Hut 6.

12th. September 1941

Dear Commander Travis,

The problems with which we have to deal in Hut 6 fall into two main classes - those in which we have to try 17,576 positions per wheel order and those in which we need only try a limited number of positions. Problems of the first class can only be dealt with by means of a bombe, and the possibility of dealing with a particular problem depends chiefly on the strength of the menus that can be prepared.   For running on a standard bombe a menu must be strong enough to produce a small number of stops because the testing of a large number of stops would take too much time.   Weaker menus can be run on Jumbo because this machine tests its own stops, but the menus that can be run are limited by two factors.   When a menu is so weak that Jumbo has to stop hundreds of times in each run, the running time becomes too long. Also, when Jumbo produces a large number of stories, which have to be examined by running tapes, the time and labour required for this part of the work becomes excessive.   It is also true, when we want to run a job that is going to involve a considerable number of stops, it is a disadvantage to have three banks on the same machine because each has to wait while the stops produced by the other banks are being tested, and we do not always want to use all three banks for the same long job.

Problems of the second class are dealt with by hand methods, using Type X machines, hand enigmas and cyclometers. Running a menu involves first some preliminary work on the Type X machines and an examination of the results.   Then some menus we have to run tapes on Type X machines and examine them, while for weaker menus we have to take counts by the dotting method on hand enigmas.   All these operations are slow and laborious.   In this class of problem, as in the first class, the time factor prevents us from dealing with some cases.

In order to increase the range of problems of both classes which can be dealt with I should like to introduce three new machines.   One of them is a super test plate which will run a tape and take counts.   The other two are machines of the bombe type but with refinements which will cut down the time required both for running and for testing.   The general principles on which these machines will work are described below, but while we are considering new types of machinery we should also consider the existing types.

At present we have eight bombes of which only one is a Jumbo.   We find in Hut 6 that, of the menus which can be made up on colours which are not regularly broken, the majority can only be run on Jumbo. In consequence it is apt to happen that, when for some reason the bombes are free, it is difficult to make full use of them. The regular colours have also been tending to get more difficult, and I should not be at all surprised to find that before long we shall often need Jumbo to deal with them. I understand that Hut 8 also feel that the ratio of Jumbos to other bombes ought to be increased in the near future. Only three more Jumbos have been ordered, and these are to be numbers 9, 12 and 15. This is not enough and I would suggest ordering several more at once so that the parts will be available should we need Jumbos urgently.   If it will not upset Keene's plans, it might be wiser to arrange that the next three Jumbos shall be numbers 9, 11 and 14.

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The proposed new machines may for the present be called "The Mammoth", "The Baby Jumbo" and "The Quagger".   Their exact specification will depend on Keene's progress, but the main ideas are as follows.

THE MAMMOTH

This machine will only have one bank.   Its 351 relays will do the testing work of Jumbo's machine gun instantaneously.   These relays will also enable us to run a weak menu by making certain assumptions.   For instance we may assume that two out of ten letters of the menu are self steckered or that some letter of one chain is steckered to some letter of another chain.   Assumptions of this nature do not involve a great risk and considerably reduce the stopping time.   The machine will not attempt to examine all possible steckers of any letter but it will make successive runs assuming in each run that a particular letter of the menu is self steckered.   It will not be much use for menus that can be run on ordinary bombes, but it will be able to deal with menus that could not be run on Jumbo.   In fact it will be a research machine for dealing with particularly difficult problems of the first class.   When it is dealing with a very unpleasant problem, it will be used in combination with the Quagger.

THE BABY JUMBO

This is really a Jumbo with only one bank and with a number of refinements which could not be introduced on the three bank model.   It will be useful for running weak menus which are going to take a long time, and its refinements will of course extend the range of menus that can be run. It will use the machine gun principle, and will not be as powerful a machine as the Mammoth, but in combination with the Quagger it will be able to deal with problems of the second class, and this may well prove to be extremely important.

THE QUAGGER

This is a machine which will run tapes and take counts as well as doing the jobs of the old test plate.   It will be used in problems of both classes.   The Mammoth or Baby Jumbo will produce stories in the form of punched cards.   By means of these cards the enigma wheels and stecker of the Quagger will be automatically set and a message will be automatically run off.   In problems of the second class the saving of time that will be achieved by the Baby Jumbo and the Quagger will be very considerable.

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Keene thinks that all three machines are possible, but the Mammoth depends on experiments with a new type of relay. I should like to give him a definite order, so that he can proceed with designs and drawings immediately. As far as I can see we are not likely to need more than one Mammoth and one Baby Jumbo, but these machines will require bombe frames, so we must decide at what point we are prepared to break into the production of ordinary bombes and Jumbos.   I am not sure how many Quaggers will be needed, but one Quagger will not be able to keep pace with the other machines. Provided the Quagger is a success I rather expect we shall need about three.   I suggest that, subject to Keene's comments we should place the following orders.

1.   Three Jumbos in addition to those already ordered. The positions of these machines in the bombe production sequence to be decided later.

2.   The Jumbos already on order to be made earlier than is at present arranged.

3.   One Baby Jumbo, to be about the 16th. bombe.

4.   One Mammoth, to be about the 18th. bombe.

5.   One Quagger, with the possibility of two more.

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In addition a decision is needed about Banbury punches. Keene can produce these without much difficulty, but he wants to know how many will be required.   Arrangements must be made to get rolls of suitably strong paper with accurate printing.

Yours sincerely,

W. G. W.