Information Retrieval

The Role of Controlled Vocabularies
(Summary of Proceedings)
The NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program plays a key part in helping NASA maintain this important role.

The NASA STI Program provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program is also NASA's institutional mechanism for disseminating the results of its research and development activities.

Specialized services that help round out the Program's diverse offerings include creating custom thesauri, translating material to or from 34 foreign languages, building customized databases, organizing and publishing research results, ... even producing videos.

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- **E-mail** your question via the Internet to help@sti.nasa.gov
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INFORMATION RETRIEVAL: THE ROLE OF CONTROLLED VOCABULARIES

April 22, 1993
10:00 am - 4:30 pm
Crystal City Gateway 4
Conference Room

Attendees

NASA/Code JTT
Katie Bajis
Barbara Bauldokk
Bonnie Carroll
Beth Duston
Jim Erwin
Janice Freeman
Jennifer Garland
Laurie Harrison
Linda Hill
Glenn Hoetker
Karen Holloway
Tom Lahr
Harry Needleman
Kriston Ostergaard
Roland Ridgeway
Lou Ann Scanlan
Ron Sepic
Debbie Stubblefield
Patt Sullivan
Ardeth Taber
Kay Voglewede
John Wilson

NASA/CASI
Carl Eberline
Ron Buchan
Bob Ferris
Wanda Colquitt
Joe Gignac
Jim Schroer
June Silvester
Roy Stiltner

NASA/AIAA/TIS
Tom Cheung
Barbara Lawrence

NASA/GSFC
Paul Baker
Jane Riddle

DoD/DTIC
John Dickert
Marcia Hanna
Gretchen Schlag
Annie Washington
David Williford

DOE/OSTI
Mona Raridon

Batelle
Mason Soule

MITRE
Elaine Lusher
Inderjeet Mani

NLM/MEDLINE
Peri Schuyler

OTHER
Elliott Linder
Welcome
Jim Erwin
NASA STI Program

Overview
Dr. Linda Hill
NASA STI Program

Retrieval: Free Text, Full Text, and Controlled Vocabularies
Dr. Raya Fidel
Associate Professor
Graduate School of Library and Information Science
University of Washington

Thesaurus Standards and Practicalities
Dr. Bella Hass Weinberg
Professor
Division of Library and Information Science
St. John's University

Panel Discussion of Federal Thesauri
Moderator: John Wilson, NASA STI Program

Ron Buchan, NASA/CASI
Gretchen Schlag, DoD/DTIC
Mona Raridon, DOE/OSTI
Peri Schuyler, MEDLINE
The NASA Scientific and Technical Information (STI) Program Coordinating Council consists of participants from NASA Headquarters, NASA Centers, and NASA contractors. The Coordinating Council meets periodically to exchange information and pursue topics of vital interest to the NASA STI Program.

## Coordinating Council Meetings

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<td>Who Are Our Key Users?</td>
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<td>Seventh Meeting</td>
<td>Acquisitions</td>
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<td>Tenth Meeting</td>
<td>Information Retrieval: The Role of Controlled Vocabularies</td>
<td>April 22, 1993</td>
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Document Preparation

The following summary was prepared from the audio tape of the session by the staff at the NASA Center for AeroSpace Information (CASI) and reviewed by the speakers. The summary is intended to give the substance of the presentations and does not attempt to report on either the panel discussion or the comments from the audience.
Jim Erwin established one of the goals of today's conference as determining the ongoing role of controlled vocabulary in information retrieval. He anticipated that the meeting would help to clearly delineate where we were in the area of information retrieval and allow us to determine how we measure up against the state of the art.

Dr. Hill noted that one of the purposes of the conference was to establish a dialog among the participants on the complex topic of controlled vocabularies and their place as retrieval tools in a free text environment.

To illustrate the difficulties that can result from a lack of a controlled vocabulary, Dr. Fidel discussed a search for the subject of exposures to substances or conditions that are a risk to health by using the phrase "exposure assessment methodology" (see viewgraphs 1 and 2). The aim of the search was to find information about measurement techniques. The difficulty is that each word in the phrase is so common that, if you ran a search using the words only, you would get a great many citations on a variety of subjects (see viewgraph 3). The ambiguity inherent in the individual words is matched by the ambiguity of the phrase itself. In order to insure broad recall of relevant records, the searcher needs to generate a set of synonyms for each concept. Synonyms include the words that people actually use in practice when they talk about a particular concept. Thus, an effective list of synonyms will include words sharing the same meaning as well as associated terms generated by the searcher out of her knowledge of real-life linguistic behavior.

This example of searching for the subject "exposure assessment methodology" illustrates the differences between free text (or even full text)
Information Retrieval: The Role of Controlled Vocabularies

searching and the use of controlled vocabularies (thesaurus terms). The searcher needed to find records that were relevant to the topic. In a free text environment without benefit of a controlled vocabulary, all that she had to search with were natural language terms from the documents or records. She did not have the benefit of controlled vocabulary where terminology for concepts had been standardized. She could not search with concepts. So, she made up the appropriate concepts for that particular search and tried to generate terms that matched those concepts to get at the information that she wanted. This approximates what is done when indexing with a controlled vocabulary. The indexer identifies concepts based on a reading of the material and then chooses the appropriate words (descriptors) from the controlled vocabulary (the thesaurus) to represent those concepts (see viewgraph 4).

**Need for controlled vocabularies**

Why should we create these controlled vocabularies beforehand and use them in indexing? One of the great values of controlled vocabularies is that they make implicit concepts explicit through hierarchical relationships between terms. These relationships between broad terms and narrow terms cannot be derived from an analysis of free text. They must be intellectual constructs. We have terminological control and content analysis through indexing. We need a controlled vocabulary if we want to retrieve concepts that can be represented in various ways, or inferred, in free text.

**Cost versus effectiveness**

Are controlled vocabularies cost-effective? Free text advocates argue that they are not cost-effective. Some studies found that free text and controlled vocabulary searching have the same results. Other studies have found that one or the other of the
Information Retrieval: The Role of Controlled Vocabularies

methods were more effective. Most of the studies were flawed; the question has not been answered.

A renewed interest in retrieval techniques and the differences among them resurfaced with the advent of full text searching. There were conflicting results from studies comparing full text searches with controlled vocabulary searches. A study (Tenopir, 1985) using the Harvard Business Review Online database, reported on a controlled experiment in which 31 requests were searched in four different formats: only the text, only the title, only the abstract, and only the descriptors. Results indicated that full text searches retrieved more than the other methods, yielding high recall, but with low precision. The controlled vocabulary performed better than free text if one didn't look at the full text, but only at the titles and abstracts. The conclusion of the study was that a combination of controlled vocabulary with a full text search technique gives the best results, since the controlled vocabulary compensates for the imprecision of the full text search.

In a study (McKinin et al., 1990), 100 questions generated by people that came into the library asking for literature searches were searched using two full text databases. Although the searches resulted in high recall, it was found that using the controlled vocabulary found some articles that were missed by the full text searches. Why were they missed? In 25% of the cases, it was because the concepts were not explicit in the text. In 33% of the cases, failure to capture a document was because the researchers did not use enough synonyms. Thus, in 58% of the cases, the failures could have been avoided by the use of a controlled vocabulary.
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Precision and recall

An earlier study (Blair & Maron, 1985) found that when you have a very large full text database, you get very poor retrieval using free text searching. In this study, using a 40,000 document database and 360,000 pages of text, legal paraprofessionals with search experience searched 51 questions. Results indicated high precision (79%), but low recall (20%), a counter-intuitive result. Low recall resulted, in part, from the drawbacks that are inherent in full text searching without a controlled vocabulary: the concepts that were being searched had different terms attached to them. Accidents, for example, were variously referred to as events, incidents, situations, problems, difficulties, etc.

When to use free text and/or controlled vocabularies

In the last study cited (Fidel, 1992), 47 searchers were observed as they performed their searches. They were asked to think aloud, reflecting on their reasons for making various decisions. Dr. Fidel also interviewed each searcher. It was found that the decision whether to use a free text search term or a controlled vocabulary search term depended on the specific situation. If the term was a common one, it was best to use descriptors. If the term was well-defined and recall was not important (the client simply wanted to get some articles), then free text was used.

Conclusion

The overall conclusion drawn from a review of these studies was that full text searching can by no means replace the use of a controlled vocabulary. The ideal search environment is one in which a controlled vocabulary complemented a free text search capability.

Thesaurus Standards and Practicalities

Dr. Bella Hass Weinberg analyzed the various structures of thesauri and their display in print and online, early making the point that there was not one standard or
Information Retrieval: The Role of Controlled Vocabularies

correct structure for thesauri. Chosen for comparison were four thesauri produced by government agencies that participated in the following panel discussion: the National Aeronautics and Space Administration (NASA), the National Library of Medicine (NLM), the Department of Defense (DoD), and the Department of Energy (DOE). The structures of the thesauri are varied and complex, a situation that contributes to a lack of utilization. Using viewgraphs to illustrate the hierarchical arrangement of terms, the thesauri were presented in order of increasing complexity of structure: the Defense Technical Information Center Thesaurus (see viewgraphs 5-9), the Department of Energy's International Energy Subject Thesaurus (see viewgraphs 10-13), the NASA Thesaurus (see viewgraphs 14-23), and the National Library of Medicine's Medical Subject Headings (MeSH) (see viewgraphs 24-31). Comparisons and contrasts were made among such thesaurus features as the structure of broader and narrower terms, the presence or absence of related terms, and levels of hierarchy.

Analysis of four thesauri

Specifically, Dr. Weinberg analyzed in some detail the following aspects of the four thesauri (see viewgraph 32): the primary alphabetic sequence, the dictionary, the concordance of all words, and the classified display. Again, the overriding point was how confusing thesauri can be to users.

Alphabetic sequence

In the DOE thesaurus, the primary alphabetic sequence is called Subject Thesaurus; in DTIC it is called Posting Terms; in MeSH, Annotated Alphabetic List; and in the NASA Thesaurus, Hierarchical Listing.

Dictionary

Dictionary functions are also variously accomplished. In the DOE thesaurus, some definitions are within the alphabetic sequence, with a tag. In
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DTIC, there are some definitions, without a tag. MeSH includes some lexical information within scope notes. NASA carries the definitions in a separate volume.

Concordance

DOE has no concordance. DTIC calls its concordance Key Words Out of Context, and places it in Section 3. MeSH calls it Permutated Medical Subject Headings, while NASA calls it Access Vocabulary.

Classified display

DOE has no classified display. DTIC has a separate hierarchical listing. MeSH has a separate hierarchical display, one that consists of tree structures with no redundancy to the alphabetic display. NASA's thesaurus does not have a separate printed panorama of the classification of all its descriptors. However, it provides complete broader- and narrower-term relationships for each term within the alphabetical sequence, called the Hierarchical Listing.

Semantic relationships

Next, Dr. Weinberg discussed thesaurus notation for semantic relationships (see viewgraph 33). In abstract terms there are three categories of semantic relationships: equivalence, hierarchy, and association.

Online thesaurus display

In her discussion of online thesaurus display, Dr. Weinberg noted that, compared with print displays, online displays in the major vendor systems are poorer, offering less information to the user (see viewgraphs 34-45). For example, scope notes are truncated. The definition information is not yet available in the major online systems. She found that some people who are mounting thesauri at DIALOG do not understand thesaurus codes. Used and Used For are both truncated to U and used in both directions in certain databases (see viewgraph 39).

Conclusion

In conclusion, Dr. Weinberg noted the great variations in thesauri structures. She argued that
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greater uniformity would simplify consultation of thesauri. (She is not, however, advocating uniformity in vocabularies.) She also called for a common command language for information retrieval that would enhance end user employment of the controlled vocabulary that we put so much effort into building.

Panel discussion

In the lively panel discussion on developing federal thesauri, a number of important issues were covered: the uses of retrospective indexing, the question of whether the addition of more postings to controlled vocabularies constitutes an advantage or a disadvantage to searchers, the impact of machine-aided indexing, and efforts aimed at standardizing terminology. What the panelists agreed upon was the need for on-going consultations among the panel participants on standardizing their respective vocabularies whenever possible.

References


Viewgraphs

Retrieval: Free Text, Full Text, and Controlled Vocabularies

Dr. Raya Fidel
Exposure Assessment Methodology

Exposure AND Assessment AND Methodology

Raya Fidel

April 22, 1993
• A term has many meanings
• A term is ambiguous
• A term is vague
• A term occurs too frequently in the database's text
A term is a common term

- A term is mapped to a descriptor
  - A term cannot be mapped to a descriptor
    - A term is mapped to a descriptor
      - The descriptor is an exact match
        - The descriptor is a partial match
          - The descriptor is a broader term
            - A term cannot be mapped to a descriptor
              - Don't know if mapped

A term is a single-meaning term

- A term is mapped to a descriptor
  - The descriptor is an exact match
    - The descriptor is a partial match
      - The descriptor is a broader term
        - A term cannot be mapped to a descriptor
          - Don't know if mapped

A. Use descriptors
B. Use textwords
C. Use textwords
D. Use textwords to probe indexing
E. Change database
F. Use descriptors
G. Use descriptors
H. Use textwords for an inclusive search
I. Use textwords
J. Use textwords in combination with descriptors
K. Use descriptors
L. Use textwords
M. Use textwords to probe indexing
N. Use textwords to introduce uncommon types of search keys
O. Try it anyway
P. Use textwords
Q. Use textwords to probe indexing
R. Enter as a descriptor a term that might be a descriptor
Viewgraphs

Thesaurus Standards and Practicalities

Dr Bella Hass Weinberg

Viewgraphs 5 through 31 are pages from the DoD, DOE, NASA, and NLM thesauri.

Viewgraphs 32 and 33 are charts comparing the structures of the four thesauri.

Viewgraphs 32 through 45 are illustrations of DIALOG'S online thesaurus.
Defense Technical Information Center

Thesaurus

September 1990

distributed by

Defense Technical Information Center
DEFENSE LOGISTICS AGENCY
Cameron Station • Alexandria, Virginia 22304-6145
POSTING TERM ENTRY EXPLANATION

a. ARMY
b. (Scope note if necessary)
c. UF Army department
d. UFC Army medicine
e. BT *MILITARY FORCES (UNITED STATES)
f. NT FIELD ARMY
g. Army department
   use ARMY
       Army medicine
       use ARMY
       and MILITARY MEDICINE

a. Posting Term - A main entry appearing in boldface type which represents a significant class of concepts used for indexing and retrieval.

b. Scope Note - Exists when necessary to further define or limit the meaning or usage of a posting term.
   NOTE: A date immediately preceding a scope note denotes the year and month the term was established as an authorized DTIC posting term.

c. Used For (UF) - The posting term at the main entry is to be used for any term following this notation. Reciprocates with use reference.

d. Used For Combination (UFC) - The posting term at the main entry together with one or more other posting terms are to be used for any term following this notation. Reciprocates with multiple use reference.

e. Broader Term (BT) - Posting terms following this notation represent a broader class which includes the main entry posting term.
   NOTE: An (*) symbol in front of a BT indicates the existence of broader generic levels of terms.

f. Narrower Term (NT) - Posting terms following this notation are within the class of concepts represented by the main entry posting term.
   NOTE: An (*) symbol in front of a NT indicates the existence of narrower generic levels of terms.

g. Use Reference - Refers the user to one or more preferred main entry posting terms. Always reciprocates with UF and UFC references.
ENVIRONMENTAL ENGINEERING
BT ENGINEERING

ENVIRONMENTAL IMPACT
(81/09) - Predetermination of the extent of pollution or environmental degradation.

ENVIRONMENTAL IMPACT STATEMENTS

ENVIRONMENTAL MANAGEMENT
BT MANAGEMENT

ENVIRONMENTAL PROTECTION
BT PROTECTION

ENVIRONMENTAL PSYCHOLOGISTS
BT PERSONNEL

ENVIRONMENTAL TESTS
BT *TEST METHODS
NT COLD WEATHER TESTS
DESERT TESTS
LIQUID IMMERSION TESTS
SALT SPRAY TESTS
SEA TESTING
TROPICAL TESTS

ENVIRONMENTS
NT *AEROSPACE ENVIRONMENTS
CONFINED ENVIRONMENTS
ELECTROMAGNETIC ENVIRONMENTS
INDUCED ENVIRONMENTS
LUNAR ENVIRONMENTS
*OCEAN ENVIRONMENTS

ENZOOTIC
(83/05) - A disease affecting animals in limited geographic regions.
BT DISEASES

ENZYME ANTAGONISTS
use ANTIMETABOLITES

ENZYME CHEMISTRY
BT *BIOCHEMISTRY

ENZYME INHIBITORS
BT INHIBITORS
NT *CHOLINESTERASE INHIBITORS
SERINE

ENZYME PRECURSORS
UF CHYMOSINODEN
PEPSINODEN
PLASMINODEN
PREENZYMES
PROENZYMES
PROFIBRINOLYSIN
PROFIBRIN
TRYPSINODEN
NT *ENZYMES
PROTHROMBIN

ENZYMES
BT *ENZYME PRECURSORS
NT ADENYL CYCLASE
*COENZYMES
COLLAGENASE
*DEHYDROGENASES
DEXTRANSUCCURASE
GLUCANASES
*HYDROLASES
*ISOMERASES
*ISOZYMES

KETOACID LYASES
LUCIFERASE
*LYASES
MUCOLYTIC ENZYMES
NUCLEASE
*OXIDOREDUCTASES
PEPSINS
SACCHARIDASES
TRANSFERASES

EOSINOPHILS
BT *LEUKOCYTES

EPHEMERIDES
UF EPHEMERIS

EPHEMERIS
use EPHEMERIDES

EPICENTERS
BT GEOPHYSICAL AREAS

EPIDEMIOLOGY
BT *MEDICINE

EPIDERMIS
(83/05) - The superficial portion of the skin, composed of a horny layer (stratum corneum) and a living, cellular part in layers named from outside inward: The stratum lucidum (when present), the stratum granulosum, the stratum spinosum, and the stratum germinativum. Skin is composed of dermis and epidermis.
BT *SKIN(ANATOMY)

EPILEPSY
BT *CONVULSIVE DISORDERS

EPIMERASES
use RACEMASES AND EPIMERASES

EPINEPHRINE
BT *CATECHOLAMINES
NT NOREPINEPHRINE

EPITAXIAL GROWTH
BT *CRYSTAL GROWTH

EPITHELIUM
BT TISSUES(BIOLOGY)

EPIZOOTIC
(83/05) - Affecting many animals of one kind in one region simultaneously; widely diffused and rapidly spreading.
BT DISEASES

EPITHELIAL

EPOXIDATION
BT *OXIDATION

EPOXY COATINGS
BT COATINGS

EPOXY COMPOSITES
(81/09) - Composite materials or structures in which the binding material is epoxy compound, reinforced with various kinds of fibers, cast, layed-up or molded in various shapes.
BT *COMPOSITE MATERIALS

EQUIVALENT CIRCUITS
BT *CIRCUITS

ERASER

ERBIUM
BT *RARE EARTH ELEMENTS
<table>
<thead>
<tr>
<th>ABBREVIATION</th>
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<td>BOOM (EQUIPMENT)</td>
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<td>BZB (PHYSIOLOGY)</td>
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**Legend:**
- **ABBREVIATION:** Initials used to represent specific equipment or supplies.
- **EXPANSION:** Detailed description or full form associated with the abbreviation.

*Note: This table is a partial listing and may contain errors in formatting and content.*
INTERNATIONAL ENERGY

Subject Thesaurus

1990
**DISTRICT HEATING [01]**
- **DA**: January 1975
- **BT1**: Heating
- **NT1**: Geothermal District Heating
- **RT**: Central Heating Plants
- **RT**: Co-Generation
- **RT**: DEUS
- **RT**: Dual-Purpose Power Plants
- **RT**: Geothermal Heating Systems
- **RT**: Heat Distribution Systems
- **RT**: Hot Water
- **RT**: Thermal Transmission ICES

**DISTRIBUTION [01]**
(For energy distribution use ENERGY SPECTRA.)
- **UF+**: Inclusive Distribution
- **NT1**: Angular Distribution
- **NT1**: Spatial Distribution
- **NT1**: Tissue Distribution
- **RT**: Allocations
- **RT**: Asymmetry
- **RT**: Boltzmann Statistics
- **RT**: Gaussian Processes
- **RT**: Isotropy
- **RT**: Particle Kinematics
- **RT**: Symmetry

**Inclusive Distribution**
- **USE**: Distribution
- **AND**: Inclusive Interactions

**HELIOS FACILITY**
- **DA**: July 1979
- **RT**: Carbon Dioxide Lasers
- **RT**: Laser Fusion Reactors
- **DEF**: A 10 kJ. 8-beam. CO2 laser facility at Los Alamos for laser fusion experiments

**ACTINIDE COMPOUNDS [01]**
- ***NT1**: Actinium Compounds
- ***NT1**: Americium Compounds
- ***NT1**: Berkelium Compounds
- ***NT1**: Californium Compounds
- ***NT1**: Curium Compounds
- ***NT1**: Einsteinium Compounds
- ***NT1**: Fermium Compounds
- ***NT1**: Lawrencium Compounds
- ***NT1**: Mendelevium Compounds
- ***NT1**: Neptunium Compounds
- ***NT1**: Nobelium Compounds
- ***NT1**: Plutonium Compounds
- ***NT1**: Protactinium Compounds
- ***NT1**: Thorium Compounds
- ***NT1**: Uranium Compounds
<table>
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<th>Volume 1 · Hierarchical Listing</th>
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| Volume 2 · Access Vocabulary  |
| Volume 3 · Definitions        |
FAR ULTRAVIOLET RADIATION
(200 TO 2000 ANGSTROMS)
VACUUM ULTRAVIOLET RADIATION
ELECTROMAGNETIC RADIATION
• ULTRAVIOLET RADIATION
• FAR ULTRAVIOLET RADIATION
• LYMAN ALPHA RADIATION
• LYMAN BETA RADIATION
IONIZING RADIATION
• ULTRAVIOLET RADIATION
• FAR ULTRAVIOLET RADIATION
• LYMAN ALPHA RADIATION
• LYMAN BETA RADIATION
• BREMSSTRAHLUNG
MAGELLAN ULTRAVIOLET ASTRONOMY SATELLITE
NEAR ULTRAVIOLET RADIATION
X RADIATION
ULTRAVIOLET TELESCOPES
X RAYS

TYPICAL USE CROSS REFERENCE ENTRY

VACUUM ULTRAVIOLET RADIATION
USE FAR ULTRAVIOLET RADIATION

TYPICAL ARRAY TERM ENTRY

USE OF A MORE SPECIFIC TERM IS RECOMMENDED—CONSULT THE TERMS LISTED BELOW
CLUMPS
GALACTIC CLUSTERS
GLOBULAR CLUSTERS
PLEIADES CLUSTER
PRAESEPE STAR CLUSTERS
STAR CLUSTERS
VIRGO GALACTIC CLUSTER
ENVIRONMENT EFFECTS
Environment Experiment, Electromagnetic
USE ELECTROMAGNETIC ENVIRONMENT EXPERIMENT
Environment Interactions, Man
USE MAN ENVIRONMENT INTERACTIONS
Environment, Lunar
USE LUNAR ENVIRONMENT
ENVIRONMENT MANAGEMENT
Environment, Mars
USE MARS ENVIRONMENT
ENVIRONMENT MODELS
ENVIRONMENT POLLUTION
ENVIRONMENT PROTECTION
ENVIRONMENT SIMULATION
Environment Simulation, Space
USE SPACE ENVIRONMENT SIMULATION
ENVIRONMENT SIMULATORS
Environment, Space
USE AEROSPACE ENVIRONMENTS
Environmental Chambers
USE TEST CHAMBERS
ENVIRONMENTAL CHEMISTRY
ENVIRONMENTAL CONTROL
ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL INDEX
ENVIRONMENTAL LABORATORIES
Environmental Lubrication, Space
USE SPACECRAFT LUBRICATION
ENVIRONMENTAL MONITORING
ENVIRONMENTAL QUALITY
ENVIRONMENTAL RESEARCH SATELLITES
Environmental Sat Sys, National Operational
USE NOESS
ENVIRONMENTAL SURVEYS
Environmental Temperature
USE AMBIENT TEMPERATURE
ENVIRONMENTAL TESTS
ENVIRONMENTS
Environments, Aerospace
USE AEROSPACE ENVIRONMENTS
Environments, Arctic
USE ICE ENVIRONMENTS
Environments, Earth Orbital
USE EARTH ORBITAL ENVIRONMENTS
Environments, Extraterrestrial
USE EXTRATERRESTRIAL ENVIRONMENTS
Environments, Fricionless
USE FRICTIONLESS ENVIRONMENTS
Environments, Gas
USE EARTH ORBITAL ENVIRONMENTS
Environments, Geosynchronous Earth Orbital
USE EARTH ORBITAL ENVIRONMENTS
Environments, High Altitude
USE HIGH ALTITUDE ENVIRONMENTS
Environments, High Gravity
USE HIGH GRAVITY ENVIRONMENTS
Environments, High Temperature
USE HIGH TEMPERATURE ENVIRONMENTS
Environments, Ice
USE ICE ENVIRONMENTS
Environments, LEO
USE EARTH ORBITAL ENVIRONMENTS
Environments, Low Earth Orbital
USE EARTH ORBITAL ENVIRONMENTS
Environments, Low Temperature
USE LOW TEMPERATURE ENVIRONMENTS
Environments, Marine
USE MARINE ENVIRONMENTS
Environments, Planetary
USE PLANETARY ENVIRONMENTS
Environments, Rotating
USE ROTATING ENVIRONMENTS
Environments, Spacecraft
USE SPACECRAFT ENVIRONMENTS
Environments, Thermal
USE THERMAL ENVIRONMENTS
ENZYME ACTIVITY
ENZYMES
Enzymes, Co
USE COENZYMES
ENZYMEOLOGY
EOCR (Reactor)
USE EXPERIMENTAL ORGANIC COOLED REACTORS
EGO
USE EGO
EOLE SATELLITES
EOAP
USE EARTH & OCEAN PHYSICS APPLICATIONS PROGRAM
EOR (Rendezvous)
USE EARTH ORBITAL RENDEZVOUS
EDS
USE LANDSAT SATELLITES
EDS-EOS, Earth Observing System
USE EARTH OBSERVING SYSTEM (EOS)
EDS-A
USE LANDSAT E
EDS-B
USE LANDSAT F
EOXIOMOPHILS
EPE-A
USE EXPLORER 12 SATELLITE
EPE-B
USE EXPLORER 14 SATELLITE
EPE-C
USE EXPLORER 15 SATELLITE
EPE-D
USE EXPLORER 25 SATELLITE
EPHEMERIDES
EPHEMERALES, Planet
USE PLANET EPHEMERIDES
EPHEMERIS TIME

Equation, Diophantine
EPICARDIUM
EPICYCLOIDS
EPIDEMIOLOGY
EPIDERMIS
EPILEPSY
EPINEPHRINE
EPITAXY
Epitaxy, Grapho
USE GRAPHOEPITAXY
Epitaxy, Liquid Phase
USE LIQUID PHASE EPITAXY
Epitaxy, Molecular Beam
USE MOLECULAR BEAM EPITAXY
Epitaxy, Vapor Phase
USE VAPOR PHASE EPITAXY
EPITHEL IUM
EPN
USE EFFECTIVE PERCEIVED NOISE LEVELS
Epoxide
USE TIME MEASUREMENT
EPOXIDATION
Epoxides
USE EPOXY COMPOUNDS
Epoxy Composites, Boron
USE BORON-EPOXY COMPOSITES
Epoxy Composites, Graphite
USE GRAPHT-EPOXY COMPOSITES
EPOXY COMPOUNDS
EPOXY MATRIX COMPOSITES
EPOXY RESINS
Epoxy Resins, Phenolic
USE PHENOLIC EPOXY RESINS
EQUALIZERS (CIRCUITS)
Equation, Bernoulli
USE BERNOULLI THEOREM
Equation, Bethe-Salpeter
USE BETHE-SALPETER EQUATION
Equation, Blasius
USE BLASIUS EQUATION
Equation, Boltzmann Transport
USE BOLTZMANN TRANSPORT EQUATION
Equation, Boltzmann-Vlasov
USE BOLTZMANN-VLASOV EQUATION
Equation, Born-Mayer
USE BORN APPROXIMATION
Equation, Brillouin-Wigner
USE BRILLOUIN-WIGNER EQUATION
Equation, Burger
USE BURGER EQUATION
Equation, Chandrasekhar
USE CHANDRASEKHAR EQUATION
Equation, Charpy
USE CHARPY EQUATION
Equation, Continuity
USE CONTINUITY EQUATION
Equation, Diophantine
USE DIOPHANTINE EQUATION
### TYPICAL ACCESS VOCABULARY ENTRIES


Pseudoterms (permutations) derived from non-postable multiword term. Postable term reference follows USE.

<table>
<thead>
<tr>
<th>Term</th>
<th>USE Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Density Explorer A</td>
<td>EXPLORER 19 SATELLITE</td>
</tr>
<tr>
<td>A, Air Density Explorer</td>
<td>EXPLORER 19 SATELLITE</td>
</tr>
<tr>
<td>Density Explorer A, Air</td>
<td>EXPLORER 19 SATELLITE</td>
</tr>
<tr>
<td>Explorer A, Air Density</td>
<td>EXPLORER 19 SATELLITE</td>
</tr>
</tbody>
</table>

Embedded term.

Pseudoterms (permutations) derived from embedded term.

<table>
<thead>
<tr>
<th>Term</th>
<th>USE Reference</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Chemistry, Biogeo</td>
<td>BIOGEOCHEMISTRY</td>
</tr>
<tr>
<td>Geochemistry, Bio</td>
<td>BIOGEOCHEMISTRY</td>
</tr>
</tbody>
</table>

Postable multiword term.

Pseudoterms derived from multiword term.

<table>
<thead>
<tr>
<th>Term</th>
<th>USE Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO SOYUZ TEST PROJECT</td>
<td></td>
</tr>
<tr>
<td>Project, Apollo Soyuz Test</td>
<td>APOLLO SOYUZ TEST PROJECT</td>
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<td>Soyuz Test Project, Apollo</td>
<td>APOLLO SOYUZ TEST PROJECT</td>
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<tr>
<td>Test Project, Apollo Soyuz</td>
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</tbody>
</table>

Typical OTHER WORD entry (abbreviation) with postable term reference.

<table>
<thead>
<tr>
<th>Term</th>
<th>USE Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>MASSACHUSETTS</td>
</tr>
<tr>
<td>Zn</td>
<td>ZINC</td>
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</tbody>
</table>

Typical OTHER WORD entry (chemical symbol) with postable term reference.
Definitions are given for most terms added to the NASA Thesaurus since 1976 as well as for many earlier terms. Definitions of more common or general scientific terms are given a NASA slant if one exists. Certain terms are not defined as a matter of policy: common place names, chemical elements, specific models of computers, and nontechnical terms. Other terms lack definitions because the NASA Thesaurus predates by a number of years the systematic effort to define terms. Nevertheless, definitions of older terms are continually being added.

The following data are provided for each definition: term in uppercase/lowercase form, definition per se, source, and year the term (not the definition) was added to the NASA Thesaurus. The NASA History Office is the authority for capitalization of NASA names. USE cross references from the NASA Thesaurus are also included in uppercase/lowercase form.

SOURCES OF DEFINITIONS
Definitions with no source given were constructed by lexicographers at the NASA Scientific and Technical Information (STI) Facility, who rely on the following sources for their information: experts in the field, literature searches from the NASA STI database, and specialized references, including those listed below.

ASTM. *Compilation of ASTM Standard Definitions*, 6th edition. Philadelphia, PA, ASTM, 1986. Copyright, the American Society for Testing and Materials (ASTM). All rights reserved. Used with the permission of ASTM. Two ASTM sources are distinguished: standards are identified by an alphanumeric designation with no hyphen; committees are identified by an alphanumeric designation with a hyphen. The original definitions appeared in the *Annual Book of ASTM Standards*.


In some cases, definitions used from these sources have been subjected to editorial alterations, such as making a definition agree in number with the NASA form of the term.

TYPICAL TERM DEFINITION ENTRY

| TERM | prisms |
| DEFINITION | Transparent bodies with at least two polished plane faces inclined with respect to each other, from which light is reflected or through which light is refracted. When light is refracted by a prism whose refractive index exceeds that of the surrounding medium, it is deviated or bent toward the thicker part of the prism. |
| YEAR | ASTM (E 175, E-25) 1968 |
| SOURCE OF DEFINITION | ASTM (E 175, E-25) 1968 |
entropy
A measure of the extent to which the energy of a system is unavailable.  
ASTM (C 904, C-3) 1968

entropy (statistics)
A factor or quantity that is a function of a mechanical system and is equal to the logarithm of the probability of the particular arrangement in that state.  
1980

entry guidance (STS)
The precise steering commands for trajectory from initial penetration of the earth's atmosphere until the terminal area guidance is activated at an earth-relative speed (about 2500 fps).  
SP-7 1968

environmental chambers
Use test chambers  
1980

environmental chemistry
Collective term comprising the complex chemical relationships involving the atmosphere, climatology, air and water pollution, fuels, pesticides, energy, biochemistry, geochemistry, etc.  
1980

environmental temperature
Use ambient temperature  
1980

environments
External conditions or the sum of such conditions, in which pieces of equipment, living organisms, or systems operate as in temperature environment, vibration environment, or space environment. Environments are usually specified by a range of values, and may be either natural or artificial.  
SP-7 1968

eosinophils
A type of white blood cell or leukocyte which stains a red color with eosin stain; normally about 2 to 3 percent of white cells in the blood but tending to decrease during stressful situations and thus usable as an index for stress.  
SP-7 1968

ephemerides
Periodical publications tabulating the predicted positions of celestial bodies at regular intervals, such as daily, and containing other data of interest to astronomers. A publication giving similar information useful to a navigator is called an almanac.  
SP-7 1968

ephemeris time
The uniform measure of time defined by the laws of dynamics and determined in principle from the orbital motions of the planets, specifically the orbital motion of the earth as represented by Newcomb's Tables of the Sun.  
SP-7 1968

epithaxy
The oriented growth of a crystalline substance on a substrate of the same or different crystalline substance.  
ASTM (F 127, F-1) 1968

epoxy matrix composites
High strength compositions consisting of epoxy resin and a reinforcing matrix of filaments or fibers of glass, metal, or other materials.  
1980

epoxy resins
Viscous liquids or brittle solids containing epoxide groups that can be crosslinked into final form by means of a chemical reaction with a variety of setting agents used with or without heat.  
ASTM (C 904, C-3) 1968

equations of motion
A set of equations which give information regarding the motion of a body or of a point in space as a function of time when initial position and initial velocity are known. Used for motion equations.  
SP-7 1968

equations of state
Equations relating temperature, pressure, and volume of a system in thermodynamic equilibrium. Used for state equations.  
SP-7 1968

equatorial atmosphere
The composition and characteristics of the earth's atmosphere at and/or near the equator.  
SP-7 1968

equatorial regions
Areas on or near the earth's equator; regions between the Tropic of Cancer and the Tropic of Capricorn (23 degrees 27 minutes North or South of the Equator).  
SP-7 1968

equators
The primary great circle of a sphere or spheroid, such as the earth, perpendicular to the polar axis; or a line resembling or approximating such a circle.  
SP-7 1968

equinoxes
One of two points of intersection of the ecliptic and the celestial equator occupied by the sun when its declination is zero degrees.  
SP-7 1968

ERBE
Use earth radiation budget experiment  
SP-7 1968

ergometers
Instruments for measuring muscular work.  
SP-7 1968

ergonomics
Use human factors engineering  
1980

erosion
Progressive loss of original material from a solid surface due to mechanical interaction between that surface and a fluid, a multicomponent fluid, or impinging liquid or solid particles. Used for scars (geology).  
ASTM (G 75, G-2) 1968

erosive burning
Combustion of solid propellants accompanied with nonsteady, high velocity flows of product gases across burning propellant surfaces.  
1980

error band
Use accuracy  
SP-7 1968

error signals
Voltages the magnitude of which are proportional to the difference between an actual and a desired position.  
SP-7 1968

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NASA/STIF FRAME NUMBER 42
MEDICAL SUBJECT HEADINGS—
ANNOTATED ALPHABETIC LIST

1993

U.S. DEPARTMENT OF HEALTH
AND HUMAN SERVICES
Public Health Service
National Institutes of Health

National Library of Medicine
Library Operations
Medical Subject Headings
Bethesda, MD 20894
SAMPLE ENTRIES

Below are sample entries for one MeSH Heading and one Topical Subheading. Further explanation may be found in the following introductory sections.

• NEOPLASMS

consider also terms at CANCER, CARCINO-, ONCO-, and TUMOR

C4

avoid: too general; prefer specifics; policy: Manual section 24; /chem ind permitted but consider also CARCINOGENS; /class: consider also NEOPLASM STAGING (see note there) but "grading" - /pathol; /esiol: consider also ONCOGENIC VIRUSES; /prev: Manual 24.32-36 or TN 136; TN 135: MeSH terms for neoplasms classified by tissue; /drug ther: consider also ANTINEOPLASTIC AGENTS & its specifics; /gene: consider also GENES, SUPPRESSOR, TUMOR; /immunol: consider also ANTIGENS, NEOPLASM & ANTIBODIES,

NEOPLASM; /microbiol: consider also ONCOGENIC VIRUSES; /prev: consider also ANTICARCINOGENIC AGENTS; /radiother: consider also BRACHYTHERAPY; do not use /second ( - NEOPLASM METASTASIS);

familial: consider also NEOPLASTIC SYNDROMES, HEREDITARY; metastatic cancer of unknown origin: index under NEOPLASM METASTASIS; Tumor Key: TN Suppl CATALOG: form qualif permitted

/diagnosis was NEOPLASM DIAGNOSIS 1964-65; /etiolog was NEOPLASM ETIOLOGY 1964-65; /immunology was NEOPLASM IMMUNOLOGY 1964-65; /radiotherapy was NEOPLASM RADIOTHERAPY 1964-65; /therapy was NEOPLASM THERAPY 1964-65; NEOPLASM STATISTICS was heading 1964-65; CARCINOGENESIS was heading 1977

use NEOPLASMS /CI or NEOPLASMS /ET to search CARCINOGENESIS 1977

see related

ANTIBODIES, NEOPLASM
ANTICARCINOGENIC AGENTS
ANTIGENS, NEOPLASM
ANTINEOPLASTIC AGENTS
CARCINOGENS
DNA, NEOPLASM
GENES, SUPPRESSOR, TUMOR
ONCOGENIC VIRUSES
PLEURAL EFFUSION, MALIGNANT
PRECANCEROUS CONDITIONS
RNA, NEOPLASM

FORWARD SEE RELATED CROSS-REFERENCES TO OTHER DESCRIPTORS

X CANCER
X TUMORS
XR MEDICAL ONCOLOGY

SUBHEADING 'BINATION RENCE

NEOPLASMS/secondary see NEOPLASM METASTASIS

BACKWARD SEE RELATED CROSS-REFERENCE FROM OTHER DESCRIPTOR

PRE-EXPLOSION SYMBOL

TOPOICAL SUBHEADING

INDEXING ANNOTATION

\!/etiolog

subhead only; includes "pathogenesis" & "causes"; see MeSH scope note in Introduction; indexing policy: Manual 19.8.32; DP: /etiolog or /ET

66; used with Category C & F 1966-74; C & F3 1975 forward

search policy: Online Manual; use: main heading/ET or ET (SH) or SUBS APPLY ET
The image contains a page of a document with text and some raw textual content that was previously extracted for it. The page appears to be a page from a medical or scientific reference, possibly listing various terms with their corresponding MeSH (Medical Subject Headings) codes. MeSH is a system used by the National Library of Medicine to index, organize, and retrieve biomedical literature. The text appears to be in a format similar to a table or a list, with terms and codes interspersed throughout.

The page includes terms related to various medical and scientific fields, such as proteases, enterotoxins, enteroviruses, enuresis, and environmental health. Each term is accompanied by a MeSH code, which is a numerical identifier assigned to the terms to facilitate cataloging and retrieval.

The bottom of the page includes a note indicating that certain descriptors are indented in the MeSH tree structures at this number, suggesting a hierarchical structure to the classification system.
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National Library of Medicine
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Bethesda, MD 20894

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**12a. DISTRIBUTION/AVAILABILITY STATEMENT**
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**12b. DISTRIBUTION CODE**
UNCLASSIFIED

**13. ABSTRACT (Maximum 200 words)**
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**14. SUBJECT TERMS**
Descriptors: Index Terms, Information Retrieval, Subject Index Terms
Identifiers: MeSH, MEDLARS, MEDLINE

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**19. SECURITY CLASSIFICATION OF ABSTRACT**
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**20. LIMITATION OF ABSTRACT**
UNLIMITED
MEDICAL SUBJECT HEADINGS—TREE STRUCTURES

1993

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
National Institutes of Health

National Library of Medicine
Library Operations
Medical Subject Headings
Bethesda, MD 20894
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DIALOG DATABASES WITH ONLINE THESAURI
(PARTIAL LISTING)

??THESAURI

THE FOLLOWING ARE DIALOG FILES THAT CONTAIN AN ONLINE THESAURUS:

1  ERIC
11  PSYCINFO
37  SOCIOLOGICAL ABSTRACTS
72,172,173  EMBASE
154,155  MEDLINE
DIALOG: ERIC

?s environment
  S1  40800
?s environment/de
  S2  27317
?s environment/df
  S3  3250
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DIALOG ONLINE THESAURUS DISPLAY: ERIC

?expand e3

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### Printed Thesaurus

**INDEXING**

**Jul. 1966**

CIJE: 354   RIE: 458

**SN**

Assignment of index terms to documents of objects in order to later retrieve or locate these documents or objects according to the selected concepts designated by the index terms (note: do not use for "cost indexes")
## DIALOG THESAURUS CODES

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**DIALOG THESAURUS CODES: PSYCINFO**

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MESH ON DIALOG

File 153: MEDLINE 75-82

?expand (migraine)

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### BROADER TERM/NARROWER TERM SEQUENCE

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**RECOMMENDED THESAURUS DISPLAY**

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‡ CONSIDER DELETION

(rev. 5/31/88)
DIALOG: TREE STRUCTURES

?expand dc = C23.888.592.612

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The theme of this NASA Scientific and Technical Information Program Coordinating Council meeting was the role of controlled vocabularies (thesauri) in information retrieval. Included are summaries of the presentations and the accompanying visuals. Dr. Raya Fidel spoke on Retrieval: Free Text, Full Text, and Controlled Vocabularies. Dr. Bella Hass Weinberg spoke on Controlled Vocabularies and Thesaurus Standards. The presentations were followed by a panel discussion with participation from NASA, NLM, DTIC, and DOE; this discussion, however, is not summarized in any detail here.

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Available from NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090