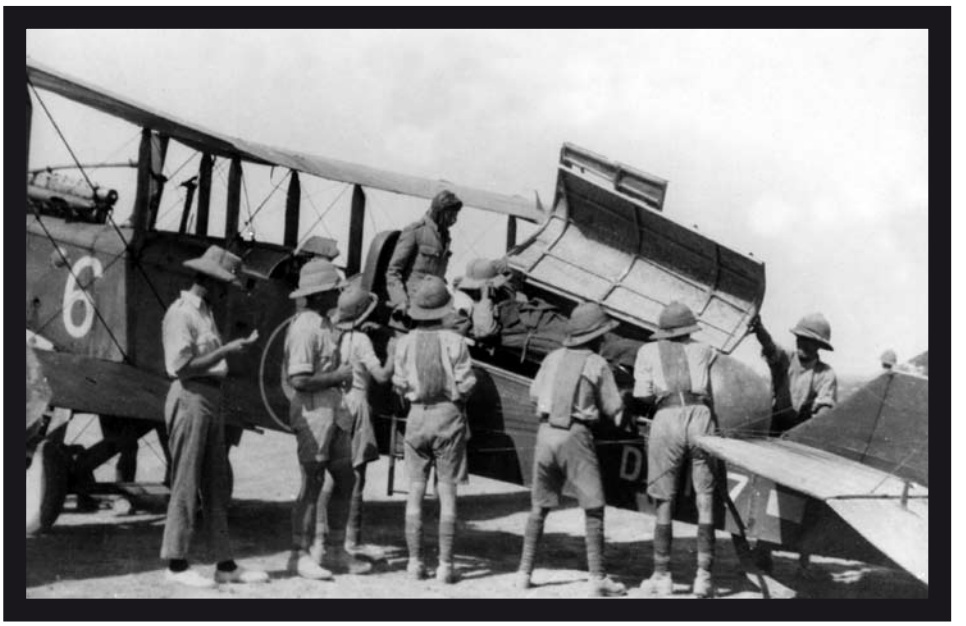


An early example of casevac: a wounded soldier is placed aboard a specially converted DH9, 1919

A History of military Aeromedical Evacuation

By Flt Lt Mary Hudson

'I am becoming increasingly alarmed by the air-mindness of the RAMC and their tendency to usurp RAF functions or make extravagant demands upon our resources'[1]
RAF DGMS 17 November 1960

'*Our primary casualty retrieval is excessively slow. A simple casevac request has to go to too much 'middle-management" before a flight decision is made. In Vietnam, wounded soldiers arrived in hospital within twenty five minutes of injury. In Iraq in 2005, that figure is over one hundred and ten minutes. We use support or anti-tank helicopters that are re-roled on an ad hoc basis for the critical care and transport of our sickest patients. We still do not have a dedicated all-weather military helicopter evacuation fleet…'*
Lt Col P Parker RAMC June 2007[2]

In June 2007 an article in the Journal of the Royal Army Medical Corps was seized upon by the worldwide media and lawyers representing wounded soldiers as evidence that lives of British casualties in Iraq and Afghanistan were at risk because of inadequate helicopter casualty evacuation (casevac) arrangements.[3] The issue of dedicated casevac helicopters was raised again. A Sunday Times article in November 2007 claimed that German casevac helicopters had refused to fly at night, hampering Operation DESERT EAGLE and leaving Norwegian and Afghan forces, which they were covering, unsupported.[4] This article results from an interest sparked by the renewed debate and looks at the development, provision and use of aeromedical aircraft, focusing on the development and resourcing of air evacuation. It does not consider the development of associated medical techniques.

Post-war, a clear divide developed between casevac (the emergency evacuation of a casualty from (or near) the point of wounding to adequate medical care) and medevac (the transfer of patients, already under medical care, to another medical facility). Just to confuse the issue US forces have different definitions and a different approach to casevac. They opt for a 'scoop and run' approach focusing on the speed of transfer and opting for inflight stabilization of the casualty. British casevacs are primarily from a Role 1 or Regimental Aid Post to a Role 2 hospital but in Iraq and Afghanistan there has been an increasing demand for US-style 'scoop and run". US military air ambulances do not carry doctors but rely on highly experienced Emergency Medical Technicians (EMTs). The US military have dedicated air ambulances for tactical air evacuation but use convertible transport aircraft for strategic aeromedical evacuation.

The UK has no dedicated air ambulances but does include doctors on casevac sorties. British aeromedical policy has traditionally been based on back-load, 'supplies up casualties back", but, in recent conflicts, aircraft have been allocated tactical casevac as a primary task or designated an aeromedical flight such as the VC10 flights from Montevideo to UK during the Falklands War. These different approaches have evolved from the same beginnings.

Early Days
'We shall revolutionize war surgery if the aeroplane can be adopted as a means of transport for the wounded.' French Officer Oct 1913.[5]

Legend states that the first aeromedical evacuation was by hot air balloon during the Siege of Paris in 1870.

Although the claim appears to have its origins in a mistranslation of French documents, the benefits of moving the injured by air were recognised at a very early stage in aviation history. In 1909 two American officers built a military air ambulance using their own money. This aircraft flew in January 1910, but crashed soon after[6] and military attempts to persuade the US Secretary of State for War to invest in aircraft for medical evacuation failed. His decision appears to have been influenced by an editorial in the Baltimore Sun which declared 'the hazard of being severely wounded was sufficient without the additional hazard of transportation by aircraft.'![7] The French military were quick to recognise the possibilities of the use of aircraft for medical purposes. During a French Army exercise in 1912 an aircraft was used to find casualties and relay their location to search parties crawling slowly over the ground. Casualty 'spotting' was the first medical role identified for aircraft.[8]

First World War

During the 1915 Serbian retreat in Albania the French made the first known wartime aeromedical flights, evacuating Serbian casualties using unmodified fighter aircraft.[9] The next year the French government were persuaded to permit the conversion of some Dorland AR II fighters into air ambulances capable of carrying two stretchers internally. Six aircraft were converted, some of which were used, in 1917, to evacuate wounded from battlefields at Amiens.[10] The first recorded British aeromedical flight took place on 19 September 1917 when a soldier with the Imperial Camel Corps was flown out of the Sinai Desert on a DH4. The forty five minute flight saved the trooper an uncomfortable three day journey by camel litter.[11] In Egypt a DH6, modified to a design produced by the RAF Medical Officer, was used for aeromedical flights from August to December1918.[12] However, the major development in medical evacuation during the First World War was the emergence of the motor ambulance not aeromedical aircraft.[13]

Interwar

Civil and military aeromedical aircraft were becoming widely accepted, especially when long distances or difficult terrain were involved. In May 1929 the first International Congress on Sanitary Aviation was held in Paris to which the Air Ministry sent an RAF Medical Officer.[14] On the civil side, faced by vast distances needing cover, the Australian Flying Doctor Service began in 1928. It used a DH50 biplane seconded from the Queensland and Northern Territory Airline Service, now known as QANTAS.[15] Distance also prompted the Americans to take a serious interest in aeromedical evacuation. In February 1918 the US Air Service converted a JN-4 aircraft into the first US air ambulance capable of carrying a patient internally.[16] By the end of 1918 other aircraft had been converted and the aeromedical transfer of patients from airfields to general hospitals by air was promoted.[17] The US Army produced a DH-4 conversion capable of carrying a pilot, two litter patients and, significantly, a medical orderly. Several of these of aircraft were used on the Mexican Border in 1920.[18] The first US contract for military air ambulances was let in 1924.[19] Although the military recognised the advantages of aeromedical evacuation, the War Department was less convinced. It ruled that aeromedical flights were unjustified whilst safer methods of transport

existed.[20] As if to reinforce this view the US Army's prize air ambulance, which could carry four litter patients and six sitting patients, crashed in a severe electrical storm in May 1928, killing all seven onboard.[21] However, the same year, the US Marines successfully used aeromedical evacuation in Nicaragua, lifting patients from isolated jungle posts to general hospitals. These air ambulances were 'front-loaded' with medical supplies, the first time an air ambulance was utilized on both the inward and outward flights.[22]

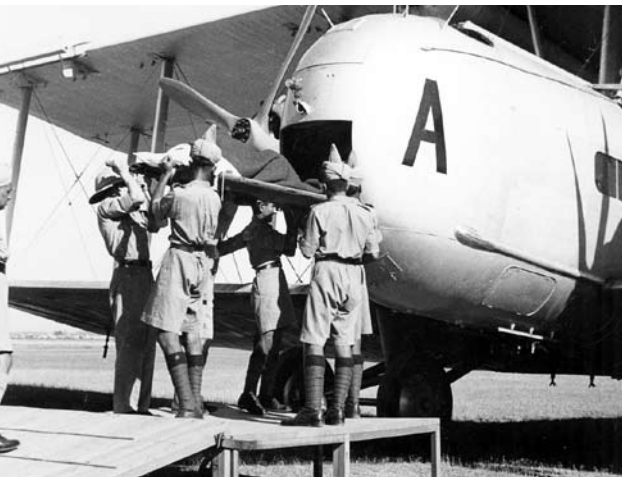
Although US development of aeromedical evacuation using fixed wing aircraft slowed as the result of the crash,[23] the US Army had also begun to experiment with autogyros, receiving its first one from France in 1928.[24] By 1933 a US manufacturer had already designed an autogyro ambulance to carry a pilot and three patients, two in wire baskets and one sitting.[25] Three years later the US Medical Field Service School tested the casevac capabilities of autogiros but lack of funds prevented the formation of a planned autogyro casevac unit.[26] Meanwhile, a recommendation was made that the US Army should have two types of air ambulance, a heavy transport for medevac, and a smaller lighter aircraft capable of landing and taking off on small emergency strips for casevac.[27] This recommendation was adopted for the Second World War.

The interwar period saw the growth in the military use of aircraft for aeromedical flights during a variety of colonial skirmishes. The French and British developed both the techniques involved and the aircraft used. During their colonial war in Morocco the French demonstrated the potential of aeromedical evacuations in remote and rugged areas. In 1922-23, using six air ambulances capable of carrying two or three litter patients, they evacuated more than 2,200 patients from forward airstrips near the Atlas Mountains to hospitals in base areas.[28] These flights were made in a few hours as opposed to days, in considerably more comfort and without accident. A French doctor declared 'by rapidly removing the wounded from the fighting zone, the medical aeroplane has, in a remarkable manner relieved the convoys, economized the fighting troops and hastened the advance of the attacking columns'. He predicted 'in the future, hours will replace days in calculating the duration of wounded transport.'[29]

The British also used aeromedical evacuation in expeditionary wars. The RAF element, Z Force, of the 1920 campaign in British Somaliland included a DH9 air ambulance with Red Cross markings which could carry three stretcher patients.[30] The RAF's first aeromedical service was provided by a Vimy of 216 Squadron which, between 1920-1922, was allocated for emergency aeromedical evacuation from isolated areas in the Middle East.[31] This aircraft had Red Cross markings but carried non-medical passengers and was not a dedicated air ambulance. The markings were later removed because of the limitations they imposed on the use of the aircraft.

In 1923 troop transport aircraft of 45 and 70 Squadrons evacuated 359 Army patients during operations in Kurdistan by 'back-loading', ie aircraft bringing forward men and supplies took back casualties.[32] At home the RAF had experimented with a dedicated air ambulance service based at RAF Halton. However, this was short-

lived, lasting only from 1925-27 as it was more economical to use troop carriers than dedicated specialized aircraft. Today air ambulances in the UK are operated by civil authorities or voluntary organisations with the occasional assistance of military assets or Coastguard SAR helicopters.



The Valentia had a square opening in the nose to allow for stretchers to be loaded

Waziristan 1937

Waziristan operations showed how valuable aeromedical evacuation could be in the rugged terrain of the North West Frontier. The Army Medical Service (AMS) requested aircraft for aeromedical evacuation of casualties from Waziristan to base hospitals in what is now Pakistan. The RAF agreed to the back-loading of casualties on Valentia Bomber Transport (BT) aircraft bringing in troops and supplies. The Valentia had a square opening in the nose to allow for stretchers to be loaded and carried four stretcher cases and five sitting patients together with one attendant and medical equipment. The aircraft came from the Indian BT Flight, later supplemented with a detachment from 70 Squadron in Iraq. This aeromedical evacuation relied solely on the 'opportune back-loading of BT aircraft of the Force'.[33]

The importance of patient selection was appreciated by the Army medics and strict guidelines established for selection of stretcher cases for evacuation. Patients requiring immediate specialist and nursing skills, the lack of which would result in fatal complications or a serious degree of permanent disability, were selected. Sitting cases were chosen from suitable patients available at the time the aircraft was due to leave. No hard and fast rules were followed for the selection of these. The aeromedical flight reduced a hazardous two day journey to less than five hours; casualties who would not have survived a gruelling journey by road and train reached better medical facilities safely. This successful evacuation, based on backloading, was seen by the AMS as 'a pointer to what might have been achieved with aircraft specifically allotted to the Medical Service". In all some ninety-three casualties were evacuated by air.[34]

At the request of HQ RAF India the AMS produced a report which recommended that air evacuation should be accepted as a recognised medical evacuation method in all future operations and should be 'utilized to the fullest extent within the available resources of aircraft'. Significantly it also recommended that 'aircraft be primarily allotted to the Medical Services for the specific purpose of the transport of sick and wounded'. It noted that the terrain of the North West Frontier together with its climatic conditions made aeromedical evacuation the best option and stated that 'our aim should be, at least, to provide sufficient aircraft to transport all serious cases to base hospitals, thereby

increasing their chance of recovery, and concomitantly improving the general morale of troops'. The General Officer Commanding-in-Chief, Northern Command, forwarded the report to Chief of the General Staff HQ India with the comment that 'Air transport is an invaluable adjunct to the normal means of evacuating sick and wounded. During the present operations in Waziristan it has been possible to utilize this method of transport for evacuation of wounded as there have been troop carrying aircraft which could be made available for this role." His comments on allotment of aircraft were more pragmatic than that of his medics: 'The number of BT aircraft in India, however, is limited and therefore, it is not possible to allot them primarily to the Medical services. Medical requirements can only be met if the circumstances permit'.[35]

The clash between demand and resources had begun, evinced by Army agitation for allotted/dedicated aeromedical aircraft and the Air Ministry's well-founded resistance. The British Red Cross conducted air ambulance trials in 1936 which led to an approach to the Army Medical Directorate (AMD) by aircraft manufacturers for input to the design and construction of specialized air ambulances.[36] As if fired by this the Director-General Army Medical Services (DGAMS) drew the Army Council's attention to the failure to incorporate aeromedical evacuation in the Army's plans for war, pointing out that this might prove to be an indispensable method of transport where lines of communication were poor.[37] With the RAF deeply engaged in their pre-war expansion programme DGAMS was informed that they could not be asked to provide special ambulance aircraft. He was assured that, if circumstances warranted aeromedical evacuation, both civil and military aircraft would be adapted for the purpose.[38]

Overseas British commanders were seizing on the concept of aeromedical evacuation and evinced high expectations of it. In January 1937 Commander-in-Chief Egypt told the War Office that aeromedical was the only acceptable form of medical evacuation in the desert, emphasising the difficulties of casevac from a mobile military force resulting from the need to locate such units and the nature of the terrain and climate. Casualties faced long, arduous and highly uncomfortable journeys in motor ambulances. The aircraft he demanded were not forthcoming and it was suggested that provisional arrangements should be made to requisition civil aircraft for wartime air ambulances. The C-in-C reiterated his demand in 1939 suggesting that some obsolete bombers, due to be scrapped by the RAF, should be converted to air ambulances operated either by the RAF or the Egyptian Government. This proposal gained no support in the Air Ministry and the question of dedicated air ambulances was temporarily overtaken by events as Britain geared up for the imminent war.[39]

The Air Ministry acknowledged the value of aeromedical evacuation, but was forced to be economical in its use of limited resources, thus it followed a policy of provision through back-loading aircraft. With the absence of conflict in northern Europe this approach was entirely confined to the colonies in the inter-war period. Between the end of the First World War and the last years of rearmament severe constraints on the military budget ensured that aircraft

resources were very thinly spread across both home and overseas commitments. Post 1919, Trenchard was compelled to sacrifice many front-line squadrons in favour of a training system designed to allow the RAF to expand rapidly in time of need. This policy left little scope for the creation of a dedicated air transport force, such transport aircraft as the RAF ordered predominantly took the form of dual-role 'bomber-transports' – a more economical solution than the procurement of two entirely separate designs. When rearmament began in the mid-1930s, the RAF's attention focused on metropolitan requirements, primarily involving the creation of strategic bomber and fighter forces. Transport aircraft did not feature prominently in their planning because the Army made few demands for air transport in Britain, and a commitment to send anything more than a Field Force to France was only accepted by Chamberlain's government in the spring of 1939.

In contrast Germany was evolving a military aeromedical capability. The rearmament restrictions imposed by the Treaty of Versailles meant German civil aircraft production kept military requirements very much in mind. Lufthansa was not only the training ground of the Luftwaffe pilots, but also operated the aircraft on which the German air transport fleet was based. This fleet gave the Germans the ability to plan for aeromedical evacuation and to trial their ideas prior to the Second World War. The Spanish Civil War (1936-38) provided the Germans with a proving ground for several of their ideas on the use of air power, including aeromedical evacuation. Amongst the assets of the German Condor Legion in Spain were Junkers 52 (Ju-52) transport aircraft, readily convertible to air ambulances capable of carrying up to 10 stretcher cases and eight sitting casualties together with doctors and/or medical orderlies. The Luftwaffe evacuated some 500 patients from Spain to Germany; and pioneered both long distance and altitude aeromedical evacuation. Flights of over 1500 miles were made reaching altitudes of 18,000 feet over the Alps; the Ju-52s carried medical supplies, including oxygen, for medical intervention in flight. These flights took ten hours instead of seven days by train and boat.[40] The Russians also used air evacuation during their war against Finland (1939-40) moving casualties from divisional to base hospitals. These aircraft carried surgeons and medical supplies, including oxygen.[41]

Second World War

Lessons learnt in Spain enabled the Germans to incorporate aeromedical evacuation in plans for the invasion of Poland. During the first few weeks of the campaign they evacuated 2,500 patients to hospitals in Germany by air. Only four deaths occurred in flight, all on aircraft not carrying medical staff or oxygen.[42] In 1940 the Head of the German Army Medical Air Services declared that the German experiences in Spain and Poland showed specialized air ambulances were not necessary, stating that 'the surgical [air ambulance] airplanes which have been exhibited [by manufacturers] with great pride, I consider misconceived playthings, which present an entirely erroneous conception'. He dismissed them as 'fair weather butterflies'[43] and advocated the conversion of suitable transport aircraft with standard stretcher racks stored on the aircraft. Soon after the beginning of the War the Germans established Luftwaffe aeromedical units equipped with Junkers transports and Storch STOL

Soon after the beginning of the War, the Germans established Luftwaffe aeromedical units equipped with Junkers Ju-52 transports

aircraft. These units included flying, medical and maintenance personnel, all commanded by a flight surgeon. Facilities, manned by the units' medical personnel, were established at airheads enabling patients to be held overnight. The small Storch aircraft and ground ambulances brought in casualties. Aircraft belonging to these aeromedical units were initially painted white and displayed Red Crosses. This livery was readily spotted and gave away positions of advance airfields. Camouflage was adopted but with the Red Crosses retained in white circles. Attacks on well marked Junkers aircraft on the Eastern Front and in the Mediterranean led to the removal of the Red Cross and the aeromedical aircraft flew with troop transports or with fighter escorts. They were equipped with guns for self-defence. In addition to the dedicated aeromedical Junkers, other troop carriers including Condor transports were used. The troop carriers carried about 80% of patients leaving the aeromedical Junkers to concentrate on the seriously injured casualties. By May 1945 some 2.5 million patients were reported to have been evacuated by air.[44]

After the outbreak of war the onset of hostilities in France and the Low Countries quickly demonstrated the utility of transport aircraft, and the demand for air lift grew rapidly. The British Air Ministry was in a very difficult position. In 1940 the RAF possessed no standard air transport design equivalent to the Luftwaffe's Ju-52 and experience suggested that at least five years would be required to bring a new aircraft from the drawing board into front-line service. Hence there was little prospect of obtaining a British design in the short-to-medium term. The Air Ministry was used to having to prioritise to meet its commitments at home and abroad. This influenced its thinking: needs demonstrated by colonial experiences were ignored as the demands of home defence grew. With the need to obtain the most economical use of aircraft resources with multi-role as a favoured option the dual-roled BT aircraft remained the RAF's solution to the transport shortage.

Civilian sources could not mitigate the lack of transport aircraft.[45] British civil aviation had lagged behind other countries; long distance routes were served by flying boats, short haul by biplanes. Development of a civil monoplane was slow; no easily adaptable British manufactured civil aircraft were available. America also faced acute shortages and many demands on resources.[46] The C-47 transport workhorse was developed from the DC3 civil airliner which first flew in 1935, but the military version did not reach the USAAF until October 1941 and not in any numbers until 1942. The British order for these aircraft lacked priority, although eventually 1,900 Dakotas were supplied under

Lend Lease, the first did not arrive until March 1943.[47]

Inevitably, world war provided the catalyst for development of aeromedical evacuation. In September 1939 the RAF had no viable plan for this. Vague assumptions had been made that military aircraft would be converted or civilian aircraft requisitioned for this role, but there were too many demands on too few aircraft. Aeromedical evacuation provision joined the long queue of other demands made on a very limited transport capability and vied with them for priority. Yet, within weeks, the Air Ministry was under pressure from its own Advanced Air Striking Force (AASF) to provide aircraft for aeromedical evacuation from France. An ad hoc arrangement was cobbled together by adding casualties to the backloads of Air Transportation Service (ATS) aircraft chartered from civil companies. The Air Ministry informed Air Vice-Marshal Playfair, Air Officer Commanding (AOC) AASF that it 'agreed in principle' that the AASF and the RAF Component of the BEF could add casualties to the already back-loaded returned stores, mail and passengers on the Maintenance Command ATS civil aircraft which had flown in urgent supplies. The Ministry also agreed that aircraft carrying casualties could divert to RAF Benson, the airfield closest to RAF Hospital, Halton. However, the Ministry stipulated that 'when the evacuation of casualties cannot be effected without interference with the normal duties of Maintenance Command civil aircraft, they must be evacuated by the normal [surface] methods already arranged.'[48] The system did not run smoothly. In mid November Playfair, at the behest of his Principal Medical Officer (PMO), wrote to the Under Secretary of State (USofS) for Air requesting a dedicated air ambulance to take casualties to England and, in France, to transfer selected cases from the forward fighting units to medical facilities. Playfair knew his request was against Air Ministry policy but he believed it should be reconsidered. He cited an incident where a civil ATS aircraft left France with a casualty and, despite instructions, landed at Shoreham instead of RAF Benson. The pilot told the accompanying medical orderly that he would not go beyond Shoreham and did not know where Benson was.[49] The requested air ambulance was not forthcoming and, when ATS routes closed on 9 December 1939, medical evacuation from France reverted to surface methods. Although unsatisfactory, backloading ATS civil aircraft enabled 93 patients to be evacuated back to the UK between September and early December 1939.[50]

Returning from a Middle East tour in 1940 the Secretary of State (SofS) for War (Eden) raised again the subject of air ambulances. Following a negative response from the Air Ministry, he sent a cable to the Foreign Secretary requesting America be asked to provide air ambulances through their Red Cross. An approach was made through the British Red Cross but no aircraft were available and neither British nor American supply organizations would give the request priority.[51] The clash between demand (War Office) and resources (Air Ministry) began in earnest. The War Office badgered the Air Ministry with unrealistic demands for dedicated aircraft; Eden made a direct demand to the SofS for Air (Sinclair) for at least twelve air ambulances for the Middle East. The reply was unequivocal; no aircraft were available for allocation

as air ambulances.[52] Pressure also came from below; a medical officer in North Africa reported that 'There is a general feeling amongst senior officers and men, which is increasing as time goes on, that after two years of war, air evacuation of casualties should be available, and I am constantly being asked when it will be possible and what is being done about it'.[53] It was well known that the Germans were using aeromedical evacuation. Eden even made veiled threats to Sinclair warning of severe criticism in Parliament and the Press if it became known that there were no dedicated British air ambulances.[54] However, in June 1941, when these demands were being made, a specialized RAF air ambulance unit was formed to serve the sick and wounded in the UK. It comprised seven dedicated aircraft specifically equipped for the air ambulance role, staffed by RAF medical personnel.[55] Several of the aircraft were 'presentation aircraft' ie paid for by public subscription. There is no evidence that this unit was considered for deployment overseas.

Discussions between the Air Ministry and the War Office continued throughout 1941; whilst funding was not an issue suitable aircraft were unobtainable[56]. Air ambulances could only be made available through diverting resources from production of much needed operational aircraft[57]. By mid-year Sinclair agreed to the conversion of transport aircraft in the Middle East when required stipulating they were not to carry the Red Cross which would prevent their use as military transports.[58] The Army was not satisfied; in 1942 the Adjutant General stated in post visit report on the Middle East 'An important point in morale is the removal of the wounded. It is unbelievable that, at this stage of the war, the United Kingdom has not one single air ambulance. Although much use was made of returning transport aircraft, it meant that the wounded were taken to the aircraft and not the aircraft to the wounded'.[59] He believed it was essential to provide RAF air ambulances to supplement the dedicated three RAAF DH86 and one SAAF Lodestar air ambulance already in the region. These were already supplemented, when available, by Bombay aircraft of 216 (BT) Squadron. Together they were known as the 'Forward Shuttle Flight'.[60] In 1943 the Army Council informed the Air Council that back-loading transport aircraft was insufficient and dedicated air ambulances were required as well. They also demanded two types of aircraft for medical evacuation; light aircraft for use in forward areas and larger aircraft for evacuation to hospitals in rear areas; a two stage lift. In response the Air Council refused to restrict AOCs in their use of transport aircraft but agreed casualty evacuation would be made a priority task. They firmly rejected a two stage lift.[61] Lack of aircraft was only part of the problem; the RAF was well aware that a considerable support element would be needed if a dedicated air ambulance force was established. Experience with airborne and special duties forces showed that demands for expansion followed the creation of limited size forces.

After much pressure, in March 1944, the Air Ministry finally agreed in principle to the allocation of one flight of six aircraft to each main theatre. Their primary role was aeromedical evacuation of serious casualties when other transport aircraft could not use the most advanced airfields. These aircraft could also be used take supplies and

reinforcements forward but priority would be given to medical personnel and stores.[62] The Army Council seized on this and, to the Air Ministry's dismay, immediately informed their CinCs that these aircraft were coming.[63] With their hand forced the Air Ministry sent the aircraft however, Army Medical Staff Officers in theatre continued to make unrealistic demands. The Director Medical Services (DMS) of Allied Forces HQ (AFHQ) stated 'it is the contention of this Directorate that of any transport aircraft provided for the theatre, the medical services are entitled to an allotment proportionate to their needs' based on 'the acceptance by London and Washington of the necessity for air transportation of casualties'. The provision of such aircraft was 'not contingent on the existence of a superfluity of aircraft'.[64] In 1944 it was also suggested that HQ Mediterranean Allied Air Forces (HQMAAF) be ordered to make aircraft available.[65] HQMAAF upheld the principle of operational requirements first and felt that 'AAI [Allied Army Italy] do not understand this principle, and they do in fact regard the provision of aircraft as a right, to deal with the normal and therefore readily foreseen daily evacuation of sick and wound'.[66] Aeromedical evacuation continued to tax the Allied air transport capability in all theatres.

After December 1941 the British relied heavily on US resources for aeromedical evacuation. The European war prompted the formation of US Medical Air Evacuation Squadrons (MEAS), authorized in November 1941 just days before Pearl Harbour. Units comprising four squadrons with allocated aircraft were planned; the first squadron stood up in May 1942 and was assigned aircraft. By late 1942, the acute need for aircraft of all types forestalled dedicated air ambulances; Troop Carrier (TC) and Air Transport (AT) units were allocated aeromedical evacuation as a secondary task. MEAS were renamed Medical Air Evacuation Transport Squadrons (MAETS) and were comprised entirely of medical personnel. MAETS were assigned to TC and AT units in theatre.[67] The US formed a School of Air Evacuation to train medical personnel in aeromedical duties. Although the Americans had units termed 'evacuation squadrons' their role was primarily that of transport and they were frequently assigned short notice transport flights which resulted in a lack of aircraft for aeromedical tasks.[68] The misconception that the Americans operated dedicated air ambulance aircraft results from the change of plan and consequent renaming. Even at the time there was confusion; records show there was no clear understanding of whether MAETS had their own aircraft or not.[69] The C-47 (Dakota) was the main aeromedical transport but the Americans also had a small single-engined aircraft, the L5, in accordance with the pre-war recommendation. These could carry one stretcher or one sitting patient and proved invaluable in the Far East campaigns, especially Burma, for casevac from jungle clearings.

The first large scale aeromedical evacuation occurred in 1942 during the British retreat in Burma when ten USAAF transport aircraft evacuated some 1,900 casualties from Myitkyina. Later that year 13,000 Allied casualties were flown out of New Guinea[70]. In the Far East campaigns mountainous jungle terrain often made air evacuation the only realistic solution. Even so many casualties only reached the airstrips after tortuous journeys,

carried by comrades, local natives or on vehicles which slipped and slid over almost impassable roads.[71] A major development in aeromedical evacuation resulted from the need to evacuate wounded Chindits from the jungles of Burma. Wingate's Chindits, long range penetration forces sent to attack Japanese lines of communication, relied on air drops for supplies but had no provision for casevac. They were forced to carry casualties with them or abandon them; for most of their sick and injured the prospects were bleak. In a rare exception a Dakota took out seventeen casualties, landing and taking off from a jungle clearing which was 400 yards short of the minimum designated 1,200 yards.[72] Lack of casevac provision had an adverse impact on the morale of the Chindits (and similarly the US 'Merrill's Marauders'); abandoning sick and wounded put a strain on them, especially the decision making commanders.[73] Wingate recommended the provision of air ambulances and the 1943 Quebec Conference agreed that casualties suffered by the 2nd Chindit expedition would be evacuated using USAAF L5s and Dakotas.[74] During the Chindits' advance to the Chindwin some 700 casualties were casevaced by L5s.[75] RAF radio operators with the Chindits called in the aircraft which landed on emergency strips cut in jungle clearings. Gliders inserting Chindits into jungle clearings also took out early casualties; Dakotas snatched up the gliders without landing.[76] In January 1945 the US L5s were supplemented by an RAF Casualty Evacuation Flight (also equipped with L5s) attached to 194 Squadron.[77] The division between casevac and medevac had begun. Thanks to light aircraft, casualties could now be in hospital four to six hours of being wounded.[78]

The US light aircraft, although attached to British Corps, remained under American control. In forward areas they were under direction of the DDMS of the British Corps. A British report dated 1945 indicates conflicts in priorities; 'Both the [US] squadron commanders and the medical branch at Corps assumed that casualty evacuation was the first task, but there was no authority for this from a higher formation and the view was not held throughout the Corps'. There is evidence that major clashes took place; the report states (with underlining) that secondary tasks had not interfered with casevac only 'because the commanders, coming ultimately under the command of the USAAF were in a strong position to act on their own view (and that of the Corps medical branch) of their chief duty'.[79] The report accepted that spare capacity could be used provided this did not interfere with casevac. Secondary tasks flown by the light aircraft included 'front-loading' supplies on casevac sorties, reinforcements, communications flights for general officers, artillery spotting, reconnaissance flights, and picking up messages. Tasks which could not be combined with a casevac were flown only when there were spare aircraft. Some 7,705 casualties were evacuated by light aircraft in Burma prompting the report to recommend the provision of thirty two light aircraft (with casevac as a clearly defined primary task) for each Corps of three Divisions. No other tasking was acceptable if it interfered with the primary task. The report did not, however, suggest where these aircraft were to come from.

Flying boats also undertook aeromedical evacuations.[80] The Chindits' freedom of action was hampered by their casualties who could not be evacuated because of

monsoon induced ground conditions. Three 230 Squadron Sunderlands were detached from Ceylon to Dibrugarh on the Brahmaputra River. Chindit casualties, brought to Lake Indawgyi in Burma on mules or carried by their fellows, were then collected from the Lake by Sunderland. Rapid turnarounds under threat of attack took place; supplies brought in were unloaded and the casualties taken on board. These sorties were very dangerous; the aircraft faced atrocious weather conditions which prevented fighter escort and made flying in mountainous terrain extremely hazardous. The Sunderland's low 'ceiling' forced pilots to fly through cloud filled gaps in the mountains separating India and Burma.[81]

The battles of Imphal and Kohima produced significant developments; large scale movement of troops and casualties by air began. During Imphal an average of a thousand casualties a week were evacuated.[82] As the battle intensified entire Base medical units were flown out. Mass casualty evacuations soon gave way to a continuous flow to hospitals around Comilla and Agartala airfields from which supplies went up to Imphal but 'the ideal of concentrating hospitals and bringing all casualties by air to Dacca could not be achieved, owing to the acute shortage of aircraft, and to the fact that the medical authorities had no ambulance aircraft which could be diverted at will. Throughout the battle for Imphal, one squadron of Dakota ambulance aircraft could have covered the evacuation of all the wounded into Dacca'. The writer accepted the principle of back-loading the transport aircraft but suggested that it be reversed with aeromedical aircraft bring back supplies from Dacca airfields. He believed this would provide the medics greater control over the aircraft.[83]

In South East Asia Command (SEAC) the speed of casevac, especially of urgent cases, was greatly increased by air evacuation. Transfer from forward medical facilities to base hospitals (in India) fell from weeks in 1942 to days in 1943 and hours in1944-45.[84] Another major development in this theatre was the first use of helicopter casevac. In January 1945 a US Sikorsky YR-4 collected a wounded soldier from the Naga Hills. It had been sent to Burma for Combat Search and Rescue (CSAR) duties with the Air Jungle Rescue Unit (AJRU) and was the first helicopter dedicated to this role. Since the pilot had no knowledge of jungle flying and lacked a radio he was escorted by two L5 aircraft from AJRU during this casevac sortie. American CSAR helicopters were also used for casevac in Luzon coming under ground fire for the first time but evacuating some 70 wounded.[85] These helicopters were a presage of things to come.

During the Second World War aeromedical evacuation was used to great effect. American aeromedical planning evolved from the Tunisia experience, developed further in Italy and was refined for the invasion of Europe. During the latter 350,000 sick and wounded were flown from mobile fronts to general hospitals in England and France[86]. Eisenhower told a press conference on 18 June 1945 that 'We evacuated almost everyone from our forward hospitals by air, and it has unquestionably saved hundreds of lives – thousands of lives'.[87] Aeromedical evacuation was now a long way from being viewed as inherently dangerous. Before 1942 the British had struggled

with the provision of an aeromedical capability but with the entry of American into the War the Allies came to rely heavily on American resources for this, especially for air casevac. Lacking sufficient air transport resources to fulfil all demands let alone, despite much Army pressure, to provide dedicated air ambulances, Air Ministry policy remained that of 'back-loading' casualties. They firmly refused to restrict the role of any transport aircraft to aeromedical. Nevertheless, the RAF moved thousands of casualties (some 300,000 in 1944 alone[88]) in theatres throughout the world, especially North West Europe and South East Asia. Although conflicting demands on resources throughout the War prevented either the US and UK from providing dedicated air ambulances, evacuation by air was the outstanding medical evacuation development of the war and air casevac, largely a terrain induced requirement, began to emerge as a distinct entity.

Post war

Post-war, the British Army continued to demand allocated aircraft, primarily light aircraft for casevac, but RAF resources remained very limited. The 1947 'Statement of Army Policy for Land/Air Warfare' incorporated a requirement for a specific allotment of aircraft for aeromedical duties.[89] This document did acknowledge that allocation was dependant on resources but gave air ambulances a high priority. DGAMS wanted dedicated specialized air ambulances with Red Cross markings rather than converted transport aircraft and was unhappy when this was rejected as being uneconomical.[90] The Air Ministry and RAF continued to resist Army pressure for dedicated casevac aircraft throughout the post war years. In 1963 DGMS(RAF) wrote that he had 'some experience of this type of thing, the last being at an exercise some years ago at which an Army Colonel got up and explained how much better he could do casualty air evacuation if he had his own aircraft which he could order back and forth as he chose. As the particular circumstances of the exercise we were discussing were that we were out numbered three to one in the air I had little difficulty in pointing out the error of his assumptions, though I doubt he was convinced. No doubt the same balderdash is still present, I do not know, I have not been invited since'.[91]. Feelings ran high. Converted RAF transport aircraft remain the RAF's chosen option for medevac today. A variety of aircraft have been used in this role, most recently RAF Tristars and C17s. The RAF medevac provision is appropriately roled transport aircraft staffed with RAF medical teams drawn from the RAF's Tactical Medical Wing.

Early medevac flights brought the sick and wounded back to the UK through a string of staging posts across the world.[92] A significant UK development was the 1956 arrival in service of the Comet, the RAF's first jet transport aircraft flown by 216 Squadron who had also provided the first RAF aeromedical service in the 1920s. The Comets provided a much faster service, reducing the need for staging.[93] In America the USAF introduced a specifically designed medevac aircraft, the C-9 'Nightingale", in 1971. Its usage was not confined to the military and they found that reliance on the C-9s caused delays because they flew fixed schedules and operated separately from the rest of the air mobility assets. This segregation reduced the availability of C-9s.[94] The last C-9 was withdrawn in

A significant UK development was the 1956 arrival in service of the Comet, the RAF's first jet transport aircraft flown by 216 Squadron

2005 and has not been replaced,[95] instead designated transport aircraft are used for strategic medevac; an option facilitated by new medevac technology, primarily patient support pallets.[96] Casevac is seen as a role for helicopters.

Advent of the casevac helicopter

An important post war development has been the emergence of the helicopter. The British Army identified casevac as a possible role for the nascent helicopter in their 1945 study on roles for helicopters.[97] A further paper on the Load Carrying Helicopter justified the Army's need for such aircraft: 'The load carrying helicopter, which must be regarded as a flying three-tonner and not as conventional aircraft, cannot wholly replace MT but by its speed, mobility and capacity for heavy loads, and by its small requirements in men it can reduce the MT required in the field thereby easing congestion on the roads and administrative overheads.'[98] This paper also identified a casevac role. The DGMS raised the use of helicopters with the Air Ministry in November 1948; the Air Ministry agreed the need for a helicopter for medical/rescue work but said that this could not be afforded at the present time.[99] The Air Ministry, responsible for the provision of aircraft for Army use, was only prepared to fund a small helicopter being developed for Air Observation Post (AOP) squadrons.[100] It was another Far East operation, the counter insurgency campaign in Malaya, which was to provide the incentive for the introduction of helicopters to the role and to signal the way ahead for casevac.

Malaya

In 1948 it had been suggested to DGAMS during a tour of the Far East that a helicopter would be invaluable for casevac in Malaya.[101] On his return the Army Medical Directorate (AMD) approached the Americans on the matter,[102] but the catalyst for helicopter casevac was a signal dated 8 March 1949 from the C-in-C Far East Land Forces (FARELF) to the Commanders-in-Chief Committee in London requesting helicopters for casevac.[103] Helicopters were in their infancy and a scarce commodity. After much difficulty and some Ministerial pressure[104] helicopters for casevac in Malaya were resourced. The helicopters sent, Sikorsky S51s (designated Dragonfly by the RAF), were very much a second choice having originally been turned down as unsuitable by C-in-C FARELF.[105]

From the beginning power-to-lift ratios have limited helicopters and the Dragonfly was severely underpowered. At sea level it could reach 150 feet from a jump take off (providing there was no wind) with an all up weight of 5,200lb but this decreased to 40-50 feet with the addition of only another 200lb.[106] The RAF Casualty Evacuation Flight (CEF)

Wounded being loaded onto a Dragonfly

formed at Kuala Lumpur on 1 May1950 with two Dragonflies and proceeded to demonstrate the Dragonfly's casevac capabilities to senior officers.[107] It is clear that the RAF viewed CEF as an experimental unit conducting trials on the use of helicopters for casevac role[108]. The first casevac sortie was made on 14 June1950 and, by year's end, twenty nine casevacs had been completed. The original concept of carrying casualties externally in panniers was amended by local production of a coffin shaped woven basket which fitted inside the helicopter.[109] Gradually the CEF developed the art of landing in primary jungle clearings but was heavily reliant on the ground force who requested a casevac correctly preparing a landing site in the thick teak jungle. Requests for helicopter casevac were received by Advanced Air HQ (AAHQ) who decided on the feasibility. The decision was based on the clearing to be used, the weight to be lifted, the helicopter's performance and refuelling facilities available on route. All jungle evacuation sorties were hazardous; if the proposed landing site was unknown an AOP Auster checked it first. Sometimes a touchdown was impossible and the casualty had to be bundled aboard. The Dragonflies had no navigation aids were accompanied by Austers on cross country flights, which then stood by at the location during casevac pickups. The helicopter pilots were given the option of dispensing with this escort but only if the filed flight plan was strictly adhered to.[110]

From the start ground forces had misplaced expectations, seeing the helicopter as the answer to all their casevac difficulties. Popular conception had helicopters landing on any terrain, operating at night, flying in all weathers, locating patrols anywhere, carrying kit as well as passengers, and needing no space for take off. Dragonflies had low lift limitations, low endurance, lacked instrumentation thereby limiting flying to visual conditions and needed landing sites of a minimum size identified by correct coordinates![111] Ground forces required educating about the helicopter. However, despite their limitations, CEF helicopters provided a vital service. Lives were saved by their ability to make pickups from thick jungle clearings and the casualties were thus saved several days of painful journey.[112] Despite dangerous conditions and the embryonic nature of helicopter operations CEF only suffered two accidents, sadly one of them was fatal.[113] Although casevac was their primary task, following Air Ministry policy CEF aircraft did not display the Red Cross.

Senior Army officers were quick to grasp the potential of the helicopter in Malaya, a country which geographically and climatically hampered movement making the counter insurgency campaign much harder. Conflicting views were held on the role of the CEF;

the medical view was that CEF existed solely for casevac duties as that was why they had been requested;[114] Assistant Chief of Air Staff Plans (ACOS(P)) thought that whilst Air CinC Far East Air Force (FEAF) would be asked to 'limit flying to casualty operations and minimum essential training and test flying we must expect a certain amount of other flying for experimental and communication purpose'.[115] In December 1950 the Senior Air Staff Officer (SASO) HQ FEAF reported to ACOS(Operations) that 'although they [Dragonflies] were sent out mainly for operational trials they have met 90% of the calls made for casualty evacuation and the Army has grown to rely on them'.[116] The CEF was tasked by HQ FEAF through and was an allocated unit not a dedicated one. It was soon used for other roles including communications, riot control, aerial survey work, transporting captured terrorists, SAR and even crop spraying.[117] The CEF developed a particularly close working relationship with the Special Forces: in addition to casevac sorties, supply and reconnaissance flights were made for them.[118] The success of the CEF, aroused the interest of other nations. In October 1950 CEF was visited by the PMO of the French Air Force in Indo–Chine (Vietnam);[119] the French went on to order nine Dragonflies for casevac duties in their campaign there.[120] By the end of 1953 they were operating eighteen casevac helicopters.[121] The USAAF also visited the CEF whose helicopter operations they considered to be the most difficult in the world.[122] As a result of this visit the USAAF requested a report from CEF on their casevac operations for study by the American authorities. In 1953 the RAF, realising the CEF was too small to meet the variety of operational tasks placed on it, reformed 194 Squadron, equipped with helicopters, which subsumed CEF.[123] Casevac remained a task but was no longer the primary one. After this short experiment with allotted casevac helicopters, as in the Second World War and despite pressure for dedicated aircraft,[124] the Air Ministry choose to reaffirm its policy of economical approach to the use of aircraft.

The first systematic use of helicopters for casevac from the battlefield occurred in the Korean War

KOREA

The CEF was the first unit allocated to operational helicopter casevac. The Americans had used CSAR helicopters for casevac in 1945 and now began to develop a dedicated casevac capability. The first systematic use of helicopters for casevac from the battlefield occurred in the Korean War. The clatter of rotors in the opening sequence of the TV programme 'MASH' has become synonymous with helicopter casevac but this method of medical evacuation evolved out of circumstance, not planning. The 3rd Air Rescue Squadron of the recently formed United States Air Force (USAF) started to receive occasional requests to provided casevac for the Army from difficult forward

locations.[125] Terrain and insecure lines of communication influenced the choice of air evacuation and now helicopters were more readily available. Korea, unlike Malaya, had no thick jungles and the helicopter ambulances rarely flew over hostile territory.[126] This made their use somewhat easier.

The birth of the USAF in 1948 stripped the US Army of all except light aircraft and helicopters designed to provide support to ground combat troops in forward areas. This support role included casevac from the front.[127] The USAF was tasked to provide medevac to rear facilities but, at the outset of the war, the Army had no helicopter air ambulance units. By early 1951 the Army were able to provide helicopter air ambulances (Bell H-13 Sioux).[128] These were deployed in three detachments of four Sioux. Four detachments deployed but the first to arrive was seized by senior commanders for non-medical tasks.[129] By the end of the war there were six detachments, each placed with a Mobile Army Surgical Hospital (MASH).[130] These were positioned close to the frontlines therefore the helicopters did not have to fly far or for long periods with casualties. The air ambulances were under the operational control of the Eighth US Army Korea (EUSAK) Surgeon. Casevac requests were passed from Casualty Clearing Stations (CCS) to the Divisional Surgeon, on to the Corps Surgeon and finally to the EUSAK Surgeon, approvals passed back through the same chain.[131]All communication between each stage in the chain was either by unreliable radio or telephone which could cause delays of several hours, a sometimes fatal occurrence for the casualty. Eventually the EUSAK Surgeon delegated approval authority to Corps Surgeons who had direct communications with the MASH helicopter bases, but he stipulated that helicopters be used only for very serious casualties unable to withstand ground evacuation.[132]

As in Malaya ground forces needed to be prevented from being over optimistic and recognise the limitations of helicopters. The vulnerability of helicopters to ground fire through lack of speed and low flight altitudes was not appreciated.[133] Unable to glide and liable to control problems, almost any battle damage incurred by helicopters proved fatal.[134] Although carrying Red Cross markings there were instances when medevac helicopters carried ammunition up to the front.[135] The authorities imposed restrictions on casevac pick-ups under fire but the pilots often ignored these; during the first six months of 1951 alone 1,985 patients were casevaced.[136]. The Sioux carried casualties on stretchers in pods fitted externally. This was not ideal; it was reported that 'some men have to be strapped down before they will stay there. One pilot reported that on three occasions patients had attempted to break out of the litter in flight'.[137]

On 28 October1952 the US Department of the Army announced that helicopter ambulance units for the casevac of critically wounded soldiers from forward areas had been authorized as an integral part of the Army Medical Services in theatre. The aircraft would be flown by Medical Service Corps (MSC) lieutenants and the units would have MSC commanders.[138] Previously the pilots had been line officers from the Artillery, Infantry, Engineers or Signals.[139]On 29 August1953 the first five MSC pilots joined the 1st Helicopter Ambulance Company in Korea and

forward helicopter evacuation was established as the role of the Army Medical Service.[140] This did not preclude use of non-medical helicopters when required, especially those of the Army Transportation Corps (US ATC) who used the first transport helicopter (H-19 Chickasaw) for casevac.[141] In the last months of the war Chickasaws evacuated over 3,000 casualties. However, helicopter casevac only counted for a small percentage of the total number of casualties evacuated. The EUSAK Surgeon reported that over 50% of those casevaced by helicopter would have died if ground transport had been used[142] but helicopters supplemented not replaced normal ground evacuation methods.[143]

Casevac helicopters were vulnerable to ground fire and the occasional attack by enemy aircraft but the latter could usually be minimised by fighter escort.[144] Other dangers faced were power lines, freezing winters, summer dust and pilot fatigue caused by the physical nature of early helicopter flying.[145] The greatest problem was the need for constant repairs; the American aviation industry was no more geared-up for helicopter production in 1950 than it had been for meeting the demand for aircraft generated by the 2nd World War. When production finally increased there were problems with delivery and the supply of spares, fuel and new aircraft. Air ambulances competed with about 635 operationally tasked helicopters for what was available[146]. One detachment lost a third of potential flying days in three months because of spares shortages.[147] Despite their problems the Americans made air ambulances available to the UN multinational force[148] and the British relied on the Americans for the casevac capability. An appeal for UK casevac helicopters for the Commonwealth Division had been rejected.[149] Between January 1951 and 27 July 1953 US air ambulances evacuated some 17,690 patients and saved countless lives. 'Few technical innovations were equal in importance to the growing use of the helicopter for medical evacuations. Costly, experimental and cranky, the helicopter could be justified only on the grounds that those it carried, almost to a man, would have died without it'.[150] By the end of the Korean War helicopter medical evacuation was well established. The US Army decided that helicopter air ambulances should have a permanent organization, accepting the Surgeon General's recommendation that 'all aircraft designed, developed, or accepted for the Army (regardless of intended primary use) be chosen with a view toward potential use as air ambulances'.[151]

VIETNAM

The Korean War established the operational roles of the military helicopter, and underlined their potential as air ambulances. In Vietnam the helicopter come into its own, especially the UH-1A Iroquois better known as the Huey. Although still suffering limitations Hueys had twice the speed and endurance of the Sioux, being capable of 120mph, and with an endurance of three hours although the combat troops were never more than 35 miles from a hospital.[152] Hueys carried casualties internally allowing medical treatment in flight, they could fly at night and in most weathers. New models which came into service had improved lift and instrumentation which extended the load carrying and bad weather/night flying capabilities[153]. Dedicated air ambulance units arrived in early 1962, initially in support of

US Military Advisors and the South Vietnamese Army.[154] Flown by MSC pilots with first aid training, Huey air ambulances came to be known as 'Dust-Off', the call sign of the first air ambulance unit in Vietnam which derived from the amount of dust kicked up by their rotors.[155] This name remains in use today.

From May 1962 to March 1973 air ambulances carried over 850,000 patients, both allied military personnel and Vietnamese civilians.[156] Hueys could carry six stretcher patients or nine sitting plus four crew members. The crew comprised two pilots, a crew chief and a medical corpsman; today's Dust-Off Blackhawks have the same crew composition. Hueys were fitted with a special internal rescue winch (hoist) enabling casualties to be lifted through the jungle canopy at the hover.[157] During major offensives or when heavy casualties were taken Dust-Off Hueys were supplemented by transport helicopters back-loading. These normally transported non-emergency cases as they carried no medical corpsmen to provide medical aid in flight.

Although the Hueys carried Red Cross markings they frequently came under fire. Whilst the Geneva Conventions do not permit transport displaying the Red Cross to carry non-medical supplies or personnel or have assault weapons systems, at times Hueys with Red Cross markings carried ammunition, non-medical supplies or non medical personnel. Crews carried side arms for personal protection but other weaponry, M16 rifles and sometimes M79 grenade launchers, was carried to provide suppressive fire. The Air Ambulance Platoons of the 1st Cavalry and 101st Airborne Divisions also mounted M60 machine guns on their Hueys and carried a gunner as a fifth crewmember.[158] When available, helicopter gunships escorted the air ambulances. Some air ambulance pilots were uncomfortable with these arrangements and refused to carry more than a side arm or have a gunship escort.[159] The air ambulance units came under pressure from commanders to remove the Red Cross on several occasions, not because of concerns about the Geneva Conventions, but out of a desire to extend the role of the aircraft to non-medical tasks. This was successfully resisted by the Medical Services. There seems to have been no formal questions raised as to the appropriateness of displaying the Red Cross whilst carrying suppressive fire weapons, especially a machine gun and gunner.

In addition to hostile fire air ambulance pilots had to contend with jungle, mountains and poor weather. Casevac helicopter loss rates were higher than those of other helicopter sorties, 3.3 times higher in terms of losses to ground fire.[160] Hoist missions were the most hazardous, involving hovering, often under fire, close to the top of the jungle canopy with nowhere to land if things went wrong. When other helicopters were grounded by weather or night the casevac crews would fly in response to urgent callouts, performing some incredible pick-ups from 'hot' landing sites in appalling weather. Some 1,400 air ambulance pilots served in Vietnam; forty were lost to enemy action with another hundred and eighty injured. A further forty eight were killed and two hundred injured in accidents caused by weather, night flying etc.

Air ambulance units (except Air

Ambulance Platoons) came under the command of the Army Medical Service. The Air Ambulance Platoons, although flown by MSC pilots were under the command of their combat assault division. Most Dust-Off units worked in cellular detachments providing either area support to allied forces in a defined area, or direct dedicated support to a particular combat unit in a particular operation. Requests for casevac were normally made by medical corpsmen with ground forces directly to the supporting air ambulance unit by radio. Three levels of casualty classification were used – *urgent*, where the patient was in immediate danger of losing life or limb; *priority*, where the patient was seriously but not critically wounded and could wait a while for casevac; and *routine*. Later a fourth classification was added, *tactically urgent*, where staying with the casualty was endangering the lives of others. In practice casualties were often over-classified, a continuing problem.

Dust-Off helicopters kept combat units within half an hours flying time of an allied base. Air ambulances aimed to launch within three minutes of a callout, in urgent cases a Dust-Off already airborne for another casevac would divert to pick up the casualty. Casualties were flown directly to the facility which offered the most appropriate not necessarily the closest care. The aim was to get the casualty to definitive trauma treatment within the hour, a target known as 'Golden Hour' which significantly affects chances of survival. In many cases initial basic first aid (the same level of treatment available at battalion or divisional aid posts) was given on board by the crew medical corpsman. During flight the pilot passed information on his estimated time of arrival, the number of casualties and type of wounds. This enabled the hospital to be at full readiness for the incoming casualties. The casevac potential of helicopters, first trialled in Malaya, was being realised.

The influence of Vietnam

The work of the helicopter ambulances in the Vietnam War has shaped casualty evacuation ever since. News footage and films about Vietnam ensured the Huey casevac helicopters worldwide recognition. Expectations of helicopter casevac, high from the beginning, were raised by the achievements of Dust-Off crews, not just amongst the military but, significantly, the media and civilians. Vietnam provides the yardstick against which many measure helicopter casevac today. Post Vietnam helicopters are firmly established as a battlefield prime mover, and ground forces in the line of fire and emotionally involved with the wounded, have come to view helicopter casevac as a right rather than an asset which needs to be husbanded and prioritised. Even with the considerable numbers of Dust-Off air ambulances and supplementary helicopters in Vietnam, the Americans had to prioritise callouts and contend with casualty over-classification; this remains a problem for US and UK forces today. The practice of providing in-flight medical intervention on the way to more advanced treatment, developed in Vietnam by the USAMS, also continues. Since Korea the US military has maintained dedicated air ambulances, currently Blackhawk helicopters which combine speed and range with high tech improvements including clinical cabin facilities, communications and a 'glass' cockpit providing night and bad weather capabilities. In 2004 the US Army planned to allocate 24% of

Vietnam provides the yardstick against which many measure helicopter casevac today

its new and refurbished Blackhawks as 'dedicated lifesavers'.[161] They have made a considerable investment of high tech equipment in casevac and CSAR which, in addition to the aircraft themselves, includes a Medical Suite Trainer with a fully functional medical cabin and ancillaries. The US Army Medical Department maintains the principal of 'presence with the soldier'; during Operation Enduring Freedom Dustoff crews accompanied troop carrying Chinooks and Blackhawks in the first wave of air assaults. Staying a few flying minutes back from the fighting they were able to retrieve wounded swiftly. Several crews were awarded medals for pick-ups under fire. The Blackhawk provides improved in- flight medical intervention but has the same crew constitution as the Huey. Doctors are not included as regular crew members, instead highly experienced Emergency Medical Technicians (EMT), often mobilized civilians, are carried.

Whilst the US policy remains 'scoop and run' (lift from the site of injury) British policy is to helicopter medics, including a doctor (anaesthetist or GP with trauma experience) to the casualty to ensure stabilization before flight. Helicopter casevac is an expensive option and ideals cannot always be met; the UK approach is not to dedicate but to allocate helicopters. In both the Falklands and the Balkans Royal Navy Sea Kings provided casevac coverage. In Bosnia a Sea King from 845 Naval Aviation Squadron was on permanent standby for aeromedical evacuation together with a medical team of an anaesthetist and paramedic. All requests for casevac were passed to the medical operations desk at HQ of Multinational Division (SW). The Medical Desk made the decision to scramble or not based on information from non-medical personnel at the casevac site. The UK experience in Bosnia showed helicopters were often sent when a ground ambulance would have sufficed and a study showed that 78% of patients had not benefited from air evacuation.[162]

Allocation of aircraft was the basis for UK casevac planning in both Gulf Wars. During Op Granby nineteen Pumas and twelve Sea Kings were allocated to transfer casualties from ambulance collection points to dressing stations and on to damage control surgery facilities/ field hospitals. The helicopters carried RAF Medical Assistants to provide any required first aid in flight but ambulance crews on the ground were expected to have stabilized the patient for flight. This is the closest that the UK has come

to mirroring the American system of using medical corpsmen in the air ambulances. RAF Medical Assistants have some limited trauma training but their non-deployed duties are largely administrative. The Op GRANBY experience led to the inclusion of a GP in the medical team carried despite the limitations on medical intervention imposed by the helicopter environment. In Op TELIC all UK helicopter assets were available for casevac missions, but the casevac plan for 1(UK) Armoured Division relied on the traditional policy of backloading from forward medical facilities to field hospitals. Three Blackhawk air ambulances were initially provided by the US; when these moved north two UK Pumas were allocated for casevac. Previously, during Op GRANBY, American Blackhawks had also provided casevac support for 7th (UK) Brigade.

The decision to backload does not appear to have been accompanied by any definitive statement of priority (as recommended in 1945) for casevac taskings. Much depended on the willingness of the commander of the Joint Helicopter Force (JHF) to give it a high priority. The JHF commander agreed that a casevac sortie should include the collection of the casualty, delivery to the appropriate medical facility, and the recovery of the medical team and equipment back to their starting base. This avoid problems encountered in 1939 when medics accompanying patients back to UK found it nearly impossible to return their duties in France. Requests for casevac were passed to the Patient Evacuation Team (PET), manned by RAF flight nurses, at HQ 1(UK) Armoured Division. Working closely with the helicopter tasking desk PET made the

Heat and altitude still seriously hamper helicopter performance and make the powerful Chinook much in demand

decision to scramble. A medical officer advised HQ 1(UK) Armoured Division medical cell on bed availability which influenced the casevac destination. The average response time of the UK allocated helicopters was twenty two minutes, almost exactly the same as the dedicated US Blackhawks.[163]

Despite technical advances helicopters remain limited by the power-to-weight quandary. The last major improvement in this area was the change from piston propulsion to gas turbine engines which occurred with the Huey. As in Malaya heat and altitude still seriously hamper helicopter performance and make the powerful Chinook much in demand. In Afghanistan, where the base altitude is 5,000 feet, the US operated casevac Blackhawk HH60Ls stripped of litter carousals for extra lift.[164] Lift capacity remains an area in which real improvement is still awaited. Helicopters also remain highly vulnerable to attack; air attack can be minimised by gaining air superiority but the ground fire problem remains. As shown in Somalia, ground fire does not need to be sophisticated to have a

serious effect.[165] In Afghanistan and Iraq the small arms threat covers the whole country and the threat environment has to be factored in. Terrain, topography and climate continue to influence the demand for helicopter, rather than ground, casevac despite the low medical benefit of indiscriminate use of helicopter evacuation even for trauma patients. Thus selectivity of use remains a problem and, despite much guidance, remains subjective. The renewal of expeditionary warfare in inhospitable terrain has caused a growth in reliance on helicopter casevac to the apparent exclusion or even consideration of alternative methods. This approach fails to take into account high costs and limited resources, a failing with an historic background. Ground troops, the media and the public are beginning to view helicopters as the only method of casevac where previously aeromedical evacuation was seen as an adjunct, albeit a very welcome one, to normal ground methods. There are renewed calls in the UK for dedicated casevac helicopters and much talk about the 'Golden Hour'. Criticism based on failures to meet this target abounds[166] and unfavourable comparisons are made with Vietnam, but the distances covered in Afghanistan are much greater. Casualty transfer times achieved by Dust-off Hueys focussed attention on the principle which appeared to be readily achievable but in many ways this was a false dawn. Problems continue to exist in communications and other areas influencing the speed of response. During Op GRANBY a badly injured British casualty took 12 hours to reach hospital despite being the sole casualty at the time.[167] Casevac support had been allocated over 30 helicopters but the weather was terrible and the battlefield chaotic.

Provision of aeromedical transport and, in particular helicopter casevac, has always been costly and, within the UK military, makes demands on very limited resources. Historically both the US and the UK have chosen to use converted transport aircraft for strategic aeromedical evacuation. The US military, after a brief period with the C-9, moved back from dedicated medical airlift to designated[168] and the UK has moved from a back-loading policy to one of allocation. Air evacuation of casualties, especially more recently helicopter casevac, has been an emotive subject since its inception. It is an area in which strongly held conflicting views have existed within the military and one in which public opinion has been easily influenced by the media. The history of military aeromedical evacuation shows that cost and aircraft resources have had to be balanced against the desire to provide the best medical care. It is a highly expensive option in terms of assets and resources hence it has been and always will be an area of compromise.

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