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**Helicopters
In Emergency
Medical Service
NHTSA
Experience
To Date**

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Helicopters in Emergency Medical Service NHTSA Experience To Date

The purpose of this paper is to document, in one source, the efforts by the National Highway Traffic Safety Administration to study the role of the helicopter in emergency medical service. A five-year period from mid-1967 to mid-1972 is documented by extracts from final contract reports with comments and overall conclusions by this writer.

The National Highway Safety Act of 1966 authorized and directed the Secretary (of Transportation) to assist and cooperate with other Federal departments and agencies, State and local governments, private industry and other interested parties, to improve highway safety. Limited funding provisions were included in the Act to assist in accomplishing its goals. Section 402 provided matching funds for State use and Section 403 provided for full Federal funding of Research and Demonstration Projects.

One subject, on which the Act directed the Secretary to provide a uniform standard for the States' highway safety program, was "Emergency Services." Highway Safety Standard 11 "Emergency Medical Services" was issued June 27, 1967. The stated purpose of this standard is to:

- I. Provide quick identification and response to accidents.
- II. Sustain and prolong life through proper first aid measures, both at the scene and in transit.
- III. Provide the coordination, transportation, and communications necessary to bring the injured and definitive medical care together in the shortest practicable time, without simultaneously creating additional hazards.

Studies were made of existing operations, and methods were explored which would improve the response to highway-related emergencies. Along with other system improvements, the helicopter was proposed as one method of reducing the interval from the time of the accident to the arrival of emergency medical care, and to reduce the time of transportation from the scene to the hospital.

Two of these early studies which included specific information on utilization of the helicopter in the emergency medical service were *Economics of Highway Emergency Ambulance Service* and *Emergency Care Systems Demonstration Projects* funded under Section 403.

Economics of Highway Emergency Ambulance Service¹

The *Economics of Highway Emergency Ambulance Service* provides information on the economic problems of emergency ambulance services and provides guidelines that planners can use in developing economical and efficient emergency ambulance service. This report provides guideline information that can be used to identify and evaluate alternate solutions to specific problems in providing emergency ambulance service.

One chapter of this report is devoted to the helicopter ambulance. Among the findings and conclusions was the determination that potential use of helicopters as emergency ambulance vehicles needs objective evaluation. Too many people have formed a positive opinion without benefit of data or cost-benefit evaluation studies. Careful planning and coordination among medical, police, manufacturer, purveyor and aviation agencies, and among municipal authorities are essential to make a helicopter system function effectively. Any viable system will cut across municipal, county (even State) bounds and coordinated action is required. Limited numbers of currently available and certified helicopters are suitable for individual emergency ambulance missions. Payload and size should accommodate two to four litters internally – smaller ones are unsatisfactory; larger ones are uneconomical.

Emergency Care Systems Demonstration Project²

The *Emergency Care Systems Demonstration Projects* was designed to provide a complete description of the emergency care system, in terms of its functional components, and to determine the subsystem design required to obtain an effective operational system. In addition, operational plans for emergency care demonstration projects were developed. One of the subsystems examined was airborne emergency care system vehicles. This included fixed wing Short Take-Off and Landing (STOL) aircraft as well as helicopters. Although the additional speed and payload of the fixed wing STOL aircraft gave certain advantages over the helicopter, the helicopter retained certain critical advantages especially at congested hospital delivery points.

¹*Economics of Highway Emergency Ambulance Service*, Dunlap and Associates, Inc. (1968)–DOT/HS 003-295, NTIS/PB 178-837, Contract No. FH-11-6541.

²*Emergency Care Systems Demonstration Projects*, Franklyn Institute Research Laboratories (1968)–DOT/HS 800-006 thru 009 (4 volumes), NTIS/PB 179-847 thru 850 (4 volumes), Contract No. FH-11-6596.

In studying the U.S. Army success with the helicopter evacuation, it was found that one of its greatest assets was the efficient communication system which permits prompt notification and effective dispatch control. There is no civilian counterpart to this system and this lack of communications decreases the effectiveness of the civilian emergency helicopter ambulance. Cost figures for various operational plans utilizing a selection of available helicopter types were developed by this study.

In using either of these studies for planning, the planner must adjust the costs developed to present dollar values, and must account for new equipment and practices which have been developed since these reports.

During fiscal year 1968, two States utilized Section 402 matching funds to conduct pilot helicopter emergency ambulance service programs. Pennsylvania started a one-year operation in November 1967 with a Bell 47-J-2A; and the Nebraska 14-month study began in January 1968 utilizing two Sikorsky S-55 helicopters. Neither of these programs lived up to the high expectations of the planners, although much was learned from these early trials.

Pennsylvania Project No. EMS 68-1-001³

The Pennsylvania trial of the helicopter in emergency air ambulance use was of one year duration to determine how effective a helicopter ambulance could be in increasing the chances of survival of traffic accident victims. The test area, in the southeastern corner of Pennsylvania, consisted of nearly 900 square miles, one million persons and 34,000 miles of public highways. The Bell 47-J-2A was available from 7 a.m. to 9 p.m. for one year and was controlled by the State Police. For the first 3½ months the helicopter was based in the Philadelphia area and received 14 requests which resulted in three airlifts. During the remainder of the year, the helicopter was based in the more rural Exton area where 130 accident responses were made which resulted in 46 completed airlifts. Regular police traffic patrols were main-

³Commonwealth of Pennsylvania, *Helicopter Ambulance Study*. May 1969. Final Report. Project EMS 68-1-001. Robert R. Coleman, Project Director, Pennsylvania Department of Highways. DOT/HS 008-477, NTIS/PB 197-240.

tained during the trial period. The following table summarizes the major activities during the 12-month period:

Traffic Service	Flights
disabled vehicles	83
accident response	144
air lifts completed	49
Police Service	
criminal	55
civil search	24
miscellaneous	30
Other	
demonstrations, accident simulations, etc.	77
Patrols recording no incidences	244

Functioning as an ambulance, the helicopter completed 49 airlifts of victims to hospitals. The overall response from time of call to delivery of the patient to the hospital averaged 19.5 minutes. The average trip time from base to accident scene was 7.5 minutes and from accident scene to hospital, 5.8 minutes. (This indicates an average response distance of less than 10 miles and an average patient carry of less than 8 miles, and does not give a comparable ground ambulance response time.) The types of injuries sustained by persons airlifted included lacerations, fractures, chest and internal injuries. The time factor in transporting the victims to the hospital was not critical in the majority of incidents. Six of the 49 injured persons had suffered injuries that were later classed as "life threatening." Two of these six victims died after arrival at the hospital. Two lives were "probably" saved as a result of rapid transfer to the hospital.

While the Bell 47-J-2A was satisfactory for this study and performed well within its design limits, it had serious shortcomings and was not considered satisfactory for use in a regular emergency ambulance service. The internal litter and seating arrangements made it difficult to load a litter victim. For a two-week period, the helicopter operated as a unit of a ground ambulance service for test and evaluation. Ground ambulance attendants were part of the flight crew during

seven airlifts of injured persons. These attendants were impressed by the speed and accessibility of the helicopter, but regarded the space limitations, litter arrangements and limited medical equipment as quite inferior to their own ground ambulances.

The helicopter crew had direct radio contact with the State Police net and all messages to hospitals concerning arrival of injured persons had to be relayed by phone through the State Police stations. While the communication system could have been improved, the lack of requests for helicopter ambulance service throughout the study was a result of personal decisions rather than a communications hardware deficiency.

Nebraska Project No. EMS 68-1-001, 002⁴
(Operation SKY-AID)

Operation SKY-AID was a 14-month study to field test, under civilian conditions, the role a helicopter might play in providing emergency service under the most diversified combination of circumstances possible and to provide operating data pertinent to helicopter operations, i.e., weather, night flying communications and maintenance. Two Sikorsky S-55 helicopters were utilized in the program which covered the 35 southeastern counties of Nebraska. During this program, flights were prescheduled for selected weekends and hours of unusually heavy traffic. Crews were on 15 minute calls from 8 a.m. to 5 p.m., Monday through Friday, and one hour call at other times.

Although any one of the ambulance flights potentially could have proved lifesaving to a severely injured accident victim, there were fewer casualties during the scheduled flying hours than had been anticipated. Most of the missions consisted of highway traffic surveillance. (This report does not state the total number of patients carried during the test, but indications are that it was more than one but less than five.)

The helicopters used during this project were reported ideal for space requirements, accessibility to patient in flight and stability; however, this type helicopter was reported too low powered for access to limited landing sites and the dispatch delay time was undesirable for emergency ambu-

⁴Nebraska Air Ambulance Project, *Operation Sky-Aid* July 1969, Final Report. Project EMS 68-1-001, 002. Paul R. Haith, M. Ed., Project Coordinator. DOT/HS 008-478, NTIS/PB 203-293.

lance service. Also, even though this project utilized to the fullest extent all available communication systems, communications were inadequate. This study also found that a standby helicopter ambulance program, with a helicopter parked at a medical center prepared to answer emergency calls, is neither feasible nor recommended. A more feasible plan would give consideration combining medical emergency services with services for other agencies.

Both of the foregoing tests experienced several common difficulties which can be expected in any attempted use of the helicopter for emergency ambulance service unless they are anticipated and planned around. Similar difficulties have also appeared in later Section 403 funded demonstration projects.

One difficulty which was not unexpected was the high cost of operation. What was not foreseen was the high cost per patient due to the low usage as an emergency ambulance. Although most advocates of emergency helicopter ambulance service can cite cases where this service could have saved lives or improved the final medical outcome due to the accident victim's injuries, they fail to realize how few such cases occur within the effective operating radius of the helicopter during any given time period. Even when there was a case for which the helicopter would have been the proper response vehicle, failure to alert the helicopter operator was, and still is, a primary problem.

Another difficulty indicated by these tests was the inadequate radio communications with the helicopter crew. Unlike the U.S. military radio communications which have a compatible world-wide system, civilian public service radio communications are generally fragmented or non-existent to the extent that much of the effectiveness of providing rapid helicopter emergency ambulance service is lost. The inability of the crew of the helicopter to communicate immediately with a control center, pick-up site personnel, or destination medical center can cause unnecessary delays. This problem was foreseen in earlier studies.

Also, both test programs indicated difficulties associated with the types of helicopters selected for use. The type of helicopter selected for emergency ambulance use will have a bearing on the outcome of any helicopter emergency ambulance project. There are many types of helicopters available today. Few of these helicopters are suitable for this type of work, and none can be considered ideal.

At the end of fiscal year 1968 and during fiscal year 1969, six projects were contracted under Section 403 (Research and

Demonstration Projects) which included investigation, to various degrees, of the use of helicopters as emergency ambulances. In the following paragraphs are abstracts of the emergency air ambulance portions of final reports from the contractors listed below:

University of California – Los Angeles

The Metropolitan Washington Council of Governments (DC)

City of Detroit, MI

Arizona State University

Metropolitan Inter-county Council (MN)

Mississippi State University

University of California – Los Angeles⁵

This project titled, “Emergency Medical Service Systems,” was to develop and demonstrate means for evaluating the effectiveness of improvements to Emergency Medical Service systems. The project was to measure the benefit, in terms of patient outcome, of improvements to various EMS sub-systems aimed at reducing time to treatment and raising the level of care. Analytical models were developed to describe the operating characteristics and performance of proposed systems. Certain demonstration efforts were evaluated in communications, training of paramedical personnel, and helicopters.

The helicopter emergency ambulance study was conducted in three phases with a converted Bell Jet Ranger:

1. A response time study in which a helicopter was dispatched to emergency medical incidents in tandem with ambulances that serviced a suburban area; the helicopter did not land, but estimated probable landing difficulties;

⁵*Emergency Medical Service System*, University of California-Los Angeles, DOT/HS (to be published); NTIS/PB (to be published), Contract No. FH-11-6849.

2. **A landing feasibility study** to assess the operational potentialities of helicopters, in a suburban/urban environment, in a variety of controlled landing site conditions;
3. **A patient retrieval demonstration** to assess the operation efficiency and medical effectiveness of helicopter ambulance in a rural environment.

The overall objective of these demonstrations was to examine the feasibility of integrating helicopters into the emergency rescue transportation system, both to supplement and to complement ground rescue ambulances.

The feasibility of using helicopters as emergency air ambulances has been well demonstrated both in the U.S. and abroad. However, this project showed in its response time study that despite its speed and ability to fly to a destination in a straight line, a helicopter, on the average, cannot reach the scene of a medical emergency in an urban or suburban area ahead of a ground ambulance dispatched simultaneously from a well deployed fleet of vehicles. Furthermore, in highly developed areas, the presence of poles, overhead wires, tall buildings, and heavy street traffic tend to delay or preclude a helicopter landing, unless a trained controller is at the scene to point out obstacles, control traffic, and guide the helicopter by means of hand signals and/or direct voice communications.

Taking these factors into account, it appeared that helicopter ambulances had their greatest potential in rural areas, where the response time of conventional ambulance service was relatively long, and where the presence of open areas would permit unassisted helicopter landings and take-offs. Rural areas are also characterized by a relatively small population base. Thus the frequency of occurrence of medical emergencies was projected to be relatively low within the area serviced by helicopters. This infrequent demand for emergency ambulance transport, coupled with the high initial investment cost and recurring operating costs of a helicopter, indicate that it might be uneconomical to operate a helicopter solely as an air ambulance in a rural environment. Therefore, helicopters whose presence in rural areas has been justified for other purposes should be sought. In this way, the medical and operational benefits of the secondary role need only be balanced against the incremental cost of operation.

The area selected for the patient retrieval demonstration (Antelope Valley-Newhall area) contained a County Fire Department base and covers about 2,200 square miles, with a population of approximately 120,000. The county fire department helicopter standby hours for the emergency ambulance test were from noon to 8 p.m. on Fridays, Saturdays and Sundays for a 13-month period. Crews attended an 80 hour emergency medical training course at a teaching hospital prior to initiating the service. The incidents to which the helicopter responded were those for which the estimated response time of a conventional ambulance was 15 minutes or more.

The helicopter was deployed or scheduled for deployment as an air ambulance on 180 days. As an air ambulance it retrieved 88 patients and was considered instrumental in saving the lives of five. It also was successful in transferring 12 patients, six of whom were considered to have life threatening injuries, from small hospitals to hospitals with greater capabilities. Although extensive preplanning and establishment of protocol of operations was accomplished with all concerned organizations, data indicated that if the helicopter operator had been promptly notified of all potential qualifying cases, 41 additional patients would have been transported.

Of the cases transported, the reviewing physician judged 27% to have had sustained life-threatening injuries. In general, the helicopter was used for a greater portion of life-threatening cases than were the surface ambulances based on a 2:1 patient admission rate at the receiving hospitals. The following table compares service times for surface and air ambulance during the patient retrieval demonstration phase. The great difference in waiting time to treatment in the hospital is generally credited to advance notification by radio of arrival time and nature of patient's injury.

Comparative Service Times of Ground Ambulance Calls Greater Than 15 Minutes and Air Ambulance

Time from Dispatch to:	Mean Times Ambulance	Mean Times Helicopter	Diff. in Minutes	Pct. Change
Arrival on Scene	20.9	14.6	6.3	30.1
Arrival at Hospital	41.4	32.3	9.1	22.0
Treatment at Hospital	52.6	35.8	16.8	31.9

This comparison should be interpreted as a potential area of improvement in emergency ambulance service in this community and not as a criticism of existing service, since 50% of all calls were responded to by ground ambulance within 10 minutes. The foregoing table is based on only those calls with a greater than 15 minute response. Given the cost and utilization of the air ambulance, careful planning is required before the use of helicopters as air ambulances is arbitrarily decided upon.

This project concluded that the helicopter ambulance could provide improved emergency service to emergency victims who are located 15 minutes or more from the nearest ground ambulance. This improved emergency service, under conditions similar to this trial, would include a 30.1% decrease in time to arrival on scene and a 22% decrease in arrival time at the most appropriate (rather than merely the closest) hospital. This service could be offered at a cost comparable to present ground ambulance costs if the helicopter were made available daily and its use continued beyond the demonstration period. Air ambulance service could be used in other outlying areas of the country having potentially long response times (15 minutes or more) in emergencies. It cannot be stressed too strongly that these findings depend on (1) the helicopter having another function against which the procurement and other fixed costs of operation can be offset, (2) demand for emergency service continuing at identical levels, and (3) no expansion of ground ambulance service or deployment patterns that would effectively reduce the time to arrival on the scene. If one or all of the foregoing conditions were not met, then the economies of operation would change significantly and the medical benefits would be diminished.

The Metropolitan Washington Council of Governments (DC)⁶

This project was to explore the feasibility of integrating a regional helicopter ambulance service with existing ground ambulance service to provide a more efficient, rapid emergency rescue and treatment capability in the Washington

⁶*Report on the Feasibility of Developing an Experimental Helicopter Ambulance Service in the Washington Metropolitan Area* - Metropolitan Washington Council of Governments, Washington, D.C. (1969)-DOT/HS 800-530, Contract No. FH-11-6853.

metropolitan area (District of Columbia and five surrounding counties in Virginia and Maryland). As the study progressed, it became apparent that key blocks of data needed to determine both the quality and deficiencies of the existing crash rescue system were not available. As a result, the feasibility of integrating a regional helicopter ambulance service had to be based on unsupported estimates and probabilities. It was concluded that the feasibility could only be determined by a demonstration project. (An alternate method of determining feasibility would have been to institute a reporting system which would have collected the needed data. A demonstration project without comparable existing data cannot measure the benefits added by the demonstration.)

City of Detroit, MI⁷

The "Emergency Medical Services for an Urban Area" demonstration project by the city of Detroit and the University of Michigan Highway Safety Research Institute was to study alternative methods of public-supported ambulance use in medical emergencies on the basis of timeliness, quality and cost. Sought were methods of improving emergency medical assistance. Existing public and private (contracted) ground and air ambulance services were evaluated as to time elapsed between the call for help and the victim's delivery to a hospital, and the treatment available from ambulance crews. There also was analysis of communications, including the performance of two citizen-band radio reporting groups, with the object of improving the speed of accident detection and notification.

In the air ambulance portion of this project, the Bell 47-J flew patrol missions over the 140 square mile area of the city between 4 and 7 p.m., Monday through Friday (weekend and late evening flights were scheduled on occasion), for a six month period. The primary mission of the crew was to land at injury accident sites, provide paramedic care, and transport the victim to one of six local hospitals having a helipad or helistop.

A police ground unit was necessary and always requested at the accident scene for traffic control or crowd

⁷*Emergency Medical Services for an Urban Area*, City of Detroit (1970), Final Report, DOT/HS 800-418, NTIS/PB 197-752, Contract No. FH-11-6901.

security. Four hundred and eighty-seven hours were flown on 131 missions. It was demonstrated that an air ambulance can successfully land – on a busy freeway or a major thoroughfare during rush-hour traffic, or on a vacant lot or playground in a residential neighborhood – and transport an injured victim to a hospital.

In the course of the demonstration, the crew was dispatched to 37 incidents, with 27 successful landings resulting in the transfer of 23 persons. Eight landings were made on freeways, 11 on surface streets, and 8 on off-street areas. Because the injury occurrence process was random, the range of victim's condition varied from minor injuries to critical cases. For the most part, those transported by helicopter were not seriously injured. Three of the victims, however, did fall into a critical category: one apparently died before the craft arrived, another died in flight, and the third was successfully transported and treated.

The primary benefit of the helicopter ambulance is its speed of response and the resultant benefit that this speed affords the victim. To place the helicopter in a perspective of an urban emergency-medical-response system, its time-saving benefits must be compared to those of ground ambulances. The helicopter, operating city-wide, did achieve some time savings, but the benefit was small when compared to the speed of ground operations. The average time from dispatch to hospital was 9 minutes for the Fire Rescue squads and 8.2 minutes for the helicopter ambulance. The helicopter usually could not approach a victim as closely as a ground vehicle and the victim loading process was more complex. In addition, the helicopter traveled greater distances and had only six helipad hospitals on which to rely, while the ground vehicles covered shorter distances and relied on 14 hospitals.

This demonstration study concluded that the time savings of a helicopter ambulance in an urban area does not justify the cost of a helicopter ambulance operating exclusively on patrol. Use of a helicopter for medical emergencies in an urban area may be justified under limited conditions. If a municipality operates a multipurpose helicopter which has a secondary role of standby for emergency medical transport, a screening procedure should be set up to limit the demand and reserve air conveyances for only the seriously injured. The definition of serious would include the nature of injury, the time-treatment requirement, and the distance to be covered to get to proper treatment.

Arizona State University⁸

The Air Medical Evacuation System (AMES) demonstration project by Arizona State University was to test the AMES concept previously developed at that University. This concept was to provide air ambulance service to rural portions of Arizona utilizing helicopters with additional missions. This system incorporated the helicopter, controlled by the Arizona State Highway Patrol, with well trained paramedical personnel, and a well designed communication system.

Two specially equipped FH-1100 turbine-powered helicopters operated 24 hours a day within a 150 mile radius from a base in central Arizona. The aircraft carried two internal litters, the pilot and an Arizona Highway Patrolman. Both men were trained as paramedical specialists and had over 150 hours in an advanced in-hospital training program. Three physicians, all with military air evacuation and rescue experience, monitored the system continuously. The AMES responded to medical emergencies such as highway accidents, hunting, camping and boating mishaps, and inter-hospital transfers. The communication system could reach any point in the State utilizing the Arizona Highway Patrol frequencies and a separate medical channel. The net could also be patched into the telephone system, whenever desired.

After several months of intensive training, statewide service was initiated on May 30, 1969. By January 31, 1970, the aircraft had flown 1,185 hours and evacuated 225 persons in the course of 213 missions. In addition to medical experience which included evacuation of accident victims, hospital and premature infant transfers, venomous animal bites, tetanus, burns and general trauma, the AMES flew 613 "other" missions, including manhunts, aircraft searches, patrol, surveillance, etc. AMES developed criteria for types of patients suited for this service as well as those definitely not suited; necessary on-scene preparation, procedures, and medications; standards of evacuation care; strategies and devices for comfort and telemetry; and choice of receiving facility.

On-site pickup of the ill and injured was made during the entire test. Hospital transfers to more suitable facilities

⁸*Air Medical Evacuation System (Ames)*, Arizona State University (1970), Final Report. DOT/HS 800-267, NTIS/PB 193-724; Appendix DOT/HS 800-268; NTIS/PB 193-725. Contract No. FH-11-7090.

were started near the mid-point of the project. Following is a summary of patient origin:

Distribution of Patients				
Type Mission	No. Missions	No. Persons	Pct. of Total*	Persons/Mission
1. Evacuation:				
a. Highway	81	116	52	1.42
b. Non-remote, non-highway	24	25	11	1.04
c. Remote	11	12	5	1.09
2. Transfer	55	72	32	1.30
3. Dry runs	42	0 (not included in % of Total)		
Total	213	225	100	

*(171 w/patient)

Physicians' comments concerning the patients after delivery by AMES indicate that the time saved effected a reduction in morbidity in at least 9 cases and the paramedic's action in at least one other case. The time saved improved the patient's chance of survival in at least four cases and on two occasions, the paramedic was credited with saving the patient's life.

Traveling by helicopter imposes a certain degree of roughness and vibration on the passengers. When comparing this to the roughness and vibrations encountered in riding in a ground ambulance, it is necessary to consider other factors such as smoothness and contours of the roadway. Any rough movement, vibrations or sudden jerks of a patient cannot help but to bring him further discomfort and could add to the severity of his condition. In only four cases did the paramedic comment about the adverse effect of the helicopter with respect to deterioration of the patient's condition. Relative to the ground ambulance, the helicopter was rated less detrimental on rural/remote missions and more detrimental on urban missions.

In addition, this project provided quantitative answers to the question of cost and operational effectiveness of civilian air medical (helicopter) systems. The expense of such a system is substantial. The conclusion was that the high cost

can be justified when the helicopter is operated as a rural, remote area system—not as a replacement for, but as a supplement to existing ground ambulance and law enforcement operations if the helicopter is used for other supporting missions, such as law enforcement, patrol, or surveillance, without sacrificing the medical evacuation capabilities or priorities of the system. On the basis of the experience that was gained, it was concluded that the helicopter can perform a very effective role in general law enforcement operations, while, at the same time, performing its primary mission of medical evacuation.

One additional significant conclusion of the project was that a properly designed emergency medical communications system is a key component of an air medical evacuation system operation.

Although not specifically pointed out in the report, the success of this project's operation was partly responsible to good planning by all agencies and organizations responsible for and interested in providing the existing emergency medical service for the demonstration area.

Metropolitan Inter-County Council (MN)⁹

This project entitled Helicopter Ambulance Service to Emergencies (HASTE) was a cooperative, coordinated multi-county emergency medical service response system. It was designed to determine the efficacy of utilizing highly trained and experienced rescue personnel, flown by helicopter to accident scenes, for providing primary or backup medical service to accident victims in the shortest time.

Designed and administered by the Metropolitan Inter-County Council, project HASTE was to take full advantage of the benefits and capabilities of a multi-county representative group organized to identify common needs and solve mutual problems through cooperative program efforts. The Minnesota State Health Department served as the prime subcontractor with responsibility for program implementation, data collection, and final evaluation.

The flight demonstration portion of this project was accomplished in two phases and utilized three types of helicopters. The first flight phase employed a Bell 47-J, without litter capability, which carried a well trained

⁹*Helicopter Ambulance Service to Emergencies (HASTE)*. Metropolitan Inter-County Council, Minnesota (1971), Final Report. DOT/HS 800-495, NTIS/PB 200-308, Contract No. FH-11-7128.

Professional Rescue Instructor of Minnesota (PRIM) to stabilize the victim at the accident scene prior to his transportation to the hospital by ground ambulance. This phase was in operation for three months and resulted in three victims receiving care; nine missions to carry blood, serum, or drugs; and 20 missions being aborted for various reasons. The second flight phase employed a Bell Jet Ranger for the first 10 months (the subcontractor went out of business without prior notice) and a Sikorsky S-62-A which completed the last two months of the project. During this second phase, in addition to carrying the PRIM to the scene to care for the victim, helicopter transportation of the victim was provided to the hospital if the injuries warranted this type of transportation. Seventy patients were carried; on 45 missions patients were attended but not transported; blood, serum, or drugs were transported on 45 missions; and 336 missions were aborted for various reasons.

In the opinion of the medical advisory committee, only 35 of the 70 patients transported to hospitals by helicopter had conditions or suspected conditions serious enough to warrant helicopter transportation. And of these 35, the committee concluded that eight were benefited in a way in which they would not have been by ground ambulance transportation.

The high rate of aborted flights seems to be due to the dispatch criteria which was very liberal. The helicopter was dispatched on any information of a personal injury accident, including those monitored on police frequencies, without regard to severity or of ground ambulance capability in the area. Over 65% of the flights aborted were turned around due to prior arrival of ground units or because the victim had received either minor or no injury. The project personnel felt that the helicopter emergency ambulance was under-utilized and a careful reading of the report will give clues as to a variety of reasons. (The use of a trained central dispatcher could have improved the utilization of the helicopter and reduced the number of aborted flights.)

Conclusions derived from this demonstration project included the determination that helicopter emergency ambulance service in a large metropolitan area such as Minneapolis, St. Paul, and suburbs is not feasible, but that helicopter ambulance service would be reasonable in the outlying areas of the State. In order to be financially feasible and practical in these outlying areas, the helicopter emergency ambulance would have to have a multipurpose use.

In comparing the two types of helicopters utilized to transport patients, the Bell Jet Ranger was found to be adequate in nearly every aspect of operation. The possible exception would be the space limitation inside the helicopter. Lack of space restricts certain medical procedures that could have been done by paramedics such as cardiopulmonary resuscitation and splinting of lower extremities using fixation or traction type splints. Since only three or four instances of cardiopulmonary resuscitation were required during the project, this factor may not have been of too much consequence. The size problem could be remedied with a slight increase in cabin interior size. The Sikorsky S-62-A has adequate space in its interior cabin for all procedures. However, the ship's size proved a deterrent to officers on the ground. The 8,000 pound helicopter not only caused much more wind disturbance upon landing, but because of its large size it could not necessarily land on the untraveled portion of the highway or the shoulder as the Bell Jet Ranger could. Cost of operation of the Sikorsky S-62-A was found to be considerably more than that of the Jet Ranger.

Mississippi State University¹⁰

This project known as Coordinated Accident Rescue Endeavor-State of Mississippi (CARE-SOM) was conducted under two separate contracts. The first by the College of Engineering, Mississippi State University, was to evaluate the problems and benefits of a comprehensive and integrated medical response system using a balanced program of helicopter and ground ambulance to serve three large predominately rural areas of the State. The second portion was conducted by the College of Business and Industry, Mississippi State University, which continued the original studies and developed cost and organizational information for the helicopter ambulance use in a multipurpose role.

Three operational zones of a 50 mile radius each were utilized with the operation of the system composed of helicopters and ground ambulances, based on using the method of transportation which could get to the injured and transport them to the nearest hospital in the minimum amount of elapsed time. Time-Response Contour Maps were

¹⁰ *Coordinated Accident Rescue Endeavor, State of Mississippi (CARE-SOM)*, Mississippi State University (1970). Final Report, DOT/HS 800-460, NTIS/PB 199-756; Appendices DOT/HS 800-461, NTIS/PB 199-757, Contract No. FH-11-7146; and Extension of Project CARE-SOM, Final Report (1971), DOT/HS 800-584, NTIS/PB 204-999; Contract No. HS 019-1-020.

developed to determine the portions of the operating area which were better served by the ground ambulance. Each zone system was operated by local people who were a part of the existing emergency medical services, including physicians, hospital personnel, ambulance attendants and law enforcement officers.

One FH-1100 helicopter was assigned to each zone to provide the air ambulance service. Existing ground ambulances were utilized and were provided with two-way radio communications to hospitals and law enforcement officers. The helicopters operated between the hours of 7 a.m. and 9 p.m. daily, from November 1969 through June 1970, and again from November 1970 through February 1971.

During the six month period of November 1969 - April 1970, a total of 828 missions were flown for all purposes; of these, 457 were directly involved with medical emergencies and the transferring of 332 patients. During the four month period of November 1970 - February 1971, a total of 478 missions were flown, of which, 207 were directly involved with medical emergencies and 189 patients were carried on 161 missions. The missions from these periods were classified, as follows:

Type of Medical Mission	Inclusive Dates	
	11/69-4/70	11/70-2/71
Traffic accidents	182	97
Inter-hospital transfers	180	70
Other medical emergencies	82	38
Blood, drug, equipment transfers	13	2
Total	457	207

Poor response and cooperation by hospitals and ground ambulance services resulted in insufficient data for any attempt to estimate lives saved or reduction of patient condition deterioration because of helicopter rather than ground ambulance patient movement. (More and better planning is needed in this area.)

The number of requests for the helicopter, other than hospital transfers, appeared to be inversely proportional to the distance of the caller from the helicopter base. This reluctance to request the helicopter for long-range missions could be due to the lack of familiarity with the project. Of interest is the average distance by type of mission. Less than 5% of all missions involved flight distances falling in the 50 to

80 mile range. Inter-hospital transfers generally involved flight distances in excess of 80 miles. The average distance flown during inter-hospital transfers was 107.67 miles as compared to only 30.63 miles for traffic accidents and other medical emergencies.

The flight speed of the helicopters varied with the type of mission being flown. Since traffic accidents and other medical emergency flights were generally of short duration, the portion of the time spent in steady level flight was less, in relation to the total flight time, than that of the longer inter-hospital transfer missions. As a result, the average flight speed of the three helicopters was only 83.56 miles per hour for traffic accidents and other medical emergency missions as compared to an average speed of 94.73 miles per hour for inter-hospital transfers.

Summarized in the report are recommendations for improvements to the configuration of the FH-1100 as used in this project. Some of the problems which were encountered were with the communication system, litters, and cabin space. Additional findings of this project which are relative to any study of the helicopter as an emergency ambulance are listed below:

- The results of a study made among 61% of the CARE-SOM participating hospitals reveal that an estimated average of 26 minutes was saved in getting an emergency case under the care of a physician as a result of having radio communications with the ambulances (surface). Only 7% of the hospitals in Mississippi have a doctor on the premises on a 24-hour basis.
- The highest frequency of missions flown by the Project CARE-SOM helicopters to traffic accidents and other medical emergencies were within a distance of 25 miles from the location of the helicopter base of operations, but the effective range of the helicopter is best determined from the Time-Response Contour Map.
- The helicopter speed advantage over ground units was most effectively utilized for inter-hospital transfer missions of approximately 80 miles distance or greater.
- Helicopters were effective in responding to non-traffic related emergencies in areas removed from public roads or highways.

- That there are some times and places where the helicopter has no advantage over the ground ambulance for response to the scene of an accident or illness.
- That there are other times and places where the helicopter has no advantage over the ground ambulance for response to inter-hospital patient transfer.
- That the above times and places should initially be identified during the planning stage of a proposed helicopter emergency ambulance service.
- That there are certain categories of injury or illness where the patient's condition will receive no additional benefit from helicopter use.
- That the use of the helicopter as an emergency ambulance can provide medical advantage in only a small percentage of the total number of sick or injured in any given operating area.
- That the helicopter emergency ambulance must be known to and accepted by all other elements of the emergency medical service as having a proper role and place in the system before it can function effectively.
- That communications can greatly affect the time from dispatch to treatment in both ground and helicopter emergency ambulance response, and that inadequate communications can negate the potential time advantage of the helicopter.
- That the more economical ground ambulance, if available, should be used when no apparent benefit to the patient will be realized by use of the helicopter.
- That needless expense can be incurred by the helicopter ambulance service when some form of control or other deterrent to misuse is not available.
- That funds on the order of \$200,000 to \$250,000 per year, per helicopter should be available to start a proper, continuously available emergency helicopter ambulance service utilizing the 3,000 lb. class jet helicopter (FH-1100 or Bell Jet Ranger). Savings from this amount can be realized by fleet type operations, shared personnel and facilities, and other favorable factors which may be available in certain operating areas.

much as a dual-purpose system is recommended, it was recommended that the medical attendants be members of the Highway Patrol. These individuals would be selected from among volunteers from the Patrol and would be permanently assigned to the air rescue service. They would receive additional medical training, and would receive pay commensurate with their added training and specialized duties.

Rapid and reliable communications capabilities are an absolute requisite if the potentialities and advantages of helicopter ambulances are to be realized. The greater the number of functions required of the helicopter, the more versatile the radio communications equipment must be.

In summary, the report stated that a State-operated helicopter system offers many advantages over autonomous helicopter ambulance districts. The helicopters can be utilized more efficiently, can provide highway safety services without disruption of medical service capabilities, and can be meshed into a State disaster plan more readily.

A complete plan for a Mississippi Statewide helicopter ambulance and police service is presented in the CARE-SOM Extension final report. This plan includes organization, job descriptions, equipment, operating procedures, budget, and report system.

The foregoing demonstration projects have shown that helicopters can be used as an emergency ambulance in a civilian emergency medical system. Certain truths have been established that should be recognized by any planner in considering the helicopter as an emergency ambulance vehicle:

- That the helicopter can rapidly deliver, to the scene of an injury or illness, an emergency medical technician who can evaluate the degree of danger to the victim and provide emergency medical care at the scene.
- That the helicopter emergency ambulance can transport a patient rapidly from point to point with an emergency medical technician to provide enroute emergency medical care as required.
- That the helicopter can provide rapid transportation of personnel, blood, drugs, or other material requirements to the place of emergency need from the place of supply.
- That the helicopter can provide the above services to some geographic areas not accessible to the ground vehicles.

- That there are some times and places where the helicopter has no advantage over the ground ambulance for response to the scene of an accident or illness.
- That there are other times and places where the helicopter has no advantage over the ground ambulance for response to inter-hospital patient transfer.
- That the above times and places should initially be identified during the planning stage of a proposed helicopter emergency ambulance service.
- That there are certain categories of injury or illness where the patient's condition will receive no additional benefit from helicopter use.
- That the use of the helicopter as an emergency ambulance can provide medical advantage in only a small percentage of the total number of sick or injured in any given operating area.
- That the helicopter emergency ambulance must be known to and accepted by all other elements of the emergency medical service as having a proper role and place in the system before it can function effectively.
- That communications can greatly affect the time from dispatch to treatment in both ground and helicopter emergency ambulance response, and that inadequate communications can negate the potential time advantage of the helicopter.
- That the more economical ground ambulance, if available, should be used when no apparent benefit to the patient will be realized by use of the helicopter.
- That needless expense can be incurred by the helicopter ambulance service when some form of control or other deterrent to misuse is not available.
- That funds on the order of \$200,000 to \$250,000 per year, per helicopter should be available to start a proper, continuously available emergency helicopter ambulance service utilizing the 3,000 lb. class jet helicopter (FH-1100 or Bell Jet Ranger). Savings from this amount can be realized by fleet type operations, shared personnel and facilities, and other favorable factors which may be available in certain operating areas.

- That each potential operating area for a helicopter emergency ambulance service is unique unto itself and plans for each area must recognize the various conditions existing in each area.
- That the benefits to a patient which may be derived by utilization of the helicopter emergency ambulance are difficult to measure (a problem common to most elements of emergency medical service) and that there is no common standard against which to measure these benefits.
- That there are certain equipment criteria and personnel proficiency standards which will increase apparent benefits to a patient and increase the effectiveness of the helicopter as an emergency ambulance.
- That the helicopter can be a useful supplement to an emergency medical service system, but is not a cure for all problems and will not replace proper planning, equipping, training and staffing of other elements of the system.

There appears to be three needs remaining to be resolved, other than funding, before the true benefits of the helicopter as an emergency ambulance can be realized. Each of these needs is interdependent upon the others and an attempt should be made to resolve each in the order listed below:

- A need to evaluate the possible additional benefits which can be accrued to a patient by use of a helicopter emergency ambulance over the ground ambulance.
- A need to establish a minimum criteria for the helicopter emergency ambulance vehicle and a minimum performance proficiency level for the assigned crew in order to achieve the most feasible and desirable of the benefits established above. It may also be desirable to establish a maximum equipment criteria and personnel proficiency level above which no significant additional benefits would be derived.
- A need to regulate the helicopter emergency ambulance service to assure a standard which will make these possible benefits available in any service offered.

It will not be necessary to fund additional complete demonstration projects in order to evaluate the results of studies of the foregoing needs. Existing helicopter emergency ambulance services can be utilized to make the evaluation.

At the present time it does not seem wise to invest in a helicopter emergency ambulance element to an emergency medical service system until all other elements of the system are complete and operating effectively. An inefficient and fragmented emergency medical service system will result in an inefficient helicopter ambulance service which will be extremely expensive for the limited benefits derived. Expenditure of a large portion of available emergency medical service funds for a helicopter operation will restrict the proper development of other elements of the service. However, a helicopter operation which is presently justified and operating outside of an existing emergency medical service system may be compatible with and augment the existing emergency medical service system with relatively small additional cost. Continued improvement of other elements of the system would still be financially possible and such improvements would increase the benefits derived from these multiple-use helicopters.

One test program to augment the civilian emergency medical service with helicopters and crews presently justified and operating for other purposes is the MAST test program which began in July 1970.

Military Assistance to Safety and Traffic (MAST)¹¹

Military Assistance to Safety and Traffic is a program of utilizing military helicopters and medical corpsmen as an adjunct to the existing local emergency medical service system for the purpose of providing assistance to civilian victims of traffic accidents and other medical emergencies. Existing equipment and personnel from active duty Army and Air Force units are involved. These military personnel work in cooperation with local health care providers and law enforcement officials according to a locally developed plan between the civilian and military communities. No personnel or equipment are transferred solely for the purpose of MAST support. The program is sponsored by six government agencies forming the MAST Interagency Executive Group, with administration assigned to the MAST Interagency Coordinating Committee. This committee is comprised of representatives from the Departments of Defense, Transportation, and Health, Education and Welfare.

MAST projects were initiated during the test program and are continuing operations at San Antonio, Texas; Colorado Springs, Colorado; Seattle - Tacoma, Washington;

¹¹ *MAST, report of test program*, Interagency Study Group, July-December 1970, GPO Stock NR. 1727-0030.

Phoenix, Arizona; and Mountain Home, Idaho. This program attempts to provide better care in medical emergencies by transportation of medical specialists and equipment to the emergency scene; transporting patients from the scene of the emergency to the appropriate medical facility; and inter-hospital transfer of critical patients where ground ambulance transportation is not available, or air transportation is in the best interest of the patient. In the first six months of the program test, 182 missions were flown, 249 patients were carried, and 290 hours were flown. Of these patients, 115 were emergency site pick-ups and 134 were inter-hospital transfers.

As of June 30, 1972, MAST has completed 1,165 missions, carried 1,433 patients, and logged 2,494 hours flight time at the five sites. Costs are being covered by funds already available for operations and training. No special funds have been allocated, nor have existing funds been reapportioned. No charge has been made for any assistance provided.

Originally, Reserve and National Guard units, as well as active duty military units, were studied to determine the possibility of their use. Many problems, as yet not resolved, were encountered in planning their use. It was decided early in the study to restrict the test program to only regular active duty military units. During the test period it was learned that certain types of military units could engage in the MAST program with no degrading impact on either unit training or operations, and by their very nature provide realistic training experience and motivation. These units were identified as U.S. Army Medical Units (Air Ambulance) and U.S. Air Force Recovery and Rescue Units (Local Base Rescue). Army tactical units were found to be able to support a MAST project, but could do so at the expense of their other training and operational programs.

Although the Army's UH-1 and the Air Force's H-43 helicopters were well-equipped for their military mission, the one predominant problem in their use in civilian emergency medical service was the lack of radio communication. Where civilian radio capability did exist, military equipment was not compatible.

During the test program, it was attempted to establish radio communications by use of portable radios in the helicopters on public service frequencies. Several difficulties were encountered:

- Various public safety organizations in each operating area utilized different frequencies on any one of three

available bands. A different radio would be required for each of the bands utilized and each radio is normally limited to one or two preset frequencies in that band. An emergency medical communication system is needed in each operating area which would require the helicopter to have only one additional radio with one or two frequencies on the same band similar to the system described in project CARE-SOM.

- The portable radios utilized were not integrated into the helicopter's normal communication system which utilizes headphones and microphone integral with the crewman's helmet. Use of the portable radio required the pilot or crewman to remove his helmet and be isolated from the interphone system of the helicopter. The safety and efficiency of the helicopter and crew is compromised by the arrangement.
- The portable radios used an antenna attached to the radio. With the antenna being inside of the helicopter, the performance of the radio was reduced. A remote, outside mounted antenna would improve the performance of the radio.

Following the evaluation of the MAST test program, a decision was made to continue the five test sites in operation and to plan for expansion to other sites where Army Aero-medical units and Air Force Local Base Rescue units were located, and where the surrounding civilian communities expressed a desire to receive MAST support. MAST is not intended to compete with any existing or planned emergency air ambulance service, but may be utilized to augment such a service. As with other helicopter emergency ambulance projects, the benefits to be received will be relative to the effectiveness of the civilian emergency medical service which the MAST project supports. The emergency medical service which MAST will support is expected to provide the military unit with radio communication equipment compatible with its own emergency medical service communication system, and to provide heliports or helistops at its hospitals designated to receive MAST patients.

Activation of additional MAST projects where planning is complete is awaiting congressional sanction of the MAST concept. After additional experience is gained at those sites where additional funding is not required, thought can be given to utilizing other military resources to assist the civilian emergency medical services.

In brief summary, the helicopter is not any more ready to completely replace the ground ambulance in emergency medical service than the helicopter air taxi is ready to completely replace the ground taxi. It does not take any great effort or management skill to buy or lease a helicopter, hire a pilot and start flying over the countryside. Add a litter and it could be called a helicopter ambulance. Hire another pilot or two and it can be ready to fly at any time, day or night. You still do not have an effective helicopter emergency ambulance, and will not have one until you utilize a **proper helicopter with the proper equipment** and man it with a **pilot and attendant** who maintain a **desired level of proficiency** in flying and medical care. Your helicopter emergency ambulance may now be effective if its use is planned and coordinated with other effective elements of an emergency medical service system designed specifically for the area in which it is designated to operate.

Present policy of the National Highway Traffic Safety Administration is:

1. Beginning with FY 1973, the NHTSA will not approve Federal funding participation in new purchases of helicopters under Section 402. Similarly, the NHTSA will not approve applications for Federal funding of rented, leased, or contractor-provided helicopters or helicopter services.
2. NHTSA will contribute to the cost of maintenance and operation of helicopters previously leased or purchased under Section 402, but participation will be limited to those costs related to traffic safety operations.
3. New helicopter demonstration projects proposed for funding under Section 403 will not be approved unless the project involves field testing of new concepts or new types of equipment to prove their effectiveness in traffic safety programs. Each proposal will be justified and determined on a case-by-case basis.

Publications identified by NTIS/PB-(number) are available from:

National Technical Information Service
 5285 Port Royal Road, Springfield, Virginia 22151
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 or 133

MAST

MILITARY ASSISTANCE TO SAFETY AND TRAFFIC

REPORT OF TEST PROGRAM

by the Interagency Study Group

July—December 1970

**Department of Defense, Department of Transportation,
and Department of Health, Education, and Welfare**

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NOTE: The Appendices to the MAST Report were not printed because of the large amount of material contained therein. Included in the Appendices are: background correspondence, site reports, cost data, medical evaluation proposals, U.S. Army National Guard involvement, National Medevac concept, and civilian air ambulance operations.

Information on the above may be obtained by writing: MAST Executive Secretary, Department of Transportation, Washington, D.C.



SUMMARY

The Military Assistance to Safety and Traffic (MAST) program was undertaken to explore the feasibility of utilizing military helicopters and service paramedical personnel in responding to civilian medical emergencies, in particular to highway accidents. During several months in 1970, pilot or demonstration projects were implemented at five military installations. Three projects were sited at Army installations and two at Air Force Bases. The program represented a joint endeavor by the Departments of Defense (DOD), Health, Education, and Welfare (DHEW) and Transportation (DOT) to demonstrate, in civilian applications, the capabilities of those military resources and techniques which have been employed so effectively in combat. MAST was essentially an operational test, where military resources of known capability were meshed with local Emergency Medical Service (EMS) systems with a minimum of delay and administrative difficulty, and

with no additional men, money, or aircraft provided.

The substance of this report clearly demonstrates that it is entirely feasible to utilize military helicopters and paramedical personnel to augment local EMS systems. The extent to which the military capability made an effective contribution varied with circumstances, as detailed in the report. At one of the MAST sites, military operations were distinctly successful, and the program had a high degree of community acceptance and acclaim. At the other sites, operations were successful, but a lower degree of utilization and public involvement was experienced.

Based upon the experience achieved during the trial period, continuation and expansion of the program to additional sites is recommended. A comprehensive evaluation of the MAST program at the most active site (San Antonio) is being prepared by Ohio State University (OSU), under a DHEW contract. This will be submitted as an additional report when that work has been completed in the next few months.



CONCLUSIONS

1. Although operational experience was limited by the short period of the test program and the limited number of test sites, it demonstrated that the concept of using military helicopters and paramedical personnel in an air ambulance role to respond to civilian medical emergencies is entirely feasible from both the military and civilian viewpoint.
2. The military services possess a significant capability for providing assistance to civilian emergencies in terms of helicopters particularly suitable as air ambulances, trained paramedical personnel, immediate 'round-the-clock response, communications, and related support. This capability does not exist to the same degree in the civilian community at present, owing largely to financial considerations.
3. The type of military aviation unit supporting the MAST operations had no bearing on its capability for conducting air ambulance

operations. The unit's responsiveness to MAST requests, however, was directly related to its primary military mission.

- Army medical air ambulance units are particularly well suited for supporting civilian medical emergencies. Such missions provide realistic training, experience, and motivation for assigned personnel.
- Army tactical aviation units can provide a responsive air ambulance service, but personnel and helicopters must be diverted from training to sustain a continuous effective effort.
- Air Force local base rescue units, although ideally organized and equipped for performing MAST missions, require augmentation to provide full responsiveness for assisting in civilian medical emergencies. This is due to their assigned military missions, and the small number of helicopters and crews authorized/ assigned at each base.

4. Throughout the entire test period, military assistance to civilian emergencies was provided by the supporting aviation units without significant degradation of unit integrity, effectiveness, training, and impairment of their primary military mission.

5. The availability of military resources (aircraft and personnel) and the establishment of the necessary mechanism for responding to civilian medical emergencies does not necessarily ensure that the community will utilize the military capability fully or effectively.

6. Less than full-time capability for response by the helicopter activity tends toward a limited utilization of the service by the community.

7. The degree of utilization of the military helicopters, once a responsive service was established, was not a function of any factors within the military, but was related to factors in the community which were not precisely identified.

8. The local community's emergency medical system must be highly developed and well-organized to fully integrate and make the most effective use of military air ambulances. An adequate emergency medical communication system is vital for making responsive and effective use of military air ambulances. It assures prompt notification, proper coordination, and direct communication between the military and various elements of the emergency medical system.

9. A high degree of acceptance of the MAST program was demonstrated by local government, the general public, the medical and

hospital community, and law enforcement officials. Some degree of reluctance on the part of law enforcement officers to request MAST missions appeared to be a factor which limited the use of military helicopters at some test sites.

10. No additional men, money, or aircraft were required by the military units supporting MAST operations.

11. Costs and operating data from the test program are of limited value to civilian helicopter operators, because the aircraft involved are larger and more expensive to purchase and operate than those presently used for most civilian operations.



RECOMMENDATIONS

1. MAST should be continued as a demonstration program until the Stanford Research Institute Study* is completed and evaluated. Any expansion should be held in abeyance until the overall evaluation of the program is completed.
2. In the selection of additional sites, consideration should be given to those communities where MAST assistance has been requested and where investigation indicates the likelihood of effective utilization.
3. In the development of future MAST projects, adequate time should be allowed for planning, organizing, and disseminating operational procedures. The local emergency medical service should be viewed as a system and participation by all EMS elements, including any civilian helicopter operations, should be encouraged.

*The Department of the Army has contracted Stanford Research Institute to evaluate the operations and marginal costs of MAST alternatives. This study is to be completed by September 30, 1971.

4. The process of implementing a MAST project in a State should be coordinated through the Governor's office, so that operations may be interfaced with civilian emergency services.
5. A cooperative relationship with civilian helicopter operators should be established and maintained to provide for the most effective development of both military and civilian air ambulance operations.
6. Enabling legislation must be secured prior to implementation of MAST as a permanent national program.

INTRODUCTION

The purpose of the MAST program was to test, by actual operation, the feasibility of using military helicopters and paramedical personnel to respond to civilian medical emergencies. This report sets forth the background which led to the implementation of the MAST program; relates the operational experience; makes a judgment as to the feasibility of the MAST concept, from both the military and civilian viewpoint; discusses some cost considerations; and presents a number of conclusions and recommendations for expansion of the MAST program. Because many elements of the MAST operations are being treated more comprehensively in a DHEW supported MAST evaluation study being prepared by Ohio State University, detailed matters are not specified in this report.

It should be recognized that the MAST operational experience was limited both in time and in the number of sites at which the program was conducted. A further limitation was the stipulation that the program was to be undertaken with existing military resources and that no additional men, money, or equipment were to be provided. The time factor is particularly significant, since information obtained from civilian helicopter projects and confirmed by U.S. Coast Guard experience, indicates that *establishment* of a new service does not mean that effective utilization will ensue immediately, or even in a matter of months.



BACKGROUND ON MAST

On August 26, 1969, the Secretary of Defense suggested to the Secretary of Transportation that an Interagency Planning Group, representing the Departments of Defense, Health, Education, and Welfare, Justice, Interior, Transportation and the Office of Emergency Preparedness be established to consider a proposal to use military resources in response to civilian medical emergencies. Of specific interest was the employment of military helicopters and paramedical personnel in responding to highway accidents. In his letter of September 28, 1969, the Secretary of Transportation concurred with the idea of establishing the study group. The Undersecretary of Transportation was appointed chairman. One consideration for having the Department of Transportation chair this effort was that the

Department, through its National Highway Traffic Safety Administration (NHTSA), had funded a number of helicopter air ambulance demonstration projects under the Highway Safety Act. It was also engaged in facilitating the use of Coast Guard helicopters, when available for civilian emergencies through local arrangements between Coast Guard District Commanders and state officials. (Experimentation with the use of military helicopters, communications, and medical personnel for this type activity was also proposed in the Report of the President's Task Force on Highway Safety in December, 1969).

The acronym MAST (Military Assistance to Safety and Traffic) was given to the program and the first meeting of the MAST Interagency Study Group was held on December 11, 1969. At this meeting it was agreed that the general question of how military helicopters and other military resources could be utilized for responding to civilian emergencies would be studied. Four major working groups comprised of members from the participating agencies were established. The first group was to analyze the legal and federal state and local relationships; the second, the command, control and communications aspects; the third, funding and coordination; finally, an executive group was to coordinate the overall operation of the program.

On February 3, 1970, the Interagency Study Group met to consider the work of the several sub-groups and determined that the MAST program would be developed in the following manner: Phase 1 - design of the project and site selection; phase 2 - operations; phase 3 - evaluation; and phase 4 - report and recommendations. DOT, DHEW, and DOD, were each asked to provide a full time working member to undertake the basic program activity. These individuals were designated the MAST administrative staff.

In April, 1970, the MAST administrative staff visited three sites: San Antonio, Texas; St. Louis, Missouri; and Lincoln, Nebraska, representing a regular Army unit, a Reserve unit, and a National Guard unit. In subsequent correspondence between DOD and DOT, it was agreed that the number of test sites should be limited to five, and that initially only active duty military units would be utilized. Accordingly, additional sites at Fort Lewis, Washington, Fort Carson, Colorado, Luke AFB, Arizona, and Mountain Home AFB, Idaho, were selected. The selection criteria used were: the existence of a military capability; a State-government expression of interest in having the military involvement; a rural environment contiguous to adequate medical activity; and different climate and terrain conditions.

At each site, essentially the same procedure was followed. The concept of using the military helicopters and paramedical personnel was presented to the community's medical, public safety, and political

leadership in a meeting organized by DHEW affiliates. An offer was made to make these resources available, if desired, on the basis of a simple project proposal to be prepared and submitted by the civilian and military representatives of the geographical area.

At all sites, the idea was enthusiastically received, proposals were submitted, and upon their approval by the Interagency Study Group, MAST operations were authorized. Operations began in San Antonio, Texas, on July 15, 1970; Colorado Springs, Colorado, and West Central Washington operations began on August 6, 1970; and Phoenix, Arizona, and Boise, Idaho, operations were implemented on September 1, 1970.

At each site, the program was developed by the civilian community working with the military project officer. General requirements were that the helicopters would augment or supplement the local EMS system, not replace any existing elements of it; that the operation would not be directed into downtown or metropolitan areas where ground ambulance services in general would be more responsive; and that the military operations should avoid any competition with operators of air or ground ambulance services. Requests for the helicopter assistance were based upon judgment by responsible medical or public safety officials at the scene of the emergency that the patient's medical condition was serious or life-threatening and required his expeditious transport to a medical facility capable of providing the necessary treatment.



OPERATIONAL EXPERIENCE

From July 15 through December 31, 1970, 182 MAST missions were flown by helicopters from all sites—more than one mission a day. Tabulations of the operating data is set forth on the following page. Operating procedures are presented in the site reports. Basically, operations employed military helicopters in an air ambulance role. No law enforcement, surveillance, or other related functions were undertaken. Responses to missions were based solely upon a judgment by responsible medical or public safety officials that a serious emergency existed. Some 48% of those patients assisted were highway accidents victims. Seventy-two percent of the missions flown were inter-hospital transfers generally involving a patient who had been initially taken to a local hospital, where it had been determined that he required transfer to receive more definitive medical treatment. (Because of the program's accomplishments, operations at all five sites are being continued. As of August 22, 1971, 553 missions have been flown and 718 persons assisted.)

The data below compares the MAST test operations with two civilian helicopter medical projects funded by the NHTSA. The total number of missions flown during similar periods of operations is roughly of the same order of magnitude. Although a number of factors would have to be taken into account to draw any useful conclusions from this comparison, it is interesting to note that the average number of patients evacuated per mission is approximately the same (1.3) for the projects. This tends to support the conclusion from previous studies that helicopters used for responding to civilian medical emergencies should be capable of transporting two patients simultaneously.

<u>Project</u>	<u>Missions</u>	<u>Patients</u>	<u>Hours</u>	<u>Average Number Patients Per Mission</u>
MAST				
4-6 months (5 bases)	182	249	290	1.3
AMES				
6 months (1 base)	171	225	306	1.3
CARE-SOM				
6 months (3 bases)	239	332	195	1.4

The following data shows the wide variation in the number of missions flown in the five MAST areas.

<u>MAST Unit</u>	<u>Missions</u>	<u>Patients</u>
FORT SAM HOUSTON	114	138
FORT LEWIS	34	44
FORT CARSON	25	45
LUKE AIR FORCE BASE	5	18
MOUNTAIN HOME AIR FORCE BASE ..	4	4

MAST OPERATING DATA
July 15—December 31, 1970

Site	Months of Experience	Number Missions	Hours Flown	Patients Evacuated			Number ² Critical/Serious	Number Non-Critical
				Highway Casualties	Other Medical ¹ Emergencies	Total		
FORT SAMI HOUSTON Texas	5 1/2	114	141.4	86	52	138	82	56
FORT CARSON Colorado	5	26	87	15	30	45	22	23
FORT LEWIS Washington	5	34	41	14	30	44	19	25
LUKE AFB Arizona	4	5	13.2	3	15	18	5	13
MOUNTAIN HOME AFB Idaho	4	4	7.5	0	4	4	3	1
TOTAL		182	290.1	118	131	249	131	118

^{1/} Includes heart attacks, gunshot wounds, accidental injuries, illness, premature infants, burns, etc.

^{2/} Patients admitted to hospitals in critical or serious condition, as recorded in admission reports

MAST OPERATING EXPERIENCE
July 15-December 31, 1970

Data Elements	San Antonio Texas		Colorado Springs Colorado		West Central Washington		Mountain Home Idaho		Phoenix Arizona		TOTALS
	7/15/70	8/6/70	8/6/70	9/1/70	8/6/70	9/1/70	9/1/70	9/1/70	9/1/70	9/1/70	
MISSIONS											
Total Number	114	25	25	34	34	4	4	5	182		
Day	56	20	20	21	21	3	3	3	103		
Night	58	5	5	13	13	1	1	2	79		
Average time per mission	1 Hr 12 Min	3 Hrs 30 Min	3 Hrs 30 Min	1 Hr 12 Min	1 Hr 12 Min	1 Hr 54 Min	2 Hrs 36 Min	30 Min			
Average time to lift off	2 Min	20 Min	20 Min	6 Min	6 Min	48 Min	30 Min	30 Min			
Average time to pickup site	27 Min	52 Min	52 Min	29 Min	29 Min	1 Hr	6 Min	30 Min			
Average time from pickup to hospital	24 Min	1 Hr 11 Min	1 Hr 11 Min	25 Min	25 Min	36 Min	36 Min	30 Min			
Average distance to pickup site	48 Miles	62 Miles	62 Miles	38 Miles	38 Miles	62 Miles	62 Miles	30 Miles			
Aborted missions	6	2	2	3	3	6	6	0	17		
Weather	0	0	0	2	2	0	0	0	2		
Other	6	2	2	1	1	6	6	0	15		
HOURS FLOWN											
Total number	141.4	87	87	41	41	7.5	7.5	13.2	260.1		
Day	66.4	70	70	24	24	4.2	4.2	6.6	171.2		
Night	75	17	17	17	17	3.3	3.3	6.6	118.9		
PATIENTS											
Total Number	138	45	45	44	44	4	4	18	249		
Day	67	37	37	25	25	3	3	6	128		
Night	81	8	8	19	19	1	1	12	121		
Critical	62	22	22	19	19	3	3	5	131		
Non-critical	56	23	23	25	25	1	1	13	118		
Dead on arrival	4	0	0	1	1	0	0	0	5		
Died after admission	2	4	4	1	1	0	0	1	8		
Type of Patients											
Highway accident	86	15	15	14	14	0	0	3	118		
Inter-hospital transfer	111	20	20	0	0	0	0	0	131		
Premature infant	4	5	5	2	2	0	0	0	11		
Hoist	1	0	0	0	0	1	1	3	5		
Other	62	5	5	30	30	4	4	15	106		
Hospitals with helipads	18	4	4	5	5	4	4	5	36		

Considerable attention was directed to determining the causes of the significant disparity between the various projects. Obviously, the projects were located in varying population bases as to number, distribution, and urban/rural configuration. Each area had emergency medical systems with elements which varied in number and capability. However, other less tangible factors are believed to be of greater relevance.

The relatively low mission activity at the two Air Force sites is partially attributed to the inability of the local base rescue units, as presently constituted, to maintain a 'round-the-clock, immediate response capability because of the limited number of helicopters and crews and the nature of their primary military mission. The test program was to determine the feasibility of using military resources in varying circumstances. Intuitively, one might expect that even with only a part-time availability, MAST services would experience a high demand. While operations were limited, the data indicates that a part-time response capability will not be effectively utilized. This factor was confirmed in discussions with several responsible law enforcement officials.

The relatively high mission activity at San Antonio is attributed to a fortuitous combination of many factors. These included a large metropolitan area, a full-time medical company conducting the MAST operations, good command-level support, effective local planning and organization, favorable terrain and weather conditions, cooperating hospitals with helicopter-landing facilities, and an unusually high degree of active and favorable publicity concerning the program. During the first days of MAST operations, a mission was flown which was credited with saving a youth's life. This incident became front-page news, and the program was off to a flying start. Location of the MAST unit in San Antonio proper—a city where the military enjoys a close and favored association with the community—appeared to be a real, although intangible, reason for the obvious success of the project.

The reasons for the limited operational activity in Washington and Colorado are similar. MAST operations were conducted by regular Army tactical units located contiguous, but not central, to a populous metropolitan area. They did not enjoy the homogeneous political and operating area that characterized San Antonio, and were not as closely located to centers of emergency medical service. Some reluctance was expressed in both project areas to commit community resources and attention to a program which was recognized as a demonstration, with no assurance of its continuation. Established patterns in local emergency care systems were not dramatically altered by MAST. Reluctance to request military assistance was understandably generated following the loss of one helicopter and crew of four from Fort Lewis while making an approach on a MAST mission. Law enforcement officials felt responsible for the accident, and were reluctant to request

further MAST missions. Weather conditions caused some aborted missions, and this probably raised some doubts as to the legitimacy of requesting MAST missions.

The location of the helicopters, away from population centers, and a limited public awareness of MAST activity in Washington and Colorado influenced the lower utilization of the service at these sites. Although considerable effort was made by the military and civilian project personnel to sell the program, no significant increase in mission activity has been noted. Taking all factors into consideration after extensive discussion with both military and civilian project representatives concerned, *definitive causes of the lower utilization at these sites were never fully and satisfactorily established.* The military unit never failed to respond, except in those weather conditions cited. The simple fact is that fewer requests were received than would have been expected.

No major difficulties were encountered during the test phase of the program that would affect the establishment of MAST projects in other locations. Communications between the helicopter and civilian EMS elements— public safety and medical—could have been greatly improved with more adequate equipment, but this inadequacy did not significantly hamper operations. The program essentially tested only the feasibility of the military involvement and did not feature any new techniques or exotic procedures. It was a simple operation requiring intensive community support, organization, and selling. Operating procedures must be simple, well-understood, and thoroughly disseminated.

MEDICAL EVALUATION

An attempt has been made to evaluate the medical justification of calling for a MAST mission rather than depending on available ground ambulance transportation and personnel. The decision to call for a MAST mission was sometimes made by physicians, especially in the case of hospital transfer. It is not prudent to question the decision of a physician at the scene of a medical emergency that he and the medical facilities available are not adequate to care for a patient and that rapid, i.e., MAST evacuation of the patient to a major treatment center is necessary. In other instances (especially at the scene of an accident or acute illness), the decision to call for a MAST mission is made by a law enforcement official.

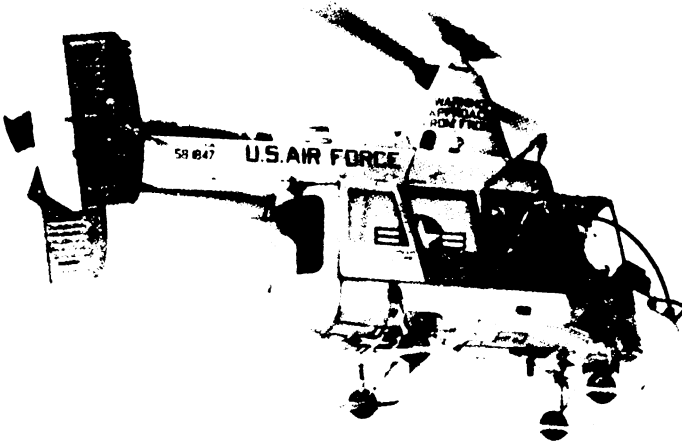
The medical evaluation in large part answers the questions: how often were the missions justified on a basis of severity of the patient's condition, distance (measured in time for ground transportation), isolation of the site, or combination of these factors?

The mission reports were reviewed for the following four sites: Fort Lewis, Washington; Fort Carson, Colorado; Mountain Home AFB, Idaho; and Luke AFB, Arizona. Since a contract has been awarded to Ohio State University to conduct a detailed evaluation of the Fort Sam Houston, Texas, test site, no attempt was made to evaluate the missions from that site. The objective of the MAST program was to test the feasibility of using military helicopters and personnel for evacuating civilian medical emergencies. Evaluation of the medical justification of utilizing this form of rapid patient transportation was not a major goal of the test project. It should be noted that the reporting forms used were adapted from another project and did not lend themselves to facilitation of medical evaluation. Regrettably, the patient's condition upon arrival at a major treatment center and the subsequent course of his illness were not documented by physicians in most instances.

It should also be pointed out that some unnecessary calls are justified when law enforcement officials are placed in a position of making a medical decision. In the interest of the patient, the error should always be in the direction of calling for the MAST mission.

At the four sites, fifty-six flights were evaluated on which one or more patients were transported. A total of seventy-three patients were transported on these flights. Of the fifty-six flights, a total of forty-six were judged to be justified on a basis of the condition of one or more of the patients transported, distance from a treatment facility (measured in time required for ground transportation), isolation of the site, or combinations of these factors. Of the forty-six flights, fifteen were justified in large part by the remoteness of the pick-up site, although many of these patients were severely ill or injured. On six

flights, there was insufficient patient information available on which to make a judgment. On four flights, the mission apparently was not justified. Of these four flights, one was for a liver transplant patient, one was for a child with convulsions, one was for a patient with a gunshot wound of the lower leg, and one was for a young woman with acute bronchitis who was apparently not in severe respiratory difficulty. It is felt that ground transportation would not have deleteriously affected these patients.



FEASIBILITY OF MAST—MILITARY ASPECTS

The limited MAST experience demonstrated that the concept of using military helicopters and paramedical personnel to respond to civilian emergencies is operationally feasible. Further, it proved desirable from the standpoint of training and motivation for the medical unit in particular. Aeromedical evacuation procedures developed for combat situations are readily transferrable to civilian applications. Public acceptance of the concept was clearly established and reflected most favorably upon the military.

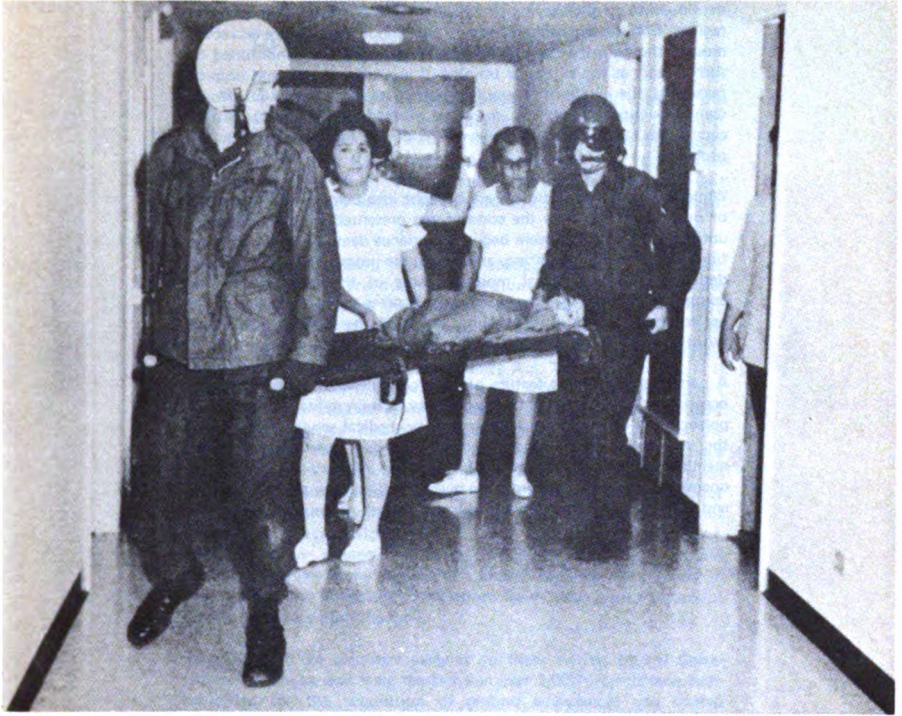
Although the military has traditionally responded to civilian emergencies, this assistance has previously been rendered on an individual, local, "ad hoc" basis with no prearranged plan or procedures. MAST built upon this background by providing an authoritative sanction and mission. It brought together military and

civilian authorities and provided efficient procedures to make the military contribution rapid and effective. Feasibility, from the military viewpoint, was established by the fact that MAST missions were successfully carried out by regularly constituted military units with no additional resources committed to the program. While men and aircraft were, in varying degrees, dedicated to the MAST missions, at no site did MAST operations exceed the regular flying time programmed for the supporting aviation unit. The MAST mission did not significantly detract from the basic military mission, although the measures taken by the tactical aviation units to maintain the response capability necessary for a satisfactory service did represent some diminution of unit training.

By the nature of their mission and orientation, Army medical air ambulance units are particularly effective in supporting the civilian EMS, as evidenced by the distinct success of the San Antonio project. Based upon extensive discussion with unit personnel, MAST missions flown by the 507th Medical Company had no degrading impact on either unit training or operations, and by their very nature provided realistic training experience and motivation for 507th personnel.

Army tactical units, while more limited by the constant demands of their training mission, can also respond to civilian emergencies effectively. To provide the necessary instant response capability, however, helicopters and personnel must be diverted from "line" training activity. It may be necessary to augment these tactical units with additional aircraft and personnel, as well as to recognize MAST type activity as part of the unit mission, if they are tasked to provide responsive air ambulance support to the civilian community. *MAST operations were a "natural" for the medical company, but an "add-on" for the tactical units.*

Military priorities and the small number of helicopters and crews severely minimized the effectiveness of the two Air Force projects. The Air Force sites did not have the capability for immediate, round-the-clock response, and this operated to the detriment of these projects. At one site, after having experienced what seemed an inordinate response time, the law enforcement officials understandably were reluctant to rely upon the service, even though response at other times would have been satisfactory. Although the operations conducted were quite successful and were undertaken with vigor and enthusiasm by the units involved, the experience confirmed what had been noted in civilian projects sponsored by NHTSA, namely, that less than full-time, round the clock capability is not accepted as a responsive service by the local EMS system. Because of their primary mission of local base rescue, and the size of the aviation activity, this type of unit cannot provide the immediate response needed to achieve the degree of utilization and acceptance experienced elsewhere.



FEASIBILITY OF MAST—CIVILIAN VIEWPOINT

The feasibility of MAST from the civilian viewpoint is shown by the testimonial material in the Appendices and, also, by the specific requests for MAST by other communities. The medical evaluation will also support the feasibility of augmenting the civilian EMS system with military helicopters. Discussion with medical and public safety officials in the MAST communities confirmed the public recognition of need and feasibility of the MAST concept.

The effective utilization of the military resources was directly influenced by the proficiency, organization, and leadership of the civilian EMS systems they supplemented. Experience indicated that no one system design or operating procedure could, or should, be

developed to fit the varying circumstances of different communities or regions. EMS system capabilities vary tremendously in nature and scope around the country. Success of MAST operations is conditioned by such factors as the extent of training of law enforcement and hospital personnel, the extent of community awareness and information efforts, communications capability, the type of medical facilities and their capabilities, and the active involvement of the local leadership in the program.

While the MAST operations were brought into being with a minimum of delay from the time the concept was presented to the community until flying operations were begun, experience demonstrated that more time for planning, organizing, and selling the program would have been desirable. Involvement of more elements of the local or regional communities might have been achieved. It takes time to implement and perfect basic operating procedures at all of the working levels and jurisdictions in the areas which encompass MAST activities.

A particularly desirable feature of the program was that it provided the occasion at some sites for the community to train military paramedical personnel in civilian aspects of emergency medical service. Conversely, the military had the opportunity to conduct briefings and train members of the civilian community in the military aspects of the operation. By such measures, the overall EMS system derived benefit, and closer and more desirable working relationships resulted.

MILITARY AND CIVILIAN HELICOPTER CONSIDERATIONS

The MAST concept was immediately accepted by local officials and the general public at all sites. The only objections to MAST were presented by private helicopter operators associated with the Helicopter Association of America (HAA). MAST was viewed by the private operators and HAA as an "encroachment" by the Federal Government and the military into what they consider to be the domain of private enterprise.

In present circumstances, the military capability—adequate helicopter air ambulances, trained paramedical personnel, immediate, round-the-clock response time, communications and support—simply does not exist to the same degree in the civilian community. The NHTSA funded five demonstration projects utilizing civilian helicopters under Section 403 of the Highway Safety Act. This type of activity is relatively costly, and few communities are able to justify or support helicopter air ambulance service against a background of other urgent needs in emergency medical services. Under Section 207 of the Highway Safety Act, the States estimated their own needs to achieve the performance levels of the Highway Safety Program Standard on Emergency Medical Services. These estimates totalled \$209,000,000 for FY '72 alone. Emergency Medical Services suffer deficiencies of this magnitude nationwide, and in such basic areas as training, communications, ground ambulance service, etc. Inadequate ground ambulance service alone represents a serious problem, particularly in rural areas where financial considerations have driven great numbers of private purveyors from the field.

Some idea of the priorities assigned to these matters by the States themselves can be seen from the fact that over 1,000 projects have been submitted for the acquisition of ground ambulances and related expenses under the matching-fund programs of Section 402 of the Highway Safety Act. During the same period, only four projects for helicopters in EMS were funded, and one of these involved National Guard aircraft and flying personnel. None is currently being funded. Creation of a responsive civilian air ambulance service alone would be a financial impossibility, even for communities of some size; the economic basis for the operation would generally have to be developed for multifunctional use of the aircraft and personnel. A discussion of civilian air ambulance operations is presented in the Appendices.

When MAST was undertaken, the Secretary of Defense indicated that the experience gained was to be made available to the civilian sector so that helicopter operators might be assisted and encouraged. Increasing

interest in the versatile capability of helicopters heightened by the federally-funded projects, the increasing availability of more suitable helicopters, the trend toward concentration of medical facilities in metropolitan areas, and diminishing rural ground-ambulance service are factors which indicate civilian air ambulance operators have a promising future. Under present financial circumstances, however, and in the light of 56,000 annual highway fatalities alone, the military capability should be utilized where it can contribute effectively, while at the same time civilian operations should be encouraged and assisted as practicable. These considerations have been discussed with the Helicopter Association of America, and continuing efforts should be made to foster civilian air ambulance development.

COST CONSIDERATIONS

MAST operations conducted during the test period did not receive any additional funding from any of the services or agencies involved. All missions flown by the aviation units involved were accommodated in their regular flying operations as aviation training.

Costs associated with the MAST operation are of limited relevance and utility to the civilian community, since helicopters designed for the military mission are larger and more costly than those ordinarily feasible and employed in civilian applications. The only significant costs that can appropriately be assigned to MAST operations are those related to the direct operating costs of the helicopters and salaries of aviation crew members. (Even here, it must be recognized that flight operations would ordinarily have been flown for training had there been no MAST missions.) Fixed costs of acquisition, depreciation, hull and liability insurance, hangar fees and administrative costs, all of which are major factors to civilian operators, have no direct application to the military case.

Should MAST be continued or expanded on a regular basis, it would be desirable to identify costs that can realistically be associated with MAST. This data is set forth in the Appendices.

LEGAL ASPECTS

Local commanders are presently authorized to provide assistance to any individual in a serious emergency when other means of transport are not available, feasible, or adequate (AR-500-60 and AFR 76-6). Since the program was undertaken as a pilot project, no fundamental legislative or administrative measures authorizing permanent operation were necessary and none have been put forth.



FUTURE ACTIVITY

The capability of helicopters in Emergency Medical Service systems and the feasibility of using military resources has been clearly seen in MAST. Continued experimentation with these concepts is justified on the basis of accomplishments to date, and has been recommended by such authorities as the National Advisory Commission on Health Manpower in 1967 and the President's Commission on Highway Safety in 1969. The MAST program is consistent with the objective of the President's Health Message to Congress in 1971 which discusses—among other matters—the need to provide health care in rural and outlying areas.

The clearly successful operation at San Antonio demonstrates what MAST can accomplish under the best circumstances. Operations at other sites, while certainly beneficial, showed a significantly lower degree of utilization. This presents a real question as to whether dedication of the helicopters and military personnel necessary to

provide the instant response ('round-the clock'), by which the benefits of the system can most effectively be realized, is adequately justified to fly about one mission per week (Fort Lewis and Fort Carson).

The potential of MAST was demonstrated at San Antonio, but was not realized to the same degree at other sites. Inconclusive causes were adduced for this lower utilization. A sensible course would be to advance the MAST concept to selected additional sites—to find other San Antonios— rather than to undertake a broader national program until the determinants of a well-utilized program emerge more clearly.

Another factor which argues for a gradual, rather than an all out, program is the desirability of encouraging civilian operations.

The testimonial material in the appendices illustrates the acceptance of military assistance by the civilian community. For this reason alone, it would be desirable for all the Services to become involved in MAST operations.

The initial program was undertaken with active duty aviation units only. National Guard and Reserve components, however, are now beginning to receive more adequate helicopters (UH 1D) and qualified personnel, and it seems likely that an effective contribution could be made if a responsive service were established. A proposal for arranging National Guard active duty training time so as to provide a full time response is presented in the Appendices. National Guard or Reserve units, with their close association in the community, might influence the utilization of MAST at some sites.

In the future, it seems likely that the capabilities of the helicopter will find increasing application in air ambulance roles, as well as in other functions. A limited expansion of the MAST operation is recommended as the next step in advancing air ambulance operations. Comprehensive planning for broader expansion of the program appears warranted by the potentialities already seen.

It seems reasonable to assume a role exists for both military and civilian operations. A proposal for a national approach using military or civilian helicopters is contained in the Appendices. This type of planning is recommended under sponsorship of the Interagency Study Group while MAST operations continue.

Future MAST projects should be coordinated through the Governor's office to insure the military assistance is integrated with civilian EMS projects supported by the Departments of Transportation, and Health, Education, and Welfare and, also, Civil Defense.

As previously indicated, operations at the five project sites are continuing, pending a final evaluation of the overall program and a decision as to future military involvement in MAST-type activities. Since January 1, 1971, there has been a significant increase in the number of MAST missions flown by the supporting aviation units at Fort Carson, Colorado and Fort Lewis, Washington. Through August 22, 1971, Fort Carson has accomplished 129 evacuations involving 173 seriously injured or ill civilian patients; Fort Lewis has flown 108 missions evacuating 123 patients.

The increased activity at both sites is attributed to an extensive educational program concerning all aspects of MAST which is being conducted on a continuing basis by the civilian and military officials participating in the two projects. This has resulted in the more direct involvement of representatives from all elements of the local EMS system as well as other public officials, concerned with using the military capability. Although the Fort Sam Houston, Texas site was considered to be the most successful project during the test period, the projects at Fort Carson and Fort Lewis are now operating with equal effectiveness.

In August 1971, both Luke AFB and Mountain Home AFB received additional aircraft and crew, enabling them to respond to MAST requests on a round-the-clock basis. This increased military capability should result in more effective operations at both sites.

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**Health Services and Mental Health Administration
Regional Medical Programs Service**

MAST

A COOPERATIVE PROGRAM OF:
 DEPARTMENT OF TRANSPORTATION
 DEPARTMENT OF DEFENSE
 DEPARTMENT OF HEALTH
 EDUCATION AND WELFARE

**Interim Planning Guide
 Military Assistance to Safety and Traffic
 (MAST)**

1. Introduction

Purpose: The purpose of this outline is to specify the procedures and define the criteria for implementing MAST operations in selected communities that have expressed an interest in establishing a MAST project where a military capability exists and where an air ambulance service can be effectively utilized. The word "community" in this outline includes all political subdivisions within the proposed MAST operating area.

Concept of Operations: The MAST concept supplements the existing emergency medical service system by providing for military helicopters configured as air ambulances, crew members, medical equipment, and supplies to be maintained in a state of readiness to respond efficiently and effectively to serious civilian medical emergencies. Serious medical emergencies are defined as situations where an individual's condition requires that he be air-evacuated to a medical care center as soon as possible to prevent his death or the aggravation of his illness or injury. The decision to request a MAST helicopter is based solely on the judgment of the law enforcement officers, physicians, or other responsible persons such as public safety officials at the scene of the emergency.

In addition to responding to serious medical emergencies resulting from highway accidents, MAST units also will respond to gunshot wounds, heart attacks, farm accidents and similar emergencies. As examples, inter-hospital transfer of patients, premature infant transfer, pick-up and delivery of blood, medicine, and human organs for transplant also are considered valid MAST operations. The evacuation of non-critical patients from remote or inaccessible areas where ground transportation is not feasible or practicable may be accomplished by military air ambulances when requested by an appropriate official.

2. Responsibility

The Departments of Defense, Transportation, and Health, Education and Welfare are jointly responsible for overall policies, implementation and operation of the MAST Program. Duties related to the MAST Program will be assigned as follows:

a. The Interagency Executive Group; composed of members from the Departments of Transportation, Defense, Health Education, and Welfare, Interior, Justice, and the Office of Emergency Preparedness; will act as the final decision authority in all MAST activities.

b. The Interagency Coordinating Committee, composed of one member from each department, will report to the MAST Interagency Executive Group and serve as the administrative staff to the Executive Secretary of the Interagency Executive Group. Each member shall be responsible individually to the senior member of the MAST Interagency Executive Group who represents his department.

c. Local MAST Coordinating Committee, composed of individuals representing the providers of emergency medical services (EMS) in the geographic areas served by the MAST Project will be responsible for local MAST operations and coordination. This coordination will be performed on a day-to-day basis by a civilian coordinator appointed from the committee and a military officer assigned from the local military base. Committee composition may vary according to local needs.

3. Considerations

Military Resources: The locations of military units possessing sufficient potential resources for supporting MAST operations will be determined by the department possessing the resources. No military unit will be relocated solely to provide MAST support. At the present time, the only regular military units authorized for participation in the MAST program are U. S. Army aero-medical units and U. S. Air Force Aerospace Recovery and Rescue detachments.

Civilian Resources: At the present time, only a limited civilian air ambulance capability exists comparable to that available to the military services. In many rural and isolated areas demographic constraints restrict adequate ground ambulance operations. Civilian medical capability for treatment of critically injured is generally centered in metropolitan areas.

Funding: Initially, only aero-medical and Air Force Aerospace Recovery and Rescue detachments will participate in the MAST Program. As experience is gained, it may be possible to include non-medical helicopter units. Enabling legislation will be required and must contain provisions for reimbursing the DOD for the marginal cost of conducting MAST operations in the latter case. Non-military resources for conducting MAST activities will be provided by the civilian community.

4. Site Selection

Responsibility: The MAST Interagency Coordinating Committee is responsible for selecting and evaluating prospective sites where MAST support has been requested.

Initial Requests: Initial requests for MAST support will be directed to the Executive Secretary of the Interagency Executive Group.

a. The civilian department's representatives on the Interagency Coordinating Committee will screen requests to insure:

- (1) Requests are non-competitive with private enterprise.
- (2) Local EMS system is able to utilize MAST.
- (3) Proper coordination is effected with state officials concerned with emergency medical programs.

b. The Department of Defense representative will screen the request for availability of suitable military resources.

Upon notification that the prospective site has met Department of Transportation, Department of Health, Education and Welfare and Department of Defense criteria above, the MAST Interagency Coordinating Committee will meet with the requesting community EMS leaders and the local military commander(s). This meeting will allow the detailed explanation of MAST concept and program criteria prior to final submission of a community proposal. During this meeting, it will be made clear to the responsible community officials that, in the event of a military contingency, MAST operations may be discontinued with little or no advance notice. Similarly, emphasis will be placed on the fact that military support must not compete with private air or ground ambulance service. Military support is intended to supplement the services of those agencies.

Criteria - Military: Adequate military resources for supporting MAST operations must be available within the proposed operating area. Primary missions of supporting military aviation units will take precedence over MAST requirements.

Criteria - Civilian: The civilian community must submit a plan which demonstrates its capability to utilize the military resources as an adjunct to the existing civilian emergency medical services system. The community also must be willing to provide the necessary civilian communication equipment (including maintenance) to enable the military aircraft to communicate with the various elements of the civilian EMS system.

Demonstration of Need: Community requests must contain evidence documenting the need for MAST support, and a comprehensive plan for effective utilization of air ambulances.

Resources - Military: Supporting military units must have a sufficient number of aircraft adequately equipped to support MAST missions, and sufficient personnel trained to deliver the appropriate level of emergency medical care without compromising primary military mission and effectiveness.

Resources - Civilian: The civilian community must have a major medical facility within the proposed operating area. The facility must be equipped and staffed to provide the required medical support. The community also must present evidence of cooperative agreements between all components of the civilian emergency medical service system. These components must be equipped and staffed to provide the necessary support to the MAST Program.

Area of Operation: MAST operations should be conducted primarily in non-urban areas extending outward 80-100 miles from the supporting military base. Projects will not be approved for communities where a civilian helicopter operator has established an effective air ambulance service equipped and staffed to provide the required level of medical and operational support.

Civilian Education and Public Information: A civilian education and public information program must be implemented to assure full utilization of MAST potential. Explanation of the purpose, capabilities and limitation of the project should be made through all forms of news media, civic groups, and professional organizations. Individual and collective accomplishments of the project should be given timely release to these same groups. Continuing orientation and training programs must be conducted to familiarize civilian personnel with MAST procedures. These activities will be the responsibility of the local MAST coordinators.

Communications: The civilian community must provide the communications equipment necessary to alert the military support unit, provide enroute and pickup-site information and guidance, and permit consultation with the destination hospital. The military unit will be responsible for installation of community-provided communication equipment in military aircraft. The community retains all maintenance responsibility for this communications equipment. Communication capabilities should provide direct linkage between the participating hospitals, helicopters, highway patrol, ground ambulances and military communication centers for MAST operations.

Local MAST Coordinating Committee: The local MAST Coordinating Committee shall be composed of individuals representing the emergency medical services in the geographic area served by the MAST Project. This committee will generally consist of representatives from the local military base, ambulance services, medical society, hospital association, health department, civil government, law enforcement, and other appropriate health-oriented organizations. The committee will be responsible for preparing the MAST project proposal and operating plan and for coordinating all MAST activities necessary for planning, implementation, operation, and evaluation of MAST operations. In the preparation of the MAST project proposal and operational plan, the committee will coordinate its actions with the recognized local EMS coordinating councils or committees located within the MAST operating area.

One civilian member of the local MAST Coordinating Committee will be designated as the civilian MAST coordinator. This individual will be responsible for directing and coordinating all non-military aspects of the project on a day-to-day basis.

A military officer from the supporting base will serve as a member of the local MAST Coordinating Committee and will be responsible for coordinating all military activities concerning the project.

- Training: A continuous training program will be conducted for all military and civilian personnel participating in MAST operations. Training courses will relate to flight operations, capabilities and limitations of military helicopters, loading and unloading procedures, safety precautions, use of emergency and special medical equipment, communications, and procedures for administering emergency medical treatment. Medical training of military corpsmen will be monitored to ensure maintenance of not less than the minimum level of proficiency recommended by the National Academy of Sciences in the Basic Emergency Medical Technician-Ambulance training course published by the Department of Transportation.

Reporting System: There will be a reporting system which permits central recording of necessary information to document and permit evaluation of the MAST Project. For this purpose uniform forms and procedures will be established by the MAST Interagency Coordinating Committee.

5. Evaluation and Approval

Local: Procedures must be prepared and implemented to ensure adequate review and evaluation of the medical treatment and transportation of each MAST patient. This should include the care provided by both military and civilian personnel. Findings and recommendations resulting from this review and evaluation will be communicated to all personnel involved in the care and support of each patient.

National: Site evaluation visits by the MAST Interagency Coordinating Committee or its designated representatives will be conducted on either an announced or unannounced basis. Participation in a MAST Project will not reduce the requirement for the communities involved to provide a high quality EMS system. It should be clearly understood that MAST will augment but not replace any element of the existing or planned emergency medical service.

Site Approval and Implementation Procedure:

Upon receipt of a proposal for establishing a MAST Project from a community, the MAST Interagency Coordinating Committee will review it to ensure that it conforms with the criteria set forth in the preceding paragraphs.

The proposal will then be forwarded by the Executive Secretary to the members of the MAST Interagency Executive Group for their departmental review and comment. All departments concurring, the proposal will be forwarded by the MAST Executive Secretary to the chairman of the MAST Interagency Executive Group for action. The MAST Interagency Executive Group then will review and approve or disapprove the request. If approved, a letter of agreement will be sent to the chairman of the local MAST coordinating Committee in the proposed operating area. The letter of agreement will contain a proposed date for project implementation and the procedures to be followed to achieve this objective. The Secretary of the appropriate Department will take necessary action to implement the project. If disapproved, the chairman will notify the local MAST Coordinating Committee of the decision.

Civilian Air Ambulance Operator Involvement:

In the event a private helicopter operator possessing the necessary equipment and trained personnel to conduct air ambulance operations desires to become a part of the local emergency medical service program, it will be the responsibility of the civilian element of the local MAST Coordinating Committee to evaluate his resources and capability. Based on this evaluation, the committee will determine if the private air ambulance operator should be integrated with or replace the MAST Project.

If combined military and civilian operations are desired by the committee, a joint agreement specifying the nature of support to be provided by the military and private air ambulance operator must be negotiated. This proposed agreement will be forwarded to the MAST Interagency Coordinating Committee for review and approval or appropriate action.

In the event the local MAST Coordinating Committee determines that military assistance is no longer needed, a notice will be forwarded to the chairman of the MAST Interagency Executive Group who will, in conjunction with members of his committee, terminate the Project MAST site. A letter of termination indicating the date operations will be discontinued will then be sent by the chairmen of the MAST Interagency Executive Group to the local MAST Coordinating Committee and the Departments represented on the MAST Interagency Executive Group.

Community Check List

1. Study the Planning Guide for MAST and make initial determination:
 - a. that your community is capable of meeting the criteria, and
 - b. that proper military support is possible in your area.
2. Inform individuals and organizations, which could be represented in the prospective Local MAST Coordinating Committee, about the MAST program; its benefits, responsibilities, and limitations.
3. Hold an exploratory meeting of the prospective Local MAST Coordinating Committee in order to determine whether or not all necessary organizations within the proposed MAST operating area are willing to work together to improve the Emergency Medical Services within your area, and supplement this service with a MAST project.
4. Send an initial request from a responsible official to the Executive Secretary, MAST Interagency Executive Group in care of;

National Highway Traffic Safety Administration 42-15
400 7th Street, S.W.
Washington, DC 20590

In this request indicate:

Who may be contacted as spokesman for the requestor,
What organizations will be represented on the local committee,
What local, regional or state EMS planning groups will assist, and
Identification of the need for a MAST project in your area.

Also, attach to the request, statements reflecting the possible concern for competition from a MAST project by representatives of air and/or ground ambulance services.