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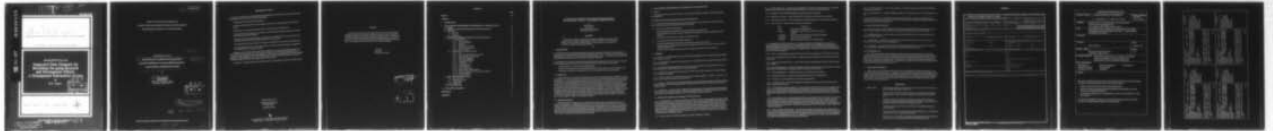
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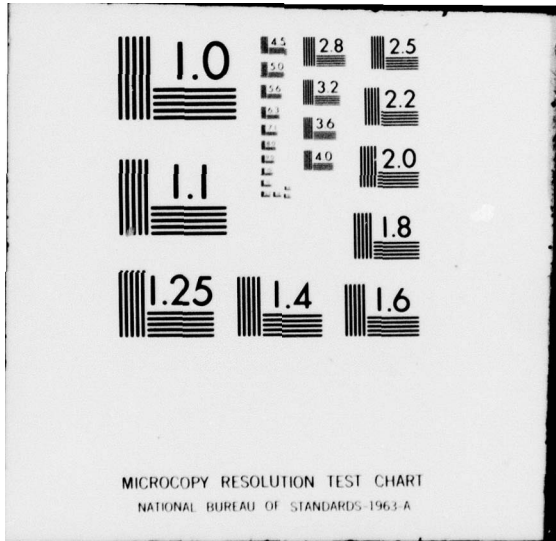
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NORTH ATLANTIC TREATY ORGANIZATION
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT
(ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

AGARD Report No.669

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**SUGGESTED DATA ELEMENTS FOR RECORDING
ON-GOING RESEARCH AND DEVELOPMENT EFFORTS:
A MANAGEMENT INFORMATION SYSTEM**

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by

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Hubert E. Sauter
Administrator

Defense Documentation Center
Alexandria, Virginia 22314

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- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community.

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PREFACE

A problem which has become of increasing concern over recent years to aerospace management in general and information specialists in particular is that of eliciting and providing information about on-going research and development efforts. This publication addresses the problem and provides some constructive suggestions, based on a survey of practice in the various NATO countries conducted by the AGARD Technical Information Panel. The proposals are modest but practical: they constitute a beginning.

A.S.T.TAN
Chairman
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SUGGESTED DATA ELEMENTS FOR RECORDING ON-GOING RESEARCH AND DEVELOPMENT EFFORTS: A MANAGEMENT INFORMATION SYSTEM

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SUMMARY

Data elements integral to a Research and Development Management Information System are gathered from a sampling of operating systems, listed, and defined. A work unit level of reporting is defined, and its advantages are given. An input form used by one of the study contributors is included as a guide in the Appendix.

1. INTRODUCTION

1.1 Scientific research and technological development continuously redraw the boundaries of human achievement. These efforts and the information they generate have flourished in recent decades. Their ultimate efficacy, however, may well depend upon a current research and development (R & D) information system: one that makes vital data describing on-going R & D projects available to the scientific and technological community.

1.2 Realizing that the operation of current R & D information systems is imperative, the Advisory Group for Aerospace Research and Development's (AGARD) Technical Information Panel (TIP) has sought to do three things:

- establish and define the level at which reporting takes place,
- identify and define data elements for reporting R & D programs at local, national, and international levels, and
- encourage the establishment of working groups to effect the standardization of these data elements.

1.3 UNISIST Study

A study performed for the United Nations Educational, Scientific and Cultural Organization (UNISIST) documents the importance of current research information (CRI) systems and lays a comprehensive groundwork for their design and implementation.¹ It acknowledges that information networks "play important roles in fostering communication within the scientific and technological community at the local and national level and in the creation of ties at the international level". However, the guidelines contend that if these networks deal only with scientific knowledge represented by the primary and secondary literature, they "provide only part of information required, since several years generally elapse from the time that a R & D project is initiated until its results are published". A CRI system bridges the gap by providing "a vital information source to science policy-makers, R & D managers and the scientific community as a whole". The guidelines discuss the rationale for establishing a CRI system, uses to which a registry can be put, and pertinent administrative and operational procedures. (Systems design is based on a registry system containing descriptions of current research effectively indexed.) Possible layouts for input and output forms are recommended. They warn that data "not be too difficult to collect or too expensive to process".

1.4 AGARD Study Approach

UNISIST's guidelines encourage the study of similar systems as a prerequisite in developing a CRI system. To construct a working base for selecting definitive data elements, the TIP sent inquiries to its members in 12 countries. Responses indicated that at the present time only three of these countries operate systems for recording on-going R & D. As expected, the number and kinds of data elements varied greatly. Data elements were extracted from these systems and from several such systems operating in the United States, where the study was conducted. (One contributing US-based organization was the Defense Documentation Center (DDC), Alexandria, Virginia, which developed a system in 1968.) A list of representative, descriptive data elements resulted.

2. DATA ELEMENTS FOR RECORDING R & D PROGRAMS AT A WORK UNIT LEVEL

2.1 Purpose

To compile and define specific data elements for recording and facilitating the exchange of information generated by on-going R & D.

2.2 Objectives of an R & D Data Collection System at the Work Unit Level

2.2.1 An R & D work unit information system increases the effectiveness of R & D programs by making brief descriptions of current efforts available to scientists, engineers, and managers.

2.2.2 The system can help the R & D manager to:

- identify on-going R & D technology in any scientific discipline or technological area,
- coordinate programs more easily with other components and organizations to eliminate undesirable overlap of effort, and
- determine whether specific areas of endeavor are adequately covered.

2.2.3 The system can help the individual scientist or engineer to:

- determine the approach and current status of technical efforts related to his own work,
- identify scientists or engineers who are working in technical areas of interest so they can be contacted for further technical information, and
- maintain current awareness through periodic review of progress statements on pertinent work units.

2.3 Definitions

2.3.1 *Work Unit* – the smallest segment into which research and development efforts are normally divided for purposes of local management control.

2.3.1.1 It is a subdivision of a larger Task Area, Subsystem, or the equivalent selected to provide effective local technical control and supervision.

2.3.1.2 It is technically distinguishable in scope and objective from other scientific or technical efforts with which it may be aggregated for financial, administrative, or contracting purposes.

2.3.1.3 In general, the work unit shall be determined by technical considerations and should not be based on funding levels or manpower requirements.

2.3.1.4 The term "work unit" is synonymous with such terms as "problem assignment", "subtask", "work item", "job order", and various other terms used at the local work level.

2.3.2 *Research* – includes all efforts to increase knowledge of natural phenomena and environment and efforts to solve long-term problems in the physical, engineering, life, and social sciences. Such efforts contribute to the state-of-the-art in fields of science.

2.3.3 *Development* – includes all efforts to eliminate major technical barriers and solve significant technical problems in the design of new systems and equipment. Significant technological efforts are those that contribute to the development of scientific and engineering techniques or to the state-of-the-art in fields of technology.

2.4 Data Elements Comprising an R & D Summary at the Work Unit Level

2.4.1 *General Information* – the work unit summary is a collection of technical and management data elements which describe on-going scientific and technical effort at a base level. The summaries should be prepared at the lowest security level possible without sacrificing the integrity and usefulness of the information presented. Some of the work to be reported may be of such a classified nature that it will not be possible to prepare a meaningful unclassified summary. (The terms classified and unclassified as used in this paper refer to security classifications.) The primary concern of the originator should be to prepare a summary which gives a clear and factual description of the work even if it requires assignment of security classification to the whole summary, or parts of it. The system should be able to control access to and distribution of classified information.

2.4.1.1 *Date of summary* – date that the summary or summary modification is prepared.

2.4.1.2 *Security classification* – indicates security classification of total summary. Individual parts may be unclassified. Summary security cannot be lower than the classification assigned to any of the individual data elements.

2.4.1.3 *Regrading* – used on classified summaries to indicate declassification instructions.

2.4.1.4 *Distribution instructions* – indicates whether there is any limitation on distribution of the summary.

2.4.1.5 *Date of previous summary* – date of last summary or summary modification, if any, prior to the current one.

2.4.1.6 *Kind of summary* – indicates the type of summary being reported.

| Entry | Explanation |
|-------------|---|
| New | Initial report on an approved effort. |
| Change | Submission of report revisions to a previously submitted summary. |
| Termination | Report on an effort which has been cancelled or suspended. |
| Completion | Final report on completed effort. |
| Correction | Minor or editorial corrections to an existing summary. |

2.4.2 *Bibliographic and Technical Information* – to instigate the collection of bibliographic data elements, use a standard already developed and tested. Two such guides are the Anglo American Cataloging rules and Standards for Descriptive Cataloging of Government Scientific and Technical Reports.^{2,3} Because of the indirect connection between on-going R & D and the technical reports spawned by completed research, the Standards for Descriptive Cataloging appear to be more flexible and adaptable.³

2.4.2.1 *Title* – brief, unambiguous description of the work unit. Security classification of title itself may be necessary.

2.4.2.2 *Security classification of the work effort* – indicates the security classification of the work effort described in the summary.

2.4.2.3 *Start/estimated completion dates* – dates on which the research work began and the date the work is expected to be completed.

2.4.2.4 *Responsible organization* – identifies the organization directly responsible for the work unit. Note: this may be different from the funding and/or performing organization. Include full name and address.

2.4.2.5 *Performing organization* – identifies where the work is being done and who is doing it.

2.4.2.6 *Responsible individual* – identifies the individual responsible for the work being reported.

2.4.2.7 *Investigators* – identifies the leader of the project and two associates.

2.4.2.8 *Contract/grant data* – indicates the beginning and ending dates of the contract, the contract type, contract number, and the amount of monies.

2.4.2.9 *Technical abstract (objective/approach)* – provides a brief technical summary of the work. Describes the work in terms of its technical objectives and anticipated results, applications, or goals in quantitative terms if possible. The approach to the problem should be described through a brief outline of the plan, including specific tests or equipment, theoretical work being conducted, major technical problems, and factors which may tend to accelerate or decelerate the work.

2.4.2.10 *Keywords/index terms* – keywords express the major concepts described in the technical effort. Keywords may be used in conjunction with other retrieval terms to retrieve work unit summaries by subject. They also reflect new terminology being cultivated in the various scientific and technical fields which can be incorporated into a dynamic retrieval vocabulary. It is advisable to use terminology from one of the many established thesauri. The following two are often used by technical report processors: *Thesaurus of Engineering and Scientific Terminology* and *DDC Retrieval and Indexing Terminology*.^{4,5}

2.4.2.11 *Subject category fields and groups* – identify the scientific and/or technological area(s) to which the work relates. If the work relates to more than three areas, the three most significant areas should be entered in descending order of importance and the descriptive names only of the less significant areas entered as keywords. These fields and groups should be based on established lists such as the one prepared by the US Committee on Scientific and Technical Information (COSATI) of the Federal Council on Science and Technology.⁶

2.4.2.12 *Resource estimates, e.g., money, people, equipment* – provides the best estimate of R & D funds, equipment, and manpower requirements.

2.4.2.13 *Related publications* – complete bibliographic citation for any technical reports, etc., produced relating to this work.

2.4.2.14 *Progress statement* – contains dates of the reporting interval covered and a statement of progress toward achievement of the plans outlined in the Technical Abstract. It should interpret scientific results achieved with respect to the objectives stated and indicate applications.

2.5 Agency Internal Project Information

2.5.1 *Agency Accession* – a unique number for each work unit summary assigned by the reporting agency. When the work unit which it identifies has been completed or terminated, that accession number will not be used again.

2.5.2 *Budget/Program Codes* – special numbers and codes that identify related work (e.g., tasks and projects), type of research, budget categories, etc.

2.5.3 *Funding Agency* – identification of the agency that is providing the funds for this work unit. This may be different from the responsible or performing organization.

2.5.4 *Funding Type* – indicates whether the work is supported through grant, contract, in-house effort, other agency, etc. Also, if possible, indicates the basis for payment, e.g., fixed price, cost-plus-fixed fee, etc.

2.6 Data Submission Form

Each country with an operating R & D Management Information System has an entry form for recording data elements required by that system. Even so, experience has shown that contributors will not supply all the data elements. However, a form does provide a convenient data-capturing mechanism that appraises contributors of omissions. Submission forms in use vary from system to system. Two representative examples are the Current Research Report form, which appears on page 39 of the UNISIST study, and Appendix A to this paper, the Research and Technology Work Unit Summary used by the Defense Documentation Center.

3. CONCLUDING STATEMENTS

R & D can solve a world of problems if, and only if, effective reporting systems are implemented and used. The system of data elements proposed herein is one beginning. As countries begin using a system, they will establish working groups to carry on the task of data element synthesis and standardization. By reflecting precision (that hallmark of the scientific method) in a CRI system, the common bond of scientists, engineers, and managers worldwide will be tightened and accentuated. Information exchange leaves a valuable commodity in its wake; understanding. Among the NATO nations, it is a goal that will be pursued.

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2. – American Library Association, Library of Congress, Library Association and Canadian Library Association. *Anglo-American Cataloging Rules*, American Library Association, 1970.
3. – *Standard for Descriptive Cataloging of Government Scientific and Technical Reports*, Committee on Scientific and Technical Information of the Federal Council on Science and Technology (COSATI), AD 641 092, 1966 (being revised 1978).
4. – *Thesaurus of Engineering and Scientific Terms*, Office of Naval Research Project LEX, AD 672 000, 1967.
5. – *Defense Documentation Center Retrieval and Indexing Terminology*, Vol.1, AD A001 200, January 1975 and Vol.2, AD A001 201, January 1975.
6. – *Subject Category List*, Committee on Scientific and Technical Information of the Federal Council on Science and Technology (COSATI), AD 624 000, October 1965.

APPENDIX A

| RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY | | | | 1. AGENCY ACCESSION* | 2. DATE OF SUMMARY* | REPORT CONTROL SYMBOL | |
|--|--------------------|-------------------------------|-------------------|--|---------------------|---|--|
| 3. DATE PREV SUMRY | 4. KIND OF SUMMARY | 5. SUMMARY SCTY* | 6. WORK SECURITY* | 7. REGRADING* | 8a. DISB'N INSTR'N | 8b. SPECIFIC DATA - CONTRACTOR ACCESS <input type="checkbox"/> YES <input type="checkbox"/> NO | |
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| 10. NO. / CODES:* | PROGRAM ELEMENT | PROJECT NUMBER | TASK AREA NUMBER | WORK UNIT NUMBER | | | |
| a. PRIMARY | | | | | | | |
| b. CONTRIBUTING | | | | | | | |
| c. CONTRIBUTING | | | | | | | |
| 11. TITLE (Precede with Security Classification Code)* | | | | | | | |
| 12. SCIENTIFIC AND TECHNOLOGICAL AREAS* | | | | | | | |
| 13. START DATE | | 14. ESTIMATED COMPLETION DATE | | 15. FUNDING AGENCY | | 16. PERFORMANCE METHOD | |
| 17. CONTRACT, GRANT | | | | 18. RESOURCES ESTIMATE | | a. PROFESSIONAL MAN YRS | |
| a. DATES/EFFECTIVE: | | EXPIRATION: | | PRECEDING | | b. FUNDS (In thousands) | |
| b. NUMBER:* | | d. AMOUNT: | | FISCAL YEAR | | | |
| c. TYPE: | | | | CURRENT | | | |
| e. KIND OF AWARD: | | | | | | | |
| 19. RESPONSIBLE DOD ORGANIZATION | | | | 20. PERFORMING ORGANIZATION | | | |
| NAME:* | | | | NAME:* | | | |
| ADDRESS:* | | | | ADDRESS:* | | | |
| RESPONSIBLE INDIVIDUAL | | | | PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution) | | | |
| NAME: | | | | NAME:* | | | |
| TELEPHONE: | | | | TELEPHONE | | | |
| | | | | SOCIAL SECURITY ACCOUNT NUMBER | | | |
| 21. GENERAL USE | | | | ASSOCIATE INVESTIGATORS | | | |
| | | | | NAME: | | | |
| | | | | NAME: | | | |
| 22. KEYWORDS (Precede EACH with Security Classification Code) | | | | | | | |
| 23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.) | | | | | | | |

* Available to contractors upon originator's approval.

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