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Flying Personnel Research Committee

(6) The Construction and Usage of Simple Questionnaires

by

(10) M. F. Allnutt and C. B. Bolton

RAF Institute of Aviation Medicine,
Farnborough, Hants

Ministry of Defence (Air Force Department)

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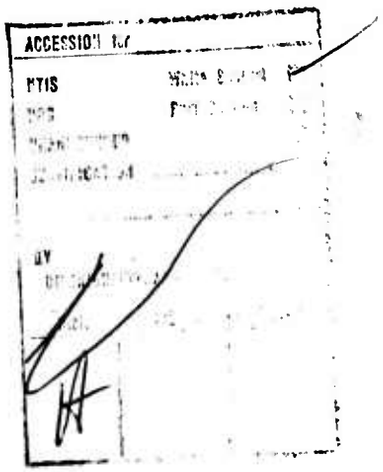
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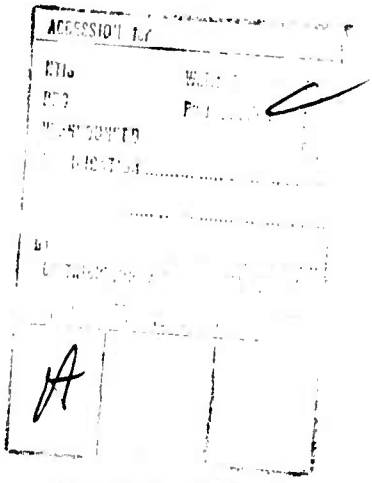
ABSTRACT

This memorandum provides a brief guide to the construction and usage of simple questionnaires to collect opinions on various topics. Although it is devoted primarily to user trials of aircrew equipment, many of the principles discussed are common to other situations.



questionnaires; subjective measures.

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INTRODUCTION

Assumptions

In this memorandum it is assumed that a questionnaire is to be used to elicit information on certain topics, and that the reader will be a member of the Trials Team responsible for constructing and using the questionnaire.

General

A questionnaire is an instrument for conveying a respondent's opinion on a topic to the questioner with the minimum loss of information and with the maximum clarity. It may be the sole source of such information (eg information on comfort) or it may be used to complement objective information from other sources (eg aircrew opinion on a particular item of equipment is used to complement objective data as to how well that equipment functions in practice). Questionnaires are usually cheap, simple and effective but are always open to a number of biases such as those produced by conscious mis-reporting, distortions of memory or by the undue influence of the Trials Team. A poor questionnaire will lead to:

a. False information

b. Insufficient or imprecise information

c. Wasted effort

d. A bad reception for any further studies.

Where at all possible, a member of the Trials Team should, in the early stages of planning a questionnaire, have an informal discussion with some of its intended recipients in order to gain an impression of the language which they use, the type and level of the information which they will be able to provide and the issues which they believe to be important.

Before starting to compile a questionnaire the Trials Team should be able to answer the following questions:

a. What precisely are the factors about which information is being sought?

b. For what purposes are the answers needed? Are they to be used as a basis for deciding between two or more items of equipment (ie a 'count of heads') or are they merely seeking information on an issue?

c. What type and form of answers are expected?

d. What analysis will be performed on the data? This decision is most important as far too many questionnaires have items which allow a choice of, say, seven responses to a particular question which are then promptly collapsed into three categories in the analysis, so losing data and wasting effort. It would have been far better to have used three categories in the first place. The very difficult problem of summarising open-ended questions will be discussed in the Analysis Section (see page 15).

Professional Help

Like many complex instruments, a questionnaire appears to be easy to construct and use but in fact it requires a great deal of care. Whenever possible it should be discussed at an early stage with a psychologist who has experience in this field, just as the design and analysis of the trial should be checked with a statistician. However, although the psychologist can help considerably in deciding how to ask questions, you must know what you want to ask, ie do not ask the psychologist merely to 'Design a questionnaire for a trial on a particular item' - he cannot!

Probably the best procedure for someone writing their first questionnaire is to prepare a draft of all the questions which they wish to include and to ask a psychologist to comment on and, if necessary, modify the draft. Three very useful basic references are listed at the end of this memorandum, that by Oppenheim being particularly recommended (see page 17).

CONSTRUCTING A QUESTIONNAIRE

Types of Question

There are basically two types of question used in a questionnaire, 'open-ended' and 'forced-choice'. The former type is illustrated by items such as 'What do you think about ....?' where the respondent is free to use his own words to reply, whereas in the latter type of question the respondent is either asked to choose one out of a list of possible answers (digital) or to mark a line whose end-points are defined (analogue). The majority of questionnaires will probably contain both open-ended and forced-choice questions and due care will have to be taken to see that they are analysed differently.

Wording of Questions

Having collected together all the questions which they wish to ask the respondent, the Trials Team should give attention to the actual wording of those questions. Precise, clearly-worded questions will elicit clear answers; ambiguous or poorly-worded questions will most certainly produce ambiguous and useless answers. When deciding on the wording of any item, three principles should be observed. They are:

a. Politeness. Questions should always be 'respondent orientated', that is they should be worded for the convenience of the respondent. They must use the words which those who are to reply

to the questionnaire would normally use, which will not necessarily be those of the Trials Team. The aim is to motivate the respondents to give the most clear and honest answers of which they are capable. Such a response will not be engendered by curt instructions, irrelevant or apparently irrelevant questions, or a badly laid-out questionnaire. The use of the word 'please', if not overdone, coupled with a modicum of discreet flattery, should encourage clear and honest answers.

b. Clarity. It is all too easy to assume that the person answering the questionnaire will 'know what the writer is getting at'. Such an assumption is often shattered by the arrival of the first few completed questionnaires. Great care should be taken to avoid:

(1) Double Questions. For example, 'Did you find the boots comfortable or would you rather they were changed?'. The answer 'yes' here would be ambiguous. Instead these should be written as two separate questions.

(2) Negative Questions. For example, 'Don't you feel that there isn't a future for ....?'. Instead this should be written as 'Do you feel that there is a future for?'.

(3) Ambiguous Boundaries. Avoid divisions such as 0 - 10, 10 - 20, 20 - 30. These should be written as 0 - 10, 11 - 20, 21 - 30. Similarly the question 'How long have you been on the Squadron?' could produce such answers as 'Over two years', 'One year and thirty-three days', 'Since I got back from lunch', or 'Too long'. One way of overcoming this problem is to offer the respondent clearly defined categories and to state the units in which you require your answer, eg if you really wish to know the sortie length in terms of hours and minutes then put in the answer space '.... hrs .... mins'.

(4) Abbreviations. Avoid these unless you have first spelled them out in full. Abbreviations may be very familiar to you, for example you may have worked on the SRS (sweat resistant sock) for many years, but the abbreviation may be entirely new, and hence meaningless, to the respondents.

It is better to err on the side of excessive clarity, and be accused of pedantry, than to write a slick questionnaire which elicits meaningless responses. The respondents may well be filling in the questionnaire at the end of a tiring and stressful day when their concentration will be at a fairly low ebb, their temper frayed and their patience eroded.

c. Fairness, or Objectivity. If a question is not completely fair, the data obtained from it are not worth having. The writer of the question must never influence the respondent's opinion by giving an indication of which response is 'better' or is the one preferred by the Trials Team. It is the subtle, rather than the glaring, examples of bias which are the problem. Few, if any, people would write a question in the form of 'You do prefer Brand X don't you?', but many lead the respondent in subtle ways. For example, the respondent is asked to compare the 'standard' item of equipment with the 'new', 'improved', or 'research-proven' item which has the 'Good Housekeeping' seal of its sponsors emblazoned all over it. The questionnaire, briefing and items to be evaluated must all appear in a strictly neutral guise.

Ordering the Questions

a. General Principles. There is no one correct format for a questionnaire, but certain principles have been found to aid efficiency. These principles are that:

(1) The first impression of the questionnaire should be that it is relevant, clear and easy to complete.

(2) The questionnaire should be as brief as possible. Questions should be included only if they are really necessary and not on the grounds that the information might turn out to be useful for some purpose at some time in the future.

(3) The questions should follow each other in a logical order, thus helping the respondent to think clearly about the topic.

Always remember the 'halo' effect in which the respondent's attitude to one item will carry over to adjoining items. Thus, if he has been expressing a positive attitude to a series of items he will be pre-disposed to express a positive, rather than a negative, attitude to the next item on the list. To prevent this it is a good practice to alternate items on which positive and negative attitudes are expected, always of course taking great care to see that the items are very clearly worded. There will also be a tendency for a respondent to give similar ratings to factors which he feels ought to be positively correlated such as fabric weight and warmth. Similarly, it has been shown that people tend to choose the first and l a s t items in a list more often than the others.

b. Specific Techniques

(1) Funnel Questions. One technique used to order questions is to go from the general to the specific. Thus the opening questions will ask about the item of equipment in general terms and these will be followed by questions on specific features of the equipment. Having obtained opinions on

these specific issues it is a good idea, whenever possible, to conclude with a 'verdict' question in which the respondent is asked to commit himself to an overall opinion on the equipment.

(2) Filter Questions. A second technique is to use filter questions whereby the items to which a respondent replies depend on his answers to previous items, eg 'If you have answered 'yes' to Question 7, please explain why you feel that ....; if you have answered 'no' please go on to Question 9. Filter questions require very clear instructions as to the alternative procedures.

c. Proposed Layout. The questionnaire should be headed with the title, date and, if necessary, the appropriate reference number of the trial. It must also contain sufficient information to define who did what, where, when, for how long, in what and with what. For a simple evaluation of a piece of aircrew equipment a suitable order for questions might be:

(1) Biographical Questions. For example, name, aircraft type, duties, flying hours on type, size, weight (if relevant) etc.

(2) Background Questions. For example, today's date, dates covered by the questionnaire, trial location, experience with type of equipment, trials equipment Serial Number etc. If an individual sortie questionnaire is used, the approximate time of take-off may be required to tie in with meteorological data on temperature and humidity.

(3) Factual Questions on the Trial. For example, length of time for which the equipment was used, longest continuous period of use, etc.

(4) General questions on the equipment.

(5) Detailed questions on the equipment.

(6) A verdict question in which the respondent is asked to give his overall opinion on the item or choose between two or more items. It may be useful to add another category, eg 'some other item [ ], please describe: .....'.

(7) A 'sweeper' question in which the respondent is given space to make or amplify any points which he feels to be important and which were not covered elsewhere in the questionnaire. For example a good 'sweeper' question might be 'If you were responsible for the further development of the SRS what changes, if any, would you make?'

NB: If the trials design requires intermediate or sortie questionnaires it may be decided that details which do not change need not be repeated, eg age, rank etc. However, dates, times and locations should be on every questionnaire together with some means of linking it easily with the main questionnaire.

Layout of the Questionnaire

The basic principle for laying out a questionnaire is that it should provide the least possible work for the respondent and, as a secondary aim, for the person who has to analyse it. This goal is usually achieved through careful preparation of the questionnaire with due consideration being given to:

a. Numbering all the questions so that items are not omitted.

b. Giving the respondent clear instructions as to how to indicate his answer. Thus if you wish a tick (✓) to indicate 'yes' or the answer of choice, say so.

c. Laying down clear procedural instructions. For example, if only navigators are to answer Section B, then this must be stated together with an instruction as to what non-navigators are to do.

d. The careful allocation of space. Nothing is more annoying to the respondent than having to squeeze a lot of information into too small a space. Thus 'John Smith' may be satisfied with the space available for his name while 'Reginald Barrington-Smythe's' attitude to the whole questionnaire will be soured by having to cram such a fine name into so small a space. The amount of space provided for the answer will often be taken by the respondent to indicate the length of answer which is being sought and provision has to be made for people with large handwriting who use a felt pen. The respondent may be invited to write on the back of the questionnaire if he requires further space for any particular response or to attach an additional sheet.

e. Efficiency and clarity can be aided by giving the respondent a series of response boxes down the right hand side of the page. The advantages of this approach are that the respondent's work is kept to a minimum (he has merely to place a tick in the most appropriate box) and that both he and the analyser of the questionnaire know exactly where to look for these response boxes. If response boxes are used it must be made abundantly clear that a tick (✓) in the box indicates the chosen answer, as some respondents are given to putting a large cross over the box of the unwanted or non-selected answer - to the confusion of the analyser. On a similar theme, a statement of the units in which the response is required, eg 'hours', 'days', etc saves time and avoids confusion.

Four further statements are necessary to complete the questionnaire; these are:

a. A request to the respondent to check back to ensure that he has answered <u>all</u> the questions.

b. A message of thanks.

c. The name and address of the Trials Team.

d. Lastly, and most importantly, there should be clear written instructions telling the respondent when to complete the questionnaire and what to do with it when completed, ie the name and location of the person to whom it should be given and the time by which it is required. It is vital that this information be written clearly at the bottom of all questionnaires.

A sample questionnaire which incorporates many of these recommendations, suggestions and different forms of questions is given in the Annex (pages 18-22).

<u>Rating Scales</u>

A question and response box is only one of several techniques for obtaining information. As rating scales have been quite widely used in trials of equipment it is worth making special mention of them. A rating scale often consists of a line (often 100 mm long) which represents a continuum between two clearly defined end-points. For example the end-points might be 'extremely hot' and 'extremely cold' and it is assumed that thermal neutrality would be indicated by a mark halfway along the line. Sometimes intermediate points on the line are labelled or the line is divided into labelled boxes. There is no one correct technique and the method chosen will depend on the nature of the parameter and the personal preference of the investigator. A rating scale

can be a useful technique for obtaining information in certain contexts but there are many provisos:

a. The end-points of the scale must be true opposites, eg black and white, hot and cold; avoid opposing hot with comfortable, cool with heavy.

b. Each end-point should have precisely the same meaning to all respondents; a very difficult, if not impossible, thing to achieve. Careful preliminary trials will be necessary to select those parameters which can elicit useful information.

c. The end-points should preferably be absolutes. Black and white qualify here, but not hot and cold because they could be hotter or colder and therefore may need qualifying descriptions.

d. Since some people seem incapable of dividing a 100 mm line into two approximately equal portions, some investigators choose to include a marked mid-point. However, what shade of grey is the mid-point of black and white? Is skin temperature the neutral point between hot and cold?

e. Probably the greatest danger in the use of rating scales lies in their spurious air of accuracy. To say that Item A is 32.7 mm better than Item B on a particular parameter appears impressive but is of little value unless the variance of the rating is taken into account, ie is everybody's rating near to this figure or are they widely scattered? In addition, such a measure is unnecessary if the information required was merely whether Item A was better than Item B. If this were the case then a straight question to that effect should have been used. If the strength of preference is required this can be qualified by the use of boxes labelled 'slightly better than ....' and 'much better than ....'. In the light of the above considerations,

rating scales should only be used in trials if no better method can be found; ie they should rarely be needed.

USING A QUESTIONNAIRE

Pilot Trials

When the questionnaire has been assembled it is most desirable that it should be tried out on a group of people similar to those to whom it is to be administered, ie a questionnaire destined for squadron aircrew should be tried out on squadron aircrew. It is only by doing this that the errors and ambiguities of the questionnaire can be corrected before time and effort are wasted on the actual trial. One's colleagues or non-aircrew are not a satisfactory substitute on the pilot trial as they may have different knowledge and vocabulary from the respondents. Usually one relevant person actually completing the questionnaire will be worth ten others just 'casting their eyes over it'. Any inadequacies in the questionnaire should be corrected and, ideally, the modified questionnaire tested again.

Briefing the Subjects

The briefing given by the Trials Officer to the trials subjects must be scrupulously fair and objective to guard against the possibility of his influencing the results. To that end, it should be written down and read out to the assembled subjects. The ideal would be to record the briefing on tape and play this to the subjects - this procedure ensures that should the briefing have to be given more than once, a quite usual occurrence, it will be identical each time. Similar extreme care will, of course, be necessary in any question and answer session which follows the briefing.

To reinforce the verbal briefing and act as a reminder a written trials instruction should be provided for retention by each subject.

Such a written briefing should be attached securely to every questionnaire. Do not take it for granted that all of the trials subjects will be available for a personal briefing by the Trials Team; leave, sickness, etc often preclude this. It is therefore important that the written trials brief which is attached to each questionnaire should, although short, include all the information necessary for the subject to conduct the trial as intended.

The verbal briefing of trials subjects should also include a 'run through' of the questionnaire to ensure that the subjects are fully aware of the information being sought from them and that all questions on the proforma are fully understood.

Both verbal and written briefings should include:

a. A statement of the purpose of the trial and an explanation as to why a questionnaire is being used, without giving any information as to the expected verdict on the equipment.

b. Trials procedure, ie period of wear, order of wearing etc.

c. Clear instructions as to when the questionnaire is to be completed and to whom it is to be given.

d. A statement that the information which the respondent gives will be used solely for the purposes of the trial and will not be presented anywhere in a manner which can tie it back to him.

e. A reminder that his personal opinion is being sought and that he should not be influenced by crewroom chat, ie to enter on his questionnaire only what he has experienced himself and his own opinions, and that information is wanted only on what has happened - not on what he surmises may happen in other circumstances/roles/aircraft/climates.

Debriefing

To obtain the maximum value from a trial it is necessary for each individual subject to be debriefed privately by the Trials Officer or a member of his team as soon as the trial is completed.

When intermediate questionnaires have been completed by the trials personnel and returned to the Trials Officer at the mid-trial point these should have been scrutinised by the Trials Officer for omissions and ambiguities prior to the final debriefing. Scrutiny of intermediate questionnaires can often indicate additional questions which need to be posed at the final debriefing.

During the individual debriefing the Trials Officer should ensure that the subjects' final questionnaires are indeed complete and the responses unambiguous. Great care must again be exercised to avoid bias in the wording and information of any questions put to him to clarify or supplement his written answers. The debriefing session is also the last opportunity to ask any questions which are not on the trials questionnaire but which have occurred or arisen during the course of the trial. If there are such questions they should be prepared with similar care to those in the original questionnaire to ensure that each supplementary question is asked in precisely the same way of each subject.

Analysis and Report

a. Analysis. When all the questionnaires have been returned the data must be collated into presentable form. The three main types of data can be treated in different ways:

(1) Forced-choice responses can be expressed in terms of the number and/or percentage of responses in each box. It is, of course, important to quote the size of the sample so that the figures can be evaluated in context.

(2) Ratings can be averaged and these, together with an estimate of the variance, presented in the report.

(3) The responses to open-ended questions are rather harder to analyse. They are perhaps best presented by quoting examples of the most common type of response. Qualifying each type of response by the number of people who made it can be misleading as many readers of the report may draw false conclusions about those respondents who did not make that particular type of comment, ie people may not make a particular response to an open-ended question, not because they do not support it, but because they forgot about it at the time they were completing the questionnaire. More sophisticated statistical techniques for analysis are available but are better carried out in co-operation with a statistician.

b. Non-Response. Non-response is not a random process, and a certain group of people who fail to complete a questionnaire may be atypical in their views and therefore should not be ignored. This factor is probably a minor one in Service trials where the great majority of a sample will reply, but if the non-response rate is high, an explanation must be sought. For example, it might be found that a particular group of people were posted before the trial was completed and thus the sample might no longer be considered truly representative.

c. The Report. One convenient way of reporting questionnaire data is for the forced-choice and rating responses to be summarised separately. It is important that a complete questionnaire should be included in the report as merely quoting particular questions out of context may be misleading. The correct interpretation of the collated data will depend on the skill of the Trials Team. A well designed questionnaire should give clear

answers and these, coupled with comments on the size and nature of the sample, should ensure that accurate information is conveyed to the trials sponsors. Remember that the report must be understood and acted upon by non-experts in this particular field. Wherever possible ensure that the conclusions and recommendations are simple and explicit (ie avoid 'sitting on the fence' unless the results are 49:51 or closer).

CONCLUSIONS

A well-constructed questionnaire can, when used in a carefully-organised trial, provide a great deal of useful data. This goal is not difficult to achieve, but all those who construct and use questionnaires must be aware of, and avoid, the various pitfalls which lie in their path. The errors which are most likely to occur are:

a. Errors of sampling, eg an incorrect or too small a sample.

b. Ambiguous questions, eg double or negative questions, poor definitions etc.

c. Bias in the questionnaire design or wording, eg leading questions, emotional words, 'halo' effects etc.

d. Bias of the Trials Team, eg the respondents being aware of the opinion of the Trials Team either through a biased briefing or questionnaire, or by loose talk.

e. Errors of analysis, eg non-response being ignored, rating scales being taken too literally, etc.

f. Faulty interpretations of the results, eg the Trials Team assuming that their findings apply to all men in all aircraft under all conditions.

RECOMMENDED READING

1. Oppenheim, A.N., 'Questionnaire Design and Attitude Measurement.' London : Heinemann 1966 (reprinted 1973).

2. Moser, C.A. and Kalton, G., 'Survey Methods in Social Investigation.' London : Heinemann 1971.

3. Warren, N. and Jahoda, M., 'Attitudes'. London : Penguin 1973.

NB This questionnaire is used as a vehicle to demonstrate layout and various types of question which can be used. It does not purport in any other way to be typical, real, complete or ideal in its sequence.

FILE REF NO

POSTAL ADDRESS OF
THE TRIALS TEAM

QUESTIONNAIRE: AERDC TRIAL OF AIR VENTILATED AIRCREW COVERALL (AVAC) (3a-T4) SUMMER 1974

The information given by you in this questionnaire will be used only for the purpose of this trial and will not be presented in any form from which individuals can be identified. Please respond, where appropriate, by putting a tick (✓) in the selected box.

1 Name, rank, squadron .....

2 Airfield from which flying recorded here was done

.....

3 Inclusive dates covered by this proforma. From .....

To .....

4 Approx hours of wear covered by this proforma. Airborne .....

Ground .....

5 Aircraft type and Mk .....

6 Crew Duty, if 'Other' please specify ..... Pilot ☐

Nav ☐

AEO ☐

Other ☐

---

7 Please indicate all clothing worn under the AVAC during these trials:

Personal jockey style underpants ☐

Personal boxer style underpants ☐

Cotton athlete type singlet ☐

Cotton aircrew tee shirt ☐

7 Cont'd

Other: please specify .....

.....

.....

.....

---

8 Is the above what you would have worn on these sorties if you had been wearing the Mk 2C AVS?

Yes ☐

No ☐

If 'No', please describe the difference and the reasons for them:

.....

.....

.....

---

9 Please specify all the clothing and equipment worn <u>over</u> the AVAC:

.....

.....

.....

.....

---

10 Please indicate by a mark on the line at the appropriate place the frequency with which you normally wear the Mk 2C AVS at this time of year in this theatre of operations.

always — 50% of the time — never

---

11 How do you rate the general (ie non-thermal) comfort of the AVAC? Please place a mark on the line at what you judge to be the appropriate place.

very comfortable — very uncomfortable

---

12 How do you rate the thermal comfort outside the aircraft on the ground of the AVAC compared with the Mk 2C AVS and Mk 7A aircrew coverall combination?

AVAC very much hotter ☐ AVAC slightly cooler ☐

AVAC slightly hotter ☐ AVAC very much cooler ☐

Both much the same ☐

---

13 How do you rate the fabric of the AVAC for tear resistance as compared with the Mk 7A aircrew coverall? Mark the line in what you think is the appropriate spot.

AVAC tears much more easily — Both much the same — AVAC much more tear resistant

AVAC tears a bit more easily — AVAC bit more tear resistant

---

14 No. of times the AVAC was laundered ☐

Please specify any difficulties .....

.....

.....

.....

---

15 Is compatibility of the AVAC with other equipment, eg Life-preserver, seat, harness, satisfactory?

Yes ☐

No ☐

If 'No', please elaborate .....

.....

.....

.....

.....

---

16 Has the AVAC failed/torn anywhere?

Yes ☐

No ☐

If 'Yes', please elaborate .....

.....

.....

.....

---

17 If you are <u>required</u> to wear some form of ventilated garment for flying duties, would you prefer:

a. Air ventilated aircrew coverall (AVAC) ☐

b. Mk 7A coverall with Mk 2C air ventilated coverall ☐

---

18 Given a completely <u>free choice</u> would you routinely wear for flying duties:

a. Air ventilated aircrew coverall (AVAC) ☐

b. Mk 7A coverall with Mk 2C AVS ☐

c. Mk 7A coverall alone ☐

d. Some other garment(s) ☐

If 'd', please describe .....

.....

.....

.....

---

19 What changes, if any, would you make to the AVAC if you were responsible for its further development?

.....

.....

.....

.....

.....

---

20 If you have suggested changes at 19 above, would their incorporation affect your choice in Questions 17 and 18 above? If no, please go on to Question 21. If yes, what would your choice then be:

a. In answer to Question 17

(1) Air ventilated aircrew coverall ☐

(2) Mk 7A coverall with Mk 2C AVS ☐

b. In answer to Question 18

(1) Air ventilated aircrew coverall ☐

(2) Mk 7A coverall with Mk 2C AVS ☐

(3) Mk 7A coverall alone ☐

(4) Some other garment(s) ☐

---

21 Date this questionnaire was completed .....

Thank you for your co-operation. Please check carefully that you have answered all the questions fully as this will assist the Operational Requirements Branch in coming to a decision on this item of equipment. PLEASE HAND THIS FORM NOW TO YOUR SQUADRON TRIALS LIAISON OFFICER - Flt Lt I B Seedy.

Author(s)	Ministry of Defence, London. Flying Personnel Research Committee.
ALLNUTT M F BOLTON C B	No. FPRC/Memo 255
	Date. Feb 1975 (Received Jun 74)

Title. THE CONSTRUCTION AND USAGE OF SIMPLE QUESTIONNAIRES

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