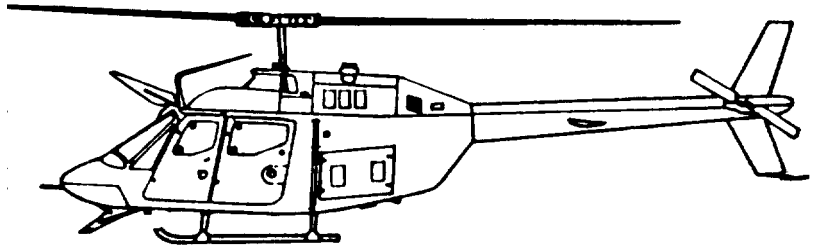
TECHNICAL MANUAL

OPERATORS, AVIATION UNIT,
AND AVIATION
INTERMEDIATE MAINTENANCE



BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

HELICOPTER,
OBSERVATION
OH-58A & OH-58C

ITEM NSN
INSIDE FRONT COVER

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HEADQUARTERS, DEPARTMENT OF THE ARMY

4 January 1991

Technical Manual
No, 55-1520-228-BD

U.S. ARMY AVIATION SYSTEMS COMMAND
4 January 1991

TECHNICAL MANUAL

BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

OH-58A AND OH-58C HELICOPTER

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of away to irnprove the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, U.S. Army Aviation Systems Command, AtTN: AMSAV-MC, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished to you.

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HOW TO USE THIS MANUAL

This manual is developed to assist the soldier in a battlefield environment to make assessment and repair of damage to the OH-58 helicopter which cannot, due to asset availability or environmental factors, be repaired in the normal prescribed manner. Within this technical manual, the word shall is used to indicate a mandatory requirement. The word should is used to indicate a nonmandatory but preferred method of accomplishment. The word may is used to indicate an acceptable method of accomplishment.

1. Organization of the Manual. This manual contains a general information chapter (chapter 1), a general assessment chapter (chapter 2), and specific repair chapters (chapters 4 thru 19). Chapter 3 is not used. It also contains five appendices. References (Appendix A), special or fabricated tools (Appendix B), expendable/durable supplies and materials list (Appendix C), substitute materials and parts (Appendix D), and BDAR fixes authorized for training (Appendix E).

2. Chapter 2 is used to assess the helicopter in general and references specific chapters for detailed repair procedures of the major functional groups. The major functional groups correspond with the functional groups of the -23 series manuals that are employed in routine repairs to the helicopter.

3. Chapter 3 is not used in this manual. It would normally contain repairs for equipment which does not fall under one of the standard helicopter functional groups.

4. Each functional group chapter is organized as follows:

a. Section I - Introduction.

(1) Scope. Purpose of the chapter.
(2) Assessment procedures. General assessment information for the repairs covered therein.
(3) Repair procedure index.

b. Section II - Repair Item. A subsection is included for each repair item covered in that functional group. It contains the following:

(1) General. About the nature and cause of damage and repair.
(2) Item and trouble statement with:

(a) Limits given.
(b) Personnel and time required to effect repairs.
(c) Materials and tools needed.
(d) Procedural steps to accomplish the repair.

(3) If more than one method of repair can be used, the various options will be included next.

NOTE

The first option is the preferred choice, the second option is the next preferred, etc. Selection of the option should be the most preferred method possible under the circumstances and with the available materials and manpower.

HOW TO USE THIS MANUAL (Cont)

5. Finding Repairs in this Manual.

a. When the damage is obvious and known, find the functional group chapter of which the damaged item is a part. Turn to the repair procedure index, section I, subparagraph c of each chapter to locate the item being repaired. Then turn to the repair section and review each option to ascertain the appropriate fix. Read the entire section for the option, then effect the repairs following the procedures given.

b. When the damage is hidden and/or unknown, follow the overall assessment procedures provided in chapter 2, and follow the procedures and directions provided.

6. Preparation.

a. Each mechanic/technician shall have read chapters 1 and 2 and become familiar with the repairs and layout of the manual prior to attempting to accomplish BDAR repairs.

b. All warnings, cautions, and safety precautions shall be followed, inasmuch as possible, at all times during BDAR procedures so as not to further damage and/or jeopardize either personnel or the equipment during or subsequent to the BDAR action. Ensure all documentation is completed as directed in this manual and by local command.

7. Expendable/Durable Supplies and Materials.

a. Each fix or repair option contains a short listing of materials and tools considered basic to the repair. It is important to note that the expendable materials listed usually cover a wide range for any one item.

Example: **MATERIALS/TOOLS REQUIRED:**
- Drill with Bit
- Sheet Metal (items 131-142, Appx C)
- Rivets (items 98-115, Appx C)

In this example, sheet metal covers the range of items 131 thru 142 in Appendix C. This means that, depending on the circumstances and location of the fix, any one of these metals could be used. Likewise any one of the rivets, items 98 thru 115, may be used to attach the patch plate depending on the application.

b. One of the key points concerning successful BDAR repairs is flexibility. The users of this manual should strive to use the items on hand, provided a safe repair is made. The stringent requirements of normal maintenance may be lifted.

CHAPTER 1

GENERAL INFORMATION

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

1-1. PURPOSE. The purpose of Battle Damage Assessment and Repair (BDAR) is to quickly return the disabled helicopter to the operational commander by expediently fixing, bypassing, or jury-rigging components to restore the minimum essential systems required for the support of the specific combat mission for self-recovery. These repairs will be temporary and may not restore full performance capability. Standard repair will be completed as soon as practical.

1-2. SCOPE.

a. This technical manual (TM) describes BDAR procedures applicable to OH-58 helicopter series, and these procedures are to be used by crew, operators, aviation unit maintenance (AVUM) teams, and aviation intermediate maintenance (AVIM) support teams.

b. Standard repair techniques for the OH-58 helicopter are included in other technical manuals which are referenced in Appendix A of this TM. Details of these procedures are not duplicated in whole in this TM. If the repairs are more than one page in length, the repairs may only be referenced in appropriate chapter.

c. All possible types of combat damage and failure modes cannot be predicted, nor are all effective field expedient repairs known. This TM provides guidelines for assessing and repairing battlefield failures of OH-58 helicopters and is not intended to be a complete catalog of all possible emergency repairs. The repairs described here will serve as guidelines and will stimulate the experienced mechanic/operator to devise repairs as needed to rapidly return equipment to operation in a combat situation.

d. The direct replacement of a piece of equipment by its spare, even under battlefield conditions, is not a BDAR fix and may not be covered is in this TM. A standard procedure should be performed in preference to a BDAR fix when time and spares are available.

1-3. APPLICATION.

a. The procedures in this manual are designed for battlefield environments and should be used in situations where standard maintenance procedures are impractical. These procedures are not meant to replace standard maintenance practices, but rather to supplement them strictly in a battlefield environment. Standard maintenance procedures will provide the most effective means of returning damaged equipment to ready status provided that adequate time, replacement parts, necessary tools, and trained/qualified repair persons are available. BDAR procedures are only authorized for use in an emergency situation in a battlefield environment, and only at the direction of the commander. They are not to be continued after the equipment is out of the battle environment.

b. BDAR techniques are not limited to simple restoration of minimum functional combat capability. If full functional capability can be restored expediently with a limited expenditure of time and assets, it will be accomplished.

c. Some of the special techniques in this manual, if applied, may result in shortened life or in further damage to major components of the helicopter. The commander must decide whether the risk of having one less helicopter available for combat outweighs the risk of applying the potentially destructive expedient repair technique. Each technique gives appropriate warnings, cautions, and lists systems limitations caused by this action.

1-4. DEFINITIONS.

a. Battlefield Damage. Any incident such as combat damage, random failures, operator errors, accidents, and wear-out failures which occur on the battlefield and which prevent the helicopter from accomplishing its mission.

b. Repair of Fix. Any expedient action that returns a damaged part or assembly to a full or an acceptably degraded operating condition, including:

(1) Short cuts in parts removal or installation.

(2) Installation of components from other equipment that can be modified to fit or interchange with components on the damaged equipment.

(3) Repair using parts that serve a noncritical function elsewhere on the same equipment for the purpose of restoring a critical function.

(4) Bypassing of noncritical components in order to restore basic functional capability.

(5) Expeditious cannibalization procedures.

(6) Fabrication of parts from kits or readily available materials.

(7) Jury-rigging.

(8) Use of substitute materials.

c. Damage Assessment. A procedure to rapidly determine what is damaged, whether it is repairable, what assets are required to make the repair, who can do the repair (e.g., crew, maintenance team or maintenance support team), and where the repair should be made. The assessment procedure includes the following steps:

(1) Determine if the repair can be deferred, or if it must be done.

(2) Isolate the damaged areas and components.

(3) Determine which components must be fixed.

(4) Prescribe fixes.

(5) Determine if parts or components, materials, and tools are available.

(6) Estimate the manpower and skill required.

(7) Estimate the total time (clock hours) required to make the repair.

(8) Establish the priority of the fixes.

(9) Decide where the fix shall be performed.

(10) Decide if recovery or evacuation is necessary and to what location.

d. Fully Mission Capable (FMC). The helicopter can perform all its combat missions. To be FMC, the helicopter must be complete and fully operable with no faults listed in the aircraft inspection and maintenance record as prescribed in DA PAM 738-751.

e. Combat Capable. Equipment meets the minimum functional combat capability requirements. (See paragraph 1-8.)

f. Combat Emergency Capable. The equipment meets the needs for specific tactical missions; however, all systems are not functional. Also, additional damage due to the nature of an expedient repair may occur to the equipment if it is used. The commander must decide if these limitations are acceptable for that specific emergency situation.

g. Cannibalization or Controlled Exchange. Throughout this manual, cannibalization and controlled exchange are used interchangeably meaning the removal of an item of materiel from one piece of equipment for immediate use in another. Generally the rules for cannibalization/controlled exchange provided in TM 55-1500-328-25, as modified by local authority, will prevail.

h. Evacuation, A combat service support function involves the movement of recovered helicopters from a main supply route, maintenance collection point, or maintenance activity to higher categories of maintenance. The materiel may be returned to the user, to the supply system for reissue, or to property disposal activities.

i. Recovery. The retrieval of immobile, inoperative, or abandoned OH-58 helicopter from the battlefield or immediate vicinity, and its movement to a maintenance collection point, the main supply route, or a maintenance activity for disposition, repair, or evacuation.

j. Self-Recovery. The ability of a battle damaged helicopter to retrieve itself (fly out) from a battlefield environment. It usually will involve flying with degraded flight status and with restrictions and limitations placed on performance characteristics such as limitations placed on weight, airspeed, engine torque, and other characteristics. In BDAR repairs, the limitations recommended should be followed. Emergency flight procedure in TM 55-1520-228-10 should further be consulted.

k. Maintenance Collection Point. A point operated by AVIM unit for the collection of equipment for repair.

1. Maintenance Support Team (MST). A team of AVIM mechanics and technical specialists who are trained in assessing battlefield damage and field repair procedures.

m. Maintenance Team (MT). Helicopter crew chief or AVUM mechanics/technicians who are trained in assessing battlefield damage and field repair procedures.

1-5. QUALITY DEFICIENCY REPORT/EQUIPMENT IMPROVEMENT RECOMMENDATION (QDR/EIR) . If your helicopter and equipment need improvement, let us know: Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, U.S. Army Aviation Systems CoMMand, ATTN: AMSAV-QF, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. We'll send you a reply.

Section II. STANDARDS AND PRACTICES

1-6. BDAR CHARACTERISTICS. BDAR capability requires simplicity, speed, and effectiveness. Some BDAR procedures include repair techniques that violate standard peacetime maintenance practices In a combat emergency situation, greater risks are sometimes necessary and acceptable.

1-7. WAIVER OF PRECAUTIONS. Under combat conditions, BDAR may be performed on helicopters which are in flight or which are under power while on the ground. While some of these BDAR actions may require waiving of safety precautions, the cautions to protect personnel life should not be overlooked. Other similar precautions may be waived at the discretion of the commander. BDAR fixes may be required in a chemically toxic environment or under other adverse battlefield conditions with severe limitations in personnel, facilities, equipment, and materials. Performance of repair tasks may be necessary while wearing protective gear. Decontamination procedures are described in FM 3-5.

1-8 OPERATING CHARACTERISTICS. This manual covers expedient repairs for the OH-58 helicopter and its components. It is entirely possible that in a combat situation, the helicopter having undergone one or more repairs may suffer degradation of its normal operating characteristics (e.g., reduced speed, reduced load capability, reduced range, etc.), and still be able to carry out all or parts of an assigned mission. The minimum functional combat capability (MFCC) criteria for the OH-58 is as follows:

a. Flight Capability for Mission Completion. Helicopter's flight characteristics degraded to a minimum of combat capable (CC).

(1) Sufficient power delivered to main and tail rotor to accommodate lift capability for helicopter crew and cargo.

(2) No fuel leaks which will curtail the intended length of flight.

(3) No degradation of any component/system which will end in failure and curtailment of intended mission.

(4) Communications. Must have intercom communications within aircraft and at least two tactical receiver-transmitter (R-T) units operating at full capability.

NOTE

Criteria may be waived for recovery or if the tactical situation demands otherwise.

b. Flight Capability for Self-Recovery Capability (SRC).

(1) Must have power delivered to main and tail rotor at acceptable limits.

(2) Maximum engine torque:

80% at 0 kts
64% at 16 kts
53% at 32 kts
50% at 50 kts

(3) Lift capability for crew members. Unload unnecessary weight.

(4) Flight controls at minimum function level acceptable for flight.

(5) Instruments/avionics as required to meet mission needs.

(6) Maximum airspeed of 50 kts.

(7) Maximum flight duration of 2 hours. Consideration will be given to minimize flight duration.

(8) Be prepared for emergency procedures. See TM 55-1520-228-10, Chapter 9.

WARNING

Careful consideration shall be given to the operation of the Identify Friend or FOE (IFF), Mode 4, avionics system. Failure of the IFF or failure to properly communicate with area air defense command prior to liftoff could result in an attack from friendly forces due to mistaken identity.

1-9. TRAINING.

a. BDAR by its nature involves fixes, bypasses, and/or jury-rigging, which is outside authorized standard repairs, and may degrade the inherent safety of the helicopter. Therefore, BDAR actions are not intended to supplement, replace standard maintenance practices during peacetime, nor should they be employed indiscriminately to facilitate training.

b. Repairs described in this manual, which can be appropriately accomplished in order to provide training, are listed in Appendix E and are highlighted in each repair chapters repair procedure index. The trainable repair in the index will be blocked in.

Section III. TASKS AND RESPONSIBILITIES

1-10. TAGGING/IDENTIFYING BDAR REPAIRS.

a. All damage will be identified on aircraft inspection and maintenance record, DA Form 2408-13 and DA Form 2408-18, as per DA PAM 738-751. See Figures 1-1, 1-2.

b. Recording of BDAR repairs and the use of status symbols, as defined in DA PAM 738-751, will be completed as soon as practical to indicate any limitations and restrictions or required standard repairs.

c. In addition to recording all damage, the area damaged will be marked on aircraft or component part using damage assessment markings as shown in Figure 1-3.

d. Status Symbols. Status symbols used in aircraft logbooks to record defects are defined below.

(1) Red "X." A red "X" shows that a defect exists and the aircraft is unsafe for flight.

(2) Circled red "X." A red "X" inside a red circle indicates a limiting defect. The aircraft may be flown under specific limits as directed by higher authority, or as directed locally until corrective action is taken.

(3) Red horizontal dash (-).

(a) This symbol indicates an inspection, special inspection, component replacement, maintenance operational check, or test flight is needed. The symbol is also used to indicate that a normal modification work order (MWO) is overdue.

(b) This symbol also shows that the condition of the equipment is unknown. A potentially dangerous condition may exist. The condition will be corrected as soon as possible.

(4) Red diagonal (/). This symbol indicates a defect exists that is not serious enough to ground the aircraft.