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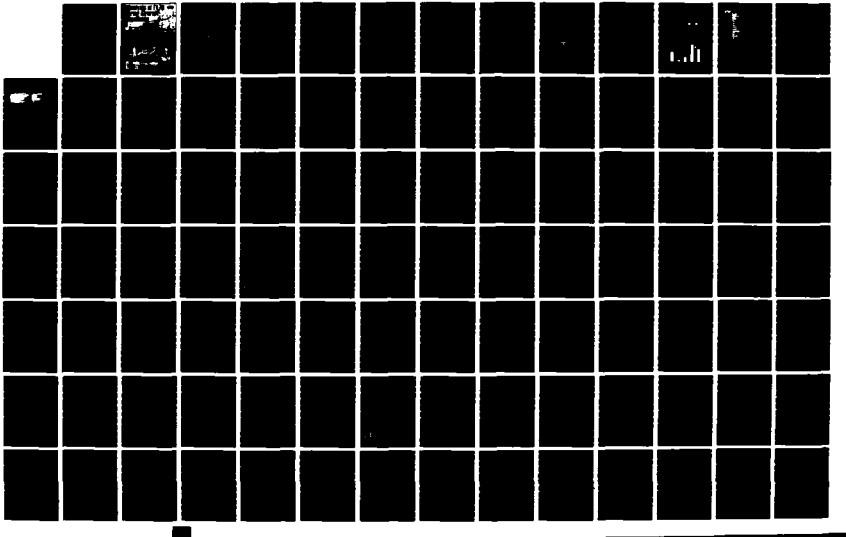

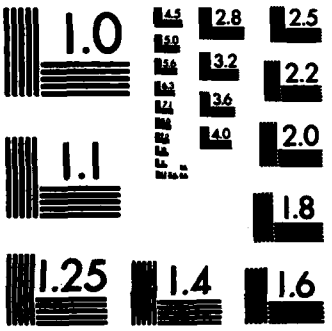

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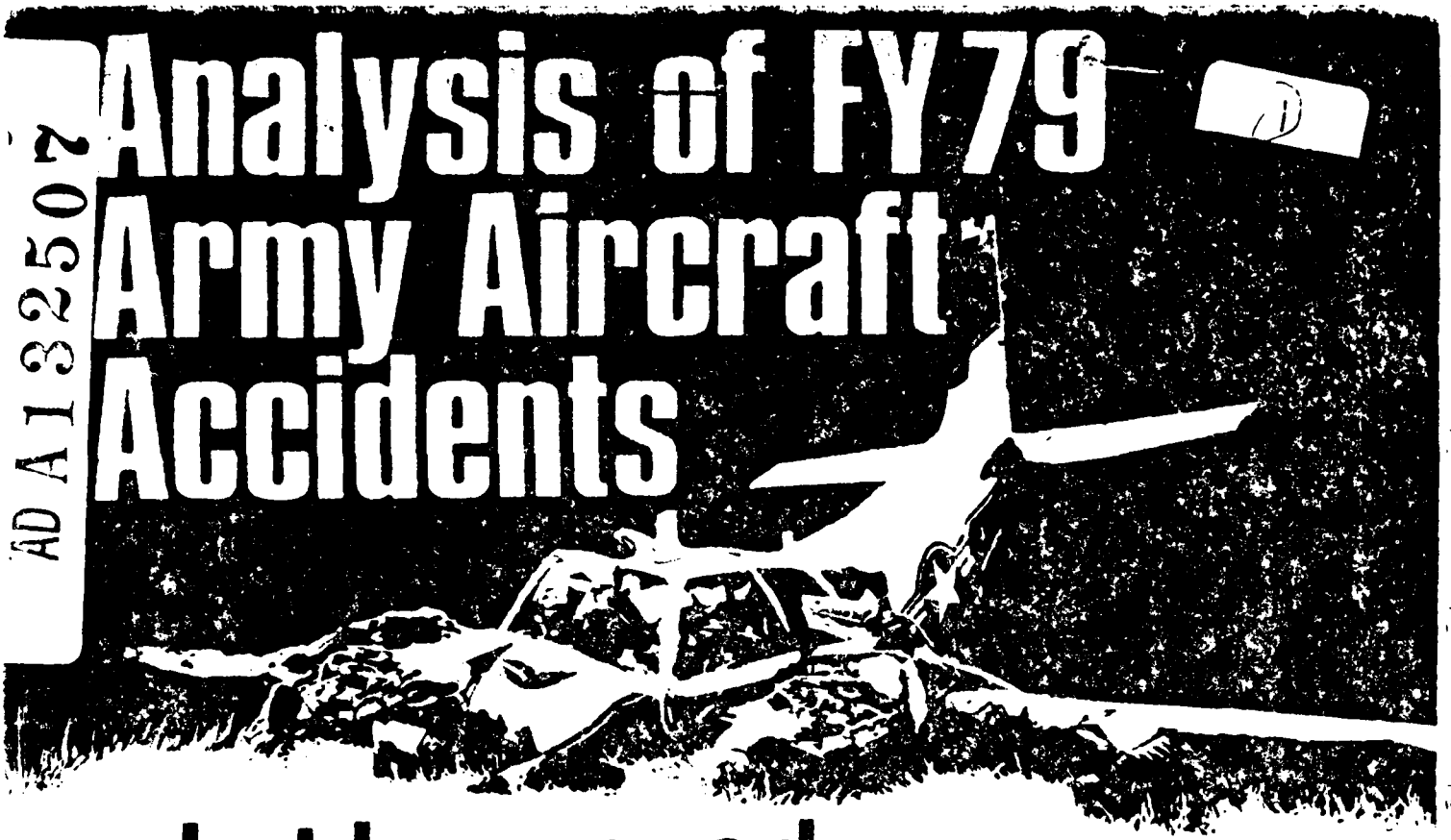
Analysis of FY79 Army Aircraft Accidents



what happened
why it happened
what to do about it

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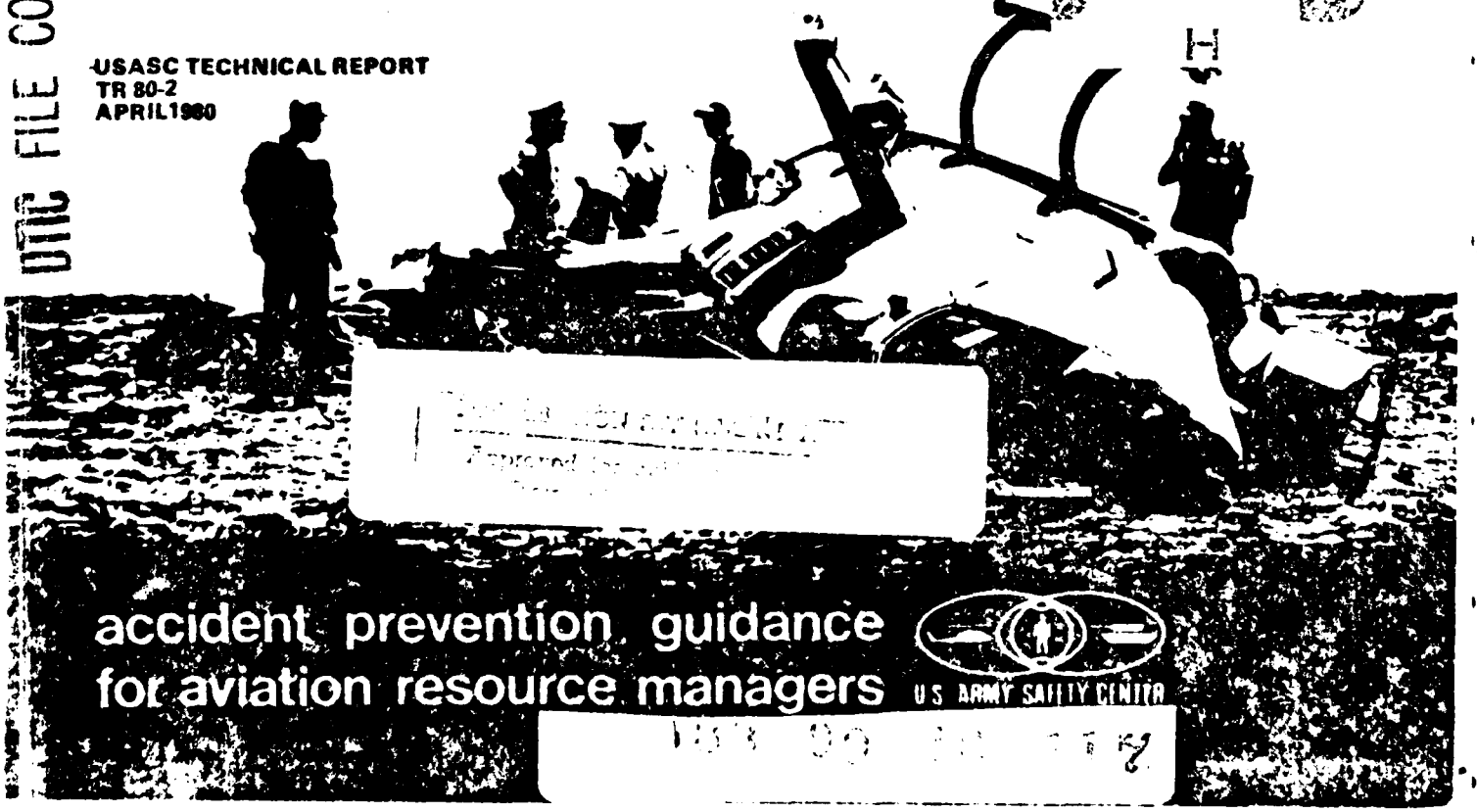

accident prevention guidance
for aviation resource managers

U.S. ARMY SAFETY CENTER

Analysis of FY 79 Army Aircraft Accidents

Prepared by
G. Dwight Lindsey

**Directorate for
Investigation, Analysis, and Research**

**Colonel E.E. Waldron II
Commander**

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Army aircraft accident data for FY 79 were analyzed. The major accident cause factors (hazards) were identified and ranked according to the magnitude of their effect and probability of occurrence. Prevention requirements based on the hazard analysis are discussed.

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Foreword

The Army aircraft accident rate for FY 79 was 5.2 per 100,000 flying hours. This is the lowest rate for the Total Army since the beginning of a formal aviation accident prevention program in 1958.

This is a particularly significant accomplishment considering that it was achieved while flying under realistic conditions during increased involvement in field training exercises.

Credit for this fine record goes to everyone in Army aviation who enthusiastically accepted and supported the aviation accident prevention program.

Today, manpower and equipment resources are carefully budgeted. Every loss due to an aircraft mishap immediately reduces the effectiveness of our combat-ready force. As a consequence, all aviation resource managers—at unit, installation, MACOM, and DA levels—must continue to assign a high priority to the requirement to eliminate mishaps.

This fourth annual report was prepared to give aviation resource managers detailed information on inadequacies in the Army aviation system that cause or contribute to mishaps.

Any further improvement in the accident record will be directly related to how well the "lessons learned" in this report are applied during the command decisionmaking process and day-to-day unit operations.

This year's report has been expanded to include an analysis of FY 79 aircraft incidents and the mishap history of aircraft components that failed since October 1971. Analyses in these areas clearly point up the need to broaden the scope of accident prevention programs to include the prevention of not only accidents but also incidents and those mishaps that are caused by failure of low-cost components.

EDWARD E. WALDRON II
Colonel, TC
Commanding

Executive Summary

This report provides aviation resource managers with an opportunity to review, assess, and learn from man and machine performance problems that are part of current "real world" Army operations. It includes detailed lessons learned concerning man and machine failures that cause or contribute to aircraft mishaps and aviation system inadequacies that cause or allow these failures to occur.

The 75 Army aircraft accidents reported and investigated during fiscal year 1979 formed the data base for this report. Three-fourths of these accidents occurred in utility and observation aircraft, but cargo helicopters and fixed wing aircraft accounted for most of the dollar losses. Nearly all of the Army aircraft accidents/fatalities in FY 79 were in utility and cargo type aircraft. Observation aircraft accidents produced the second largest number of injuries, but there were no fatalities in these crashes.

Twenty-three different aviation system inadequacies were identified in the analysis. These system inadequacies were ranked according to their overall level of importance for prevention in decreasing order based on a combination of the following elements: frequency of occurrence, dollar losses, severity of injury, and severity of aircraft damage. The top five aviation system inadequacies were (1) inadequate motivational states, (2) faulty judgment, (3) improperly designed equipment, (4) inadequate unit training, and (5) inattention. These general system inadequacy categories are operationally defined and discussed in the report. The top five FY 79 system inadequacies are identical to those identified in FY 78's analysis (reference 3) except for "inadequate unit training," which replaced "inadequate written procedures."

Prevention requirements based on analysis of FY 79 data fall into four general areas: equipment design, human performance research/evaluation, written guidelines, and flight training. Specific prevention requirements for these areas are detailed in the last section of this report.

Three major needs repeated from last year: (1) development and procurement of a helicopter wire protection system, (2) research of problems involving aircrew division of attention between flight duties/tasks during periods of high workload, and (3) provision for adequate guidance in maintenance and field manuals.

Additional requirements indicated by the results of the analysis, but not directly related to accident cause factors, include the following:

- A multi-year analysis study similar to this report to identify and rank long-term system inadequacies and prevention requirements.
- An indepth analysis of each aircraft system and of each major system inadequacy identified in this report.
- Development/procurement of an aircraft flight/crash data recorder.
- An automated data system for recording aviator flight activity.
- Improved written guidelines on—and enforcement of—the requirements in AR 95-5 for reporting aviation mishaps.

An analysis of aircraft incidents is in appendix G. This analysis highlighted the need to make the prevention of these less severe mishaps an integral part of the overall mishap prevention program. This need has particularly been evident since 1974 when NOE and other modes of terrain flight became a tactical requirement. The first step in preventing these mishaps is thorough investigation and detailed reporting in compliance with AR 95-5.

The mishap history of 720 aircraft parts/components that failed or malfunctioned causing or contributing to mishaps during FY 79 is in appendix H. This analysis confirms the need to improve the reliability and maintainability of these parts. Since 1 October 1971, relatively low-cost parts have accounted for 64 accidents, 44 incidents, 246 forced landings, and 6,946 precautionary landings.

In addition to the primary findings, this report provides researchers, designers, aviation safety officers, and aviation resource managers at all levels with the capability to easily extract and analyze those man or machine problems unique to a particular specialty area or field of concern.

Contents

Analysis of FY 79 Army Aircraft Accidents

Introduction

Army aircraft accidents are costly in terms of lives lost, injuries, materiel losses, and mission degradation. In fiscal year 79, aircraft accidents killed 18 people, injured 50, and cost $38.4 million. Consequently, it is essential that the "lessons learned" from these accidents be applied to eliminate inadequacies in the aviation system, thereby reducing accidental losses and improving operational readiness.

This is the fourth annual report (references 1, 2, and 3) aimed at providing "lessons learned" to aviation resource managers, supervisors, operators, support personnel, researchers, designers, and others concerning the system inadequacies causing or contributing to Army aircraft mishaps. This report provides information needed to better understand the strengths and weaknesses of the man-machine relationship in daily operations and to improve risk management.

Despite the rising costs of accidents, the Army aviation accident prevention program for fiscal 79 was more successful than previous years. The 75 major and minor accidents and the 5.2 accident rate per 100,000 flying hours were the lowest in the recorded history of Army aviation.

DOD Instruction 1000.19 classifies aircraft accidents which result in a fatality; or the total destruction of the aircraft; or a total cost of property damage, occupational illness, and injury of $200,000 or more, as Class A mishaps. Using this criteria, the Army had 39 Class A mishaps during fiscal 79 and a Class A mishap rate of 2.7 per 100,000 flying hours.

Objectives

The primary objective of the analytical effort on which this report is based is the same as that of system safety programs: **to maintain the highest level of operational effectiveness through the conservation of aviation resources by early identification, evaluation and correction of system inadequacies.** This objective is accomplished through an intensive five-stage safety management program called ICAFT. ICAFT refers to investigation, computerization, analysis, feedback, and tracking. It is a closed-loop approach to safety intended to identify, manage, and track aviation hazards from initial occurrence to final elimination. The five stages of ICAFT are described in appendix E.

Intended Uses

This report is intended to provide key information to aviation personnel in system safety programs, to make Army-level management aware of aviation hazards and mishap prevention requirements, to identify and direct research and development requirements for current and future aircraft, to determine areas of emphasis and need for improvements in unit and school training, to identify inadequacies and improvements needed in Army regulations, field manuals, and other written guidelines that direct human behavior, and to provide feedback to unit and command personnel regarding aviation hazards and suggested remedies. This information should increase the aviation manager's knowledge and awareness of current problem areas in the operational environment, help him maintain higher levels of interest in aviation safety, and provide him a tool in the area of hazard prevention.

This report also provides aviators, safety officers, maintenance personnel, researchers, designers, and others with the information needed to review, assess, and learn from man, machine, and environmental performance problems that are part of current "real world" Army operations, and analyze those man or machine performance problems unique to a particular specialty area or field of concern. For example, those only interested in a particular type of system inadequacy, e.g., unit training or improperly designed equipment, can easily access this information for analysis by using appendices B and E. If a particular type of aircraft, e.g., UH-1 helicopters, is the sole concern, then the data relevant to this materiel system can be quickly isolated for review in appendices C and D.

It is generally accepted that funding for improvements in aircraft hardware and personnel training will be limited. The increasing cost of more sophisticated future aircraft makes it imperative that these limited funds be well spent. This report is designed to provide information to managers at all levels to help them optimize expenditures.

Method

A brief outline of the method used to prepare this report is presented below. A more detailed explanation of the method can be found in appendix E.

Data Source. Data used for this report were obtained from an analysis of the reports on 75 Army aircraft accidents occurring in FY 79. The accident classification, fatalities, injuries, and cost associated with these accidents are summarized in table 1. Twenty of these accident reports, prepared by field investigation teams, contained insufficient information to determine definite cause factors.

Definitions and Terminology

Ricketson 3W Approach - An approach to accident analysis that requires the identification of what happened (failures), what caused it to happen (failure causes), and what to do about it with respect to man, machine, and environmental cause factors.

Human Error or Task Error (TE) - Job performance which deviated from that required by the operational situation and caused or contributed to an accident. Required performance includes that stipulated by (1) school training, (2) on-the-job training, (3) U.S. Army regulations and guidelines, (4) standing operating procedures, or (5) commonly accepted practices. An error is assigned only when it is judged that a person of normal or reasonable competence could have performed the task correctly in the existing operational situation.

System Inadequacy (SI) - Condition resulting from an element of the aviation system not operating as intended or designed, which caused, allowed, or contributed to the occurrence of a task error or materiel failure. An aviation hazard consists of both man and machine failures and the associated cause factor.

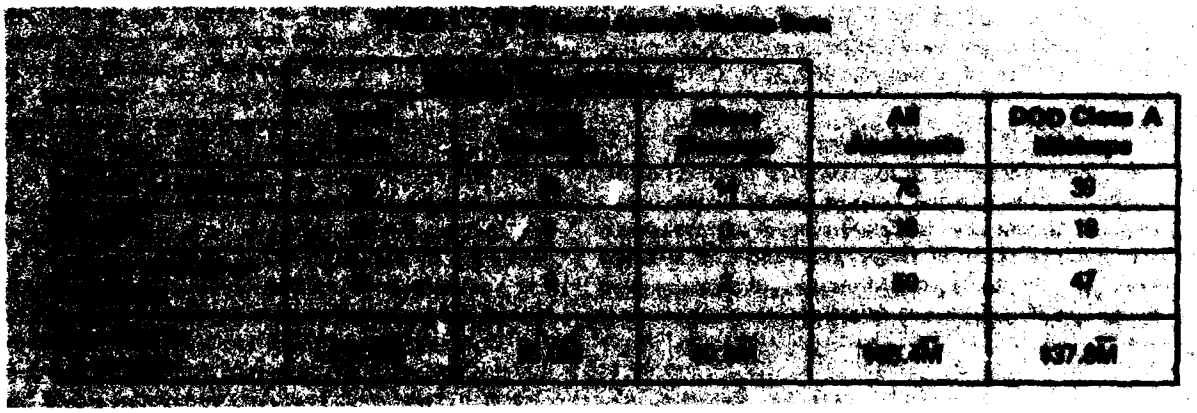
Remedial Measure (RM) - Action required to correct or at least reduce the operational impact of an inadequacy. The RM may be directed at any command level for implementation and is not restricted by current technology or budgetary, personnel, and equipment resources.

Accident Cost - Combination of the dollar losses incurred as a result of aircraft damage, personnel injury, and property damage.

Hazard Significance Level Analysis (HSL) - A mathematical method for ranking hazards according to their overall importance for prevention, using a combination of four critical decisionmaking variables: frequency of occurrence, dollar losses, severity of injury to man, and severity of hardware damage.

Class A Aircraft Mishap - A mishap in which a fatality occurs; or the aircraft is totally destroyed; or the total cost of property damage and injury is $200,000 or greater.

Individual Analysis. As in prior years, individual accidents were analyzed in accordance with the 3W requirements and the concepts and procedures outlined in chapter 11, AR 95-5. The method of analysis is further explained in appendix E. Figure 1 shows the process used to analyze each accident.



SEQUENCE OF ANALYSIS

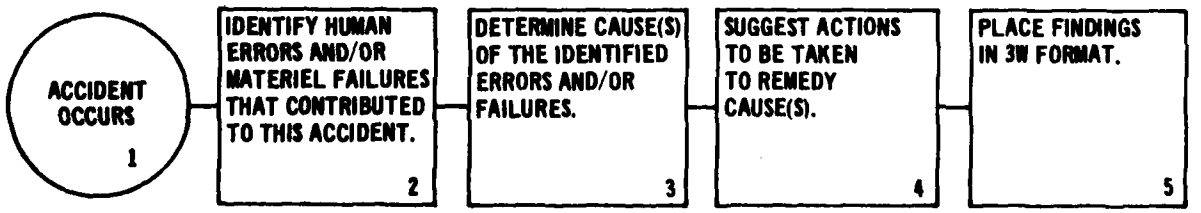


FIGURE 1. – Identification of Hazards in Each Individual Accident

In this report, the man and machine aspects of the Ricketson 3W approach are examined (table 2). Environmental factors are found to be causative or contributing to the occurrence of a task error or materiel failure.

Accidents in which human errors were determined to be definite factors were subjected to a TEIR analysis and those involving definite materiel failure or malfunction were subjected to a FIRE analysis.

The models used for the human error accident and the materiel failure/malfunction accident are shown in figures 1 and 2 of appendix E. Information from the TEIR and FIRE analyses was then placed into a format designed for ease of data coding, computer processing, and use in the collective analysis.

Collective Analysis. Figure 2 shows the process by which the collective analysis was accomplished.

A complete description of the HSL analysis is provided in appendix E. The rationale and format used to develop this analysis were modeled after reference 7, "System Safety Program Requirements," Mil Standard 882A, 28 June 1977. A study titled "Engineering Analysis of Crash Injury in Army Aircraft" (reference 5) also employed the same general methodology to examine crash injury and aircraft crashworthiness.

Individual Hazard Prevention Requirements. Prevention actions either completed or in progress to eliminate or reduce the impact of a system inadequacy have been identified, reviewed, and integrated with the 3W narratives on a case-by-case basis in appendix F. Consequently, appendix F is an important safety tool in that it provides the following information about each accident case:

- The definite failures of man or machine.
- The elements of the aviation system that caused or allowed the failures.
- Suggested remedial actions.
- Corrective actions completed or in progress.

Collective Hazard Prevention Requirement. The last step was to identify the most pressing system inadequacy prevention requirements. Selection of these requirements was based on the HSL analysis and the expertise of safety personnel at the Army Safety Center, e.g., engineers and human factors specialists, investigators, and air safety specialists. Many of the most effective remedies for recurring human-related problems are often found in the area of improved equipment design.

TABLE 2.—3W Approach to the Investigation, Analysis, and Prevention of Accidents

Accident Cause	What Happened	Why Caused It	What to do About It	Acronym
Man	Task Error	System Inadequacies or Hazards	Remedial Measures	TEIR
Machine	Failure or Malfunction	System Inadequacies or Hazards	Remedial Measures	FIRE

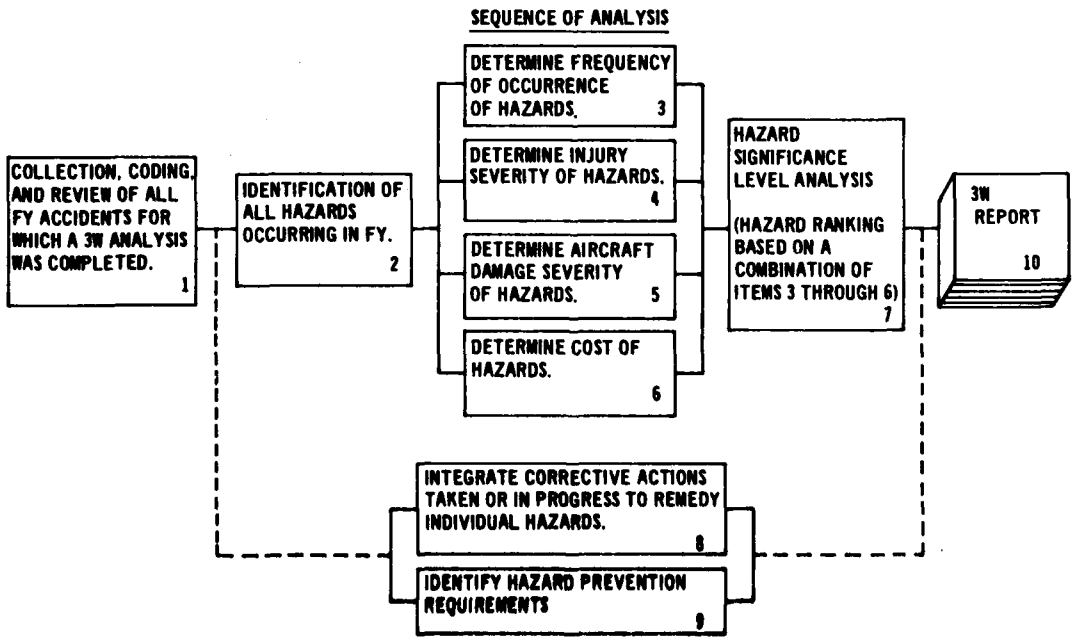


FIGURE 2.—Sequence of Overall Analysis

Results and Discussion

General. As noted earlier, the number of accidents (75) and the accident rate (5.2) for FY 79 were the lowest in the recorded history of Army aviation. Two prevalent cause factors in accidents of past years were disorientation/vertigo and fatigue/sleep deprivation. These factors were nearly eliminated as causes in fiscal 79 and the last several years. This indicates that "lessons learned" are being applied and the strengths and weaknesses of the man-machine relationship as it affects Army operations are becoming better understood.

Most of the aircraft accident dollar losses ($36.3 million) and injuries/fatalities (68) for FY 79 occurred in "total loss" classifications. This finding is not surprising; however, the magnitude of losses (85%) accounted for by this accident category is notable.

Frequency of accidents and cost by types of Army aircraft are shown in figure 3. Aircraft types are presented in order of accident frequency.

As shown in figure 3, two aircraft types, the utility and observation helicopters, accounted for most of the Army aircraft accidents (68%). However, most of the dollar losses were the result of accidents involving cargo helicopters and fixed wing (primarily OV-1) aircraft.

The number of fatalities and injuries by aircraft type are shown in figure 4. Aircraft types are presented in order of injury frequency.

Utility, observation, and cargo helicopters accounted for the majority of fatalities and personnel injuries. While observation aircraft accidents were responsible for the second largest number of injuries, there were no fatalities in these crashes. Utility and cargo aircraft accidents accounted for nearly all (78%) of the FY 79 fatalities.

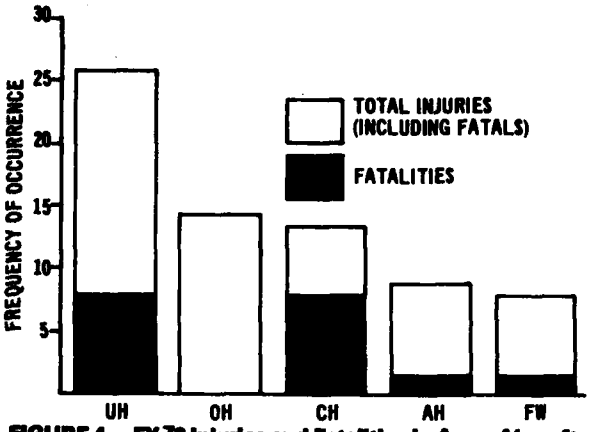


FIGURE 4.—FY 79 Injuries and Fatalities in Army Aircraft Accidents

Hazard Ranking. Twenty-three different system inadequacies were identified in the 75 aircraft accident reports analyzed. These inadequacies were rank-ordered using the HSL analysis to determine their overall level of importance for remedial action(s). The results of the analysis are shown in table 3. Inadequacies are listed in decreasing order of significance based on a combination of four variables: frequency of occurrence, dollar losses, severity of injury, and severity of aircraft damage. Methodology for determining the meaning of the HSL indices, significance grouping, and cost determination can be found in appendix E. For instance, index "B" refers to the number of times a system inadequacy was identified in accidents. "I" indicates "life threatening" injury severity level, and "a" refers to the aircraft damage severity level of "total loss."

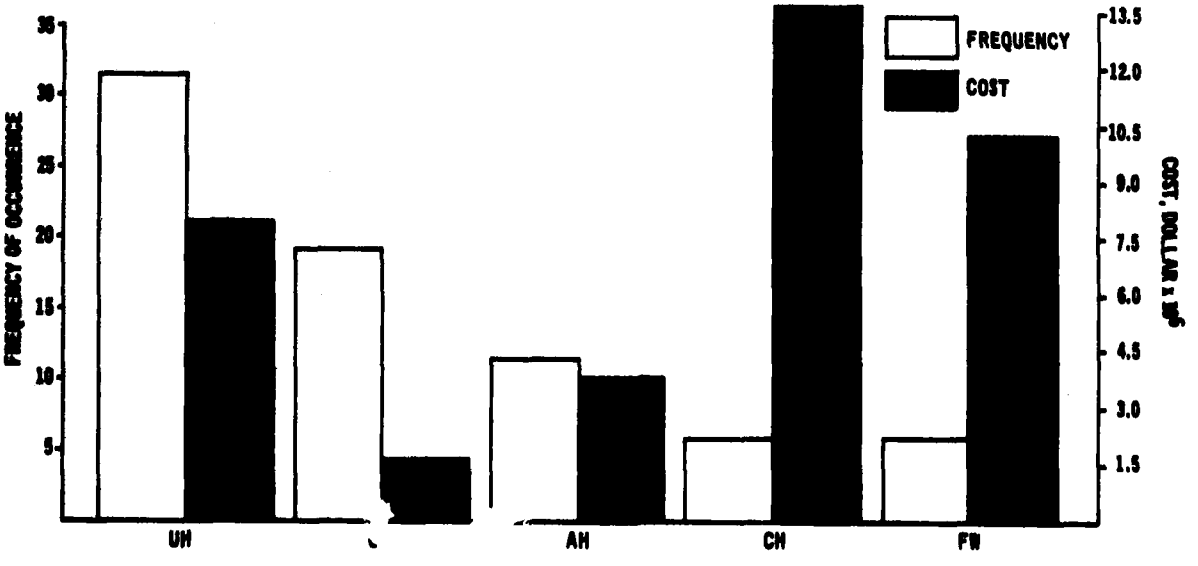
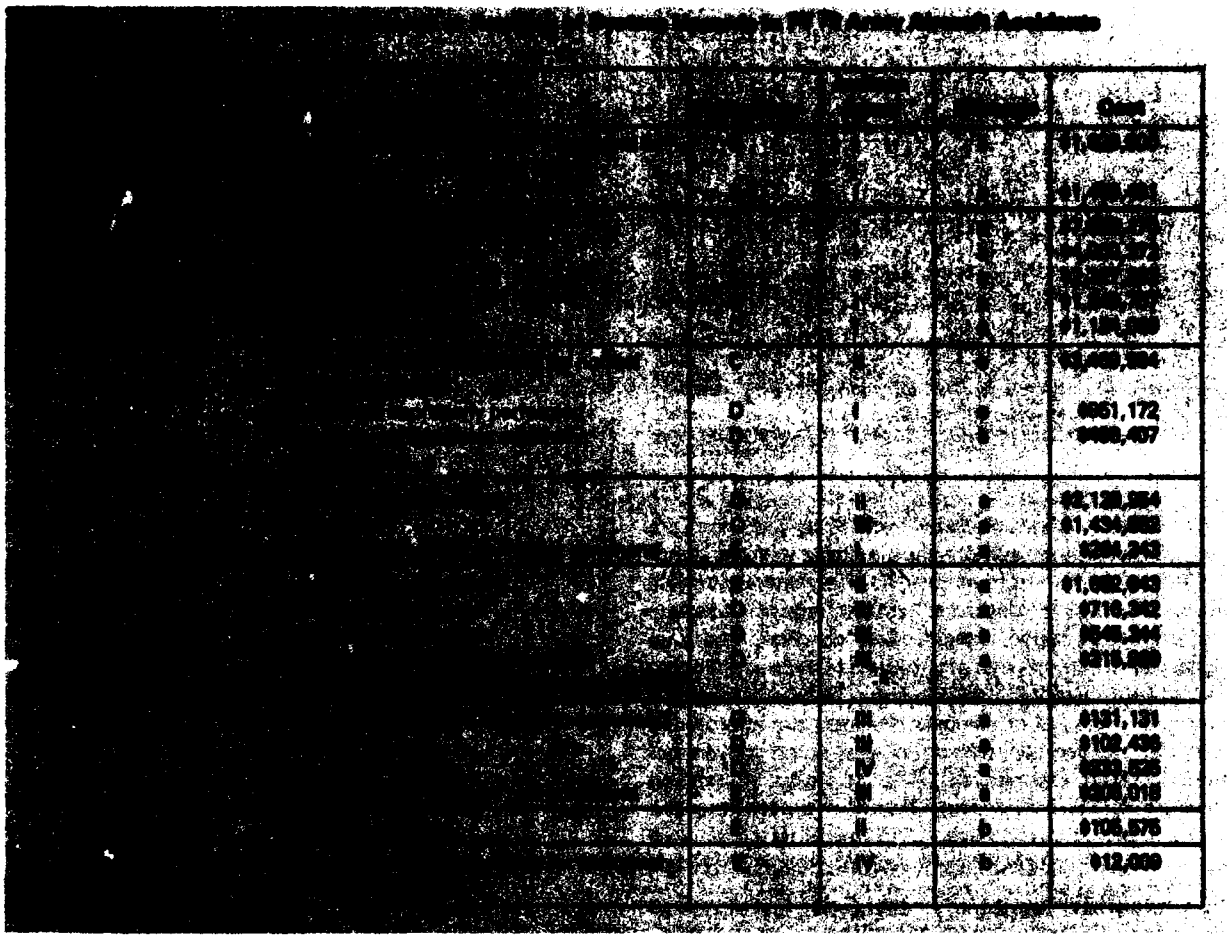


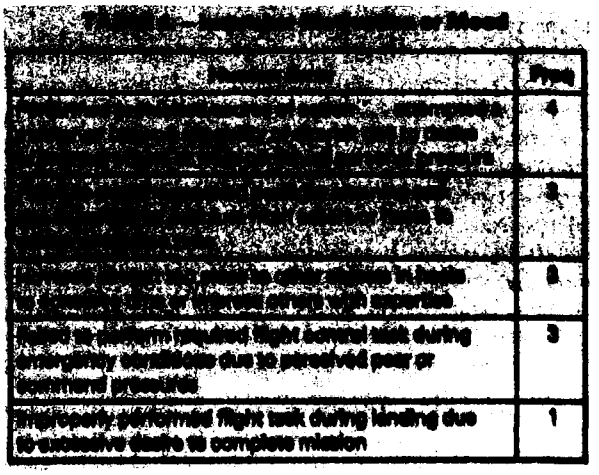
FIGURE 3.—FY 79 Accident Frequency and Cost by Aircraft Type



Top Five System Inadequacies. A general discussion of the top five system inadequacies identified in the HSL analysis is presented in this section. Each of the system inadequacy categories is operationally defined and discussed according to the ranking or priority shown in table 3. More specific information can be easily obtained through an examination of each 3W narrative case presented in appendix F.

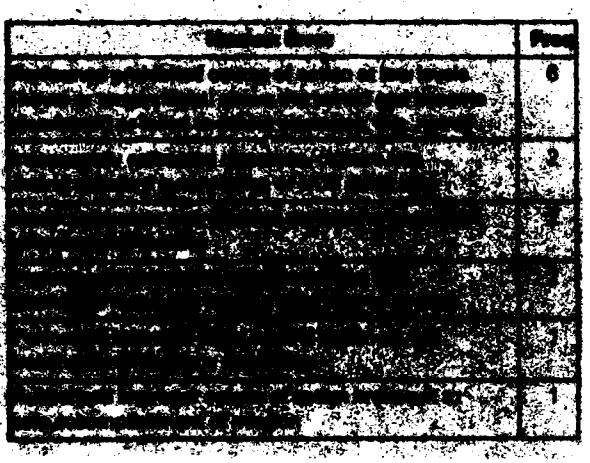
I. Improper motivation or mood: command or peer pressure, get-homeitis, etc. The HSL analysis in table 3 shows this inadequacy to be the top-ranked or most critical problem in Army aircraft accidents during FY 79. It accounted for more than $1.6 million dollars of FY 79 accident costs. The human errors caused or contributed to by this inadequacy are shown in table 4.

The human errors in table 4 were most often committed by pilots or instructor pilots in utility helicopters on service or training missions. These errors are not new to Army aviation. Generally, these errors were knowingly committed by experienced aviators who allowed the performance of their duties to be adversely affected by an excessive desire (1) to impress peers or supervisors, (2) to save time by taking a shortcut for personal or job-related reasons, or (3) to complete the mission. These findings are similar to those in the FY 78 report (reference 3) in which motivational problems were ranked fifth by the HSL analysis.



II. Faulty judgment. Faulty judgment was the second-ranked inadequacy during FY 79. It accounted for $1.5 million in aviation resource losses. The most frequent human errors associated with faulty judgment are shown in table 5.

TABLE 5.—Faulty Judgment



[illegible]	Freq
[illegible]	6
[illegible]	2
[illegible]	1
[illegible]	1
[illegible]	1

The human errors associated with faulty judgment are also not new to Army aviation and are similar to those identified in the FY 78 report (reference 3). They generally involve errors in making decisions which require accurate estimations of speed, height, and distance, and true assessment of aircraft/aviator capability at low altitudes. For these decisions, the aviators either lacked the information needed or inadequately used the information available. The decisionmaking problems noted above most often involved experienced pilots of utility aircraft on training missions. This finding differs from the results of the FY 78 analysis in which observation helicopter pilots were found to be committing these decision errors most often.

III. Equipment improperly designed for required operation. Improper equipment design was the third-ranked inadequacy and, while occurring less frequently, it was the most costly ($7.9 million). Human errors, as well as materiel failures, caused or induced by the inadequate design of aircraft equipment are presented in table 6.

In the FY 78 report (reference 3) more than half of the improperly designed components in accidents were in OH-58A aircraft. This finding was not repeated in FY 79, when more than half of the system inadequacies involving improperly designed equipment occurred in utility and cargo aircraft. The types of human errors and machine failures caused or contributed to by inadequately designed aircraft equipment were widely distributed (see table 6). Generally, materiel failures involved engines and transmissions, and human errors involved improper tasks, committed by experienced pilots on aircraft controls, that were induced by equipment configuration.

IV. Inadequate unit training. Inadequate unit training was not one of the top five system inadequacies in FY 78. However, in FY 79 this inadequacy was ranked fourth and accounted for $4 million in resource losses. The human errors associated with this inadequacy are listed in table 7.

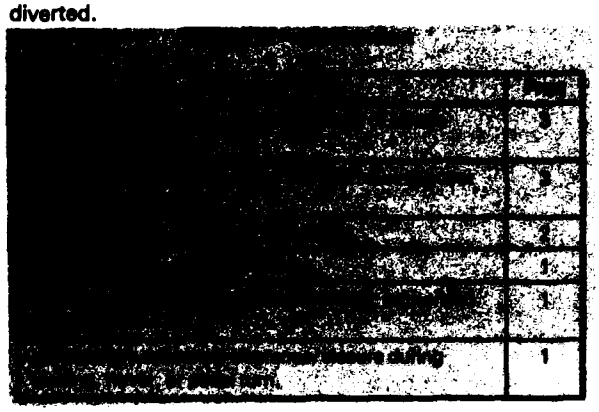
Most of the human errors caused or contributed to by inadequate unit training involved formation flight or environmental factors. These errors were not peculiar to a particular type of aircraft or duty position.

TABLE 6.—Equipment Improperly Designed for Required Operations

Material Failure or Human Error	Freq
Machine-related	7
UH-1H engine failure resulted when the accessory drive gear shaft (P/N 1-070-140-1) sheared through fatigue mechanisms. Normal operating loads acting upon manufactured sharp edges created stress risers in the groove that holds the retaining ring.	
UH-1H engine failed (first-stage gas producer turbine rotor, P/N 1-100-060-01) because the design of the turbine rotor blade is such that it allows dirt build-up at the blade base. This dirt build-up causes misalignment of the blade position eventually resulting in blade to casing contact and turbine failure.	
OH-58A engine failure resulted from fatigue failure of the gear, cluster spur, P/N 6854149. The gear does not have sufficient strength or adequate meshing and the vibration level was high.	
UH-1H fuel warning system (right fuel flow switch, P/N 204-260-654-1) malfunctioned. The fuel boost warning system signals failure when the pump has not failed.	
CH-47C combining transmission (P/N 114D5200-2) failed. The spiral bevel gear separated from the gear shaft flange because the connection allowed fretting and cracks to occur adjacent to the bolt area and eventual separation.	
YCH-47D forward transmission oil cooler fan failed (fan blades cracked and separated). The current aircraft configuration is designed so that the aircraft's normal operating rpm places the fan in resonance.	
CH-54A main rotor system failed. The horizontal pin, P/N S1510-23099-1, NSN 1615-00620-4866, failed because the design specifications provide for a plating thickness insufficient to prevent corrosion-fatigue.	
Operator-related	3
AH-1S pilot conducting contour flight improperly divided his attention between the tasks inside and outside the aircraft because of the cockpit configuration. The pilot was unable to properly divide his attention between operating the tactical FM radio controls and maintaining adequate visual contact outside the aircraft because the ECAS version of the AH-1S requires the pilot to perform unusual movement to operate a control—lean forward and reach around the cyclic control to operate the radio.	
RV-1D pilot inadvertently feathered the No. 2 propeller because the design of the autofeather switch and warning light allows an aviator to unknowingly or inadvertently arm the autofeather switch. A visual check of the system will not allow the pilot to determine the switch position and the warning light is difficult to see in its present location.	
TH-55A student pilot inadvertently increased collective while retarding throttle and override during a practice autorotation. The hand action required to place the throttle in override and hold it there against spring tension can cause this inadvertent action (increased collective).	

V. Inattention. The fifth-ranked inadequacy, inattention, was a definite cause factor in accidents, accounting for $2.3 million in resource losses. Table 8 lists the human errors associated with this inadequacy. These errors were committed by experienced aviators, but were not peculiar to an aircraft type.

Accidents involving this inadequacy occurred when the aviator's task loading was high, e.g., during hover, landing, and low-level flight. Most of the errors committed by pilots or instructor pilots during this high workload condition involved channelizing or directing too much attention to objects or events taking place inside the cockpit. Unlike FY 78, operating controls or monitoring instruments, rather than concentrating on maps, instructions, or other factors, were the tasks inside the cockpit on which their attention was channelized or excessively diverted.



Identification of Hazard Prevention Requirements

Management Level. The aviation system inadequacies listed in rank order in table 3 were analyzed to determine pressing prevention requirements which affect the efficiency and safety of operations. A listing of these requirements is provided below. These requirements are based on the HSL analysis and the expert judgment of human factors and materiel specialists and aircraft system managers at the Army Safety Center. The requirements represent prevention needs for FY 79. A number of actions has been taken, is in progress, or is being considered. Some of the more effective remedies to prevent the recurrence of human-related problems are found in the area of improved equipment design.

FY 79 Hazard Prevention Requirements for Army Aviation

Requirement Area

A. Equipment Design (Hazards 1, 3, 5, 6, 9, 10 in table 3)

1. Wire Strike Protection.

• Expedite procurement and fielding of wire strike protection systems for the OH-58, UH-1, and AH-1.

• Initiate research and development programs to develop wire strike protection systems for the UH-60 and AH-64.

• Continue efforts to determine the feasibility, practicality, and cost effectiveness of equipping Army helicopters with a wire or wire-like object detection system.

2. AH-1S. Evaluate the need to relocate the FM radio from its present position in the AH-1S to a cockpit area that does not require the pilot to reach forward and around the cyclic for operation. This would be particularly important during terrain flight when there is a significant need for vigilance outside the aircraft and the copilot cannot assist or the task assignments are not clear.

3. UH-1. Redesign the UH-1 fuel boost warning system to eliminate false warning indications.

4. OH-58.

• Improve the OH-58 engine (T63-A-700) gear cluster spur, P/N 6854149, to include increased strength, adequacy of meshing, and lower vibration levels. (T63-A-720 engines have incorporated these improvements.)

• Redesign the OH-58 tail rotor pitch change mechanism or revise maintenance procedures to prevent improper installation.

5. CH-47.

• Modify the CH-47 spiral bevel gear connection to the gear shaft flange to a connection that does not allow fretting and cracking to occur adjacent to the bolt holes.

• Redesign the YCH-47D forward transmission oil cooler fan so that the aircraft's normal operation cannot place the fan in resonance, causing eventual failure.

6. CH-54. Redesign the CH-54A horizontal pin in main rotor system to require a plating of sufficient thickness to prevent corrosion failures.

7. OV-1. Redesign the OV-1 autofeather/synchrophaser switch to one that does not cause the users to inadvertently arm the autofeather system, and reposition the autofeather/speedboard warning light to a place where it is not difficult to see.

8. General. Develop a program to insure known safety-related materiel deficiencies intentionally installed on aircraft when parts are not available are monitored to preclude failure.

B. Human Performance Research/Evaluation (Hazards 1, 2, 4, 5, 11, 12 in table 3)

1. OH-58. Reevaluate the OH-58 crew requirements based on today's scout missions, flight environment, and task workload.

2. OV-1. Determine if a valid requirement exists for pilots of OV-1 aircraft to conduct formation flights.

3. General.

• Perform research to identify the most critical causes of improper division of attention between flight duties in rotary wing aircraft and develop corrective actions to reduce or eliminate problem, i.e., heads-up display. Particular emphasis should be directed toward flight modes of high task workload.

• Evaluate the need to upgrade procedures/training provided aviators with regard to proper methods of avoiding or coping with reduced visibility problems encountered when hovering/taxiing over snow or dusty terrain.

• Perform research to identify, define, and rank the task performance problems of aviators (instructors, pilots, and students) during actual and simulated autorotations.

• Perform research to identify, define, and rank problems involving rotary wing instructor pilots improperly monitoring the performance of pilots to such a degree that safe operating conditions are exceeded. Particular emphasis should be directed toward the higher task workload situations, such as training for simulated emergency conditions.

• Develop safe operating parameters and guidelines for helicopter operations in the vicinity of parachutes.

• Develop research effort to determine the instruments/procedures/training techniques needed to enhance pilot capability to accurately estimate clearance/closure rate and correct control inputs, especially during autorotations.

C. Written Guidelines (Hazards 1, 3, 2, 5, 8, 22 in table 3)

1. AH-1. Revise TM 55-1520-221-20 (AH-1) to require a check of the torque of the tail rotor gearbox attaching bolt during every phase inspection or PE, and after first flight following any 90-degree gearbox installation.

2. UH-1.

• Revise TM 55-1520-210-23 (UH-1) to include, at unit and intermediate maintenance levels, the requirement to

measure each trunnion bore and trunnion pin, and to conduct a spring pull test of assembled parts.

• Evaluate the need to change TM 55-1520-210-10 (UH-1) in the area of loss of effective tail rotor thrust with no break in drive systems, particularly at out-of-ground effect hover altitudes to provide prescribed recovery techniques.

3. OH-58.

• Revise procedures in TM 55-1520-228-23 (OH-58) with a "WARNING" note or other means to insure the pitch control tube and key are not forced through the control housing.

• Revise TM 55-1520-228-23 (OH-58) to give tail rotor rigging procedures to eliminate difficulty and increase the degree of accuracy within design tolerances.

4. General.

• Evaluate the adequacy of TC 1-13 (Hot Weather Flying Sense) and FM 1-51 (Rotary Wing Flight) in the area of normal/emergency procedures in night/dusty operations.

• Improve field investigations and reports of mishaps to insure sufficient information IAW AR 95-5 is provided to adequately identify for remedial action the "failures that cause or contribute to an accident," as well as the aviation "system inadequacies or conditions that induced the failures."

• Evaluate the adequacy of written guidelines on the subject of required clearance between aircraft in refueling areas and the need to include parking and maneuver clearance requirements in FM 1-105 (Aviator's Handbook) and TC 1-135 (UH-1 Aircrew Training Manual).

• Revise FM 1-51 (Rotary Wing Flight) to include detailed duties for each crewmember with particular emphasis on the tasks and coordination required in maintaining constant external surveillance during terrain flight operations, i.e., radio frequency changes and transfer of aircraft control.

• Review the current regulations and manuals to determine the adequacy of guidance provided to aviators regarding authorized and unauthorized terrain flight.

• Evaluate effectiveness of programs designed to insure aviator compliance with written guidelines establishing required terrain flight procedures, especially with regard to unauthorized terrain flight.

D. Weight and Balance (Hazard 5 in table 3). Investigate methods/instruments for improving the ease and accuracy of calculating weight and balance and aircraft performance, i.e., better performance charts and electronic computers.

E. Flight Training (Hazards 1, 2, 5, 20 in table 3)

1. AH-1. Provide additional training in power recovery techniques to AH-1 instructor pilots by using the AH-1 visual simulator, i.e., recovery during low and high rate of descent conditions.

2. OH-58. Evaluate the adequacy of the OH-58 aviator instrument training program which allows the majority of training to be conducted in the UH-1 synthetic flight training system (SFTS). Particular emphasis should be directed toward evaluating all instrument tasks to determine which should be performed in observation aircraft and which have adequate transfer of training benefits to be performed in the UH-1 SFTS. The annual 20-hour SFTS requirement for observation helicopter pilots should then be modified based on the task evaluation of instrument flight rquirements.

3. General.

• Improve IP/SIP monitoring of nonstandard maneuvers performed by pilots who are under instruction/evaluation in more than one aircraft. This is particularly important for pilots being influenced by a combination of factors from different aircraft such as different standard maneuver requirements, procedures, techniques, and fields of view from the cockpit.

• Assess/evaluate the adequacy of current training in the area of proper division of attention between flight tasks/duties inside and outside the aircraft during high pilot task workload conditions, i.e., hover, landing, autorotation, and confined area training in various environmental conditions.

• Provide school training, through the use of flight simulators, for instructor pilots regarding the correct procedures for low level, low rpm recovery from autorotations.

• Upgrade aviator rotary wing training to provide a better understanding of aircraft performance capabilities in the areas of (1) power required versus power available, (2) interpretation of tail rotor problems, and (3) actions to take when tail rotor effectiveness is lost.

The requirements listed above provide insight into safety needs and each should be closely monitored and managed. Following are areas in which these requirements should be considered:

1. Research and development for current and future aircraft.

2. Emphasis and direction to upgrade training at unit and school levels.

3. Unit and Army-wide accident prevention programs.

4. Evaluation and revision of Army regulations, technical manuals, field manuals, and other written guidelines that direct human behavior.

Unit Level. Remedial actions or prevention requirements for which a unit has primary implementation responsibility are given on a case-by-case basis in appendix f. In addition to indepth information relevant to individual unit problems, appendix F also gives detailed data on Army-wide aviation problems. The hazard data presented in this appendix provides unit-level personnel with the information needed to easily perform different kinds of reviews, analyses, or assessments of "real world" hazards in Army operations that are unique to the primary concerns of a unit.

These remedial actions were developed by the accident investigation board on an individual case basis and should be carefully considered. However, these remedial actions are not intended to (1) be all-inclusive, (2) represent the actions that specialists in the behavior of men or materiel might select, or (3) be identical to remedial actions that

would result from a collective analysis of a problem area. Other effective corrective actions may be developed and implemented at unit level. Appendix F also includes information on mishap prevention actions which have been completed or are in progress.

Other Requirements. The results of this study support several other requirements. A multi-year study similar to this report should be performed to determine long-term aviation system inadequacies and mishap prevention requirements. Consideration should also be given to developing research efforts aimed at providing indepth analysis of **each** aircraft system and each of the major aviation hazards identified in this report.

One of the most common recommendations made by accident investigation boards was "to inform personnel of problems encountered through communications media." Communications media like FLIGHTFAX are invaluable for giving field personnel information on aviation hazards. The data in this report support the need for the Army Safety Center to continue current efforts in publicizing major aviation hazards through articles, publications, training films, and other communications media.

The final needs indicated by the results of this study involve aids to accident investigation and analysis; specifically, an onboard flight/crash data recorder, an automated data system for recording aviator flight activity, and improved written gudelines on—and enforcement of—the requirements in AR 95-5 for reporting aviation mishaps.

Like those of past years, this analysis indicates that improvement in the quality and specificity of data, i.e., "real time" data, is required. Without an improvement in data, accidents will continue to occur from repeat causes and few safety improvements or advancements will be realized beyond the present plateau.

An onboard flight data recorder would, for the first time, provide invaluable "real time" information about the aircraft. This would reduce (1) subjective "guesstimations" and the resultant number of nonspecific, inaccurate, or erroneous findings, and (2) the number of accidents in which insufficient information was available to determine definite causes. The flight data recorder could also reduce the cost and time for mishap investigations.

Human error, particularly pilot error, continues to be largest problem in Army aircraft accidents. Data concerning the adequacy of aviator skill development and maintenance in terms of (1) total amount of flight experience in different types of aircraft, missions, and tasks, and (2) the recency of hours flown and distribution of practice for these hours in different types of aircraft, missions, and tasks, are essential ingredients for understanding these aviator-related problems. Automation of the aviators' flight activity data would improve the accuracy and speed with which such valuable information can be gathered.

Without this basic data, it is difficult to adequately monitor the pulse of aviator flight experience and make informed decisions regarding important aviation resource management questions. For example: Are there differences in the types and amounts of flight experience of aviators involved in aircraft accidents and those who are not?

How do we know if or when the flight and training experience of the Army aviator population in various aircraft, missions, and tasks fall below that minimally required to be prepared for future threats?

How can we determine how the kinds of flight experience used to develop and maintain aviator skills have changed in the last 10 years?

How can we determine the specific effects of reduced flight hours and aviator manpower on the overall, as well as specific, kinds of aviator skills and level of experience available for Army-wide operational mission effectiveness?

Automation of aviator flight activity data is a key to answering these questions. However, while this flight activity data is one of the few available measures of general aviator performance, it is not centralized and automated as are similar types of aircraft information.

Decision-level consideration should be given to an onboard flight/crash data recorder and the automation of aviator flight activity data. Some efforts are underway. An Aircraft Accident Information Retrieval System (AIRS) has advanced to the prototype "brass board" stage at the Applied Technology Laboratory of the Research and Technology Laboratories (AVRADCOM). Also, ODCSOPS has contracted for automation of the aviator flight activity records.

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10. AR 385-40, *Accident Reporting and Records,* effective 1 July 1972.

Appendix A TEER and FINE Categories

Task Error and Material Failure/Malfunction

0 Unknown
1 Inadequate flight planning: before or during mission (e.g., weather analysis, compatibility of crew/equipment/aircraft with mission, flight plan, mission briefing)
2 Inadequate aircraft inspection: before or during mission (e.g., aircraft records, CSI, preflight, thru-flight)
3 Inadequately performed required maintenance, maintenance inspection or maintenance records keeping
4 Inadequate crew coordination
5 Inappropriately divided attention
6 Inaccurately estimated clearance/closure
7 Improper flight control action(s)
8 Misdiagnosed in-flight failure/aircraft action
9 Inappropriately monitored instruments or performance of equipment
10 Inappropriately monitored performance of personnel
11 Inappropriately assigned personnel or equipment
12 Inappropriate work-rest cycle
13 Failed to provide required information: written procedures, flight information
14 Authorized a course of action that is prohibited by AR, FM, TM, SOP, directive, or common practice
15 Performed a course of action that is prohibited by AR, FM, TM, SOP, directive, or common practice
16 Inappropriately performed or failed to perform a course of action that is required by AR, FM, TM, SOP, directive, or common practice
17
18 Failed to maintain geographic orientation

COMPONENT THAT FAILED/MALFUNCTIONED:

19 Airframe (01): cockpit assembly
20 Airframe (01): fuselage assembly
21 Landing gear (02): wheels, skids
22 Landing gear (02): brakes
23 Power plant (03): engine + fuel control
24 Power plant (03): engine installation, shutoff valves, throttle linkage
25 Rotor/transmission (04): main transmission + short shaft
26 Rotor/transmission (04): main rotor system
27 Rotor/transmission (04): tail rotor system
28 Rotor/transmission (04): auxiliary gearboxes (42°, 90° and hanger bearings)
29 Propeller and propeller accessories (05)
30 Hydraulic system (06): flight controls
31 Hydraulic system (06): utility systems (landing gear, cargo hoist)
32 Pneumatic systems (07)
33 Aircraft instruments (08)
34 Electrical system (09): aircraft lighting
35 Electrical system (09): other (heater, fire detector)
36 Electrical system (09): battery, generator
37 Fuel system (10): fuel cells
38 Fuel system (10): piping and associated hardware
39 Flight control system (11)
40 Utility system (12)
41 Cargo and personnel equipment (17)
42 Avionics (19): communications
43 Avionics (19): navigation
44 Avionics (19): stabilization system
45 Armament (20)

System Inadequacy

0 Unknown or insufficient information
1 Inadequate school training
2 Inadequate unit training
3 Inadequate experience

INADEQUATE PSYCHOPHYSIOLOGICAL STATE:

4 Competence
5 Attention
6 Judgment
7 Overconfidence in self
8 Overconfidence in others
9 Overconfidence in vehicle or equipment
10 Lacked confidence in vehicle or equipment
11 Lacked confidence in self
12 Motivation or mood: command pressure, excessive self-motivation, get-home-itis, peer pressure
13 Fatigue, illness, or effect of alcohol/drugs
14 Habit interference
15 Environmental influences: fog, smoke, haze, dust, sand, temperature, bird strikes, FOD
16 Equipment not available or improperly designed for required operation
17 Inadequate airfield or in-flight facilities/services
18 Maintenance not performed or performed inadequately: inspection, installation, troubleshooting
19 Inadequate written procedures for operation in normal man-machine-environmental conditions
20 Inadequate written procedures for operation in abnormal/emergency man-machine-environmental conditions

INADEQUATE SUPERVISION/COORDINATION:

21 Higher command
22 Unit commander
23 Maintenance officer
24 Operations officer
25 Flight leader/platoon leader
26 IP or SIP
27 Pilot in charge of aircraft
28 Safety personnel

29 Weight & balance officer/technician
30 Manufacture, assembly, packaging, or quality control performed inadequately
31 Personnel utilized improper procedure
32 Personnel improperly utilized component or system

Remedial Measure

0 Unknown
1 Upgrade/provide school training
2 Upgrade/provide unit training
3 Revise/provide procedures for normal operation: AR, TM, FM, SOP, directive, reading file
4 Revise/provide procedures for abnormal/emergency operation: AR, TM, FM, SOP, directive, reading file
5 Insure personnel are ready/capable of performing job assigned regarding their training, experience, or psychophysiological state
6 Inform personnel of problems encountered and remedies via meetings, publications, EIRs, and directives/safety-of-flight messages
7 Positive command action to encourage proper performance and discourage improper performance
8 Provide proper personnel (numbers or qualifications) or reallocate the function to another duty position
9 Provide required vehicle/equipment or redesign existing vehicle/equipment
10 Provide required facilities and services or improve existing facilities and services

IMPROVE MONITORING OF PERSONNEL AND UNIT ACTIVITIES BY:

11 Higher command
12 Unit commander
13 Maintenance officer
14 Operations officer
15 Flight leader or platoon leader
16 IP/SIP
17 Pilot in charge of aircraft

18 Perform studies/research to determine solution to system inadequacy
19 Improve quality control

APPENDIX B

Distribution of Task Errors and Material Failures Across System Inadequacies/Hazards

SYSTEM INADEQUACY/HAZARD CATEGORY

TASK ERROR/MATERIEL FAILURE	0	1	2	3	4	5	6	7	8	9	12	13	14	15	16	17	18	19	20	21	22	26	27	30	Total
0	315 346 372 321 354 375 339 363 8																								8
1			304 350 2			351 1	301 1	340 1			303 371 2														7
3	305 1																	376 1							2
4							362 1								362 1			362 1							3
5	370 1		319 1		318 1																				3
6	356 1	328 357 2	328 1	316 325 2	349 1	325 1	309 316 2	335 1										365 1	357 1						14
7			304 314 2	329 338 352 358 377₂ 6	377₂ 378 3		334 1	369 1			375 1	352 1	377 1	352 359 2	302 1			329 1				302 338 352 358 4			24
8					377 378 2													345 1							3
9						306 1									339 1										2
10	356 1	314 1				303 1		320 1	302 338 369 3																7
12											331 1														1
13																		340 1		351 1					2
14			322 1				349 1		330 1		322 1					322 1					330 1				6
15	368 1			349 1		344 1	326 378 327₂ 344 349₂ 7	344 378 1		339 1	319 344 353 3							319 326 345 3				322 1	349 366 2		22
16	311 348 351 3	367 1	319 332 2			307 374 332 347 371 5	331 332 2	331 1			301 371 343 348 355 5	331 1	371 1												21
17						337 1																			1
23	311 324 327 3														310 311 317 3		361 1							311 1	8
25	364 1														342 1										2
26															377 379 2										2
27																	313 355 2	360 1							3
30																	305 1								1
38															318 1										1
39																	341 1							341 1	2
TOTAL	20	4	9	9	7	11	15	7	4	1	13	2	2	2	10	1	5	10	1	1	1	5	2	2	144

Small numbers in cells refer to case numbers for narratives in Appendix F. Large number in cells refers to the number of occurrences.

APPENDIX C
Distribution of Aircraft Across Failure (TE/FM) Categories

TASK ERRORS OR MATERIEL MALFUNCTIONS

Aircraft	0	1	3	4	5	6	7	8	9	10	12	13	14	15	16	17	23	25	26	27	30	38	39
UH	321 346 353 373 — 4	301 303 304 — 3			318 319 — 2	303 316 325 325 349 356 357 — 7	304 314 330 338 369 375 378 — 7	345 378 — 2		303 314 320 338 356 369 — 6			322₂ 330₂ 349 — 5	319 322 326 345 349 366 368 378 — 8	301 311 319 343 346₂ — 6		310 311 — 2					318 — 1	341 — 1
OH	315 — 1	340 — 1	376 — 1				329 — 1				331 — 1	340 — 1		353 — 1	307 331 332 335 — 4	337 — 1	317 361 — 2			355 — 1			
AH	356 — 1	351 — 1	305 — 1	362 — 1		335 — 1	352 359 — 2					351 — 1		327₂ — 2	347 351 367 374 — 4		327 — 1			313 — 1	305 — 1		
CH		350 — 1				365 — 1	377₂ — 2	377 — 1										342 364 — 2	377 379 — 2				
TH-55	372 — 1				370 — 1		302 358 — 2		306 — 1	302 — 1							324 — 1			360 — 1			
OV-1						328 — 1			339 — 1					339 344 — 2									
C-7		371 — 1													371₃ — 3								
T-42							334 — 1																
U-21	338 — 1																						
TOTAL	8	7	2	1	3	10	15	3	2	7	1	2	5	13	17	1	6	2	2	3	1	1	1

Small numbers in cells refer to case numbers for narratives in Appendix F. Large number in cells refers to the number of occurrences

APPENDIX D
Distribution of Aircraft Across System Inadequacy/Hazard Category

SYSTEM INADEQUACY/HAZARD CATEGORY

Aircraft	0	1	2	3	4	5	6	7	8	9	12	13	14	15	16	17	18	19	20	21	22	26	27	30
UH	311₂ 321 345 348 355₂ 363 368 373 10	314 357 2	304₂ 314 319₂ 322 6	316 323 330 349 4	318 349 378₂ 4	303 325 2	301 303 316 326 349₂ 378 7	320 369 378 3	330 338 369 3		301 303 319 322 343 348 375 7				310 311 318 3	322 1	341 1	319 326 345₂ 4	357 1		330 1	322 338 2	349 366 2	311 341 2
OH	315 1		332 1	329 1		307 332 337 3	331 332 2	331 340 2			331 353 355 3	331 1			317 1		355 361 2	329 340 376 3						
AH	305 327 351 354 4	367 1		352 359 2		347 351 374 3	327₂ 362 3	335 1				352 1		352 359 2	362 1		305 313 2	362 1		351 1		352 1		
CH	364 1		350 1	377₂ 2	377₃ 3								377 1		342 377 379 3			365 1						
TH-55	324 370 372 3					306 1			302 1						302 1			360 1				302 358 2		
OV-1		328 1	328 1			344 1	344 1	344 1		339 1	344 1				339 1									
C-7						371 1					371₂ 2		371 1											
T-42							334 1																	
U-21	333 1																							
TOTAL	20	4	9	9	7	11	14	7	4	1	13	2	2	2	10	1	5	10	1	1	1	5	2	2

Small number in cells refer to case numbers for narratives in Appendix F. Large number in cells refers to the number of occurrences.

Appendix E

Method

Data Source

Data used for this report were obtained from an analysis of the reports on Army aircraft accidents. Damage, injury, fatality, and cost associated with these accidents are summarized in table 1 on page 2.

Objective

The primary objective of the analytical effort is the same as that of system safety programs: **to maintain the highest level of operational effectiveness through the conservation of aviation resources by early identification, evaluation, and correction of system inadequacies.** This objective is accomplished through an intensive five-stage safety management program called ICAFT. ICAFT refers to investigation, computerization, analysis, feedback, and tracking. It is a closed-loop approach to safety intended to identify, manage, and track aviation hazards from initial occurrence to final elimination. Following are the five stages of ICAFT:

1. **Hazard Investigation.** This stage is accomplished on an individual case basis through aircraft accident investigations using the "Ricketson 3W approach" (reference 4). This approach requires isolation of failures (man or machine) that are causative to an accident. Additionally, the Ricketson 3W approach employed by the Army Safety Center takes a significant step beyond many programs in accident investigation by also requiring the isolation of the "root causes"—the factors that cause or contribute to the failures. The approach incorporates multiple causation and requires the establishment of a link between failures and failure causes. This reduces the circular arguments so often posed on who is to blame for an accident, e.g., human error or materiel design inadequacy, and emphasizes prevention measures.

2. **Computerization.** All information collected on failures and failure causes is processed into the Army Safety Center computer data base. Thus, data on man or machine problems are centralized and can be easily accessed and analyzed.

3. **Analysis and Research.** The hazards in the centralized data base are collectively analyzed on a yearly and multiyearly basis to (a) identify, define, and determine the magnitude of the problem presented by hazards, (b) prioritize the hazards identified in terms of high payoff potential or those areas having the most pressing need for preventive actions, and (c) identify additional corrective actions needed, i.e., remedial actions not appropriate or defined well enough from the single occurrence of a hazard.

4. **Feedback.** The hazards identified and prioritized are then transmitted through technical reports, interagency coordination, and other means to the various agencies responsible for corrective actions, e.g., Army command, human factors and materiel research activities, aviation schools, and media specialists.

5. **Tracking/Action.** The Army Safety Center has a system manager for each type aircraft (UH, OH, AH, etc.). These system managers are responsible for initiating, tracking, and coordinating corrective actions above major command level to be taken on human and materiel problems identified through individual and collective accident analyses. This type of hazard management insures that prevention requirements are systematically managed and do not "drop through the crack." The results of this corrective action tracking system are also being computerized.

Individual Analysis

The aircraft accidents were investigated and analyzed using the Ricketson 3W approach. This approach is based on a conceptual framework adapted from a model by Ricketson, 1975.

Figure E-1 presents a model of the human error accident. The premise of this model is that when one or more of the 12 basic elements of the aviation system do not operate as intended, an overload (item 13) is placed on the man's role in the system (item 14). That is, the man must continue to perform normal tasks while correcting for the abnormal system condition. If the overload is of such magnitude or persistence that the man cannot cope with it and continue to perform normal tasks, he begins to make errors (item 15). Most of these errors do not result in an accident (item 16). But, as the magnitude and frequency of errors increase, the likelihood of the error causing an accident increases. When an accident occurs that has been caused by a human error(s), it is probable that this error has occurred many times before the accident happened. Also, it is likely to continue to occur unless some remedial action is taken to correct the system inadequacy causing the error.

This basic model was used to develop the approach outlined in table E-1. The approach requires the accident investigation board to identify what happened, what caused or allowed it to happen, and what to do about it (3W) with respect to man, machine, the environment, and their interaction. This report only addresses the man and machine cause factors.

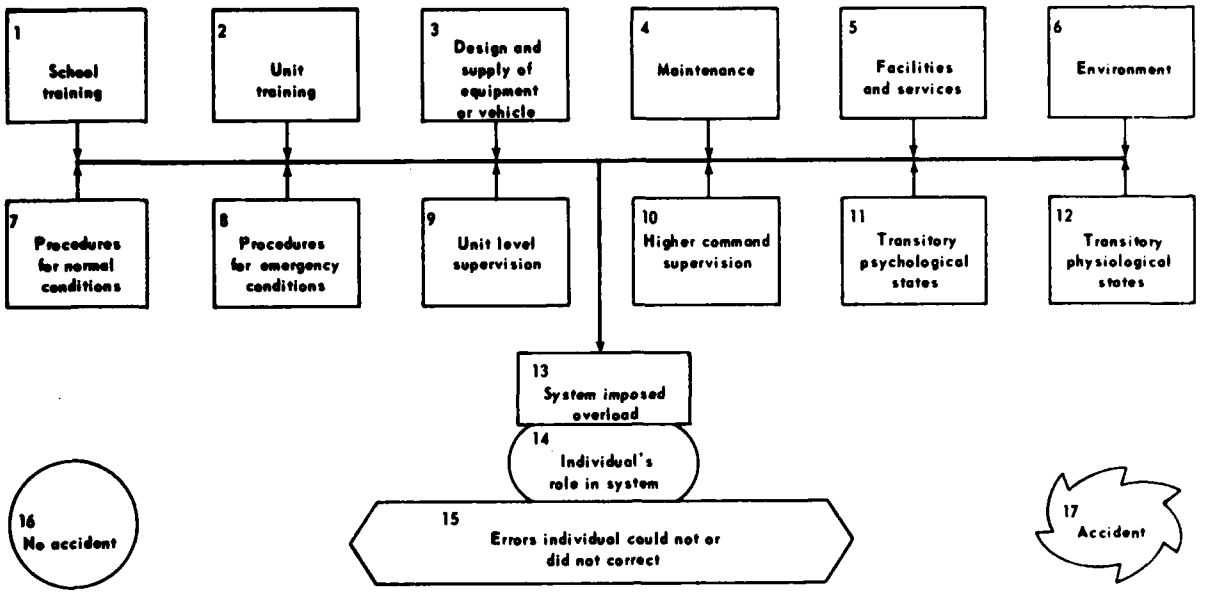

FIGURE E-1.—Model of Human Error Accident

TABLE E-1.—3W Approach to the Investigation, Analysis, and Prevention of Accidents

Accident Cause	What Happened	What Caused It	What to do About It	Acronym
Man	Task Error	System Inadequacies	Remedial Measures	TEIR
Machine	Failure or Malfunction	System Inadequacies	Remedial Measures	FIRE

Human Error. The acronym for the 3W approach to the investigation, analysis, and prevention of human error accidents is TEIR. The elements of TEIR are defined as follows:

1. A task error (TE) is job performance which deviated from that required by the operational situation and caused or contributed to an accident. Required performance includes that stipulated by (a) school training, (b) on-the-job training, (c) U.S. Army regulations and guidelines, (d) standing operating procedures, or (e) commonly accepted practices. An error is assigned only when it is judged that a person of normal or reasonable competence could have performed the task correctly in the existing operational situation.
2. A system inadequacy (I) or hazard is an element of the aviation system that did not operate as intended or designed. An I is assigned only when it is judged to have caused, allowed, or contributed to the occurrence of a TE. More than one I may be assigned to a given TE.
3. A remedial measure (R) is an action required to correct or at least reduce the operational impact of an inadequacy. The R may be directed at any command level for implementation and is not to be restricted by current technology or budgetary, personnel, and equipment resources. More than one R may be recommended for a given inadequacy.

Materiel Failure. The 3W approach relating to materiel failure/malfunctions is also based on the conceptual framework adapted from Ricketson's (1975) model. Figure E-2 presents a model of the materiel failure/malfunction accident.

The acronym for the 3W approach to the investigation, analysis, and prevention of mishaps caused by materiel failure/malfunction is FIRE. The elements of FIRE are defined as follows:

1. A materiel failure/malfunction (F) is a component or system that (a) ceases to operate entirely, (b) operates, but not as designed or intended, (c) operates as designed, however, operational needs require enhanced performance. A materiel failure/malfunction is considered for analysis only when it is judged to have caused or contributed to the mishap, not resulted from the mishap.
2. A system inadequacy (I) is an element of the aviation system that did not operate as intended or designed. An I is assigned only when it is judged to have caused, allowed, or contributed to the occurrence of an F. More than one I may be assigned to a given F.
3. A remedial measure (RE) is an action required to correct or at last reduce the operational impact of an inadequacy. The RE may be directed at any command level for implementation and is not to be restricted by current technology or budgetary, personnel, and equipment resources. More than one RE may be recommended for a given inadequacy.

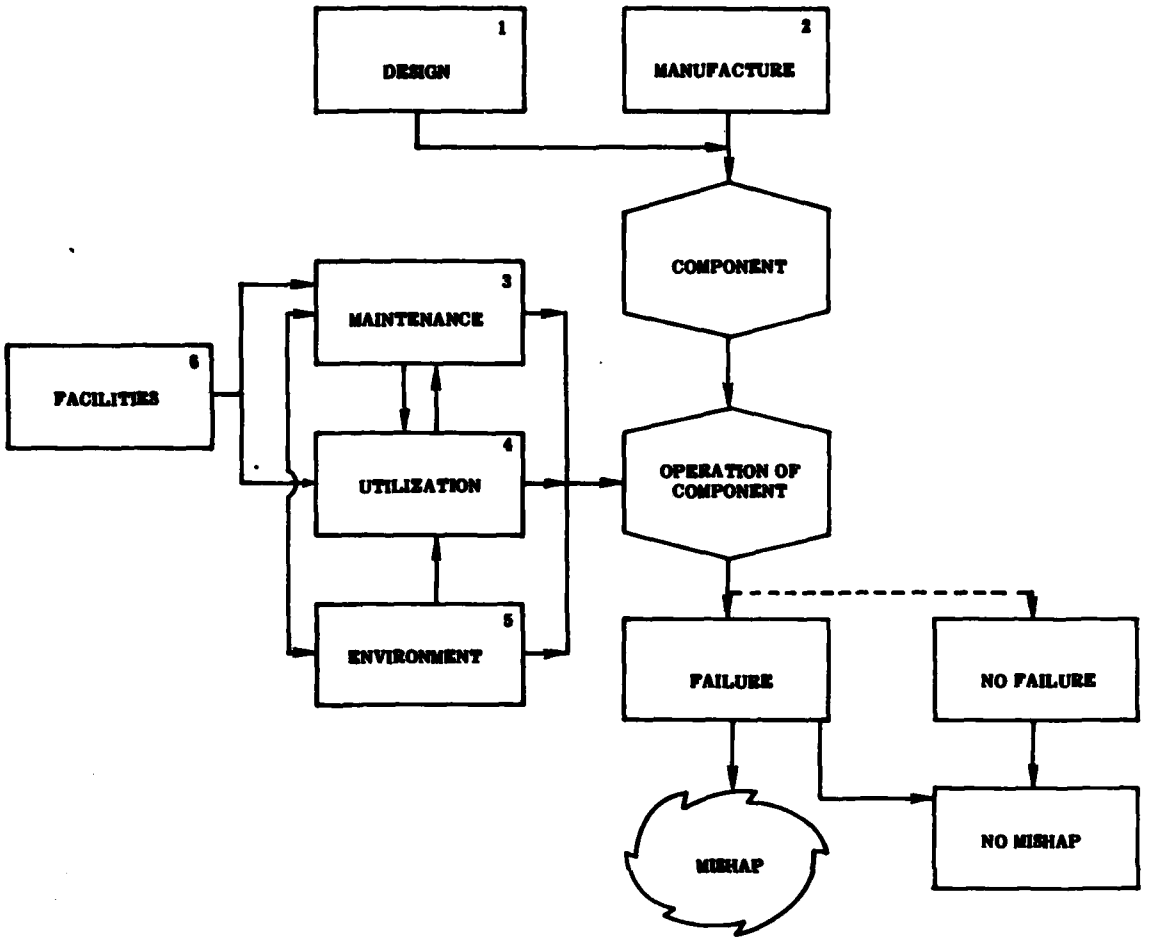

FIGURE E-2.—3W Model of Mishap Caused by Materiel Failure/Malfunction

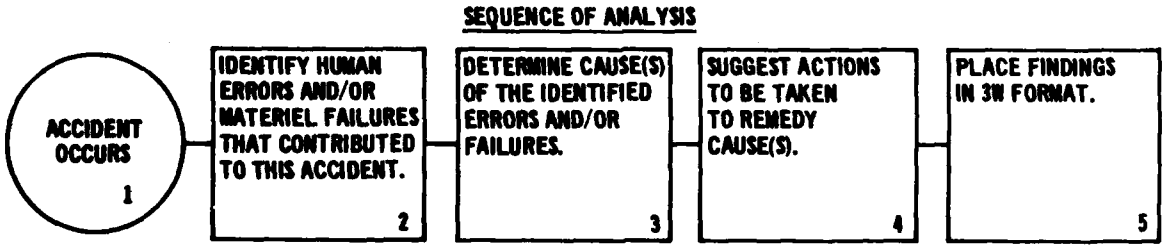

FIGURE E-3.—Identification of Hazards in Each Individual Accident

Individual Accident Analysis. Figure E-3 shows the general process by which the individual analysis of an accident was accomplished.

1. Accident Occurrence. Once an aircraft mishap occurred, the mishap classification was determined IAW procedures outlined in AR 385-40, Accident Reporting and Records. This AR lists five principal aircraft mishap classifications: (1) major accident; (2) minor accident; (3) incident; (4) forced landing; and (5) precautionary landing. This report will include only those mishaps falling into the "major" and "minor" accident categories. For further definition, the "major" accident classification was divided into two groups—"major total" and "major substantial." The "major total" classification refers to those "major" accidents in which the aircraft was damaged to the extent that repair would not be feasible. The "major substantial" (usually referred to as "major" only) classification refers to those "major" accidents in which a substantial amount of damge was done.

2. Identify Human Errors and/or Materiel Failures. The first step in the identification of hazards in each accident was to determine what happened, e.g., what human errors

and/or materiel failures/malfunctions occurred that contributed to THIS accident. This was done using the concepts and procedures outlined in AR 95-5, chapter 11. According to these procedures, all duty positions and all hardware systems would be investigated to determine if any contributed to the accident. Only those failures (human errors and materiel failure/malfunctions) that directly contributed to the accident were considered for this report.

Accident investigation and reporting are usually divided into two major phases: precrash, which includes everything up to and including the accident sequence; and postcrash, e.g., the survival and rescue phase. Only those human errors and materiel failures/malfunctions that caused/allowed/contributed to the precrash phase of the accident were considered for this report. The definitions of these human and materiel failures were previously given.

3. Determine Cause(s) of Identified Errors and/or Failures. When the human errors and/or materiel failures/malfunction had been identified, the next step was to determine what problem within the aviation system (refer to models in figures E-1 and E-2) caused or allowed the error or failure. Often it is possible to identify what happened (error that was made or part that failed) but not what caused it. This lack of information can be attributed to several things: (1) catastrophic accident in which all occupants were killed and physical evidence (aircraft) was destroyed; (2) human error that cannot be traced to an individual, e.g., maintenance personnel at either unit or overhaul facility incorrectly routed hydraulic lines; (3) cause of component failure could not be determined by teardown analysis facility; (4) board could not identify any definite human error or materiel failures.

4. Suggest Remedial Measures. Once the failure and/or error had been identified and the problem within the system that caused or allowed it had been determined, the next step was to suggest action to be taken to remedy the system problem. This remedy can be aimed at any level of command as it is not bound by current manpower, budget, or state-of-art limitations. Also, more than one remedy may be needed to solve the problem or reduce its effect on operations.

5. Place Individual Findings Into 3W Format. Category numbers (see appendix A) were assigned to each contributing error or failure, its cause(s) and associated remedial measure(s). This procedure requires that all the basic information concerning each accident be coded into a form that lends itself to computerization. These basic elements include type aircraft, duty position, accident classification, materiel costs, injury costs, etc.

Collective Analysis. Figure E-4 shows the process by which the overall analysis was accomplished.

1. Collection, Coding and Review. When each individual accident had been reviewed and a 3W analysis completed for those containing sufficient information, they were collated for a collective analysis.

2. Hazard Identification. All system inadequacies that occurred in FY 79 are identified in table 3 on page 11. These were identified by system inadequacy or hazard category (appendix A) and presented by frequency of occurrence. Based on the philosophy of the model of

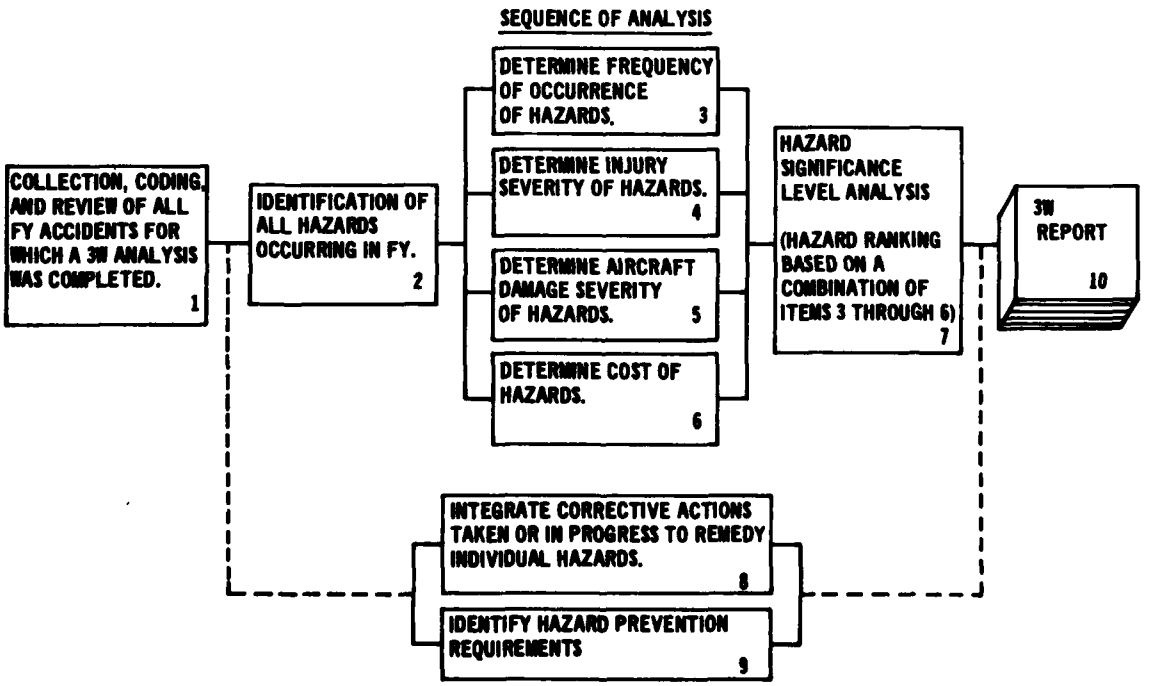

FIGURE E-4.—Sequence of Overall Analysis

figure E-1 or E-2, any problem that occurs once is likely to occur again. For this reason, no hazard or system inadequacy is eliminated because of a low frequency of occurrence.

3-6. Elements Used for Determining Hazard Significance Level.

a. Ranking According to Frequency. Each system inadequacy category was evaluated based on frequency of occurrence and placed in the appropriate frequency index shown in table E-2. The format and rationale for this frequency ranking procedure were modeled after reference 7.

b. Ranking According to Injury Severity. Each system inadequacy was evaluated relative to the severity of the injuries associated with it. This evaluation placed each system inadequacy into one of the injury severity ranks shown in table E-4. The rationale and format for this ranking procedure was taken from reference 7.

TABLE E-2.—System Hazard Frequency Ranking

Frequency Index	Descriptive Nomenclature	Mathematical Definition
A	Frequent	$0.2 < f^*$
B	Reasonably frequent	$0.1 < f \leq 0.2$
C	Occasional	$.05 < f \leq 0.1$
D	Remote	$.01 < f \leq .05$
E	Improbable	$f \leq 01$

*f is defined as the relative frequency of system inadequacy.

$$f = \frac{\text{Frequency of occurrence of system inadequacy}}{\text{Number of man/machine failures}}$$

TABLE E-3.—Injury Severity Ranking

Severity Index	Descriptive Nomenclature	Definition
I	Life-threatening	Results* in fatal injury
II	Serious	Results in major injury
III	Marginal	Results in minimal injury
IV	Negligible	No injury

*Worst credible result

c. Determine Aircraft Damage Severity. Each system inadequacy was evaluated relative to the severity of aircraft damage associated with it. This evaluation placed each hazard into one of the ranks shown in table E-4.

d. Determine Cost of Hazards. Each of the system inadequacies was evaluated relative to the costs associated with it. This cost is the sum of aircraft damage, injury, and property damage costs. These costs were proportioned by:

$$\text{System Hazard Cost} = \frac{\text{Total Cost of Accident}}{\text{Number of System Inadequacies Identified in the Accident}}$$

For Example:

Case #215

$$\text{System Inadequacy Cost} = \frac{\$93,460}{4}$$

$$\text{System Inadequacy Cost} = \$23,365$$

The method used to arrive at the dollar cost associated with each inadequacy category involved the addition of all dollar costs of the cases in which a particular inadequacy was a factor. This approach assigns the same dollar cost weight to each system inadequacy identified in the accident. No attempt was made to apply differential weights to the system inadequacies (cause factors).

7. Overall Ranking of Hazards (HSL Analysis). The results of evaluating each inadequacy according to its frequency and severity (as described above) were used to place the inadequacy into overall significance groups. Frequency and severity rankings of each inadequacy were weighted equally in this process. Table E-5 indicates how all inadequacies were placed into one of 10 significance groups as determined by the combination of frequency and severity indices.

TABLE E-4.—Aircraft Damage Severity Ranking

Severity Index	Descriptive Nomenclature	Definition
a	Total	Results in total loss* damage
b	Major	Results in major damage
c	Minor	Results in minor damage

*Aircraft damage classifications are based on procedures and criteria described in Army Regulation 385-40.

TABLE E-5.—Hazard Significance Groups Based on Frequency, Aircraft Damage Severity, and Injury Severity

Significance Group	Index	Significance Group
1	AIa	1
2	AIIa, AIb, BIa	2
3	AIIIa, AIIb, AIc, BIIa, BIb, Cla	3
4	AIVa, AIIIb, AIIc, BIIIa, BIIb, BIc, CIIa, CIb, Dla	4
5	AIVb, AIIIc, BIVa, BIIIb, BIIc, CIIIa, CIIb, CIc, DIIa, DIb, EIa	5
6	AIVc, BIVb, BIIIc, CIVa, CIIIb, CIIc, DIIIa, DIIb, DIc, EIIa, EIb	6
7	BIVc, CIVb, CIIIc, DIVa, DIIIb, DIIc, EIIIa, EIIb, EIc	7
8	CIVc, DIVb, DIIIc, EIVa, EIIIb, EIIc	8
9	DIVc, EIVb, EIIIc	9
10	EIVc	10

The inadequacies within each group were then rank-ordered according to accident costs. As a result, the ordered list comprised a "totem pole" of aviation hazards.

8. Integrate Corrective Actions Completed or In Progress to Remedy Specific Hazards. At this point, only the hazard identification stage had been completed. The next step involved the identification of remedial actions for system inadequacies on a case-by-case basis. These prevention actions were obtained from the Army Safety Center aircraft system managers and were integrated with the TEIR and FIRE narrative for each accident case in appendix F.

9. Identify Hazard Prevention Requirements. The final step (item 9) was to analyze the collective nature of the FY 79 aviation hazards and to identify the most pressing *prevention requirements*. The identification of prevention requirements was based on the HSL analysis and the judgment of human factors specialists and the aircraft system managers at the Army Safety Center. This process allows for the incorporation of prevention requirements based on more than statistics alone. It allows for the incorporation of specialty expertise not always available to accident investigators, as well as for knowledge of hazards that transcends that found in an accident report, i.e., state-of-the-art prevention capabilities.

Appendix F

3W Narratives and Remedial Actions Taken or in Progress for FY 79 Army Aircraft Accidents

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
301	P	1 UH-1H pilot on a medevac mission performed inadequate in-flight planning. Contrary to common practice, he accepted a very dusty airstrip as his landing point when suitable grassy areas were nearby. The pickup point was selected by an untrained member of a ground patrol who led the aircraft to the pickup point by flashlight. The pilot was using the searchlight during the night approach and should have been able to identify more suitable landing areas without unnecessary time or effort. He unnecessarily placed the aircraft and crew in a hazardous environment—a night landing in a dust cloud.	6 UH-1H pilot performed a course of action unacceptable in common practice because of inadequate judgment. There were grassy areas nearby (within 100 meters) which the crew could have selected by using the searchlight, but the pilot elected to land in the dust where the patrol member with the flashlight was standing. This patrol member was not trained in LZ selection and there was no urgency about the pickup since the injuries to the patient were not serious (broken/sprained ankle).	6 Aviation safety officer should inform unit aviators of the inherent hazards of operating in dusty PZs and establish procedures within the unit whereby the operating crews can select the landing area when making patient pickups in restrictive or hazardous areas.
		16 UH-1H pilot on a medevac mission improperly performed a course of action required by common practice. He made a shallow, fast approach at night to an area he knew to be very dusty. He was using the searchlight and had it extended 45 degrees down/forward with the landing light retracted and not in use. These conditions led him to become engulfed in the dust cloud before he was prepared to land. Visual contact with the ground was lost while still 10-15 feet in the air. Unable to judge his speed or altitude due to the dust and glare, the pilot lowered the collective abruptly, resulting in a slight left yaw and a very hard landing, right skid first.	12 UH-1H pilot on a medevac mission improperly performed a course of action required by common practice (made shallow fast approach at night to dusty LZ without using landing light, allowing aircraft to be engulfed in dust cloud) because of excessive self-motivation in attempting to maneuver the aircraft as close to the patient as the terrain would allow. As the dust cloud engulfed the aircraft, the pilot abruptly applied downward collective pitch, causing the aircraft to land hard and sustain minor damage.	7 Unit commanders should take positive command action to emphasize to unit aviators the importance of not jeopardizing aircraft and crews for the sake of convenience in loading medevac patients.
		16 (Repeat)	12 (Repeat)	6 Aviation safety officer should inform aviators of the inherent hazards of operating in dusty PZs with emphasis on problems encountered when hovering and establish procedures within the unit whereby aviators do not jeopardize aircraft and crews for the sake of convenience in loading medevac patients.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		16 (Repeat)	12 (Repeat)	3 TRADOC task USAAVNC to provide proper procedure for abnormal/emergency (night/dusty) operations in written form similar to TC 1-28. These guidelines should be such that operational units can employ them by adapting to their particular operational environment.
DA Form 2028 is being evaluated by the proponents of TC 1-13 and FM 1-51 on the subject of normal/emergency procedures in night/dusty operations.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
302	IP	10 TH-55A IP, during a standard autorotation, improperly monitored performance of personnel (Initial Entry Rotary Wing student pilot). He failed to detect, in sufficient time to recover, SP actions which caused an accelerated rate of descent for the deceleration phase of the autorotation. SP inadvertently increased collective while retarding the throttle to override, causing an accelerated rate of descent when the collective was relowered. As a consequence of the IP failing to detect these actions in time for recovery, the helicopter hit the runway tail low and hard. This resulted in the main rotor blades severing the tail boom and deformation of the airframe.	8 TH-55A IP improperly monitored performance of personnel (did not detect an accelerated rate of descent during a standard autorotation) because of overconfidence in others. He considered the SP as the best he had ever instructed in some 1,800 IP flying hours, and had instructed him to perform a standard autorotation as the first maneuver after takeoff.	6 Contractor inform personnel of problems encountered when IPs fail to anticipate unexpected SP actions due to overconfidence. This can be accomplished by flight commanders briefing TH-55 IPs. (NOTE: Has been implemented.)
		(10) (Repeat)	8 (Repeat)	3 USAAVNC (DES) revise procedures for normal (practice of nonstandard maneuvers) operation whereby, during instructional flights, the IP will demonstrate the first nonstandard maneuver. This demonstration will remind the SP of proper procedures and correct sight pictures, and will allow the IP to evaluate prevailing environmental conditions and aircraft characteristics for that maneuver.
	SP	7 TH-55A SP, while performing a standard autorotation during a day dual training flight, made improper flight control actions and did not compensate for an accelerated rate of descent. At 100-200 feet, he properly retarded the throttle to override and inadvertently increased collective. He then relowered the collective and the accelerated rate of descent resulted. The deceleration and initial pitch did not compensate for the more rapid rate of descent and, as a result, the helicopter hit the runway hard enough for the main rotor to sever the tail boom and deform the airframe.	26 TH-55A SP made improper flight control actions (during autorotation inadvertently increased collective while retarding throttle to override, and an accelerated rate of descent resulted upon relowering of collective) because of inadequate supervision by the IP. IP allowed SP to use insufficient deceleration and initial pitch commensurate with the autorotational rate of descent.	6 Contractor inform personnel of problems encountered when IPs fail to improperly monitor flight control actions of SPs during training for autorotations in TH-55 aircraft. Particular attention should be given to inadvertent increases in collective while retarding throttle during the autorotational descent. This can be accomplished by flight commanders briefing TH-55A IPs. (Note: Has been implemented.)

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
302	SP	7 (Repeat)	16 TH-55A SP made improper flight control actions (during autorotation inadvertently increased collective while retarding throttle and override and an accelerated rate of descent resulted upon relowering of collective) because equipment improperly designed for required operation. To complete a practice touchdown autorotation requires that the throttle be retarded to override. The hand action required to place the throttle in override and hold it there against spring tension can lead to inadvertent increase of collective.	18 U.S. Army Safety Center (ASD-LOH) perform study to determine solution to the inadequate design of the TH-55 throttle, i.e., magnitude of problem amongst users and impact of redesign prior to forwarding to DARCOM.
		7 (Repeat)	16 (Repeat)	9 DARCOM provide required equipment or redesign existing equipment to eliminate the need for the TH-55A throttle to be placed and held in override when performing a touchdown autorotation. (NOTE: The throttle rigging as presently incorporated in the Hughes 269C helicopter may offer a viable solution to this system inadequacy.)

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Procedures for practice of nonstandard maneuvers as suggested have been evaluated, and it has been determined that it is not feasible at present.

99 No contributing material failure.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
303	IP	10 UH-1H IP on a day AAPART standardization flight **improperly monitored performance of personnel** (pilot) during the final phase of a standard touchdown autorotation. IP allowed pilot to maintain an excessive nose-high deceleration attitude too close to the ground. As a consequence, the tail skid and tail rotor blades struck the runway, resulting in separation of one blade and the 90-degree gearbox.	5 UH-1H IP improperly monitored performance of personnel (allowed pilot to maintain a nose-high autorotation deceleration attitude too close to the ground) because of **inattention.** He elected to check the aircraft instruments and look at the pilot's face for "any unusual signs of stress" rather than looking outside the cockpit. As a consequence, he did not detect the excessive attitude in sufficient time to initiate corrective action.	6 USAAVNC (DES) **inform personnel (IPs and SIPs) of the problems encountered** regarding improper IP scanning techniques that divert attention from essential visual cues during the deceleration and touchdown phase of autorotation.
		1 UH-1H IP on a day AAPART standardization flight performed **inadequate flight planning before the mission** in that he did not, or have the pilot, compute weight and balance (DD Form 365F) as required by par. 3-6 of TM 55-1520-210-10 and par. 4-1 of AR 95-1. As a consequence, a standard touchdown autorotation was conducted with an aft CG (station 140) in disregard of the caution note on page 7-7, par. 7-11, TM 55-1520-210-10 (when flying at an aft CG (station 140 to 144) terminate an approach at a minimum of a five-foot hover prior to landing to prevent striking the tail on the ground.) Performance of the autorotation resulted in the tail skid and rotor blades striking the ground.	12 UH-1H IP performed inadequate flight planning before a mission (did not compute or have computed a weight and balance form - DD Form 365F) because of **excessive self-motivation.** He neglected to make the weight and balance computation in his desire to complete the flight portion of an annual AAPART standardization flight which had been twice before delayed. Even the decision to fly that day was delayed until noon when the weather indicated improvement for flight in special VFR conditions. This neglect resulted in the failure to realize a CG condition for which a caution note existed on performing tail-low maneuvers.	12 **Unit commanders improve monitoring of personnel** by developing procedures to insure that flight personnel complete all preflight requirements prior to flight (that the weight and balance form (DD Form 365F) is checked and/or completed, and caution, warning, or other limitations/restrictions to flight operations are noted.)

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
303	P	6 UH-1H P, during a day AAPART standardization flight, inaccurately estimated clearance/closure while performing the deceleration and touchdown of a standard autorotation. He considered the initial deceleration attitude as insufficient and increased it. He maintained the nose-high attitude (estimated as 30 degrees) until the tail skid and rotor blades struck the runway and resulted in separation of the 90-degree gearbox and one blade.	6 UH-1H P inaccurately estimated clearance/closure (during standard touchdown autorotation, a nose-high deceleration attitude was maintained until tail skid and rotor blades struck runway) because of inadequate judgment. He maintained the nose-high deceleration attitude too long because he was criticized for insufficient deceleration attitude on his last flight (which was a standardization flight in an OH-58A) and probably overcompensated for the previously noted deficiency. The overcompensation was aggravated by the performance of a nonstandard maneuver in two different aircraft requiring different control movements and procedures and having a different sight picture from the cockpit to adjust speed, depth, and distance.	16 Unit IP/SIP improve monitoring of personnel by insuring that pilots under evaluation do not overcompensate for previously noted deficiencies.
		6 (Repeat)	6 (Repeat)	16 Unit IP/SIP improve monitoring of personnel by insuring that those under instruction/evaluation for nonstandard maneuver in more than one type aircraft receive demonstrations, instructions, and training emphasis prior to the nonstandard maneuver beyond that which is normally provided. This should be particularly important in insuring pilot judgment is not adversely influenced by combinations of factors such as transferring flight task problems from one aircraft to another which has different standard maneuver requirements, procedures, techniques, and cockpit fields of view.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Article on inadequate division of attention during autorotation to be published in FLIGHTFAX.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
304	PIC	1 UH-1H formation commander (acting as copilot and PIC) **inadequately planned flight** (inadequate mission briefing). He did not brief the other aviators in his formation on correct spacing and formation of landing IAW AR 95-1, FM 1-51, and the facility SOP. When he performed an abrupt deceleration during a formation landing and started a right turn into his formation, he did not know the position of the other aircraft. The second aircraft was forced to execute a go-around. The lead aircraft, fearing a midair with the second aircraft, increased his deceleration. The tail rotor struck the ground and failed. The aircraft spun and landed hard.	2 UH-1H formation commander inadequately planned (inadequate mission briefing) a formation flight because of **inadequate unit training.** The facility does not have a training program to establish and maintain proficiency in formation flying techniques and procedures IAW AR 95-1, FM 1-51, and TC 1-135. The formation commander was not familiar with the procedures in these references.	2 Facility commander **upgrade unit training** to establish and maintain a formation flying training program that emphasizes flying techniques and procedures in FM 1-51.
		7 UH-1H pilot-in-command of lead aircraft (acting as copilot and formation commander) in a formation flight of three aircraft **performed an improper flight control action** not IAW FM 1-51 when he made an abrupt deceleration and started a right turn during a formation landing. As a result, the second aircraft in formation was forced to execute a go-around. The lead aircraft PIC, fearing a midair, increased his deceleration and the tail rotor struck the ground. The tail rotor failed and the aircraft spun and landed hard.	2 UH-1H PIC of lead aircraft (acting as copilot and formation commander) performed an improper flight control action during a formation landing because of **inadequate unit training.** The Army aviation flight activity does not have a training program to establish and maintain proficiency in formation flying techniques for those aviators who are not receiving formation training from their unit IAW AR 95-1, FM 1-51, and TC 1-135. The formation commander (PIC lead, UH-1H) was not familiar with correct spacing in formation or command and control procedures for formation flying.	2 Facility commander **upgrade unit training** to establish and maintain a formation flying training program that emphasizes flying techniques and procedures in FM 1-51.
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS			
	No actions other than unit level/higher command.	99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
305		30 AH-1S, on a training mission with allied forces, had a hydraulic system flight control malfunction (cyclic servo cylinder bearing (P/N 204-76-168-1) side loaded and bound/locked up). While hovering to a forward area refueling point, the pilot applied aft cyclic to arrest forward movement. The aircraft began to move rearward as attempts to center the cyclic yielded negative results. Increased collective was applied to assure clearance between the tail skid and the ground. As the aircraft gained rearward speed and altitude, the pilot elected to land immediately. The aircraft struck the ground in a near-level attitude, sustaining major damage to the skids, cross tubes, wing stores, and fuselage underside.	18 AH-1S had a hydraulic system flight control malfunction. The malfunction occurred because of inadequately performed unit maintenance. The cyclic servo cylinder bearing side loaded and bound/locked up due to improper application of torque to the bearing housing nut. Sufficient torque, as prescribed by TM 55-1520-234-20, par. 7-11, was not applied to bearing housing nut (P/N 204-076-202-7, as illustrated in TM 55-1520-234-23P, pg. 493) at an undetermined time. As a result, the aircraft sustained major damage.	13 Unit maintenance officer improve monitoring of personnel and unit activities to assure servo cylinder installation/inspection is accomplished in accordance with appropriate maintenance directives.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No action to date has been taken to determine why a significant number of mishap reports prepared by field investigation boards contain insufficient information to determine remedial action.		3 AH-1S on a training mission had a hydraulic system flight control failure caused by aircraft mechanic inadequately performing unit maintenance (improper application of torque to bearing housing nut). As a result, the cyclic servo cylinder locked up, and the hydraulic system flight controls failed. The aircraft struck the ground in a near-level attitude, causing major aircraft damage.	0 Insufficient information was available in the accident report prepared by an accident investigation board selected from field units to determine why unit maintenance was performed inadequately, i.e., inadequate school training of maintenance personnel, inadequate written guidelines, inadequate equipment.	18 USASC perform studies/research to determine why this accident and many others contain insufficient information, i.e., selection of untrained or insufficiently trained investigators, selection of accident board members with inadequate experience, or information not available/obtainable.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
308	SP	9 TH-55A student pilot on his first supervised solo training flight performed an improper flight control action. During final approach for his second landing, he had difficulty maintaining proper rpm control because of improper throttle/collective coordination. The antioverspeed device frequently retarded the rpm from 3025 to 2800, causing the aircraft to yaw a number of times. At approximately 40' agl, the aircraft stopped its forward flight and began drifting rearward and to the right as it descended. As a result, the aircraft impacted the ground on the right skid, causing major damage.	5 TH-55 student pilot performed an improper flight control action (overcontrolled throttle/collective coordination) because of inattention. During the supervised solo flight, the student pilot became distracted from flying the aircraft and concentrated heavily on rpm control. This situation was compounded by his belief that the antioverspeed device was not functioning properly although his IP did announce and demonstrate in all phases of flight that it was functioning properly. Consequently, the SP became so involved in the rpm that he failed to maintain control of the aircraft.	1 USAAVNS upgrade school training requiring TH-55 instructor pilots to emphasize to all student pilots the need for complete familiarization of all aircraft systems as a prerequisite for accurate and timely analysis of real or suspected malfunctions and subsequent application of necessary corrective action.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Action to upgrade school training has been taken by USAAVNC.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
307	P	16 OH-58A pilot on a visual reconnaissance mission failed to perform two courses of action that are required by TC 1-137, task #2003, page 6-25 (clear aircraft and maintain appropriate hover altitude ± 1 foot). As a result the tail rotor struck a portion of a target vehicle, causing separation of the tail rotor and 90-degree gearbox, and major damage to the vertical stabilizer.	5 OH-58A pilot failed to perform two required courses of action as specified in TC 1-137 (failure to clear aircraft and maintain appropriate altitude). He improperly divided his attention between locating targets and controlling his aircraft. After conducting a higher recon, the aircraft was landed on a road to perform a visual recon from inside the aircraft. The observer requested a 30° right turn. The pilot attempted a right pedal turn with the skids touching the ground. Because the pilot's attention was divided between aircraft control and maximum service to the observer, he failed to see and avoid an obstruction within the aircraft's area of operation.	6 Inform personnel of problems encountered and remedies via meetings and publications to provide guidance to pilots involved in aerial reconnaissance missions so they understand that their primary duty is aircraft control (including terrain and obstacle clearance). This can be implemented through the medium of safety meetings and FLIGHTFAX.
		99 No contributing material failure.		
308		Event not recorded as Army aircraft mishap.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
309		Event not recorded as Army aircraft mishap.		
310		23 UH-1M, on a night additional flight training period (AFTP), was entering an airport traffic pattern when the engine failed (accessory drive carrier gear shaft, P/N 1-070-140-1, sheared). At approximately 90 KIAS and 1000' agl, the engine suddenly stopped. The aircraft was autorotated to a field and sustained minor damage to the tail rotor drive shaft and coupling, main rotor blades, and tail boom.	16 UH-1M engine failed because the accessory drive carrier gear shaft sheared through fatigue mechanisms due to improper design for required operation. Teardown analysis revealed the shaft (P/N 1-070-140-1, as depicted in TM 55-2840-229-23P, pg. 123) failed through fatigue mechanisms. Normal operating loads acting upon manufactured sharp edges created stress risers in the groove which holds the retaining ring.	18 TSARCOM engineering personnel perform research to determine a solution to the accessory drive carrier gear shaft design inadequacy. Review of the use of a sharp-edged cut in the retaining ring groove is indicated. A radiused edge would most likely eliminate the type failure encountered.
	CORRECTIVE ACTIONS COMPELTED OR IN PROGRESS	98 No contributing human error.		
	TSARCOM initiated, per letter dated 8 Feb 89, a Class II change to engineering drawing to add ring groove radius criteria. All gears will be magnetic particle inspected at overhaul.			

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
311		23 UH-1H in support of an ARTEP mission experienced failure of T53-L-13B power plant at 400 feet msl (200 feet agl) and 95 knots in straight and level flight. Maneuvering the aircraft to an emergency landing site, the pilot applied incorrect emergency flight control techniques, and the aircraft hit the ground hard.	0 UH-1H experienced failure of T53-L-13B power plant because of unknown/ insufficient information. The aircraft accident investigation board, selected from field units, is believed to have incorrectly submitted the engine for teardown analysis in that the engine was shipped under some label, such as "Aircraft Accident Damage" vice "Aircraft Accident Investigation Exhibit." As a result, CCAD rebuilt and released the engine without a teardown analysis and the aircraft accident investigation report was never closed out. NOTE: USASC identified the above problem (Jan 80) and requested a search of the engine (SN LE21006) historical records to determine if it was possible to still identify the cause for engine failure. Information received telephonically was sufficient to establish the cause of engine failure and is written as system inadequacy No. 16 (inadequate design of component).	6 USASC inform personnel of problems encountered and remedies via publications, such as FLIGHTFAX, on the proper packaging and labeling of aircraft accident investigation exhibits submitted for teardown analysis to determine the cause of failure.
		23 (Repeat)	16 UH-1H experienced failure of T53-L-13B power plant (first-stage gas producer turbine rotor, P/N 1-100-880-01) because of inadequate design of component. Design of turbine rotor blade base for P/N 1-100-880-01 was such that a buildup of dirt at the blade base could occur. This buildup caused misalignment (described as warpage) of the blade position, eventually resulting in blade-casing contact and turbine failure.	9 DARCOM redesign existing equipment (first-stage gas producer turbine rotor) to prevent the buildup of dirt at the base of the rotor blade (P/N 1-100-880-01). NOTE: This inadequate design was identified and a modification to the turbine rotor blade instigated on 8 Mar 73 as MWO 55-2840-229-50/1. Modification was to be accomplished during overhaul/rebuild of the engine and the turbine rotor was to be renumbered as P/N 1-100-880-90.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
311		23 (Repeat)	30 UH-1H experienced failure of T53-L-13B power plant (first stage gas producer turbine rotor, P/N 1-100-880-01) because **quality control was performed inadequately.** A material design deficiency was known and installed on this aircraft, but quality control procedures were not established to monitor and ensure that this design deficiency did not cause an engine failure. On 8 Mar 73, MWO 55-2840-229-50/1 was issued to correct the problem of dirt buildup on the turbine rotor blades and was renumbered as P/N 1-100-880-09. The modification was to be accomplished during overhaul; however, this engine (SN LE21006) completed overhaul at AVCO Lycoming on 29 May 73 with the old blades (P/N 1-100-880-01) installed because the newly designed blades were not available. This engine was allowed to operate for 7 years without a monitoring program until failure at 1686.5 hours.	18 DARCOM (TSARCOM) **perform studies/research to determine solution** to why the quality control system allows a known material deficiency to be installed on an aircraft and operate without a monitoring program or effort to ensure that the deficiency does not cause failure of the material system.
		23 (Repeat)	30 (Repeat)	19 DARCOM (TSARCOM) **improve quality control** of T53-L-13B power plants in which a known design deficiency (first-stage gas producer turbine rotor, P/N 1-100-880-01) was installed by identifying and establishing a program to ensure that those identified engines do not fail because of the known design deficiency.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
311	PIC	16 UH-1H pilot on an ARTEP support service mission, in response to an engine failure, **improperly performed a course of action required by par. 4-2b and 4-5 of TM 55-1520-210-10, dtd 25 Aug 71,** in that he did not lower collective and establish an autorotative glide. (He attempted to stretch the glide.) This resulted in a dissipating rotor rpm throughout the emergency descent. The pilot arrived over the touchdown area with insufficient rotor energy to control the rate of descent, and the aircraft landed hard. NOTE: The reviewing official lauded the pilot's action of not reducing collective; however, analysis of the board concluded that the touchdown area was within range for a normal autorotation as evidenced by the aircraft touching down in the far end of the zone.	0 UH-1H pilot improperly performed a course of action required by TM (attempted to achieve reduced rate of descent during engine-out condition by not lowering collective) because of **unknown or insufficient** information. The report, prepared by an accident investigation board selected from field units, did not provide sufficient information to determine why the pilot employed a technique which is not sanctioned for autorotations. This technique was discussed in: (1) U.S. Army Aviation Systems Test Activity final report, **Investigation of Engine Rigging, Airspeed, and Rotor RPM Effects on Steady State Autorotation Performance** (USAASTA Project No. 70-23, dated December 1970), and stated that, "The use of a low rotor rpm technique to achieve reduced rates of descent or longer glide distances in autorotation is valid only under a limited set of conditions and should be avoided by the average pilot"; and (2) USAASTA Project 68-04, dated April 1968, **Special Study of Autorotation Procedures,** said, "A maximum glide technique that utilizes low rotor rpm, especially at high gross weights, can be misleading in that the rate of descent may increase, glide distance decrease, and rotor energy will be less than that required to control the rate of descent at termination of this autorotation." NOTE: Par. 9-15 of TM 55-1520-210-10, dated 18 May 79 (operators manual), specifically addresses the inadvisability of collective application to reduce rotor rpm for extended glide distance.	18 USASC **perform studies/research to determine** why this accident report and others contain insufficient information, i.e., selection of untrained or insufficiently trained investigators as board members, selection of board members with insufficient experience, lack of an automatic in-flight data recorder, or information not available/obtainable.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
311	PIC	16 (Repeat)	0 (Repeat)	11 TRADOC (USAAVNC-DES) **Improve monitoring of personnel** to ensure that the Army helicopter community does not propagate the technique of reducing rotor rpm to achieve reduced rates of descent or longer glide distances in autorotation. This could be accomplished during standardization evaluation flights.
		16 (Repeat)	0 (Repeat)	6 USASC **Inform personnel of problems encountered and remedies via aviation/standardization meetings and publications.** Stress that the technique of reducing rotor rpm to achieve reduced rates of descent or longer glide distances in autorotation is valid only under a limited set of conditions and should be avoided by the average pilot, i.e., someone other than an experimental test pilot.
312		Event not recorded as Army aircraft mishap.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Article on proper submission of exhibits for teardown analysis is scheduled for publication in FLIGHTFAX.

Inadequate design of turbine rotor blade was identified and remedied through MWO 55-2840-229-50/1 on 8 March 1973. Modification of turbine rotor blade is accomplished during overhaul/rebuild of engine. The turbine rotor blade was renumbered as P/N 1-168-800-00.

USASC is coordinating with TSARCOM to determine why the modification program allows a known material deficiency to be installed on an aircraft without adequate monitoring.

USASC has initiated action by requesting TSARCOM to establish a monitoring system on engines which have not had MWO 55-2840-229-50/1 applied.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
313		27 AH-1G on a ferry flight experienced a failure of the 90-degree gearbox attaching mechanism. The aircraft was in straight and level flight at 700 feet agl, 135 knots, when the 90-degree gearbox attaching bolts failed (broke), allowing the gearbox to separate from the aircraft. The aircraft entered the trees and rolled inverted, sustaining major damage.	18 AH-1G experienced a 90° gearbox attaching mechanism failure because the gearbox was improperly installed by the depot during depot level maintenance repair. During the repair, the mounting holes were bored oversize and sleeved back to size. The steel sleeves installed appear to be approximately .003" too long. When the gearbox was installed it was not rotated counterclockwise against the mount, plus the too-long steel sleeves contacted the aluminum washers and the aluminum input quill. The bolts were then torqued with the aluminum washers bearing against the steel sleeves (not against the mount) and the studs floating in the mount (not clocked against the holes). Through normal vibration and additional vibrations from a loose long silent chain, the sleeves chafed the aluminum washers and the gearbox studs worked against the mount holes. This allowed the mounting bolts to lose their torque and in turn created more vibrations which led to the ultimate failure.	19 **CCAD improve quality control at depot level installation** to insure proper maintenance procedures.
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS			
	DA Form 2028 submitted to TSARCOM for better guidelines for security inspection of gearbox.	27 (Repeat)	18 (Repeat)	3 **TSARCOM revise TM 55-1520-221-20** to require a check of the torque of the tail rotor gearbox attaching bolt during every phase inspection or PE and after first flight following any 90-degree gearbox installation.
	TSARCOM issued maintenance advisory message 291741Z Nov 78, subject: Maintenance Advisory Message Concerning AH-1G, AH-1S(MOD), and AH-1S (PROD) Tail Rotor Gearbox Installation (AH-1-78-18).	27 (Repeat)	18 (Repeat)	6 **TSARCOM issue a safety-of-flight message** requiring one-time inspection of the 90° gearbox and tail rotor mounting points for evidence of loss of torque on the studs and to insure bushings used are of the correct length for the mount. Any black residue (fretting corrosion products) around the washers and between the parting surfaces of the input quill and 90° gearbox is evidence of loss of torque.
	Article published in FLIGHTFAX, Vol 7, No. 14, 24 Jan 79, titled "One more for Murphy."	98 No contributing human error.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
314	RSP	7 UH-1M rated student pilot (RSP) on an RWQC evaluation ride made **improper flight control actions.** During a standard autorotation, the RSP increased collective early (above 15 feet) in violation of TC 1-136, task number 4002. The rate of collective application was slow and was not detected by the IP (see IP task error). As a result, there was insufficient rpm to maintain directional control and the aircraft touched down with approximately 40 degrees left yaw and rolled on its side.	2 RSP made improper flight control actions (increased collective early during a standard autorotation) because of **inadequate unit training.** Although the RSP met flight time requirements, his poor performance during the oral and flying evaluation indicates he was not prepared for the flight evaluation.	2 **Upgrade training** to add more emphasis on standard autorotation pitch-pull application.
	IP	10 UH-1M IP on an RWQC evaluation ride **improperly monitored the performance of an RSP** as required by common practice. During a standard autorotation, the IP failed to "guard" the collective to detect the RSP increasing collective early. As a result, the IP was unaware the RSP had increased collective early. When the IP did become aware of a problem and took the controls, there was insufficient rotor rpm to maintain directional control. The aircraft touched down with approximately 40° left yaw and rolled on its right side.	1 UH-1M IP improperly monitored the performance of an RSP (failed to "guard" the collective) because of **inadequate school training.** IP school training does not teach IPs how to properly monitor the control inputs of a student.	1 TRADOC (USAAVNC) **upgrade school training** (IPQC) to teach prospective IPs how to properly monitor the flight controls. When visual capability simulators become available, they could be used to enhance this training.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USAAVNC Flight Training Supplement to TC 1-135 changed to include comprehensive information on proper monitoring by IP of SP flight control actions. The information is applied to academic and flight line instruction.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
315		0 Insufficient information to perform materiel failure or human error analysis. IP was transitioning an RSP into the JOH-58C. During a practice autorotation, the RSP flared a little high and the IP came on the controls when the RSP lost sight of the intended touchdown area due to the wide instrument glare shield in the "C" model. In the words of the IP, "Touchdown was harder than preferred but not abnormal." The IP felt the aircraft shudder on touchdown when the tail boom buckled; however, he states the rotor rpm was within the safe operating range as specified by TM 55-1520-235-10 and subsequent inspection found no evidence of "tranemission spike knocks" or "pylon whirl" normally associated with low rpm autorotations. The accident investigation board found the cause to be suspected design error which permitted the tail boom to fail in a "vibratory resonant mode" during normal operating conditions as specified in the operators manual. After this accident, tests were conducted by the manufacturer under TSARCOM supervision and no design deficiencies were found to support the findings of the accident board. Additionally, no other mishaps of this nature have been reported previously or in the six months following this accident. The most probable cause(s) of this accident is (are): a. Rotor rpm during autorotative touchdown below the safe operating range specified in the operators manual and below that reported by the IP, and/or b. A materiel defect or preexisting damage to the tail boom that resulted in a structural strength below that required for normal operations and aircraft design specifications.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
316	IP	6 UH-1H IP demonstrating an NOE quick stop/deceleration over downsloping terrain **inaccurately estimated clearance/ closure** of tail rotor to ground contrary to standard 2, task 5007, TC 1-135. As a result, the tail rotor blades struck the ground, causing major damage to the aircraft.	6 IP inaccurately estimated clearance/ closure (failed to maintain tail rotor clear of ground) because of **inadequate judgment.** Although terrain over which quick stop/deceleration was performed sloped downward, IP misjudged extent this factor affected tail rotor clearance and he failed to modify the deceleration phase of maneuver as required.	2 Unit commander **upgrade unit training** to insure readiness/capability of unit IPs to perform job assigned. To implement remedy, the judgmental factors & techniques appropriate for maintaining tail rotor clearance during conduct of quick stops/ decelerations over uneven terrain should be evaluated and emphasized as a matter of special interest during IP standardization rides.
		6 (Repeat)	6 (Repeat)	6 Aviation safety officer **inform** assigned aviator **personnel** of the highlights of this accident and lessons to be learned via next scheduled unit aviation safety meeting.
		6 (Repeat)	6 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning inadequate judgment **via FLIGHTFAX and/or AVIATION DIGEST.**
		6 (Repeat)	3 IP inaccurately estimated clearance/ closure (failed to maintain tail rotor clear of ground) because of **inadequate recent experience.** As one of three unit UH-1 IPs responsible for training needs of only 10 UH-1 aviators, he was tasked too infrequently to maintain a high level of proficiency in conducting NOE training, e.g., he had not demonstrated a quick stop/deceleration for a period of 3 months prior to the date of the accident.	7 Commander take **positive command action** to establish a UH-1 IP/aviator ratio more compatible with workload. To implement remedy, the current number of personnel maintaining UH-1 IP status in the unit should be reduced to one.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		6 (Repeat)	3 (Repeat)	11 Aviation standardization officer **improve monitoring** of the apportionment of SIP/IP resources throughout command to detect and correct inequities in instructor pilot utilization. To implement remedy, the staff supervision authority and accompanying duties of the aviation standardization officer prescribed by par. 6-7, AR 95-1, should be exercised as necessary.
***Article published in* FLIGHTFAX, Vol. 8, No. 8, 21 Nov 79, "Keep That Tail Up." The article illustrates proper procedures for NOE decelerations and results of improper control inputs.**		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
317		23 OH-58A, during a confined area takeoff, experienced total power plant (turbine engine) failure at approximately 40' agl and 15 kts. This failure was caused by fatigue failure of the gear, cluster spur, P/N 6854149. The pilot was unable to successfully autorotate from this phase of the takeoff and the aircraft impacted in a small ditch in a vertical, level descent attitude with no forward, sideward, or rearward movement, resulting in total loss.	16 OH-58A experienced a power failure because of inadequate design of the gear cluster spur, P/N 6854149. The gear did not have sufficient strength or adequate meshing and the vibration level was too high. As a result, there was a fatigue failure of the gear. Laboratory analysis revealed the gear failed through fatigue mechanisms. However, the primary cause for fatigue failure could not be determined due to the extensive mechanical damage incurred during failure.	9 TSARCOM institute a policy to replace, during normal attrition, all OH-58A T63-A-700 engines with T63-A-720 engines. The newer engine incorporates modifications which increase the strength of the failed gear, improve gear meshing, and reduce vibration.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		98 No contributing human error.		
There are 685 OH-58A models being converted to C models. The C model is powered by the T63-A-720. Based on the number of A-700 engines in the inventory, and considering the Army's overhaul capability, a changeout to A-720 engines by normal attrition appears several years away. The Safety Center has encouraged the user community in the past to initiate a product improvement to replace all T63-A-700s with T63-A-720 engines.				
TSARCOM is presently analyzing the equipment and procedures used to check engine vibrations. The Chadwick Helmuth Vibrex, presently used to track rotor blades, has the capability to monitor engine vibrations if the wiring harness and sensors are made available. The use of the Vibrex to check engine vibrations and the possibility of establishing a scheduled preventive maintenance vibration test, perhaps every 300 hours, is now under consideration by TSARCOM.				

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
318		38 UH-1H on a low-level navigation mission experienced a **fuel warning system (right fuel flow switch) malfunction.** While UH-1 was at 90 knots and less than 80 feet agl in diving descending flight down the side of a hill, the right fuel boost segment light and master caution light illuminated, even though the boost pump system was still working properly. The light illuminated because the flow switch (P/N 204-060-654-1) became blocked by some foreign objects, causing an increase in line pressure. This diverted the pilot's and copilot's attention into the cockpit, which caused them to not see wires which the aircraft hit, sustaining total loss damage.	16 UH-1H experienced a fuel warning system malfunction (right fuel flow switch, P/N 204-060-654-1) because of **inadequate design.** The segment warning light told the pilot he had a failure of the right fuel boost pump but, in fact, the pump and the system were still functioning normally. The pilot diverted his attention to this light and failed to detect wires in the flight path.	9 **DARCOM redesign the fuel boost warning system** to give a warning only when the pump has actually failed. A malfunction of any other component within this system which does not render the system inoperative should not be indicated in the cockpit.
13	P **CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS** **Article published in FLIGHTFAX, Vol. 7, No. 18, 21 Feb 1979, "Wire Strike Kills Four." Article summarizes the mishap, its causes, system inadequacies, and remedial measures.** **TSARCOM evaluated the fuel boost warning system and found design to be inadequate (per TSARCOM letter dated 8 Feb 1980).**	5 UH-1H pilot on a terrain flight navigation training mission **improperly divided his attention** in violation of common practice. During a descending flight down the side of a hill, the right fuel boost segment light and the master caution light illuminated, causing the pilot to concentrate his attention inside the aircraft rather than outside. In so doing, neither the pilot nor the copilot was looking outside the aircraft. (The copilot was reading a map and was not looking outside either.) As a result, the crew did not observe wires in their flight path in time to avoid them. The aircraft struck the wires and crashed, causing total loss damage.	4 UH-1H pilot improperly divided his attention (diverted his vision inside the cockpit to the master caution light when he should have been looking outside) because of **inadequate composure.** The pilot's apprehension of an impending failure indicated by the master caution light resulted in a momentary diversion of his concentration.	6 **USASC inform personnel of problems encountered and remedies.** Safety meetings held for pilots should emphasize the need for the pilot to ensure terrain and obstacle clearance at all times. In-cockpit duties should be handled by the copilot.
		5 (Repeat)	4 (Repeat)	3 ***USAREUR revise current doctrine of unlimited "terrain flight" in Germany.*** Terrain flight as defined in TM 1-1 includes low level, contour, and NOE flight. Low level and NOE are acceptable; however, contour flight (constant airspeed and varying altitudes) leads to high-speed flight at low altitude, thus unnecessary exposure to wire hazards.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
319	IP	15 UH-1H IP on a service mission (passenger standby) performed a course of action prohibited by common practice. The IP attempted to park his aircraft very close, much closer than was necessary, to another running UH-1H. As a result, he inaccurately estimated the clearance and the main rotor blades of the two aircraft were overlapping. It is not possible to estimate such clearance with a high degree of accuracy because of human psyiological limitations. The blades overlapped at first without touching due to the left cyclic inputs by both pilots. Before the IP could move clear of the other aircraft, the blades meshed, resulting in major damage.	12 UH-1H IP performed a prohibited course of action (parked too close to another aircraft) because of excessive self-motivation. The IP was overly concerned about creating a good impression of Army aviators by not taking up much space and adding to the congested parking situation on the airport.	6 Unit commander should inform personnel of the hazards of allowing their good intentions to be carried too far and interfere with sound operating practices.
		15 (Repeat)	19 UH-1H IP performed a prohibited course of action (parked too close to another aircraft) because of inadequate written procedures. There is no written guidance available to crewmembers on parking clearance or maneuver clearance requirements.	3 TRADOC (USAAVNC) revise procedures in FM 1-105 and/or TC 1-135 to give guidance on parking and maneuver clearance requirements.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
319	CE	16 UH-1H crew chief **failed to perform a course of action required** by FM 55-67N, task 551-67N-1708, page 3-23. The crew chief, performing taxi direction task, did not select a parking position with a minimum of 75 feet clearance between the center line of his aircraft and any obstruction. As a result, the aircraft parked in a position where adequate main rotor clearance did not exist. Major damage resulted when the blades meshed with the rotor blade of the aircraft parked next to it.	2 UH-1H crew chief failed to perform a required course of action (insure 75 feet clearance when performing aircraft taxi direction duties) because of **inadequate unit training.** The crew chief had not received any unit training on performing aircraft taxi direction duties, task 551-67N-1708, FM 55-67N, dated 20 Mar 78, and he was unaware of the existence of written guidance on the task.	2 TRADOC (USAAVNC) **provide unit training** material to aviation units so they can establish unit training programs for crew chiefs. This training should include all those tasks in FM 55-67N.
		5 UH-1H crew chief on a service mission (PAX standby) **improperly divided attention** in violation of common procedures. While performing aircraft taxi direction duties, he fixed his attention on tail rotor clearance at the expense of checking for main rotor clearance. He did not realize until after the aircraft was parked that its main rotor blades were overlapped by the blades of the running aircraft parked next to it. As a result, the two aircraft meshed main rotor blades, causing major damage.	2 UH-1H crew chief improperly divided attention (fixed his attention on part of the aircraft) because of **inadequate unit training.** The only training the crew chief had on taxi direction duties was in school, and this involved only learning hand signals. He had not received instruction at unit level and had almost no experience in this task. Had he received this instruction, it is felt he would have been more aware of main rotor clearance and, therefore, not have made the error.	2 TRADOC (USAAVNC) **provide unit training** material to aviation units so they can establish unit training programs for crew chiefs. This training should include all those additional tasks an aircraft mechanic needs to know in order to function as a crewmember.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USASC is coordinating with TRADOC (USAAVNC) to determine the need for unit training material for crew chiefs.

USASC is evaluating publications which contain parking and maneuver clearance requirements and the need to publish these procedures in aviator manuals, i.e., FM 1-165 and TC 1-135.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
320	IP	10 UH-1H IP improperly monitored the performance of personnel. During the student pilot's (SP's) termination of an approach using simulated hydraulic power failure procedures, the SP allowed the aircraft to loss translational lift and drift to the side of the runway. The IP failed to take corrective action in sufficient time to prevent loss of aircraft control. Both main and tail rotor blades struck the runway and the aircraft came to rest on its right side with total loss damage.	7 The IP improperly monitored performance of the student pilot because of overconfidence in himself. During the approach sequence, he recognized the SP's mistakes and, as the approach continued, critiqued him IAW the USAAVNC Flight Training Guide on both the loss of translational lift and the aircraft drifting away from the runway center line. Even though he considered the SP below average in flying skills, he "perceived no danger" and delayed taking control of the aircraft. In an attempt to comply with the IP's instructions to return to the center of the runway, the SP lost control of the aircraft. The IP came on the controls but was unable to recover prior to ground contact. The aircraft sustained total loss damage.	2 USAAVNC upgrade/provide additional unit training to the IPs with emphasis on each IP recognizing his own abilities and limitations. Each IP must then use these as a basis for establishing predetermined limits beyond which he will not allow a student to proceed before initiating corrective action and/or taking control of the aircraft.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

8 No actions other than unit level/higher command.

99 No contributing material failure.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
321		0 Insufficient information to perform TEIR or FIRE analysis. UH-1H on a day training mission during APU starting procedures experienced an electrical system failure. At starter switch release point in the starting sequence the crew chief told the pilots smoke was coming from the engine compartment. The crew shut the engine down. The crew chief emptied the aircraft fire extinguisher on the fire and then used a 50-pound ground CO_2 extinguisher to completely extinguish the fire. Teardown and analysis of the starter/generator found it to be functioning properly. The cable was not shipped to the laboratory and the cause of the short circuit was not determined. It is also not known why the investigators from a field unit failed to submit the starter/generator cable for analysis. NOTE: Mishap occurred on 8 November 1978. Mishap classified as accident on 17 November 1978. Investigation commenced on 20 November 1978. Investigator did not submit starter/generator cable for TDA for unknown reasons.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
322	P	14 UH-1H pilot on a unit training mission **authorized a course of action prohibited by common practice.** The pilot instructed his copilot to reposition the aircraft to a refueling point where he knew adequate rotor clearance did not exist between his aircraft and another aircraft that was shut down. As a result, the aircraft meshed rotor blades when the crew chief of the shutdown aircraft rotated his blades in preparation for runup.	17 UH-1H pilot authorized a prohibited course of action (parking aircraft with inadequate rotor clearance) because of **inadequate airfield facilities.** The refueling system was laid out with 50 feet separation between points 3 and 4. FM 10-68, par. 7-15, recommends 100 feet separation, but the minimum is 75 feet between temporary and semipermanent AH-1 and UH-1 refueling points. The FARE system layout also recommends 100 feet separation with 80 feet being the minimum (FM 10-68, par. 7-4 and 7-6).	11 **Higher command improve monitoring of unit activities.** This could be implemented by establishing a procedure for inspecting aircraft refueling systems before use during field exercises.
		14 (Repeat)	12 UH-1H pilot authorized a prohibited course of action (parking aircraft with inadequate rotor clearance) because of **inadequate motivation (haste).** The pilot was attempting to save time at the expense of good operating procedures.	6 Unit commander **inform personnel** of the hazards of taking shortcuts to save time. This could be accomplished in a unit safety meeting.
		14 (Repeat)	12 (Repeat)	3 **Revise procedures for normal operation** in FM 1-105. FM 1-105 should be revised to include specific guidance on parking clearance between aircraft and between aircraft and obstacles.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
322	CE	15 UH-1H crew chief on a unit training mission **performed a course of action prohibited by common practice.** The crew chief untied and rotated the main rotor blade without looking to see if there was adequate clearance with the aircraft running on the next refueling point. As a result, he did not know there was insufficient clearance, and the blades meshed when he rotated the blade on his aircraft.	26 UH-1H crew chief performed a prohibited course of action (rotated blade without checking clearance) because of **inadequate supervision by the pilot-in-command (PIC).** The PIC knew that adequate rotor clearance did not exist, and he assumed the crew chief was also aware of this fact. Considering the low experience of the crew chief, the PIC should have provided more positive supervision of the crew chief.	17 **Improve monitoring of personnel** (crew chief) by pilot in charge of aircraft. This could be implemented by unit commanders insuring all PICs are aware of their responsibility to supervise the actions of crewmembers during a mission.
	FTS	14 Fuel team supervisor (FTS) **authorized a course of action prohibited by FM 10-68,** par. 7-4, 7-6, or 7-15. He supervised installation of a refueling system with only 50 feet clearance between points. The recommended distance is 100 feet with 75 feet or 80 feet minimum depending on the type system established. As a result, there was inadequate clearance to permit two UH-1s to operate on points 3 and 4 and a blade strike resulted.	2 Fuel team supervisor authorized a prohibited course of action (improper installation of a fuel system) because of **inadequate unit training.** Neither the supervisor nor any of his personnel were familiar with the required clearances between refueling points IAW FM 10-68. The unit did not have a training program to insure personnel remained current and could perform job tasks correctly.	2 Unit commander **provide a unit training** program to insure personnel know how to perform their job tasks correctly. Commander should establish a program that will expose personnel to the current technical aspects of their duties on a frequent, recurring basis.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

DA Form 2028 is being evaluated by the proponent of FM 1-165 on the subject of clearance between aircraft in refueling areas.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
323	P	6 UH-1H pilot on a day, VMC flight test for an additional Airline Transport Pilot Type Rating (VFR only) **inaccurately estimated** clearance during the termination of a precision autorotation. During the final portion of the decelerative flare, he misjudged his altitude, resulting in inadequate clearance between the aircraft tail rotor and the ground. The tail rotor hit the ground, causing the 90° gearbox to separate and subsequent tail boom damage.	3 UH-1H pilot inaccurately estimated clearance (misjudged altitude, allowing tail rotor to strike ground) because of **inadequate experience.** Although he had an airline transport pilot rating and more than 5,000 hours of flight time, both were in large twin-engine helicopters in which touchdown autorotations are not performed. In light single-engine helicopters, the pilot had less than seven hours of training involving touchdown autorotations.	5 Contracting officer's representative **insure personnel are capable of performing job assigned** by directing the contractor to give the pilot additional autorotational training until he attains the proficiency necessary to meet the standards of FAA Advisory Circular 61-82, Flight Test Guide Airline Transport Pilot, Rotorcraft Helicopter.
		6 (Repeat)	3 (Repeat)	18 Contracting officer's representative coordinate with appropriate agencies to **perform studies** to determine the adequacy of current hiring procedures which allow the selection and approval of pilot candidates who are not qualified in the aircraft they are employed to fly.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

8 No actions other than unit level/higher command.

99 No contributing materiel failure.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
324		13 TH-55A experienced a failure of the engine (No. 4 piston, P/N 75089). The aircraft was on downwind at 700 feet agl and 60 knots airspeed when the rpm increased from 2700 to 2900. The aircraft immediately began to experience momentary power fluctuations that terminated with the engine stopping completely. The aircraft was autorotated into the trees. The aircraft entered the trees at a near-level attitude, with little or no forward airspeed and minimum rotor rpm. It pitched nose down and crashed in a near-vertical, inverted position. The tail boom and main rotor blades separated from the aircraft as a result of tree and ground impact.	0 The No. 4 piston failed through stress corrosion mechanisms. It is unknown why this defect occurred in the piston.	18 USAAVNC perform a study of TH-55A engine piston failures and a search of maintenance overhaul repair records to determine if a trend is developing.
		13 (Repeat)	0 (Repeat)	18 USASC perform a study (computer) of all TH-55A engine failures to determine if a trend is present.
		13 (Repeat)	0 (Repeat)	18 TSARCOM perform a search of TH-55A engine repair records on failed or defective pistons to determine if a trend is present.
		13 (Repeat)	0 (Repeat)	18 DARCOM investigate the causes of stress corrosion to determine if these occur due to manufacturing procedures or operating environmental factors.
		96 No contributing human error.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

A USASC mishap data analysis revealed that there has never been another mishap attributed to the failure of the piston (P/N 75089).

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
325	IP	6 UH-1H instructor pilot conducting night transition training at an approved stage field **inaccurately estimated clearance/closure** with the ground while attempting to make a right hovering pedal turn around the tail rotor of the aircraft. As a result, the right skid hit the ground. The IP increased collective and applied left lateral cyclic to regain ground clearance. The inertia produced by the right downward drift of the aircraft resulted in an excessive roll to the right (dynamic rollover). The main rotor blades struck the ground, causing main rotor disintegration and mast separation. The fuselage impacted on the right side and continued to roll to the inverted position.	5 UH-1H IP inaccurately estimated aircraft clearance and closure to the ground while attempting a hovering right pedal turn about the tail rotor due to **inadequate attention.** The IP's attention was unduly channelized on a moving refueling truck (at night) in an attempt to determine whether to hover to the refueling area or continue a 180-degree pedal turn about the tail rotor and hover forward to another training area. As a result, he was unable to apply corrective action to recover from dynamic rollover.	6 USASC **inform personnel of the problems encountered and remedies** through publications and directives in order to ensure that all aviators are aware of the importance of dividing one's attention to permit a continuous crosscheck/scan while hovering a helicopter at night. This can be implemented through the medium of FLIGHTFAX.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		6 (Repeat)	5 (Repeat)	6 USASC **inform personnel** of the insidious nature of the conditions and circumstances that resulted in dynamic rollover in this case and the remedies to avoid this phenomenon in the future. This can be implemented through FLIGHTFAX.
Article on inadequate division of attention is scheduled for publication in FLIGHTFAX.				
Article on dynamic rollover is scheduled for publication in FLIGHTFAX.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
326	CP	15 UH-1H copilot on a training mission performed a course of action not in accordance with AR 95-1, par. 3-15a. The copilot attempted a steep right turn at a low altitude (40 feet above trees) using a bank angle of 70-75 degrees. This is an abnormal attitude not necessary for normal flight. He unnecessarily placed himself, aircraft, and passengers in a position that endangered life. As a result, the aircraft began a high rate of descent. The copilot was able to level the aircraft and arrest the rate of descent, but the aircraft struck trees and sustained minor damage. The aircraft was brought to a hover over the trees and landed 200 meters away.	6 UH-1H copilot performed a course of action prohibited by AR (steep turn at low altitude not necessary for normal flight) because of inadequate judgment. Copilot indicated his poor judgment by disregarding the capability of the aircraft and making the unnecessary steep turn. As a result, the aircraft descended and struck the trees. This is further supported by his not making a precautionary landing after striking a hardwood tree with the bottom of the aircraft 10 to 15 minutes before the accident.	6 Company commander should inform unit aviators of the hazards associated with steep turns at low altitudes. A safety meeting on the circumstances of this mishap would be one method of accomplishing this.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		15 (Repeat)	19 UH-1H copilot performed a course of action prohibited by AR (steep turn at low altitude not necessary for normal flight) because of inadequate written procedures in TM 55-1520-210-10. Although there are some written restrictions that prohibit the copilot's attempted steep turn, these restrictions are ambiguous and subject to individual interpretation.	3 DARCOM should revise TM 55-1520-210-10 to include more specific guidance on prohibitive maneuvers. Specific bank angles and pitch attitudes should be included.
USASC evaluation of the operators manual determined information contained is adequate. Additionally, aerodynamics of steep turns are explained in FM 1-51, dated 16 April 1979, page 3-3 ("Altitude Control and Coordinated Turns").		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
327		23 AH-1G, on a day VFR training mission, experienced **engine failure.** At low altitude (less than 200 feet agl) and cruise airspeed (100-120 kts) with a nonrated person at the controls, the second-stage power turbine disk (P/N 1-140-270-01) of the T53-L13 engine burst due to creep rupture. The engine failed before the pilot regained control to avoid striking trees. This resulted in total loss damage and one fatality.	0 AH-1G T53-L13 engine experienced creep rupture of the second-stage power turbine disk and burst because of **unknown causes.** Creep rupture is the time-dependent plastic deformation (elongation due to intergranular cracking and slipping) of a material subject to stress and is a function of the amount of stress and temperature. There is no evidence in this case of an overspeed or overtemperature condition.	18 DARCOM **perform studies/research to determine solution** to whatever caused or allowed creep rupture to burst the second-stage power turbine wheel.
	P	15 AH-1G pilot on a day, VFR, single-pilot mission **performed a course of action prohibited by AR 95-1, par. 3-15; local supplement to FORSCOM Reg 350-3, par. 3-16h(7)(f) p. 4; Appendix 12, SOP and by command directive,** in that he was performing terrain flight in an area where such flight was not authorized. As a result, when engine failure occurred, there was insufficient time and altitude to avoid striking trees and causing total loss damage and one fatality.	6 AH-1G pilot performed a prohibited course of action (performed unauthorized terrain flight) because of **inadequate judgment.** The pilot had performed unauthorized terrain flight on the previous day without retribution or consequence. This event reinforced the poor judgment he manifested in again deciding to undertake an unauthorized mode of flight.	6 USASC **inform personnel of problems encountered** as a result of inadequate judgment **and their remedies** via articles in the AVIATION DIGEST and/or FLIGHTFAX.
		15 (Repeat)	6 (Repeat)	7 Unit commander take **positive command action to encourage proper performance and discourage improper performance.** (This remedy can be implemented by the judicious use of disciplinary measures and flight evaluation boards.)
		15 (Repeat)	6 (Repeat)	6 Unit aviation safety officers **inform personnel of problems encountered** as a result of judgment **and** their **remedies** via safety meetings. Such meetings should stress the dangers of unauthorized terrain flight.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
327	P	15 AH-1G pilot on a day, VFR, single-pilot mission **performed a course of action prohibited by AR 95-1, par. 1-13,** in that he allowed a nonrated person (armament technician) to fly the helicopter during unauthorized low-level flight. While the technician was flying, the engine failed before the pilot regained control and could avoid striking trees. This resulted in total loss damage and one fatality.	6 AH-1G pilot performed a prohibited course of action (allowed a nonrated person to fly the helicopter during unauthorized low-level flight) because of **inadequate judgment.** Although publications prohibit nonrated personnel from flying, the practice appears to be common at unit level. The rationale was presented that if the pilot is incapacitated, then the nonrated person could basically control the helicopter.	7 Unit commander take **positive command action to encourage proper performance and discourage improper performance** by insuring that nonrated personnel are not allowed to fly the aircraft.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USASC is coordinating with TSARCOM to determine what causes or allows creep rupture to occur and how to prevent future occurrences.

Article published in FLIGHTFAX, Vol. 7, No. 38, 11 Jun 79, titled "Pilot Error Greatest Single Cause of Navy and Army Aircraft Accidents," and Vol. 7, No. 45, 29 Aug 79, titled "A Result of Many Factors."

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
328	P	6 OV-1C pilot inaccurately estimated clearance between his aircraft and the lead aircraft. While flying as No. 2 in a formation of two OV-1 aircraft at 8,000 feet agl and 180 KIAS, the pilot, at the request of the lead aircraft, attempted to move his aircraft to the right front of the lead aircraft. During this attempted maneuver, the aircraft entered on a converging course which the No. 2 aircraft pilot did not recognize until the resultant collision was unavoidable. Both aircraft sustained total loss damage.	2 OV-1C pilot inaccurately estimated clearance because of inadequate unit training. The ATM only requires unit pilots to practice formation flight once each semiannual period. As a result of this inadequate training, the pilot did not anticipate or recognize the hazards involved in the attempted maneuver, i.e., the tendency to turn left when looking over the left shoulder, the possible distraction in checking instruments during formation flights, and the possibility of an illusion caused by "perceptual tropism." The aircraft was on a converging course and collided with the No. 1 aircraft before corrective action could be initiated. Both aircraft were total losses.	2 Unit commander upgrade unit training to provide unit aviators with sufficient skills and levels of proficiency to safely accomplish the requirements of the applicable ATMs.
		6 (Repeat)	1 OV-1C pilot inaccurately estimated clearance because of inadequate school training. Formal school transition training into the OV-1 aircraft includes only a demonstration by the instructor pilot of formation flying. OV-1 formation flying is not a graded maneuver and no requirement exists for the student to possess or demonstrate any level of formation flying proficiency to successfully transition into the aircraft. As a result of this inadequate school training, the pilot did not anticipate or recognize the hazards involved in the attempted maneuver, i.e., the tendency to turn left when looking over the left shoulder, the possible distraction in checking instruments during formation flights, and the possibility of an illusion caused by "perceptual tropism." The aircraft was on a converging course and collided with the No. 1 aircraft before corrective action could be initiated. Both aircraft burned on ground impact.	18 Department of Army perform studies to determine if a valid requirement exists for OV-1 formation flight. If a requirement exists, modify the COI for OV-1 transition training to include proper formation flight instruction. If no requirement exists, direct the discontinuation of the performance of OV-1 formation flying at all levels of command.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

FLIGHTFAX articles have been published on the system inadequacies and appropriate remedial measures for this mishap.

OV-1 formation flight has been deleted from the ATM as a required maneuver. The mission proponent has rewritten the penetration mission so that when a flight of two aircraft is required there will be a minimum separation distance between aircraft.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
329	CP	7 OH-58A copilot flying from the left seat on a mission to carry two passengers on an area reconnaissance made an improper flight control action. After returning to the area to drop off the passengers and landing on a 3° slope with snow and a 2" crust of ice, the skis of the aircraft broke through the crust (left side sank approximately 7" and the right ski sank approximately 11"). The aircraft attitude at this time was 6° in relation to the horizon. The slope of the terrain allowed both skis to slide underneath the ice crust approximately 3". The copilot, not realizing that the skis were caught underneath the ice crust, applied an excessive amount of collective. The collective application increased to the point that the left ski broke the crust. When the left ski broke loose, the power applied caused the aircraft to roll right. The rotor blades struck the snow and the aircraft came to rest on its right side, resulting in total loss damage.	19 OH-58A copilot made an improper flight control action (applied excessive collective on a slope takeoff) because of inadequate written procedures. TC 1-12, FM 1-51, and FM 1-106 do not adequately address the hazards of breaking through crusted snow during snow operations. This lack of information caused the crew to not realize the specific hazard of breaking through the crust and catching a ski underneath. TC 1-12, FM 1-51, and FM 1-106 do not give guidance concerning what the best course(s) of action(s) is(are) if the skis do break through the ice crust.	18 TRADOC perform a study to determine optimum procedures for ski-equipped helicopters operating in environments in which ice crusts exist. This study should focus on a solution to the problem of skis breaking through and catching underneath the ice crust. Once these procedures are developed, they should be incorporated into TC 1-12, FM 1-51, and FM 1-106.
		7 (Repeat)	3 (Repeat)	6 Since this is the first mishap of this type, USASC should inform personnel of problems encountered and remedies. USASC should publish a discussion of the hazards of breaking through ice crusts in articles in FLIGHTFAX and the AVIATION DIGEST.
		7 (Repeat)	3 OH-58A copilot made an improper flight control action (applied excessive collective on a slope takeoff) because of (limited) inadequate experience. The number of ski sets presently available are insufficient to equip the aircraft needed to train unit personnel in the techniques of snow operations.	9 Department of the Army should provide required equipment to meet the training needs of subordinate units.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

A winter flying article was published in FLIGHTFAX, Vol. 8, No. 2, dated 18 Oct 79.

A requirements document for skis has been sent to DARCOM. If approved, skis will then come under the Army logistics system for stockage and issue as opposed to the present local purchase method.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
330	CP	7 UH-1H copilot on a tactical training mission attempting a slope landing from the left seat performed an **improper flight control action** when he aborted the slope landing by rapidly increasing collective pitch without bringing the cyclic to the neutral position, contrary to TC 1-135, Utility Helicopter Aircrew Training Manual, task #5014, page 6-111. A main rotor blade struck the slope and the aircraft became uncontrollable and crashed.	3 UH-1H copilot performed an improper flight control action when he rapidly increased collective pitch without bringing the cyclic to the neutral position because he had **inadequate experience.** This was the copilot's fourth flight in the left seat of the UH-1H since graduation from flight school. This was his first attempt at a slope landing from the left seat.	17 **Pilot-in-command improve monitoring** of copilot activities. The PIC should be aware of the limits of his copilot and not request tasks/maneuvers which may exceed the copilot's skill level during early stages of training.
		7 (Repeat)	3 (Repeat)	3 **Revise procedures for normal operations** in unit SOP. Unit SOP should provide guidance on the utilization of new aviators and the tasks they should be able to perform.
	PIC	14 UH-1H pilot-in-command on a tactical training mission **authorized a course of action prohibited by common practice** when he tasked the copilot to perform a slope landing from the left seat of the aircraft. (The copilot had recently graduated from flight school and had never performed a slope landing from left seat). The copilot overcontrolled and the main rotor struck the slope. The aircraft became uncontrollable and crashed.	8 UH-1H pilot-in-command authorized a course of action prohibited by common practice when he tasked an inadequately experienced copilot to perform a slope landing from the left seat because the PIC was **overconfident** of the capabilities of the copilot. He stated the copilot had performed well on a previous day's flight and was of above average quality for a newly graduated aviator.	17 Same as previous.
		14 (Repeat)	8 (Repeat)	3 Same as previous.
		14 Unit operations officer **authorized a course of action prohibited by unit SOP** when he assigned a tactical training mission to an ARL 2 aviator (as defined by SOP). This aviator had not completed the tactical portion of his unit standardization ride and had not been released to perform tactical training or missions. The aviator overcontrolled during a slope landing in a UH-1H. The main rotor struck the slope, and the aircraft became uncontrollable and crashed.	22 Unit operations officer authorized a prohibited course of action when he assigned a tactical training mission to an ARL 2 aviator (as defined by SOP).	3 **Revise procedures for normal operations** in unit SOP. Unit SOP should provide guidance on the utilization of new aviators and the tasks they should be able to perform.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		99 No contributing materiel failure.		
No actions other than unit level/higher command.				

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
331	P	16 OH-58 pilot on tactical training mission **improperly performed a course of action** required by TC 1-137, task #5026. He hovered the aircraft at a slow airspeed (2-5 KIAS) and low altitude (2-5 ft agl) over snow-covered terrain instead of using an airspeed just above translational lift or a high hover as prescribed by task #5026, TC 1-137. As a result, the aircraft became engulfed in rotor-induced recirculating snow, the pilot lost outside visual references, and the aircraft struck the snow-covered terrain left skid first while on a left slip, coming to rest on its left side.	6 Pilot improperly performed required course of action (hovered over snow-covered terrain in a manner conducive to causing recirculating snow) because of **inadequate judgment.** Although forewarned of recirculating snow conditions in the LZ, the pilot chose to hover his aircraft in a manner conducive to aggravating the hazard instead of selecting a more prudent course of action.	2 Commander **upgrade unit training** to insure readiness/capability of unit pilots to safely operate aircraft over snow-covered terrain. To implement remedy, the judgmental factors and techniques appropriate to hover/taxi over snow should be evaluated during the pilot's postaccident checkride and further emphasized as a matter of special interest during unit training.
		16 (Repeat)	6 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning inadequate judgment **via FLIGHTFAX** and/or **AVIATION DIGEST.**
[redacted]		16 (Repeat)	13 Pilot improperly performed required course of action (hovered over snow-covered terrain in manner conducive to causing recirculating snow) because of suspected **fatigue.** At time of accident, he had exceeded day/night flight and total duty limits of table 5-1, AR 95-5, and admittedly was momentarily confused as to what he should do when the aircraft became engulfed in rotor-induced recirculating snow and he lost outside visual references. By the time he made the decision to add power and climb above the recirculating snow, the left skid had already dug into the snow-covered terrain while the aircraft was slipping to the left, and the subsequent rollover to the left became inevitable.	7 Commander **take positive command action** to encourage assigned aviation crewmembers to avoid fatigue-induced errors. To implement remedy, the provisions of the unit crew rest SOP should be enforced by additional comand emphasis on compliance.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
331	P	16 (Repeat)	13 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning inadequate crew rest **via FLIGHTFAX** and/or **AVIATION DIGEST.**
		16 (Repeat)	7 Pilot improperly performed required course of action (hovered over snow-covered terrain in a manner conducive to causing recirculating snow) because of suspected **overconfidence in self.** The pilot had been routinely flying in recirculating snow conditions for three days up to the time of the accident without difficulty and believed that he was fully capable of coping with the existing environment. As a result, he had not developed a full appreciation for the probability of inadvertently encountering a loss of outside visual references and was admittedly caught by surprise when it occurred.	7 Commander **take positive command action** to encourage assigned aviation crewmembers not to exceed their capabilities because of overconfidence. To implement remedy, unit personnel should be periodically briefed concerning how adverse psychophysiological states such as overconfidence can lead to errors.
		16 (Repeat)	7 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning overconfidence **via FLIGHTFAX** and/or **AVIATION DIGEST.**

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
331	P	12 OH-58 pilot on tactical training mission **improperly managed work-rest cycle** contrary to table 5-1, AR 95-1. At time of accident, pilot's cumulative day/night flight time total for the 48-hour period preceding the accident exceeded the criteria prescribed by table 5-1 by one hour and his total duty time for the preceding 72-hour period exceeded table 5-1 by two hours. As a result, the pilot's judgment and reaction time were probably influenced by fatigue to the extent that he improperly hovered the aircraft over snow-covered terrain, and when confronted with a loss of outside visual references, he became momentarily confused as to proper recovery procedures. The aircraft struck the snow-covered terrain and rolled on its left side.	12 Pilot mismanaged his work-rest cycle (exceeded crew rest limits to degree fatigue probably affected his judgment and reaction time) because of suspected **get-home-itis.** When pilot's flight was delayed at an interim location short of his destination LZ for 1½ hours because of bad weather, he was aware that any further flight on his part during the hours of darkness would probably exceed day/night crew rest flight limits. Regardless, he permitted a desire to complete the flight to the destination LZ to override the prudence of remaining overnight at the interim location, and he chose to fly an additional thirty minutes at night once the weather cleared.	7 Commander **take positive command action** to encourage assigned aviation crewmembers not to exceed their capabilities because of get-home-itis. To implement remedy, unit personnel should be periodically briefed concerning how adverse psychophysiological states, such as get-home-itis, can lead to errors.
		12 (Repeat)	12 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning get-home-itis **via FLIGHTFAX** and/or **AVIATION DIGEST.**
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USASC routinely publishes articles on judgment, fatigue, overconfidence, and get-home-itis.

USASC sent a letter to TRADOC Scout System Manager recommending that the user requirement for an adjustable landing light be reevaluated. The OH-58C will have an adjustable landing light. USASC, as in the past, supports installation of an adjustable landing light on the OH-58A model.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
332	P	16 OH-58 pilot on night tactical training mission **improperly performed a course of action required by TC 1-137, task #5026.** He hovered the aircraft over snow-covered terrain at an altitude (5-10 ft agl) that caused rotor-induced recirculating snow and reduced visibility. As a result, the pilot became disoriented and failed to perceive that the aircraft was drifting (moved laterally approximately 100 feet and rearward approximately 70 feet). The aircraft sustained major damage when it was backed into a tree.	6 Pilot improperly performed required action (hovered over snow-covered terrain in a manner that caused recirculating snow, decreased visibility, and disorientation) because of **inadequate judgment.** Pilot was aware of the recirculating snow hazard that existed in the area. He committed several actions which, together, led to loss of his night visual acuity, decreased his visibility outside the aircraft and caused him to become disoriented, e.g., he hovered the aircraft too low and too slow to prevent recirculating snow, he used the landing light intermittently, and he then turned the aircraft in a direction facing away from nearby ground references.	2 Commander **upgrade unit training** to insure readiness/capability of unit pilots to safely operate aircraft over snow-covered terrain under day and night conditions. To implement remedy, the judgmental factors and techniques appropriate to hover/taxi over snow should be evaluated during the pilot's postaccident checkride and further emphasized as a matter of special interest during unit training.
		16 (Repeat)	6 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** concerning inadequate judgment **via FLIGHTFAX** and/or **AVIATION DIGEST.**
		16 (Repeat)	2 Pilot improperly performed required action (hovered over snow-covered terrain in a manner that caused recirculating snow, decreased visibility and disorientation) because of **inadequate unit training.** The pilot's training records revealed that he had been recommended for additional night training after a standardization ride because of a lack of proficiency. This training was not accomplished prior to the accident.	2 Commander **upgrade unit training** to include more specific training on operations in snow. To implement this remedial measure a night training program should be established that prescribes a night hourly goal and includes tasks required to be performed at night by TC 1-137.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
332	P	16 (Repeat)	2 (Repeat)	6 Aviation Safety Officer **inform personnel of problems encountered and remedies via meetings, publications and directive messages** concerning the hazards of night operations while hovering over loose and blowing snow. All unit members should be directed to become familiar with TC 1-28 and the article on minimal light operations that appeared in FLIGHTFAX, Number 14, Volume 6, 25 January 1978.
		16 (Repeat)	5 Pilot improperly performed required action (hovered over snow-covered terrain in a manner that caused recirculating snow, decreased visibility, and disorientation) because of suspected **inadequate** division of **attention.** While the pilot was hovering the aircraft, he turned the aircraft away from the nearest ground references (parked helicopter and adjacent tree line) and then became preoccupied with the approach of a ground vehicle.	1 USASC coordinate with USAAVNS to **upgrade school training** to determine the need for placing more emphasis on environmental flight planning as it pertains to aviators flying into or encountering loose, blowing snow, especially at night.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Reference FLIGHTFAX, Vol. 8, No. 7, dated 14 Nov 79, "Accident Review."

An analysis of aircraft mishap experience indicates that OH-58 pilots do not have sufficient instrument training in the OH-58 to prepare them for flight in inadvertent IMC. When flying an OH-58 at night, in snow, rain or marginal weather, the pilot must be prepared to transition to instrument flight if the need arises. It appears that pilots, whose primary aircraft is the OH-58, are performing the majority of their training in the UH-1 SFTS. USAAVNC (DTD) has been notified of this problem.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
333		0 Insufficient information to perform 3W analysis (TEIR-FIRE). U-21A landed gear up on a foamed runway because the nose gear stuck in the partially extended position. The nose gear actuator (P/N 50-820208-1) disintegrated due to unknown causes. Actuator was sent to CCAD for analysis but was lost in transit. Therefore, a cause of failure of the actuator cannot be determined.		
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS			
	TEARCOM published a U-21 maintenance advisory message 79-02, later updated to U-21 safety-of-flight message 79-03, which called for a one-time inspection and outlined detailed procedures for reassembly and installation of landing gear actuators. These procedures reduce the likelihood of internal failure of the actuators.			
334	IP	7 T-42A IP on a transition training flight performed **improper flight control actions** contrary to the procedures in Flight Training Guide, T-42 Instructor Pilot Qualification Course, Sep 75. During a simulated single-engine landing, the IP changed the power setting of the simulated dead engine (No. 2) from zero thrust to the idle power setting. He also saw the RSP move both props to the high rpm position. These actions produce an abnormal landing configuration (high drag and yaw). As a result, the aircraft landed hard and bounced 15-20 feet in the air. In addition, when the RSP applied power for a two-engine go-around, the No. 2 engine did not respond as rapidly as the No. 1 engine since it had been at idle for an extended period of time. The aircraft entered a right roll and crashed, causing major damage.	6 T-42A IP performed improper flight control action (changed No. 2 engine power setting from zero thrust to idle) because of **inadequate judgment.** To compensate for the RSP's using excessive power on the No. 1 engine, he chose to reduce the No. 2 engine to idle power so as not to disturb the RSP's concentration.	7 Unit commander should provide **positive command action** to encourage proper performance and discourage improper performance. All IPs should be informed of the necessity to follow established procedures.
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS			
	No action other than at unit level.			
	FLIGHTFAX articles have been published on the system inadequacies and appropriate remedial measures associated with this mishap.			
		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
335	IP	6 AH-1G IP on a unit training mission (NOE) inaccurately estimated clearance. He successfully maneuvered the aircraft between two trees 54 feet apart and then began a left pedal turn when he thought he was clear of the trees. This assumption was based on the length of time since the trees passed out of his view at the 120-degree points. In fact, he was still very close to the trees since his forward movement had been very slow (2 knots). As a result, the main rotor blades struck the trees on the left rear during the turn when the aircraft drifted slightly left or descended several feet. (There were not enough visual cues to detect this movement.)	7 AH-1G IP inaccurately estimated clearance because of overconfidence. The IP felt he was proficient enough to estimate clearance with a high degree of accuracy by using time and rate of movement when, in fact, he could not.	6 USASC inform aviation personnel of the hazards of making close tolerance clearance estimates by means other than direct visual contact. When methods such as rate of movement are used, a greater margin for error must be allowed.
2	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS Article published in FLIGHTFAX, Vol. 7, No. 24, 13 Jun 78, titled "Out of Sight."	6 (Repeat) 99 No contributing material failure.	7 (Repeat)	6 Unit commander inform aviation personnel of the hazards of making close tolerance clearance estimates by means other than direct visual contact. This should be included in a safety briefing prior to NOE training missions.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
336		Event not recorded as Army aircraft mishap.		
337	P	17 OH-58A pilot on a routine service mission during landing approach to a tactical field site **failed to detect obstacles (wires)**. As a result, the aircraft hit and severed multiple communication wires. Aircraft control was lost at touchdown as the wires (wrapped around the mast) severed the pitch change control linkage and the aircraft became airborne on its own volition and crashed.	5 OH-58 pilot failed to detect wires in the aircraft flight path because of **inadequate division of attention.** During high recon, the pilot identified a large cable as the wire hazard depicted on his map but failed to notice the less visible multiple wires which paralleled the cable at a higher altitude. During the landing approach, the pilot allowed his attention to become channelized on the landing pad, the pre-landing check, and the previously identified cable and failed to see the other wires.	2 Unit commander **upgrade unit training program** to ensure unit IPs and UTs stress the importance of proper division of attention, especially as it applies to detection of obstacles during terrain flight and landing approaches in the tactical training environment.
		17 (Repeat)	5 (Repeat)	6 Unit commander **inform personnel of problems encountered and remedies** through briefings and safety meetings. The circumstances surrounding this mishap should be used as a teaching vehicle to stress the importance of constant surveillance for flight hazards (obstacles) when operating in unimproved tactical areas.
		17 (Repeat)	5 (Repeat)	18 TSARCOM **expedite research** to develop an effective wire cutter/detection system for installation on rotary wing aircraft to increase aircraft survivability following inadvertent wire strikes.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

A wire strike protection system (WSPS) has been successfully tested on an OH-58A. A product improvement plan (PIP) to provide all OH-58s with the WSPS has been approved. USASC feels that the WSPS is the most significant material improvement to enhance safety in years and will continue its efforts to accelerate the modification program.

Information relevant to this accident was published in FLIGHTFAX, Vol. 8, No. 10, dated 5 Dec 79.

A description of the WSPS as tested was published in FLIGHTFAX, Vol. 8, No. 11, dated 12 Dec 79, "The Wire Strike Picture."

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
338	IP	7 UH-1H pilot on training mission (AAPART ride), while performing an NOE quick-stop maneuver at five-foot skid height, performed an **improper control action.** He applied too much aft cyclic control for the amount of collective pitch applied. As a result, he failed to keep the tail rotor clear of all obstacles, permitting it to strike the ground. Antitorque control was lost, and the aircraft landed hard, with major damage.	26 Pilot performed an improper control action (did not coordinate collective pitch and cyclic so as to keep the tail rotor clear of obstacles during an NOE quick-stop maneuver) because of **inadequate supervision by the IP.** The IP had experienced improper control action by the pilot on two previous quick-stops at a higher altitude. He then placed the pilot at a five-foot skid height downwind with the CG aft (142.78) for another NOE quick-stop without restricting the pilot's cyclic control latitude, which should have been dictated by the pilot's previous performance.	6 Commander **inform personnel of problems encountered and remedies via meetings.** Emphasis should be placed on the importance of CG location awareness and wind conditions throughout each flight in relation to planned maneuvers.
		7 (Repeat)	26 (Repeat)	11 **Commander improve monitoring of IPs by SIPs** during AAPART rides, emphasizing the necessity for guarding (restricting) control inputs of pilots during critical phases of maneuvers in close proximity to terrain or other obstacles during standardization meetings and standardization flights with unit IPs.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
338	IP	10 UH-1H IP on a training mission (conducting an AAPART ride) while supervising performance of an NOE quick stop **improperly monitored performance of personnel (pilot)**. He permitted the pilot to apply too much aft cyclic control for the amount of collective pitch applied. As a result, the pilot failed to maintain enough altitude for the tail rotor to clear all obstacles, permitting the tail rotor to strike the ground. Loss of antitorque control and hard landing resulted.	8 UH-1H IP improperly monitored performance of personnel (permitted the pilot to apply such control actions so as not to maintain enough altitude for the tail rotor to clear obstacles during an NOE quick-stop maneuver) because of **overconfidence in others (pilot)**. Although the pilot had demonstrated improper control action on two previous NOE quick stops at a higher altitude, the IP placed the pilot at a 5-foot skid height, downwind with a marginal CG for another NOE quick stop. The IP considered the pilot to be experienced (2,000 hours) and knew he (pilot) had previously been an IP. Therefore, the IP made no effort to guard the controls or otherwise restrict the pilot's movement of either collective or cyclic control.	6 USASC **inform personnel of problems encountered and remedies via publications** (article in FLIGHTFAX).
		10 (Repeat)	8 (Repeat)	11 Higher command **improve monitoring of personnel** performing AAPART rides by IPs. During orientation briefing by SIPs conducting standardization rides with IPs, emphasis should be placed on an IP not becoming overconfident in the ability of any pilot he may be flying with regardless of the pilot's background, flying experience, or qualification.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Article published in FLIGHTFAX, Vol. 8, No. 3, 17 Oct 79, "Accident Review." The article discusses the problems encountered in the mishap.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
339	P	15 RV-1D pilot on an operational mission ILS approach **performed a course of action prohibited** by AR 95-1, paragraph 4-4d. He did not abort his mission after encountering forecast moderate icing conditions early in the flight. At that time he determined the No. 1 engine lower ring and chin cowl were accumulating an excessive amount of ice and the deice equipment was not working properly. This ice accumulation ultimately (during ILS approach) broke off and was ingested by the No. 1 engine, causing it to fail. This failure and an inadvertent autofeather of the No. 2 engine resulted in ejection and total loss of the aircraft.	9 RV-1D pilot violated AR 95-1 (continued flight into moderate ice with the No. 1 engine deice equipment not working) because of **overconfidence** in the aircraft and his own abilities to handle the ice. During recent proficiency flights with unit IPs, he had demonstrated his ability to handle any situation and was sure of his ability to fly in moderate ice.	7 **Unit commander improve monitoring of personnel and unit activities** to ensure that violations of regulations supporting safe aircraft operating procedures are discouraged. This can be accomplished through the unit standardization and safety program.
		15 (Repeat)	9 (Repeat)	7 **Higher command emphasize the need for all flight planning requirements** prescribed in TM 55-1520-213-12 and AR 95-1. This can be accomplished through visits by the battalion safety office.
		15 (Repeat)	9 (Repeat)	7 **DCSOPS direct DES to place more emphasis on flight planning** actions prescribed in TM 55-1520-213-10 and AR 95-1 during their standardization visits.
		15 (Repeat)	9 (Repeat)	6 USASC **inform personnel of problems encountered and possible remedies** regarding cold weather and icing conditions through FLIGHTFAX and other safety publications.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
339	P	9 RV-1D pilot on an operational mission ILS approach improperly monitored the performance of his aircraft in violation of TM 55-1520-213-10. During initial descent the pilot turned the autofeather/ syncrophaser switch from the sync position one click up to the off position. Then during the before-landing check he is suspected of moving the switch one more click up, which armed the autofeather system. When the No. 1 engine failed he rapidly applied full power, contacting the micro-switches and autofeathering the No. 2 propeller. The engine failure and this autofeather of the No. 2 propeller caused total loss of power, resulting in crew ejection and total loss of the aircraft.	16 RV-1D pilot inadvertantly feathered the No. 2 propeller because the autofeather switch and warning light are inadequately designed, allowing the pilot to unknowingly select the autofeather position. A visual check of the switch will not allow the pilot to determine the switch position and the warning light is difficult to see in its present location.	12 Unit commander improve monitoring of personnel and unit activities to insure all procedures in -10 CL concerning autofeather use are adhered to during all phases of flight.
		9 (Repeat)	16 (Repeat)	9 DARCOM redesign the autofeather/ syncrophaser switch to ensure that users cannot inadvertently arm the autofeather system. A bayonet lock switch requiring a lift and movement to arm is a possible solution. Additionally the autofeather/ speed board warning light should be repositioned to the location of the present marker beacon warning light.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

FLEETWAX actions have been published on the system inadequacies and appropriate remedial measures associated with this mishap.

TSARCOM has approved redesign of the autofeather/syncrophaser switch to a positive lever lock switch to prevent inadvertent arming of the autofeather system.

Repositioning of the autofeather armed light to a position commensurate with the OV-1D was rejected by TSARCOM because it would delay the installation of the vertical instrument display (VIDS).

A recommendation was forwarded to TSARCOM to prescribe a positive preflight action to determine whether or not the engine anti-icing ducts are functioning properly. This issue is still unresolved.

Icephobic materials are being developed by the Cold Regions Research and Engineering Lab to prevent or reduce the intensity of ice buildup.

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CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
340	P	1 OH-58A pilot on an aerial surveillance mission did not perform adequate flight planning as required by FM 1-1, par. 1-6, and TC 1-137, task 5001. The pilot did not mark all hazards in his area of operation on the map that he used in the aircraft. As a result, he did not know there were wires crossing the river, and wires were not seen in time to avoid them. The aircraft struck the wires at approximately 50 knots and 70 feet agl and crashed, sustaining total loss damage.	7 OH-58A pilot did not perform adequate flight planning (did not mark all hazards on his map) because of overconfidence. The pilot knew there were many wire hazards in the area but felt that he and the copilot could see them. He felt it was unnecessary to post wires to his map because they "would be on the lookout for wires."	12 Unit commander take positive command action to insure overconfidence does not lead to incomplete flight planning. This could be accomplished in a unit safety meeting which instructs aviators on the hazards of overconfidence.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		1 (Repeat)	7 (Repeat)	18 DARCOM perform studies/research to determine the feasibility or cost-effectiveness of wire detection and wire protection devices currently under development for rotary wing aircraft.
A wire strike protection system (WSPS) has been successfully tested on an OH-58A. A product improvement plan (PIP) to provide all OH-58s with the WSPS has been approved. USASC feels that the WSPS is the most significant material improvement to enhance safety in years and will continue its efforts to accelerate the modification program.		13 Operations officer failed to provide information required by FM 1-1, par. 1-6. The unit hazards map did not include hazards in the mission area assigned to an OH-58A. As a result, the OH-58A pilot did not know the location of the wires and they were not seen in time to take evasive action. The aircraft struck the wires and crashed, sustaining total loss damage.	19 Operations officer failed to provide required information (adequate hazards map) because of inadequate written procedures. The unit SOP did not include instruction which would insure aviators were provided with hazards information in their area of operation prior to terrain flight missions.	3 Unit commanders should establish procedures which will insure adequate hazards maps are maintained.
Information relevant to this accident was published in FLIGHTFAX, Vol. 8, No. 10, dated 5 Dec 79.		13 (Repeat)	19 (Repeat)	12 Unit commander improve supervision of unit activities. The unit commander should insure the operations officer provides aviators with required information, i.e., hazards map for terrain flight missions.
A description of the WSPS as tested was published in FLIGHTFAX, Vol. 8, No. 11, dated 12 Dec 79, "The Wire Strike Picture."		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
361		39 A UH-1H that had just taken off to return to base from a service mission began an uncontrolled descending right turn and crashed in trees. The flight controls failed when the white drive link trunnion came out of the rotating swashplate in flight, leaving the pilot without control of the white main rotor blade.	18 The flight controls failed (drive link trunnion came out of rotating swashplate), because personnel utilized improper procedures. Maintenance personnel failed to apply prescribed torque values to the bolts securing the trunnion of the drive link in the bore of the rotating swashplate. As a result, the trunnion was not secured with sufficient force in the trunnion bore and wore through the retaining bolts, coming out in flight.	13 Improve monitoring of personnel by maintenance officer to assure proper procedures are followed and proper torque values applied, especially during assembly/ installation of such critical systems as flight controls.
		39 (Repeat)	18 (Repeat)	6 TSARCOM inform personnel of problems encountered and remedies via a safety-of-flight message.
		39 (Repeat)	18 (Repeat)	6 Company commander inform personnel of problems encountered and remedies via safety meetings for both flight and maintenance personnel.
		39 (Repeat)	18 (Repeat)	6 Group commander inform personnel of problems encountered and remedies via safety meetings.
		39 (Repeat)	18 (Repeat)	6 USASC inform personnel of problems encountered and remedies via publications. An article has been prepared for publication in FLIGHTFAX.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
341		39 (Repeat)	30 The flight controls failed (drive link trunnion came out of rotating swashplate) because quality control was performed inadequately during rework of the swashplate assembly. The trunnion bore was rebored to an oversize condition and centrifugal force (rotation of swashplate) caused the trunnion to wear through the two bolts clamping the trunnion bore and positioning the trunnion until they came out in flight.	19 TSARCOM improve quality control in its rework facilities, especially those facilities performing work on critical components such as flight controls. All flight control components should be individually inspected to assure that all measurable tolerances are within prescribed limits before the component is released into the supply system or installed on an aircraft.
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS			
	TSARCOM safety-of-flight message 282045Z Mar 79 issued requiring one-time inspection of UH-1B/D/H and EH-1H series helicopter swashplate outer ring.			
	Article published in FLIGHTFAX, Vol. 7, No. 24, 4 April 79, "Warning: UH-1 Trunnion Deficiencies Can Kill."	39 (Repeat)	30 (Repeat)	3 TSARCOM revise procedures for normal operation in TM. Inspection procedures in TM 55-1520-210-20, par. 8-8b, should be modified to prescribe tolerances for and require measurement of each trunnion bore diameter by a technical inspector before reassembly of any disassembled trunnion assembly.
	TSARCOM changed inspection criteria of trunnion bore and trunnion bore assembly contained in TM 55-1520-210-23 (Change 6).			
	Inspection procedures in TM 55-1520-210-23-1 will be modified to include the requirement to measure each trunnion bore and trunnion pin, and to conduct a spring pull test of the assembled components. These procedures will be published in a forthcoming change to TM 55-1520-210-23-1.	39 (Repeat)	30 (Repeat)	18 DARCOM perform research to determine solution to system inadequacy such as a design change for the trunnion retaining mechanism.
	Insufficient information contained in the mishap report to warrant design review of the trunnion retaining mechanism.			

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
342		25 CH-47C on an administrative flight experienced a failure of the combining transmission (P/N 114D5200-2). At 100 knots and 720 feet agl, the spiral bevel gear began separating from the gear shaft flange. The crew heard the noise caused by the spiral bevel gear rubbing the case and made an immediate precautionary landing. Just after landing the gear completely separated from the gear shaft and the main rotor blades meshed, causing major damage.	16 CH-47C combining transmission (P/N 114D5200-2) failed because the spiral bevel gear connection to the gear shaft flange was improperly designed for the required operation. The connection allowed fretting and cracks to occur adjacent to the bolt holes. It is suspected this situation resulted in a fatigue mechaniem which caused eventual separation of the gear from the gear shaft.	9 DARCOM provide redesigned equipment (combining transmission) to units. An engineering change proposal (ECP691) to correct this deficiency was submitted on 11 Apr 75. On 24 Apr 77, change 1 to the second revision (ECP691R2C1) was approved.
	CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS TSARCOM issued safety-of-flight message 1220SZ Jul 78 removing 114D5200 series combining transmissions from service. On 16 July 1979, a contract was awarded to CCAD for acceleration of the overhaul/modification program to incorporate ECP 691R2C1 in the combining transmissions.	98 No contributing human error.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
343	IP	16 UH-1M IP on a day, VFR transition training flight **improperly performed a course of action required by TC 1-135, task 4062.** During a standard autorotation when the airspeed slowed beneath that desired by the IP he directed that the autorotation be performed in a manner contrary to the task description. He instructed the pilot to delay initiating the deceleration until reaching 50 feet agl, an altitude 20 to 50 feet below that required. As a result, in attempting to slow the aircraft, the pilot applied excessive deceleration for existing wind conditions (50 to 90 degrees relative bearing at 8 to 16 knots) that resulted in an excessive rate of descent which collective application did not correct. Consequently, the tail skid struck the ground, followed by the tail rotor which separated from the vertical fin, causing major damage to the aircraft.	12 UH-1M IP improperly performed a required course of action by directing that the autorotative deceleration be performed at less than prescribed altitude because of **excessive self-motivation.** He felt that because the pilot was only to be available for two weeks of annual training that he needed to maximize available training time in order to complete the transition within the prescribed period. Therefore, when wind conditions were less than ideal and the maneuver deviated from the standard, the IP elected to modify its performance in order to salvage whatever training benefit possible from its execution.	6 Unit ASO **inform personnel of the problems encountered as a result of excessive self-motivation and remedies via safety meetings.**
		16 (Repeat)	12 (Repeat)	6 U.S. Army Safety Center **inform personnel of the problems encountered as a result of excessive self-motivation and remedies via articles in the AVIATION DIGEST and FLIGHTFAX.**
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		16 (Repeat)	12 (Repeat)	7 Unit/facility commander take **positive command action** to insure that all personnel are familiar with and adhere to TC 1-135, TC 1-136, and the requirements of the ATM program.
Articles on excessive self-motivation and its effect on safe mission accomplishment are scheduled for publication in FLIGHTFAX.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
344	IP	15 IP of JOV-1D on service mission performed a course of action prohibited by AR 95-1, par. 3-15. From an altitude of 865 feet agl, he placed aircraft in a steep banked descending maneuver that caused a 12,000 fpm sink rate to develop. As a result he was unable to fully arrest the rate of descent before ground impact and the aircraft was destroyed.	6 IP committed task error because of inadequate judgment. Altitude of aircraft (865 feet agl) and commonsense dictated that aerobatic maneuvers involving a high sink rate be avoided. Regardless, the IP rolled the aircraft into a 95-100 degree banked descending turn that caused an extremely high rate of descent to set in.	12 Commander, USAADTA, upgrade unit training to insure assigned aviators possess the judgment necessary to safely accomplish assigned missions. To implement remedy, unit IPs must evaluate judgment as a matter of special interest during training and standardization rides and SIPs must evaluate IP judgment during IP standardization rides.
		15 (Repeat)	6 (Repeat)	6 ASO, USAADTA inform assigned aviators of the highlights of this accident and lessons-to-be-learned via next scheduled safety meeting.
		15 (Repeat)	6 (Repeat)	6 USASC inform personnel of problems encountered and remedies concerning inadequate judgment via FLIGHTFAX and/or the AVIATION DIGEST.
		15 (Repeat)	5 IP committed task error because of suspected channelization of attention. When IP placed aircraft in a steep banked descent to enter low-level run, he probably crosschecked RMI in relation to last outbound heading he received from air traffic controller instead of maintaining his attention outside the cockpit. This course of action would have momentarily delayed his recognition of and reaction to the high sink rate that was developing.	12 Commander, USAADTA upgrade unit training to insure assigned aviators avoid errors caused by channelized attention. To implement remedy, unit SIPs/IPs should evaluate this aspect of aviator proficiency during training flights and standardization rides.
		15 (Repeat)	5 (Repeat)	6 USASC inform personnel of problems encountered and remedies concerning channelized attention via FLIGHTFAX and/or the AVIATION DIGEST.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
344	IP	15 (Repeat)	7 IP committed task error because of *suspected* **overconfidence in self.** *IP was* reputed to be highly skilled but somewhat overconfident concerning his flying ability. Earlier in flight, though not specifically required by mission at time, he performed a split "S" aerobatic maneuver from an altitude of 2,625 feet agl that induced a *15,000 fpm rate of descent and resulted in a* low-level pullout. When the other crewmember aboard the aircraft exclaimed that the maneuver had scared him, the IP discounted the other crewmember's concern in a manner indicative of overconfidence.	12 Commander, USAADTA **upgrade unit training** to insure assigned aviators avoid errors related to overconfidence. To implement remedy, unit SIPs/IPs should evaluate this aspect of aviator proficiency during training flights and standardization rides.
		15 (Repeat)	7 (Repeat)	6 USASC inform personnel of problems encountered and remedies concerning overconfidence **via FLIGHTFAX** and/or the **AVIATION DIGEST.**
		15 (Repeat)	12 IP committed task error because of *suspected* **excessive motivation.** Mission importance (DOD-directed high priority test), the type of flying involved (low level combined with evasive maneuvers), and the opportunity to "look good" to the other crewmember aboard the aircraft, ground support personnel, and members of other services observing the flight may have influenced him to perform a steep banked descending maneuver at low altitude that he normally would have avoided under less ostentatious circumstances.	12 Commander, USAADTA **upgrade unit training** to insure assigned aviators avoid errors related to excessive motivation. To implement remedy, unit SIPs/IPs should evaluate this aspect of aviator proficiency as a matter of special interest during training flights and standardization rides.
		15 (Repeat)	12 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** re-regarding excessive motivation **via FLIGHTFAX** and/or the **AVIATION DIGEST.**
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No action other than that at unit level.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
345	MTP	8 UH-1H maintenance test pilot performing a post-phase test flight **misinterpreted insufficient tail rotor thrust as an in-flight tail rotor failure.** As a result, when the aircraft began to turn, he retarded throttle and autorotated from his hover height of 35-40 feet. A hard landing resulted and major damage was incurred. Had he recognized what was happening he could have recovered by reducing collective pitch until he was safely on the ground or until he had descended to a safe hover autorotation altitude.	19 Pilot misinterpreted an in-flight failure (interpreted insufficient tail rotor thrust as tail rotor failure) because of **inadequate written procedures for operation in normal man-machine-environmental conditions.** TM 55-1520-210-10 does not adequately discuss tail rotor failure or insufficient tail rotor thrust at an out-of-ground-effect hover nor does it prescribe recovery techniques for either of these emergencies.	3 TSARCOM **provide procedures for normal operation.** TM 55-1520-210-10 should be revised to provide a discussion of tail rotor failure and insufficient tail rotor thrust at out-of-ground-effect hover altitudes. The discussion should include prescribed recovery techniques. Terrain flying identifies out-of-ground-effect hovering as a normal flight maneuver. Therefore, emergencies related to out-of-ground-effect should be adequately discussed and recovery techniques prescribed.
		8. (Repeat)	19 (Repeat)	6 USASC **inform personnel of problems** encountered and remedies via an article in FLIGHTFAX.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
345	MTP	15 UH-1H maintenance test pilot conducting a post-phase test flight **performed a course of action prohibited by TM.** He operated a UH-1H at a gross weight of 7,764 pounds (over 7,500 pounds) at an engine rpm of 6000 in violation of the operating limits published in fig 7-2, TM 55-1520-210-10, and placarded on the aircraft instrument panel. As a result, he experienced a loss of tail rotor thrust at 35-40 feet altitude and entered autorotation. The aircraft landed hard, sustaining minor damage.	19 Pilot performed a course of action prohibited by TM (operated a UH-1H at a gross weight in excess of 7,500 pounds (7,764 pounds) at an engine rpm less than 6400 (6000 N_2) because **of inadequate written procedures for operation in normal man-machine-environmental conditions.** TM 55-1500-219-MTF, the manual for maintenance test flight, prescribes that low rpm hover check be performed at 6000 N_2 but contains no advisory or caution against flying the aircraft at a gross weight in excess of 7,500 pounds and N_2 of less than 6400. Since a maintenance test flight is probably the only justifiable reason for flying with N_2 below 6400 rpm, the checklist for maintenance test flights (TM 55-1500-219-MTF) should contain a discussion of and caution against performing any part of the maintenance test flight with an aircraft over 7,500 pounds gross weight and N_2 less than 6400.	3 U.S. Army Transportation School **revise procedures for normal operation.** TM 55-1500-219-MTF be changed to include a discussion of and caution against conducting any part of a maintenance test flight with an aircraft gross weight in excess of 7,500 pounds and N_2 less than 6400 rpm.
		15 (Repeat)	19 (Repeat)	6 **Commander improve monitoring of personnel and unit activities** to assure unit personnel properly conduct preflight planning for all flights and comply with operating limitations contained in fig. 7-2, TM 55-1500-210-10, and placarded on the instrument panel of the aircraft.
		15 (Repeat)	19 (Repeat)	6 USASC inform personnel of problems encountered and remedies via an article in FLIGHTFAX.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Recommended change to TM 55-1520-210-10 (loss of effective tail rotor thrust, no break in drive system) is currently under evaluation by TSARCOM.

Article published in FLIGHTFAX, Vol. 8, No. 3, 17 Oct 79, "Accident Review." The article gave a synopsis of the accident to include misinterpretation of loss of tail rotor thrust as an in-flight tail rotor failure, and included discussion on conducting test flights with gross weights greater than 7,500 pounds and N_2 less than 6400 rpm.

Recommended change to TM 55-1500-219-MTF will appear as a "CAUTION" in future change and/or revision to the manual. In addition, the change will also be incorporated into TM 55-1520-210-23-1 for UH-1D/H and EH-1H helicopters.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
346		0 Insufficient information to perform 3-W analysis (TEIR/FIRE). UH-1H engine lost power during night flight over trees. The IP autorotated, using the searchlight, flared, and pulled pitch at tree-top level over 70-foot pine trees. The aircraft fell vertically on the right side and slightly nose down, resulting in total damage. CCAD analysis of the engine determined that engine failure resulted from loss of drive to the fuel control through failure of the accessory gearbox gear shaft, P/N 1-080-252-06. The gear shaft failure resulted from abrasive wear mechanisms and was probably a result of inadequate lubrication. Cause of the improper lubrication could not be determined. Early fuel controls required grease-packed lubrication of this gear shaft. Later modifications incorporated provisions for pressure lubrication of this gear shaft by passing the gearbox oil through small orifices in the gear shaft onto the face of the gear splines. Grease lubrication of current fuel control gear shafts result in blockage of the oil orifices and lack of lubrication of the gear shaft. This can result in a failure of the gear shaft and can go undetected due to friction heat generated during the failure. This heat can soften or melt the grease blockage of the oil orifices and once the blockage is removed, the gearbox oil purges the area of all traces of the grease during the later stages of the accident sequence. The most probable cause of this accident is human error on the part of unknown maintenance personnel. This is an assumption based on the known cause factors in similar accidents involving failure from lack of lubrication of the same gear shaft.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
307	IP	16 AH-1S IP on a training flight improperly monitored performance of pilot in that he did not recognize the higher than normal nose-high attitude that the pilot allowed to develop during the acceleration phase of a straight-in autorotation. As a result, the aircraft hit the ground in a tail-low attitude at a slightly high rate of descent, causing minor damage.	5 AH-1S IP improperly monitored performance (did not recognize the higher than normal nose-high attitude) because of inadequate attention. IP should have adopted an increased state of readiness as aircraft approached critical phase of autorotation. IP admitted that the autorotation felt normal up to the time he felt the main rotor flex and heard blade contact with the fuselage.	7 Unit commanders should take positive command action to ensure IPs are attentive and alert during critical stages of nonstandard maneuvers. To implement remedy, unit SIPs should evaluate this aspect of IP's proficiency as a matter of special interest during IP's standardization flight evaluation.
		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
348	IP	16 UH-1M IP, during a transition training flight, **failed to adequately perform a course of action required by SOP** concerning touchdown autorotations. Although a ground reconnaissance was performed, he did not insure that the touchdown lane was free of obstructions. After touchdown from a practice autorotation, the helicopter slid into a metal storm drain cover, causing minor damage.	12 UH-1M IP failed to perform a course of action as required by SOP (failed to insure that touchdown autorotation lane was free from obstructions) because of **excessive self-motivation and get-homeitis.** This was an afternoon flight rescheduled from the morning period due to mechanical problems, and the IP expedited his reconnaissance due to personal commitments for that evening.	6 USASC **inform personnel of problems encountered and remedies via publications,** such as FLIGHTFAX and AVIATION DIGEST, on the hazards of allowing personal factors to adversely affect the performance of tasks.
	LCO	16 UH-1M unit commander **failed to perform a course of action required by AR 95-1, par. 3-2c(1),** in that he did not designate a practice rotary wing touchdown emergency procedure training location free from obstructions. As a consequence, an IP, during unit transition training flight, performed a practice touchdown autorotation and the aircraft slid into a metal storm drain cover, causing minor damage. NOTE: Even though the IP did not perform a thorough ground reconnaissance, paragraph 3-2c(1) of AR 95-1 is interpreted to mean that the local commander is responsible for surveying and designating in writing those areas free from obstructions to be used in practice touchdown emergency procedure training.	0 UH-1M unit commander failed to perform a course of action required by AR (he did not designate a practice rotary wing touchdown emergency procedure training area free from obstructions) because of **unknown/insufficient information.** The accident report, prepared by an investigation board selected from field units, did not contain sufficient information to determine why these actions were taken.	10 Unit/local commander **improve existing facilities** for practice rotary wing touchdown emergency procedure training by designating in writing those areas appropriately surveyed and free of obstructions.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Article on how personal factors affect job performance is scheduled for publication in FLIGHTFAX.

No action to date has been taken to determine why a significant number of mishap reports prepared by field investigation boards contain insufficient information to determine remedial actions.

16 (Repeat)

0 (Repeat)

18 USASC **perform studies/research to determine** why this accident report, and many others, contain insufficient information, i.e., selection of untrained or insufficiently trained investigators as board members, selection of board members with insufficient experience, lack of an automatic in-flight data recorder system, or information not available/obtainable.

99 No contributing materiel failure.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
349	P	6 UH-1H pilot on a service mission **inaccurately estimated clearance/ closure** rate of aircraft to ground during an emergency landing approach with power available. He initiated the deceleration phase of the approach at too low an altitude (approximately 25 feet agl) to fully realize an appreciable reduction in forward speed and sink rate before touchdown became imminent. As a result, the pilot was late in applying the control inputs necessary to arrest the aircraft's rate of descent and to achieve a near-level attitude upon landing, and the aircraft touched down hard in a tail-low attitude.	4 The pilot inaccurately estimated clearance/closure (initiated deceleration and subsequent landing control inputs too late to arrest rate of descent prior to touchdown) because of a suspected loss of **composure.** Following onset of emergency (audio/visual indications of low engine/rotor rpm, 6000/300 respectively, needles joined) the pilot began to remedy the low rpm condition by beeping up N_2. Concurrently, the copilot, thinking a low-side governor failure had occurred, placed the governor switch in the emergency position without the pilot's knowledge while throttle was in the full-on position. When the pilot attempted to compensate for the resulting engine/rotor overspeed by adding collective and rolling off throttle, the copilot returned the governor switch to the auto position, causing further confusion. It is suspected the pilot became task overloaded at this point to a degree that his remaining actions began to lag behind task requirements.	5 Commander **insure assigned aviators are ready/capable of performing job assigned regarding their composure** (level of equanimity). To implement remedy, the subject of stress and its relationship to crewmember performance should be discussed at unit safety meetings. In addition, the types of errors that lead to creating a high stress situation, such as cited in this mishap, should be discussed, to include preventive measures.
R		6 (Repeat)	4 (Repeat)	6 ASO **inform assigned aviator personnel of the human error identified in this mishap, underlying causes, remedies and lessons to be learned via next unit aviation safety meeting.**
		6 (Repeat)	4 (Repeat)	6 USASC **inform personnel of problems encountered** in this and similar mishaps **and remedies via FLIGHTFAX.**

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
349	P	14 UH-1H pilot on a service mission **authorized an imprudent course of action that was irrelevant to safe accomplishment of the mission**, i.e., he permitted the copilot to beep down N_2 to an rpm condition considerably less than 6600 rpm to allegedly conserve fuel. As a result, it is suspected that a further beep-down of N_2 inadvertently occurred later in flight, causing the aircraft rpm warning system to activate. This, in turn, precipitated a sequence of events, terminating in a hard landing and major damage to the aircraft.	6 The pilot authorized an imprudent course of action (permitted mission to be flown with N_2 beeped down below 6600 rpm to allegedly conserve fuel) because of **inadequate judgment.** The aircraft was refueled prior to starting the return leg of the mission and estimated time en route was one hour. Accordingly, the need for fuel/range management was irrelevant to safe accomplishment of the mission.	7 Commander take **positive command action to discourage crew error** attributable to inadequate judgment. To implement remedy, the judgment of assigned aviators should be evaluated as a matter of special interest during standardization flight evaluations and unit training flights.
		14 (Repeat)	6 (Repeat)	6 ASO **inform assigned aviator personnel of the human error identified in this mishap, underlying causes, remedies and lessons to be learned via next unit aviation safety meeting.**
28		14 (Repeat)	6 (Repeat)	6 USASC **inform personnel of problems encountered** in this and similar mishaps **and remedies via FLIGHTFAX.**
	CP	15 UH-1H copilot on service mission **performed a course of action prohibited by common practice.** During an emergency landing approach with power available, pilot at the controls—the copilot—placed the governor switch into the emergency position without the pilot's knowledge while the throttle was in the full-on position. As a result, the aircraft's engine, transmission, and rotors sustained a severe overspeed. The pilot compensated for the overspeed by adding collective and rolling off throttle. However, the copilot returned the governor switch to the auto position at this point, causing further confusion. It is suspected that the cumulative effect of these actions task overloaded the pilot to a degree he was subsequently unable to properly complete the approach and land the aircraft without causing major damage.	3 The copilot performed a prohibited course of action (placed governor switch in emergency position while throttle was in full-on position) because of **inadequate experience.** The copilot possessed a total of 275 flight hours and had not experienced a similar in-flight emergency before.	5 Commander **insure assigned personnel are ready/capable of performing job assigned regarding their experience.** To implement remedy, less experienced aviators in the unit must be continuously monitored, evaluated, and trained as necessary to insure they are capable of coping with in-flight emergencies.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
349	CP	15 (Repeat)	3 (Repeat)	6 USASC **inform personnel of problems encountered in this and similar mishaps and remedies via FLIGHTFAX.**
		15 (Repeat)	6 The copilot performed a prohibited course of action (placed governor switch in emergency position while throttle was in full-on position) because of **inadequate judgment.** Although the copilot cannot be faulted for misinterpreting a probable beeped down N_2 condition as a low-side governor failure, his actions in cycling the governor switch into and out of the emergency position without the pilot's knowledge and while the throttle was in the full-on position are inexcusable and could have led to catastrophic consequences.	5 Commander **insure assigned personnel are ready/capable of performing job assigned regarding their judgment.** To implement remedy, aviator judgment must be evaluated as an area of special interest during standardization evaluations and unit training flights.
		15 (Repeat)	6 (Repeat)	6 USASC **inform personnel of problems encountered in this and similar mishaps and remedies via FLIGHTFAX.**
		15 (Repeat)	27 The copilot performed a prohibited course of action (placed governor switch in emergency position while throttle was in full-on position) because of **inadequate supervision/coordination by the pilot in charge of aircraft.** The pilot did not brief the copilot prior to flight regarding duties and responsibilities in the event of an emergency. Also, when the pilot later began to remedy what he thought was a simple beeped down N_2 condition in flight, he did not coordinate this action with the copilot or inform him of his intentions.	7 Commander **take positive command action to encourage proper performance and discourage improper performance.** To implement remedy, the practices of omitting crewmember briefings prior to flight and failing to maintain proper crew coordination must be eliminated and the need for aviator professionalism emphasized.
		15 (Repeat)	27 (Repeat)	6 USASC **inform personnel of problems encountered in this and similar mishaps and remedies via FLIGHTFAX.**
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Article scheduled for publication in FLIGHTFAX. The article will inform personnel of the multiple problems encountered in this mishap to include cockpit coordination and communication, composure, experience, and how these affect judgment and performance in emergency conditions.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
350	P	1 CH-47A pilot on a service mission performed inadequate flight planning. He planned for and attempted a normal VFR takeoff under weather, light, and terrain conditions that dictated an altitude over airspeed takeoff with a possible VHIFR continuation. As a result, he lost visual contact with the ground and permitted the aircraft to impact on the 7-degree slope of the takeoff path while attempting to transition to instruments. Upon impact the aircraft tumbled end over end, sustaining major damage and causing fatal injuries to three of the four crewmembers.	2 Pilot performed inadequate flight planning (planned normal VFR takeoff when terrain and weather conditions dictated an altitude over airspeed departure with possible VHIFR continuation) because of inadequate unit training. The pilot's training records reflect that he had not performed any VHIFR recoveries in over a year; therefore, it would be presumptuous to expect him to plan for or perform a procedure in which he had not maintained proficiency.	2 Commander upgrade unit training to provide at least the minimum training tasks designated in TC 1-139.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		99 No contributing materiel failure.		
No actions other than unit level command.				

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
351	IP	1 TH-1G IP during a day VFR gunnery checkride performed **inadequate flight planning** before the mission. Specifically, he did not plan the flight to arrive at his destination with a 30-minute fuel reserve as required by AR 95-1, par. 4-2 (failed to correlate the amount of fuel aboard the aircraft, with a projected fuel flow rate to calculate a reasonable flight duration). Instead, he relied upon the indications of an inaccurate fuel gauge and continued flight until the engine stopped due to fuel exhaustion. This mishap resulted in total loss damage and one fatality.	5 TH-1G IP performed inadequate flight planning (failed to correlate the amount of fuel aboard the aircraft with a projected fuel flow rate to calculate a reasonable flight duration, and as a result, experienced in-flight fuel exhaustion) because of **inattention.** He failed to comprehend that fuel exhaustion for 1,560 pounds of fuel burning at a rate of 585 pounds per hour would occur at 2 hours and 46 minutes. (If he had planned a consumption rate of 600 pounds per hour for the assumed 1,560 pounds, refueling or termination of the flight should have occurred after 2 + 05 hours.)	7 Unit commander provide **positive command action to encourage proper performance** and discourage improper performance in regard to adequate flight planning for fuel requirements. This could be implemented by requiring the pilot-in-command to complete and file a "performance planning card" as shown in the nine-chapter operators manuals.
		16 TH-1G IP on a day VFR gunnery checkride **improperly performed a course of action required by common practice.** When the engine stopped due to fuel exhaustion, he attempted to stretch the autorotational glide at a low altitude. This action caused the rotor rpm to decrease (which a witness described as so slow he could count the blades) and increase the vertical descent rate. As a consequence, the helicopter struck trees wih a high rate of descent. (Pilot was unable to decelerate and reach a zero rate of descent and zero ground speed at treetops.) The mishap resulted in total loss damage and one fatality.	0 TH-1G IP improperly performed a course of action required by common practice in that he attempted to stretch an autorotational glide after the engine stopped due to fuel exhaustion. **Information** in the report was **insufficient** to definitely establish a system inadequacy. It is suspected that the aviator attempted to use a technique (reduced rpm to stretch the glide) that has propagated through the Army helicopter community without proper sanction. The U.S. Army Aviation Systems Test Activity final report, **Investigation of Engine Rigging, Airspeed, and Rotor rpm Effects on Steady State Autorotation Performance** (USAASTA Project No. 70-23, dated December 1970) concluded that, "The use of a low rotor rpm technique to achieve reduced rate of descent or longer glide distances in autorotation is valid only under a limited set of conditions and should be avoided by the average pilot." USAASTA Project 68-04, dated April 1968, **Special Study of Autorotational Procedures,** said, "A maximum glide technique that utilized low rotor rpm, especially at high gross weights can be misleading in that the rate of descent may increase, glide distance may decrease, and rotor energy will be less than that required to control the rate of descent at termination of this autorotation."	6 TRADOC (USAAVNC-DES) **inform personnel of problems encountered and remedies via** aviation/standardization **meetings** and **publications.** Stress that the technique of reducing rotor rpm to achieve reduced rates of descent or longer glide distances in autorotation is valid only under a limited set of conditions and should be avoided by the average pilot; i.e., someone other than an experimental test pilot.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
361	MS	13 TH-1G maintenance supervisor provided a helicopter for a day VFR gunnery checkride with inadequately performed required maintenance contrary to AR 95-1, par. 4-17, and USAAVNC Cir 95-69, Appendix B (Minimum Essential Equipment). This aircraft was assigned to fly with a known unreliable fuel quantity indicator (during the previous 30 days, it had been written up as unreliable seven times, but nothing in the accident report indicated disposition of those writeups) contrary to the instructions. As a consequence, the IP relied upon the inaccurate fuel quantity gauge to continue his checkflight where fuel exhaustion occurred with an indication of approximately 780 pounds of fuel. This mishap resulted in total loss damage to the aircraft and one fatality.	21 TH-1G maintenance supervisor inadequately performed required maintenance (failed to insure that a helicopter with a reliable fuel quantity gauge was assigned for flight) because of inadequate supervision by higher command. Higher command allowed the issuance of minutes condoning the policy to fly a helicopter with an unreliable fuel gauge.	2 TRADOC (USAAVNC) provide positive command action to encourage proper performance and discourage improper performance to insure that when aircraft are scheduled to fly that an accurate and reliable fuel quantity gauge is installed. One way to implement this policy is to insure that all directives/SOPs/circulars/etc. are not in conflict with or circumvent the intent of the basic policy.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No actions other than unit level/higher command.		99 No contributing material failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
352	P	7 JAH-1G pilot on a ferry flight made an improper flight control action in violation of TC 1-138, task 3003, pg. 6-32. During level flight at approximately 200' agl (8,300' msl), he encountered a fog bank and realized he was about to enter IMC. He attempted an abrupt right 180-degree turn by applying excessive right pedal, causing the aircraft to skid and assume a nose-low attitude. He increased collective pitch to arrest the aircraft's rate of descent, but this resulted in a loss of rpm. The pilot then lowered the collective pitch in an attempt to regain the rpm but, because of this low altitude, the aircraft hit trees and crashed.	26 Pilot performed an improper control action (made an abrupt, uncoordinated right turn that caused the aircraft to lose altitude and strike the tree) because of inadequate supervision/coordination by the IP. As pilot-in-command, the IP was responsible for monitoring the actions of the pilot and ensuring safety of flight. Regardless, he failed to prevent or remedy the pilot's improper control actions in time to prevent tree strike and major damage to the aircraft.	2 Commander upgrade unit training to ensure assigned instructor pilots are ready/capable of preventing/remedying pilot error as necessary. To implement remedy, IP proficiency in fulfilling this responsibility should be evaluated as an area of special interest during IP training and standardization flight evaluations.
		7 (Repeat)	26 (Repeat)	6 Aviation safety officers should inform assigned aviator personnel of the highlights of this mishap, lessons to be learned, and remedies via next scheduled unit aviation safety meetings.
[redacted]		7 (Repeat)	13 Pilot performed an improper control action (made an abrupt, uncoordinated right turn that caused the aircraft to lose altitude and strike a tree) because of the suspected combined effect of fatigue (had exceeded crew rest limits) and hypoxia (both crewmembers were moderately heavy smokers and had been flying for 30 minutes at an indicated altitude equivalent to a physiological altitude of approximately 12,500 feet msl). As a result, it is suspected that the pilot's visual acuity, reaction time, and motor skill levels were degraded to a degree that he became uncoordinated.	2 Commander upgrade unit training to ensure assigned aviator personnel avoid conditions of flight that can lead to the development of fatigue and/or hypoxia. To implement remedy, the expertise of command medical personnel such as a flight surgeon should be solicited to periodically address the causes and effects of adverse psychophysiological states, including measures on how to avoid them. Additionally, guidelines as provided by appropriate regulations governing crew rest policy should be strictly adhered to.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
352	P	7 (Repeat)	3 Pilot performed an improper control action (made an abrupt, uncoordinated right turn that caused the aircraft to lose altitude and strike a tree) because he was not recently experienced in AH-1G aircraft. A review of the pilot's ATM records revealed that he was not current in AH-1G aircraft as required by par. 4-10c, DARCOM Regulation 95-2.	12 Commander improve monitoring of unit personnel and training activities to ensure aviators are current in MTDS aircraft assigned each mission. To implement remedy the standardization program should be closely scrutinized to ensure that the provisions of Ch 2, AR 95-1, and DARCOM Regulation 95-2 are closely adhered to.
		7 (Repeat)	15 Pilot performed an improper control action (made an abrupt, uncoordinated right turn that caused the aircraft to lose altitude and strike a tree) because of the suspected influence of adverse environmental factors. At the time of the mishap, it was raining and visibility was further restricted by a partial coating of the canopy by a hazy, foreign material later identified as dirt embedded in particles of enamel paint.	2 Commander upgrade unit training to ensure assigned aviators avoid errors attributable to adverse environmental influences. To implement remedy, unit aviators must be periodically trained (briefed) on how to properly assess adverse environmental factors and their accompanying risks versus the need for mission accomplishment.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

No actions other than unit level/higher command.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
363	IP	15 OH-58a instructor pilot on a service mission **performed a course of action prohibited by FM 1-51, par. 3-10d, and by common practice,** and exceeded the scope of the authorized mission. The IP caused the aircraft to be hovered in the immediate vicinity of a flare parachute canopy which he attempted to retrieve with an improvised hand hook from the copilot's seat. The canopy ballooned due to the rotorwash and became entangled in the rotating swashplate and pitch change controls, resulting in complete loss of aircraft control. The aircraft hit the ground right side low and rolled on the right side, sustaining total loss damage. 99 No contributing materiel failure.	12 OH-58A instructor pilot performed a course of action prohibited by FM 1-51, par. 3-10d, and by common practice due to **excessive self-motivation.** This motivation was the result of a strong desire to accommodate the requests of friends for flare parachute canopies. The aircraft was intentionally hovered in close proximity to the parachute canopy which became entangled in the flight controls and resulted in total loss damage.	7 Brigade commander exercise **positive command action to discourage improper performance** by the unit instructor pilot. This action must encourage and provide incentives for compliance with the provisions of applicable publications and proper penalties for their disregard. This action must also discourage the practice of arbitrarily undertaking flight activities which are not part of or associated with properly staffed and approved flight missions.

AD-A132 507 ANALYSIS OF FY79 ARMY AIRCRAFT ACCIDENTS(U) ARMY SAFETY 2/2
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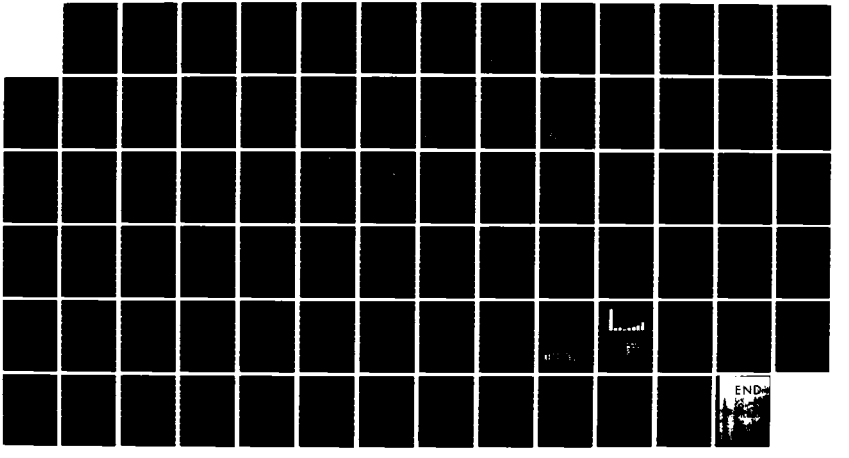

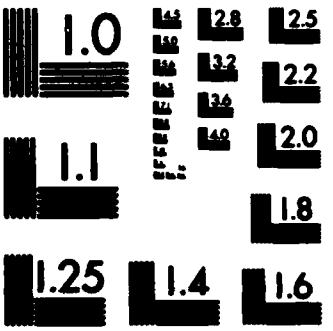

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CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
354		23 AH-1G, while flying straight and level at 125 kts and 1,499 feet agl, had an engine (powerplant) malfunction. Approximately 20 minutes after takeoff, the pilot heard the low rpm audio and saw the warning light. The pilot entered autorotation and switched the governor to emergency, but the engine would not respond and stabilized at 30 percent N_1. The autorotation was continued to a dirt road, but the aircraft overshot the intended landing area and landed hard, sustaining minor damage. 0 Insufficient information available to determine if human error was involved, i.e., maintenance error.	0 This engine was submitted to CCAD for analysis. CCAD was unable to find anything wrong with the engine. Fire analysis cannot be completed due to insufficient information.	

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
355	P	16 OH-58A pilot on a TAC air strike control mission **failed to perform a course of action required by par. 9-25, TM 55-1520-228-10.** When the aircraft began an uncontrollable right spin at a two-foot hover, the pilot did not close the throttle and accomplish an autorotational landing. He first attempted to fly out of the spin and when that proved unsuccessful, he elected to land with the throttle still on (and the aircraft still spinning). As a result, the aircraft main rotor struck the ground and the aircraft rolled on its right side, causing major damage.	12 OH-58A pilot failed to perform a required course of action (failed to perform an autorotational landing) because of **excessive self-motivation.** The pilot had already evaluated the landing area as unsuitable for touchdown, so he felt it was definitely unsuitable for a hovering autorotation and could damage the aircraft. In addition, the article he had read about tail rotor stall led him to believe the aircraft could be flown out of this situation.	6 **USASC inform personnel of the hazards** of attempting to "save" an aircraft by using other than standard emergency procedures. Commander inform personnel of the hazards of using other than standard emergency procedures.
		CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS **Refer to FLIGHTFAX, Vol. 8, No. 16, dated 6 Feb 80, for accident review. A description of how the roller bearing was displaced, with pictures, can be found in FLIGHTFAX, Vol. 7, No. 45, dated 29 Aug 79.** **Change 9 to TM 55-1520-228-23-1 was published on 13 Dec 79. The change revises the maintenance procedures concerning the pitch change mechanism.** **In light of the revised maintenance procedures concerning the pitch change mechanism, redesign of pitch change mechanism is no longer considered necessary.**		
		27 OH-58A on a TAC air strike control mission experienced a malfunction in the **tail rotor system.** During flight one of the rollers from the roller bearing, P/N 206-011-731-1, became trapped in the outer end of the key slot in the pitch control tube, P/N 206-011-724-1. This condition restricted left pedal movement and limited tail rotor blade angle of attack to approximately 8 degrees. As a result, the pilot had insufficient antitorque control, and the aircraft began an uncontrollable right spin while hovering at 2 to 3 feet. The aircraft was landed while spinning and rolled on its right side, causing major damage.	18 OH-58A experienced a tail rotor system malfunction (roller bearing trapped in the outer key slot in the pitch control tube) because **maintenance installation was performed inadequately.** During installation, the pitch key was placed in the slot of the pitch control tube and then the pitch control tube was forced through the tail rotor control housing assembly from the back side. Since the diameter of the key is .0033 to .0042 larger than the inside diameter of the bearing in the control housing, the key dislodged one of the roller bearings from the retainer. The roller bearing was then trapped inside the output shaft where it eventually became trapped in the key slot of the control tube.	3 DARCOM **revise procedures in TM 55-1520-228-23** to insure the pitch control tube and key are not forced through the control housing. This information could be in the form of a "warning" note.
		27 (Repeat)	18 (Repeat)	9 DARCOM **redesign the tail rotor pitch change mechanism** to prevent improper installation. This could be accomplished by increasing the diameter of the pitch key so that it can not enter the bearing in the control housing.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
366	P	6 UH-1H pilot, during a standardization check flight, while performing a practice touchdown autorotation with turn, inaccurately estimated clearance/closure during the deceleration phase. As a result, he did not adjust cyclic as necessary to attain the correct landing attitude from a tail-low attitude IAW task 4003 of TC 1-135. The tail skid and rotor blades struck the runway, causing separation of the 90° gearbox.	0 UH-1H pilot inaccurately estimated clearance/closure (during the deceleration phase of a practice touchdown autorotation with a turn, he did not adjust cyclic to attain correct landing attitude) because of unknown/insufficient information. The accident report, prepared by an accident investigation board selected from field units, did not contain sufficient information to determine why the pilot misjudged his autorotative landing attitude.	18 TRADOC (USAAVNC-DES) perform studies/research to determine why pilots are inaccurately estimating clearance/closure during the deceleration phase of practice touchdown autorotations. This is a chronic problem that continues to result in notable losses in aviation resources.
		6 (Repeat)	0 (Repeat)	18 USASC perform studies/research to determine why this accident and many others contain insufficient information, i.e., selection of untrained or insufficiently trained investigators as board members, selection of board members with insufficient experience, lack of an automatic in-flight data recording system, or information not available/obtainable.
	IP	10 UH-1H IP, on a standardization check flight, improperly monitored performance of personnel during the deceleration phase of a practice autorotation with a turn. He failed to initiate corrective action when the pilot failed to adequately adjust cyclic to attain the correct landing attitude for touchdown. As a consequence, the tail skid and rotor blades struck the runway, causing separation of the 90° gearbox.	0 UH-1H IP improperly monitored performance of personnel (failed to initiate corrective action when the pilot failed to adjust cyclic to attain the correct landing attitude for the touchdown of an autorotation) because of unknown/insufficient information. The accident report, prepared by an accident investigation board selected from field units, did not contain sufficient information to determine why the IP did not take over the aircraft controls following the pilot's error.	18 TRADOC (USAAVNC-DES) perform studies/research to determine why IPs fail to initiate corrective action for pilot errors in a timely manner to prevent mishaps. This is a problem that continues to result in notable losses in aviation resources.
		10 (Repeat)	0 (Repeat)	18 USASC perform studies/research to determine why this accident and many others contain insufficient information, i.e., selection of untrained or insufficiently trained investigation board members, selection of board members with insufficient experience, lack of an automatic in-flight data recording system, or information not available/obtainable.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Research is being initiated by USASC to determine why pilots are inaccurately estimating clearance/closure during the deceleration phase of autorotations.

No action to date has been taken to determine why a significant number of mishap reports prepared by field investigation boards contain insufficient information to determine remedial actions.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
357	P	6 UH-1H pilot on a day VFR passenger service mission inaccurately estimated clearance/closure while making a precautionary landing (crew and passengers smelled smoke) to a sand bar. During final phase of a rushed landing approach, he did not adjust cyclic to attain the correct touchdown attitude, and he failed to apply power in sufficient time to arrest the rate of descent. The helicopter impacted the sand bar on the tail rotor and skid, resulting in separation of one tail rotor blade and the 90° gearbox.	20 UH-1H pilot inaccurately estimated clearance/closure (during touchdown for a precautionary landing situation, he rushed his approach and failed to adjust cyclic for a landing attitude and arrest a high rate of descent) because of inadequate written procedures for operation in abnormal/emergency man-machine-environmental conditions. The operators manual (TM 55-1520-210-10) does not address "emergency descent" as required by par. 3-2.10.1-8a of MIL-M-63029A (Military Specifications Manual, Technical: Requirements for Operators and Crewmembers Manuals and Checklists for Aircraft).	4 DARCOM provide procedures for abnormal/emergency operation in the operators manual (TM 55-1520-210-10) to address "emergency descent" as required by MIL-M-63029A.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
Insufficient information contained in the mishap report analysis to establish lack of emergency descent instructions as a cause factor.		6 (Repeat)	1 UH-1H pilot inaccurately estimated clearance/closure (during touchdown for a precautionary landing situation, he rushed his approach and failed to adjust cyclic for a landing attitude and arrest a high rate of descent) because of inadequate school training. School failed to provide information on the techniques—and hazards—for performing an emergency descent.	1 TRADOC (USAAVNC) provide school training on the techniques—and hazards—for performing an emergency descent. This training should be implemented upon the identification of the techniques and hazards by DARCOM (AEFA).
Insufficient information contained in mishap report analysis to establish causal role of emergency descent training.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
388	SP	7 TH-55 student pilot on a supervised solo training flight lost control of the aircraft. Student pilot performed improper flight control actions to successfully terminate a normal approach. As a result, he lost control of the aircraft which made several turns to the right while descending until it hit the ground, sustaining major damage.	26 Student pilot performed improper flight control actions (overcontrolled) during a normal approach and lost control of the aircraft because of inadequate supervision by the IP. This student was obviously not ready to solo: (1) He had to perform a go-around because of control problems during first supervised solo the day before the accident and did not technically complete his first supervised solo. (2) He had similar control problems on his second supervised solo that resulted in loss of control of the aircraft and this accident. (3) Student had maximum time (15.6 hours) permitted prior to solo, indicating a weak student. (4) IP admits SP was unable to perform at his flight hour level on the postaccident checkride.	16 Contractor assure that IPs in their employ improve monitoring of personnel (student pilots) to better determine the ability of their students to solo at the specified flight hour level.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USAAVNC has taken the necessary action.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
359	IP	7 IP of an AH-1S (Mod) on a transition training mission performed an improper flight control action (attempted a late power recovery) from an autorotation. During the termination of an autorotation, the RSP applied excessive initial collective pitch, causing the aircraft to "balloon." The IP was attempting a power recovery when the aircraft started to yaw to the right due to low rotor rpm and the application of power. The aircraft touched down left skid first, bounced, and continued the right yaw, causing the main rotor blades to strike the ground and the aircraft to come to rest on the left side with total damage.	3 IP of an AH-1S (Mod) performed an improper flight control action (attempted a late power recovery) because of inadequate experience as an instructor pilot. The individual had been rated as an IP for only eighteen days and had logged only twenty-seven hours as an instructor even though he had over 800 hours in this model aircraft. As a result of this inexperience as an IP, he attempted to power recover from a "ballooned" autorotation instead of placing the aircraft on the ground.	1 U.S. Army Aviation School upgrade school training to include in the instructor pilot POI recommended recovery techniques for use in student-induced unusual situations. A canvass of experienced IPs would be a ready source of these techniques.
		7 (Repeat)	3 (Repeat)	1 U.S. Army Aviation School upgrade school training for IPs to include practice in the SFTS of recovery techniques for student-induced unusual situations.
[redacted]		7 (Repeat)	15 IP of an AH-1S (Mod) performed an improper flight control action (attempted a late power recovery) because of environmental influences (suspected optical illusions). Much of the limited experience of the IP had been gained on a training strip and a taxiway, both of which are approximately one-third the width of the runway on which the mishap occurred. The added width of the runway may have caused the aircraft to appear closer to the runway surface than it actually was, resulting in the IP thinking he had less altitude and time than he actually did have in which to accomplish the power recovery maneuver.	4 U.S. Army Aviation School revise/provide procedures for emergency operation training requiring that both school and unit autorotative training performed during a transition course of instruction be restricted to touchdown areas of one size due to an optical illusion problem that affects the depth perception when alternating between wide versus narrow and long versus short touchdown areas.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS **Article published in FLIGHTFAX, Vol. 7, No. 29, 18 Jul 78, titled "A New Approach to an Old Problem."**	7 (Repeat) 99 No contributing materiel failure.	15 (Repeat)	6 U.S. Army Safety Center inform personnel through articles in the various safety publications of the optical illusion problem that affects depth perception when transitioning between narrow and wide touchdown areas.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
380	IP	27 TH-55A experienced a fatigue corrosion failure of the tubular steel spar interface of the tail rotor blade, P/N 269A6035-17. The aircraft was at a stabilized, stationary 3-foot hover when the IP heard a grinding noise and felt severe vibrations throughout the airframe. As the IP attempted to take control of the aircraft, it violently pitched nose-down and simultaneously yawed right. Main rotor blades hit the lane, and tail of aircraft flipped over cabin area. The aircraft came to rest on its left side 180° from its initial heading.	19 TH-55A experienced a fatigue corrosion failure of the tubular steel spar interface of the tail rotor blade, P/N 269A6035-17, due to suspected inadequate written maintenance inspection procedures as outlined in the appropriate maintenance manuals. The current procedures outlined in the maintenance manual were followed but were not sufficient to detect the fatigue corrosion.	18 DARCOM research the feasibility of developing additional inspection procedures for the TH-55A tail rotor blade, P/N 269A6035-17, to discover corrosion in the fiberglass to steel spar interface and reduce the possibility of fatigue failures and mishaps.
		27 (Repeat)	19 (Repeat)	18 USASC performs a study (computer) of TH-55A tail rotor failures involving the fiberglass to tubular steel spar interface to determine if a trend is present.
		98 No contributing human error.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

USAAVSC has established a procedure whereby the contractor will X-ray the -17 blades more frequently to insure that corrosion is not present. USAAVSC is attempting to obtain an improved blade (269A6035-21) at an accelerated rate. Complete changeover to -21 blade is projected for September 1989.

A USASC study indicates that this is the only mishap on record caused by failure of the -17 blade.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
361		23 OH-58A experienced an engine (fuel control) malfunction. At approximately 100 feet agl and 80-90 knots during a 180-degree turn, the fuel bypass valve and/or main fuel metering valve stuck open due to binding caused by hard foreign particles, resulting in a reduction in fuel flow and subsequent loss of engine power.* This occurred following the reduction of power by the pilot in a turn. As collective pitch (power) was reapplied to stop the descent, the low rpm audio came on and the aircraft continued to descend into 30- to 50-foot pine trees, sustaining total loss damage. *This engine had only 7.6 hours.	18 OH-58A engine (fuel control) bypass valve malfunctioned (stuck open due to hard foreign particle contamination) because maintenance was performed inadequately at CCAD during engine buildup. Hard foreign particles were permitted to enter one of the ports on the fuel control while the port was uncovered during installation on the engine. The foreign particles caused binding of the bypass valve and/or main fuel metering valve and eventual sticking in the open position.	19 CCAD improve quality control in their engine shop to assure contaminants are not permitted to enter uncovered ports in fuel controls or other components during engine buildup (installation of subassemblies on the engine). **CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS** CCAD production and quality personnel have been made aware of this problem.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
382	P	4 AH-1S pilot conducting contour flight on a service mission was involved in **inadequate crew coordination.** While flying at 10 feet agl and 40-50 KIAS, the pilot, without coordinating the transfer of aircraft control or alerting his copilot who was studying a map, to assist in maintaining terrain clearance, leaned forward and directed his attention to changing frequencies on the tactical FM radio. The aircraft entered a shallow descent and hit the ground, sustaining major damage.	19 AH-1S pilot conducting contour flight on a service mission was involved in inadequate crew coordination due to **inadequate written procedures.** Chapter 5 of FM 1-51 covers navigation crew duties during terrain flight and emphasizes pilot concentration outside the aircraft. However, there is no written requirement or crew duty publication that requires the AH-1 crew to transfer aircraft control or verbally coordinate the pilot's transfer of attention to the cockpit during terrain flight for radio frequency changes or other functions taking longer than a glance at an instrument or the movement of a switch. As a result of this lack of coordination, the copilot detected the aircraft descent too late to prevent ground contact.	3 **TRADOC revise/provide procedures** for normal operation. The appropriate publications should be updated to include detailed duties for each crewmember with particular emphasis on the duties and coordination required in maintaining constant external surveillance during the terrain flight phase of missions.
		4 (Repeat)	16 AH-1S pilot conducting contour flight on a service mission improperly divided his attention due to **inadequate design of the aircraft** (cockpit configuration). The tactical FM radio controls on the ECAS version of the AH-1S are located at the bottom center of the instrument panel which requires the pilot to lean forward and reach around the cyclic control to operate the radio. The pilot was unable to accomplish this function and maintain visual contact outside the cockpit. The copilot detected the aircraft descent too low to prevent the ground contact.	18 **TSARCOM conduct a study** (cockpit configuration review) of the ECAS version of the AH-1S to consider and evaluate the relocation of the tactical FM radio controls to a better cockpit location. The tactical FM radio is the most frequently used radio during terrain flight which requires maximum outside visual contact.
		4 (Repeat)	6 AH-1S pilot failed to alert his copilot to maintain terrain clearance because of **inadequate judgment.** The pilot elected to divert his attention to tuning the radio without adequate regard for the aircraft's critical flight altitude of 10 feet agl. Moments before, but at a higher altitude, he had successfully tuned the radio without alerting the copilot; however, this time the copilot was studying the map and without an altitude safety factor, the aircraft hit the ground before corrective action could be taken.	7 Installation Flight Standardization Board incorporate into the training evaluation and standardization program **increased emphasis on flight management.** As part of this emphasis, crew coordination, task priority determination, and continuous external surveillance during terrain flight should be closely evaluated on all check flights.
		99 No contributing materiel failure.		

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

DA Form 2028 submitted to FMI 1-51 on the subject of radio frequency changes and transfer of aircraft control.

USASC will coordinate with TSARCOM to conduct a cockpit configuration review of the present location of the FM radio.

CASE NUMBER	SAFETY FUNCTION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	RESIDUAL HAZARDS
39F		0 Insufficient information was available to determine if either material failure or human error contributed to this accident. The crew of a UH-1H on a service mission reported a loss of engine power when the pilot attempted to level off during a descent from 1,000 feet msl to 700 feet msl. When power was applied to level off, the N_2 and rotor tachometers were noted to be indicating 3000 engine/770 rotor rpm, and the aircraft continued to descend. The low rpm warning light was illuminated, but the audio was not activated. An autorotation was initiated by the copilot after both aviators checked to ensure that the throttle was full on. The copilot performed the autorotation, which terminated when the aircraft struck a rice paddy dike, causing the main rotor blade to sever the tail boom. Teardown and analysis performed by CCAD failed to reveal any mechanical malfunction which could have caused the alleged loss of power. The engine was torn down and examined. The fuel control was functionally checked and then torn down. Fuel systems and electrical systems were checked and found to operate normally.	0 Insufficient information.	0 Insufficient information.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
304		25 CH-47C combining transmission, P/N 114D288-8, failed during an autorotation. When the IP increased the thrust lever (approx. 1 inch) at 300 feet agl to spool up the engines for a termination with power, a left input roller bearing, P/N 114D571-1, failure caused binding in the combining transmission. As a result, the aircraft lost rotor rpm and the No. 1 engine transmission shaft failed due to overstress. The aircraft touched down hard and slid 630 feet, causing total loss damage.	0 CH-47C combining transmission failed due to suspected maintenance error during depot overhaul. The roller bearing, P/N 114D617-1, was so badly destroyed that the cause of the failure was indeterminable. However, the combining transmission was less than three hours out of overhaul. Inadequate lubrication and installation of the combining transmission were ruled out as possible cause factors.	19 DARCOM (TSARCOM) inspect the depot overhaul facility and procedures to insure proper quality control during the overhaul of combining transmissions.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

TSARCOM inspected depot overhaul facility and all discrepancies noted were corrected.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
365	P	6 The pilot of a CH-47C on a support mission to deploy FARE systems in a tactical DZ inaccurately estimated the clearance required to safely operate his helicopter in the presence of unsecured parachutes. After operating in the vicinity of numerous parachutes for approximately 30 minutes, a G11-A (100 ft. diameter) cargo parachute which was lying 70 meters from the helicopter was blown up into the air and descended into the aft rotor system while the rotor system was in the 3° desent position. The parachute caused the aft rotor to slow down, causing a dephasing of the tandem rotor systems. The blades meshed, causing blade separation and resulting in an unbalanced rotor condition. The helicopter began to shake violently and caught fire. The fire destroyed the helicopter.	19 The pilot of a CH-47C inaccurately estimated the clearance required to safely operate his helicopter in the presence of unsecured parachutes because of inadequate written procedures. Existing publications do not address the hazards associated with operations adjacent to unsecured parachutes.	18 DARCOM perform research to establish safe operating parameters that will serve as guidelines for helicopter operations in the vicinity of parachutes.
366		6 (Repeat)	19 (Repeat)	6 USASC should inform personnal of problems encountered and recommend remedies. USASC should publish a diacussion of the hazards associated with helicopter operations near parachutes in articles in FLIGHTFAX and the AVIATION DIGEST.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS		6 (Repeat)	19 (Repeat)	3 Department of the Army should provide procedures for the normal operation of helicopters in the vicinity of parachutes.
Article published in FLIGHTFAX, Vol. 8, No. 19, 5 Dec 79, "Unsecured Parachutes vs Helicopters . . . And the Winner Is?" Article points out dangers involved in operating a helicopter near unsecured equipment and parachutes.		6 (Repeat)	19 (Repeat)	6 Unit ASO should inform unit personnel of problems encountered and remedies via safety meetings and unit SOPs.
		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
366	CP	15 UH-1H copilot (PIC not on controls) on a service mission performed a course of action prohibited by TM 55-1520-210-10 and TC 1-135. During takeoff from a high altitude site (7,500 feet), he allowed the aircraft to come to a high hover (50' +), resulting in a loss of rotor rpm. He then started a turn, causing the aircraft to exceed its power limitations. The aircraft crashed, sustaining minor damage.	27 UH-1H copilot performed a course of action prohibited by TM 55-1520-210-10 and TC 1-135 (allowed rotor rpm to decay during takeoff) because of inadequate supervision by the pilot in charge of the aircraft. The PIC failed to monitor the actions of the copilot and allowed him to exceed the limitations of the aircraft, causing a loss of power. When the PIC took the controls, he was unable to regain engine and rotor rpm before the aircraft hit the ground.	2 Upgrade/provide unit training to ensure that designated PICs understand their responsibility and authority for all aspects of the technical operation of the aircraft. This understanding should be checked by unit IPs as part of the oral examination of annual standardization rides.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No action other than unit level/higher command.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
357	IP	16 TH-1G IP, during a transition, failed to perform a course of action required by local directives dated 5 Feb 79. In violation of the MFR, the IP allowed the RSP to touch down on the last one-third of the lane during a practice low-level, flat-glide autorotation. Insufficient lane remained at touchdown, and the aircraft slid off the hard surface and yawed 90 degrees to the right. The skids seperated, and the aircraft overturned into a concrete drainage ditch.	1 TH-1G IP failed to perform a course of action required by local directives (i.e., not to touch down on the last one-third of the lane while performing practice autorotations) because of inadequate school training. RSP placed the aircraft outside the normal/safe operating parameters during the final phase of low-level autorotation near the restricted final one-third of the runway. The IP was not trained in the recovery techniques for these conditions and was uncertain what actions to take. The aircraft touched down with insufficient lane remaining and slid off the runway, causing major damage.	1 USAAVNC should provide school training for IPs regarding the correct procedures for low-level, low rpm power recovery from autorotations. The SFTS should be used in this IP training since it is not practical to endanger aircraft by operations outside safe parameters.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No actions other than unit level/higher command.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
388	P	15 JUH-1H pilot conducting a routine service mission performed a course of action prohibited by TM 55-1520-210-10, figures 7-3 and 7-5. With the knowledge available that the aircraft was incapable of hovering under the conditions which were present, he flew the aircraft into a density altitude environment with a gross weight for which power required exceeded power available. He allowed the aircraft to slow to approximately translational lift airspeed and descended below the terrain elevation to his front. Engine rpm bled off and the aircraft settled and impacted on a gradual slope, causing major damage.	0 JUH-1H pilot flew the aircraft into a density altitude environment with a gross weight for which power required exceeded power available because of unknown/insufficient information. The accident report, prepared by a team selected from field units, did not address why the pilot performed this course of action.	18 USASC perform studies to determine why this report and many others contain insufficient information (i.e., selection of untrained or inadequately trained accident investigation teams; lack of automated in-flight retrieval data systems; or information not available/obtainable.)

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

No action to date has been taken to determine why a significant number of mishap reports prepared by field investigation boards contain insufficient information to determine remedial action.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
369	P	7 UH-1H pilot on a day VFR NOE requalification training flight made improper flight control actions contrary to task #5007 of TC 1-135 (ATM-Utility Helicopter). Following a demonstration and two practice quick-stop maneuvers, he entered the third quick-stop maneuver by slightly lowering collective and pulling aft cyclic in an abrupt manner at an altitude lower than the previous two. This caused the helicopter to rotate longitudinally about the main rotor mast instead of the tail rotor as the pivotal point, and consequently, the tail stinger and rotor blades struck the ground, where separation of the tail rotor and 90-degree gearbox occurred. Ground impact was hard enough to fracture the skids and the helicopter rolled left to a near-inverted position. Separation of the main rotor and displacement of the main transmission occurred during rollover.	7 UH-1H pilot made improper flight control actions (entered NOE quick-stop maneuver by lowering collective and pulling aft cyclic in an abrupt manner at an altitude which resulted in rotation about the main rotor vice tail rotor, and the tail stinger and rotor struck the ground) because of overconfidence in self. Two years previously he had qualified in NOE flight and had just correctly completed two maneuvers by rotating about the tail rotor. He assumed that his level of proficiency was commensurate to prevent improper flight control actions.	6 Aviation safety officers inform personnel (SIPs, IPs, and Pst) of problems encountered and remedies regarding the hazards of performing NOE quick-stops at a very low altitude where pilot proficiency levels may induce improper flight control actions, which causes the helicopter not to maintain a constant tail rotor height. To implement this remedial measure, USAAVNC (DES) inform ASOs of the potential improper control actions which cause the helicopter not to maintain a constant tail rotor height.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
369	IP	10 UH-1H instructor pilot on a day VFR, NOE requalification training flight improperly monitored performance of personnel. He allowed the pilot, after a demonstration and two practice NOE quick-stop maneuvers, to enter a third at a lower altitude (from 10- to about 5-foot skid height) and apply incorrect flight control actions (lower collective and pull aft cyclic in an abrupt manner). This caused the helicopter to rotate longitudinally about the main rotor mast instead of the tail rotor as the pivotal point, and, consequently, the tail stinger and rotor blades struck the ground, where separation of the tail rotor and 90-degree gearbox occurred. Ground impact was hard enough to fracture the skids and the helicopter rolled left to a near-inverted position. Separation of the main rotor and displacement of the main transmission occurred during rollover.	8 UH-1H instructor pilot improperly monitored performance of personnel (allowed pilot to enter NOE quick-stop maneuver from a low altitude and use improper flight control actions) because of overconfidence in others. He was aware that the pilot had qualified in NOE flight two years before and had just executed correctly two quick-stop maneuvers by using the tail rotor as the pivotal point. Even though he was guarding the controls in a responsible manner, he allowed the maneuver to progress (low altitude entry) to where he could not prevent the mishap when the pilot made improper flight control actions (lowered collective and pulled aft cyclic in an abrupt manner).	16 Unit IP/SIPs improve monitoring of personnel during NOE training to insure that the maneuvers being performed are commensurate with the level of proficiency. In particular, the IP/SIP should not allow the maneuver to proceed or progress to the point that he could not correct for an improper flight control action and prevent a mishap.
		10 (Repeat)	8 (Repeat)	3 USAAVNC (DES) revise procedures for normal operation in the respective TCs regarding entry altitude for practice NOE quick-stop maneuvers, whereby a minimum altitude would be established which will prevent ground contact of the tail stinger/rotor should the trainee use improper flight control actions.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

DES evaluated the remedial measure. Successful completion of NOE deceleration maneuvers is a function of proper technique by pilot and monitored performance of personnel by the instructor pilot. Raising entry altitude to a minimum may prevent tail rotor strikes, but it will also degrade the intent of the maneuver to a point where it is no longer useful as a training requirement. Furthermore, it may add additional judgmental problems to the pilot/IP (i.e., loss of visual cues, maintaining established altitude), causing further degradation of the maneuver. Evaluation of the remedial measure led to the conclusion that raising entry altitude of NOE deceleration to a standard minimum will make the maneuver too restrictive in both training and in tactical environments.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
370	IP	5 TH-55A instructor pilot conducting initial entry rotary wing training was on downwind leg at a stagefield when he perceived the aircraft was not producing full power. IP elected to remain in the traffic pattern and attempt a precautionary landing to the stagefield, but allowed the aircraft to descend too low to make the planned touchdown point because of **improperly divided attention.** IP's preoccupation with rpm caused him to lose 500 feet during downwind and base legs at the traffic pattern, making it impossible to reach the intended landing point because of altitude, power, and trees in the flight path.	0 TH-55A instructor pilot improperly divided his attention (allowed aircraft to descend to a point too low to make intended precautionary landing site) because of **unknown/insufficient information.** The accident report, prepared by an accident investigation board from the field, did not contain sufficient information to determine why the pilot improperly divided his attention.	6 USASC should **inform personnel of problems encountered and remedies** via meetings, publications, and directive messages to insure that all aviators are aware of the importance of dividing one's attention between a continuous cross-check inside and outside the aircraft. This can be implemented through FLIGHTFAX.
		5 **(Repeat)**	0 **(Repeat)**	18 USASC **perform studies/research to determine** why this accident and many others contain insufficient information; i.e., selection of board members with insufficient experience, selection of untrained or insufficiently trained investigators as board members, lack of an automatic in-flight data recording system, or information not available/obtainable.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS **USASC routinely publishes articles dealing with diversion of attention.** **USASC is conducting an analysis to determine the need for a flight data recorder. A technical report will be published around June 1988.**		15 TH-55A instructor pilot conducting initial entry rotary wing training was making a precautionary landing with a perceived partial power loss when he **performed a course of action prohibited by par. 5-20 and fig. 5-4, TM 55-1520-223-10.** He initiated an autorotation at low airspeed and 25 feet agl with a smooth running engine that was maintaining 2500 rpm with considerable collective applied. This resulted in a hard landing with major damage. 99 No contributing materiel failure.	6 TH-55A instructor pilot initiated an autorotation in an unsafe flight regime (par. 5-20 and fig. 5-4, TM 55-1520-233-10) because of **inadequate judgment.** Even though the aircraft was producing enough power to hover (2500 rpm, 25" MP), the IP erroneously felt something was dragging down the rotor rpm and autorotated out of "desperation."	6 Aviation safety officer **inform personnel of the circumstances of the accident and problems encountered** concerning errors in judgment and emphasizing proper procedures/techniques for autorotation as prescribed in TM 55-1520-233-10.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
371	P	1 C-7A (DHC-4) pilot on a day VFR passenger service mission performed inadequate flight planning during the mission. After two aborted approaches under gusting crosswind conditions which approached and may have exceeded crosswind limits, he elected to perform the shortfield landing from the opposite direction. During rollout, he failed to maintain direction or control or stop before striking a fire hydrant surrounded by a concrete wall.	12 C-7A pilot performed inadequate flight planning (after two aborted approaches under gusting crosswind conditions which approached and may have exceeded crosswind limits, he elected to perform the shortfield landing from the opposite direction) because of peer and command pressure. This motivation is a result of: the crosswind landing requires a great amount of skill and ability and presents a personal challenge; acceptance to the pilot community requires unaborted crosswind landings; and if a landing is not accomplished, then the command (contractor) must furnish other means of transportation.	3 Contracting officer representative revise procedures for normal operation of crosswind landings. In cooperation with the contractor and other appropriate authority, establish proper and positive crosswind limits for the C-7A operations and ensure that these limits are adhered to.
		1 (Repeat)	21 C-7A pilot performed inadequate flight planning because of inadequate supervision/coordination by contracting officer. The contracting officer issued a Letter of Exception to the C-7A operators manual which is in violation of AR 70-62. The Letter of Exception authorized that the crosswind limits be raised to 22 knots at 90°. As a result, the pilot attempted to land the aircraft in a crosswind condition, exceeding the limits prescribed by figures A6-1&2 of TO 1C-7A-1-1, the C-7A operators manual.	3 Contracting officer revise procedures for normal operations by revoking Letter of Exception to the C-7A operators manual which increased the crosswind limitations to 22 knots at 90°. Further, contracting officer coordinate with U.S. Air Force (Commander, MR-ALC-MNSRDD, Warner-Robbins AFB, GA, the agency exercising engineering cognizance) to provide appropriate guidance.
		16 C-7A (DHC-4) pilot on a day VFR passenger service mission improperly performed a course of action required by common practice during rollout of a gusting left crosswind landing. He applied full reverse thrust on the left engine (upwind side) which caused the airplane to veer left, run off the runway, and hit a fire hydrant surrounded by a concrete wall.	14 C-7A pilot improperly performed a course of action required by common practice (failed to maintain directional control by applying full reverse thrust on the upwind engine during rollout of left crosswind landing) because of habit interference (psychological set). He anticipated, planned for, and aborted two approaches which would have required correction for a right crosswind during rollout. On the third approach, from the opposite direction involving a left crosswind situation, he released the right reverse thrust lever (downwind engine) and continued to full reverse thrust on the left margin.	6 Contracting officer representative inform personnel of problems encountered and remedies via aviation safety meetings on the hazards of psychological sets. Stress that the intense preplanning for a set of conditions which disallows the flexibility necessary to respond to deviant conditions should be avoided.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
371	P	16 (Repeat)	14 (Repeat)	6 USASC inform personnel of problems encountered and remedies via publications such as the AVIATION DIGEST on the subject of psychological sets. The article should emphasize that, although planning is a necessary facet for a safe flight, intense preplanning which disallows the flexibility necessary to respond to deviant conditions can be hazardous.
		16 C-7A (DHC-4) pilot on a day VFR passenger service mission failed to perform a course of action required by common practice during rollout of a gusting left crosswind landing. He failed to attempt directional control by use of nose wheel steering or to stop by applying brakes, after inappropriate response from manipulation of the reverse thrust levers. The airplane ran off the runway to the left and hit a fire hydrant surrounded by a concrete wall.	5 C-7A pilot failed to perform a course of action required by common practice (failed to attempt directional control by use of nose wheel steering or to stop by applying brakes when the airplane veered off the runway) because of channelized attention. His attention was so centered and concentrated on manipulation of the reverse thrust levers that other control means were neglected.	6 Contracting officer representative inform personnel of problems encountered and remedies via aviation safety meetings on the hazards of directing attention so intently that alternate courses of action are excluded.
		16 (Repeat)	5 (Repeat)	3 Contracting officer representative revise procedures for normal operation whereby all means are used to control, slow, and stop the C-7A during landing rollout. This should be interpreted to mean judicious use, rather than nonuse of brakes.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
371	CP	16 C-7A (DHC-4) copilot, on a day VFR passenger service mission, failed to perform a course of action required by common practice. During rollout of a crosswind landing when the airplane veered off the runway and headed toward a concrete wall, he failed to apply brakes without being commanded and thereby help the pilot stop the airplane.	12 C-7A (DHC-4) copilot failed to perform a course of action required by common practice (failed to apply brakes during a landing rollout which would have helped the pilot stop the airplane) because of motivation. He said he would not take any action without being commanded and the pilot could not communicate during this critical period because of his physical duties and inability to activate the intercommunication system.	6 Contract officer representative informs personnel of problems encountered and remedies at aviation safety meetings on the hazards of inaction during emergency situations. During emergencies, when pilots are unable to communicate instructions, the copilot should initiate those actions within their capability to prevent or minimize an accident.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS No actions other than at unit level. A FLIGHTFAX article has been published on the system inadequacies and remedial measures associated with this mishap.		16 (Repeat) 99 No contributing material failure.	12 (Repeat)	4 Contract officer representative and contractor revise procedures for emergencies to prevent copilot inaction during emergencies. Copilot duties should be developed and documented in sufficient detail so those actions necessary to prevent an accident can be accomplished when a pilot is unable to communicate/issue instructions.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
372	SP	0 Insufficient information to perform human error or material failure analysis. No evidence of teardown and analysis of the engine or components (by CCAD) to determine what caused the failure. Aircraft airworthiness section of report did not address the "rough engine or airframe vibrations." Human error was suspected but not addressed in the report and no weather report was included.		**CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS** **A TSARCOM safety-of-flight message (OH-58-93-02) includes changes to TM 55-1520-228-23 concerning rigging procedures. A formal change will be forthcoming.** **A TSARCOM safety-of-flight message (OH-58-93-02) required a one-time inspection of tail rotor rigging on all OH-58 aircraft. TB 55-1520-228-20-28, "One-Time Inspection of OH-58A/C Helicopter Tail Rotor Rigging," dated 8 Feb 93, has been published.**
373		0 This mishap report contains insufficient information to identify human or material failures due to the following reasons: 1. CCAD teardown analysis does not confirm the board's findings that the anti-collision wires were frayed and arcing, creating an ignition source for the oil. 2. The board suspected that the tail rotor drive shaft was weakened by fire and failed due to an engine compressor stall. This was not supported by evidence presented in the report and the engine was not submitted for teardown analysis. CCAD found that the drive shaft was not damaged or affected by heat and the failure was due only to overstress. 3. CCAD teardown analysis indicates the line ruptured due to chafing. The board presented no evidence or discussion to indicate cause of rupture.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
374	IP	16 TH-1G instructor pilot on an end-of-stage checkride failed to perform a course of action required by the AH-1G Aviation Qualification Course Flight Training Guide, par. 3-17d. During an autorotation with turn (RSP on the controls) he allowed the aircraft to descend below 200 feet agl without obtaining lane alignment to the touchdown area and allowed the rotor rpm to decay below 284 after reaching 100 feet agl. As a result, aircraft control was lost and it hit trees parallel to the lane and crashed, sustaining major damage.	5 Instructor pilot failed to perform the proper course of action because of inadequately divided attention. During the initial portion of the maneuver the IP and RSP became engrossed in the RSP's rotor rpm control because of the RSP's problem with it on the previous autorotation. As the aircraft neared the ground, their attention was diverted back outside (lane alignment problem) and the decaying rotor rpm went undetected until it was approximately 220-240 rpm.	1 USAAVNC provide additional training in power recovery techniques to all AH-1 instructor pilots by utilizing the AH-1 visual simulator (i.e., recovery during low rotor rpm and high rate of descent conditions).
		16 (Repeat)	5 (Repeat)	12 Unit commanders and safety officers improve monitoring of instructor pilots to insure that all training procedures and maneuver requirements are complied with. Particular emphasis should be placed on the power recovery requirements for all autorotative maneuvers.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
No actions other than unit level/higher command.		99 No contributing materiel failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
376	IP	7 UH-1H IP, while demonstrating an autorotation with turn to a and touchdown area during initial rotary wing qualification training, applied improper flight control actions. While attempting to reduce ground run, the IP abruptly applied collective pitch at 8-10 feet agl, contrary to the procedures outlined in TC 1-135, task No. 4003. He then held the aircraft off the ground with collective pitch, contrary to common practice, until rotor rpm decayed to a point that effective antitorque control was lost. As a result, the aircraft touched down hard, yawing left (20°-30°) of the desired runway heading. Both cross tubes collapsed and the bottom of the aircraft was damaged.	12 UH-1H IP made improper flight control actions (abruptly applied collective pitch at 8 to 10 feet and held the aircraft off the ground with collective pitch until rotor rpm decayed and effective antitorque control was lost) because of suspected excessive motivation to accomplish an autorotation with turn better than the SP he was instructing. SP was a rated FAA helicopter pilot and considered to be one of the top flight students in his class.	6 USAAC inform instructor pilots and aviation safety personnel of the problems encountered by providing them with topics for unit safety meetings focusing on instances of excessive instructor pilot self-motivation during flight training. Articles pertaining to excessive motivation should be published in FLIGHTFAX.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
Topics for safety meetings are provided through "Safety Talks for ASOs," which is published annually. Article on the effects of excessive self-motivation on safe mission accomplishment is scheduled for publication in FLIGHTFAX.		7 (Repeat) 99 No contributing materiel failure.	12 (Repeat)	12 Unit flight commanders improve monitoring of instructor pilots to detect excessive self-motivation as related to instructor pilot to student pilot relationships. Flight commanders should also brief instructor pilots on the problems encountered due to excessive motivation among instructor pilots.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
376	GM	3 General mechanic improperly performed required maintenance on an OH-58A during a 600-hour phase 2 maintenance inspection. He failed to properly rig the tail rotor after reinstallation of the tail rotor assembly IAW par. 11-93, TM 55-1520-228-23. During an ensuing maximum performance takeoff, this out-of-rig condition resulted in insufficient tail rotor authority, contributing to the aircraft entering an uncontrollable 540° spin about the vertical axis at approximately 75 to 100 feet agl. After the crew stopped the spin, the aircraft descended to the ground, hitting hard in a level attitude and sustaining total loss damage.	19 General mechanic improperly performed required maintenance (failed to properly rig tail rotor) because of inadequate written procedures. The present method used to rig the tail rotor for OH-58 series aircraft IAW par. 11-93 and figure 11-10, view A-A, TM 55-1520-28-23, is inadequate. This procedure requires that the bellcrank and rod assembly be installed with a clearance of .17 to .23. To achieve this clearance requires that a shim be held perfectly perpendicular between two offsetting surfaces, which is almost impossible to do because of its location.	3 DARCOM revise TM 55-1520-228-23 to provide improved tail rotor rigging procedures on all OH-58 series aircraft to eliminate difficulty and enhance degree of accuracy within design tolerances.
		3 (Repeat)	19 (Repeat)	6 DARCOM inform personnel of problems encountered and remedies to be applied by dispatching a safety-of-flight message requiring a one-time inspection of tail rotor rigging on all OH-58 series aircraft.
		99 No contributing material failure.		

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
377	P	7 YCH-47D pilot on a level flight performance test was following through on the flight controls during emergency running landing. **Pilot performed an improper flight control action** (TM 55-1520-240-10, par. 8-68) in that he reduced the thrust lever to, or very close to, the detent position which resulted in a significantly reduced pitch attitude and aerodynamic braking capability. During running landing, the aft rotor droop stops were pounded and failed, and aircraft incurred major damage during shutdown.	3 Pilot improperly reduced the thrust lever to the detent position during running landing because of **inadequate** recent CH-47 **experience.** He had received a 5-hour transition in the YCH-47D and had accumulated only 4 hours flight time prior to the mishap. He had not flown a CH-47 aircraft within the previous 60 days to the transition.	2 USAAEFA **upgrade unit training** to ensure test pilots receive proficiency training in a similar aircraft (mission-type design) prior to conducting preliminary evaluation testing. This pretransition refresher training program should be designed and monitored to ensure personnel attain a proper proficiency level in the particular aircraft to be tested.
		7 (Repeat)	3 (Repeat)	5 DARCOM **ensure personnel are capable of performing job assigned regarding their training** by ensuring that contracts for preliminary Army evaluation testing include provisions for sufficient flight time during transition at the contractor's when similar aircraft for proficiency training are not available or in the system.
		7 (Repeat)	14 Pilot improperly reduced the thrust lever to the detent position during running landing because **of habit interference** (he expected to attain the proper pitch attitude at that position). However, because of significant differences of the detent position between this aircraft and the only other YCH-47D he had flown, and between this aircraft and other CH-47 aircraft (pilot has 1,100 hours in CH-47A, B, C series) he could not achieve the proper pitch attitude.	5 DARCOM **ensure personnel are capable of performing job assigned regarding their training** by ensuring that contracts for preliminary Army evaluation testing include provisions for familiarization flights for test pilots prior to flying (testing) an aircraft for the first time that is significantly different (control responses, etc.) from an aircraft previously flown. These familiarization flights should be designed to ensure that the test pilots fully understand the handling qualities of the aircraft.
		7 (Repeat)	4 Pilot reduced thrust lever to, or very close to, the detent position during running landing because he probably **lost composure** (equanimity) due to repeated warnings from the flight engineer. These warnings intensified the pilot's desire to get the aircraft on the ground and stopped, and they aggravated an already extremely tense situation.	6 USAAEFA **inform personnel of problems encountered and remedies via aviation safety meetings.**

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
377	CP	7 YCH-47D copilot on a level flight performance test was executing emergency running landing when the aircraft began to drift and then skid to the left. Copilot performed an improper flight control action (TM 55-1520-240-10, par. 5-45) in that he exceeded the longitudinal and lateral cyclic limits in an effort to slow the aircraft and correct the yaw and subsequent skid. These actions resulted in aft rotor droop stop pounding and failure, and the aircraft incurred major damage during shutdown.	3 Copilot improperly exceeded the longitudinal and lateral cyclic limits because of inadequate recent CH-47 experience. He had received a 5-hour transition in the YCH-47D and had accumulated only 4 hours flight time prior to the mishap. He had not flown a CH-47 aircraft within the previous 60 days prior to the transition.	2 USAAEFA upgrade unit training to ensure test pilots receive proficiency training in a similar aircraft (mission-type design) prior to conducting preliminary evaluation testing. This pretransition refresher training program should be designed and monitored to ensure personnel attain a proper proficiency level in the particular aircraft to be tested.
		7 (Repeat)	3 (Repeat)	5 DARCOM ensure personnel are capable of performing job assigned regarding their training by ensuring that contracts for preliminary Army evaluation testing include provisions for sufficient flight time during transition at the contractor's when similar aircraft for proficiency training are not available or in the system.
		7 (Repeat)	3 (Repeat)	5 DARCOM ensure personnel are capable of performing job assigned regarding their training by ensuring that contracts for preliminary Army evaluation testing include provisions for familiarization flights for test pilots prior to flying (testing) an aircraft for the first time that is significantly different (control responses, etc.) from an aircraft previously flown. These familiarization flights should be designed to ensure that the test pilots fully understand the handling qualities of the aircraft.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
377	CP	7 (Repeat)	4 Copilot improperly exceeded the longitudinal and lateral cyclic limits because he probably lost composure (equanimity) due to repeated warnings from the flight engineer. These warnings intensified the copilot's desire to keep the aircraft on the ground and get it stopped, and they aggravated an already extremely tense situation.	6 USAAEFA inform personnel of problems encountered and remedies via aviation safety meetings.
	FE	8 YCH-47D flight engineer on a level flight performance test was on landing approach when aircraft experienced forward transmission oil cooler fan failure. Flight engineer misinterpreted this in-flight failure as an impending power train failure. As a result, he issued repeated warnings to the other crewmembers which may have caused them to perform improper flight control actions. During running landing, the aft rotor droop stops were pounded and failed, and aircraft incurred major damage during shutdown.	4 Flight engineer misinterpreted an in-flight failure (interpreted failure of forward transmission oil cooler fan as impending power train failure) because he lost composure (equanimity). Having experienced two previous combining transmission failures and being aware of the recent CH-47 drive train problems caused him to perceive this failure incorrectly.	6 USAAEFA inform personnel of problems encountered and remedies via aviation safety meetings.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
USASC drafting correspondence to DARCOM recommending PAE personnel be capable of performing job assigned regarding their training.		26 YCH-47D aircraft returning from level flight performance test experienced a failure of the forward transmission oil cooler fan. While on landing approach, 11 blades on the fan cracked and the remaining 3 fractured and separated, resulting in a loud noise (ping/bang) and a medium-to-high frequency airframe vibration. During emergency running landing the aft rotor droop stops were pounded and failed, resulting in major damage to aircraft during shutdown.	16 YCH-47D forward transmission oil cooler fan failed during flight because it was improperly designed for required operation. In its current configuration, the aircraft's normal operating rpm places the fan in resonance.	9 DARCOM, in conjunction with Boeing Vertol Company, initiate action to properly redesign the fan.
The forward transmission oil cooler was redesigned by Boeing Vertol to correct premature failure.				

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
378	P	15 The pilot of a UH-1H on a tactical training mission **performed a course of action not IAW chapter 5 of FM 1-51 and common practice** when he maneuvered his aircraft between two poles in a tactical landing zone. When a single strand of 1/8-inch diameter copper wire was sighted approximately 15 feet from the nose of the UH-1, the PIC reacted to its proximity by attempting a quick-stop. He applied an excessive amount of aft cyclic in an attempt to avoid a wire strike (forward speed 5 to 10 knots). This resulted in the tail rotor system striking the ground, causing the tail rotor 90-degree box to separate from the aircraft and loss of antitorque control. The aircraft spun 180 degrees to the right and landed hard when the pilot abruptly lowered the collective.	6 The pilot of a UH-1H on a tactical training mission performed a course of action not IAW chapter 5 of FM 1-51 and common practice (maneuvered aircraft between two poles in a tactical landing zone) because of **poor judgment.** The pilot was aware of the probability of the presence of a wire between the poles which were located along the intended flight path, but he elected to maneuver his aircraft between them.	6 Unit commander use this case to **inform personnel of the circumstances and events** that contributed to the PIC's decision to proceed between the two poles instead of a more prudent course of action that would have more adequately evaluated and avoided the risks involved.
		15 (Repeat)	6 (Repeat)	6 Aviation officer **inform aviators of the highlights of this mishap and lessons learned** through appropriate publications.
		15 (Repeat)	6 (Repeat)	6 USASC **inform the aviation community of the highlights of this mishap and the lessons learned** through FLIGHTFAX and other publications.
		15 (Repeat)	7 The pilot of a UH-1H on a tactical training mission performed a course of action not IAW chapter 5 of FM 1-51 and common practice (maneuvered aircraft between two poles in a tactical landing zone) because of **overconfidence** in his ability to stop the aircraft in time to avoid a wire strike. This overconfidence influenced his decision to continue the approach into an area after sighting several poles which greatly increased the probability of the presence of wires.	6 USASC **inform the aviation community of the highlights of this mishap and the lessons learned** through FLIGHTFAX and other publications.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
378	P	7 The pilot of a UH-1H on a tactical training mission made an **improper flight control action** when excessive aft cyclic was applied while hovering forward at a speed of 5 to 10 knots in a tactical landing zone. When a wire was sighted approximately 15 feet in front of the aircraft, the pilot reacted to its proximity by attempting a quick-stop. He applied an excessive amount of aft cyclic in an attempt to avoid a wire strike. The resulting tail-low attitude allowed the tail rotor system to strike the ground, and a loss of antitorque control occurred after the tail rotor assembly was torn from the aircraft. The aircraft spun right 180 degrees and sustained major damage when the pilot abruptly lowered the collective and landed hard.	4 The pilot of a UH-1H on a tactical training mission made an improper flight control action (applied excessive aft cyclic in an attempt to quickly stop the aircraft to avoid a wire) because of a loss of **composure (panic)** when a 1/8-inch diameter copper wire was observed in his flight path. The detection of the wire, coupled with a warning shout from the copilot, caused the PIC to rapidly apply an excessive amount of aft cyclic in an attempt to avoid hitting the wire.	6 USASC **inform the aviation community of the highlights of this mishap and the lessons learned** through FLIGHTFAX and other publications.
		8 The pilot of a UH-1H on a tactical training mission **misinterpreted aircraft action.** He failed to recognize the spinning of the aircraft to the *right* as a loss of antitorque control and abruptly lowered the collective to get the aircraft on the ground as quickly as possible. The loss of antitorque control was caused by the separation of the tail rotor system from the aircraft after an excessive amount of aft cyclic was applied which resulted in the tail rotor striking the ground. Aft cyclic was applied in an effort to prevent the aircraft (altitude - 3 to 5 feet, airspeed 5 to 10 knots) from hitting a 1/8-inch diameter copper wire which was detected approximately 15 feet forward of the cockpit. The aircraft sustained major damage when it landed hard.	4 The pilot of a UH-1H on a tactical training mission misinterpreted aircraft action (failed to recognize the spinning of his aircraft in a clockwise direction as a loss of antitorque *control*) because of **confusion** (composure). Unaware that the tail rotor assembly had separated from the aircraft, the PIC (who was already stressed) was confused by the spin of the aircraft. He perceived a spin to the left when in fact the aircraft was spinning to the right. He abruptly lowered collective, resulting in a hard landing.	6 USASC **inform the aviation community of the highlights of this mishap and the lessons learned** through FLIGHTFAX and other publications.

CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS

Mishap review scheduled for publication in FLIGHTFAX.

99 No contributing material failure.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
379		26 CH-54A on a service mission to ferry the aircraft from one state to another experienced a failure of the **main rotor system.** The horizontal pin, P/N S1510-23099-1, NSN 1615-00-620-4866, failed because of corrosion-fatigue. As a result, a main rotor blade separated from the aircraft and the aircraft crashed, sustaining total loss damage.	16 CH-54A main rotor system failed (horizontal pin) because of **improper design for required operation.** Design specifications do not require a plating of sufficient thickness to prevent corrosion. Recent aircraft utilization rates have resulted in more than 6 years' operating time between inspection on this part.	3 **DARCOM (TSARCOM) revise procedures** in TM 55-1520-217-23 to require adequate inspection of main rotor system components.
CORRECTIVE ACTIONS COMPLETED OR IN PROGRESS				
TSARCOM issued TB 1520-217-20-13, 1 Nov 79, requiring a one-time inspection of horizontal hinge pins by use of alternating testing. This inspection will be required every 100 flight hours.		26 (Repeat)	16 (Repeat)	9 **DARCOM (TSARCOM) initiate action to redesign** the horizontal pin to prevent corrosion-fatigue.
USASC submitted QDR Standard Form 368 to TSARCOM recommending redesign of horizontal hinge pin to prevent corrosion fatigue.		98 No contributing human error.		

Appendix G
Analysis of FY 79 Incidents

This appendix presents the results of the analysis of the 56 Army aircraft mishaps classified as incidents by AR 385-40 and reported to the Safety Center during FY 79. The $746,000 cost attributed to these mishaps was 47 percent less than the $1,422,000 cost of the 163 incidents reported in FY 78.

This decrease in cost, indicated in figure G-1, began after a peak of slightly more than $2 million was reached in FY 77. The decline shown for FY 78 and FY 79 unfortunately cannot be attributed to prevention measures. Rather, the decline primarily results from an FY 78 change in the criteria used to classify incidents. As a result, 69 mishaps in FY 78 that cost $261,667 and 195 mishaps in FY 79 that cost $1,198,377, which before FY 78 would have been classified as incidents, are now classified as precautionary landings with damage.

A more effective incident prevention program is needed. This need was anticipated in 1974 when NOE and other modes of terrain flight, particularly for rotary wing aircraft, became a tactical requirement. As expected, the frequency of blade and airframe strikes with trees, rocks, wires and other objects, and flight into inadvertent IMC due to dust, snow, etc., increased.

The increase in average annual cost of incidents has also pointed out this need. Over the 6-year period shown in figure G-1, the average cost per incident increased more than fivefold, from $2,400 in FY 74 to $13,000 in FY 79. There are indications that the average cost of incidents will continue to climb as more expensive aircraft, e.g., AH-1S, UH-60, OH-58C, CH-47D, join the fleet and as night operations increase.

A special program, however, is not advocated or required. A review of the system inadequacies in table G-1 and a reading of the 3W narrative analysis of each incident in this section will show that the causes of incidents and accidents are generally alike. The only difference between the two is cost which is often a matter of chance; for example, having a place to safely land when a failure occurs. Therefore, increased attention should be given to preventing the causes of incidents and making this effort a more integral part of the aviation safety program.

There are many reasons why the prevention of incidents has not received the necessary attention. The dollar cost of an incident is much less than an accident; the incident rate, unlike the accident rate, is not used to measure safety performance; and the absence of injuries, especially fatal

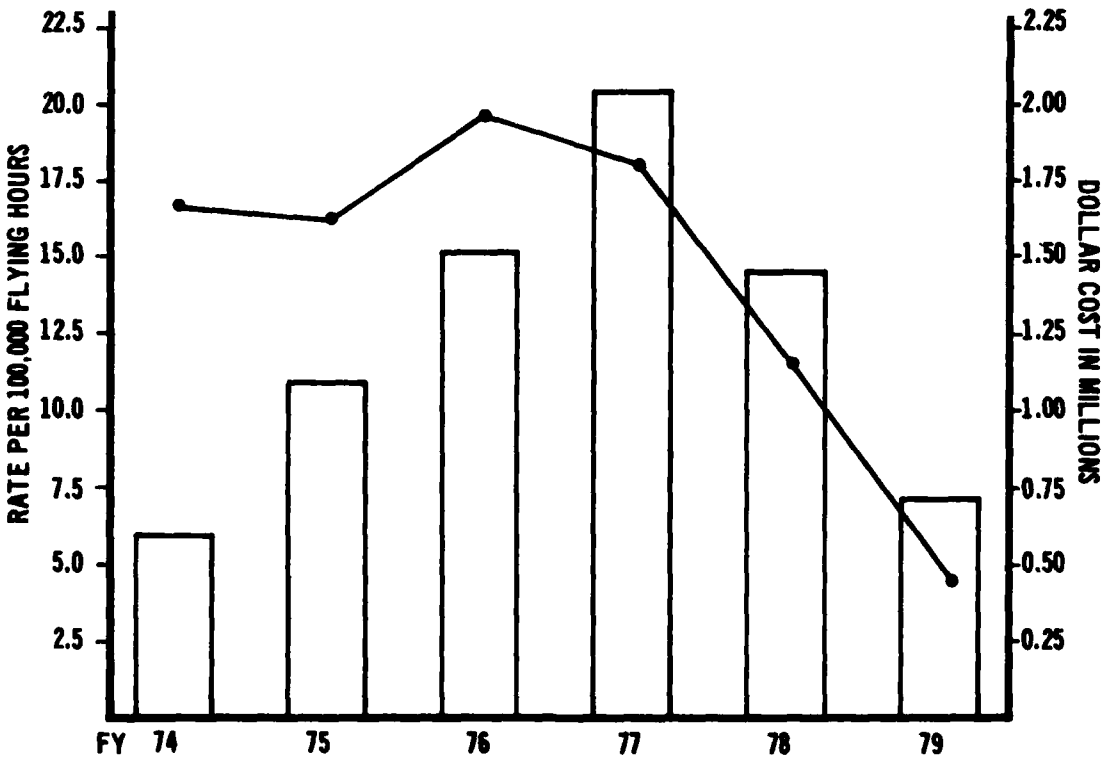


FIGURE G-1. – Rate of Occurrence and Cost of Mishaps Classified as Incidents

or crippling ones, greatly lessens the concern of authorities.

These reasons help explain why the prevention of incidents has a low priority among aviation resource managers. A change and a redirection of prevention efforts is in order if the objective of the Army aviation safety program is to be met. Adoption of the philosophy that by eliminating or reducing inadequacies in the aviation system, a more efficient system will result, would be a step forward. If the system operates more efficiently, task errors, materiel failures and malfunctions, and environmental influences on man and machine will be either reduced or eliminated.

The analysis of incidents could not be as complete or as thorough as that for major accidents. This shortcoming is attributed primarily to the quality of the information on incidents provided the Safety Center. The incomplete information points out that investigations are inadequate and that steps are not being taken to insure that pertinent and essential data, i.e., the 3Ws, is reported as required by AR 95-5. This observation is supported by data in table G-1. Of the 77 system inadequacies listed, 28 could not be defined because of a lack of information. The 28 inadequacies, whatever they may have been, accounted for 39 percent of FY 79 dollar losses. The lack of causal information severely hinders prevention measures.

This strongly suggests that the first step to be taken toward a more effective incident prevention program is to conduct more thorough investigations and submit more detailed reports as required by AR 95-5. In recognition of this, the Safety Center in the 20 February 1980 issue of **FLIGHTFAX** published a worksheet to be used in the preparation of a preliminary report of aircraft mishap (PRAM) (page 124). Careful adherence to the requirements of the worksheet will improve the quality of the information gathered. Particular attention should be given to paragraphs 12, 13, and 14. These items solicit the 3W information as described in the method section (appendix E) of this report. Officers appointed to investigate incidents, especially first-time appointees, should be instructed to review the requirements for a PRAM in AR 385-40. Review of appendices G and H in this report would also be beneficial.

Operational definitions of the system inadequacies, listed in table G-1, are found in the narrative analysis of incidents. These definitions can be easily located through the use of one or more of the matrices in this appendix. The definitions are indexed by case number with respect to the aircraft involved and also by the task errors or materiel failures identified in each case. A matrix of task errors and materiel failures by aircraft, indexed by case number, is also provided on page 127. The single incident omitted from these analyses was of a C-12A on landing roll that collided with a deer. The damage to the C-12A amounted to $35,000.

	Cost	Frequency
	$276,017	28
	97,884	4
	96,289	2
	80,246	8
	48,144	5
	43,226	7
	22,911	3
	13,844	3
	13,111	1
	7,762	4
	5,838	6
	5,780	2
	5,080	1
	1,989	2
	889	1

WORKSHEET FOR PREPARING PRELIMINARY REPORT OF AIRCRAFT MISHAP (PRAM)

U.S. ARMY SAFETY CENTER

Addressees

Subject: Preliminary Report of Aircraft Mishap, CSGPA 1550 (MIN)

1. a. Date_____ b. Time (local)_____
   c. ☐ Dawn ☐ Day ☐ Dusk ☐ Night
2. Give distance from mishap site in direct nautical miles and direction from nearest military installation or prominent geographical feature; otherwise, use latitude and longitude.

_____

3. a. Aircraft type, design, series _____
   b. Complete serial number _____
4. a. Unit identification_____
   b. Unit identification code (UIC)_____
   c. Home station of unit operating the aircraft _____
5. a. Mishap classification _____
   b. Actual or estimated cost_____
   c. Brief description of damage _____

_____

6. a. Operator's duty (IP or pilot) _____
   b. Name (last, first, MI) _____
   c. SSN_____ d. Grade _____
   e. Unit assigned _____
   f. Home station _____
7. a. List all other crewmembers (name, SSN, grade, duty position, unit).

_____

_____

   b. Number of military occupants on board (other than crew) _____
   c. Number of other occupants (other than crew)_____
8. List all injured personnel and give the following information for each: name, SSN, grade, duty position, sex, degree of injury.

_____

_____

9. a. Mission_____ b. Type clearance (IFR or VFR) _____
   c. Destination_____ d. Time in flight _____
10. Phase of operation (landing, takeoff, etc.) _____
11. Description of how mishap occurred. Begin with first indication of emergency, malfunction, failure, or unusual occurrence. Include crew response and reaction of aircraft to control inputs if other than normal. Include airspeeds and altitudes agl as necessary to aid in description. Include density altitude and gross weight where inadequate aircraft performance is a factor (inadequate power for conditions) and describe termination of problem (landing, further damage, procedures used). Give details of any ejection or bailout.

_____

_____

_____

_____

Note: For Class D and E mishaps, add the following information when known; for each cause factor identified in items 12, 13 and 14, tell what caused or permitted it to happen and what corrective action should be taken. If information is not known within 24 duty hours of mishap, provide via supplement report as soon as known.

12. Describe each environmental cause factor and how it contributed to the mishap.

_____

_____

PRAM worksheet

13. Decribe each human error cause factor and how it contributed to the mishap.

_____

_____

14. a. Describe each materiel failure or malfunction cause factor and how it contributed to the mishap.

_____

_____

For each failure or malfunction identify the following:

b. EIR control number (block 3 of SF 368) _____

c. NSN _____

d. Part number (obtain from failed part) _____

e. Nomenclature of suspected or failed part _____

f. Name of publication from which nomenclature obtained _____

If major component failure or malfunction contributed, additionally submit:

g. Component model _____

h. Series _____ i. Serial number _____

j. Total time _____

k. Time since overhaul (to nearest hour) _____

l. Overhaul facility _____

m. Date of last overhaul _____

n. Previous storage history _____

o. Cause of failure _____

p. Power settings _____

q. Significant indications _____

NOTE: For each separate failure or malfunction that contributed to the mishap, repeat item 14.

15. a. List other personnel injured as a result of mishap. _____

_____

b. Brief description of damage to government or public property other than the aircraft.

_____

_____

16. a. Date nearest FAA facility was notified, if required (AR 95-30).

_____

b. Brief description of any violations to civil or military regulations (If none, so state).

_____

_____

c. Classified material ☐ was ☐ was not on board (for missing aircraft only).

d. Aircraft ☐ was ☐ was not serviced with fire resistant hydraulic fluid.

e. Dangerous or hazardous material ☐ was ☐ was not being transported at time of mishap.

Material ☐ did ☐ did not contribute to mishap. Any other information pertinent to hazardous materials being transported at time of mishap:

_____

f. Aircraft ☐ was ☐ was not performing

☐ authorized ☐ unauthorized,

☐ supervised ☐ unsupervised

(1) Terrain flight: ☐ low level ☐ contour ☐ NOE

(2) ☐ Tactical IFR training

g. USASC will periodically issue instructions requiring the reporting of other specific data pertaining to mishap prevention problem areas. Such data will be reported in this subparagraph.

17. For additional information, contact: Name _____

Address _____

Duty _____ Telephone number _____

Distribution of System Inadequacies Across Task Errors: FY 79 Incidents

SYSTEM INADEQUACIES

	0	1	2	3	4	5	6	7	10	11	13	15	16	17	21	23	25	26	28	40	45	Total
0	39 44 55 3			11 22 54 3	12 28 34 50 4		7 14 2	32 1	16 1		26 30 2		1 12 20 53 4	36 1	18 1	13 42 2	8 1	15 1			23 31 2	28
2		35 1						35 1			30 1											3
3				22 1					52 1													2
4								41 1														1
5					4 5 34 3	50 1	3 46 2	16 1						43 1								8
6			22 1				21 1					25 35 2		43 1								5
12							9 1						2 51 2									3
13							6 40 2															2
15			29 1				47 49 2									37 1						4
16							5 13 25 3					31 1						45 1			38 1	6
18										22 1				43 1	24 1	48 1			33 1			5
19			17 1		34 1					22 1			27 1							56 1	38 1	6
25								30 1														1
27												19 1										1
31								41 1										20 1				2
Total	3	1	3	4	8	1	13	6	2	2	3	4	7	4	2	4	1	3	1	1	4	77

Distribution of Aircraft Across Task Errors/Material Failures: FY 79 Incidents

	0	1	2	3	4	5	6	7	10	11	13	15	16	17	21	23	25	26	28	40	45	Total
UH-1	44 55 2		17 22 29 3	22a 54 3			7 9 14 21 49 5	38 32 41 3		22 1	38a 2		2 51 2	36 1		42 1		35 46 2	33 1			26
OH-58		35 1					3 6 13 25 4	16 35 2	16 52 2			19 25 35 3		43 1		13 1						14
AH-1					5 28 50 3	50 1	5 40 46 47 4				25 1	31 1				48 1					23 31 38 3	14
CH-47				11 1	4 12 34a 4								12 27 2				6 1					8
CH-54													20 1					20 1				2
OH-6													53 1									1
U-8	39 1																					1
U-21															18 24 2							~2
OV-1																37 1						1
T-42													1 1									1
C-12																				56 1		1
TOTAL	3	1	3	4	7	1	13	5	2	1	3	4	7	2	2	4	1	3	1	1	3	71

Distribution of Remedies by System Inadequacies: FY 79 Incidents

SYSTEM INADEQUACIES

REMEDIES	0	2	3	4	5	6	12	13	15	16	18	19	25	27	31	Total
2		35₂ 2			3 50 2	35 1			47 1							6
3								40 1	49 1			17 38 22 56 27 34 6				8
5		30 1	52 1			21 1		6 1								4
6	18 1			41 1	4 43 5 46 16 34 6	21 22 25 43 4	2₂ 2		29 1		24 1			19 1	20 41 2	19
7						22 1	51 1				22 1		30 1			4
9	15 1									5 31 13 43 25 45 6						7
12			22 1				9 1				33 1					3
18	1 23 44 7 26 50 8 28 53 11 30 54 12₂ 31 55 13 32 14 34 16 36 20 39 22 42 26								37 1	38 1	48 1					29
Total	28	3	2	1	8	7	4	2	4	7	4	6	1	1	2	80

Distribution of Aircraft Across System Inadequacies: FY 79 Incidents

	0	2	3	4	5	6	12	13	15	16	18	19	25	27	31	Total
UH-1	7 32 55 14 36 15 42 22 44 30 54 11	30 1	22 1	41 1		21 22 2	2 9 51 3		29 1	45 49 2	22 33 2	17 22 2	30 1		41 1	26
OH-58	13 16 2	35a 2	52 1		3 16 43 3	25 35 43 3		6 1		13 25 43 3				19 1		16
AH-1	23 26 28 31 50 5				5 46 50 3			40 1	47 1	5 31 38 3	48 1	38 1				15
CH-47	8 11 12a 34 5				4 34 2							27 34 2				9
CH-54	20 1														20 1	2
OH-6	53 1															1
U-8	18 39 2															2
U-21											24 1					1
OV-1									37 1							1
T-42	1 1															1
C-12												56 1				1
Total	28	3	2	1	8	5	3	2	3	6	4	6	1	1	2	75

3W Narratives and Remedial Actions for FY 79 Army Aircraft Incidents

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-1	P	16 T-42A pilot on a service mission **improperly performed a normal landing** as described in TC 1-145, Task 1006. He landed in a slightly nose-low or level attitude and the aircraft porpoised, causing a propeller blade tip to strike the ground.	0 The report contained **insufficient information** to determine why the pilot improperly performed a normal landing.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-2	IP	16 UH-1H IP on a practice sod autorotation **failed to perform a course of action required by TC 1-135, Aircrew Training Manual.** He did not execute a go-around or power recovery when it became apparent that the aircraft might strike trees on the approach end of the intended landing area, as required by Task #4002, TC 1-135. The IP elected to apply collective pitch to stretch his glide distance. This control input caused rotor rpm to decay, leaving insufficient rpm for the initial and cushioning pitch application, resulting in a hard landing.	12 UH-1H IP failed to perform a required course of action (did not execute a go-around or power recovery when it became apparent that the aircraft would not make the intended landing area) because of **excessive self-motivation.** The IP had experienced difficulty earlier in making standard autorotations into the same area. This was his fifth attempt into the area. The first three attempts were terminated with power recoveries.	6 USAAVNC **inform school IPs** of the importance of terminating a maneuver when it becomes apparent that the standards established for that maneuver are being exceeded via safety meetings and briefings.
		16 (Repeat)	12 (Repeat)	6 USASC **inform personnel of problems encountered and remedies** via FLIGHTFAX and AVIATION DIGEST.
I-3	P	6 OH-58A pilot on an observer training mission **inaccurately estimated his clearance** while hovering near trees. As a result, the main rotor blades struck a tree, damaging both blades.	5 OH-58A pilot inaccurately estimated his clearance while hovering near trees (allowed the aircraft to drift into the trees) because of **inadequate attention.** He was distracted by a low-flying T-33 and was not aware that his aircraft was drifting into a tree.	2 Company commander should provide **unit training** to improve aviator attention. The importance of proper attention to visual references at all times, especially during hovering, should be stressed.
I-4	CE	4 CH-47A crew chief on an external load training mission performed **inadequate crew coordination.** The aircraft was positioned over a load, and while the crew chief was attempting to secure the load with a cargo hook loading pole, the aircraft settled onto the load, resulting in damage to the aircraft.	5 CH-47A crew chief performed inadequate crew coordination (did not warn the pilot that the aircraft was settling onto the load) because of **inadequate attention.** The crew chief was concentrating on securing the rigging and was not paying enough attention to positioning of the aircraft.	6 Unit commander should, during safety meetings, **inform personnel of problems** encountered regarding attention, stressing the need for continual coordination between crewmembers during external load missions.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-5	P	6 AH-1S pilot, during an NOE training flight, **improperly estimated clearance** and aircraft hit the top 4 feet of 75-foot tree, resulting in damage to the main rotor blades and tow missile launcher.	16 AH-1S pilot improperly estimated clearance (hit the top 4 feet of 75-foot tree) because **equipment is not properly designed.** The pilot was unable to see the tree because the XM 73 reflex sight blocked his view.	9 **DARCOM** should **provide required equipment** that would give aviators a clear field of view.
	CP	4 AH-1S copilot on an NOE training flight performed **inadequate crew coordination.** He failed to warn the pilot of a tree in their flight path. Consequently, the aircraft hit the tree, resulting in damage to the main rotor blades and tow missile launcher.	5 AH-1S copilot failed to warn the pilot of a tree in their flight path because of **inadequate division of attention.** His attention was focused inside the aircraft while refolding his map and he did not see the tree.	9 USASC **inform personnel of the potential problems** that may be encountered as a result of inadequate division of attention while performing NOE flight.
I-6	P	6 OH-58A pilot on an NOE training mission **inaccurately estimated clearance.** While flying over forested area, the main rotor blades struck a tree, damaging both main rotor blade tips.	13 OH-58A pilot **inaccurately estimated clearance** (main rotor blades struck a tree) because of **fatigue.** The pilot had gotten only about three hours' sleep the previous night.	5 Unit commander should **insure that personnel are ready and capable of performing job assigned.** Unit should establish a crew rest policy and strictly enforce it.
I-7	CP	6 UH-1H copilot at the controls on a training mission **inaccurately estimated his clearance.** While on approach to a landing zone, the aircraft encountered blowing snow and hit a tree while setting down, damaging both main rotor blades.	0 The report contained **insufficient information** to determine why UH-1H copilot at the controls inaccurately estimated his clearance (hit a tree during an approach to a landing zone).	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-8		25 CH-47C had a **transmission failure** during runup. Normal generator check was being made when both generator lights, both rectifier lights, and both hydraulic lights illuminted. The aircraft was shut down and inspection revealed that both generator shafts were sheared, damaging the aft tranamission.	0 The report contained **insufficient information** to determine why the CH-47C had a transmission failure (both generator shafts sheared, damaging the aft transmission).	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-9	P	6 UH-1H pilot, during an ARTEP training exercise, **inaccurately estimated** his clearance while performing NOE flight and hit a tree with his main rotor blades, damaging both blades.	12 UH-1H pilot **inaccurately estimated** his clearance while performing NOE flight because of **excessive self-motivation.** The pilot was being evaluated by an SIP and was trying too hard.	12 Unit commander should **improve monitoring** of personnel and unit activities to detect excessive self-motivation as related to safe operation of aircraft. Such monitoring should be increased during field training exercises to insure that common safety practices are not sacrificed in accomplishing the mision.
I-10		C-12 hit deer.		
I-11	CE	3 CH-47C chief **inadequately performed required maintenance.** While changing a defective ICS panel crew chief placed the defective ICS panel on the center console. He leaned on the console, causing the ICS panel to activate the d.c. beep switches. This caused an engine overspeed condition which required the replacement of both forward and aft rotor head assemblies.	0 The report **contained insufficient information** to determine why the crew chief did not take needed precautionary measures to prevent inadvertent activation of the d.c. beep switches.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-12	GSY	16 Ground guide **improperly performed a course of action required by TM 55-450,** Chapter 5, Section IV, by turning a CH-47 180 degrees to back it over the load. The crew of the CH-47, thinking it was going to pick up passengers, did not maintain visual contact with the load, and as a result, struck the load when given the signal to descend, damaging the underside of the aircraft.	0 The report contained **insufficient information** to determine why the ground guide elected to back the aircraft over the load rather than using the standard procedures outlined in TM 55-450, Chapter 5, Section IV.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
		4 Ground support crew **performed inadequate crew coordination** during internal/external air transport movement of passengers and a 105mm howitzer by a CH-47B. The flight crew was expecting to pick up the passengers first and then the external load as briefed by the air mission commander. The mission was changed but the ground crew failed to relay the change in mission to the flight crew.	0 The report contained **insufficient information** to determine why the ground support crew failed to relay a change in mission to the flight crew of a CH-47B.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-13		23 OH-58A had a partial power plant failure during a night training mission. Aircraft was flying straight and level when N_2 surged to 110%. The aircraft yawed left and the low rpm audio and engine-out light came on. The pilot entered autorotation and the aircraft sustained incident damage as a result of a hard landing.	0 OH-58A had a partial power plant failure due to causes that could not be determined. It was suspected that the aircraft had a governor overspeed, followed by activation of the overspeed protection feature of the compound power turbine governor to limit N_2 rpm. Subsequent N_2 rpm was not sufficient for flight and the pilot was forced to land. The suspected governor was sent to CCAD for teardown analysis. Analysis failed to reveal a cause for the reported N_2 surge.	18 USASC, in coordination with TSARCOM, initiate an effort directed at resolving the chronic problem of unexplained partial and total loss of engine power.
	P	6 OH-58A pilot on a night training mission was making an emergency descent following a partial power loss and improperly estimated clearance/closure. During descent, the pilot was forced to decelerate early to avoid hitting a set of powerlines, resulting in a near-vertical descent for the last 50-60 feet. The aircraft sustained incident damage as a result of a hard landing.	16 OH-58A pilot improperly estimated clearance/closure during a night emergency descent because equipment is improperly designed for required operation. The pilot was unable to see a set of powerlines in front of the aircraft until just before touchdown because of the glare from the fixed landing light.	9 DARCOM take action to redesign and modify the fixed landing light to reduce glare when illumination of a night landing area is required.
I-14	IP	6 UH-1H IP, demonstrating NOE flight techniques, misjudged obstacle clearance, and main rotor blades hit a tree.	0 The report contained insufficient information to determine why the IP inaccurately estimated clearance between the main rotor blades and the tree.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-15		26 UH-1H on a training mission had a failure of the sprag clutch during shutdown. At the "retard throttle to flight idle" sequence in the shutdown procedure, the IP heard a loud whining sound and noticed that rotor rpm had dropped below that of the engine. The IP took no immediate action because he wanted maintenance to observe what was happening. The sprag clutch reengaged without warning, shearing the No. 1 section of the tail rotor drive shaft and twisting the main mast.	0 A teardown analysis by CCAD was unable to determine the cause for the sudden engagement (malfunction) of the sprag cluth.	9 TSARCOM provide required equipment by expediting replacement of existing sprag clutches with new "form" sprag clutch.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-16	P	7 OH-58A pilot on a training mission in preparation for an IP checkride made an **improper flight control action.** During a practice standard autorotation, the pilot allowed the aircraft to touch down in a nose-high attitude (on the heel of the skids) and applied aft cyclic after ground contact, causing a main rotor blade tip to strike the tail rotor drive shaft.	5 OH-58 pilot performed an improper flight control action (applied aft cyclic upon touchdown in a nose-high attitude) because of **inadequate attention.** It is suspected that the pilot was preoccupied because of a recent change in civilian jobs and was not paying full attention during a critical phase of the maneuver.	5 Command should **insure personnel are ready/capable of performing job assigned** regarding their psychophysiological state by keeping up-to-date and aware of the outside activities of assigned aviators which could adversely affect their capabilities.
	IP	10 OH-58A IP on a training mission to prepare a pilot for an IP checkride **improperly monitored performance** of the pilot. During a practice standard autorotation, the pilot allowed the aircraft to touch down in a nose-high attitude and applied aft cyclic. The IP could not respond fast enough to correct the situation. As a result, a main rotor blade tip struck the tail rotor drive shaft, bending it.	0 The report contained **insufficient information** to determine why the IP failed to react in time to prevent the application of aft cyclic.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-17	P	2 UH-1M pilot on a night training mission performed an **inadequate aircraft preflight inspection.** The pilot failed to insure that the main rotor blade tiedown was removed during preflight inspection. As a result, the tiedown struck and damaged a tail rotor blade during the start.	19 UH-1H pilot performed an inadequate aircraft preflight inspection (failed to insure the main rotor tiedown was removed) because of **inadequate written procedures.** Neither the TM 55-1520-220-10 nor the checklist specifies that the main rotor blade tiedown be removed and stowed in the cockpit.	3 TRADOC **revise** TM 55-1520-220-10 and the checklist to specify that the main rotor tiedown be removed and stowed in the cockpit during the preflight inspection.
I-18		21 JU-8F landing gear would not extend or lock in the down position. After exhausting all attempts to get nose gear down, the aircraft was landed on a foamed runway, resulting in incident damage. Maintenance checks revealed that the landing gear chain broke.	0 Teardown analysis, i.e., microscopic and binocular, did not reveal any defects or malfunction. Examination of the chain master links revealed two distinct worn areas caused by the pins rubbing against the links. A determination could not be made if the pin locks came off and/or were not installed.	6 USASC **inform personnel** of this problem and others associated with the maintenance and operation of aircraft that are approaching retirement.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-19	CE	15 OH-58A crew chief, during a training mission, performed a course of action prohibited by common practice. While the aircraft was operating at flight idle, the crew chief was unloading TA-50 gear and placing the gear forward of the aircraft. The crew chief tossed a sleeping bag from the front of the aircraft toward the stacked gear. The bag came undone, became airborne, and entered the main rotor system, damaging the main rotor blades.	27 OH-58A crew chief performed course of action prohibited by common practice (he tossed a sleeping bag into the air from the front of the aircraft while it was operating at flight idle) because of inadequate supervision by the pilot in charge of the aircraft. He did not insure that the crew chief carried the equipment a safe distance from the aircraft.	6 Unit should inform personnel of problems encountered regarding the hazards of loading or unloading operating aircraft.
I-20		26 CH-54A aircraft, during an engine start, had a failure of the main rotor system (rotor brake disc). After completing No. 1 engine start, the rotor brake was released and engine was accelerated from ground idle to 85% operating rpm. A loud banging noise was heard and the engine was shut down. Inspection revealed damage to the rotor blades and engine area caused by rotor brake disc disintegrating. Rotor brake disc failed as a result of stress corrosion cracking on shutdown of the previous flight.	31 CH-54 rotor brake disc failed as a result of stress corrosion cracking because personnel probably used improper procedures during shutdown. A continuous network of surface cracks (heat checks) caused by excessive heat served as the stress corrosion origin. These heat checks were most likely caused by engaging the rotor brake at too high an rpm.	6 USASC inform personnel of problems encountered and remedies via an article in FLIGHTFAX to caution CH-54 crews about engaging the rotor brake at excessive rpm.
	CE	16 CH-54A crew chief failed to perform an aircraft daily inspection required by TM 55-1520-217-PMS-1, item 4.35, pg 24. He failed to check the rotor brake disc for heat checks and crazing. As a result, he did not detect a continuous network of heat checks on the brake disc. The rotor brake disc disintegrated during startup and damaged the rotor blades and engines. The rotor brake disc failed as a result of stress corrosion cracking.	0 The report contained insufficient information to determine why the crew chief failed to perform a course of action required by TM 55-1520-217-PMS-1.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-21	P	6 UH-1H pilot on dusk VMC passenger service mission inaccurately estimated clearance/closure in that he allowed the helicopter tail rotor to strike tree limbs while making a left hovering turn in a snow and gusty wind environment. As a consequence, antitorque control was lost and a hovering autorotation was made. Note: Pilot was positioning the helicopter to pick up senior Army officials (code 5 and 7).	6 UH-1H pilot inaccurately estimated clearance/closure (allowed helicopter tail rotor to strike tree limbs while making a left hovering turn in a snow and gusty wind environment) because of judgment. A number of factors influenced the pilot's decision to position the helicopter too close to trees in the snow and gusty wind environment. These factors were (1) command pressure to expedite the mission and for the crew to do a better job, (2) excessive self-motivation to impress the senior officers, (3) overconfidence in self, and (4) a combination of boredom, inattention, and get-home-itis.	6 USASC inform personnel of problems encountered and remedies via publications such as FLIGHTFAX and AVIATION DIGEST whereby judgment is influenced by command pressure, excessive self-motivation, overconfidence in self, boredom, inattention and get-home-itis.
		6 (Repeat)	6 (Repeat)	5 Unit commander insure personnel are ready/capable of performing job assigned regarding their training, experience or psychophysiological state while providing passenger service to senior Army officers. On this type of mission the pilot must continually exercise sound and mature judgment and not be influenced by command pressure, excessive self-motivation, overconfidence in self, boredom, inattention or get-home-itis.
I-22	P	2 UH-1H pilot on a service mission performed an inadequate aircraft inspection during preflight. He failed to note a discrepancy between what the aircraft logbook said, "FM antenna removed," and the antenna actually on the aircraft. As a result, when the aircraft was picked up to a hover, the antenna flew into the tail rotor, damaging both blades.	6 UH-1H pilot performed an inadequate aircraft inspection (failed to note a discrepancy between what the logbook said and the actual condition of the aircraft) because of inadequate judgment. The pilot had already turned down one aircraft and allowed a sense of mission urgency to override good judgment and performed a hurried review of the aircraft and its logbook.	6 USASC inform personnel of problems encountered and remedies concerning errors in judgment via FLIGHTFAX and AVIATION DIGEST, emphasizing the importance of conducting a thorough preflight inspection.
		2 (Repeat)	6 (Repeat)	7 Unit commander should take positive command action to encourage proper performance and discourage improper performance concerning preflight procedures.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-22	MS	11 Unit TI, being the only maintenance personnel on duty, **improperly assigned an aircraft** with a grounding fault (FM antenna not properly secured) as a replacement aircraft. He had been requested to replace an aircraft that had been grounded on runup. Since the logbook of the aircraft did not indicate that the FM antenna was placed on the aircraft and was not properly secured, he allowed the aircraft to be flown. As a result, when the aircraft was picked up to a hover, the antenna came off and flew into the tail rotor, damaging both blades.	18 Unit TI improperly assigned an aircraft with a grounding fault (FM antenna was not secured to the aircraft) **because of inadequate maintenance recordkeeping.** The avionics repairman made an incorrect entry and assigned it the wrong status symbol and made no change to the block 7 status. The maintenance supervisor corrected the status symbol but did not verify the initial entry, assuming the avionics repairman made the correct entry.	7 Unit commander should **take positive command action** to encourage proper performance and discourage improper performance with regard to maintenance personnel following the maintenance procedures established by TM 38-750 and FM 55-41.
		11 (Repeat)	19 Unit TI improperly assigned an aircraft with a grounding fault (FM antenna was not secured to the aircraft) because of **inadequate written procedures.** The unit has no policy or procedure established requiring accurate and current aircraft status being maintained in the maintenance office.	3 Unit should **provide procedures in the unit SOP** to require accurate and current aircraft status to be maintained in the maintenance office.
		3 Unit maintenance officer **inadequately performed maintenance recordkeeping as required by TM 38-750, par. 4-45, -46.** He downgraded an aircraft status assigned by an avionics repairman without verifying the entry or assigning a new status to the reentry. As a result, the aircraft with a loose FM antenna was assigned as a replacement aircraft and allowed to fly. The FM antenna came off and flew into the tail rotor, damaging both blades.	3 Unit maintenance officer performed a course of action prohibited by TM 38-750, par. 4-45, -46 (downgraded an aircraft status without verifying the initial entry or assigning a new status to the reentry) because of **inadequate experience.** He had just recently completed the AMOC course and had limited maintenance experience.	12 Unit commander should **improve monitoring of personnel** regarding their total experience to insure they are capable of performing the job assigned.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-22	AVT	3 Avionics technician inadequately performed required maintenance recordkeeping by entering an incorrect statement on the 2408-13. He had removed the FM antenna assembly for repair. When it stated to rain, and with freezing temperatures expected, he put the antenna assembly back on the aircraft without securing it to the aircraft to prevent the rain from getting inside the tail boom. He then made the entry "removed the FM antenna" and gave it a red X status, which did not accurately describe the fault. This status was subsequently downgraded by the maintenance officer. The aircraft was then used as a replacement aircraft the next morning and the FM antenna flew off into the tail rotor, damaging both blades during initial hover.	0 The report contained insufficient information to determine why the avionics repairman inadequately performed required maintenance recordkeeping.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-23		45 During firing of M-129 gun assembly, a loud explosion was heard and felt through the aircraft. A 40mm round exploded before it was clear of the aircraft, damaging the M-129 gun and aircraft.	0 The report contained insufficient information to determine why the 40mm round exploded prematurely.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-24		21 U-21A on a night service mission had a landing gear malfunction. During attempted gear retraction after takeoff, the nose gear actuator (P/N 50520208-1) broke, preventing the nose gear from moving from a position approximately half-way retracted. After troubleshooting the problem, the crew elected to land with the main gear extended. The nose gear collapsed on landing rollout, resulting in incident damage.	18 U-21A had a landing gear failure (nose gear actuator) because maintenance was not performed IAW TM 55-1520-209-23-1, pg 3-51. The cause for the actuator failure was attributed to the stripped threads in the nut assembly (P/N 50-82050). The nut assembly was started in the wrong lead thread.	6 USASC inform personnel of problems encountered and remedies via an article on importance of proper maintenance procedures in FLIGHTFAX.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-25	P	15 OH-58A pilot on a service mission, as flight lead in a flight of two aircraft, performed a course of action prohibited by common practice. After making a successful precautionary landing because of a snowshower which reduced visibility to less than one mile, the pilot decided to reposition his aircraft to another location to join up with the other aircraft in the flight which had landed approximately 600 meters away. While executing an approach to the second location, the pilot experienced a whiteout condition due to snow sticking on the windshield and landed hard, resulting in slight damage. Visibility was about one-half mile in a snowshower at the time.	6 OH-58A pilot performed a course of action prohibited by common practice (attempted to reposition his aircraft during a snowshower with visibility of about one-half mile) because of inadequate judgment. He decided to reposition during a snowshower when visibility was estimated to be about one-half mile due to concern over the experience level of the crew in the trail aircraft. Both crewmembers of the trail aircraft had just recently been transitioned into the OH-58A. Flight lead had both visual and radio contact with the trail aircraft.	6 USASC inform personnel of problems encountered concerning poor judgment via articles in FLIGHTFAX and the AVIATION DIGEST.
		6 OH-58A pilot on a service mission, as flight lead in a flight of two aircraft, inaccurately estimated his closure while attempting to land during a snowshower with visibility estimated to about one-half mile. He made his approach and experienced a whiteout condition due to snow sticking on the windscreen. The aircraft hit the ground hard, resulting in some damage.	16 OH-58A pilot inaccurately estimated his closure rate, resulting in a hard landing, because equipment is not available for required operation. The OH-58A is not equipped with a rain/snow removal system. When the pilot experienced the sudden in-flight heavy snow buildup, he had no means to remove the snow.	9 DARCOM initiate action to install a rain/snow removal system for the OH-58A.
I-26	MCO	13 Major command, during a field training exercise, failed to provide required information (hazard map issued did not have all the wire hazards marked). As a result, an AH-1S in a flight of five aircraft flying down a shallow valley in a contour flight mode struck a set of wires which were not marked on the hazards map. The wires passed over the top of the canopy, struck the upper pylons, cut through to the swashplate and drive link assemblies, then snapped. The aircraft was landed near the point of impact with the wires without further incident.	0 The report contained insufficient information to determine why the wires were not marked on the field hazard map.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-27	CE	16 CH-47B CE on a training mission failed to perform a course of action required by common practice. He raised the ramp without first clearing the area of obstructions. As a result, a set of aircraft chocks which were placed between the fuselage and the ramp by a noncrewmember loading a jeep damaged the fuselage as the ramp was being raised.	19 CH-47B CE failed to perform a course of action required by common practice (raised the rear ramp without first clearing the area) because of inadequate written procedures. There are no written directions governing the storage and securing of wheel chocks. Unit procedure for storing wheel chocks in the right rear of the aircraft cabin are conducive to this type incident.	3 Unit should revise the SOP to provide directions for storing wheel chocks to prevent similar incidents from occurring.
I-28	P	4 TH-1G pilot on a practice gunnery training mission performed inadequate crew coordination (misinterpreted communications). While maneuvering to engage another target, the pilot fired on a target he believed to be the right target, but which, in actuality, was not. The target fired on was too close to the aircraft and the shrapnel from the 40mm round detonation damaged the aircraft slightly. The aircraft was landed without further damage.	0 The report contained insufficient information to determine why the pilot engaged the wrong target.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-29	PIC	2 PIC of UH-1H on a night training mission performed an inadequate preflight inspection. He failed to remove the ground plug prior to flight. As result, incident damage to the skin of the tail boom was incurred by the plug striking the tail boom.	15 PIC of UH-1H performed an inadequate preflight inspection (failed to remove a ground plug) because of adverse environmental influences. Wind was reported to be blowing at 15 knots with the outside temperature at 30 degrees F. It is suspected that the preflight inspection was hurried to get out of the wind and cold.	6 USASC should inform personnel of problems encountered and remedies via publications regarding the hazards associated with performing inadequate preflight inspections.
I-30	FCO	13 Flight leader of a flight of five UH-1Hs on a training mission failed to provide required flight information. Encountering strong winds on approach to a hot refueling site, flight lead executed a go-around. He evidently did not advise his flight of the wind conditions, as the flight continued the approach to land. Chock 3 had considerable control difficulty and decided to go around. During the go-around, the pilot of Chock 3 overtorqued his aircraft.	0 The report contained insufficient information to determine why flight lead did not advise the aircraft in his flight of the wind conditions he encountered on approach.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-30	P	7 UH-1H pilot on a training mission **performed an improper flight control action.** Chock 3 in a flight of five aircraft landing at a hot refueling point had considerable control difficulty due to strong winds near the ground and decided to go around. Evidently, flight lead had led his flight to a downwind condition. During the early stage of the go-around, the pilot thought he was going to hit the ground and applied excessive power. It is suspected that he exceeded 61 pounds of torque.	25 UH-1H pilot performed an improper flight control action (applied excessive power while executing a go-around) because of **inadequate supervision** on the part of flight lead. Evidently, flight lead did not advise the remainder of the flight of the adverse winds he encountered on his approach which caused him to execute a go-around. As a result, the pilot of Chock 3 overtorqued his aircraft while executing a go-round.	7 Unit should take **positive command action to encourage proper performance and discourage improper performance** of personnel. Unit should insure that flight leaders properly brief their flights concerning flight routes and wind conditions.
	GSY	13 Ground support person operating the radio at the POL site **failed to provide required flight information** to a flight of five aircraft landing to refuel. As a result, the flight attempted to land downwind. Chock 3 had considerable control difficulty near the ground and executed a go-around. While executing the go-around the pilot overtorqued the aircraft to keep from hitting the ground.	2 Ground support person **failed to provide required flight information** (did not advise an incoming flight of the wind conditions) because of **inadequate training.** The radio operator was not properly trained to provide accurate and timely information to aircrews.	5 Unit should **insure personnel are ready/capable of performing job assigned regarding their training and experience level.** Prior to assigning an individual to control an aircraft at a landing site, the unit commander must insure the individual is properly trained.
I-31	G	15 AH-1G gunner on an aerial gunnery training mission **performed a course of action prohibited by common practice.** He continued to fire his M29 grenade launches even though his rounds were continuing to impact beyond the target after he had lowered the sight to bring the round on target. The M28A1 gun turret suddenly depressed, causing the M29 round to impact and burst near the aircraft, causing damage to the aircraft.	16 AH-1G gunner performed a course of action prohibited by common practice (continued to fire even though the gun turret system would not respond to command from the gunner's station) **because equipment is not available for required operation.** There are no indications provided to the gunner which would let him know when the gun turret is malfunctioning.	9 DARCOM **should provide required equipment** for the safe operation of the M28A1 gun turret. In the event of a malfunction in one of the turret systems, a warning indication should be given to the gunner and the gun should automatically stop firing.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-31		46 The electronic component assembly (NSN 1005-00-179-5824) on an AH-1G aircraft **malfunctioned**, causing the M28A1 turret not to respond to the commands from the gunner's sighting station. During firing of the M29 grenade launcher, the gun turret depressed suddenly, causing rounds to impact near the aircraft. Shrapnel from the rounds struck the aircraft, causing damage to the leading edge of the left wind and center canopy.	0 The report contained **insufficient information** to determine what caused the M28A1 turret to depress suddenly during firing of the M29 grenade launcher.	18 DARCOM should **perform studies/ research** to determine what causes the M28A1 turret to malfunction in this manner.
I-32	P	7 UH-1H pilot on a service support maintenance mission performed an **improper flight control action.** It is suspected that the governor was beeped down with the heel of the pilot's hand while resting it on top of the collective. Pilot entered autorotation when engine-low rpm audio came on and aircraft struck treetops during descent.	0 The report contained **insufficient information** to determine what caused or allowed the pilot to improperly position his hand on the collective in a manner to cause the beeping down of the governor.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-33		28 UH-1H, during a normal approach to landing, had a **failure of the No. 1 hanger bearing** while on short final at 10-20 feet agl, causing loss of tail rotor control. The aircraft yawed right approximately 120 degrees and landed hard, damaging the cross tubes and airframe. The No. 1 hanger bearing seized, causing the No. 1 tail rotor drive shaft to twist and break.	18 UH-1H No. 1 hanger bearing failed because of **inadequate maintenance** (improper or inadequate lubrication). Teardown of the hanger bearing revealed severe skidding of the balls and complete plastic deformation of the raceways and cage. The bearing was a dry charcoal gray color. This latter condition, in combination with the severe skidding, led CCAD to conclude that the bearing probably failed as a result of improper or inadequate lubrication.	12 Unit commander **insure** by-the-book **maintenance IAW** TM 55-1520-210-23/2, par. 6-170, page 6-129, which requires hand packing of the bearing.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-34	CE	4 CH-47B flight engineer on tactical training mission to transport an M102 Howitzer performed inadequate crew coordination. He failed to properly brief the gun crew as to their duties while unloading. As a result, one of the gun crewmembers unhooked the winch cable attached to the gun, allowing the gun to roll into the side of the aircraft, damaging the aircraft.	0 The report contained insufficient information to determine why the crew chief failed to properly brief the gun crew as to their duties while unloading their gun.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
	GSY	4 An artillery gunner on an artillery raid performed inadequate crew coordination while unloading an M102 Howitzer from a CH-47B. Noticing that the gun was not coming out of the aircraft, he went forward to release the winch cable holding the gun without any instruction to do so, nor did he tell anybody that he was doing so. At the time, the flight engineer was winching the gun back into the aircraft because the gun had shifted when he started letting the winch out and he could not get the attention of the gun crew to help straighten it out. After the cable released, the gun rolled into the side of the aircraft, damaging the aircraft.	19 An artillery gunner performed inadequate crew coordination (released a winch cable holding an M102 Howitzer without any prior coordination) because of inadequate written procedure for operation in normal man-machine environment. The unit SOP does not outline specific duties for either ground or aviation personnel during the loading or unloading of vehicles and weapon systems from aircraft in a tactical environment.	3 Unit commander provide procedures for loading and off-loading of vehicles and weapon systems from aircraft in a tactical environment in the unit SOP.
		4 (Repeat)	5 An artillery gunner performed inadequate crew coordination (released a winch cable holding an M102 Howitzer without any prior coordination) because of inattention. Individual's attention became channelized toward getting the gun out of the aircraft as quickly as possible. Therefore, when he saw that the gun was not coming out, he went forward and released the winch cable that was holding the gun, thereby allowing the gun to roll freely as nobody anticipated his action.	6 Unit commander inform personnel of problems encountered concerning inattention during loading or unloading of vehicles or weapon systems from aircraft.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-35	P	7 OH-58A pilot on an ATM training mission made **improper flight control actions** when the aircraft encountered strong downdrafts while in cruise flight at about 80 knots and 200-300 feet agl over mountainous terrain. Encountering a severe downdraft, the pilot applied full aft cyclic. Then he neutralized the cyclic and added power in an effort to stop the descent. The correct procedure specified in TC 1-10, page 32, prescribes that if a downdraft is encountered, apply full power and maintain best rate of climb airspeed. By the time the pilot had regained control of the aircraft, he had descended to within 70 feet of the ground and hit a powerline which shattered the left windshield and severed the left door post.	2 OH-58A pilot made improper flight control actions (applied full aft cyclic on encountering a severe downdraft) because of **inadequate unit training.** The unit did not have a training program for qualifying aviators in mountain flying skills even though such flights were evidently conducted on a regular basis.	2 Unit should **provide training** in mountain flying techniques. A recommended course of instruction for qualifying aviators for mountain flying is provided in TC 1-10, Chapter 6.
		1 OH-58A pilot on an ATM training mission **performed inadequate flight planning.** The pilot selected a route of flight which would carry him over mountainous terrain that was not suitable for the weather conditions. He knew that strong winds existed along his route of flight, and he expected the wind velocity to increase. The aircraft encountered a severe downdraft as it crossed a ridge line, which induced a rapid loss of altitude. The pilot was unable to stop the descent in time to prevent the aircraft from striking a powerline which shattered the left windshield and severed the left door post.	2 OH-58A pilot performed inadequate flight planning (selected a route of flight which would carry him over mountainous terrain that was not suitable for the weather conditions) because of **inadequate training.** The unit did not have a training program for qualifying aviators in mountain flying skills even though such flights were evidently conducted on a regular basis.	2 Unit should **provide training** in mountain flying techniques. A recommended course of instruction for qualifying aviators is provided in TC 1-10, Chapter 6.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-35	P	15 OH-58A pilot on an ATM training mission **performed a course of action prohibited by the unit SOP.** The pilot descended to an altitude of 200 to 300 feet agl under turbulent conditions while flying over mountainous terrain where the existence and height of obstacles were unknown. This action was not IAW the unit SOP requirement for aircraft flying outside the reservation to maintain a minimum altitude of 500 feet agl. As a result, the aircraft encountered a severe downdraft and the pilot was unable to stop the descent in time to prevent the aircraft from striking a wire which shattered his left windshield and severed the left door post.	6 OH-58A pilot performed a course of action prohibited by the unit SOP (conducted flight at an altitude below 500 feet agl) because of **inadequate judgment.** He elected to descend to 200-300 feet agl on encountering turbulent conditions at his cruise altitude of 500-600 feet agl. He was not aware of the strong downdrafts that could be anticipated with the weather conditions that existed at the time.	2 Unit should **provide training** in mountain flying techniques. A recommended course of instruction for qualifying aviators is provided in TC 1-10, Chapter 6.
I-36	P	17 UH-1H pilot struck wire on takeoff. The pilot had landed to inform a vehicle driver he was entering restricted area. During takeoff, the pilot noticed an unmarked cable and, in an attempt to avoid hitting the cable, vertical fin of the aircraft struck the cable.	0 The report contained insufficient information to determine why the pilot was unable to maneuver the helicopter in a manner required to avoid the cable strike.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-37		23 OV-1D on a night training mission had a **malfunction of the No. 1 engine** while on final approach. Several of the variable inlet guide vanes were broken off and were ingested into the compressor section, causing considerable damage when a bird hit the left propeller spinner and slid into the engine intake. The engine was secured.	15 OV-1D had an engine malfunction because of a **bird strike.** A bird struck the left engine propeller and was ingested into the engine. Several of the variable inlet guide vanes were ingested into the compressor section, causing considerable damage.	18 DARCOM initiate studies/research and become active in the aviation-wide effort devoted to the problem of bird strikes to determine solutions to the bird strike/ingestion problem.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-38		45 M28AE1/7.62 minigun subsystem **malfunctioned** during a practice low-level autorotation. Prior to touchdown, the minigun subsystem deflected to the full-down position. Upon touchdown the minigun barrel struck the runway, causing damage to the minigun and turret. The TCV switch was in the stowed position at the time.	16 M28AE1/7.62 minigun subsystem malfunctioned (deflected to a full-down position during a practice low-level autorotation) because **equipment is improperly designed.** The exact cause of the malfunction is not known. It is suspected that the limiter switch may receive a momentary surge or loss of power which forces the gun system to the full depression limit.	18 DARCOM **perform studies/research** to determine what causes the M28AE1 gun system to deflect to a full-down position with the TCV switch in the stowed position.
		45 (Repeat)	19 M28AE1/7.62 minigun subsystem malfunctioned (deflected to a full-down position during a practice low-level autorotation) because of **inadequate written procedures for normal operations.** The AH-1S operators manual, TM 55-1520-234-10, does not indicate that the M28AE1/7.62 minigun system should be removed prior to conducting nonstandard maneuvers.	3 DARCOM **revise** TM 55-1520-234-10, AH-1S operators manual, to remove the M28AE1/7.62 minigun system prior to conducting nonstandard maneuvers. Weights should be installed to compensate for the removed subsystem to insure proper weight and balance.
I-39		0 U-8F on a training mission lost right engine inboard cowling as aircraft was passing through 80 knots, 2,000 feet down the runway, when rotation was started for takeoff. The aircraft, following the aborted takeoff, came to rest 250 feet off the end of the runway with a busted left tire.	0 This report contained **insufficient information** to determine what caused or allowed the engine cowling to depart the aircraft. It is suspected that during the preflight inspection a crewmember failed to insure the cowling was securely locked. It was also noted the runway did not meet the criteria established in the accelerate-stop chart.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-40	P	6 AH-1G pilot, during a tactical training exercise, **improperly estimated clearance** and struck a tree while hovering. On departing a field site, the pilot hovered his aircraft, waiting the departure of other aircraft. The pilot did not realize he had struck a tree until the aircraft was shut down.	13 AH-1G pilot improperly estimated clearance (struck a tree while hovering and waiting on other aircraft to depart) because of **fatigue.** He received only 5 hours' sleep the night before because of a late mission briefing and had been on duty for about 11 hours at the time of the incident. Also, for the preceding two days, he had been studying during most of his free time for an exam. These factors caused a reduced sense of awareness and a narrower span of attention.	3 Unit commander **establish a crew rest policy** for field activities. This policy must be in writing, be made available to all personnel, and be strictly enforced by the unit commander.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-41	P	7 UH-1H pilot on a training mission, while attempting a slope landing, performed **improper flight control actions.** During landing to a slope, the pilot let the collective down too fast, allowing the aircraft to rock back. The pilot then increased collective to bring the aircraft up to a hover. At that time the copilot got on the controls with the pilot and would not relinquish control. The pilot, unable to gain control, rapidly lowered the collective to get the aircraft on the ground as fast as he could. As a result, the aircraft sustained damage from the hard landing.	4 UH-1H pilot made improper flight control actions (rapidly lowered collective to get the aircraft on the ground) because of a loss of **composure.** The pilot became angry when his copilot would not relinquish the controls after he told the copilot "I've got the controls." Since the copilot would not let go of the controls, the pilot rapidly lowered the collective to get the aircraft on the ground.	6 Unit commander **inform personnel of problems encountered and remedies** via safety meetings. All aviators should receive briefings on the importance of positive change of aircraft controls and the fact that the pilot-in-command has authority for the operation of the aircraft.
		7 (Repeat)	31 UH-1H pilot made improper flight control actions (rapidly lowered the collective to get the aircraft on the ground) because the copilot **utilized improper procedures.** The copilot would not relinquish control to the pilot when the pilot said "I've got the controls." The copilot initially got on the controls when the pilot jerked the aircraft off the ground while attempting a slope landing.	6 (Repeat)
I-42		23 UH-1H on a night training mission had a partial **engine failure** on takeoff from a confined area at 50 feet agl. The aircraft was autorotated, hit the ground, and bounced back into the air. At that time, the engine began to develop power and control was regained. The aircraft was landed without further damage.	0 The investigator and CCAD were unable to determine why a UH-1H had a partial engine failure on takeoff from a confined area. Teardown analysis revealed moderate to heavy sand erosion of the compressor blades, starter vanes, and compressor housing. The compressor first-stage blades exhibited leading edge roll-over. Such erosion could have caused the compressor to stall and the resultant low or erratic power. The engine deterioration should have been identified during the HIT check.	18 USASC, in coordination with TSARCOM, **initiate an effort directed** at resolving the chronic problem of unexplained partial and total loss of engine power.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-43	P	17 OH-58A pilot on a training mission, while flying at about 200 feet agl and 60 KIAS, failed to detect an obstacle. He did not see a 1/2-inch diameter wire in his flight path. The aircraft struck the wire and the pilot was able to safely land without further damage. Visibility was poor at the time because of rain.	16 OH-58A pilot failed to detect an obstacle (did not see a 1/2-inch-diameter wire) because equipment is not available for required operation. The OH-58A is not equipped with a rain removal system and, as a result, the pilot's forward visibility was reduced because of accumulation of rain droplets on the windshield.	9 DARCOM initiate action to provide a rain removal system for the OH-58A.
		17 (Repeat)	6 OH-58A pilot failed to detect an obstacle (did not see a 1/2-inch-diameter wire) because of inadequate judgment. He elected to continue to fly in a low-level flight mode even though forward visibility was reduced because of accumulation of rain droplets on the windshield.	6 Unit commander inform personnel of the hazards associated with operating in the low-level flight mode via safety meetings.
		17 (Repeat)	5 OH-58A pilot failed to detect an obstacle (did not see a 1/2-inch-diameter wire) because of improperly divided attention. The pilot's attention was channelized downward, concentrating on terrain clearance, and his scan for hazards was reduced because forward visibility was poor due to accumulation of rain droplets on the windshield.	6 (Repeat)
I-44	P	0 UH-1M pilot, returning from a live gunnery training mission, on short final of his approach to a desert rearm/refuel point encountered IMC created by the dust raised by the rotorwash. The aircraft landed nose low and was allowed to rock back on its skids. Mast bumping occurred as the controls were displaced when the aircraft settled back on its skids. Mast bumping was severe enough to cause deformation of the mast and main rotor head stops.	0 The report contained insufficient information to determine the cause of this incident. It is strongly suspected that the rearm/refuel point located in a dusty desert environment was inadequately maintained and/or managed, i.e., restriction of vehicle traffic, relocation of the point, wetting down of the area, etc.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-45		26 UH-1H on a training mission had a failure of the sprag clutch. As the instructor pilot was increasing throttle to regain normal operating rpm after completion of a practice touchdown autorotation, he saw that the engine rpm had exceeded the rotor rpm. He immediately shut off the engine. As the engine and rotor were slowing down, the sprag clutch reengaged. The sudden stoppage severed the tail rotor drive shaft. Subsequent teardown revealed two sprags had failed because of fatigue.	16 UH-1H had a failure of the sprag clutch (two sprags failed through fatigue) because equipment is not properly designed. Teardown analysis indicated the probable cause for the failure was a load concentration and uneven loading sustained by the sprags when engaged over the oil holes of the inner race. No material anomalies were noted which could have contributed to the fatigue failure of the sprags.	9 TSARCOM provide required equipment by expediting the replacement of the existing sprag clutches with the new "form" sprag already in the system.
I-46	P	6 AH-1G pilot on a tactical training mission while hovering OGE over trees inaccurately estimated clearance and struck a tree with the tail rotor. The pilot was forced to hover OGE for an extended period of time (10-15 minutes on two separate occasions) while awaiting contact with aggressors. After contact was made, the pilot returned to home station where the damage was found on postflight inspection.	5 AH-1G pilot inaccurately estimated clearance (struck a tree with the tail rotor while hovering OGE over trees) because of inattention. He became bored because of the extended period of time (10-15 minutes on two separate occasions) that he was required to hover awaiting contact.	6 Unit commander inform personnel of problems encountered and remedies via safety meetings.
I-47	RSP	6 AH-1S rated student pilot on a training mission inaccurately estimated his height above the ground while executing a standard autorotation. He pulled initial pitch too high, allowing the aircraft to settle with low rpm. As a result, there was insufficient rpm left to cushion the landing. The aircraft sustained a hard landing.	15 AH-1S rated student pilot inaccurately estimated his height above the ground (pulled pitch too high) while executing a standard autorotation because of environmental influences (optical illusion). Because training was conducted at two airstrips of different width, the pilot could have perceived a height closer to the ground than he actually was.	2 Unit commander should upgrade unit training by conducting all nonstandard maneuvers at one location until the student pilot is proficient.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-48		23 AH-1G on a training mission had a **power plant malfunction** when oil pressure was lost. The pilot entered autorotation to an open area. While executing the autorotation, the pilot had to extend his flight path when some ROTC students stood on the spot the pilot was aiming for. As a result, the pilot had insufficient rpm left to cushion the aircraft. The aircraft landed hard, damaging the skids and tail stinger.	18 AH-1G had a power plant malfunction (loss of oil pressure) because **maintenance was performed inadequately.** Maintenance personnel failed to correctly install the No. 4 coupling (NSN 4730-00-773-2822) from the engine oil sump to the engine oil line. The coupling was not properly tightened, which allowed a build-up of pressure and subsequent rupture of the oil cooler.	0 **Unknown.** The investigation made by the unit was unable to determine what level maintenance failed to properly install the engine oil sump coupling. The aircraft was "new" to the unit after rebuild at CCAD.
I-49	P	6 UH-1M pilot on a training mission **inaccurately estimated clearance.** Aircraft was being hovered to a parking position when tip of the rotor blade struck a piece of angle iron which was protruding approximately 7 feet out from the building. Blade strike resulted in major damage to both main rotor blades and was treated as a sudden stoppage.	15 UH-1M pilot inaccurately estimated his clearance (struck a piece of angle iron protruding from a building) because of **environmental influences.** At the time of the incident, the natural lighting conditions were beginning to fade with the beginning of twilight. The lack of natural light, combined with an overcast sky condition, made the angle iron difficult to discern due to the relative position of the aircraft and the piece of angle iron.	3 Unit should **revise its procedures** (SOP) to require use of ground guides to position aircraft when environmental conditions are such that crew visibility is inadequate.
I-50	IP	5 AH-1S IP at the controls on a service mission **improperly monitored his instruments** and, as a result, did not detect a transient overtorque of 64 psi for 3 seconds during a steep right turn. The aircraft was the lead aircraft in a flight of four and was attempting to take up the trail position.	5 AH-1S IP improperly monitored his instruments (did not detect a transient overtorque condition) because of **inattention.** He was distracted when he attempted to stay within close proximity to the flight by making a steep right turn to take up the trail position.	2 Unit should **upgrade unit training** to emphasize the condition known as transient torque common in the AH-1 aircraft.
	P	4 AH-1S pilot on a training mission performed **inadequate crew coordination.** While the IP was executing a steep right turn, the pilot failed to inform him of a high torque setting which the pilot noted throughout the maneuver.	0 **Unknown.** The investigation made by the unit did not determine why the pilot failed to notify the IP of the overtorque condition.	18 USASC in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-51	P	16 UH-1H pilot on training mission improperly performed a normal approach as required by Task #3502, TC 1-135. He did not reduce his airspeed on final, and, as a result, the tail boom struck the ground when the pilot had to decelerate close to the ground.	12 UH-1H pilot improperly performed a normal approach as required by Task #3502, TC 1-135 (airspeed was too fast for the approach) because of excessive self-motivation. The pilot was attempting to emulate the lead aircraft's approach.	7 Unit commander should take positive command action to insure that lead aircraft in formation flights conduct maneuvers commensurate with the lowest experience level of the pilots in the formation.
I-52	IP	10 OH-58A IP on a training flight to transition a rated pilot into a new category aircraft improperly monitored performance of that person. During practice autorotation, the IP allowed the pilot to apply cushioning pitch too high and obtain an excessive nose-high attitude. The aircraft landed hard on the heels of the skids, rocking fore and aft and sustaining a spike knock.	3 OH-58A IP improperly monitored performance of personnel (allowed pilot to pull pitch too high along with excessive aft cyclic) because of suspected inadequate recent experience. The IP had just completed the IP course at Fort Rucker 4 months before and had accumulated only 12 hours IP time.	5 Unit commander should insure personnel are ready and capable of performing job assigned. This could be accomplished by having the SIP conduct more frequent currency rides with assigned IPs.
I-53	P	16 OH-6A pilot on a training mission improperly performed a low-level autorotation as required by Task #4004, TC 1-137. Upon entry, the pilot lowered the collective and retarded the throttle to engine idle but failed to apply sufficient aft cyclic to maintain entry altitude while decelerating. The aircraft was landed with low rotor rpm and the main rotor flexed down, striking the tail boom.	0 The report contained insufficient information to determine why the pilot improperly performed a low-level autorotation (failed to apply sufficient aft cyclic to maintain entry altitude while decelerating).	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-54	GM	3 UH-1H general mechanic improperly installed the aft engine exhaust pipe "V" band clamp retaining nut. As a result, it is suspected that it backed off, allowing the exhaust pipe to be dislodged, and dropped down on the No. 1 bearing heatshield. The aircraft sustained major heat damage.	0 The report contained insufficient information to determine why the GM improperly installed the exhaust pipe "V" band clamp.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.

CASE NUMBER	DUTY POSITION	TASK ERROR OR FAILURE/MALFUNCTION	SYSTEM INADEQUACY	REMEDIAL MEASURE
I-55	SP	0 UH-1H IP with a student pilot was practicing hovering autorotations. The SP entered the autorotation and, at ground contact, applied full collective. The aircraft ballooned to about 5 to 7 feet as the IP took the controls. Insufficient rpm remained to cushion the landing. The aircraft hit the ground and bounced, damaging the landing gear. On previous hovering autorotations the SP had held the aircraft off the ground, letting it drop the last 6 to 12 inches. The application of full collective was unexpected and caught the IP completely by surprise. There was nothing he could do to prevent this mishap.	0 The report contained insufficient information to determine why the SP suddenly and unexpectedly applied full collective without demonstrating inclination for such action.	18 USASC, in coordination with MACOMs, initiate action necessary to determine why this incident report and many others contain insufficient information and did not comply with AR 95-5, namely Chapters 11 and 14.
I-56		40 C-12A on a training mission had a malfunction of its utility system. While taxiing for departure, the forward air conditioning condenser (P/N 101-384003-1) exploded, causing extensive damage to right side and top of nose section.	19 C-12A had a malfunction of the utility system (forward air conditioning condenser exploded) because of inadequate written procedures. No maintenance procedures are provided maintenance personnel for a malfunction of a high pressure switch. Maintenance personnel disconnected this switch when it was suspected of being bad. As a result, this allowed the system to overpressurize, causing the condenser to explode.	3 TSARCOM should issue correct maintenance procedure when a malfunction of the air conditioner high pressure switch is suspected which would prohibit the operation of the air conditioner with the overpressure switch disabled.

Appendix H
Mishap History of Part Failures

This appendix presents the mishap history of Army aircraft parts/components (hereafter referred to as parts) that failed or malfunctioned, causing or contributing to 1,652 materiel-related mishaps during FY 1979. These parts were reported under 720 different part numbers and were distributed by aircraft type as follows: 263 UH-1 parts, 108 OH-58 parts, 97 AH-1 parts, 92 CH-47 parts, 38 OV-1 parts, and 37 U-21 parts. The remaining 85 parts were distributed over the other aircraft types.

The mishap history is presented to solicit the support of aviation resource managers in an effort to improve the reliability of these relatively low-cost parts. This would ultimately improve Army combat readiness through increased aircraft availability.

The requirement to improve reliability of low-cost parts was documented in USASC Technical Report 79-4, "Survey of Forced and Precautionary Landing Cost," July 1979. The survey found that 42 percent of the forced landings and 39 percent of the precautionary landings resulted in failure of the aircraft to complete the assigned mission. Also, on an average, these aircraft were out of service for 44 hours.

The report recommended "that an assertive effort be made to turn back the long history of failure of a relatively few low-cost items that cause a disproportionately high number of mishaps" and "that a similar pattern of failure should not be allowed to occur in the next generation of Army aircraft, i.e., AAH, UTTAS, ASH."

To learn the mishap history of the 720 parts, a search by aircraft type and model was made of the Army Safety Center's aviation mishap file dating back to 1 October 1971. The search found that the 720 parts contributed to or caused 64 accidents, 44 incidents, 247 forced landings, and 6,946 precautionary landings, for a total of 7,301 mishaps over the eight-year period.

Cost data were obtained by matching the Army Safety Center's mishap file with data from the Army Master File Catalog Data Agency, New Cumberland, Pennsylvania. In the tables by aircraft type (page 156), part failures attributed to inadequate maintenance are listed under the column labeled **NUM MTN OCC (number of maintenance occurrences)**.

The 10 parts reported to have failed most frequently in FY 79 are shown in table H-1. The total cost of these parts, including two fuel controls costing $9,750 each, was less than $21,000.

Six of the 10 parts have a combined mishap history of 1,391 failures dating back to FY 72. Three of these, two switches and a battery, head the FY 79 list. Three of the ten, two pressure switches and a submerged pump, have the same manufacturer code.

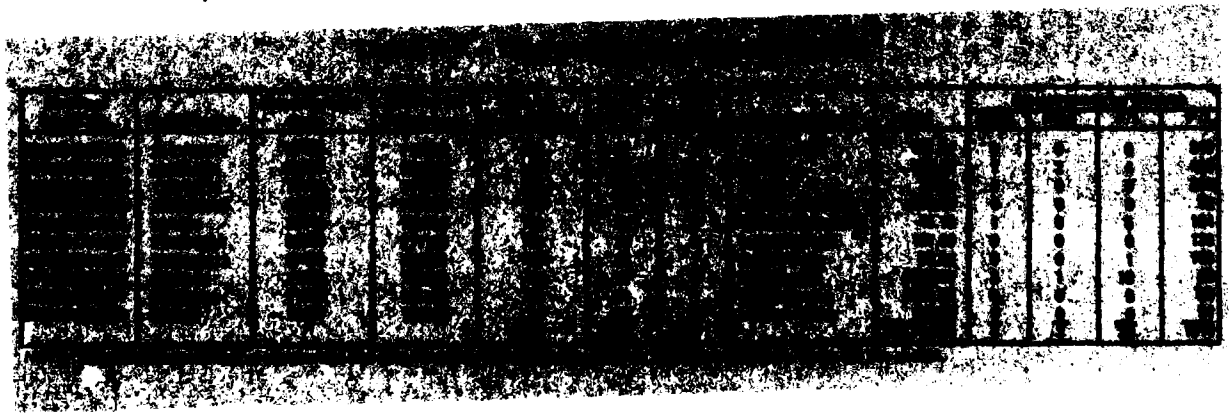
The two fuel controls, from the same manufacturer, have an interesting history. The latest version, indicated by an **A** suffix to the part number, has failed 32 times since November 1978, the date of its first failure. The first reported failure of the older version was August 1973. Twenty-six percent of the combined 121 fuel control failures were attributed to the latest version. Each of the fuel controls was reported in 21 mishaps in FY 79.

Switch failures were reported more often than any other parts failures. During FY 79, 50 different switches (by part number) of 13 different manufacturers accounted for 15 percent of the part failures. Over the 8-year period, these switches acounted for 17 percent of the part failures. By aircraft the different switches to fail were UH-1 - 17, AH-1 - 9, OH-58 - 6, and CH-47 - 5. The cost of the 50 switches range from a low of $1.32 to a high of $1,357, with 30 switches costing less than $40.

Figure H-1 shows the fiscal year in which the 720 parts were first reported in a mishap.

A review of available data did not disclose a plausible explanation for the high percentage of first failures in FY 79. The forced and precautionary landing survey mentioned earlier revealed a U-shaped pattern similar to that shown in figure H-1, i.e., a higher percentage of first failures in the first and last years surveyed.

This distribution of first failures, together with the findings of the survey, may indicate the onset of a failure history for the 324 parts first reported in FY 79. To prevent this, commodity managers and reliability, maintainability,



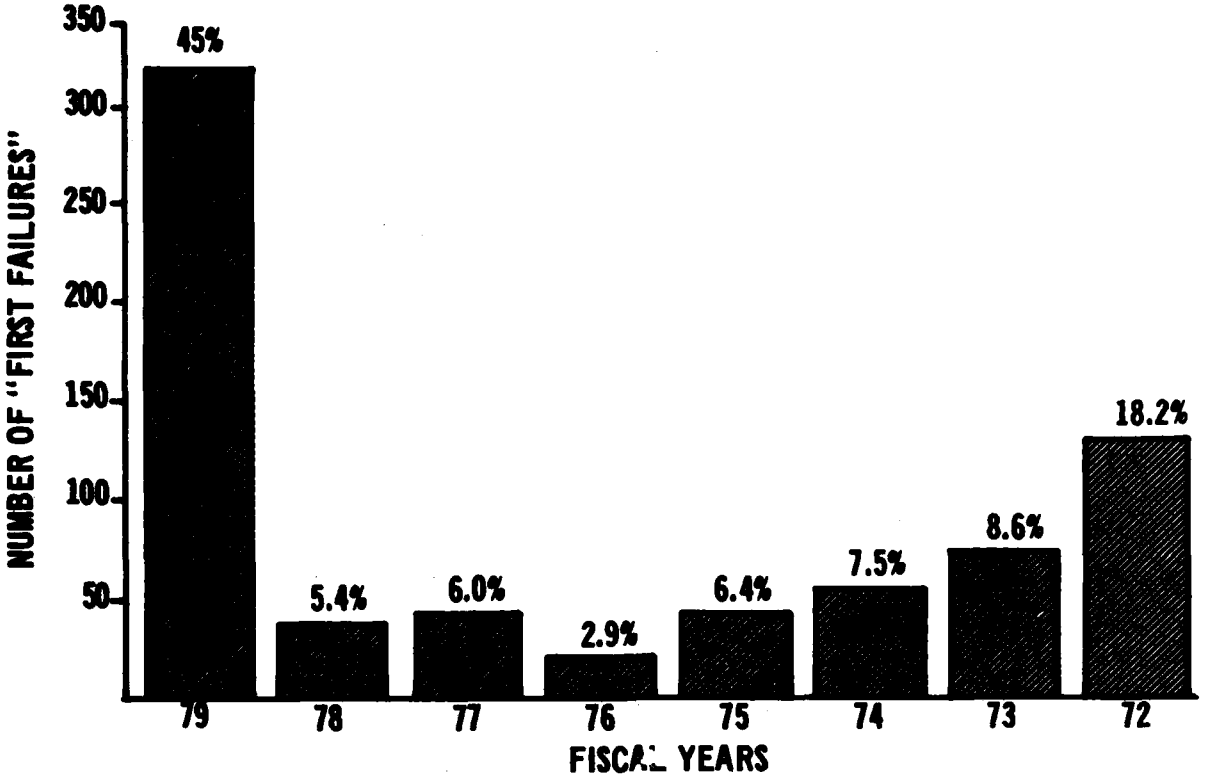


FIGURE H-1.—Year the 729 Parts That Failed During FY 79 Were First Reported in a Mishap

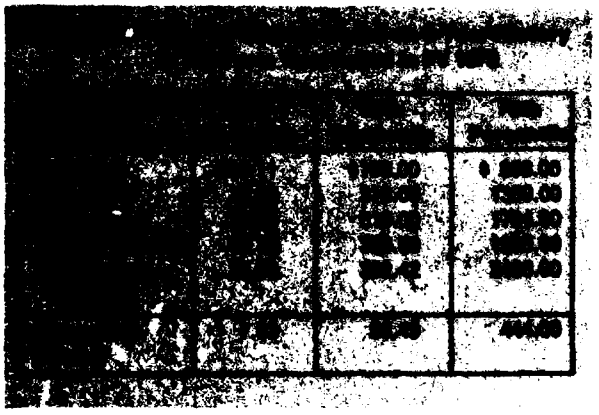
and product assurance personnel are urged to review the failure causes of these parts. By aircraft type, the UH-1 accounted for 35.8 percent; AH-1, 16.0 percent; OH-58, 13.3 percent; CH-47, 13.0 percent; OV-1, 7.4 percent; and U-21, 6.5 percent of the FY 79 first failures. The remaining 8 percent were distributed over lower density aircraft.

The eight-year history of the maintenance-related part failures is indicated by aircraft type on page 156. These data show nine parts with 10 or more maintenance-related failures: UH-1 actuator, P/N 1109015001 (23); UH-1 battery, P/N MS244081 (22); UH-1 actuator, P/N 17008008 (19); AH-1 gasket, P/N 2080401673 (19); U-21 switch, P/N MS 234411 (17); UH-1 packing, P/N MS287784 (14); UH-1 chip detector, P/N 87628 (1); UH-1 locknut, P/N AN626808 (10); and OH-58 switch, P/N 124112230 (10). Of the 77 actuator-related mishaps, 42 (55 percent) were maintenance related.

Severity of aircraft mishaps did not relate to part costs, i.e., the more costly parts did not cause accidents, the most severe mishap. Table H-2 shows that the cost ($2,486) of parts that caused 75 percent of precautionary landings is almost twice the cost ($1,388) of the parts that caused accidents. Fifty percent of the more than 7,000 materiel-related mishaps were caused by parts that cost less than $160.

Many actions must be taken before a marked reduction in these failures can be realized. The objective of these actions must be improved quality and, hence, the reliability of these low-cost parts.

The long history of failure of many of these parts suggests an evaluation of the design specifications and operational requirements upon which these specifications are based may be in order. It may also be necessary to examine manufacturing standards and practices that have the capacity to degrade the maintainability and reliability of these low-cost items. Improvements in any of these areas would become evident in the mishap history of these parts.



NOTE: The information in this appendix must not be used in a manner that will discourage or even tend to discourage aviators from making forced or precautionary landings. Their judgment concerning when to execute either a forced landing or precautionary landing should not be adversely modified. The objective of this information is not to restrict aviators' use of these maneuvers but to reduce the need to rely on these maneuvers by avoiding the causes.

Mishap History and Costs of Parts That Failed in FY 79
1 October 1971-30 September 1979

UNI-1

NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
6140007532251	MS244981	96906	436	720129	BATTERY	554.00	22	1	2	4	429	54
5930006463695	2040760571	97499	349	711002	SWITCH PRESS	31.51	3	0	0	0	349	62
6620005951503	228554	25140	160	720106	GENERATOR TACH W2	45.19	1	1	0	5	154	36
6620001791886	PDI254388	81966	133	711108	INDICATOR PPESS	157.00	2	0	0	0	133	34
4730007862092	1300243	97484	112	711003	CHIP DETECTOR	8.27	7	0	0	0	112	14
5930007991440	2040605413	97499	107	720301	SWITCH PRESS	53.94	1	0	0	1	106	30
1615009191993	87525	97484	93	711102	CHIP DETECTOR	14.96	10	0	0	0	93	9
2915000180012	2050606063	97499	93	770810	PUMP SUBMERGED	232.00	1	0	0	0	92	39
2915002237004	R420047	11599	89	730820	FUEL CONTROL	9750.00	4	2	1	18	68	21
2915000128696	2050606075	97499	82	720619	PUMP SUBMERGED	510.00	2	0	1	1	80	12
1615000725799	2040112505	97499	81	711110	M/R BLADE	7058.00	4	0	2	6	72	15
6420000474946	3440130A221	02987	77	711215	TRANSMITTER PRESS	95.22	1	0	0	0	77	15
1650000142038	20407605311	97499	76	711005	SERVO CYLINDER	923.00	1	0	0	1	75	4
1615004776304	876748	97484	71	720429	CHIP DETECTOR	29.23	6	0	0	0	71	4
5930000760835	2040600081	97499	64	730326	SWITCH	60.34	1	0	0	0	64	10
6340006279190	22702851	80009	58	711014	CONTROL ALARM	219.84	2	0	0	0	57	9
4120008659483	MS21983R	96906	55	711001	INVERTER	344.34	3	0	0	1	54	5
6495005800451	MS280343	96906	55	711118	TRANSMITTER	24.17	3	0	0	0	55	9
6420001791886	864263	18937	51	780128	INDICATOR PRESS	157.00	0	0	0	0	51	20
1650001834426	2050760387	97499	50	711105	SERVO CYLINDER	920.00	2	2	0	0	48	3
5330009052966	MS287784	96906	47	720111	PACKING	.03	14	0	0	0	46	2
5330009045695	MS287786	96906	44	720407	PACKING	.02	7	0	0	1	43	6
2840000249449	118015001	91547	40	720103	ACTUATOR	515.00	23	0	1	3	36	9
5930001794546	2040403763	97499	40	720223	SWITCH	36.01	2	0	0	0	40	6
6420000474946	TPU66A	81349	40	711101	TRANSMITTER PRESS	95.22	1	0	0	0	40	6
1615009329951	2040406009	97499	39	711109	HANGER ASSY	444.00	1	2	3	2	32	1
1680000232727	294F54G180	19500	38	720710	SENSING ELEMENT FIRE	102.00	8	0	0	0	38	3
2840000495456	117005008	91547	37	720201	ACTUATOR	527.00	19	0	0	4	33	6
6420005751427	2050405121	97499	36	770615	THERMOSTAT	87.00	0	0	0	0	36	13
5935007792317	41806	19500	35	720228	CONNECTOR	12.28	3	0	0	0	35	1
1680000098716	2040013763	97499	34	721114	BRAKE ASSY	164.00	2	0	0	0	34	4
2915002237004	R4200A7A	11599	32	781101	FUEL CONTROL	9750.00	1	0	0	5	26	21
6620001791886	R64264	18937	32	790430	INDICATOR PRESS	157.00	0	0	0	0	32	9
1680007698274	440810045	96182	31	731108	PANEL ASSY	433.00	1	0	0	0	31	2
6620005951503	GFU7A	23669	30	720317	GENERATOR TACH	45.19	0	0	0	0	30	2
6680008410302	2040701551	97499	28	711205	INDICATOR	187.00	0	2	0	0	26	6
4730007732621	37550412	00624	27	711030	COUPLING	52.30	7	0	0	1	26	3
6685005575910	157800	65092	27	721107	INDICATOR EGT	149.70	1	0	0	0	27	4
6110009180370	R103351	72914	26	740715	PANEL ASSY	30.28	3	0	0	0	26	9
5905007793979	412501000	19500	26	720326	RESISTOR ASSY	1.49	0	0	0	0	26	3
6620005951503	32005007	25140	24	720210	GENERATOR TACH W2	45.19	0	0	0	0	24	10
1650001489077	2050760097	97499	22	770726	SERVO CYLINDER	837.00	1	0	0	1	21	10
4340004893527	2050753881	97499	21	750602	BOX WARNING	254.00	0	0	0	0	21	5
4320009777488	1300212	91547	21	720922	OIL PUMP	204.00	4	0	0	1	20	2
2995009003153	2040607621	97499	21	720906	ACTUATOR LINEAR	198.00	1	0	0	1	20	3
2915000093705	RG122400	51663	20	780211	PUMP SUBMERGED	242.00	0	0	0	0	20	5
4730009884533	2040403681	97499	20	730205	VALVE	27.10	0	0	0	0	20	4
6690000078380	R0J67FPC1	82047	19	711026	INDICATOR	187.00	0	0	0	0	18	10
1650000142038	166023	00286	18	750409	SERVO CYLINDER	923.00	0	0	0	0	18	4
1615001575729	KSP90015	84955	18	730509	TRUNNION ASSY	68.45	0	0	0	0	18	4
5330007534432	451858N60	76680	17	731213	SEAL	1.39	1	0	0	0	17	3

5935001040096	1300178	91547	16	721027	ADAPTER CONNECTOR	62.39	0	0	0	0	16	4
5930006463495	6607P89	97499	16	790517	SWITCH	31.51	0	0	0	0	16	3
5935006884350	MS3126F14190	96906	15	741126	CONNECTOR	7.31	5	0	0	0	15	3
1615001343087	2050402633	97499	15	730612	QUILL ASSY	1786.00	0	1	1	3	10	2
1490009099098	MP4983	83777	15	730126	BRAKE ASSY	164.00	0	0	0	0	15	5
5330008337491	MS28778S	96906	15	711108	PACKING	.03	2	0	0	0	15	4
4810009062326	26330053	80234	15	750616	VALVE ASSY	513.00	0	0	0	0	15	2
4730002775083	AN628906	88044	15	720131	LOCKNUT	.10	10	0	0	0	15	3
2935000660300	2040604483	97499	15	711030	TURBINE FAN	516.00	1	0	0	0	15	2
2925005555340	AN3025300	88044	15	711201	RELAY	141.68	0	0	0	0	15	4
3110000714568	1300176	91547	15	720115	BEARING NR3	134.00	0	0	0	2	13	2
2915000921138	74865	11599	14	711105	BELLOWS	193.00	1	3	0	7	4	1
3110000480070	P203NPPFS50160	21335	13	721017	BEARING	1.90	1	0	0	0	13	3
2940001763780	110036106	91547	13	720209	BLADE	25.16	0	1	0	6	6	2
1560009090307	20503067324	97499	13	730406	WINDOW ASSY	106.00	0	0	3	0	10	3
5930004002798	100316	05160	12	730502	SWITCH PRESS	79.42	1	0	0	0	12	1
4320009371443	PV30448	62983	12	770622	PUMP	817.00	1	0	0	0	12	7
2915009215660	RG12470	51663	12	720710	PUMP SUBMERGED	510.00	0	0	0	0	12	2
2925008681795	1300242	91547	12	720816	WIRE HARNESS	140.00	1	0	0	0	12	2
4720009667495	12403R600096	98441	12	711226	TUBE ASSY	4.39	1	0	0	0	12	3
3110009119384	2040406231	97499	11	711005	HANGER ASSY	19.30	2	0	0	1	10	2
5930004053675	2050616355	97499	11	740924	SWITCH	74.97	0	1	0	0	10	4
6110005992567	MS1807112	96906	11	790319	REGULATOR VOLTAGE	297.90	5	0	0	0	11	6
1560009780008	2040617051	97499	10	711104	CAM DROOP	7.89	7	0	0	0	10	4
1615000896509	2040400161	97499	10	720101	TRANSMISSION	11620.00	0	0	0	0	10	4
1650008556057	2040765041	97499	10	711214	VALVE	146.00	0	0	0	0	10	3
5330008930347	1300232	91547	10	741112	SEAL	1.50	1	0	0	0	10	3
5930006463495	910022	29324	10	790525	SWITCH	31.51	0	0	0	0	10	4
2915009534097	74836	11599	10	761126	BELLOWS	177.00	0	0	0	2	8	6
5330001514238	KIT5091	08162	10	720507	SEAL	13.62	0	0	0	0	10	2
5330008111445	NAS1595G	80205	9	740317	PACKING	.07	5	1	0	0	8	3
2925000721060	79247	11599	9	771112	SOLENOID	63.01	0	0	0	0	9	4
5945006409315	MS24171D1	96906	9	730613	RELAY	33.10	0	0	0	1	8	1
6620005538998	MS280051	96906	9	720901	TRANSMITTER	277.43	0	0	0	0	9	2
6620005951503	22A703	25140	9	790501	GENERATOR TACH V-2	45.19	1	0	0	0	9	6
6680001811955	2050616337	97499	9	740529	INDICATOR FUEL	432.00	1	0	0	0	9	1
1490007598274	14110450045	96182	8	750122	PANEL ASSY	433.00	0	0	0	0	8	2
5935009003701	1021461475	77820	8	770822	CONNECTOR	6.39	4	0	0	0	8	4
5935002630213	30051P12S3S	97499	8	750331	CONNECTOR	8.40	3	0	0	0	8	2
2925009279483	30F20618	83298	8	730802	STARTER GENERATOR	1049.00	0	0	0	1	7	3
6620005145334	MS280101	96906	8	731217	INDICATOR	70.13	0	0	0	0	8	3
4820000655502	PB17365	51663	8	761004	VALVE RELIEF	26.37	0	0	0	0	8	2
5330007431473	455942H	76680	7	720112	SEAL	6.41	1	0	0	0	7	3
5330002651088	MS29513027	96906	7	720427	PACKING	.05	2	0	0	0	7	1
3120008390871	2040111191	97499	7	740925	BEARING ROD END	14.87	0	0	0	0	7	3
2915009124522	2050606065	97499	7	740924	PUMP SUBMERGED	220.00	0	0	0	0	7	1
5935008497173	MS3106R366P	96906	7	741004	CONNECTOR	10.88	0	1	0	0	6	1
6105006696434	XW201732	70255	7	730702	MOTOR ASSY	201.58	0	0	0	0	7	1
5930007381640	8190017	81349	7	790518	SWITCH	53.94	0	0	0	0	7	3
2940005223709	110009013	91547	7	750121	CASE ASSY	2525.00	2	2	0	0	5	1
6680009325133	41105C584E3	55972	6	730704	INDICATOR TACH	187.00	0	0	0	0	6	4
5930005011740	MS25089J0	96906	6	730122	SWITCH	2.86	1	0	0	0	6	2
6340006779190	2272858	80099	6	720215	CONTROL ALARM	219.84	0	0	0	0	6	1
5925006863207	MS252445	96906	6	750604	CIRCUIT BREAKER	6.61	0	0	0	0	6	2
5905005132360	RER75F1R00R	81349	6	770913	RESISTOR	2.86	0	0	0	0	6	3
5330009473205	450120H	76680	6	761206	SEAL	.87	0	0	0	0	6	2
3110000345257	MS276416	96906	6	770608	BEARING	1.71	0	0	0	0	6	2
4730000711303	AF93531J	00624	6	760928	COUPLING	22.89	0	0	0	0	6	3

4730000674908	37520012	00624	5	721025	TRANSMITTER PRESS	67.37	0	0	0	0	5	1
4720004739052	1240276O0133	98441	5	740924	HOSE ASSY	5.31	0	0	0	0	5	2
4820007203991	MS28890G	96906	5	740723	VALVE CHECK	17.96	0	0	0	0	5	2
5315007155433	2040607525	97499	5	771015	PIN	.34	1	0	0	0	5	2
6620005570582	217A100A	1950	5	711117	INDICATOR	164.00	0	0	0	0	5	2
2915009696363	2050606133	97499	5	750226	SWITCH	24.00	1	0	0	0	5	2
2935004105884	2040605499	97499	5	740402	COOLER ASSY	117.00	1	0	0	0	5	1
5340009909300	EA870006	81996	5	711227	CLAMP, LOOP	.47	1	0	0	0	5	3
1680009042442	440810019	96182	5	740506	PANEL ASSY	433.00	0	0	0	0	5	2
5145008519505	MS25190R20	96906	5	730730	WIRE	11.38	1	0	0	0	5	2
1615001291564	X134296	99186	5	741022	RING CLUTCH	181.00	0	0	3	0	2	1
1615006907502	20404050211	97499	5	750507	CAP ASSY	35.57	4	0	0	0	5	1
1560002215717	2050605373	97499	5	750219	THERMAL VALVE	234.00	0	0	0	0	5	2
6115039422094	30R3737	83298	5	711019	GENERATOR	830.00	0	0	0	0	5	1
6115007251790	30010000	31435	4	711115	GENERATOR, DC	830.00	0	0	0	1	3	1
1560007894969	2050616341	97499	4	790309	PUMP ASSY	11.05	0	0	0	0	4	1
1650001336942	2040760529	97499	4	790227	SERVO CYLINDER	568.00	0	0	0	1	3	3
6140010451116	BR433AA	80058	4	790314	BATTERY	735.00	0	0	0	0	4	2
2915000970325	MS29530G	96906	4	731004	VALVE ASSY	37.75	0	0	0	0	4	1
2940009489351	116024401	91547	4	731005	BAND COMPRESSOR	1.05	2	0	0	0	4	1
5935007298935	2620PS	95238	4	731027	CONNECTOR	4.40	2	0	0	0	4	1
5945006866877	MS2414601	96906	4	730312	RELAY	23.95	0	0	0	0	4	1
5930007964343	13AT66	73949	4	730904	SWITCH	20.02	1	0	0	0	4	1
6620005573023	MIL125623TXPENU1	81349	4	711004	INDICATOR V1	218.00	0	0	0	0	4	2
2995008931216	2040607657	97499	4	750517	LEVER	21.04	2	1	0	0	3	2
6620005570582	21700141	19500	4	790910	INDICATOR	164.00	0	0	0	0	4	1
3110000796387	2040117121	97499	4	720511	BEARING	29.24	0	0	0	0	4	1
5315007892886	130026801	91547	4	760826	PIN	1.96	1	1	1	1	0	1
6140007532251			4	790919	BATTERY	554.00	0	0	0	0	4	1
4720001929962	20506265015	97499	4	730929	HOSE ASSY	23.71	3	0	0	0	4	1
4720009581318	MS8001F200A	96906	4	780331	HOSE ASSY	7.31	3	0	0	0	4	3
4730000740561	AE93532J	00624	3	731001	COUPLING HALF	18.72	1	0	0	0	3	2
4920007520058	2050606661	97499	3	750206	VALVE	14.89	3	0	0	0	3	2
4920001819226	20506369111	97499	3	781107	VALVE CHECK	66.80	0	0	0	0	3	3
4910010223699	2040760551	97499	3	790329	VALVE, IRREVERSIBLE	247.00	0	0	0	0	3	3
4730008070691	MS2192660	96906	3	730707	ELBOW TUBE	1.99	1	0	0	0	3	2
4730006407213	MS2190205	96906	3	770127	NIPPLE TUBE	.36	1	0	0	0	3	1
4680008483911	39300401409	89305	3	790507	INDICATOR FUEL	451.00	0	0	0	0	3	2
5330005740925	NAS6176	80205	3	720323	PACKING	.03	1	0	0	0	3	1
5306002020441	MS970508	96906	3	770622	BOLT	.68	1	0	0	1	2	2
3020004539441	107006204	91547	3	750313	GEAR SPUR	257.00	1	0	0	1	2	1
5905000590451	AN55342	88044	3	750508	THERMO COUPLE	12.53	0	0	0	0	3	2
2840009255813	119001002	91547	3	741107	TURBINE ROTOR	2039.00	0	0	1	0	2	1
2915000180012	1644168	25140	3	780726	PUMP SUBMERGED	232.00	0	0	0	0	3	2
2915000190012	RG122400	51663	3	780119	PUMP SUBMERGED	232.00	0	0	0	0	3	1
6620005538954	21850A	19500	3	731205	TRANSMITTER	74.06	0	0	0	0	3	1
1650004579944	2050760345	97499	3	740128	FILTER ASSY	48.77	1	0	0	0	3	1
1560009900308	20503067323	97499	3	781117	WINDOW ASSY	106.00	0	0	0	0	3	2
1615000601062	20401140011	97499	3	740301	SWASHPLATE ASSY	2066.00	0	0	0	0	3	2
6620005851503	MILG26611	81349	3	790517	GENERATOR TACH V-2	45.19	0	0	0	0	3	2
1615004071960	2040110621	97499	3	781121	TIP CAP	2.39	0	0	0	0	3	1
1615000693327	2040406875	97499	3	740729	COUPLING	344.00	1	2	0	0	1	1
6615000139715	CN998ASN43	81349	3	750603	GYRO	3350.00	0	0	0	0	3	1
1615004195944	2040114621	97499	3	780509	BOOT	11.30	2	0	0	0	3	2
1615013891950	540015O011	97499	2	790819	BLADE MR	8499.00	0	0	0	1	1	1
1615002137261	20401210119	97499	2	760106	HUB ASSY	7467.00	0	0	0	0	2	1
1615007727714	02W10116	00736	2	790728	FILTER	59.48	1	0	0	0	2	2
1615006785414	2040406203	97499	2	790409	DRIVE SHAFT T/R	394.00	1	0	0	0	1	1

1440018732278	2040607095	97499	2	790315	IDLE STOP	40.93	2	0	0	2	0	2
1490009554057	1U102	94641	2	760630	VALVE	146.00	0	0	0	0	2	1
6620021791896	PD125438A	96906	2	790608	INDICATOR PRESS	157.00	0	0	0	0	2	2
6140010519844	BR400A	80058	2	790909	BATTERY	41.26	0	0	0	0	2	2
2840009798618	110044007	91547	2	790508	COMPRESSOR ASSY	2197.00	0	0	0	0	2	1
2915000129604	PG12470	97499	2	790213	PUMP SUBMERGED	510.00	0	0	0	0	2	2
5930000508622	2040709070	97499	2	730328	SWITCH ROTARY	25.72	0	0	0	0	2	1
5930010427036	MS24660236	96906	2	771219	SWITCH	16.18	0	0	0	1	1	1
5330019847138	116029002	91547	2	790507	GASKET	.07	1	0	0	0	2	2
5330009460058	MS29561024	96906	2	750520	PACKING	.05	0	0	0	0	2	1
5340002259053	4562350	98625	2	790613	COUPLING	5.62	0	0	0	0	2	1
5930004871481	C100E239	81640	2	770518	SWITCH	5.54	0	0	0	2	0	1
5930006157895	MS2510521	96906	2	720315	SWITCH TOGGLE	6.56	0	0	0	0	2	1
5940009130408	MS25036101	96906	2	790322	TERMINAL, WIRE	.03	1	0	0	0	2	2
5935008354338	MS310RR14S6S		2	790221	CONNECTOR ASSY	2.75	0	0	0	0	2	2
3020002771123	MS202202	96906	2	740420	PULLEY GROOVE	5.28	0	0	0	0	2	1
3040001575087	20401176211	97499	2	780510	LINK ASSY	30.68	1	0	0	0	2	1
6620007338432	39300401970	89305	2	780123	FUEL QUANTITY	318.00	1	0	0	0	2	1
3110009889492	1300082018	91547	2	771117	BEARING	43.30	0	0	0	0	2	1
3110004795425	R5452Z	38443	2	781202	BEARING	6.54	0	0	0	0	2	2
3120009040920	1300341	91547	2	790716	BEARING ROD END	4.11	1	0	0	0	2	1
4010000179267	2050017069	97499	2	711022	CABLE ASSY	7.70	2	1	0	0	1	1
2915009289998	RB12519	51663	2	721212	STRAINER INLET	2.03	1	0	0	0	2	1
2915007817917	84200A7	11599	2	780808	FUEL CONTROL	9750.00	0	0	0	0	2	1
6620005951503	3200S005	25140	2	790220	GENERATOR TACH	45.19	0	0	0	0	2	2
2915009499158	2040606545	97499	2	781119	SWITCH	28.90	0	0	0	0	2	1
6610007317969	MS173131	96906	2	760518	INDICATOR ATTITUDE	1213.00	0	0	0	0	2	1
2945004422539	101038005	91547	2	730907	FILTER AIR	1134.00	2	0	0	0	2	1
4820009378701	2040763433	97499	2	760217	VALVE ASSY	33.20	0	0	0	0	2	1
4920009230625	2040764373	97499	2	770415	VALVE CHECK	14.22	0	0	0	0	2	1
6620011791896	1816722	81996	2	711112	INDICATOR PRESS	157.00	0	0	0	0	2	1
5330005840265	MS28775012	96906	2	761123	PACKING	.02	1	0	0	0	2	1
4730005567398	MS21922G	96906	2	731121	SLEEVE	.22	1	0	0	0	2	1
4730009340068	300554120	96906	2	790409	COUPLING HALF	49.33	0	0	0	0	2	2
4810000877692	130019105	91547	2	790828	VALVE SOLENOID	71.00	0	0	0	0	2	1
4730000336550	305551112D	00624	2	781104	COUPLING HALF	61.17	1	0	0	0	2	2
4730005411749	MS2192406	96906	2	780630	TUBE NIPPLE	.66	1	0	0	0	2	1
4720009662240	1300137	91547	2	730707	HOSE ASSY	11.05	2	0	0	0	2	1
4720009042426	12404140140	98441	2	790120	HOSE ASSY	11.91	0	0	0	0	2	2
4720007395877	S347164300W110	78750	2	741125	HOSE ASSY	33.82	1	0	0	0	2	1
4720001829966	20506265017	97499	1	790109	HOSE ASSY	35.31	0	0	0	0	1	1
4720001499602	20506265033	97499	1	790814	HOSE ASSY	20.53	1	0	0	0	1	1
4720009662204	1300142	91547	1	781023	HOSE ASSY	9.74	0	0	0	0	1	1
4720009593616	12402760D146	98441	1	790227	HOSE ASSY	4.65	0	0	0	0	1	1
4910000496712	28040	80234	1	790925	VALVE	513.00	0	0	0	0	1	1
4730007732619	37554	00624	1	790711	COUPLING HALF	21.24	1	0	0	0	1	1
6125009659683	MGH159200	96906	1	790612	INVERTER	344.34	0	0	0	0	1	1
4730007732613	375510	00624	1	781026	COUPLING HALF	37.00	0	0	0	0	1	1
5330008721278	A506R0H	76680	1	790827	SEAL	.97	0	0	0	0	1	1
5330005793163	MS28775214	96906	1	790417	PACKING	.04	1	0	0	0	1	1
5305001050531	118013501	91547	1	790125	SCREW MACHINE	.47	0	0	0	0	1	1
5306001821529	AN4H11	88044	1	781023	BOLT	5.42	1	0	0	0	1	1
5306001511413	AN423A	88044	1	790314	BOLT	7.53	1	1	0	0	0	1
5310000897208	116063501		1	790623	WASHER SPECIAL	.06	0	0	0	0	1	1
5306009056503	72372	11599	1	790426	BOLT	4.06	1	0	0	0	1	1
5306006396646	NAS4641027	80205	1	790724	BOLT SHEAR	1.07	0	0	0	0	1	1
5310009479858	216105501	91547	1	790405	NUT, JAM	.49	0	0	0	0	1	1
5310001991028	AN924120	88044	1	790712	NUT	.41	1	0	0	0	1	1

2915008455866	RR12580	51663	1	790227	PUMP BOOST	279.00	0	0	0	0	1	1
2915009942016	6824812678	11599	1	790504	GOVERNOR	2750.00	0	0	0	0	1	1
2915007406505	8700087	11599	1	790402	GOVERNOR, OVERSPEED	715.00	0	0	0	0	1	1
2915004539564	89970	11599	1	790724	SHAFT AND RING	79.11	0	0	0	1	0	1
6680009325133	2040701551	02987	1	790206	INDICATOR TACH	187.00	0	0	0	0	1	1
2915009243560	116022003	91547	1	781101	VALVE ASSY DRAIN	64.78	0	0	0	0	1	1
3120010588873	KSP60991	84955	1	790718	BEARING PLAIN	131.00	0	0	0	0	1	1
4710002788726	2050761401	97499	1	790625	TUBE ASSY	.21	1	0	0	0	1	1
3110000697207	2040403091	97499	1	790715	NUT PLAIN	22.56	1	0	0	0	1	1
3040009827507	2040762673	97499	1	790717	CONNECTING LINK	38.29	0	0	0	0	1	1
3020010493468	1560UH17521	97499	1	790330	CHAIN ASSY	26.42	0	0	0	0	1	1
5935007254446	MS3122F20390	96906	1	790125	CONNECTOR	10.04	0	0	0	1	0	1
5935009134716	MS3106R10S23S	96906	1	790620	CONNECTOR	3.98	0	0	0	0	1	1
5935005043684	A101892	95712	1	790407	ADAPTER CONNECTOR	2.54	0	0	0	0	1	1
5935002014421	2620M	95238	1	790506	CONNECTOR	.59	0	0	0	0	1	1
5945007525599	MS245772A		1	790928	FLASHER ASSY	29.07	0	0	0	0	1	1
5930006126993	21230	77820	1	790628	SWITCH TRIGGER	10.88	0	0	0	0	1	1
5340006586170	191311537M	98625	1	790829	CLAMP	36.66	1	0	1	0	0	1
6520005851503	224554	25140	1	790308	GENERATOR TACH N2	45.19	0	0	0	0	1	1
5345008384774	120008028F20	97499	1	781116	SHIM	.76	0	0	0	0	1	1
5921005033434			1	790206	VHF T366 ARC	144.00	0	0	0	0	1	1
5345009495495	110028901	91547	1	781107	SHIM	.30	1	0	0	0	1	1
5826004077300	R128ARN82		1	790828	RECEIVER	2000.00	0	0	0	0	1	1
5821009355072	SMB692590		1	790508	RECEIVER, TRANSMITTE	3627.00	0	0	0	0	1	1
5821009355072	ANARC115		1	790522	RECIEVER, TRANSMITTE	3627.00	0	0	0	0	1	1
5826009273448	2040753993	97499	1	790622	BOARD ASSY	141.00	0	0	0	0	1	1
5905002953760	AN31555025	12697	1	790517	RESISTOR	3.19	0	0	0	0	1	1
6685007820636	MS280343	96906	1	790921	THERMOCOUPLE	310.00	1	0	0	0	1	1
5910005430845	CP5381KF105K1	81349	1	790911	CAPACITOR	2.61	0	0	0	0	1	1
2940010097371	110056201	91547	1	790405	BLADE TURBINE	39.96	0	0	0	1	0	1
2840009462416	110111007	91547	1	790524	VANE ASSY STATOR	163.00	0	0	0	0	1	1
6140007532251	88432A	80058	1	790719	BATTERY	554.00	0	0	0	0	1	1
1680009257072	2040016015	97499	1	790215	STICK ASSY	50.52	0	0	0	0	1	1
2840001763759	1002860R	91547	1	790521	BLADE	52.10	0	0	0	0	1	1
2840001344903	118015001	91547	1	790319	ACTUATOR	1425.55	0	0	0	0	1	1
2840009768715	103004008	91547	1	781205	VALVE ASSY	9.10	0	0	0	0	1	1
2840008093885	115024003	91547	1	781103	DIFFUSER EXHAUST	7697.00	0	0	0	0	1	1
2840007756517	116044401	91547	1	790323	SHAFT	133.00	0	0	0	1	0	1
1650008556057	1011025	94641	1	781106	VALVE	146.00	0	0	0	0	1	1
1650001576943	2040109377	97499	1	790307	DAMPER	470.00	1	0	0	0	1	1
1615010309959	SKCPE2811		1	790116	COUPLING	2000.00	0	0	0	0	1	1
1680004507746	2050315143	97499	1	790801	HANDLE	7.28	1	0	0	0	1	1
1680002957984	249100	96182	1	790510	PANEL ASSY	528.00	0	0	0	0	1	1
1680001439794	6SA1191		1	790413	ACTUATOR ASSY	2215.00	0	0	0	0	1	1
1660007629781	2040724751	97499	1	790215	MIXING VALVE	269.00	0	0	0	0	1	1
1560009219559	2040720241	97499	1	781005	SUSPENSION ASSY	1902.00	0	0	0	0	1	1
1560010577306	2050636051	97499	1	790427	VALVE SHUTOFF	48.35	0	0	0	0	1	1
1560007800894	2040012951	97499	1	790125	LEVER	33.49	0	0	0	0	0	1
1560007593669	2040013371	97499	1	790406	BELL CRANK ASSY	15.30	0	0	0	0	1	1
1560006330813	2040018091	97499	1	790205	BELLCRANK	46.53	1	0	0	0	1	1
1560001690533	2050606515	97499	1	790920	CAP AND ADAP ASSY	324.00	0	0	0	0	1	1
6115009011919	TYPESFU5A	99238	1	790309	GENERATOR	830.00	0	0	0	0	1	1
1615007050661	20404020713	97499	1	790731	QUILL ASSY T/R	1203.00	0	0	0	0	1	1
1515008309754	2040404381	97499	1	790509	COLLECTIVE LEVER	174.00	1	0	0	0	1	1
1615009191893	D7526080C12	97484	1	790302	PLUG MAGNETIC	14.96	0	0	0	0	1	1
1615009389784	20401140613	97499	1	790306	SCISSORS ASSY	252.00	0	0	0	0	1	1
1615001336872	20401180117	97499	1	790920	HUB ASSY	2123.00	0	0	0	0	1	1
1615001830834	2040400163	97499	1	790319	TRANSMISSION	11620.00	0	0	0	0	1	1

1615000686635	2050400043	97499	1	790320	DRIVE SHAFT	2687.00	0	0	0	C	1		1	
4140002254451	273073	96906	1	790328	BATTERY	24.14	0	0	0	C	1		1	
		TOTAL	4164				308	26	20	94	4015		966	

Mishap History and Costs of Parts That Failed in FY 79
1 October 1971-30 September 1979

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NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
5330009090794	MS287788	96906	18	720309	O-RING	.03	4	0	0	0	18	1
4720008645799	EAB44040140	81996	14	711116	HOSE ASSY	11.40	1	0	0	0	14	2
1610091336940	73R1691	73030	7	730712	PROP CONTROL	10615.00	1	0	0	0	7	3
2915002236382	98*0082	11599	6	771028	FUEL CONTROL	6501.00	0	0	0	0	6	2
6115009731223	AGE1211A	07639	5	720209	GENERATOR	1750.00	0	0	0	0	5	1
6140007532251	88433A	96906	5	750819	BATTERY	554.00	0	0	0	0	5	3
6125009586915	MS174042	96906	4	711124	GENERATOR	1376.00	1	0	0	0	4	1
3040007468427	107014001	91547	4	770908	GEAR ASSY	202.00	0	1	0	2	1	3
2915009455884	117042001	91547	3	711202	FUEL MANIFOLD	75.82	0	0	0	0	3	1
1650001336938	134M1005891	26512	3	770312	ACTUATOR	1022.00	0	0	0	0	3	2
1485004450979	134SCM10913	26512	3	730516	CYLINDER WIPER	148.00	0	0	0	0	3	1
1560000176078	15600V11561	81996	2	770421	CAP ASSY	41.48	0	0	0	0	2	1
4320007959852	134SCP1233	26512	2	790410	PUMP, ROTARY FUEL	2115.00	0	0	0	0	2	1
4730002775081	AN628908	88044	2	740206	LOCK NUT TUBE	.02	2	0	0	0	2	1
5330002979990	MS28775222	96906	2	761222	PACKING	.06	0	0	0	0	2	1
6615009191962	CN1151AASN76		1	790221	ASN 76 GYRO	15600.00	0	0	0	0	1	1
5310009455722	134P301161	26512	1	790320	WASHER KEY	.62	0	0	0	0	1	1
4720007850916	MS27363G0160		1	790822	HOSE	9.41	1	0	0	0	1	1
3040005873749	1080270044	91547	1	790919	GEAR SHAFT	447.00	1	0	0	0	1	1
6420034882510	134SCAV22017	26512	1	790821	INDICATOR TORQUE	5236.00	0	0	0	0	1	1
2995009526796	1358056	82402	1	790810	INPUT SHAFT	392.00	0	0	0	0	0	1
1610006711092	55790AP8	73030	1	790924	CONTROL PROP	10510.00	0	0	0	0	1	1
1560010083040	134EC7*014831		1	790508	OJCT ASSY	321.00	0	0	0	0	1	1
1560009662478	134AV10501133	26512	1	790320	CABLE ASSY DOWNLOCK	194.00	1	0	0	0	1	1
1680006119471	702036	33525	1	781226	SENSING ELEMENT	37.92	0	0	0	0	1	1
6615007714636	CU792ASW12		1	781006	COUPLER	5806.00	0	0	0	0	1	1
1430009503166	134SCL1133	26512	1	781128	BRAKE ASSY	777.00	0	0	0	0	1	1
1650007723423	134A100541		1	790111	CYLINDER ASSY	1476.00	0	0	0	0	1	1
1650007723422	134M100543	26512	1	790116	ACTUATOR ASSY	1821.00	0	0	0	0	1	1
2915002236186	91500R7	11599	1	790423	FUEL CONTROL	5797.00	0	0	0	0	1	1
2915000729082	134SCP1157	26512	1	790531	PUMP SUBMEGERED	2233.00	0	0	0	0	1	1
6130004070865	356900800001	02987	1	790713	INVERTER P#R STAT	738.00	0	0	0	0	1	1
2840000548748	1300164	91547	1	790404	HOSE ASSY	17.49	1	0	0	0	1	1
5965004294280	ANAL0147	80058	1	790421	CONTROL UNIT	1020.83	0	0	0	0	1	1
5895000491555	ANAPX72		1	790222	TRANSPONDER	2500.00	0	0	0	0	1	1
5935008144621	MS3116P1419S	96906	1	790317	CONNECTOR	6.65	0	0	0	0	1	1
5930006157880	MS3505926	96906	1	781024	SWITCH	2.55	0	0	0	0	1	1
5930005046223	MS250894C	96906	1	781108	SWITCH	3.04	0	0	0	0	1	1
		TOTAL	103				13	1	0	2	99	47

Mishap History and Costs of Parts That Failed in FY 79
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NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
5930002991066	124112230	73168	206	711011	SWITCH	29.81	10	0	0	0	206	40
5930000077666	2060764041	97499	110	730414	SWITCH	59.09	1	0	0	0	110	9
2915001306096	6874255	73342	96	711222	GOVERNOR	441.00	2	1	3	28	64	11
1615001216543	2060400035	97499	94	720113	TRANSMISSION	7731.00	1	1	0	1	92	16
5930001689019	7G1991	09049	83	720416	SWITCH	61.26	4	0	0	0	83	14
5930001354282	20607636R1	97499	65	720316	SWITCH	29.51	1	0	0	0	65	1
2915001344564	6871111	73342	55	720219	FUEL CONTROL	875.00	8	0	0	20	34	9
2925000813547	23032022	31435	32	750306	GENERATOR	1200.00	1	0	0	0	32	14
5930008689474	2060625423	97499	31	720326	SWITCH, PRES	23.41	0	0	0	0	31	19
4620001792175	2060626271	97499	27	730620	GENERATOR TACH	123.00	0	0	0	2	25	7
4730001454904	B9TRR	79326	21	720608	ELBOW ASSY	121.06	6	0	0	3	18	1
2995001344543	2060627211	97499	20	721206	ACTUATOR LINEAR	268.00	3	0	0	3	17	2
2995009166161	6871641	73342	19	720224	CHIP DETECTOR	7.69	0	0	0	0	19	3
1615004322492	2060404009	97499	19	740315	GEAR BOX	1350.00	0	1	0	0	18	5
1615001225150	2060404007	97499	15	711101	GEAR BOX	1350.00	0	0	0	0	15	1
3110001068664	2060403397	97499	15	740320	BEARING	6.27	1	0	1	1	13	2
4320001345157	2060760303	97499	15	760823	PUMP	1465.00	0	0	0	0	15	4
6620001792254	31002001	26665	13	730514	INDICATOR PRESSURE	132.00	0	0	0	0	13	2
3110004261195	6876008	73342	13	740821	BEARING NO 2	124.00	0	1	0	5	7	1
2940002441774	6871165	73342	13	740729	SCROLL ASSY	1124.00	4	0	0	2	11	3
6695001792248	26002001	26665	13	720524	INDICATOR, TEMP	301.43	2	0	0	0	13	2
2940002424477	6876266	73342	12	740828	COMPRESSOR	4100.00	2	0	0	7	5	1
6110001388687	2060754473	97499	12	740702	REGULATOR VOLTAGE	363.00	4	0	0	0	12	6
1615004431095	2060112503	97499	11	770901	BLADE ASSY	6228.00	0	0	0	0	11	4
4820006269108	6873599	73342	11	770907	VALVE CHECK	131.00	1	0	0	4	7	5
5330001794032	450127H19	76680	11	721210	SEAL	1.43	1	0	0	0	11	2
2925000813547	2925G6002	81996	10	750811	GENERATOR	1200.00	0	0	0	0	10	1
6140002288447	2060753631	97499	10	730608	BATTERY	478.00	3	0	0	0	10	2
1680001336074	2060754567	97499	10	740508	PANEL ASSY	888.00	0	0	0	0	10	2
6140002289447	28180	74025	10	750605	BATTERY	478.00	0	0	0	0	10	1
1560002291920	2060305393	97499	9	740605	MOUNT ASSY	351.00	1	0	0	0	9	1
2925001797143	23032022	31435	9	711109	GENERATOR	1200.00	1	0	0	0	9	2
6695005222483	2060755451	97499	9	730823	SENSOR TACH	74.85	0	1	0	0	8	4
2995003499285	6875224	73342	7	740309	ACCUMULATOR	21.23	3	0	0	3	4	3
1615001574660	2060401381	97499	7	740408	SEAL	30.87	0	0	0	0	7	1
1680001264350	2060010761	97499	7	770124	GRADIENT ASSY	165.00	2	0	0	0	7	1
2915001306096	25244381	06948	7	790228	GOVERNOR	441.00	0	0	0	1	6	4
2940009399395	6852020	73342	7	730426	SPRAY NOZZLE	312.00	0	0	0	3	4	1
6130001688544	2060753645	97499	6	780307	INVERTER	459.00	0	0	0	0	6	3
1660011334076	2060704753	97499	6	760324	BLOWER DEFOGGING	97.57	0	0	0	0	6	1
6685001812213	2060702679	97499	6	731021	INDICATOR TEMP	128.00	2	0	0	0	6	2
6680001506525	2060702655	97499	5	770323	INDICATOR ENGINE	249.00	0	0	0	0	5	2
6140002288447	BR67AA	80058	5	780815	BATTERY	478.00	0	0	0	0	5	2
2995011790812	41280220	04638	5	780913	CONTROL ASSY	96.21	3	0	0	0	5	4
3110010186506	2060403390	97499	5	781023	BEARING	6.27	0	0	0	0	4	3
4710009259212	6854139	73342	4	780411	TUBE ASSY	9.39	3	1	0	2	1	1
4920009305273	2040764371	97499	4	731010	VALVE CHECK	17.64	1	0	0	0	4	1
1650010142332	2060760311S	97499	4	780927	SERVO ACTUATOR	850.00	0	0	0	0	4	3
6680004007292	2060763731	97499	4	730227	GENERATOR TACH	147.00	0	0	0	0	4	1
5930002441969	2060626591	97499	4	781204	SWITCH	54.39	0	0	0	0	4	3
5340009372408	2520659	06848	3	790517	SPRING	3.67	2	2	0	0	1	2

2940009192420	6891929	73342	3	760907	GEARBOX HOUSING	832.00	0	0	0	0	3	1
5310002005760	AN9244	88044	3	761110	NUT	.17	3	0	0	1	2	1
5330002446404	MS2877306	96906	3	780426	RETAINER	.07	3	0	0	0	3	1
5330009921960	MS28775235	96906	3	711111	PACKING PREFORMED	.13	1	0	0	0	3	1
4730001819336	6870693	73342	3	761116	T-TUBE	20.50	0	0	0	0	3	1
4730002789101	AN737RR44	88044	3	771111	CLAMP	.15	0	0	0	1	2	1
3120001697813	20604003221	97499	3	720217	BEARING	1.50	0	0	0	0	3	2
3110004802784	20604003?7	97499	3	760208	BEARING	463.00	0	0	0	0	3	2
2925011797143	2925F6002	81996	3	771108	GENERATOR	1200.00	0	0	0	0	3	1
2915009440914	2570?90	06848	2	770420	SPRING	3.58	0	0	0	0	2	1
4710001316466	6870035	73342	2	751105	TUBE ASSY	4.94	0	0	0	0	2	1
4730002290935	A?948376	00624	2	711111		45.72	1	0	0	0	2	1
4810001779742	20606?5041	97499	2	770819	VALVE	407.13	1	0	0	0	2	1
4730007294351	MS2439404	96906	2	760224	ELBOW	.83	2	0	0	0	2	1
5330001341500	451883M19	76680	2	761227	SEAL	1.89	0	0	0	0	2	1
6130001688544	PS2??	97499	2	780808	INVERTER	459.00	0	0	0	0	2	1
2940002441748	6?71164	73342	2	780606	COVER ASSY	205.00	1	0	0	1	1	1
1540000092295	20606?6021	97499	2	771115	TANK	3410.00	0	0	0	0	2	1
5340001811379	M10807	83014	2	750331	HINGE ASSY	4.40	0	0	0	0	2	1
5340001359872	4606AC	94581	2	781010	CLAMP	15.79	0	0	0	0	2	2
5340001312588	2060010613	97499	2	760924	CLEVIS ROD END	27.19	1	0	0	0	2	1
?977000571?08	230331141		2	740707	BRUSHES	5.04	0	0	0	0	2	1
5940009597004	6855369	73342	2	741212	TERMINAL ASSY	32.71	1	0	0	0	2	1
5930009550569	M20078	81640	2	770908	SWITCH	16.41	0	0	0	1	1	1
5940010077976	M792?33		1	790705	SPLICE	.09	0	0	0	0	1	1
5340009473?56	68?55462	73342	1	790515	SCREW	22.62	0	0	0	0	1	1
5330010173913	410136M19	76680	1	790727	SEAL	1.69	0	0	0	0	1	1
5365002202067	2060400?61	97499	1	790418	SHIM	2.82	1	0	0	0	1	1
5930002991066	1241102230	73168	1	790326	SWITCH	29.81	0	0	0	0	1	1
5905001369876	2060756623	97499	1	790305	RHEOSTAT	9.38	0	0	0	0	1	1
1560001?41?6?	2060690519	97499	1	781003	COVER DRIVE SHAFT	40.44	1	0	0	0	1	1
1560010177496	ICH25	97499	1	790406	TAIL BOOM ASSY	5532.00	0	1	0	0	0	1
1615001273053	2060015261	97499	1	781023	BELL CRANK	95.28	0	0	0	0	1	1
1615001216430	2060104541	97499	1	790313	UNIBALL, CYLIC	268.00	1	0	0	0	1	1
1615001200?91	20604010012	97499	1	790402	DRIVE SHAFT ASSY	1596.00	1	0	0	0	1	1
1680001258?71	2060011743	97499	1	790705	JACK SHAFT ASSY	411.00	0	0	0	0	1	1
1680007754182	010138501	45402	1	790502	REEL ASSY	139.00	0	0	0	0	1	1
1680001789226	2060011765	97499	1	790829	TUBE ASSY	74.54	0	0	0	0	1	1
1615010340405	20604000323	97499	1	790907	TRANSMISSION	25000.00	0	0	0	0	1	1
?330001317273	45150M19	76680	1	790515	SEAL	2.51	0	0	0	0	1	1
5330002438013	MS29?13243	96906	1	790228	PACKING PREFORMED	.20	1	0	0	0	1	1
?310005597455	6746974	73342	1	781024	NUT	.61	0	0	0	0	1	1
?310009502634	6?223169	73342	1	790325	NUT, SPUR ADAPTER	4.92	0	0	0	0	1	1
4820010105829	2529254	06848	1	790705	DIAPHRAGM ASSY	18.51	1	0	0	0	1	1
5305000885164	MS246682	96906	1	781117	SCREW FLAT HEAD	.03	0	0	0	0	1	1
4730006946912	MS24392J4	96906	1	790309	NIPPLE TUBE	.73	0	0	0	0	1	1
4920006268108	25244293	06848	1	790320	DOUBLE CHECK VALVE	131.60	0	0	0	0	1	1
4920007749353	6856983	73342	1	790808	VALVE	90.17	0	0	0	0	1	1
4730002290934	L555560	00624	1	790814	COUPLING HALF	21.64	1	0	0	0	1	1
4730001347?80	AF94838F	00624	1	790301	COUPLING HALF	37.49	1	0	0	0	1	1
4720009167?02	1300114N?0	97499	1	790215	TUBING	.06	0	0	0	0	1	1
3120001317157	2060010623	97499	1	790821	WASHER THRUST	7.25	0	0	0	0	1	1
4320001345197	65216	75250	1	790308	PUMP HYDRAULIC	1465.00	0	0	0	0	1	1
4140000048?75	2060739033	97499	1	781031	BLOWER ASSY	764.00	0	0	0	0	1	1
3110001068664	P?106NPPB2A2	97499	1	790316	BEARING	6.27	0	0	0	0	1	1
2915009441011	252358668	06848	1	790220	RESTRICTOR	16.76	0	0	0	1	0	1
2915004787292	68770?6	73342	1	790201	JET ASSY	39.77	0	0	0	0	1	1
2925009410316	6854021	73342	1	790716	CABLE & CONDUIT	46.22	0	0	0	0	1	1

2990071778764	2060627085	97499	1	790482	TJBE ASSY TORQUE	131.00	0	0	0	0	1	1
2990001347446	2060427201	97499	1	790215	BELLCRANK ASSY	81.19	0	0	0	0	1	1
3020001344905	6871218SGR	73342	1	790427	GEAR ASSY	285.00	0	0	0	1	0	1
3020000714852	6854149	73342	1	781214	GEAR CLUSTER	171.00	0	1	0	0	0	1
		TOTAL	1290				95	10	4	91	1183	300

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NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
6680001P30374	114FS2372	77272	23	720817	TRANSDUCER	679.00	1	0	0	0	23	3
5930009231451	114FS2364	77272	16	730926	SWITCH	1051.00	0	0	0	0	16	1
1615007816813	114D600120	77272	15	711119	ENGINE XMSN	9220.00	0	0	0	0	14	4
6115031116928	31161001	31435	15	740710	GENERATOR	4659.00	1	0	0	0	14	3
1615000791007	114D6200A	77272	13	760520	TRANSMISSION	26500.00	0	0	0	1	12	3
1615000824666	114022009	77272	11	741217	TRANSMISSION	63438.00	0	0	1	0	10	4
6115007891536	31220002	31435	11	720213	GENERATOR	1689.00	0	0	0	0	11	1
5930009232560	114FS2354	77272	11	730710	SWITCH	1357.00	0	0	0	0	11	2
6620005538386	MS280053	96906	10	740731	TRANSMITTER	176.79	0	0	0	0	10	1
6680009556048	114FS2371	77272	10	720212	TRANSDUCER	679.00	0	0	0	0	10	2
1615000832910	56R25A	00624	9	740528	BULB ASSY	54.84	0	0	0	0	9	2
1680001350284	114PS2002	77272	9	711005	ACTUATOR N1	388.00	0	0	0	0	9	2
1680009418796	466718IC	18965	7	750514	FAN HYDRAULIC	1979.00	0	0	0	0	7	4
1615001762628	114D52002	77272	7	730809	COMBINING XMSN	20325.00	1	0	0	0	7	2
4320000162886	114MS1309	77272	7	750605	PUMP	4045.00	0	0	0	0	7	1
2995001505915	114ES2831	77272	6	750320	BOX ASSY	3439.00	1	0	0	0	6	1
2945009867078	208015602	91547	6	730813	FILTER	76.74	0	0	0	1	5	1
5330005822133	MS28775011	96906	6	760427	PACKING	.03	0	0	0	0	6	1
1615008721213	114D30487	77272	6	720105	SHAFT ASSY	640.00	1	0	0	0	6	3
2940007793763	210124204	91547	6	740926	BLADE	38.01	0	1	1	0	4	2
1650009877532	114MS1065	77272	5	730810	MOTOR	1979.00	0	0	0	0	5	1
1615006211852	1140220011	77272	5	790521	TRANSMISSION	63438.00	0	0	0	0	5	3
6620005851503	32008	25140	5	760719	GENERATOR TACH	45.19	0	0	0	0	5	2
2995001599002	114PS2063	77272	5	740618	ACTUATOR N1	14774.00	0	0	0	0	5	1
3110009360469	114DS3401	77272	5	711127	BEARING	111.00	2	0	0	0	5	1
3110000515627	114DS2811	77272	4	720405	BEARING	968.00	0	0	0	0	4	1
2995001344691	114MS2002	77272	4	720618	STARTER	1409.00	0	0	0	0	4	1
2995009059716	216035010	91547	4	761119	ACTUATOR	535.00	1	0	0	0	4	1
2915007410002	592964113	73030	4	730626	FUEL CONTROL	9733.00	0	0	0	0	4	1
5330001495088	230038701	91547	4	760504	SEAL	263.00	0	0	0	0	4	3
5905004465449	114FS2591	77272	4	741105	RESISTOR	65.89	0	0	0	0	4	1
1615006211853	1140120009	77272	4	770530	TRANSMISSION	79000.00	0	0	0	0	4	1
1560004713329	1145164718	77272	4	750729	DOOR	10935.00	0	0	2	0	2	1
1680001030029	114CS11424	77272	4	770131	ACTUATOR	1693.00	0	0	0	0	4	1
1680038059426	355603575	73168	3	750318	SENSING ELEMENT	69.44	1	0	0	0	3	1
1615008721212	114D30706	77272	3	720208	SHAFT ASSY	862.00	0	0	0	0	3	1
5340009002392	J91045	76005	3	780512	MOUNT	13.56	0	0	0	0	3	2
5821000752426	SYLZ75613	05624	3	721213	CONTROL BOX	564.00	0	0	0	0	3	1
5310001864947	MS287774	96906	3	770628	WASHER	1.77	1	0	0	0	3	2
4320001287429	114MS1273	77272	3	770228	PUMP	3421.00	0	0	0	0	3	1
4710009913156	38175	18965	3	790920	TUBE ASSY	4.74	0	0	0	0	3	1
3110000345902	114DS5711	77272	2	770920	BEARING	309.00	0	1	0	0	1	1
3020001812952	1140052443	77272	2	790314	BEVEL GEAR	2166.00	1	1	0	1	0	2
2915017410002	592964L13	73030	2	780608	FUEL CONTROL	9733.00	0	0	0	0	2	1
4820009033756	MS24423P	96906	2	780502	VALVE CHECK	25.62	1	0	0	0	2	1
5930000190340	X862S	73949	2	730131	SWITCH SUBASSY	14.25	0	0	0	0	2	1
5930009105942	114MS1123	77272	2	750811	SWITCH	154.00	0	0	0	0	2	1
1615000749932	114D32411	77272	2	770715	SHAFT	2222.00	0	0	0	0	1	1
1560004713330	1145164717	77272	2	740713	DOOR	13356.00	0	0	1	0	1	1
1560007583237	X133646RFVD	99186	2	750415	CLUTCH	867.00	0	0	0	0	2	1
1615000195174	114032501	77272	2	790424	BEARING	18991.00	0	0	0	0	2	1

6110009923630	91250010	31435	2	720627	REGULATOR VOLT	710.00	0	0	0	0	2	1
1490009480968	68119	81982	2	730723	MOTOR	890.00	0	0	0	0	2	1
1490000714177	114MS10612	77272	2	720320	OIL COOLER	670.00	0	0	0	0	2	1
1490000724878	114MS1031	77272	1	790418	VALVE DIRECTIONAL	338.00	0	0	0	0	1	1
1490000343674	114MS1293	77272	1	790601	MOTOR HYDRAULIC	1366.00	0	0	0	0	1	1
1490007748398	114MS12014	77272	1	790515	FILTER ASSY	95.86	0	0	0	0	1	1
1490009974681	14832	77272	1	790331	ACTUATOR PISTON	322.00	0	0	0	0	1	1
1490001813944	114M59007	77272	1	790209	DAMPENER, FLUTTER	1444.00	0	0	0	0	1	1
1490001030029	14C511424	77272	1	790124	ACTUATOR	1693.00	0	0	0	0	1	1
1680007929836	114V5000		1	790927	MODULATOR	188.00	0	0	0	0	1	1
2940005821470	214005810	91547	1	781104	NOZZLE	51.85	0	0	0	0	1	1
2840001523779	213109014	91547	1	790614	HOUSING ASSY	3801.00	0	0	0	0	1	1
2940001530132	203007006	91547	1	790214	GEAR ASSY	742.00	0	0	0	0	1	1
2910001794986	1008290	55920	1	790302	FUEL CONTROL	997.00	1	0	0	0	1	1
2940008973187	213109003	91547	1	790207	COMBUSTER HOUSING	1623.00	0	0	0	0	1	1
2915000251770	2614S011	91547	1	790530	FUEL CONTROL	38188.00	0	0	0	0	1	1
1615000016441	1140500121	77272	1	790322	XMSN, COMBINING	20400.00	0	0	0	0	1	1
1560010718756	1145392043	77272	1	790510	COVER ACCESS	227.00	0	0	0	0	1	1
1615000924666	114012007	77272	1	790530	TRANSMISSION	63438.00	1	0	0	0	1	1
1615001685993	1140200130	77272	1	790923	TRANSMISSION	40064.00	0	0	0	0	1	1
1615008914639	114R15433	77272	1	790612	SOCKET ASSY	2568.00	0	0	0	0	1	1
1615007816613	114D62004	77272	1	790919	ENGINE XMSN	9220.00	0	0	0	0	1	1
5930009319370	230017601	91547	1	781114	SWITCH	1.32	0	0	0	0	1	1
5930006831629	MS2452323	96906	1	790614	SWITCH	4.57	0	0	0	0	1	1
6140007532749			1	790810	ABATTERY	468.00	0	0	0	0	1	1
6685008801532	114E25701	77272	1	790507	CABLE ASSY	79.86	0	0	0	0	1	1
5330008918433	114RS2121	77272	1	781214	SEAL	6.21	0	0	0	0	1	1
4730009946895	AN815-6S	77272	1	790621	NIPPLE TUBE	11.91	1	0	0	0	1	1
4730006189032	MS21907S		1	790814	ELBOW FITTING	1.92	0	0	0	0	1	1
4730006400830	MS21906D4	96906	1	790424	ELBOW, TUBE	.59	0	0	0	0	1	1
5325004890928	24009	71286	1	781025	TURKLOCK FASTENER	.23	0	0	0	0	1	1
5315009847377	RC104	0844	1	790719	PIN	.81	0	0	0	0	1	1
4730009289033	3A17532	51663	1	790507	VALVE REGULATOR	.68	1	0	0	0	1	1
5330001660992	MS32481014	81349	1	781012	PACKING	.06	0	0	0	0	1	1
2925010095696	114E25817	77272	1	790727	THERMOCOUPLE	133.00	0	0	0	0	1	1
3020007665907	114D60862	77272	1	790608	SPIRAL BEVEL GEAR	347.00	0	0	0	1	0	1
3110001189654	230003401	91547	1	790118	BEARING 3	123.00	0	0	0	0	1	1
3110008285174	114DS5412	77272	1	781028	BEARING	643.00	0	0	0	1	0	1
3110001365798	2300037	91547	1	781116	BEARING NO 4	401.00	0	0	0	0	1	1
4710009026544	114M3103379	77272	1	790503	TUBE ASSY	10.03	1	0	0	0	1	1
4720001039439	2300251	91547	1	790508	HOSE ASSY	18.11	1	0	0	0	1	1
		TOTAL	350				18	3	5	9	334	123

Mishap History and Costs of Parts That Failed in FY 79
1 October 1971-30 September 1979

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NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
1615009192677	20404001213	97499	132	711101	GEAR BOX 90	1538.00	7	1	0	0	131	18
2915009942016	81800A1	11599	120	711009	GOVERNOR ASSY OS	2750.00	2	3	2	18	96	15
5330001075393	2050401873	97499	111	730327	GASKET	.82	19	0	0	3	108	8
5930009397584	88617	81873	54	711014	SWITCH	44.43	0	0	0	0	54	3
2915009993705	2050606063	97499	48	720314	FUEL PUMP	242.00	0	0	0	0	48	13
1650001435940	20407600511	97499	39	711005	SERVO CYLINDER	1999.00	1	4	0	1	34	4
1615009182476	20404000337	97499	38	711224	GEAR BOX 42	1144.00	3	0	1	0	37	3
5930001563315	76981	09049	33	720227	SWITCH PRESS	56.10	1	0	0	0	33	7
6685005570370	MS280091	96906	32	711230	INDICATOR TEMP XMS	98.12	1	0	0	0	32	5
1615004905877	20904040011	97499	25	711109	GEAR BOX 90	1952.00	5	2	2	0	21	2
1615001830934	2040400165	97499	22	711010	TRANSMISSION	11620.00	1	0	0	0	22	4
1615001724508	2050017211	97499	21	740717	CHAIN ASSY	218.00	3	2	2	9	8	1
1615006246963	2040017393	9799	16	720225	CHAIN ASSY	218.00	1	0	0	6	10	1
6625001160682	5700740803	97499	13	711012	TRANSDUCER	81.95	0	0	0	0	13	3
5930008776666	86506	09049	11	720909	SWITCH PRESS	92.34	0	0	0	0	11	6
1615005709765	2040408163	97499	10	721010	VALVE ASSY	1139.00	1	0	0	0	10	2
6110004548843	2090752281	97499	10	720314	REGULATOR VOLT	357.00	0	0	0	0	10	3
2915000179021	2050606063	97499	10	760330	PUMP SUBMERGED	242.00	1	0	0	0	10	1
6620001791886	21701141	80099	10	720525	INDICATOR PRESS	157.00	0	0	0	0	10	3
3120009820804	540011111013	97499	9	730824	BEARING	28.52	0	0	0	0	9	1
5930008426470	F74356	50625	9	740513	SWITCH	46.00	0	0	0	1	8	1
6620000674946	41800041	80099	9	720612	TRANSMITTER	95.22	1	0	0	0	9	2
1650000119022	5700760021	97499	8	711028	SERVO ACTUATOR	1052.00	0	0	0	0	8	2
2940001763782	110028609	91547	6	720301	COMPRESSOR BLADE	19.87	1	1	0	3	2	1
4730002776371	AN6289D4	88044	6	730122	LOCKNUT	.10	4	0	0	0	6	1
5330002859842	MS2877810	96906	5	720326	PACKING	.04	1	0	0	0	5	1
2915010059197	100770A2	11599	5	771128	FUEL CONTROL	9750.00	0	0	0	3	2	3
1560008089413	2090605011	80099	5	711117	BYPASS VALVE	168.00	0	0	0	0	5	1
6620009746490	2090606025	97499	5	741029	INDICATOR FUEL	402.00	1	2	0	1	2	1
6115010568714	2090759971	97499	5	790728	GENERATOR	2600.00	0	0	0	0	5	1
5935002630213	MS3406R12S3S	96906	4	731213	CONNECTOR	8.40	0	0	0	1	3	1
5826000879084	57007403723	97499	4	790522	SEAS CARD PITCH	555.00	1	0	0	0	4	3
1650009225946	41103740	81873	4	721006	SERVO CYLINDER	730.00	1	1	0	0	3	1
4720000691525	1300202	91547	4	741212	HOSE ASSY	5.84	3	0	1	0	3	1
4730002896089	MS21902D6	96906	4	750907	FITTING	.36	0	0	0	0	4	1
5330008571457	130023101	91547	3	731003	SEAL	.42	1	0	0	0	3	1
5310009618390	MS178254	96906	3	730523	NUT	.26	2	0	1	0	2	1
3110010198101	H33C32	89513	3	790612	BEARING	8.95	0	0	0	0	3	2
1650008721141	2040760057	97499	3	720227	SERVO CYLINDER	1999.00	0	1	0	0	2	1
2940001763788	110036105	91547	3	750410	COMPRESSOR BLADE	55.07	0	0	0	1	2	2
1615008156482	2040107753	97499	3	721219	HOUSING	11.32	0	0	0	0	3	1
6620005851503	MILG2661GEU7A		3	760812	GENERATOR TACH	45.19	0	0	0	0	3	1
5930010393139	2050760445	97499	3	790515	SWITCH	147.00	0	0	0	0	3	1
5930009611318	139243	73370	3	770421	SWITCH	77.46	1	0	0	0	3	2
5826000879090	57007403719	97499	2	750421	SENSOR AMPLIFIER	674.00	1	0	0	0	2	1
5340000780314	H9051	83014	2	720122	COWLING LATCH	10.98	0	0	1	0	1	1
1615003467659	2120107751	97499	2	780909	CROSSHEAD	328.15	1	0	0	0	2	1
1560001790471	2090705543	97499	2	750625	DUCT	42.85	0	0	0	0	2	1
1680009215992	R460M1511	81039	2	780921	BRAKE MAGNETIC	164.00	1	0	0	0	2	1
3020004246956	2040107681	97499	2	790228	SPROCKET ASSY	14.78	2	0	0	0	1	2
4720001819273	2090606581	97499	2	790716	HOSE ASSY	41.80	0	0	0	0	2	2

4720009035560	RE12YZ083000	99755	1	790924	HOSE ASSY	21.16	0	0	0	0	1	1
4720009564706	1300244	91547	1	790402	HOSE ASSY	12.90	1	0	0	0	1	1
4910005464960	344526	92003	1	790918	POPPET VALVE	22.20	0	0	0	0	1	1
4920001919247	2090604561	97499	1	790214	DRAIN VALVE	39.76	1	0	0	0	1	1
4730006946915	AN8158D		1	790803	NIPPLE TUBE	.52	1	0	0	0	1	1
4730007732622	377550416	00624	1	790718	COUPLING	44.01	1	0	1	0	0	1
6210001340851	20407570549	97499	1	790713	PANEL ASSY	23.09	1	0	0	0	1	1
6615002606314	57007403721	97499	1	790226	CARD, ROLL	535.00	0	0	0	0	1	1
4730009242056	A590036	00624	1	790315	COUPLING ASSY	57.60	0	0	0	0	1	1
5315009141794	MS24665285	96906	1	781130	COTTER PIN	.34	1	0	0	0	1	1
5310001671345	AN3159R	88044	1	781025	NUT	1.95	1	1	0	0	0	1
5330008184501	MS28775136	96906	1	790525	PACKING PREFORMED	.07	1	0	0	0	1	1
5330005805037	MS29561009	96906	1	790607	PACKING	.03	1	0	0	1	0	1
5330007264153	MS29561024	96906	1	790509	PACKING	.13	1	0	0	0	1	1
5330002638032	MS2051210	96906	1	790604	PACKING	.04	0	0	0	0	1	1
3040009321194	2090010647	97499	1	790209	CONNECTING LINK RIGI	117.00	1	0	0	0	1	1
6695010281091	2090756581	97499	1	790514	INDICATOR PRESS	615.00	0	0	0	0	1	1
3110009096706	1300119035	91547	1	790426	BEARING	80.15	0	0	0	0	1	1
3110009679749	2040401367	97499	1	790802	BEARING	318.00	0	0	0	0	1	1
6420009744489	2090606021	97499	1	790508	TRANSMITTER	355.00	0	0	0	0	1	1
2915008692709	139240	21769	1	790316	SWITCH	117.00	0	0	0	0	1	1
2995010097763	117005012	91547	1	790220	ACTUATOR	719.00	1	0	0	0	1	1
1730009123098	1231455	6K223	1	790823	JACK HYDRAULIC	852.00	1	1	0	0	0	1
1680010288288	20907532563	97499	1	790220	PANEL	2405.00	0	0	0	0	1	1
2840010095731	113061012	91547	1	790221	HOUSING, VALVE	4062.00	0	0	0	0	1	1
2940009248577	110038301	91547	1	790305	BLADE	6.90	0	0	0	0	1	1
2915000190012	20506016063	97499	1	790302	PUMP SUBMEGERED	232.00	0	0	0	0	1	1
1650009312347	20907602111	97499	1	790307	CYLINDER ASSY	120.00	0	0	0	0	1	1
1650043547	887001	81873	1	790226	MODULAR ASSY	639.00	0	0	0	0	1	1
1680005637136	2090740521	97499	1	790620	SERVO ELECTRONIC	2968.00	0	0	0	0	1	1
1660011761512	61752831	07217	1	790118	CONTROL SENSOR	555.00	0	0	0	0	1	1
6420005951503	2254	25140	1	781005	GENERATOR TACH	45.19	1	0	0	0	1	1
6110008354806	20407570537	97499	1	790709	PANEL INDICATOR	14.67	0	0	0	0	1	1
1440010321311	3234004120		1	790918	TOW CONTROL	7142.00	0	0	0	0	1	1
1430006253744	3234007110		1	781116	POWER SUPPLY	19974.00	0	0	0	0	0	1
1090000748878	11678163		1	781204	RESOLVER	1393.00	1	0	0	0	1	1
1615002542199	2120107111	97499	1	790515	LINK ASSY	58.42	0	0	0	0	1	1
1615000701130	SGT12701	92003	1	790406	DAMPNER ASSY	827.00	0	0	0	0	1	1
1615009477496	5400110015	97499	1	781019	BLADE ASSY	12.43	1	0	0	0	1	1
5926001453044			1	790906	COMPENSATOR	255.00	0	0	0	0	1	1
6125001488342	PS3521	10109	1	790511	INVERTER	2583.00	0	0	0	0	1	1
5930019397594	80C87A	81873	1	790402	SWITCH	44.43	0	0	0	0	1	1
5930005813510	MS25126C3	96906	1	790507	SWITCH	8.40	0	0	1	0	0	1
5935001060096	13001782	91547	1	790611	CONNECTOR	62.39	0	0	0	0	1	1
5945009370375	56HL265		1	781206	RELAY	12.53	0	0	0	0	1	1
5945008270044	MS24181D2	96906	1	790403	RELAY MAIN INV	149.03	0	0	0	0	1	1
		TOTAL	934				84	19	12	48	852	191

Mishap History and Costs of Parts That Failed in FY 79
1 October 1971-30 September 1979

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NATIONAL STOCK NUM	PART NUM	MFG CODE	NUM OF OCC	DATE FIRST OCCURR	GENERIC NOMENCLATURE	PART COST	NUM MTN OCC	MISHAP EXPERIENCE ACC	INC	FL	PL	FY79 OCC
5930009033893	MS243311	96906	54	720105	SWITCH	20.75	17	0	0	0	64	10
2915001472313	25245461	06840	34	711026	FUEL CONTROL	1558.00	1	0	0	0	34	6
5930009925344	LCM25	91929	19	741005	SWITCH	21.39	7	0	0	0	19	3
5330002519371	MS29513339	96906	10	740514	PACKING	.27	1	0	0	0	10	2
2915001781049	503890535	70898	9	770303	PUMP SUBMERGED	354.00	0	0	0	0	9	1
1480003081064	SK434144	57711	9	740911	SHAFT ASSY	68.92	1	0	0	0	9	1
6105001340927	995240253	70898	7	740819	MOTOR ASSY	223.00	0	0	0	0	7	1
1660009325160	C10040	89513	6	770921	HEATER	1634.00	0	0	0	1	1	5
2915009924577	1111595272	45681	5	730625	VALVE ASSY CHECK	19.83	0	0	0	0	5	1
2925000873705	50389107	70898	4	730629	STARTER-GENERATOR	1616.00	1	0	0	0	3	1
2915009369555	71154	00502	3	711027	FUEL BOOSTER PUMP	369.00	1	0	0	0	3	1
5330007804490	3013800	00198	3	750621	SEAL	13.93	0	0	0	0	3	1
1460001365020	G02012	89513	2	790117	IGNITER PLUG	5.14	0	0	0	0	2	2
1480002366721	50361131	70898	2	770718	RETAINER	65.11	1	0	0	0	2	1
1560009496300	50921582	70898	2	761014	GASKET	5.79	0	0	0	0	2	1
5930006835977	MS244201	96906	2	780725	SWITCH SAFETY	49.37	0	0	0	0	2	1
5926001798437	CP941A SN86		2	740731	COMPUTER	1180.68	1	0	0	0	2	1
6685009900930	3012075	00198	1	790710	CONNECTOR	45.11	1	0	0	0	1	1
5920001993988	FLLJ	09922	1	790705	LIMITER CURRENT	.85	1	0	0	0	1	1
5905009911449	3008040	00198	1	790608	TUBE, BALLAST	4.32	0	0	0	0	1	1
5925008077697	507250101		1	790517	CIRCUIT BREAKER	9.13	0	0	0	0	1	1
6685009362434	260253	65092	1	790720	INDICATOR ITT	303.45	0	0	0	0	1	1
5999001349602	503613101	70898	1	790109	GROUND FAULT DET	6.56	0	0	0	0	1	1
5945008461313	5038004811	70898	1	781201	RELAY ARMATURE	22.59	0	0	0	0	1	1
6105010179077	50380114	70898	1	790209	LANDING GEAR MOTOR	380.00	0	0	0	0	1	1
1420009393091	50820250	70898	1	790125	NUT ASSY	36.13	1	0	1	0	0	1
1480009033312	505211984	70898	1	781011	ACTUATOR	243.00	0	0	0	0	1	1
6620008914458	3185001	80099	1	781210	TRANSMITTER TORQUE	383.00	0	0	0	0	1	1
5310001670937	AN9606161	88044	1	781020	WASHER	.45	1	0	0	0	1	1
5306001443858	AN2522	88044	1	790315	BOLT	.10	1	0	0	0	1	1
5905009896245	MS35207262		1	790910	SCREW	.46	1	0	0	0	1	1
2915008973981	2573383	06948	1	790804	GOV CAM LEVER	10.13	1	0	0	0	1	1
2925001570807	3015270	00198	1	781101	BOX ASSY	149.00	0	0	0	0	1	1
6610001345525	AAU32A		1	790424	ALTIMETER AIMS	1630.00	0	0	0	0	1	1
4320001507289	02480010401	77200	1	790814	PUMP FUEL	712.00	0	0	0	0	1	1
4710009372122	3007846	00198	1	790313	TUBE ASSY	37.32	0	0	0	0	1	1
4140009365569	5007022873	75477	1	790216	FAN VANE AXIAL	1708.00	0	0	0	0	1	1
		TOTAL	203				38	0	1	1	196	59

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