Paper No. 29

EXPLANATION OF ABBREVIATIONS USED

GST	General Staff Target
NGAST	Naval General and Air Staff Target
II	Image Intensification
LLTV	Low Light Television
IR	Infra-red
FLIR	Forward Looking Infra-red
MTI	Moving Target Indication
R & D	Research and Development

ARMY HELICOPTER OPERATIONS AT NIGHT AND IN ADVERSE WEATHER

Lieutenant Colonel A C D Watts, AAC, Headquarters Director Army Air Corps

INTRODUCTION

1. One of the major limitations and indeed criticisms levelled at the helicopter is that it is severely restricted in its ability to operate at night and in adverse weather. How often has it been said: "Oh it's all very well banging on about how wonderful the helicopter is but what happens at night or when the weather clamps - the helicopter crews sit on the ground twiddling their thumbs while we, the infantry, have to go on fighting 24 hours a day". Well of course there is some truth in that. It is as well to remember, though, that the critic happily forgets that many other weapon systems on the battlefield are also severely restricted by the same conditions!

2. We are, however, in the Army Air Corps along with the rest of the Army placing great emphasis on improving our capability because not only will our effectiveness be increased over the 24 hour battlefield day but it will also improve our survivability significantly particularly against the air threat and low level air defence threats.

3. I want to make it quite clear that we are very conscious of the paramount need to economise. With the severe pressure being applied to the Defence Vote it places a premium on us to ask only for those things that are absolutely essential and to be quite ruthless in discarding those goodies that might fall into the category of "nice to have".

4. We have already taken some steps to improve our capability and I would like to briefly run over them first, then I propose to discuss and analyse the problems that still exist and to propose a way in which they may be partially overcome.

WHAT WE HAVE DONE ALREADY

5. The two man crew. We have recently made provision for all our helicopters to have a two man crew. In our armed helicopters this is a pilot and airgunner, and in our reconnaissance helicopters a pilot and observer. The reasons for this are:

a. It is essential in the Armed Action role.

b. It increases our reconnaissance ability by having a trained observer equipped with stabilised optical equipment.

c. It relieves the work load on the single pilot crewed helicopter,

and it is this latter factor that is particularly relevant to operations at night and in adverse weather.

6. New helicopters. We have introduced Gazelle into service and are about to introduce Lynx in the next two years. Both these helicopters are easier to fly than their predecessors and are basically more stable machines, allowing more of the crew's time to be devoted to the task rather than to mastering the machine.

7. Night Trials. We have conducted a number of night flying and firing trials in a series of exercises nicknamed FIREFLY. These trials have produced much useful information on techniques and equipment. I am glad to say that the

trials have confirmed many of our views that up until now have been largely theoretical.

8. Training. We have recognised the need for increased emphasis on night flying training and I know that many units now do much more than was normal only two or three years ago. This is one major benefit that has come out of our experiences in Northern Ireland.

9. GST 3528 - NGAST 6643. We have set out our ultimate requirements in the two staff targets and the former one has been extant for almost five years now and has been the vehicle upon which much of the work at the various R & D establishments has been funded. The research includes activities in the II, LLTV, IR and Radar fields. We have trialled a number of equipments for the R & D establishments with varying success.

10. We are therefore in a fairly strong position to know what is feasible in the future and more important, to recommend a policy that makes sense, not only tactically but financially.

WHAT PROBLEMS STILL EXIST

11. Our ability to fly at night is limited to a relatively short time of the year at the moment, as I shall explain later, and it is a major problem. The other problem is that even assuming we could fly in pretty poor weather and on black nights how much could we usefully achieve? I want to take these two aspects separately starting with flight first.

Darkness and Weather

12. There are four main factors to be considered:

a. Darkness.

b. Meteorological Visibility.

c. Cloud base.

d. Icing.

All four of these factors affect flight but only:

a. Darkness

b. Meteorological Visibility

affect the performance of the task.

13. The meteorological statistics that we have used can be agrued but they have been gained from the best source possible - that is to say the Met Office at Bracknell and have been confirmed by the Met Staff in Germany as being representative of the area in which we envisage the major part of our operations will take place. The figures quoted are:

a. Based on one station in Germany, Hannover (200 ft AMSL) being the most appropriate one for the 1 (BR) Corps area of operations.

b. The figures have been reduced to an annual average. You should bear in mind that they will vary considerably from month to month and even from hour to hour.

Taking each factor in turn we can see that -

14. Darkness exists for 45% of the year.
This next slide splits that darkness percentage into $\frac{1}{2}$ moon or better, $\frac{1}{4}$ moon and less than $\frac{1}{4}$ moon; and you will see that it is 40%, 10% and 50% respectively, and this can be expressed as a percentage of the year at 18%, 4% and 23% respectively.

15. Meteorological Visibility. Now for the second factor. It is a fact that if you want to detect a tank at 4000 metres, which is reasonable, with an anti-tank missile range of 4000 metres, you need meteorological visibility of 8000 metres or better. This slide breaks down the met visibility into percentages of the year, ie for day and night, when it is less than 1 km, better than 1 km but less than 8 km and 8 km or better. You will see that it is 4%, 37% and 59% respectively.

16. Cloud Base. When considering whether cloud is a significant factor and therefore should be catered for in our avionic fit, it is worth analysing the facts as shown on this slide. The cloud base is down to 300 ft above ground level for only 3% of the year. We consider, therefore, that it is not a major factor.

17. Icing. There is very little reliable data on this but we believe that icing conditions exist for a relatively small proportion of the year. Although it may be concentrated into the winter months and therefore hamper our operations considerably for short periods. But the fact is that to provide a helicopter with full protection from icing is expensive, heavy and demands a lot of power. This is a field in which further study is necessary and until we know more about it we intend to reserve our decision on what degree of protection we finally select.

18. Summary. What can be deduced from these facts therefore? This slide shows how we have categorized the weather:

a. Condition 1

Daylight	Cloud base	300 ft AGL or better.
	Visibility	1000 metres or better.

This condition exists for 53% of the year and we believe, from a purely subjective assessment backed by experience, is a condition in which the average army pilot can cope now with no additional instrumentation over and above the standard fit in all our helicopters.

b. Condition 2

Night	Cloud base	500 ft AGL or better.
	Visibility	4000 metres or better.
	Darkness	$\frac{1}{2}$ moon or better, any degree of cloud base.

This condition exists for 13% of the year. Experienced pilots in a high state of night flying training can operate in a considerable portion of this now, over areas they know well, albeit with a high pilot workload. If we are to be able to guarantee operation under these conditions, over unfamiliar territory, and by any pilot I believe we need the following additional aids:

(1) A Radio Altimeter to give him positive height above ground level. A barometric altimeter is not enough.

(2) A light weight self contained accurate navigation system.

(3) II Goggles to give him vision so as to avoid obstacles and to some extent assist in map reading.

c. Condition 3

Night	Cloud base	300 ft AGL or better and less than 4/8 cover.
	Visibility	2000 metres or better.
	Darkness	¼ moon to ½ moon.

This condition exists for 2% of the year and is not one into which we can safely operate at present. With the additional aids I have just referred to we could fly under condition 3. Preferably the nav system should be self contained and require little or no updating because of the obvious difficulty in recognizing updating landmarks and because of the need to know where the helicopter is in relation to obstacles much more accurately because of the lower flight level. A system of 1% or 2% accuracy is needed. The system will clearly be of great benefit in condition 1 as well.

d. Condition 4

Night	Darkness	Less than ¼ moon with any cloud cover.

This condition exists for 26% of the year and offers the field for most improvement. The nav system and the rad alt of course will be invaluable but unhappily the special equipment needed to penetrate the complete darkness - such as thermal imaging and radar are complex, as yet unreliable, difficult to interpret and are enormously expensive.

19. I have not mentioned flight in cloud but you will remember that the cloud is below 300 ft AGL for only 3% of the year. We believe that it is not cost effective to equip all our helicopters for protracted flight in cloud. This means in effect that we do not need to deploy a tactical approach and let down aid, thus saving money and specially trained men. Obviously there will be occasions when it will be necessary to penetrate cloud for short periods either to climb above it to avoid high ground or to stay in it whilst transiting high ground. This is likely to be most acute when recovering aircraft after an engagement. We could overcome this if we were prepared to accept the tactical rigidity imposed by having, say, one or two recovery Landing Sites carefully selected in open ground which allows the aircraft to home overhead using its VHF(FM) Homer or navigation system and then to conduct a procedural let down.

WHAT EFFECT ON TASKS

20. Being able to fly under the conditions I have mentioned only allows us to carry out about 30% of our tasks and these largely in the Command and Control and Movement of Men and Materiel roles only. It is a sobering thought that we need to see some distance, to carry out the other 70% of our tasks and what stops us seeing? -

darkness and poor visibility.

21. How can we overcome the darkness and visibility? Well there are two ways - the poor man's solution and the rich man's solution.

a. The Poor man's Solution.

(1) Met Vis. The only way is to get closer to the enemy so that you can actually see him. This imposes the need for a

much higher degree of fieldcraft and stealth and the requirement to fly even lower than we do now. In fact our aircrew need to have a highly developed eye for ground. Taking as their guide Nelson's famous signal "Engage the enemy more closely".

(2) Darkness. We must make the maximum use of white light in all its forms - Artillery flare shells, Recce flares and searchlights. The latter can be used with IR filters and appropriate binoculars making it slightly less obvious. I don't think we use these techniques nearly enough and if we did we ought to be able to do a number of tasks which at the moment we cannot contemplate at night.

b. The Rich man's Solution. The promise of FLIR, and Radar and LLTV is fascinating but of course only radar will defeat both visibility and darkness. As you know thermal imaging is dependent to some extent on reasonable visibility and LLTV is dependent on at least ¼ moon or better. But the weights, reliability, complexity and costs of these equipments is high and they have a long way to go before they will be developed to a practical point.

It is, however, worth taking the Rich man's solution a step further, just to see whether it really is just a Rich man's dream.

a. If we assume an aircraft costs £500,000 and a radar with MTI costs £100,000.

b. For the price of two aircraft (which would represent the loss of 2% effectiveness in a fleet of 100 aircraft) you could buy 10 kits which would be enough for 1 per ten squadrons.

c. You would then be able to guarantee target acquisition and, using white light, carry out an anti-tank engagement at night.

d. The equipment would also incidentally improve our recce capability. The total overall increase in our effectiveness could be as much as 17%.

So we need to maintain a close interest in the R & D of such equipments and constantly monitor their progress because at some time in the future it may be cost effective to instal the equipment in a few of our aircraft.

CONCLUSION

22. We plan to equip our aircraft so that they can fly by day down to at least 300 ft AGL in visibility of 1000 metres and at night down to at least 300 ft AGL in visibility of 2000 metres and with light conditions of ¼ moon or better, by equipping them with radar altimeters, self contained accurate navigation systems, and II goggles. In fact day, night contact flight only. They will have a limited cloud flying ability and we will accept the tactical rigidity imposed by carefully selected recovery LS and procedural let downs.

23. We must improve our night flying training and our fieldcraft so that we can work closer to the enemy to overcome the visibility problem.

24. We must make much more use of white light and pursue as many techniques as possible to make it effective.

25. We must not close our minds completely to fitting a few of our aircraft with more complex equipment but not until that equipment is shown to be more effective and reliable than it is at the moment.

26. If we do limit initially our additional equipment to the three bits I have mentioned and pursue our night flying training with imagination and vigour, the grounds for criticism which I mentioned at the outset can be greatly reduced.