NORTH CAROLINA SCIENCE AND TECHNOLOGY RESEARCH CENTER
A UNIT OF THE DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES

A STUDY OF THE RELATIVE EFFECTIVENESS AND COSTS OF COMPUTERIZED INFORMATION RETRIEVAL IN THE INTERACTIVE MODE

by

Frederick O. Smetana
Mary Ann Furniss
T. Robert Potter

NOVEMBER 1974

STR - 505

RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709

A STUDY OF THE RELATIVE EFFECTIVENESS AND COSTS OF COMPUTERIZED INFORMATION RETRIEVAL IN THE INTERACTIVE MODE

by

Frederick O. Smetana
Mary Ann Furniss
T. Robert Potter

North Carolina Science and Technology Research Center
Research Triangle Park, N.C.

ABSTRACT

Results of a number of experiments to illuminate the relative effectiveness and costs of computerized information retrieval in the interactive mode are reported. It was found that for equal time spent in preparing the search strategy, the batch and interactive modes gave approximately equal recall and relevance. The interactive mode however encourages the searcher to devote more time to the task and therefore usually yields improved output. Engineering costs as a result are higher in this mode. Estimates of associated hardware costs also indicate that operation in this mode is more expensive. Skilled RECON users like the rapid feedback and additional features offered by this mode if they are not constrained by considerations of cost.

TABLE OF CONTENTS

	Page
OBJECTIVES OF THE STUDY	1
RESEARCH METHODS	1
SEARCH QUESTION	3
RESULTS OF THE FIRST SEARCH PROBLEM	5
LOGICAL PROCESSES EMPLOYED BY SEARCHER WWS AS DEDUCED FROM HIS SEARCH	6
SECOND SEARCH LOGIC EMPLOYED BY WWS	20
LOGICAL PROCESSES EMPLOYED BY SEARCHER MRN	21
LOGICAL PROCESSES EMPLOYED BY SEARCHER TRP	32
LOGICAL PROCESSES EMPLOYED BY SEARCHER SRW	39
LOGICAL PROCESSES EMPLOYED BY SEARCHER AWL	44
LOGICAL PROCESSES EMPLOYED BY SEARCHER PJC	56
LOGICAL PROCESSES EMPLOYED BY SEARCHER SFS	63
LOGICAL PROCESSES EMPLOYED BY SEARCHER CLN	69
CORRELATION OF SEARCH RESULTS WITH SEARCHER'S BACKGROUND	79
CORRELATION OF SEARCH LOGIC WITH RECALL ACHIEVED	80
RELATIVE EFFECTIVENESS OF INTERACTIVE AND BATCH SEARCH MODES	81
RELATIVE COSTS OF BATCH AND INTERACTIVE SEARCH MODES	84
SUBJECTIVE USER EXPERIENCE	88
APPENDIX	

OBJECTIVES OF THE STUDY

Upon acquisition of a RECON terminal, the North Carolina Science and Technology Research Center undertook a series of experiments designed to illuminate

1. The effectiveness (as measured by recall and relevance) of the interactive search mode as compared with the batch search mode.

2. The differences in costs between searches performed interactively and those performed in batch processes.

3. The search methods employed and results achieved by searchers of varying background and searching experience.

RESEARCH METHODS

The last objective was attacked first. Each searcher was put before the cathode ray tube display and typewriter keyboard. A printer alongside was rigged to record the entire "conversation," including clock time, between the searcher and RECON. The searcher was handed a statement of the problem and asked to go to work. The room was semi-sealed against disturbance. Only if the searcher had trouble making himself understood to the system (which sometimes happened with inexperienced searchers) or encountered technical difficulty (which occurs at random times) did he emerge and ask assistance of monitoring personnel.

The search problem selected was one received during the normal course of business at the North Carolina Science and Technology Research Center. It had proven to be particularly troublesome because the 400 or so relevant documents in the collection suffered from indexing vagaries that made their retrieval difficult without, at the same time, retrieving a large quantity of extraneous material. In such a problem, it was felt, a searcher could really demonstrate his skill and knowledge. The search problem statement is reproduced at the end of this section. The printed record of the "conversation" with the computer was given to the experiment director along with the "hit" list the searcher felt was his best effort. Abstracts for all of those "hits" were examined by the experiment director who decided which of the hits were relevant. This was done to determine what portion of the searcher's hit list was pertinent and how many of the pertinent documents in the entire collection the search identified.

The printed records of the "conversations" with the system were then prepared in the form of a standardized flow chart to facilitate identifying the approach and results of each searcher. In the process of preparation, mistakes which elicited responses from the system such as "Invalid Command Proceed" were eliminated as were garbled conversations resulting from system failures. Reproduced as Figure 1 (see end of this section) is the flow

chart for a search performed by an undergraduate engineering student with a fair knowledge of the scientific fundamentals involved and a better knowledge of system operation and indexing problems. The search shown in Figure 1 required the searcher to remain at the terminal approximately three hours. Figures 2-8 present flow charts depicting the search procedure used in the other seven searches made on this same question.

Several approaches were tried in order to develop data toward the first objective. The same individual was asked to make his search first by the batch process and then, before the results of his efforts were known, do it again on RECON. The outputs and strategies were then compared by the experiment director. A limited number of searches, done by one person on RECON and another by batch process, were tried but the results there seemed more dependent on individual approaches than on the differences between RECON and the NC/STRC batch search procedure. This approach was therefore discontinued.

Costs differences between a batch process search and an interactive search were also very difficult to evaluate for a number of reasons:

1. The line charges and computer charges per search on RECON are not directly known because of the way the system and its accounting are set up;

2. An individual usually does not perform a search exactly the same way on the two systems.

3. RECON experiences occasional shutdowns and frequent overloadings of the system which result in long response times to questions and instructions.

4. An engineer can and usually does obtain intermediate output during a RECON search which he uses to phrase his remaining questions.

Although discussing the cost differences between the batch and interactive search approaches was judged to be a difficult task for the reasons mentioned above, it was felt that STRC had enough specific accounting data on the batch system and could obtain enough data on the other RECON-type on-line search systems to make a worthwhile cost comparison between the two modes of searching. In addition, the experimental RECON searches provided sufficient data on the amount of human effort involved in the interactive search mode and STRC cost accounting reports provided the same information for batch searches. The resultant cost comparison can be found in another section of this report entitled "Relative Costs of Batch and Interactive Search Modes."

In addition to these tests, members of the technical staff of NC/STRC used RECON as they wished during normal Center operations. As their skills and knowledge of the system improved, various members began to make increasing use of it. Included herein is a report of one subjective reaction to RECON - what he liked, what he did not like, and how he liked to use it.

SEARCH QUESTION

"Airborne Thermal Mapping of Water Surfaces"

A consulting firm is bidding on a contract to map the water temperature in lakes which are used to cool thermal power plants. The mapping will be done by flying over in an airplane (3000' - 6000' above lake surface), observing the lake with a radiometer, recording the radiometer output, and then processing the data so as to be able to draw lines of constant temperature on an accurate outline of the lake. The purpose, of course, is to make it possible to check compliance with thermal pollution standards easily and quickly.

Specifications call for measuring accuracies of 0.5°F. The consulting firm thinks that 1°F is about all that they can do realistically. So, they would like to know (a) does any responsible group claim 0.5°F. accuracy? (b) If so, what

1. *sensor technology*
2. *mathematical modeling techniques*
3. *data reduction methods*
4. *computerized data processing techniques*

do they employ?

NOTE: A radiometer is a device which senses the heat radiated from the surface of a body. It can be focused so that it "looks" at a relatively small area. The atmosphere absorbs some of this radiation, the absorption being dependent upon air temperature, density, and distance the radiation travels. Therefore, the angle at which the radiometer looks at the surface from the airplane determines how much air the heat waves have to go through, what its density is, and how it's "layered."

From this knowledge and a mathematical model of the absorption and dispersion of infrared radiation by a variable density atmosphere, one can arrive at an estimate of the surface temperature in terms of the radiometer indication. Also, a lake is only a semi-opaque body, which means that all of the radiation that one detects is from the layer immediately below the surface. These effects are also included in the mathematical model.

The radiometer output is an electrical signal proportional to the intensity of the thermal radiation and its spectral distribution (how much energy is radiated at each wavelength). One must therefore have a procedure for converting this signal to temperature. Ideally, the whole process could be one in which the user merely submits a magnetic tape recording of radiometer output looking at a given part of the lake to a computer program. The program reduces the data from this and other passes over the lake, and from these maps the lake surface temperatures.

RESULTS OF THE FIRST SEARCH PROBLEM

The search question posed was first performed by FOS as a batch search. Several reruns and considerable expense were required to obtain a sufficient quantity of relevant output. Center management felt that it would therefore be a good question on which to compare the effectiveness of various approaches to the question and the backgrounds of the searchers. The capability of recording the dialog which the searcher had with the system made it possible to study in detail the logic used by each individual. From this dialog, more formalized flow charts were prepared. The seven flow charts are discussed in detail below. Following this is a correlation of the relevancy and recall of the various searches with search logic and searcher's background. Completing the data assembled from this experiment is Table I (see Appendix). This lists the documents recovered from all searches which the experiment director called pertinent, the searches identifying that document, the number of pertinent documents identified by each search as a percentage of the total pertinent documents (recall) and as a percentage of the hits found by that search (relevance). Also shown in Table I are 10 additional pertinent documents found by the experiment director by constructing a search from the index terms appearing most often in the highly pertinent documents. This post experiment search had 103 hits of which 45 were pertinent. Thirty-five of these had been recovered during the experiment.

In passing, it may be noted that manual review of each search output in sequence will usually lead to some inconsistencies in identifying documents which had been identified as pertinent in one search, but were not so identified by the experiment director in his review of the search indicated. Between 6% and 30% of the pertinent hits in each search were so affected. In a topic of this nature many documents will be of at least peripheral interest to a broadly-trained, innovative researcher. However, as one moves further and further from the central thrust of the subject, discrimination becomes fuzzy. Whereas today a particular document with a tenuous relation to the subject might seem of possible interest, tomorrow, it may not. As a result of this ambiguity, in subsequent comparisons of searcher effectiveness a master hit list was compiled by keypunching the output of each search - along with an identifying code to indicate the source search - and then sorting. Only the abstracts from the master hit list were then examined to select the relevant documents. The relevant document accession numbers were then keypunched and inserted in a computer program which gives the recall and relevance for each individual search.

LOGICAL PROCESSES EMPLOYED BY SEARCHER WWS AS DEDUCED FROM HIS SEARCH

In order to follow the logical processes depicted in Figure 1, one should note that the following symbolism is employed:

(1) A rectangle indicates the term which was the basis for a following operation.

(2) In the upper left corner of the rectangle is a symbol denoting the source of the term:

m	from his mind
e	from a previous expansion
t	from a thesaurus expansion
c	from a document's bibliographic citation

(3) A rectangle with curved sides attached indicates what the searcher saw on the CRT screen, e.g., a "display."

(4) The elongated hexagon denotes an operation, e.g., expand "thermal."

(5) The diamond indicates a decision which can be answered yes or no.

(6) The circle indicates premature termination of an operation.

(7) Operations, display, etc., are arranged in chronological order with arrows leading from the proper antecedents and to the point in the search where subsequent operations are performed.

(8) Where it is necessary to break a line at the bottom of a column an identifying letter is inserted so that when the reader again sees that letter he knows the line of which it is a continuation.

(9) Lines to the right of terms in a display indicate that the searcher selected those terms to form sets.

The searcher began by requesting an expansion about the term he considered to be basic to the whole search, the term "thermal." On the basis of the first display[+] he selected two terms and felt that these were sufficiently pertinent[++] for him to continue the displays until the display limit was reached. From this expansion he selected a total of 9 terms

---

[+] Display refers to the material presented at a given time on the face of the cathode ray tube viewing device.

[++] Approximately 14 additional terms are displayed on the CRT each time the command "more" is given until the limit of 41 terms has been reached.

and formed 8 sets. Note that he is assured of a large number of documents upon which he could perform further logical operations by the fact that the term "thermal" is posted to 10,954 documents.

One of the terms displayed in the expansion, "thermal emission," seemed, on the basis of the problem statement and his general knowledge of the subject area, to be worth examining further. The searcher therefore requested a thesaurus expansion from which he selected three terms. He then combined these to form set 9.

To get another start on the problem, the searcher went back to the central idea and selected a broad but related term, "temperature," on which to request an expansion. He knew from previous experience that asking the same question in several ways is often necessary to assure that documents dealing with a particular subject (but indexed by different individuals using similar but not identical terms) are retrieved. Unfortunately, he misspelled it "temperture." The display indicated no postings under this term. The searcher nevertheless did find what he considered to be a useful term in this display. He then decided to overcome his spelling deficiency by using first the root of the term, "tempera." This produced the desired result and he again displayed all the terms up to the limit, selecting 12 to form 10 additional sets.

Next, he chose to perform a thesaurus expansion on one of the terms which appeared during the previous display, "temperature measurement." This term, of course, is specifically what the search is about. Since the measurement was to be carried out by observing the radiation, he chose "radiation pyrometer" as a set.

Since the search statement had contained the term "radiometer," he then decided to see what useful terms might be alphabetically related to this. The expansion was reasonably productive but he decided on viewing the first display that a thesaurus expansion would be more appropriate. From this he selected seven terms.

He then went back to the general concept of "measurement" and performed a thesaurus expansion which yielded a number of useful terms.

In the general sense the concepts of "temperature" and "heat" are closely related. Seeking to formulate the idea of "temperature measurement by detection of radiant heat flux" in other terms, he chose to expand the general term "heat." Only three of the terms displayed, he felt, added significantly to those he had already selected.

He then approached the idea of measuring the temperature distribution over a surface as a form of mapping and sought to determine whether any of the related terms would be useful. From the thesaurus expansion he selected only three.

He then tried a different approach on the idea of measurement by using the term "sensing." This appeared to be quite productive. At this point he decided to winnow down the number of documents to those more pertinent. He combined those sets dealing with temperature measurement

to get a single set, number 39. He also combined sets dealing with radiometers to obtain set 40 and sets dealing with mapping and sensing to obtain set 41. The sets dealing with temperature in a general way were intersected with set 41 to give a new set, 42, which contained 465 documents indexed under both the idea of temperature and that of mapping. The general idea of measurement was then combined with set 41. The new set, number 43, was intersected with sets on heat and radiation measurement to obtain 1443 documents dealing specifically with radiation mapping. Set 43 was also intersected with sets 39 and 40. The result was a set of 1473 documents dealing with mapping by radiometer.

In this process, one term with only two postings caught his eye: "sensor for airborne terrain analysis." He decided therefore to display the two citations to see how relevant they were. They were not.

Up to this point he had established that the documents in sets 39, 40, 42, 44, and 45 with some 9000 postings seemed to bear on the problem of measuring or mapping radiation fluxes over large areas. Since he was specifically interested in the emission from water he developed some expansions about the idea of liquids. Except for the general terms themselves, the results did not appear to him to be particularly promising. He then began to explore the idea of surfaces and assembled all the documents (495) dealing with the idea of liquid surfaces.

Backtracking for a moment, he intersected the idea of radiometers (set 40) with the concepts of temperature measurement, temperature mapping, and radiation mapping (sets 39, 42, and 44). This produced set 53 with 347 accessions. Ultimately, he decided that set 53 represented his best effort on the question, but at the time, he decided to try one more tack to see if some useful documents might show up.

He had not yet investigated the possibilities of approaching the question from the point of view of sensing from an aerial platform, which is how this job was to be done in the field. He began to travel this path by asking for an expansion on airborne. Although he selected one term, the expansion did not appear to be too fruitful. He then made a thesaurus expansion on the selected term without gaining what he considered to be additional insight. At this point he tried an expansion on a general, but related, term, "aerial." Again he got only one term which he felt might be useful, so that he decided not to continue the expansion.

The two terms selected from this effort he combined to create set 56. He was obviously undecided as to what to do with it at the moment because he then intersected set 53 with set 52 (dealing with liquid surfaces) and got only 4 documents (set 57). This of course is too few, so he then tried searching the 2956 accessions in set 56 for index terms also in set 53 (by performing a logical intersection or "and"). This gave set 58 with 31 documents.

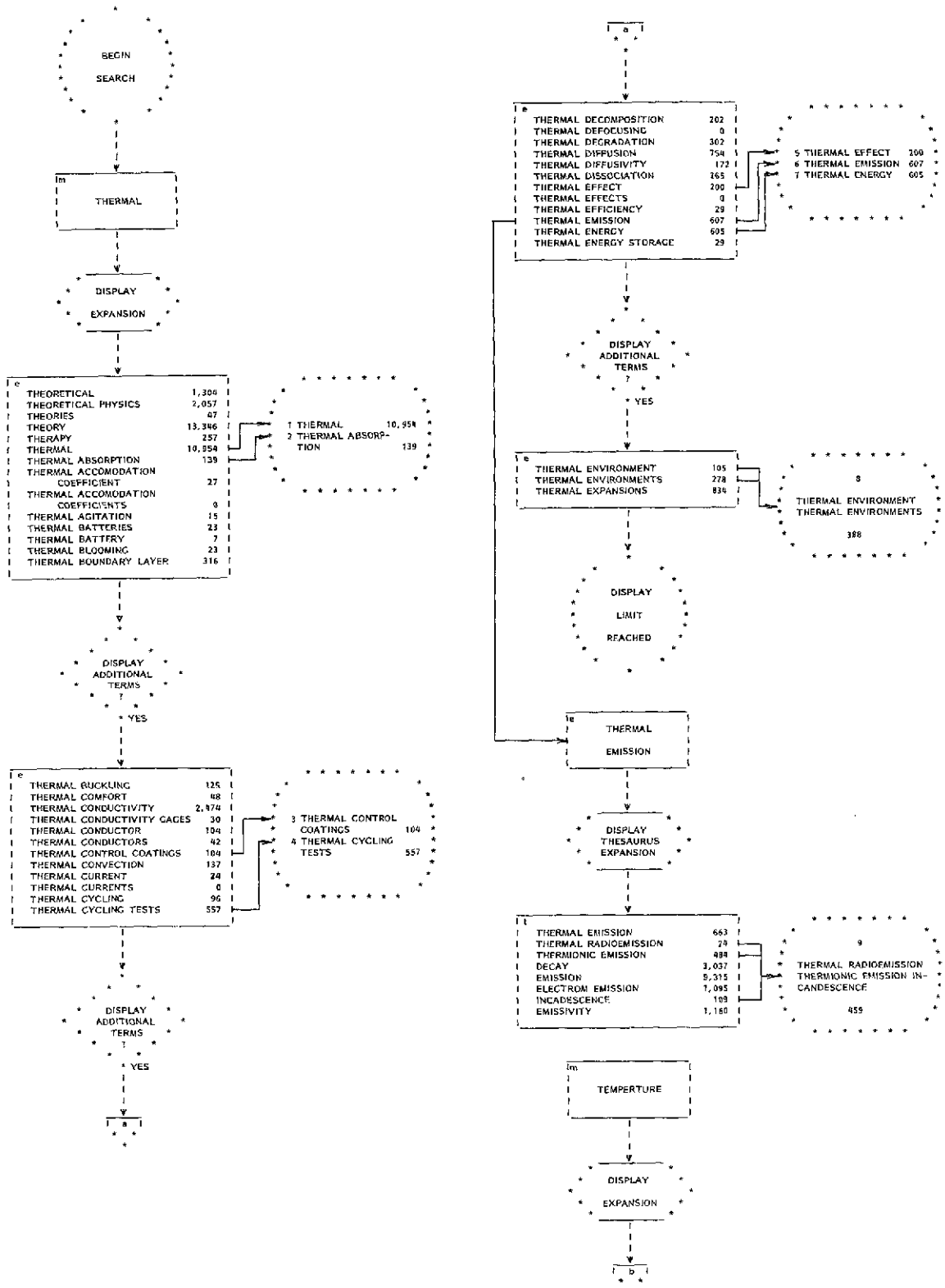
To see if he were in the right area in his selections, he asked for two of the citations from set 57. These looked to be very pertinent, so he intersected set 57 with set 58. Since three of the four documents in

set 57 also appeared in set 58, he felt that set 58 was probably also quite pertinent. He therefore asked that complete bibliographic information on the documents in 57 and 58 be printed. Since both were subsets of 53, he felt that 53 would probably also contain a large amount of relevant data. Finally, then, he asked that all the accession numbers in set 53 be printed.

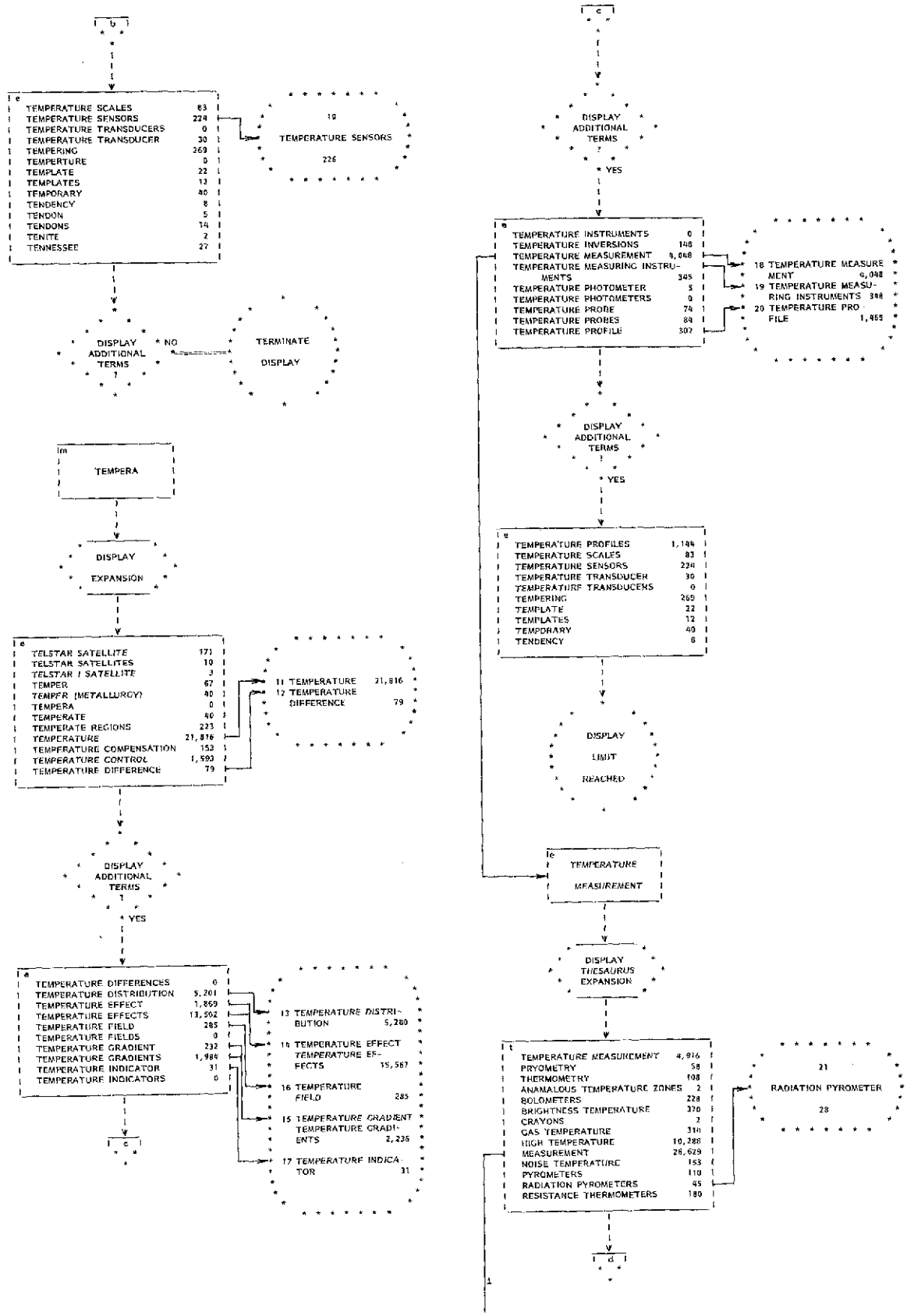
As a matter of interest it may be noted that ultimately 388 separate relevant documents were found in the system through a total of eight searches by different individuals. The particular search discussed here found 121 or 31.2% of these. Of the 347 hits designated by the searcher as constituting his search results, 34.9% were relevant. This is very good performance for this type of question (i.e., one without highly specific indexing).

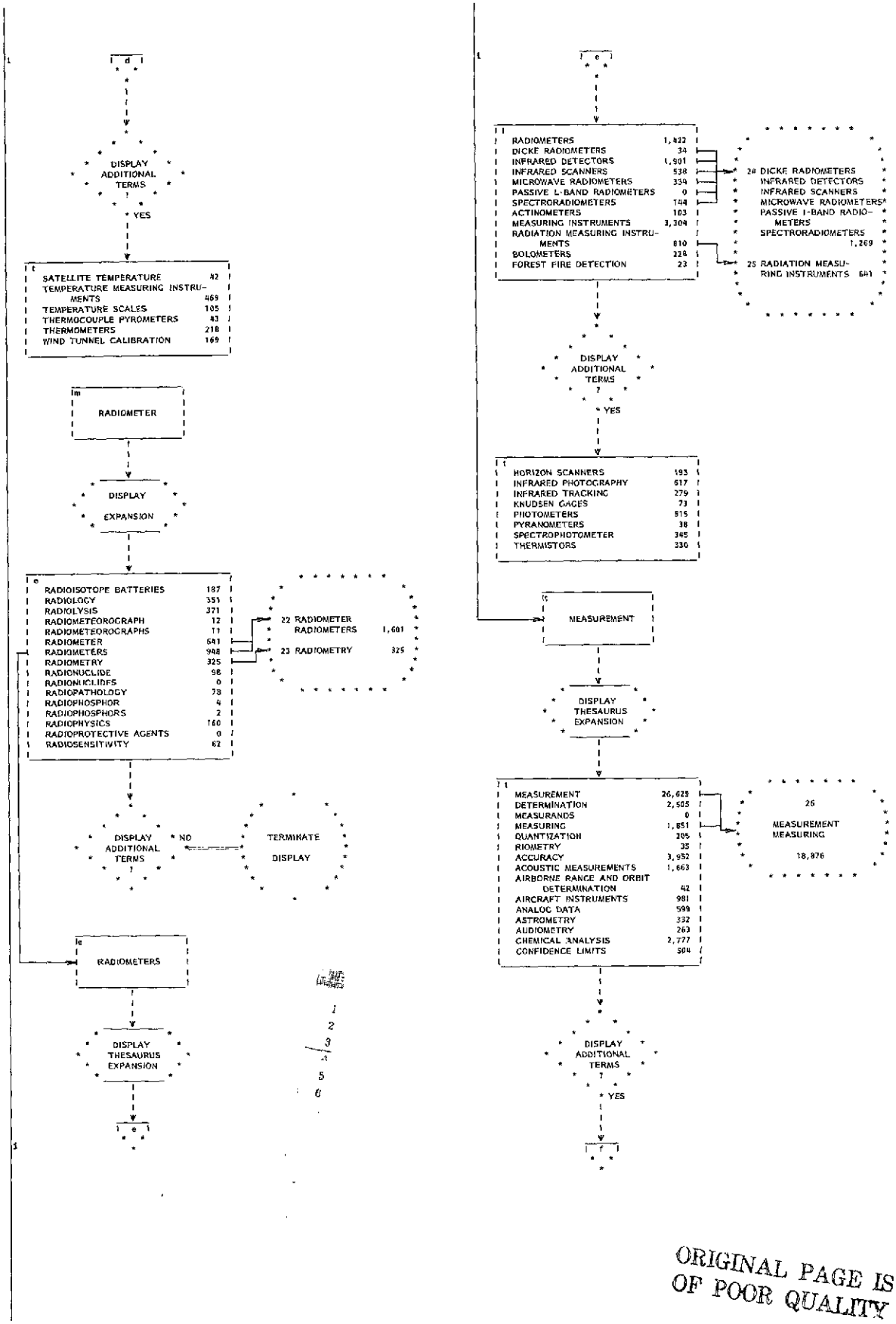
Of particular note also is the fact that this search found 55 relevant documents turned up by no other search. The additional 66 relevant documents were found in one or more of the other searches. Only 15 of the 388 relevant documents appeared in 5 or more searches. Only 5 relevant documents appeared in 6 or more of the searches and of these, 3 appeared in 7 searches. No document appeared in more than 7 searches.

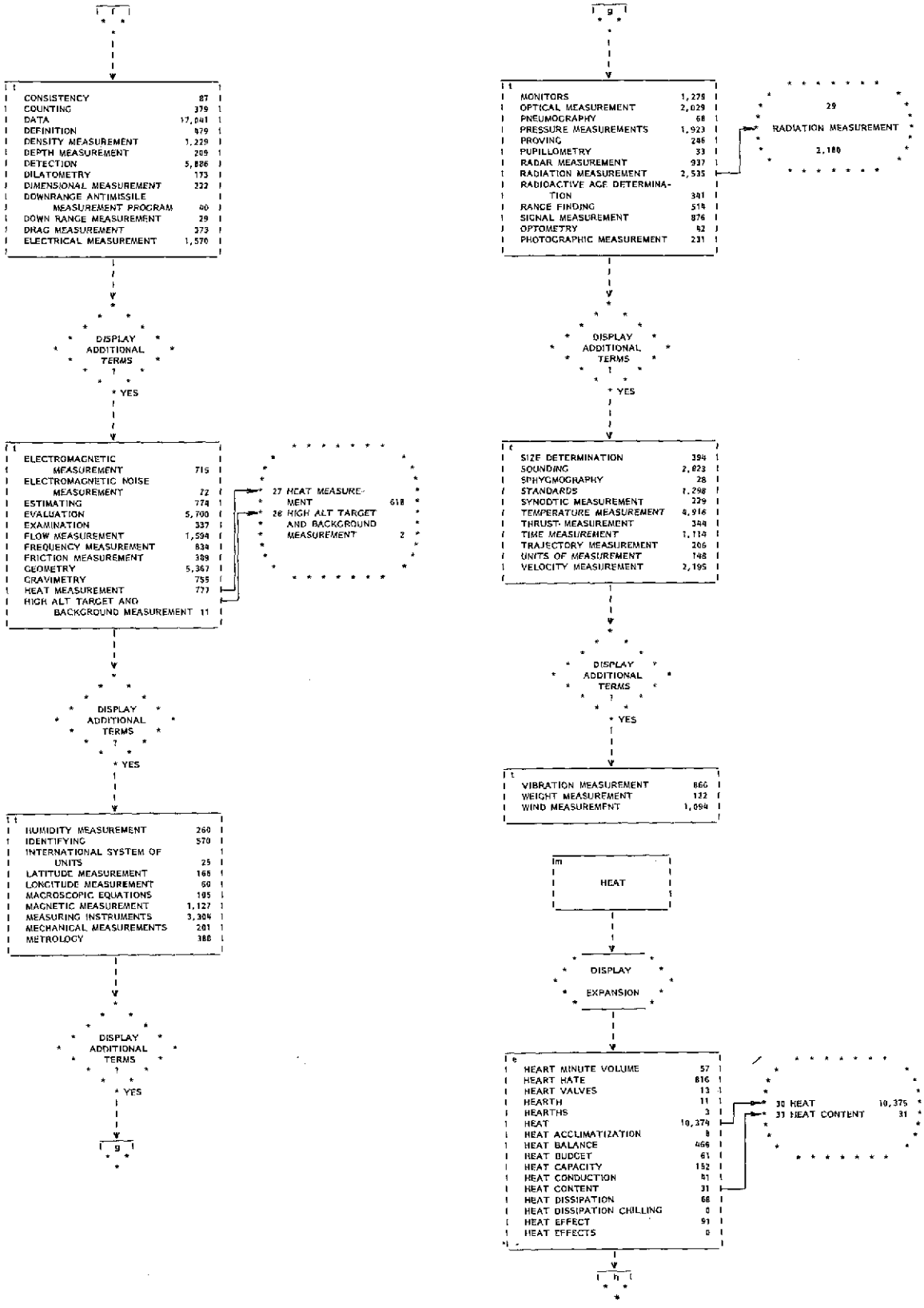
FIGURE 1

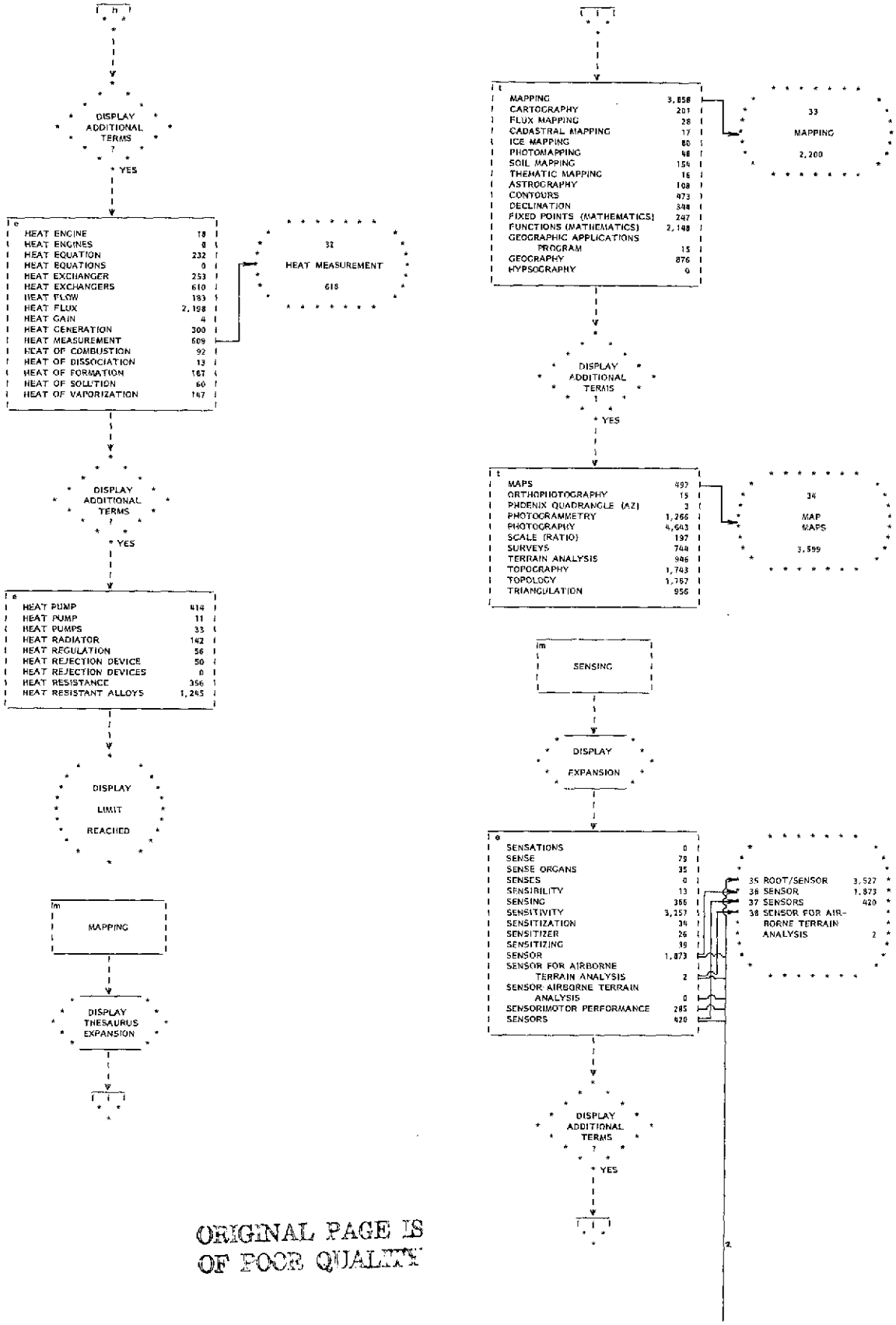


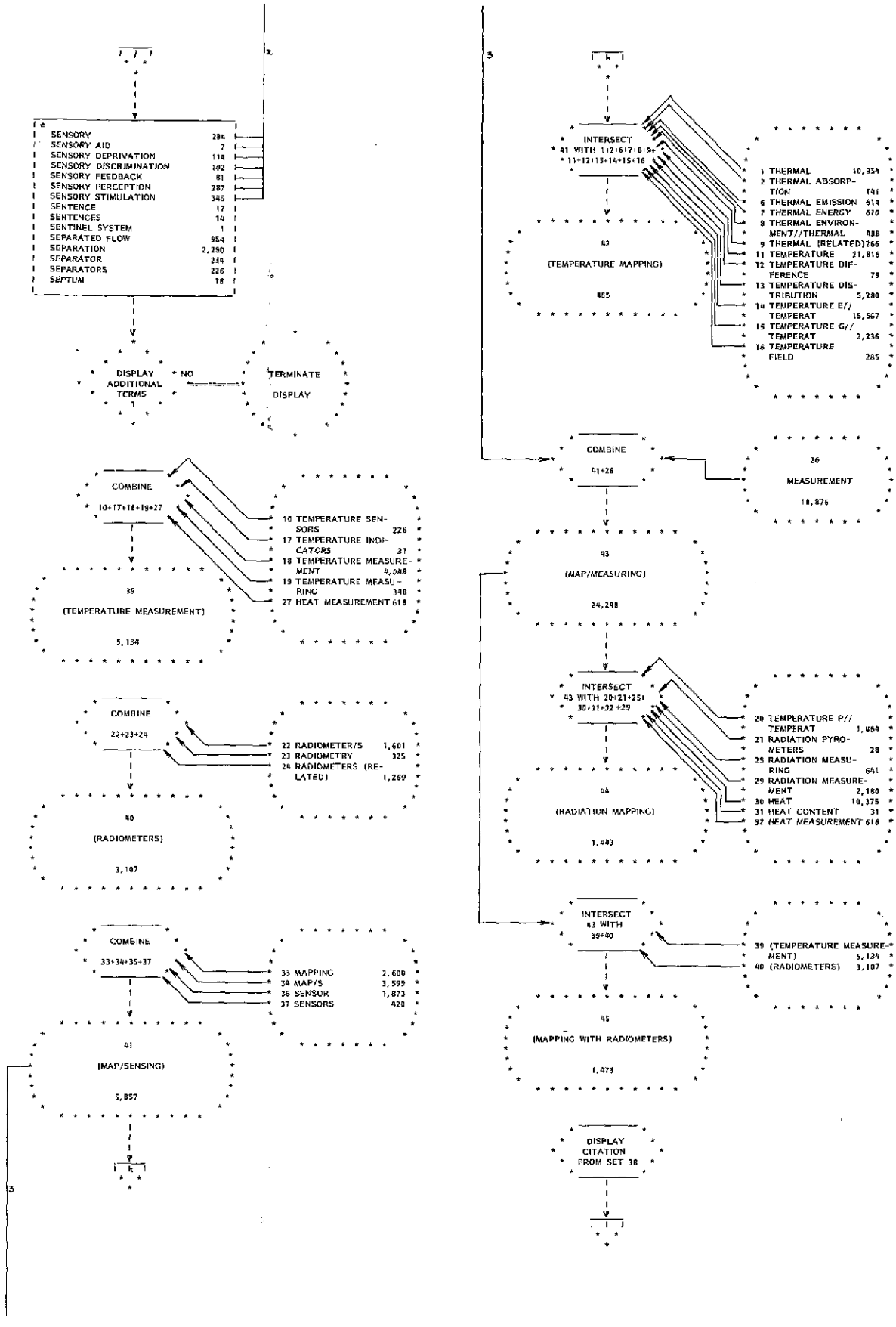
ORIGINAL PAGE IS
OF POOR QUALITY

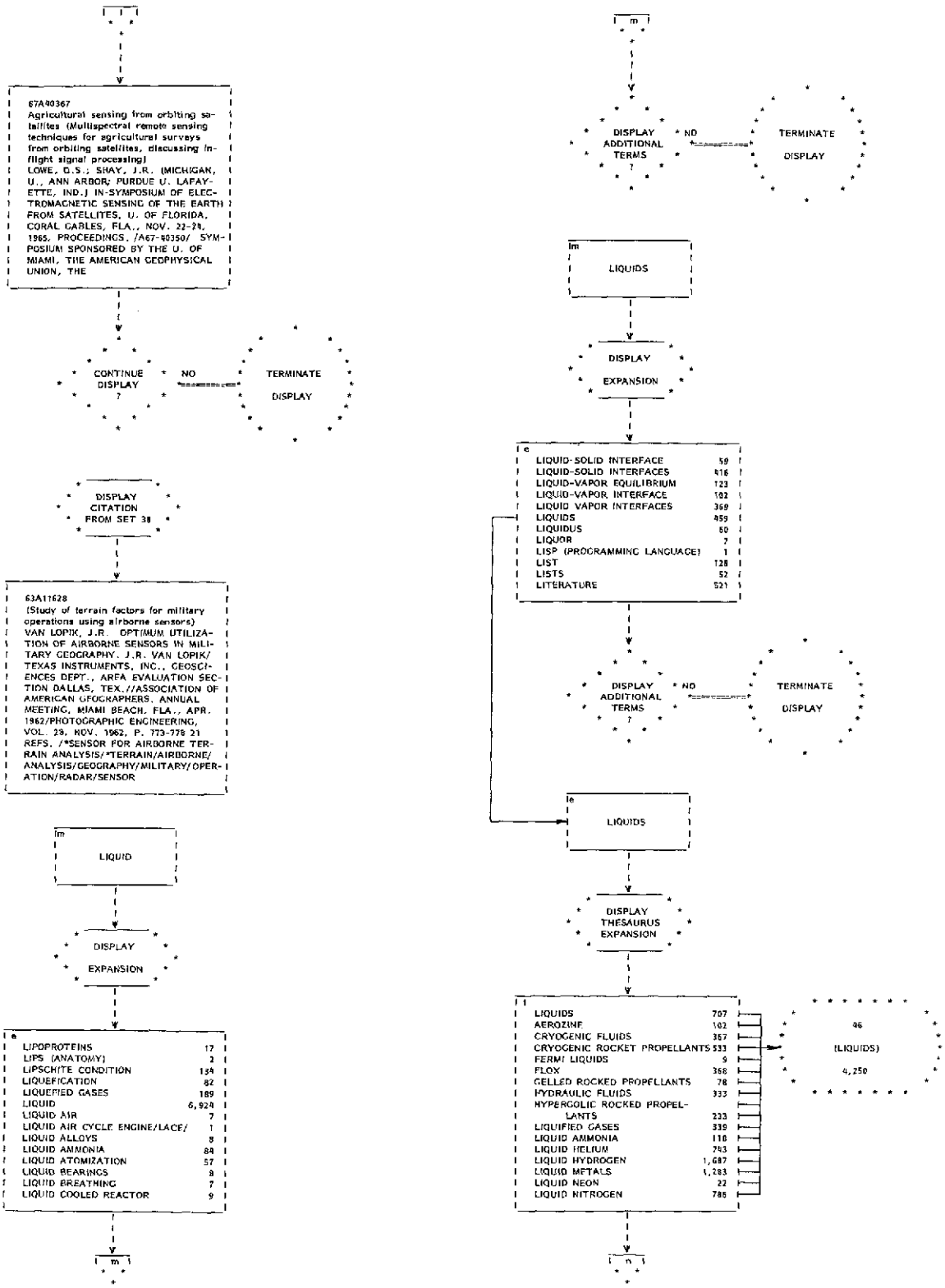


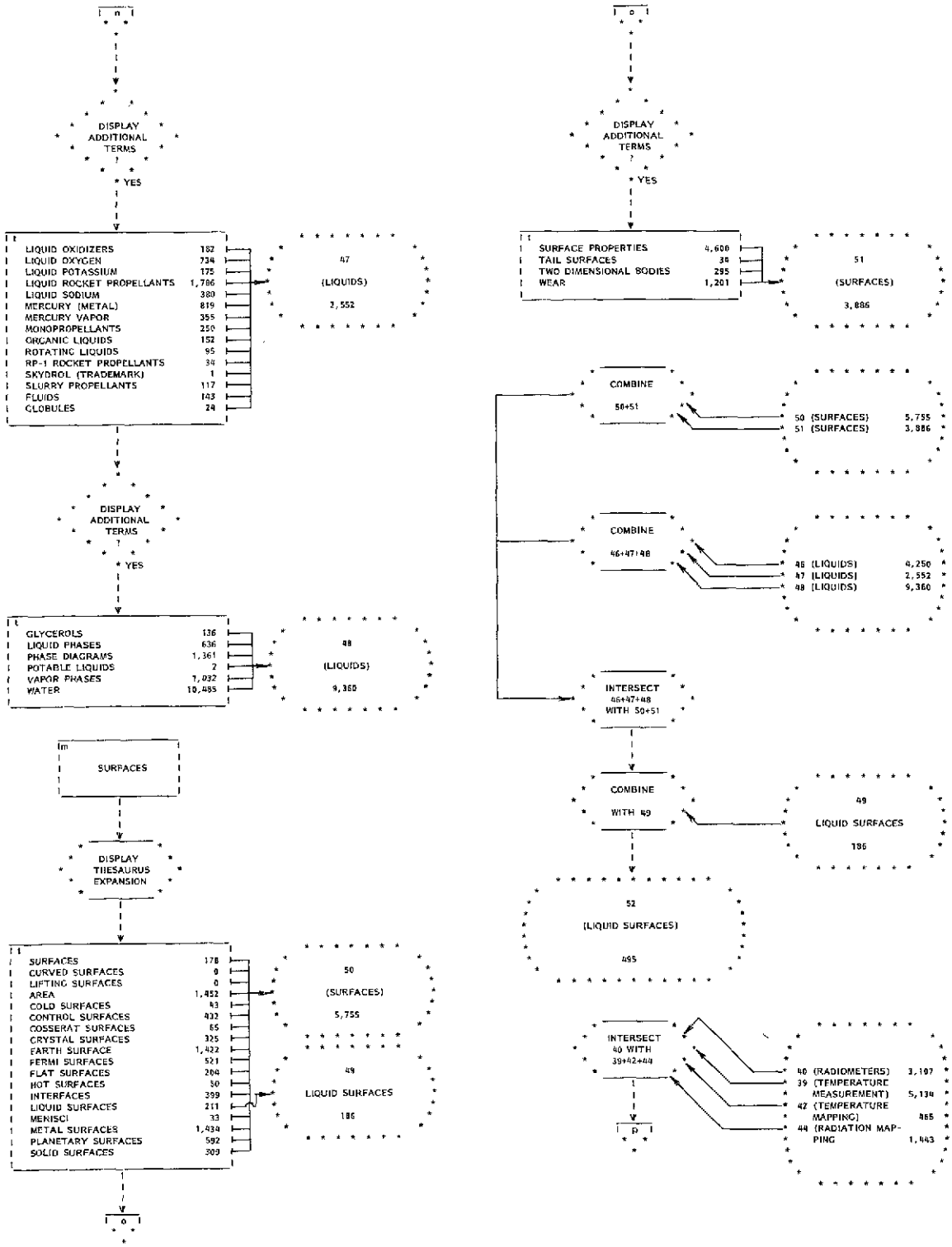


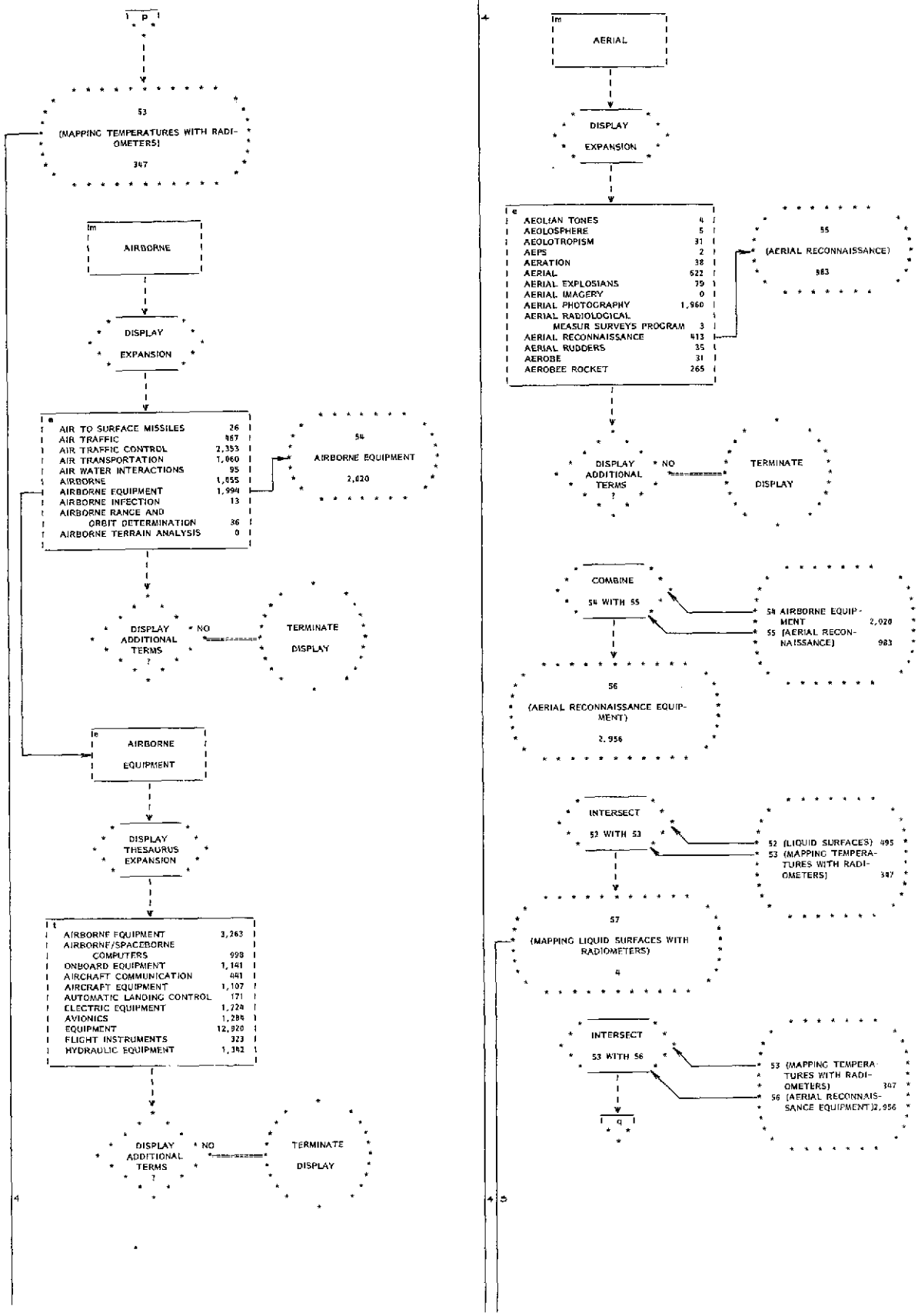


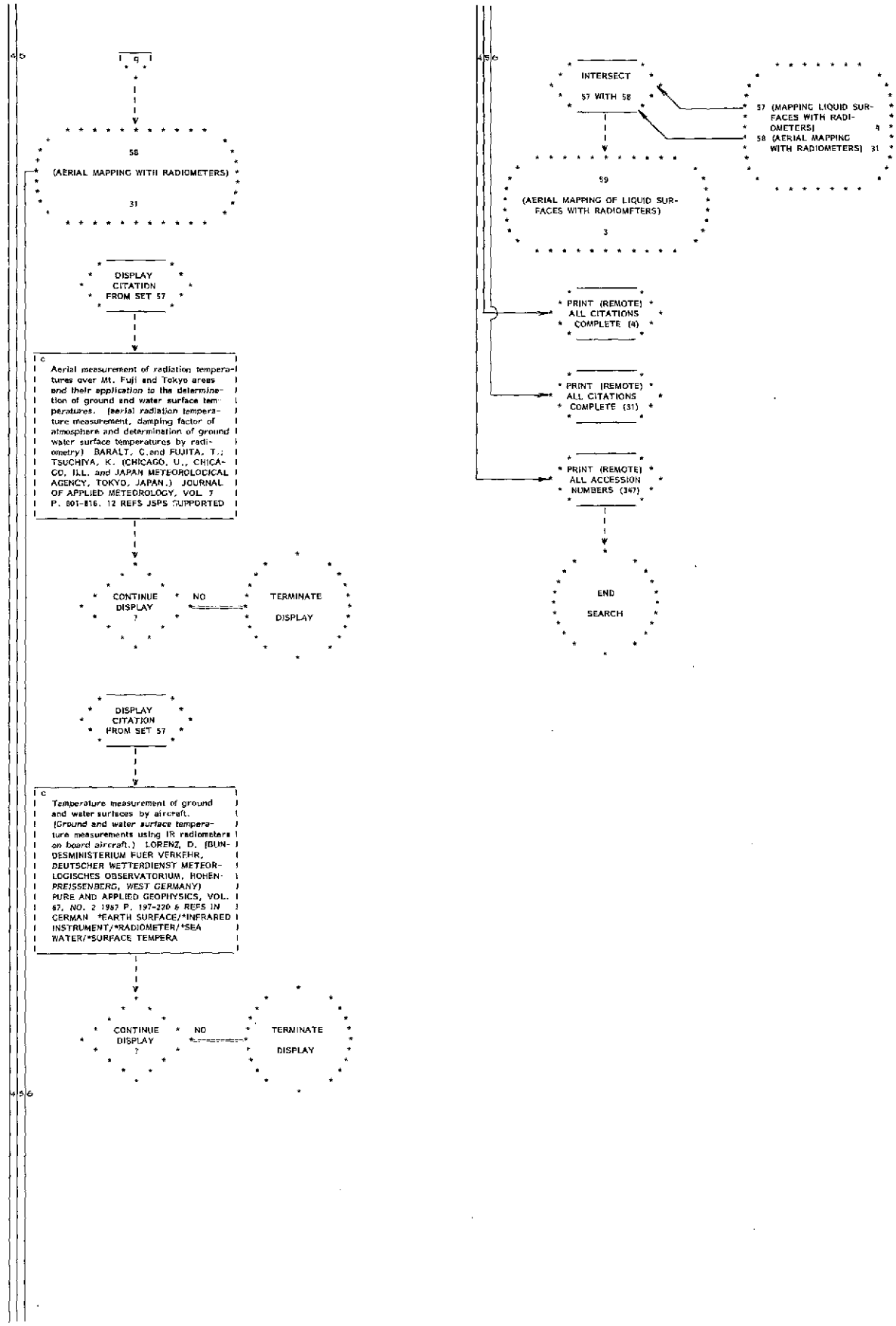



SENSORY 284
SENSORY AID 7
SENSORY DEPRIVATION 114
SENSORY DISCRIMINATION 102
SENSORY FEEDBACK 81
SENSORY PERCEPTION 287
SENSORY STIMULATION 346
SENTENCE 17
SENTENCES 14
SENTINEL SYSTEM 1
SEPARATED FLOW 954
SEPARATION 2,290
SEPARATOR 234
SEPARATORS 226
SEPTUM 78
DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
COMBINE 10+17+18+19+27
39 (TEMPERATURE MEASUREMENT) 5,134
10 TEMPERATURE SENSORS 226
17 TEMPERATURE INDICATORS 37
18 TEMPERATURE MEASUREMENT 4,048
19 TEMPERATURE MEASURING 348
27 HEAT MEASUREMENT 618
COMBINE 22+23+24
40 (RADIOMETERS) 3,107
22 RADIOMETER/S 1,601
23 RADIOMETRY 325
24 RADIOMETERS (RELATED) 1,269
COMBINE 33+34+36+37
41 (MAP/SENSING) 5,857
33 MAPPING 2,600
34 MAP/S 3,599
36 SENSOR 1,873
37 SENSORS 420
INTERSECT 41 WITH 1+2+6+7+8+9+11+12+13+14+15+16
42 (TEMPERATURE MAPPING) 865
1 THERMAL 10,954
2 THERMAL ABSORPTION 181
6 THERMAL EMISSION 614
7 THERMAL ENERGY 610
8 THERMAL ENVIRONMENT//THERMAL 488
9 THERMAL (RELATED) 266
11 TEMPERATURE 21,816
12 TEMPERATURE DIFFERENCE 79
13 TEMPERATURE DISTRIBUTION 5,280
14 TEMPERATURE E// TEMPERAT 15,567
15 TEMPERATURE G// TEMPERAT 3,236
16 TEMPERATURE FIELD 285
COMBINE 41+26
43 (MAP/MEASURING) 24,248
26 MEASUREMENT 18,876
INTERSECT 43 WITH 20+21+25+30+31+32+29
44 (RADIATION MAPPING) 1,483
20 TEMPERATURE P// TEMPERAT 1,468
21 RADIATION PYROMETERS 28
25 RADIATION MEASURING 641
29 RADIATION MEASUREMENT 2,180
30 HEAT 10,375
31 HEAT CONTENT 31
32 HEAT MEASUREMENT 618
INTERSECT 43 WITH 39+40
45 (MAPPING WITH RADIOMETERS) 1,473
39 (TEMPERATURE MEASUREMENT) 5,134
40 (RADIOMETERS) 3,107
DISPLAY CITATION FROM SET 38


67A40367
Agricultural sensing from orbiting satellites (Multispectral remote sensing techniques for agricultural surveys from orbiting satellites, discussing in-flight signal processing)
LOWE, D.S.; SHAY, J.R. (MICHIGAN, U., ANN ARBOR; PURDUE U. LAFAYETTE, IND.) IN-SYMPOSIUM OF ELECTROMAGNETIC SENSING OF THE EARTH FROM SATELLITES, U. OF FLORIDA, CORAL GABLES, FLA., NOV. 22-24, 1965. PROCEEDINGS. /A67-40350/ SYMPOSIUM SPONSORED BY THE U. OF MIAMI, THE AMERICAN GEOPHYSICAL UNION, THE
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
DISPLAY CITATION FROM SET 38
63A11628
(Study of terrain factors for military operations using airborne sensors)
VAN LOPIK, J.R. OPTIMUM UTILIZATION OF AIRBORNE SENSORS IN MILITARY GEOGRAPHY. J.R. VAN LOPIK/ TEXAS INSTRUMENTS, INC., GEOSCIENCES DEPT., AREA EVALUATION SECTION DALLAS, TEX.//ASSOCIATION OF AMERICAN GEOGRAPHERS, ANNUAL MEETING, MIAMI BEACH, FLA., APR. 1962/PHOTOGRAPHIC ENGINEERING, VOL. 29, NOV. 1962, P. 773-778 21 REFS. /*SENSOR FOR AIRBORNE TERRAIN ANALYSIS/*TERRAIN/AIRBORNE/ ANALYSIS/GEOGRAPHY/MILITARY/OPERATION/RADAR/SENSOR
LIQUID
DISPLAY EXPANSION
LIPOPROTEINS 17
LIPS (ANATOMY) 3
LIPSCHITE CONDITION 134
LIQUEFICATION 82
LIQUEFIED GASES 189
LIQUID 6,924
LIQUID AIR 7
LIQUID AIR CYCLE ENGINE/LACE/ 1
LIQUID ALLOYS 8
LIQUID AMMONIA 84
LIQUID ATOMIZATION 57
LIQUID BEARINGS 8
LIQUID BREATHING 7
LIQUID COOLED REACTOR 9
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
LIQUIDS
DISPLAY EXPANSION
LIQUID-SOLID INTERFACE 59
LIQUID-SOLID INTERFACES 816
LIQUID-VAPOR EQUILIBRIUM 123
LIQUID-VAPOR INTERFACE 102
LIQUID VAPOR INTERFACES 369
LIQUIDS 459
LIQUIDUS 60
LIQUOR 7
LISP (PROGRAMMING LANGUAGE) 1
LIST 128
LISTS 52
LITERATURE 521
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
LIQUIDS
DISPLAY THESAURUS EXPANSION
LIQUIDS 707
AEROZINE 102
CRYOGENIC FLUIDS 357
CRYOGENIC ROCKET PROPELLANTS 533
FERMI LIQUIDS 9
FLOX 368
GELLED ROCKED PROPELLANTS 78
HYDRAULIC FLUIDS 333
HYPERGOLIC ROCKED PROPELLANTS 333
LIQUIFIED GASES 339
LIQUID AMMONIA 118
LIQUID HELIUM 743
LIQUID HYDROGEN 1,687
LIQUID METALS 1,283
LIQUID NEON 22
LIQUID NITROGEN 786
46
(LIQUIDS)
4,250


n
DISPLAY ADDITIONAL TERMS
YES
LIQUID OXIDIZERS 182
LIQUID OXYGEN 734
LIQUID POTASSIUM 175
LIQUID ROCKET PROPELLANTS 1,786
LIQUID SODIUM 380
MERCURY (METAL) 819
MERCURY VAPOR 355
MONOPROPELLANTS 250
ORGANIC LIQUIDS 152
ROTATING LIQUIDS 95
RP-1 ROCKET PROPELLANTS 34
SKYDROL (TRADEMARK) 1
SLURRY PROPELLANTS 117
FLUIDS 143
GLOBULES 24
47 (LIQUIDS) 3,552
DISPLAY ADDITIONAL TERMS
YES
GLYCEROLS 136
LIQUID PHASES 636
PHASE DIAGRAMS 1,361
POTABLE LIQUIDS 2
VAPOR PHASES 1,032
WATER 10,485
48 (LIQUIDS) 9,360
SURFACES
DISPLAY THESAURUS EXPANSION
SURFACES 178
CURVED SURFACES 0
LIFTING SURFACES 0
AREA 1,452
COLD SURFACES 43
CONTROL SURFACES 402
COSSERAT SURFACES 65
CRYSTAL SURFACES 325
EARTH SURFACE 1,422
FERMI SURFACES 521
FLAT SURFACES 264
HOT SURFACES 50
INTERFACES 399
LIQUID SURFACES 211
MENISCI 33
METAL SURFACES 1,434
PLANETARY SURFACES 592
SOLID SURFACES 309
50 (SURFACES) 5,755
49 LIQUID SURFACES 186
o
o
DISPLAY ADDITIONAL TERMS
YES
SURFACE PROPERTIES 4,600
TAIL SURFACES 38
TWO DIMENSIONAL BODIES 295
WEAR 1,201
51 (SURFACES) 3,886
COMBINE 50+51
50 (SURFACES) 5,755
51 (SURFACES) 3,886
COMBINE 46+47+48
46 (LIQUIDS) 4,250
47 (LIQUIDS) 2,552
48 (LIQUIDS) 9,360
INTERSECT 46+47+48 WITH 50+51
COMBINE WITH 49
49 LIQUID SURFACES 186
52 (LIQUID SURFACES) 495
INTERSECT 40 WITH 39+42+44
p
40 (RADIOMETERS) 3,107
39 (TEMPERATURE MEASUREMENT) 5,134
42 (TEMPERATURE MAPPING) 465
44 (RADIATION MAPPING) 1,443


p
53
(MAPPING TEMPERATURES WITH RADIOMETERS)
347
m
AIRBORNE
DISPLAY EXPANSION
e
AIR TO SURFACE MISSILES 26
AIR TRAFFIC 867
AIR TRAFFIC CONTROL 2,353
AIR TRANSPORTATION 1,060
AIR WATER INTERACTIONS 95
AIRBORNE 1,855
AIRBORNE EQUIPMENT 1,994
AIRBORNE INFECTION 13
AIRBORNE RANGE AND ORBIT DETERMINATION 36
AIRBORNE TERRAIN ANALYSIS 0
54
AIRBORNE EQUIPMENT
2,020
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
le
AIRBORNE EQUIPMENT
DISPLAY THESAURUS EXPANSION
t
AIRBORNE EQUIPMENT 3,263
AIRBORNE/SPACEBORNE COMPUTERS 998
ONBOARD EQUIPMENT 1,141
AIRCRAFT COMMUNICATION 441
AIRCRAFT EQUIPMENT 1,107
AUTOMATIC LANDING CONTROL 171
ELECTRIC EQUIPMENT 1,224
AVIONICS 1,286
EQUIPMENT 12,920
FLIGHT INSTRUMENTS 323
HYDRAULIC EQUIPMENT 1,362
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
4
m
AERIAL
DISPLAY EXPANSION
e
AEOLIAN TONES 4
AEOLOSPHERE 5
AEOLOTROPISM 31
AEPS 2
AERATION 38
AERIAL 622
AERIAL EXPLOSIANS 79
AERIAL IMAGERY 0
AERIAL PHOTOGRAPHY 1,960
AERIAL RADIOLOGICAL MEASUR SURVEYS PROGRAM 3
AERIAL RECONNAISSANCE 413
AERIAL RUDDERS 35
AEROBE 31
AEROBEE ROCKET 265
55
(AERIAL RECONNAISSANCE)
983
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
COMBINE
54 WITH 55
54 AIRBORNE EQUIPMENT 2,020
55 (AERIAL RECONNAISSANCE) 983
56
(AERIAL RECONNAISSANCE EQUIPMENT)
2,956
INTERSECT
52 WITH 53
52 (LIQUID SURFACES) 495
53 (MAPPING TEMPERATURES WITH RADIOMETERS) 347
57
(MAPPING LIQUID SURFACES WITH RADIOMETERS)
4
INTERSECT
53 WITH 56
53 (MAPPING TEMPERATURES WITH RADIOMETERS) 347
56 (AERIAL RECONNAISSANCE EQUIPMENT) 2,956
q
4
5


4 5
q
58
(AERIAL MAPPING WITH RADIOMETERS)
31
DISPLAY CITATION FROM SET 57
c
Aerial measurement of radiation temperatures over Mt. Fuji and Tokyo areas and their application to the determination of ground and water surface temperatures. (Aerial radiation temperature measurement, damping factor of atmosphere and determination of ground water surface temperatures by radiometry) BARALT, C.and FUJITA, T.; TSUCHIYA, K. (CHICAGO, U., CHICAGO, ILL. and JAPAN METEOROLOGICAL AGENCY, TOKYO, JAPAN.) JOURNAL OF APPLIED METEOROLOGY, VOL. 7 P. 801-816. 12 REFS JSPS SUPPORTED
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
DISPLAY CITATION FROM SET 57
c
Temperature measurement of ground and water surfaces by aircraft. (Ground and water surface temperature measurements using IR radiometers on board aircraft.) LORENZ, D. (BUNDESMINISTERIUM FUER VERKEHR, DEUTSCHER WETTERDIENST METEOROLOGISCHES OBSERVATORIUM, HOHENPREISSENBERG, WEST GERMANY) PURE AND APPLIED GEOPHYSICS, VOL. 67, NO. 2 1967 P. 197-220 6 REFS IN GERMAN *EARTH SURFACE/*INFRARED INSTRUMENT/*RADIOMETER/*SEA WATER/*SURFACE TEMPERA
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
4 5 6
4 5 6
INTERSECT 57 WITH 58
57 (MAPPING LIQUID SURFACES WITH RADIOMETERS) 4
58 (AERIAL MAPPING WITH RADIOMETERS) 31
59
(AERIAL MAPPING OF LIQUID SURFACES WITH RADIOMETERS)
3
PRINT (REMOTE) ALL CITATIONS COMPLETE (4)
PRINT (REMOTE) ALL CITATIONS COMPLETE (31)
PRINT (REMOTE) ALL ACCESSION NUMBERS (347)
END SEARCH

SECOND SEARCH LOGIC EMPLOYED BY WWS

After completing his assigned search, searcher WWS felt that the task could probably have been done more simply by employing a single intersection between two groups of very general terms. Accordingly, he began by selecting "thermal" (12,557 postings), "temperature" (25,518 postings), "temperature gradient" and "temperature gradients" (2,428 postings), "maps," "map," and "mapping" (4,226 postings). He then intersected the last group with the union of the first three to obtain 205 hits. Interestingly enough, this search produced only 8 good hits, half of which were not found in any other search.

LOGICAL PROCESSES EMPLOYED BY SEARCHER MRN

The searcher is a trained literature chemist with specialization in the medical and biological areas. He had relatively low familiarity with RECON and its capabilities at the time the experiment was conducted. In addition, his thought processes were somewhat disturbed by several short but annoying systems failures during the course of his search.

He began (Figure 2) by asking for an expansion on the name of the instrument cited in the problem statement as being the one used to measure temperature. From this he selected three terms which he combined to form set 1. It also became obvious from examining this display that a simple alphabetical listing of the terms in the neighborhood of "radiometer" would not give him a clue as to terms functionally related to radiometers. He therefore asked for a thesaurus expansion on "radiometers." This he deemed more productive because he combined nine of the 20 related terms displayed to create set 2.

He next tried the idea of pollution, reasoning that because the radiometer was used to investigate thermal pollution, he might find a connection. The dictionary expansion seemed fruitless, so he tried a thesaurus expansion. Even though he looked at all the terms in this expansion, he decided that none was really suitable. He apparently did not regard the term "thermal pollution" as being sufficiently descriptive of measurement problems in thermal pollution to choose it.

Following this tack, he examined an expansion about the term "airplane," the vehicle on which the sensor is mounted during measurement. Since there are no postings under this term, it was obvious that a different term is used by the indexers to describe flying machines. He therefore tried "aircraft" and found some 10,000 postings. In an attempt to be a little more specific, he requested a thesaurus expansion on the term. The phlethora of types displayed caused him to settle for the general term as set 3.

He then tried the idea of "sensor," a concept taken from the problem statement. From the expansion he selected only the general term for set 4. He also tried a thesaurus expansion on "sensors," selecting the general term as set 5 and "remote sensors" as set 6. To clean things up a bit he combined sets 4, 5, and 6 in set 7.

Water, being the medium whose temperature is to be monitored, then seemed worth checking out. A dictionary expansion was performed with the result that three of the terms - "water," "water temperature," and "water pollution" - were selected as sets 8, 9, and 10. On the hunch that something very specific might turn up on the intersection of "water pollution" and "remote sensors," the operation was performed (set 11) and some of the citations examined. At that time, the citations did not appear to be particularly relevant so the searcher tried another but similar tack combining sets 2, 4, and 5 dealing with sensors and radiometers to form set 12 and intersecting this with "water pollution" (set 10). The resulting set (13) had 36 hits, but an examination of one citation suggested that the proper connection had not yet been made. The citation did suggest another term which seemed to be related to the problem, "aerial reconnaissance" (set 14).

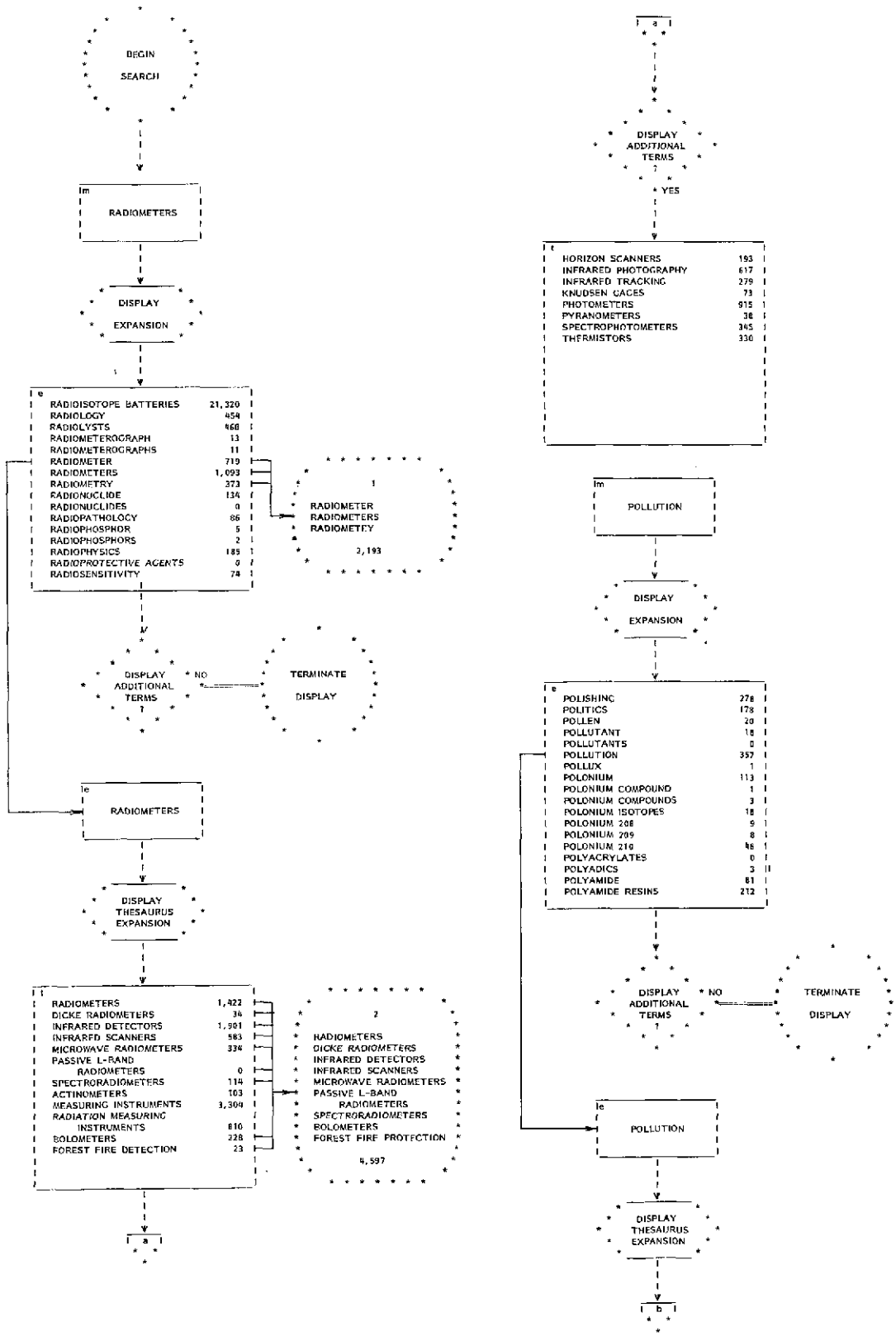
An index term from set 11 - "thermal pollution" - was then used as the basis for an expansion without yielding anything of great interest except the term itself (set 15).

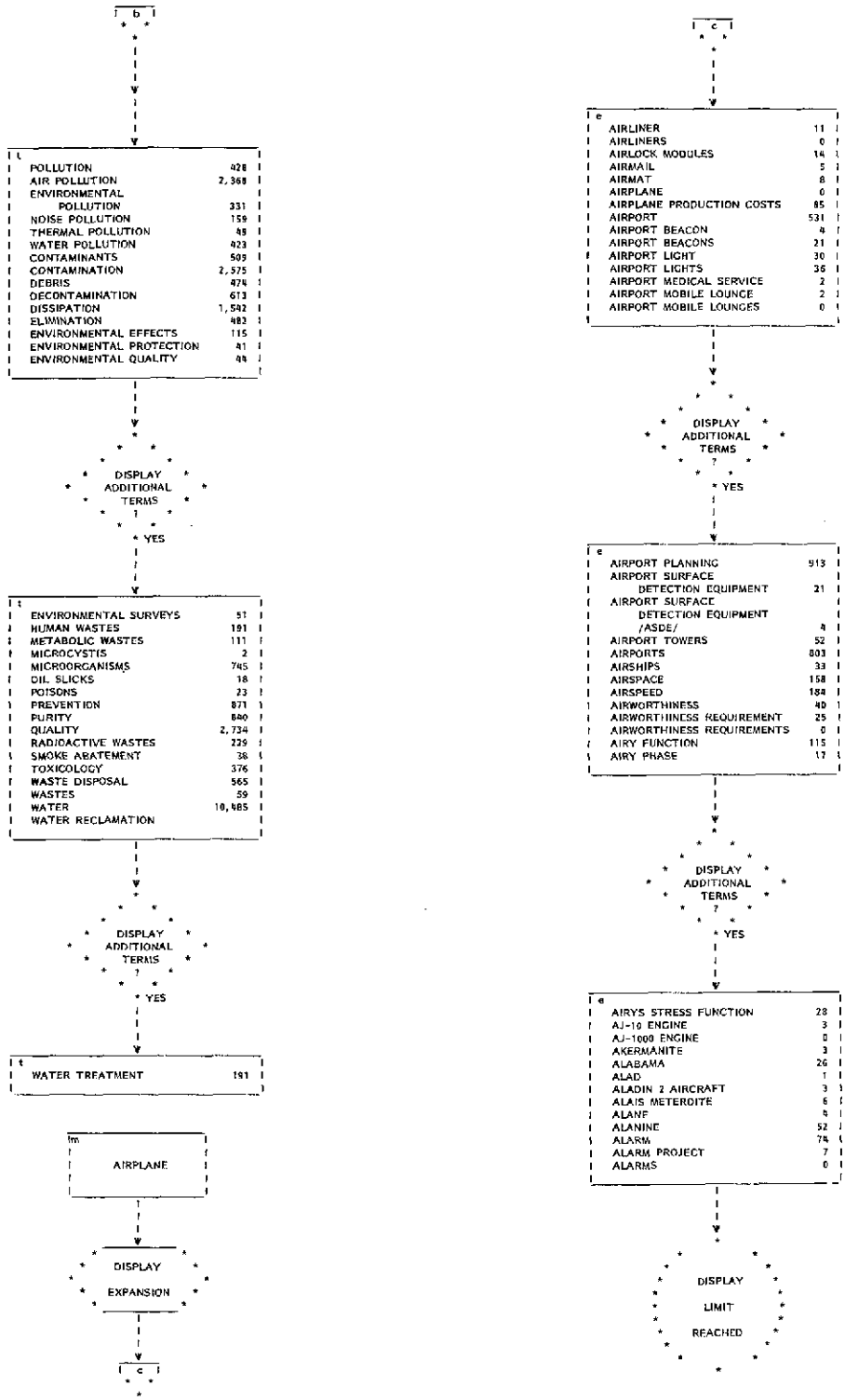
The searcher then combined set 6 and 14 to collect documents dealing with aerial reconnaissance and remote sensing and searched these for those documents also indexed under "water temperature," "water pollution," and "thermal pollution." The resulting set (16) contained 126 documents. Apparently he had some second thoughts about the utility of such an intersection because the results were left to lie while he attempted a different approach: combining radiometers and sensors (sets 2, 4, and 5) and intersecting these with "water" to create set 17 with 86 hits. This he intersected with set 3, "aircraft." Only one document was recovered in this set (18). Since the number of hits was insufficient, he tried the idea of intersecting the water and thermal pollution terms with "aircraft" to create set 19 with 142 hits.

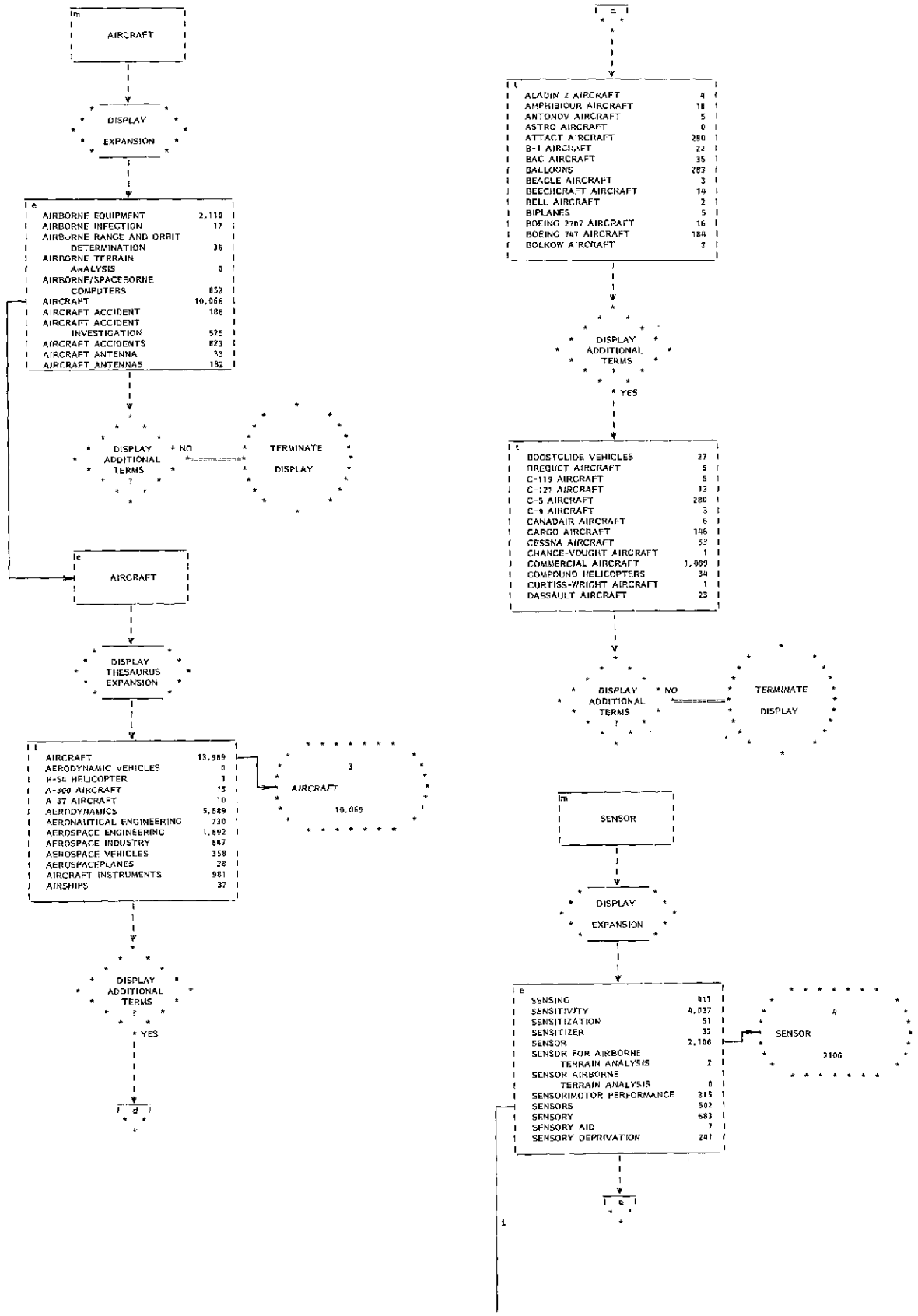
At this point he decided to look to some of the citations in sets 17, 18, and 19. Apparently set 19 appeared to stray from the subject. The others, however, seemed reasonably pertinent. He therefore combined these with 16 to create set 20 with 211 hits.

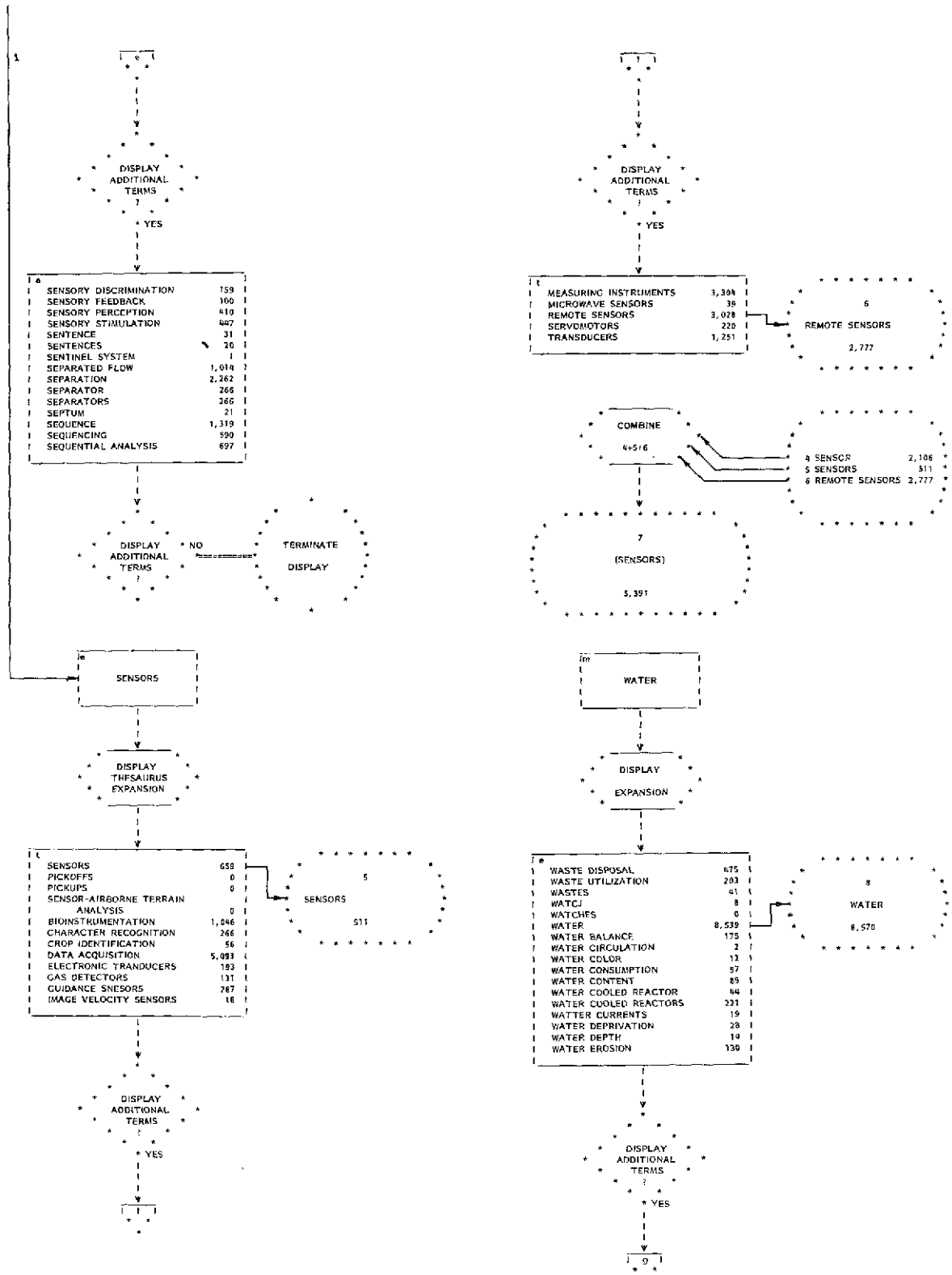
His next step was to combine sets 6 and 14 dealing with remote sensors and aerial reconnaissance and intersect the result with sets 9, 10, and 15 which had been used earlier intersected with aircraft to obtain low relevancy set 19. He seemed to hope that by employing more specific terms than aircraft he might obtain more pertinent citations. The new set, 21, contained 126 items. Apparently forgetting his history in creating set 17, he repeated the procedure to create set 22. He also repeated the creation of set 18 to form set 23. Sets 21, 22, and 23 were combined to form set 24 of 211 items and the results declared the final hit list. This list is substantially the same as set 20. 39 documents in the final hit list were regarded by the experiment director as relevant. 9 of these were <u>not</u> found by any other searcher. Recall was 10% of the total relevant documents in the file and 18.5% of the final hit list was relevant.

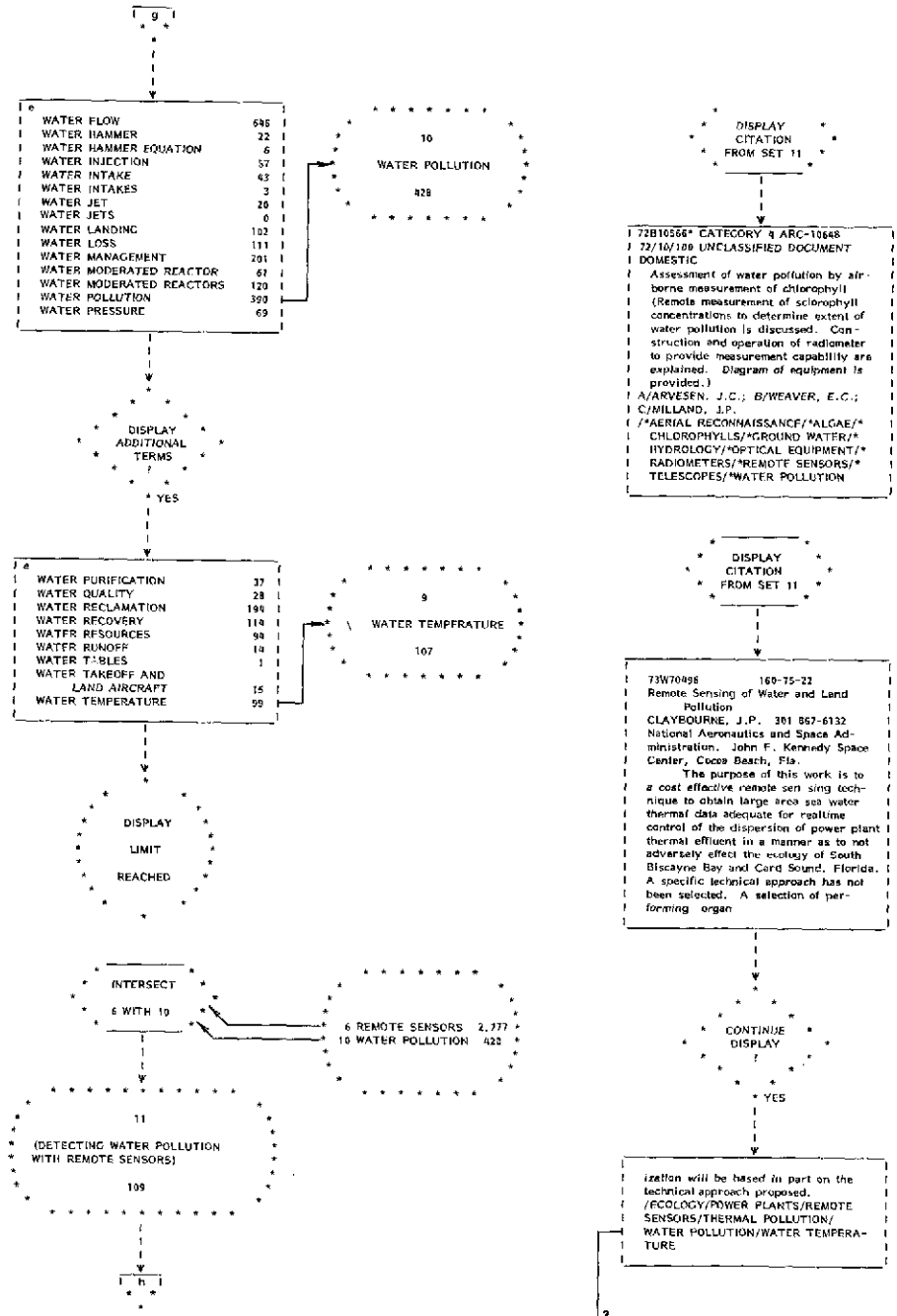
FIGURE 2

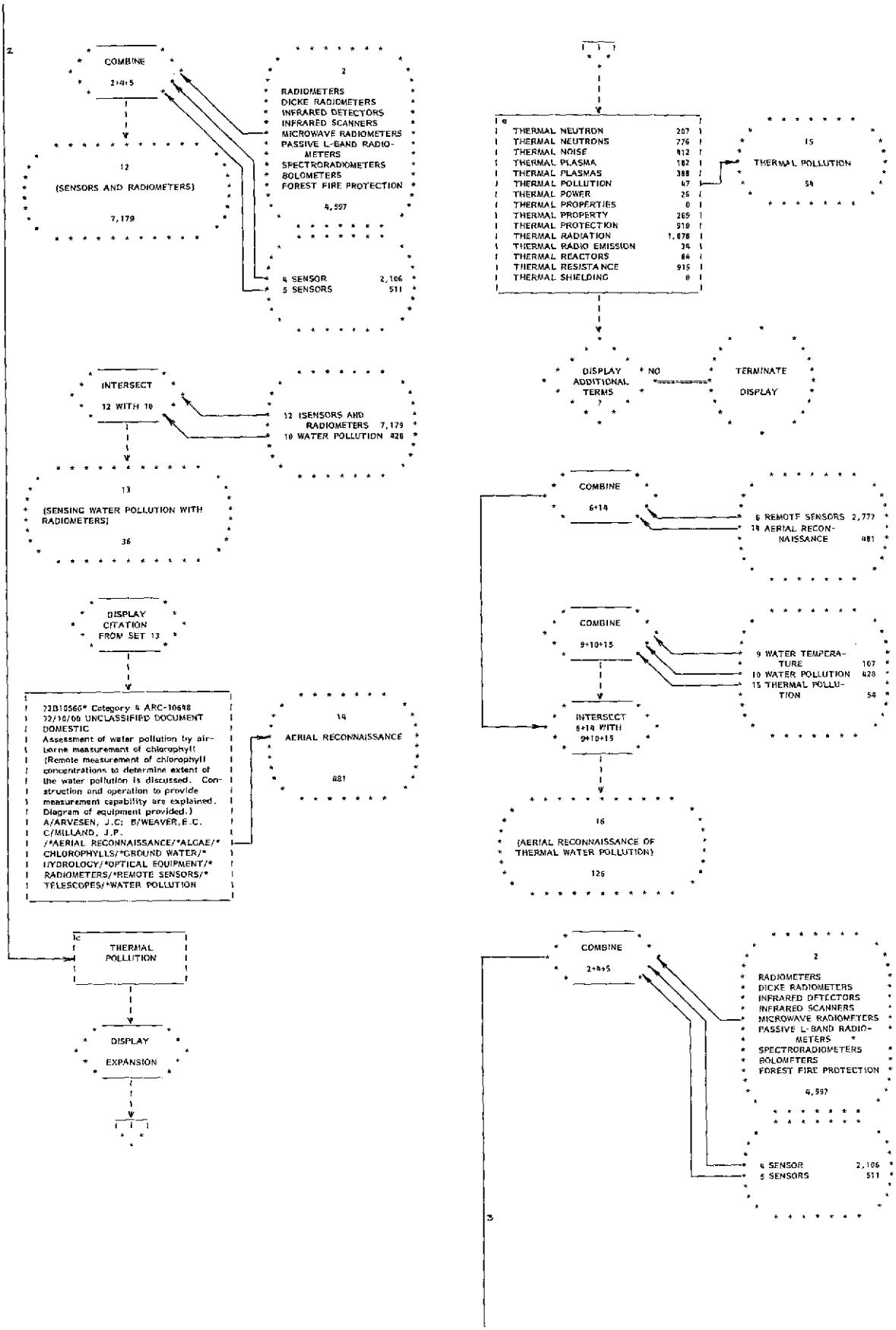

BEGIN SEARCH
1m
RADIOMETERS
DISPLAY EXPANSION
1e
RADIOISOTOPE BATTERIES 21,320
RADIOLOGY 454
RADIOLYSTS 468
RADIOMETEROGRAPH 13
RADIOMETEROGRAPHS 11
RADIOMETER 719
RADIOMETERS 1,093
RADIOMETRY 373
RADIONUCLIDE 134
RADIONUCLIDES 0
RADIOPATHOLOGY 86
RADIOPHOSPHOR 5
RADIOPHOSPHORS 2
RADIOPHYSICS 185
RADIOPROTECTIVE AGENTS 0
RADIOSENSITIVITY 74
1
RADIOMETER
RADIOMETERS
RADIOMETRY
2,193
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
1e
RADIOMETERS
DISPLAY THESAURUS EXPANSION
1
RADIOMETERS 1,422
DICKE RADIOMETERS 34
INFRARED DETECTORS 1,901
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 334
PASSIVE L-BAND RADIOMETERS 0
SPECTRORADIOMETERS 114
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
BOLOMETERS 228
FOREST FIRE DETECTION 23
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
BOLOMETERS
FOREST FIRE PROTECTION
4,597
a
a
DISPLAY ADDITIONAL TERMS ?
YES
1e
HORIZON SCANNERS 193
INFRARED PHOTOGRAPHY 617
INFRARED TRACKING 279
KNUDSEN GAGES 73
PHOTOMETERS 915
PYRANOMETERS 38
SPECTROPHOTOMETERS 345
THERMISTORS 330
1m
POLLUTION
DISPLAY EXPANSION
1e
POLISHING 278
POLITICS 178
POLLEN 20
POLLUTANT 18
POLLUTANTS 0
POLLUTION 357
POLLUX 1
POLONIUM 113
POLONIUM COMPOUND 1
POLONIUM COMPOUNDS 3
POLONIUM ISOTOPES 18
POLONIUM 208 9
POLONIUM 209 8
POLONIUM 210 86
POLYACRYLATES 0
POLYADICS 3
POLYAMIDE 81
POLYAMIDE RESINS 212
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
1e
POLLUTION
DISPLAY THESAURUS EXPANSION
b

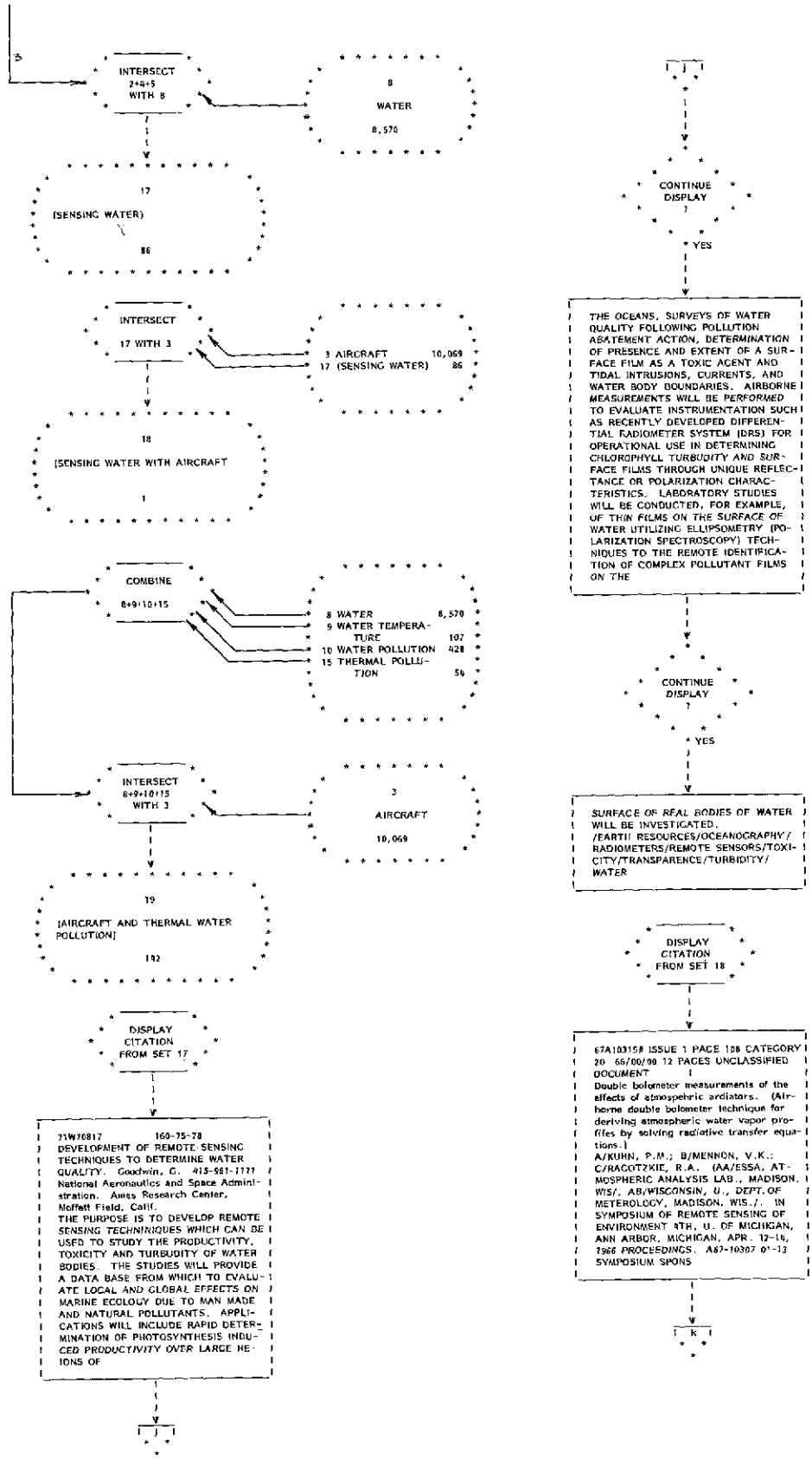

b
POLLUTION 428
AIR POLLUTION 2,368
ENVIRONMENTAL POLLUTION 331
NOISE POLLUTION 159
THERMAL POLLUTION 48
WATER POLLUTION 423
CONTAMINANTS 505
CONTAMINATION 2,575
DEBRIS 474
DECONTAMINATION 613
DISSIPATION 1,582
ELIMINATION 483
ENVIRONMENTAL EFFECTS 115
ENVIRONMENTAL PROTECTION 41
ENVIRONMENTAL QUALITY 48
DISPLAY ADDITIONAL TERMS ?
YES
ENVIRONMENTAL SURVEYS 51
HUMAN WASTES 191
METABOLIC WASTES 111
MICROCYSTIS 2
MICROORGANISMS 745
OIL SLICKS 18
POISONS 23
PREVENTION 871
PURITY 840
QUALITY 2,734
RADIOACTIVE WASTES 229
SMOKE ABATEMENT 38
TOXICOLOGY 376
WASTE DISPOSAL 565
WASTES 59
WATER 10,485
WATER RECLAMATION
DISPLAY ADDITIONAL TERMS ?
YES
WATER TREATMENT 191
AIRPLANE
DISPLAY EXPANSION
c
c
AIRLINER 11
AIRLINERS 0
AIRLOCK MODULES 14
AIRMAIL 5
AIRMAT 8
AIRPLANE 0
AIRPLANE PRODUCTION COSTS 85
AIRPORT 531
AIRPORT BEACON 4
AIRPORT BEACONS 21
AIRPORT LIGHT 30
AIRPORT LIGHTS 36
AIRPORT MEDICAL SERVICE 2
AIRPORT MOBILE LOUNGE 2
AIRPORT MOBILE LOUNGES 0
DISPLAY ADDITIONAL TERMS ?
YES
AIRPORT PLANNING 913
AIRPORT SURFACE DETECTION EQUIPMENT 21
AIRPORT SURFACE DETECTION EQUIPMENT /ASDE/ 4
AIRPORT TOWERS 52
AIRPORTS 803
AIRSHIPS 33
AIRSPACE 158
AIRSPEED 184
AIRWORTHINESS 40
AIRWORTHINESS REQUIREMENT 25
AIRWORTHINESS REQUIREMENTS 0
AIRY FUNCTION 115
AIRY PHASE 17
DISPLAY ADDITIONAL TERMS ?
YES
AIRYS STRESS FUNCTION 28
AJ-10 ENGINE 3
AJ-1000 ENGINE 0
AKERMANITE 3
ALABAMA 26
ALAD 1
ALADIN 2 AIRCRAFT 3
ALAIS METEORITE 6
ALANE 4
ALANINE 52
ALARM 74
ALARM PROJECT 7
ALARMS 0
DISPLAY LIMIT REACHED

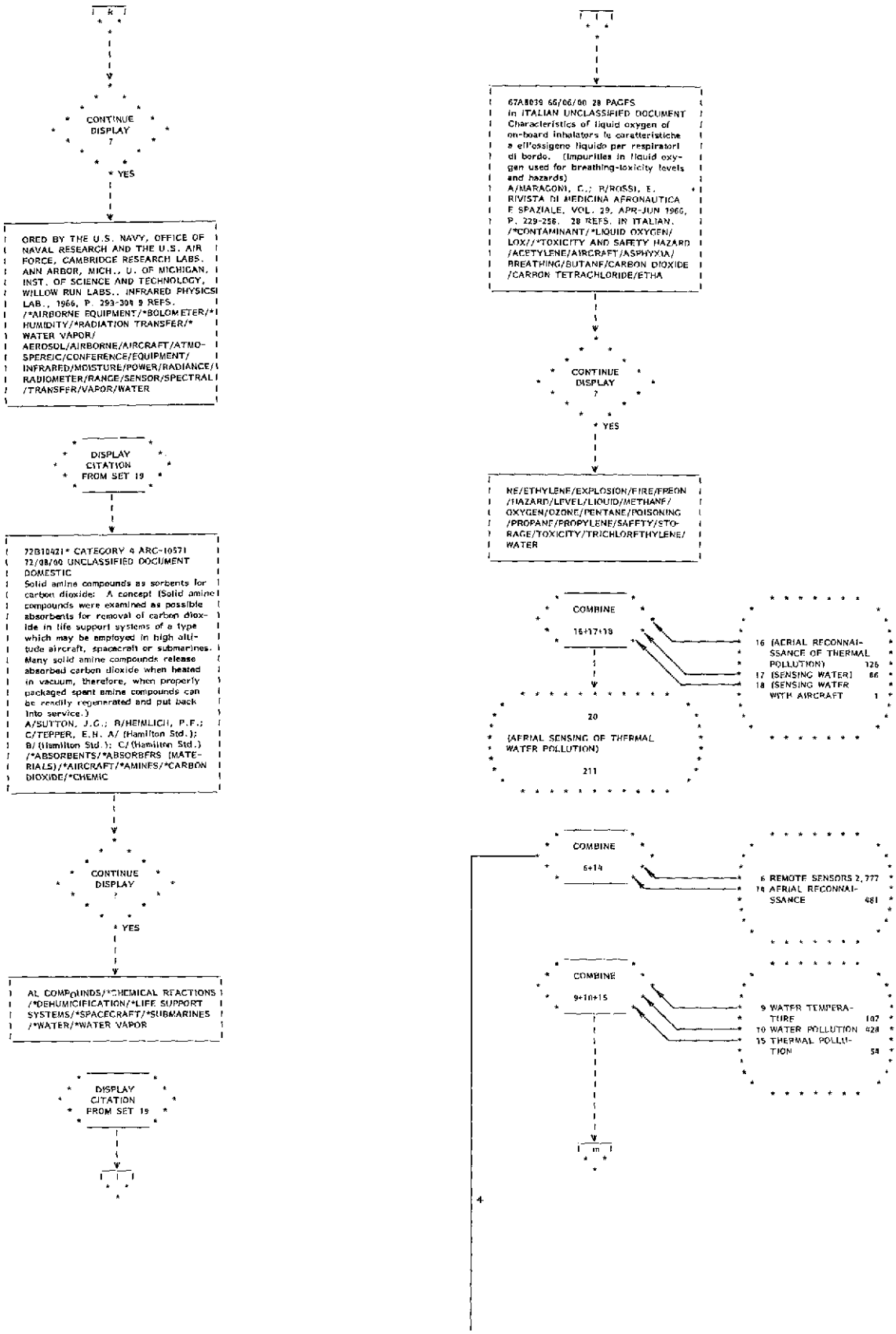

AIRCRAFT
DISPLAY EXPANSION
AIRBORNE EQUIPMENT 2,116
AIRBORNE INFECTION 17
AIRBORNE RANGE AND ORRIT DETERMINATION 36
AIRBORNE TERRAIN ANALYSIS 0
AIRBORNE/SPACEBORNE COMPUTERS 852
AIRCRAFT 10,066
AIRCRAFT ACCIDENT 188
AIRCRAFT ACCIDENT INVESTIGATION 525
AIRCRAFT ACCIDENTS 823
AIRCRAFT ANTENNA 33
AIRCRAFT ANTENNAS 182
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
AIRCRAFT
DISPLAY THESAURUS EXPANSION
AIRCRAFT 13,969
AERODYNAMIC VEHICLES 0
H-54 HELICOPTER 1
A-300 AIRCRAFT 15
A 37 AIRCRAFT 10
AERODYNAMICS 5,589
AERONAUTICAL ENGINEERING 730
AEROSPACE ENGINEERING 1,692
AEROSPACE INDUSTRY 647
AEROSPACE VEHICLES 358
AEROSPACEPLANES 28
AIRCRAFT INSTRUMENTS 981
AIRSHIPS 37
3
AIRCRAFT
10,069
DISPLAY ADDITIONAL TERMS ?
YES
ALADIN 2 AIRCRAFT 4
AMPHIBIOUR AIRCRAFT 18
ANTONOV AIRCRAFT 5
ASTRO AIRCRAFT 0
ATTACT AIRCRAFT 280
B-1 AIRCRAFT 22
BAC AIRCRAFT 35
BALLOONS 283
BEAGLE AIRCRAFT 3
BEECHCRAFT AIRCRAFT 14
BELL AIRCRAFT 2
BIPLANES 5
BOEING 2707 AIRCRAFT 16
BOEING 747 AIRCRAFT 184
BOLKOW AIRCRAFT 2
DISPLAY ADDITIONAL TERMS ?
YES
BOOSTGLIDE VEHICLES 27
BREQUET AIRCRAFT 5
C-119 AIRCRAFT 5
C-121 AIRCRAFT 13
C-5 AIRCRAFT 280
C-9 AIRCRAFT 3
CANADAIR AIRCRAFT 6
CARGO AIRCRAFT 146
CESSNA AIRCRAFT 53
CHANCE-VOUGHT AIRCRAFT 1
COMMERCIAL AIRCRAFT 1,089
COMPOUND HELICOPTERS 34
CURTISS-WRIGHT AIRCRAFT 1
DASSAULT AIRCRAFT 23
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
SENSOR
DISPLAY EXPANSION
SENSING 917
SENSITIVITY 4,037
SENSITIZATION 51
SENSITIZER 32
SENSOR 2,106
SENSOR FOR AIRBORNE TERRAIN ANALYSIS 2
SENSOR AIRBORNE TERRAIN ANALYSIS 0
SENSORIMOTOR PERFORMANCE 215
SENSORS 502
SENSORY 683
SENSORY AID 7
SENSORY DEPRIVATION 241
4
SENSOR
2106

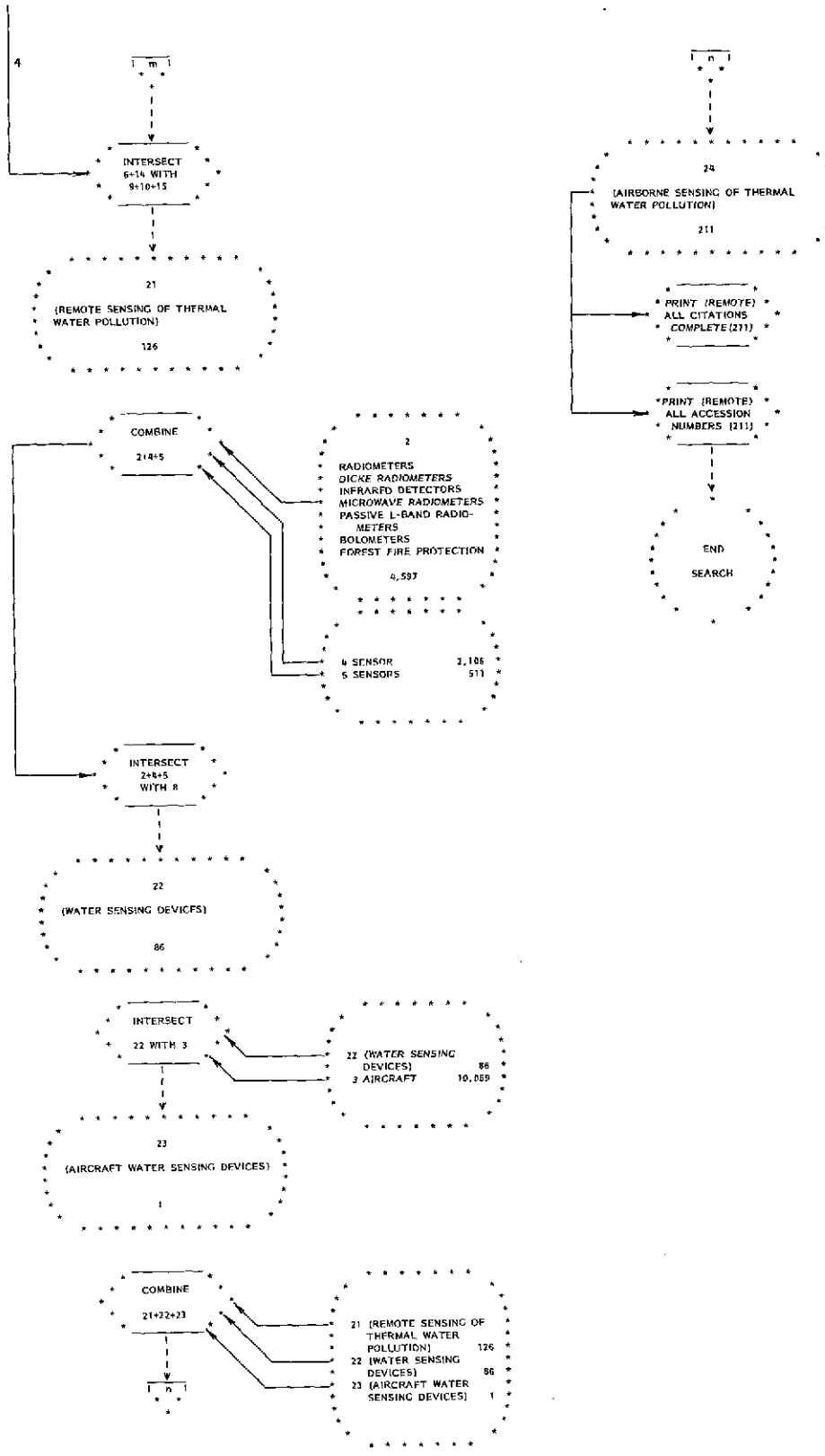

DISPLAY ADDITIONAL TERMS ?
YES
SENSORY DISCRIMINATION 159
SENSORY FEEDBACK 100
SENSORY PERCEPTION 410
SENSORY STIMULATION 847
SENTENCE 31
SENTENCES 20
SENTINEL SYSTEM 1
SEPARATED FLOW 1,014
SEPARATION 2,262
SEPARATOR 266
SEPARATORS 266
SEPTUM 21
SEQUENCE 1,319
SEQUENCING 590
SEQUENTIAL ANALYSIS 697
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
SENSORS
DISPLAY THESAURUS EXPANSION
SENSORS 659
PICKOFFS 0
PICKUPS 0
SENSOR-AIRBORNE TERRAIN ANALYSIS 0
BIOINSTRUMENTATION 1,046
CHARACTER RECOGNITION 266
CROP IDENTIFICATION 56
DATA ACQUISITION 5,093
ELECTRONIC TRANDUCERS 193
GAS DETECTORS 131
GUIDANCE SNESORS 787
IMAGE VELOCITY SENSORS 18
5 SENSORS 511
DISPLAY ADDITIONAL TERMS ?
YES
DISPLAY ADDITIONAL TERMS ?
YES
MEASURING INSTRUMENTS 3,304
MICROWAVE SENSORS 36
REMOTE SENSORS 3,028
SERVOMOTORS 220
TRANSDUCERS 1,251
6 REMOTE SENSORS 2,777
COMBINE 4+5+6
4 SENSOR 2,108
5 SENSORS 511
6 REMOTE SENSORS 2,777
7 (SENSORS) 5,391
WATER
DISPLAY EXPANSION
WASTE DISPOSAL 475
WASTE UTILIZATION 203
WASTES 41
WATCJ 8
WATCHES 6
WATER 8,539
WATER BALANCE 175
WATER CIRCULATION 2
WATER COLOR 13
WATER CONSUMPTION 57
WATER CONTENT 89
WATER COOLED REACTOR 44
WATER COOLED REACTORS 221
WATTER CURRENTS 19
WATER DEPRIVATION 28
WATER DEPTH 14
WATER EROSION 139
8 WATER 8,570
DISPLAY ADDITIONAL TERMS ?
YES


9
WATER FLOW 646
WATER HAMMER 22
WATER HAMMER EQUATION 6
WATER INJECTION 57
WATER INTAKE 43
WATER INTAKES 3
WATER JET 26
WATER JETS 0
WATER LANDING 102
WATER LOSS 111
WATER MANAGEMENT 201
WATER MODERATED REACTOR 67
WATER MODERATED REACTORS 120
WATER POLLUTION 390
WATER PRESSURE 69
10
WATER POLLUTION
828
DISPLAY ADDITIONAL TERMS ?
YES
WATER PURIFICATION 37
WATER QUALITY 28
WATER RECLAMATION 196
WATER RECOVERY 114
WATER RESOURCES 98
WATER RUNOFF 14
WATER TABLES 1
WATER TAKEOFF AND LAND AIRCRAFT 15
WATER TEMPERATURE 99
9
WATER TEMPERATURE
107
DISPLAY LIMIT REACHED
INTERSECT 6 WITH 10
6 REMOTE SENSORS 2,777
10 WATER POLLUTION 828
11
(DETECTING WATER POLLUTION WITH REMOTE SENSORS)
109
h
DISPLAY CITATION FROM SET 11
72B10566* CATEGORY 9 ARC-10648
72/10/100 UNCLASSIFIED DOCUMENT
DOMESTIC
Assessment of water pollution by airborne measurement of chlorophyll (Remote measurement of sclorophyll concentrations to determine extent of water pollution is discussed. Construction and operation of radiometer to provide measurement capability are explained. Diagram of equipment is provided.)
A/ARVESEN, J.C.; B/WEAVER, E.C.; C/MILLAND, J.P.
/*AERIAL RECONNAISSANCE/*ALGAE/* CHLOROPHYLLS/*GROUND WATER/* HYDROLOGY/*OPTICAL EQUIPMENT/* RADIOMETERS/*REMOTE SENSORS/* TELESCOPES/*WATER POLLUTION
DISPLAY CITATION FROM SET 11
73W70496 160-75-22
Remote Sensing of Water and Land Pollution
CLAYBOURNE, J.P., 301 867-6132
National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
The purpose of this work is to a cost effective remote sensing technique to obtain large area sea water thermal data adequate for realtime control of the dispersion of power plant thermal effluent in a manner as to not adversely effect the ecology of South Biscayne Bay and Card Sound, Florida. A specific technical approach has not been selected. A selection of performing organ
CONTINUE DISPLAY ?
YES
ization will be based in part on the technical approach proposed.
/ECOLOGY/POWER PLANTS/REMOTE SENSORS/THERMAL POLLUTION/ WATER POLLUTION/WATER TEMPERATURE
2


COMBINE
2+4+5
12
(SENSORS AND RADIOMETERS)
7,179
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIO-METERS
SPECTRORADIOMETERS
BOLOMETERS
FOREST FIRE PROTECTION
4,597
4 SENSOR 2,106
5 SENSORS 511
INTERSECT
12 WITH 10
12 (SENSORS AND RADIOMETERS 7,179
10 WATER POLLUTION 428
13
(SENSING WATER POLLUTION WITH RADIOMETERS)
36
DISPLAY CITATION FROM SET 13
72B10566* Category 4 ARC-10648
72/10/00 UNCLASSIFIED DOCUMENT
DOMESTIC
Assessment of water pollution by airborne measurement of chlorophyll (Remote measurement of chlorophyll concentrations to determine extent of the water pollution is discussed. Construction and operation to provide measurement capability are explained. Diagram of equipment provided.)
A/ARVESEN, J.C; B/WEAVER, E.C.
C/MILLAND, J.P.
/*AERIAL RECONNAISSANCE/*ALGAE/*CHLOROPHYLLS/*GROUND WATER/*HYDROLOGY/*OPTICAL EQUIPMENT/*RADIOMETERS/*REMOTE SENSORS/*TELESCOPES/*WATER POLLUTION
14
AERIAL RECONNAISSANCE
481
THERMAL POLLUTION
DISPLAY EXPANSION
THERMAL NEUTRON 207
THERMAL NEUTRONS 776
THERMAL NOISE 812
THERMAL PLASMA 182
THERMAL PLASMAS 388
THERMAL POLLUTION 47
THERMAL POWER 25
THERMAL PROPERTIES 0
THERMAL PROPERTY 269
THERMAL PROTECTION 910
THERMAL RADIATION 1,878
THERMAL RADIO EMISSION 26
THERMAL REACTORS 88
THERMAL RESISTANCE 915
THERMAL SHIELDING 0
15
THERMAL POLLUTION
54
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
COMBINE
6+14
6 REMOTE SENSORS 2,777
14 AERIAL RECONNAISSANCE 481
COMBINE
9+10+15
9 WATER TEMPERATURE 107
10 WATER POLLUTION 428
15 THERMAL POLLUTION 54
INTERSECT
6+14 WITH 9+10+15
16
(AERIAL RECONNAISSANCE OF THERMAL WATER POLLUTION)
126
COMBINE
2+4+5
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIO-METERS
SPECTRORADIOMETERS
BOLOMETERS
FOREST FIRE PROTECTION
4,597
4 SENSOR 2,106
5 SENSORS 511


3
INTERSECT
2+4+5
WITH 8
8
WATER
8,570
17
(SENSING WATER)
86
INTERSECT
17 WITH 3
3 AIRCRAFT 10,069
17 (SENSING WATER) 86
18
(SENSING WATER WITH AIRCRAFT
1
COMBINE
8+9+10+15
8 WATER 8,570
9 WATER TEMPERATURE 107
10 WATER POLLUTION 428
15 THERMAL POLLUTION 56
INTERSECT
8+9+10+15
WITH 3
3
AIRCRAFT
10,069
19
(AIRCRAFT AND THERMAL WATER POLLUTION)
192
DISPLAY
CITATION
FROM SET 17
71W70817 160-75-78
DEVELOPMENT OF REMOTE SENSING TECHNIQUES TO DETERMINE WATER QUALITY. Goodwin, C. 415-961-1777 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PURPOSE IS TO DEVELOP REMOTE SENSING TECHNIQUES WHICH CAN BE USED TO STUDY THE PRODUCTIVITY, TOXICITY AND TURBUDITY OF WATER BODIES. THE STUDIES WILL PROVIDE A DATA BASE FROM WHICH TO EVALUATE LOCAL AND GLOBAL EFFECTS ON MARINE ECOLOGY DUE TO MAN MADE AND NATURAL POLLUTANTS. APPLICATIONS WILL INCLUDE RAPID DETERMINATION OF PHOTOSYNTHESIS INDUCED PRODUCTIVITY OVER LARGE REGIONS OF
J
J
CONTINUE
DISPLAY
?
YES
THE OCEANS, SURVEYS OF WATER QUALITY FOLLOWING POLLUTION ABATEMENT ACTION, DETERMINATION OF PRESENCE AND EXTENT OF A SURFACE FILM AS A TOXIC AGENT AND TIDAL INTRUSIONS, CURRENTS, AND WATER BODY BOUNDARIES. AIRBORNE MEASUREMENTS WILL BE PERFORMED TO EVALUATE INSTRUMENTATION SUCH AS RECENTLY DEVELOPED DIFFERENTIAL RADIOMETER SYSTEM (DRS) FOR OPERATIONAL USE IN DETERMINING CHLOROPHYLL TURBUDITY AND SURFACE FILMS THROUGH UNIQUE REFLECTANCE OR POLARIZATION CHARACTERISTICS. LABORATORY STUDIES WILL BE CONDUCTED, FOR EXAMPLE, OF THIN FILMS ON THE SURFACE OF WATER UTILIZING ELLIPSOMETRY (POLARIZATION SPECTROSCOPY) TECHNIQUES TO THE REMOTE IDENTIFICATION OF COMPLEX POLLUTANT FILMS ON THE
CONTINUE
DISPLAY
?
YES
SURFACE OF REAL BODIES OF WATER WILL BE INVESTIGATED.
/EARTH RESOURCES/OCEANOGRAPHY/ RADIOMETERS/REMOTE SENSORS/TOXICITY/TRANSPARENCE/TURBIDITY/ WATER
DISPLAY
CITATION
FROM SET 18
67A10315# ISSUE 1 PAGE 108 CATEGORY 20 66/00/00 12 PAGES UNCLASSIFIED DOCUMENT
Double bolometer measurements of the effects of atmospehric ardiators. (Airborne double bolometer technique for deriving atmospheric water vapor profiles by solving radiative transfer equations.)
A/KUHN, P.M.; B/MENNON, V.K.; C/RACOTZKIE, R.A. (AA/ESSA, ATMOSPHERIC ANALYSIS LAB., MADISON, WIS/, AB/WISCONSIN, U., DEPT.OF METEROLOGY, MADISON, WIS./. IN SYMPOSIUM OF REMOTE SENSING OF ENVIRONMENT 4TH, U. OF MICHIGAN, ANN ARBOR, MICHIGAN, APR. 12-14, 1966 PROCEEDINGS. A67-10307 01-13 SYMPOSIUM SPONS
K


K
CONTINUE DISPLAY ?
YES
ORED BY THE U.S. NAVY, OFFICE OF NAVAL RESEARCH AND THE U.S. AIR FORCE, CAMBRIDGE RESEARCH LABS. ANN ARBOR, MICH., U. OF MICHIGAN, INST. OF SCIENCE AND TECHNOLOGY, WILLOW RUN LABS.. INFRARED PHYSICSI LAB., 1966, P. 293-309 9 REFS.
/*AIRBORNE EQUIPMENT/*BOLOMETER/*HUMIDITY/*RADIATION TRANSFER/*WATER VAPOR/
AEROSOL/AIRBORNE/AIRCRAFT/ATMOSPEREIC/CONFERENCE/EQUIPMENT/INFRARED/MOISTURE/POWER/RADIANCE/RADIOMETER/RANGE/SENSOR/SPECTRAL/TRANSFER/VAPOR/WATER
DISPLAY CITATION FROM SET 19
72B10421* CATEGORY 6 ARC-10571
72/08/00 UNCLASSIFIED DOCUMENT
DOMESTIC
Solid amine compounds as sorbents for carbon dioxide: A concept (Solid amine compounds were examined as possible absorbents for removal of carbon dioxide in life support systems of a type which may be employed in high altitude aircraft, spacecraft or submarines. Many solid amine compounds release absorbed carbon dioxide when heated in vacuum, therefore, when properly packaged spent amine compounds can be readily regenerated and put back into service.)
A/SUTTON, J.C.; B/HEIMLICH, P.F.; C/TEPPER, E.H. A/ (Hamilton Std.); B/ (Hamilton Std.); C/ (Hamilton Std.)
/*ABSORBENTS/*ABSORBERS (MATERIALS)/*AIRCRAFT/*AMINES/*CARBON DIOXIDE/*CHEMIC
CONTINUE DISPLAY ?
YES
AL COMPOUNDS/*CHEMICAL REACTIONS/*DEHUMICIFICATION/*LIFE SUPPORT SYSTEMS/*SPACECRAFT/*SUBMARINES/*WATER/*WATER VAPOR
DISPLAY CITATION FROM SET 19
67A8039 66/06/00 28 PAGES
in ITALIAN UNCLASSIFIED DOCUMENT
Characteristics of liquid oxygen of on-board inhalators (a caratteristiche a ell'ossigeno liquido per respiratori di bordo. (Impurities in liquid oxygen used for breathing-toxicity levels and hazards)
A/MARAGONI, C.; B/ROSSI, E.
RIVISTA DI MEDICINA AERONAUTICA E SPAZIALE. VOL. 29, APR-JUN 1966, P. 229-256. 28 REFS. IN ITALIAN.
/*CONTAMINANT/*LIQUID OXYGEN/LOX/*TOXICITY AND SAFETY HAZARD/ACETYLENE/AIRCRAFT/ASPHYXIA/BREATHING/BUTANE/CARBON DIOXIDE/CARBON TETRACHLORIDE/ETHA
CONTINUE DISPLAY ?
YES
NE/ETHYLENE/EXPLOSION/FIRE/FREON/HAZARD/LEVEL/LIQUID/METHANE/OXYGEN/OZONE/PENTANE/POISONING/PROPANE/PROPYLENE/SAFETY/STORAGE/TOXICITY/TRICHLORETHYLENE/WATER
COMBINE 16+17+18
16 (AERIAL RECONNAISSANCE OF THERMAL POLLUTION) 126
17 (SENSING WATER) 86
18 (SENSING WATER WITH AIRCRAFT 1
20
(AERIAL SENSING OF THERMAL WATER POLLUTION)
211
COMBINE 6+19
6 REMOTE SENSORS 2,777
19 AERIAL RECONNAISSANCE 481
COMBINE 9+10+15
9 WATER TEMPERATURE 187
10 WATER POLLUTION 428
15 THERMAL POLLUTION 58
m
4


4
1 m 1
INTERSECT
6+14 WITH
9+10+15
1
21
(REMOTE SENSING OF THERMAL
WATER POLLUTION)
126
COMBINE
2+4+5
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIO-
METERS
BOLOMETERS
FOREST FIRE PROTECTION
4,587
4 SENSOR 2,106
5 SENSORS 511
INTERSECT
2+4+5
WITH 8
1
22
(WATER SENSING DEVICES)
86
INTERSECT
22 WITH 3
22 (WATER SENSING
DEVICES) 86
3 AIRCRAFT 10,089
1
23
(AIRCRAFT WATER SENSING DEVICES)
1
COMBINE
21+22+23
21 (REMOTE SENSING OF
THERMAL WATER
POLLUTION) 126
22 (WATER SENSING
DEVICES) 86
23 (AIRCRAFT WATER
SENSING DEVICES) 1
1 n 1
1 n 1
24
(AIRBORNE SENSING OF THERMAL
WATER POLLUTION)
211
PRINT (REMOTE)
ALL CITATIONS
COMPLETE (211)
PRINT (REMOTE)
ALL ACCESSION
NUMBERS (211)
END
SEARCH

LOGICAL PROCESSES EMPLOYED BY SEARCHER TRP

Searcher TRP is a graduate electrical engineer with many years experience in component and device manufacturing industry. At NC/STRC his specialization has been in biomedical equipment. He is familiar with the NASA file and with RECON.

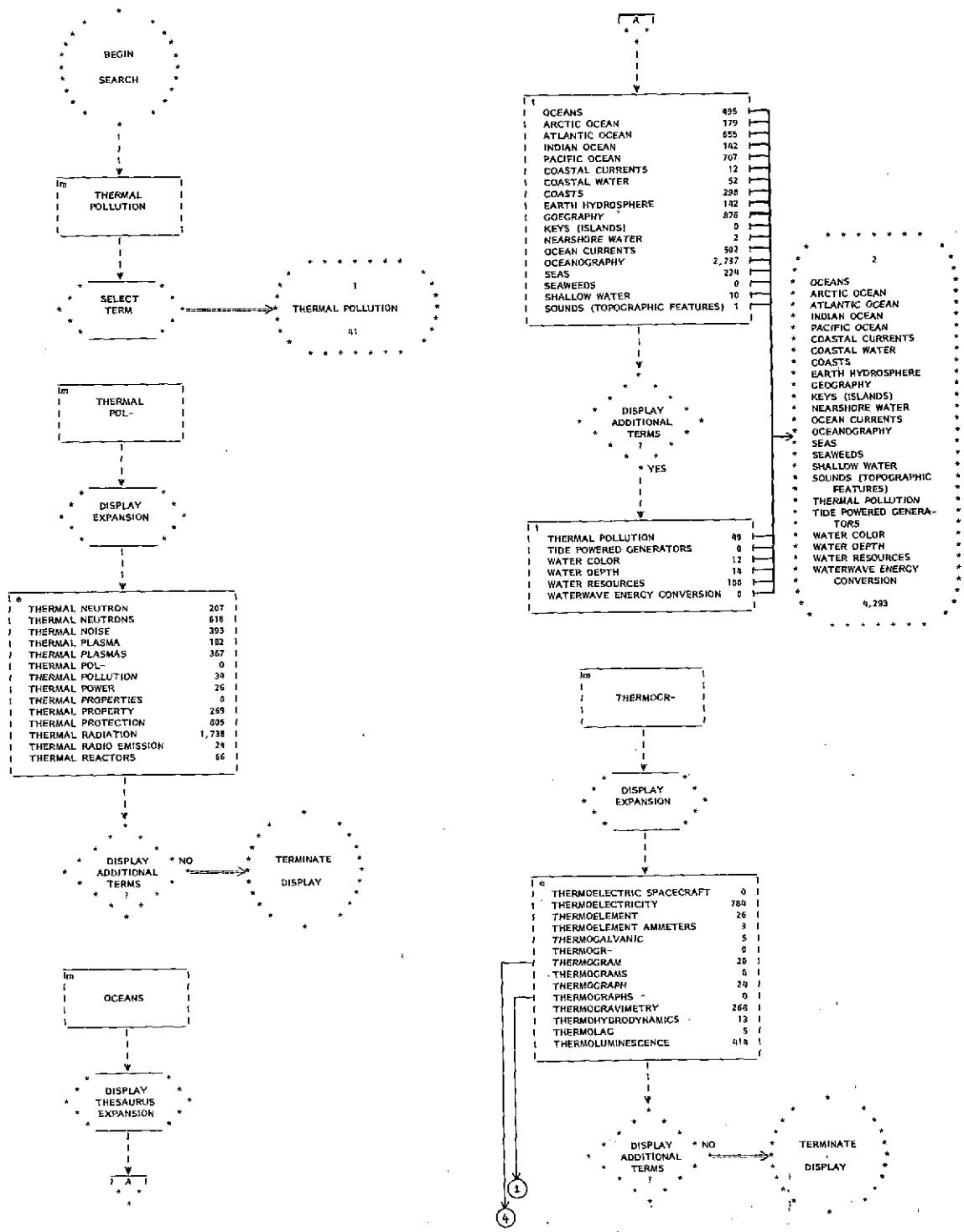
This searcher began his search, Figure 3, by selecting a term associated with the central thrust of the question, "thermal pollution." He then performed a dictionary expansion on the term to see if there was related material of interest, but found none. He then performed a thesaurus expansion on "oceans," and apparently with the idea that since oceans are larger than lakes more reports and papers deal with them. Much of the results, however, would be applicable in either case. From this expansion he selected 24 terms with a total of 4,293 postings to be set 2.

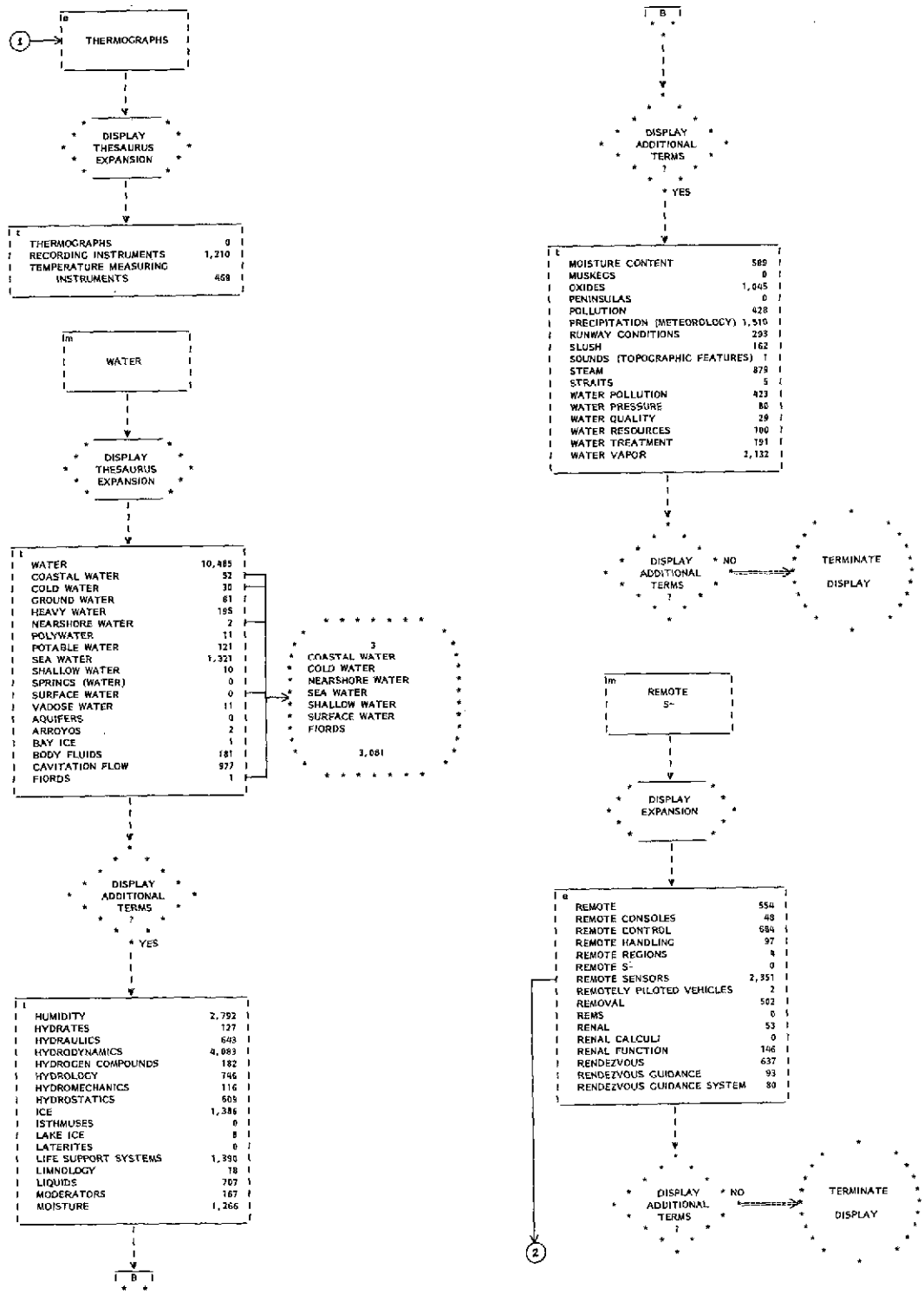
Following this, he asked for a dictionary expansion on the root "thermogr" which relates to the practice of recording temperature measurements. The expansion suggested to him that he make a thesaurus expansion on "thermographs." He decided against using any terms from this expansion, however. From a thesaurus expansion on water he selected 7 terms from which to create set 3. He then moved on to request a dictionary expansion on "remote s-" from which he decided to examine a thesaurus expansion on "remote sensors." This, however, did not seem to be particularly useful.

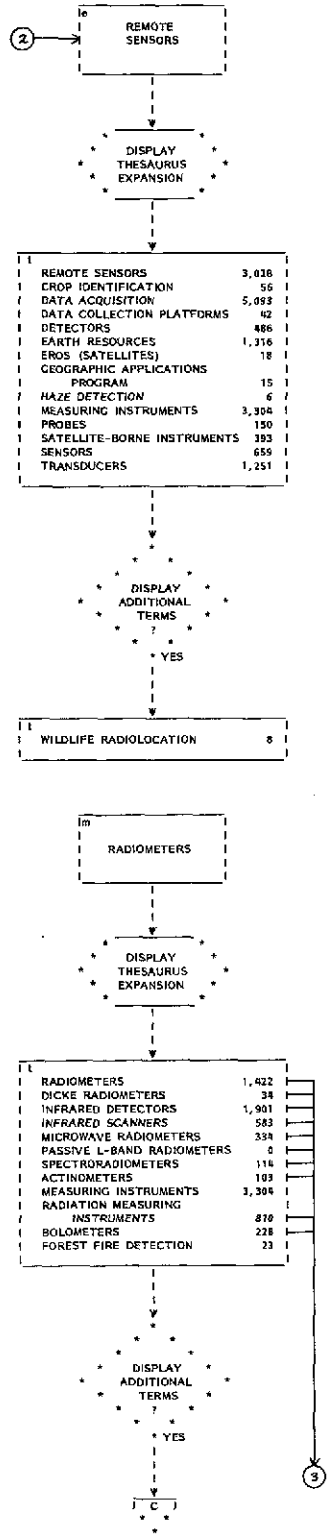
He next called for a thesaurus expansion on "radiometers" from which he selected 11 terms in order to create set 4 with 3,300 postings. At this point he also decided to select "thermograms" as set 5 and "remote sensors" as set 6, probably because he felt that the terms he had now seen under radiometers were no more pertinent than "thermographs" and "remote sensors." He then intersected the union of terms 4 and 6 with the union of terms 1, 2, 3, and 5. This produced set 7 with 626 hits, a respectable body of documents upon which one could probably perform further sorting advantageously. He attempted this by removing ocean radiometry (the intersection of set 4 with the union of sets 2 and 3) from set 7. This left him with 438 hits (set 9). Examination of the first two citations in set 9 indicated that this set was not highly responsive to the question.

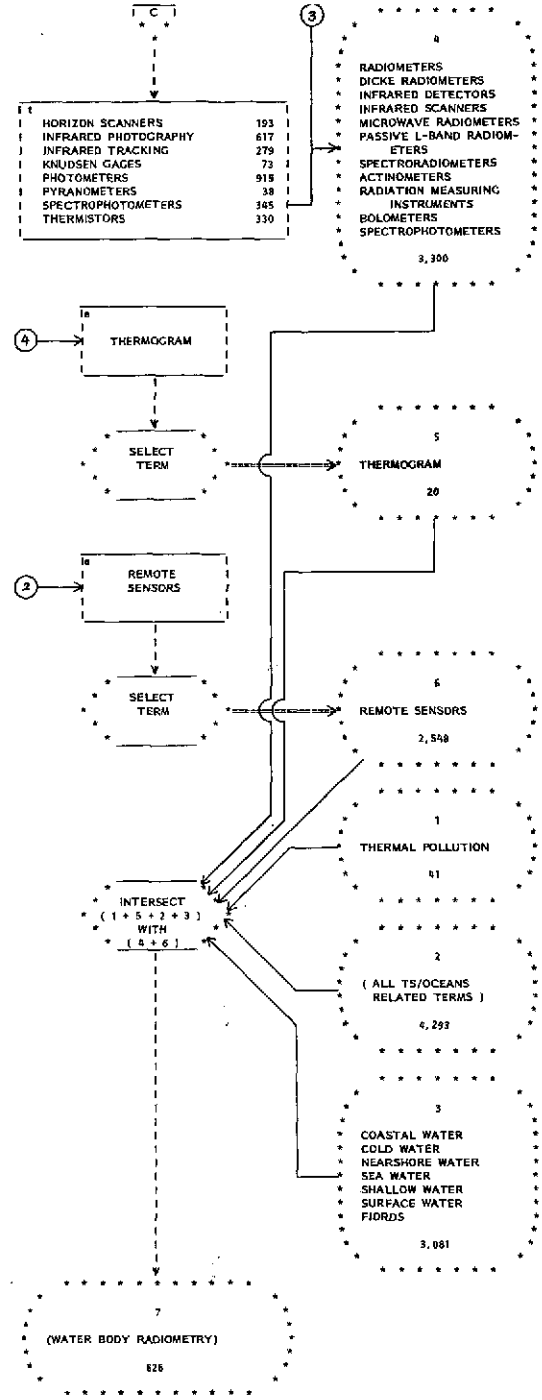
The searcher then felt that he should probably attack the problem along the lines of "temperature measurement." This expansion was not fruitful so he fell back to the base term "temperature." From this expansion he selected 14 terms with 43,078 postings as set 10 and another 14 terms with 6,332 postings as set 11. He had some second thoughts, however, about operating on such a large group of postings and recreated a display centered about "temperature field" from which he selected what he considered to be the most pertinent terms (8 with 13,146 postings) in order to form set 13. He then intersected this with set 6 (remote sensors) and added to this result the items deleted from set 9 dealing with radiometry of oceans (set 8). The resulting set of 319 documents he called his final hit list. Of the 319 hits, 97 or 30.4% were relevant. These 97 constituted 25% of the relevant documents found by all searches. Fourteen of the 97 relevant hits were unique to this search.

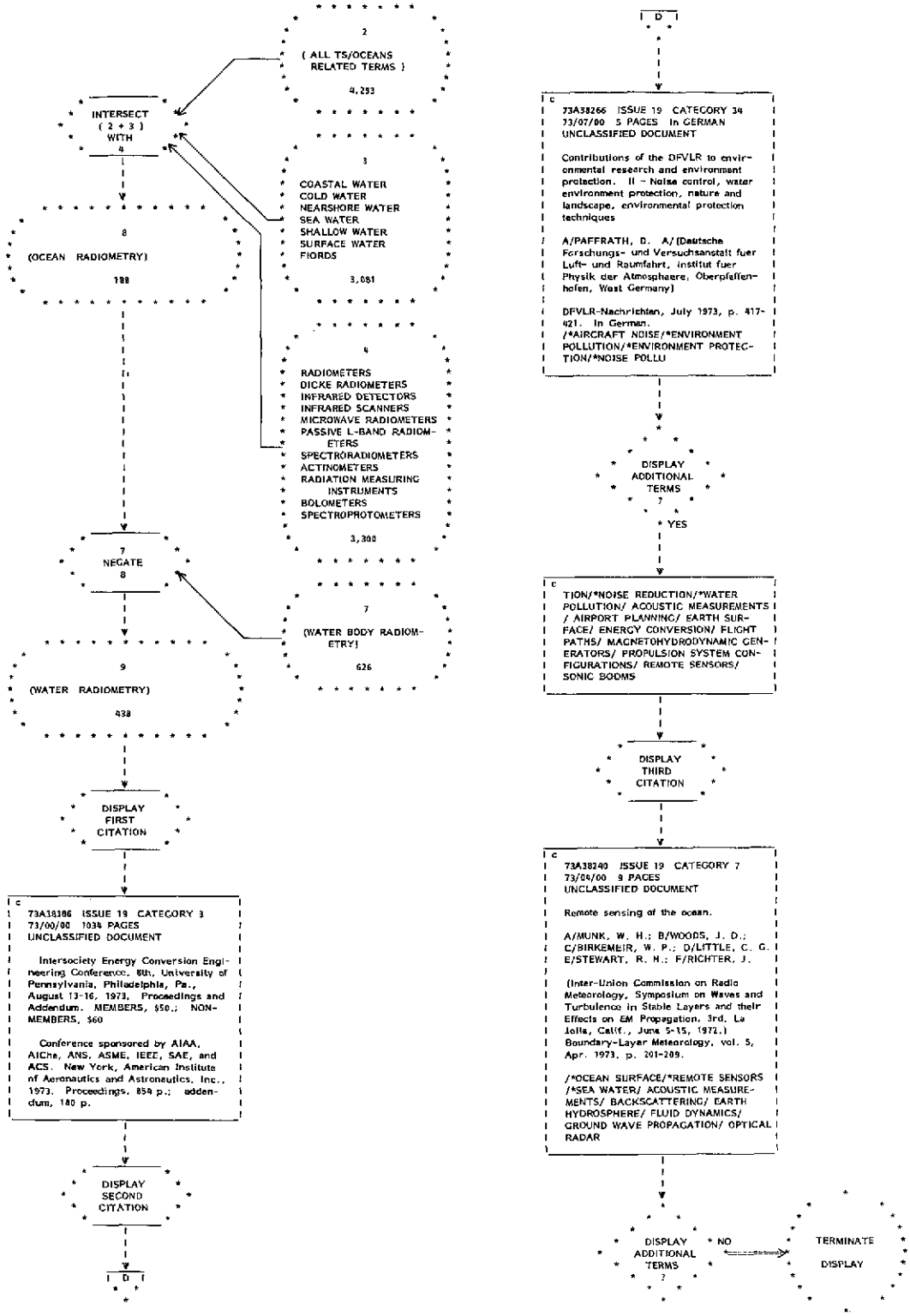
FIGURE 3

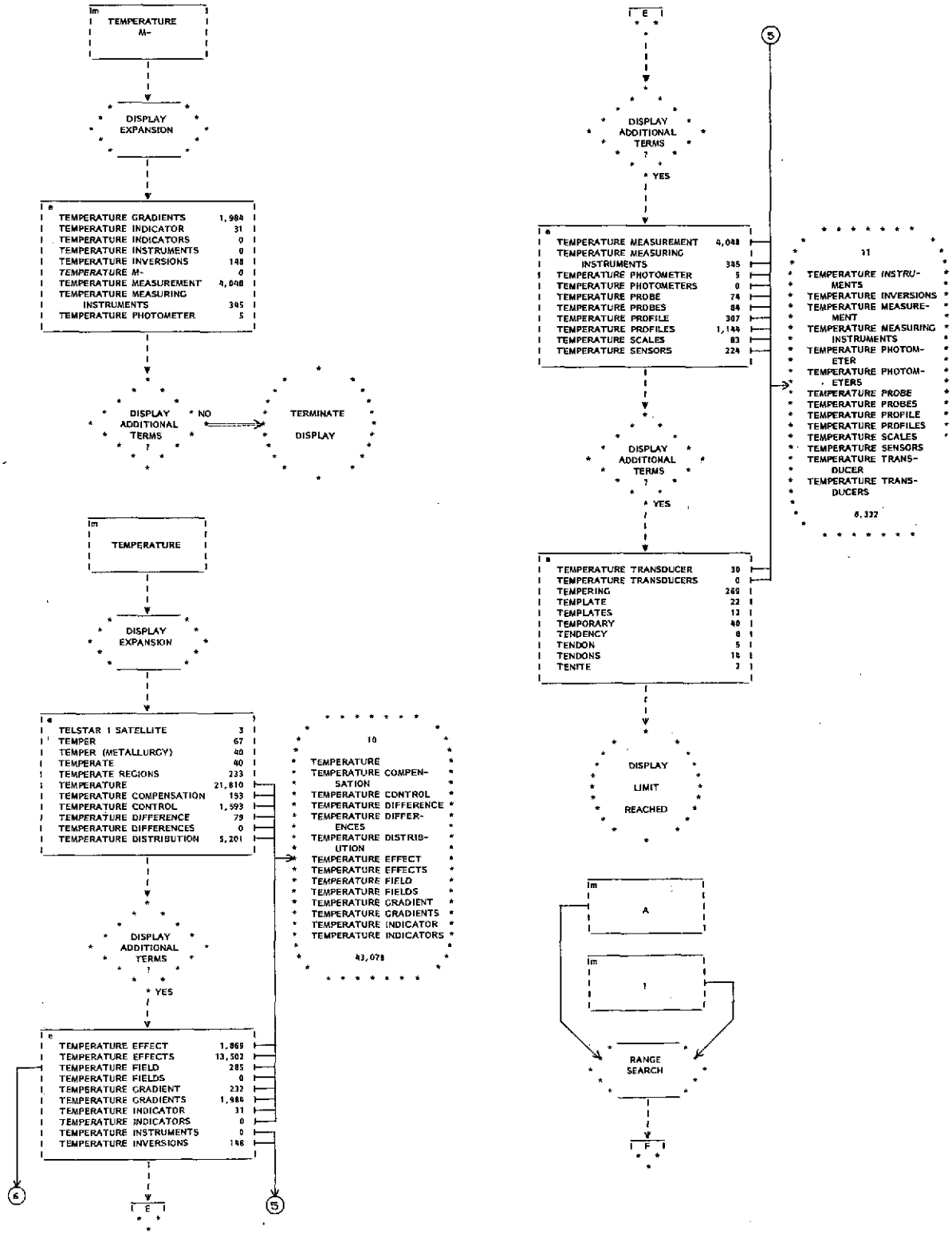

BEGIN SEARCH
THERMAL POLLUTION
SELECT TERM
1
THERMAL POLLUTION
41
THERMAL POL-
DISPLAY EXPANSION
THERMAL NEUTRON 267
THERMAL NEUTRONS 618
THERMAL NOISE 393
THERMAL PLASMA 182
THERMAL PLASMAS 367
THERMAL POL- 0
THERMAL POLLUTION 39
THERMAL POWER 26
THERMAL PROPERTIES 0
THERMAL PROPERTY 269
THERMAL PROTECTION 605
THERMAL RADIATION 1,738
THERMAL RADIO EMISSION 24
THERMAL REACTORS 66
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
OCEANS
DISPLAY THESAURUS EXPANSION
A
A
OCEANS 495
ARCTIC OCEAN 179
ATLANTIC OCEAN 855
INDIAN OCEAN 142
PACIFIC OCEAN 707
COASTAL CURRENTS 12
COASTAL WATER 52
COASTS 298
EARTH HYDROSPHERE 142
GOEGRAPHY 878
KEYS (ISLANDS) 0
NEARSHORE WATER 2
OCEAN CURRENTS 583
OCEANOGRAPHY 2,737
SEAS 224
SEAWEEDS 0
SHALLOW WATER 10
SOUNDS (TOPOGRAPHIC FEATURES) 1
DISPLAY ADDITIONAL TERMS ?
YES
THERMAL POLLUTION 49
TIDE POWERED GENERATORS 0
WATER COLOR 12
WATER DEPTH 14
WATER RESOURCES 108
WATERWAVE ENERGY CONVERSION 0
2
OCEANS
ARCTIC OCEAN
ATLANTIC OCEAN
INDIAN OCEAN
PACIFIC OCEAN
COASTAL CURRENTS
COASTAL WATER
COASTS
EARTH HYDROSPHERE
GEOGRAPHY
KEYS (ISLANDS)
NEARSHORE WATER
OCEAN CURRENTS
OCEANOGRAPHY
SEAS
SEAWEEDS
SHALLOW WATER
SOUNDS (TOPOGRAPHIC FEATURES)
THERMAL POLLUTION
TIDE POWERED GENERATORS
WATER COLOR
WATER DEPTH
WATER RESOURCES
WATERWAVE ENERGY CONVERSION
4,293
THERMOGR-
DISPLAY EXPANSION
THERMOELECTRIC SPACECRAFT 0
THERMOELECTRICITY 784
THERMOELEMENT 26
THERMOELEMENT AMMETERS 3
THERMOGALVANIC 5
THERMOGR- 0
THERMOGRAM 20
THERMOGRAMS 6
THERMOGRAPH 24
THERMOGRAPHS 0
THERMOGRAVIMETRY 268
THERMOHYDRODYNAMICS 13
THERMOLAG 5
THERMOLUMINESCENCE 418
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
1
4

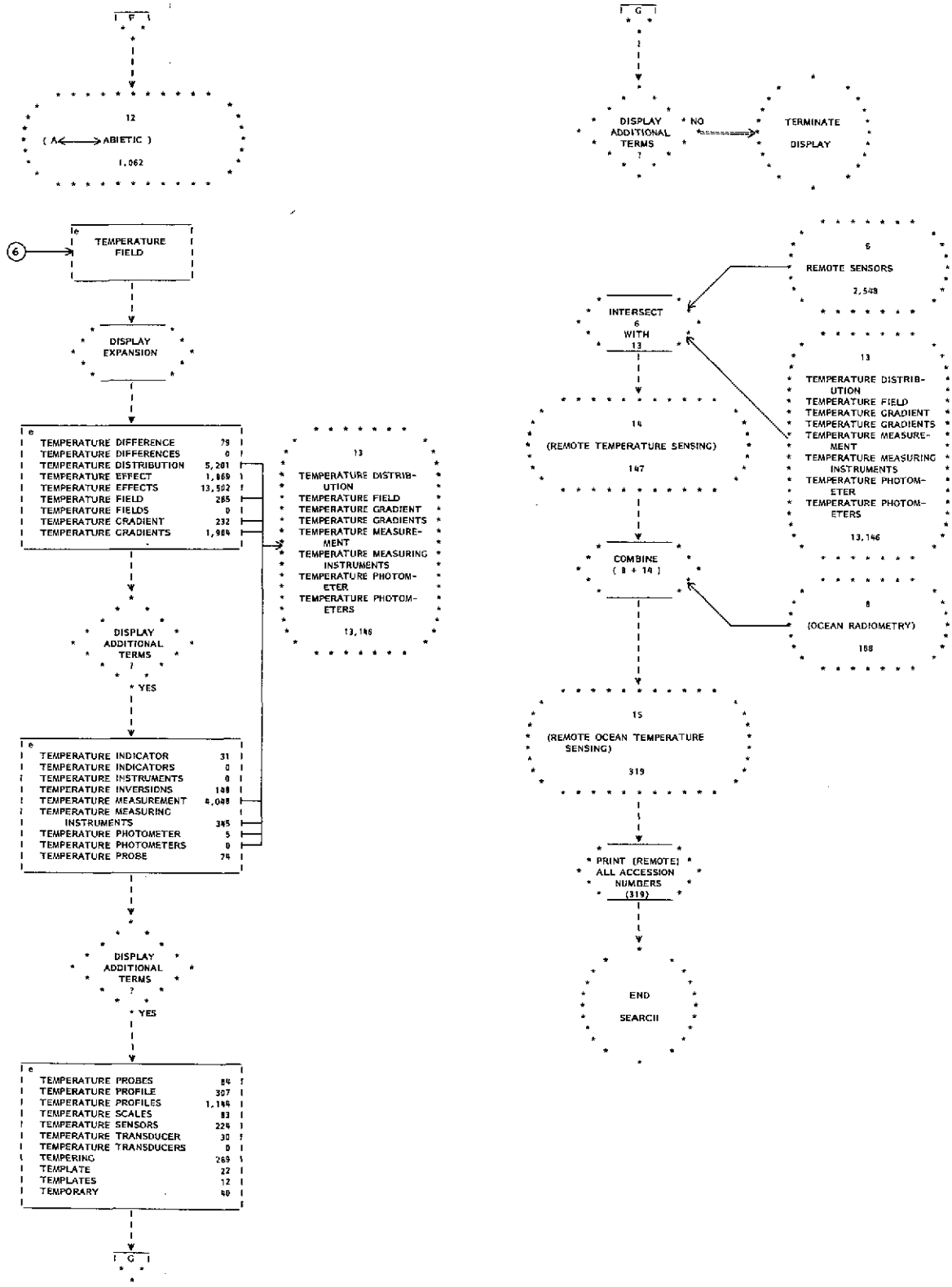

1
THERMOGRAPHS
DISPLAY THESAURUS EXPANSION
THERMOGRAPHS 0
RECORDING INSTRUMENTS 1,210
TEMPERATURE MEASURING INSTRUMENTS 469
WATER
DISPLAY THESAURUS EXPANSION
WATER 10,485
COASTAL WATER 52
COLD WATER 30
GROUND WATER 61
HEAVY WATER 195
NEARSHORE WATER 2
POLYWATER 11
POTABLE WATER 121
SEA WATER 1,321
SHALLOW WATER 10
SPRINGS (WATER) 0
SURFACE WATER 0
VADOSE WATER 11
AQUIFERS 0
ARROYOS 2
BAY ICE 1
BODY FLUIDS 181
CAVITATION FLOW 977
FIORDS 1
3
COASTAL WATER
COLD WATER
NEARSHORE WATER
SEA WATER
SHALLOW WATER
SURFACE WATER
FIORDS
3,081
DISPLAY ADDITIONAL TERMS
YES
HUMIDITY 2,792
HYDRATES 127
HYDRAULICS 648
HYDRODYNAMICS 4,089
HYDROGEN COMPOUNDS 182
HYDROLOGY 746
HYDROMECHANICS 116
HYDROSTATICS 609
ICE 1,386
ISTHMUSES 0
LAKE ICE 8
LATERITES 0
LIFE SUPPORT SYSTEMS 1,390
LIMNOLOGY 78
LIQUIDS 707
MODERATORS 167
MOISTURE 1,266
B
B
DISPLAY ADDITIONAL TERMS
YES
MOISTURE CONTENT 589
MUSKEGS 0
OXIDES 1,045
PENINSULAS 0
POLLUTION 428
PRECIPITATION (METEOROLOGY) 1,510
RUNWAY CONDITIONS 293
SLUSH 162
SOUNDS (TOPOGRAPHIC FEATURES) 1
STEAM 879
STRAITS 5
WATER POLLUTION 423
WATER PRESSURE 80
WATER QUALITY 29
WATER RESOURCES 700
WATER TREATMENT 191
WATER VAPOR 2,132
DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
REMOTE S-
DISPLAY EXPANSION
REMOTE 554
REMOTE CONSOLES 48
REMOTE CONTROL 684
REMOTE HANDLING 97
REMOTE REGIONS 8
REMOTE S- 0
REMOTE SENSORS 2,351
REMOTELY PILOTED VEHICLES 2
REMOVAL 502
REMS 0
RENAL 53
RENAL CALCULI 0
RENAL FUNCTION 146
RENDEZVOUS 637
RENDEZVOUS GUIDANCE 93
RENDEZVOUS GUIDANCE SYSTEM 80
DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
2


2
1e
REMOTE SENSORS
DISPLAY THESAURUS EXPANSION
REMOTE SENSORS 3,036
CROP IDENTIFICATION 56
DATA ACQUISITION 5,093
DATA COLLECTION PLATFORMS 42
DETECTORS 486
EARTH RESOURCES 1,316
EROS (SATELLITES) 18
GEOGRAPHIC APPLICATIONS PROGRAM 15
HAZE DETECTION 6
MEASURING INSTRUMENTS 3,304
PROBES 150
SATELLITE-BORNE INSTRUMENTS 393
SENSORS 659
TRANSDUCERS 1,251
DISPLAY ADDITIONAL TERMS ?
YES
WILDLIFE RADIOLOCATION 8
1m
RADIOMETERS
DISPLAY THESAURUS EXPANSION
RADIOMETERS 1,422
DICKE RADIOMETERS 38
INFRARED DETECTORS 1,901
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 338
PASSIVE L-BAND RADIOMETERS 0
SPECTRORADIOMETERS 114
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 870
BOLOMETERS 228
FOREST FIRE DETECTION 23
DISPLAY ADDITIONAL TERMS ?
YES
C
3


C
3
4
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
ACTINOMETERS
RADIATION MEASURING INSTRUMENTS
BOLOMETERS
SPECTROPHOTOMETERS
3,300
HORIZON SCANNERS 193
INFRARED PHOTOGRAPHY 617
INFRARED TRACKING 279
KNUDSEN GAGES 73
PHOTOMETERS 915
PYRANOMETERS 38
SPECTROPHOTOMETERS 345
THERMISTORS 330
4
1e
THERMOGRAM
SELECT TERM
5
THERMOGRAM
20
2
1e
REMOTE SENSORS
SELECT TERM
6
REMOTE SENSORS
2,548
1
THERMAL POLLUTION
41
INTERSECT (1 + 5 + 2 + 3) WITH (4 + 6)
2
(ALL TS/OCEANS RELATED TERMS)
4,293
3
COASTAL WATER
COLD WATER
NEARSHORE WATER
SEA WATER
SHALLOW WATER
SURFACE WATER
FIORDS
3,081
7
(WATER BODY RADIOMETRY)
626


2
(ALL TS/OCEANS RELATED TERMS)
4,253
INTERSECT (2 + 3) WITH 4
3
COASTAL WATER
COLD WATER
NEARSHORE WATER
SEA WATER
SHALLOW WATER
SURFACE WATER
FIORDS
3,081
8
(OCEAN RADIOMETRY)
198
4
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
ACTINOMETERS
RADIATION MEASURING INSTRUMENTS
BOLOMETERS
SPECTROPROTOMETERS
3,300
7
NEGATE 8
7
(WATER BODY RADIOMETRY)
626
9
(WATER RADIOMETRY)
438
DISPLAY FIRST CITATION
c
73A18186 ISSUE 19 CATEGORY 3
73/00/00 1034 PAGES
UNCLASSIFIED DOCUMENT
Intersociety Energy Conversion Engineering Conference, 8th, University of Pennsylvania, Philadelphia, Pa., August 13-16, 1973. Proceedings and Addendum. MEMBERS, $50.; NONMEMBERS, $60
Conference sponsored by AIAA, AIChe, ANS, ASME, IEEE, SAE, and ACS. New York, American Institute of Aeronautics and Astronautics, Inc., 1973. Proceedings, 859 p.; addendum, 180 p.
DISPLAY SECOND CITATION
D
D
c
73A38266 ISSUE 19 CATEGORY 34
73/07/00 5 PAGES In GERMAN
UNCLASSIFIED DOCUMENT
Contributions of the DFVLR to environmental research and environment protection. II - Noise control, water environment protection, nature and landscape, environmental protection techniques
A/PAFFRATH, D. A/(Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Physik der Atmosphaere, Oberpfaffenhofen, West Germany)
DFVLR-Nachrichten, July 1973, p. 417-421. In German.
/*AIRCRAFT NOISE/*ENVIRONMENT POLLUTION/*ENVIRONMENT PROTECTION/*NOISE POLLU
DISPLAY ADDITIONAL TERMS ?
YES
c
TION/*NOISE REDUCTION/*WATER POLLUTION/ ACOUSTIC MEASUREMENTS / AIRPORT PLANNING/ EARTH SURFACE/ ENERGY CONVERSION/ FLIGHT PATHS/ MAGNETOHYDRODYNAMIC GENERATORS/ PROPULSION SYSTEM CONFIGURATIONS/ REMOTE SENSORS/ SONIC BOOMS
DISPLAY THIRD CITATION
c
73A38240 ISSUE 19 CATEGORY 7
73/04/00 9 PAGES
UNCLASSIFIED DOCUMENT
Remote sensing of the ocean.
A/MUNK, W. H.; B/WOODS, J. D.; C/BIRKEMEIR, W. P.; D/LITTLE, C. G. E/STEWART, R. H.; F/RICHTER, J.
(Inter-Union Commission on Radio Meteorology, Symposium on Waves and Turbulence in Stable Layers and their Effects on EM Propagation, 3rd, La Jolla, Calif., June 5-15, 1972.) Boundary-Layer Meteorology, vol. 5, Apr. 1973, p. 201-209.
/*OCEAN SURFACE/*REMOTE SENSORS /*SEA WATER/ ACOUSTIC MEASUREMENTS/ BACKSCATTERING/ EARTH HYDROSPHERE/ FLUID DYNAMICS/ GROUND WAVE PROPAGATION/ OPTICAL RADAR
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY


TEMPERATURE M-
DISPLAY EXPANSION
TEMPERATURE GRADIENTS 1,984
TEMPERATURE INDICATOR 31
TEMPERATURE INDICATORS 0
TEMPERATURE INSTRUMENTS 0
TEMPERATURE INVERSIONS 148
TEMPERATURE M- 0
TEMPERATURE MEASUREMENT 4,048
TEMPERATURE MEASURING INSTRUMENTS 345
TEMPERATURE PHOTOMETER 5
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
TEMPERATURE
DISPLAY EXPANSION
TELSTAR 1 SATELLITE 3
TEMPER 67
TEMPER (METALLURGY) 40
TEMPERATE 40
TEMPERATE REGIONS 233
TEMPERATURE 21,810
TEMPERATURE COMPENSATION 193
TEMPERATURE CONTROL 1,593
TEMPERATURE DIFFERENCE 79
TEMPERATURE DIFFERENCES 0
TEMPERATURE DISTRIBUTION 5,201
10
TEMPERATURE
TEMPERATURE COMPENSATION
TEMPERATURE CONTROL
TEMPERATURE DIFFERENCE
TEMPERATURE DIFFERENCES
TEMPERATURE DISTRIBUTION
TEMPERATURE EFFECT
TEMPERATURE EFFECTS
TEMPERATURE FIELD
TEMPERATURE FIELDS
TEMPERATURE GRADIENT
TEMPERATURE GRADIENTS
TEMPERATURE INDICATOR
TEMPERATURE INDICATORS
43,078
DISPLAY ADDITIONAL TERMS ?
YES
TEMPERATURE EFFECT 1,869
TEMPERATURE EFFECTS 13,502
TEMPERATURE FIELD 285
TEMPERATURE FIELDS 0
TEMPERATURE GRADIENT 232
TEMPERATURE GRADIENTS 1,984
TEMPERATURE INDICATOR 31
TEMPERATURE INDICATORS 0
TEMPERATURE INSTRUMENTS 0
TEMPERATURE INVERSIONS 148
E
6
5
E
DISPLAY ADDITIONAL TERMS ?
YES
TEMPERATURE MEASUREMENT 4,048
TEMPERATURE MEASURING INSTRUMENTS 345
TEMPERATURE PHOTOMETER 5
TEMPERATURE PHOTOMETERS 0
TEMPERATURE PROBE 74
TEMPERATURE PROBES 84
TEMPERATURE PROFILE 307
TEMPERATURE PROFILES 1,144
TEMPERATURE SCALES 83
TEMPERATURE SENSORS 224
11
TEMPERATURE INSTRUMENTS
TEMPERATURE INVERSIONS
TEMPERATURE MEASUREMENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE PHOTOMETER
TEMPERATURE PHOTOMETERS
TEMPERATURE PROBE
TEMPERATURE PROBES
TEMPERATURE PROFILE
TEMPERATURE PROFILES
TEMPERATURE SCALES
TEMPERATURE SENSORS
TEMPERATURE TRANSDUCER
TEMPERATURE TRANSDUCERS
6,332
DISPLAY ADDITIONAL TERMS ?
YES
TEMPERATURE TRANSDUCER 30
TEMPERATURE TRANSDUCERS 0
TEMPERING 269
TEMPLATE 22
TEMPLATES 13
TEMPORARY 40
TENDENCY 0
TENDON 5
TENDONS 15
TENITE 2
DISPLAY LIMIT REACHED
A
1
RANGE SEARCH
F
5


F
12
(A ABIETIC)
1,062
6
TEMPERATURE FIELD
DISPLAY EXPANSION
TEMPERATURE DIFFERENCE 79
TEMPERATURE DIFFERENCES 0
TEMPERATURE DISTRIBUTION 5,201
TEMPERATURE EFFECT 1,869
TEMPERATURE EFFECTS 13,502
TEMPERATURE FIELD 285
TEMPERATURE FIELDS 0
TEMPERATURE GRADIENT 232
TEMPERATURE GRADIENTS 1,984
13
TEMPERATURE DISTRIB-UTION
TEMPERATURE FIELD
TEMPERATURE GRADIENT
TEMPERATURE GRADIENTS
TEMPERATURE MEASURE-MENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE PHOTOM-ETER
TEMPERATURE PHOTOM-ETERS
13,146
DISPLAY ADDITIONAL TERMS ?
YES
TEMPERATURE INDICATOR 31
TEMPERATURE INDICATORS 0
TEMPERATURE INSTRUMENTS 0
TEMPERATURE INVERSIONS 148
TEMPERATURE MEASUREMENT 8,048
TEMPERATURE MEASURING INSTRUMENTS 385
TEMPERATURE PHOTOMETER 5
TEMPERATURE PHOTOMETERS 0
TEMPERATURE PROBE 74
DISPLAY ADDITIONAL TERMS ?
YES
TEMPERATURE PROBES 86
TEMPERATURE PROFILE 307
TEMPERATURE PROFILES 1,146
TEMPERATURE SCALES 83
TEMPERATURE SENSORS 224
TEMPERATURE TRANSDUCER 30
TEMPERATURE TRANSDUCERS 0
TEMPERING 269
TEMPLATE 22
TEMPLATES 12
TEMPORARY 40
G
G
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
5
REMOTE SENSORS
2,548
INTERSECT 6 WITH 13
13
TEMPERATURE DISTRIB-UTION
TEMPERATURE FIELD
TEMPERATURE GRADIENT
TEMPERATURE GRADIENTS
TEMPERATURE MEASURE-MENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE PHOTOM-ETER
TEMPERATURE PHOTOM-ETERS
13,146
14
(REMOTE TEMPERATURE SENSING)
147
COMBINE (8 + 14)
8
(OCEAN RADIOMETRY)
188
15
(REMOTE OCEAN TEMPERATURE SENSING)
319
PRINT (REMOTE) ALL ACCESSION NUMBERS (319)
END SEARCH

LOGICAL PROCESSES EMPLOYED BY SEARCHER SRW

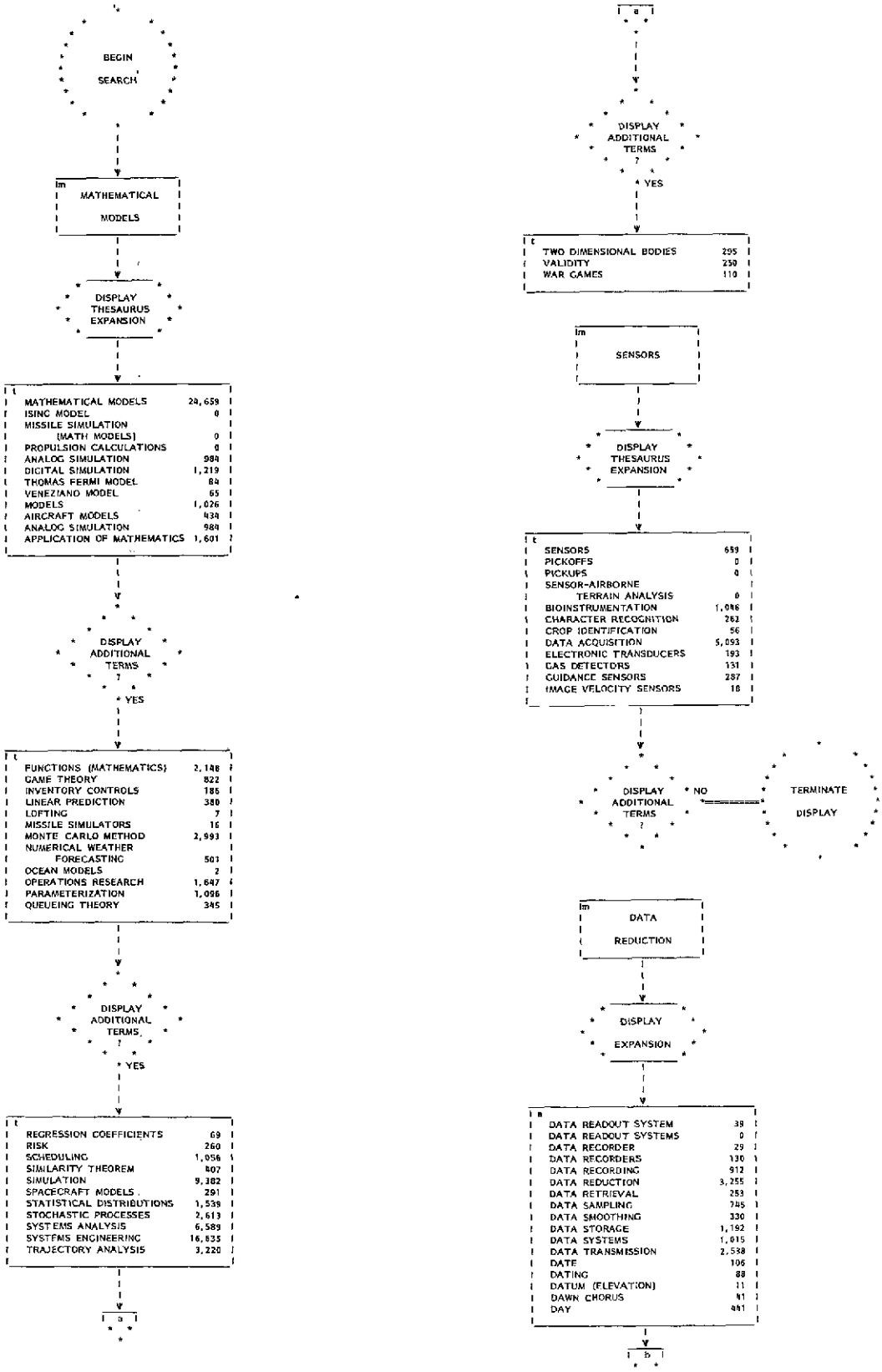
Searcher SRW is a graduate in English Education and is employed by NC/STRC in providing search service primarily to the education community and in general marketing. He is familiar with search techniques and philosophy and, to some extent, with the NASA file. He has no formal background, however.

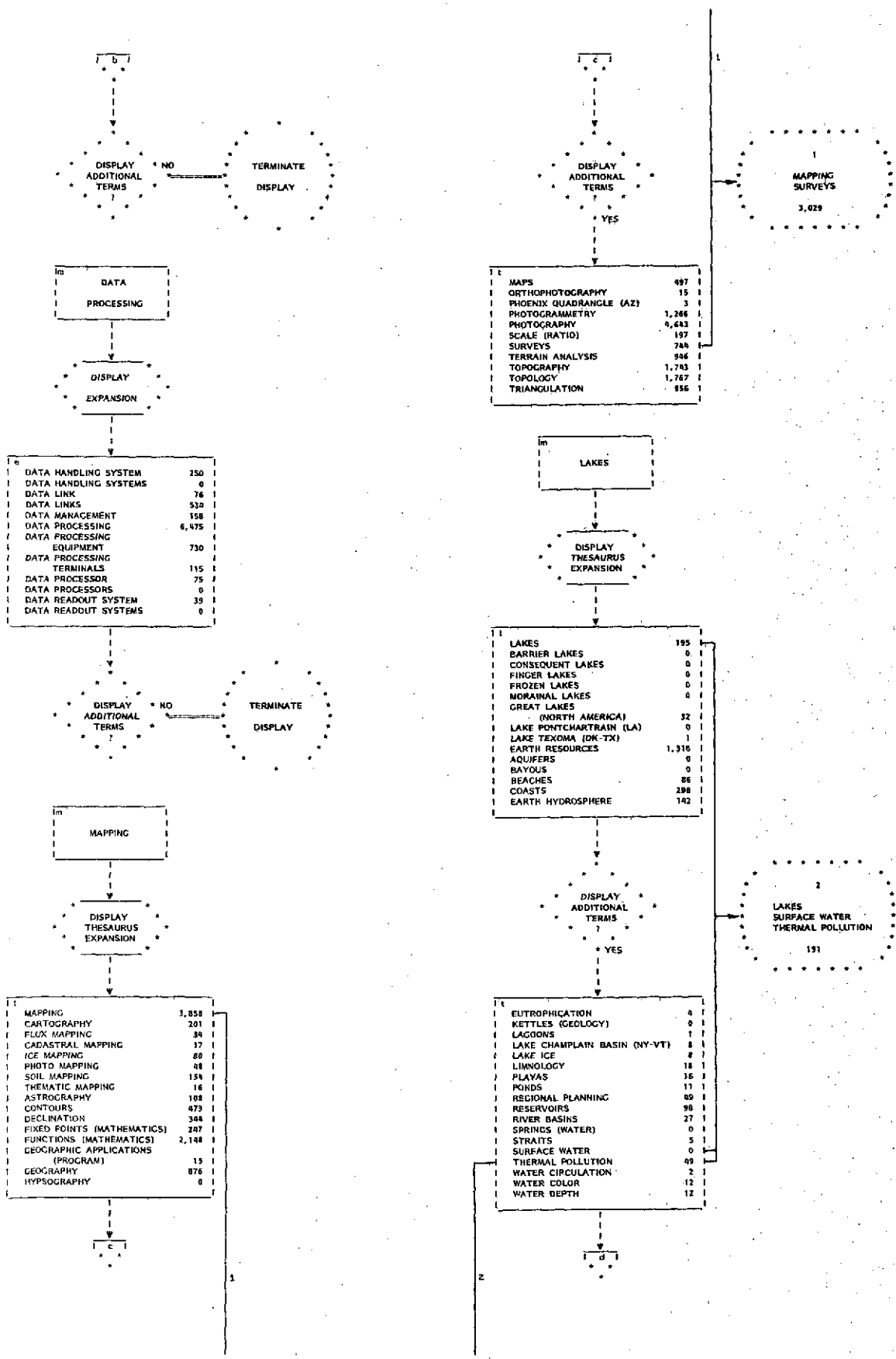
He began his search, Figure 4, with a thesaurus expansion on mathematical models. This concept, of course, is related to the interpretation of the sensor output. It is a bit strange, however, to begin at this point. He continued the expansion to its end without finding any terms he felt would be suitable. He then tried the idea of sensors. The thesaurus expansion did not seem to him to be particularly fruitful and was terminated after the initial display. He then moved to the idea of data reduction. The dictionary expansion here did not appear to be useful nor did a subsequent expansion on "data processing."

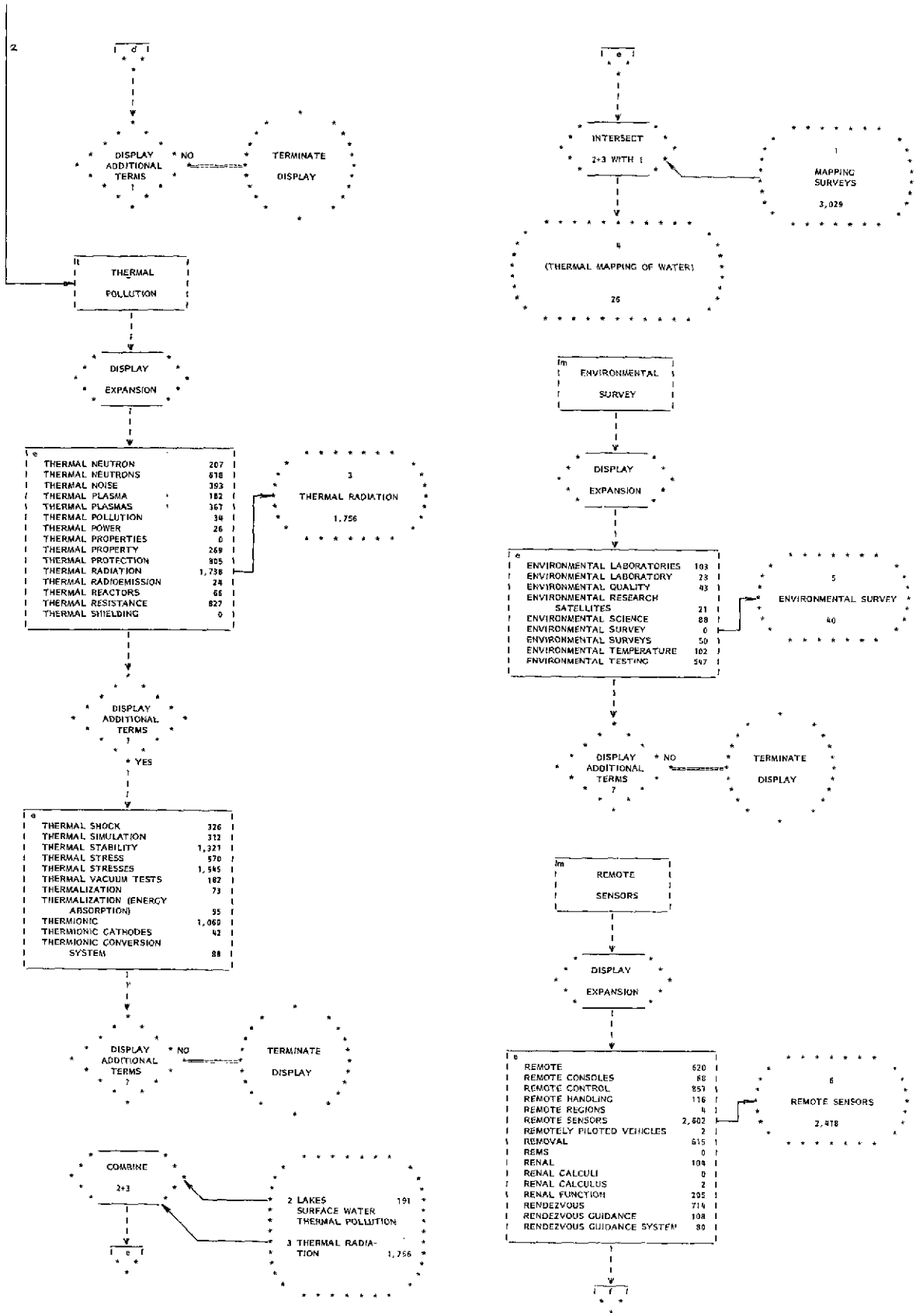
After drawing a blank from this line of questioning, the searcher moved to the area of mapping. From the thesaurus expansion, he picked the generating term along with "surveys" as set 1. A thesaurus expansion on "lakes" yielded three terms, "lakes," "surface water," and "thermal pollution" from which he formed set 2. Since thermal pollution was precisely the thing whose measurement was sought, he also tried a dictionary expansion on that term. From this expansion he selected "thermal radiation" as set 3. He then combined sets 2 and 3 and intersected this union with set 1 to obtain 26 items (set 4) dealing with mapping of lakes and thermal pollution.

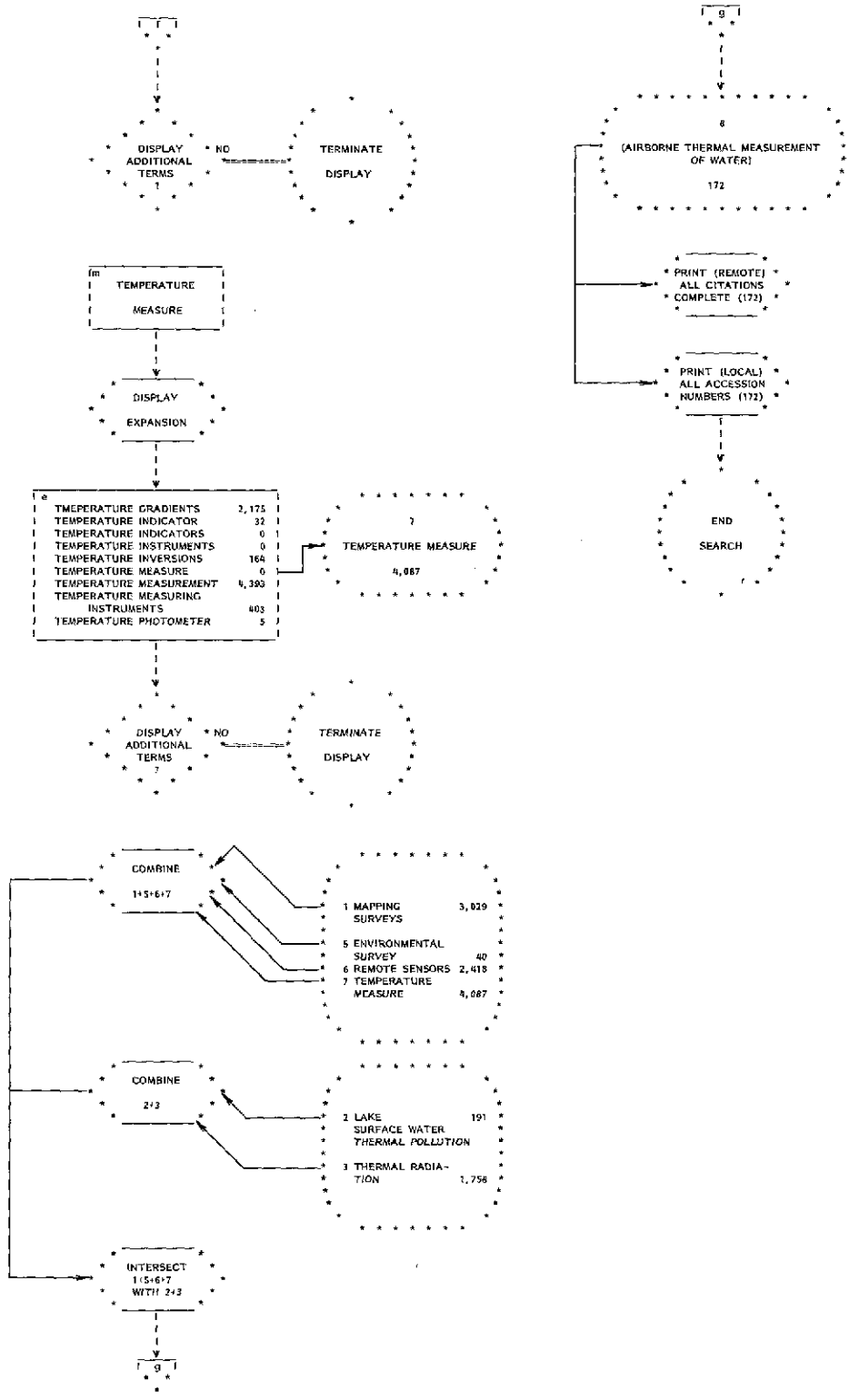
Searcher SRW then examined the dictionary expansion on "remote sensors," selecting only the generating term as set 6. One other expansion occurred to him: "temperature measurement." This became set 7. Combining sets 1, 5, 6, and 7, he intersected these with the union of sets 2 and 3. Note that this is an expanded version of set 4. The 172 hits obtained from set 8 were selected as the final hit list. Forty-eight of these were regarded as pertinent by the experiment director. Thus while 27.9% of the hits were relevant, only 12.4% of those identified in the collection as being pertinent were recovered. Fourteen of the pertinent hits (or almost 30%) were not recovered by any other search.

FIGURE 4


BEGIN SEARCH
im
MATHEMATICAL MODELS
DISPLAY THESAURUS EXPANSION
t
MATHEMATICAL MODELS 24,659
ISING MODEL 0
MISSILE SIMULATION (MATH MODELS) 0
PROPULSION CALCULATIONS 0
ANALOG SIMULATION 984
DIGITAL SIMULATION 1,219
THOMAS FERMI MODEL 84
VENEZIANO MODEL 65
MODELS 1,026
AIRCRAFT MODELS 434
ANALOG SIMULATION 984
APPLICATION OF MATHEMATICS 1,601
DISPLAY ADDITIONAL TERMS ?
YES
t
FUNCTIONS (MATHEMATICS) 2,148
GAME THEORY 822
INVENTORY CONTROLS 185
LINEAR PREDICTION 380
LOFTING 7
MISSILE SIMULATORS 16
MONTE CARLO METHOD 2,993
NUMERICAL WEATHER FORECASTING 501
OCEAN MODELS 2
OPERATIONS RESEARCH 1,647
PARAMETERIZATION 1,096
QUEUEING THEORY 345
DISPLAY ADDITIONAL TERMS ?
YES
t
REGRESSION COEFFICIENTS 69
RISK 260
SCHEDULING 1,056
SIMILARITY THEOREM 407
SIMULATION 9,382
SPACECRAFT MODELS 291
STATISTICAL DISTRIBUTIONS 1,539
STOCHASTIC PROCESSES 2,613
SYSTEMS ANALYSIS 6,589
SYSTEMS ENGINEERING 16,833
TRAJECTORY ANALYSIS 3,220
a
a
DISPLAY ADDITIONAL TERMS ?
YES
t
TWO DIMENSIONAL BODIES 295
VALIDITY 250
WAR GAMES 110
im
SENSORS
DISPLAY THESAURUS EXPANSION
t
SENSORS 659
PICKOFFS 0
PICKUPS 0
SENSOR-AIRBORNE TERRAIN ANALYSIS 0
BIOINSTRUMENTATION 1,086
CHARACTER RECOGNITION 262
CROP IDENTIFICATION 56
DATA ACQUISITION 5,093
ELECTRONIC TRANSDUCERS 193
GAS DETECTRS 131
GUIDANCE SENSORS 287
IMAGE VELOCITY SENSORS 18
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
im
DATA REDUCTION
DISPLAY EXPANSION
a
DATA READOUT SYSTEM 38
DATA READOUT SYSTEMS 0
DATA RECORDER 29
DATA RECORDERS 130
DATA RECORDING 912
DATA REDUCTION 3,255
DATA RETRIEVAL 253
DATA SAMPLING 745
DATA SMOOTHING 330
DATA STORAGE 1,192
DATA SYSTEMS 1,015
DATA TRANSMISSION 2,538
DATE 106
DATING 88
DATUM (ELEVATION) 11
DAWN CHORUS 41
DAY 441
b
b


b
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
DATA PROCESSING
DISPLAY EXPANSION
DATA HANDLING SYSTEM 250
DATA HANDLING SYSTEMS 0
DATA LINK 76
DATA LINKS 530
DATA MANAGEMENT 158
DATA PROCESSING 6,475
DATA PROCESSING EQUIPMENT 730
DATA PROCESSING TERMINALS 115
DATA PROCESSOR 75
DATA PROCESSORS 0
DATA READOUT SYSTEM 39
DATA READOUT SYSTEMS 0
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
MAPPING
DISPLAY THESAURUS EXPANSION
MAPPING 3,858
CARTOGRAPHY 201
FLUX MAPPING 39
CADASTRAL MAPPING 17
ICE MAPPING 80
PHOTO MAPPING 48
SOIL MAPPING 154
THEMATIC MAPPING 16
ASTROGRAPHY 108
CONTOURS 473
DECLINATION 348
FIXED POINTS (MATHEMATICS) 247
FUNCTIONS (MATHEMATICS) 2,148
GEOGRAPHIC APPLICATIONS (PROGRAM) 13
GEOGRAPHY 876
HYPSOGRAPHY 0
c
1
c
DISPLAY ADDITIONAL TERMS ?
YES
1
MAPPING SURVEYS 3,029
MAPS 497
ORTHOPHOTOGRAPHY 15
PHOENIX QUADRANGLE (AZ) 3
PHOTOGRAMMETRY 1,266
PHOTOGRAPHY 4,483
SCALE (RATIO) 197
SURVEYS 744
TERRAIN ANALYSIS 906
TOPOGRAPHY 1,793
TOPOLOGY 1,767
TRIANGULATION 856
LAKES
DISPLAY THESAURUS EXPANSION
LAKES 195
BARRIER LAKES 0
CONSEQUENT LAKES 0
FINGER LAKES 0
FROZEN LAKES 0
MORAINAL LAKES 0
GREAT LAKES (NORTH AMERICA) 32
LAKE PONTCHARTRAIN (LA) 0
LAKE TEXOMA (OK-TX) 1
EARTH RESOURCES 1,316
AQUIFERS 0
BAYOUS 0
BEACHES 86
COASTS 298
EARTH HYDROSPHERE 142
DISPLAY ADDITIONAL TERMS ?
YES
2
LAKES SURFACE WATER THERMAL POLLUTION 151
EUTROPHICATION 4
KETTLES (GEOLOGY) 0
LAGOONS 1
LAKE CHAMPLAIN BASIN (NY-VT) 8
LAKE ICE 4
LIMNOLOGY 18
PLAYAS 36
PONDS 11
REGIONAL PLANNING 89
RESERVOIRS 98
RIVER BASINS 27
SPRINGS (WATER) 0
STRAITS 5
SURFACE WATER 0
THERMAL POLLUTION 49
WATER CIRCULATION 2
WATER COLOR 12
WATER DEPTH 12
d
2


2
d
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
THERMAL POLLUTION
DISPLAY EXPANSION
e
THERMAL NEUTRON 207
THERMAL NEUTRONS 618
THERMAL NOISE 393
THERMAL PLASMA 182
THERMAL PLASMAS 367
THERMAL POLLUTION 34
THERMAL POWER 26
THERMAL PROPERTIES 0
THERMAL PROPERTY 269
THERMAL PROTECTION 805
THERMAL RADIATION 1,738
THERMAL RADIOEMISSION 24
THERMAL REACTORS 66
THERMAL RESISTANCE 827
THERMAL SHIELDING 0
3
THERMAL RADIATION
1,756
DISPLAY ADDITIONAL TERMS ?
YES
e
THERMAL SHOCK 326
THERMAL SIMULATION 312
THERMAL STABILITY 1,327
THERMAL STRESS 570
THERMAL STRESSES 1,545
THERMAL VACUUM TESTS 182
THERMALIZATION 73
THERMALIZATION (ENERGY ABSORPTION) 95
THERMIONIC 1,060
THERMIONIC CATHODES 42
THERMIONIC CONVERSION SYSTEM 88
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
COMBINE 2+3
e
2 LAKES SURFACE WATER THERMAL POLLUTION 191
3 THERMAL RADIATION 1,756
e
INTERSECT 2+3 WITH 1
1
MAPPING SURVEYS
3,029
4
(THERMAL MAPPING OF WATER)
26
m
ENVIRONMENTAL SURVEY
DISPLAY EXPANSION
e
ENVIRONMENTAL LABORATORIES 103
ENVIRONMENTAL LABORATORY 23
ENVIRONMENTAL QUALITY 43
ENVIRONMENTAL RESEARCH SATELLITES 21
ENVIRONMENTAL SCIENCE 88
ENVIRONMENTAL SURVEY 0
ENVIRONMENTAL SURVEYS 50
ENVIRONMENTAL TEMPERATURE 102
ENVIRONMENTAL TESTING 547
5
ENVIRONMENTAL SURVEY
40
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
m
REMOTE SENSORS
DISPLAY EXPANSION
e
REMOTE 620
REMOTE CONSOLES 88
REMOTE CONTROL 857
REMOTE HANDLING 116
REMOTE REGIONS 4
REMOTE SENSORS 2,602
REMOTELY PILOTED VEHICLES 2
REMOVAL 615
REMS 0
RENAL 104
RENAL CALCULI 0
RENAL CALCULUS 2
RENAL FUNCTION 205
RENDEZVOUS 714
RENDEZVOUS GUIDANCE 108
RENDEZVOUS GUIDANCE SYSTEM 80
6
REMOTE SENSORS
2,478
f


DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
TEMPERATURE MEASURE
DISPLAY EXPANSION
TMEPERATURE GRADIENTS 2,175
TEMPERATURE INDICATOR 32
TEMPERATURE INDICATORS 0
TEMPERATURE INSTRUMENTS 0
TEMPERATURE INVERSIONS 164
TEMPERATURE MEASURE 0
TEMPERATURE MEASUREMENT 4,393
TEMPERATURE MEASURING INSTRUMENTS 403
TEMPERATURE PHOTOMETER 5
TEMPERATURE MEASURE 4,087
DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
COMBINE 1+5+6+7
1 MAPPING SURVEYS 3,029
5 ENVIRONMENTAL SURVEY 40
6 REMOTE SENSORS 2,418
7 TEMPERATURE MEASURE 4,087
COMBINE 2+3
2 LAKE SURFACE WATER THERMAL POLLUTION 191
3 THERMAL RADIATION 1,756
INTERSECT 1+5+6+7 WITH 2+3
(AIRBORNE THERMAL MEASUREMENT OF WATER) 172
PRINT (REMOTE) ALL CITATIONS COMPLETE (172)
PRINT (LOCAL) ALL ACCESSION NUMBERS (172)
END SEARCH

LOGICAL PROCESSES EMPLOYED BY SEARCHER AWL

This searcher is a graduate chemist with long research experience in the textile industry and recent professional experience in textile information retrieval. The NASA file and RECON are relatively unfamiliar to him.

He began his search (Figure 5) with a dictionary expansion on "water temperature." The disappointingly (to him) small number of postings and lack of related terms caused him to terminate the expansion after one display and ask for a thesaurus expansion. What he saw then also did not appeal to him. It did, however, suggest another avenue of investigation (an expansion on "surface temperature"). Before pursuing that, however, he decided to determine the possibilities of the term "lake." The dictionary expansion yielded one set (set 1). Then departing from the practice of the other searchers, he asked for and printed locally thesaurus expansions on lakes, surface temperature, radiometer, dicke radiometers, and infrared detectors as well as a dictionary expansion of radiometer without creating any sets at the time of the individual displays. This fact is not evident from an examination of Figure 5.

From this printed list of terms, he then selected as set 2 "surface temperature." He intended to perform an intersection of 1 and 2 but performed a union instead. This became set 3. The intersection became set 4 but had only 3 terms. He then consulted the printout again and selected "lakes" as set 5. This he intersected with 2 and got six hits, hardly better than "lake"*"surface temperature." Again he consulted the term printout and selected "water temperature" as set 7. An intersection of set 5 with set 7 gave only one hit, however. These three tries at identifying very specific documents he recognized to be failures so he returned to the practice of displaying and printing terms.

A dictionary and a thesaurus expansion on water were first. From this he selected "water" as set 9. From the previous printout he selected "radiometer" as set 10. An intersection of these two items produced set 11 with 49 hits. He then consulted his printout and selected "temperature" as set 12. An intersection of this with set 11 produced 20 hits. He then returned to the printout and selected nine additional sets (14-22) "coastal water," "sea water," "great lakes (North America)," "beaches," "coasts," "ponds," "reservoirs," "river basins," and "water resources." By this time he had realized that if he were going to retrieve a large percentage of the pertinent documents in the file he would have to search through a large number of documents.

He continued making thesaurus expansions on water-related terms: "rivers," "coastal water," "sea water," "great lakes (North America)," "ponds," and "reservoirs." In the process he also created sets 23, 24, 25, 26, 27, and 28, "rivers," "estuaries," "streams," "oceans," "ponds," and "reservoirs." He also selected "river" (set 29) and "stream" (set 30). He then began combining terms putting together 9, 14, 15, 16, 17, 18, 19, 20, and 21 to make set 31; and 22, 23, 24, 25, 26, 27, 28, 29, and 30 to make set 32. In set 33 he combined sets 31 and 32. The total postings in this set were 10,964.

Again he consulted his printout of terms. From this he selected 10 additional sets dealing with radiometers. He summed them in set 44 to obtain 3,377 postings. He then tried intersecting set 44 with set 33 to yield set 45 with 151 postings. This set, he expected, would contain documents dealing with radiometeric measurements of water. To see what output would be generated by another water term "lake," he intersected set 44 with set 1 and got only 1 hit. Set 5, "lakes," was also intersected with set 44 to give set 47 with 7 hits. He then added sets 45, 46, and 47 to give a total of 157 hits (set 48). Departing slightly from this line of attack, he intersected set 7 (water temperature) with set 44 and got 12 hits. These he then added to set 48 to get 164 hits (set 50). He then summed set 50 with the results of three previous intersections: lake*surface temperature, set 4; lakes*surface temperature, set 8. The resulting set, set 51, had 172 hits.

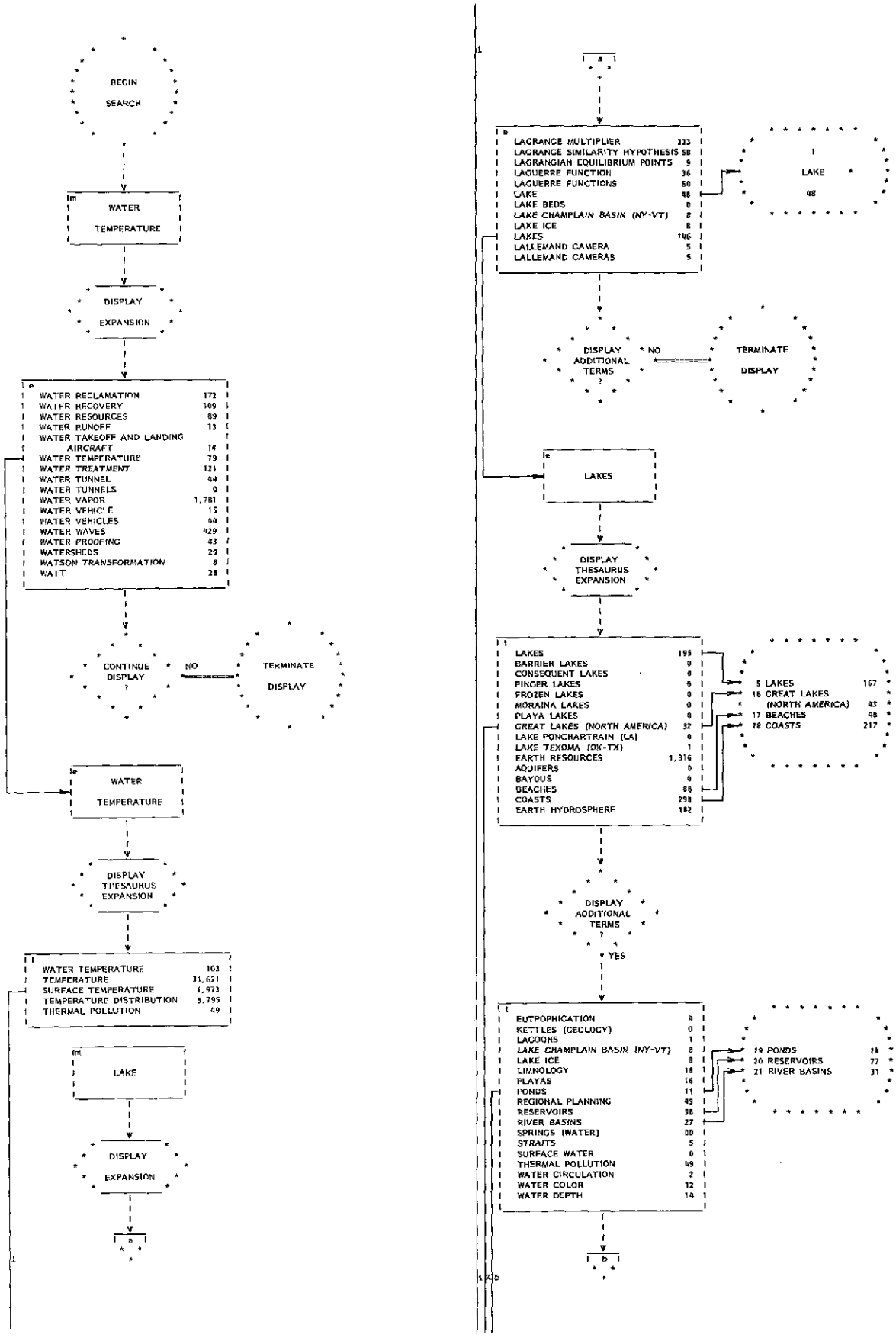
Again consulting his term printouts, he selected "measuring instruments" as set 52 and "radiation measuring instruments" as set 53. Departing from his previous practice, he selected as sets directly without first viewing as expansions several synonyms for that portion of the measuring instrument in contact with the phenomenon being observed: sensors (set 54), sensor (set 55), detectors (set 56), detector (set 57), scanners (set 58), scanner (set 59), probes (set 60), and probe (set 61). These 10 he summed to obtain set 62 with 12,471 postings.

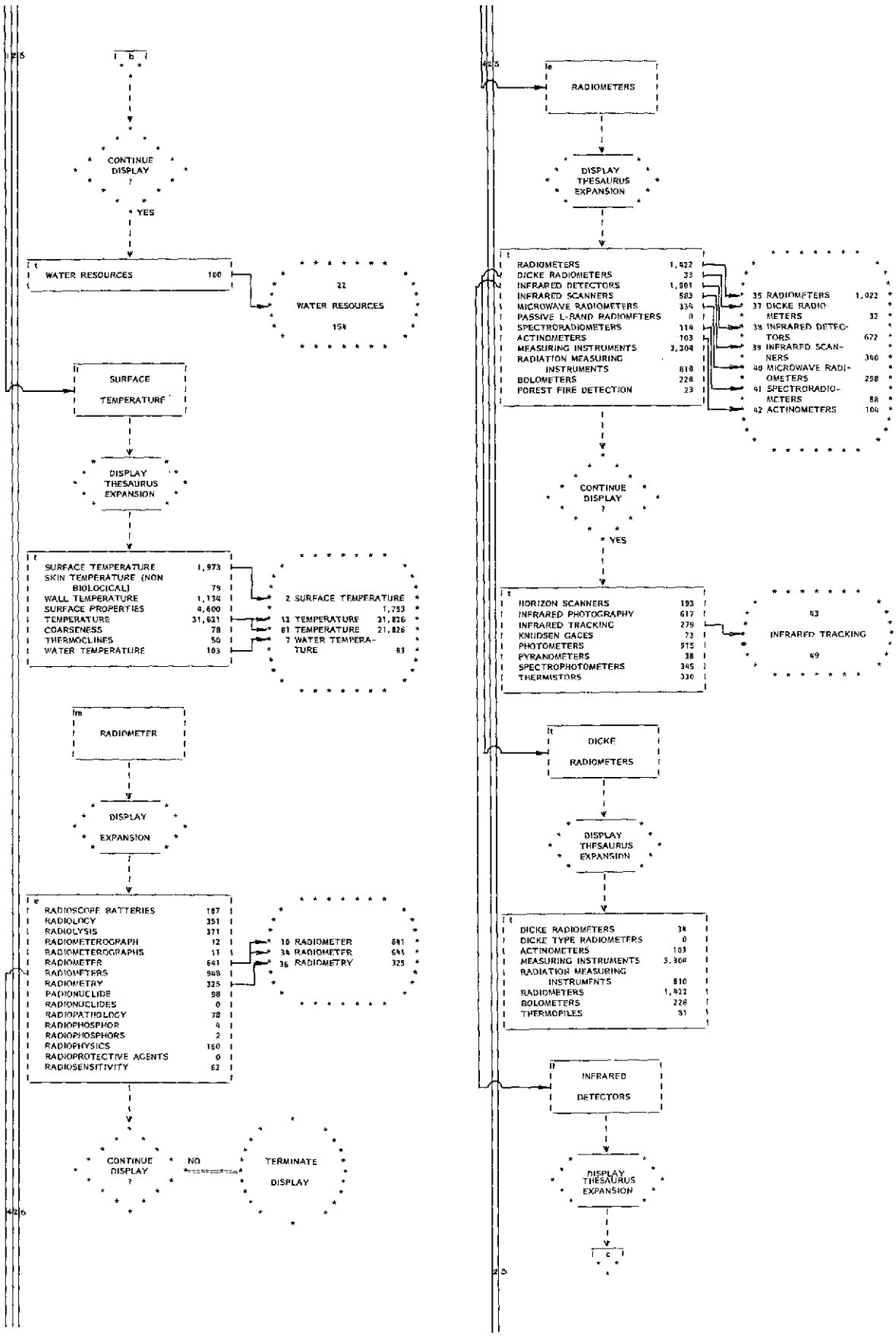
Having decided that to insure high recall one must examine a large number of documents, he added to set 33 sets 1 (lake), 5 (lakes), and 7 (water temperature) to create set 63. Although he had already used these sets previously, he apparently decided to broaden the search somewhat by including in the investigation, at least for the time being, possible relevant documents which may have been eliminated during previous intersections. Set 63 had 11,155 postings compared with 10,964 in set 33 alone. An intersection of set 62 with set 63 yielded 292 hits. These hits should be related to measuring things about water, though not specifically the radiation emitted. He added these 292 hits to the 172 he had obtained previously (set 51) which he felt were reasonably specific with regard to radiation measurement of bodies of water, after first ascertaining that intersecting either set 51 or set 64 with set 12 (temperature) would give a very small output. He then elected to print the hit list for the 447 items in set 67. A disc overflow temporarily interrupted his search for the final aspect of the search: mathematical models for interpreting radiometer indications.

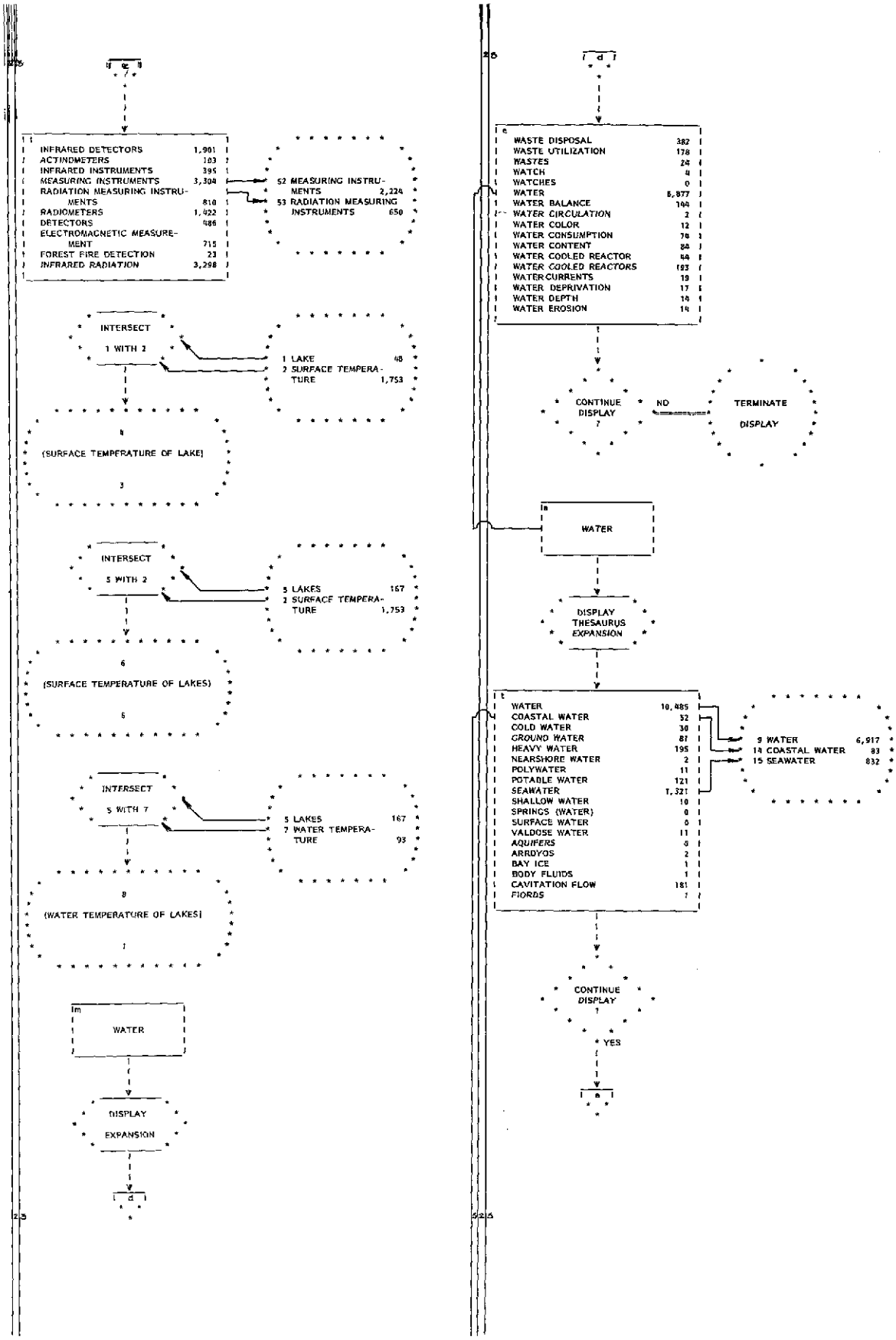
When he was able to resume his search, he performed expansions on "mathematical models," "data reduction," and "computer program." From these dictionary expansions he selected "mathematical logic" (set 68), "mathematical model" (set 69), "mathematical models" (set 72), "data reduction" (set 73), "computer program" (set 74), and "computer programs" (set 75). The numbers for sets 70 and 71 were unused. The six foregoing items were summed to create set 76 with 34,935 items. This was intersected with the union of "thermal radiation" and "infrared radiation" to yield set 80 with 223 postings. After seeing that an intersection of set 80 with the term "temperature" only produced 3 hits, searcher AWL asked that the items in set 80 be printed and added to those previously printed (set 67). These two groups he called his final hit list.

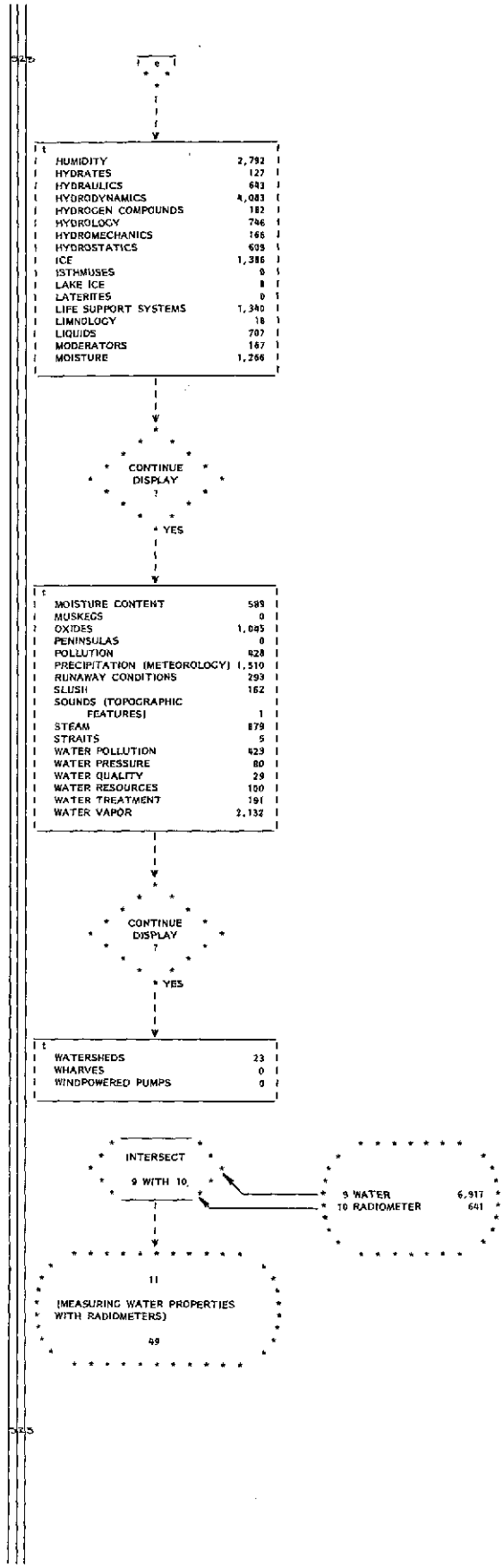
Of this total of 670 documents, 87 or 13% were judged to be relevant by the experiment director. This search found 22.4% of the relevant documents identified as being in the NASA collection. Ten of the 87 relevant documents were not found by any other search. It may be pointed out that although this search utilized a large number of terms and a large number of postings, comparatively few terms were in the area of temperature measurement, radiant heat flux measurement, thermal emission, heat transfer, etc. This apparently is the reason that this broad search failed to retrieve more relevant documents.

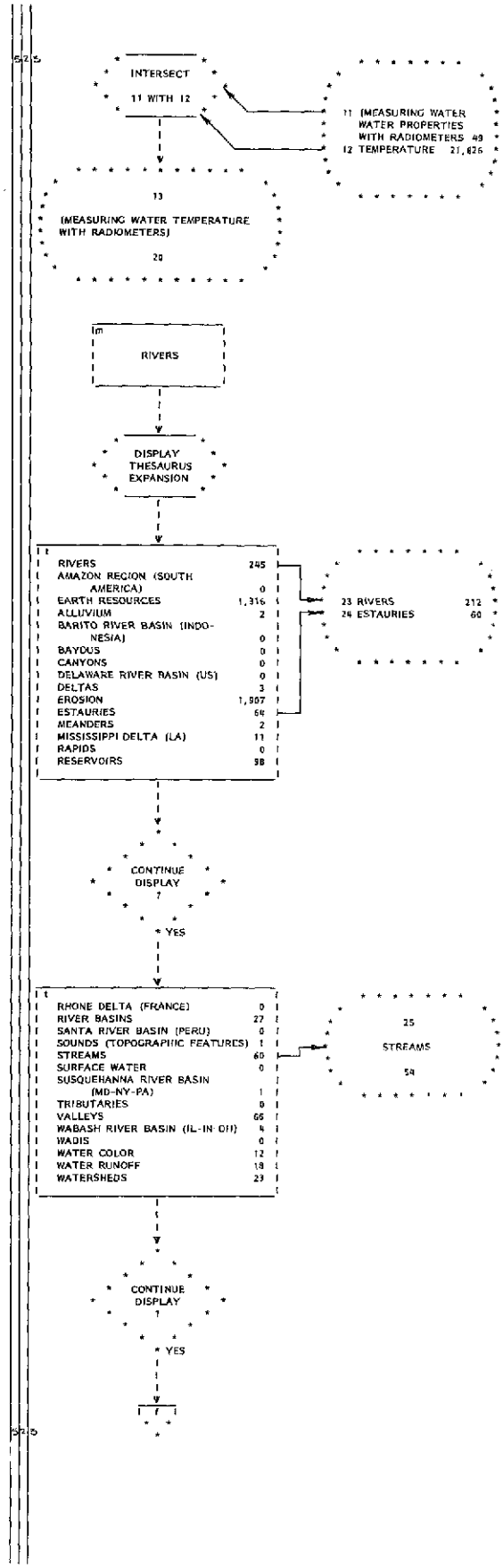
FIGURE 5

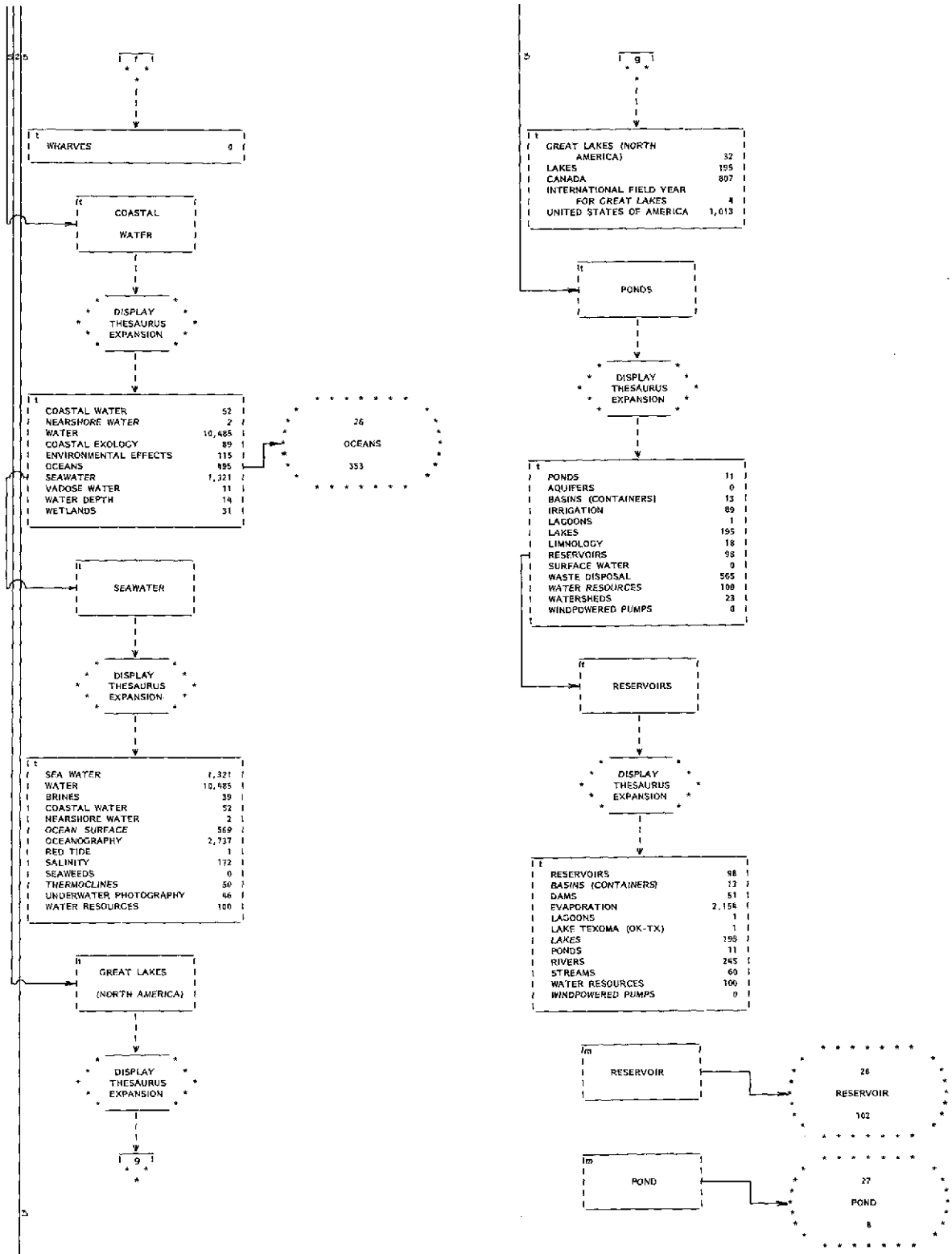

BEGIN SEARCH
WATER TEMPERATURE
DISPLAY EXPANSION
WATER RECLAMATION 172
WATER RECOVERY 109
WATER RESOURCES 89
WATER RUNOFF 13
WATER TAKEOFF AND LANDING AIRCRAFT 14
WATER TEMPERATURE 79
WATER TREATMENT 121
WATER TUNNEL 44
WATER TUNNELS 0
WATER VAPOR 1,781
WATER VEHICLE 15
WATER VEHICLES 44
WATER WAVES 429
WATER PROOFING 43
WATERSHEDS 20
WATSON TRANSFORMATION 8
WATT 28
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
WATER TEMPERATURE
DISPLAY THESAURUS EXPANSION
WATER TEMPERATURE 103
TEMPERATURE 31,621
SURFACE TEMPERATURE 1,973
TEMPERATURE DISTRIBUTION 5,795
THERMAL POLLUTION 49
LAKE
DISPLAY EXPANSION
a
LAGRANGE MULTIPLIER 333
LAGRANGE SIMILARITY HYPOTHESIS 58
LAGRANGIAN EQUILIBRIUM POINTS 9
LAGUERRE FUNCTION 36
LAGUERRE FUNCTIONS 50
LAKE 48
LAKE BEDS 0
LAKE CHAMPLAIN BASIN (NY-VT) 8
LAKE ICE 8
LAKES 146
LALLEMAND CAMERA 5
LALLEMAND CAMERAS 5
1 LAKE 48
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
LAKES
DISPLAY THESAURUS EXPANSION
LAKES 195
BARRIER LAKES 0
CONSEQUENT LAKES 0
FINGER LAKES 9
FROZEN LAKES 0
MORAINA LAKES 0
PLAYA LAKES 0
GREAT LAKES (NORTH AMERICA) 32
LAKE PONCHARTRAIN (LA) 0
LAKE TEXOMA (OK-TX) 1
EARTH RESOURCES 1,316
AQUIFERS 0
BAYOUS 0
BEACHES 86
COASTS 298
EARTH HYDROSPHERE 182
5 LAKES 167
16 GREAT LAKES (NORTH AMERICA) 43
17 BEACHES 48
18 COASTS 217
DISPLAY ADDITIONAL TERMS ?
YES
EUTROPHICATION 4
KETTLES (GEOLOGY) 0
LAGOONS 1
LAKE CHAMPLAIN BASIN (NY-VT) 8
LAKE ICE 8
LIMNOLOGY 18
PLAYAS 16
PONDS 11
REGIONAL PLANNING 49
RESERVOIRS 58
RIVER BASINS 27
SPRINGS (WATER) 00
STRAITS 5
SURFACE WATER 0
THERMAL POLLUTION 49
WATER CIRCULATION 2
WATER COLOR 12
WATER DEPTH 14
19 PONDS 14
20 RESERVOIRS 77
21 RIVER BASINS 31
b

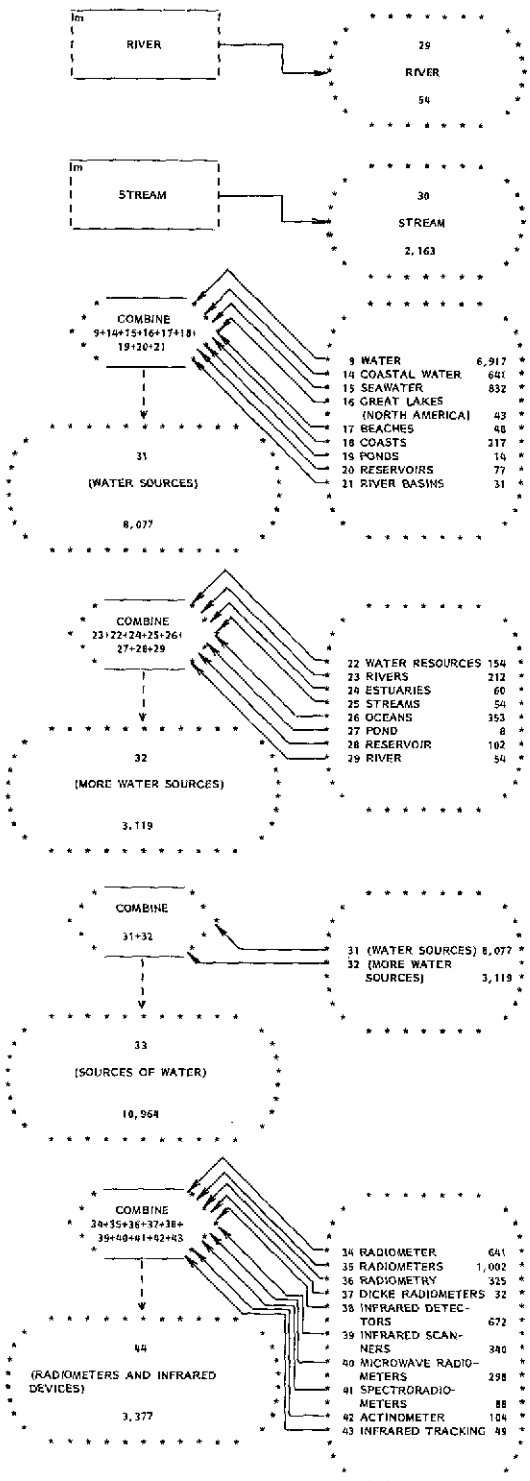

b
CONTINUE DISPLAY ?
YES
WATER RESOURCES 100
22 WATER RESOURCES 158
SURFACE TEMPERATURE
DISPLAY THESAURUS EXPANSION
SURFACE TEMPERATURE 1,973
SKIN TEMPERATURE (NON BIOLOGICAL) 79
WALL TEMPERATURE 1,134
SURFACE PROPERTIES 4,600
TEMPERATURE 31,631
COARSENESS 78
THERMOCLINES 56
WATER TEMPERATURE 103
2 SURFACE TEMPERATURE 1,753
13 TEMPERATURE 31,826
81 TEMPERATURE 21,826
7 WATER TEMPERATURE 83
RADIOMETER
DISPLAY EXPANSION
RADIOSCOPE BATTERIES 187
RADIOLOGY 351
RADIOLYSIS 371
RADIOMETEROGRAPH 12
RADIOMETEROGRAPHS 11
RADIOMETER 641
RADIOMETERS 948
RADIOMETRY 325
RADIONUCLIDE 98
RADIONUCLIDES 0
RADIOPATHOLOGY 78
RADIOPHOSPHOR 4
RADIOPHOSPHORS 2
RADIOPHYSICS 160
RADIOPROTECTIVE AGENTS 0
RADIOSENSITIVITY 62
10 RADIOMETER 641
34 RADIOMETER 641
36 RADIOMETRY 325
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
RADIOMETERS
DISPLAY THESAURUS EXPANSION
RADIOMETERS 1,422
DICKE RADIOMETERS 33
INFRARED DETECTORS 1,801
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 334
PASSIVE L-RAND RADIOMETERS 0
SPECTRORADIOMETERS 114
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
BOLOMETERS 228
FOREST FIRE DETECTION 23
35 RADIOMETERS 1,422
37 DICKE RADIOMETERS 32
38 INFRARED DETECTORS 672
39 INFRARED SCANNERS 340
40 MICROWAVE RADIOMETERS 298
41 SPECTRORADIOMETERS 88
42 ACTINOMETERS 104
CONTINUE DISPLAY ?
YES
HORIZON SCANNERS 193
INFRARED PHOTOGRAPHY 617
INFRARED TRACKING 279
KNUDSEN GAGES 73
PHOTOMETERS 915
PYRANOMETERS 38
SPECTROPHOTOMETERS 345
THERMISTORS 330
43 INFRARED TRACKING 49
DICKE RADIOMETERS
DISPLAY THESAURUS EXPANSION
DICKE RADIOMETERS 34
DICKE TYPE RADIOMETERS 0
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
RADIOMETERS 1,422
BOLOMETERS 228
THERMOPILES 81
INFRARED DETECTORS
DISPLAY THESAURUS EXPANSION
c

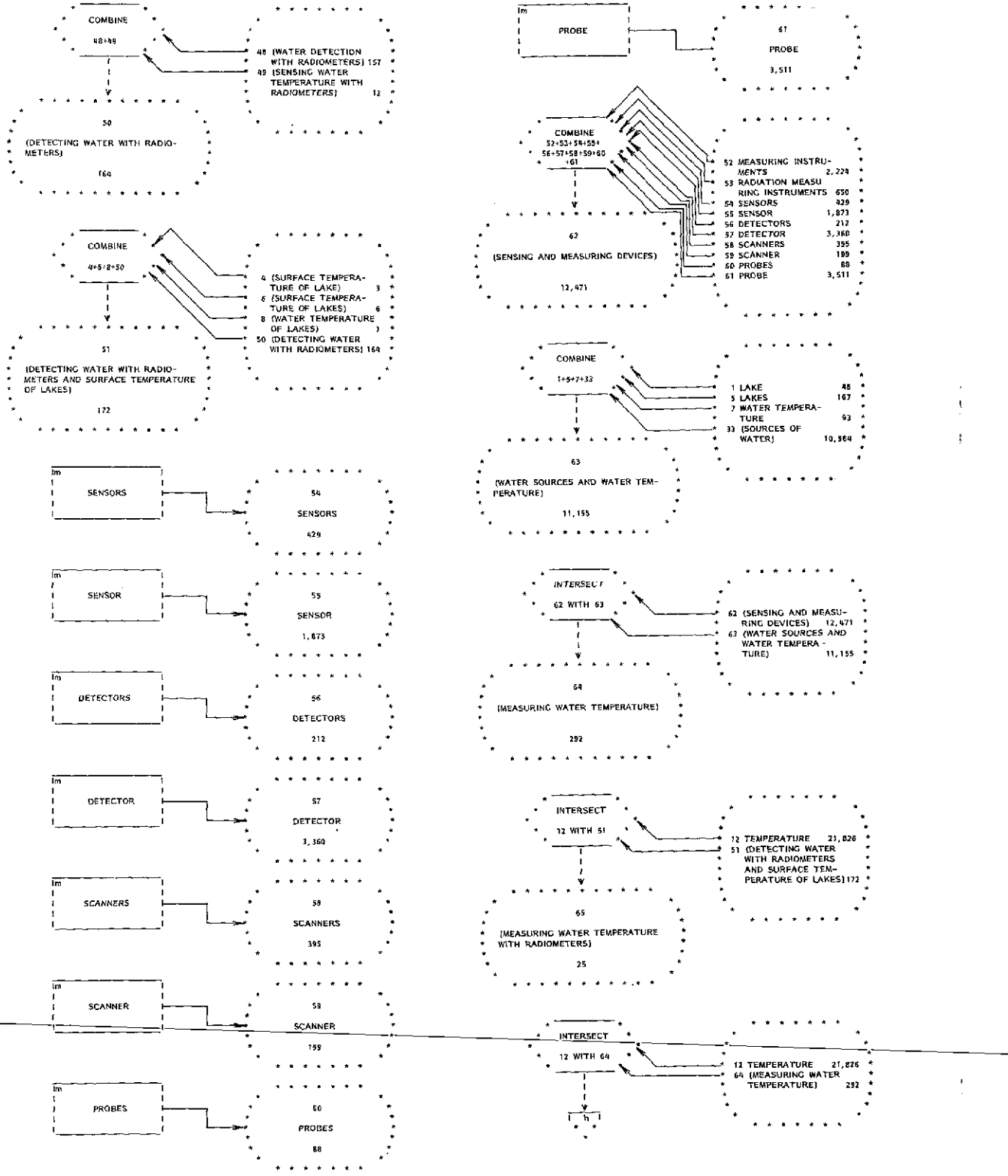

INFRARED DETECTORS 1,901
ACTINOMETERS 103
INFRARED INSTRUMENTS 395
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
RADIOMETERS 1,422
DETECTORS 486
ELECTROMAGNETIC MEASUREMENT 715
FOREST FIRE DETECTION 23
INFRARED RADIATION 3,298
52 MEASURING INSTRUMENTS 2,224
53 RADIATION MEASURING INSTRUMENTS 650
INTERSECT 1 WITH 2
1 LAKE 48
2 SURFACE TEMPERATURE 1,753
(SURFACE TEMPERATURE OF LAKE)
INTERSECT 5 WITH 2
5 LAKES 167
2 SURFACE TEMPERATURE 1,753
(SURFACE TEMPERATURE OF LAKES)
INTERSECT 5 WITH 7
5 LAKES 167
7 WATER TEMPERATURE 93
(WATER TEMPERATURE OF LAKES)
WATER
DISPLAY EXPANSION
WASTE DISPOSAL 382
WASTE UTILIZATION 178
WASTES 24
WATCH 4
WATCHES 0
WATER 8,877
WATER BALANCE 144
WATER CIRCULATION 2
WATER COLOR 12
WATER CONSUMPTION 76
WATER CONTENT 84
WATER COOLED REACTOR 44
WATER COOLED REACTORS 193
WATERCURRENTS 19
WATER DEPRIVATION 17
WATER DEPTH 14
WATER EROSION 14
CONTINUE DISPLAY
NO
TERMINATE DISPLAY
WATER
DISPLAY THESAURUS EXPANSION
WATER 10,485
COASTAL WATER 52
COLD WATER 30
GROUND WATER 87
HEAVY WATER 195
NEARSHORE WATER 2
POLYWATER 11
POTABLE WATER 121
SEAWATER 1,321
SHALLOW WATER 10
SPRINGS (WATER) 8
SURFACE WATER 0
VALDOSE WATER 11
AQUIFERS 8
ARROYOS 2
BAY ICE 1
BODY FLUIDS 1
CAVITATION FLOW 181
FIORDS 7
9 WATER 6,917
14 COASTAL WATER 83
15 SEAWATER 832
CONTINUE DISPLAY
YES

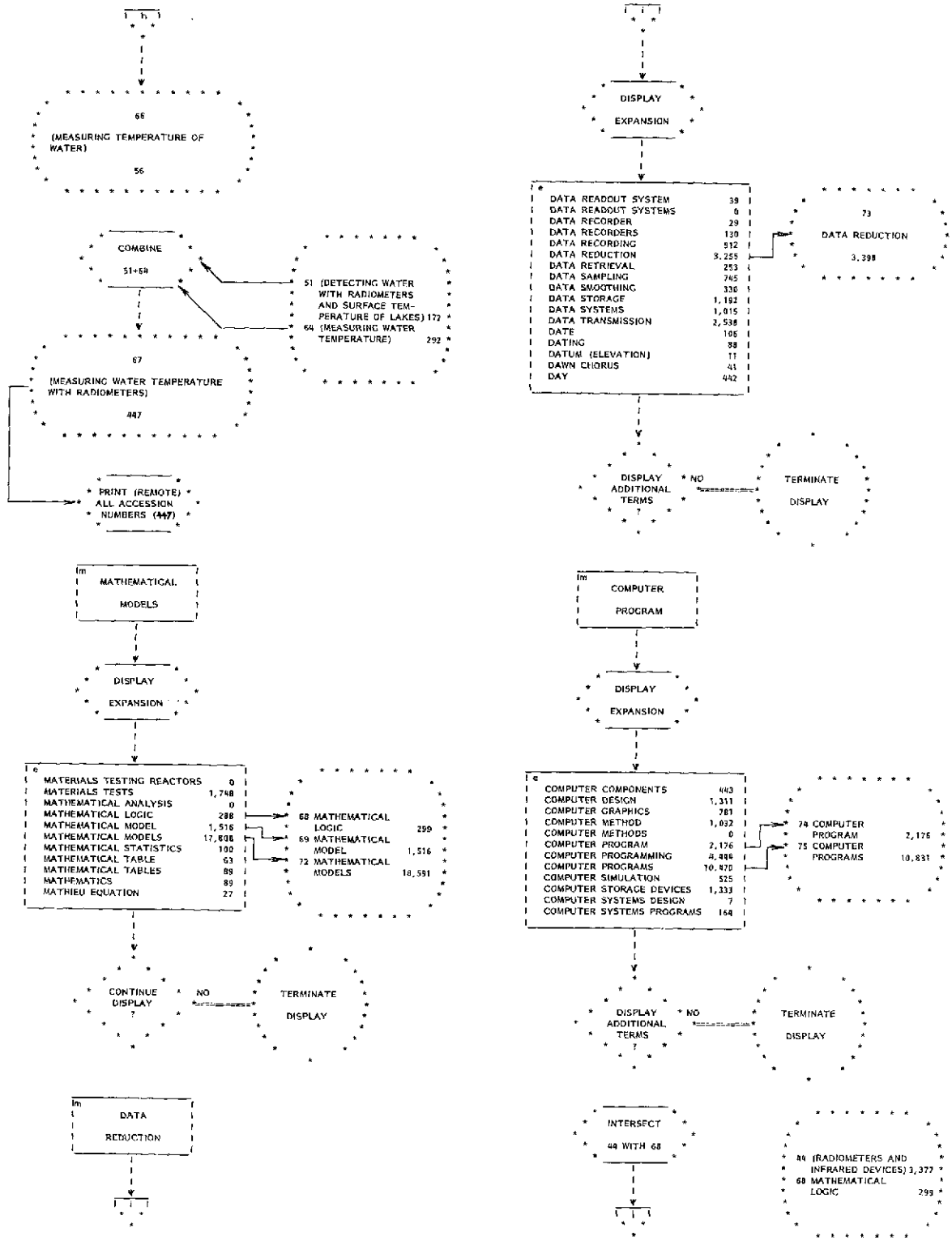

HUMIDITY 2,792
HYDRATES 127
HYDRAULICS 643
HYDRODYNAMICS 4,083
HYDROGEN COMPOUNDS 182
HYDROLOGY 746
HYDROMECHANICS 166
HYDROSTATICS 609
ICE 1,386
ISTHMUSES 0
LAKE ICE 8
LATERITES 0
LIFE SUPPORT SYSTEMS 1,340
LIMNOLOGY 18
LIQUIDS 707
MODERATORS 167
MOISTURE 1,266
CONTINUE DISPLAY ?
YES
MOISTURE CONTENT 589
MUSKEGS 0
OXIDES 1,085
PENINSULAS 0
POLLUTION 828
PRECIPITATION (METEOROLOGY) 1,510
RUNAWAY CONDITIONS 293
SLUSH 162
SOUNDS (TOPOGRAPHIC FEATURES) 1
STEAM 879
STRAITS 5
WATER POLLUTION 429
WATER PRESSURE 80
WATER QUALITY 29
WATER RESOURCES 100
WATER TREATMENT 191
WATER VAPOR 2,132
CONTINUE DISPLAY ?
YES
WATERSHEDS 23
WHARVES 0
WINDPOWERED PUMPS 0
INTERSECT 9 WITH 10
9 WATER 6,917
10 RADIOMETER 641
11 (MEASURING WATER PROPERTIES WITH RADIOMETERS) 49

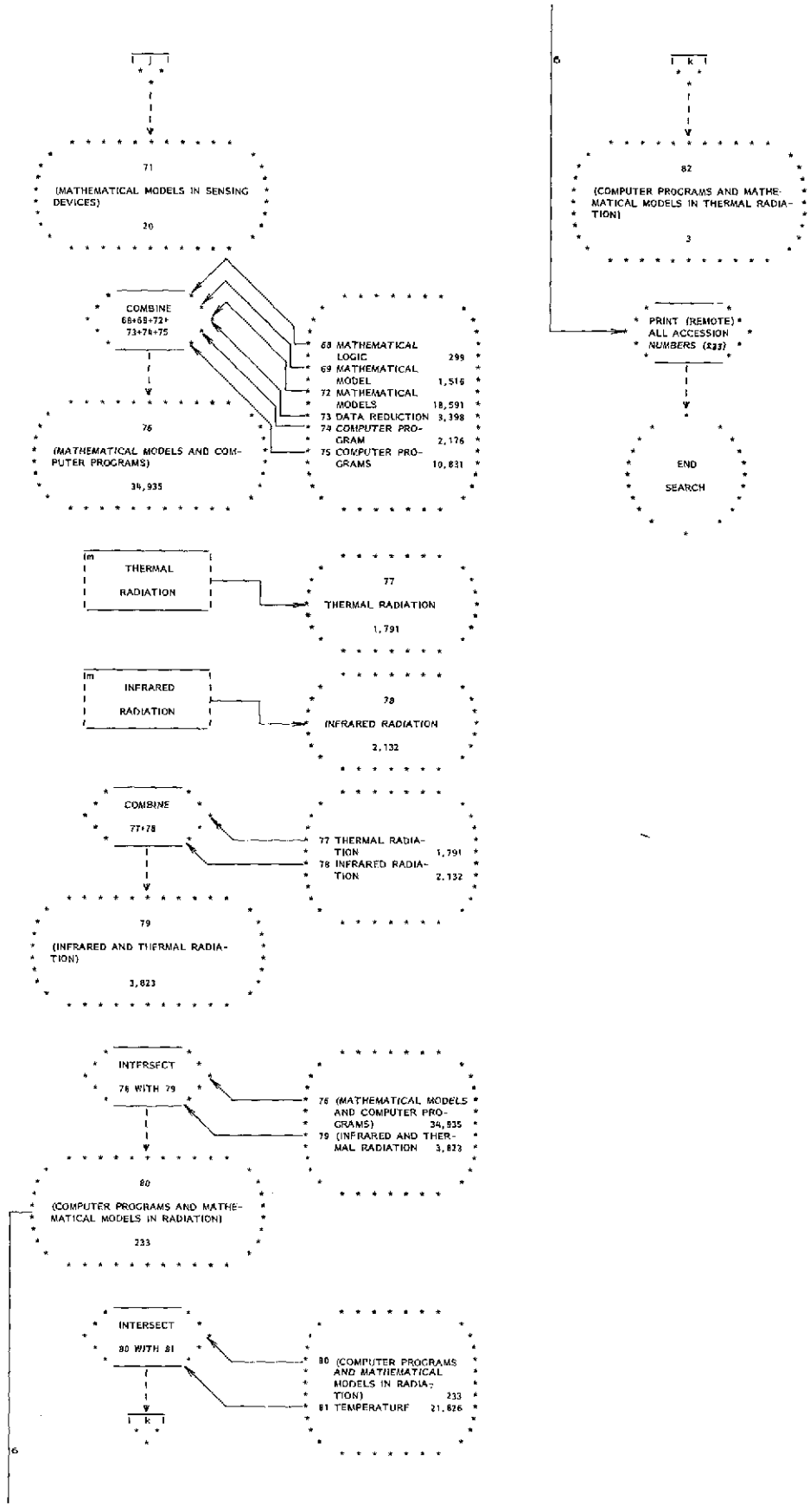

INTERSECT 11 WITH 12
11 (MEASURING WATER WATER PROPERTIES WITH RADIOMETERS 49
12 TEMPERATURE 21,626
13 (MEASURING WATER TEMPERATURE WITH RADIOMETERS) 20
RIVERS
DISPLAY THESAURUS EXPANSION
RIVERS 245
AMAZON REGION (SOUTH AMERICA) 0
EARTH RESOURCES 1,316
ALLUVIUM 2
BARITO RIVER BASIN (INDONESIA) 0
BAYOUS 0
CANYONS 0
DELAWARE RIVER BASIN (US) 0
DELTAS 3
EROSION 1,907
ESTAUARIES 64
MEANDERS 2
MISSISSIPPI DELTA (LA) 11
RAPIDS 0
RESERVOIRS 98
23 RIVERS 212
24 ESTAURIES 60
CONTINUE DISPLAY ?
YES
RHONE DELTA (FRANCE) 0
RIVER BASINS 27
SANTA RIVER BASIN (PERU) 0
SOUNDS (TOPOGRAPHIC FEATURES) 1
STREAMS 60
SURFACE WATER 0
SUSQUEHANNA RIVER BASIN (MD-NY-PA) 1
TRIBUTARIES 0
VALLEYS 65
WABASH RIVER BASIN (IL-IN-OH) 4
WADIS 0
WATER COLOR 12
WATER RUNOFF 18
WATERSHEDS 23
25 STREAMS 59
CONTINUE DISPLAY ?
YES


f
WHARVES 0
COASTAL WATER
DISPLAY THESAURUS EXPANSION
COASTAL WATER 52
NEARSHORE WATER 2
WATER 10,485
COASTAL EXOLOGY 89
ENVIRONMENTAL EFFECTS 115
OCEANS 895
SEAWATER 1,321
VADOSE WATER 11
WATER DEPTH 14
WETLANDS 31
26
OCEANS
353
SEAWATER
DISPLAY THESAURUS EXPANSION
SEA WATER 1,321
WATER 10,485
BRINES 39
COASTAL WATER 52
NEARSHORE WATER 2
OCEAN SURFACE 569
OCEANOGRAPHY 2,737
RED TIDE 1
SALINITY 172
SEAWEEDS 0
THERMOCLINES 50
UNDERWATER PHOTOGRAPHY 46
WATER RESOURCES 100
GREAT LAKES (NORTH AMERICA)
DISPLAY THESAURUS EXPANSION
g
GREAT LAKES (NORTH AMERICA) 32
LAKES 195
CANADA 807
INTERNATIONAL FIELD YEAR FOR GREAT LAKES 4
UNITED STATES OF AMERICA 1,013
PONDS
DISPLAY THESAURUS EXPANSION
PONDS 11
AQUIFERS 0
BASINS (CONTAINERS) 13
IRRIGATION 89
LAGOONS 1
LAKES 195
LIMNOLOGY 18
RESERVOIRS 98
SURFACE WATER 0
WASTE DISPOSAL 565
WATER RESOURCES 100
WATERSHEDS 23
WINDPOWERED PUMPS 0
RESERVOIRS
DISPLAY THESAURUS EXPANSION
RESERVOIRS 98
BASINS (CONTAINERS) 13
DAMS 51
EVAPORATION 2,158
LAGOONS 1
LAKE TEXOMA (OK-TX) 1
LAKES 195
PONDS 11
RIVERS 245
STREAMS 60
WATER RESOURCES 100
WINDPOWERED PUMPS 0
RESERVOIR
28
RESERVOIR
102
POND
27
POND
8


In
RIVER
29
RIVER
54
In
STREAM
30
STREAM
2,163
COMBINE
9+14+15+16+17+18+
19+20+21
31
(WATER SOURCES)
8,077
9 WATER 6,917
14 COASTAL WATER 641
15 SEAWATER 832
16 GREAT LAKES (NORTH AMERICA) 43
17 BEACHES 46
18 COASTS 217
19 PONDS 14
20 RESERVOIRS 77
21 RIVER BASINS 31
COMBINE
23+22+24+25+26+
27+28+29
32
(MORE WATER SOURCES)
3,119
22 WATER RESOURCES 154
23 RIVERS 212
24 ESTUARIES 60
25 STREAMS 54
26 OCEANS 353
27 POND 8
28 RESERVOIR 102
29 RIVER 54
COMBINE
31+32
33
(SOURCES OF WATER)
10,964
31 (WATER SOURCES) 8,077
32 (MORE WATER SOURCES) 3,119
COMBINE
34+35+36+37+38+
39+40+41+42+43
44
(RADIOMETERS AND INFRARED DEVICES)
3,377
34 RADIOMETER 641
35 RADIOMETERS 1,002
36 RADIOMETRY 325
37 DICKE RADIOMETERS 32
38 INFRARED DETECTORS 672
39 INFRARED SCANNERS 340
40 MICROWAVE RADIOMETERS 298
41 SPECTRORADIOMETERS 88
42 ACTINOMETER 104
43 INFRARED TRACKING 49
INTERSECT
33 WITH 44
45
(DETECTING WATER WITH RADIOMETERS)
151
33 (SOURCES OF WATER) 10,964
44 (RADIOMETERS AND INFRARED DEVICES) 3,377
INTERSECT
1 WITH 44
46
(DETECTING LAKE WITH RADIOMETERS)
1
1 LAKE 48
44 (RADIOMETERS AND INFRARED DEVICES) 3,377
INTERSECT
5 WITH 44
47
(DETECTING LAKES WITH RADIOMETERS)
7
5 LAKES 157
44 (RADIOMETERS AND INFRARED DEVICES) 3,377
COMBINE
45+46+47
48
(WATER DETECTION WITH RADIOMETERS)
157
45 (DETECTING WATER WITH RADIOMETERS) 151
46 (DETECTING LAKE WITH RADIOMETERS) 1
47 (DETECTING LAKES WITH RADIOMETERS) 7
INTERSECT
7 WITH 44
49
(SENSING WATER TEMPERATURE WITH RADIOMETERS)
12
7 WATER TEMPERATURE 83
44 (RADIOMETERS AND INFRARED DEVICES) 3,377


COMBINE
48+49
48 (WATER DETECTION WITH RADIOMETERS) 157
49 (SENSING WATER TEMPERATURE WITH RADIOMETERS) 12
50
(DETECTING WATER WITH RADIOMETERS)
164
COMBINE
4+5+6+50
4 (SURFACE TEMPERATURE OF LAKE) 3
6 (SURFACE TEMPERATURE OF LAKES) 6
8 (WATER TEMPERATURE OF LAKES))
50 (DETECTING WATER WITH RADIOMETERS) 164
51
(DETECTING WATER WITH RADIOMETERS AND SURFACE TEMPERATURE OF LAKES)
172
Im
SENSORS
54
SENSORS
429
Im
SENSOR
55
SENSOR
1,873
Im
DETECTORS
56
DETECTORS
212
Im
DETECTOR
57
DETECTOR
3,360
Im
SCANNERS
58
SCANNERS
395
Im
SCANNER
59
SCANNER
199
Im
PROBES
60
PROBES
88
Im
PROBE
61
PROBE
3,511
COMBINE
52+53+54+55+56+57+58+59+60+61
52 MEASURING INSTRUMENTS 2,228
53 RADIATION MEASURING INSTRUMENTS 650
54 SENSORS 429
55 SENSOR 1,873
56 DETECTORS 212
57 DETECTOR 3,360
58 SCANNERS 395
59 SCANNER 199
60 PROBES 88
61 PROBE 3,511
62
(SENSING AND MEASURING DEVICES)
12,471
COMBINE
1+5+7+33
1 LAKE 48
5 LAKES 167
7 WATER TEMPERATURE 93
33 (SOURCES OF WATER) 10,984
63
(WATER SOURCES AND WATER TEMPERATURE)
11,155
INTERSECT
62 WITH 63
62 (SENSING AND MEASURING DEVICES) 12,471
63 (WATER SOURCES AND WATER TEMPERATURE) 11,155
64
(MEASURING WATER TEMPERATURE)
292
INTERSECT
12 WITH 51
12 TEMPERATURE 21,826
51 (DETECTING WATER WITH RADIOMETERS AND SURFACE TEMPERATURE OF LAKES) 172
65
(MEASURING WATER TEMPERATURE WITH RADIOMETERS)
25
INTERSECT
12 WITH 64
12 TEMPERATURE 21,826
64 (MEASURING WATER TEMPERATURE) 292


h
66
(MEASURING TEMPERATURE OF WATER)
56
COMBINE
51+64
51 (DETECTING WATER WITH RADIOMETERS AND SURFACE TEMPERATURE OF LAKES) 172
64 (MEASURING WATER TEMPERATURE) 292
67
(MEASURING WATER TEMPERATURE WITH RADIOMETERS)
447
PRINT (REMOTE) ALL ACCESSION NUMBERS (447)
DISPLAY EXPANSION
e
DATA READOUT SYSTEM 39
DATA READOUT SYSTEMS 0
DATA RECORDER 29
DATA RECORDERS 130
DATA RECORDING 512
DATA REDUCTION 3,255
DATA RETRIEVAL 253
DATA SAMPLING 745
DATA SMOOTHING 330
DATA STORAGE 1,192
DATA SYSTEMS 1,015
DATA TRANSMISSION 2,538
DATE 106
DATING 88
DATUM (ELEVATION) 11
DAWN CHORUS 41
DAY 442
73
DATA REDUCTION
3,398
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
m
MATHEMATICAL MODELS
DISPLAY EXPANSION
e
MATERIALS TESTING REACTORS 0
MATERIALS TESTS 1,748
MATHEMATICAL ANALYSIS 0
MATHEMATICAL LOGIC 288
MATHEMATICAL MODEL 1,516
MATHEMATICAL MODELS 17,608
MATHEMATICAL STATISTICS 100
MATHEMATICAL TABLE 63
MATHEMATICAL TABLES 88
MATHEMATICS 89
MATHIEU EQUATION 27
68 MATHEMATICAL LOGIC 299
69 MATHEMATICAL MODEL 1,516
72 MATHEMATICAL MODELS 18,591
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
m
DATA REDUCTION
m
COMPUTER PROGRAM
DISPLAY EXPANSION
e
COMPUTER COMPONENTS 443
COMPUTER DESIGN 1,311
COMPUTER GRAPHICS 781
COMPUTER METHOD 1,032
COMPUTER METHODS 0
COMPUTER PROGRAM 2,176
COMPUTER PROGRAMMING 4,486
COMPUTER PROGRAMS 10,870
COMPUTER SIMULATION 525
COMPUTER STORAGE DEVICES 1,333
COMPUTER SYSTEMS DESIGN 7
COMPUTER SYSTEMS PROGRAMS 164
74 COMPUTER PROGRAM 2,176
75 COMPUTER PROGRAMS 10,831
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
INTERSECT
44 WITH 68
44 (RADIOMETERS AND INFRARED DEVICES) 3,377
68 MATHEMATICAL LOGIC 299


j
71
(MATHEMATICAL MODELS IN SENSING DEVICES)
20
COMBINE
68+69+72+
73+74+75
76
(MATHEMATICAL MODELS AND COMPUTER PROGRAMS)
34,935
68 MATHEMATICAL LOGIC 299
69 MATHEMATICAL MODEL 1,516
72 MATHEMATICAL MODELS 18,591
73 DATA REDUCTION 3,398
74 COMPUTER PROGRAM 2,176
75 COMPUTER PROGRAMS 10,831
6
k
82
(COMPUTER PROGRAMS AND MATHEMATICAL MODELS IN THERMAL RADIATION)
3
PRINT (REMOTE) ALL ACCESSION NUMBERS (233)
END
SEARCH
im
THERMAL
RADIATION
77
THERMAL RADIATION
1,791
im
INFRARED
RADIATION
78
INFRARED RADIATION
2,132
COMBINE
77+78
79
(INFRARED AND THERMAL RADIATION)
3,823
77 THERMAL RADIATION 1,791
78 INFRARED RADIATION 2,132
INTERSECT
76 WITH 79
80
(COMPUTER PROGRAMS AND MATHEMATICAL MODELS IN RADIATION)
233
76 (MATHEMATICAL MODELS AND COMPUTER PROGRAMS) 34,935
79 (INFRARED AND THERMAL RADIATION 3,823
INTERSECT
80 WITH 81
k
6
80 (COMPUTER PROGRAMS AND MATHEMATICAL MODELS IN RADIATION) 233
81 TEMPERATURE 21,626

LOGICAL PROCESSES EMPLOYED BY SEARCHER PJC

This searcher is an electrical engineer by training. He has had many years of industrial research, development, manufacturing, and management experience. His professional interests center on devices and systems rather than searching specific technical questions.

He began his search (Figure 6) by requesting an expansion on temperature. After reviewing all 41 terms, he constructed two sets, 1 dealing with temperature measurement and 2 dealing with temperature transducers. The first display of the expansion on "radiometer" indicated to him that the pertinent terms were just the three he used to create set 3 and he did not continue to display additional terms.

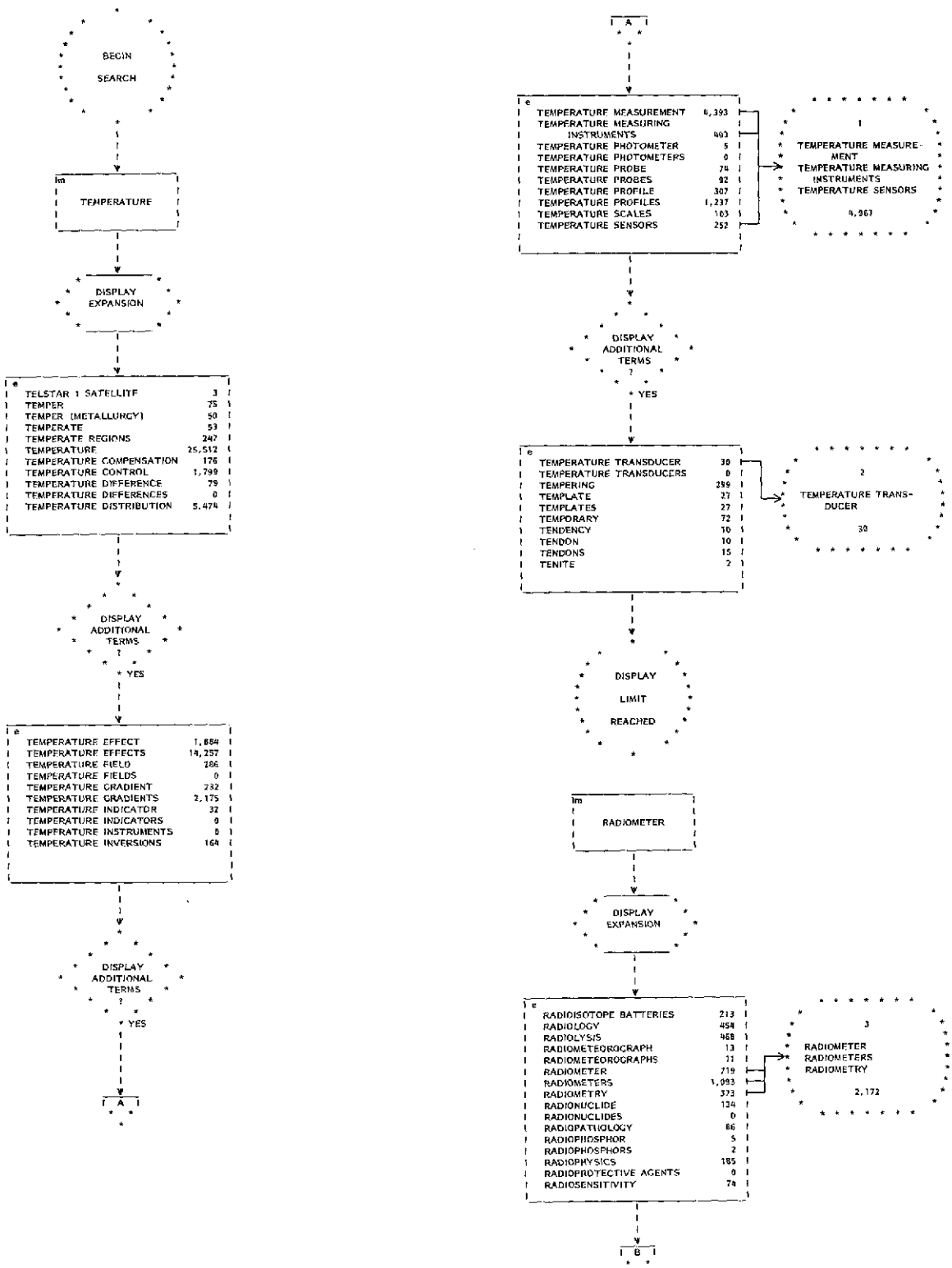
Thinking that measurement precision would certainly be a crucial aspect of the search, he selected "precision" as set 4 without first performing an expansion. He then returned to the earlier sets and performed an intersection of the union of sets 1 and 2 with set 3. The resulting set, 5, dealing with radiometers for temperature measuring, contained 147 items. Fearing that this was too small a group to represent the real content of the file, he tried a slightly different tack. He intersected a union of the first three sets with set 4. The resulting set, 6, contains documents which should deal with the precision with which one can make temperature measurements but only partially with radiometers. Only 19 citations were so identified. Examination of the full citation for two of these indicated that they were not particularly pertinent. Nevertheless, he asked that these 19 citations be printed in full and considered part of the final hit list. Moving then to the idea of the mathematical models by which the radiometer indications were interpreted, searcher PJC asked for an expansion on "mathematical model" and selected two terms from the first and final display to create set 7. He then selected set 8, "temperature measurement," and set 9, "temperature distribution," without examining an expansion. Performing an intersection of set 7 with the union of sets 8 and 9, he obtained set 10 with 375 postings dealing with mathematical models for temperature measurement.

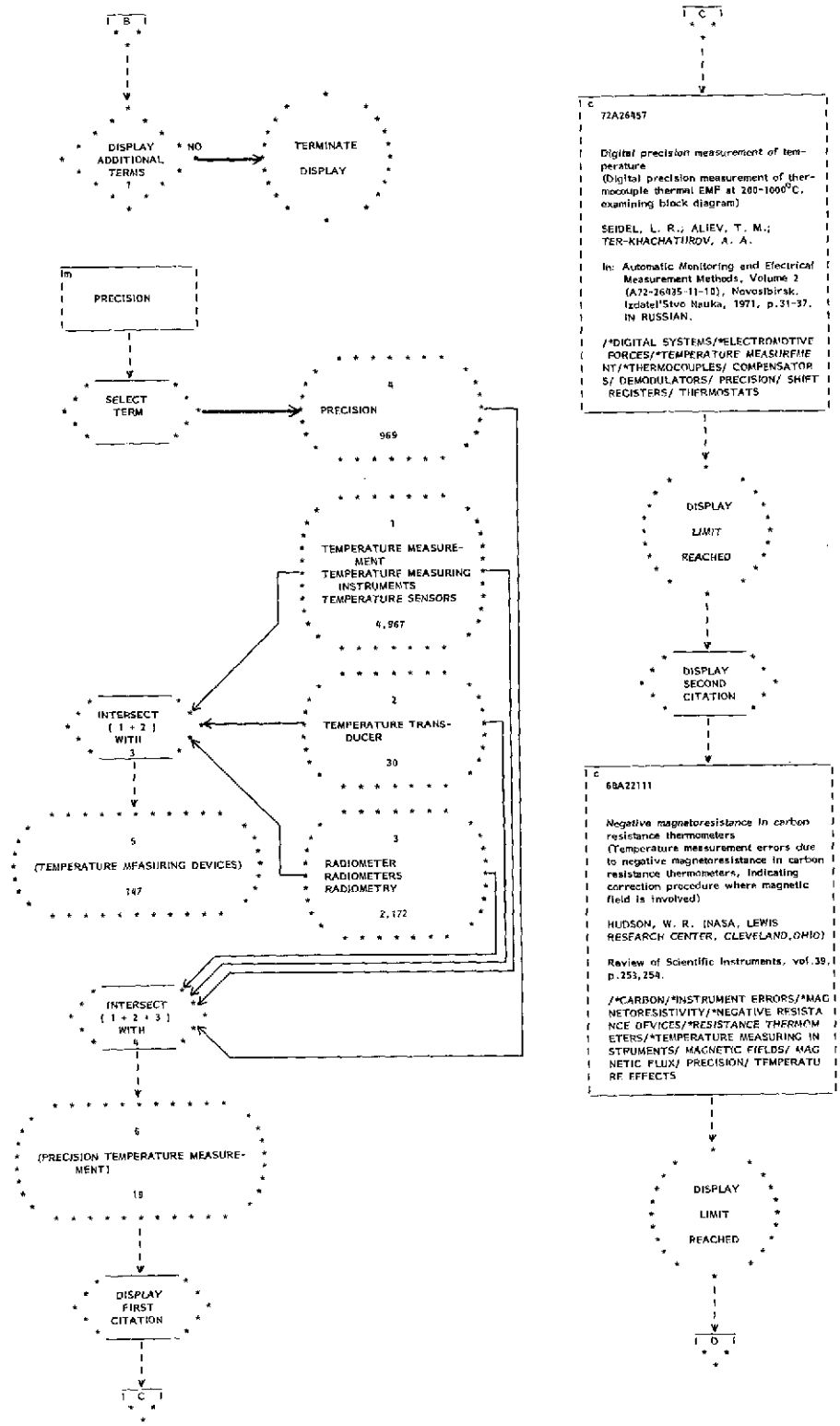
He then selected the term "data reduction" (set 11). Backing up for the moment, he tried an intersection of set 7 with set 9 to obtain set 12, a somewhat more restrictive form of set 10 with 298 postings. Documents in set 12 should deal with mathematical models for temperature distributions. Apparently searcher PJC reasoned that the restricted form contained sufficient data from which one could sift a suitable number of pertinent hits since he used set 12 as the basis of further investigation and dropped set 10 from further consideration. Before continuing in this vein, however, he intersected set 11 with set 1 to obtain 53 citations (set 13) dealing with data reduction of temperature measurements. Examination of the first three citations revealed them to be of little or moderate interest. When, however, an intersection of set 12 with set 4 gave no hits, he decided to print set 13 as part of his final hit list.

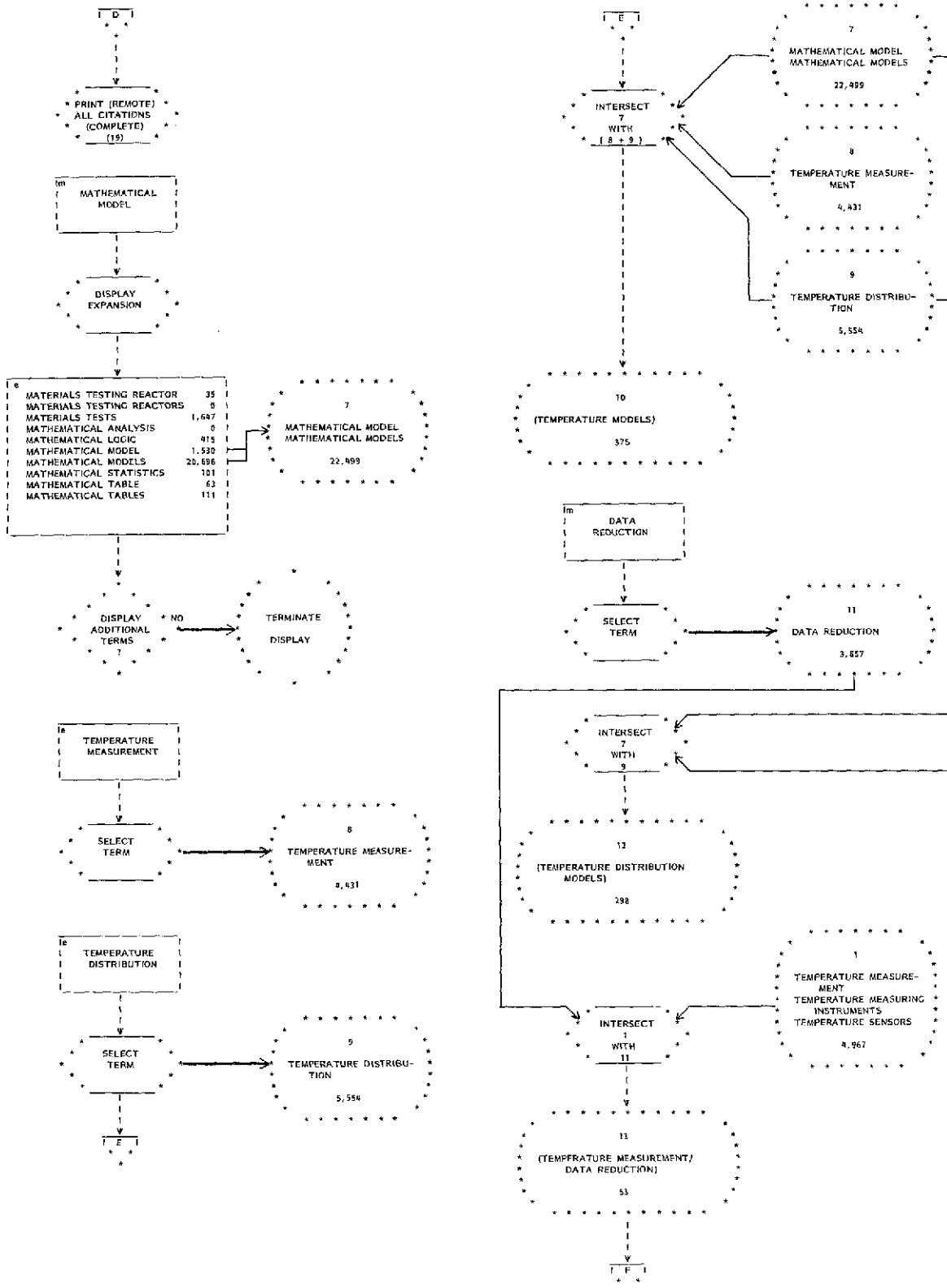
Taking one additional tack, he selected "remote sensors" and intersected this with the union of sets 1, 8, and 9, all dealing with temperature measurement. This produced set 15 with 107 hits which he chose to add to his final hit list.

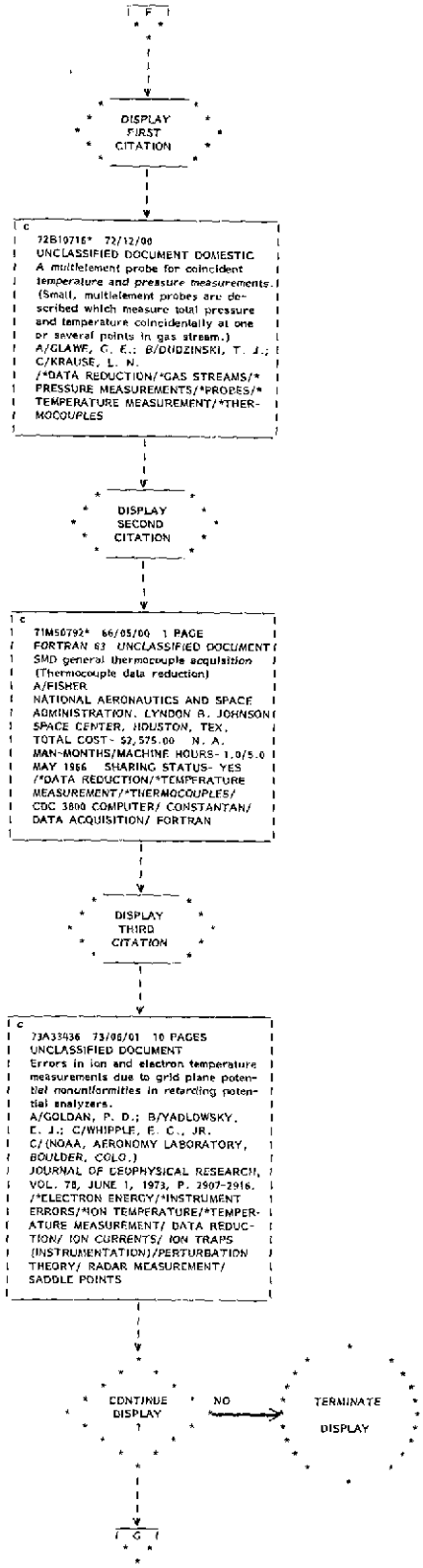
Of the 44 good hits found (out of a total of 179) by this search, only two were not found in at least one other search. Despite the limited promise of the citations he examined, about 25% of the hits in the search turned out to be relevant documents. Overall recall, however, was fairly low.

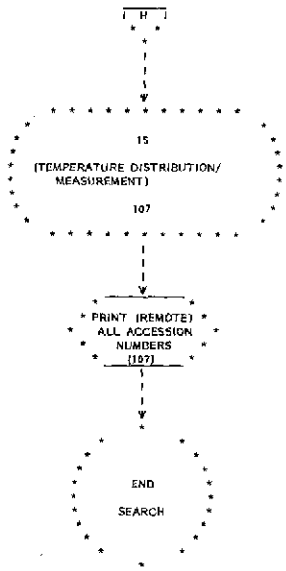
FIGURE 6


BEGIN SEARCH
im
TEMPERATURE
DISPLAY EXPANSION
e
TELSTAR 1 SATELLITE 3
TEMPER 75
TEMPER (METALLURGY) 50
TEMPERATE 53
TEMPERATE REGIONS 247
TEMPERATURE 25,512
TEMPERATURE COMPENSATION 176
TEMPERATURE CONTROL 1,799
TEMPERATURE DIFFERENCE 79
TEMPERATURE DIFFERENCES 0
TEMPERATURE DISTRIBUTION 5,474
DISPLAY ADDITIONAL TERMS ?
YES
e
TEMPERATURE EFFECT 1,884
TEMPERATURE EFFECTS 14,257
TEMPERATURE FIELD 286
TEMPERATURE FIELDS 0
TEMPERATURE GRADIENT 232
TEMPERATURE GRADIENTS 2,175
TEMPERATURE INDICATOR 32
TEMPERATURE INDICATORS 0
TEMPERATURE INSTRUMENTS 0
TEMPERATURE INVERSIONS 164
DISPLAY ADDITIONAL TERMS ?
YES
A
A
e
TEMPERATURE MEASUREMENT 4,393
TEMPERATURE MEASURING INSTRUMENTS 603
TEMPERATURE PHOTOMETER 5
TEMPERATURE PHOTOMETERS 0
TEMPERATURE PROBE 74
TEMPERATURE PROBES 92
TEMPERATURE PROFILE 307
TEMPERATURE PROFILES 1,237
TEMPERATURE SCALES 103
TEMPERATURE SENSORS 252
1
TEMPERATURE MEASUREMENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE SENSORS
4,967
DISPLAY ADDITIONAL TERMS ?
YES
e
TEMPERATURE TRANSDUCER 30
TEMPERATURE TRANSDUCERS 0
TEMPERING 289
TEMPLATE 27
TEMPLATES 27
TEMPORARY 72
TENDENCY 16
TENDON 10
TENDONS 15
TENITE 2
2
TEMPERATURE TRANSDUCER
30
DISPLAY LIMIT REACHED
im
RADIOMETER
DISPLAY EXPANSION
e
RADIOISOTOPE BATTERIES 213
RADIOLOGY 454
RADIOLYSIS 468
RADIOMETEOROGRAPH 13
RADIOMETEOROGRAPHS 11
RADIOMETER 719
RADIOMETERS 1,093
RADIOMETRY 373
RADIONUCLIDE 134
RADIONUCLIDES 0
RADIOPATHOLOGY 86
RADIOPHOSPHOR 5
RADIOPHOSPHORS 2
RADIOPHYSICS 185
RADIOPROTECTIVE AGENTS 0
RADIOSENSITIVITY 74
3
RADIOMETER
RADIOMETERS
RADIOMETRY
2,172
B


B
DISPLAY ADDITIONAL TERMS
7
NO
TERMINATE DISPLAY
Im
PRECISION
SELECT TERM
4
PRECISION
969
1
TEMPERATURE MEASUREMENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE SENSORS
4,967
2
TEMPERATURE TRANSDUCER
30
3
RADIOMETER
RADIOMETERS
RADIOMETRY
2,172
INTERSECT (1 + 2) WITH
3
5
(TEMPERATURE MEASURING DEVICES)
147
INTERSECT (1 + 2 + 3) WITH
4
6
(PRECISION TEMPERATURE MEASUREMENT)
18
DISPLAY FIRST CITATION
C
C
72A26857
Digital precision measurement of temperature
(Digital precision measurement of thermocouple thermal EMF at 200-1000°C, examining block diagram)
SEIDEL, L. R., ALIEV, T. M.; TER-KHACHATUROV, A. A.
In: Automatic Monitoring and Electrical Measurement Methods, Volume 2 (A72-26035-11-10), Novosibirsk, Izdatel'stvo Nauka, 1971, p.31-37. IN RUSSIAN.
/*DIGITAL SYSTEMS/*ELECTROMOTIVE FORCES/*TEMPERATURE MEASUREMENT/*THERMOCOUPLES/ COMPENSATORS/ DEMODULATORS/ PRECISION/ SHIFT REGISTERS/ THERMOSTATS
DISPLAY LIMIT REACHED
DISPLAY SECOND CITATION
C
68A22111
Negative magnetoresistance in carbon resistance thermometers
(Temperature measurement errors due to negative magnetoresistance in carbon resistance thermometers, indicating correction procedure where magnetic field is involved)
HUDSON, W. R. (NASA, LEWIS RESEARCH CENTER, CLEVELAND, OHIO)
Review of Scientific Instruments, vol.39, p.253,254.
/*CARBON/*INSTRUMENT ERRORS/*MAGNETORESISTIVITY/*NEGATIVE RESISTANCE DEVICES/*RESISTANCE THERMOMETERS/*TEMPERATURE MEASURING INSTRUMENTS/ MAGNETIC FIELDS/ MAGNETIC FLUX/ PRECISION/ TEMPERATURE EFFECTS
DISPLAY LIMIT REACHED
D
C


D
PRINT (REMOTE) ALL CITATIONS (COMPLETE) (19)
MATHEMATICAL MODEL
DISPLAY EXPANSION
MATERIALS TESTING REACTOR 35
MATERIALS TESTING REACTORS 8
MATERIALS TESTS 1,647
MATHEMATICAL ANALYSIS 0
MATHEMATICAL LOGIC 415
MATHEMATICAL MODEL 1,530
MATHEMATICAL MODELS 20,696
MATHEMATICAL STATISTICS 101
MATHEMATICAL TABLE 63
MATHEMATICAL TABLES 111
7
MATHEMATICAL MODEL MATHEMATICAL MODELS
22,499
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
TEMPERATURE MEASUREMENT
SELECT TERM
8
TEMPERATURE MEASUREMENT
4,431
TEMPERATURE DISTRIBUTION
SELECT TERM
9
TEMPERATURE DISTRIBUTION
5,554
E
E
7
MATHEMATICAL MODEL MATHEMATICAL MODELS
22,499
INTERSECT 7 WITH (8 + 9)
8
TEMPERATURE MEASUREMENT
4,431
9
TEMPERATURE DISTRIBUTION
5,554
10
(TEMPERATURE MODELS)
375
DATA REDUCTION
SELECT TERM
11
DATA REDUCTION
3,657
INTERSECT 7 WITH 9
12
(TEMPERATURE DISTRIBUTION MODELS)
298
1
TEMPERATURE MEASUREMENT TEMPERATURE MEASURING INSTRUMENTS TEMPERATURE SENSORS
4,967
INTERSECT 1 WITH 11
13
(TEMPERATURE MEASUREMENT/ DATA REDUCTION)
53
F


F
DISPLAY FIRST CITATION
c
72B10716* 72/12/00
UNCLASSIFIED DOCUMENT DOMESTIC
A multielement probe for coincident temperature and pressure measurements.
(Small, multielement probes are described which measure total pressure and temperature coincidentally at one or several points in gas stream.)
A/GLAWE, G. E.; B/DUDZINSKI, T. J.; C/KRAUSE, L. N.
/*DATA REDUCTION/*GAS STREAMS/*PRESSURE MEASUREMENTS/*PROBES/*TEMPERATURE MEASUREMENT/*THERMOCOUPLES
DISPLAY SECOND CITATION
c
71M50792* 66/05/00 1 PAGE
FORTRAN 63 UNCLASSIFIED DOCUMENT
SMD general thermocouple acquisition (Thermocouple data reduction)
A/FISHER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
TOTAL COST- $2,575.00 N. A.
MAN-MONTHS/MACHINE HOURS- 1.0/5.0
MAY 1966 SHARING STATUS- YES
/*DATA REDUCTION/*TEMPERATURE MEASUREMENT/*THERMOCOUPLES/
CDC 3800 COMPUTER/ CONSTANTAN/ DATA ACQUISITION/ FORTRAN
DISPLAY THIRD CITATION
c
73A33436 73/06/01 10 PAGES
UNCLASSIFIED DOCUMENT
Errors in ion and electron temperature measurements due to grid plane potential nonuniformities in retarding potential analyzers.
A/GOLDAN, P. D.; B/YADLOWSKY, E. J.; C/WHIPPLE, E. C., JR.
C/(NOAA, AERONOMY LABORATORY, BOULDER, COLO.)
JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 78, JUNE 1, 1973, P. 2907-2916.
/*ELECTRON ENERGY/*INSTRUMENT ERRORS/*ION TEMPERATURE/*TEMPERATURE MEASUREMENT/ DATA REDUCTION/ ION CURRENTS/ ION TRAPS (INSTRUMENTATION)/PERTURBATION THEORY/ RADAR MEASUREMENT/ SADDLE POINTS
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
G
G
INTERSECT 12 WITH 4
12
(TEMPERATURE DISTRIBUTION MODELS)
288
4
PRECISION
969
NULL SET
PRINT (REMOTE) ALL CITATIONS (COMPLETE) (53)
PRINT (REMOTE) ALL ACCESSION NUMBERS (53)
13
(TEMPERATURE MEASUREMENT/DATA REDUCTION)
53
m
REMOTE SENSORS
SELECT TERM
14
REMOTE SENSORS
2,657
8
TEMPERATURE MEASUREMENT
8,431
INTERSECT 14 WITH (8 + 9 + 1)
9
TEMPERATURE DISTRIBUTION
5,554
1
TEMPERATURE MEASUREMENT
TEMPERATURE MEASURING INSTRUMENTS
TEMPERATURE SENSORS
4,967
H


H
15
(TEMPERATURE DISTRIBUTION/
MEASUREMENT)
107
PRINT (REMOTE)
ALL ACCESSION
NUMBERS
(107)
END
SEARCH

LOGICAL PROCESSES EMPLOYED BY SEARCHER SFS

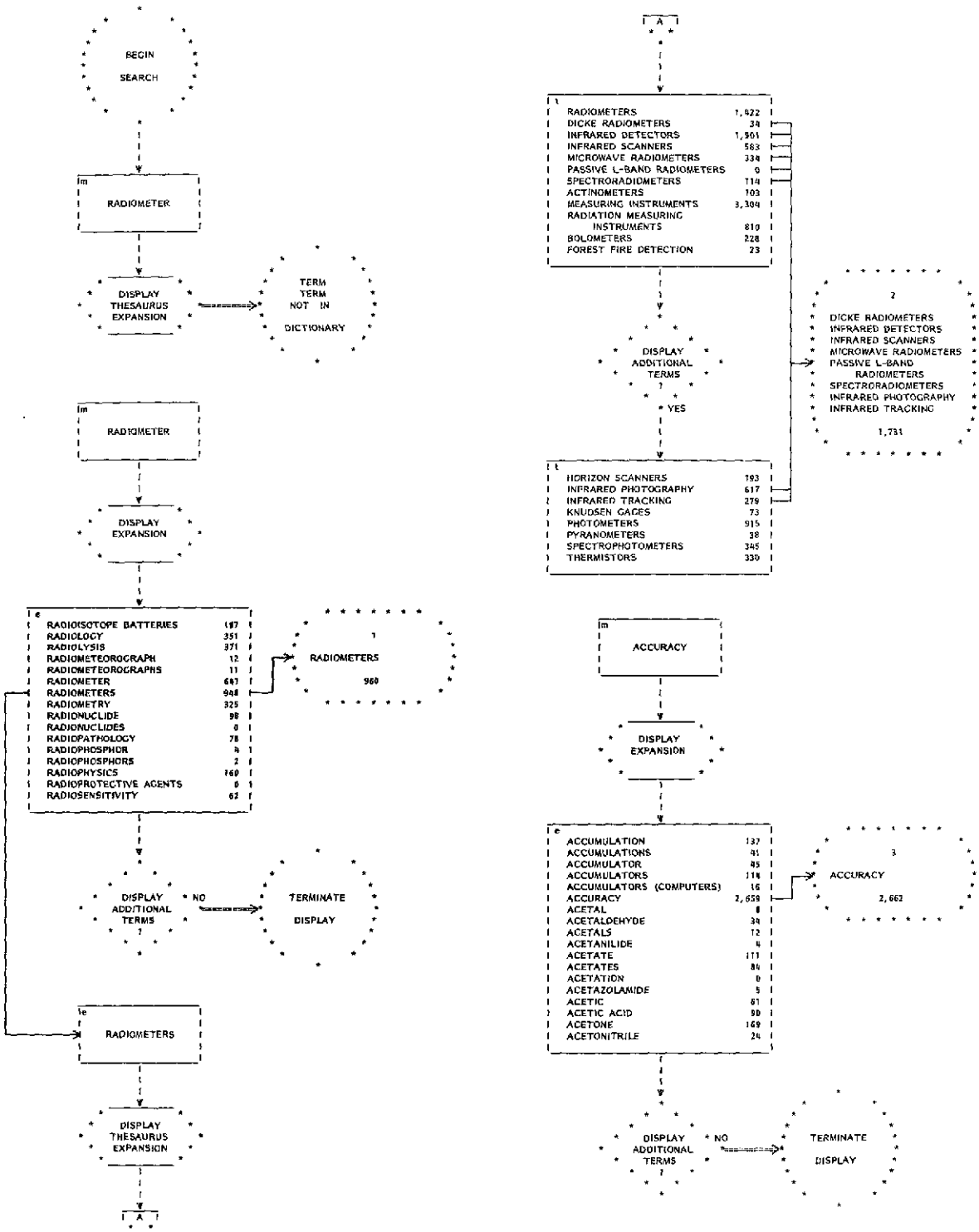
Searcher SFS is a young, graduate industrial engineer with a specialization in production but with no industrial experience. He is familiar with searching procedures, the NASA data base, and with RECON.

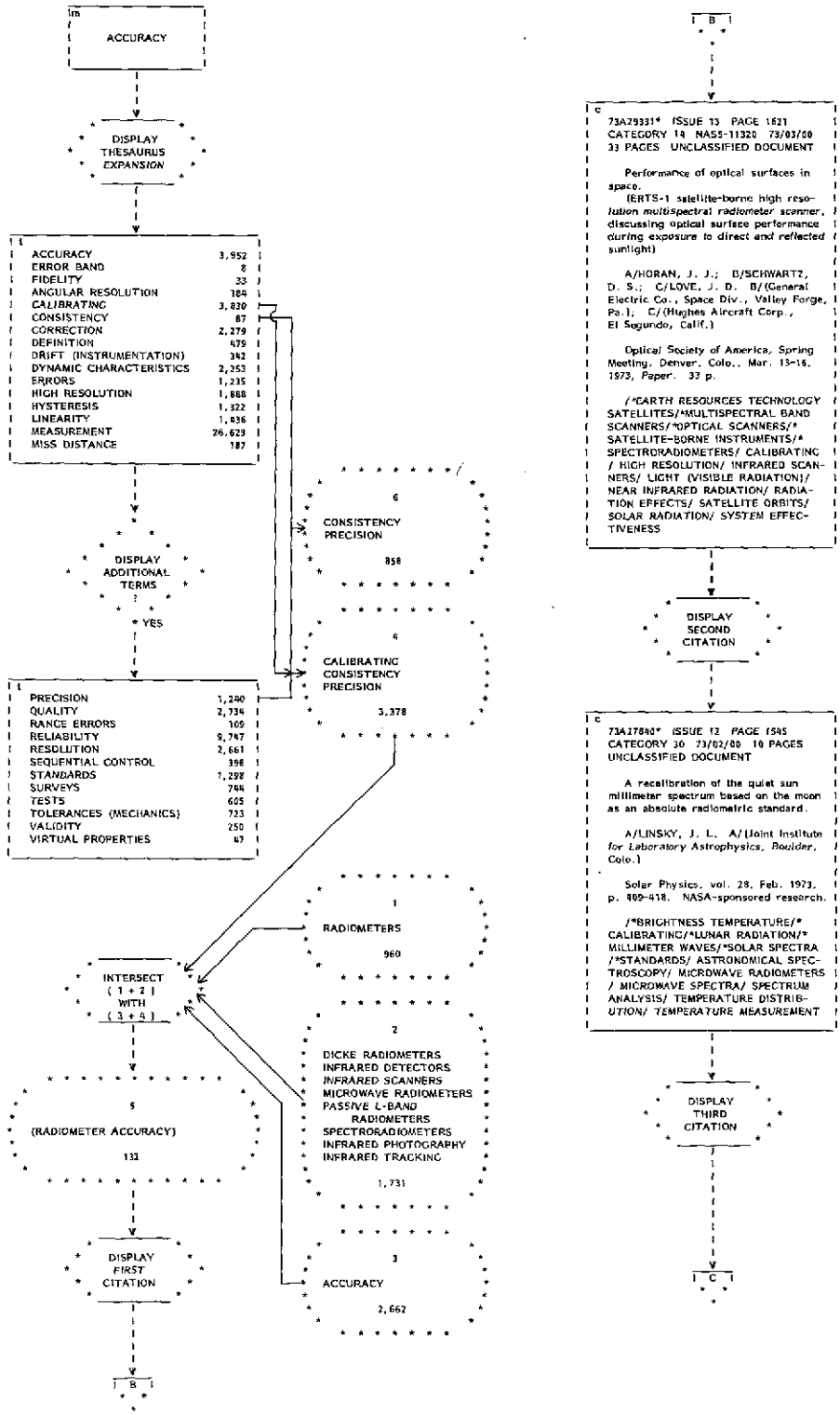
As seen in Figure 7, he began by attempting a hierarchical (thesaurus) expansion on the basic instrument used to make the measurement of lake temperature from an overflying aircraft (radiometer). Since the term did not appear in the singular in the dictionary, he asked for an expansion of that portion of the alphabetical dictionary. In this fashion he found that thesaurus expansions are generally made about plural forms. He selected radiometers as a set and then went on to perform the expansion he had originally set out to do, i.e.,on radiometers. From the resulting display of 20 terms he grouped eight to create set 2.

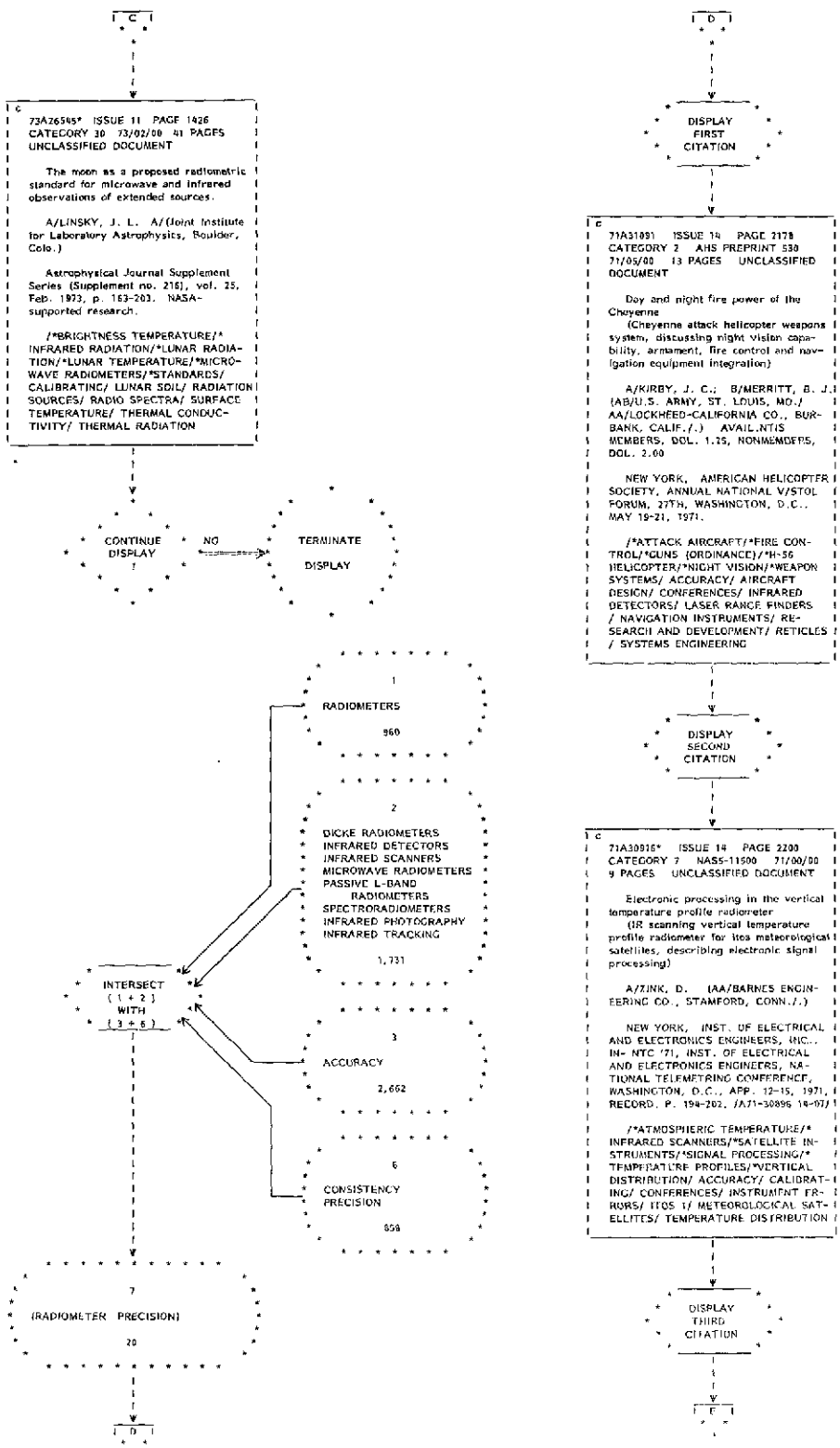
Since the customer had been concerned about possible accuracy of measurement, searcher SFS next asked for an expansion on the word "accuracy." Other than the term itself (set 3), nothing else in the display appeared to be of interest. He then tried a thesaurus expansion on "accuracy." From these displays he selected three terms from which he created set 4. He then intersected a union of set 1 and 2 (radiometers) with a union of sets 3 and 4 (accuracy). This produced 132 hits. Upon display of the first three citations, he decided that the index term "calibrating" was responsible for retrieving these citations which were not directly pertinent. He therefore dropped calibrating from set 4 thereby creating set 6. He then repeated the intersection (this time with set 6 instead of set 4) to obtain set 7 with only 20 hits. The first three citations from set 7 were only slightly more pertinent than those from set 5. This indicated to him that if he were to find a significant number of pertinent documents, a new tack would be required.

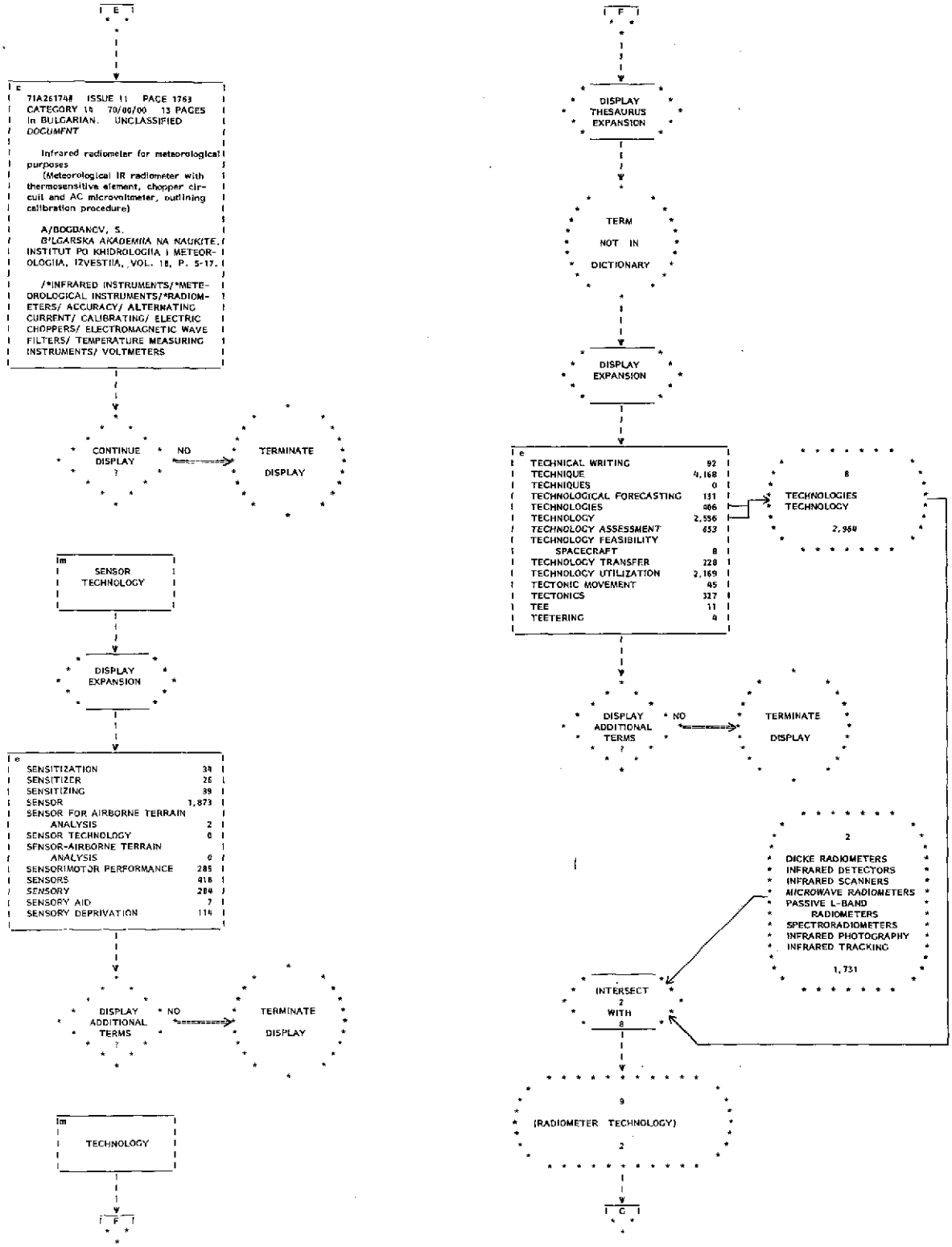
He tried an expansion on sensor technology but was disappointed with the neighboring terms and therefore discontinued the expansion. He then decided to perform a thesaurus expansion on "technology" with the result that he learned the term does not appear in the thesaurus. A dictionary expansion on the same term showed it did appear in the pre-1968 file with 2,556 postings and that "technologies" was the correct term for the post-1967 file. From these two terms, he created set 8. This he then intersected with set 2 (the thesaurus expansion on radiometers) and obtained only two hits which he displayed. They were not pertinent so he decided to accept as his final hit list the 132 items from set 5, knowing of course that the relevance of at least the first three citations was not good. He later redid the search along essentially the same lines and got a total of 160 hits. The latter items were the ones evaluated. Some 60 items from this group were regarded by the experiment director as pertinent. Thirty-one of these were not found by any other searcher. The 60 pertinent items found in this search can be compared with the total number of pertinent items found in all searches (388) to point out that while the relevance is high, the recall is only 15.5%.

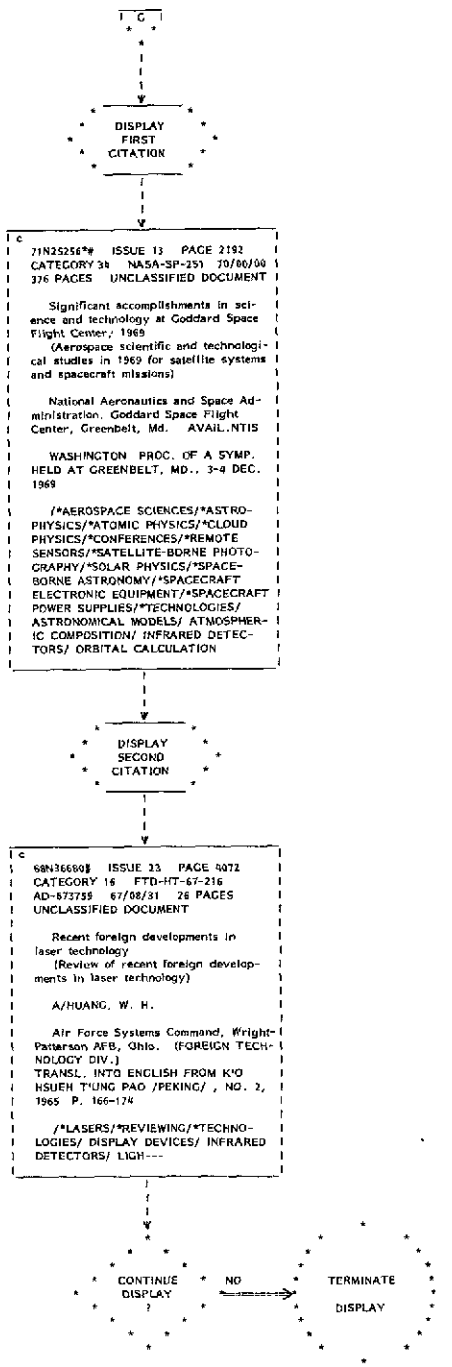
FIGURE 7

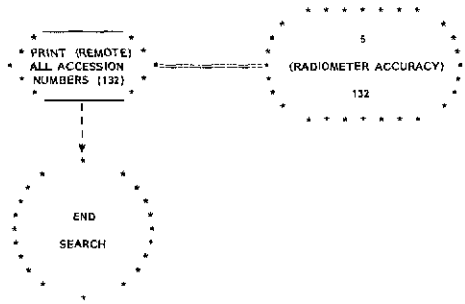

BEGIN SEARCH
RADIOMETER
DISPLAY THESAURUS EXPANSION
TERM NOT IN DICTIONARY
RADIOMETER
DISPLAY EXPANSION
RADIOISOTOPE BATTERIES 187
RADIOLOGY 351
RADIOLYSIS 371
RADIOMETEOROGRAPH 12
RADIOMETEOROGRAPHS 11
RADIOMETER 667
RADIOMETERS 948
RADIOMETRY 325
RADIONUCLIDE 98
RADIONUCLIDES 0
RADIOPATHOLOGY 78
RADIOPHOSPHOR 4
RADIOPHOSPHORS 2
RADIOPHYSICS 160
RADIOPROTECTIVE AGENTS 0
RADIOSENSITIVITY 62
7 RADIOMETERS 960
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
RADIOMETERS
DISPLAY THESAURUS EXPANSION
A
A
RADIOMETERS 1,422
DICKE RADIOMETERS 34
INFRARED DETECTORS 1,901
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 334
PASSIVE L-BAND RADIOMETERS 0
SPECTRORADIOMETERS 114
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
BOLOMETERS 228
FOREST FIRE DETECTION 23
DISPLAY ADDITIONAL TERMS ?
YES
7 DICKE RADIOMETERS INFRARED DETECTORS INFRARED SCANNERS MICROWAVE RADIOMETERS PASSIVE L-BAND RADIOMETERS SPECTRORADIOMETERS INFRARED PHOTOGRAPHY INFRARED TRACKING 1,731
HORIZON SCANNERS 193
INFRARED PHOTOGRAPHY 617
INFRARED TRACKING 279
KNUDSEN GAGES 73
PHOTOMETERS 915
PYRANOMETERS 38
SPECTROPHOTOMETERS 345
THERMISTORS 339
ACCURACY
DISPLAY EXPANSION
ACCUMULATION 137
ACCUMULATIONS 41
ACCUMULATOR 85
ACCUMULATORS 178
ACCUMULATORS (COMPUTERS) 16
ACCURACY 2,659
ACETAL 8
ACETALDEHYDE 34
ACETALS 12
ACETANILIDE 4
ACETATE 171
ACETATES 84
ACETATION 0
ACETAZOLAMIDE 5
ACETIC 61
ACETIC ACID 90
ACETONE 169
ACETONITRILE 24
3 ACCURACY 2,662
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY


1m
ACCURACY
DISPLAY THESAURUS EXPANSION
1 1
ACCURACY 3,952
ERROR BAND 8
FIDELITY 33
ANGULAR RESOLUTION 184
CALIBRATING 3,820
CONSISTENCY 87
CORRECTION 2,279
DEFINITION 479
DRIFT (INSTRUMENTATION) 342
DYNAMIC CHARACTERISTICS 2,253
ERRORS 1,235
HIGH RESOLUTION 1,868
HYSTERESIS 1,322
LINEARITY 1,836
MEASUREMENT 26,629
MISS DISTANCE 187
DISPLAY ADDITIONAL TERMS ?
YES
1 1
PRECISION 1,240
QUALITY 2,734
RANGE ERRORS 109
RELIABILITY 9,747
RESOLUTION 2,661
SEQUENTIAL CONTROL 398
STANDARDS 1,298
SURVEYS 744
TESTS 605
TOLERANCES (MECHANICS) 723
VALIDITY 250
VIRTUAL PROPERTIES 47
6
CONSISTENCY PRECISION
858
4
CALIBRATING CONSISTENCY PRECISION
3,378
1
RADIOMETERS
960
2
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
INFRARED PHOTOGRAPHY
INFRARED TRACKING
1,731
3
ACCURACY
2,662
INTERSECT (1 + 2) WITH (3 + 4)
5
(RADIOMETER ACCURACY)
132
DISPLAY FIRST CITATION
B
B
c
73A29331* ISSUE 13 PAGE 1621
CATEGORY 14 NASS-11320 73/03/00
33 PAGES UNCLASSIFIED DOCUMENT
Performance of optical surfaces in space.
(ERTS-1 satellite-borne high resolution multispectral radiometer scanner, discussing optical surface performance during exposure to direct and reflected sunlight)
A/HORAN, J. J.; B/SCHWARTZ, D. S.; C/LOVE, J. D. B/(General Electric Co., Space Div., Valley Forge, Pa.); C/(Hughes Aircraft Corp., El Segundo, Calif.)
Optical Society of America, Spring Meeting, Denver, Colo., Mar. 13-16, 1973, Paper. 33 p.
/*EARTH RESOURCES TECHNOLOGY SATELLITES/*MULTISPECTRAL BAND SCANNERS/*OPTICAL SCANNERS/* SATELLITE-BORNE INSTRUMENTS/* SPECTRORADIOMETERS/ CALIBRATING / HIGH RESOLUTION/ INFRARED SCANNERS/ LIGHT (VISIBLE RADIATION)/ NEAR INFRARED RADIATION/ RADIATION EFFECTS/ SATELLITE ORBITS/ SOLAR RADIATION/ SYSTEM EFFECTIVENESS
DISPLAY SECOND CITATION
c
73A27840* ISSUE 12 PAGE 1595
CATEGORY 30 73/02/00 10 PAGES
UNCLASSIFIED DOCUMENT
A recalibration of the quiet sun millimeter spectrum based on the moon as an absolute radiometric standard.
A/LINSKY, J. L. A/(Joint Institute for Laboratory Astrophysics, Boulder, Colo.)
Solar Physics, vol. 28, Feb. 1973, p. 409-418. NASA-sponsored research.
/*BRIGHTNESS TEMPERATURE/* CALIBRATING/*LUNAR RADIATION/* MILLIMETER WAVES/*SOLAR SPECTRA /*STANDARDS/ ASTRONOMICAL SPECTROSCOPY/ MICROWAVE RADIOMETERS / MICROWAVE SPECTRA/ SPECTRUM ANALYSIS/ TEMPERATURE DISTRIBUTION/ TEMPERATURE MEASUREMENT
DISPLAY THIRD CITATION
C


C
73A26565* ISSUE 11 PAGE 1426
CATEGORY 30 73/02/00 41 PAGES
UNCLASSIFIED DOCUMENT
The moon as a proposed radiometric standard for microwave and infrared observations of extended sources.
A/LINSKY, J. L. A/(Joint Institute for Laboratory Astrophysics, Boulder, Colo.)
Astrophysical Journal Supplement Series (Supplement no. 216), vol. 25, Feb. 1973, p. 163-203. NASA-supported research.
/*BRIGHTNESS TEMPERATURE/* INFRARED RADIATION/*LUNAR RADIATION/*LUNAR TEMPERATURE/*MICROWAVE RADIOMETERS/*STANDARDS/ CALIBRATING/ LUNAR SOIL/ RADIATION SOURCES/ RADIO SPECTRA/ SURFACE TEMPERATURE/ THERMAL CONDUCTIVITY/ THERMAL RADIATION
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
1
RADIOMETERS
960
2
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
INFRARED PHOTOGRAPHY
INFRARED TRACKING
1,731
INTERSECT (1 + 2) WITH (3 + 6)
3
ACCURACY
2,662
6
CONSISTENCY PRECISION
858
7
(RADIOMETER PRECISION)
20
D
D
DISPLAY FIRST CITATION
C
71A31091 ISSUE 14 PAGE 2178
CATEGORY 2 AHS PREPRINT 530
71/05/00 13 PAGES UNCLASSIFIED DOCUMENT
Day and night fire power of the Cheyenne
(Cheyenne attack helicopter weapons system, discussing night vision capability, armament, fire control and navigation equipment integration)
A/KIRBY, J. C.; B/MERRITT, B. J. (AB/U.S. ARMY, ST. LOUIS, MO./ AA/LOCKHEED-CALIFORNIA CO., BURBANK, CALIF./.) AVAIL.NTIS MEMBERS, DOL. 1.25, NONMEMBERS, DOL. 2.00
NEW YORK, AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL V/STOL FORUM, 27TH, WASHINGTON, D.C., MAY 19-21, 1971.
/*ATTACK AIRCRAFT/*FIRE CONTROL/*GUNS (ORDINANCE)/*H-56 HELICOPTER/*NIGHT VISION/*WEAPON SYSTEMS/ ACCURACY/ AIRCRAFT DESIGN/ CONFERENCES/ INFRARED DETECTORS/ LASER RANGE FINDERS / NAVIGATION INSTRUMENTS/ RESEARCH AND DEVELOPMENT/ RETICLES / SYSTEMS ENGINEERING
DISPLAY SECOND CITATION
C
71A30816* ISSUE 14 PAGE 2200
CATEGORY 7 NAS5-11500 71/00/00
9 PAGES UNCLASSIFIED DOCUMENT
Electronic processing in the vertical temperature profile radiometer
(IR scanning vertical temperature profile radiometer for itos meteorological satellites, describing electronic signal processing)
A/ZINK, D. (AA/BARNES ENGINEERING CO., STAMFORD, CONN./.)
NEW YORK, INST. OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., IN- NTC '71, INST. OF ELECTRICAL AND ELECTRONICS ENGINEERS, NATIONAL TELEMETRING CONFERENCE, WASHINGTON, D.C., APR. 12-15, 1971, RECORD. P. 194-202. /A71-30896 14-07/
/*ATMOSPHERIC TEMPERATURE/* INFRARED SCANNERS/*SATELLITE INSTRUMENTS/*SIGNAL PROCESSING/* TEMPERATURE PROFILES/*VERTICAL DISTRIBUTION/ ACCURACY/ CALIBRATING/ CONFERENCES/ INSTRUMENT ERRORS/ ITOS 1/ METEOROLOGICAL SATELLITES/ TEMPERATURE DISTRIBUTION
DISPLAY THIRD CITATION
F
F


E
71A26174# ISSUE 11 PAGE 1763
CATEGORY 16 70/00/00 13 PAGES
In BULGARIAN. UNCLASSIFIED
DOCUMENT
Infrared radiometer for meteorological purposes
(Meteorological IR radiometer with thermosensitive element, chopper circuit and AC microvoltmeter, outlining calibration procedure)
A/BOGDANOV, S.
B'LGARSKA AKADEMIIA NA NAUKITE, INSTITUT PO KHIDROLOGIIA I METEOROLOGIIA, IZVESTIIA, VOL. 18, P. 5-17.
/*INFRARED INSTRUMENTS/*METEOROLOGICAL INSTRUMENTS/*RADIOMETERS/ ACCURACY/ ALTERNATING CURRENT/ CALIBRATING/ ELECTRIC CHOPPERS/ ELECTROMAGNETIC WAVE FILTERS/ TEMPERATURE MEASURING INSTRUMENTS/ VOLTMETERS
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
SENSOR TECHNOLOGY
DISPLAY EXPANSION
SENSITIZATION 38
SENSITIZER 26
SENSITIZING 89
SENSOR 1,873
SENSOR FOR AIRBORNE TERRAIN ANALYSIS 2
SENSOR TECHNOLOGY 0
SENSOR-AIRBORNE TERRAIN ANALYSIS 0
SENSORIMOTOR PERFORMANCE 285
SENSORS 418
SENSORY 284
SENSORY AID 7
SENSORY DEPRIVATION 114
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
TECHNOLOGY
F
F
DISPLAY THESAURUS EXPANSION
TERM NOT IN DICTIONARY
DISPLAY EXPANSION
TECHNICAL WRITING 92
TECHNIQUE 4,168
TECHNIQUES 0
TECHNOLOGICAL FORECASTING 131
TECHNOLOGIES 406
TECHNOLOGY 2,556
TECHNOLOGY ASSESSMENT 653
TECHNOLOGY FEASIBILITY SPACECRAFT 8
TECHNOLOGY TRANSFER 228
TECHNOLOGY UTILIZATION 2,169
TECTONIC MOVEMENT 45
TECTONICS 327
TEE 11
TEETERING 4
8
TECHNOLOGIES TECHNOLOGY
2,964
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
2
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
INFRARED PHOTOGRAPHY
INFRARED TRACKING
1,731
INTERSECT 2 WITH 8
9
(RADIOMETER TECHNOLOGY)
2
G


G
DISPLAY FIRST CITATION
c
71N25256*# ISSUE 13 PAGE 2192
CATEGORY 38 NASA-SP-251 70/00/00
376 PAGES UNCLASSIFIED DOCUMENT
Significant accomplishments in science and technology at Goddard Space Flight Center, 1969
(Aerospace scientific and technological studies in 1969 for satellite systems and spacecraft missions)
National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. AVAIL.NTIS
WASHINGTON PROC. OF A SYMP. HELD AT GREENBELT, MD., 3-4 DEC. 1969
/*AEROSPACE SCIENCES/*ASTROPHYSICS/*ATOMIC PHYSICS/*CLOUD PHYSICS/*CONFERENCES/*REMOTE SENSORS/*SATELLITE-BORNE PHOTOGRAPHY/*SOLAR PHYSICS/*SPACE-BORNE ASTRONOMY/*SPACECRAFT ELECTRONIC EQUIPMENT/*SPACECRAFT POWER SUPPLIES/*TECHNOLOGIES/ ASTRONOMICAL MODELS/ ATMOSPHERIC COMPOSITION/ INFRARED DETECTORS/ ORBITAL CALCULATION
DISPLAY SECOND CITATION
c
68N36680# ISSUE 23 PAGE 4072
CATEGORY 16 FTD-HT-67-216
AD-673759 67/08/31 26 PAGES
UNCLASSIFIED DOCUMENT
Recent foreign developments in laser technology
(Review of recent foreign developments in laser technology)
A/HUANG, W. H.
Air Force Systems Command, Wright-Patterson AFB, Ohio. (FOREIGN TECHNOLOGY DIV.)
TRANSL. INTO ENGLISH FROM K'O HSUEH T'UNG PAO /PEKING/ , NO. 2, 1965 P. 166-174
/*LASERS/*REVIEWING/*TECHNOLOGIES/ DISPLAY DEVICES/ INFRARED DETECTORS/ LIGH---
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY


PRINT (REMOTE) ALL ACCESSION NUMBERS (132)
5
(RADIOMETER ACCURACY)
132
END SEARCH

LOGICAL PROCESSES EMPLOYED BY SEARCHER CLN

This searcher is an aerospace engineer with a research and development background (primarily in structures) and a familiarity with the data base and with RECON.

He began his search (Figure 8) by requesting an expansion on "radiometer." Although he only looked at the initial display, he selected four terms centering around "radiometer" from which to create set 1. He then requested a thesaurus expansion on "radiometers" selecting 9 from which he created set 2.

His next idea was to examine the potential of terms related to thermal pollution. The dictionary expansion, he concluded, was not very productive so he tried thesaurus expansion. From this he took 13 terms to form set 3. One of the other terms in the expansion, "Lakes," seemed to him to offer an opportunity to examine a very pertinent aspect of the problem. He collected 9 terms from the thesaurus expansion to form set 4. Then, approaching the crux of the matter, he requested an expansion on "water." Set 5, taken from this expansion, deals with "water," "water intake(s)," and "water management" and has some 8,700 postings.

He then approached the idea of "remote sensing" but when the term was not found in the thesaurus dictionary, he abandoned the idea and proceeded to intersect the union of sets 1 and 2 with the union of sets 3, 4, and 5. The resulting set, 7, should contain documents dealing with radiometry of water systems. Set 7 consists of 230 items. The searcher displayed the accession numbers of these and then displayed the full citation for a new N-document and an older A-document. These appeared to be approaching the core of the matter; in particular, the first item seemed quite pertinent.

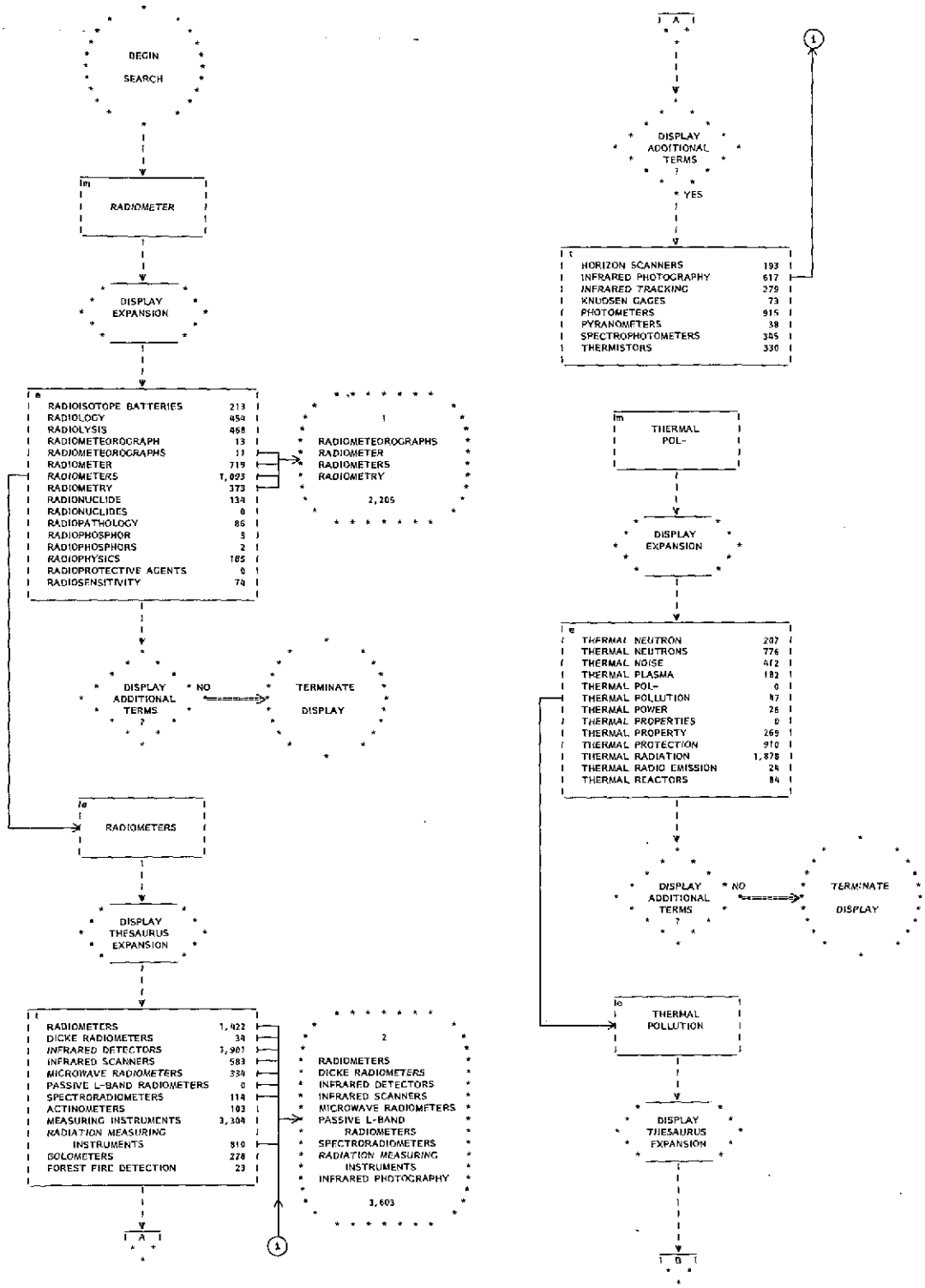
The searcher next left these documents and proceeded to examine another aspect of the problem statement; a mathematical model of the emission, transmission, and reception of radiant energy. He began by requesting an expansion on "mathematical model" and selected two terms from among the 24 that he examined. Out of these he created set 8. Since the customer, as indicated by the problem statement, was interested in solving any mathematical model deemed appropriate by computer, the searcher next asked for an expansion on "computerized." The first display convinced him that in asking for an expansion on "computerized," he had passed the point in the dictionary where the terms of most interest lay. He therefore asked for an expansion on "computer" and from this selected four terms with total postings of 16,367 as set 9.

Continuing with the idea of computerized processing of data according to a given mathematical model, the searcher asked for an expansion on "data." He formed set 10 with 12,745 postings from 5 of the terms in this expansion which, incidently, he carried through to 40 terms. Next, he asked for a thesaurus expansion on "Data reduction." The results he did not care for. He then intersected a union of sets 8, 9, and 10 with a union of sets 1 and 2 to obtain set 11 of 288 postings which dealt with modeling and processing of radiometer data. Apparently, the number of documents in this set was somewhat larger than he reasoned might be really pertinent so he performed

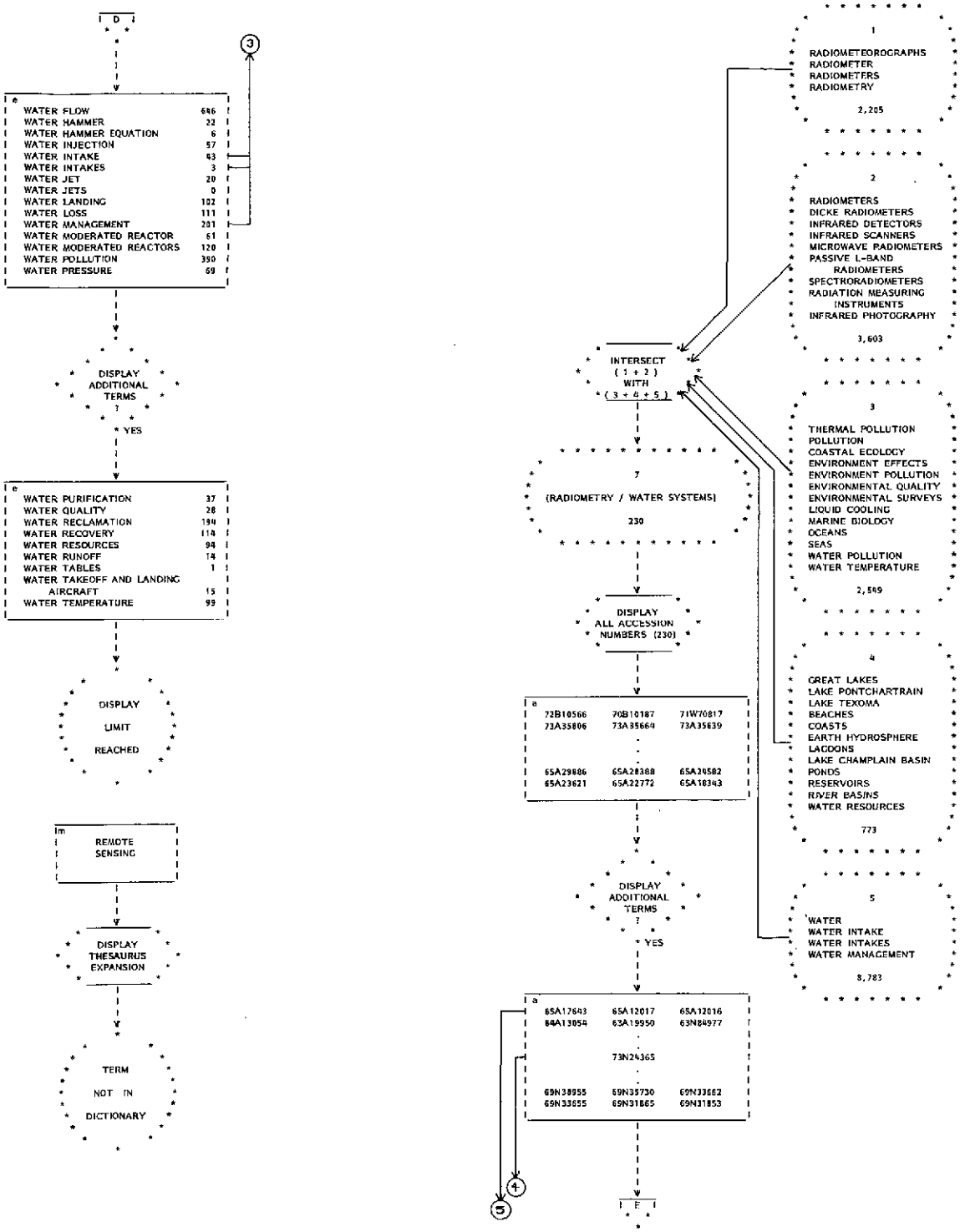
(1+2) * (8+10) and got set 12 with 256 hits; (1+2) * 10 and got 202; (1+2) * (8+9) and got 102. Each of these subsets of 11 were fairly large, indicating substantial overlap in indexing. He tried to get somewhat more specific hits by performing (1+2) * (8+9) * 10 which yielded set 15 with 16 hits.

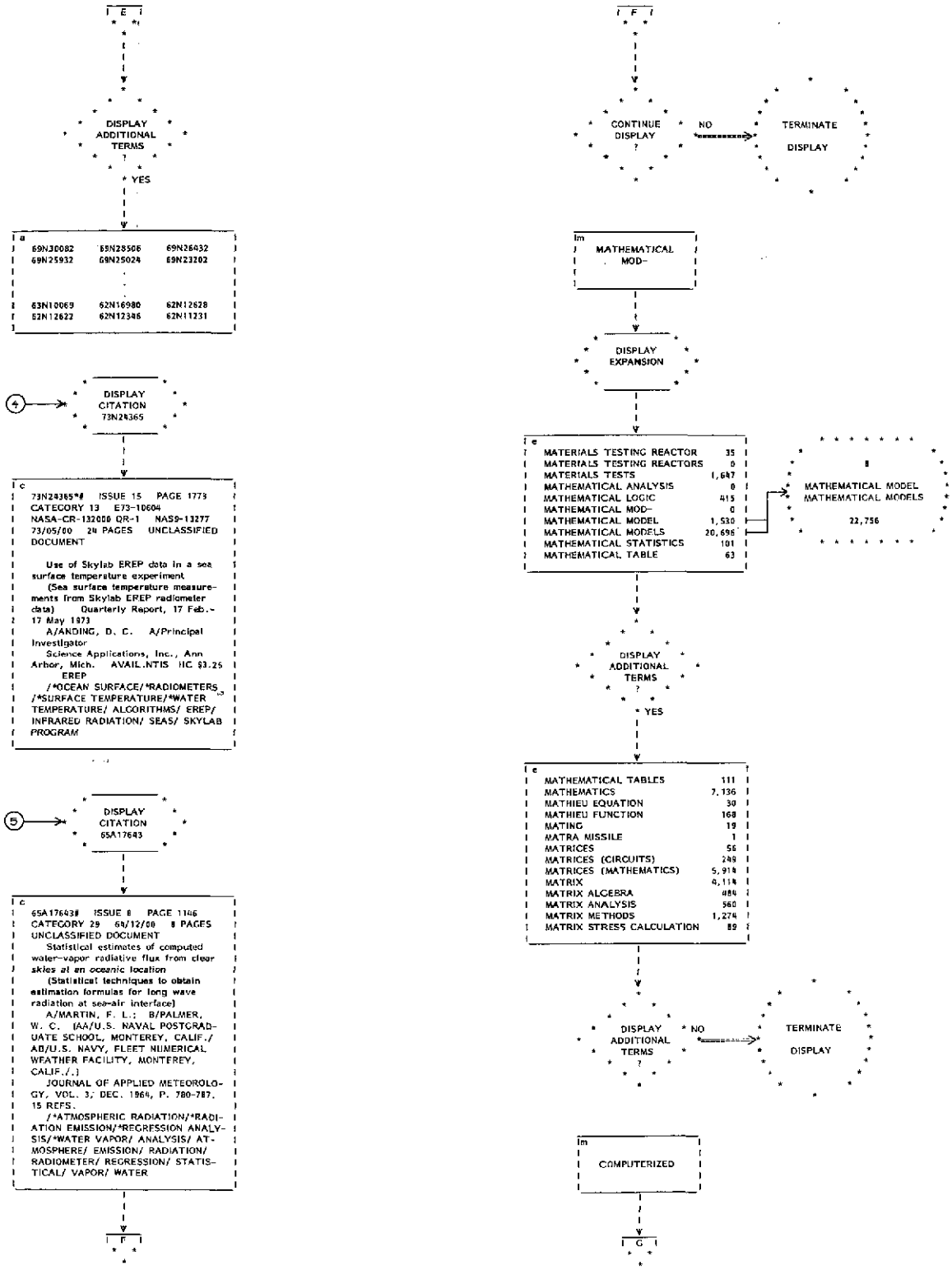
Backtracking, the searcher then combined sets 7 and 11 to obtain set 16 with 504 documents dealing generally with radiometry, water systems and data analysis. At this point, he decided he would go back to the thesaurus expansion of "radiometers." From this expansion, he selected five terms, instead of the nine he used to form set 2, to create set 17. He then performed an operation similar to the creation of set 11, except that he replaced set 2 by set 17. This gave him 164 hits (compared with 288 in set 11). He added to this set, set 18, the 230 documents from set 7 dealing with radiometry and water systems to form set 19 with 387 documents. This he called his final hit list. Ninety-seven of these hits were considered good (relevant) by the project director. Eighteen of these were <u>not</u> found by any other searcher.

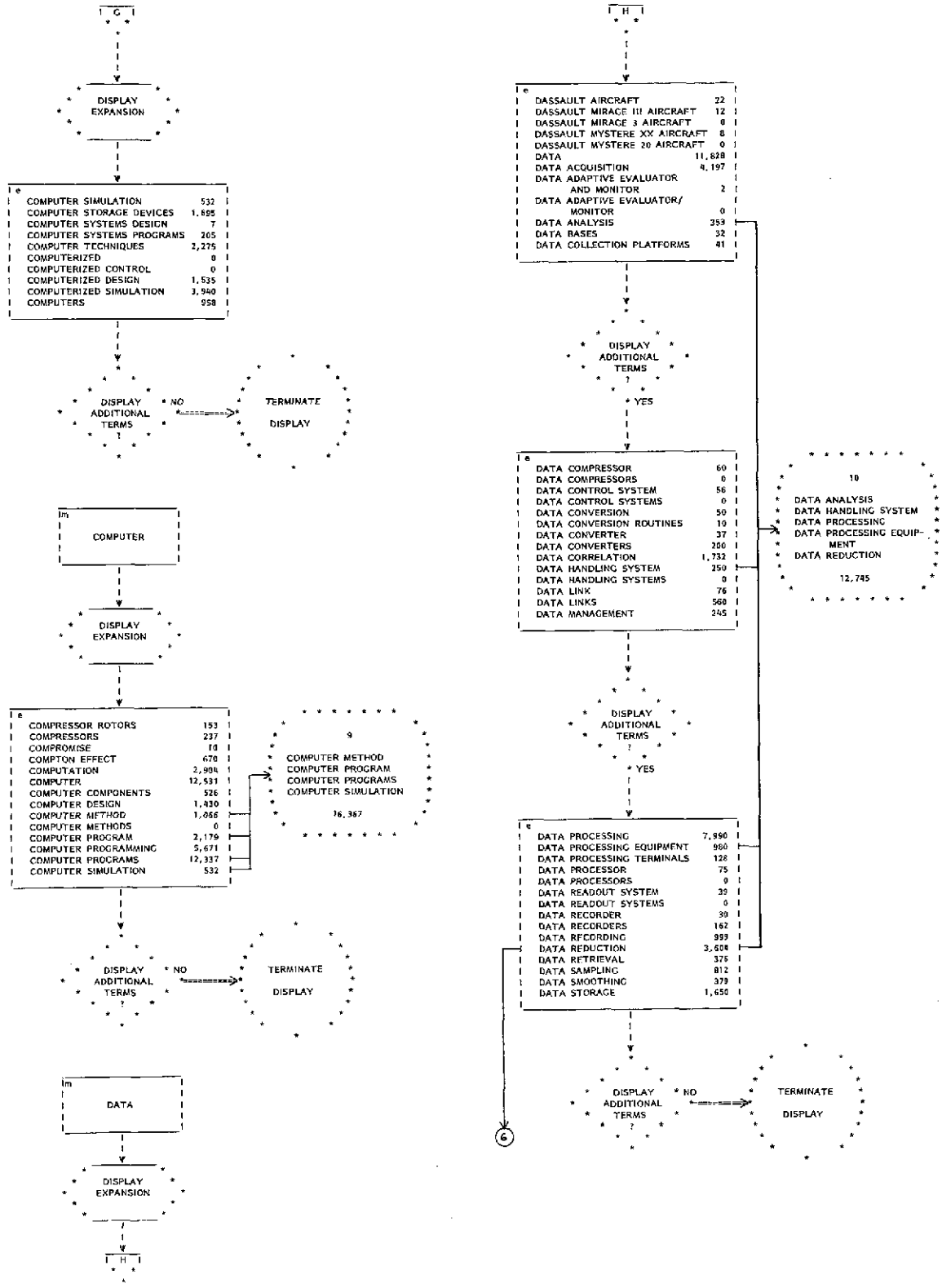
FIGURE 8

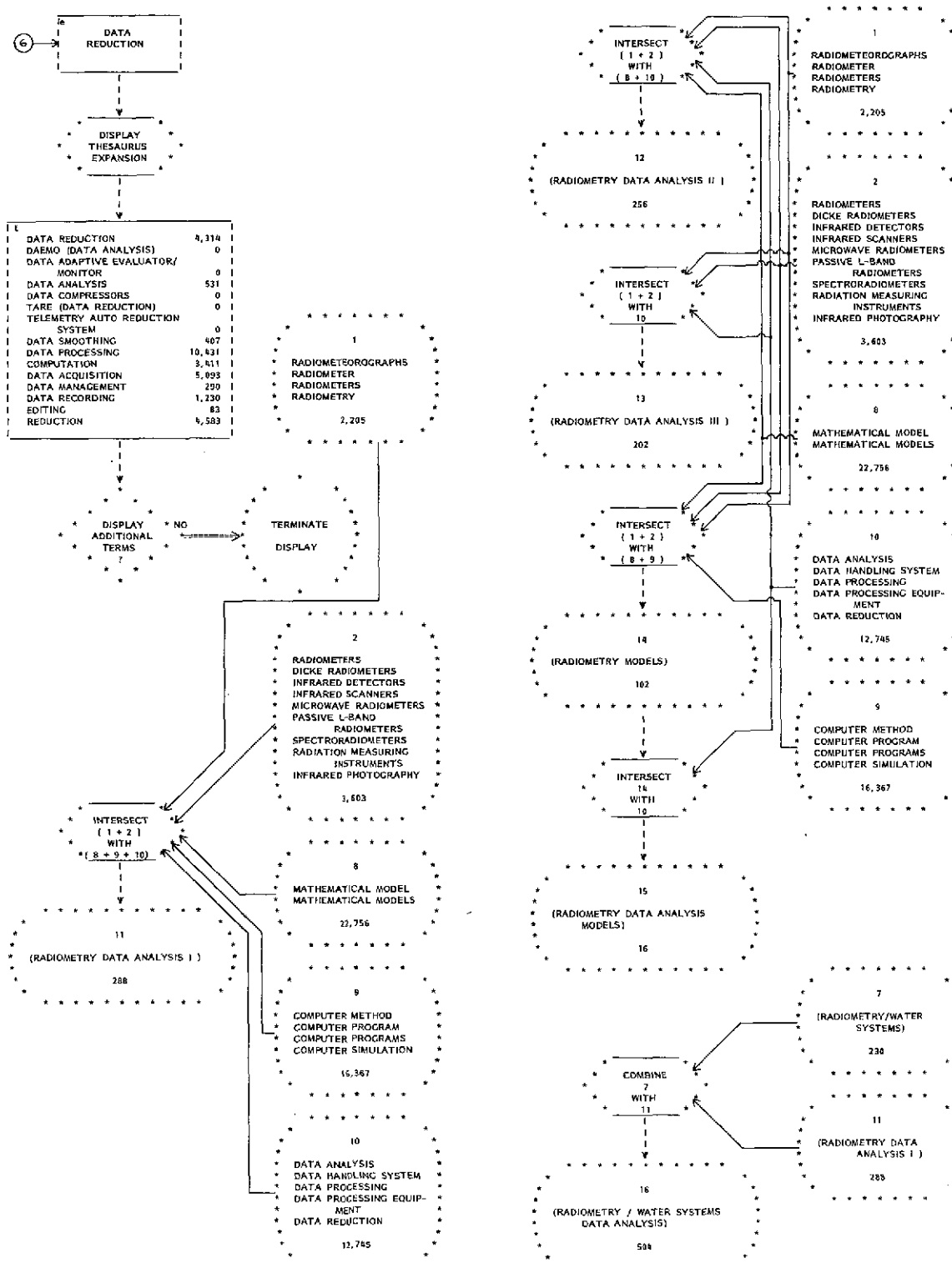

BEGIN SEARCH
RADIOMETER
DISPLAY EXPANSION
RADIOISOTOPE BATTERIES 213
RADIOLOGY 454
RADIOLYSIS 468
RADIOMETEOROGRAPH 13
RADIOMETEOROGRAPHS 11
RADIOMETER 719
RADIOMETERS 1,093
RADIOMETRY 373
RADIONUCLIDE 134
RADIONUCLIDES 0
RADIOPATHOLOGY 86
RADIOPHOSPHOR 5
RADIOPHOSPHORS 2
RADIOPHYSICS 185
RADIOPROTECTIVE AGENTS 0
RADIOSENSITIVITY 74
1
RADIOMETEOROGRAPHS
RADIOMETER
RADIOMETERS
RADIOMETRY
2,205
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
RADIOMETERS
DISPLAY THESAURUS EXPANSION
RADIOMETERS 1,422
DICKE RADIOMETERS 34
INFRARED DETECTORS 1,901
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 334
PASSIVE L-BAND RADIOMETERS 0
SPECTRORADIOMETERS 114
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
GOLOMETERS 228
FOREST FIRE DETECTION 23
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
RADIATION MEASURING INSTRUMENTS
INFRARED PHOTOGRAPHY
3,603
A
DISPLAY ADDITIONAL TERMS ?
YES
HORIZON SCANNERS 193
INFRARED PHOTOGRAPHY 617
INFRARED TRACKING 279
KNUDSEN GAGES 73
PHOTOMETERS 915
PYRANOMETERS 38
SPECTROPHOTOMETERS 385
THERMISTORS 330
THERMAL POL-
DISPLAY EXPANSION
THERMAL NEUTRON 207
THERMAL NEUTRONS 776
THERMAL NOISE 412
THERMAL PLASMA 182
THERMAL POL- 0
THERMAL POLLUTION 87
THERMAL POWER 28
THERMAL PROPERTIES 0
THERMAL PROPERTY 269
THERMAL PROTECTION 910
THERMAL RADIATION 1,878
THERMAL RADIO EMISSION 24
THERMAL REACTORS 84
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
THERMAL POLLUTION
DISPLAY THESAURUS EXPANSION
A
B

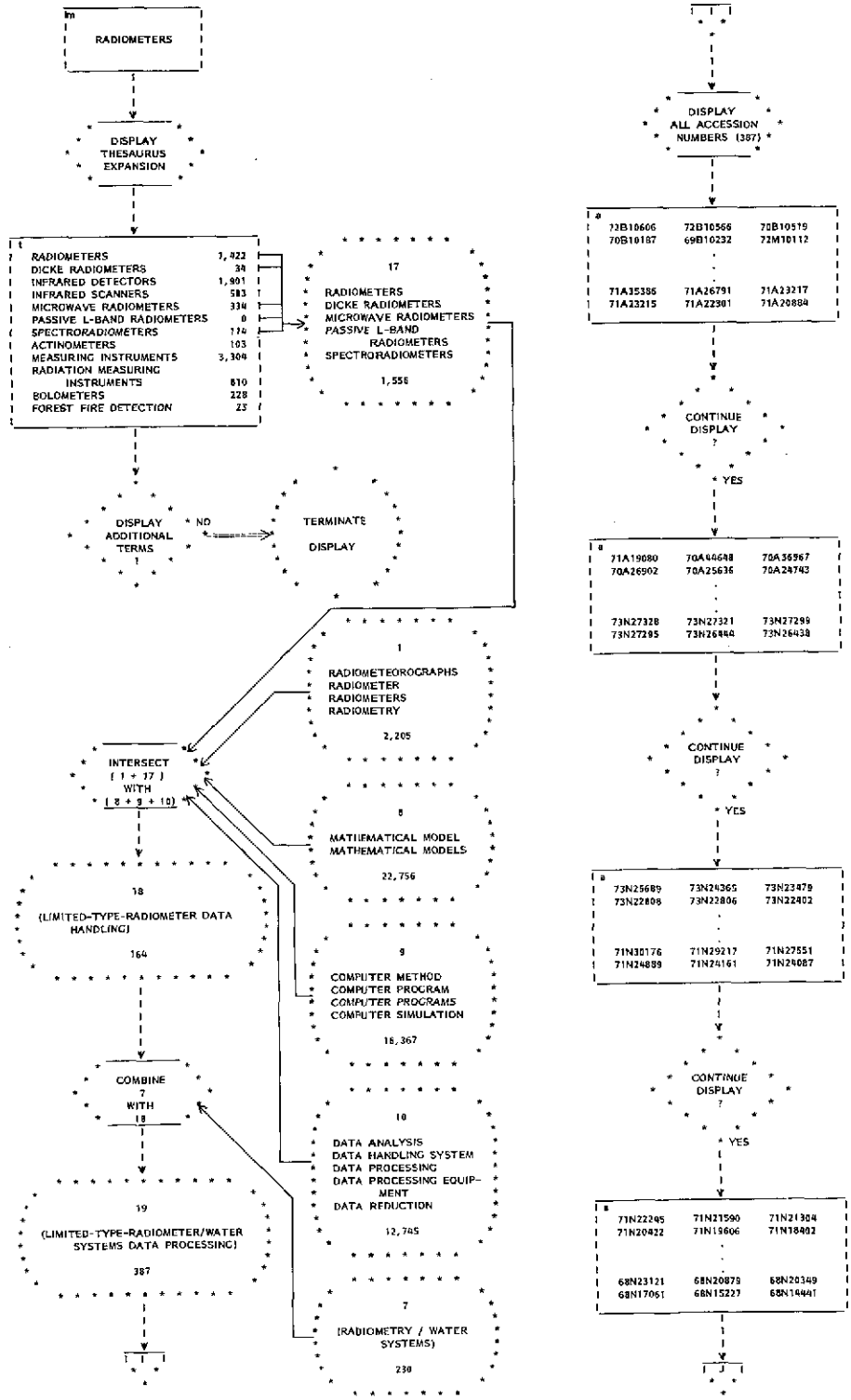

B
THERMAL POLLUTION 49
POLLUTION 428
BIOLOGICAL EFFECTS 1,475
COASTAL ECOLOGY 99
ENVIRONMENT EFFECTS 115
ENVIRONMENT POLLUTION 331
ENVIRONMENTAL QUALITY 88
ENVIRONMENTAL SURVEYS 51
ENVIRONMENTS 299
HEAT TRANSFER 14,915
LAKES 195
LIQUID COOLING 446
MARINE BIOLOGY 248
NUCLEAR REACTORS 2,366
3
THERMAL POLLUTION
POLLUTION
COASTAL ECOLOGY
ENVIRONMENT EFFECTS
ENVIRONMENT POLLUTION
ENVIRONMENTAL QUALITY
ENVIRONMENTAL SURVEYS
LIQUID COOLING
MARINE BIOLOGY
OCEANS
SEAS
WATER POLLUTION
WATER TEMPERATURE
2,549
DISPLAY ADDITIONAL TERMS ?
YES
OCEANS 895
PLANKTON 125
SEAS 229
WATER POLLUTION 823
WATER TEMPERATURE 103
C
EUTROPHICATION 4
KETTLES (GEOLOGY) 0
LAGOONS 1
LAKE CHAMPLAIN BASIN (NY-VT) 8
LAKE ICE 8
LIMNOLOGY 18
PLAYAS 16
PONDS 17
REGIONAL PLANNING 45
RESERVOIRS 98
RIVER BASINS 27
SPRINGS (WATER) 0
STRAITS 5
SURFACE WATER 0
THERMAL POLLUTION 49
WATER CIRCULATION 2
WATER COLOR 12
WATER DEPTH 14
2
DISPLAY ADDITIONAL TERMS ?
YES
WATER RESOURCES 100
LAKES
DISPLAY THESAURUS EXPANSION
LAKES 195
BARRIER LAKES 0
CONSEQUENT LAKES 0
FINGER LAKES 0
FROZEN LAKES 0
MORAINAL LAKES 0
PLAYA LAKES 0
GREAT LAKES (NORTH AMERICA) 32
LAKE PONTCHARTRAIN (LA) 0
LAKE TEXOMA (OK-TX) 1
EARTH RESOURCES 1,316
AQUIFERS 0
BAYOUS 0
BEACHES 96
COASTS 298
EARTH HYDROSPHERE 142
4
GREAT LAKES
LAKE PONTCHARTRAIN
LAKE TEXOMA
BEACHES
COASTS
EARTH HYDROSPHERE
LAGOONS
LAKE CHAMPLAIN BASIN
PONDS
RESERVOIRS
RIVER BASINS
WATER RESOURCES
773
DISPLAY ADDITIONAL TERMS ?
YES
C
2
WATER
DISPLAY EXPANSION
WASTE DISPOSAL 475
WASTE UTILIZATION 203
WASTES 41
WATCH 8
WATCHES 0
WATER 8,539
WATER BALANCE 175
WATER CIRCULATION 2
WATER COLOR 12
WATER CONSUMPTION 97
WATER CONTENT 89
WATER COOLED REACTOR 44
WATER COOLED REACTORS 221
WATER CURRENTS 19
WATER DEPRIVATION 28
WATER DEPTH 14
WATER EROSION 155
5
WATER
WATER INTAKE
WATER INTAKES
WATER MANAGEMENT
8,783
DISPLAY ADDITIONAL TERMS ?
YES
3
D

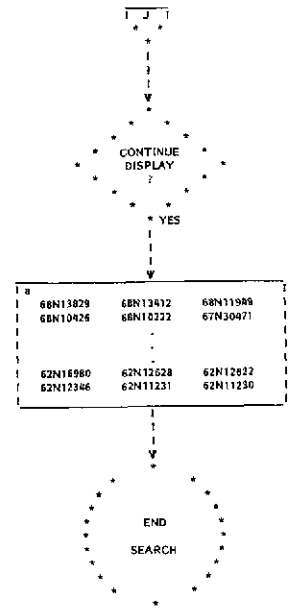

D
e
WATER FLOW 686
WATER HAMMER 22
WATER HAMMER EQUATION 6
WATER INJECTION 57
WATER INTAKE 63
WATER INTAKES 3
WATER JET 20
WATER JETS 0
WATER LANDING 102
WATER LOSS 111
WATER MANAGEMENT 201
WATER MODERATED REACTOR 61
WATER MODERATED REACTORS 120
WATER POLLUTION 350
WATER PRESSURE 69
DISPLAY ADDITIONAL TERMS ?
YES
e
WATER PURIFICATION 37
WATER QUALITY 28
WATER RECLAMATION 194
WATER RECOVERY 118
WATER RESOURCES 98
WATER RUNOFF 14
WATER TABLES 1
WATER TAKEOFF AND LANDING AIRCRAFT 15
WATER TEMPERATURE 99
DISPLAY LIMIT REACHED
Im
REMOTE SENSING
DISPLAY THESAURUS EXPANSION
TERM NOT IN DICTIONARY
3
1
RADIOMETEOROGRAPHS
RADIOMETER
RADIOMETERS
RADIOMETRY
2,205
2
RADIOMETERS
DICKE RADIOMETERS
INFRARED DETECTORS
INFRARED SCANNERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
RADIATION MEASURING INSTRUMENTS
INFRARED PHOTOGRAPHY
3,603
INTERSECT (1 + 2) WITH (3 + 4 + 5)
7
(RADIOMETRY / WATER SYSTEMS)
230
DISPLAY ALL ACCESSION NUMBERS (230)
a
72B10566 70B10187 71W70817
73A35806 73A35664 73A35639
65A29886 65A28388 65A26582
65A23621 65A22772 65A18343
DISPLAY ADDITIONAL TERMS ?
YES
a
65A17643 65A12017 65A12016
64A13054 63A19950 63N84977
73N24365
69N38955 69N35730 69N33662
69N33655 69N31865 69N31853
4
5
F
3
THERMAL POLLUTION
POLLUTION
COASTAL ECOLOGY
ENVIRONMENT EFFECTS
ENVIRONMENT POLLUTION
ENVIRONMENTAL QUALITY
ENVIRONMENTAL SURVEYS
LIQUID COOLING
MARINE BIOLOGY
OCEANS
SEAS
WATER POLLUTION
WATER TEMPERATURE
2,569
4
GREAT LAKES
LAKE PONTCHARTRAIN
LAKE TEXOMA
BEACHES
COASTS
EARTH HYDROSPHERE
LAGOONS
LAKE CHAMPLAIN BASIN
PONDS
RESERVOIRS
RIVER BASINS
WATER RESOURCES
773
5
WATER
WATER INTAKE
WATER INTAKES
WATER MANAGEMENT
8,783


E
DISPLAY ADDITIONAL TERMS ?
YES
a
69N30082 69N28506 69N26432
69N25932 69N25024 69N23202
63N10069 62N16980 62N12628
62N12622 62N12346 62N11231
4
DISPLAY CITATION 73N24365
c
73N24365*# ISSUE 15 PAGE 1773
CATEGORY 13 E73-10604
NASA-CR-132008 QR-1 NAS9-13277
73/05/00 24 PAGES UNCLASSIFIED
DOCUMENT
Use of Skylab EREP data in a sea surface temperature experiment
(Sea surface temperature measurements from Skylab EREP radiometer data) Quarterly Report, 17 Feb.-17 May 1973
A/ANDING, D. C. A/Principal Investigator
Science Applications, Inc., Ann Arbor, Mich. AVAIL.NTIS HC $3.25
EREP
/*OCEAN SURFACE/*RADIOMETERS/*SURFACE TEMPERATURE/*WATER TEMPERATURE/ ALGORITHMS/ EREP/ INFRARED RADIATION/ SEAS/ SKYLAB PROGRAM
5
DISPLAY CITATION 65A17643
c
65A17643# ISSUE 8 PAGE 1146
CATEGORY 29 68/12/00 8 PAGES
UNCLASSIFIED DOCUMENT
Statistical estimates of computed water-vapor radiative flux from clear skies at an oceanic location
(Statistical techniques to obtain estimation formulas for long wave radiation at sea-air interface)
A/MARTIN, F. L.; B/PALMER, W. C. (AA/U.S. NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF./ AB/U.S. NAVY, FLEET NUMERICAL WEATHER FACILITY, MONTEREY, CALIF./.)
JOURNAL OF APPLIED METEOROLOGY, VOL. 3, DEC. 1964, P. 780-787. 15 REFS.
/*ATMOSPHERIC RADIATION/*RADIATION EMISSION/*REGRESSION ANALYSIS/*WATER VAPOR/ ANALYSIS/ ATMOSPHERE/ EMISSION/ RADIATION/ RADIOMETER/ REGRESSION/ STATISTICAL/ VAPOR/ WATER
F
F
CONTINUE DISPLAY ?
NO
TERMINATE DISPLAY
Im
MATHEMATICAL MOD-
DISPLAY EXPANSION
e
MATERIALS TESTING REACTOR 35
MATERIALS TESTING REACTORS 0
MATERIALS TESTS 1,647
MATHEMATICAL ANALYSIS 0
MATHEMATICAL LOGIC 415
MATHEMATICAL MOD- 0
MATHEMATICAL MODEL 1,530
MATHEMATICAL MODELS 20,696
MATHEMATICAL STATISTICS 101
MATHEMATICAL TABLE 63
8
MATHEMATICAL MODEL
MATHEMATICAL MODELS
22,756
DISPLAY ADDITIONAL TERMS ?
YES
e
MATHEMATICAL TABLES 111
MATHEMATICS 7,136
MATHIEU EQUATION 30
MATHIEU FUNCTION 168
MATING 19
MATRA MISSILE 1
MATRICES 56
MATRICES (CIRCUITS) 249
MATRICES (MATHEMATICS) 5,914
MATRIX 4,114
MATRIX ALGEBRA 484
MATRIX ANALYSIS 560
MATRIX METHODS 1,274
MATRIX STRESS CALCULATION 89
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
Im
COMPUTERIZED
G


C
DISPLAY EXPANSION
e
COMPUTER SIMULATION 532
COMPUTER STORAGE DEVICES 1,895
COMPUTER SYSTEMS DESIGN 7
COMPUTER SYSTEMS PROGRAMS 205
COMPUTER TECHNIQUES 2,275
COMPUTERIZED 0
COMPUTERIZED CONTROL 0
COMPUTERIZED DESIGN 1,535
COMPUTERIZED SIMULATION 3,940
COMPUTERS 958
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
m
COMPUTER
DISPLAY EXPANSION
e
COMPRESSOR ROTORS 153
COMPRESSORS 237
COMPROMISE 10
COMPTON EFFECT 670
COMPUTATION 2,908
COMPUTER 12,531
COMPUTER COMPONENTS 526
COMPUTER DESIGN 1,430
COMPUTER METHOD 1,068
COMPUTER METHODS 0
COMPUTER PROGRAM 2,179
COMPUTER PROGRAMMING 5,671
COMPUTER PROGRAMS 12,337
COMPUTER SIMULATION 532
9
COMPUTER METHOD
COMPUTER PROGRAM
COMPUTER PROGRAMS
COMPUTER SIMULATION
16,367
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
m
DATA
DISPLAY EXPANSION
H
H
e
DASSAULT AIRCRAFT 22
DASSAULT MIRAGE III AIRCRAFT 12
DASSAULT MIRAGE 3 AIRCRAFT 0
DASSAULT MYSTERE XX AIRCRAFT 8
DASSAULT MYSTERE 20 AIRCRAFT 0
DATA 11,828
DATA ACQUISITION 8,197
DATA ADAPTIVE EVALUATOR AND MONITOR 2
DATA ADAPTIVE EVALUATOR/ MONITOR 0
DATA ANALYSIS 353
DATA BASES 32
DATA COLLECTION PLATFORMS 41
DISPLAY ADDITIONAL TERMS ?
YES
e
DATA COMPRESSOR 60
DATA COMPRESSORS 0
DATA CONTROL SYSTEM 56
DATA CONTROL SYSTEMS 0
DATA CONVERSION 50
DATA CONVERSION ROUTINES 10
DATA CONVERTER 37
DATA CONVERTERS 200
DATA CORRELATION 1,732
DATA HANDLING SYSTEM 250
DATA HANDLING SYSTEMS 0
DATA LINK 76
DATA LINKS 560
DATA MANAGEMENT 245
10
DATA ANALYSIS
DATA HANDLING SYSTEM
DATA PROCESSING
DATA PROCESSING EQUIPMENT
DATA REDUCTION
12,745
DISPLAY ADDITIONAL TERMS ?
YES
e
DATA PROCESSING 7,890
DATA PROCESSING EQUIPMENT 960
DATA PROCESSING TERMINALS 128
DATA PROCESSOR 75
DATA PROCESSORS 0
DATA READOUT SYSTEM 39
DATA READOUT SYSTEMS 0
DATA RECORDER 30
DATA RECORDERS 162
DATA RECORDING 993
DATA REDUCTION 3,608
DATA RETRIEVAL 375
DATA SAMPLING 812
DATA SMOOTHING 379
DATA STORAGE 1,650
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
G


DATA REDUCTION
DISPLAY THESAURUS EXPANSION
DATA REDUCTION 4,314
DAEMO (DATA ANALYSIS) 0
DATA ADAPTIVE EVALUATOR/ MONITOR 0
DATA ANALYSIS 531
DATA COMPRESSORS 0
TARE (DATA REDUCTION) 0
TELEMETRY AUTO REDUCTION SYSTEM 0
DATA SMOOTHING 407
DATA PROCESSING 10,431
COMPUTATION 3,411
DATA ACQUISITION 5,093
DATA MANAGEMENT 290
DATA RECORDING 1,230
EDITING 83
REDUCTION 4,583
DISPLAY ADDITIONAL TERMS
NO
TERMINATE DISPLAY
INTERSECT (1 + 2) WITH (8 + 9 + 10)
11 (RADIOMETRY DATA ANALYSIS I) 288
1 RADIOMETEOROGRAPHS RADIOMETER RADIOMETERS RADIOMETRY 2,205
2 RADIOMETERS DICKE RADIOMETERS INFRARED DETECTORS INFRARED SCANNERS MICROWAVE RADIOMETERS PASSIVE L-BAND RADIOMETERS SPECTRORADIOMETERS RADIATION MEASURING INSTRUMENTS INFRARED PHOTOGRAPHY 3,603
8 MATHEMATICAL MODEL MATHEMATICAL MODELS 22,756
9 COMPUTER METHOD COMPUTER PROGRAM COMPUTER PROGRAMS COMPUTER SIMULATION 16,367
10 DATA ANALYSIS DATA HANDLING SYSTEM DATA PROCESSING DATA PROCESSING EQUIP-MENT DATA REDUCTION 12,745
INTERSECT (1 + 2) WITH (8 + 10)
12 (RADIOMETRY DATA ANALYSIS II) 256
INTERSECT (1 + 2) WITH 10
13 (RADIOMETRY DATA ANALYSIS III) 202
INTERSECT (1 + 2) WITH (8 + 9)
14 (RADIOMETRY MODELS) 102
INTERSECT 14 WITH 10
15 (RADIOMETRY DATA ANALYSIS MODELS) 16
COMBINE 7 WITH 11
16 (RADIOMETRY / WATER SYSTEMS DATA ANALYSIS) 506
7 (RADIOMETRY/WATER SYSTEMS) 230


RADIOMETERS
DISPLAY THESAURUS EXPANSION
RADIOMETERS 1,423
DICKE RADIOMETERS 34
INFRARED DETECTORS 1,901
INFRARED SCANNERS 583
MICROWAVE RADIOMETERS 334
PASSIVE L-BAND RADIOMETERS 0
SPECTRORADIOMETERS 174
ACTINOMETERS 103
MEASURING INSTRUMENTS 3,304
RADIATION MEASURING INSTRUMENTS 810
BOLOMETERS 228
FOREST FIRE DETECTION 23
17
RADIOMETERS
DICKE RADIOMETERS
MICROWAVE RADIOMETERS
PASSIVE L-BAND RADIOMETERS
SPECTRORADIOMETERS
1,556
DISPLAY ADDITIONAL TERMS ?
NO
TERMINATE DISPLAY
1
RADIOMETEOROGRAPHS
RADIOMETER
RADIOMETERS
RADIOMETRY
2,205
INTERSECT (1 + 17) WITH (8 + 9 + 10)
8
MATHEMATICAL MODEL
MATHEMATICAL MODELS
22,756
18
(LIMITED-TYPE-RADIOMETER DATA HANDLING)
164
9
COMPUTER METHOD
COMPUTER PROGRAM
COMPUTER PROGRAMS
COMPUTER SIMULATION
16,367
COMBINE 7 WITH 18
10
DATA ANALYSIS
DATA HANDLING SYSTEM
DATA PROCESSING
DATA PROCESSING EQUIPMENT
DATA REDUCTION
12,745
19
(LIMITED-TYPE-RADIOMETER/WATER SYSTEMS DATA PROCESSING)
387
7
(RADIOMETRY / WATER SYSTEMS)
230
DISPLAY ALL ACCESSION NUMBERS (387)
72B10606 72B10566 70B10519
70B10187 69B10232 72M10112
71A35386 71A26791 71A23217
71A23215 71A22301 71A20884
CONTINUE DISPLAY ?
YES
71A19080 70A44648 70A36967
70A26902 70A25636 70A24743
73N27328 73N27321 73N27299
73N27295 73N26444 73N26438
CONTINUE DISPLAY ?
YES
73N25689 73N24365 73N23479
73N22808 73N22806 73N22402
71N30176 71N29217 71N27551
71N24889 71N24161 71N24087
CONTINUE DISPLAY ?
YES
71N22295 71N21590 71N21304
71N20422 71N19606 71N18402
68N23121 68N20879 68N20349
68N17061 68N15227 68N14441


J
CONTINUE DISPLAY ?
YES
68N13829
68N13412
68N11989
68N10426
68N10222
67N30471
62N16980
62N12628
62N12622
62N12366
62N11231
62N11230
END SEARCH

CORRELATION OF SEARCH RESULTS WITH SEARCHER'S BACKGROUND

Results produced by the eight significant searches on this subject can be divided roughly into two groups: those which gave at least 87 good hits (average 101) and those with 60 or fewer good hits (average 48). The first group of searches was written either by experienced searchers or by engineers with a working knowledge of the subject area. Searcher AWL compensated for his lack of familiarity with the subject area by doing a rather broad search. His recall was fairly good (22.4% compared with 31.2% for the best search in the group) but his relevance was low (13% compared with 36.6% for the best in the group). Searchers TRP and CLN, the most experienced in the group on the NASA file, both have backgrounds in areas related to the subject area but not directly on it. Their searches gave good recall and relevance and, in addition, employed considerably simpler logics than the batch search or the one done by WWS. The latter two searches were done by working engineers with backgrounds fairly close to the subject area. From their results it seems that being more diligent usually will lead to a slight improvement in recall percentage.

The other four searches were performed either by searchers with no relevant education or experience or by searchers with little regular search experience. Searcher SFS, closest of the four to the subject area by background and search experience, also did the best job in terms of relevance and recall. While his search had the best relevance of any search done on this subject, his unfamiliarity with the subject undoubtedly contributed to his failure to follow synonymous paths to the other documents on the subject and thus limited his recall.

CORRELATION OF SEARCH LOGIC WITH RECALL ACHIEVED

As the initial investigation into the effects of search logic on the recall achieved, the reasons searcher WWS failed to retrieve some of the documents found in the batch search were studied. It was found that the excluded documents were generally indexed under one of three groups of terms:

(1) INFRARED INSTRUMENTS
INFRARED RADIATION
INFRARED IMAGERY

(2) THERMAL POLLUTION

(3) SURFACE TEMPERATURE

It was then found that the terms in group (1) do not appear in the thesaurus expansion of radiometers. Thus, unless the searcher happened to think along these lines, the terms would not have been suggested to him otherwise. A similar situation exists with respect to group (3). This term does not appear under a thesaurus expansion of "temperature." Failure to include "thermal pollution" seems to have been just a mental lapse on the part of searcher WWS.

No comparisons with the batch search are possible for pre-1968 documents because the batch search excluded these. Thirty-six good hits were found by the WWS "A" search for this period.

The WWS "A" search found 58 good hits not found by the 152-term batch search; only 27 good hits were the same in both searches. The reason, apparently, is that the batch search employed a double intersection along the following lines: (temperature measurement) * (radiometers) * (accuracy). Examination of 24 of the good documents found by WWS but missed in the batch search indicated that these documents were not indexed under a term synonymous with accuracy such as calibrating, correction, digital filtering, etc., all of which were used in the third group of the intersection. They were, therefore, not selected.

In general one must conclude that, for this topic at least, high recall can only be obtained by:

1. employing every conceivable term related to the subject
2. single intersections only
3. extensive manual sort down.

One may also conclude that while each of the searches employed a valid search logic, those that employed the most terms and the most different approaches to the same topic were the most successful in terms of recall. Some approaches of course favored higher relevance than others. Searches employing these approaches only appeared to be highly (>30%) relevant but were so at the expense of recall.

RELATIVE EFFECTIVENESS OF INTERACTIVE AND BATCH SEARCH MODES

A second experiment, this one attempting to access the relative effectiveness of the interactive and batch search modes, was also conducted. Engineering time to conduct the search was compared with search results as measured by good hits. As shown in Table 2, engineer CLN got essentially the same results (using substantially the same logic) by RECON as he did by the batch process. The search time was almost identical. On another question it took him somewhat longer to search via RECON (probably because of long question response times). Again the good hits were substantially the same items.

On question #4, PJC took 25% more time to do the problem on RECON as by the batch process, while searcher SFS took only half as long to get a few more good hits on question #5. In the latter case, he spent a good deal of time working out the strategy prior to the batch search. When he went to the RECON terminal, he knew generally how he was going to attack the problem.

Generally, the effectiveness of a RECON search was not better than that of a batch search conducted by the same individual using the same amount of engineering time to prepare the search. One can also correlate reasonably well, using a logarithmic function, the engineering time spent in preparing the search with results (recall) achieved.

One final piece of data bearing on this question is the study made of searcher TRP's batch and RECON searches during a given period (Tables 3 and 4). Some 15 batch searches and 10 RECON searches were studied. It was found that his RECON searches achieved about twice the average relevance of his batch searches at the cost of about 35% more engineering time per search.

TABLE 2

Search Question: *Airborne Thermal Mapping of Water Surfaces*

	ENGINEERING TIME	COMPUTER TIME	GOOD HITS
Manual - Batch FOS	108 min.		104
RECON: TRP	163 min.		97
MRN	180 min. total 51.91 at RECON		39
WWS "A"	170 min.		121
WWS "B"	25.43 min.		8
PJC	64 min		44
SRW	102.51 min.		48
SFS	60.8 min.		60
CLN	124.35 min.		97
AWL	184 min.		87
Search Question A (CLN)			
Batch	90 min.		*
RECON	91.82 min.		*
Search Question B (CLN)			
Batch	75 min.	1.13 min.	101
RECON	105 min.		*
Search Question C (PJC)			
Batch	60 min.	3.85 min.	689
RECON	75.51 min.		*
Search Question D (SFS)			
Batch	90 min.	1.45 min.	158*
RECON	42.72 min.		222*

* Output substantially the same - By substantially the same we mean about the same hits as well as the same number of hits.

TABLE 3

BATCH SYSTEM

Statistics Based on TRP's NASA Searches

	Total Engineer Time (prep. & eval.) in hrs.	Total Hits	Evaluated Hits	% Relevant Hits
1)	2.5	256	44	17.2
2)	3.5	409	31	7.6
3)	2.5	257	64	24.9
4)	3.0	112	5	4.5
5)	3.5	385	63	16.4
6)	3.5	207	42	20.3
7)	2.5	71	64	90.1
8)	2.5	167	120	71.9
9)	3.0	275	77	28.0
10)	3.0	216	35	16.2
11)	3.0	447	54	12.1
12)	3.0	353	49	12.9
13)	3.5	74	7	9.5
14)	3.0	169	60	35.5
15)	1.5	143	15	10.5
	Average = 2.9	Average = 236.1	Average = 45.6	Average = 25.2%

TABLE 4

RECON

Statistics Based on TRP's NASA Searches

	Total Engineer Time (prep. & eval.) in hrs.	Total Hits	Evaluated Hits	% Relevant Hits
1)	4.0	219	100	45.7
2)	3.0	236	108	45.8
3)	3.0	183	101	55.2
4)	3.0	457	32	7.0
5)	5.0	no data	53	no data
6)	4.0	111	51	45.9
7)	5.5	no data	150	no data
8)	3.5	166	38	22.9
9)	5.0	no data	183	no data
10)	4.5	483	319	66.0
	Average = 4.1	Average = 265	Average = 113.5	Average = 45.6%

RELATIVE COSTS OF BATCH AND INTERACTIVE SEARCH MODES

Cost Structure for the Batch Retrieval System - STRC-IVS

Direct Costs

Engineering Time

This is the time spent by an engineer (or search analyst) in preparing a search strategy for input to the computer and in evaluating the search output once his strategy has been run. Typically, this time is spent in several ways: discussing the search problem with a client, looking through the appropriate thesaurus for terms, checking those terms against a computer-produced list of authorized terms and postings, composing the search strategy, and then finally reading or scanning the hit abstracts for relevant documents. STRC cost accounting reports show that, on the average, an engineer spends 1 1/2 - 2 hours in preparing a search and 2 - 2 1/2 hours in evaluating the search output at a total cost of roughly $35 to $40.

Clerical Time

Clerical time for a search includes such functions as interpreting search requests, verifying search terms and postings, keypunching or keyboarding via terminal the actual search request, checking search output, retrieving and Xeroxing hit abstracts, and binding search bibliographies. Accounting statistics show that on the average, the clerical time (two hours) involved in a search costs STRC $5 to $6.

Xeroxing Cost

The average cost for Xeroxing of search output is roughly $7.

Computer Cost

STRC searches run on an overnight, no-priority basis on the Triangle Universities Computation Center's (TUCC) IBM 370/165. The TUCC charges for zero priority service include the following:

1) CPU time @ $350/hour
2) EXCP (I/O) time @ $262.50/hour
3) Core use @ $.70/kilo-byte hour
4) Unit record I/O transmission (i.e., printing time) @ $.00085/UR (line)

Accounting records show that on the average, the computer cost for a NASA search ranges from $10 to $20.

The total direct cost for an STRC batch search then averages $60 - $70.

Overhead for the NASA File

A number of overhead items are incurred in maintaining the NASA file and the costs involved are absorbed by STRC.

Monthly File Maintenance

1) $50 to $75 computer cost
2) $5 clerical cost

Direct Access Storage

1) Rental of five 2314 disk packs @ $9.50/pack/month

Magnetic Tapes (Back-up and Maintenance)

1) Approximately 50 tapes at one-time purchase price of $9.50/tape.

Discussion of Possible Cost Structures for RECON Interactive Searches

Since STRC is not aware of any cost accounting scheme that might exist for RECON searches, one can only speculate on what the elements of such a scheme might be. It is logical to conclude that one or more of the following items might be included in the cost/search for RECON.

Computer Cost

Costs for interactive services vary from machine to machine, but it may help to give an example of the TUCC charges for interactive service on the 370/165:

1) CPU time @ $1000/hour
2) I/O channel program time @ $750/hour
3) I/O wait time @ $375/hour
4) Port connect time @ $2/hour

These costs are definitely high estimates for RECON since it runs on a less expensive machine, the IBM 360/50. The RECON charges would probably run less than 1/5 the TUCC charges and maybe as low as 1/10 for CPU time.

Communications Cost

This would include terminals, communications controllers, leased lines or dial-up ports, and modems. One example of cost in this area is that of the leased communications line to College Park @ $150 - $200/month. This cost would be reduced if STRC were to install dial-up RECON service @ roughly $.28/minute. The Bunker Ramo terminal and controller now in use with RECON leases for $345/month.

On-Line Storage Cost

It is estimated that a file the size of the NASA RECON file(s) could cost as little as $800/month for on-line direct-access storage depending on the devices used.

People Cost

Systems and Programming Support

This includes people time at NASA and STRC in monitoring the system.

Engineering or Search Analyst Time

Here the engineering functions would be essentially the same as in batch but the amount of time involved might be quite different. The engineering functions of preparing a search would be performed at the terminal, and the time involved would depend quite heavily on the response-time of the terminal and on the amount of browsing that the engineer might engage in. Average times for this activity on experimental searches are two to three hours. In addition, the engineer might carry out some of his search evaluation at the terminal and thus reduce the amount that he normally would have to perform at his desk later. Cost for engineering time would be at least equal to the $35-$40 cost for batch engineering time and may even exceed it.

Clerical Cost

Obviously, with RECON, the clerical functions or preparing a search for entry into the computer would be eliminated. The only clerical time involved then would be the time spent in pulling and Xeroxing abstracts and in binding search results. This averages approximately $3-$4/search.

A more useful rule of thumb for the possible pricing of RECON searches would be to use a charge structure similar to that of one of the organizations (such as Lockheed or Systems Development Corporation) that offer nation-wide interactive on-line search service on a number of files. This approximate charge would substitute for all of the above cost elements with the exception of the people cost. These organizations normally charge the on-line user a fixed hourly rate for his terminal connect time (i.e., the total elapsed time in the system from sign-on to sign-off). These hourly rates range from $25-$80 per file searched. For a file the size and complexity of the NASA file, the rate probably would be in the neighborhood of $50/hour for file access. In addition, the user must pay the telephone company for direct-dial service (or use of the TYMSHARE network) to the computer. From STRC to College Park, the phone cost would average $15/hour. Therefore, our hourly rate (based on a Lockheed-type pricing scheme) for RECON service might be $65/hour.

Batch vs. RECON Cost Comparison Based on Estimated RECON Cost

If one multiplies the Lockheed-type hourly rate by the two to three average hours per search that were spent at the RECON terminal during experimental searches (see TABLE 2), then he comes out with a computer cost figure ($130-$195)roughly 10 times that of the STRC average batch cost ($10-$20). Since experimental results show that the engineer does not spend less time in preparing a RECON search and may likely spend more, the cost for his time will be at least what it is for a batch search ($35-$40). Although there may be some savings in the clerical cost, they are miniscule ($2-$3) in comparison with computer and engineering costs and Xeroxing costs should remain the same. The total estimated cost for a RECON search ($175-$245) is then roughly two or three times that of a batch STRC search ($60-$70).

It also should be mentioned that the Lockheed-type hourly rate that was used in estimating the RECON costs may be unrealistically low as it is based on a rather high volume of usage and it may exclude some very high overhead costs.

CONCLUSIONS

Although this discussion has been attempting to compare apples and oranges and the author is fully aware of that, the evidence (based on similar on-line systems) at this time seems to show that the batch approach to searching NASA is two to three times more economical then the RECON approach. However, no attempt has been made in this section to judge the relative values of the results of each approach, and that has to be an important consideration in the total picture.

SUBJECTIVE USER EXPERIENCE

[The thoughts presented below were compiled by NC/STRC's most experienced RECON user. While they are those of a single individual, they do seem to parallel rather closely the experiences of other RECON users on the staff at comparable points in their acquaintence with RECON.]

One of the first problems that faces a novice at the RECON terminal (if a non-typist) is that of the keyboard. Most of the difficulty disappears after a few hours of practice, but the problem of where the "F" (or some other elusive letter) went remains to plague the user for many months. This produces a tendency to use EXPAND functions for no other purpose than to select a term which appears to be too much trouble to type. I suspect that even an accomplished typist might be tempted to do the same, particularly when the desired term is an especially long one or when the exact spelling (singular or plural, hyphen or space, etc.) is not certain.

The big problem, which although purely psychological is not unimportant, is the nagging suspicion that the fumbling approach to initial use will result in the grinding halt of a multi-million dollar computer probably accompanied by sparks and smoke at the other end of the phone line. Initial instruction to the operator should make clear that nothing could be done either to harm the system or even to produce a ton or two of computer printout. The worst that can happen is that the operater is informed, "IFOOL, WRONG..."

The uncertainty of what will happen under given circumstances leads the novice to make much more use of the EXPLAIN function than is called for. Although much of the material under command of the EXPLAIN key is basic to operation of RECON, it appears to be on one hand overly simplified and on the other hand too sophisticated for other than academic interest. Basic information concerning key functions appears to be dwelt upon with excruciating detail while practical material of use to the operator is difficult to find. As examples, the EXPAND and COMBINE functions are pursued in great detail. These functions are normally well understood before one approaches the keyboard. The error codes which are normally disregarded with a "try-again-maybe-it'll-work-this-time" attitude take up a large part of the EXPLAIN file. In practice, I doubt that anyone ever looks at error codes other than as a matter of curiosity. On the other hand, how does one determine the techniques for obtaining material from the "Corporate Source" file? Or how does one know if selections made with a range function are inclusive or exclusive of the cut-off indicated by the printer? Academic information available from the EXPLAIN function appears to completely swamp or obscure information that is of primary importance to the user.

Much of the above criticism could be remedied by the availability of a detailed user's manual which explains the operation of RECON from the beginner's standpoint. Although an in-house manual was prepared for the use of novice operators at this location, I feel that a professionally prepared operator's manual is a dire need. Many hours of trial and error at

the console could be spared if a thorough, concise operational handbook were available to the novice searcher. Although the text should be primarily concerned with operational matters, it should include systems information to enable a searcher to appreciate why it may take a minute or more in order to turn a page.

When a search is undertaken, the EXPAND key is probably used more than all others combined. I normally approach the terminal with a tentative strategy in hand which includes all proposed terms and a Boolean expression which combines them. These are obtained by use of a printed Thesaurus and postings lists and by a manual search of annual, cumulative indices of the abstract journals. The provisional selection of terms from printed sources, rather than using the EXPAND functions to obtain them, is a big time saver. I estimate that terms can be found up to 10 times faster. Often this material is reinforced with a list of known "good" accessions numbers which have been obtained from a quick manual search. The EXPAND function serves its primary purpose as a mean toward selecting terms, either in the alphabetic subject listing or the related subject "Thesaurus" listing, which have a close "group" relationship. For example, a group of terms which have a subject heading of "LASER___" or a hierarchical heading such as "SEMICONDUCTOR DEVICES" can be selected on large collections from expansions of the SUBJECT or THESAURUS files. This ability to quickly select multi-term sets is one of the most appreciated abilities of RECON.

The SELECT key is the second most used key. It is probably used more often than it should be. There is a decided tendency to select ranges of terms, both from the subject and Thesaurus listings which include non-desired or irrelevant terms, simply because it is easier to do so than to exclude those which do not apply to the question at hand. This sometimes includes an overabundance of material in the final result which was not desired and appeared only because an "uncalled for" term (or terms) was unwittingly included. Since the Thesaurus postings provide an easy access to related terms, there is also a tendency to favor that portion of the file. This may or may not be desirable since that portion of the collection is the most recent; but I sometimes feel that the pre-1968 material gets short shrift (because term selection is in general more difficult) since there is no easy way to obtain a selection of hierarchical related terms.

After a collective selection has been made, using a range of terms, all terms having the same root, or other devices to select a collection of terms, it is fairly difficult to determine what has been done after the fact. Under the best of circumstances, one is left with a series of numbers which must be compared with an expansion on the terminal in order to determine the exact terms included. Under circumstances involving long strings of selected term codes (E1, E3, E4, E6, E7, E9, E11, ...) the printout display does not include the end of the series and leads one to wonder just what terms were chosen.

The COMBINE key, which brings a search to its fruition, is a real joy to operate. The ability to add, delete, and otherwise manipulate selected sets in real time is a boon to the searcher. It completely eliminates the problem of "should a given term be included because of its inclusiveness or excluded because of its generalness!" The ability to use or not use sets in order to arrive at a manageable result is one of the major satisfactions of RECON.

The DISPLAY function is another major advantage of RECON. The ability to observe results immediately is extremely valuable to the operator. By perusing the results of a strategy, one quickly becomes aware of the strengths and weaknesses of the strategy as used. This provides an opportunity to have second thoughts about the propriety of using certain terms or of combining them in a given fashion. Often overlooked terms are uncovered and the unwise use of other terms is apparent. I very rarely leave a search done on RECON in its original form. I very rarely rerun a search done on a batch system. The ability to specify display form with the FORMAT key is a time saving device when checking search results. By using only the "of interest" material available in a citation, normally title, notation of content and terms, it is possible to save many page turnings and therefore many minutes.

Most of the other function keys require no comment. They are needed and do their jobs with dispatch. It is often difficult to be patient and understanding when it takes longer than a minute to turn a page, but the page eventually turns. It is also a soul soothing satisfaction to be able to check the status of the most recent command. It is much better to know that one is number five in the waiting line than to simply hope that something is happening at the other end of the line. It is rather like blowing in a silent telephone to see if sidetone is still there. The TRANSMIT key has more frustration built in than I feel necessary. After it is pressed, it is too late to make any change, correction, or bail out until the terminal is polled. When the system is busy, there is often more than enough time to abort a command between the transmit command and a poll. It should be possible to do so.

Mysterious messages appear at irregular intervals on the hard copy printer. These messages are often (it only appears to be "usually") incomplete or garbled. While this printout, along with the information displayed on the video screen, sometimes indicates the status of the system, I feel that it is a poor excuse for real information about what is really going on. If it were possible to query the system to determine status at any given moment, it would lend a much more satisfying atmosphere to the operator's sensibilities. It would certainly help to determine which of the numerous possibilities (terminal broken, printer inoperative, phone line down, Washington bombed, etc.) keep things from happening in the proper manner. In particular, there is a need to know why processing of a command sometimes takes so long (~ 40 minutes).

In summation, the RECON user can find many things that he feels can be improved. Most of them will boil down to a matter of personal preference or a matter of how long a waiting period is required before something happens. From a standpoint of effectiveness as compared to batch or off-line searching, I feel that there is no comparison. The RECON is much more effective, and I personally would not consider an off-line search if RECON were available. Since I normally do the same amount of preparatory work for either type of search, there are no economies to be gained before the search is actively pursued. I suspect that manual preparation and direct keyboard input about break even. The ability to monitor-as-you-go, however, starts consuming time as one attempts to optimize results. In the end, a RECON search takes more time than one done off-line. At the same time, I feel very strongly that the RECON search does a much better job as far as both retrieval and relevance are concerned. I wouldn't do it any other way.

APPENDIX

TABLE I

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FOS	WWS	WWS2	SRW
A69-31543					X					
A69-33280							X			
A69-33286	X	X	X		X		X	0		
A69-36071						X				
A69-42211								X		0
A70-14617							X			
A70-15770		X	X	X				X		0
A70-16363								X		
A70-17104							X			
A70-17415							X			
A70-19616						X				
A70-22014			X							
A70-22869	X	X			0			X		
A70-22885		X	X		X					
A70-23525						X				
A70-23536	X				X		X			
A70-23754							X	0		
A70-23756	X	X			X		X	0		
A70-23763										X
A70-24740			0	0	0			X		
A70-24741				X						
A70-25636			0		X					
A70-26502					X					
A70-26903	X				0		X	0		
A70-26905	X				0					
A70-26949	0				0			X		
A70-27689								X		
A70-29655						X	X			
A70-29658						X	X			
A70-29659						X				
A70-31231	X				X			0		
A70-31806						X				
A70-33170	X				X		X	0		
A70-33905		X								
A70-35617										X
A70-35621	X						X			0
A70-36967		0	0	X						
A70-37087						X				
A70-39147						X				
A70-39798						X				
A70-40803	0				X					
A70-43087						X				
A70-44648	0		0		0			X		
A70-45363							X			
A71-10135								X		
A71-16672								X		
A71-21270								X		
A71-23217			X							
A71-23590					X		X	0		
A71-24685								X		

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MBN	TMP	SRS	FOS	NWS	NWS2	SPW
A63-11385								X		
A64-11916								X		
A64-13054		X	0							
A64-16324								X		
A64-18229								X		
A64-27107		X								
A65-12016		0	X							
A65-14509								X	X	
A65-16410								X		
A65-17643		0	X							
A65-23621		0	X							
A65-24582		X	X							
A65-29886		X	X							
A67-10274								X		
A67-27606								X		
A67-31339			X					0		
A67-34001								X		
A67-36521								X		
A67-40353								X		
A67-41373	X									
A67-41789		X	X					X		
A68-15566							X	0		
A68-15646						X				
A68-19734							X			
A68-20370							X			
A68-20492							X			0
A68-21362								X		
A68-24736							X	0		X
A68-28257							X			
A68-32124						X				
A68-32593						X				
A68-33895						0	X			
A68-34972								X		0
A68-37954							X			
A68-40988							X	0		
A68-42874							X			
A68-43279								X		
A68-43280							X	0		
A69-10693			X		X		X	0		
A69-12435						X		X		0
A69-12457										X
A69-13933							X			
A69-14653		X	0		X			X		
A69-20455							X			
A69-22166							X	0		
A69-26976	X				X			0		
A69-26997	X				0					
A69-29515	X				0					
A69-29528		X	X		X					
A69-29534			X							

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FOS	WWS	WWS2	SRW
A71-26174						X	X	0		
A71-27260					X					
A71-30126							X			
A71-30916						0	X			
A71-32296								X		
A71-36364	X				X			X		
A71-40224						X				
A71-41300										X
A71-41986	X	0	X		X		X	0		0
A71-42126								X		
A71-42150										X
A71-42151							X			
A71-43512						X	X			
A72-10546	0	0	X	0	0		X	0		
A72-11733			X							
A72-11786	0				0		X	0		0
A72-11795					X					X
A72-11803	X				X		X			
A72-11804						X		X		
A72-11808							X			
A72-11810		0			0		0	X		
A72-11866		X			X			X		
A72-11877		X					X			0
A72-11886			X			0				
A72-13441						X	X			
A72-15909										X
A72-16599		0	0	X	0					
A72-16600			0	X	0					
A72-16912							X			
A72-17385			0	X	0					
A72-17430					X					
A72-17925			X			X				
A72-20692								X		
A72-21824								X		
A72-22652						X				
A72-23301			X							X
A72-24749		0			X					
A72-25348							X			
A72-26083			0		0		X			
A72-27706								X		0
A72-30587								X		
A72-31242			0		X					
A72-31252				X						X
A72-33630										X
A72-33631								X		
A72-35495								X		
A72-37005						0	X			
A72-37196								X		
A72-37252						X				
A72-39640							X			

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FOS	WWS	WWS2	SRW
A72-39677	0				0		X			
A72-39795			X							
A72-44274						X				
A72-45107	0							X		0
A73-10590						X	X			
A73-10833								X		
A73-12361						X				
A73-15773	X				X					
A73-15780						X				
A73-18317								X		
A73-20873						0	X			
A73-21622						X	X			
A73-22510	0						X			
A73-23634								X		
A73-25774			X	0	0					
A73-26252						X	0			
A73-26305								X		
A73-26514						X				
A73-28020								X		
A73-33360	X			X	X					0
N62-12628		X	0							
N63-20195		0	X							
N63-20710		X								
N64-10915		0	X							
N64-11474								X		
N64-13743								X		
N64-16705			X							
N64-19254		X	X							
N64-19406								X		
N64-19629								X		
N64-20104								X		
N64-23939								X		
N65-10973									X	
N65-21425								X		
N65-23528								X		
N65-27649		X								
N65-30376		X	0							
N65-30377		X	X							
N65-30756		0		X						
N65-31359								X		
N65-32220			X							
N65-33583									X	
N65-33590									X	
N65-33597								X		
N65-33598		X	X							
N65-33599		X		X					X	
N65-33602		X	0					X		
N65-35196		X						X		
N65-35518			X							
66-12619			X							

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FOS	WWS	WWS2	SRW
N66-13422									X	
N66-21223								X		
N66-22546		X								
N66-23806			X							
N66-28422		X	X					X		
N66-31370								X		
N66-33394			X							
N66-36781								X		
N67-13466		O		X						
N67-13492		O	O	X						
N67-13511									X	
N67-13529		X	X							
N67-15350		X	X					X		
N67-19838		O	X							
N67-20728								X	X	
N67-24302								X		
N67-28948		X	X	X				X		
N67-29052								X		
N67-30471		O	X							
N67-30735		X								
N67-34744								X		
N67-35894								X		
N68-10677							X			
N68-14108		X					O			
N68-14987		X			X					O
N68-16117						X	O			
N68-19309						X				
N68-19332							X			
N68-19465		X								
N68-19845						X				
N68-19870					X					
N68-20041		X			X					
N68-20264							X			
N68-21736						X	X			
N68-23121			X							
N68-23710								X		
N68-24292						X				
N68-27972		X								
N68-28922		O			X					
N68-30012						X	X			
N68-30499		X	O	X				X		O
N68-30637						X				
N68-30647		X	O	X	X					
N68-33396					X					
N68-33400		X	X	X				O		O
N68-33402						X				
N68-34126								X		
N68-34246		X	X	X			X			
N68-36931		O	O		O		X			
N69-10125								X		

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FCS	NWS	NWS2	SRH
N69-11537		0	X	X	X					
N69-16087						X				
N69-19061			X							
N69-19416							X			
N69-20041					X					
N69-22873							X			
N69-23202	0	X	X	X		X				
N69-23741								X		X
N69-23895							X			
N69-25932		X	X							
N69-27484								X		
N69-27634						X				
N69-28326	X				X		X			
N69-28506	X	X	X		X		X	0		X
N69-31076		X			X					
N69-31853			X		X					
N69-31856								0		X
N69-31865		0	0	X			X	0		
N69-31868		X			0					
N69-34261							X			
N69-37466							X			X
N69-37972					X					
N69-38955			X		X					X
N69-39604	X				0					
N69-41046		X								
N69-41211		0	0	X						
N70-13584			X				X			
N70-13942		X			X		X			
N70-14448		X			X					
N70-17108							X			
N70-17428					X					
N70-17760	0					X				
N70-20193		X			X					
N70-24782							X			
N70-24798			0				X			
N70-26221						X				
N70-27958	X	X	X		X		X	0		
N70-33736	0				X		X			
N70-35009					X					
N70-35160					X					
N70-39550		X	0							
N70-41149										X
N70-42743							X			
N71-10210								X		X
N71-10354			X		X					
N71-11155										X
N71-11161	X	X			X		X	X		
N71-11164					X			0		
N71-11166	X				X					
N71-11167		X			X					

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MRN	TRP	SFS	FOS	WWS	WWS2	SRW
N71-11171		O	O		X					
N71-13090				X						
N71-13532							X			
N71-13732		X			X		O	O		X
N71-16135										X
N71-16146										X
N71-16168				O						X
N71-18402		X	X		X					
N71-20422		X	O		X					
N71-21304			O	O	X					
N71-21590			X		X		O	O		
N71-22607								X		
N71-24809										X
N71-25960					X					
N71-26475								X		
N71-26774						O		X		
N71-26904					X			X		
N71-27545								X		
N71-27551		X	X		X		X	O		
N71-27553						X				
N71-27556						X				
N71-28731				X						
N71-29217		O	O	X						
N71-30176			X							
N71-31570							X			
N71-31790		X					X	O		
N71-32422			X							
N71-32636				X						
N71-32997							X			
N71-33094						X				
N71-34110							X			
N71-34567			O				X	O		
N71-35494	O				X	X	X	O		
N71-36998					X					
N72-11523					X					
N72-12301										X
N72-12306										X
N72-12312			O	X	O					
N72-13364	X				X			X		
N72-15912							X			
N72-16105	X				X			X		
N72-17270		X								
N72-17298							X			
N72-17306								X		O
N72-17320		X								X
N72-18346			X							
N72-18360					X	X				
N72-18438						X				
N72-18439						X				
N72-18442								X		

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

HIT ACCESSION NUMBERS	PJC	AWL	CLN	MBN	TRD	SFS	FOS	WMS	WMS2	SBU
N72-18632							X			
N72-19449					X					
N72-19516						X				
N72-19518								X		
N72-20052			X							
N72-21357			X		X					
N72-22309							X			
N72-22365			X							
N72-22435						X				
N72-24403				X						
N72-26290				X						X
N72-27406				X						
N72-27438			X							
N72-28403				X						
N72-29324	O	O		X	O		O			
N72-29379			X							
N72-29406							X			
N72-29473						X				
N72-30247							X			
N72-30382	X				X		X			
N72-32334		X								C
N72-33784	X				X		X			
N73-10484			X		X					
N73-12425								X		X
N73-13332	X				X					O
N73-16160			X							
N73-16303							X			
N73-16358				O			X			O
N73-16387		X	O	X			X			
N73-16398				X						
N73-16954							X			
N73-17510							X			
N73-17536		X	X							
N73-17938							X			
N73-20423			X							
N73-20450	X				X					
N73-22406						X				
N73-25422	X									
TOTAL RELEVANT MASTER TOTAL=388	044	087	097	039	097	060	105	121	008	048
TOTAL HITS	179	670	387	211	319	160	284	347	205	172
RELEVANCE	24.6%	13.0%	25.0%	18.5%	30.4%	37.5%	36.6%	34.9%	3.9%	16.9%
RECALL	11.3%	22.4%	25.0%	10.0%	25.0%	15.5%	26.8%	31.2%	2.1%	12.4%

RECON PROBLEM NUMBER 1: RECALL AND RELEVANCE REPORT

A SEARCH WAS PERFORMED USING TERMS FROM SOME OF THE 388 RELEVANT DOCUMENTS.
THERE WERE 103 HITS; 45 GOOD; 35 WERE FOUND IN THE 10 TEST SEARCHES.
THE 10 HITS BELOW WERE MISSED IN ALL THE TEST SEARCHES:

N64-27622	N65-14317	N65-30391	N65-33596	N66-32534
N67-29516	N67-38049	N71-28455	A73-35644	A73-35577