Economic Production of Helicopters—Some Future Possibilities

By L J HARPER

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DR G S HISLOP (*Chairman of the Executive Council*) *in the Chair*

INTRODUCTION BY THE CHAIRMAN

The CHAIRMAN, in introducing the Author, said that Mr HARPER was educated at Latymer School, London, and at the London School of Economics in Sociology He spent seven years with I C I Ltd , in the Leather Cloth Division and Plastics Division in personnel management He became involved in work study problems and their application towards the end of the war and spent his last two years in I C I practising and teaching work study to management and other grades

Mr Harper was senior organiser of studies at the Work Study School, at the College of Aeronautics, Cranfield, from its beginning in November, 1952, preparing for the first course, which commenced in January, 1953

He was currently concerned with the formulation, teaching and control of three ten-week courses per year for middle to senior levels of management, as well as short courses for specialist groups He was currently acting as Head of the Work Study School owing to the recent death of the Principal

MR L J HARPER

SUMMARY OF PAPER

Scope

Economic Production of anything is achieved when the Output/Input ratio is at optimum level Output refers to all goods and services of the enterprise Input concerns Capital, Material and Labour As Capital and Material generally constitute the greatest proportion of the Input factor, the most useful economies can be achieved by examining these aspects first

To set out to examine any part of the Input factor we need a scientific method Work Study supplies a series of techniques which provide one answer to this need

A dynamic approach, particularly in the field of Method Study, will inevitably result in a reduction of the Input factor but requires thoroughly trained personnel in a properly constituted department

Conclusions

The establishment of the Work Study function will be expensive but will result in economies otherwise not available to management

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The record shows its applicability to every field in which it has been applied and will undoubtedly show results in Helicopter manufacture Quality and safety factors are not adversely affected

To become or remain competitive we cannot afford the high cost of low overheads where production and methods engineering are concerned

The Work Study function must be established as a senior appointment to obtain the best results

Suggested Lines of Attack

Capital and Material economies can result from intensive study and will produce labour economies as a secondary effect A survey of available equipment and its usage should be undertaken first Habits of stocking, developed particularly in war-time, should be examined to ensure that correct stock levels are held Material, tools, piece parts should be classified more logically than by their use or name This will lead to a rationalisation of stocks and a simplification of procedure

Control procedures always benefit from a thorough investigation A comparison between current control requirements and those obtaining say ten years ago might prove to be very revealing of the inevitability of the growth of non-productive functions

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I have seen and heard helicopters, I have never flown or made them Consequently it will be understood that my lecture can not possibly be concerned with the details of the techniques and technology of Helicopter production or the local problems which the industry has to face In any case, caution dictates a degree of innocence when amongst experts

However, I am going to adhere to the title of the lecture but in this fashion

First I will talk about Production and what it means, then we will consider what we mean by Economic Production After that we shall examine the means at our disposal for achieving Economic Production and see whether or not these means are appropriate to the Economic Production of Helicopters If we can reach some agreement then, I am sure we shall have indicated " Some Future Possibilities," and thus the meaning of the title will have been revealed

Production then what does it mean ? In the most limited sense it means the end product of the assembly line—the motor cars, the tins of baked beans, the tons of steel, the helicopters and so on More broadly, Production means the goods and/or services produced by the organisation and its individuals When we are dealing with the subject of Production we must not forget that the designer has produced something on paper, so has the accountant, and the wages clerk and in fact everyone whose job in life it is to supply a service of one sort or another So in considering Production, let us not narrow our field of vision down to the factory floor We will keep a broad view of the whole undertaking whilst discussing Production

Now—Economic Production It has been said that the well-being of an enterprise depends upon its ability to produce the right goods or services at the right price and at the right time In a competitive market all three of these requirements are of paramount importance and all others become

supplementary to them The first, however, I shall not deal with but let us examine the other two " at the right price and at the right time "

The price of the product must depend primarily on what goes into it This we will call Input to compare with Production which we have called Output The Input can be classified under three headings (*a*) Capital, (*b*) Material, (*c*) Labour

The proportions in which these stand in relation to one another will be dependent upon the type and size of the undertaking but, generally, in the manufacturing industries Labour costs per annum are the least significant except that, in the final analysis, all costs represent someone's earnings

The measure of an industry's well being, efficiency or Productivity, call it what you will, is to be found in the ratio of Output to Input and Economic production depends upon the effectiveness with which management and labour (for it demands a joint effort) can improve this ratio

Let us then consider the Output figures If we think solely in terms of saleable products we must to some extent overlook all the non-saleable products and this might lead us to think of them as essential and unalterable by-products But as even by-products represent work on someone's part, this implies that all the work going on in the, so called, Indirect jobs is essential We must look at this a little later as clearly it is untenable

If we are going to think about Output at all we surely then must consider Input primarily Let's look at each of the three components separately

Capital concerns buildings, plant, machinery and the wherewithal to maintain normal trading throughout the years With the development of new techniques of production, more and more capital per head of operators is being invested every year If we need, as obviously we do, to improve our economic position by improving the Output Input ratio, should we not consider first where the greatest savings are to be made ? In other words, should we not examine our capital resources in great detail and determine whether or not we are getting full value from them I would suggest that far too often we are complacent in this matter, accepting that a particular building must be used for a certain purpose " because it always has " despite claims of greater economic significance accepting that a newly acquired piece of machinery is the most efficient of its kind because the makers said it was so Here I would quote a certain cotton mill in the North of England where, quite recently, an increase in output of 27% was achieved on a very expensive piece of machinery, with a reduction of 20% in labour cost, because the manager did not believe that the machine, the best of its kind in the world, could not be improved

This is the sort of approach which I think we need in tackling the problems of capital economies

Can we make the same sort of point about Material ? It is quoted by an authority on the subject that the average cost of holding material stocks is 25% per annum of the original cost I recently saw in an aircraft factory, stock valued at £1 m , held entirely for the manufacture of wings Such stocks tie up capital, cost a great deal of money in storage charges and, by their very magnitude, engender wasteful habits amongst operators With perhaps 10 people employed in the stores a reduction of 10% in personnel would have meant a saving of about £600 per annum in wages Based on the 25% storage charge quoted a reduction of only 5% in the stocks held

would have shown a return of £12,500 per annum Not readily demonstrated or recognised perhaps but at least £50,000 worth of capital would have been released for other purposes Equally, whilst considering Material, can we not question our acceptance of the fitness of the materials we use Clearly, I am not a metallurgist nor could I be so bold as to doubt the opinions of the experts I do know however that we are all inclined to accept the *Status Quo* without question Again, may I quote an example of a factory in Africa making heavy duty cans for oil from the local installation Many years ago the gauge of tinned steel had been laid down and having regard to the condition of the roads a fairly thick plate was used Now the roads are metalled but it was not by chance that the specification for the cans was altered to meet the improved conditions An attitude of mind and a deal of investigation was needed

In examining the Labour aspect of industrial economy we can clearly see the advantages to be gained from improvements in methods and procedures A great deal more can be saved by the elimination of unnecessary tasks, many of which again are accepted by custom and practice Also, in this day and age, when skilled craftsmen are at such a premium, there is a very real need to determine whether or not we are using these skills to the best advantage

So far, I have perhaps merely underlined the functions of good managers And yet, the examples I have quoted and many hundreds of others besides, are the results of investigation by specially trained men, not acting as managers but providing an essential service to good management They were in fact trained Work Study men The technique which they use are quite well-known and do not involve the Black Arts Basically they develop a critical and analytical attitude of mind which aims at the solution of many of industry's problems

At the risk of repeating what some of you already know I would like to show by slides, a brief outline of the techniques and objectives of Work Study

The first slide (Fig 1) shows that basically Work Study embraces two closely related techniques, Method Study and Work Measurement

The second slide (Fig 2) shows the relationship between the short term approach of Work Study and the more fundamental research of Process Study Not a distinct separation as you will see

The third slide (Fig 3) indicates in slightly more detail the steps and techniques to be followed in Method Study, followed by the fourth slide (Fig 4) which outlines some of the Measurement procedures

The fifth slide (Fig 5) indicates the objectives of Method Study

The sixth slide (Fig 6) defines Work Measurement and the seventh (Fig 7) shows the objectives

The techniques are not complicated but do require adequate training

Well now, we have looked at some aspects of Economic production and have seen a little of one of the means of achieving at least an improvement in the economics Let us now examine some lines of thought regarding the future possibilities of economic production of Helicopters Again, on the grounds of ignorance of your industry, may I be forgiven if I make suggestions which you cannot accept ?

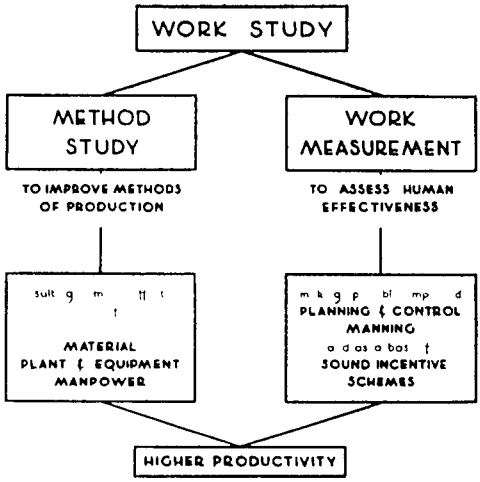

Fig 1 The work study approach

You can take it, however, that I can list the first half dozen or so objections which will inevitably spring to mind when I suggest a more virile approach to Work Study We get the same reaction from most people at the beginning " Our industry is different," " It won't work here," " We don't make anything standard," and so forth

These are traditional beliefs and often, let's face it, arise from either a jealousy regarding our skills and craft or a fear of having our shortcomings discovered

Work Study is not used to denigrate or dilute craftsmanship, nor is it used as a means of disclosing personal deficiencies To hold an inquest into why there has been inefficiency and to apportion blame for it is obviously both evil and time wasting Our concept is, " There is *always* a better way "

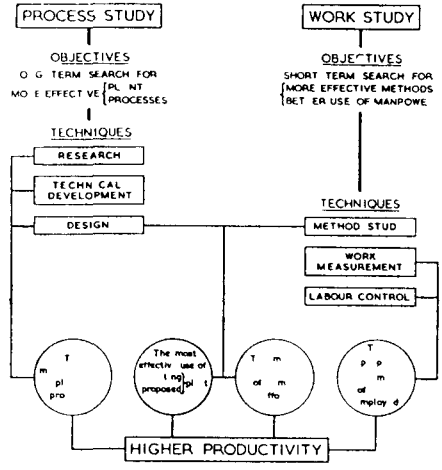

Fig 2 Work study in relation to process study

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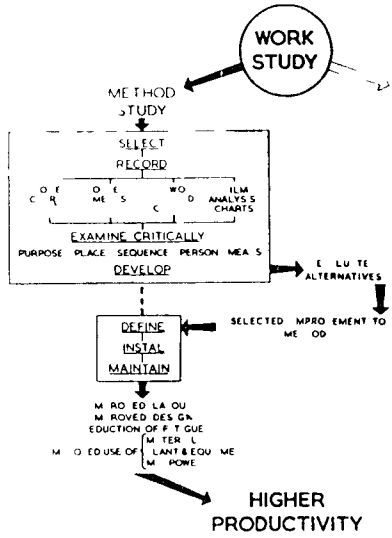

Fig 3 The techniques of method study

and the job is to find it and put it to work If then, with this approach, we can ask you to think at least twice before saying " It won't work here " I would like to indicate some of my personal thoughts on the subject of Work Study in the field of Helicopter Production

First, I would suggest that, as some quite healthy results have been shown by use of Work Study in such diverse fields as Farming, Surgery, Design, Laboratories and Use and Training of Military Personnel as well as the obvious fields there can be no fundamental reason for rejecting it from other activities and therefore it is worth investigating properly

If it is to be investigated properly it can only be done by affording to the Work Study function the right degree of importance and support from the very top This involves the selection of the right people to undertake adequate training to carry out a management function of a high order The head of the department must be able to talk on equal terms with at least second line management It is not a boy's job and should be treated as a promotion Certainly don't look around for someone you can spare If you can spare them—fire them If on the other hand a man has made a mark for himself within the organisation and has the right personality and background, even though it is inconvenient to have to release him it is better to do so than to invest in a lesser man and perhaps do more harm than good

Whilst dealing with staffing don't imagine that a Work Study department of one man and a clerk or typist will be able to re-organise your factory in three weeks

It is not possible to give a clear indication of how large a staff is required to undertake the Work Study function in such an industry as yours, but it is probable that the numbers needed will be greater than you think Certainly the costs are part of the overheads but sometimes there is a high cost in low overheads I have in mind a factory with which I was at one time associated

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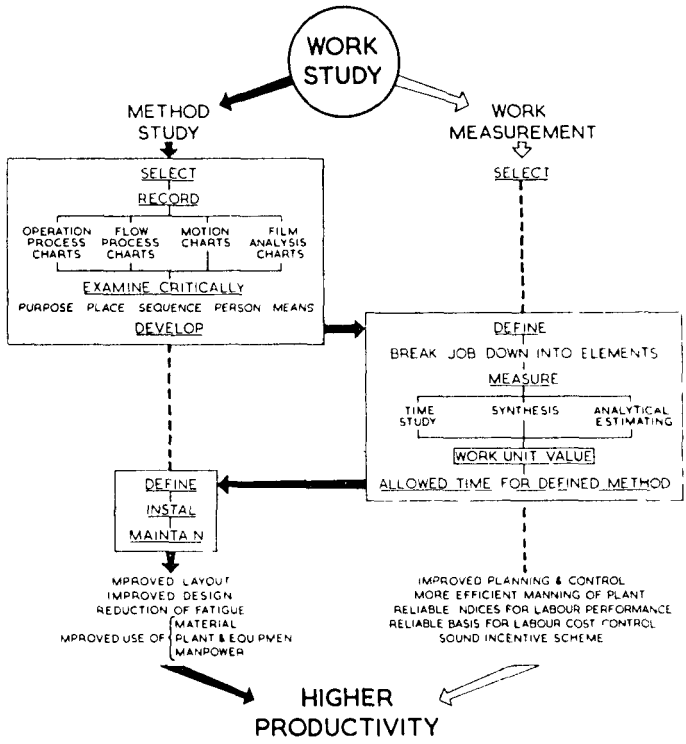

Fig 4 The techniques of work study

where, to cater for the work of a small number of craftsmen it was necessary to have as many as one Work Study man to eight craftsmen A high proportion maybe but by affording this high overhead cost, net savings (after allowing for payment of the Work Study men) amounted to nearly £14,000 annually This would not have been available to the company without some form of direct study of the work

Enough people then of the right calibre, properly trained and with intelligent terms of reference and enough time to do their job thoroughly and then we will see results

Secondly, whereabouts to start investigations Bold as I am I should not wish to give the impression that I know precisely the sources of your troubles I would hazard a guess, however, that they don't all arise on the production floor, even if they manifest there An investigation into control procedures aimed at simplifying the paper work so that people can get the information they want in order to run their jobs better, always pays I am sure I don't need to amplify this, we have all suffered from systems which get us bogged down

I am not referring here to the mechanics of running an office but rather, the collection and dissemination of allegedly essential information

Of equal or perhaps major importance I would suggest an investigation

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METHOD STUDY

OBJECTIVES

IMPROVED FACTORY AND WORKPLACE LAYOUT
IMPROVED DESIGN OF PLANT AND EQUIPMENT
IMPROVED USE OF { MATERIAL / PLANT AND EQUIPMENT / MANPOWER }
MORE EFFICIENT HANDLING OF MATERIAL
IMPROVED FLOW OF PRODUCTION
BETTER WORKING ENVIRONMENT
STANDARDISATION OF METHODS

Fig 5

WORK MEASUREMENT

DEFINITION

THE DETERMINATION OF THE PROPER TIME TO BE ALLOWED FOR THE EFFECTIVE PERFORMANCE OF A SPECIFIED TASK

Fig 6

WORK MEASUREMENT

OBJECTIVES

1 MORE ECONOMIC AND EFFECTIVE MANNING
2 IMPROVED PRODUCTION PLANNING AND CONTROL
3 RELIABLE PERFORMANCE INDICES
4 PROVISION OF A RATIONAL BASIS FOR INCENTIVE SCHEMES
4 RELIABLE BASIS FOR LABOUR COST CONTROL

Fig 7

into the quantity, disposition and use of capital equipment Let us use the approach of the steam shovel before getting involved with salt spoon techniques Most of our factories have expanded rapidly since perhaps 1938 and mushroom growth is generally untidy growth Often we try to make amends by installing mechanical handling equipment because of the bad location of certain shops An honest investigation into the costs of compromise of this nature usually shows how shortsighted such a policy is This can only be demonstrated by finding out what you have got, where it is, how much use you get out of it and what its annual costs are Perhaps you think this is unrewarding My experience tells me that for every £1 worth of time spent on such an investigation, anything from £10 to £100 will be returned even in the industries with little capital outlay

Thirdly, Materials, the Sacred Cow of the aircraft industry I cannot believe that all the exotic nonsense surrounding this subject is absolutely necessary Can we honestly say that we have never felt a degree of frustration when face to face with specification problems ? Perhaps I am in a safe position as I don't live with the hot breath of A I D scorching my neck all day, but I have seen enough to know that I could live very comfortably on the money which might be saved by a critical investigation of true requirements, stocks, use, identification and control, etc , of the materials used in your type of industry Can it be that this young but great industry has allowed its spirit of revolution to become atrophied into a state of evolution, if not mortification in this subject ? Again, if we find out what we've got, where it is, how it is used and question the justification, I think we should

be able to eliminate a fair amount of hocus pocus with good results all round

And lastly, but not necessarily the least, our labour force How to do a job and how long it should take should surely be determined by management, not by the operative Let's forget trades unions for the moment, important as their contribution is If we want a job done to a certain quality standard then clearly we must lay down that standard precisely, and just as precisely lay down the method by which it should be done Unless this is done how can we expect to maintain any degree of standardisation of methods and results ? So often we are told that quality is affected by Work Study I would not disagree for the approach is to first, determine the *true* requirements, a thing often left undone or too loosely done, and then to establish a means by which this standard can be achieved Quality is affected for good not for ill

Having determined the How, we can then think about fair and equitable bases for time values I understand that again, this is not possible except by Ratefixing due to the complexity of the jobs Let me remind you of the example I quoted of one Work Study man to eight craftsmen applied to engineers in a fine precision model shop carrying out one-off jobs often to verbal instructions From my personal knowledge of this job I would have sympathy with anyone saying " It won't work here " Oddly enough, it does work even if at a relatively high cost in overheads

To avoid grasping the nettle for this reason is unrealistic and to cling to a procedure of Oriental bargaining such as is used in farming or bricklaying is almost criminal at the present price of skilled labour A much more precise and consistent approach is necessary if we are to deal effectively with manning, planning and costing and have incentive schemes with rational bases I suggest that, at present, much of the aim of the Ratefixing function is to correct supposed anomalies in the wages structure, with the results that we now have an utterly chaotic condition of pay rates It is difficult to accept that times estimated to the nearest thousandth of an hour (as is done) at one end of the scale and to the nearest hour or day at the other end provide either consistent or equitable incentive values

But the proper time for the effective performance of a specified task can be determined by one or another of the techniques of Work Measurement and will be of very great value in aiming towards Economic Production

Finally, how can management, as at present constituted, hope to undertake any part of this function of Work Study along with all the day-to-day problems which have to be faced ?

Clearly the service must be provided by specialists and enough of them to be able to do justice to the job When this is available to management I submit that " Some Future Possibilities " will be discovered

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