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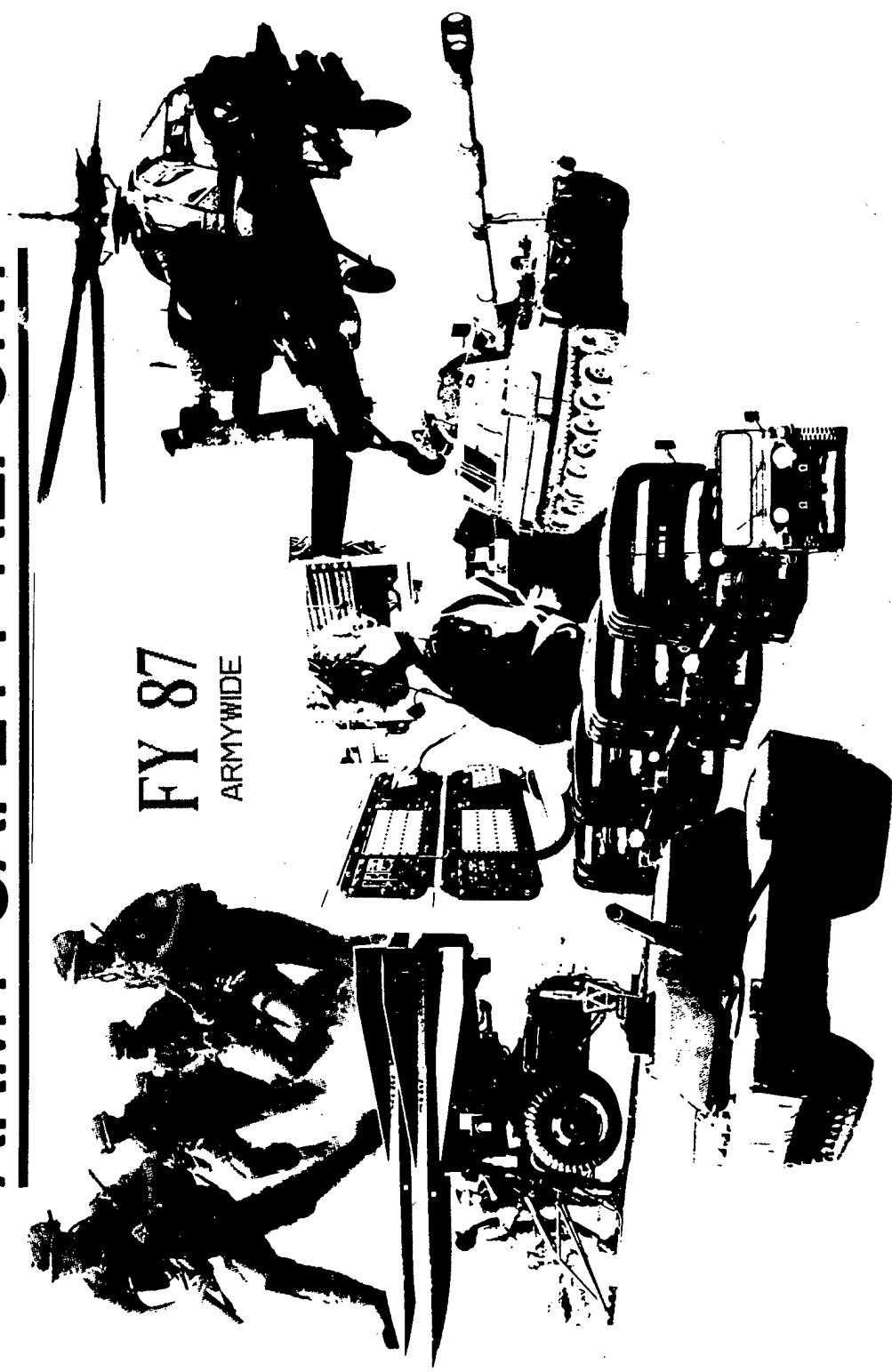
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U.S. ARMY SAFETY CENTER

ARMY SAFETY REPORT



FY 87
ARMYWIDE

Data as of 13 Jan 88

ENC 87-01

PREFACE

PURPOSE. This Army Safety Report provides an overview of FY 87 Armywide accident experience and concentrates on major types of accidents, problem areas, principal cause factors, and countermeasures. Every commander/manager can find within this report accident problem areas and cause factors associated with activities, personnel, and equipment similar to those for which he/she is responsible. It is intended that this information be used as lessons learned to generate corrective actions before personnel and equipment are lost to accidents from similar causes.

DATA NOTES.

1. The FY 87 data in this report are based on ground and aviation accidents that occurred during FY 87. The exception is lost-time civilian employee injuries which are counted only by compensation claims. These claims are recorded on the Federal Employees' Compensation Act (FECA) monthly Table II computer tape provided by the Department of Labor. Some claims recorded on Table II during FY 87 were for injuries suffered in years prior to FY 87. In Part 1, accident reports (DA Form 285) involving only civilian employee injury are not counted so there is no duplicate counting.
2. In Part 2, analysis of civilian employee involvement in the major types of accidents, uses only data from DA Forms 285 and 2397 because FECA Table II data does not provide sufficient information whereby the type of accident can be identified. Part 3 contains an analysis of lost-time civilian injury claims.
3. The FY 87 data are based on reports of accidents and claims recorded in the Army Safety Management Information System (ASMIS) as of 13 January 1988.
4. AR 385-40 details accident investigation and reporting requirements. This regulation was revised effective 1 May 1987. Accident reporting criteria were changed to raise the minimum property damage threshold from \$700 to \$1,000 and to institute FECA Claims as the official Army record of civilian injury only accidents. Accident experience for previous years included in this report have been adjusted to these present criteria so that valid comparisons can be made.
5. Rates are shown where applicable to the right of bars except where otherwise noted. The base numbers of the rates are shown at the bottom of the page where applicable. It should be noted that the method for calculating rates is not the same as in previous years. Therefore, rates for previous years have been recalculated using this new method.

EXECUTIVE SUMMARY

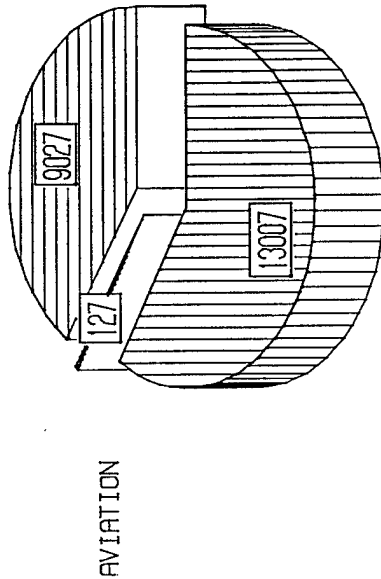
Army accidents can be divided into three broad categories: aviation accidents, ground accidents (e.g., Army motor vehicle, Army combat vehicle, privately owned vehicle, personnel injuries), and Federal Employee Compensation Act (FECA) Claims. The charts opposite graphically summarize the contribution of each of these categories to total Army accidents, fatal injuries, nonfatal injuries, and cost for FY 87.

The Army's record of conserving resources through accident prevention was a good one in fiscal year (FY) 87. The total number of accidents, fatalities, and nonfatal injuries decreased in FY 87 from FY 86. However, the total cost of accidents increased in FY 87. A reduction in all types of accidents produced the decrease in FY 87 accidents. The increase in total cost for FY 87 was primarily attributed to increased property damage cost of aviation accidents involving the UH-60 and AH-64 aircraft. More detailed information is contained in this report for commanders and other resource managers concerning problem areas, cause factors, and countermeasures for aviation accidents and the major types of ground accidents. Additionally, detailed information is provided on FECA Claims problem areas and accomplishments.

TOTAL FY 87 U.S. ARMY ACCIDENTS

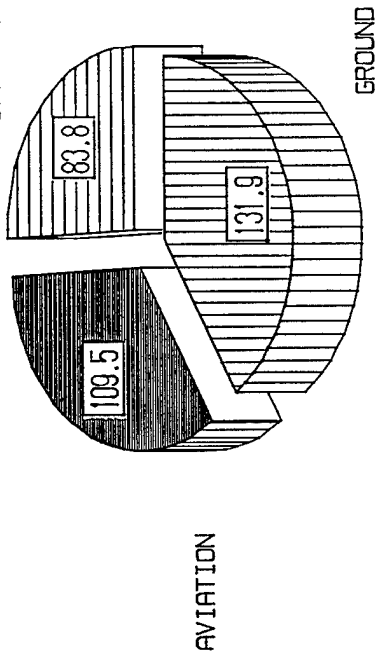
ACCIDENTS

OWCP CLAIMS



TOTAL COST (M)

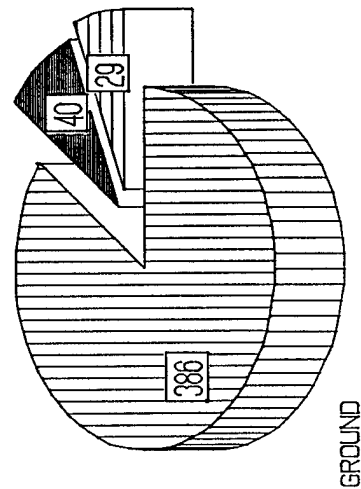
OWCP CLAIMS



FATALITIES

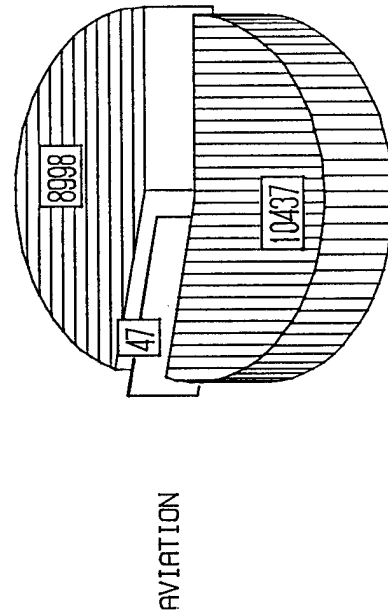
AVIATION

OWCP CLAIMS



NON-FATAL INJURIES

OWCP CLAIMS



GROUND

Data as of 13 Jan 88

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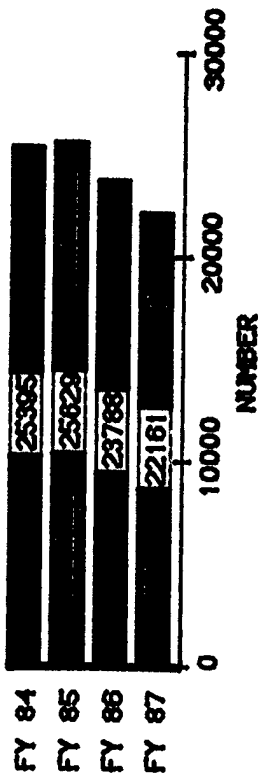
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PART 1

ACCIDENT STATISTICS

TOTAL U.S. ARMY ACCIDENT EXPERIENCE

ACCIDENTS



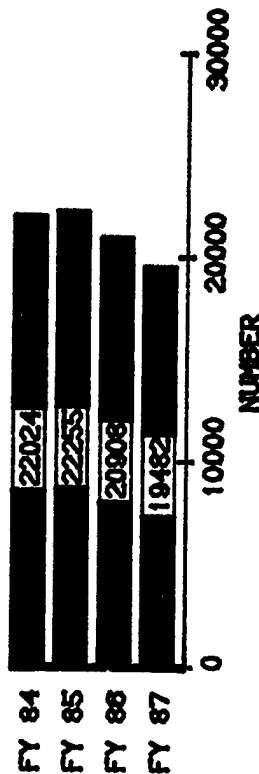
The number of accidents has decreased for the second consecutive year. FY 87 accidents were 7% (-1627) fewer than FY 86. This is attributed to decreases in all categories of accidents. FECA lost time and fatal civilian injury claims were down by 3% (-267); aviation accidents were down by 14% (-15); and ground accidents were down by 9% (-1350). The decrease in ground accidents is attributed to a 7% (-607) decrease in personnel injury accidents; a 17% (-317) decrease in privately owned vehicle accidents; a 9% (-280) decrease in Army motor vehicle accidents; a 13% (-66) decrease in Army combat vehicle accidents; and an 11% (-80) decrease in all other ground accidents.

FATALITIES



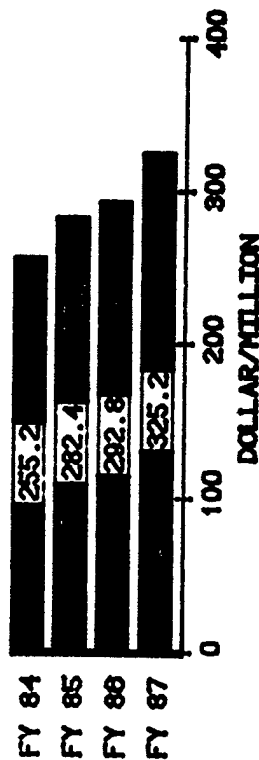
A decreasing trend in fatalities is apparent over the 4-year period when the 248 fatalities from the FY 86 Gander accident are excluded. Overall, the number of fatalities decreased by 35% (-250) in FY 87 compared to FY 86, but less than 1% (-2) if the Gander accident is excluded. Increases in military fatalities in aviation accidents (+13) and ground accidents (+2) in FY 87 were offset by decreases in FECA civilian fatality claims (-4) and fatal injuries to other civilians in ground accidents (-13).

NON-FATAL INJURIES



A decreasing trend in nonfatal injuries has existed since FY 85. During FY 87 a 7% (-1426) decrease in nonfatal injuries occurred compared to FY 86. A decrease occurred in all categories of accidents. FECA civilian lost-time claims decreased by 3% (-258); nonfatal injuries in aviation accidents by 17% (-10); and nonfatal injuries in ground accidents by 10% (-1158). Military nonfatal injuries decreased by 10% (-1040) and civilian nonfatal injuries, which included those civilians not covered by FECA, decreased by 4% (-366).

TOTAL COST

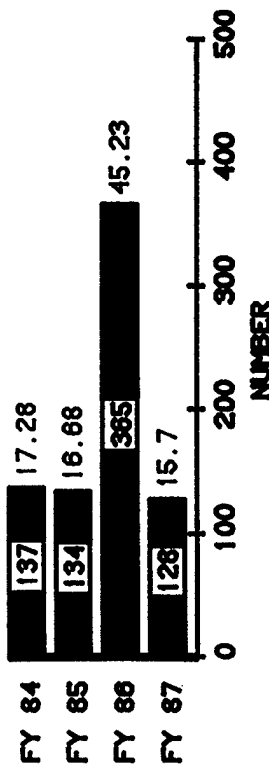


The trend in accident cost is increasing at a rate of \$23 million per year. FY 87 accident cost was 11% (+ \$32.4M) more than FY 86. This increase is primarily attributed to increased property damage cost of aviation accidents involving the HH-60 and the AH-64 aircraft.

ON- AND OFF-DUTY INJURIES

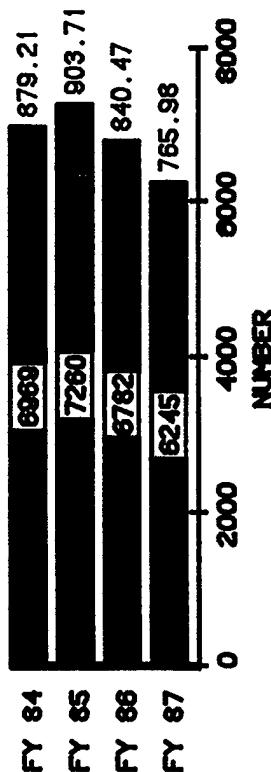
U.S. ARMY MILITARY INJURIES ON DUTY

FATALITIES / RATE



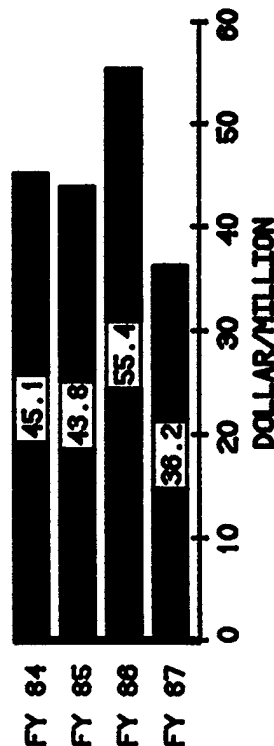
On-duty military fatalities have shown a gradual decrease since FY 84 except for FY 86 which includes 248 fatalities from the Gander accident. However, excluding Gander, fatalities in FY 87 were 9% (+11) more than in FY 86. This increase is attributed primarily to a 48% (+13) increase in aviation fatalities. While the overall number of ground accident fatalities decreased by 2% (-2), notable increases occurred in Army combat vehicle accidents (+7), explosive accidents (+5) and other Army vehicle accidents (+4).

NON-FATAL INJURIES / RATE



A decreasing trend in on-duty nonfatal military injuries has existed since FY 85. Injuries in FY 87 were 8% (-537) fewer than FY 86. Injuries in aviation and ground accidents decreased by 18% (-10) and 8% (-527) respectively. However, there was a noteworthy increase in injuries from explosive accidents in FY 87 (+41) compared to FY 86.

INJURY COST

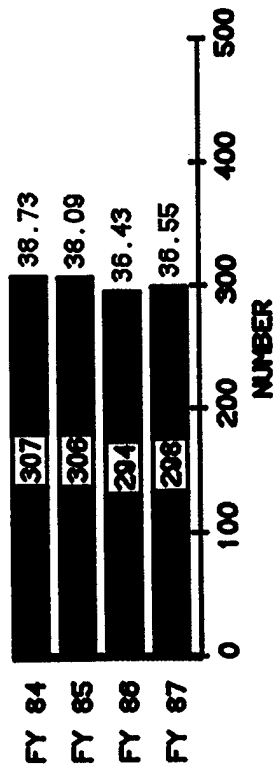


Injury cost associated with on-duty military injuries has decreased each year since FY 84 except for FY 86 which includes the \$15 million Gander accident. Excluding Gander, the FY 87 injury cost was 10% (-\$4.2 million) less than FY 86. Aviation injury cost increased by 4% (+\$0.3 million) as a result of the increase in FY 87 aviation fatalities. However, a decrease of 14% (-\$4.5 million) in ground accident injury cost more than offset this increase. Nevertheless, increases were noted in Army combat vehicle accidents (+\$0.3 million); explosive accidents (+\$1.4 million); and other Army vehicle accidents (+\$0.2 million) which parallels the increase in injuries from these types of accidents.

FATALITY/INJURY RATE PER 100,000 MILITARY POPULATION

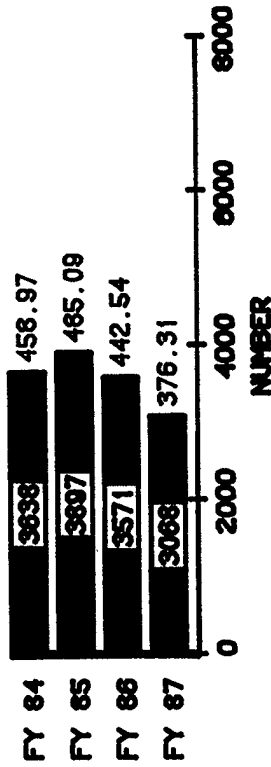
U.S. ARMY MILITARY INJURIES OFF DUTY

FATALITIES / RATE



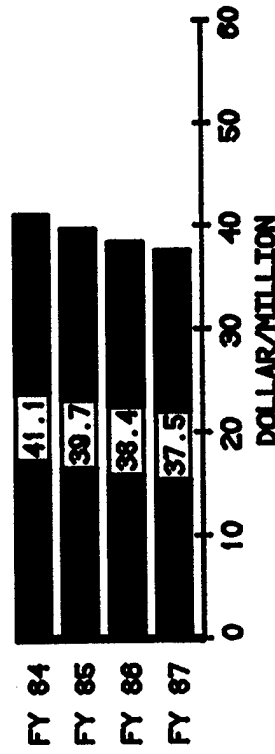
Off-duty military fatalities have shown a decline from FY 84 through FY 86 with a slight increase in FY 87 compared to FY 86. The major portion of this increase is attributed to personnel injury accidents involving activities of operating aircraft (+2), passenger in aircraft (+4), parachuting (+4), hunting (+3), and materiel handling (+2). Much of the increase was offset by decreases in weapons handling (-6) and human locomotion (-4).

NON-FATAL INJURIES / RATE



Nonfatal injuries to off-duty military personnel have decreased since FY 85 with the FY 87 total being 14% (-503) fewer than FY 86. Decreases in personnel injury accidents (-157) and privately owned vehicle accidents (-333) account for most of this decrease.

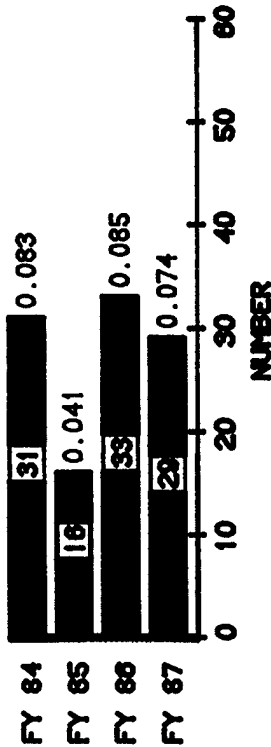
INJURY COST



Injury cost of off-duty military injuries has decreased each year since FY 84. An increase in off-duty military fatality cost (+\$0.7 million) in FY 87 was more than offset by a decrease in the cost of off-duty military nonfatal injuries (-\$1.6 million) and accounts for an overall reduction of \$900,000 in off-duty military injury cost.

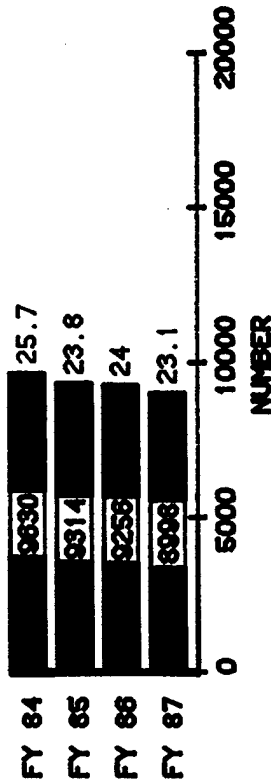
U.S. ARMY ON-DUTY CIVILIAN INJURIES CIVILIAN LOST-TIME AND FATAL FECA CLAIMS

FATALITIES / RATE



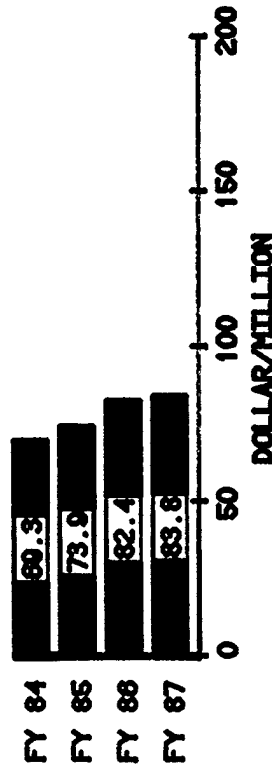
The Department of Labor (DOL) Office of Worker's Compensation (OWCP) Table II Data reflects a decrease from 33 fatal injury claims in FY 86 to 29 in FY 87.

NON-FATAL INJURIES / RATE



Lost-time claims created in FY 87 (8,998) were 3% (-258) fewer than FY 86 (9,256).

CIVILIAN INJURY COST

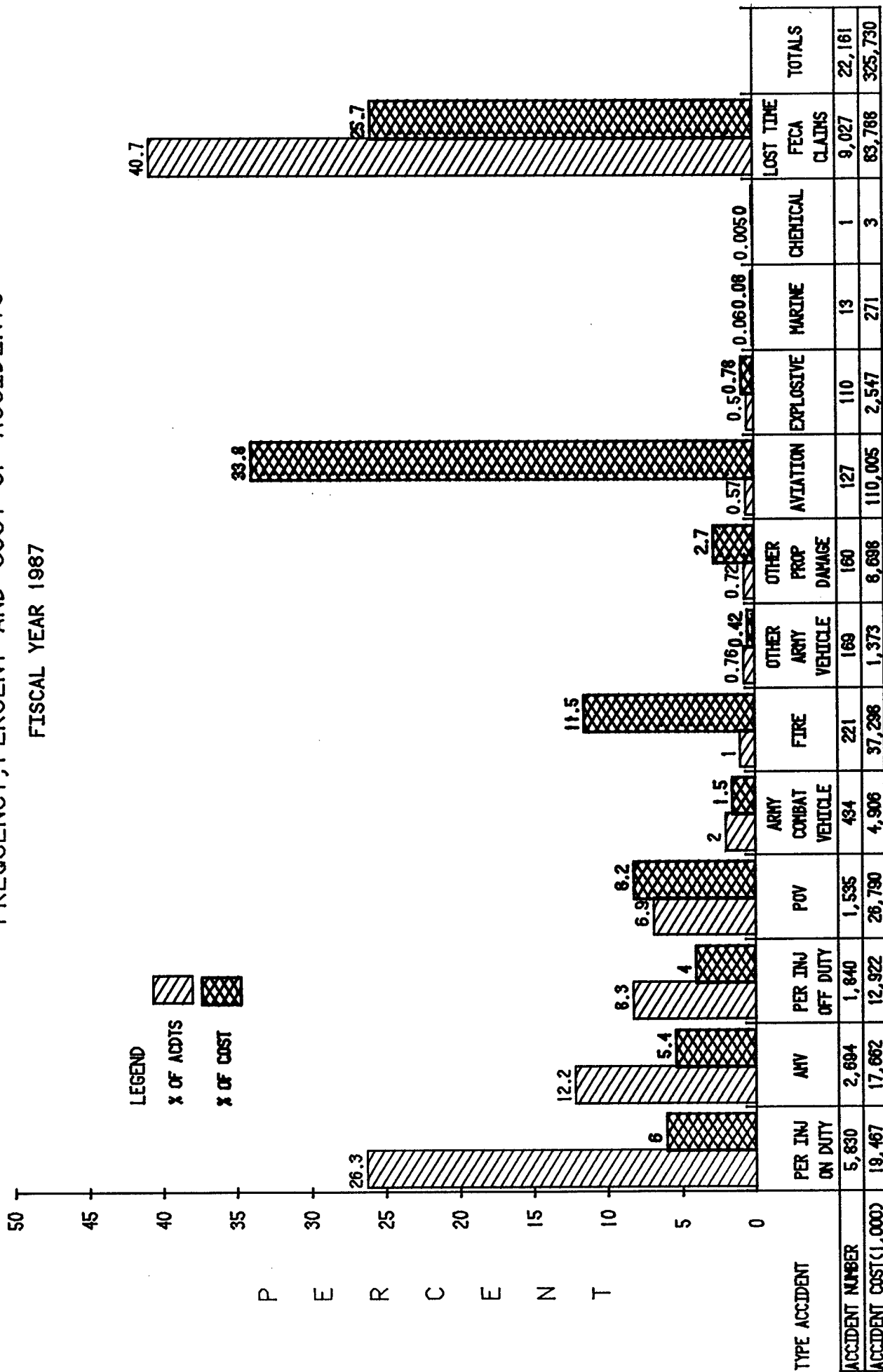


Although the number of lost-time and fatal claims showed a decrease in FY 87 compared to FY 86, injury cost charged against the Army continued to increase. This cost represents the total outlay during the year, much of which is cost associated with claims created in prior years. The effect of the decreases in claims during FY 87 will be seen during subsequent years.

TYPES OF ACCIDENTS

FREQUENCY, PERCENT AND COST OF ACCIDENTS

FISCAL YEAR 1987



PART 2
CAUSES AND COUNTERMEASURES

PART 2

CAUSES AND COUNTERMEASURES

This section provides an indepth look at the top five ground accident categories (on-duty personnel injury, Army motor vehicles, off-duty personnel injury, privately owned vehicles, Army combat vehicles) and aviation. The top problem areas and principal cause factors are identified for each accident category. Cause factor information was provided by FY 87 DA Form 2397-2-R aviation reports and DA Form 285-1 reports submitted on fatal and selected (random sample) serious ground accidents (damage to Army property of \$1,000 or more, loss of 20 or more workdays or a more serious injury). DA Form 285-1 reports are not required for off-duty accidents unless they involve Army operations or materiel. Therefore, cause factor information was not available for privately owned vehicle and off-duty military personnel injury accidents. A summary of DA Form 285-1 ground accident reports follows:

TYPE ACCIDENT	FATAL ACCTS	RANDOM SAMPLE	OTHER
Personnel Injury	9	69	0
Army Motor Vehicle	42*	120	2
Army Combat Vehicle	18**	16	3

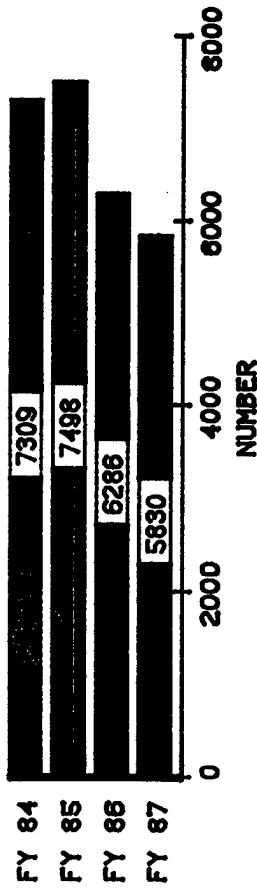
*Includes 22 accidents involving fatal injuries to non-Army personnel.

**Includes 2 accidents involving fatal injuries to non-Army personnel.

PERSONNEL INJURY ACCIDENTS

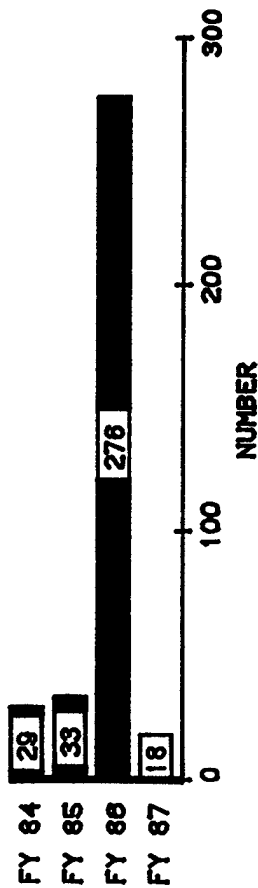
PERSONNEL INJURY ACCIDENTS ON DUTY

ACCIDENTS



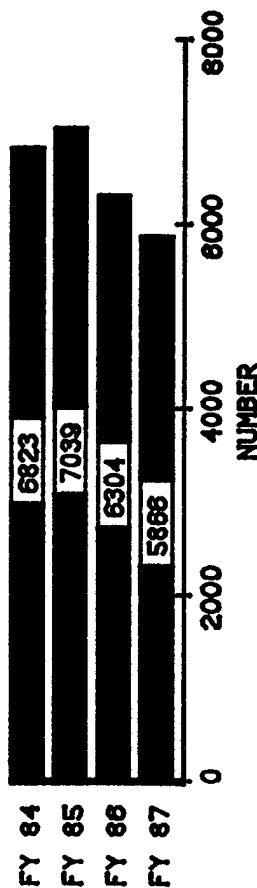
A decreasing trend in on-duty personnel injury accidents which developed in FY 86 has continued through FY 87. A 7% (-456) decrease was experienced in FY 87 compared to FY 86.

FATALITIES



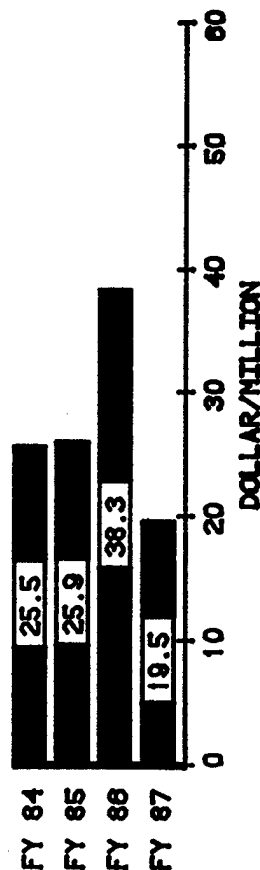
The high number of fatalities in FY 86 includes the 248 in the Gander accident. Excluding these, FY 87 fatalities were 36% (-10) fewer than the remaining 28 fatalities of FY 86. Fatality reductions in activities involving combat soldiering (-5) and maintenance/repair/servicing (-4) account for 90% of the decrease.

NON-FATAL INJURIES



Nonfatal injuries have decreased each year since FY 85. The number in FY 87 was 7% (-438) less than FY 86. This stems primarily from injury reductions in the activities of combat soldiering (-110), maintenance/repair/servicing (-109), and human locomotion (-125). Other notable injury changes occurred in activities involving weapons handling (-25), food and drink preparation (-26), sports (-20), physical training (+24) and being a passenger (+28).

TOTAL COST



The cost of FY 86 accidents include \$15 million associated with the Gander accident. Excluding this cost, FY 87 was 16% (-\$3.8 million) less than FY 86. This parallels the decrease in fatalities and nonfatal injuries.

ON-DUTY MILITARY PERSONNEL INJURIES FY 87

ACTIVITIES	TOTAL INJURIES	
Combat Soldiering	1,204	
Maintenance/Repair/Serviceing	545	
Physical Training	501	
Sports	494	
Handling Material/Passengers	484	
Human Locomotion	430	
Being a Passenger	276	
Handling Vehicle/Vessel/Animal	157	
Weapons Handling	144	
Soldiering	140	
Miscellaneous (18 other activities)	453	
		Fatalities 18
		Nonfatal Injuries 4,810
TOTAL	4,828	TOTAL 4,828

On-duty military personnel injuries accounted for 82% (4828/5884) of the on-duty personnel injuries. The remaining 18% (1056) on-duty personnel injuries involved Army civilian personnel not subject to the Federal Employees' Compensation Act.

Looking at the top three activities for on-duty military:

- Combat soldiering was the number one activity for on-duty military injuries. Most of these injuries occurred in designated training areas. The most frequent task involved was tactical parachuting.
- Maintenance/repair/servicing was the number two activity for on-duty military injuries. Most of the injuries occurred in maintenance facilities (vehicle facilities being the most prevalent) and training areas. The most frequent task involved was installing/removing/modifying equipment.
- Physical training was the number three activity for on-duty military injuries. Most of the injuries occurred in travel ways (primarily roadways) and on military designated training areas. The most frequent tasks involved were jogging/running and the confidence course.

ON-DUTY MILITARY PERSONNEL INJURIES

PROBLEM AREA: Combat Soldiering

Combat soldiering injuries accounted for 25% of the on-duty military personnel injuries.

Principal Cause Factor: Inadequate Self-Discipline (42%)

Inadequate self-discipline consists of personal characteristics, such as overconfidence or improper attitudes toward job requirements, that cause individuals to commit task errors that cause accidents. Examples specific to FY 87 are:

- Failure to employ proper parachute landing fall techniques.
- Failure to take appropriate precautions to avoid serious injury during combat soldiering activities (Land Navigation Course, etc.).

Countermeasure:

Unit Level

Training to standards and strict compliance by everyone is the key to safe airborne operation. Particular emphasis must be placed on the five points of performance as outlined in Chapter 2 of FM 57-220, Basic Parachuting Techniques and Training. These are specific actions that a parachutist performs between the time of aircraft exit to recovery after landing.

Airborne refresher training must be accomplished in the proper environment to ensure proper execution of all procedures from aircraft exit to recovery after landing.

Principal Cause Factor: Inadequate Unit Training/Experience (39%)

Unit training/experience are inadequate when personnel perform accident-causing behaviors because unit training or supervised on-the-job experience provided did not prepare them to perform assigned tasks properly. Examples for FY 87 of tasks for which training/experience was inadequate are:

- Parachute landing fall techniques.
- Proper aircraft exit techniques for parachute jumping.

Countermeasure:

Unit Level

Training to standards and strict compliance by everyone is the key to safe airborne operation. Particular emphasis must be placed on the five points of performance as outlined in Chapter 2 of FM 57-220, Basic Parachuting Techniques and Training. These are specific actions that a parachutist performs between the time of aircraft exit to recovery after landing.

Airborne refresher training must be accomplished in the proper environment to ensure proper execution of all procedures from aircraft exit to recovery after landing.

PROBLEM AREA: Maintenance/Repair/Serviceing

Maintenance/repair/serviceing injuries accounted for 11% of the on-duty military personnel injuries.

Note: The principal cause factors were not identified for the majority of maintenance/repair/serviceing injuries. Since very few such accidents reported principal cause factors for FY 87, the information below is based on data from the previous year.

Principal Cause Factor: Inadequate Self-Discipline (41%)

Inadequate self-discipline consists of personal characteristics, such as overconfidence or improper attitudes toward job requirements, that cause individuals to commit task errors that cause accidents. Examples include:

- Failure to use proper lifting technique.
- Failure to maintain three points of contact when mounting/dismounting/working on tracked vehicle.

Countermeasures:

MACOM/Installation Level

HSC worked on developing a back injury prevention program.

Unit Level

Demand compliance with established work procedures, especially routine tasks.

Make sure protective equipment is worn on the job.

Principal Cause Factor: Inadequate Supervision (22%)

Supervision is inadequate when it leads to or allows accident-causing behaviors. Examples include:

- Allowing personnel to perform tasks unsafely.

- Failure to check/monitor task performance.

Countermeasures:

DA Level

USASC initiated development of a Safety Resource Manual for Supervisors which will guide supervisors in their safety duties and responsibilities.

USASC initiated development of a resource kit of lesson plans, posters, sample standing operating procedures, and tailgate safety training sessions for use by supervisors of maintenance activities.

MACOM/Installation Level

Fort Benning organized a 6-hour course of instruction which is mandatory for Assistant Safety Officers.

Fort McClellan briefed management officials on OSH program requirements and assets available to them.

Fort McClellan presented a training course each quarter for collateral duty safety officers (military and civilian).

Fort Knox reproduced the USASC maintenance safety kit with the addition of Commanding General endorsement.

Unit Level

Improve direct supervision of maintenance activities.

Ensure standing operating procedures adequately describe procedures to be followed and cover safety aspects of all activities.

Hold personnel accountable for safe conduct at their job.

Principal Cause Factor: Inadequate Written Procedures (19%)

Inadequate written procedures are those written, unwritten-but-understood, or nonexistent procedures for normal, abnormal, or emergency conditions which lead to or allow accident-causing behaviors. Examples include:

- No written safety policy or standing operating procedures that personnel could follow when confronted with a safety hazard.

Countermeasures:

DA Level

USASC initiated development of a Safety Resource Manual for Supervisors which will guide supervisors in their safety duties and responsibilities.

USASC distributed a Maintenance Operations Support Kit which included materials designed to enhance written procedures.

Unit Level

Ensure standing operating procedures adequately describe procedures to be followed and cover safety aspects of all activities.

Ensure technical manuals are available for the repair/service to be performed. Demand compliance with published procedures.

PROBLEM AREA: Physical Training

Physical training injuries accounted for 10% of the on-duty military personnel injuries.

Note: The principal cause factors were not identified for the majority of physical training injuries. Therefore, the information below is based on the small number of accidents which reported cause factors.

Principal Cause Factor: Inadequate Self-Discipline (67%)

Inadequate self-discipline consists of personal characteristics, such as overconfidence or improper attitudes toward job requirements, that cause individuals to commit task errors that cause accidents. An example specific to FY 87 is a failure to stop running when knee was aching due to overconfidence in physical ability.

Countermeasure:

Unit Level

Training to standards and strict compliance by everyone is the key to safe physical training. Trainers must adhere to guidance given in FM 21-20, Physical Fitness Training, and AR 350-15, Army Physical Fitness Program.

Principal Cause Factor: Inadequate Supervision (11%)

Supervision is inadequate when it leads to or allows accident-causing behavior.

An example specific to FY 87 is allowing inexperienced soldier to negotiate a rope slide.

Countermeasure:

Unit Level

Training to standards and strict compliance by everyone is the key to safe physical training. Trainers must adhere to guidance given in FM 21-20, Physical Fitness Training, and AR 350-15, Army Physical Fitness Program.

Principal Cause Factor: Inadequate Unit Training/Experience (11%)

Unit training/experience are inadequate when personnel perform accident-causing

behaviors because unit training or supervised on-the-job experience provided did not prepare them to perform assigned tasks properly.

Note: Due to the small number of cases available, examples would not necessarily be representative and are therefore not reported.

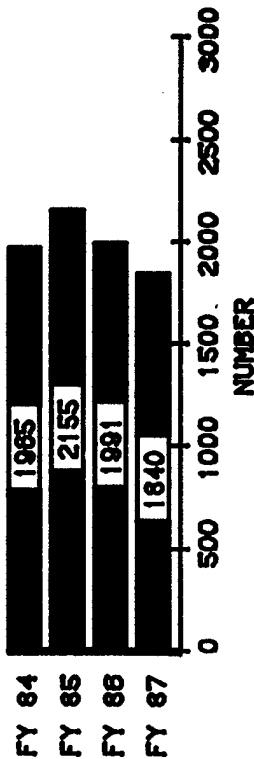
Countermeasure:

Unit Level

Training to standards and strict compliance by everyone is the key to safe physical training. Trainers must adhere to guidance given in FM 21-20, Physical Fitness Training, and AR 350-15, Army Physical Fitness Program.

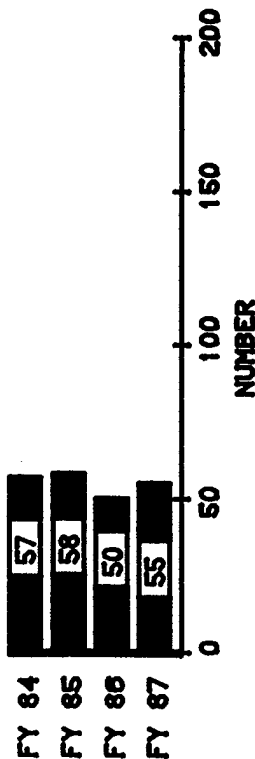
PERSONNEL INJURY ACCIDENTS OFF DUTY

ACCIDENTS



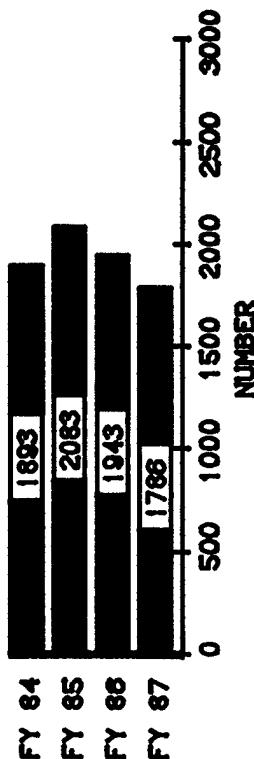
Off-duty personnel injury accidents have decreased each year since FY 85, with FY 87 being 8% (-151) fewer than FY 86.

FATALITIES



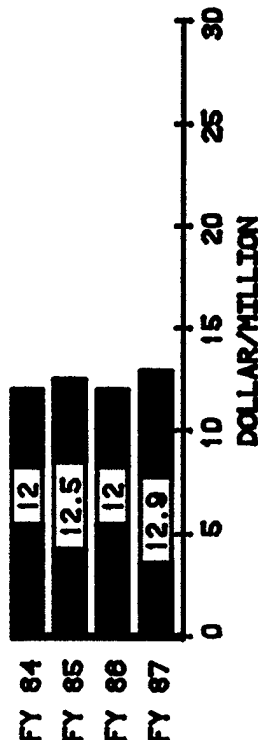
Fatalities increased by 10% (+5) in FY 87 compared to FY 86. This results from increases in fatalities involving activities of aircraft operation (+2), passenger in aircraft (+4), parachuting (+4), hunting (+3), and materiel handling (+2). Offsetting some of these increases were decreases involving weapons handling (-6) and human locomotion (-4).

NON-FATAL INJURIES



Nonfatal injuries decreased by 8% (-157) in FY 87 and represents the lowest number in 4 years. More than half of this decrease resulted from fewer injuries during activities of human locomotion (-54) and sports (-31). Also contributing were decreases in weapons handling (-13), materiel handling (-13), food and drink preparation (-11), being a passenger (-14), and horseplay (-19).

TOTAL COST



An 8% (+0.9 million) increase in the total cost of these accidents occurred in FY 87 compared to FY 86. This resulted from the increase in fatalities (+\$1.5 million) coupled with an increase in the more costly permanent total disabling injuries (+4) which resulted in an additional cost increase of \$0.7 million. Offsetting much of this increase was a decrease of \$1.5 million cost of the less severe lost-work-day injuries.

OFF-DUTY MILITARY PERSONNEL INJURIES FY 87

ACTIVITIES	TOTAL INJURIES	
Sports	930	
Human Locomotion	446	
Maintenance/Repair/Servicing	108	
Personal Hygiene/Sleeping	75	
Handling Material/Passengers	57	
Janitorial/Housekeeping/Grounds Keeping	42	
Food/Drink Preparation	34	
Horseplay	24	
Bystanding/Spectating	21	
Being a Passenger	21	
Miscellaneous (14 other activities)	80	
Unreported	3	
		Fatalities 55
		Nonfatal Injuries 1,786
TOTAL	1,841	TOTAL 1,841

Most (75%) of the off-duty military injuries occurred in two activities: sports (51%) and human locomotion (24%).

Sports. As expected, most of these injuries occurred in recreation/entertainment facilities. The sports primarily involved were basketball, softball, and touch football.

Human Locomotion. The most frequent activity involved was walking. Most of these injuries occurred in housing facilities (individual and family) and on travel ways (pedestrian way and roadway).

OFF-DUTY MILITARY PERSONNEL INJURIES

PROBLEM AREAS: Sports (basketball, softball, touch football)
Human Locomotion (walking)

Principal Cause Factors:

Principal cause factors are not reported for off-duty accidents. Therefore, countermeasures are keyed to problem areas in general.

Countermeasures:

DA Level

USASC provided the Army Family and Community Support Center a draft regulation to implement safety policy in Morale/Welfare/Recreation (MWR) activities.

USASC conducted an analysis of Army drowning accidents. The following actions resulted:

- AR 385-15, Water Safety, was revised.
 - An Army Recreational Water Safety Kit was developed and released in Apr 87.
 - USASC coordinated with the U. S. Coast Guard for Armywide participation in the 1987 National Safe Boating Week. USASC distributed 1200 National Safe Boating Week Action Manuals to MACOM and installation safety offices in Mar 87.
 - USASC published water sports and recreation articles in the spring, summer and fall issues of "Army Family Safety," an insert in the National Safety Council's "Family Safety and Health" magazine.
- USASC developed an installation safety guide for off-duty activities. Included are:
- An off-duty safety program manual.

- USASC contracted for development of 44 support kits covering topics in home, community, sports, recreation, and family transportation safety.
- USASC's contract remained through Summer 1987 for the purchase of 150,000 quarterly subscriptions to the National Safety Council's "Family Safety and Health" magazine with a USASC prepared 4-page "Army Family Safety" insert for Armywide distribution through Army community support channels. An additional 500,000 copies of the insert were published and distributed.
- USASC is revising AR 385-5, Army Sports and Recreation, to assure current accident prevention procedures are adequately addressed. A first draft was developed in Apr 87. Plans are to publish as one of the modules to the Army Health Promotion Program scheduled for 4th Qtr FY 88.

MACOM/Installation Level

MDW conducted water safety training in coordination with the U. S. Coast Guard.

HSC commander transmitted holiday safety messages for each 3-day weekend which targeted off-duty fatalities and privately owned vehicle safety.

HSC fielded seasonal safety pamphlets targeted at recreational and off-duty causes of injury among both soldiers and civilians.

USARJ distributed bilingual educational materials to assist in reducing injuries sustained from falls.

Fort Sill sent out "Direct Fires" after fatalities (black border) and near misses (red border) for commander's use in increasing awareness.

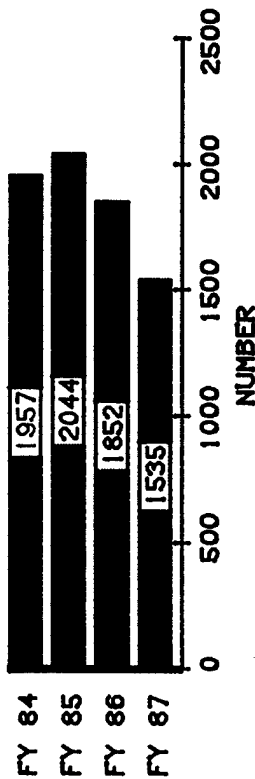
Unit Level

Stress individual self-discipline when off duty. Teach soldiers to recognize hazards and the proper reaction.

PRIVATELY OWNED VEHICLES

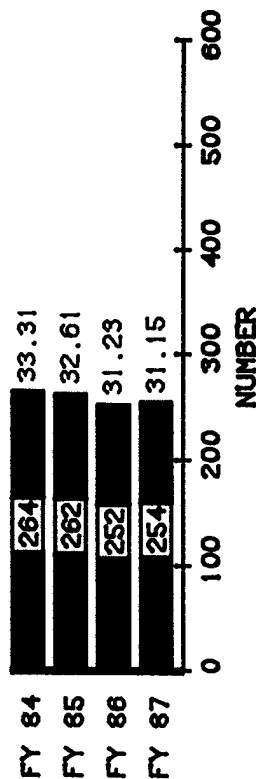
PRIVATELY OWNED VEHICLE ACCIDENTS

ACCIDENTS



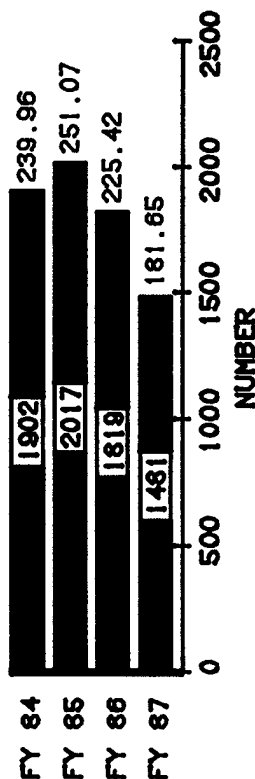
A decreasing trend in privately owned vehicle accidents has existed since FY 85. The number of accidents experienced in FY 87 was 17% (-317) less than the number reported for FY 86. Of these accidents where the vehicle was reported, motorcycle accidents decreased by 24% (-113). However, much of this decrease was offset by increases in accidents involving sedans 3% (+28) and trucks 26% (+28).

FATALITIES/RATE



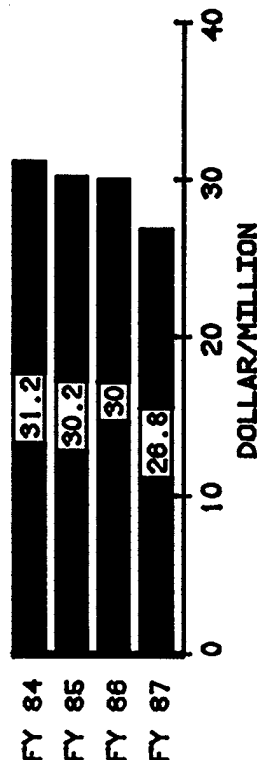
Fatalities have shown a small decrease each year since FY 84 except during FY 87, where a slight increase (+2) was experienced compared to FY 86. This is attributed to an increase in fatalities involving sedans (+9), trucks (+7), and unidentified privately owned vehicles (+3). However, these increases were almost offset by decreases in motorcycle (-11) and train (-5) fatalities.

NON-FATAL INJURIES/RATE



Nonfatal injuries have decreased the past 3 years. The number in FY 87 was 19% (-338) fewer than FY 86. This is attributed to a decrease in motorcycle injuries (-113) and unidentified privately owned vehicles (-226). Injury increases involving sedans (+19) and trucks (+28), paralleled increases in accidents involving these vehicles. However, these were more than offset by injury decreases in other types of privately owned vehicles.

TOTAL COST

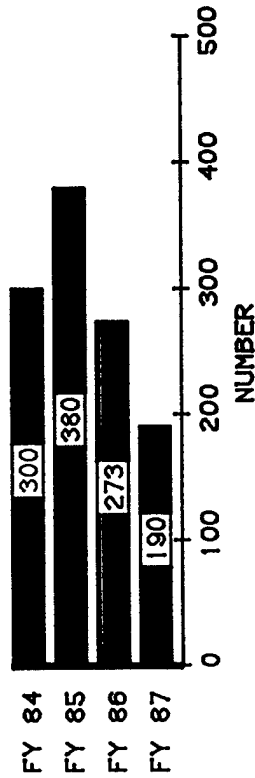


The cost of privately owned vehicle accidents has decreased gradually over the past 4 years. FY 87 cost showed the greatest decline with an 8% (-\$2.2 million) decrease from FY 86. This results from fewer nonfatal injuries in FY 87.

INJURY RATE PER 100,000 MILITARY POPULATION

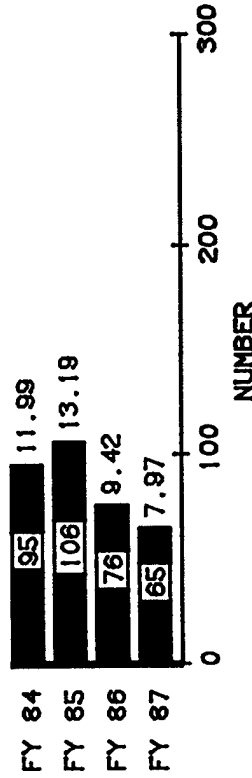
PRIVATELY OWNED VEHICLE ACCIDENTS (WITH ALCOHOL/DRUGS ON PART OF ARMY OPERATOR)

ACCIDENTS



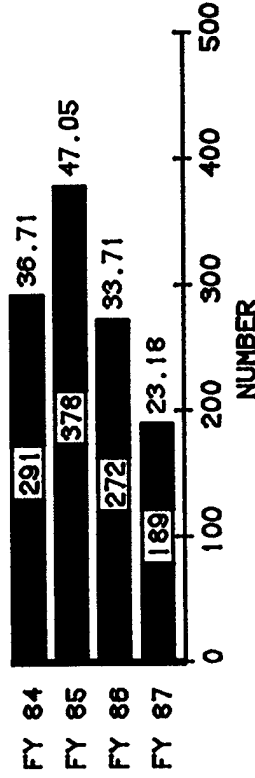
Accidents involving alcohol or drugs on the part of the Army operator have decreased significantly since FY 85. FY 87 showed a 30% (-83) decrease over FY 86. Decreases in sedan (-38) and motorcycle (-37) accidents account for 88% of the reduction.

FATALITIES/RATE



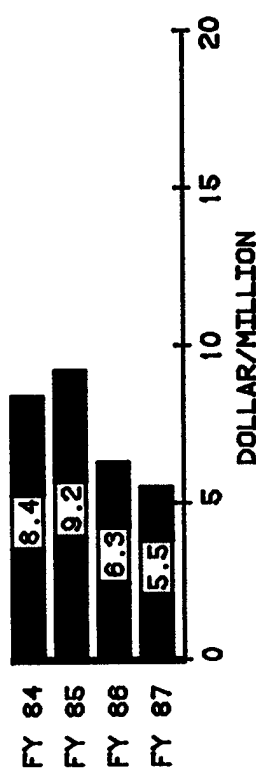
Fatalities involving alcohol or drugs on the part of the Army operator have decreased each year since FY 85. Fatalities involving sedans and motorcycles decreased by 9 and 8, respectively, in FY 87. An increase of 6 fatalities in trucks in FY 87 was more than offset by the decreases in sedan and motorcycle fatalities.

NON-FATAL INJURIES/RATE



Nonfatal injuries showed decreases similar to those in accidents and fatalities resulting from alcohol or drugs. FY 87 nonfatal injuries were 31% (-83) fewer than FY 86. Major decreases in nonfatal injuries involving sedans (-24), motorcycles (-35), and trucks (-12) account for most of the reduction.

TOTAL COST



The decrease in cost parallels those in accidents and injuries in alcohol- and drug-related privately owned vehicle accidents.

INJURY RATE PER 100,000 MILITARY POPULATION

PRIVATELY OWNED VEHICLE ACCIDENTS
FY 87

VEHICLE	NUMBER	ACCIDENTS %	COST	INJURIES	
				FATAL	NONFATAL
Auto\Sedan	803	57	16,677,469	175	774
Motorcycle/Moped	335	24	4,358,590	35	316
Truck	127	9	2,781,671	28	121
Van	16	1	300,955	3	18
Bicycle	15	1	68,680	1	14
Truck/Tractor	7	<1	126,238	2	4
Bus	5	<1	106,513	1	3
Trains	2	<1	237,000	1	1
Trailer	1	<1	47,000	1	-
Other POV	73	5	904,382	7	74
Unreported	32	2	245,460	-	27
Total for completed DA Form 285 reports	1,416	100	25,853,958	254	1,352
Abbreviated DA Form 285 reports	119	-	935,910	-	129
Total	1,535	-	26,789,868	254	1,481

PRIVATELY OWNED VEHICLE ACCIDENTS

Of the 1,535 POV accidents for FY 87, 92% (1416/1535) provided completed DA Form 285 information (although not required in all cases), 8% (119/1535) were reported on abbreviated DA Form 285 reports. These off-duty nonfatal military POV accidents do not require a complete DA Form 285 and were submitted as abbreviated reports in accordance with AR 385-40. The information provided on these abbreviated reports is limited and does not support analysis in terms of the vehicle involved or accident cause factors. Accidents with completed DA Form 285 information are analyzed below.

The chart shows that two types of vehicles accounted for 82% of these accidents and 81% of the costs. These two types were autos/sedans and motorcycles/mopeds.

Eighty-nine percent of these POV accidents (autos/sedans and motorcycles/mopeds) reported driver error. The most frequent errors reported were:

- a. Improper decision. This type error resulted most frequently in driving under the influence of alcohol and excessive speed.
- b. Misjudged clearance/speed/weight/size. This type of error resulted most frequently in excessive speed and loss of control.

PRIVATELY OWNED VEHICLE ACCIDENTS

PROBLEM AREA: Driver Error

Improper decision, misjudged clearance/speed/weight/size.

Principal Cause Factors:

Principal cause factors are not reported for off-duty POV accidents. Therefore, countermeasures are keyed to the problem area in general.

Countermeasures:

DA Level

USASC implemented the Army Motorcycle Safety Course. A total of 48 installations brought the program on line in FY 87.

USASC began filming the Army Driver Improvement Program. This series of 12 films focuses on changing inappropriate driving behavior and attitude.

USASC prepared CSA holiday safety messages which emphasized the control of drinking and driving.

USASC prepared COUNTERMEASURE articles for publication.

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents, to clarify POV accident prevention requirements.

USASC contracted for production of eight POV accident prevention packets as part of the Family Safety Program, Installation Safety Support Kit.

MACOM/Installation Level

MDW implemented the Army Motorcycle Safety Course for the National Capital Region and conducted a drunk and drugged driving awareness week.

All MACOMS conducted safety belt campaigns.

Fort Leonard Wood started a Motorcycle Safety Foundation (MSF) Course and received recognition from the MSF.

HSC commander transmitted holiday safety messages for each 3-day holiday weekend which targeted off-duty fatalities and privately owned vehicle safety.

Fort McClellan implemented a POV accident prevention program to identify personnel who drink and drive, educate personnel to the hazards of drinking and driving, conduct winter holiday season vehicle inspections, and conduct a safety belt publicity campaign.

Unit Level

Enforce the requirement to use safety belts in vehicles, and helmets while riding motorcycles, on and off post and on and off duty.

Deal firmly with each driving under the influence (DUI) offender.

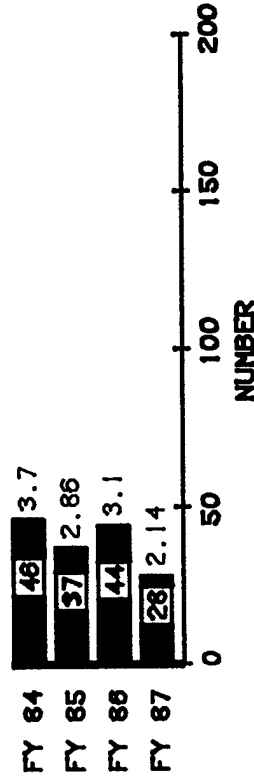
ARMY MOTOR VEHICLES

U.S. ARMY MOTOR VEHICLE ACCIDENTS

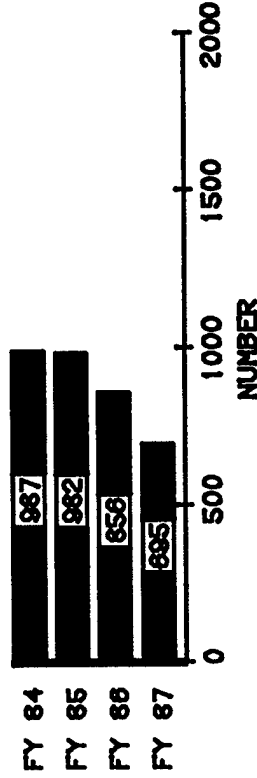
ACCIDENTS/RATE



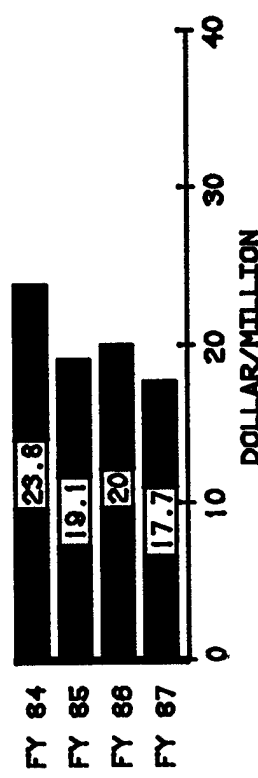
FATALITIES/RATE



NON-FATAL INJURIES



TOTAL COST



ACCIDENT RATE PER MILLION MILES
FATALITY RATE PER HUNDRED MILLION MILES

A decreasing trend in Army motor vehicle accidents continued through FY 87. Nine percent (-280) fewer accidents occurred in FY 87 compared to FY 86. Decreases occurred in both tactical (-162) and commercial type (-118) vehicle accidents. The decrease in tactical vehicle accidents consisted primarily of decreases involving 1/4-ton trucks (-129), M880/890 (-50), 2 1/2-ton trucks (-16) and other tactical vehicles (-60) which offset increases in accidents involving 8-ton and larger trucks (+26), HMMWV (+50), and CUCV (+13). Decreases in commercial vehicle accidents is attributed to decreases in accidents involving sedans and station wagons (-56), 1/4- thru 3/4-ton trucks (-14), vans (-14) and other commercial vehicles (-40).

The number of fatalities resulting from AMV accidents have averaged 42 per year during the 3-year period of fiscal years 84 through 86. The number in FY 87 was 33% (-14) fewer than the prior 3-year average and 36% (-16) fewer than FY 87. Decreases in fatalities in 1/4-ton trucks (-4), M880/890 trucks (-3), CUCV (-3), and commercial type busses (-3) account for the major portion of the decreases from FY 86.

A decreasing trend in nonfatal injuries in Army motor vehicle accidents has continued since FY 84. The number in FY 87 was 19% (-161) fewer than FY 86. The decrease in FY 87 resulted primarily from a decrease in nonfatal injuries in 1/4-ton trucks (-103), M880/890 trucks (-21), CUCV (-14), and commercial vans (-27). Decreases in other tactical vehicle injuries (-42) and other commercial vehicles (-12) was offset by notable increases in injuries involving 2 1/2-ton, 8- and 10-ton, and larger trucks (+18); Gamma Goat (+3) and HMMWV (+37).

The total cost of Army motor vehicle accidents in FY 87 was the lowest since FY 84. The FY 87 cost was 11% (-\$2.3 million) less than FY 86. This decrease is keyed to the decrease in both fatal and nonfatal injuries. Damage cost in FY 87 showed a slight increase (+\$0.4 million) compared to FY 86. The increase in damage cost is attributed primarily to the increase in accidents involving trucks, 8 ton or more, and HMMWV and CUCV.

ARMY MOTOR VEHICLE ACCIDENTS
FY 87

VEHICLE	NUMBER	ACCIDENTS		COST	INJURIES	
		%			FATAL	NONFATAL
<u>TACTICAL</u>						
CUCV	338	13		1,908,388	-	62
5-Ton Truck	286	11		3,220,246	6	68
2 1/2-Ton Truck	212	8		2,117,639	4	77
1/4-Ton Truck	178	7		1,444,523	6	123
Over 10-Ton Truck	107	4		1,317,092	1	14
M880-890 Truck	70	3		371,895	1	26
HMMWV	66	2		335,043	-	45
8- & 10-Ton Trucks	58	2		1,001,829	2	17
Tactical Trailer	36	1		105,707	-	8
Gamma Goat	30	1		234,426	2	25
HET	7	<1		39,188	-	-
1/2 & 1 1/2-Ton Trucks	3	<1		6,905	-	1
Other Tactical Vehicle	172	6		1,067,317	1	50
<u>COMMERCIAL</u>						
Sedan/Station Wagon	607	23		2,162,010	4	88
Van	172	6		659,354	-	22
Bus	66	2		461,401	-	6
1/4- & 3/4-Ton Truck	59	2		182,951	-	11
Over 2-Ton Truck	37	1		267,696	-	15
Rental Vehicle	14	1		89,527	-	2
(Short-term)						
1- & 2-Ton Trucks	13	<1		50,545	-	4
Truck-Tractor	9	<1		64,270	-	1
CJ5/6/7	6	<1		14,323	-	-
Motorcycle/Moped	4	<1		57,916	1	2
Contractor Vehicle	3	<1		5,102	-	1
Trailer	1	<1		4,853	-	-
Train	1	<1		1,383	-	-
Other Commercial Vehicle	139	5		470,535	-	27
TOTAL	2,694	100		17,662,064	28	695

This chart shows that five types of vehicles accounted for 60% of the Army Motor Vehicle accidents and 61% of the cost. These five types were the sedan/station wagons, CUCV, 5-ton trucks, 2 1/2-ton trucks and the 1/4-ton trucks. In the following paragraphs, accidents involving these vehicles are analyzed with respect to driver errors and materiel failures.

ARMY MOTOR VEHICLE ACCIDENTS INVOLVING DRIVER ERROR
FY 87

Type Vehicle	No. of Acdts	Driver Error*			
		Improper Attention	Misjudged Clearance/Speed/Weight/Size	Failed to Anticipate	Failed to Follow Procedures/Decision Orders/Laws
Sedan/Station Wagon	283	28	16	13	21
CUCV	251	20	19	18	14
5-Ton Truck	207	15	20	16	13
2 1/2-Ton Truck	132	11	23	14	10
1/4-Ton Truck	123	14	18	21	20
					12
					10
					13
					19
					10

*Of 14 driver errors available for selection by field investigators, the five shown were reported with the greatest frequency for accidents involving the top five vehicles.

Sixty-one percent of these AMV accidents (sedans/station wagons, CUCV, 5-ton trucks, 2 1/2-ton truck and 1/4-ton trucks) involved driver error. As shown in the chart, the most frequent errors were:

- a. Improper attention. This error resulted primarily in loss of control and failure to yield the right-of-way.
- b. Misjudged clearance/speed/weight/size. This error resulted primarily in loss of control and excessive speeding.
- c. Failed to anticipate. This error resulted primarily in loss of control.

d. Improper decision. This error resulted primarily in excessive speed, fatigue, loss of control, failure to yield the right-of-way, and following too closely.

e. Failed to follow procedures/orders/laws. This error resulted primarily in failure to yield the right-of-way and loss of control.

ARMY MOTOR VEHICLE ACCIDENTS INVOLVING MATERIEL FAILURES
FY 87

TYPE OF VEHICLE	NO. OF ACDTS	PERCENT OF ACCIDENTS BY COMPONENTS									
		Tires	Brakes	Tires	Brakes	Body/Frame	Steering	Transmission	Other	Fuel System	Other
2 1/2-Ton Truck	43	14	66	14	66	14	2	2	2	3	2
5-Ton Truck	32	6	72	6	72	6	3	10	10	3	10
CUCV	15	53	20	13	7	7	7	7	7	7	7
1/4-Ton Truck	10	40	20	20	10	20	10	10	10	10	10
Sedan/Station Wagons	12	33	25	8	8	8	8	8	8	8	18

Only 7% of these AMV accidents involved material failure/malfunction. Shown on the chart, however, over four-fifths (83%, 93/112) involved the following three most frequent components:

- a. Brakes. Brake failures accounted for over one-half (55%, 62/112) of these accidents which most frequently involved poor preventive maintenance on brakes.
- b. Tires/wheel. Almost one-fifth (18%, 20/112) of the accidents involved tire failures. Blowouts were responsible for most material failures, especially the CUCV right rear tire.
- c. Body/frame. Proper preventive maintenance checks and services would have prevented the majority of approximately 10% (11/112) of the accidents caused by improperly secured seats and other vehicle components.

ARMY MOTOR VEHICLES

PROBLEM AREA: Driver Error

Improper attention, misjudged clearance/speed/weight/size, failed to anticipate, improper decision, failed to follow procedures/orders/laws.

Principal Cause Factor: Inadequate Self-Discipline (52%)

Inadequate self-discipline consists of personal characteristics, such as over confidence or improper attitudes toward job requirements, that cause individuals to commit task errors that cause accidents. Examples specific to FY 87 are:

- Excessive speed for road condition or posted limits.
- Failure to stop/yield, improper turn, improper lane change.
- Failure to stay alert or attentive to road.

Countermeasures:

DA Level

USASC published articles in COUNTERMEASURE dealing with winter driving (Oct 86), maneuver area safety (Dec 86), driver training (Jan, Aug, and Sep 87), safe operation of M809 series 5-ton trucks (Feb 87), AMV operations in confined areas (Mar 87), summer stress and the AMV operator (Apr 87), tactical parking and night displacements (Jun 87), safety belts (May and Sep 87), and various specific driver errors (all issues).

USASC reprinted (to provide more kits to the field) the Commander's Guide to AMV Accident Prevention Kit containing posters and general and specific suggested countermeasures.

MACOM/Installation Level

At Fort Leonard Wood, all trainee soldier drivers were given a Defensive Driving Course in their unit.

All MACOMs instituted an intensive seatbelt education and enforcement program.

USARJ distributed a command letter pointing out specific driver errors and requesting more direct supervisory involvement.

INSCOM increased command emphasis on training and orientation of safety rules/requirements and procedures.

Fort McClellan established a requirement for every Army motor vehicle operator involved in an accident, as well as his or her NCOIC, First Sergeant, Company Commander, Battalion Commander, and O6, to report to the Commanding General.

EUSA applied a safety awareness program to counter human errors and factors likely to impair sound judgment.

Fort Belvoir implemented a remedial driving program to reduce driver errors and reinforce positive attitudes and skills.

Unit Level

Establish and enforce safe speed limits for various road and weather conditions.

Hold drivers accountable for safe performance.

Hold senior occupant/assistant driver responsible for his duties.

Principal Cause Factor: Inadequate Unit Training/Experience (21%)

Unit training/experience are inadequate when personnel perform accident-causing behaviors because unit training or supervised on-the-job experience provided did not prepare them to perform assigned tasks properly. Examples for FY 87 of areas for which training/experience was inadequate are:

- Training/experience in vehicle being operated at time of accident.
- Training/experience in adverse conditions (weather, regional hazards, etc.).

Countermeasures:

DA Level

USASC published articles in COUNTERMEASURE dealing with winter driving (Oct 86), maneuver area safety (Dec 86), driver training (Jan, Aug, and Sep 87), safe operation of M809 series 5-ton trucks (Feb 87), M916 tractor-truck downhill procedures (Feb 87), AMV operations in confined areas (Mar 87), HMMWV operation (Mar 87), tactical parking and night displacements (Jun 87), and safety belts (May and Sep 87).

USASC worked with the Transportation School in developing simulator-enhanced driver training.

USASC worked with the Combined Arms Training Activity toward development of an Armywide driver training strategy.

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents.

MACOM/Installation Level

Fort Knox reproduced the USASC Army motor vehicle kit with added Commanding General endorsement.

EUSA required all drivers of military vehicles to attend special orientation on winter driving in Korea.

Fort Belvoir implemented a remedial driving program to reduce driver errors and reinforce positive attitudes and skills.

Unit Level

Pair an experienced driver with an inexperienced one to provide supervision and hands-on training.

Develop and enforce a program to ensure training includes seasonal and local driving hazards.

Principal Cause Factor: Inadequate Supervision (11%)

Supervision is inadequate when it leads to or allows accident-causing behaviors.

Countermeasures:

DA Level

USASC published articles in COUNTERMEASURE dealing with the importance of supervision in accident prevention (Nov 86, Feb, Mar, Apr, Jun, and Jul 87).

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents.

MACOM/Installation Level

USARJ sent out a command letter pointing out specific driver errors and requesting more direct supervisory involvement.

Fort McClellan established a requirement for every Army motor vehicle operator involved in an accident, as well as his or her NCOIC, First Sergeant, Company Commander, Battalion Commander, and O6, to report to the Commanding General.

Unit Level

Ensure first-line supervisors strictly require and supervise drivers preoperation checks.

Restrict Army motor vehicle dispatches when road and weather conditions are hazardous.

Ensure all appropriate vehicle technical manuals are used.

Hold first-line supervisors accountable for their soldiers and equipment, day and night. A soldier's actions and his equipment condition are a reflection of his NCO.

Principal Cause Factor: Fatigue (8%)

Fatigue is a temporary physical and/or mental state that causes individuals to make accident-causing errors due to reduced physical or mental capabilities resulting from previous activity and/or lack of rest.

Countermeasures:

DA Level

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents, to include reduction of maximum driving time in AMVs.

USASC published an article in COUNTERMEASURE dealing with the danger of driving when fatigued (Apr 87).

Unit Level

Establish and enforce a unit crew rest policy.

Step up supervision during extended training periods to ensure troops do not shortcut procedures and safety precautions due to fatigue.

PROBLEM AREA: Materiel Failure

Brakes, tires, body/frame, steering, axles, transmission.

Note: The principal cause factors were not identified for the majority of Army motor vehicle materiel failures. Therefore, the information below is based on the small number of accidents where cause factors were reported.

Principal Cause Factor: Inadequate Maintenance (38%)

Maintenance (inspection, installation, troubleshooting, recordkeeping, etc.) is inadequate when it causes or contributes to an accident-causing materiel failure/malfunction. Examples specific for FY 87 are:

- Jury-rigged a wiring harness on a 5-ton truck.
- Load restraining strap inadequately installed on item being transported.

Countermeasures:

MACOM/Installation Level

TACOM issued Safety-of-Use message 87-86 requiring PMCS on CUCV tires and emphasizing proper speed limit.

Unit Level

Operator before-, during-, and after-operation PMCS must be accomplished in accordance with appropriate technical manual, and supervised by the first-line leader.

Scheduled maintenance must be accomplished by qualified mechanics under supervision of their maintenance leader. Periodic quality control checks must be accomplished at the critical points in the service.

Principal Cause Factor: Inadequate Manufacture, Assembly, Packaging, or Quality Control (38%)

Manufacture, assembly, packaging, or quality control is inadequate when it leads to accident-causing materiel failures/malfunctions. An example for FY 87 is tire failure due to possible manufacture deficiency.

Countermeasure:

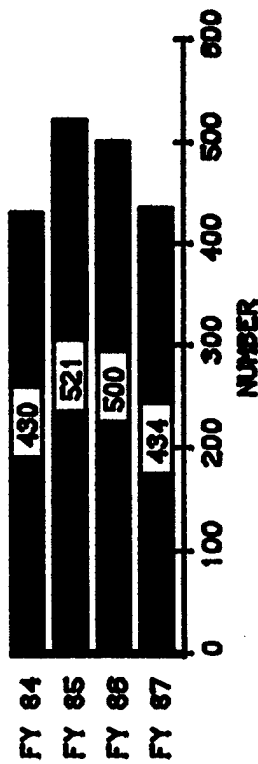
MACOM/Installation Level

TACOM issued Safety-of-Use message 87-67 recalling selected Firestone Town and Country radial tires for M880-series trucks.

ARMY COMBAT VEHICLES

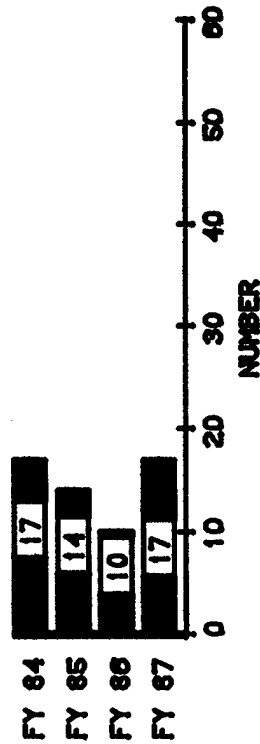
COMBAT VEHICLE ACCIDENTS

ACCIDENTS



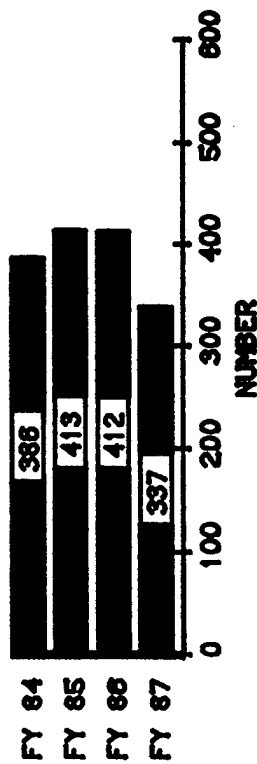
The number of combat vehicle accidents has decreased for the third consecutive year. FY 87 accidents were 13% (-66) fewer than the number experienced in FY 86. M60 and M48 tank accidents decreased by 43 and 12, respectively. M113 and other carrier accidents decreased by 19 and 11, respectively. These decreases offset a significant increase in M1 tank accidents (+27).

FATALITIES



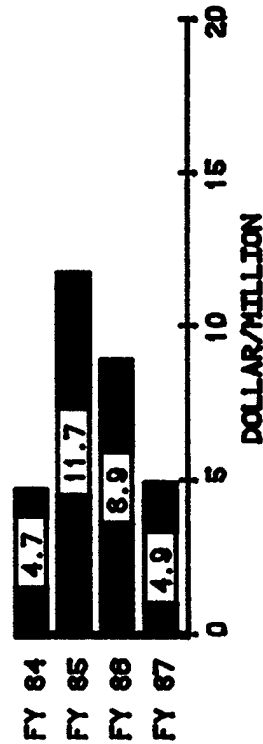
The number of fatalities resulting from combat vehicle accidents during FY 87 (17) equalled the number during FY 84. This was 70% (+7) more than FY 86. This increase is attributed primarily to four fatalities resulting from accidents involving self-propelled howitzers/guns in FY 87 (none in FY 86) coupled with an increase from 4 to 8 fatalities involving the M113 carriers.

NON-FATAL INJURIES



The number of nonfatal injuries in combat vehicle accidents in FY 87 (337) was the lowest in the 4-year period. This was 18% (-75) fewer than FY 86. This decrease is attributed to fewer nonfatal injuries in accidents involving the M60 tank (-25), the M48 tank (-11), self-propelled guns/howitzers (-10), M113 carriers (-31), and other carriers (-15) which offset an increase in injuries involving the M1 tank (+24).

TOTAL COST



Significant decreases have occurred in the total cost of combat vehicle accidents since FY 85. FY 87 cost was 45% (-\$4.0 million) less than FY 86. This decrease is attributed primarily to a decrease in damage cost to M60 tanks (-\$0.4 million), track recovery vehicles (-\$2.1 million), carriers other than the M113 (-\$1.1 million) and fighting vehicles (-\$1.1 million).

COMBAT VEHICLE ACCIDENTS
FY 87

VEHICLE	ACCIDENTS			INJURIES	
	NUMBER	%	COST	FATAL	NONFATAL
M113 Carrier	97	22	894,545	8	86
M1 Tank	79	18	1,718,306	-	55
M60 Tank	78	18	699,920	1	59
Other Carrier	64	15	584,723	1	50
SP Guns & Howitzers	37	9	357,295	4	30
Fighting Vehicles	31	7	303,511	1	20
VTR	15	3	143,219	1	12
M551 Sheridan	13	3	28,092	-	11
Other Tank	8	2	21,805	-	8
AVLB	5	1	51,762	-	3
CEV	4	1	26,340	-	1
M48 Tank	2	<1	73,462	1	2
Other Track Vehicle	1	<1	3,500	-	-
TOTAL	434	100	4,906,480	17	337

This chart shows that four types of vehicles accounted for 73% of the combat vehicle accidents and 79% of the costs. These four types were M113 carriers, M1 tanks, M60 tanks, and other carriers. The reason for a separate category entitled "other carriers" is because, although they have the same basic chassis as the M113, they have different equipment and are used for different tasks (e.g., M577 command carrier, M548 ammo carrier). In the following paragraphs, accidents involving these vehicles are analyzed with respect to driver error and materiel failures.

COMBAT VEHICLE ACCIDENTS INVOLVING DRIVER ERROR FY 87

Type Vehicle	No. of Acdts	Driver Error*			
		Misjudged Clearance/Speed/Weight/Size	Failed to Follow Procedures/Order/Laws	Failed to Recognize Decision	Failed to Anticipate
M113 Carrier	32	29	12	7	17
M1 Tank	15	29	12	18	12
M60 Tank	17	16	11	32	5
Other Carrier	24	11	32	11	7
					18

*Of 14 driver errors available for selection by field investigators, the five shown were reported with the greatest frequency for accidents involving the top four vehicles.

Twenty-eight percent of these combat vehicle accidents (M113 carrier, M1 tanks, M60 tanks, and other carriers) involved driver errors. As shown in the chart, the most frequent errors were:

- Misjudged clearance/speed/weight/size. This type error resulted primarily in the loss of control.
- Failed to follow procedures/orders/laws. This type error resulted most frequently in following too closely, failure to lock/block/secure, and loss of control.
- Failed to recognize. This type error resulted primarily in loss of control.
- Improper decision. This type error resulted most frequently in loss of control and failure to use personal protective equipment.
- Failed to anticipate. This type error resulted primarily in loss of control.

COMBAT VEHICLE ACCIDENTS INVOLVING MATERIEL FAILURES
FY 87

TYPE OF VEHICLE	NO. OF ACDTS	PERCENT OF ACCIDENTS BY COMPONENTS					
M113 Carrier	9	Tracks 34	Steering 22	Weapon 11	Electrical 11	Transmission 11	Tiedown Strap 11
M1 Tank	5	Weapon 40	Electrical 40	Tracks 20			
M60 Tank	7	Brakes 44	Weapon 14	Electrical 14	Seat 14	Hatches 14	
Other Carrier	9	Steering 56	Weapon 11	Electrical 11	Hatches 11	Accelerator 11	

Only 9% of these combat vehicle accidents involved materiel failure/malfunction. As shown on the chart, the most frequent components involved were:

- a. Carrier steering. Most common malfunctions were binding and locking of laterals and loose/sheared differential locking pins.
- b. Weapons system. Most materiel failures/malfunction occurred during firing; specifically, two tank main guns burst.
- c. Electrical. Malfunctions primarily due to inoperative CVC helmets/crew intercoms and inoperable vehicle head/blackout/warning lights.
- d. Tracks. Most common malfunctions reported were broken track shoes.
- e. Tank brakes. Poor preventive maintenance accounted for most of the materiel failures/malfunction.
- f. Hatches. Malfunctions continue because of broken/failed hatch locking devices.

ARMY COMBAT VEHICLES

PROBLEM AREA: Driver Error

Misjudged clearance/speed/weight/size, failed to follow procedures/orders/laws, failed to recognize, improper decision, failed to anticipate.

Note: The principal cause factors were not identified for the majority of Army combat vehicle driver errors. Therefore, the information below is based on the small number of accidents which reported cause factors.

Principal Cause Factor: Inadequate Self-Discipline (28%)

Inadequate self-discipline consists of personal characteristics, such as overconfidence or improper attitude toward job requirements, that cause individuals to commit task errors that cause accidents.

Note: Due to the small number of cases available, examples would not necessarily be representative and are therefore not reported.

Countermeasures:

DA Level

USASC produced and fielded an Armor Commander's Guide, Branch Loss Control Support Packet. This is a prevention kit containing posters and material designed to assist commanders with specific countermeasure suggestions.

USASC revised AR 600-55 to update driver selection and licensing procedures and strengthen driver training requirements.

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents.

USASC worked with the Armor School in developing realistic driver training for tank drivers.

USASC developed articles related to inadequate self-discipline for COUNTERMEASURE (Oct 86 through Sep 87), and a special edition COUNTERMEASURE, "Somebody Knew" (Jan 88).

MACOM/Installation Level

TACOM issued a safety-of-use message establishing fording limits for the M113 family of vehicles.

AMC/TACOM implemented and continues to monitor product improvements to alleviate fire problems with the electrical system in the M1-series vehicles.

AMC/TACOM is implementing product improvement to the hydraulic system on the M1 tank that allows the auxiliary hydraulic pump to operate with master battery on.

Unit Level

Low or unacceptable equipment operation and maintenance standards must not be tolerated. Leaders and supervisors must closely supervise operational performance and maintenance operations.

Principal Cause Factor: Inadequate Unit Training/Experience (18%)

Unit training/experience are inadequate when personnel perform accident-causing behaviors because unit training or supervised on-the-job experience provided did not prepare them to perform assigned tasks properly.

Note: Due to the small number of cases available examples would not necessarily be representative and are therefore not reported.

Countermeasures:

DA Level

USASC revised AR 600-55 to update selection and licensing procedures and strengthen driver training requirements.

USASC is assisting TRADOC with development of a driver simulation trainer.

USASC developed articles for COUNTERMEASURE related to driver training (Jan, May, Jun, Jul, Aug, and Sep 87).

MACOM/Installation Level

AMC/TRADOC are assisting in development and implementation of improved driver training and improving the driver position to increase operational capability.

AMC/TACOM published a warning and sent warning stickers out to all units with armor vehicles to warn of danger to crewmembers in the turret and driver compartments of rotating turrets.

INSCOM increased command emphasis on training and orientation of safety rules/requirements and procedures with notice that failure to comply would result in disciplinary action.

Unit Level

Allow only properly trained and licensed drivers to operate vehicles.

Match the driver experience to the mission.

During training, expose drivers to all conditions under which they will be required to operate, especially night driving with night vision goggles/devices (NVG/NVD).

Principal Cause Factor: Inadequate Supervision (18%)

Supervision is inadequate when it leads to or allows accident-causing behaviors.

Note: Due to the small number of cases available, examples would not necessarily be representative and are therefore not reported.

Countermeasures:

DA Level

USASC produced and fielded an Armor Commander's Guide, Branch Loss Control Support Packet. This is an accident prevention kit containing posters and material designed to assist commanders with specific countermeasure suggestions.

USASC revised AR 600-55 to update driver selection and licensing procedures and strengthen driver training requirements.

USASC revised AR 385-55, Prevention of Motor Vehicle Accidents.

USASC is assisting and monitoring development of unit-level safety films and programs.

MACOM/Installation Level

AMC is identifying and executing product improvements required for safer operation of Army combat vehicles.

Fort Benning organized a 6-hour course of instruction which is mandatory for assistant safety officers.

Fort McClellan presented a training course each quarter for collateral duty safety officers (military and civilian).

Unit Level

Improve direct supervision of maintenance.

Ensure preventive maintenance checks and services (PMCS) are made and proper technical manuals are available.

Principal Cause Factor: Fatigue (11%)

Fatigue is a temporary physical and/or mental state that causes individuals to

make accident-causing errors due to reduced physical or mental capabilities resulting from previous activity and/or lack of rest.

Note: Due to the small number of cases available, examples would not necessarily be representative and are therefore not reported.

Countermeasures:

DA Level

USASC published an article in COUNTERMEASURE dealing with danger of driving when fatigued (Apr 87).

Unit Level

Sleep plans should be part of standing operating procedures. They should be adhered to by all levels of command.

Under extreme conditions or unusual hours of continuous operation, a second driver or operator should be appointed.

PROBLEM AREA: Materiel Failure

Tracks, weapon system, steering, electrical, brakes, hatches.

Note: The principal cause factors were not identified for the majority of Army combat vehicle materiel failures. Therefore, the information below is based on the small number of accidents which reported cause factors.

Principal Cause Factor: Inadequate Maintenance (67%)

Maintenance (inspection, installation, troubleshooting, recordkeeping, etc.) is inadequate when it causes or contributes to an accident-causing materiel failure/malfunction.

Note: Due to the small number of cases available, examples would not necessarily be representative and are therefore not reported.

Countermeasures:

Unit Level

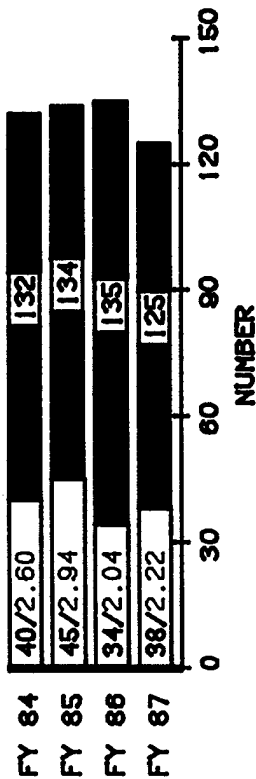
Operator before-, during-, and after-operation PMCS must be accomplished in accordance with appropriate technical manual, and supervised by the first-line leader.

Scheduled maintenance must be accomplished by qualified mechanics under the supervision of their maintenance leader. Periodic quality control checks must be accomplished at the critical points in the service.

AVIATION

U.S ARMY AVIATION FLIGHT ACCIDENT EXPERIENCE

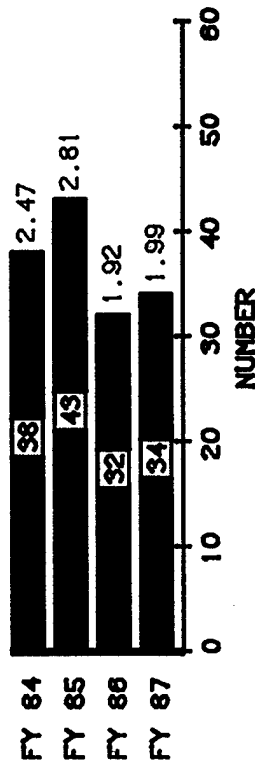
CLASS A, B, C ACCIDENTS/RATE



CLASS-A

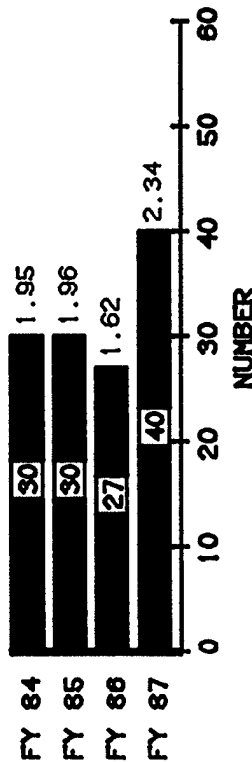
The number of class A, B, and C flight accidents in FY 87 decreased by 7% (-10) compared to FY 86. Decreases in accidents involving the AH-1 (-5), TH-55 (-7), UH-1 (-11), and fixed wing aircraft (-7) accounted for the major part of this decrease. However, a large part of these decreases was offset by increases in accidents involving the AH-64 (+4), the MH-6 (+4), and the UH-60 (+10). The number of class A accidents remained low compared to FY 84 and FY 85; however, a 12% (+4) increase over FY 86 was experienced. The class A rate was the second lowest in Army aviation history which was attained in FY 86.

DESTROYED AIRCRAFT/RATE



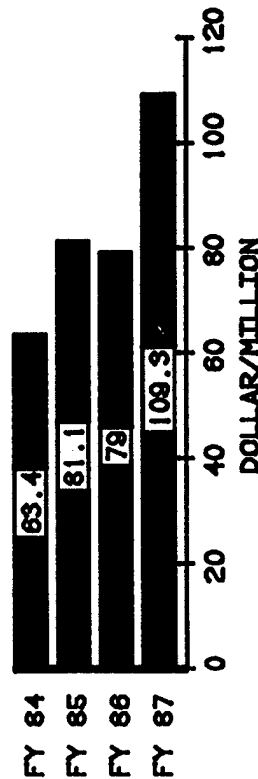
The number of destroyed aircraft increased from 32 in FY 86 to 34 in FY 87 and is primarily attributed to an increase in the number of destroyed UH-60 aircraft (+4). Other notable decreases in the number of destroyed AH-1 (-3) and UH-1 (-2) were offset by an increase of one in other type aircraft.

FATALITIES/RATE



The number of fatalities resulting from aviation accidents in FY 87 was 48% (+13) more than FY 86 and was 10 more than both FY 84 and FY 85. However, one-fourth (10) of these resulted from one accident. Included in the 40 fatalities in FY 87 was one USAF servicemember. Excluded from these were three DAC fatalities in FY 87 which are counted under FECA claims and three non-Army civilians.

CLASS A, B, C COST



The cost of aviation accidents continues to increase. The FY 87 cost was 38% (+\$30.3 million) more than FY 86. This increase is attributed primarily to an increase in the destruction of the more expensive UH-60 aircraft which accounted for \$19.4 million of the total increase and the AH-64 aircraft which accounted for another \$16.5 million of the increase. A smaller increase in damage cost associated with the CH-47 (+\$2.9 million), OH-58 (+\$0.6 million) and the OV-1 (+\$1.0 million) was offset by a decrease in cost associated with the AH-1 (-\$4.0 million), UH-1 (\$-3.4 million), and the BG-8 (\$-2.5 million). Cost associated with the increase in fatalities was partially offset by a decrease in nonfatal injury cost and resulted in only a \$0.6 million increase in injury cost.

RATES PER 100,000 FLYING HOURS

ARMY AVIATION FLIGHT ACCIDENT ANALYSIS - FY 87

<u>Aircraft Type</u>	<u>Number of Class A, B, & C Accidents</u>	<u>Total Cost</u>
UH1	28	12.0
AH1	18	7.4
OH58	18	2.3
UH60	16	35.2
CH47	9	9.2
AH64	9	38.0
U21	5	1.0
MH6	5	1.0
OH6	4	.8
C12	3	.1
OV1	3	1.5
TH55	2	.1
CH54	2	.1
UNK HEL	1	<.1
RV1	1	<.1
U8	1	<.1
AH6	0*	.4
TOTAL	125	109.3

*AH-6 - Second aircraft in midair accident.

AVIATION

PROBLEM AREA: Human Error

Job performance different from that required by the operational situation, e.g., improper control inputs or coordination, failure to follow procedures, decisions to attempt actions beyond the capability of the aircraft/person at the controls, misjudgments of clearance/rate of closure, improper division of attention, improper planning, inadequate communication.

Principal Cause Factor: Inadequate Self-Discipline (49%)

Inadequate self-discipline consists of personal characteristics such as overconfidence or improper attitudes toward job requirements that cause individuals to commit task errors that cause accidents. Examples specific to FY 87 are:

- Decisions not to perform required premission procedures such as updating wire-hazards map, not performing OGE check, and not setting altimeters, due to improper attitude, haste, or overconfidence in one's own or the aircraft's capabilities.
- Decisions to focus attention on lower priority flight tasks at the expense of more critical tasks, such as looking inside the cockpit long enough for the aircraft to descend into trees/ground, releasing collective to shine flashlight on magnetic compass long enough for aircraft to descend into trees, air traffic controller unnecessarily focusing on verification of scope operation and identification of IFR traffic long enough for converging traffic to collide, and walking into tail rotor while inspecting the aircraft due to inadequate division of attention.
- Decisions to attempt flight maneuvers that exceed aircraft capabilities, such as intentionally flying into almost certain LFE situation and allowing the aircraft to enter an uncommanded descent several times without identifying the condition as settling with power, due to overconfidence in one's own flying ability or in aircraft's capability.
- Decisions to attempt flight maneuvers that exceed personal capabilities

such as flight course reversal maneuver not found in the ATM, night terrain approach to unmarked, unlighted, snow-covered field, flying too fast and too low for prevailing visibility, flying over water with NVGs and pink light filter with ambient light near zero, and prohibited aerobatics while carrying passengers, due to overconfidence in flying ability.

Countermeasures:

DA Level

USASC incorporated Aircrew Coordination Training into the Aviation Safety Officer Course in January 1988. ASOs are trained to teach Aircrew Coordination as a unit-level program targeted at the reduction of human-error accidents involving inadequate self-discipline. Aircrew Coordination Training emphasizes the commander's role in influencing aircrew performance, the importance of proper mission briefings, and the consideration of crew rest in mission assignment.

MACOM/Installation Level

USAAVNC is conducting similar training entitled, "Dynamics of Aircrew Coordination and Communication." USASC and USAAVNC are coordinating efforts to improve effectiveness of pilot decision making training programs designed to reduce human-error accidents.

Unit Level

Commanders identify crewmembers who violate established procedures and take appropriate corrective actions. Failure by commanders to take corrective actions is tacit approval of procedural violations.

Commanders ensure standardized unit training programs are established in accordance with DA guidance for all type missions to be performed by the unit, both specified and implied.

Commanders ensure training standards are established, practical, clearly understood, and enforced.

Commanders ensure appropriate training is provided to crewmembers prior to mission assignments.

Commanders support and participate in an active Aircrew Coordination Training program.

Principal Cause Factor: Inadequate Unit Training/Experience (17%)

Unit training/experience is inadequate when personnel perform accident-causing behaviors because unit training or supervised on-the-job experience did not prepare them to perform assigned tasks properly. Examples specific to FY 87 include:

- Units assigned aviators who had not received required specialized training to perform high-skill missions such as:
 - multiship NVG airmobile mission.
 - tactical terrain flight training mission.
 - night gunnery under NVG.
 - slingload operations.
 - NOE mission.
 - mountain flying.
- Units assigned flight missions to aviators who did not have the required general training in:
 - cockpit communication/coordination.
 - LTE emergency procedures.

Countermeasures:

DA Level

USASC has incorporated Risk Management Training in the Army Safety Officer course and developed an exportable Risk Management Training Kit for leaders.

Proper risk management ensures that pilot proficiency, training level, and currency are considered in mission planning and crew selection.

Unit Level

Aircrew Coordination Training at the unit level provides leaders with additional decision-making skills for making crew selection and assignment.

Aircrew Coordination Training provides crewmembers with decision-making skills for self-evaluation of mission readiness.

Commanders ensure a standardized unit training program is established for all types of unit missions, both specified and implied.

Commanders ensure training standards are established, practical, clearly understood, and enforced.

Commanders ensure appropriate training is provided to crewmembers prior to mission assignments.

Commanders support and participate in an active Aircrew Coordination Training program.

Commanders ensure that proper risk management procedures are exercised prior to any mission assignments.

Principal Cause Factor: Inadequate Supervision (10%)

Supervision is inadequate when it leads to or allows accident-causing behaviors or material failures. Examples specific to FY 87 include:

- Commander allowed aviators to perform high-risk flights for which there was no mission requirement and for which they were untrained.
- Flight Operations Officer assigned slingload mission to aviator who was outside crew rest guidelines, was not current for the assigned mission, and who should have been with an instructor pilot.

- Aviation Safety Officer failed to ensure safety inspection of landing area which had been strung with overhead wires. A safety inspection was required by standing operating procedures.
- Commander allowed use of outdated operator's manual in preparing slingload even though current operator's manual had been distributed to the unit.
- Army-level management has not provided all OH-58s with product improvement modification which corrects the OH-58s' inadequate directional control problem.

Countermeasures:

DA Level

Aircrew Coordination Training, as incorporated into the Aviation Safety Officer Course, emphasizes the commander's role in influencing crewmember performance. Aircrew Coordination Training also emphasizes the importance of proper mission briefings and the consideration of crew rest in mission assignment.

MACOM/Installation Level

Aircrew Coordination Training, as incorporated into the Aviation Safety Officer Course, emphasizes the commander's role in influencing crewmember performance. Aircrew Coordination Training also emphasizes the importance of proper mission briefings and the consideration of crew rest in mission assignment.

Risk Management Training includes consideration of mission brief quality, crewmember readiness, and tactical operations in mission planning and crew assignment.

Unit Level

Commanders identify crewmembers who violate established procedures and take appropriate corrective actions. Failure by commanders to take corrective actions is tacit approval of procedural violations.

Commanders ensure training standards are established, practical, clearly understood, and enforced.

Commanders ensure appropriate training is provided to crewmembers prior to mission assignments.

Commanders support and participate in an active Aircrew Coordination Training program.

Commanders ensure that a risk management program is conducted at unit level.

Principal Cause Factor: Inadequate Written Procedures (8%)

Inadequate written procedures are those written, unwritten-but-understood, or nonexistent procedures for normal, abnormal, or emergency conditions which lead to or allow accident-causing behaviors or materiel failures. Examples specific to FY 87 include:

DA Level

- ATM FC 1-211 does not adequately emphasize remaining in ground effect when taking off over sloping terrain unless it is certain that out-of-ground-effect power is available for the terrain and conditions.
- UH-1 operator's manual and FM 1-202 contain no guidance which cautions aircrews about engine startup or shutdown procedures when there are updrafts such as those associated with pinnacle operations.
- AH-64 operator's manual fails to address inadvertent activation of the engine chop collar as a possible reason for dual engine failure.
- AH-64 ATM does not adequately define crew duties associated with vertical helicopter instrument recovery procedures.
- FC 1-219 (ATM for NVG) contains inadequate information regarding limitations of NVGs and pink light filter. Also, there are no written procedures for flying over water with NVGs when the ambient light is near zero.

- OV-1D Technical Manuals 55-1510-213-CL and 55-1510-213-10 are not well organized with respect to hydraulic system failure procedures (which don't include landing gear extension). Emergency landing gear extension is contained in the section on landing and ditching.
- Army-level guidance and unit standing operating procedures contain inadequate guidance for NVG multiship operations regarding lead changes, minimum crew requirements, separation distances, approved NVG formations, which crewmembers should wear NVG, and equipment limitations of the AN-PVS-5 NVGs in the UH-60.
- OH-58 manufacturer has inadequate written procedures on how to confirm proper installation of the fuel shutoff valve, including ensuring that the valve fully opens and closes.
- Criteria do not exist for the inspection and serviceability for the four UH-60 tiedown assemblies in connection with rappelling procedures, installation and removal, premission inspection, adequate torque, and self-locking nuts.
- RV-1D Technical Manual 55-1510-213-23-2 contains inadequate installation and inspection criteria for the turnlock fasteners on outboard access door of engine upper afterbody. Checks and inspections in the phased maintenance checklist and the daily inspection checklist also are inadequate.
- UH-1H PMD, Task No. 7.11, is vague on procedures for checking deflector nozzles.
- There is no published directive giving specific CH-54 rigging procedures for slingloading certain kinds of shipping containers, e.g., transmission container.
- Aircrew Training Manuals lack information on the employment and capabilities of the wirestrike protection systems installed on certain aircraft.
- Inspection criteria for maintenance of UH-1H compensating T-1 bellows are inadequate, allowing bellows to collapse and subsequent compressor stalls at all power settings.

Unit Level

- Unit's TSOP violates directive from CSA, 27 Feb 86, and does not incorporate that directive, which prohibits stringing communication wire between trees in a landing zone.
- Unit does not have a written external load standing operating procedure in accordance with AR 385-95, or a crew endurance annex tailored to the mission in accordance with CAM Reg 95-1.

Countermeasures:

DA Level

VCSA issued directives in 'Thurman Sends' message addressing lead change procedures for all NVG operations.

Safety-of-flight message addressed inadvertent activation of the engine chop collar. Chop collars are to be painted yellow and safety wired with breakaway wire.

USASC recommended AMC revise FC 1-211 to emphasize the importance of remaining in ground effect when taking off over sloping terrain unless it is certain that out-of-ground effect hover power is available.

AH-64 safety-of-flight message provided emergency procedures in the event of tail rotor failure.

USASC and USAAVNC conducted worldwide briefings to aircrews on NVG operations.

MACOM/Installation Level

USASC and USAAVNC conducted worldwide briefings to aircrews on NVG operations.

Principal Cause Factor: School Training (4%)

School training is inadequate when accident-causing errors are made because school training provided was inadequate in content or amount. Examples specific to FY 87 are:

- School training does not provide aviators:
 - any practice or demonstration autorotations under NVGs.
 - adequate emphasis on handling antitorque malfunctions.
 - adequate awareness of aircraft capabilities while in uncoordinated flight.
 - adequate training in cockpit communication, including standard phraseology.
 - adequate emphasis on dangers of excessive maneuvers at terrain altitudes.
 - adequate training on appropriate actions to take when wirestrikes are imminent.

Countermeasures:

DA Level

USASC recommended AVSCOM upgrade flight simulators to more accurately simulate aircraft with antitorque malfunctions including loss of components.

USASC recommended TRADOC improve flight school tactical training by ensuring emphasis is placed on the dangers of excessive maneuvers while flying at terrain flight altitudes.

USASC recommended USAAVNC place additional emphasis on antitorque malfunctions in all helicopter flight training courses and develop flight maneuvers to increase awareness of aircraft capabilities to fly in uncoordinated flight.

USASC recommended USAAVNC ensure flight training emphasizes to students the importance of using standard phraseology in the cockpit.

USASC recommended TRADOC implement touchdown autorotation training with NVGs during initial NVG qualification.

USASC recommended USAAVNC provide aviator training relative to wirestrikes including information and instruction on capabilities and employment of the WSPS.

USASC recommended USAAVNC, as the proponent for NVG operations, form a study group to establish/clarify NVG doctrine/tactics, training and qualification requirements, equipment and personnel requirements for NVG operations.

MACOM/Installation Level

USAAVNC is implementing a program titled "Dynamics of Aircrew Coordination and Communication" designed to improve communication between aircrewmembers in the cockpit.

Principal Cause Factor: Equipment/Materiel Improperly Designed/Not Provided (3%)

Equipment/materiel is improperly designed when it leads to personnel behaviors or material failures which cause accidents. This category also includes accidents caused by failure to provide equipment/materiel. Examples specific to FY 87 include:

- OV-1 emergency stores release handle was mistaken for the landing gear handle because they are marked alike, shaped alike, nearly the same size, and located near each other on the control pedestal.
- AH-64 cockpit canopy frame members obstruct pilots' field of view, particularly during critical flight maneuvers such as low-level flight. Attention has been called to this design deficiency in the July 85 production test, the March 86 production verification test, and as the priority improvement item during development of the AH-64B ROC at DCD, Ft. Rucker, 86.
- UH-60 cockpit canopy frame members obstruct pilots' field of view, particularly during critical flight maneuvers such as lead change in night formation while using NVGs.

- UH-60 cockpit lighting is not compatible with NVG use.
- UH-1 hanger bearing assembly is designed so that an AH-1 male spherical coupling, a critical component, may be improperly installed and fail in a catastrophic way.

Countermeasures:

MACOM/Installation Level

Redesign of the cockpit canopy for the AH-64B is being considered to improve operator field of view.

AVSCOM conducted a study of the UH-60 field of view to define and quantify existing limitations. Design improvements will be identified for incorporation in the UH-60B.

AVSCOM and CECOM have action to identify and correct problems concerning NVG compatibility in the UH-60 cockpit. The UH-60 production line has been changed to provide ANVIS compatible aircraft.

Maintenance information message was dispatched to the field which reviews the correct procedure for spherical bearing installation in the AH-1 and UH-1.

Principal Cause Factor: Inadequate Manufacture, Assembly, Packaging, or Quality Control (1%)

Manufacture, assembly, packaging, or quality control is inadequate when it leads to accident-causing personnel errors or materiel failures. Examples specific to FY 87 include:

- AH-64 duplex bearing of the tail rotor swashplate was improperly lubricated and its bearing cage was not detected to be below specified hardness and form requirements by the manufacturer's quality control process.
- OH-58D fuel shutoff valve was improperly rigged during manufacture because production personnel failed to follow the final assembly instructions.

- AH-1F first-stage-gas-producer nozzle was improperly welded by company which supplied the part to Lycoming, the engine manufacturer, and was not identified as defective because of inadequate quality control by the manufacturer.
- UH-60 transmission blower shaft was improperly seated and torqued by the manufacturer.
- UH-1H tail rotor drive shaft coupling was incorrectly assembled with the wrong male spherical coupling by aviation intermediate maintenance company.

Countermeasures:

DA Level

USASC recommended AMC initiate action to ensure the OH-58D fuel shutoff valve installation procedures include checks for proper operation.

USASC recommended that maintenance manuals for the OH-58 A, C, and D be changed to require periodic checks for proper operation of the fuel shutoff valve.

USASC recommended AMC ensure that engine manufacturers maintain adequate quality control of all engine parts.

USASC recommended a one-time issue to UH-60 AVUM units of a flex boroscope to facilitate UH-60 transmission blower shaft inspections.

Safety-of-flight message required a one-time inspection of all UH-1 tail rotor drive shaft couplings to ensure correct assembly and components.

USASC recommended AMC develop a heat and fire sensor system for installation in the AH-64 which would provide adequate warning to the aircrew in the event of an impending emergency (overheat/fire).

USASC recommended modifications be incorporated into the AH-64 to improve crashworthiness.

MACOM/Installation Level

AVSCOM reviewed the manufacturing process of the AH-64 tail rotor swashplate bearing to insure adequate quality control measures were in place.

Principal Cause Factor: Inadequate Maintenance (1%)

Maintenance (inspection, installation, troubleshooting, recordkeeping, etc.) is inadequate when it leads to accident-causing personnel errors or materiel failures. Examples specific to FY 87 are:

- Crewmember took fuel sample from AH-1F then failed to completely secure left side engine and transmission cowlings, left several latches open, then started the engine and took off.
- UH-1H compensating T-1 bellows collapsed, which caused severe compressor stalls at all power settings, due to inadequate maintenance inspection criteria.
- UH-1H compressor stall was caused by an out-of-adjustment VIGV. Aircraft was flown without a required TEAC after its last phase maintenance. The UH-1H PMD Task No. 7.11 is vague on procedures for checking the deflector nozzles; procedures in the unit ranged from visual checks with flashlights to probing the nozzles with hacksaw blades.
- U21A landing gear bolt fell out during takeoff, making it impossible to retract or extend and lock the main gear, because of installation not in accordance with Technical Manual 55-1510-209-23P, Fig. 83.

Countermeasures:

Unit Level

Commanders establish standing operating procedures for flightline and maintenance operations and enforce compliance to standards.

Commanders enforce the performance of correct maintenance procedures in accordance with established regulations and procedures.

Principal Cause Factor: Fatigue and Inadequate Facilities or Service (7%)

Fatigue is a temporary physical/mental state that causes accidents when errors are made due to reduced physical or mental capabilities resulting from previous activity/lack of rest.

Facilities or services are inadequate when space/support/materiel provided for personnel to accomplish their functions cause errors or failures that cause accidents.

Examples specific to FY87 include:

- Aviator fatigue resulting from task stress/exceeding crew rest requirements contributed to:
 - 118% overtorque in AH-1E.
 - misunderstanding in UH-60 cockpit communication and premature slingload release.
 - inadvertent reduction in UH-1H collective pitch during descent and subsequent hard landing.
- Decision to land CH-47B too fast, inadequate crew coordination during approach, and focusing attention inside instead of clearing approach path for hazards.
- OH-58C pilot's loss of control of aircraft during NOE deceleration and subsequent hard landing.
- Some helicopter dearm pads have no markings showing the pilot where to land and position the aircraft to minimize danger from the tail rotor during dearming. They also are not lit with rehostat-controlled flush-mounted blue taxiway lighting for night operations with and without NVG.

Countermeasures:

DA Level

USASC recommended TRADOC standardize nontactical fixed facility FARP pad size, marking, and lighting.

MACOM/Installation Level

Aircrew Coordination Training promotes efficient aircrew communication, coordination, and resource management during periods of peak cockpit workload. Aircrew Coordination Training promotes awareness of the effects of stress on performance and provides stress management tools.

Risk Management Training provides commanders with tools to evaluate and assign aircrewmembers in accordance with the crewmember's current mission capabilities.

Unit Level

Commanders support and participate in an active Aircrew Coordination Training program.

Commanders ensure that an active Risk Management program is exercised at unit level.

Commanders increase the frequency of maintenance intervals on flight-critical components when operating under adverse environmental conditions.

Commanders periodically review unit crew rest policy for consistency with specified and implied missions.

Commanders establish unit training programs that specialize in the unique problems encountered in adverse environmental areas when planning future operations in those areas; i.e., mountains, deserts, snow.

PROBLEM AREA: Materiel Failure

Occurs when systems, components, or parts are no longer able to perform their functions satisfactorily (provided failure was not due to exceeding design capability/operating limits); e.g., failures caused by inadequate design, improper assembly by manufacturer, inadequate quality control.

- UH-60 tail rotor shaft failed due to suspected improper torquing to the flange retaining nut during assembly by the vendor.
- UH-1M 90-degree/42-degree intermediate gearbox failed internally, most likely due to input level gearshaft misalignment with output level gearshaft.
- OH-58A fuel control bellows collapsed because of stress corrosion cracking due to unknown reasons.
- RV-1D turnlock fastener stud from outboard access door of engine upper afterbody dislodged and entered engine due to improper design. Fastener has no safety device to prevent its ingestion.
- OV-1D high-pressure hydraulic hose ruptured for unknown reasons.
- UH-1H engine failed most likely due to fragmentation of N-2 second stage P/T nozzle which disintegrated for unknown reasons.
- Transmission shipping container's lifting points failed due to unknown causes while being sling lifted by CH-54A.
- MH-6E fuel float lodged on fuel pump, due to inadequate design, causing fuel quantity indicating system to send false signal to cockpit.
- AH-1S engine ingested spacer sleeve which probably had been lodged in engine for some time but became dislodged because of vibration set up by failure of cap screws and bearing support liner which fractured due to fatigue preceded by fretting corrosion and deformations of the screw threads. Reasons for corrosion and deformation are not stated.
- AH-1P second stage power turbine blades failed for unknown reasons.

- AH-1E and AH-1F M197 20mm gun turret system stowed position failed due to undetermined causes.
- AH-64A bearing and oil slinger of shaft-driven compressor failed in unknown mode/sequence due to inadequate design which requires bearing to turn at extreme speed during normal operation.
- AH-64A duplex bearing of tail rotor swashplate failed due to overheating because of insufficient lubrication; also, bearing cage was below required hardness and form requirements. These deficiencies were allowed by a lack of quality control in the production process.
- OH-58A cluster helical torque gear of the engine failed through fatigue mechanism due to normal-operation side loading/deflection of the gear in excess of the gear's design limitations.
- UH-1H engine diffuser section failed and due to inadequate design allowed other components to displace, causing total engine failure.

Countermeasures:

DA Level

- UH-60 safety-of-flight message directed a one-time inspection of tail rotor shaft flange retaining nut.
- UH-60 engineering change proposal under development which provides for redesign of the axial fan assembly.
- USASC recommended redesign of the UH-60 aft tiedown assembly to meet requirements of Technical Manual 55-1500-204-25/1.
- Safety-of-flight message restricted flight of OH-58A and OH-6A aircraft with T63-A-700 engine installed due to potential for failure of the helical torque meter gear. T63-A-700 engines will have a redesigned helical torque meter gear installed by retrofit.
- USASC coordinated with AMC for development of an improved particle separator for the AH-1 and UH-1 aircraft for use in severe sand/dust environments.

AH-1 safety-of-flight message revised prelanding checks/procedures to ensure the M197 system is in the stow position prior to landing.

USASC coordinated with AMC to analyze the T63-A-700 fuel control bellows to determine susceptibility to stress corrosion cracking.

USASC coordinated with AMC to ensure quality control of engines during manufacturing.

USASC coordinated with AMC to establish limiting criteria (number and degree of overtemp/overspeeds) beyond which T53 engine power turbine blades will not be returned to service.

AH-64 safety-of-flight message imposed a service life and required inspections of the tail rotor swashplate bearing.

AH-64 product improvement developed to update all shaft-driven compressors to the -13 model with an improved high-speed oil slinger.

PROBLEM AREA: Environment

Environmental factors which affect human/machine performance to the extent that they cause/contribute to an accident; e.g., unrecognizable soft-landing area, pinnacle updrafts, sand erosion of engine parts, lightning.

- Upon landing, MH-6E skid heels sank in soft sand in unrecognizable wash area, allowing tail rotor contact with ground.
- During coastdown of UH-1H main rotor blades on pinnacle, updrafts caused rotor blade to teeter down and cut number 5 tail rotor drive shaft.
- Lightning strikes experienced by:
 - U-21A outside clouds in as-forecast weather.
 - U-21A in weather conducive to lightning.
 - C-12C in instrument meteorological conditions.

- OH-58C engine experienced sand erosion as result of long-term terrain flight in desert environment, resulting in engine's inability to produce full power. Erosion effects were not detected through normal daily engine check procedures or through routine maintenance inspection of the engine.
- AH-1F engine failed due to sand/dust ingestion which caused pitting in the blade root area. The compressor blade pitting could not have been detected during routine maintenance/inspection.

Countermeasures:

DA Level

USASC recommended USAAVNC evaluate the need to develop helicopter shutdown procedures when encountering hazardous wind conditions associated with pinnacle operations.

USASC recommended TRADOC continue to educate aircrews on the likelihood of lightning strikes during aviation operations and known prevention measures that should be taken.

MACOM/Installation Level

A product improvement is under development to provide an improved engine inlet particle separator for the AH-1 and UH-1 aircraft.

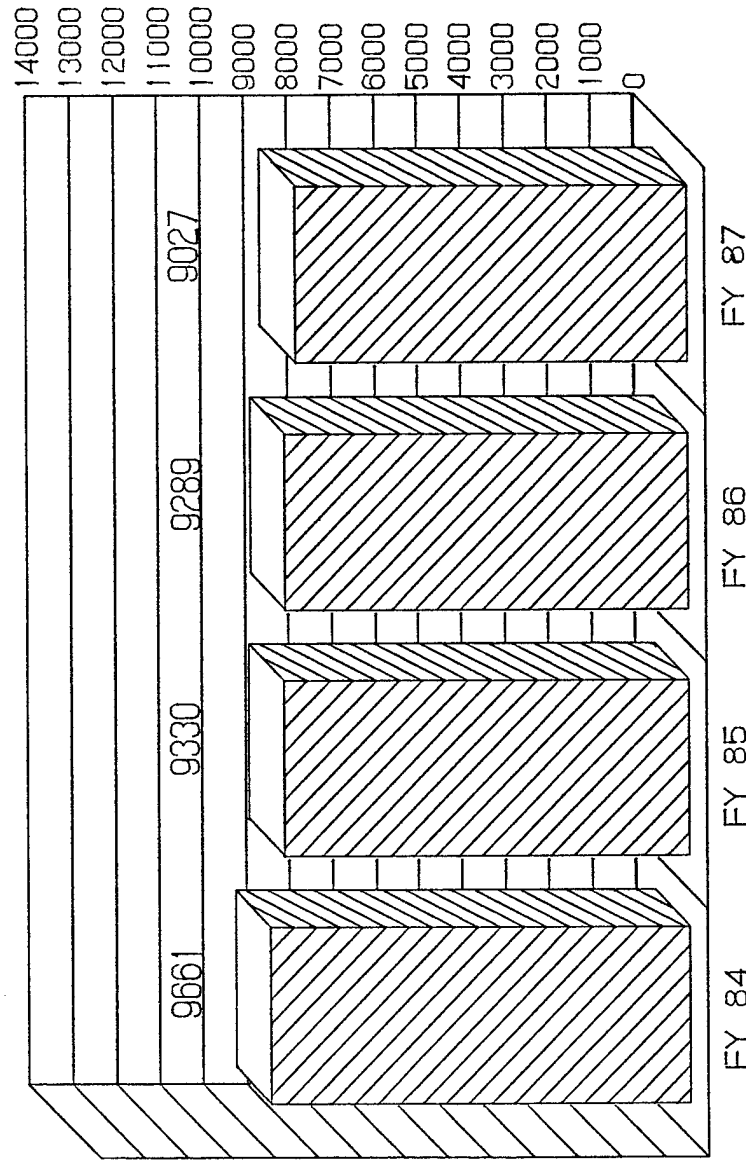
Unit Level

Units operating in severe environmental conditions should appropriately increase the frequency of engine flushes and engine inlet inspections.

PART 3

FEDERAL EMPLOYEE COMPENSATION ACT CLAIMS

U.S. ARMY ON-DUTY CIVILIAN INJURIES CIVILIAN LOST-TIME AND FATAL FECA CLAIMS



Data as of 13 Jan 88.

FEDERAL EMPLOYEE COMPENSATION ACT CLAIMS

FY 87

ANALYSIS

The Army uses Department of Labor Office of Workers' Compensation Programs (OWCP) data for official safety and occupational health reporting. The following analysis was based on lost-time and fatal injury and illness OWCP claims processed during FY 87.

- Five types of injuries accounted for 84 percent of the lost-time and fatal claims. Of these, back injuries constituted 29 percent (2,617 cases); multiple strains produced 20 percent (1,783); bruises and abrasions were 17 percent (1,557 cases); while fractures produced 8 percent of lost-time and fatal claims (556). The remaining large category was a grouping of unclassified traumatic injuries, which included 1,108 cases or 12 percent.
- Back-strain injuries are divided into lower back (2,409 or 89 percent) and upper back (157 or 6 percent). The most frequent causes of these injuries were: handling materials and equipment (1,506 or 55 percent), falls (300 or 11 percent), slipping without falls (366 or 13 percent), and unclassified causes (299 or 11 percent).
- The extremities of individuals were the most common anatomical locations for multiple strain and trauma injuries. Extremities sustained 1,130 (63 percent) of the strains, 896 (58 percent) of bruises/abrasions and 469 (84 percent) of fractures. Of the unclassified traumas, 494 (45 percent) occurred to extremities. Overall, this represents 2,989 (60 percent) of total strain and trauma losses. The most common causes of injuries to extremities were: falls (812 or 27 percent), slips (651 or 22 percent), materials handling (421 or 14 percent), strikes against objects (399 or 13 percent), and strikes by falling objects (227 or 8 percent).
- There were 29 claims for compensation of loss of life against the Army in FY 87. One claim was an inadvertent duplicate, caused by overlapping responsibility in Puerto Rico. Of the 28 remaining claims, 7 were derived

from deaths in prior years. Circulatory disease, stroke, and other conditions, only marginally related to the workplace, accounted for 7 deaths. One death resulted from violence. Vehicle and mobile equipment accidents were the single most common source of on-the-job fatalities.

GOALS

- Meet the President's challenge to reduce compensable illnesses and injuries by 3 percent annually.
- Improve medical services in support of the 3-percent reduction.
- Field the civilian supervisor elements of the Safe Army Now training program to control workplace injuries.
- Produce coordinated illness and injury prevention programs for installation use.

INITIATIVES

The Army initiated and sustained a number of successful programs in support of workplace injury and illness reduction in 1987. The following actions contributed to this year's gains:

- Improved management controls. Consolidation of claims data management at one location reduced conflict and confusion in goals measurement. A better allocation of goals among subordinate commands and installations tightened accountability and responsiveness. Regulations simplifying civilian employee accident reporting procedures allowed increased attention on prevention. Guidance requiring coordination of subordinate safety, medical, and civilian personnel staff functions through Safety and Occupational Health Quality Control Committees was emphasized.

- Continued command emphasis. Reorganization of the Department of the Army staff placed the safety function under the Chief of Staff. The Director of

Army Safety was established as a full-time general officer duty. Other indications of sustained high-level emphasis on safety and health include:

- Improved installation organization of safety functions under AR 5-3. Execution of the requirement for direct access to the commander is being accomplished. At some locations, tentative steps towards consolidation of fire, safety, health, and environmental functions are evident.
- Inclusion of Presidential goal performance in the Vice Chief of Staff, Army, quarterly In-Process Review. Staff principals of selected MACOMs are invited to attend and discuss their accident and illness reduction efforts.
- A constant flow of command correspondence and other publications from Headquarters, Department of the Army (HQDA) through subordinate commands to local Army workplaces. The Army Presidential goal action plan calls for a long-term campaign to bring guidance and awareness items before the Army's commanders and managers.
- Items of interest on HQDA evaluations of MACOM safety and health programs. Both Presidential goal performance and the execution of occupational safety and health responsibilities are reviewed during scheduled evaluations. Five smaller MACOMs were visited during FY 87. The FY 88 schedule of evaluations includes commands with a large portion of the Army's civilian employees. The U.S. Army Health Services Command (HSC) scheduled visits to several installations to provide command emphasis and support.
- Improved Occupational Health staffing. The HSC initiated an Industrial Hygiene Career Plan including a proposed intern program. Occupational Health Nurses were included in Army Medical Department nurse career progression planning. Occupational medicine positions achieved an 85-percent fill rate. An occupational health program was established to support the Army forces in Korea.
- Army Safety and Health Training. Centralized and local safety training continued in FY 87. Areas of expansion included funding support of the DOL/DOD Hazard Communication Training Program and safety/health membership on

the contract oversight committee. Occupational health training enhancements include adding compensation program training to the Army Medical Department curriculum and development of two health hazard assessment videotapes for field training.

- Other initiatives. Noteworthy workplace injury and illness prevention innovations can be drawn from all levels of command.

-- The Army Back Complaint (ABC) program. The ABC was initiated by the Surgeon General, with Department of the Army Safety support. It will be fielded in early 1988 to attack the Army's greatest compensation cost problem.

-- Industrial Safety. An Industrial Safety Installation Support Kit project was initiated. Nineteen kits are in current production, with publication of the first group scheduled for the second quarter of FY 88. Kits are designed to assist local safety offices mount prevention efforts against common hazardous operations.

-- Model Installation Compensation Project. U.S. Army Training and Doctrine Command's model compensation control project, executed at Fort Knox, radically reduced claims at that installation, and provided valuable lessons on reduction of workplace losses at installation level.

-- Army Driver Improvement Program (ADIP). This countermeasure is a series of modular training films produced throughout 1987. The films, targeted on civilian and military drivers, address the cause of a large proportion of serious occupational accidents. Films are in post-production, and will be released throughout the spring and summer of 1988.

-- Army Accident Prevention Programs. This series of assistance packets represented by the 1986 Maintenance Accident Prevention Program (MAPP) continues. A second issue of MAPP materials was made in FY 87, and a third updated issue is planned. The Materials Handling Accident Prevention Program (MHAPP), currently in production, responds to the operations that cause the second largest number of Army compensable injuries.

-- Occupational Health Management Information System (OHMIS). Fielding of the integrated computerization project for occupational health service providers neared completion in FY 87. The Hearing Evaluation Automated Registry System (HEARS) is 90 percent fielded. The Health Hazard Information Module (HHIM) is completely operational. Hardware for the Medical Information Module (MIM), an employee record and history tool, has been deployed. Needed software has been tested and will be distributed in spring 1988.

-- Mobile Occupational Health Vehicle (MOHV). Basing locations for MOHVs have been established at all installations. Road testing of the vehicle has been successfully completed. The first delivery is scheduled for spring 1988 at Fort Drum. Training manuals and videotapes for support of MOHV have been developed.

FEDERAL EMPLOYEE COMPENSATION ACT CLAIMS

FY 88

GOALS

Army safety and health goals for FY 88 include:

- Improve performance toward the President's goal for the reduction of civilian employee injuries and illnesses.
- Reduce the Army's dollar loss resulting from compensation and continuation of pay.
- Identify and institutionalize Armywide Safety and Occupational Health Program innovations.

OBJECTIVES

These goals will be accomplished by achieving the following objectives:

- Maintain the current emphasis that resulted in 1987 successes.
- Improve occupational health services for military and civilian personnel.
- Train supervisors of civilian employees on their health and safety responsibilities through the Safe Army Now Course.
- Develop and implement the Army Hazard Communication Program.
- Employ appropriate Accident Prevention Program and Industrial Safety Installation Support packages.
- Place 25 Mobile Occupational Health Vehicles (MOHV) into service.

- Execute the Army Back Complaint (ABC) program.
- Integrate occupational health into the Army Health Clinic/Troop Medical Clinic system.
- Optimize use of the Occupational Health Management Information System (OHMIS).
- Continue HQDA and HSC evaluations of MACOM safety and health programs.
- Increase medical support to chemical surety operations.
- Assess military equipment and materiel to eliminate or reduce health hazards.

