May 2014 note: this is believed to be the oldest available formalisation of the PicMA philosophy. Capt. Baillie was BEA's General Manager Flight Operations. It is not known who the original audience was but the document was used as pilot briefing in the late 1960s. This version has been converted by OCR from poor quality photocopies but the text is entirely unchanged from the original. - steve_admin@picma.org.uk

Control Cabin Management – Monitored Approach
– The Double Check

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CONTROL CABIN MANAGEMENT - MONITORED APPROACH

FOREWORD

This paper was written by my predecessor Captain W Baillie who, when General Manager (Flight Operations) in BEA, evolved the philosophy of control cabin management which is the foundation of BEA's operating procedure and technique.

It is a feature of modern airline operation that a large number of regulations, instructions, advices and so forth are issued to pilots every year. The objective of all this information is to improve the safety and efficiency of operations. However, the mere writing of instructions and regulations will not make flying safer. It is the application of the instructions by the pilots in the control cabin that determines the safety and efficiency of the operation. I think that pilots will more readily accept the written rules and regulations and more easily apply them if they under- stand something of the reasoning and philosophy behind these regulations.

The purpose of giving you this paper is to explain some of the thoughts which lie behind certain fundamental aspects of our operating procedures.

E W LOWDEN

CONTROL CABIN MANAGEMENT - MONITORED APPROACH

In presenting this Paper on "BEA and the Monitored Approach" I feel that at the start I ought to disclaim on BEA's behalf any claim that our ideas on human fallibility are highly original. A great deal of research has been done on such problems by specialists in the fields of psychology and ergonomics and their findings have been read with the greatest interest by all who deal with that great enigma which is commonly called "the human factor". However, I think it is true to say that we have taken a lead in accepting the facts about human errors in aircraft operation in adopting as a standard procedure the principles of systematic cross-checking and the monitored approach (i.e. co-pilot on instruments).

Recent studies of the working of the human brain show clearly that although it is perhaps the most remarkable piece of mechanism in nature it is in some ways ill-adapted to the demands made upon it by our all-electric, high-speed civilization

This is hardly surprising when one considers that for by far the greater part of his history, Man has had to contend with nothing faster than a galloping horse. Now the horses are harnessed by the tens of thousands in the sleek nacelles of his Jets and when they are let loose things happen pretty quickly. In order to cope with the speed and complexity of modern machines Man still relies upon the system by which his brain has always managed; he commits to his subconscious many useful reflexes and reserves the conscious level for the deliberate acts of decision taking and command.

The reflex system is fine until it gets too big for its boots and begins to manufacture answers and trigger-off actions which it thinks should be suitable to the occasion, even when in fact the appropriate conditions for these answers and actions are not actually present. It is a fatal weakness of the habit- forming mechanism that it can be highly uncritical and may in this way present erroneous data to the higher levels of consciousness.

The importance of this mechanism in relation to the possibility of error has been demonstrated by research workers of the Medical Research Unit at Cambridge who emote certain air and railway accidents as examples.

A few years ago there was a very serious railway accident on the outskirts of London, in which many people were killed or injured. In evidence before the enquiring officials, the driver of a train which ran into another one in thick fog said that he was certain that a vital signal was showing green. An overwhelming weight of evidence proved that in fact it was showing yellow. Further questioning of the driver proved that in many journeys past this signal he had rarely seen it showing anything but green. On the night in question his habit mechanism was expecting to see a green light and it told the driver that it had seen one.

As a result of this and similar accidents it has been accepted that there lie within every human operator, however efficient and conscientious, latent possibilities of error which cannot be ignored. One must distinguish in this respect between errors of negligence and those which arise from deeper imperfections.

Errors of negligence may be caused by such factors as poor or inadequate training, poor morale or discipline, or pressing emotional problems. It will be noted that no hard and fast line can be drawn between these factors; they tend to interact in the typically complex human manner so that it is dangerous to be dogmatic about casual factors. Suffice to say that the greater the load on the higher levels of consciousness, the greater will be the tendency for the subconscious to invade the

territory of the conscious and attempt to supply reactive answers to problems which are normally dealt with at the conscious level.

It is probably true to say that there was a time in aviation history when, in spite of all the evidence to the contrary, airline managements believed that they could so train and indoctrinate flight crews that they would not make mistakes. I am speaking now of 'aircrew errors' so-called, and not those mistakes which could fairly be blamed on inadequacies of instrumentation or communication.

As the result of our own experience we in BEA have come to realise that this is not the right road to error-free flying. There are far too many factors affecting even the most highly trained pilot or crew member to enable us to say with confidence that this man is so well-trained, so self- disciplined and so utterly reliable that he won't make a mistake. Naturally, commonsense and prudence make us select and train men who fit this description but it is not enough. Given a certain combination of circumstances there is a real risk that an error might occur.

In the past there was evidence to show that avoidable accidents were occurring simply because crew members were considered as individuals, each with a specific function to perform. In a good crew each man knew his job and made his full contribution to the total crew effort. The only supervision was the traditional one exercised sporadically by the Captain. Errors made by individuals could go undetected.

The hazards Inherent in a wrong or inadequate relationship between the members of an aircraft crew are particularly apparent during the most critical period of flight - the let- down, approach and landing. The fundamental basis of the problem is the heavy physical and mental load placed on the Captain of the aircraft during the most critical stage of a flight. Fundamentally, the solution is to reduce the load on the Captain and to check and cross-check all vital actions throughout this period of the flight, taking full advantage of the skill and capability of both pilots, or all three pilots when a third pilot is carried. This raises three main requirements -

(1) A correct distribution of workload.
(2) A standard and simple system of cross-checking.
(3) A first-class training and refresher organisation to ensure that crews are fully capable of carrying out (1) and (2).

In considering the problems of workload allocation in modern aircraft it is as well to remember that the basic principles of pilotage were formulated in an era of one pilot crews. Hence the tendency has been, as crews became larger, merely to transfer to other crew members various ancillary duties which appeared to lie outside the central care of the pilot's job, that of flying the aircraft. In other words, the aim has been to preserve intact the business of handling the primary controls. Only a few people appear to have questioned the wisdom of assuming that in the changed operating conditions of recent years, with the emphasis on regular operations in all weather conditions, the old ideas still held good.

All these traditional attitudes towards the job of flying transport aircraft emphasised the importance of the particular role of each crew member and did little or nothing to promote ideas of integration and teamwork. This was especially true of the job of the Captain which was kept in isolation by emphasis on the status aspect and the supposed indivisibility of the basic act of flying the aircraft. Errors on his part could pass undetected and result in a serious accident.

It is human to err and human fallibility in any one individual never can be eliminated. Therefore it must be accepted that operating procedures which are based on the assumption of individual infallibility are quite out ox date and fail to meet the safety standards now required.

In this paper we give details of the "Monitored Approach Procedure" which was introduced in BEA a number of years ago and was our first endeavour to take account of all the above arguments. To the best of our knowledge and belief this procedure has worked well and may have prevented a number of accidents. Encouraged by this apparent success we are now taking active measures to extend the principles of this philosophy to all phases of the operation in an attempt to produce a comprehensive system of "Flight Deck Management". Some details of this further development are given in this paper under the heading "The Double Check Concept".

THE MONITORED APPROACH

by Capt W Baillie. June 1964

BEA's active interest in this aspect of operating techniques really began in 1948, not long after the formation of the airline, when a serious accident involving one of our aircraft raised questions about the division of workload in the control cabin.

This accident occurred during an instrument letdown in cloud to an airport which was surrounded by higher ground. Following the customary procedure of that period the Captain carried out this operation more or less single handed, the co-pilot merely obeying such instructions as the Captain gave him. Owing to a high wind and failure to obtain the outer marker the Captain eventually let—down into a hill some sixteen miles from the field. Fortunately everyone escaped with only minor injuries.

Clearly there were aspects of this operation which went e beyond the question of the competence of the pilot. Was there any way in which the work-load on the principal figure could have been relieved? Why did not the co-pilot realise and point out that the Captain was seriously in error? Was it right to assume that the let-down must be carried out by the Captain?

From this germ grew the whole of BEA's philosophy on the “monitored approach" and the principle of crew cross-checking with which it is closely associated. Leaving aside for the moment the general consideration of cross-checking during other phases of flight, let us consider this vital let-down, approach and landing phase. To an increasing degree aircraft are being equipped with integrated flight systems, auto-pilots and improved radio-aids which greatly ease the task of letting-down on instruments. To an increasing degree let-down patterns and the associated equipment are becoming standardised. It follows that a well trained co-pilot who is fully conversant with these aids should be able to carry out a let-down to acceptable standards. This leaves the final approach and touch—down phase to be considered.

It is well known that the most dangerous phase in an approach under marginal conditions is that indeterminate period when the pilot has half his attention on the flight instrument panel and half on the visual references which are appearing outside, while a further part or his brain is doing its best to correlate the two sets of references and translate them into manual movement of the controls. Quite apart from the obvious difficulty of this task, there are the inevitable psychological factors which tend to cloud the pilots judgment. The feeling that if he goes a little bit lower he could get in and avoid going through the whole procedure again; the seldom acknowledged personal pride factor which puts a premium on "getting in first time". Many an aircraft has been lost through the insidious promptings of such voices as these.

The obvious solution to these problems was to divide the task so that one pilot handled the let-down and remained firmly on instruments while the other carried out the landing as soon he had adequate visual reference. If visual reference failed or was never obtained the pilot on instruments was in a position to control the aircraft with a minimum of uncertainty. If the Captain was satisfied that he had full visual reference he would then carry on to do the actual landing. It was therefore decided to invite Captains to try out the first system on a voluntary basis. They were asked to report their reactions to the idea and to actual experience. The response was particularly interesting when it is compared with that of a group of Electra pilots in Australia who as recently as 1960 took part in a

controlled experiment on these lines (Australian Department of Supply, Australian Defence Scientific Service, Aeronautical Research Laboratories Human Engineering Note 3).

Comparison of the remarks of the pilots shows that in each case there was a slight balance in favour of the system which I shall for convenience call "Monitored Approach", which could be defined as Co-pilot let-down to break-off point, Captain visual approach and landing".

The average pilot is conservative in his approach to innovations. He has to very sure that new a new idea does not one difficulty and raise half-a-dozen new ones. Above all he wants to be certain that his present system, which may have shortcomings but does work, is not swept away in favour of something which is possibly dangerous. His first reaction is therefore likely to be one of doubt if not of active opposition.

In BEA's case we had exactly this experience. As a group, Management Pilots, Training Captains and a small number of "innovating" pilots agreed that the system had much to recommend it, although reservations were expressed on such aspects as change of trim on handover, standardisation of system and the quality of co-pilots' instrument flying. On the other hand, some very experienced pilots expressed strong opposition to the scheme.

During the period of about three years during which the Monitored Approach System was operated on a voluntary basis there was a stead swing of opinion in its favour. Typical of the 'conversations' which took place was that of a Captain who had long expressed his opposition. One day he made three unsuccessful attempts to get into Hamburg and finally on the fourth he decided have a go at Monitored Approach. To his intense surprise he got in easily and he found the whole operation so relaxed and different from his previous 'single-handed' efforts that he was thereafter an ardent supporter.

When sufficient evidence had been obtained to show that the Monitored Approach System offered solid advantages and was gaining a general acceptance amongst pilots of all grades, we decided to move to the final stage involving its adoption as a standard operating procedure.

Before this could be effected we had to prepare more detailed instructions than had hitherto been in force. Certain points such as the discretionary powers of the Captain had to be considered and included in the final document. Perhaps most important of all, the ground had to be carefully prepared by the issue of a comprehensive Bulletin summing up the problem we were facing, the proposed solution, the trial experience so far obtained and the reasons for the decision to introduce the system as a practice. In describing the trial period, the Bulletin listed the main objections which had been voiced and showed how these objections either lacked substance or could be overcome.

The ultimate responsibility of the Captain for the safety of the aircraft is recognised. He is responsible for deciding whether or not a monitored approach is carried out on any particular occasion.

Finally the adoption of the system as a standard procedure was promulgated and incorporated in the Standing Instructions. It is now in use as the normal procedure when weather conditions necessitate an instrument approach.

As practised in BEA the Monitored Approach is initiated on all occasions when circumstances are such that it is necessary to rely on instruments after passing the holding or main approach beacon, and under these conditions the handover of the controls takes place not later than passing the beacon.

Modern performance criteria prohibits the principle of holding the critical height when visual reference has not been achieved. Under the new regulations the aircraft is assumed to be descending on the correct approach path and, therefore, when it reaches critical height it is in the correct position for continuing a sate approach. If visual contact is not obtained the aircraft must immediately climb away in the overshoot pattern.

Under the Monitored Approach System this means that the Captain gives the order to overshoot, but if he does not do so the co—pilot is under instructions to overshoot on his own initiative on reaching the critical height. The co-pilot is never permitted to fly below the critical height so that we have a "fail safe" system in this respect. Full details of the practical application of the system are given in the Appendix 1 to this Paper, which is a direct extract from the relevant section of BEA's Operations Manual.

Arguments For and Against.

It is not suggested that the Monitored Approach is the perfect answer to the problems of getting down safely. On the other hand, we do feel that its logic should appeal to many operators and pilots who are beginning to realise that the latest generation of aircraft can be operates safely only if the crew duties are correctly allocated and the full value is obtained from the experience and ability of each crew member.

Use of the Monitored Approach Procedure enables a constant double check to carried out. The chances of both pilots making the same mistake are relatively remote, so any errors should he immediately detected. As the Captain is relieved of the routine of concentration on the instruments he can initiate the checks necessary for the safe operation of the aircraft. He can also carry out the R/T communications himself, an important consideration in terminal areas where speed and accuracy of acknowledgment are particularly necessary.

He is also free to consider the implications of weather reports and ATC instructions and to relate them to the local traffic conditions.

Although the Captain's overall responsibility for the operation of the aircraft remains entirely unchanged, the co-pilot assumes a greater share of the physical responsibility of flying the aircraft, thus relieving the Captain of a good deal of strain.

One of the most important advantages of the system, particularly when the weather is marginal, lies in the fact that during the let-down the Captain has been free from concentration on instrument flying. Instead of being "amongst the trees" he can take a good look at "the wood"; in other words, he has a better idea of the whole situation and is able to concentrate on those factors which affect his decision to carry on or to discontinue the approach.

Throughout the let-down the Captain can scan ahead and inside the control cabin. His eyes will be far better adapted to picking up visual references than they would if he had been gazing at his flight instruments. He may well obtain visual reference before reaching break-off height, in which case he will have longer to establish himself.

If the co-pilot does make a mistake during the let-down, experience shows that the Captain is quick to see the error. Recent experience of auto-coupled approaches has shown an even greater need than ever to supervise the co-pilot‘s selection of "feed-in" facilities as this can be a ready source of error or omission.

Finally, the is every incentive for the Captain to use the secondary aids which may act as a further cross-check on the accuracy of the approach.

The success of this procedure obviously depends on two factors:—

1. The use of “recommended procedures" by all pilots. This reduces the risk of undetected error or misunderstanding, and makes it possible for two pilots to work together as a team, even though they may not have flown together before.

2. The instrument flying ability of the First Officer. All First Officer are trained to he required standard during type conversion and Captains should ensure that this standard is maintained by adequate Practice. A monitored should only be continued if the Captain is satisfied that the First Officer is up to the required standard.

The importance of ensuring adequate standards for co-pilots has already been mentioned but it can hardly be over-emphasised that this is the key to general acceptance of the procedure by line Captains. The word ‘standards’ has been used here to cover all aspects of the co-pilot's duties, although instrument flying ability is obviously the main consideration. The general feeling of mutual confidence upon which sound teamwork is built derives not so much from tghe knowledge that crew members are competent in certain narrow spheres but rather from the belief that they are professional men who thoroughly understand the work and responsibilities of their colleagues.

The job of the co-pilot is a responsible one which demands the best that a man can give. Under the monitored approach system he is given a vital part of the operation. Granted the co-pilot is under supervision and granted that he probably has an auto-pilot with numerous feed-in facilities, it is still a highly important job. No let-down is entirely routine, each has its subtleties, many are extremely critical. This is a sphere in which the co-pilot may really feel that he is in no sense a mere recorder of events and a manipulator of ancillary controls. In practice it has been found that co-pilots gain confidence and skill very quickly once they are given the responsibility. For these reasons we have found that the co-pilots like the Monitored Approach Procedure very much.

Another common objection is the possible deterioration in Captain’s instrument flying standards. This is easily overcome by taking every opportunity of practising let-downs in good weather which, together with routine refresher flying, should prevent any marked falling off in standards. In BEA this has never presented any problem and our check flight reports show that there has been no falling off in Captains standards in this respect.

The adoption of the system of cross-checking and the monitored approach demands a fundamental change in the respective functions and indeed, of the conventional relationship between Captain and co-pilots. In this new relationship it is up to each crew member to adopt an attitude of mind which “asks the reason why”. No action which appears to be contrary to the control instructions, the let-down sheet, the Operations Manual or the Drill Cards can be allowed to pass unchallenged. We have long ago passed the stage where the unhappy co-pilot would merely raise his eye-brows, shrug his shoulders, say to himself "I suppose he knows what he's doing” and return the contemplation of his log or the vagaries of the radio-compass. There may well be some reluctance to accept these changes but it is contended that the potential advantages of the system are such that these changes are worth accepting.