USAARL Report No. 89-21

A Survey of U.S. Army Aeromedical Equipment

(Reprint)

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September 1989

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Public release; distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) USAARL Report No. 89-21	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Aeromedical Research Laboratory 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) P.O. Box 577 Fort Rucker, Alabama 36362-5292	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
(U) A survey of U.S. Army aeromedical equipment

12. PERSONAL AUTHOR(S)
Glenn W. Mitchell, James E. Adams

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Technical	FROM _____ TO _____	1989 September	4

16. SUPPLEMENTARY NOTATION
Originally published in Aviation, Space, & Environmental Medicine Vol 60, No. 8, 807-810, 1989

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Aeromedical evacuation; helicopter ambulance; MEDEVAC; medical equipment testing
06	12		
23	06		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)
Medical equipment is necessary to support patients requiring air transportation, but it may not be compatible with the aviation environment. Aircraft systems may cause errors in the functioning of medical equipment, or that equipment may interfere with the aircraft. Medical equipment has been tested, primarily for fixed wing aircraft, to military standards by the U.S. Air Force. This study reports 1986 and 1987 surveys which documents the use of such equipment on U.S. Army medical evacuation aircraft and compares items in current use to the U.S. Air Force's test results. Of the 115 different nonissue items reported in use, 32 have been formally evaluated, and 9 of those were judged unacceptable for use on aircraft. Only two items reported in the survey were tested inflight in helicopters. The remaining 83 items have not been tested. Helicopters have unique requirements, and the U.S. Army has begun a program to evaluate medical equipment for helicopter use.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Chief, Scientific Information Center	22b. TELEPHONE (Include Area Code) (205) 255-6907 22c. OFFICE SYMBOL SGRD-UAX-SI

TECHNICAL NOTE

A Survey of U.S. Army Aeromedical Equipment

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MITCHELL GW, ADAMS JE. *A survey of U.S. Army aeromedical equipment.* Aviat. Space Environ. Med. 1989; 60:807–10.

Medical equipment is necessary to support patients requiring air transportation, but it may not be compatible with the aviation environment. Aircraft systems may cause errors in the functioning of medical equipment, or that equipment may interfere with the aircraft. Medical equipment has been tested, primarily for fixed wing aircraft, to military standards by the U.S. Air Force. This study reports 1986 and 1987 surveys which document the use of such equipment on U.S. Army medical evacuation aircraft and compares items in current use to the the U.S. Air Force's test results. Of the 115 different nonissue items reported in use, 32 have been formally evaluated, and 9 of those were judged unacceptable for use on aircraft. Only two items reported in the survey were tested inflight in helicopters. The remaining 83 items have not been tested. Helicopters have unique requirements, and the U.S. Army has begun a program to evaluate medical equipment for helicopter use.

The use of the helicopter as a platform for medical evacuation (MEDEVAC) was proven to be effective during the Korean conflict with the use of the H-5 and the H-13 "Angel of Mercy." But it was not until the transportation of almost 900,000 sick and wounded during the Vietnam conflict (2) that the role of the helicopter in aeromedical evacuation caught the public's attention. In the Korean conflict, aeromedical evacuation missions carried no medical personnel and provided little in the way of definitive treatment. During the Vietnam conflict, patient interventions by MEDEVAC crews consisted of more definitive emergency treatment, such as airway control and blood volume expansion, using equipment sets carried by the medics. With the establishment of the Military Assistance to Safety and Traffic (MAST) program in the early 1970's, MAST units, assisting civilian emergency medical services systems, achieved additional advances in onboard patient care with the addition of life support equipment.

Advanced life support equipment carried by MAST and other MEDEVAC units was acquired through interactions with supported medical treatment facilities and civilian emergency medical services. The addition of advanced life support equipment enhanced the quality of medical care available to air ambulance patients, but little consideration was given to the potential hazards of using equipment that may not be compatible with the aircraft or the flight environment.

Use of medical equipment on aircraft presents a unique problem. Items necessary to support a patient requiring air transportation may not be compatible with the aviation environment. Aircraft systems, such as those emitting electrical signals, may cause errors in the functioning of medical equipment and lead to improper diagnoses and treatments which endanger the patient. Onboard medical equipment can also interfere with the aircraft systems and compromise the safety of the entire crew. There are military standards for equipment to be used aboard aircraft, and medical equipment items have been tested by the U.S. Air Force (USAF) for military use (1,3–8). However, most of that testing has been directed toward fixed-wing aircraft. Helicopters have unique requirements, and much of the available medical equipment proposed for use in helicopters must be tested for that application.

The U.S. Army Aeromedical Research Laboratory (USAARL) developed a program to provide technical test and evaluation of medical equipment for use onboard Army helicopters. The focus is on aeromedical evacuation mission medical equipment that is supplemental to the essential medical equipment listed in Army Regulation 40-2 and supplemental to the medical equipment set (MES) authorized by the current Table of Organization and Equipment (TO&E). To obtain information on the types of supplemental medical equipment

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This manuscript was received for review in November 1988. The revised manuscript was accepted for publication in January 1989.

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The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of Defense unless otherwise noted.

TABLE III. NUMBER OF COMBINED MEDICAL ITEMS BY USAFSAM ACCEPTABILITY AND HELICOPTER INFLIGHT TESTING (IFT) STATUS.

Helicopter acceptability	Fixed-wing aircraft		
	Acceptable	Not acceptable	Not evaluated
Yes w/ IFT	1	0	83
Yes w/o IFT	10	0	0
No w/ IFT	0	1	0
No w/o IFT	10	8	0
Missing data*	2	0	0
TOTAL	23	9	83

* Helicopter suitability for two medical items is not determined due to missing test data.

ated by the USAF, only 2 items had helicopter inflight testing. Unless the USAF has a request to test medical equipment from its Aerospace Rescue and Recovery Service (ARRS) or the U.S. Army Medical Department Board through a Letter of Agreement, aeromedical equipment technical feasiblity testing is fixed-wing aircraft oriented only.

Medical items were then regrouped by equipment function type and acceptability. The results for acceptable and unacceptable or not tested equipment are shown in Tables IV and V, respectively, by equipment category. The miscellaneous equipment category includes many passive devices, such as special purpose stretchers and immoblizers, that are unlikely to interfere with other equipment and require only environmental testing. Most of these items also do not require formal safety of flight releases unless they are attached to the airframe.

Comments by the respondents on both survey cycles were recorded. Army air ambulance units reported using equipment, some evaluated and approved for aeromedical evacuation use, which "would not stay in calibration," which was "unreliable," "inaccurate," gave "irregular . . . readings," and was interfered with by helicopter vibrations which "caused too erratic readings," or "created erroneous results."

DISCUSSION

Army air ambulance units have acquired medical equipment through hospitals and commercial purchase to supplement medical equipment authorized by the TO&E. The acquisition of supplemental medical equipment was an effort by some Army air ambulance units to upgrade the quality of life support provided to the community through the Military Assistance to Safety and Traffic Program. Other medical equipment not owned by air ambulance units routinely accompanies patients during interhospital transfers or from onscene pickup points to a treatment facility.

In most cases, the supplementary equipment used has not been evaluated sufficiently to have formal safety approval. Several adverse situations are possible: 1) the equipment may not be safe to operate in an aviation environment; 2) the equipment may interfere with aircraft systems; 3) the equipment may give false indications of a patient's condition due to aircraft system interference; and 4) the equipment may not be installed on the aircraft safely enough to prevent further injury to the patient during adverse flight conditions.

In the past, clearance to use medical items onboard Army air ambulances has been based on a U.S. Army Health Services Command policy that recommended use of USAF approved medical items. The USAF technical report identifies acceptable or not acceptable status for each item of equipment for all aircraft. An informal review by USAFSAM personnel in 1988 revealed that not all of the medical items listed as acceptable are necessarily suitable for helicopters either by military standards or flight tests. In addition, no known safety-of-flight releases have been obtained through the U.S. Army Aviation Systems Command for any of the listed equipment.

TABLE IV. NUMBER OF MEDICAL EQUIPMENT ITEMS DETERMINED ACCEPTABLE FOR FIXED-WING AIRCRAFT AND/OR HELICOPTER USE (USAFSAM) BY CATEGORY.

Equipment category	Fixed-wing	Helicopter
Cardiac defibrillator/ monitor/recorders	5	4
Infusion pumps	2	1
Electronic blood pressure monitors	2	1
Respirators/ventilators/ resuscitators	8	1
Suction equipment	3	2
Transport incubators	1	1
TOTAL	21	10

TABLE V. NUMBER OF MEDICAL EQUIPMENT ITEMS DETERMINED NOT ACCEPTABLE OR NOT EVALUATED FOR AIRCRAFT USE (USAFSAM) BY CATEGORY.

Equipment category	Not acceptable	Not evaluated
Cardiac/defibrillator/ monitor/recorders	2	0
Infusion pumps	3	2
Electronic blood pressure monitors	0	5
Respirators/ventilators/ resuscitators	1	3
Suction equipment	1	9
Transport incubators	1	2
Oxygen equipment/ humidifiers	1	21
Miscellaneous*	0	41
TOTAL	9	83

* Miscellaneous includes medical items such as extrication devices, traction devices, litters, etc.

The new U.S. Army program will provide technical feasibility testing, including inflight tests, for all medical equipment to be used aboard Army aircraft. The volume of equipment to be tested will be compounded by the rapid development of new medical technology for use during patient transports. For example, advanced cardiac equipment, such as intraaortic balloon pumps, was not used by any of the units in 1986–87, but is now being used during air ambulance transfers. The situation in civilian emergency air ambulance operations is not known, although it is presumed to be similar.

The results of this survey support the need for evaluation of both fixed and rotary wing suitability for all medical equipment to be used aboard aircraft, both military and civilian. Items routinely transferred between aircraft types will, of course, require both types of testing. Liaison between the Army and Air Force programs has already been established.

CONCLUSION

The results of two complementary surveys of U.S. Army air ambulance units show that some units have been using medical equipment that may not be suitable for use onboard helicopters. The U.S. Air Force School of Aerospace Medicine conducts a test and evaluation program for USAF aeromedical equipment, but the program emphasis is understandably fixed-wing oriented due to USAF mission requirements. Although Army aeromedical equipment should be compatible with USAF aircraft for patient transfers, this equipment should also be tested to rotary wing aircraft standards, including inflight testing on appropriate helicopters. A new U.S. Army program has been designed to meet this need. The need for such testing has implications for civilian helicopter aeromedical services as well.

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