FOR INFORMATION ONLY
ACTION BY HIGHER AUTHORITY PENDING

2542 Library X

AD _____

RDT&E PROJECT NO None

USATECOM PROJECT NO 1-VG-123-000-003

TEST AGENCY PROJECT NO. None

TEST SPONSOR TACOM

TEST SPONSOR PROJECT NO None

TRADOC AC NO None

PRODUCT IMPROVEMENT TEST (PHASE I) OF NON-METALLIC FUEL TANKS FOR TRUCKS M151 AND M715

FINAL LETTER REPORT

BY

LYNN D. DAVIS
2LT, OD
15 MAY 1974

U. S. ARMY ARCTIC TEST CENTER

APO SEATTLE 98733

AD 526091

Reproduction Limitations

Reproduction of this document in whole or in part is prohibited except with permission of Headquarters, Army Materiel Command.

Disposition Instructions

Destroy this report when it is no longer needed. Do not return it to the Arctic Test Center.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 1-VG-123-000-003	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Product Improvement Test (Phase I) of Non-Metallic Fuel Tanks for Trucks M151 and M715		5. TYPE OF REPORT & PERIOD COVERED Final Letter Report (Phase I), 20 Mar 73 - 19 Apr 74
		6. PERFORMING ORG. REPORT NUMBER NA
7. AUTHOR(s) Lynn D. Davis 2 LT, Ordnance Corps		8. CONTRACT OR GRANT NUMBER(s) NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS Commander U.S. Army Arctic Test Center APO Seattle 98733		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NA
11. CONTROLLING OFFICE NAME AND ADDRESS Commander U.S. Army Tank-Automotive Command ATTN: AMSTA-RPT, Warren, MI 48090		12. REPORT DATE 15 May 1974 13. NUMBER OF PAGES 12
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* Commander U.S. Army Test and Evaluation Command ATTN: AMSTE-BB Aberdeen Proving Ground, MD 21005		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE NA

16. DISTRIBUTION STATEMENT *(of this Report)*

Distribution limited to U.S. Government agencies only; test and evaluation; 15 May 1974. Other requests for this document must be referred to Commander, Tank-Automotive Command, ATTN: AMSTA-RPT, Warren, Michigan 48090

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

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

Non-metallic fuel tank
Cold weather testing (arctic)
Plastics
Trucks, M151, M715, and M725
Rotational molded

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

A product improvement test of a non-metallic fuel tank was conducted from 20 March 1973 to 19 April 1974 by the Arctic Test Center at Fort Greely, Alaska. Sixteen non-metallic fuel tanks (rotational molded, nylon type) were installed in eight M715/M725 and eight M151 tactical trucks. The vehicles using the non-metallic fuel tanks operated at temperatures ranging from 83°F to -51°F and accumulated 62,915 miles of operation. The nylon used in the construction of the non-metallic fuel tanks for both type

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

20. (Cont'd) vehicles appeared durable. The M715 type non-metallic fuel tanks (as tested) could not be mounted securely. The M151 type non-metallic fuel tanks did not provide a suitable means for securing the fuel in-tank assembly to the collar of the non-metallic fuel tanks.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY ARCTIC TEST CENTER
APO SEATTLE 98733

STEAC-MT-VB 15 May 1974

SUBJECT: Final Letter Report of Phase I of the Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project No. 1-VG-123-000-003

Commander
U.S. Army Tank-Automotive Command
ATTN: AMSTA-RPT
Warren, Michigan 48090

1. REFERENCES:

a. Letter, AMSTE-BB, TECOM, 13 April 1972, subject: Customer Test Directive: Product Improvement Test of Non-Metallic Fuel Tanks for Trucks, M151 and M715, TECOM Project Nos. 1-VG-123-000-001/-002/-003.

b. Letter, AMSTE-BB, TECOM, 15 December 1972, subject: Customer Test Directive: Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project Nos. 1-VG-123-000-001/-002/-003/-004.

c. Letter, STEAC-MT-VB, ATC, 25 September 1973, subject: Interim Report of Phase I of Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project Nos. 1-VG-123-000-001/-002/-003/-004.

2. BACKGROUND:

a. History:

(1) U.S. Army Tank-Automotive Command (TACOM) developed a non-metallic fuel tank which had certain apparent advantages over standard metal fuel tanks: the non-metallic fuel tanks were less susceptible to corrosion, were lighter in weight, and were less expensive.

(2) The Arctic Test Center (ATC), Tropic Test Center, and Yuma Proving Ground were directed by U.S. Army Test and Evaluation Command (TECOM) to conduct a two phase product improvement test of non-metallic fuel tanks (references 1a and 1b).

SUBJECT: Final Letter Report of Phase I of the Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project No. 1-VG-123-000-003

(3) An interim report was submitted by ATC on 25 September 1973 (reference 1c).

b. Description of Materiel:

There are three types of non-metallic fuel tanks:

TYPE	DESCRIPTION	PHASE OF TESTING
A	Blow molded polyethylene	II
B	Rotational molded, cross linked polyethylene	II
C	Rotational molded, nylon	I

Photographs 1 and 2 illustrate the two types of phase I non-metallic fuel tanks.

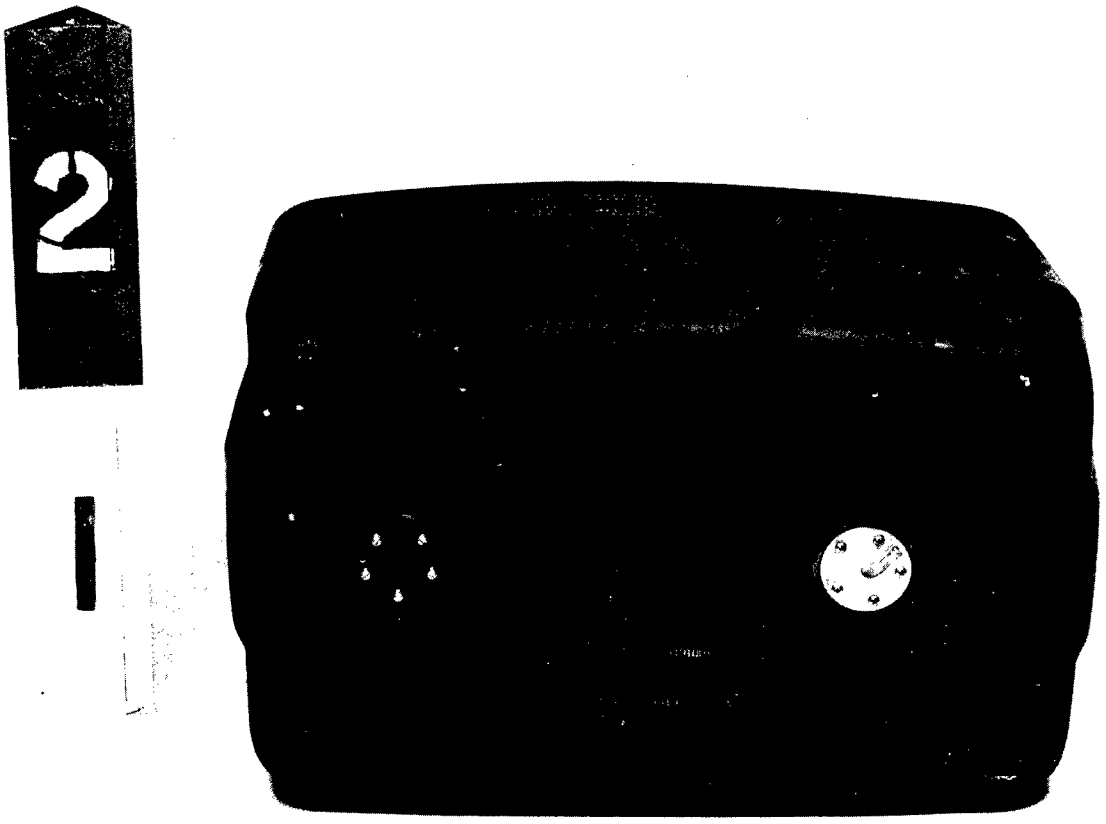

PHOTO 1.--Phase I Type Non-Metallic Fuel Tanks for M715/M725 Vehicle

SUBJECT: Final Letter Report of Phase I of the Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project No. 1-VG-123-000-003

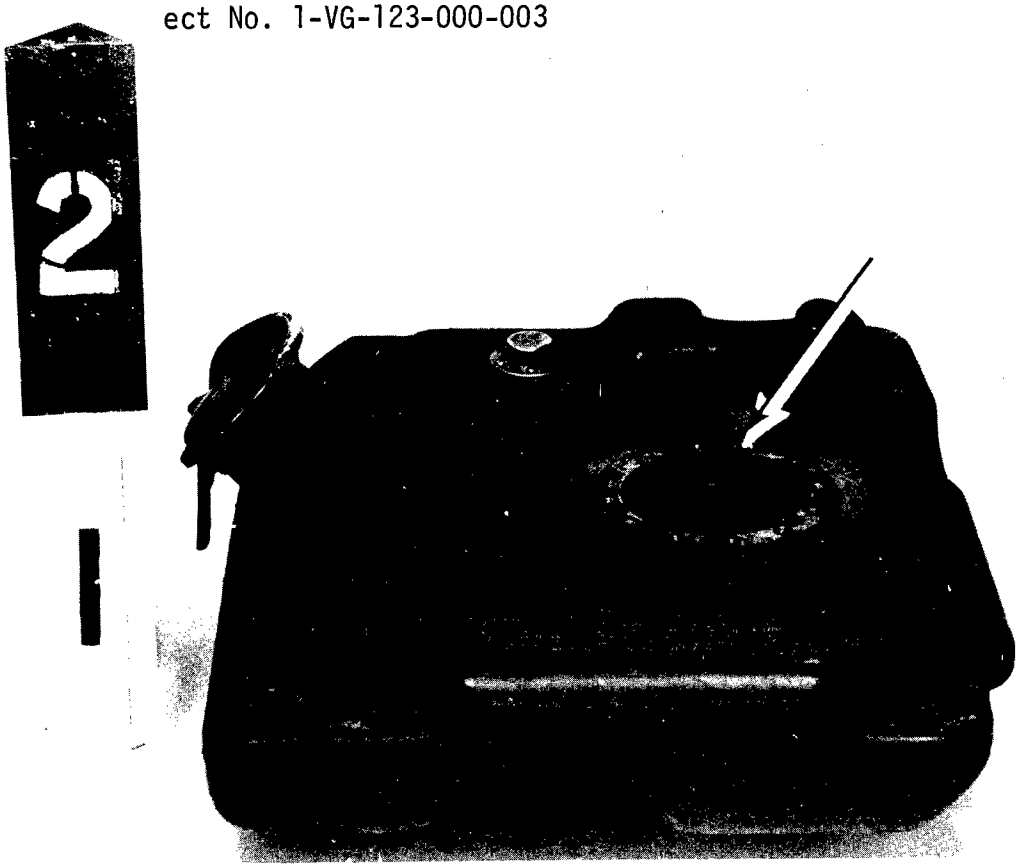

PHOTO 2.--Phase I Type Non-Metallic Fuel Tanks for M151 Vehicle. Arrow Shows Location of Fuel Tank Collar.

c. Scope:

(1) ATC conducted phase I of a produce improvement test of a non-metallic fuel tank from 20 March 1973 to 19 April 1974 at Fort Greely and Fort Wainwright, Alaska. Temperatures during testing ranged from 83°F to -51°F.

(2) Sixteen non-metallic fuel tanks (eight for M151 series vehicles and eight for M715 series vehicles) were installed between 20 March and 3 April 1973 on test support vehicles as follows:

Number of Fuel Tanks	Type Vehicle	Location
8	M151	Ft. Wainwright
6	M715	Ft. Wainwright
1	M725	Ft. Wainwright
1	M715	Ft. Greely

(3) Test personnel inspected the non-metallic fuel tanks each month for leaks, cracking, or any other unusual conditions. A record of the test support vehicle's odometer reading was taken during the monthly inspections, and comments of the test team and operators were recorded.

(4) Six M715 and six M151 phase I type non-metallic fuel tanks will be returned to TACOM for analysis. Two of each type (four total), phase I non-metallic fuel tanks will be retained by ATC for possible rupture testing during phase II of testing.

3. OBJECTIVE:

To provide TACOM with operational test data on non-metallic fuel tanks mounted on tactical wheeled vehicles.

4. SUMMARY OF RESULTS:

a. The non-metallic fuel tanks were visually inspected for any evidence of damage prior to installation. All non-metallic fuel tanks were received in serviceable condition for testing.

b. Table 2, inclosure 1, shows the operational data on the nonmetallic fuel tanks.

c. Tables 3 and 4, inclosure 1, show the maximum and minimum weekly ambient temperatures.

d. No difficulties were encountered installing the M715/M725 non-metallic fuel tanks, however:

(1) On 2 April 1973 an M715/M725 Non-Metallic Fuel Tank (No. 51), was found to be missing during the operation of the test support vehicle. The test support vehicle was on dispatch in the local area of Fort Wainwright, Alaska, when it ran out of fuel. Inspection of the vehicle revealed that the non-metallic fuel tank was missing. The take-up bolts

on the supporting bands of the non-metallic fuel tank were present; however, the outboard supporting band was not connected to its retaining clip. The driver could not explain the disappearance, and a search by unit personnel and the Military Police failed to locate the tank. Further inspection of other M715/M725 test support vehicles revealed that the supporting straps which hold the non-metallic fuel tanks to the under-carriage of the vehicles were loose and moving outward from each other. The supporting straps were loosening as they moved outward on the bottom curved surface of the non-metallic fuel tanks. As an interim fix, two metal bands were used to connect the supporting straps and prevent them from separating. Molded channels for the straps or a basket type supporting strap was recommended.

e. The M151 Non-Metallic Fuel Tanks were installed between 17 March and 3 April 1973. The M151 Non-Metallic Fuel Tanks were not equipped with a high enough collar (reference photo 2) to permit reinstallation of the fuel in-tank assembly. An extension ring (spacer) was used to raise the fuel in-tank assembly so that it did not rest against the inside bottom of the tank. When the TACOM representative was supervising the installation of the spacers, he noticed that the modification would require an extra Gasket, Fuel Tank Cover (FSN 291-678-1855). At this time the TACOM representative, not having the extra gaskets, recommended using a permatex sealant in place of the gaskets. A higher non-metallic fuel tank collar would have eliminated the problem.

(1) On 13 April 1973 one of the M151 Non-Metallic Fuel Tanks began to leak fuel between the fuel tank and the extension ring of the fuel in-tank filter assembly. Both the TACOM representative's original permatex sealant (No. 1) and a harder grade (No. 3) failed to seal the leak. There were six separate instances where the permatex failed to retain a seal on the non-metallic fuel tanks. By 14 August 1973, all non-metallic fuel tanks were sealed by either cork or neoprene gaskets. No seals which utilized cork or neoprene gaskets leaked throughout the test.

(2) On 17 April 1973 personnel using an M151 vehicle equipped with a non-metallic fuel tank observed fuel leaking from the seal between the tank and the fuel in-tank assembly (before the second gasket was installed). These personnel performed unauthorized field maintenance in an effort to stop the leakage and in doing so, pulled two metal threaded inserts (used to secure the fuel in-tank assembly to the collar of the non-metallic fuel tank) from the tank's collar by possibly over-torquing the bolts. The inserts were reinstalled satisfactorily using epoxy glue.

(3) During removal of the M151 Non-Metallic Fuel Tanks, it was observed that a total of 24 out of a possible 96 (eight tanks x 12 inserts/tank) metal threaded inserts had pulled away from the collar of the tanks. No leaks were observed at these seals prior to removal. Table 1 below shows frequency of insert failure. This problem has been eliminated in the phase II tanks by replacement of the metal threaded inserts by a bolt plate inside the non-metallic fuel tank's collar.

TABLE 1.--Frequency of Metal Threaded Insert Failure

Tank SN	Number of Failures	Percentage Failed
40	5	42
42	6	50
49	6	50
51	0	0
54	2	17
56	2	17
57	0	0
63	3	25

6. CONCLUSIONS:

a. That the supporting straps on an M715/M725 did not satisfactorily secure the M715/M725 Non-Metallic Fuel Tanks.

b. That permatex sealant did not effectively seal the junction between the non-metallic fuel tank's collar and the extension ring (spacer) of the M151 tank.

c. That metal threaded inserts are not a suitable means for securing the fuel in-tank assembly to the collar of the non-metallic fuel tanks.

7. RECOMMENDATIONS: That

a. The M715/M725 Non-Metallic Fuel Tanks have channels molded in them to aid in holding supporting straps in place or,

b. That the M715/M725 vehicle's supporting straps be modified to a harness type supporting system.

STEAC-MT-VB 15 May 1974
SUBJECT: Final Letter Report of Phase I of the Product Improvement Test of Non-Metallic Fuel Tanks for Trucks M151 and M715, TECOM Project No. 1-VG-123-000-003

c. The M151 Non-Metallic Fuel Tanks be molded with a higher collar which could accommodate the fuel in-tank assembly without the use of an extension ring (spacer).

FOR THE COMMANDER:

Incl
as

LLOYD R. SUMMERS
CPT, AG
Adjutant

CF:

Cdr, TECOM, ATTN: AMSTE-BB, APG, MD 21005 (2)
Cdr, TACOM, ATTN: AMSTA-RPT, Warren, MI 48090 (20)
Cdr, USARAL, ATTN: ARACD, APO Seattle 98749 (2)

TABLE 2.--Operational Data on the Phase I Non-Metallic Fuel Tanks

Vehicle Type	Vehicle USA Number	Tank ID Number	Date Installed (1973)	Time Tested (days)	Vehicle Mileage (miles)	Vehicle Location	Remarks
M151	2J9588	56	27 March	386	4,990	Ft. Wainwright	Tank No. 51 (M151 model) is not the same as No. 51 (M715 model).
M151	2J9460	51	28 March	386	4,673	Ft. Wainwright	
M151	2J9530	40	30 March	383	5,507	Ft. Wainwright	
M151	2K4404	54	29 March	384	2,858	Ft. Wainwright	
M151	2J9513	42	2 April	381	5,084	Ft. Wainwright	
M151	2J9311	57	2 April	381	2,437	Ft. Wainwright	
M151	2K4445	63	3 April	379	8,472	Ft. Wainwright	
M151	2K6116	49	3 April	379	3,163	Ft. Wainwright	
M715	03N56068	18	20 March	387	3,567	Ft. Greely	
M715	03N56268	51	27 March	6	87	Ft. Wainwright	N.M. Fuel Tank No. 51 disappeared on 2 April 1973. New N.M. Fuel Tank No. 39 installed on 10 July 1973.
		39	10 July	226	395		
M715	03P10068	23	27 March	365	1,303	Ft. Wainwright	
M715	03N53768	22	29 March	385	8,575	Ft. Wainwright	
M715	03P13668	52	28 March	387	4,805	Ft. Wainwright	
M715	03P00268	46	28 March	387	4,436	Ft. Wainwright	
M715	03N88968	21	28 March	386	528	Ft. Wainwright	
M725	03E27868	27	28 March	386	2,035	Ft. Wainwright	

Total 62,915 miles

TABLE 3.--Ft. Wainwright Ambient Temperatures °F

Week	Weekly Maximum	Weekly Minimum	Weekly Average
18 Mar 73 - 24	43	-21	7
25 - 31	48	2	30
1 Apr - 7	51	9	31
8 - 14	52	18	37
15 - 21	44	17	32
22 - 28	44	15	29
29 - 5 May	60	23	45
6 - 12	60	23	45
13 - 19	70	33	53
20 - 26	67	31	51
27 - 2 Jun	69	31	51
3 - 9	69	39	53
10 - 16	77	44	61
17 - 23	78	38	61
24 - 30	76	34	55
1 - 7 Jul	73	40	56
8 - 14	77	42	58
15 - 21	76	39	53
22 - 28	83	41	62
29 - 4 Aug	70	35	54
5 - 11	83	36	50
12 - 18	62	30	46
19 - 25	83	39	54
26 - 1 Sep	58	25	43
2 - 8	67	28	47
9 - 15	74	29	47
16 - 22	MISSING	MISSING	MISSING
23 - 29	47	22	33
30 - 6 Oct	49	28	36
7 - 13	33	15	25
14 - 20	44	1	22
21 - 27	31	2	15
28 - 3 Nov	24	-9	11
4 - 10	20	-11	7
11 - 17	17	-36	-19
18 - 24	15	-35	-3
25 - 1 Dec	11	-34	-11
2 - 8	6	-28	-13
9 - 15	10	-23	-7
16 - 22	24	-17	2
23 - 29	39	-16	3
31 Dec 73 - 6 Jan 74	21	-12	7

TABLE 4.--Ft. Greely Ambient Temperatures °F
(Only for Vehicle 03N56068)

Week	Weekly Maximum	Weekly Minimum	Weekly Average
18 Mar 73 - 24	44	-30	13
25 - 31	45	10	33
1 Apr - 7	44	10	32
8 - 14	49	16	39
15 - 21	46	22	33
22 - 28	43	15	29
29 - 5 May	61	27	45
6 - 12	55	23	41
13 - 19	65	34	52
20 - 26	61	30	48
27 - 2 Jun	66	29	50
3 - 9	64	32	50
10 - 16	75	38	58
17 - 23	71	43	58
24 - 30	74	38	55
1 - 7 Jul	68	47	57
8 - 14	75	46	58
15 - 21	73	42	56
22 - 28	80	44	65
29 - 4 Aug	66	37	54
5 - 11	67	42	53
12 - 18	67	32	47
19 - 25	80	45	56
26 - 1 Sep	57	29	45
2 - 8	62	27	48
9 - 15	70	27	49
16 - 22	66	31	45
23 - 29	46	19	33
30 - 6 Oct	55	24	34
7 - 13	33	6	22
14 - 20	33	-5	22
21 - 27	34	-13	19
28 - 3 Nov	30	-11	17
4 - 10	18	-14	6
11 - 17	16	-43	-15
18 - 24	8	-36	-4
25 - 1 Dec	9	-37	-5
2 - 8	10	-12	0
9 - 15	12	-23	0
16 - 22	31	-26	8
23 - 29	32	-8	12

TABLE 4.--Ft. Greely Ambient Temperatures °F (Cont'd)
(Only for Vehicle 03N56068)

Week	Weekly Maximum	Weekly Minimum	Weekly Average
30 Dec - 5 Jan 74	25	-4	8
6 - 12	9	-40	-8
13 - 19	-9	-40	-18
20 - 26	0	-45	-19
27 - 2 Feb	-8	-51	-24
3 - 9	18	-27	0
10 - 16	-5	-46	-24
17 - 23	-9	-49	-30
24 - 1 Mar	10	-36	-7
2 - 8	10	-42	-10
9 - 15	27	-46	-7
16 - 22	57	-22	26
23 - 29	57	-10	24
30 - 5 Apr	41	-14	18
6 - 12	50	2	28
13 - 19	49	21	37