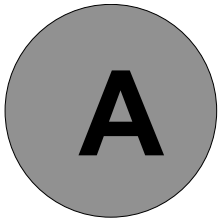

GUIDANCE MATERIAL:

PLANNING AND CONDUCTING FHA SESSIONS

1 PURPOSE

The purpose of this Guidance Material is to provide recommendations to conduct sessions **to identify hazard and its worst credible effect**, so when using methods 2 & 4 of setting Safety Objectives (See FHA Chapter 3 Guidance Material G).

2 THE ROLE OF THE FHA GROUP

It is usually best to initiate the FHA process in a group session, involving representatives of the various organisations concerned with the specification, development and use of the system.

The interactions between participants with varying experience and knowledge tend to lead to broader, more comprehensive and more balanced consideration of safety issues than if FHA was conducted by an individual as a desk study.

While group sessions are usually good at generating ideas, identifying issues and making an initial assessment, they do not always produce these outputs in a logical order. Also, it is difficult for a group to analyse the ideas and issues in detail – it is hard to consider all the implications and inter-relationships between issues when these have only just been raised. Much time can be wasted in highly technical discussions which may turn out to be irrelevant.

It is therefore recommended that:

- The group session should be used to generate ideas and undertake preliminary assessment only (perhaps identifying factors that are important, rather than working through the implications in detail).

- The findings should be collated and analysed after the session. This should be done by one or two individuals with sufficient breadth of expertise to understand all the issues raised, and a good appreciation of the purposes of the FHA. The person who facilitated or recorded the session will often be best able to perform this task.

- The collated results should be fed back to the group, to check that the analysis has correctly interpreted their input, and to provide an opportunity to reconsider any aspects once the 'whole picture' can be seen.

3 FHA SESSION PARTICIPANTS

As illustrated in Figure A-1, Functional Hazard Assessment sessions need to involve representatives of all the main stakeholders in the system and its safety. Typically, a session should involve:

- ***System users***: ATCOs and Flight Crew (where necessary), to assess the consequences of hazard(s) from an operational perspective;

- ***System technical experts***, to explain the system purpose, interfaces and functions;

- ***Safety and human factors experts***, to guide in the application of the FHA methodology itself and to bring wider experience of the effects of hazards;

- A ***'moderator'*** or ***'facilitator'*** to lead the session. His/her main tasks will be:
  - To guide the meeting through the different steps of the FHA process;
  - To keep the discussion centred on the question "What if?", i.e. on considering the effects of the different failure modes of the assessed functions;
  - To ensure comprehensive and balanced consideration of each function;
  - To encourage relevant contributions and ensure that all participants have an opportunity to put their views.

  Further guidance on the moderator/facilitator is provided

- A ***meeting secretary***, to record the findings, and assists the facilitator in ensuring that all aspects have been covered.

Note: specific attention should be paid to properly and extensively fill the **hazard effect** cell of the FHA table (see FHA Chapter 3 Guidance Material H). This part is key to the success of the FHA as it will be used to agree on the scope of the system under assessment, to agree on the operational consequences of the hazard, to correctly allocate a severity to the worst credible effect.

Figure A-1. FHA Session Organisation

Moderating sessions is not an easy task – the challenges include:

- Keeping within the time schedule without omitting or rushing through important issues;
- Maintaining a structured approach, and keeping the discussion relevant, without suppressing new and unexpected ideas;
- Allowing all participants an equal opportunity to contribute.

Ideally an well-experienced and trained moderator should be used.

4 SESSION PSYCHOLOGY

Some consideration of the individual and group psychology involved an FHA session is helpful in understanding how to run a successful session.

The mental processes required from each participant in order to produce the desired outputs can be categorised under two broad kinds of thinking:

- ***Creative (inductive) thinking***: This is important in the identification of failure mode(s), external events, sequence of events, hazards and the hazard effects that may result. The basic type of question being asked is ***'What could go wrong?'***. Section A.3.1 provides additional guidance for this process.
- ***Judgmental (deductive) thinking***. This is important in classifying the severity of hazard effects and in setting the Safety Objectives. The basic questions are ***'How severe are the effects of this sequence of events'***. Section A.3.2 provides additional guidance for this process.

The above are cognitive processes, undertaken by each individual participant, but the ***group dynamics*** of the session are also important in determining its success. (see section A.3.3)

3.1 The Creative Process - Identifying What Could Go Wrong

Creative thinking is necessary to ensure that the identification of potential failure mode(s), and the potential resulting hazards is as comprehensive as possible. It is important to encourage participants to think widely and imaginatively around the subject, initially without analysis or criticism.

Typically, this is achieved by a process of structured brainstorming. The structure should both ensure completeness and encourage (not constrain) wide-ranging thinking about the system.

In a FHA session, the highest level of structure is dictated by the need for systematic consideration of each function of the system. To ensure completeness, it is often useful for the facilitator to lead the session through

other, or more detailed, ways of considering the system. Examples of such lower-level structuring include:

- Consideration of other 'dimensions' of the problem, such as flight phases or operational scenarios. This helps to prevent participants becoming too 'locked in' to a mental model based purely on system functions.

- Prompt words, expressing what can go wrong, can be applied to each function of the system. Guidance Material B suggests prompt words for the identification of failure modes and external events. Wherever the combination of function and prompt word leads to the identification of a credible failure mode, the session should go on to discuss what hazards may arise from that failure mode.

- Participants should be encouraged to think beyond their own experience, considering how others might use the system and the errors they might make. To help with this, and to overcome any inhibitions participants may have about mentioning errors which they themselves have made, it can be helpful to ask what errors others – such as an inexperienced or fatigued controller or a pilot under stress – might make.

- Participants can be prompted to recall relevant incidents they have experienced or heard about. It may be helpful for the facilitator to outline a few examples and ask for others.

- Participants should be encouraged to consider latent and organisational failure modes as well as the more obvious (active) failure modes manifested during operation. Some prompt words are suggested in Guidance Material B.

- Participants should also be encouraged to compare potential resulting effects considering the possibility to detect or not a hazard occurrence.

- Where a comparative approach is being taken ('Is the system as safe as what currently exists?') it is useful to begin the session by brainstorming what are the key differences between the existing and proposed systems. This can also be helpful where a FHA has already been performed for a similar system, especially by the same group, or when considering a number of variants, as it helps avoid repetition.

A recurrent problem in designing FHA sessions is how to cover all the possible combinations of failure modes, prompt words and other ways of breaking down the problem in the time available. Rather than working through all combinations exhaustively, it may be adequate to talk through the detailed breakdown or prompt list in the introduction, but only work through a broader grouping in the session itself.

Judgements about how detailed a list of potential failure modes should be used, and hence how much time should be devoted to the FHA session, should take

into account the status of the system development (how much detail is required) and its potential to cause significant risk.

More detailed prompts can always be introduced at later iterations of the FHA process as the design develops; the main danger to be avoided is that of overlooking significant failure modes at an early stage.

The FHA session organiser should conduct a 'dry run' of the process before the session. By working through a few combinations of functions and keywords, either as a mental exercise or with one or two colleagues, the organiser should be able to check the applicability of the keywords and gauge how much information or discussion each combination is likely to generate.

In such cases users may group the failure modes into a smaller number of prompts, taking care to ensure that the reduced list spans all the possibilities in the full list.

Reminders of the full list can be provided on posters around the room, or on handouts. The facilitator can draw specific attention to such lists if the flow of ideas seems to be exhausted prematurely.

3.2 Judgmental Thinking – Classifying Hazard Effects and Setting Safety Objectives

The aim of this part of the FHA session is to elicit subjective judgements, in such a way as to make the best use of people's knowledge and experience, and to minimise – or at least reveal - any biases or uncertainties.

Where the functions and hazards are complex and closely inter-linked, session designers should consider running the judgmental part of the session some time after the creative part, to give time to collate the results into a concise form. If this is not possible, the session leaders should make sure they have an opportunity (during a break, for example) to do some preliminary collation of the findings.

Where the functions and hazards can be simply expressed and are clearly distinct, it is generally better to make the severity classification judgements for each hazard effect at the same time as it is identified, since the participants will have the hazard and associated effect in mind.

The group may initially find it difficult to agree on any severity level. It is often easier to agree on the possible range of values that could be taken, or those that are clearly not correct. For example, all members of the group may agree that the hazard effect cannot possibly be above the severity level 2. This range can then be narrowed down to a single consensus value.

Where a consensus cannot be reached, this should be documented. However, lack of consensus often indicates that the hazard or its effects has not been clearly defined, such that participants have differing ideas of what it entails. It

may be possible to resolve this in the meeting by defining the hazard and its effects more carefully, or by defining more than one hazard to represent each of the different interpretations.

Once hazard effect was being allocating the severity, the group will have to agree on the probability that each hazard may generate each of its effects. This will help identifying the worst credible case (worst credible effect of the hazard) and so identifying the safety objective of the hazard.

The hazard effects classification judgements should be tested for consistency with those for other hazard effects. The relative order of severity implied by the classifications should also be looked at, as an indication of the overall balance and correctness of judgements.

In general, FHA sessions do not need to elicit quantitative information in any detail, but there is a large body of literature on techniques if required.

3.3 Group Dynamics

These aspects apply to both the creative and the judgmental aspects of the session.

- ***Understanding of the process and motivation for attendance.*** It is important that participants have a common purpose. A pre-meeting briefing should be circulated explaining the purpose and importance of the session, and this should be underlined in the introduction on the day. Facilitators should be aware that, despite such briefings, individuals may still have other motivations for attendance.

- ***Group size.*** The size of group is principally determined by the areas of expertise required. However, groups of more than ten or so can be very difficult to control; they tend to break up into sub-groups, and there may be insufficient time for each individual to cover their points in adequate depth. A group of less than three (in addition to the facilitator and secretary) is unlikely to have sufficient breadth of expertise and experience.

- ***Dominance and reticence.*** Some individuals may dominate the conversation, others may be reticent, especially about dissenting from a perceived consensus view. Personality, and the hierarchical relationships between individuals, should be taken into account in selecting participants – the aim should be to have a reasonably equally-matched set of individuals.

- ***Defensiveness.*** Participants closely involved with the development of a system or its current equivalent may find it hard to admit that things could go wrong. It should be stressed that the identification of a potential hazard should not be seen as a criticism of any work already carried out or of current practice.

- ***Giving positive feedback during the session is important.*** All contributions should be seen to be valuable. It is helpful to write down key points visibly (on a flipchart, for example) such that participants know their points are being recorded. This can also be used as a way of pointing out that an issue has already been covered. Irrelevant issues should be passed over quickly, but not criticised destructively.

- ***Confidentiality.*** Where representatives of different organisations are present, the facilitator should be aware of possible issues which may affect what participants feel able to say.

4 GENERAL PRACTICALITIES

The importance of the practical arrangements for the session should not be underestimated. Factors to consider include:

- Location and timing of the session to minimise inconvenience and travel cost.

- Space, comfort, visibility and audibility in the meeting room.

- Providing adequate breaks and refreshments. The attention span and fatigue of the facilitator and secretary should be considered, as well as that of the participants.

- Making allowance for participants being unavailable at the last minute. It is in the nature of FHA sessions that many participants will have operational responsibilities which may have to take precedence. As it can be extremely difficult to find another time when all can be present; potential substitute attendees should be kept in reserve.

- Provision of visual and other aids. An overhead projector, flipchart and whiteboard should be available. Electronic boards and computer projectors can be used to very good effect, enabling participants to see exactly what is being recorded and confirm that the points they make are correctly understood.

- Variety is important in maintaining attention and motivation. Where a session is longer than half a day, designers should consider using varying the structure of the session, for example by using a different ‘dimension’ as in Section A.3.1. in order to introduce variety, as well as for reasons of comprehensiveness.

- Varying the presentation of the session and its findings can also be helpful. For example, the facilitator and secretary could alternate roles for each session – this also helps maintain the facilitator’s enthusiasm for the task. One session could be conducted using overhead slides and a flipchart, another using the computer projector. Participants should be encouraged to

make use of the various aids, for example by inviting them to draw on the flipchart to explain a point.