAINER.
   A. THE LOAD AND ROLL PALLET MAY BE UNLOADED USING THE REVERSE OF THE METHOD DETAILED IN 3B ABOVE.

SPECIAL HANDLING GUIDANCE
ISOMETRIC VIEW

Although the above view depicts only two pods secured to a load and roll pallet, the same procedures are applicable for a four pod load.
LOADING OF LRP AND MLRS CONTAINERS INTO END OPENING ISO CONTAINER

ATTACHMENT OF WEB STRAP ASSEMBLY TO LRP ANCHORING FACILITY

END-OVER-END LAP JOINT DETAILS

ATTACHMENT OF STEEL STRAPPING TO LRP ANCHORING FACILITY

SPECIAL HANDLING GUIDANCE
KEY NUMBERS

1. CENTER FILL PIECE, 2" X 4" X 33" (4 REDD). PREPOSITION AS SHOWN AND WIRE TIE TO A VERTICAL FRAME MEMBER OF A ROCKET POD/CONTAINER. SEE NOTE 30 ON PAGE 3.
2. TIE WIRE, NO. 14 GAGE WIRE, 24" LONG (8 REDD). INSTALL WIRE TO FORM A LOOP AROUND A VERTICAL FRAME MEMBER OF A POD AND THE CENTER FILL PIECE, PIECE MARKED 1. BRING ENDS TOGETHER AND TWIST TIGHT.
3. STACK INITIATING STRAP, 1-1/4" X .035" OR .031" BY A LENGTH TO SUIT (REF: 20'-0") (4 REDD). INSTALL SO AS TO ENCIRCLE THE CONTAINERS IN ONE STACK AS SHOWN.
4. HOLD-DOWN STRAP, 2" X .050" OR .044" X 28'-0" LONG STEEL STRAPPING (4 REDD). INSTALL EACH STRAP FROM TWO 14'-0" LONG PIECES.
5. SEAL FOR 1-1/4" STEEL STRAPPING (4 REDD, 1 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES. SEE GENERAL NOTE "H" ON PAGE 2.
6. SEAL FOR 2" STEEL STRAPPING (20 REDD, 5 PER STRAP). CRIMP EACH STRAP WITH TWO PAIR OF NOTCHES, EXCEPT FOR THOSE USED TO SECURE THE PADS, WHICH ONLY REQUIRE ONE PAIR OF NOTCHES. SEE GENERAL NOTE "H" ON PAGE 2.
7. PAD, STRAPPING, 2" X .050" OR .044" X 24" (8 REDD). PRE-POSITION THE PAD BETWEEN THE STRAPPING, PIECE MARKED 6, AND THE LOAD AND ROLL PALLET TIDDOWN PROVISION, AND SECURE WITH ONE SEAL WITH ONE PAIR OF NOTCHES. SEE THE "ATTACHMENT OF STEEL STRAPPING TO LRP ANCHORING FACILITY" DETAIL ON PAGE 5.
8. FIBERBOARD ANTI-CHAFING MATERIAL (AS REDD). FOLD FIBERBOARD TO FORM A DOUBLE THICKNESS AND PLACE UNDER STRAPPING AT ALL POINTS OF CONTACT WITH THE CONTAINERS.

(CONTINUED ON PAGE 7)
(KEY NUMBERS CONTINUED FROM PAGE 8)

(9) FORWARD BLOCKING ASSEMBLY (1 REQD). SEE THE DETAIL ON PAGE 10. PRE-POSITION PRIOR TO LOADING THE LOAD AND ROLL PALLETS IN THE CONTAINER.

(10) LOAD AND ROLL PALLETS (1 REQD). SEE THE "SPECIAL HANDLING GUIDANCE" ON PAGES 4 AND 5. SEE GENERAL NOTE "P" ON PAGE 2.


SPECIAL NOTES:

1. A 4-UNIT LOAD OF ROCKET POD/CONTAINERS (RP/C) IS DEPICTED ON A LOAD AND ROLL PALLET IN AN END OPENING ISO CONTAINER.

2. PRIOR TO LOADING THE PODS INTO THE END OPENING CONTAINER, SEE THE SPECIAL HANDLING GUIDANCE ON PAGES 3 AND 4.

3. ALL STRAPS MUST BE INSTALLED NEAR THE STRONG POINTS OR VERTICALLY REINFORCED AREAS OF THE PODS.

<table>
<thead>
<tr>
<th>BILL OF MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUMBER</td>
</tr>
<tr>
<td>2&quot; X 4&quot;</td>
</tr>
<tr>
<td>4&quot; X 4&quot;</td>
</tr>
<tr>
<td>NAILS</td>
</tr>
<tr>
<td>Ed (2&quot;)</td>
</tr>
<tr>
<td>1Gd (3&quot;)</td>
</tr>
</tbody>
</table>

STEEL STRAPPING, 2" -- -- -- 120' REQD -- -- -- 43 LBS
SEAL FOR 2" STRAPPING -- -- -- 20 REQD -- -- -- 5 LBS
STEEL STRAPPING, 1-1/4" -- 80' REQD -- -- -- 11 LBS
SEAL FOR 1-1/4" STRAPPING -- -- -- 4 REQD -- -- -- 1/4 LB
WIRE, NO. 14 GAGE -- -- -- 16' REQD -- -- -- NIL
PLYWOOD, AS REQD -- -- -- 2 SQ FT REQD -- -- -- NIL
ANTI-CHAFING MATERIAL -- -- -- AS REQD -- -- -- NIL
LOAD AND ROLL PALLETS -- -- -- 1 REQD -- -- -- 1,970 LBS

LOAD AS SHOWN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>WEIGHT (APPROX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLRS (RP/C)</td>
<td>-- -- --</td>
<td>4</td>
</tr>
<tr>
<td>DUNNAGE</td>
<td>-- -- --</td>
<td>2,076 LBS</td>
</tr>
<tr>
<td>END OPENING CONTAINER</td>
<td>-- -- --</td>
<td>4,700 LBS</td>
</tr>
</tbody>
</table>

TOTAL WEIGHT | -- -- -- | 27,088 LBS (APPROX)

*THE 4" X 4" MATERIAL SHOULD MEET THE REQUIREMENTS SET FORTH IN THE MATERIAL SPECIFICATIONS FOR LUMBER, LRP BLOCKING.

FULL LOAD PROCEDURES (STEEL STRAPPING METHOD)

PROJECT GM 620-B9

PAGE 7
1. CENTER FULL PIECE, 2" X 4" X 33" (4 REQD). PREPOSITION AS SHOWN AND WIRE TIE TO A VERTICAL FRAME MEMBER OF A ROCKET POD/CONTAINER. SEE NOTE 3D ON PAGE 3.

2. TIE WIRE, NO. 14 GAGE WIRE, 24" LONG (8 REQD). INSTALL WIRE TO FORM A LOOP AROUND A VERTICAL FRAME MEMBER OF A POD AND THE CENTER FULL PIECE. PIECE MARKED ①. BRING ENDS TOGETHER AND TWIST TIGHT.

3. WEB STRAP TIEDOWN ASSEMBLY (4 REQD). INSTALL TO EXTEND FROM AN ANCHORING FACILITY ON ONE SIDE OF THE LOAD AND ROLL PALLETS, OVER THE POD STACKS, TO AN ANCHORING FACILITY ON THE OPPOSITE SIDE OF THE PALLET. SEE GENERAL NOTE "N" ON PAGE 2. SEE THE "ATTACHMENT OF WEB STRAP ASSEMBLY TO LIP ANCHORING FACILITY" DETAIL ON PAGE 5.

4. CORNER PROTECTOR (2 PER STRAP PROVIDED). POSITION ON OUTER EDGE OF THE POD FRAME. NOTE: IF THE CORNER PROTECTOR IS MISSING THEN A FOLDED PIECE OF FIBERBOARD SHALL BE USED TO PROTECT THE WEBBING.

5. FORWARD BLOCKING ASSEMBLY (1 REQD). SEE THE DETAIL ON PAGE 10. PRE-POSITION PRIOR TO LOADING THE LOAD AND ROLL PALLET IN THE CONTAINER.

6. LOAD AND ROLL PALLET (1 REQD). SEE THE "SPECIAL HANDLING GUIDANCE" ON PAGES 4 AND 5. SEE GENERAL NOTE "F" ON PAGE 2.

**SPECIAL NOTES:**

1. A 4-UNIT LOAD OF ROCKET POD/CONTAINERS (RP/C) IS DEPICTED SECURED WITH WEB STRAPPING TO A LOAD AND ROLL PALLET AND LOADED INTO AN END OPENING ISO CONTAINER.


3. ALL STRAPS MUST BE INSTALLED NEAR THE STRONGPOINTS OR VERTICALLY REINFORCED AREAS OF THE PODS.

---

**BILL OF MATERIAL**

<table>
<thead>
<tr>
<th>LUMBER</th>
<th>LINEAR FEET</th>
<th>BOARD FEET</th>
</tr>
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<tbody>
<tr>
<td>2&quot; X 4&quot;</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>4&quot; X 4&quot;**</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAILS</th>
<th>NO. REGD</th>
<th>POUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8d (2&quot;)</td>
<td>14</td>
<td>NIL</td>
</tr>
<tr>
<td>10d (3&quot;)</td>
<td>4</td>
<td>NIL</td>
</tr>
</tbody>
</table>

| WEB STRAP ASSEMBLY (3") | 4 REGD | 44 LBS |
| WIRE, NO. 14 GAGE       |        |        |
| PLYWOOD, AS REGD        |        |        |
| ANTI-CHAFING MATERIAL   | AS REGD | NIL    |
| LOAD AND ROLL PALLET    | 1 REGD  | 1,670 LBS |

*THE 4" X 4" MATERIAL SHOULD MEET THE REQUIREMENTS SET FORTH IN THE MATERIAL SPECIFICATIONS FOR LUMBER, LRP BLOCKING.*

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**LOAD AS SHOWN**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>WEIGHT (APPROX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLRS (RP/C)</td>
<td>4</td>
<td>20,312 LBS</td>
</tr>
<tr>
<td>DUNNAGE</td>
<td></td>
<td>2,060 LBS</td>
</tr>
<tr>
<td>END OPENING CONTAINER</td>
<td></td>
<td>4,700 LBS</td>
</tr>
</tbody>
</table>

**TOTAL WEIGHT** | **27,072 LBS** (APPROX)

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**FULL LOAD PROCEDURES (WEB STRAPPING METHOD)**

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**PROJECT Code 620-89**
Header, LRP blocking lumber, 4" x 4" by inside container width (Ref: 7'-8") (1 req). Note: To facilitate variance in container interior loading space, the thickness of the header may be reduced but shall not be made less than 3".

Guide block, 4" x 4" LRP blocking lumber triangle, 3-1/2" leg by 6" leg (2 req). Locate tight against container sidewalls. Note: dimensions given for guide block are reference dimensions only. Actual dimensions may be varied to facilitate variance in the width of the LRP or the container interior.

Tie piece, 3/4" plywood triangle, 9-1/2" leg by 5-1/2" leg (2 req). Nail to the guide blocks w/2-Bd nails and to the header w/2-Bd nails. Note: size of plywood triangle may be adjusted as required to correspond to actual header and guide block sizes.

Forward Blocking Assembly

Shim, 6" x 11" plywood by thickness to suit (as req). Select thickness of plywood to fill void between face of retainer and end of loading platform. Nail plywood to filler block w/2-Bd nails before inserting into retainer.

Filler block, 11" long piece of LRP blocking lumber by thickness and depth to suit (2 req). Select size of block to fill void between retainer and side of loading platform.

Retainer nail, 10d (4 req). Nail through each retainer piece into shim and filler block with a minimum of two 10d nails.

Corner Retainer Piece

Note: Position square bar of retainer piece into recess of sidewall located just ahead of rear corner post.