A COMPARATIVE EVALUATION OF THE THESAURUS OF
ENGINEERING AND SCIENTIFIC T.. (U) CITY UNIV LONDON
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A COMPARATIVE EVALUATION OF THE THESAURUS OF
ENGINEERING AND SCIENTIFIC TERMS AND THE DDC
RETRIEVAL AND INDEXING TERMINOLOGY

A D JONES, B.Sc.

November 1977

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A COMPARATIVE EVALUATION OF THE
THESAURUS OF ENGINEERING AND SCIENTIFIC
TERMS AND THE DDC RETRIEVAL AND
INDEXING TERMINOLOGY

A thesis submitted in partial fulfilment of the
requirements for the degree of
M. Sc. in Information Science
City University, London

November 1977   Alan David Jones B.Sc.

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ABSTRACT

A comparative evaluation has been undertaken on the
DDC Retrieval and Indexing Terminology (DRIT) and the
Thesaurus of Engineering and Scientific Terms (TEST).
The study examined the hierarchic structure of both
thesauri and their lead in terminologies, and the
specificity of terms in each thesaurus was compared.
A comparison was made of the index terms assigned to
a number of abstracts, using each thesaurus, and these
terms were also compared with free language terms
assigned by the ASSASSIN computer program. It was
found that TEST, with its greater number of preferred
terms, was the more specific indexing terminology,
but DRIT gave the better guide to the selection of a
preferred term by virtue of its larger number of lead
in terms.

CONTENTS

1   Introduction

Technical reports held by the Defence Research Information Centre (DRIC) are indexed using descriptors selected from the Engineers Joint Council - Department of Defense Thesaurus of Engineering and Scientific Terms (TEST) (18).

Occasionally the need arises to index a concept which is not included in TEST's structure, neither as a preferred term nor as a term with a USE reference. In these circumstances three courses of action are open to DRIC indexing staff. First of all an existing TEST term may be used if it can be considered a synonym for the required concept, or at least is related to it in some way, and will describe the concept sufficiently for the purposes of retrieval. If this procedure is considered inadequate then groups of two or three descriptors may be assigned on a precoordination basis. When this expedient fails, DRIC indexers discuss the need for a new descriptor and introduce a new term into the system, if this is agreed to be necessary.

In 1974 the preliminary edition of the DDC Retrievel and Indexing Terminology (DRIT) (15) was published, together with an addendum containing the hierarchical structure of the thesaurus (16). This publication aroused immediate interest in DRIC especially as it was learned that there were no plans to up-date, or issue addenda to TEST. It was thought that DRIT, being a more recent publication, might perhaps handle new concepts more adequately than TEST, and may even be a possible replacement for TEST.

The most obvious feature of DRIT is the predominance of terms having a USE reference, and the use of precoordination to describe concepts which are not represented by a single descriptor. This

suggested that DRIT may be a useful guide to precoordination, and in some cases it has been possible to precoordinate terms from TEST by referring to DRIT to determine whether it handles the required concept and in what way.

The first edition of DRIT (17) was published in January 1975 in two volumes, with the hierarchical structure included in volume 2 and not published separately as with the preliminary edition. With the publication of this edition it was decided to evaluate the TEST thesaurus against DRIT, using the following terms of reference as a broad guide to the investigation:

    1   Determine which thesaurus has the more specific indexing terminology, and gives the better guidance to the selection of preferred indexing terms, expecially for new concepts.

    2   Determine which thesaurus produces the better retrieval results on DRIC's holdings.

    3   Outline any problems which may arise if TEST is replaced by DRIT, ie how compatible are the two systems?

As both thesauri are multidisciplinary it was decided to restrict the study to the field covered by the COSATI subject area of Military Science. Equivalent hierarchical structures from each thesaurus were selected from this subject area and their structural characteristics were compared. Also terms from these hierarchies were examined for specificity. To augment the latter work documents were indexed using each thesaurus and the index terms from each system were compared, and the compatibility of the two thesauri was determined from this. Alongside this study the documents were also indexed

by the ASSASSIN program in order that terms selected from the titles and abstracts of the documents could be compared with terms selected from the two controlled indexing languages.

DDC Retrieval and Indexing Terminology (DRIT)

The first edition of DRIT is in two volumes and contains 1,059 pages of indexing terms plus a hierarchy (17). There is no indication of now many terms are presented, so the first task was to determine this. Table 1 (see Appendix 1) shows the calculation, which gives a total of 91,970 entries, of which just 10,198 are preferred terms leaving a massive total of 81,772 terms with a USE reference. This gives a ratio of 1:9 preferred terms:lead in terms. TEST has 17,810 preferred terms and 5,554 USE terms, giving a ratio of 1:1.3 preferred terms:lead in terms.

As table 1 shows, the calculation of the number of terms in DRIT was made by counting the number of terms on 20 pages selected at random throughout the thesaurus, followed by simple arithmetic.

The first and most obvious comparison between the two thesauri is that TEST has the greater number (74.6% more than DRIT) of preferred terms, while DRIT is overwhelmed with lead in terms. These terms in DRIT, however, include such things as spelling variations and the use of hyphens. For example; the preferred term in DRIT is SURFACE TO AIR MISSILES, but lead in terms for this descriptor include GUIDED MISSILES (SURFACE TO AIR), SAM, SAMS, SURFACE-TO-AIR MISSILES, SURFACE TO AIR MISSILE and SURFACE-TO-AIR MISSILE (both the latter being singular terms, while the preferred term is plural.)

Many of the USE references in DRIT refer the user to more than one preferred term, for example, Nuclear weapon effects USE Nuclear weapons and Weapons effects. This use of precoordination forms the basis of many of the USE references in DRIT.

3   Literature Review

3.1   The Nature of Relations between Terms

Relations between terms are divided into two types, paradigmatic and syntagmatic. Foskett (23) defines paradigmatic relation-ships as those which are known in advance of scanning a particu-lar document, and syntagmatic relationships as those which are found only by scanning the document.

Paradigmatic relationships show the various aspects of genus-species relation and form the basis of hierarchical structures and other relations, while syntagmatic relationships are those which give rise to synthesis. For example, the combination of the terms Heat treatment and Aluminium forms a syntagmatic relationship which indicates the subject "heat treatment of aluminium". From this it can be seen that syntagmatic relations are directional, the combination of Aluminium and Heat treat-ment is not the same as the first combination. This direc-tionality of syntagmatic relations becomes more obvious in the two headlines "Dog Bites Man" and "Man Bites Dog".

Stokolova (71) defines the functions of paradigmatic relations such as consequence $\longrightarrow$ cause and material or process $\longrightarrow$ properties or characteristics as being analogous to the function of the relations species $\longrightarrow$ genus. This latter relation appears in thesauri as Broad Term $\longrightarrow$ Narrow Term (BT $\longrightarrow$ NT), ie the hierarchic structure of the thesauri, while the cause $\longrightarrow$ con-sequence, whole $\longrightarrow$ part and material $\longrightarrow$ property relations form the cross references or Related terms (RT). Whole-Part relations are sometimes in evidence in hierarchic relations also.

Gilchrist (24) defines syntagmatic relations as those holding between elements forming serial structures at a given level, referable to, though not identical with, the temporal flow of utterance or linear stretches of writing. As an example he quotes the topic "Effect of fertilizer on the Vitamin B content of Wheat" in which the three principal concepts, fertilizer, vitamin B and wheat are syntagmatically related.

3.2 Comparison and Evaluation of Thesauri

Very little work has actually been performed on evaluating one thesaurus against another. Willets (76) examined the relations between terms in thesauri and compared the ways in which these relationships are derived in 10 different thesauri. No consistent patterns were found between the thesauri in the use of related terms (RT). Hierarchic relations, broad and narrow terms (BT, NT), were mainly based on generic and part-whole relations. Willets also found that scope notes and parenthetical qualifiers were used in most of the thesauri where necessary to clarify meaning.

Subramanyam (72) outlines his criteria for comparing thesauri and then simply rates each thesaurus against these criteria, with the rider that not all criteria are applicable in each case. Subramanyam's criteria are given under the broad headings Facet analysis, Terminology Control and Notation.

Vickery (75) outlines criteria for comparison of indexing terminologies in more detail:

(1) What is the basic form of the terminology - alphabetic or systematic?

(2) How is an individual ter. located in the scheme?

(3) How many terms are there in the scheme?

(4) How specific are the terms? (This is a relative question.)

(5) Does the terminology include compound terms, phrases of two or more words, and, if so, are there rules governing their admission?

(6) To what extent are word forms (singular and plural, words with the same root) confounded or kept separate? Are there rules governing this?

(7) How are homographs of different meaning treated?

(8) Is the use of some terms limited by scope notes or definitions?

(9) To what extent are synonyms and near-synonyms confounded?

(10) If synonyms and near-synonyms are barred, are they listed in the terminology as lead in words? How many such lead in words are there?

(11) Are links made between a general term and those specific to it? If so, what is the average number of links in a hierarchy? How many terms on average are linked into a single hierarchy? To what extent do terms form part of more than one hierarchy?

(12) Are links made between terms related in ways other than genus to species? What other relations are included?

(13) How are links between terms displayed? What is the average number of links per term?

(14) If coding is used, what purpose does it serve?

This methodology covers all Subramanyam's criteria, but does not indicate how to measure specificity. As Vickery indicates (see point 4 above) this is a relative question. A method of comparing classification systems by comparing the specificity of the systems is described by Hopker (27). Hopker's method is to order each class in a group according to rank and class size. The rank of a class is determined by an arbitrary method of counting the number of terms in that class which have a given number of terms beneath them in the classification scheme. Hopker's arbitrary number of terms is 10. The class with the highest number of such terms is assigned a rank of 1, the next highest 2 and so on. A graph of class size against rank plotted for the classification systems being compared will in this way allow a direct comparison of specificity.

Although this method of comparison is completely arbitrary, all the systems being compared are subjected to the same degree of arbitrariness, so Vickery's question of relativity does not arise.

Although Hopker's method was applied to classification systems, it can be used on the hierarchical structure of thesauri. As these hierarchies tend to be smaller than classification schemes, the arbitrary figure needs to be lower.

3.3 Comparison of Indexing Language Performance

The most common method of comparing indexing languages is to
measure their performance in information retrieval. Preci-
sion and recall are often used as the yardsticks by which
performance is measured (7, 8, 24, 46, 53, 64, 66, 74) while
links, roles and other factors are introduced to assess
their effect on these yardsticks (46, 47, 53, 66, 74).

Much of the practical work in this field has not compared
like with like. Montague (48) compared two coordinate
indexing systems and a classification scheme, and found that
the coordinate indexing systems permitted quicker retrieval
and produced more relevant references than did the classifica-
tion scheme.

Cleverdon (7) in the first Cranfield test compared Facet
Analysis, UDC, Uniterms (a free text indexing language system)
and alphabetical subject headings. In this test Cleverdon
found that the alphabetical subject headings produced the most
efficient system, but the specificity of the terms was
important. However, in later tests (8) Cleverdon et al found
that a natural language system was more effective than
controlled terms. For the natural language system normalised
recall was 65.00 per cent, while the best figure for controlled
terms was 61.76 per cent. In practise these figures are so
close together, that to say one system is better than the other
is a subjective evaluation.

Operating Systems Inc (59) evaluated structured and free text searching of the NHTSA Data Base. Their results show that there is no significant difference in retrieval effectiveness of the two systems, but the free text system had considerable advantages.

Salton (65) achieved better retrieval results with his SMART system of automatic text processing than he did with a conventional controlled terminology retrieval system (MEDLARS). The initial precision and recall figures using (i) the SMART automatic discriminator dictionary and (ii) the SMART thesaurus were close to the figures for the MEDLARS search. User feedback caused a significant increase in these figures for both the SMART systems, but the difference between the two sets of figures was small, so that Salton concluded that no technical justification appears to exist for maintaining controlled manual indexing in operational retrieval environments. However, no feedback procedures were attempted on the MEDLARS system, as this facility was not built into the process. This in effect gave a biassed result in favour of the SMART system and one wonders what the results would be if equivalent feedback procedures had been used on MEDLARS to allow a fair comparison of the two systems.

Hutchins (31) asserts that natural languages perform as well as, and sometimes better than controlled languages in information retrieval. But he maintains that it is an open question as to why this is so. Lancaster (43) gives more positive reasons for this by pointing out that an uncontrolled vocabulary can be more specific than a controlled vocabulary in

searching, as particular concepts can be searched rather than general. As an example Lancaster offers the term Lung diseases as a generic term under which a thesaurus may subsume all terms for specific lung diseases, thus losing the capability of retrieving only documents relating to a specific disease.

Lancaster also states that a natural language system will have great flexibility in searching, since any term class which is formed at the input stage (by control of synonyms or establishing of hierarchies) can equally well be formed at the time of searching. According to Lancaster, this means that a controlled vocabulary can be developed which is only used as a searching aid. He further states that any existing thesaurus is potentially of value in a natural language search.

Hutchins (31) agrees that some form of vocabulary control is useful.

Lancaster (48) points out that the flexibility of being able to form classes at the time of searching is lost to a controlled vocabulary because the classes will be rigidly established by the vocabulary's structure.

To evaluate the effectiveness of a system, Keith (36) points out that it is necessary to consider the operational characteristics of the system relative to the information needs. The probability that a system will have exactly the characteristics the user requires is low, and the answer will have to be a compromise.

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3.4 The Intermediate Lexicon and Thesaurus Reconcilliation

Incompatibilities between thesaural systems arise from differences in the selection and form of the keywords used in the different systems. Two methods of relating one thesaurus to another have been developed.

Horsnell (28) describes the Intermediate Lexicon, a switching language device which facilitates the exchange of subject information between different centres using different thesauri, the Intermediate Lexicon being used to relate equivalent terms in different thesauri.

The use of switching languages such as the Intermediate Lexicon is described by Coates (9). All terms in one thesaurus are related to an equivalent notation in the switching language, and by this to equivalent terms in all other thesauri related to the intermediary.

A similar end is sought by Neville (56, 57) by means of Thesaurus Reconcilliation. This again relates terms to their equivalents in different thesauri, but without the use of an intermediary. The necessary coding is applied to the terms in each thesaurus in the system.

Both these systems are related to the present work in that they both seek equivalence between thesauri, and both could form the basis of an evaluation scheme. As well as comparing one thesaurus to another on the basis of equivalent terms, both the Intermediate Lexicon and Thesaurus Reconcilliation schemes would highlight other areas, such as where a term in one

thesaurus does not appear in antoner. In this way the degree of compatibility between the thesauri could be ascertained.

The degree of equivalence between the thesauri would be a useful guide to the comparison of the structure of thesauri, and to the specificity of terms. Thus one term in one thesaurus may appear as a USE reference in another, this USE reference being a more generic term. Both the Intermediate Lexicon and Thesaurus Reconcilliation indicate such occurrences.

3.5 Thesaural versus Free Text Indexing

There are arguments for and against both thesaural and free text systems. McArther (50) maintains that the major defect in thesauri is grouping without adequate contrasting definition within groups, and that their major virtue is that they contain some attempt at association of ideas, primarily on principles of inclusion, synonymy and antonymy.

Natural language usage is more common in automated systems, as in the work of Klingbiel (39) and Montgomery (54).

Aitcheson and Gilchrist (1) point out at once the advantages and disadvantages of free text indexing. It makes life simple at the indexing stage, but introduces problems in retrieval, because the searcher must allow for all variations and synonyms of the indexing term in question.

The National Technical Information Service (NTIS) (55) maintain that a controlled vocabulary is important for information retrieval, to such an extent that a new microthesaurus in the field of environmental science was created for use on the NTIS

data base. Previously, to search this particular subject area, it was necessary to use not only free language terms, but keywords from four thesauri - these being the Department of Defense thesaurus, the Energy Research and Development Administration thesaurus, the National Aeronautic and Space Administration (NASA) thesaurus and a controlled free language list. The new microthesaurus was evolved to cope with this problem and integrates hierarchically the vocabulary of the different sources to allow easier retrieval of environmental reports.

Pickford (60) points out that structuring can be as simple as an alphabetic listing. Moving on from here, Pickford argues that a structured thesaurus should produce consistency of indexing and aid search formulation, but that using an unstructured system can lead to economy in terms of minimal intellectual effort, and simplicity for certain classes of user, eg non information workers.

Other arguments put by Pickford for structuring are that:

(i) it leads to consistency of indexing, but it

has been challenged that this is a good thing;

(ii) it aids search formulation;

(iii) it can serve as a memory aid;

(iv) it acts as a guide to the use and understanding

the information system.

Pickford also describes problems that have arisen by using unstructured languages, the biggest problem being the difficulty in formulating searches because the inconsistency of indexing

means that users have to look in several places for their search terms. This is exactly the problem encountered by NTIS (55) above.

The opposite view is expressed by Farradane et al (22) who say that using a structured system of storing information for later retrieval can lead to situations in which relevant items are not retrieved because of technicalities of the system.

The DDC Retrieval and Indexing Terminology (14) grew from an unstructured data base. The growth of this Natural Language Data Base (NLDB), is described in reports by McCauley (5?) and Klingbiel (44, 45). Alongside this work a technique for machine aided indexing using the NLDB has been developed. This is also described in several reports by Klingbiel (38, 39, 40, 41, 42, 43).

Klingbiel maintains that for information retrieval highly structured controlled vocabularies are obsolete and the natural language of scientific prose is fully adequate for this purpose (39).

3.6 Structure, Development and Maintenance of a Thesaurus

The word thesaurus has been defined in several different ways. Davis (12) feels that the word now often means nothing more than an alphabetical listing of computer terms, while Hines and Harris (26) feel that a thesaurus is an indexing language, rather than a glossary or dictionary of a field. Gilchrist (24) offers a definition which helps to distinguish between a thesaurus and

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an information retrieval or indexing language term list. A
thesaurus is an authority file which can lead the user from
one concept to another via various heuristic or intuitive
paths. A term list is simply an authority file which presents
a straight list of terms. Gilchrist quotes Howerton's defini-
tion of an authority file as being a structured collection of
concept descriptions by means of which a body of knowledge is
classified, controlled and searched (29). As Pickford (60)
points out, structuring can be as simple as alphabetic listing.

Pickford (59) also defines the difference between an information
retrieval language and a thesaurus. The first, he maintains, is
simply what it says it is - a language for use in the retrieval
of information, and can be thought of as a list of descriptors
which cover a particular subject area. A thesaurus however is
a complex lexicon, comprising both an indexing and information
retrieval tool, which includes not only a list of keywords but
a guide to the use of the keywords.

In his model, Turski (73) assumes that in a thesaurus, no two
descriptors are synonyms and that for each unrequired term there
is a synonymous descriptor. This ideal situation is unlikely
to be achieved in practise because, as Aitcheson and Gilchrist
point out (1), many words have synonyms which are localised in
their use, and some synonyms are simply out of date termino-
logies, such as the electrical term "capacitor" which has
replaced the earlier term "condenser". A lead in terminology
cannot take all such variations into account without becoming
unwieldy.

Subramanyam (72), Braun and Schwind (6) and Rolling (67) all
state that the basic function of a thesaurus is to bring
together the language of the author, the indexer and the
enquirer.

Lancaster (48) takes the view that a controlled vocabulary
exists primarily to control synonyms, near synonyms and nomo-
graphs, and to provide sufficient hierarchical structure to
allow the conduct of generic searches. Lancaster also feels
that a controlled vocabulary must be synthetic, ie provide
facilities for combining terms to represent any subject. The
same requirements are outlined by Jones (33) and Soergel (68)
who also takes the view that homographs and homonyms as well as
synonyms must be catered for.

The importance of controlling synonyms has been demonstrated by
Bottle (5) and others. In studies Bottle found that one third
or more of indexing terms were not found in document titles,
but were synonyms or related terms. In particular the literature
of chemical compounds and biological systems included a high
proportion of synonyms. On the matter of synonyms Lancaster and
Fayen (49) state that a controlled vocabulary establishes which
of several synonyms or near synonyms will be used as preferred
terms, and provides references to this term from the possible
variants.

Haines (25) and Lancaster and Fayen (49) define three other tasks
performed by a thesaurus. It guides users to preferred terms
by means of an entry vocabulary (lead in terms), it links
together terms that are hierarchically related, and links related
terms by cross references; and finally, a thesaurus distinguishes
homographs.

On the subject of lead in terms Rolling (17) asserts their numbers should be kept as low as possible, as it seems senseless to overburden a thesaurus with unpermitted terms.

DRIT (17) provides a good example of a thesaurus which does not follow this rule. As stated in chapter 2 many of the lead in terms in DRIT are simply minor variations in spelling of the preferred term. Rolling's point is that only those terms which are not obvious synonyms should be used on lead in terms, such as this example from TEST: Cockroaches USE Blattidae.

Generally a thesaurus is generated because existing thesauri do not adequately cover the field required. The Low Intensity Conflict thesaurus described by Deacon and Harvey (13) was developed for this reason. The range of indexing terms in TEST did not always adequately describe the subject material, so the new thesaurus was based on the relevant descriptors in TEST, adding terms as they were required. NTIS (55) prepared their environmental microthesaurus to bring together the different index term sources already in existence.

TEST (18) began life as Project LEX, a thesaurus developed by a committee. Over 300 engineers, scientists, technical information and library specialists were involved in the work, totalling over 1500 working days between them in the compilation. The ASTIA Thesaurus (2) which is similar in composition to TEST was compiled by the Armed Services Technical Intelligence Agency in collaboration with the US Department of Defense. In this context, this thesaurus can be regarded as a forerunner of both TEST and DRIT, which, as noted earlier, is a computer compilation (17).

Keevil (35) describes a method of building a thesaurus in which candidate indexing and lead in terms are selected from documents as indexing proceeds. This procedure is the one most often used for maintenance and updating of thesauri. Kim (37) maintains that there are few rules and conventions for updating thesauri, and for this reason most thesauri are not systematically updated, if they are updated at all. As Schirmer (67) points out, a thesaurus will require updating as and when new concepts appear in the technical literature.

3.7 Precoordination and Postcoordination

Coordinate indexing is the process of combining concepts to define a subject. It is useful to distinguish between precoordingation and postcoordingation by means of the definition provided by both Lancaster (48) and Foskett (23).

Precoordination is the combination of separate concepts at the time of indexing, while postcoordination combines separate concepts at the time of retrieval.

According to Foskett (23) precoordinate indexing terminologies include most of the major classification schemes such as UDC, the Dewey Decimal Classification, Ranganathon's Colon Classification, the Bliss Bibliographic Classification and the Library of Congress Classification.

Willets (76) found that many thesauri include precoordination of terms in their structure, producing multiword descriptors. Some of these descriptors are heterogeneous terms but the majority are entries qualified by adjectives, such as Hydraulic

mining and Subsurface drainage. Here Willets is using the
term preccordination to describe preferred terms which consist
of two or more words or a phrase. Generally precoordination
and postcoordination are connected with the flexibility of a
thesaurus to synthesise concepts by the coordination of existing
subjects. The more a thesaurus relies on fixed precoordination
along the lines of, for a use b plus c, the less flexible it
will be.

3.8 Specificity and Exhaustivity

Foskett (23) defines specificity as the extent to which an
information system permits the user to be precise when speci-
fying the subject content of a document and exhaustivity as the
extent to which a given document is analysed to establish what
subject content is to be specified.

Higher specificity leads to higher relevance, but at the expense
of recall, whereas an increase in exhaustivity increases recall
at the expense of relevance. There is little point in increas-
ing exhaustivity unless the specificity is available, ie in
depth indexing will not give improved access to the contents of
a document unless the required additional indexing terms are
specific.

Vickery (75) points out that it is important to match the
specificty of index terms to the kinds of query that the informa-
tion system has to meet. In retrieval, low specificity will
lead to noise, whereas too high a specificity may miss relevant
items unless all the necessary specific terms are used.

Aitcheson and Gilchrist (1) confirm that specificity controls the precision capabilities of an information system, but also demands greater skill in indexing and searching. They also point out that the disadvantage of a highly specific vocabulary is that the number of index terms required for the system is increased and it is consequently more expensive to compile, maintain and operate.

3.9 Semantic and Syntactic Aspects

Jones (33) defines three requirements of thesaural systems. These requirements are:

1   a basic syntax capable of differentiating between various word functions;

2   a set of semantic relationships capable of introducing structure by eliminating synonyms, by linking words generally and by differentiating between compound forms;

3   an appreciation of the structure which emerges from, or is imposed upon a topic covered by a thesaurus.

These requirements should be compatible with the microstructure of the system.

Farradane (21) covers similar ground when he writes that it is necessary to overcome various types of ambiguity, synonyms, homonyms, jargon and even illiteracy. The human being is able to overcome errors and deduce meaning using cues of context, emphasis, gesture and knowledge, but even taking all this into

account, two persons may derive different meanings from the same
text. He also points out (19) that relations between concepts
often appear to be absent, but states that a relation between
terms is implied if they are used to index the same document.
While this implied relationship will be absent from a thesaurus,
it is a valid related term concept in any indexing system.

Braun and Schwind (6) argue in a similar vein that a semanti-
cally oriented index offers a more precise system than other
methods, and will help exclude bad terms from the terminology.
Semantic methods can be used to obtain phrases intended by the
text which is to be indexed, and syntactic method: must be used
to avoid errors and resolve ambiguities.

Austin (3) in his history of the development of PRECIS describes
the semantic aspects of the system. One of the rules states
that two terms should not be written as adjacent components
of a string if the first serves only to establish the class of
concepts to which the second belongs. For example, if the
string contained the terms Rodents and Rats adjacent to each
other, then the first term would be excluded on the grounds
that rats are, by general definition, a kind of rodent. In
this way the most specific indexing term is used and generic terms
and near synonyms are excluded.

Lancaster and Fayen (49) discuss the automatic syntactic
analysis methods which are included in some automatic systems.
These systems determine structural dependencies between words
in a sentence in the form of an abstract graph or tree in
which each word forms a node in the tree and the syntactic

dependencies are represented by branches. Automatic syntactic analysis of this type will yield a machine readable system capable of producing extremely high levels of search precision, because it allows the user to specify the exact relationships existing between words in document text as well as the words occurring in request statements. Syntactic analysis of this type may be needed for fact retrieval or question - answer systems, ie systems that attempt to provide a direct answer to a question rather than retrieving a piece of relevant text.

Semantic factoring can be a useful device for handling new concepts if this does not produce noise, ie the factor combination must not already be in use for another concept. In this instance, Blagden (4) feels that it is worthwhile introducing a new term.

The subject of compound words and semantic factoring was studied by Jones (34). His conclusions are that difficulties are caused if compound words are factored the wrong way, and that it is necessary to know the syntactic origins of words so that correct semantic factoring can be made.

Fracturing all compound words can lead to noise in retrieval. One suggestion that Jones studied is to use a single word synonym in place of the compound where one exists. Failing this the compound term should be used where the parts have lost separate meaning or where the meaning would be affected if the compound is fractured.

To handle words which have more than one semantic meaning and homographs, Willetts (76) suggests that scope notes or parenthetical qualifiers are necessary to define meaning. For example, the term Tanks would have to become Tanks (combat vehicles) or Tanks (containers).

According to Farradane (20) semantic analysis is generally inadequate and is patched up by equally haphazard devices such as links and roles and generic posting, which often only offers a selection of different possibilities of higher term. Generic posting is a useful device for broadening a search, but as Blagden (4) points out, this will improve recall at the expense of relevance.

3.10 Links and Roles

Links and Roles are devices intended to overcome false coordinations and incorrect term relationships, by labelling groups of associated terms, or indicating the roles of terms, and are a controversial issue. Farradane's opinion of them has already been seen (20).

Lancaster's opinion (47) is that they help reduce noise, but more specifically he feels that although role indicators are intended to improve the specificity of an index language and thus the precision of a search, they cannot improve recall. In fact, because they define classes more precisely, role indicators will actually reduce recall (46).

In tests, Van Oot et al (74) found that links and roles produced a marked increase in relevance, but roles blocked relevant retrieval if they were not used consistently in indexing and searching. Where they were used consistently, roles reduced false drops. On this subject, Farradane (20) feels that false drops and other noise reflect partly a lack of word control and partly a lack of semantic control. He also maintains that tests on links and roles give conflicting results.

In other tests, Montague (53) found that links and roles improved relevance by reducing false retrieval. This corresponds with Van Oot's findings. Montague also found that syntactic controls made a high level of relevance achievable, as did deep indexing, vocabulary control and provision for generic as well as specific searches. Half of the references missed in Montague's tests were due to indexing errors and insufficient depth of indexing.

Taking the opposing view, Saracevic (66) avers that syntactic features of indexing languages such as links and roles do not reduce the overall retrieval of non-relevant answers, except in rare instances. Saracevic's opinion is that more relevant answers can be achieved by making broader searches, but that this will introduce much more non-relevant material. Jones (42) agrees that links and roles have been judged to have doubtful value, but he says that they do substantially reduce noise. Hutchins (30) believes that links have some use in that they can indicate how terms are partitioned between two topics. Mandersloot et al (52) maintain that homographs do not

necessarily need roles or other codes to clarify meaning,
as the combination with other terms will usually define the
meaning of the selected homograph. For example, the combina-
tion of Tanks, Guns and Tracked vehicles is sufficient to
indicate that the term Tanks refers to a combat vehicle
rather than a water container.

3.11 Readability

No references to work on this subject were found relating
to thesauri, but two reports by Spencer et al (69, 70) present
several conclusions which are of interest.

It is generally agreed that a text comprising a mixture of
upper and lower case letters is much easier to read than an
all upper case text. This is borne out by Spencer et al.
In tests they found that for readability, a text in all upper
case was not worth considering.

In their tests on spatial and typographic coding in biblio-
graphic systems, they found that having a space between entries,
together with making the first element of an entry distinctive
from the rest of the text provided the most readable and effec-
tive system. The first element could either be in a bolder
type or physically stand out from the surrounding text.

3.12 Conclusions

From the foregoing it is possible to list the following require-
ments of a thesaurus:-

1   The thesaurus must provide adequate coverage of the
subject area it refers to. To this end sufficient pre-
ferred terms are needed to cover all concepts connected
with the subject, together with a lead in terminology
which will direct the user to the correct preferred term.
For a small thesaurus this causes few problems, but in
the case of thesaurus covering a wide subject area, or
a multidisciplinary thesaurus, there will almost certainly
be conspicuous gaps. This has already been seen in the
Low Intensity Conflict Thesaurus developed by Deacon and
Harvey (13), where TEST (18) did not adequately cover this
field but part of TEST was used as the basis of a thesaurus
dealing with a more specific subject area.

2   Generic relations between terms should be displayed
in a hierarchy, to enable generic posting and search
broadening to take place. Cross references to related
terms should be shown.

3   There should be some sort of terminology control
to handle synonyms, antonyms, homonyms and homographs,
together with a lead in vocabulary to guide the user to
a preferred term. In this context it is useful to bear
in mind Rolling's view that it is senseless to over-
burden a thesaurus with unpermitted terms (57)

4   Some provision should be made for synthesis in order
that new concepts and compound words can be handled by
the thesaurus.

5   Ideally the thesaurus should have both literary and user warrant. The thesaurus should be easy to read and to use for it to be readily accepted by users.

Vickery's criteria (75) can be used as guidelines for the start of an evaluation of thesauri (see section 3.2). From this list a basic scheme can be derived:

1   Compare the basic form of each thesaurus and the means by which individual terms are located in the thesauri. The number of terms in each thesaurus should be compared and those terms common to each be determined. In the present work, both thesauri are alphabetically structured and only a terminology comparison is required.

2   Examine the semantic and/or syntactic methods by which each thesaurus controls vocabulary, in particular synonyms, antonyms, homonyms and homographs. Also the use of compound terms, and phrases with two or more words, as preferred terms should be studied along with any rules governing the admission of these terms.

3   Evaluate the lead in vocabulary of each thesaurus in conjunction with synonym control etc. The number of such terms is important, especially if variations in spelling are used as alternative lead in terms.

4   The hierarchical structure of each thesaurus, if such a thing exists, should be compared and the use of relations other than hierarchic, between terms should be looked into.

5   How specific are the terms in the thesauri? As Vickery says, this question is subjective, but Hopker's method can be used to compare specificity and eliminate bias.

6   Ideally the performance of each thesaurus in a retrieval situation should be tested. It would be educational to use one thesaurus for indexing and the other for retrieval. This would show to what extent the two systems were compatible. Also it would be possible to obtain users opinions on each thesaurus after such an exercise. This would highlight any deficiencies in the systems.

4   Programme of Work

1   Define the subject area to be studied. In work on multi-
disciplinary thesauri such as TEST and DRIT it is impractical
to cover the whole subject field. For this reason, it was
decided to limit the study to a subject area coming broadly
under the heading "Military Science".

2   Compare the hierarchic structure of each thesaurus and
the use of cross references to related terms. This task simpli-
fies to a study of the hierarchy because while TEST has broad
term (BT), narrow term (NT) and related term (RT) cross referen-
ces, DRIT only uses broad and narrow terms.

3   Compare the lead in terminologies of each thesaurus.

4   Compare the provisions made for synthesis in each thesaurus.
In some instances, this will coincide with item 3 because where
a term is not used as a preferred term, some guidance to a
suitable term, or combination of terms, to use in its place
is necessary.

5   Compare the specificity of each thesaurus.

6   Compare the indexing terms applied to reports by using each
thesaurus, and compare each set to terms produced by the
ASSASSIN program.

7   Obtain users reactions to each thesaurus. This will be
subjective, and allowance will have to be made for the fact
that users know TEST and DRIT will be new to them.

5   Definition of Subject Area to be Studied

5.1 Introduction

As noted in chapter 4, it was decided to confine the subject
area to the field of Military Sciences, which is field 15
of the COSATI subject category list (14). The actual subject
area was defined by constructing a broad outline model of the
field (see Figure 1, Appendix 1). This was achieved with the
aid of the COSATI subject category list (14), Janes Weapons
Systems (61) and personal knowledge.

5.2 The model

As can be seen from Figure 1, the subject area as defined by
COSATI field 15 has not been strictly adhered to, and parts of
other COSATI fields have been interpolated. In particular,
field 16, Missile Technology has been incorporated as being
related to Nuclear Warfare.

The model is not exhaustive and is simply a personal viewpoint
to define subject areas of interest. The relations shown
between terms in the model are not based on the structure of
either thesaurus, but have been developed as the model grew.
The intention here was to avoid any bias towards TEST or DRIT
in constructing the model. It would be a simple matter to
prepare a much larger, more detailed model incorporating more
concepts. The size of the present model was dictated mostly
by the limitations of space available on one page. After
taking the seven main subdivisions of COSATI field 15-00, the
model emulated Topsy and "just growed".

Most of the subjects included can be recognised as being inclu-
ded in hierarchies in both thesauri, while a few are isolated
terms.

The solid lines on the model connect those subjects which may
be expected to be generically related, the arrows indicate the
direction from general to specific ie the movement down a
hierarchy. Broken lines are used to indicate other relations
which may be expected to exist between terms. For example
surface to underwater missiles may be considered as being a
related term to torpedoes (and vice versa), although the two
items are not generically linked.

Having defined a subject area it was decided to utilize the
hierarchies from both thesauri which included the following
subjects, for further study:

    Antipersonnel agents

    Biological warfare

    Bombing

    Camouflage

    Chemical warfare

    Clothing

    Defence

    Flares

    Intelligence

    Logistics

    Military facilities

    Military operations

    Military organisations

    Missiles

Reconnaissance

Security

Strategy

Surveillance

Warfare

These hierarchies are reproduced in Appendix 2. The top term in a hierarchy is shown furthest left, while hierarchical steps are indicated by successive indentation. Terms at the right of the table indicate other hierarchies which include the term opposite.

6 Comparison of TEST and DRIT

6.1 Hierarchic Relations

This section was confined to a study of hierarchic relations,
ie Broad Term (BT) and Narrow Term (NT) relations, because
DRIT does not indicate other types of relationships. TEST
includes cross references to Related Terms (RT).

The first point of interest is the close similarity between
the two hierarchic schemes. This similarity is reflected
in the rank number relations derived for the two structures
(see section 6.3).

The most obvious difference is in the grouping of subjects in
the hierarchies. While the individual hierarchies in TEST tend
to be short, DRIT groups several subjects into one long hier-
archy. As a result of this TEST seems to be outnumbered so
additional hierarchies to those originally chosen were selected
from TEST to correspond with the additional subjects included
in the Military facilities, Military organisations and Warfare
hierarchies of DRIT.

Many of the terms in DRIT's hierarchic structure appear in
more than one hierarchy, to such an extent that most of the
terms in the Chemical warfare hierarchy also appear in the
hierarchy for Warfare. Some sets of terms are common to more
than one hierarchy in both thesauri, especially terms from
the hierarchies dealing with antipersonnel agents and chemical
warfare agents.

Both thesauri utilize the same form of hierarchic structure in that in going from terms at the top step in a hierarchy to lower steps, one goes from the general to the particular. This generic structure is exhibited well in both thesauri in the hierarchies for Antipersonnel agents, where from Antipersonnel agents the first step takes the reader to Choking agents and Nerve agents, among others. One step below Nerve agents is G agents, which again steps down to particular G agents, such as GA and GB agents. Very little use is made of part-whole relations, one example appears in DRIT under Guided missiles in the step to Guided missile components.

In general the equivalent hierarchies from each thesaurus are similar to the extent that equivalent terms from the next step in the hierarchic structure of both thesauri. There are a few exceptions to this, mostly occurring where a term from one thesaurus does not have an equivalent in the other.

As is to be expected from the difference in the number of preferred terms in each thesaurus (17,810 in TEST and 10,198 in DRIT) there are more terms in TEST which do not have an equivalent term in DRIT than vice versa.

DRIT makes much use of precoordination for terms which are not preferred terms. The precoordination is printed as a lead in term, and the user is referred to the preferred terms which must be combined to represent the required term. For example for Guided bomb control systems DRIT requires the three terms Flight control systems, Guided bombs and Remote control to be used.

Many of DRIT's terms combinations are used for more than one entry. For example, the combination of Chemical warfare, and Military forces (foreign) is used for Foreign chemical warfare, Foreign chemical warfare activities and Foreign chemical warfare potential. There is an entry also for Foreign chemical warfare potentials, but here the combined terms are Chemical warfare and Foreign. What difference exists between these latter entries, is for the user to decide. These four terms and their associated USE references do not appear in TEST.

This use of precoordination in DRIT would undoubtedly lead to a great deal of noise occurring in any retrieval system based on DRIT, since many different concepts are represented by the same set of precoordinated terms.

Most of the preferred terms in DRIT have an equivalent preferred term in TEST, but there are some exceptions. For example Arsenic agents does not appear in TEST. Conversely, there are terms in TEST which do not appear as preferred terms in DRIT. The TEST term Military air facilities is not a preferred term in DRIT, the nearest entry is Military air bases and the user is instructed to use the term Military facilities instead, which is not such a specific term.

As there are terms in DRIT which do not have an equivalent in TEST, so there are similar terms in TEST. The four terms Amphibious demonstrations, Amphibious raids, Amphibious withdrawals and Diversionary landings are all narrower terms related to Amphibious operations in TEST. None of these terms has an equivalent in DRIT, the user has to rely on the term Amphibious operations to cover the requirements.

6.2 Comparison with the Model

It is interesting to compare the structure suggested in the model (Figure 1) to the actual structures used in each thesaurus. As an example consider the structure of that part of the model centred on chemical and biological warfare:

```
                    Military Science
                           |
                           v
                   Military Operations
                           |
                           v
                        Warfare
                       /        \
                      v          v
              Biological       Chemical
               Warfare         Warfare
                  |                |
                  v                v
              Biological       Chemical
               Warfare         Warfare
               agents          agents
                    \          /
                     v        v
                Antipersonnel agents
```
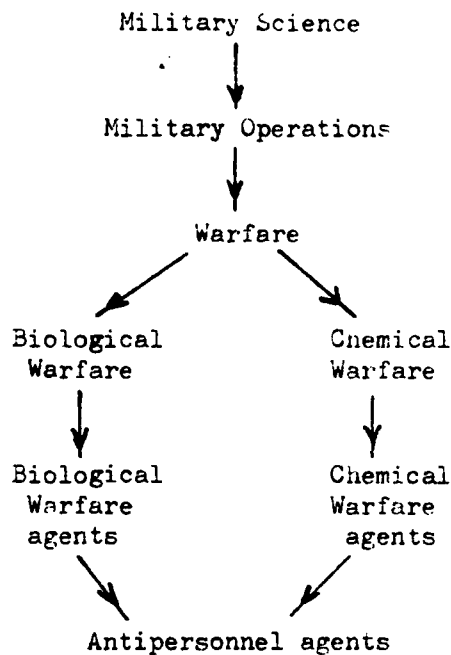
The equivalent section of TEST is confined to chemical warfare (Military chemical operations) as the terms for biological warfare and biological warfare agents (Biological operations and Biological agents) are not included in TEST's hierarchical structure but are isolates.

Military operations

Military chemical operations

The TEST terms for chemical warfare agents and antipersonnel agents do not appear in the same hierarchies as the chemical warfare term. They are in fact separate hierarchies, each with

-37-

more specific terms beneath them. Some of these more specific
terms appear in both hierarchies.

The DRIT structure is nearer the model.

```
                         Warfare
                        ↙       ↘
          Biological              Chemical
          Warfare                 Warfare
             │                       │
             ↓                       ↓
          Biologicàl              Chemical
          Warfare                 Warfare
          agents                  agents
```
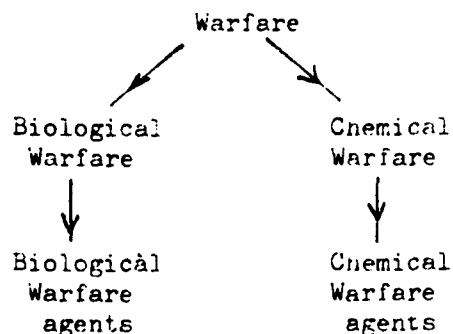
Only the term antipersonnel agents is missing. As with TEST,
this term is the head of a separate hierarchy and some of its
terms also appear under Chemical warfare agents in the main
hierarchy.

This brief study has served to highlight difference in the
structure of the two thesauri. While TEST has small hierarchic
classes related to each other, DRIT combines the equivalent
small classes into one large one.

6.3 Specificity of Terms

Hopker's method was used to compare the specificity of terms
from the two thesauri (21). Graphs showing Rank number rela-
tions and class-size-rank relations are presented in Figures 2
and 3. Tables 2 and 3 show the rank number derivation for the
19 main hierarchies studied from each thesaurus. (See
appendix 1.)

As has already been stated, some of the DRIT hierarchies tend
to be much longer than their equivalents in TEST, and include
topics which form the subject of separate hierarchies in
TEST. For example many of the terms included in DRIT's
hierarchy for Warfare come under Countermeasures in TEST. To
ensure a fair comparison these additional subjects have been
included in the calculations concerning TEST's hierarchies.

The main hierarchies affected by this are those covering the
subjects of Military facilities, Military operations, Military
organisations and Warfare.

The first column in Tables 2 and 3 shows the total number of
terms in the hierarchy, taking account of any term which appears
in more than one place in the same hierarchy. The second
column gives the number of terms which have more specific
terms below them (sub terms) in the hierarchy, irrespective of
how many such sub terms there are. This differs from Hopker's
original method where the class number was the number of terms
with 10 or more sub terms in a classification scheme. Because
the largest hierarchy studied had only 89 terms, and because
generally the only term in the hierarchy with 10 or more sub
terms is the main term, this method had to be altered.
Hopker's study covered classification schemes in which class
sizes numbered several hundreds of terms and so the number
10 was convenient.

The third column in Table 2 denotes the rank of each hierarchy.
The rank was assigned to each hierarchy according to the number
in column two, ie the hierarchy with the highest number of terms

with more specific terms was ranked number 1 and so on. It is interesting to note that only two equivalent hierarchies from each system had the same rank number, Warfare and Security, while most of the others have a rank number within 2 or 3, the greatest difference between each thesaurus being five. The class for Pyrotechnics is ranked 14 in TEST and 9 in DRIT.

Where terms have the same number of subterms, the number of terms in the hierarchy determine the ranking.

Figure 2 shows the curves of rank plotted against the number of terms with more specific terms below them in the hierarchy for each class from the two thesauri. The curves follow each other closely, which suggests that there is very little difference in specificity between the two thesauri in the subject area studied.

Figure 3 gives curves of rank plotted against the number of terms in each class. Again the two curves follow each other closely, except where the TEST class ranked 10 stands out from the rest. This is the TEST class for Missiles and combines two small hierarchies while DRIT has the two sections in one hierarchy. The DRIT class for missiles is ranked 12, and this does rise up from the curve but it is not so prominent as TEST.

The TEST class for missiles contains 35 terms, 7 of which have a more specific term below them in the hierarchy, while the DRIT class has only 20 terms, with only 2 having more specific terms below them.

On studying the hierarchies again it is possible to determine that TEST is the more specific of the two thesauri. This is borne out by the fact that several of the more specific terms in TEST are missing from DRIT. The narrower terms to Amphibious operations have already been noted (see section 6.1). Other terms missing from DRIT are GE agent, GF agent, VG agent and VS agent. All these terms appear in TEST but have no equivalent in DRIT, nor is there a USE reference relevant to these terms.

6.4 Lead in Terminologies

As is shown in Table 1, DRIT has a grand total of 91,970 entries of which 10,198 are preferred terms, leaving 81,772 unwanted terms. In contrast, TEST has 23,364 entries of which 17,810 are preferred terms, with just 5,554 terms with USE references. Also TEST has a permuted index, the user can find a word required for a subject or one close to it, and be directed to a permitted term, or terms including this word. This is not an infallible method of locating the required term - especially where the required term is not included in the thesaurus, but it avoids having the main body of the thesaurus overburdened with unwanted terms.

Of the 5,554 undesirable terms listed in TEST, the common practise is to refer to just one preferred term such as Tear gases USE Incapacitating agents. Some precoordination is practised, usually combining two terms and sometimes three. Two examples of this are; Cross servicing (military) USE Logistics services and Interdepartmental procurement; Hard point defense, USE Terminal defense and Hardened installations.

Three term combinations are comparitively rare in TEST, but are common in DRIT. Four, five and even six term combinations are to be found in DRIT, although admittedly the latter two cases are rare. DRIT has an entry AP-aluminized binder - AP sandwiches USE Aluminum and Ammonium perchlorate and Binders and Laminates and Solid rocket fuels and Solid rocket oxidizers, a combination of six terms. This particular precoordination must be quite unusable in most indexing systems, unless a computerized retrieval system is used.

When USE references are included in a thesaurus it follows that a preferred term is called upon to act for more than one subject. TEST copes fairly well in this respect, since a term is used to represent up to only five or six subjects. In DRIT however, with it far higher incidence of USE references, a term can be called upon to represent as many as 400 concepts. The DRIT preferred term "Materials" is referred to by more than 430 entries. Admittedly, about 380 of these are in combination, but this leaves at least fifty topics represented by just the one word, including Material parameters, Material performance, Material problems, Material processes, Material properties, Material requirements, Materials applications, Materials components, Materials equipment, Materials processing and Materials science.

This must inevitably lead to a lack of specificity and the introduction of noise into a retrieval system using DRIT. The example quoted is extreme but not unique (Models is another preferred term referred to by at least 400 entries) but 10 USE references to a preferred term is common in DRIT.

7.1 Introduction

An indexing comparison between the two thesauri was undertaken, using the titles and abstracts of 25 reports identified as being related to the COSATI 1500 and 1600 subject areas. At the same time the abstracts were indexed by the ASSASSIN program in order that index terms selected from the titles and abstracts of the reports could be compared with the terms from each thesaurus.

DRIC's indexing staff were asked to assign descriptors to each abstract, using each thesaurus. Each abstract was indexed twice from each thesaurus by two persons, and the two sets of descriptors were combined. Each indexer was asked to arrange the descriptors in order of relevance, so, because two indexers would probably have different ideas as to what the most important descriptors were, the final combination of descriptors can be regarded as having the most important descriptors listed first, with subsidiary terms in the second half of each list.

Also, indexers were asked to assign additional descriptors for concepts not covered by the thesaurus being used at the time, but which were considered to be relevant to the abstract. These additional terms are indicated by an asterisk in appendix 4, which shows the descriptors allocated to each reference from each system.

Appendix 4 also details the free text terms selected from the title and abstract of each reference by the ASSASSIN package.

No attempt has been made to arrange these terms in order of relevance, they are presented in alphabetical order just as ASSASSIN produced them.

The abstracts sheets given to DRIC's Techncial Information Staff for the purposes of this exercise are included in appendix 3.

7.2 Users Reactions to tne Thesauri

After using each thesaurus, eacn indexer was asked for their comments on each, using the simple questionnaire included in appendix 3.

When considering the replies from this questionnaire attention was paid to the fact that each indexer was used to TEST and that only a few of the abstracts were indexed by each person. However, first impressions of DRIT are useful, and taking the bias to TEST into account, some useful conclusions are drawn.

7.3 Indexing from TEST and DRIT

For the twenty five references studied, tne lists of indexing terms assigned from each thesaurus are similar. Where additional terms were added to a list of index terms, tnese terms come into three categories. The biggest category is the one involving terms which were added to botn lists for wnich no equivalent could be found in either thesaurus. Tnese terms are:-

Mukluks	(Reference 1)
OSIS	(Reference 3)
Masterplan	(Reference 3)
Dexterity	(Reference 4)
Reefed mains extraction	(Reference 15)
Long term effects	(Reference 16)
World wide effects	(Reference 16)
Somatic effects	(Reference 16)
GACAM-1 (Model)	(Reference 22)
TAC-CONTENDER (Model)	(Reference 22)

The second largest category, almost as big as the first, is that in which TERMS added to the DRIT list had an equivalent term in TEST.

Boots	(Reference 2)
Evaluation	(Reference 2)
Design	(References 2, 17 and 23)
Trends	(Reference 4)
Antiradar missiles	(Reference 6)
Color matching	(Reference 10)
Combat uniforms	(Reference 10)
F-region	(Reference 14)

The smallest category is that consisting of terms added to the TEST list, for which an equivalent exists in DRIT.

Crises	(References 4 and 7)
China	(Reference 4)
Ground crews	(Reference 5)
Australia	(Reference 10)

It could be argued that the second category is in fact the same size as the first because the term Design appears in three references, giving a total number of additional indexing points of 10, the same as for the first category terms. However, counting the number of additional terms, and desregarding the number of times a term was used, gives 8 indexing points for the second category.

Considering the greater number of preferred term entries in TEST, it is not really surprising that more terms were added to the lists from DRIT (18) than to those from TEST (13).

Of the terms added to both lists, six terms can be considered as being very specific, Mukluks, OSIS, Reefed mains extraction, Somatic effects, GACAM-1 (Model) and TAC-CONTENDER (Model), and two as being very general, Long term effects and World wide effects. Because of this, it is difficult to justify the inclusion of any of them in any revision of either thesaurus. For example it can be argued that Mukluks can be adequately described by both thesauri by the term Footwear, and OSIS by the combination of the terms Ocean surveillance and Information systems. On the other hand, the terms Long term effects and World wide effects are too general to be admitted, even though both thesauri already contain terms of the same type.

Turning to the third category, ie terms which appear in DRIT but not in TEST, one, Crises, does not appear in either thesaurus, but DRIT does have the corresponding term Emergencies. These terms can be considered analagous and either would be a suitable term for inclusion in a revision of TEST, as would

the term Ground crews. The other two terms, China and Australia
are not really necessary terms for a thesaurus. DRIT has
several other terms for geographic location, including terms for
all the states of the USA!

The third category, those terms in TEST which are not in DRIT,
is composed of specific terms, with the exception of Evaluation
and Design. This adds weight to the conclusion reached earlier
(see section 6.2) that TEST is the more specific of the two
thesauri.

One point of interest which arises here is TEST's term Boots
(footwear). It is difficult to see the point of having the
qualifier (footwear) in the term because the context of the
report would distinguish Boots (footwear) from any other Boots,
such as Boots (Chemist), which incidentally is the only possible
alternative to Boots (footwear) which springs to mind.

7.4 ASSASSIN

The index terms assigned by the ASSASSIN package are also
listed in appendix 4. Unlike the other two lists, these terms
are given in alphabetical order, rather than in order of
relevance.

The ASSASSIN program has produced complete factoring of all
terms, except where these have been deliberately hyphenated
in the computer input, eg Down-draught and Electronic-
countermeasures.

The ASSASSIN terms do illustrate the value of a thesaural
type indexing system, especially in the case of reference
24. Here, ASSASSIN has produced 17 terms including Air-
launched, Airframes, Cruise, Expendable, Flight and Vehicles.
The thesaural systems include the terms Airframes, Missile
airframes, Cruise missiles, and Drone aircraft (TEST) and
Airframes, Guided missiles, Cruise missiles, and Drones
(DRIT). This is an illustration of the indexers use of
knowledge that an expendable air launched cruise vehicle is
either a drone aircraft, or (more likely) a cruise missile,
and so the appropriate terms have been added. The ASSASSIN
program makes provision for additional terms of this type,
but a completely automated indexing system, as ASSASSIN was
used here, misses these points.

7.5   Term Relations in each Thesaurus

In this section some terms from the ASSASSIN list have been
selected and the term relations of their equivalents in TEST
and DRIT have been studied. In particular the terms' posi-
tions in hierarchies and their relations to other terms in the
respective hierarchies have been studied.

The terms chosen for this study are:

    ASW (an abbreviation for antisubmarine warfare)

    Air to Air engagements

    Footwear

    Mustard

Additionally the following terms, in coordination, were

selected

 Chemical Warfare

 Ocean Surveillance

 a) ASSASSIN term ASW

   TEST   term Antisubmarine warfare

   DRIT   term Antisubmarine warfare

A solid line indicates hierarchic relation, with arrows

showing the direction from general to specific, while

dotted lines indicate cross references, or related terms.

TEST

```
                                      Naval mine
                                       warfare
                         Warfare
 Acoustic                   ↓                    Undersea
 surveillance ········· ANTISUBMARINE WARFARE ···· warfare

          Antisubmarine   Harbor
           aircraft       defense              Submarine
                                               detection

             Antisubmarine        Hunter-killer
              minefields            groups
```

DRIT

```
              Warfare
                ↓
           Undersea warfare
                ↓
            ANTISUBMARINE
              WARFARE
                ↓
         Hunter-Killer groups
```
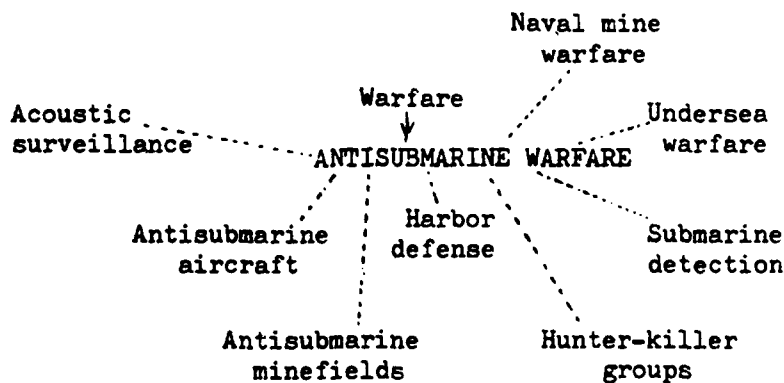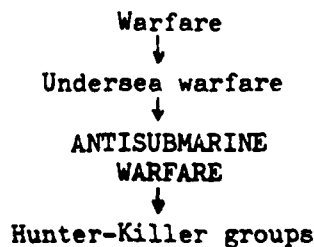
b)   ASSASSIN   term   Air to Air engagements

     TEST   term   Aerial warfare

     DRIT   term   Aerial warfare

TEST

                              Warfare
                                 |
                                 v
                           AERIAL WARFARE

DRIT

                              Warfare
                                 |
                                 v
                           AERIAL WARFARE
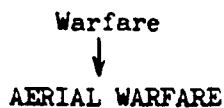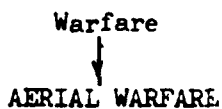
c)   ASSASSIN   term   Footwear

     TEST   term   Footwear

     DRIT   term   Footwear

TEST

                              Clothing
                                 | Socks
                                 v   .
Artic clothing .... FOOTWEAR .... Protective
                              ^ ^ `.   clothing
                           . | `.
                        Boots | `.
                       (footwear) | Shoes
                    .' |
              Combat   Hosiery
              uniforms

DRIT

                              Clothing
                                 |
                                 v
                             FOOTWEAR
                          / | \
                         v   v   v
                    Shoes   Snowshoes   Socks

-50-
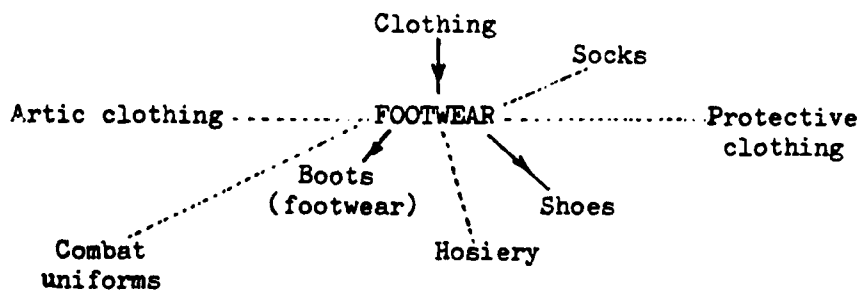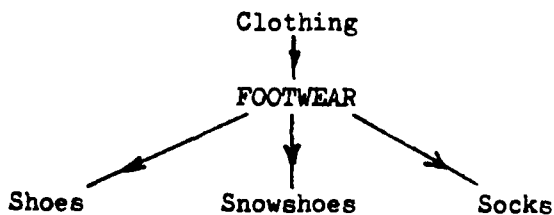
d) ASSASSIN term Mustard

    TEST   term Mustard agents

    DRIT   term Mustard Agents

TEST

```
Antipersonnel                    Military chemical
   agents  ↘                         ↙  agents
              Vesicants
Lewisite ↖      ↓
            MUSTARD AGENTS
                 ↓
            Nitrogen mustards
```

DRIT

```
Warfare                              Chemical agents
        ↘                                    ↙
          Chemical warfare
Antipersonnel              Chemical warfare
   agents  ↘                   ↙  agents
              Vesicants
Arsenic ↖       ↓        ↗ Lewisite
agents      MUSTARD AGENTS
                 ↓
            Nitrogen mustards
```
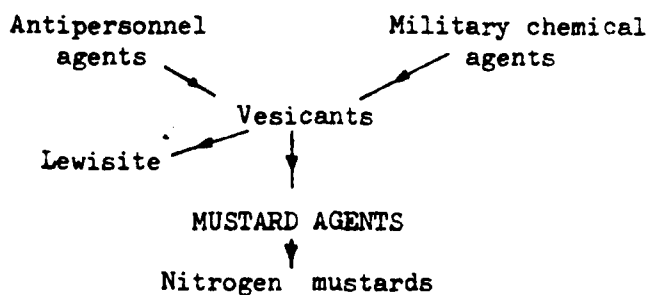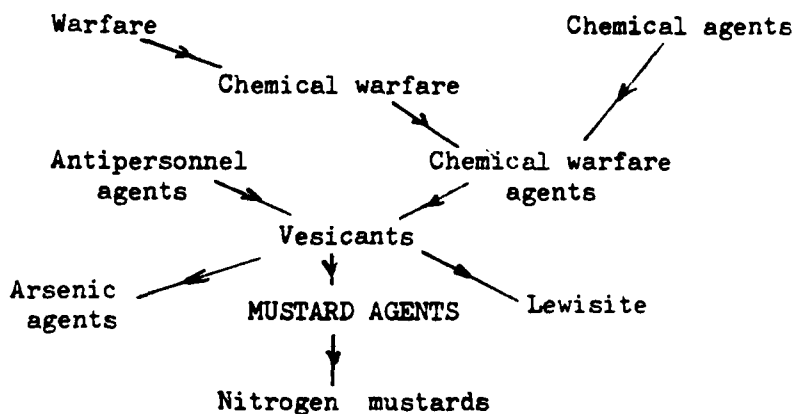
e) ASSASSIN term Chemical warfare

    TEST   term Military chemical operations

    DRIT   term Chemical warfare

TEST

Military operations
↓
CBR operations ············· MILITARY CHEMICAL ···——··· Protective masks
OPERATIONS

Chemical agent   Protective
detection   clothing

Chemical   Flame
ammunition   warfare

Military   Portable
chemical   shelters
agents

DRIT

Warfare
↓
CHEMICAL WARFARE
↓
Chemical warfare agents
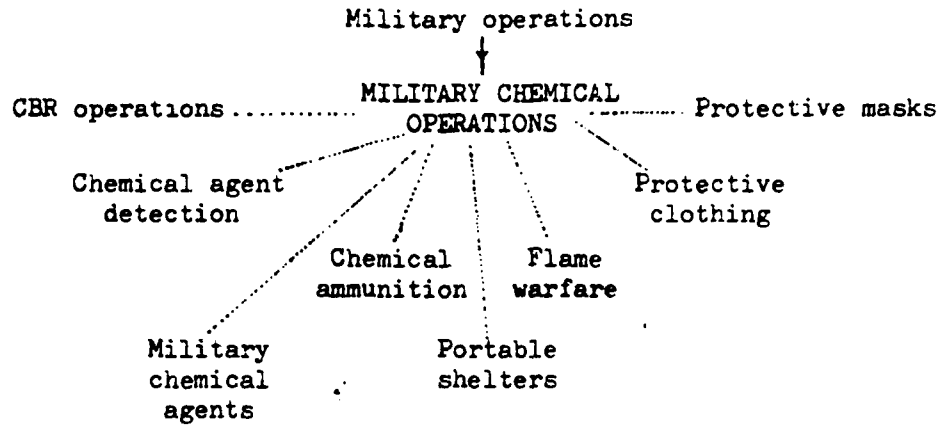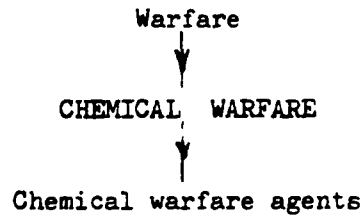
f)   ASSASSIN   term   Ocean surveillance

     TEST   term   Ocean surveillance

     DRIT   term   Ocean surveillance

TEST

Acoustic surveillance   Surveillance

OCEAN SURVEILLANCE
Coastal surveillance·········   ·······Visual surveillance
↓
Undersea surveillance

Combat
surveillance

Space   Radar surveillance
surveillance
(space borne)

DRIT

```
                                              Space surveillance
                                          →        systems
                        Surveillance
    Acoustic ——→      /          ↘       Undersea surveil-
    surveillance     /    ↓        →       lance
                    ↙
                   OCEAN SURVEILLANCE
          Combat                        ＼    Visual
          surveillance                        surveillance
```
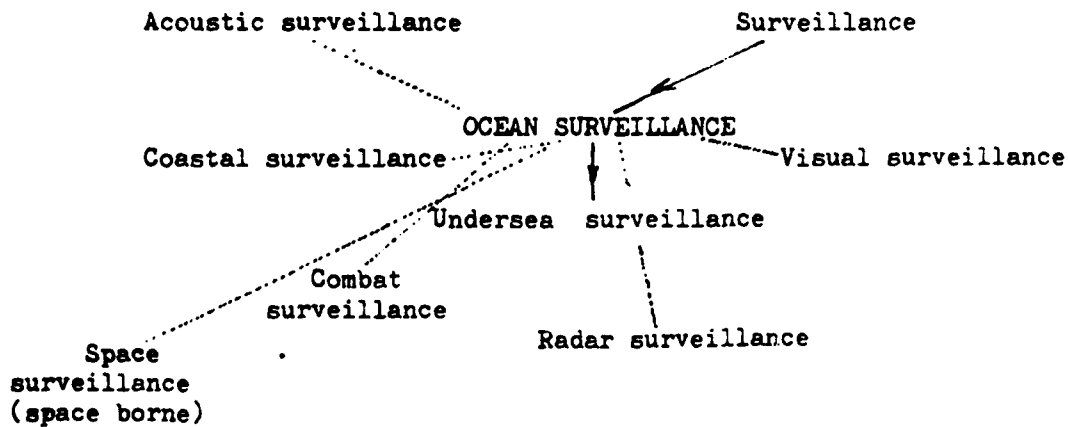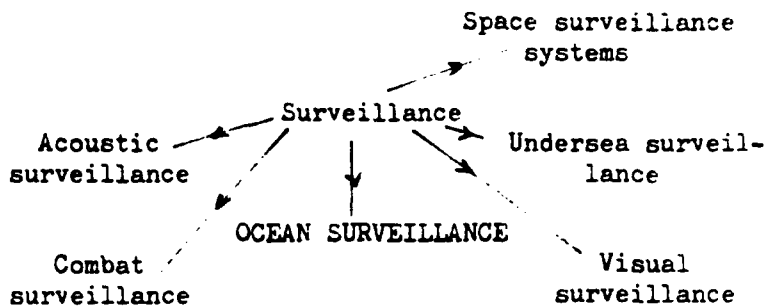
These few terms enable a closer examination of selected areas
of hierarchies, as well as an examination of related terms in
TEST.

The first term studied, Antisubmarine warfare, shows differences
in hierarchical construction. In TEST the terms Undersea war-
fare and Hunter-killer groups are terms related to Antisubmarine
warfare, whereas DRIT includes them both in the hierarchy,
Undersea warfare as a broad term and Hunter-killer groups as a
narrow term to Antisubmarine warfare.

In TEST, these terms appear in different places in the hierarchy
Undersea warfare is a narrow term from Warfare, and only appears
as a related term to Antisubmarine warfare. Hunter-killer
groups is again a related term, but does not appear in a
hierarchy. It is in fact an isolate.

The second term, Aerial warfare, is treated similarly in each
thesaurus, and no further comment is necessary.

Footwear again shows some differences. The basic structures of
the hierarchies are similar, but where TEST treats Socks as a
related term, DRIT includes it in the hierarchy. This example

also includes a term in each hierarchy that does not appear
in the other:

Boots (footware) (TEST) and Snowshoes (DRIT).

The next two terms, Mustard agents and Chemical warfare, are
best considered together because DRIT actually combines two
hierarchies in one.

The TEST and DRIT hierarthies concerning Mustard agents are
essentially similar (except for the term Arsenic agents which
appears in DRIT) up to the two broad terms Antipersonnel
agents and Military chemical agents. In the case of DRIT the
alternative term Chemical warfare agents is used for Military
chemical agents, and it is here that the second difference is
observed. Chemical warfare agents has two broader terms,
Chemical agents and Chemical warfare, which in turn is a
narrower term to Warfare.

Chemical warfare, or Military chemical operations as TEST
prefers it, is in TEST a narrower term to Military operations
rather than Warfare, and Military chemical agents is a
related term rather than a narrower term.

As can be seen from the full DRIT hierarchy included in
appendix 1, the hierarchy including Chemical warfare agents
also includes terms related to Chemistry such as Chelating
agents and Grignard reagents.

The last term, Ocean surveillance, is again treated similarly
by each thesaurus.

8   User Reaction

8.1 Readability

Samples of the presentation of each thesaurus are included in
Figures 4 and 5, see appendix 1. DRIT's computer origin is
obvious in its presentation. The only concessions to readability
are the bold print of the entry, the indenting of subsequent
lines and the large print used. No differentiation is made
between preferred terms and lead in terms, which makes search-
ing for one term in 90,000 entries rather difficult. TEST has
a similar layout to DRIT but there are not so many terms to
search through wich simplifies matters.

TEST is printed in upper and lower case, and differentiates
between preferred terms and lead in terms by printing the latter
in italic. This does make TEST the easiest of the two thesauri
to read. One indexer said that after using DRIT for more than
fifteen minutes his eyes refused to focus on the all upper
case print.

One minor difference between the two thesauri is connected
with the larger print used in DRIT. Because of this, DRIT's
presentation is a three column layout, as opposed to the four
column layout used in TEST. The inference to be drawn here
is that DRIT has been printed in a large typeface in an attempt
to make it more readable. If the print size were reduced so
that a four column layout could be used, and so reduce the
number of pages necessary, the thesaurus would be even more
unreadable than it already is.

8.2 User Preference

Nine people took part in the indexing exercise and were asked for their opinions of the two thesauri. Of the nine, five preferred TEST, two preferred DRIT, and two showed no preference. One of the latter thought the sample too small to come to any conclusions, but felt that both covered some topics well and were poor in other areas, and that these two areas did not always coincide. This same person went on to say that he preferred the more ordered arrangement of TEST, but thought that this might be due to familiarity.

The other indexer who showed no preference for either thesaurus also thought that familiarity with TEST would tend to weight any opinion of preference. He further thought that the two thesauri are totally different concepts, each having its own advantages and disadvantages.

Of the two indexers who preferred DRIT one liked the long list of USE terms which enabled a precise definition of descriptors. In a similar vein, the other indexer liked DRIT's use of precoordination, and the freedom from restriction by COSATI subject fields which are present in TEST. At the same time this indexer found DRIT's format too difficult to read, and locating descriptors was too much like hard work.

All five indexers who preferred TEST admitted that familiarity with TEST was probably a contributory factor to this preference. A greater factor was a dislike of DRIT. The most voiced dislike was the need to use too many descriptors to describe a

concept. Three or more terms to define a concept being very common. The terms in DRIT seem to cover parts of concepts rather than the whole, which again leads to a lot of precoordination.

One abstractor thought that DRIT's terms tended to be general rather than specific; another disliked the fact that DRIT has a word by word alphabetic arrangement, rather than the letter by letter arrangement of TEST. This means that words in DRIT appear in different order to that used in TEST.

Two indexers disliked the existence of such terms as Air to surface, and Air to Surface missiles as preferred terms, and the existence of such lead in terms as Surface-to-air missile and Surface to air missile, often appearing beside each other in the thesaurus.

The feature which was most liked about TEST was its structure which makes locating a term an easier task than it is with DRIT.

9   Discussion

To be accepted, a multidisciplinary thesaurus must compare favourably with TEST, which has become accepted as the leader in this field. DRIT in its present form, does not meet the requirements.

DRIT's two biggest drawbacks are the lower number of preferred terms (10,198 as opposed to TEST's 17,810) and the overwhelming number of terms with USE references, which have a suffocating effect on the thesaurus.

DRIT's preferred terms tend to be more general than the terms in TEST, and precoordination is used for many concepts. As a consequence of the general nature of the preferred terms the precoordination becomes unwieldy; many of these precoordinations combine three or more terms.

Many of the terms having a USE reference are unnecessary since they are slight variations in spelling, and are often adjacent to the term they are referred to. If these terms were edited out of the thesaurus it would not be so unwieldy and would become easier to use.

DRIT's presentation is also inferior to TEST's. It is all upper case, and makes no concession to the user in that there is no differentiation between a preferred term and a term with a USE reference.

Each thesaurus includes terms which have more than one broader term, but this practise is far more prevalent in DRIT. When generic posting is used to broaden a search this would, with DRIT, lead to the choice of broader terms envisaged by Farradane (20) and to a possible introduction of noise in retrieval.

TEST, having the fewer built-in precoordinations, would offer more
scope for synthesis than DRIT. Because many concepts are already
represented by precoordination in DRIT, precoordination for a new
concept is very likely to introduce noise once again in DRIT.
With TEST such noise is less likely to occur. Because of its 90,000
plus entries, DRIT is more likely to include a precoordination for a
concept than TEST, and DRIT is often used in DRIC as a guide, to
see how a concept not included in TEST could be precoordinated.

Should a second edition of DRIT be envisaged, the following points
could be usefully incorporated:

1)   Increase the number of preferred terms.

2)   Rationalise the number of terms with USE references.

3)   Use a mixture of upper and lower case print to make the
thesaurus easier to read.

4)   Some sort of typographic coding should be used to
differentiate between a preferred term and one with a USE
reference.

With so much in DRIT to find fault with, it is difficult to criti-
cise TEST, which has become an unofficial yardstick against which
other multidisciplinary thesauri are judged. Many specialised
thesauri begain life by taking the relevant part of the TEST thesaurus
and carrying on from there. This highlights the major fault with
TEST (which is also a fault with DRIT) is that being a multidisa-
plinary thesaurus, many subjects are not adequately covered.

TEST preferred terms are subjected to a constraint in their use by the COSATI subject field which is allocated to each term. This is a difficulty when a useful term is found and the COSATI classification indicates that the term is relevant to a field other than the required one. However this difficulty is not insurmountable, the solution is to use the COSATI numbers as a guide, and to ignore them altogether when such an occasion arises as is described above.

The limited indexing exercise conducted for this investigation has shown that some compatibility between the two thesauri exists, but there are terms in each thesaurus which have no equivalent in the other, and terms which have no exact equivalent. Some examples of the latter are Military chemical operations, Military chemical agents and Missiles from TEST which become Chemical warfare, Chemical warfare agents and Guided missiles respectively in DRIT.

From the larger number of preferred terms available in TEST and the comparative absence of fixed precoordination it is possible to deduce that TEST is the more specific thesaurus, and that it has a more flexible indexing terminology than DRIT. Also, DRIT's use of precoordination means that the same terms are used to define several different subjects. This would introduce a great deal of noise at the retrieval stage. This also allows the deduction that DRIT would not have a better performance than TEST in retrieval of documents indexed by TEST.

The investigation has shown a method of assessing the value of a thesaurus, without the necessity of a reference standard. Ideally an indexing and retrieval exercise should be conducted. However, an indexing exercise alone will give some useful information. A much

larger number of documents should be used than was included in this work, where the number was limited by time. The documents chosen should cover all fields covered by the thesaurus, not just one section as was done here. An indexing exercise on this scale will not only highlight those areas which are not so well served by the thesaurus, and which terms are missing altogether, but will enable an objective evaluation to be made of the specificity of the terms included in the thesaurus.

It can be argued that in this study like has not been compared with like because two different concepts have been studied. TEST was derived as a thesaurus per se, while DRIT evolved from a machine aided indexing background. However, DRIT has been presented as a thesaurus, and so can be compared with others. Because of its background of machine aided indexing, DRIT would be a useful publication to complement any automated or semi-automated indexing system.

10   Conclusions

TEST is the better of the two thesauri for the following reasons:

1)   It has more preferred terms.

2)   It is better structured.

3)   It is easier to read and use.

4)   It distinguishes between preferred terms and terms with USE references by using a different type face.

5)   TEST is more likely to gain user acceptance than DRIT.

TEST has a more specific indexing vocabulary than DRIT, but DRIT has many more lead in terms than DRIT and so can be said to give better guidance to the selection of preferred indexing terms. Paradoxically this is one of the faults with DRIT in its present form.

There are far too many unnecessary lead in terms in DRIT which are simply minor variations in spelling, such as singular instead of plural and hyphenated versions of the preferred term in the case of a compound word such as Surface to air missiles.

As was stated in chapter 1, there are no plans known concerning a revision of TEST, but as two versions of DRIT have already appeared, it is reasonable to conclude that DRIT will handle new concepts more adequately than TEST. This will only hold true if regular revisions of the thesaurus appear. The DRIC system of adding a term to the indexing language, as and when required, is the only alternative.

If TEST were replaced by DRIT, two major problems would arise. Firstly, for the reasons already stated, there would be a high level of noise included with material retrieved in any search strategy

based on DRIT. Secondly, a lot of relevant material would be missed because the indexing terms from the two thesauri cannot be considered compatible. This answers the second point raised in the terms of reference in the introduction: TEST will undoubtedly give the better retrieval results on DRIC's holdings.

There would be no advantage gained by replacing TEST with DRIT in its present form. This would actually introduce disadvantages. Should a new edition of DRIT be made available, taking into account t the points outlined in chapter 9, this situation may change.

Since it arose out of a machine aided indexing system, DRIT would be a useful tool in this area, but all the points discussed would still have to be borne in mind. Some editing would be useful.

As has been stated in chapter 9, DRIC staff often refer to DRIT for guidance to precoordination. This is another area where DRIT would be useful.

11   Recommendations for Further Work

In its present form, there is nothing to recommend any further study of the DDC Retrieval and Indexing Terminology. Should a second edition be published, this may warrant further study, but this would have to incorporate both editing of the massive lead in terminology to remove the unnecessary terms and extending the number of preferred terms. A case could be made for removing some of the present preferred terms which are themselves only part of another preferred term.

Any future work on a second edition of DRIT should first check for these points before any other work is done.

Evaluating any thesaurus can usefully be centred on an intensive indexing and retrieval exercise. This will highlight any deficiencies in the thesaurus and enable an objective measure of the specificity of terms to be made.

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          Butterworths, London   1970

76   Willets M

          An Investigation of the Nature of the Relations

          between Terms in Thesauri

          Journal of Documentation 31 (3) 158-184   1975

Appendix 1

Figures and Tables

Page	Number of Preferred Terms	Total Number of Terms	Number of Terms with a USE reference
61	14	77	63
98	0	70	70
152	10	71	67
181	11	78	67
293	5	75	70
330	7	55	48
345	1	72	71
356	7	71	64
413	3	76	73
478	7	82	75
633	4	75	71
730	9	67	58
773	1	80	79
826	12	80	68
857	18	74	56
870	1	63	62
922	12	74	62
1116	4	70	66
1131	20	71	51
1220	16	80	64
Totals	162	1,461	1,299
Average number of terms per page	8.1	73.05	64.95
∴ Number of Terms in DRIT (1259 pages) (to nearest whole number)	10,198	91,970	81,772

Table 1

Calculation of the Number of Terms in DRIT

Main Subject of Class	Total Number of Terms	Number of Terms with Subterms	Rank
Warfare	89	21	1
Clothing	37	11	2
Military facilities	52	9	3
Antipersonnel agents	22	7	4
Chemical warfare agents	20	6	5
Camouflage	9	5	7
Logistics	18	4	8
Defence	14	4	9
Missiles	35	3	10
Intelligence	27	3	11
Military operations	16	3	12
Reconnaissance	14	3	13
Pyrotechnics	10	3	14
Bombing	16	2	15
Surveillance	13	2	16
Security	3	1	17
Strategy	2	1	18
Biological warfare	2	0	19

Table 2

Rank-Number Table for 19 Classes from TEST

Main Subject of Class	Total Number of Terms	Number of Terms with Subterms	Rank
Warfare	84	27	1
Military facilities	54	14	2
Chemical warfare agents	37	10	3
Clothing	30	8	4
Military organisations	27	7	5
Logistics	21	7	6
Antipersonnel agents	18	7	7
Camouflage	16	5	8
Pyrotechnics	19	4	9
Military operations	18	4	10
Reconnaissance	10	3	11
Missiles	20	2	12
Defence	17	2	13
Intelligence	12	2	14
Surveillance	8	2	15
Biological warfare	4	2	16
Security	4	2	17
Bombing	15	1	18
Strategy	2	1	19

Table 3

Rank-Number Table for 19 Classes from DRIT
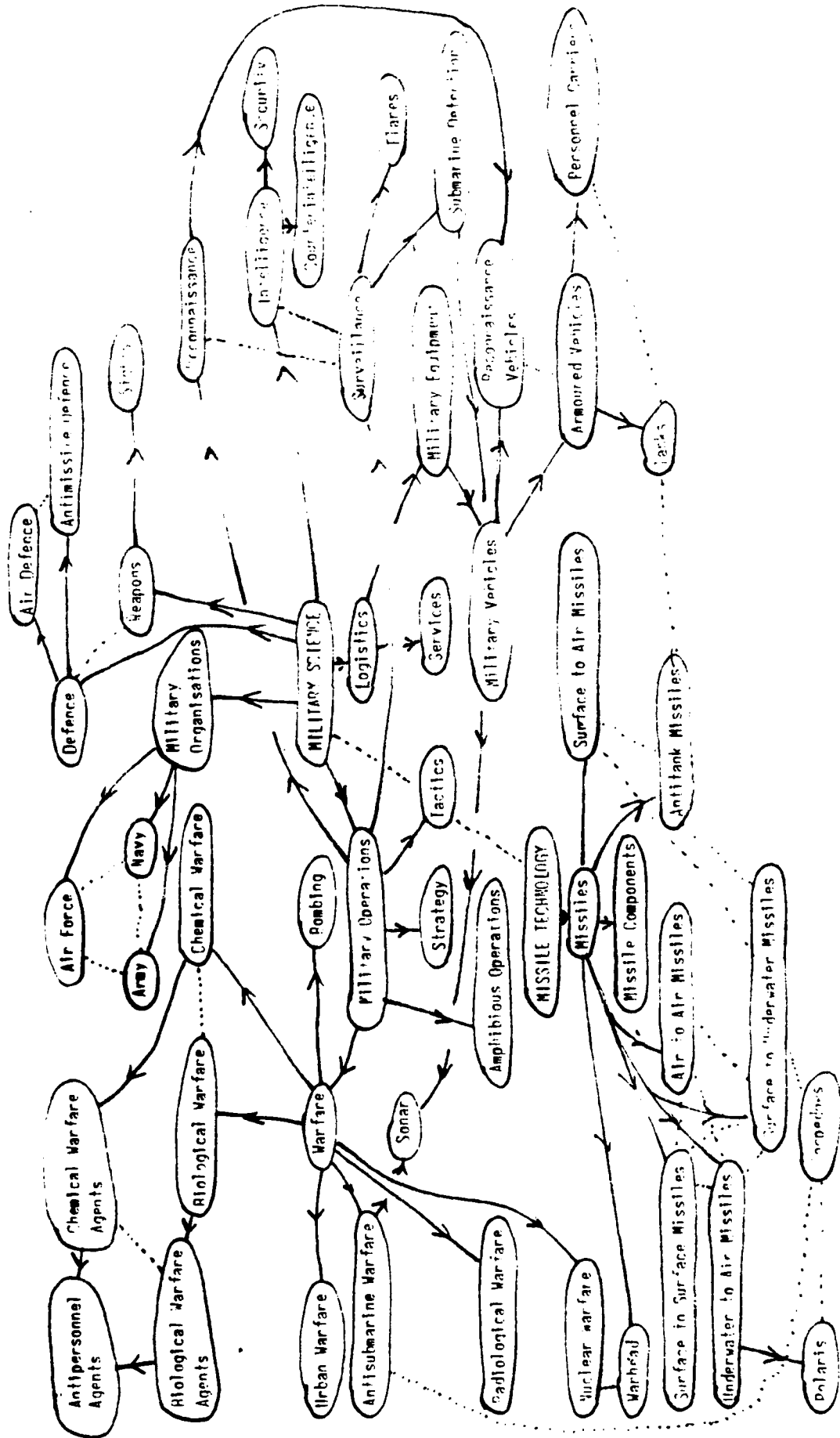
FIGURE 1 Model of Subject Area
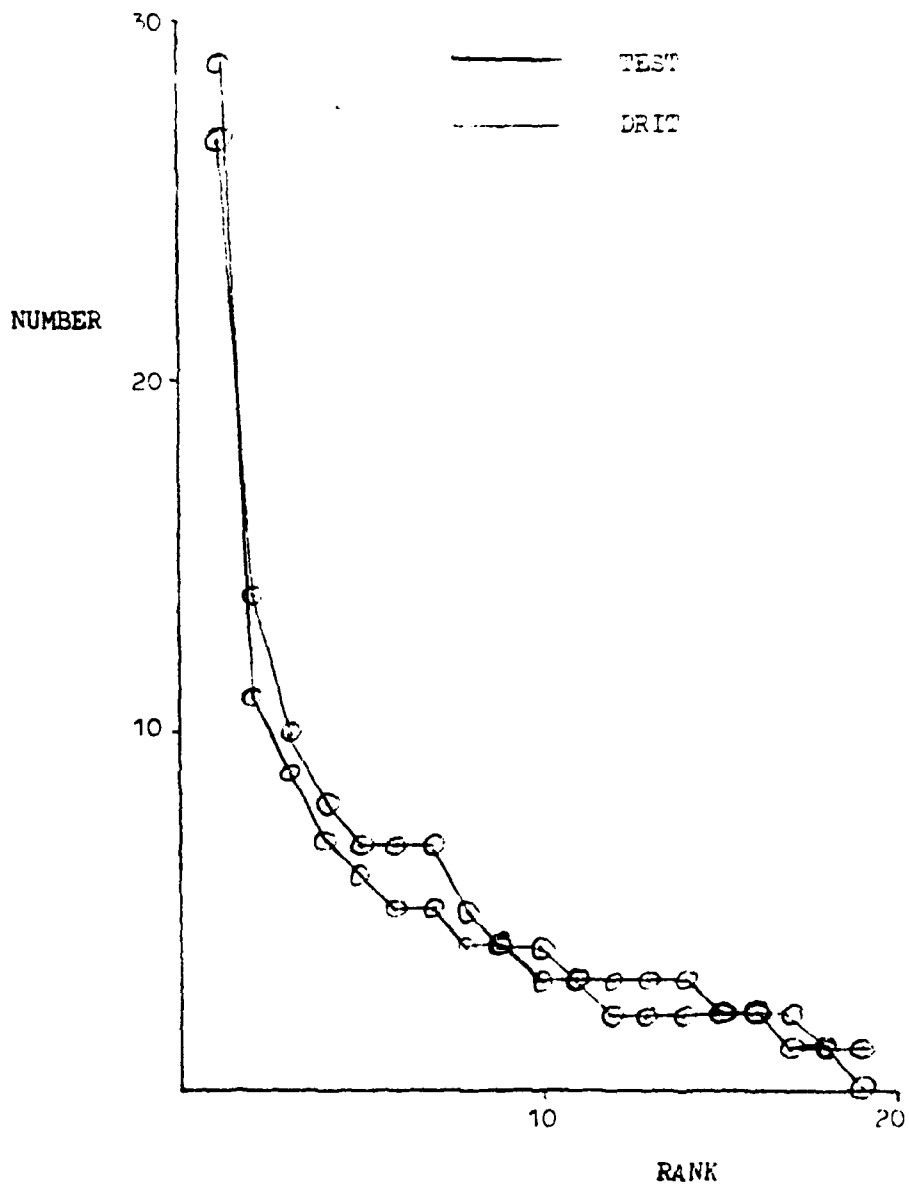
Figure 2

Rank - Number Relation
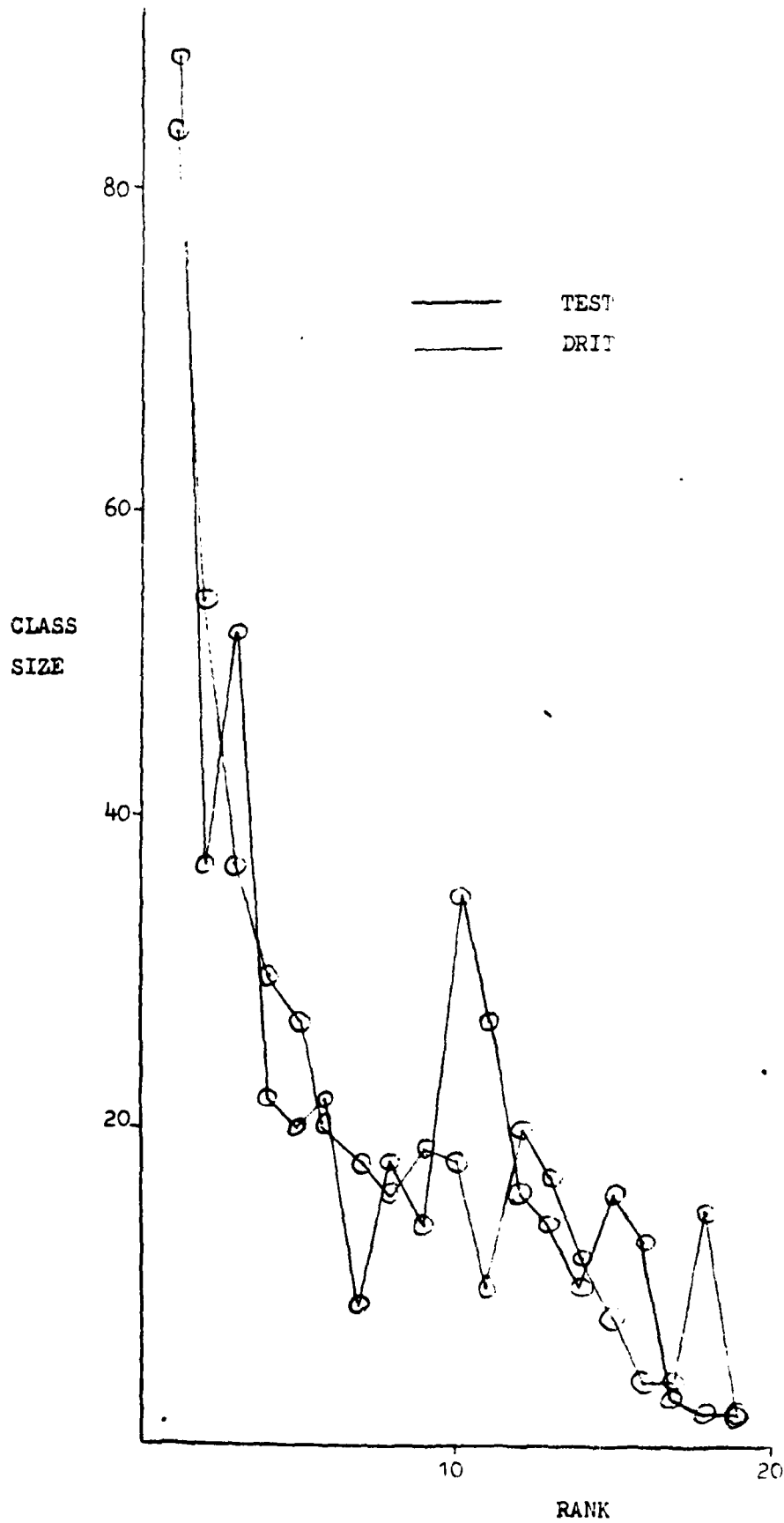
Figure 3

Class Size - Rank Relation

Microwave spectrometers 1402
  UF Radio frequency spectrometers
  BT Microwave equipment
      Spectrometers
  RT Microwave spectroscopy
Microwave spectroscopy 1402
  BT Radio frequency spectroscopy
      Spectroscopy
  RT Infrared spectroscopy
      Microwave spectrometers
      —Molecular spectroscopy
      Spectrum analysis
Microwave tubes 0901
  BT Electron tubes
      Microwave equipment
  NT Backward wave tubes
      Carcinotrons
      —Klystrons
      Magnetrons
      Platinotrons
      Reflex klystrons
      —Traveling wave tubes
  RT Antitransmit receive tubes
      Microwave oscillations
      Transmit receive tubes
      - Triodes
      --Vacuum tubes
Microyield strength 2012
  UF Precision elastic limit
  BT Elastic limit
      Elastic properties
      Mechanical properties
Midcourse defense 1503
  BT Air defense
      Antimissile defense
  RT Early warning systems
Midcourse guidance 1707
  RT —Command guidance
      Injection guidance
      Midcourse trajectories
      Preset guidance
      Rendezvous guidance
      Spacecraft guidance
      —Terminal guidance
      Torpedo guidance
Midcourse trajectories 1904
  BT Trajectories
  RT Ascent trajectories
      Descent trajectories
      Midcourse guidance
      Rendezvous trajectories
      —Spacecraft trajectories
Middle ear 0616
  UF Ear ossicles
  BT Ear
  RT Eustachian tube
Middle infrared radiation
  USE Intermediate infrared radiation
Midges
  USE Dipters
Midget submarines 1310
  BT Ships
      Submarines
Midlatitude sporadic E layer 0401
  BT Earth atmosphere
      E region
      Ionosphere
      Sporadic E layer
      Upper atmosphere
Midocean ridges
  USE Ocean ridges
Mie scattering 2006
  BT Electromagnetic scattering
  NT Rayleigh scattering
  RT Meteorological radar
Migmatite 0807
  BT Metamorphic rocks
      Rocks
  RT Gneiss
      Schist
Migraine
  USE Headache
Migrations 0616
  NT Animal migrations
      Population migrations
MIG welding
  USE Gas metal arc welding
Mildew
  USE Fungi
Mildew resistant coatings
  USE Fungus resistant coatings
Military aircraft 0103
  UF Military planes
  BT Aircraft
  NT Antisubmarine aircraft
      Attack aircraft

Bomber aircraft
Carrier based aircraft
Electronic aircraft
Fighter aircraft
Patrol aircraft
Helicopters
Reconnaissance drone aircraft
Submersible aircraft
Surveillance drones
Tactical aircraft
Tanker aircraft
Target drone aircraft
Troop carrier helicopters
  RT Airships
      —Cargo transportation
      Commercial aircraft
      Drone aircraft
      Flying platforms
      Ground effect takeoff aircraft
      Gliders
      Hovercraft
      Hypersonic aircraft
      Jet aircraft
      Military spacecraft
      Observation aircraft
      Organizational equipment (military)
      Research aircraft
      Rocket planes
      —Rotary wing aircraft
      Short takeoff aircraft
      -Supersonic aircraft
      Training aircraft
      —Transport aircraft
      Utility aircraft
      —Vertical takeoff aircraft
Military air facilities 0105
  UF Air bases
      Air force bases
      Army air bases
      Coast guard air stations
      Marine Corps air stations
      Naval air stations
  BT Military facilities
  RT Aircraft carriers
      Airports
      Airport towers
      —Air traffic control
      Hangars
      Heliports
      —Landing aids
      —Navigational aids
      Taxiways
Military alert 1503 1507
  RT Military mobilizing
Military assistance 0504
      Includes advisory personnel troops
      material and training
  BT Foreign aid
  RT Counterinsurgency
      Developing countries
Military bases 1505
  UF Overseas military bases
  BT Military facilities
  NT Missile bases
  RT Advanced bases
      Real property
Military blockades 1507
  RT Economic warfare
Military bridges
  USE Bridges (structures)
Military chemical agents 1502
      Chemicals that produce lethal or
      damaging effects on men, animals
      plants, or material, or that produce a
      screening or signalling smoke
  UF Chemical warfare agents
  NT BZ agents
      Choking agents
      GA agent
      —G agents
      GB agent
      GD agent
      GE agent
      GF agent
      Lewisite
      —Mustard agents
      —Nerve agents
      Nitrogen mustards
      Psychochemical agents
      —V agents
      VE agent
      —Vesicants
      VG agent
      VS agent
      VX agent
  RT Anticrop agents
      Antilivestock agents
      Antimaterial agents

Figure 4

TEST Presentation

MILITARY AIR WEAPON SYSTEMS
  USE AIRBORNE
    and WEAPON SYSTEMS
MILITARY AIRBORNE WEAPON
  SYSTEMS
  USE AIRBORNE
    and WEAPON SYSTEMS
MILITARY AIRCRAFT
  NT ARMY AIRCRAFT
    • BOMBER AIRCRAFT
      ELECTRONIC AIRCRAFT
    • NAVAL AIRCRAFT
    • RECONNAISSANCE AIRCRAFT
    • TACTICAL AIRCRAFT
  BT AIRCRAFT
MILITARY AIRCRAFT APPLICATIONS
  USE MILITARY AIRCRAFT
    and MILITARY APPLICATIONS
MILITARY AIRCRAFT AVIONICS
  USE AVIONICS
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT BRAKE ANTISKID
  SYSTEM
  USE BRAKES
    and MILITARY AIRCRAFT
    and SKIDDING
MILITARY AIRCRAFT BRAKE ANTISKID
  SYSTEMS
  USE BRAKES
    and MILITARY AIRCRAFT
    and SKIDDING
MILITARY AIRCRAFT COCKPIT
  DISPLAYS
  USE COCKPITS
    and DISPLAY SYSTEMS
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT CONFIGURATION
  RESEARCH
  USE MILITARY AIRCRAFT
MILITARY AIRCRAFT ENVIRONMENTS
  USE ENVIRONMENTS
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT EQUIPMENT
  USE AIRCRAFT EQUIPMENT
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT FLIGHT
  CONTROL SYSTEMS
  USE FLIGHT CONTROL SYSTEMS
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT FLOTATION
  USE FLOTATION
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT LOAD
  ENVIRONMENT
  USE ENVIRONMENTS
    and LOADING(HANDLING)
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT MAINTENANCE
  USE MAINTENANCE
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT OPERATIONS
  USE MILITARY AIRCRAFT
    and OPERATION
MILITARY AIRCRAFT OXYGEN
  SYSTEMS
  USE MILITARY AIRCRAFT
    and OXYGEN EQUIPMENT
MILITARY AIRCRAFT PROGRAMS
  USE MILITARY AIRCRAFT
MILITARY AIRCRAFT STRUCTURAL
  JOINTS
  USE AIRFRAMES •
    and JOINTS
    and MILITARY AIRCRAFT

MILITARY AIRCRAFT STRUCTURES
  USE AIRFRAMES
    and MILITARY AIRCRAFT
MILITARY AIRCRAFT SYSTEMS
  USE MILITARY AIRCRAFT
MILITARY AIRCRAFT TIRES
  USE MILITARY AIRCRAFT
    and TIRES
MILITARY AIRCRAFT VULNERABILITY
  USE MILITARY AIRCRAFT
    and VULNERABILITY
MILITARY AIRCRAFT WHEEL
  USE MILITARY AIRCRAFT
    and WHEELS
MILITARY AIRCRAFT WHEEL
  MAINTENANCE
  USE MAINTENANCE
    and MILITARY AIRCRAFT
    and WHEELS
MILITARY AIRCREW
  USE FLIGHT CREWS
    and MILITARY PERSONNEL
MILITARY AIRFIELD PAVEMENT
  SYSTEMS
  USE LANDING FIELDS
    and MILITARY FACILITIES
    and PAVEMENTS
MILITARY AIRFIELD PAVEMENTS
  USE LANDING FIELDS
    and MILITARY FACILITIES
    and PAVEMENTS
MILITARY AIRFRAME EFFICIENCY
  USE AIRFRAMES
    and EFFICIENCY
    and MILITARY AIRCRAFT
MILITARY AIRFRAMES CONSTRUCTION
  USE AIRFRAMES
    and CONSTRUCTION
    and MILITARY AIRCRAFT
MILITARY AIRPLANES
  USE MILITARY AIRCRAFT
MILITARY APPLICATIONS
MILITARY AREAS
  USE MILITARY FACILITIES
MILITARY ASPHALT
  USE ASPHALT
    and MILITARY APPLICATIONS
MILITARY ASSISTANCE
MILITARY ATTACK AIRCRAFT
  USE ATTACK AIRCRAFT
MILITARY ATTITUDES
  USE ATTITUDES(PSYCHOLOGY)
    and MILITARY PERSONNEL
MILITARY AVIATION
  USE AERONAUTICS
    and MILITARY APPLICATIONS
MILITARY AVIATION SYSTEMS
  USE MILITARY AIRCRAFT
MILITARY AVIATORS
  USE MILITARY PERSONNEL
    and PILOTS
MILITARY AVIONICS
  USE AVIONICS
    and MILITARY APPLICATIONS
MILITARY BARRIERS
  USE BARRIERS
    and MILITARY APPLICATIONS
MILITARY BASES
  USE MILITARY FACILITIES
MILITARY BATTERIES
  USE MILITARY APPLICATIONS
    and STORAGE BATTERIES

Figure 5

DRIT Presentation

95

Appendix 2

Hierarchies from TEST and DRIT

Subjects

Antipersonnel agents	Pyrotechnics (Flares)
Biological warfare	Reconnaissance
Bombing	Security
Camouflage	Strategy
Chemical warfare agents	Surveillance
Clothing	Warfare
Defence	
Intelligence	
Logistics	
Military facilities	
Military operations	
Military organisations	
Missiles	

TEST

	Other Broad Terms
Antipersonnel agents	Military chemical agents
Choking agents	Military chemical agents
Incapacitating agents	
BZ agents	
CS agents	Military chemical agents
Psychochemical agents	Military chemical agents
Nerve agents	
G agents	
GA agent	
GB agent	
GD agent	
GE agent	
GF agent	
V agents	
VE agent	
VG agent	
VS agent	
VX agent	
Vesicants	Military chemical agents
Lewisite	
Mustard agents	
Nitrogen mustards	

Other Broad Terms

Antipersonnel agents

    Choking agents   Non lethal agents

    Incapacitating agents   Non lethal agnets

        BZ agents

        CS agents   Irritating agents

    Nerve agents   Chemical warfare agents

        G agents

            GA agent

            GB agent

            GD agent

        V agents

            VE agent

            VX agent

    Vesicants   Chemical warfare agents

        Arsenic agents

        Lewisite

        Mustard agents

            Nitrogen mustards

A COMPARATIVE EVALUATION OF THE THESAURUS OF
ENGINEERING AND SCIENTIFIC T.. (U) CITY UNIV LONDON
(ENGLAND) A D JONES NOV 77 DRIC-BR-60104

F/G 5/2   NL
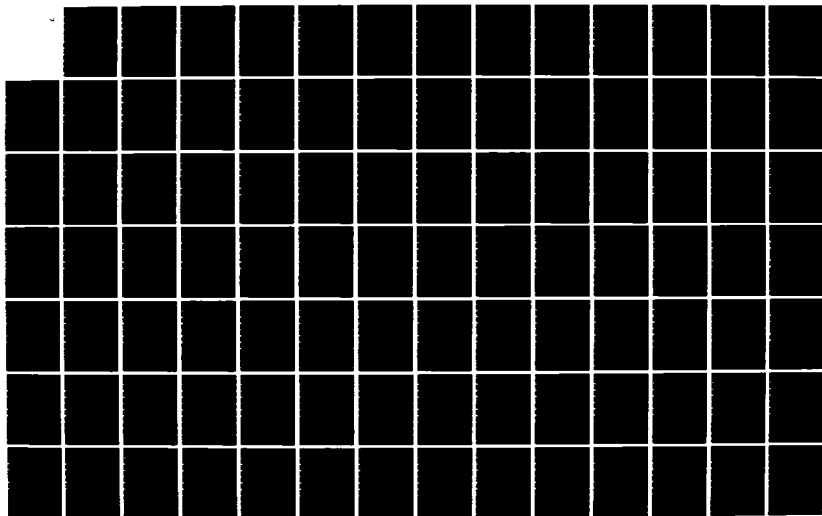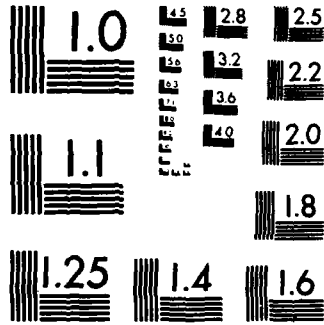
MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

TEST

Biological operations   ISOLATE

Biological agents   ISOLATE

DRIT

                                          Other Broad Terms

Biological agents

    Biological warfare agents   Biological warfare

        B agents   Chemical warfare agents

        C agents   Chemical warfare agents

Bombing

    Area bombing

    High altitude bombing

    High speed bombing

    Infrared bombing

    Low altitude bombing

    Medium altitude bombing

    Night bombing

    Pattern bombing

    Precision bombing

    Radar bombing

    Shipbombing

    Strategic bombing

    Tactical bombing

      Dive bombing

    Toss bombing

DRIT

Bombing

    Area bombing

    Blind bombing

    Dive bombing

    High altitude bombing

    High speed bombing

    Low altitude bombing

    Night bombing

    Offset bombing

    Precision bombing

    Radar bombing   Radar

    Ship bombing

    Strategic bombing

    Tactical bombing

    Toss bombing

Other Broad Terms

Camouflage

   Radar camouflage   Radar deception

      Antiradar coatings

Deception

   Radar deception

      Radar camouflage   Camouflage

        Antiradar coatings .

   Radio deception

DRIT

Deception

   Camouflage

      Antisonar coating   Antireflection coatings

      Radar camouflage   Radar deception

   Decoys

      Acoustic decoys   Acoustic countermeasures

      Infrared decoys   Infrared countermeasures,
                                        Infrared equipment

      Radar decoys   Radar deception

   Radar deception   Electronic countermeasures

      Chaff   Radar reflectors

      Radar camouflage   Camouflage

        Antiradar coatings   Antireflection coatings

      Radar confusion reflectors   Radar reflectors

      Radar decoys   Decoys

      Radar repeaters   Radar equipment, Repeaters

   Radio deception   Electronic countermeasures

TEST

Other Broad Terms

Military chemical agents

BZ agents	Incapacitating agents
Choking agents	Antipersonnel agents
Nerve agents	Antipersonnel agents

    G agents

        GA agent

        GB agent

        GD agent

        GE agent

        GF agent

    V agents

        VE agent

        VG agent

        VS agent

        VX agent

Psychochemical agents	Antipersonnel agents
Vesicants	Antipersonnel agents

    Lewisite

    Mustard agents

        Nitrogen mustards

Chemical agents

 Binary chemical agents

 Chelating agents

 Chemical warfare agents   Chemical warfare

  B agents   Biological warfare agents

  Blood agents

  C agents   Biological warfare agents

  Nerve agents   Antipersonnel agents

   G agents

    GA agent

    GB agent

    GD agent

   V agent

    VE agent

    VX agent

  Non lethal agents

   Choking agents   Antipersonnel agents

   Incapacitating agents   Antipersonnel agents

    BZ agents

    CS agents

   Irritating agents

    CS agents

   Tear gas

   Vomiting agents

  Poisonous gases   Gases

  Psychochemical agents

  Vesicants   Antipersonnel agents

   Arsenic agents

   Lewisite

Chemical agents (continued)

       Mustard agents

          Nitrogen mustards

Cryoprotective agents

Defoliants

Frothing reagents

Grignard reagents

Lethal agents   Lethality

Riot control agents   Riot control

Toxic agents

Clothing

    Camouflage clothing

    Environmental clothing

        Arctic clothing

        Exposure suits

        Overcoats

        Pressure suits

        Survival clothing

           Life jackets

    Flight clothing

    Footwear

        Boots (footwear)

        Shoes

    Gloves

        Rubber gloves

        Surgical gloves

    Goggles

        Snow goggles

    Headgear

        Hats

        Helmets

    Hosiery

        Socks

    Protective clothing

        Body armor

        Exposure suits

        Flak suits

        Gasproof clothing

Other broad Terms

Clothing

  Coveralls

  Flight clothing

    Flak suits   Protective clothing

  Footwear

    Shoes

    Snowshoes

    Socks

  Gloves

    Rubber gloves

  Goggles

  Headgear

    Helmets   Protective clothing

      Flight helmets

  Jackets

  Overcoats

  Parkas   Protective clothing

  Protective clothing

    Body armor   Armor

    Exposure suits

    Fire protective clothing   Fire resistance

    Flak suits   Flight clothing

    Gasproof clothing

    Helmets   Headgear

      Flight helmets

    Parkas   Clothing

Clothing (continued)

    Pressure suits

    Protective masks   Breathing masks, Masks

        Protective mask cannisters

        Protective mask facepieces

        Protective mask filters   Gas filter.

    Underwater clothing

  Underwear

Air defense

    Antiaircraft defense

    Antimissile defense

       Launch defense

       Midcourse defense

       Terminal defense

          Area defense

          Point defense

          Urban defense

Defense systems	ISOLATE	More specific term recommended
Harbor defense	ISOLATE	
Passive defense		
Civil defense		
Spacecraft defense	ISOLATE	

Defense systems

    Air defense

        Antiaircraft defense systems

        Antimissile defense systems

        Terminal defense

    Aircraft defense systems

    Antisattelite defense systems

    Antisubmarine defense system

    Area defense

    Civil defense

    Guided missile defense systems

    Harbor defense systems

    Passive defense

    Point defense

    Ship defense systems

    Spacecraft defense systems

Intelligence

    Acoustic intelligence

    Biographical intelligence

    Biological intelligence

    Communications intelligence

    Counterintelligence

    Economic intelligence

        Commercial intelligence

        Industrial intelligence

    Electronic intelligence

    Medical intelligence

    Military intelligence

        Air intelligence

        Army intelligence

        Naval intelligence

        Tactical intelligence

        Target intelligence

    Oceanographic intelligence

    Operational intelligence

    Photographic intelligence

    Political intelligence

    Sociological intelligence

    Strategic intelligence

    Technological intelligence

    Terrain intelligence

    Weather intelligence

Intelligence

    Acoustic intelligence

    Counterintelligence

    Electronic intelligence

    Military intelligence

        Air intelligence

        Communications intelligence

        Naval intelligence

        Strategic intelligence

        Tactical intelligence

    Photographic intelligence

    Terrain intelligence

Use from Terms

Services

    Consulting services

    Contracted services   Food services

    Field cooking

    Food dispensing

    Food preparation

    Food services

        Food dispensing

        Field cooking

        Food preparation

        Quick service meals

    Food services management

    Graves registration services   Quartermaster services

    Hospitalising   Medical services

    Logistics services

    Medical services

        Hospitalising

    Military exchange services

    Quartermaster services

        Graves registration services

    Quick service meals   Food services

    Water services

Other Broad Terms

Logistics

    Air force equipment   Military equipment

    Army equipment   Military equipment

    Military procurement   Government procurement

        Air force procurement

        Army procurement

        Naval procurement

    Military supplies   Materiel, Supplies

        Stores

    Naval logistics

        Naval equipment   Military equipment

    Spare parts   Parts

    Strategic materials

    Supplies

        Medical supplies

            Catheters

            Dressings

            Surgical supplies

                Ligatures

            Sutures

        Military supplies   Materiel, Logistics

            Stores

    Supply depots   Depots

Military facilities

   Barracks

   Commissaries

   Fortifications

   Hardened installations

   Military air facilities

   Military bases

      Missile bases

   Military depots

   Missile launching sites

Aircraft landing areas

   Flight decks

   Landing pads

   Runways

Other broad terms

Ranges (facilities)

Bombing ranges   Test facilities

Missile ranges   Test facilities

Test ranges

Acoustic ranges

Aeroballistic ranges

Ballistic ranges

TEST

Other Broad Terms

Test facilities

    Bombing ranges   Ranges (facilities)

    Missile ranges   Ranges (facilities)

    Proving grounds

    Rocket tracks

    Shock tubes   Tubes

    Test chambers

        Altitude chambers

        Anechoic chambers

        Humidity rooms

        Vacuum chambers

    Test stands

    Wind tunnels

        Hypervelocity wind tunnels

        Subsonic wind tunnels

        Supersonic wind tunnels

        Transonic wind tunnels

Laboratories

Aeronautical laboratories

Biological laboratories

Chemical laboratories

Electronics laboratories

Hydraulic laboratories

Mathematics laboratories

Medical laboratories

Metallurgical laboratories

Nuclear physics laboratories

Ordnance laboratories

Physics laboratories

Radiochemistry laboratories

Radiological laboratories

Other Broad Terms

Facilities

  Depots

    Supply depots   Logistics

  Military facilities

    Air force facilities

    Bare bases

    Barracks

    Floating bases

    Fortifications

    Naval shore facilities

      Naval air stations   Stations

      Naval research laboratories   Laboratories

    Submarine bases

  Research facilities

    Laboratories

      Aeronautical laboratories

      Biological laboratories

      Chemical warfare laboratories

      Electronics laboratories

      Flying laboratories

      Materials laboratories

      Mathematics laboratories

      Medical laboratories

        Clinical laboratories

      Metallurgical laboratories

      Naval research laboratories   Naval shore facilities

      Ordnance laboratories

      Physics laboratories

(continued)

Facilities (continued)

        Nuclear physics laboratories

      Radiochemistry laboretories

      Radiological laboratories

      Rocket laboratories

    Terminal flight facilities

      Airport control towers

      Airports

      Landing fields

        Runways

          Taxiways

      Landing mats   Mats

    Test facilities

      Altitude chambers

      Light gas guns   Gas guns

      Model basins

      Ranges (facilities)

        Acoustic ranges

        Guided missile ranges

        Range safety   Safety

      Tracks (aerodynamics)   Tracks

      Vacuum chambers   Chambers, Vacuum apparatus

      Wind tunnels

        Hypersonic wind tunnels

        Subsonic wind tunnels

        Supersonic wind tunnels

        Transonic wind tunnels

    Underground facilities

Other Broad Terms

Military operations

    Air force operations

    Airmobile operations   Airborne operations

    Area denial

    Army operations

    CBR operations

    Combined operations

    Joint operations

    Logistics operations

    Military chemical operations

    Naval operations

Amphibious operations

    Amphibious demonstrations

      Diversionary landings

    Amphibious raids

    Amphibious withdrawals

Other Broad Terms

Military operations

    Air drop operations   Aerial delivery

    Air force operations

    Airmobile operations

    Amphibious operations

      beachheads

    Area denial

    Army operations

    Interdiction

    Manoeuvers

      Fleet manoeuvers

      Flight manoeuvers

        Hovering

        Sideslip

        Turning flight

Military exercises

Military formations

Naval operations

Organisations

　　Corporations

　　Expeditions

　　Labor unions

　　Societies

　　　　Technical societies

　　　　　　Engineering societies

　　　　　　Scientific societies

　　Task forces

　　Trade associations

Military organisations

    Air force

    Armed forces (foreign)

    Armed forces (United States)

      Marine corps

    Armed forces reserves

    Army

    Coast guard

    International military forces

    Multilateral forces

    NATO forces

    Navy

Other broad terms

Organisations

   Labor unions   Industrial relations

   Military organisations

     *Calvary

    Military forces (foreign)   Foreign

    Military forces (United States)

      Air force

        Air defence command

        Air force logistics command

        Air force systems command

        Strategic air command

        Tactical air command

      Army

        Field army

      Coast guard

      Marine corps

      Navy

    Military reserves

      National guard

   NATO

   Regiment level organisations

     Battalion level organisations

     Company level organisations

     Seabees   Naval personnel

   Scientific organisations

   Task forces

*This is surely a misprint for Cavalry

  ..

Other Broad Terms

Missile components

    Missile antennas   Antennas

    Missile batteries

    Missile destructors

    Missile fuzes   Fuzes (ordnance)

    Missile warheads   Warheads

Missiles

    Air to air missiles

    Air to space missiles

    Air to surface missiles

    Air to underwater missiles

    Antiaircraft missiles

    Antimissile missiles

    Antiradar missiles

    Antisattelite missiles

    Antiship missiles

    Antisubmarine missiles

    Antitank missiles   Antitank weapons

    Ballistic missiles

        Fleet ballistic missiles

        Intercontinental ballistic missiles

        Intermediate range ballistic missiles

        Medium range ballistic missiles

        Short range ballistic missiles

    Cruise missiles

    Mobile missiles

(continued)

Missiles (continued)

Space to air missiles

Space to surface missiles

Surface to air missiles

Surface to space missiles

Surface to surface missiles

Surface to underwater missiles

Underwater to air missiles

Underwater to surface missiles

Underwater to underwater missiles

Other Broad Terms

Guided missiles

    Air to air missiles

    Air to surface missiles

    Air to underwater missiles

    Antiaircraft missiles   Antiaircraft missiles

    Antiradiation missiles

    Cruise missiles

    Fleet ballistic missiles

    Guided missile components

        Guided missile antennas   Antennas

        Guided missile batteries   Electric batteries

        Guided missile computers   Computers

        Guided missile fuzes   Fuzes (ordnance)

        Guided missile warheads   Warheads

        Guided missile windows

        Nose cones   Noses

    Reconnaissance missiles

    Surface to air missiles

    Surface to surface missiles

    Underwater to surface missiles

Pyrotechnics

    Flares

        Aircraft flares

        Colored flares

        Parachute flares

        Rocket flares

    Illuminating ammunition

    Photoflash ammunition

    Smoke ammunition

    Spotting charges

Other Broad Terms

Pyrotechnics

    Flares

        Aircraft flares

        Colored flares

        Float flares

        Infrared flares   Infrared equipment

        Parachute flares

        Rocket flares

    Illuminating grenades   Grenades

    Illuminating projectiles   Projectiles

    Photoflash ammunition   Ammunition, Photographic lighting systems

        Photoflash bombs   Bombs

        Photoflash cartridges   Cartridges

        Photoflash projectiles   Projectiles

    Smoke munitions   Ammunition

        Smoke bombs   Bombs

        Smoke projectiles   Projectiles

    Spotting charges   Explosive charges

    White phosphorus   Phosphorus

Reconnaissance

    Acoustic reconnissance

    Aerial reconnaissance

    Electronic reconnaissance

       Radar reconnaissance

       Television reconnaissance

    Ground reconnaissance

    Infrared reconnaissance

    Naval reconnaissance

       Submarine reconnaissance

    Photographic reconnaissance

    Space reconnaissance

    Ultraviolet reconnaissance

    Visual reconnaissance

DRI

Other broad Terms

Reconnaissance

    Aerial reconnaissance

    Electronic reconnaissance

      Radar reconnaissance

    Infrared reconnaissance

    Night reconnaissance

    Overflight   Flight

    Photographic reconnaissance

      Multiband spectral reconnaissance

    Tactical reconnaissance   Military tactics

TEST

 Other Broad Terms

Security

 Electronic security

 Internal security

DRIT

Security

 Electronic security

 Data processing security

 Security personnel   Personnel

Strategy

Military strategy

DRIT

Strategy

Military strategy

TEST

Surveillance

    Acoustic surveillance

    Air surveillance

    Coastal surveillance

    Combat surveillance

    Infrared surveillance

    Ocean surveillance

       Undersea surveillance

    Radar surveillance

    Space surveillance (ground based)

    Ultraviolet surveillance

    Visual surveillance

Surveillance

    Acoustic surveillance

    Combat surveillance

    Infrared surveillance

    Ocean surveillance

      Undersea surveillance

    Space surveillance systems

    Visual surveillance

Warfare

    Aerial mine warfare

    Aerial warfare

    Antisubmarine warfare

    Cold war

    Economic warfare

    Electronic warfare

    Flame warfare

    General war

    Jungle warfare

    Landmine warfare

    Limited war

    Naval mine warfare

    Night warfare

    Nuclear warfare

    Political warfare

    Psychological warfare

    Space warfare

    Special warfare

       Counterguerilla warfare

       Counterinsurgency

       Unconventional warfare

          Evasion

          Guerilla warfare

          Subversion

             Resistance movement (political)

    Tactical warfare

    Undersea warfare

    Urban warfare

Other Broad Terms

Countermeasures

    Acoustic decoys   Decoys

    Countercountermeasures

        Antijamming   Electronic counter-
measures

            Burnthrough (countermeasures)

            Radar antijamming

                Constant false alarm receivers

            Radio antijamming

    Electronic countermeasures

        Antijamming   Countercountermeasures

            Burnthrough (countermeasures)

            Radar antijamming

                Constant false alarm receivers

            Radio antijamming

        Electronic jammers

            Electronic noise jammers

                Barrage jammers

                Spot jammers

                Sweepthrough jammers

            False target generators

                Multiple target generators

            Radar track breakers

            Repeater jammers

        Radar confusion reflectors

            Chaff

        Radar deception

            Radar camouflage

                Antiradar coatings

(continued)

Countermeasures (continued)

      Radar decoys

    Radar jamming   Jamming

    Radio deception

    Radio jamming   Jamming

Jamming

    Infrared jamming

    Radar jamming

    Radio jamming

Mine countermeasures

Missile countermeasures

Optical countermeasures

    Infrared countermeasures

        Infrared decoys

        Infrared jamming

Sonar countermeasures

    Antisonar coatings

    Noise masking

        Acoustic screening

    Sonar interception

Torpedo countermeasures

Other Broad Terms

Warfare

    Acoustic warfare

    Aerial warfare

    Battles

    Biological warfare

Biological warfare agents	Biological agents
B agents	Chemical warfare agents
C agents	Chemical warfare agents

Chemical warfare

Chemical warfare agents	Chemical agents
B agents	Biological warfare agents
Blood agents	
C agents	Biological warfare agents
Nerve agents	Antipersonnel agents
G agents	
GA agent	
GB agent	
GD agent	
V agents	
VE agent	
VX agent	
Nonlethal agents	
Choking agents	Antipersonnel agents
Incapacitating agents	Antipersonnel agents
BZ agents	
CS agents	Irritating agents
Irritating agents	
CS agents	Incapacitating agents

Warfare (continued)

      Tear gas

      Vomiting agents

    Poisonous gases   Gases

    Psychochemical agents

    Vesicants   Antipersonnel agents

      Arsenic agents

      Lewisite

      Mustard agents

        Nitrogen mustards

Cold war

Economic warfare

Electronic warfare

  Electronic countercountermeasures   Countermeasures

    Antijamming

      Radar antijamming

      Radio antijamming

  Electronic countermeasures

    Jamming

      Radar jamming

      Radio jamming

      Repeater jammers

    Radar deception   Deception

      Chaff   Radar reflectors

      Radar camouflage   Camouflage

        Antiradar coatings   Antireflection coatings

      Radar confusion reflectors   Radar reflectors

      Radar decoys   Decoys

      Radar repeaters   Radar equipment,
                                  Repeaters

    Radio deception   Deception

Warfare (continued)

Radar interception	Interception
Radio interception	Interception

Limited war

Mine warfare

    Aerial mine warfare

    Land mine warfare

    Naval mine warfare

Night warfare

Nontactical warfare

Nuclear warfare

Optical warfare	Optics
Psychological warfare	Military psychology, Psychological operations

Radiological warfare

    Radiological warfare agents

Riverine warfare

Space warfare

Strategic warfare

Strike warfare

    Air strikes

Tactical warfare

    Flame warfare

Unconventional warfare

    Counterinsurgency

    Geurilla warfare

    Sabotage

    Subversion

    Terrorism

Undersea warfare

    Antisubmarine warfare

        Hunter killer groups

Appendix 3

Abstract Sheets and Questionnaire

used in Indexing Exercise

1   Use of Impermeable Mukluks in the cold. An Initial
     Investigation

R W Nolan

6.1976

Defence Research Establishment, Ottawa, Canada

UNPUBLISHED REPORT

Abstract:

A series of laboratory and field trials was conducted to compare
standard permeable Canadian Forces mukluks and experimental
impermeable mukluks with respect to comfort, moisture accumulation
due to foot perspiration and techniques for use. It was found that
if properly dried overnight, there was little difference between the
two types of mukluk. However, it was shown that conditions inside
a tent in the field in winter are such that drying is very difficult
and moisture accumulation over an extended period of time may
cause significant problems with either type of footwear. No
subjective differences between permeable and impermeable mukluks
were observed.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or or equal
relevance?

2   Experimental Trial of a Temperate Zone Winter Flying Boot.
        Aircrew Equipment Research and Development Committee Trial

        B C Short, R Needham

        6.1976

        Royal Aircraft Establishment, Farnborough, Hants UK

        UNPUBLISHED REPORT

Abstract:

An experimental trial of a new design of temperate zone winter
flying boot was carried out by RAF and RN personnel engaged in
various types of flying and survival training duties. A total of
48 subjects participated. The protocol, experience and conclusions
of the trial are given together with recommendations for further
development. The results showed that 60 perccent of aircrew had
no criticism of the current '65 pattern boot, 64 per cent of
subjects would not choose the trial boot. Most complaints regard-
ing the trial boot were related to its low height. It is recom-
mended that the trial boot should not be introduced into service
in its present form.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

**When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?**

3   Final Technical Report on Ocean Surveillance Information
     System Masterplan
     5.1976
     CTEC Inc, Falls Church, Va, USA
     UNPUBLISHED REPORT

Abstract:

Planning studies and systems engineering related to the develop-
ment of new command and control systems for the Navy are outlined.
A variety of analyses and preliminary planning documentation was
developed, which was related first to the development of an OSIS
(Ocean Surveillance Information System) masterplan and subsequently
to the development of TFCC (Tactical Flag Command Centre), which
will be specifically designed to function as a shipboard command and
control system operating in a real- or near-real-time environment.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

4   Crisis Warning and Management

        D Bonrow

        5.1976

        Maryland Univeristy, Coll Park, USA

        UNPUBLISHED REPORT

Abstract:

The project is a long-term investigation in the design and evaluation
of techniques for monitoring and analysing the crisis behaviour of
nations and the efficient organisations of crisis action groups in
the US Department of Defense. Work to date has been mainly devoted
to a study of Chinese documents to identify Chinese methods of
crisis diagnosis and their behaviour in crisis situations. A com-
parison is being made of Chinese and Western perception of conflict
situations based on the CREON data base. The literature is being
surveyed to find possible new experimental procedures for research
into crisis decision making.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?

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5   Study using Infrared Thermography of Clothing Assemblies
     for use by Personnel Working Beneath Operating Helicopters

     R P Clark, B J Mullan

     5.1976

     Royal Naval Personnel Research Committee, UK

     UNPUBLISHED REPORT

Abstract:

Clothing assemblies have been evaluated for flight deck personnel
concerned with helicopter operations. Three assemblies were worn
by subjects and exposed to the down-draught of a hovering heli-
copter for half-hour periods. Measurements were taken using
infrared thermography which indicated the assembly having the
lowest surface temperature, indicating its suitability to retain
body heat. The measurements have also revealed the areas of the
body from which greatest heat loss occurs under these conditions.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus are these
additional descriptors more relevant, less relevant, or of equal
relevance?

6   Study Based on the Problems of Electronic warfare in a
     Typical Situation of an Aerial Attack on a Target at Sea

     T Linell

     5.1976

     Research Institute for National Defence, Stockholm, Sweden

     UNPUBLISHED REPORT

Abstract:

Potential interference problems arising from self-induced
disturbances in a defined assault situation using aerial attack
(by side A), are studied. The consequences of such conflicts are
analysed from basic principles with quantitative examples. The
analysis considers both an attack system with it telecommunications
and weapons (target seeking radar missiles) and also the tele-
communication system used by the party under attack (side B),
assumed to be conducting an overseas operation; the defence consis-
ting of frigates armed with surface to air missiles and ECM
equipment for disturbing the electronic systems in the aircraft
and their armament.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

**When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?**

7   Planning for Problems in Crisis Management
     3.1976
     Consolidated Analysis Centres Inc, Washington DC, USA
     UNPUBLISHED REPORT

Abstract:
Most of the work was concentrated on Task 3 (identification of
clusters of crisis management problems). Information coded for
each of 300 crisis and 103 terrorist attacks were cross-tabulated
and typologies constructed. A table is presented in which numbers
of crises and terrorist attacks are listed against a number of
identified variables, including pre-crisis activity, duration of
crisis activity, crisis resolution, outcome, and geographical
location.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?

8   Dexterity Afforded by Experimental CW Protective Gloves

F V Vittorio, R W Nolan

2.1976

Defence Research Establishment, Ottawa, Canada

UNPUBLISHED REPORT

Abstract:

The effects of modified Chemical Warfare (CW) protective gloves
(C57-507) on manual performance and ability to withstand high
torque values without destruction are described. The manual
performance of the CW gloves was compared to General-Purpose (GP)
gloves and bare hands using five different manual tasks. The
results show that performance was significantly better with the
bare hand for all tests except the torque test where the CW
gloves permitted the highest torque values with no visible signs
of damage. The four remaining tests showed that the GP glove and
CW glove were not significantly different except for the Minnesota
Two-Hand Turning Test where manual performance was slightly better
with the GP glove.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?

9   Safety Manual Mustard Hydrolysis Project

C H Diehl

2.1976

Defence Research Establishment, Suffield, Ralston, Alberta
Canada

UNPUBLISHED REPORT

Abstract:

Sets down procedures for conducting the hydrolysis of mustard at
DRES. The paper also details the treatment to be given to personnel
exposed to mustard gas, and the procedures for decontaminating work-
ing areas.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?

10   Colour Determination of Australian Foliage from Reversal
      Film

      S E Jenkins

      12.1975

      Materials Research Labs, Maribyrnong, Victoria, Australia

      UNPUBLISHED REPORT

Abstract:

Pnotographs were taken of Australian vegetation with Ektachrome II
and 'False Colour' Ektachrome reversal films, and colorimetric
measurements obtained. The examples of camouflage netting in tne
photographs have an adequate colour match to the general vegetation
but lacked sufficient internal contrast, both for tne natural and
false colour films, to be efficient camouflage. The results of
the colour measurements of vegetation are compared with the colours
recommended to the Australian Army for camouflage netting and
uniforms and these are shown to be an exellent match.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant or of equal
relevance?

11   Airportability and Airdrop of Equipment for Explosives
      Ordnance Disposal Teams

      12.1975

      Joint Air Transport Establishment, RAF Brize Norton, Oxford
      UK

      UNPUBLISHED REPORT

Abstract:

Advises on the internal carriage and airdrop of equipment required by
explosive ordnance disposal teams. Much of the equipment required
by such teams is subject ot stringent dangerous air cargo regula-
tions. It is difficult to comply with these regulations and to
airdrop the equipment satisfactorily. It is recommended that the
equipment either be packed into a container strap personal equip-
ment parachutist and dropped with the individual or if it is too
large for this, it should be airdropped in a Gemini.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

12   Research Opportunities in the Management of weapons systems
      Acquisition
      R W Blanning, S Lana
      11.1975
      Pennsylvania University, Wharton School, Decision Science
      Dept, USA
      UNPUBLISHED REPORT

Abstract:
The object of the investigation was to identify major areas in the
field of weapons systems acquisition in which research might be done
and, within each area, to specify research projects which could
usefully be undertaken for the benefit of the US Navy. The five
research areas identified were: contractural coordination,
incentives, design changes, project management, and external
interactions. The individual research projects are described, and
an annotated bibliography is included.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

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13   Airdrop and Airportability Clearance for Laser Target
     Marker, Laser Range Finder and Night Observation Device,
     Category A.

     D A Trotman

     10.1975

     Joint Air Transport Establishment, RAF Abingdon, Berks, UK

     UNPUBLISHED REPORT

Abstract:

Presents the results of trials held to clear the Laser Target
Marker and Laser Range Finder for airdrop, to review any restric-
tions on the airportability of the equipment by helicopters or
fixed wing aircraft, and also to determine whether the Night
Observation Device Category A could be airdropped. All the equip-
ment is capable of being airdropped but careful attention must be
paid to the preparation and packing. Although the Laser Target
Marker and Laser Range Finder have been cleared spearately for
airdrop as a parachutists load, this method should only be used
when the tactical situation demands it. The best method for drop-
ping the equipment, is on a Medium Stressed Platform (MSP). The
Laser Target Marker and Laser Range Finder have been cleared, as
general cargo, for airportability in both helicopters and fixed
wing transport aircraft, subject to the provisions of this report.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?   •

     ..

14   Optical and Infrared Radiation from Nuclear Bursts

E Hyman

9.1975

Science Applications Inc, La Jolla, California, USA

UNPUBLISHED REPORT

Abstract:

The major effort during the reporting period was aimed at the
development and improvement of computer programs which describe
the phenomenology of high altitude nuclear bursts and the resulting
distrubed atmosphere. The major content of the report is contained
in appendices (A) Transport Techniques for Describing Scattering
and Energy Deposition of Energetic Auroral Electrons, (B) Angular
Properties of Particle Fluxes for Strongly Forward Peaked
Scattering, (C) Auroral Nitric Oxide, (D) Coupled Barium Cloud
Ionosphere systems, (E) Altitude Dependent Neutral Wind Effects on
Nonlinear Motion of a Barium Cloud, (F) Theoretical and Numerical
Simulation Studies of Midlatitude F region irregularities.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

15   Airdrop Clearance by Reefed Mains Extraction (RME) on the
      Medium Stressed Platforms (MSP) Mk 3 Part A Tool Kit GP,
      Engineer, 400 Hz (CES 40734) and Part B, Water Purification
      Unit Complete (lightweight) (CES 39055)

      9.1975

      Joint Air Transport Establishment, RAF Abingdon, Berks, UK

      UNPUBLISHED REPORT

Abstract:

Presents air drop tests of two items of equipment on the Medium
Stressed Platform Mk 3. The equipment tested were a Tool Kit GP,
Engineer, 400 Hz secured in a Trailer Cargo 3/4 ton GS, and a Water
Pruification Unit secured in a Trailer Cargo 3/4 ton GS. Both
loads were successfully airdropped using the platform. Rigging
and load preparation instructions for both loads are given.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

16 Long-Term Worldwide Effects of Multiple Nuclear-Weapons
    Detonations

    1975

    National Research Council, National Academy of Sciences,
    DC, USA

    UNPUBLISHED REPORT

Abstract:

The study is concerned with the long-term effects on the earth and
its inhabitants of a massive nuclear exchange involving 10,000
megatons of TNT equivalent, and assuming the detonations would
take place in the northern hemisphere. The study was confined to
phenomena occurring at distance of the order of continental
separations from the detonations, the effects of which might be
evident up to 30 years after their occurrence. Topics covered
include atmospheric effects, effects on natural and managed
terrestrial ecosystems, effects on the aquatic environment, and
somatic and genetic effects on humans.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

17   Computer Method for Optimizing Nuclear Shielding of Combat
      Vehicles

      R W Birkhahn, E H Brehm

      1975

      Bundesminister der Verteidigung, ForschBer, Germany

      UNPUBLISHED REPORT

Abstract:

A computer code has been developed for the design of optimum
shielding of combat vehicles operating in conditions of nuclear
radiation.   Using exponential attenuation formulae, guidelines are
given for the design of shielding.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

18   Parametric Study of the Initial Detection Ranges Needed for
      Anti Submarine Warfare Defence of a Force against Missile
      and Torpedo-Firing Submarines

      R A Kencroft

      12.1974

      Admiralty Research Laboratory, Teddington, Middlesex, UK

      UNPUBLISHED REPORT

Abstract:

Describes a simple analytical examination into the most fundamental
aspect in the defence of a force in transit which is the relation-
ship between the kinematics of the system and detection range.
Changes in various parameters are measured in terms of the required
detection range and special attention is focussed upon the speed of
the relocating vehicle. The results show how the manoeuvrability of
the force can dominate other factors. Finally there are examples
of closure times and how the attacker's weapon parameters can
influence his angle of approach.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

19   Examination of the Energy Transportation Security Act of 1974

A Baillie
9.1974
Tetra Tech Inc, Arlington Va, USA
UNPUBLISHED REPORT

Abstract:

The Act, which would require that a specified percentage of imported oil be carried on privately-owned US-flag commercial vessels, has been reintroduced in the 94th Congress and eventual passage is anticipated. This paper examines the various issues raised by the Act. The enactment of cargo preference is justifiable primarily on the basis of national security requirements and benefit to the merchant marine. Off-setting cost provisions are of interest because of potential inflationary impact and other provisions raise ancillary issues of lesser import. The national security requirement and the merchant marine benefit are not conclusively supported, at best, and are of marginal validity, at worst. Clearly, the burden of further support and increased validity is on the proponents of the Act.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these additional descriptors more relevant, less relevant, or of equal relevance?

20   Derivation of CARP Tables

D Otridge, M R Nash

2.1974

Joint Air Transport Establishment, RAF Abingdon, Berks, UK

UNPUBLISHED REPORT

Abstract:

An explanation is given of Computed Air Release Point (CARP)
tables and their derivation, with special application to the
production of figures for new stores. Data required and calcula-
tions necessary for any new store or parachute are presented.
The computation of store drop factors and stick lengths are also
considered. For main report see Ref 21.

Descriptors: Selected from TEST/DRIT((in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

21   Review of CARP Tables

D Otridge, M R Nash

11.1973

Joint Air Transport Establishment, RAF Abingdon, Berks, UK

UNPUBLISHED REPORT

Abstract:

A review of Computed Air Release Point (CARP) tables has been made
to include recently introduced dropping systems and reduced
dropping heights. Tables for SSL Mks I and II, 22 ft steerable
parachutes were derived. The review was extended to include Drop
Zone probability criteria. For Addendum see Ref 20.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

22   Brief Review of Some Air-to-Air Models

L B Anderson

8.1972

Institute for Defense Analysis, Arlington, Va, USA

UNPUBLISHED REPORT

Abstract:

Methods for assessing attrition in air to air engagements are
reviewed. Deterministic and expected value models are considered.
Among the models discussed are Lanchester equations, GACAM-1 and
TAC CONTENDER. Brief consideration is given to some other models
in addition.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

23   Task of Producing an Approved Design to Meet the Operational
        Requirement with Particular Reference to Quality of Design
        Matters

        D B Geake

        10.1971

        Procurement Executive, Ministry of Defence, UK

        UNPUBLISHED REPORT

Abstract:

Tasks involved in achieving quality and reliability to meet the
operational requirements for defence equipment are described.
Particular emphasis is given to the arrangements which must be
made during the research and development stages, including principle
features such as, reliability requirements in guided weapons,
management of projects, quality assurance plans, configuration
control, test plans, etc. These stages are discussed with present
policy in mind together with observations on the important role
of management in achieving reliability and quality in the production
of defence equipment.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

24   Low Cost Airframe Design Studies for an Expendable Air-
      Launched Cruise Vehicle

      A B Price, J A Heinrichs

      4.1970

      Martin-Marietta Corp, Baltimore, USA

      UNPUBLISHED REPORT

Abstract:

A study was made of a new and potentially lower cost materials and
methods for fabricating airframes for expendable flight vehicles.
Alternate construction methods were evaluated primarily on the
basis of cost, once functional adequacy was determined and specific
methods of construction were recommended for the major vehicle
sections. In all cases, new design concepts were related to
conventional sheet metal designs. Significant reductions in air-
frame fabrication costs are shown to be possible through the use of
plastic materials and their high rate processing methods.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

25   Method of Calculating Casualties from Atomic Blast in
       a City

J D Taylor

1.1960

Abstract:

Simple formulae are derived for the percentage of casualties
caused by an accurately aimed or inaccurately aimed bomb, on the
assumption that population is distributed about the city centre
with a circular normal distribution, and that the chance of becom-
ing a casualty is distributed with a circular normal distribution
about the centres of burst. Empirical formulae are derived to
estimate cumulative effect from two or more bombs when separate
aiming points are chosen to maximise kills. Although the formulae
are believed to be sufficiently accurate for many purposes, it is
also shown how greater accuracy may be achieved with the same
formulae, by using linear combinations of normal curves to approxi-
mate more closely to the population distribution and the kill
probability distance curves.

Descriptors: Selected from TEST/DRIT (in order of relevance)

Additional descriptors (not in thesaurus) (in order of relevance)

When compared with the descriptors from the thesaurus, are these
additional descriptors more relevant, less relevant, or of equal
relevance?

TEST/DRIT Comparison

Questionnaire

1   Which Thesaurus did you prefer using?   TEST/DRIT

(delete as necessary)

2   Why?

3   What did you dislike about the other thesaurus?

Appendix 4

Index Terms Assigned From
ASSASSIN, TEST and DRIT

*Indicates that the term is not included in the thesaurus

7   Use of Impermeable Mukluks in the Cold.   An Initial
     Investigation

ASSASSIN

Canadian	Impermeable
Cold	Moisture
Comfort	Mukluks
Drying	Permeable
Foot	Persipiration
Footwear	Trials
Forces	Winter

TEST

Footwear	Drying
*Mukluks	Perspiration
Arctic clothing	Protective clothing
Permeability	Performance tests
Cold weather tests	Protection

DRIT

Shoes	Materials
Footwear	Drying
*Mukluks	Materials
Permeability	Experimental design
Moisture	Laboratory tests
Cold weather tests	Field tests

2   Experimental Trial of a Temperate Zone Winter Flying Boot.
     Aircrew Equipment Research and Development Committee Trial

ASSASSIN

Aircrew	Flying
Boot	Temperate
Design	Trial
Development	Winter
	Zone

TEST

Boots (footwear)	Evaluation
Flight clothing	Temperate regions
Protective clothing	Winter
Performance tests	Human factors engineering
Environmental tests	Design

DRIT

*Boots	Acceptance tests
Footwear	*Performance tests
Flight clothing	Temperate regions
Protective clothing	Winter
Environmental tests	Human factors engineering
*Evaluation	Design

3   Final Technical Report on Ocean Surveillance Information
     System Masterplan

ASSASSIN

    Command   Ocean

    Control   OSIS

    Development   Shipboard

    Engineering   Surveillance

    Information   System

    Masterplan

TEST

    *OSIS   Naval operations

    *Masterplan   *Shipboard equipment

    Ocean surveillance   Systems engineering

    Information systems   Development

    Command and control

DRIT

    *OSIS   Command and Control systems

    *Masterplan   Tactical warfare

    Ocean surveillance   Systems engineering

    Information systems   Planning

4   Crisis Warning and Management

ASSASSIN

Chinese	Literature
Conflict	Management
CREON	Survey
Crisis	Warning
Decision	

TEST

*Crises	*China
Political sciences	Monitors
Political intelligence	Warning systems
Political warfare	Forecasting
International relations	Trends

DRIT

Emergencies	China
Political science	Decision making
Conflict	Warning systems
Behavioour	Forecasting
Nations	*Trends

5   Study Using Infrared Thermography of Clothing Assemblies
     for Use by Personnel working beneath Operating Helicopters

ASSASSIN

        Clothing   Operations
        Down-draught   Personnel
        Heat   Surface
        Helicopters   Temperature
        Hovering   Thermography
        Infrared   Working
        Measurements   Worn

TEST

        Protective clothing   Thermal insulation
        *Ground crews   Body temperature
        Flight crews   Heat loss
        Helicopters   Temperature measurement
        Hovering   Thermography
        Downwash   Infrared radiation
        Windchill

DRIT

        Protective clothing   Heat loss
        Ground crews   Temperature
        Helicopters   Heat transfer
        Hovering   Measurement
        Downwash   Thermography
        Personnel   Infrared radiation
        Human body   Infrared detection
        Heat   Ground level

6   Study Based on the Problems of Electronic Warfare in a
     Typical Situation of an Aerial Attack on a Target at Sea

ASSASSIN

Aerial	Equipment
Aircraft	Frigates
Analysis	Missiles
Armament	Radar
Assault	Sea
Attack	Seeking
Conflicts	Study
Consequences	Systems
Disturbances	Target
Interference	Telecommunications
Electronic	Warfare
Electronic-countermeasures	Weapons

TEST

Electromagnetic interference	Anti-radar missiles
Electronic warfare	Electronic countermeasures
Electronic compatibility	Radio communication
Airborne operations	Naval ships
Aerial warfare	Surface to air missiles
Wargames	Aircraft
Naval operations	Weapons
	Intercom systems

DRIT

Electronic warfare	Air to surface
Aerial warfare	Airborne
Wargames	Targets
Ships	Aircraft
Surface targets	Weapons
Ocean surface	Guided missiles
Attack	Homing
Radar	Communication
Surface to air missiles	Radio systems
*Anti-radar missiles	

7   Planning for Problems in Crisis Management

ASSASSIN

Attacks   Planning
Crisis   Problems
Crises   Resolution
Information   Terrorist
Management

TEST

*Crises   Management methods
Terrorism   Organising
International relations Data acquisition
Management analysis

DRIT

Emergencies   Management
Terrorism   Data acquisition
International relations Planning
Behaviour

ASSASSIN

5-507	Hands
Ability	Manual
Chemical	Minnesota
CW	Performance
Damage	Protective
Destruction	Tests
Dexterity	Torque
Experimental	Turning
General-purpose	Two-hand
Gloves	Warfare
GP	

TEST

Gloves	Military chemical operations
Gas-proof clothing	Torque
Hand (anatomy)	Performance tests
*Dexterity	Comparison
Manual controls	Human factors engineering
Protective clothing	

DRIT

Gloves	Chemical warfare
*Dexterity	Manual operations
Skills	Performance (human)
Proficiency	Human factors engineering
Protective clothing	

ASSASSIN

Areas	Mustard
Decontaminating	Personnel
DRES	Procedures
Exposed	Project
Gas	Safety
Hydrolysis	Working
Manual	

TEST

Mustard agents	Safety
Hydrolysis	Military chemical agents
Decontamination	Military chemical operations
Chemical agent casualties	Military personnel
Prophylaxis	Manuals
Therapy	

DRIT

Mustard agents	Safety
Hydrolysis	Chemical warfare agents
Decontamination	Exposure (physiology)
Treatment	Personnel
Therapy	Manuals
Clinical medicine	

10 Colour Determination of Australian Foliage from Reversal
Film

ASSASSIN

Army	Film
Australia	Foliage
Camouflage	Measurement
Colorimetric	Natural
Colour	Netting
Compare	Photographs
Contrast	Reversal
Determination	Uniforms
Ektachrome	Vegetation
False	

TEST

Camouflage	Color matching
Color	Comparison
Colorimetry	Contrast
Vegetation	Nets
Photographic film	Combat uniforms
Color film	*Australia

DRIT

Camouflage	*Color matching
Colors	Nets
Colorimetry	Clothing
Foliage	*Combat uniforms
Vegetation	Army personnel
Photographs	Australia
Color film	

11   Airportability and Airdrop of Equipment for Explosive
      Ordnance Disposal Teams

ASSASSIN

        Airdrop   Equipment
        Airportability   Explosives
        Cargo   Gemini
        Carriage   Ordnance
        Container   Parachutist
        Dangerous   .   Regulations
        Disposal

TEST

        Air transportation   Tools
        Explosive ordnance disposal   Aerial delivery containers
        Explosives aerial delivery   Cargo transportation
        Airdrop operations   Aviation safety

DRIT

        Air transportation   Contaminizing
        Explosive ordnance disposal   Parachute descents
        Aerial delivery   Aviation safety
        Airdrop operations   Military engineers
        Military equipment

12   Research Opportunities in the Management of Weapons
Systems Acquisition

ASSASSIN

Acquisition	Management
Annotated	Navy
Bibliography	Opportunities
Contractural	Projects
Coordination	Research
Design	Systems
Incentives	Weapons
Investigation	

TEST

Armed forces procurement	Naval research
Research management	Contract administration
Research projects	Incentives
Project management	Design
Weapons	Armed forces (United States)
Acquisition	

DRIT

Military procurement

Research management

Management planning and control

Weapons systems

Procurement

Acquisition

Contracts

Motiviation

13 Airdrop and Airportability Clearance for Laser Target
    Marker, Laser Range Finder and Night Observation Device,
    Category A

ASSASSINZ

Aircraft	Load
Airdrop	Marker
Airportability	Night
Cargo	Observation
Category	Packing
Clearance	Parachutists
Device	Platform
Equipment	Range
Finder	Restrictions
Helicopter	Tactical
Laser	Target

TEST

Airdrop operations	Lasers
Aerial delivery	Target designators
Air transportation	Low light level viewing
Airdrop containers	Aircraft
Portable equipment	Helicopters

DRIT

Airdrop operations	Range finders
Aerial delivery	Night vision devices
Air transportation	Aircraft
Laser target designators	Helicopters
Laser	

ASSASSIN

Altitude	Fluxes	Oxide
Angular	F-region	Particle
Atmosphere	Infrared	Phenomenology
Auroral	Ionosphere	Programs
Barium	Irregularities	Properties
Bursts	Mid altitude	Radiation
Clouds	Motion	Scattering
Computer	Neutral	Techniques
Coupled	Nitric	Transport
Electrons	Nuclear	Wind
Energy		

TEST

Nuclear explosion effects	Ionospheric disturbances
Earth atmosphere	Turbulence
Infrared radiation	Nitrogen oxide (NO)
Light (visible radiation)	Barium
Electron scattering	Clouds (meteorology)
Atmospheric physics	Cloud physics
Auroras	Computer programs
F-region	Nuclear explosions
Wind (meteorology)	Computerized simulation

DRIT

Nuclear explosions	Wind
Optics	Ionic disturbances
Light	*F-region
Radiation	Electron scattering
Infrared radiation	Barium
High altitude	Nitrogen oxides
Atmospheric disturbances	

ASSASSIN

Airdrop	Medium
3/4 ton-GS	Mk-3
Clearance	MSP
Engineer	Platform
Equipment	Purification
Extraction	Reefed
GP	RME
Instruments	Test
Kits	Tool-kit-GP
Lightweight	Trailer-cargo-3
Loads	Water
Mains	

TEST

Airdrop operations	Aerial delivery containers
*Reefed mains extraction	Platforms
Air transportation	Trailers
Tools	Parachutes
Tool kits	Standard operating procedures
Water treatment devices	

DRIT

Airdrop operations	Portable equipment
*Reefed mains extraction	Trailers
Tool kits	Parachutes
Water treatment	Acceptance tests

16   Long-term Worldwide Effects of Multiple Nuclear-Weapons
      Detonations

ASSASSIN

Aquatic	Long-term
Atmospheric	Massive
Continental	Megatons
Detonations	Multiple
Distances	Northern
Earth	Nuclear
Ecosystems	Nuclear-weapons
Effects	Phenomena
Environmental	Place
Equivalent	Separations
Exchange	Somatic
Genetic	Terrestrial
Hemisphere	TNT
Humans	Worldwide
Inhabitants	

TEST

Nuclear explosion effects	Aquatic biology
Radiation hazards	Fallout
*Long-term effects	Physiological effects
*Worldwide effects	Genetics
Nuclear weapons	*Somatic effects
Water pollution	Humans

DRIT

Nuclear explosions	Water
Radiation effects	Water pollution
*Long-term effects	Ecology
*Worldwide effects	Genetics
Nuclear explosion damage	*Somatic effects
Nuclear weapons	Atmosphere
Environments	Earth (planet)
Land areas	

17 Computer Method for Optimizing Nuclear Shielding of Combat Vehicles

ASSASSIN

Attenuation	Method
Combat	Nuclear
Computer	Operating
Conditions	Optimizing
Design	Optimum
Developed	Radiation
Exponential	Shielding
Formulae	Vehicles
Guidelines	

TEST

Radiation shielding	Computer programs
Combat vehicles	Mathematical models
Nuclear radiation	Design criteria
Optimization	

DRIT

Nuclear radiation protection	Computer programs
Combat vehicles	Attenuation
Radiation shielding	*Design
Optimization	

ASSASSIN

ASW	Manoeuvrability
Antisubmarine	Missiles
Attackers	Parametric
Closure	Ranges
Defence	Relocating
Detection	Speed
Dominate	Submarines
Examination	Torpedo-firing
Factors	Transit
Force	Vehicle
Kinematics	Weapon

TEST

Antisubmarine warfare	Underwater to surface missiles
Submarine detection	Submarine launched torpedoes
Target acquisition	Maneuverability
Distance	Attacks
Detection	

DRIT

Antisubmarine warfare	Mathematical models
Submarine detection	Torpedoes
Antisubmarine defense systems	Range (distance)
Naval convoys	Maneuverability
Ballistic missile submarines	Attacks
Parametric analysis	

19   Examination of the Energy Transportation Security Act
      of 1974

ASSASSIN
        1974   Marine
        94th   Merchant
        Act   Privately-owned
        Cargo   Requirements
        Commercial   Security
        Congress   Transportation
        Energy   US-flag
        Imported   .   Vessels
        Inflation

TEST
        Marine transportation   Merchant ships
        International trade   Crude oil
        Legislation   Fuel oil
        Security   Regulations
        Tanker ships

DRIT
        Marine transportation   Cargo ships
        Shipping   Petroleum industry
        Laws   Fuel oil
        Security   Mineral oils
        Merchant ships

20   Derivation of CARP Tables

ASSASSIN

    Application   Factors

    Calculations   Length

    CARP   Parachute

    Computation   Stick

    Computed-air-release-point   Stores

    Derivation   Tables

    Drop

TEST

    Airdrop operations

    Releasing

    Height

    Parachutes

    Computation

    Applications

    Tables (data)

DRIT

    Airdrop operations

    Release

    Altitude

    Parachutes

    Computation

    Tables (data)

    External stores

    Geographical areas

21   Review of CARP Tables

ASSASSIN

    22 ft   Probability

    CARP   Steerable

    Computed-air-release-point   Systems

    Drop   Tables

    Heights   Zone

    Parachutes

TEST

    Airdrop operations

    Releasing

    Height

    Parachutes

    Drop zones

    Computation

    Tables (data)

DRIT

    Airdrop operations   Computations

    Release   External stores

    Altitude   Geographic areas

    Parachutes   Tables (data)

ASSASSIN

Air-to-air	GACAM-1
Air-to-air engagements	Lanchester
Attrition	Models
Deterministic	Review
Equations	TAC-Contender
Expected	Value

TEST

Aerial warfare	Lanchester equations
Wargames	*GACAM-1 (Model)
Mathematical models	*TAC-Contender (model)
Comminution	Operations research

DRIT

Aerial warfare	Lanchester equations
Air to air	*GACAM-1 (model)
Warfare	*TAC-Contenter (model)
Wargames	Reviews
Mathematical models	Damage
Attrition	

23   Task of Producing an Approved Design to Meet the Operational
     Requirement

ASSASSIN

Assurance	Plans
Configuration	Policy
Control	Principle
Defence	Production
Design	Projects
Development	Quality
Equipment	Reliability
Guided	Requirements
Management	Tests
Operational	Weapons

TEST

Armed forces procurement	Production management
Defense systems	Project management
Design standards	Management planning
Quality assurance	Project control
Reliability	Materiel
Missile reliability	Logistics

DRIT

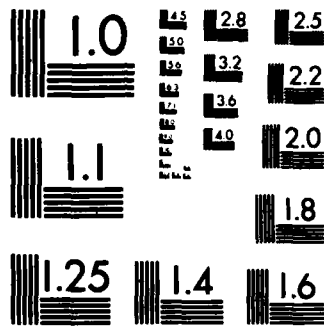|	
Military procurement	Research management
*Design	Requirements
Quality assurance	Materiel
Reliability	Logistics
Management planning and control	Military equipment

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

24   Low Cost Airframe Design Studies for an Expendable Air-
      launched Cruise Vehicle

ASSASSIN

 Air-launched   Flight
 Airframes   Functional
 Concepts   Low
 Construction   Materials
 Costs   Metal
 Cruise   Plastic
 Design   Sheet
 Expendable   Vehicles
 Fabrication

TEST

 Airframes   Materials
 Missile airframes   Plastics
 Cruise missiles   Metal sheets
 Drone aircraft   Cost engineering
 Structural design   Cost estimates
 Airborne equipment   Fabrication

DRIT

 Airframes   Construction
 Guided missiles   Costs
 Cruise missiles   Engineering
 Drones   Low cost
 Structural engineering Plastics
 Air-launched   Metals
 Vehicles   Sheets

25   Method of Calculating Casualties from Atomic Blast in a
      City

ASSASSIN

Accuracy	Circular	Kill
Accurate	City	Linear
Aimed	Curves	Maximise
Atomic	Derived	Method
Blast	Distance	Normal
Bomb	Distributed	Percentage
Burst	Distribution	Points
Calculating	Empirical	Population
Casualties	Estimate	Probability
Centres	Formulae	

TEST

Nuclear warfare casualties	Kill probabilities
Urban areas	Computation
Nuclear explosion effects	Mathematical prediction
Fission weapons	Statistical analysis
Casualties	Accuracy
Nuclear explosions	Circular error probable

DRIT

Nuclear warfare casualties	Kill probabilities
Urban areas	Computation
Nuclear explosions	Mathematical prediction
Nuclear bombs	Statistical analysis
Casualties	Circular error probable

DOCUMENT CONTROL SHEET

(Notes on completion overleaf)

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1. DRIC Reference (if known) BR 60104	2. Originator's Reference	3. Agency Reference	4. Report Security Classification UNLIMITED
5. Originator's Code (if known) 213800M	6. Originator (Corporate Author) Name and Location The City University, London, UK		
5a.Sponsoring Agency's Code (if known)	6a.Sponsoring Agency (Contract Authority) Name and Location		

7. Title
A COMPARATIVE EVALUATION OF THE THESAURUS OF ENGINEERING AND SCIENTIFIC
TERMS AND THE DDC RETRIEVAL AND INDEXING TERMINOLOGY.

7a.Title in Foreign Language (in the case of translations)

7b.Presented at (for conference papers).Title, place and date of conference

8. Author 1.Surname, initials Jones, A.D.	9a Author 2	9b Authors 3, 4...	10. Date pp ref 11.1977 194 76
11. Contract Number	12. Period	13. Project	14. Other References

15. Distribution statement
Approved for Public Release, 1984.

15. Descriptors (or keywords)
Thesauri, TEST (thesaurus), DRIT (thesaurus), Evaluation, Comparison,
Subject index terms, Terminology.

continue on separate piece of paper if necessary

Abstract   A comparative evaluation has been undertaken of the DDC Retrieval and
Indexing Terminology (DRIT) and the Thesaurus of Engineering and Scientific Terms
(TEST). The study examined the hierarchic structure of both thesauri and their
lead in terminologies, and the specificity of terms in each thesaurus was compared.
A comparison was made of the index terms assigned to a number of abstracts, using
each thesaurus, and these terms were also compared with free language terms
assigned by the ASSASSIN computer program. It was found that TEST, with its greater
number of preferred terms, was the more specific indexing terminology, but DRIT
gave the better guide to the selection of preferred terms by virtue of its large
number of lead in terms.

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9a. Author 2: Enter the name of the second author, followed by his initials.

9b. Authors 3,4...: Enter third and following authors' names.

10. Date: Enter the month (in figures) and the year of the report (Dec., 1969 is written 12.1969). If the report is undated but a period covered by the report is indicated, enter the date at the end of the period.
pp.ref. Enter the inclusive number of pages in the report containing information, i.e. including appendices, tables and illustrations, and the total number of references cited.

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Descriptors: Any number of descriptors (or key-words) can be entered. If selected from a published thesaurus, eg The Thesaurus of Engineering and Scientific Terms (TEST), this should be indicated.

Abstract: The abstract should preferably not exceed 150 words, i.e. it can be considerably shorter than the Abstract to be provided on the Title Page of the Report. Information available in the report title need not be included in the abstract.

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8