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ANALYSIS OF CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING FAILURES/MALFUNCTIONS OF LATERALS, HATCHES, TRACKS, OR ACCELERATORS/THROTTLES

PROBLEM

As of 10 May 1978 USAAAVS had received DA Form 285 reports on 357 combat-type tracked vehicle accidents that occurred during CY 77. A study of driver errors that caused/contributed to these accidents is nearing completion. During this driver-error study several types of materiel failures/malfunctions that also contributed to the accidents came to light. These materiel failures/malfunctions occurred in 77 (22%) of the accidents and involved laterals, hatches, tracks, or accelerators/throttles.

ANALYSIS

Laterals. Table 1 presents short narratives of 29 accidents that involved a malfunction of the laterals. The header information for each accident identifies the case number, type vehicle, lateral involved, total cost (injury & property damage) and location.

Table 2 shows the answers to three questions according to the type of vehicle involved. Answers to the first question indicate that the right lateral became inoperative six times more than the left. However, no significance is attributed to this difference. There also is no statistically important difference according to vehicle.

Answers to the second question indicate that final drive failures were the most frequent cause of inoperative laterals. These final drive failures involved the following components: final drive seal (1), slip ring collar (2), universal joint (3), sprocket hub bolts (1), differential (2), and an unspecified "defective final drive" (1). The next most frequent cause of inoperative laterals was steering linkage problems: loose wiring harness became entangled in linkage (1), linkage securing pin came loose due to broken cotter pin (1), bent linkage (1), linkage bolt broke (1), and linkage "improperly adjusted" (1).

Answers to the third question indicate that an overwhelming majority (72%) of these accidents involving inoperative laterals occurred in Germany. It may be that there were just as many lateral failures (proportionately) in locations other than Germany but such failures did not result in reportable accidents. That is, a lateral failure on a narrow congested German road might result in a reportable accident whereas the same failure in an open training area at Fort Knox or Fort Hood would not.

Hatches. Table 3 lists short narratives of 23 accidents in which a hatch closed unintentionally and injured a crewman or passenger. A review of these narratives reveals that the hatches closed after encountering bumps/rough terrain (14) or during normal stops/starts/movements (9). It can also be seen that the hatches involved were cargo (10), driver (8), commander (2), loader (2), and rigger (1).

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Table 4 shows that carrier type vehicles (M106, M125, M113) accounted for most (74%) of the hatch accidents. Table 4 also presents answers to three questions about these accidents. Answers to the first question indicate that most of the hatches were latched before being jarred/vibrated loose and closing.

Answers to the second question reveal that of the 17 vehicles where a latch safety pin modification is appropriate, only three vehicles had the modification installed. It should be noted that there appears to be considerable frustration concerning these inadvertent hatch closings: in five cases the corrective action was to "strap" hatches open/closed and one case indicated that this was unit SOP.

Answers to the third question show the location of these hatch accidents is spread out with minor concentrations at Fort Hood (33%) and in Germany (33%). This distribution of accidents may reflect the degree to which the safety pin modification has been implemented, and use enforced, at various locations.

Tracks. Table 5 presents short narratives of 15 accidents involving track failures. Table 6 shows that carrier type vehicles (M577, M113, M667) accounted for most (67%) of these accidents. Table 6 also presents answers to three questions about these accidents. Answers to the first question reveal that the right track broke twice as much as the left. This may indicate that right tracks receive more wear because more turns are made to the right than left.

Answers to the second question indicate that improper maintenance was responsible for seven of the 11 accidents where the cause was reported. Improper maintenance involved unserviceable/worn track (5), improper track tension (1), and track bushing missing from pin (1). Unspecified materiel "defects" accounted for four track failures and the cause of four others was not reported.

Answers to the third question show that 12 (80%) of these accidents occurred in Germany. This disproportionate number may be due operations on narrow congested German roads as indicated above in the analysis of lateral failures.

Accelerators or Throttles. Table 7 lists short narratives of 10 accidents involving accelerator or throttle malfunctions. Table 8 shows that these accidents were distributed over a variety of vehicles with a moderate concentration in carrier type vehicles (M548, M113). Table 8 also reveals that the failures were almost evenly divided between accelerators and throttles. Of the five accidents where the cause was reported improper linkage adjustment was cited four times. It can be seen that most (6) of these accidents occurred in Germany and that five of the six were in maintenance areas.

TABLE 1
NARRATIVES OF CY 77 TRACKED VEHICLE ACCIDENTS
INVOLVING LATERALS

1. [redacted] M113 Right Lateral $1,000 GER(FT CARSON)

Vehicle going forward, right lateral "froze" locking right track. Vehicle went off Autobahn and through guard rail. Cause not reported.

2. [redacted] M551 Right Lateral $422 GER 961

Vehicle going forward, right lateral "malfunctioned." Vehicle hit house with right floatation pod. Cause not reported.

3. [redacted] M60 Right Lateral $18,425 FT HOOD

Vehicle going down incline, pulled to right and would not respond to left lateral. Vehicle overturned in ravine. Cause not reported.

4. [redacted] M548 Right Lateral $1,800 GER 031

Vehicle going forward, pulled sharply to right and ran into building. Cause was defective right final drive.

5. [redacted] M113 Right Lateral $1,440 FT RILEY

Vehicle going down incline, right steering/brakes became inoperative and vehicle ran into ditch. Cause was blown right final drive seal.

6. [redacted] M60 Left Lateral $200 FT CAMPBELL

Vehicle towing a tank and developed steering malfunction. Driver applied brakes, left track locked and vehicle went into ditch. Cause was slip ring collar on right side of final drive came off.

7. [redacted] M60 Right Lateral $1,200 GER 278

Vehicle turning right, developed total loss of steering/brakes and ran into building. Cause was right final drive collar came off.

8. [redacted] M551 Left Lateral $2,500 GER 061

Vehicle going downhill, brakes were applied and there was a "mechanical failure." Left track locked, vehicle veered left and collided head-on with German POV. Cause not reported.

9. [redacted] M548 Left Lateral $390 FT KNOX

Vehicle going forward and swerved slightly right. Driver corrected, but left lateral locked due to possible mechanical malfunction. Vehicle ran off road and down embankment. Cause not reported.

10. [redacted] M688 Right Lateral $850 GER 341

Vehicle turning right and right lateral "became inoperative." Vehicle crossed highway and struck POV. Cause was bolts came loose on final drive universal joint.

11. [redacted] M220 Right Lateral $8,000 GER 310

Driver released laterals after breaking at 5 mph and right lateral stuck due to "a mechanical failure." Vehicle swerved right into a building. Cause not reported.

12. [redacted] M113 Right Lateral $30,000 GER 061

Vehicle going forward and steering mechanism would not respond. Vehicle veered right, striking home. Cause was broken universal joint.

13. [redacted] M113 Right Lateral $375 GER 067

Vehicle negotiating left curve, but steering malfunctioned. Vehicle veered right and went down embankment. Cause not reported.

14. [redacted] M60 Unknown Lateral $32,141 FT HOOD

Vehicle going forward when a "mechanical defect" resulted in the loss of brakes and steering. Cause not reported.

15. [redacted] M113 Left Lateral $800 KOR (KS197)

Vehicle starting left turn when left lateral control was lost. Vehicle veered right and went down embankment. Cause was left drive sprocket hub bolts vibrated loose (NOTE: EIR submitted to install safety locks for these bolts).

16. [redacted] M578 Right Lateral $610 FT HOOD

Vehicle started right turn, but right lateral would not respond. Vehicle ran off road and hit POV. Cause was steering linkage bolt had broken.

17. [redacted] M548 Left Lateral $1,455 GER 061

Vehicle going downhill and left lateral "went out." Vehicle veered right, jumped curb, ran through stone wall and struck tree. Cause was transmission oil filter hose blew out.

18. [redacted] M551 Right Lateral $1,026 GER 077

Vehicle started right turn but right lateral would not turn vehicle. Vehicle crossed to left side of road, climbed embankment and overturned. Cause was improperly adjusted steering.

19. [redacted] M113 Left Lateral $500 GER 155

Vehicle going forward when left lateral "locked." Vehicle veered across Autobahn into dividing guard rail. Cause was faulty left differential.

20. [redacted] M113 Left Lateral $1,950 GER 763

Vehicle going forward when it pulled sharply left. Vehicle ran off road and down embankment. Cause was left final drive universal joint broke due to metal fatigue.

21. [redacted] M113 Right Lateral $701 GER 259

Vehicle going forward when driver heard noise in vehicle and applied brakes. Right lateral was inoperative; vehicle veered left and struck POV. Cause was right differential snapped.

22. [redacted] M113 Right Lateral $30,800 GER 443

Vehicle going forward when right lateral "stuck." Vehicle veered sharply right, went up embankment and overturned. Cause not reported.

23. [redacted] M163 Left Lateral $16,800 GER 921

Vehicle going around parked POV. Driver pulled left lateral with no response due to a "mechanical steering failure." Vehicle veered right and ran off road into concrete bus stop shelter. Cause not reported.

24. [redacted] M109 Right Lateral $1,500 GER 067

Vehicle turning left and right lateral brake became inoperative. Vehicle pivoted into bay door. Cause was loose wiring harness in engine compartment became entangled in brake linkage.

25. [redacted] M113 Left Lateral $1,000 FT CARSON

Vehicle going downhill. When driver applied brakes, a "mechanical defect" resulted in left lateral locking. Vehicle veered sharply left, went up on embankment and overturned. Cause not reported.

26. [redacted] CL60 Right Lateral $3,500 GER 077

Vehicle going forward and lost right steering and brakes due to a "mechanical failure." Vehicle ran off road to right. Cause not reported.

27. [redacted] M113 Right Lateral $150 GER 310

Vehicle turning right and lost right lateral. Vehicle veered left and struck POV. Cause was broken cotter key that secures pin holding right lateral linkage in place. Pin vibrated loose during turn.

28. [redacted] M548 Left Lateral $6,000 GER 984

Vehicle going forward when left lateral "stuck." Vehicle veered left striking POV. Cause not reported.

29. [redacted] M113 Left Lateral $2,075 GER 310

Vehicle going forward when left lateral locked. Vehicle veered left hitting POV. Cause was bent lateral linkage that had been overlooked in last technical inspection.

TABLE 2

CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING LATERALS

		TYPE OF VEHICLE										
		M548	M163	M113	M220	M688	M551	M60	M109	CL60	M578	TOTAL
WHICH LATERAL INOP.?	LEFT	3	1	5			1	1				11
	RIGHT	1		7	1	1	2	2	1	1	1	17
	UNKNOWN							1				1
WHAT CAUSED INOP. LATERAL?	FINAL DRIVE	1		6		1		2				10
	STEERING LINKAGE			2			1		1		1	5
	TRANS. OIL HOSE	1										1
	UNKNOWN	2	1	4	1		2	2		1		13
WHERE DID ACCIDENT OCCUR?	GERMANY	3	1	9	1	1	3	1	1	1		21
	FT HOOD							2			1	3
	FT KNOX	1										1
	FT CARSON			1								1
	FT CAMPBELL							1				1
	FT RILEY			1								1
	KOREA			1								1
	TOTAL	4	1	12	1	1	3	4	1	1	1	29

TABLE 3
NARRATIVES OF CY 77 TRACKED VEHICLE ACCIDENTS
INVOLVING HATCHES

1. [redacted] M88 Rigger's Hatch $669 FT CARSON

Vehicle hit bank and hatch jarred loose. Assume hatch was latched.

2. [redacted] M113 Driver's Hatch $150 GER 311

Vehicle started forward and hatch came down. Assume hatch was latched. Safety pin installed, but not used.

3. [redacted] M125 Cargo Hatch $300 FT POLK

Safety latch was broken. Hatch was secured by "secondary" means which failed. Assume safety pin not installed.

4. [redacted] M60 Loader's Hatch $225 FT CARSON

Vehicle hit ditch and hatch swung free. Assume hatch was latched.

5. [redacted] M60 Loader's Hatch $450 FT HOOD

Vehicle moving, hatch came loose and closed. Assume hatch was latched.

6. [redacted] M113 Cargo Hatch $750 FT KNOX

Vehicle moving in rough terrain. Hatch jerked loose from latch and closed. Hatch was latched. Assume safety pin not installed.

7. [redacted] M113 Driver's Hatch $225 FT HOOD

Vehicle hit bump and hatch came loose from latched position. Hatch was latched. Assume safety pin not installed.

8. [redacted] M106 Cargo Hatch $225 FT HOOD

Vehicle stopped suddenly and hatch sprung up. Latch was inoperative. Assume safety pin not installed.

9. [redacted] M113 Driver's Hatch $225 GER 065

Vehicle moving forward and "unsecured" hatch struck driver's head. Assume hatch not properly latched. Assume safety pin not installed.

10. [redacted] M113 Cargo Hatch $150 GER 259

Vehicle moving forward and hatch rotated forward. Hatch was not latched. Safety pin was installed, but not used.

11. [redacted] M106 Cargo Hatch $225 FT HOOD

Vehicle hit ditch, hatch came loose from latch and closed. Hatch was latched. No safety pin installed (NOTE: Unit SOP is to "strap hatches down").

12. [redacted] M578 Rigger's Hatch $525 GER 763

Vehicle hit bump and faulty hold-down latch allowed hatch to slam down (NOTE: Faulty latch replaced).

13. [redacted] M113 Cargo Hatch $225 GER 045

Vehicle moving forward and hatch jarred loose. Assume hatch was latched. Safety pin not installed (NOTE: Safety catch mod. not installed as required by 21 D MMC Logistics Bulletin Nov 76).

14. [redacted] M113 Driver's Hatch $225 GER 045

Vehicle moving forward, small jolt sprung latch and hatch closed forward. Hatch was latched. Safety pin was installed but not used.

15. [redacted] M48 Driver's Hatch $450 NIAGARA FALLS

Vehicle moving forward, struck another tank and hatch closed. Assume hatch was not latched.

16. [redacted] M109 Driver's Hatch $225 ABERDEEN PVG GND

Vehicle moving forward and nut that locks hatch loosened allowing hatch to unlatch and slide forward. Assume hatch was latched.

17. [redacted] M113 Commander's Hatch $1,050 FT HOOD

Vehicle moving forward, hit hole and hatch unlocked. Assume hatch was latched. Assume safety pin not installed.

18. [redacted] M106 Cargo Hatch $1,200 FT HOOD

Vehicle moving forward, faulty latch spring allowed latch to come loose and the hatch closed. Hatch was latched. Safety pin not installed (NOTE: Corrective action is to strap hatch open).

19. [redacted] M113 Driver's Hatch $525 TRENTON, NJ

Vehicle moving forward, vibrations caused latch to slip and allowed hatch to close. Assume hatch was latched. Assume safety pin not installed.

20. [redacted] M113 Cargo Hatch $1,050 FT HOOD

Vehicle was bumped by another APC and the hatch slammed down. Assume hatch was latched. Safety pin was not installed (NOTE: Corrective action is to wire hatch open).

21. [redacted] M113 Cargo Hatch $2,750 FT BENNING

Vehicle moving forward in rough terrain and the latch came loose allowing the hatch to close. Hatch was latched. Safety pin not installed. (NOTE: Corrective action is to rope/chain hatches to secure them.)

22. [redacted] M113 Cargo Hatch $375 GER 394

Vehicle moving forward, hit depression causing hatch to close. Assume hatch was latched. Safety pin not installed. (NOTE: Corrective action was to strap open all M113 hatches.)

23. [redacted] M113 Driver's Hatch $150 FT BENNING

Vehicle moving forward, hit bump causing hatch to close. Assume hatch was latched. Safety pin was not installed.

TABLE 4

CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING HATCHES

		TYPE OF VEHICLE								
		M106	M125	M113	M48	M60	M109	M578	M88	TOTAL
WAS HATCH LATCHED?	YES	2		11		2	1	1	1	18
	NO	1	1	2	1					5
WAS SAFETY PIN MOD INSTALLED?	YES			3						3
	NO	3	1	10						14
	N/A				1	2	1	1	1	6
WHERE DID ACCIDENT OCCUR?	FT HOOD	3		3		1				7
	FT CARSON					1			1	2
	GERMANY			6				1		7
	FT BENNING			2						2
	FT KNOX			1						1
	FT POLK		1							1
	ABERDEEN PROV GD						1			1
	NIAGARA FALLS, NY				1					1
	TRENTON, NJ			1						1
	TOTAL	3	1	13	1	2	1	1	1	23

TABLE 5
NARRATIVES OF CY 77 TRACKED VEHICLE ACCIDENTS
INVOLVING TRACKS

1. [redacted] M577 Left Track $500 GER 093

Vehicle going downhill at 20 MPH; driver pulled laterals to slow and "left track broke." Track came off and vehicle overturned. Cause not reported.

2. [redacted] M109 Right Track $16,650 GER 067

Vehicle going forward, right track broke and came off vehicle. Vehicle went up embankment and overturned. Cause was track shoe that broke due to excessive wear.

3. [redacted] M113 Left Track $781 GER 077

Vehicle going forward and left track separated from vehicle. Vehicle swung right off Autobahn and down embankment. Cause was track shoe assembly that broke due to a "defect."

4. [redacted] M113 Right Track $30,000 FT LEWIS

Vehicle going forward and right track broke. Vehicle ran up embankment and overturned. Cause was track shoe that broke due to excessive wear.

5. [redacted] M577 Right Track $315 FT POLK

Vehicle going forward, right track broke and driver pulled both laterals. Vehicle turned left into telephone pole. Cause was a "defective" track block that broke in half.

6. [redacted] M60 Right Track $1,900 FT RILEY

Vehicle going forward and right track broke. Vehicle went left across road and struck guard rail. Cause was track block that broke due to unknown reasons.

7. [redacted] M667 Left Track $2,000 GER 940

Vehicle going forward and "threw" left track. Vehicle went left off road into trees. Cause was track shoe that broke due to unknown reasons.

8. [redacted] M113 Right Track $3,200 GER 077

Vehicle going forward and right track broke. Vehicle went right down embankment and overturned. Cause was track bushing missing from pin. Pin wore through pin guide.

9. [redacted] M113 Left Track $380 GER 110

Vehicle going forward and left track separated from vehicle due to a "mechanical failure." Vehicle veered right and ran off road into a tree. Cause not reported.

10. [redacted] M60 Left Track $750 GER 443

Vehicle going forward, left track broke and came off vehicle. Vehicls went off Autobahn to right and through guard rail. Cause was improper track tension.

11. [redacted] M113 Right Track $10,000 GER 231

Vehicle going forward and right track came off. Vehicle swerved left and hit POV. Cause was track shoe that broke due to unreported "mechanical failure."

12. [redacted] M551 Right Track $2,000 GER 761

Vehicle going forward and started pulling to left. Driver applied brakes and vehicle pulled harder left into oncoming POV. Cause was "unserviceable" track that broke.

13. [redacted] CL60 Right Track $700 GER 273

Vehicle going forward and right track came off vehicle. Vehicle veered left off Autobahn into dividing guard rail. Cause was an unserviceable track block that broke.

14. [redacted] M113 Right Track $8,200 GER 273

Vehicle going forward and right track broke. Vehicle pulled left off Autobahn into dividing guard rail. Cause was a track block that broke for unknown reasons.

15. [redacted] M113 Right Track $2,440 GER 273

Vehicle going forward and right track broke. Vehicle pulled left off Autobahn and overturned between N. and S. lanes. Cause was a track block that broke due to excessive wear.

TABLE 6

CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING TRACKS

		TYPE OF VEHICLE							
		M577	M113	M667	M551	M60	M109	CL60	TOTAL
WHICH TRACK BROKE?	LEFT	1	2	1		1			5
	RIGHT	1	5		1	1	1	1	10
WHAT CAUSED BREAK?	MATERIEL DEFECT	1	3						4
	IMPROPER MAINT.		3		1	2	1		7
	UNKNOWN	1	1	1		1			4
WHERE DID ACCIDENT OCCUR?	GERMANY	1	6	1	1	1	1	1	12
	FT LEWIS		1						1
	FT POLK	1							1
	FT RILEY					1			1
	TOTAL	2	7	1	1	2	1	1	15

TABLE 7
NARRATIVES OF CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING ACCELERATORS OR THROTTLES

1. [redacted] M60 Throttle $300 FT LEWIS

Vehicle turning corner, throttle stuck in open position and driver could not free it. Vehicle struck right rear of another M60. Cause not reported.

2. [redacted] M728 Throttle $500 GERMANY 341

Vehicle moving forward into welding shop and throttle stuck. Driver applied brakes, but vehicle continued and collided with shop equipment. Cause not reported.

3. [redacted] M42 Unknown $1,193 GALLUP, NM

Vehicle being parked in garage. Driver placed transmission in reverse, RPM increased and vehicle jumped back into truck. Cause not reported.

4. [redacted] M578 Accelerator $400 GERMANY 761

Vehicle turning and accelerator stuck. Engine RPM increased and vehicle sideswiped another vehicle. Cause was accelerator return spring that fell off due to unknown reasons.

5. [redacted] M60 Accelerator $460 GERMANY 000

Vehicle moving forward into workbay and accelerator linkage stuck. Engine went out of control and vehicle hit a trailer. Cause not reported.

6. [redacted] M113 Accelerator $2,317 FT CARSON

Maintenance replaced transmission in vehicle. When driver started vehicle, accelerator stuck to floor and driver could not stop vehicle before running over motor pool equipment. Transmission was found to be locked in gear. Cause of stuck accelerator not reported.

7. [redacted] M113 Accelerator $4,000 GERMANY 763

When driver put transmission in reverse, engine RPM rose sharply and vehicle backed through motor pool doors. Cause was an unreported "malfunction in the accelerator linkage" (NOTE: This malfunction had been reported on the vehicle's 2404 one month before the accident.)

8. [redacted] M113 Throttle $2,525 GERMANY 443

Vehicle making left turn in motor pool when "throttle stuck in the full open position." Vehicle ran over two vehicles and three trailers before driver could shut switch off. Cause was improper throttle linkage adjustment.

9. [redacted] M548 Throttle $12,600 GERMANY 066

Vehicle being "slaved" for dead batteries in motor park when engine became a runaway. Vibrations from excessive RPM caused transmission to engage and vehicle hit maintenance truck. Suspected cause was improperly adjusted throttle linkage.

10. [redacted] M109 Accelerator $250 AVON PARK, FL

Vehicle was being positioned to "slave" an M548 for dead batteries on the bombing range when the accelerator stuck. Driver could not stop vehicle before striking the M548 because of proximity. Cause was improperly adjusted accelerator linkage.

TABLE 8

CY 77 TRACKED VEHICLE ACCIDENTS INVOLVING ACCELERATORS OR THROTTLES

		TYPE OF VEHICLE							
		M548	M113	M60	M42	M109	M728	M578	TOTAL
WHAT WAS THE MALFUNCTION?	STUCK ACCELERATOR		2	1		1		1	5
	STUCK THROTTLE	1	1	1			1		4
	UNKNOWN				1				1
WHAT CAUSED THE MALFUNCTION?	LINKAGE ADJUSTMENT	1	2			1			4
	RETURN SPRING							1	1
	UNKNOWN		1	2	1		1		5
WHERE DID ACCIDENT OCCUR?	GERMANY	1	2	1			1	1	6
	FT LEWIS			1					1
	FT CARSON		1						1
	GALLUP, NM				1				1
	AVON PARK, FL					1			1
	TOTAL	1	3	2	1	1	1	1	10