



## **The place of the Helicopter in a Modern Army**

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LT -COL J W RICHARDSON (*Chairman of the Executive Council*) occupying the Chair.

### INTRODUCTION BY THE CHAIRMAN

The CHAIRMAN, in opening the meeting, said that it was a privilege to introduce Lt -Col MEAD, who tonight would give us a soldier's viewpoint on helicopters. It would be agreed that this was rather a red-letter occasion. It had been very difficult to get the Army, except in little private corners, to say very much. No doubt Colonel Mead would say that the views he expressed were purely personal opinions, as he had to do, but from his antecedents it was obvious that he knew what he was talking about.

Colonel Mead was a gunner and the son of a gunner. His 27 years' service in the Army had been divided between the Royal Artillery, the Staff and the Army Air Corps and its predecessors. In 1935, he assisted in trials of artillery observation and fire control, flying as a passenger in what his notes described as a Rota, which was understood to have been a C 30 auto-gyro. No doubt some of the older members present would be interested in this fact and would like to talk to him about it later.

He qualified as an Army pilot in India in 1943/44. In 1944/45, he was the Senior General Staff Officer (AIR) to General Wingate (and, later, General Lentaigne) in the second Chindit campaign. In this capacity, he was responsible for the planning of airborne and air-transported operations, air supply, light-aircraft operations and direct air support. In 1950, he returned to flying as a pilot and commanded 652 Air Observation Post Squadron in Germany until 1953.

Colonel Mead had completed a thousand flying hours as a pilot, chiefly in fixed-wing aircraft, but he had recently solo'd in a Skeeter helicopter while attending a short helicopter familiarisation course. He was now the General Staff Officer in charge of the War Office branch which controlled the recently-formed Army Air Corps.

SUMMARY

The helicopter is, to an army, a vehicle, a means of travelling more quickly and efficiently about the theatre of war. In this paper the types of helicopter which an army might need are considered with respect to the three functions, the carriage of individuals, of formed bodies of men, of stores.

The conclusion is reached that in an ideally equipped army six different types of VTOL aircraft are desirable. Some of the disadvantages of helicopters are then considered, not least that of expense, and it is deduced that standardisation will usually be necessary to reduce the number of different types. Alternative ways of doing this are briefly considered.

THE HELICOPTER IS A VEHICLE

British soldiers are constantly urged not to try to do the scientist's and the designer's job for them—not to try to design equipment but rather to state their requirements. In this paper, therefore, no attempt will be made to design the helicopters an Army might need, but rather to state what results an Army seeks which helicopters might achieve for it.

It must first be said that, to an Army, the helicopter is primarily a vehicle.

If this seems platitudinous, we should remember the history of the military fixed-wing aeroplane, which, after a brief genesis as a vehicle, became to the military minds of all nations a weapon pure and simple. Not for a further twenty-five years did the aeroplane win decisive recognition as a vehicle, when the campaigns in Burma, in the words of General Fuller, "scattered those verbal clouds in which the meaning of air power had been obscured by the so-called experts of 1919-1939, and brought it into the sunshine of the essentials of war"<sup>(1)</sup>

The helicopter has had a better start.

THE MODERN BATTLE

An Army's object in battle is to reach a decision, that is to destroy the opposing forces or to cause their resistance to cease.

No slow or ponderous Army will gain a decision, it must be mobile, able to make fullest use of the space in which it fights, to strike blows with the minimum of preparation, to react quickly to the moves of the enemy. It must be flexible, having the ability to adapt its tactics or plans to changing circumstances. It must have security from extraneous blows likely to deflect it from its main purpose, including blows aimed at its supply lines with the object of starving it of food, ammunition or equipment.

It has been no revolution in warfare which has caused modern armies to take to the air to the limited extent that they have, but the simple necessity to be more efficient and to use the air as a medium of travel or reconnaissance where it is quicker, more flexible, or more clever to do so. The advent of nuclear warfare, or its threat, has however underlined most sharply the necessity for such measures. Whether or not a nation proposes to start a

nuclear war, its army must be ready to fight one, and nuclear warfare imposes dispersion. The lightning blows and counterblows, therefore, which decisions demand, must involve the rapid concentration of widely scattered forces onto the decisive spot and their equally rapid dispersion when the blow has been struck. This demands a very high degree of control at a period when, because of the havoc caused by nuclear weapons, conventional means of control will be conspicuously lacking. The fullest use of air space is obviously essential, and the vulnerability of land supply-lines is particularly obvious. There is the background to an Army's needs.

#### THE ATTRIBUTES OF THE HELICOPTER

The attributes of the helicopter most likely to appeal to any Army are

- (a) *Vertical take-off and landing*, which eliminates the need for prepared airstrips. The latter, together with the fixed-wing aircraft operating from them and the wheel tracks made thereby, are exceedingly difficult to conceal. To obtain adequate concealment such strips often have to be sited far from the headquarters and units whom the aircraft support. Helicopters, able to operate from small clearings, should usually be able to land close to those headquarters and units.
- (b) *Hover*. Besides being that attribute of the helicopter which makes possible its vertical take-off and landing performance, "hover" is useful to armies for other reasons. It permits the loading and unloading of troops and supplies, for example, when the ground is unsuitable for landing. More important still, it permits very slow forward speeds at very low levels, and confers a consequent ability to operate in conditions of poor visibility which would defeat fixed-wing aircraft. It is clear that prolonged hover and prolonged slow flight at low level is what is required, with a reasonable factor of safety in each case.
- (c) *All-weather performance*. The helicopter's ability to operate in high winds is a most valuable asset.
- (d) *Load-carrying capacity*. A modern Army, regrettably, is kept in being only by a vast continuous flow-forward of food, ammunition, fuel, equipment and supplies of all kinds. In the past the final part of their journey to the soldier has been accomplished by land (which has usually meant by road) or in parachute containers dropped from fixed-wing transport aircraft. Since, in the conditions of future warfare, the existence of both the roads and the transport airfields must be considered problematical, armies have every incentive to be interested in the load-carrying qualities of helicopters.

If these four helicopter attributes are of particular interest to armies, however, we must remember that it is the attributes and not the helicopters which are important. If new types of vehicles are designed to achieve the same purpose, armies will not necessarily remain faithful to helicopters. As we shall see, the helicopter of today has a number of disadvantages as an army vehicle, the elimination of which offers a field for the ingenuity of future designers.

## AN ARMY'S NEEDS

It is intended to discuss in this paper the purposes for which an army might need helicopters, not the more controversial matter of which of the armed services should drive and maintain them. Remembering this and continuing to regard the helicopter strictly as a vehicle, we may say that an army needs it for three main purposes

- (a) For the movement of individuals
- (b) For the movement of formed bodies of men
- (c) For the movement of stores

### THE MOVEMENT OF INDIVIDUALS

Subdividing still further, we may say there are two main reasons why individuals need to be moved by air within the combat zone, first and simply because an individual in one particular place needs to proceed swiftly and comparatively safely to another place, and secondly when it is desired so to position an individual in the air that, with or without artificial aids, he can observe and report his observations. The latter type of role is, of course, *reconnaissance*. The former, which includes a great diversity of functions, is in the British Army generally described as *liaison*.

*Reconnaissance* has been all-important to armies for as long as there have been armies. It has never been more vital than now. In a modern battle commanders and staffs need up-to-date information, by day and night, from every corner of the battle zone, from deep in the enemy's rear to the depths of their own base. Failure to obtain such information promptly may exact heavy and decisive penalties, and for that reason we may regard reconnaissance as the most important of the roles likely to be given to an Army's air arm.

Deep reconnaissance over enemy-held territory does not, at first sight seem a likely helicopter role. It calls for fast aircraft, relatively invulnerable to interception by other aircraft or by projectiles, with technical devices for surveying the battlefield and transmitting their observations to the various centres where the information is required. The havoc likely to be caused to located airfields on both sides makes it essential that such aircraft have a vertical or extremely short take-off, and ultimately no doubt they will be pilotless.

Reconnaissance of the forward portion of enemy-held territory can usually be carried out by individuals mounted in light aircraft or helicopters. They will, of course, be vulnerable both to hostile aircraft and hostile guns, but can minimise such vulnerability by intelligent flying. The simplicity of this form of reconnaissance, and its speed and reliability make it inevitable that it will be employed whether or not more scientific methods of observation are also available. As a platform for the observer, the helicopter is not necessarily better than the fixed-wing aircraft (though the latter will perhaps rarely possess the all-round view of the former), but the flexibility of operation afforded the helicopter by its take-off and landing performance will certainly make it the more popular.

As we have seen, communications will be particularly vulnerable on a future battlefield, and individual airborne reconnaissance may often be the only means by which commanders and staffs can learn the situation of units and formations isolated by nuclear burst or enemy penetration.

Reconnaissance of these types needs only a single airborne individual, who can, and indeed should be the pilot of the aircraft. In view of his potential vulnerability, however, he will probably need, for many years to come, an observer to look out for hostile aircraft while he, the pilot, carries out his reconnaissance. He will also, of course, need every other possible form of early warning of such a threat.

Technical reconnaissance of various natures will be continually in demand. The most important is no doubt artillery reconnaissance, since observation is a basic need of artillery and since the observer can most conveniently engage with the artillery the targets which he discovers. The other arms will not be backward however. Tanks will require eyes to look ahead for them as they advance, to report on road blocks, demolitions, concealed enemy weapons, and such like. Engineer officers will wish to be lowered into muddy river beds to look for bridging sites, signal officers to be deposited on peaks to site radio-relay stations. Every arm and service will have its own particular requirements for air reconnaissance. A task with special significance in nuclear warfare is that of traffic control, damage to a road or bridge can quickly cause traffic-jams, and large concentrations of slow-moving or stationary vehicles are an inviting nuclear target, airborne traffic control could by anticipation prevent such disaster.

It will not always be convenient for reconnaissance to be carried out by the eyes (or instruments) of a helicopter-pilot, and it is certain that commanders of formations and units will wish to be placed in a position to observe the battle-field in general and particular terrain over which the battle is expected to be fought. In many cases a commander will wish to carry out such a reconnaissance in company with his subordinates, so that all can see, as it were, from the same angle, and can discuss as they see. It may be anticipated that future commanders may wish to spend much of their time airborne over the battlefield to see for themselves how the battle is going, to have closer contact with their formations or units and thus be able to intervene promptly when intervention is desirable. They will need therefore a form of airborne command post, with room for one or two staff officers and two or three wireless sets. Whether any of these august passengers would be available to look out for hostile aircraft is doubtful, but in any event there seems to be a requirement for a larger aircraft than the two-seater needed for simple reconnaissance.

We have considered so far, of course, only that form of reconnaissance which can be carried out by individuals or instruments carried in aircraft. Reconnaissance by parties of soldiers, carried into action by air, is a matter for later consideration.

The object of the *liaison* role is to give the individual freedom of movement, in that he can avoid blocks, demolitions, water obstacles, and above all, roads. By air he can move more swiftly, with less fatigue, and usually more safely than by conventional means of travel.

Often an individual requires to move independently from place to place. If he has no other function to perform on the way, he needs only a one-seater vehicle which he can drive himself, a sort of flying motor-cycle. It must be easily concealed and extremely simple for a non-specialist to control, it seems extremely doubtful if it could be a helicopter. This sort of vehicle might be used by dispatch-riders, staff or *liaison* officers, or unit commanders visiting sub-units or higher headquarters.

Formation commanders will usually need to take one or more staff officers with them, without whom they would become immersed in detail to the detriment of judgement and powers of decision. A larger vehicle is necessary, which no doubt implies a specialist to drive it. Door to door service is essential, and some form of fairly light helicopter is therefore the very probable answer.

Another type of individual who needs to be moved by air over the battlefield is the casualty, particularly the casualty whose chances of survival would be radically lessened by delay or movement over rough roads. The helicopter, with its ability to land and take-off gently in small clearings in the forward areas, is an ideal vehicle for this task. A large helicopter would in theory be best, with provision for ten to twenty stretcher-cases and a couple of medial orderlies. It is doubtful, however, if such a large aircraft as this could regularly be risked as far forward as there will be casualties to collect, and it will therefore be necessary for small liaison helicopters to have provision for the carriage of stretcher-case patients.

It is essential that these liaison roles should be able to be carried out by night and in bad visibility, since it is often at such periods that it will be most urgent for the movements to take place, and since it will also in many cases be the safest time for them.

To move individuals in the combat zone, therefore, an Army needs

- (a) A small, simple, one-seater device with vertical take-off and landing performance, and a radius of action of about twenty-five miles
- (b) A two-seater helicopter for reconnaissance. This needs a good rate of climb and, even more vital, of descent to enable tactical flying by the pilot-observer, and an endurance of about 90 minutes
- (c) A larger helicopter (five or six-seater) for reconnaissance, for use as a command post, and for liaison. It should be able to carry stretcher-case patients. It also needs to have some two hours' endurance to allow it to move freely between different HQ's in the theatre of war.

All these aircraft are designed to be based in the forward areas. They therefore need to be as small as possible (and able to be made smaller by such means as the folding of rotor blades), easy to conceal, easily handled by the minimum numbers, and simple to maintain by soldier-technicians in the field. They must be simple to fly low (to avoid guided missiles if for no other reason), both by day and by night, and must have a good field of observation.

In an army, like the British Army, which has world-wide commitments, they must be able to operate in extremes of heat and cold, and at high altitudes.

#### THE MOVEMENT OF FORMED BODIES OF MEN

Troop movements can be either tactical or non-tactical, in the latter case, of course, our problems are much simpler. The non-tactical movement of troops will usually follow normal supply routes, and use normal supply aircraft, which, because of the vulnerability of airfields, should include a high proportion of helicopters. This will be further discussed later in this paper.

The tactical movement of troops means their movement to the area

where they are required to fight. They must, of course, travel in the fighting order and formation appropriate to their fighting role, the basic unit will consist of about ten men, and for convenience we may call it a section. Comment has already been made in this paper on the need for speed and flexibility, for dispersion to avoid nuclear destruction and for lightning concentration to administer decisive blows. Roads, with their traffic blocks and their slow-moving vehicles, are perilous causes of concentration. Swift cross-country movement is essential, making light of physical barriers such as hills, rivers, marsh and jungle, of congested areas such as roads, and of the physiological barrier of fatigue. This needs helicopters.

It is not possible, of course, to forecast in advance the many roles in which the tactical troop-carrying helicopter might be used. The multiplicity of such roles may explain perhaps the term 'Utility Helicopter' which is often used to describe the vehicle which carries the basic section of ten fighting men. In order that its potential uses may be understood, however, a few examples may be cited —

- (a) *Reconnaissance parties* The quick movement of patrols to their area of operations, perhaps on a flank or in the rear or covering a gap, if enemy penetration or infiltration is suspected. Such parties would thus have the means to reconnoitre from the air first, to determine the best starting point for their patrol, and to move rapidly from bound to bound. They would indeed be "Sky Cavalry". Invested with mobility of this order they will be able to be held in reserve in comparatively small numbers rather than committed in advance on every potential enemy approach-route.
- (b) *Coups de main* The seizure of a bridge or other key-feature ahead of the main advance (in the manner achieved by the German glider-borne force at Eben-Emael, or by the American advanced guard at Remagen). The landing of sabotage-parties near objectives in the enemy's rear.  
The importance of surprise, in operations like these, underlines the necessity for helicopters to be able to fly low (to get cover from radar), by night, and as silently as possible.
- (c) *Concentration* The quick concentration of troops at a point from which a small scale operation is to be launched. In this manner the troops could be collected from dispersed points twenty miles or more behind their 'start-line' and carried quickly forward without the delay and fatigue associated with movement on a modern battlefield.
- (d) *Assault* The seizure of ground on the far side of an obstacle (whether a river, a minefield, or a belt of nuclear devastation) as the prelude to exploitation by armour or other more conventional troops. After we have applied nuclear treatment to an area, for example, and while our armour is crossing it, assault troops in helicopters might well descend on enemy troops beyond the lethal zone (who might be expected to be second-line troops in every sense of the word and possibly somewhat shaken), with a view to opening the way to further exploitation. Helicopters of this type could conveniently replace (and have indeed replaced) the assault landing craft used to carry units from ship to shore in amphibious operations.

In such roles one envisages a degree of enemy opposition. In other words there will be bullets flying about as the helicopters are landing. It will not be pleasant to be the driver of an unarmoured bus under fire, but glider pilots did it in the past, and helicopter pilots will be required to do so in the future. It will obviously be necessary to render the fire as innocuous as possible.

- (e) *Reinforcement* The rapid movement of troops to follow up and support those who have seized some area or feature or initiated some sort of offensive thrust.

Owing to the limited capacity and numbers of helicopters which could be used in this role, reinforcement of this kind would also be limited, but, particularly where both sides have been forced to disperse, a rapid reinforcement by a few soldiers could have a decisive effect on a local battle.

- (f) *Mopping up* Quick, if small, concentration of effort against isolated pockets of enemy resistance, which despite their isolation could otherwise interfere with progress.

- (g) *Defensive role—the stopping of gaps* In the defence the problem is to disperse (for nuclear protection) and yet have the power to stop or canalize the sudden powerful thrust the enemy may concentrate on a limited front or around a flank. To make time for the defender's concentration against such a thrust, helicopter-borne troops might be landed in suitable areas on or near the enemy's thrust-line. Similar troop-movements might be carried out to counter enemy infiltration.

All these examples have been taken from future large-scale land warfare as one conceives it. The 'utility' helicopter has similar and other more obvious roles in the so called 'police' operations in which the British and French armies, in particular, are continuously involved. Speed in concentrating against a detected terrorist group is clearly most important, if it can be kept continuously under observation while troops are flown in to cordon it off and destroy it, then the ideal has been achieved. Short of this ideal, helicopters can enormously decrease the fatigue of an approach march over difficult country, and increase the surprise effect of a sudden search of suspected villages. Operations of all these types have recently taken place in both Algeria and Cyprus.

The 'utility' aircraft which are to perform these essentially tactical roles must not be too large or unwieldy, for as we have seen they are to land and take-off in the face of the enemy and fly over routes potentially covered by enemy fire. The smallest tactical troop-load, however, is the section of about ten men, and that must therefore be its load. An armed man weighs, on the average, some 250 lb., and is therefore not to be confused with the 180 lb. passenger to be detected in the airline brochures.

Vertical take-off and landing performance is essential. The aircraft must be simple to fly, leaving the pilot some part of his attention free to devote to extraneous matters such as enemy small arms fire and its evasion. It must be able to be flown low by day and night and in bad weather. It must be able if it is British to operate effectively in hot and cold climates and high altitudes. It should have a range of some 150 miles, with its full load. It should be quickly adaptable to casualty-evacuation.



When such aircraft are used in the reconnaissance or assault role, it is essential that the enemy should be prevented from bringing aimed-fire to bear upon them. They must therefore have the means of bringing fire down upon detected enemy troops or support weapons, and, where necessary, of putting down a smoke-screen. This may imply separate weapons, under the pilot's control, carried either in the troop-carrying helicopter itself or in separate (possibly smaller) 'support' helicopters, or merely the provision of means by which the assault troops themselves may bring aimed fire to bear before the helicopter lands. In either case the resulting fire must be accurate, the mere spraying of an area with fire holds little terror nowadays for any but the most unsophisticated foes. It is desirable perhaps for the pilot to be given some form of protection against small arms fire, perhaps in the form of bullet proof waistcoat or pants.

Utility helicopters will not be based as far forward as reconnaissance or liaison helicopters, but they must nevertheless be based far enough forward for concealment to be a prime consideration. They will be based no doubt in dispersed landing-areas provided with good natural cover. They need, therefore, to be light enough to be quickly manhandled into cover by five or six men, and small enough to be concealed there.

It is apparent that the perfect utility helicopter has yet to be designed.

#### THE MOVEMENT OF STORES

It is a cardinal principle that the fighting soldier must be supplied continuously with what he needs to maintain the battle. He must on no account have to forage for himself, or be in uncertainty as to the arrival of his supplies.

The main requirements of the fighting man are

Food and water (the latter usually though not always obtainable locally)

Ammunition

Vehicle fuel, coolants, and lubricants

Replacement stores of all types

Medical stores

Engineer stores

The first five of these classes of store are generally able to be packaged in conventional loads. Engineer stores, including such vastly differing commodities as explosives, mines, revetting-stores, bridging materials, and many others, often present loads of some complexity.

In the past the supply-pattern in a theatre of war has included bases and advanced-bases, where commodities are delivered and held in bulk, and areas further forward where bulk is 'broken' and loads of all types of supply are made up for the formations for which they are destined. In the rear part of these formation areas they are held ready for collection by unit transport, or, in the case of vehicle supplies, for issue to the vehicles themselves. Delivery to bases and advanced-bases has been principally by ship or rail or both, and forward of advanced-bases has been by road. As may be supposed, considerable congestion has resulted in base areas and on railways and roads, and, when air superiority has not been held, it has usually been necessary to confine most of the movement of supplies to the hours of darkness. Where air superiority is held it has proved possible to

use transport aircraft as the sole means of supply between base and formation areas, the classic example being the supply of the Fourteenth Army in Burma, where land routes were entirely inadequate for the purpose. In any form of mobile warfare it has been necessary to drop the supplies by parachute, a proceeding wasteful in weight and space, and also in the manpower necessary to pack the parachutes and their containers at the base, and to collect the scattered containers at the other end.

In future wars it will no doubt remain necessary to establish base-areas, advanced base areas, and formation supply areas, but the threat or reality of nuclear weapons will enforce upon such areas a great expansion, so that the stores within them may be widely dispersed. It may be doubted whether in conditions of nuclear warfare ships will be able to unload at major ports, or cargo aircraft land at busy air-terminals. Rather does one envisage small ships slipping by night into a number of separate small harbours, landing craft disgorging their loads onto open beaches, and cargo aircraft landing on dispersed rough-surfaced fields or strips. Except in deserts it is impossible to use road transport for supply without its becoming canalised on a few, easily identifiable routes. This clearly could not be accepted in conditions of nuclear warfare, and air-supply must therefore be ready to take over when necessary. If fixed-wing cargo aircraft were used in this role, there would, of course, be still greater congestion in the fields or strips available in the base area, itself under nuclear threat or attack. All the disadvantages of supply-dropping and, if air superiority was not possessed, crippling losses of aircraft would have to be accepted.

Fortunate will be that commander who has at his disposal a large number of alternative routes for his supply vehicles, land-vehicles with a good cross-country performance, amphibious vehicles, and helicopters.

Helicopters in the supply role will enable base loading areas to be widely dispersed and easily concealed, since they will not have to adjoin a cargo air-strip. Their routes forward can be myriad and changed from day to day. Their supplies can be landed (not dropped—unless especially necessary) exactly where they are required. Flying low, helicopters will usually avoid hostile radar surveillance. If the final forward delivery can be by helicopter, unit drivers and transport will be spared gruelling night convoys on congested and treacherous roads and units will be less vulnerable to the activities of enemy infiltrating onto their land supply routes.

Three types of helicopter would appear to be needed.

First, for the transport of supplies between base and formation areas a helicopter is required which will carry the same sort of load as the current road supply vehicle. Only in this manner can true flexibility be ensured. Its payload should, therefore, be about 3 tons. It is desirable that this helicopter should also be able to carry tactically a platoon of infantry or its equivalent, but to do so its payload would need to be about 4 tons. Faced with these alternatives, it will probably be considered best to have a supply-vehicle of appropriate size, even if an infantry sub-unit carried by it might have to be at reduced strength. These helicopters should be adaptable for casualty-evacuations, and should have a radius of action with full-load, of some 200 miles.

Secondly, for supply delivery in the forward areas, a smaller helicopter is needed, the obvious solution being the 'utility' helicopter, which, designed

to carry its unit of ten fighting men, will alternatively be able to carry over a ton of stores or a light vehicle

To enable these aircraft to be as small as possible their loads of stores (though not, of course, soldiers) could be slung externally, and provision should always be made for this

Lastly, a weight-lifter seems to be necessary, to move heavy pieces of bridging or other awkwardly-shaped stores, to help unload ships, to move obstructions which are blocking a highway and thus causing congestion, to move medium-sized land-vehicles over rivers or other obstacles or to deliver them to parties of troops who have been moved by utility helicopter. We might estimate its required payload at about 6 tons. If a good specialist-helicopter is to be designed for this purpose it will be best not to insist on an alternative troop carrying role, although it will be essential to carry, either within the helicopter or within any land vehicle that is carried, the latter's crew. Its radius of action will probably have to be some 200 miles, if only to allow it to get back to its fuel.

Because, in conditions of air inferiority it may not be possible to carry out supply operations in normal daylight conditions, all three types of supply-carrying helicopter must be able to operate at low level by night and in bad visibility. They may, if they are British Army helicopters, be required to operate in hot and cold climates and at fairly high altitudes.

#### SUMMARY OF REQUIREMENTS

Summarising therefore the conclusions we have reached in this paper, we may say that a modern army requires the following types of aircraft with vertical take-off and landing performance

- (a) A small simple one-seater, for individual movement in the battle area
- (b) A two-seater, for reconnaissance, having a particularly good rate of climb and descent
- (c) A five or six-seater, for use as a command post, for liaison purposes, or as an armed 'support' helicopter
- (d) A 'utility' vehicle, to carry tactically a sub-unit of ten 250 lb soldiers or to deliver a ton of stores in the forward areas
- (e) A cargo vehicle to carry about three tons of supplies or alternatively some twenty-five 250 lb soldiers
- (f) A weight-lifter to lift, and carry for short distances, stores to the weight of about six tons

The liaison, utility, and cargo vehicles should be adaptable to casualty-evacuation

The first four types listed would, of course, essentially be based in the field, and due regard should therefore be given to ease of ground-handling and concealment

Because of the enormous supply problem facing any modern army, it would undoubtedly be of great advantage if all types of aircraft used the same fuel, and preferably the same fuel as that used by the army's ground vehicles

VTOL VEHICLES FOR A MODERN ARMY  
An Idealistic Picture

<i>Serial</i>	<i>Type</i>	<i>Role</i>	<i>Loads</i>	<i>Endurance (hours)</i>	<i>Radius of Action (miles)</i>	<i>Remarks</i>
1	One seater	Dispatch Rider Unit Commander	Driver only—no other passenger	—	25	Must be very simple to drive Probably not a helicopter
2	Two seater	Reconnaissance	Pilot and Observer	1½	—	
3	Five seater	Command Post Liaison Support Casualty evacuation	Pilot and four passengers Pilot and support weapons (Machine guns or rockets)	2	—	
4	Utility	Troop carrying (Tactical Sub-units) Supplies (Forward area) Casualty evacuation	Ten men One ton of stores	—	75	
5	Light cargo	Supplies Troop carrying Casualty evacuation	Three tons of stores Twenty-five men	—	200	
6	Crane	Unloading Clearance Short carry of heavy equipments	Six tons of stores or equipment	—	200	

## SOME DISADVANTAGES OF HELICOPTERS

As compared with other aircraft, one of the most obvious shortcomings of the helicopter is its confinement to comparatively slow speeds. From the military viewpoint this is not a serious disadvantage. From that same viewpoint, however, the helicopter has a number of drawbacks.

It is a noisy machine, in the first place, and noise is very apt to prevent the soldier from achieving the surprise effect which plays so big a part in winning battles and minimising casualties. Many of the potential roles of the utility helicopter, in particular, are likely to be severely prejudiced by noise.

The helicopter is inclined to be rather large in proportion to its payload, and it is correspondingly difficult to conceal both itself and its spoor. There are signs, however, that this problem of design will not remain intractable.

The helicopter is thirsty for fuel, and thirsty machines are unpopular in the forward areas. However, there are thirstier ones, notably the tank.

Above all things, the helicopter is expensive. Developed sufficiently to meet the requirements discussed in this paper it would not be surprising to find the cost of each type of helicopter two or three times that of the equivalent type of fixed-wing aircraft. In peace time this must have the most severe effect on the number of types of military helicopters developed and on the quantities purchased. For this reason alone it seems probably that fixed-wing aircraft will long be retained, side by side with helicopters, in many of the roles for which the latter are more suited.

Considering, from the financial angle, the six types of vertical take-off aircraft we have said a modern army needs, it seems unlikely that the single-seater will appear in helicopter form in many armies, and there will probably be considerable pressure to reduce by standardisation the five remaining types. It might be that the Utility helicopter, slightly increased in size, will have to do duty in the light-cargo role in addition to its other roles. Perhaps a helicopter might be found to combine the liaison and utility or alternatively the liaison and reconnaissance roles. Only it will be wiser never to forget that of all roles reconnaissance is the most vital, and no standardisation, however desirable, must be allowed to prejudice it.

If we have in this paper arrived at certain optimum military requirements which helicopters might be able to meet, and have considered at the same time some of the disadvantages (including expense) that the helicopter-designer must try to overcome, there is no underrating the magnitude of the latter's task. It will no doubt be some years before the present military requirements are satisfied and by then there will be further requirements. It would be bold to ridicule the possibility, for example, that anti-tank helicopters might be in demand in a few years' time, or even anti-helicopter helicopters.

The helicopter designer can comfort himself, however, by the thought that most of the military shortcomings of the helicopter apply with even greater force to other devices with vertical take-off and landing performance. Since it is just these latter qualities which are militarily most vital, it would seem that helicopters are likely to hold a key position for some time to come.

### REFERENCE

- 1 J F C FULLER (Major-General) "The Second World War, 1939-45" Chapter VI