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DIRECTORATE OF LAND SYSTEMS  
DEPLOYABLE SUPPORT



**SAFETY & ENGINEERING**

SERIOUS EQUIPMENT FAILURE  
INVESTIGATION TEAM (AFGHANISTAN)

SERIOUS INCIDENT

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Title: GUN 105MM FIELD, L118 TOWED.

VRN: [REDACTED]

AIR RESERVOIR CATASTROPHIC EXPLOSION

Report Reference No: SI/07/0232/SEFIT (A)

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SERIOUS INCIDENT- SI/07/0232/SEFIT (A)

GUN 105MM FIELD, L118 TOWED

VRN: [REDACTED]

AIR RESERVOIR CATASTROPHIC EXPLOSION

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Rank: WO1 (ASM)

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Date: 04 Nov 07  
Distribution delayed due to  
operational constraints

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Enclosures:

1. Serious Safety Signal HRH 021823Z NOV 07.
2. CS40, 4 Regt RA FOB - Radio Log 02 Nov 07.
3. Statement/Schedule of events [REDACTED]

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**CONTENTS**

	Paragraph
INTRODUCTION	1 - 2
DATA	3
BACKGROUND	4 - 5
TECHNICAL DATA	6
INITIAL INVESTIGATION	7 - 11
FURTHER INVESTIGATION	12 - 17
CONCLUSIONS	18 - 19
RECOMMENDATIONS	20 - 25
ACKNOWLEDGEMENTS	26 - 27



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SERIOUS INCIDENT – SI/07/0232/SEFIT(A)

GUN 105MM FIELD, L118 TOWED.

VRN: [REDACTED]

CATASTROPHIC EXPLOSION OF AIR RESERVOIR

References:

- A. Telcon [REDACTED] RA (2IC 4 Regt RA)/[REDACTED], (SEFIT (A)) on 02 Nov 07.
- B. SEF Signal HRH 021823Z NOV 07.
- C. Joint Service Publication 336/886, Vol 12, Part 2, Pam 2, Section 1.
- D. AESP 1015-K-100-201, Gun 105mm Field, L118 Towed, Technical Description.
- E. Statement/Schedule of events [REDACTED].
- F. CS40, 4 Regt RA FOB - Radio Log 02 Nov 07.
- G. Telcon [REDACTED], SEFIT(A)/[REDACTED], SEFIT(UK) on 06 Nov 07.



Figure 1 - Gun 105mm Field L118 Towed VRN: [REDACTED]

**INTRODUCTION**

1. In response to Reference A (subsequently endorsed by Reference B) and in accordance with Reference C, [REDACTED] from the Serious Equipment Failure Investigation Team (Afghanistan) (SEFIT(A)) deployed to an unspecified Forward Operating Base (FOB), Op HERRICK. The purpose of the deployment was to carry out an engineering investigation on the subject equipment (Figure 1). He was accompanied by [REDACTED], Artificer Weapons (Art Wpns), 1 Battalion REME Group and [REDACTED], Ammunition Technician, HQ NSC (A). Unit representatives, [REDACTED] and [REDACTED] (Art Wpns), were present during the investigation.

2. Some details of this investigation have been omitted for operational reasons. Any further information may be obtained through NSC(A) HQ.

**DATA**

- 3. Holding Unit: 4 Regt RA  
Eqpt Type: Gun 105mm Field L118 Towed



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Asset Code:	JW 41520001
VRN:	██████████
Mileage/Usage:	Barrel - 212 EFC Components - 380.50 EFC
Date/Type of Last Examination:	26 Sep 07 - Examination of Ordnance
Date/Type of Last Inspection:	29 Sep 07 - MEI
Date of Incident:	02 Nov 07
Date of Investigation:	03 Nov 07
Date IPT Informed:	05 Nov 07 - ██████████

## BACKGROUND

4. The following has been extracted from personal and documented accounts of the incident: At approximately 1640hrs (local time) a fire mission was received by ██████████, 4 Regt RA whilst deployed at the FOB. On the command "Fire", a loud explosion was heard on the gun line and Gun ██████████ was engulfed in a plume of flames, smoke and dust. The overhead camouflage nets were ablaze and personnel were quick to extinguish the flames that were falling onto live ammunition charges. Three personnel had suffered injuries and other troops extracted them and administered first aid. After the flames were doused, the injured personnel were evacuated and the incident reported. SEFIT(A) was informed verbally in Reference A at 1735 hours.

5. 4 Regt RA CP were informed by the FOB Gun Fitter that it was suspected oxygen had been used to pressurise the recuperator and reservoir system.

## TECHNICAL DATA

6. A full technical description of the subject equipment can be found at Reference D. A brief description of the equipment and relevant systems is as follows:

a. **General.** The equipment is a towed light-weight field gun designed for field and anti-tank roles. The ordnance is a basic monobloc construction employing an electric firing system and double baffled muzzle brake. The breech mechanism is a vertical sliding block type with the operating mechanism on the top surface of the breech ring.

b. **Recoil system.** The recoil system comprises a recuperator mounted on top of the ordnance and a hydraulic buffer beneath. The recuperator is of the hydro-pneumatic telescopic type with a front mounted reservoir to provide the extra volume required for operation of the recoil system. The reservoir is charged with compressed air to an initial pressure of 750lbf/in<sup>2</sup>. At the end of recoil the pressure in the recuperator reaches up to a maximum of 1280lbf/in<sup>2</sup>, dependent on length of recoil and type of charge.

c. The recoil system absorbs most of the recoil energy then returns the gun to the fully run-out position and retains it there during periods of rest. The system is designed to vary the length of recoil dependent upon the gun elevation. The recoil varies from a minimum 9" to a maximum 46" in length. Metal to metal recoil length is 47". This length is measured by the recoil indicator; a sliding assembly on a scale driven by the recoiling mass.



**INITIAL INVESTIGATION**

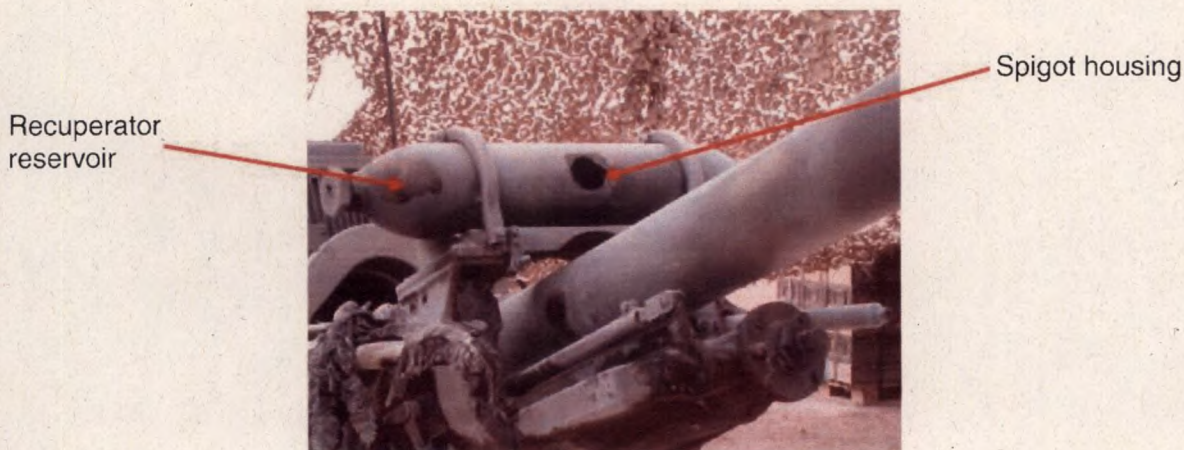
7. On arrival at the scene the Investigating Officer established that the subject equipment had been quarantined awaiting SEFIT investigation. The cartridge case was still in the breech so the system was made safe by [REDACTED] and [REDACTED]. The barrel was examined and was found to be free from explosives. Examination of the equipment was conducted. [REDACTED] (Ammo Tech) inspected the spent round and declared the ammunition satisfactory. A detailed description of the damage follows.

8. **General.** There was significant cosmetic fire and smoke damage on most components (Figure 2) which were also subject to melted camouflage net droplets. The trailer assembly escaped any significant visible damage.



**Figure 2 – Fire and smoke damage**

9. **Recuperator reservoir.** The recuperator reservoir (Figures 3 – 6a) had suffered catastrophic damage. The forward end of the spigot had fractured and been forcefully ejected from the reservoir and was not recovered. Both left and right end screwed plugs were punctured on the end faces (Figs 5 and 5a) and in the areas of the screw threads and sealing washers (Figs 6 and 6a).



**Figure 3 – Recuperator reservoir front view**



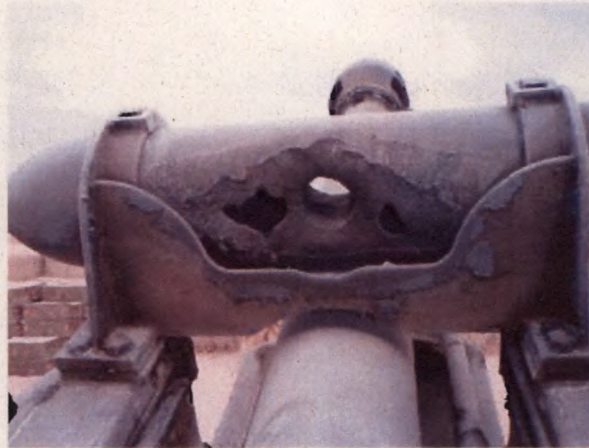


Figure 4 – Recuperator reservoir rear view



Figures 5 / 5a – Recuperator reservoir left and right end screwed plugs



Figures 6 / 6a – Recuperator reservoir left and right sealing washer areas



10. **Recuperator.** The recuperator piston rod (Figure 7) had been subjected to considerable forward force fracturing the spigot, compressing/disfiguring the brass jacking nut, and damaging the rear face of the reservoir (Figure 4). The piston rod anti-rotation washer was not recovered. There was impact damage at the rear of the recuperator where it had struck the breech ring assembly (Figure 8).

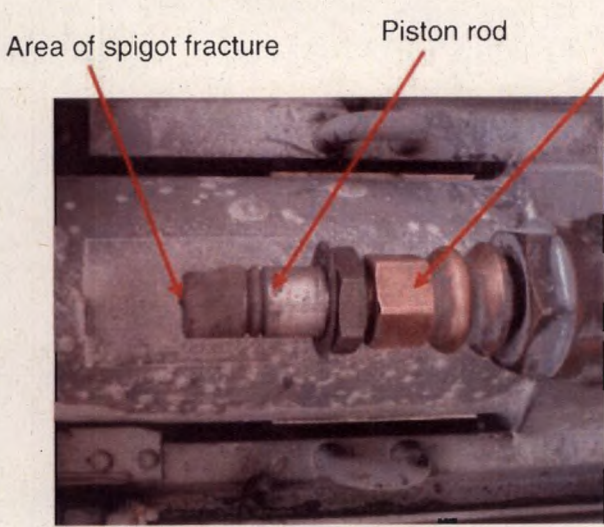


Figure 7 – Recuperator, reservoir end



Figure 7a – Serviceable comparison

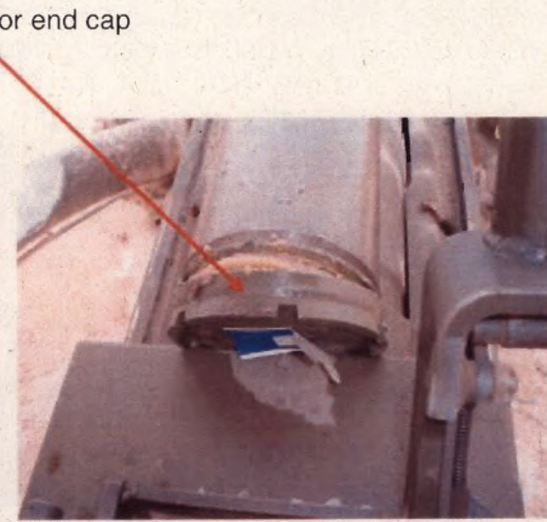
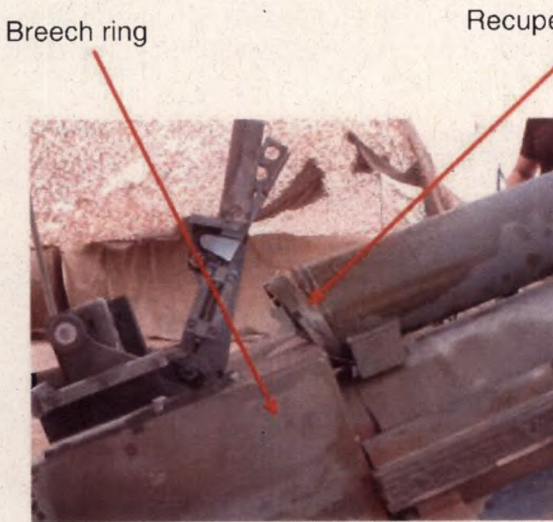


Figure 8 – Recuperator, breech ring end, side and top view



11. **Cut-off gear assembly.** There was fire damage to the clamping rod, end cap and clamping screw (front rod). There was minor cosmetic damage to the bevel gearshaft lever, scale rod and fork ends (Figure 9). There was no significant visible damage to the rear connecting rod assembly.



Figure 9 – Cut-off gear front rod assembly

#### FURTHER INVESTIGATION

12. There are no other reported instances of this failure on this equipment type.

13. According to References E and F, the equipment had recently had a new recuperator and reservoir fitted on 30 Oct 07. This was pressurised between 1820hrs and 2011hrs. A fire mission of 4 rounds was fired successfully at 1215hrs, 31 Oct 07. The recuperator lost some further pressure and was re-pressurised to 800lb/in<sup>2</sup> on 01 Nov 07. The serious incident was reported at 1640hrs, 02 Nov 07. It was then reported at 1947hrs detailed in Reference F, that compressed oxygen had possibly been introduced into the recuperator system when replaced. *Safety Check Fire* was imposed and the oxygen presence was confirmed.

14. Both oxygen and compressed air bottles (Figure 10) within the FOB were similar in size, colour and fittings (both accommodated the same pressure regulator). There was also excessive dust in the area. They were stored in the same location when not in use.



Figure 10 – Compressed air and oxygen bottles at location



15. As a result of Reference G, consultation between [REDACTED] SEFIT(UK) and [REDACTED] Material Integrity Group identified that the mixture of oxygen, XG279 grease, OM13 oil and a high pressure up to 1280lbf/in<sup>2</sup> within the recuperator could provide the correct environment for combustion/*dieselisation* upon recoil.

16. There is no reference to the dangers involved with incorrect filling of the recuperator and reservoir in the AESP 1015-K-100.

17. On inspection of the two types of bottle on site it is understandable how easy it would be to mistake them, particularly if it was assumed that all bottles were compressed air and considering the conditions at the time of use.

## CONCLUSIONS

18. A series of factors and events culminated in the failure of the recuperator and reservoir system on [REDACTED]

- a. The similarity in the two types of gas bottle present; compressed air and oxygen. These should have ideally been easily discernible.
- b. The provision of oxygen from Bulk Fuel Issues (BFI) and the subsequent onward distribution to the FOB. There were a number of opportunities to confirm/identify the gasses involved:
  - (1) On issue from BFI to 4 Regt RA.
  - (2) On receipt and onward distribution from 4 Regt RA to FOBs.
  - (3) On receipt at FOB and subsequent issue to Gun Ftr.
- c. The lack of segregation of two gasses at the FOB (in this instance, there was no awareness of oxygen being present).
- d. The initial pressurising of the recuperator taking place under darkness whilst light discipline was in place.

19. It is concluded that the catastrophic failure of the recuperator and reservoir system was due to the introduction of oxygen into the system thus providing the correct environment for combustion to take place.

## RECOMMENDATIONS

20. The engineering authority for the L118 Light Gun lies with Artillery Systems Integrated Project Team (Arty Sys IPT). The conclusions and recommendations made by the Investigating Officer are fully endorsed by the Engineering Officer.

21. It is recommended that Arty Sys IPT:

- a. Issue an immediate priority signal to remind all users of the dangers of incorrect filling of high pressure systems.
- b. Produce an amendment to the AESP warnings and cautions to include the dangers of incorrect filling of high pressure systems.
- c. Record this incident with a view to monitoring future trends.



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- d. Complete the attached report response form and return it to SEFIT(UK) technical officer within 30 days.
22. It is recommended that HQ DEME(A) H & S adviser:
- a. Advertises the dangers of incorrect filling of high pressure systems.
  - b. Complete the attached report response form and return it to SEFIT(UK) technical officer within 30 days.
23. It is recommended that DE&S LSSO:
- a. Advertise the dangers of incorrect filling of high pressure systems.
  - b. Complete the attached report response form and return it to SEFIT(UK) technical officer within 30 days.
24. It is recommended that HQ NSC(A) SO3 Fuels (in conjunction with BFI):
- a. Review its procedures in the identification, marking and confirmation with recipient of all gas cylinders prior to issue.
  - b. Complete the attached report response form and return it to SEFIT(UK) technical officer within 30 days.
25. It is recommended that 4 Regt RA:
- a. Review its processes regarding both the identification of all gas cylinders and confirmation of type and use with any recipient prior to issue.
  - b. Repair the subject equipment and return it to service.
  - c. Continue to report serious equipment failures in accordance with Reference B.
  - d. Complete the attached report response form and return it to SEFIT(UK) technical officer within 30 days.

**ACKNOWLEDGEMENTS**

26. The quick thinking and actions of personnel in the immediate aftermath of the incident prevented further injuries and danger.
27. The Investigating Officer would like to thank [REDACTED], [REDACTED] and [REDACTED] for their technical assistance during the investigation.



FORMAT FOR SERIOUS AND SAFETY FAILURE SIGNALS

Message Form

F/Sigs 294  
(Revised 1/90)

Protective Marking	RESTRICTED	Serial No.	
Descriptor/Special Handling		Store No.	
Cancel			

Line 1	Routed by		
2	Time		
3	Prepared by		
4	Time		
Precedence - Action	PRIORITY	Info PRIORITY	For single transmission
DTG: 021813Z	Month NOV	Year 07	Transmitted to
Routing indicators	From: 4 <sup>TH</sup> REGIMENT ROYAL ARTILLERY		
	To: HQ NSC(A)		Channel No / system
	DEAS ANDOVER		Time
	CESO(A) NETHERAVON		Operator
	HQ LAND WILTON		Message instructions
	52 INF BDE MAIN		Protective Marking RESTRICTED
	LAIT		SIC(s) HRM
	Info:		

HQ NSC(A) FOR ES BR PD DEAS ANDOVER FOR SEFT(UK) AND SEFT(G) PD CESO(A) NETHERAVON FOR LAIT AND  
AINC PD DEAS FOR ESM (PASS IPT) PD HQ LAND FOR US BR PD 52 INF BDE FOR ES PD  
SERIOUS EQUIPMENT FAILURE

- A. UIN AS2064 EFR NUMBER TBC
- B. EQUIPMENT L118 LIGHT GUN IIR/SEN NUMBER [REDACTED]
- C. NATURE OF INCIDENT - EXPLOSION AT DTG 021849 NOV 07 LOCAL
- D. PUBLICATION REFERENCE - AESP 1015-K-100 OCTAD
- E. ITEM AFFECTED MAIN ITEM
- F. MODIFICATION STATE
- G. 1. CATASTROPHIC FAILURE OF REGULATOR
- 2. OPERATIONAL
- 3. 2 X T2, 2 X T3
- H. TBC AS PER SEFT REPORT/SEFT REP / ATG ON SITE
- I.
- J. ONE
- K. AS PER SEFT/ATO REPORT
- L. REGTL 2IC 4 REGT RA OP HERRICK BASTION EXT 2831

Internal distribution: 2IC, OC LAD, GM(1)

Page 1 of 1 pages	File No. or Reference KHQ/03/0700	Releasing Officer's Signature [REDACTED]
Drafter's Name and Rank/Grade (In BLOCK letters)		Name (Block Letters) [REDACTED]
Branch and telephone No.		Rank/Grade W A/T
	File time/TOR	Systems
	Operator	Final check Operator
Branch and Telephone No. KHQ 010		

Descriptor/Special Handling Cancel



02007 [redacted] [redacted]

Time	Lat	Long	Remarks
1945	40	110	late team starts in my [redacted] tomorrow. Announce gun rule soon we are [redacted] to try our very best to [redacted]
1945	110	40	that's been done & can you confirm [redacted] is definitely being on [redacted] tomorrow
1947	40	110	Yes has [redacted] with [redacted] All 3 guns will be coming out of action because B we were short oxygen and compressed air. There fore we must need 2 bottles of comp. air min tomorrow or guns will not be back in action
2000	40	110	BB Safety check being done. How does gun filter know its oxygen in bottle. what marks gun filter in oxygen not air. we are diff between [redacted] & air
40	110		wheels down 12:00 late team with 2x comp air to bring other guns back in. Is c/f a fuse for [redacted] of comp air [redacted] 4x 2x has checked will lift c/f
2000	110	40	Confirm we have 2x Back camp the [redacted] [redacted]
2000	40	110	Get dialer & other [redacted] on the flight what does [redacted]

[redacted] [redacted]



statement by [REDACTED] (Page 1).  
 Concerning Equipment Support Activity on [REDACTED] Gun 2.  
 Location [REDACTED] Afghanistan.

- 14 10 07 - checked Air pressure and then filled to 800 lb/in<sup>2</sup>  
 17 10 07 - checked Air pressure - 800 lb/in<sup>2</sup>  
 21 10 07 - checked Air pressure and then filled to 800 lb/in<sup>2</sup>  
 23 10 07 - checked Air pressure - 200 lb/in<sup>2</sup>  
           Replaced Schroeder valves  
           filled to 800 lb/in<sup>2</sup>  
 24 10 07 - checked Air pressure - 200 lb/in<sup>2</sup>  
           filled to 800 lb/in<sup>2</sup>  
           found leak in recuperator  
           informed CP Gun Out  
           demanded Recuperator + Air.  
           stripped US Recuperator off Gun.  
 26 10 07 - Recuperator + Gas bottle delivered  
           Recuperator not complete with Air Reservoir  
           Requested Air Reservoir  
           Gas bottle and recuperator took at Gun position  
           All old components back-loaded on flight.  
 30 10 07 - 1820 HRS  
           Air Reservoir Delivered on [REDACTED]  
           stripped Air Reservoir 1AW ACSI 1015-K-100-523 [REDACTED]  
           Chapter 4 Para 12. [REDACTED]



Statement of [REDACTED] continued (Page 2).

- 30-10-07 - cleaned all components and re-used old O-rings from spigot.
- rebuilt Recuperator and fitted to gun (AW).
  - AESF 1016 & 100 522 and 523
  - checked stuffing box - already fitted.
  - checked oil (Recuperator) - already fitted.
  - fitted Adaptor charging to Gas Bottle.
  - charged recuperator to 800 lb/in<sup>2</sup>
  - pulled back gun 3 times.
  - Reported gun back in (20.11 HRS).
  - packed tools away
- 31 10 07 - Firing mission 4 Rounds.
- 01 11 07 - checked Air. 680 lb/in<sup>2</sup>
- filled to 800 lb/in<sup>2</sup>
- 02 11 07 - catastrophic failure of Recuperator
- Explosion on gun.
  - On checking gun it became apparent that the Air reservoir had exploded.
  - The damage looked like gas axe damage and therefore incorrect gas or oil was suspected.
  - On checking inspecting gas bottles they were found to be labeled Oxygen.



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statement of [REDACTED] (continued) [REDACTED]  
02 11 07 - Informed CPO that Gas 1 and 3 were out  
as they had been replenished with Gas  
from the cylinder that was used to  
fill Gas 2. [REDACTED]

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