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SAN DIEGO, CALIFORNIA 92152

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MARCH 1968

**A STANDARDIZED TASK FORMAT FOR PERSONNEL REQUIREMENTS
INFORMATION SYSTEM METHODOLOGY (PRISM)
PRELIMINARY REPORT**

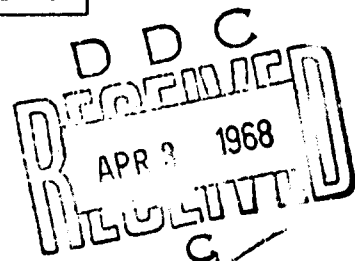
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A STANDARDIZED TASK FORMAT FOR PERSONNEL
REQUIREMENTS INFORMATION SYSTEM METHODOLOGY
(PRISM)

Gordon M. Campbell

Naval Personnel Research Activity
San Diego, California

March 1968

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A STANDARDIZED TASK FORMAT FOR PERSONNEL
REQUIREMENTS INFORMATION SYSTEM METHODOLOGY (PRISM)
PRELIMINARY REPORT

by

Gordon M. Campbell

March 1968

Task PF 0160301D01
Research Memorandum SRM 68-17

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U. S. Naval Personnel Research Activity
San Diego, California 92152

SUMMARY AND CONCLUSIONS

Problem

Effective development of new Navy weapon and support systems is dependent upon the ability to meet the personnel requirements demanded by these systems. A personnel requirements information data system incorporating modern data processing techniques is necessary for support of management decisions, for positive program control, and for effective achievement of system development milestones.

Background and Requirements

A Personnel Requirements Information System Methodology (PRISM) is being developed for the orderly generation, maintenance, updating, and application of accurate and timely human factors information throughout the development cycle of new Navy weapon and support systems.

The first report (10) concluded that the cost to develop, implement and maintain PRISM would be justified due to subsequent decreased systems development costs and increased systems effectiveness. The second report (2) concluded that a taxonomy of standardized tasks was needed for the PRISM data bank.

Approach

This report documents the development of a standardized task format designed to include all of the detailed information necessary for the development, analysis and utilization of complete Navy personnel manning and training requirements information. An information structure developed at the Aerospace Medical Research Laboratories (AMRL) was utilized as a focal point for this phase of research. The AMRL task format was modified to make it more responsive to Navy requirements.

Findings, Conclusions and Recommendations

Most of the task data requirements for a comprehensive human factors data bank have been identified. The separate data categories have been arranged into a logical order, suitable for a standardized task format adaptable to automatic data processing procedures. Standardized structures must now be developed for each of the task data categories to complete the total human factors task data bank structure.

1. It is recommended that the developed standardized task format be adopted as the basic structure for the PRISM data bank. (pages 13-17)
2. It is recommended that the development of standardized taxonomies and other information structures for the individual task data categories be continued. (pages 13-17)

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TABLE OF CONTENTS

	Page
Summary and Conclusions	iii
Use and Evaluation Form (Authorized Tear-Out Form).	v
List of Tables.	viii
I. INTRODUCTION.	1
A. Background.	1
B. Purpose	1
C. Approach.	2
II. DEVELOPMENT OF A STANDARDIZED TASK FORMAT	3
A. General Task Structure - AF PRL	3
B. General Task Structure - BUPERS	5
C. The Beginning of a Standardized Task Structure - AMRL	5
D. Analysis of AMRL Task Data Elements	10
III. CONCLUDING REMARKS	17
A. Conclusions	17
B. Recommendations	17
Appendix A - AMRL Task Data Elements and Items.	21
Bibliography.	37
Distribution List	39

LIST OF TABLES

	Page
1. AF PRL Job Inventory Sample Tasks	4
2. BUPERC Qualifications For Advancement In Rating: Sample Practical Factors	6
3. AMRL Data Elements, Items, and Probable Parameters	7
4. AMRL Data Elements: Revised	11
5. AMRL Data Elements: Final Revision	12
6. Proposed PRISM Task Data Elements and Task Format	13

I. INTRODUCTION

The Personnel Requirements Information System Methodology (PRISM) is an information storage and retrieval system for the orderly generation, maintenance, updating, and application of accurate and timely human factors information throughout the development cycle of new Navy weapon and support systems.

A. Background

Development of an integrated personnel information system was proposed by the U. S. Naval Personnel Research Activity, San Diego, in Fiscal Year 1965. Research was initiated in Fiscal Year 1966 to determine the feasibility of the proposed concept. A preliminary feasibility report was published in January 1967, (10) tentatively establishing the feasibility of a system/function/task oriented human factors data bank and information processing system. The final feasibility report of November 1967 (2) detailed the preliminary study. It expanded the original design concepts; identified groups of technical and professional users of human factors information; identified the general types and classes of data required during system development; described the relationships between data categories and system development phases under which the data will be generated and used; and specified the relationships of PRISM to the Bureau of Naval Personnel and other Navy human factors programs.

The work for Fiscal Year 1968 has been divided into two research areas; the development of a standardized task structure and the development of preliminary task data criteria. In Fiscal Year 1969 the task structure and specific task data criteria will be combined into a functional system for evaluation in a pilot study program.

B. Purpose

The basic concept for the PRISM prototype system design is simple: Every pertinent operational, maintenance and administrative task will be put into a standardized format and placed into an unequivocal taxonomic structure with no overlap or duplication of coverage between tasks. The construction of a complete human factors record for any weapon or support system will then be accomplished through the identification and updating, throughout the system development cycle, of all of the standardized task statements applicable to that particular system.

In order to facilitate data storage and retrieval, a standardized task format had to be designed including all of the task information necessary for detailed task analyses and subsequent personnel manning and training analyses. Each task requires locational identification relating the task to specified systems, time and frequency data required for task accomplishment, qualitative information to specify the type of worker required, and

verification status to indicate the relative currency and authority status of the task information. Certain other types of information are certain to be necessary or desirable, e.g., basic work verb and equipment noun modifiers would make the descriptions more detailed and specific; provision could be made to include tools and test equipments used, work areas to be utilized, related documentation, task criticality, personnel hazards, trainer requirements, modification applicability; etc.

The purpose of this report is to document the development of a standardized task format including all of the detailed information necessary for the generation and use of complete personnel manning and training requirements information. Four criteria were adopted to guide the development of the task structure: (a) task statements at the most detailed useful level of specificity; (b) flexibility to allow the selection of only that information required by any prospective user; (c) simplicity to promote understanding by all human factors personnel; and (d) adaptability to automatic data processing techniques.

C. Approach

The first step in developing the task structure was to identify the specific categories of information required for detailed human factors analysis. Information categories specified in existing documentation first were compiled to ascertain the many possible types of information currently used by human factors research personnel. These categories were analyzed to determine their applicability to the PRISM system objectives. Next, selected data categories were arranged into functional groups at a level of detail deemed to be specific enough for detailed task analyses, yet general enough to be useful and practical at the operational level. The final step was to arrange the data categories into a logical order, following, as closely as possible, the normal system development cycle.

II. DEVELOPMENT OF A STANDARDIZED TASK FORMAT

In determining the required types or categories of human factors information, it quickly became apparent that there are almost as many classification schemes as there are human factors specialists. The most significant differences were found to be in the level of detail or specificity. Other differences occur in the selection of terminology, although similarity of concepts is usually evident, regardless of the precise terminology employed.

Three of the more prominent organizations engaged in human factors task description development are the Personnel Research Laboratory, Lackland Air Force Base (AF PRL); Personnel Research Division, Bureau of Naval Personnel (BUPERS); and Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base (AMRL). Task structure research conducted at these activities provided an excellent foundation on which to build the standardized task structure for this project.

A. General Task Structure - AF PRL

Evolution of the Air Force Personnel Job Inventory began at PRL in 1959, with the development of a personnel specialist inventory. The subsequent job inventory was accomplished under Project 773⁴ (Development of Methods for Describing, Evaluating, and Structuring Air Force Occupations), Task 773⁴01 (Development of Methods for Collecting, Analyzing and Reporting Information Describing Air Force Specialties). The job inventory is one of the basic tools for the Air Force method of job analysis today. Its use has proved effective for collecting quantitative job information from large samples of personnel.

The inventory is comprised of 260 tasks grouped into 12 duty clusters. Fifteen of the tasks are shown in Table 1. Each task begins with a basic work verb such as notify, schedule, supervise, audit, evaluate, etc. The verb is followed by various object nouns, modifiers and phrases to form complete task statements. No firm task structure is used for that part of the task following the verb, so considerable variety in task structure is evident. For instance, task B.15. "Notify commander of personnel due for separation" is very simple and specific, but task C.10. "Evaluate subordinate's work for accuracy and conformance with current regulations, directives, and policies" is both complex and abstract.

The concept of beginning each task with a simple work verb is useful for a system such as PRISM. It standardizes task structure considerably, facilitating subsequent human factors analyses. The remainder of each task however, is relatively unstructured, making it difficult to compare contents of one task with another. The method has no provision for other human factors aspects like system identification, task time, frequency, qualitative requirements, or verification status. It is also very limited in its scope, because it is applicable only to personnel specialists.

TABLE 1

AF PRL Job Inventory

Sample Tasks

15. Notify commander of personnel due for separation
16. Schedule personnel for separation physical examination
17. Serve on boards, committees, and councils
18. Supervise personnel testing program
19. Supervise subordinate supervisors

C. REVIEWING AND EVALUATING

1. Audit computer edit programs with mechanized output products
2. Draft recommended changes to handbooks, manuals, and other publications
3. Evaluate adequacy of personnel testing facilities
4. Evaluate adequacy of work inspection
5. Evaluate adherence to work standards and schedules
6. Evaluate individuals for promotion and upgrading
7. Evaluate leave program
8. Evaluate organization OJT program
9. Evaluate procedure and equipment for automatic data processing
10. Evaluate subordinates' work

B. General Task Structure - BUPERS

The BUPERS Manual of Qualifications for Advancement in Rating is one of the most comprehensive and useful documents of its kind. Its purpose is to:

"a. Provide minimum occupational and military qualification standards for advancement in rate (e.g., Seaman Recruit to Seaman Apprentice) or rating (e.g., Quartermaster third class to Quartermaster second class) for all Navy enlisted personnel.

b. Serve as a basic reference for:

(1) Preparation of training courses, training publications, on-the-job training programs, and school curricula.

(2) Development of Navy wide advancement in rating examinations.

(3) Assignment and utilization of enlisted personnel.

(4) Enlisted personnel preparing for advancement in rate or rating.

c. Reflect paths of progression for enlisted career fields." (6, 1)

The practical factors of the manual are analogous to tasks of the Air Force Job Inventory. A sample of practical factors for the Personnelman are illustrative of these requirements and are shown as Table 2. The factors are very similar in structure to the job inventory tasks. They each begin with a simple work verb followed by an unstructured portion of object noun and various modifying words and/or phrases. The qualifications manual does, however, have some distinct advantages over the inventory, making it more applicable to a common human factors information system. It includes all enlisted ratings in the Navy, and provides qualitative information for each practical factor by relating it to rating (classification) and rate (skill level).

C. The Beginning of a Standardized Task Structure - AMRL

Perhaps the most discerning and penetrating job/task oriented human factors research has been accomplished at Aerospace Medical Research Laboratories under Project 1710 (Human Factors in the Design of Training Systems), Task 171006 (Personnel, Training and Manning Factors in the Conception and Design of Aerospace Systems). This research on the application of computer software techniques for handling human factors task data in support of aerospace system development programs is directly applicable to the development of PRISM. Using the most appropriate Air Force documentation available, Potter, et al. (8) listed, analyzed and categorized each data element using definitions provided in the original source documents. Their listing is presented as Table 3.

TABLE 2

BUPERS Qualifications For Advancement In Rating:
Sample Practical Factors

	Required for Advancement to PN
.42 Advise personnel and activities of availability and methods of procuring training, educational, and informational publications and aids	E-5
.80 Construct and administer elementary achievement tests	E-7
.81 Evaluate information obtained through testing and counseling; advise as to program of study	E-7
.82 Supervise and train personnel in public speaking and group discussion methods and techniques	E-7
.83 Organize, plan, and direct workflow; develop training programs	E-7
E. PERSONNEL CLASSIFICATION	
.40 Evaluate and recommend assignment of NEC Codes by using Manual of Navy Enlisted Classifications, NavPers 15105 Series	E-5
.41 Provide division officers with qualifications data of enlisted personnel for assignment to billets	E-5
.60 Make recommendations for assignment, training, education, or reenlistment	E-6
.61 Prepare and give information lectures concerning Navy ratings, schools, billets, training, educational opportunities, and advantages of a Naval career	E-6
.62 Construct an Enlisted Classification Record, NavPers 601-3, at recruit level and on authorized retest occasion	E-6
.80 Supervise and train personnel in use of Navy enlisted classification codes; advise in coding of more difficult classification cases	E-7

TABLE 3

AMRL Data Elements, Items, and Probable Parameters

1. Object System - specific, total aerospace system
2. Mission - specific operational profile for the specified object system
3. Mission Phase - specific segment of the identified mission
4. System - major functional subdivision (consisting of related elements of man/hardware/software) of the specified object system
5. Subsystem - logical subdivision (hardware/software oriented) of the specified system
6. Component - identifiable self-contained unit which performs a specific function necessary to the proper operation of the specified subsystem
7. Part - particular hardware/software item within the specified component -- this element may have up to ten entries for any one described performance
8. Hardware Status - developmental status of the specified component
9. Data Source -
Organization-organization responsible for the data being submitted
Author-two, or three initials plus last name
Date-month/day/year (dd/dd/dd) on which data is submitted
Revision-revision number of data being submitted
10. Reference -
Related Data Element(s)-specific data elements to which the specified reference pertains
Identification-name and/or identification number of the reference
Location-the specified reference is physically located
11. Security/Proprietary - security classification and/or industrial proprietary status of the data--the legal values for this element are: C, S, T, P, SP, TP; where C = confidential, S = secret, T = top secret, and P = proprietary to the organization specified in the data source element

TABLE 3 (Cont'd)

AMRL Data Elements, Items, and Probable Parameters

12. Performance Level - level of specificity to which the performance description pertains--the legal values for this element are: P, J, T, E; where P = position, J = job, T = task, and E = task element
13. Performance Description -
Verb-action portion of the performance
Object-object of the specified action
Modifier-adverb and/or adjective used to modify the specified verb and/or object
14. Performance Number - specific identifying number of the described performance
15. Performance Prerequisites - number (see Element 14) of the performance that must be accomplished in order to make possible the successful accomplishment of the described performance
16. Personnel Classification - type of personnel required to accomplish the described performance (AFSC number will be a common entry in this data element)
17. Number of Personnel - actual number of personnel required to accomplish the described performance
18. Performance Location - physical location at which the described performance is accomplished
19. Environment - critical factor of the environment associated with the described performance
20. Communication - description of the transmission of information from one human to another in relation to the described performance
Personnel-specific personnel involved in the communication process
Method-method used in the communication process--the legal values for this item are: OD, OI, W, and G; where OD = oral-direct, OI = oral-indirect, W = written, and G = gesture
Rate-number of times per unit of time (dd/dd/1) the communication process occurs:

TABLE 3 (Cont'd)

AMRL Data Elements, Items, and Probable Parameters

$\underline{dd/dd/1}$ = number of times

$\underline{dd/dd/1}$ = number of time units

$\underline{dd/dd/1}$ = the specific time unit; H=hours, M=minutes, S=seconds

Duration-length of time the communication process takes:

$\underline{ddHddMdds}$ = number of hours

$\underline{ddHddMdds}$ = number of minutes

$\underline{ddHddMddS}$ = number of seconds

21. Tools and Equipment - specific tools, equipment, fixtures, or supplies that are required to accomplish the described performance
22. Performance Frequency - number of times, per unit of time, the described performance occurs (see Item "Rate" in Element 20)
23. Time -
Total Time-time the described performance takes (see Item "Duration" in Element 20)
Incremental Time-start/stop times of the described performance relative to the next higher level described performance
24. Criticality - possible effects which would arise from the failure to accomplish the described performance
25. Hazards - possible source of physical or psychological injury which may be encountered in the described performance
26. Human Output (man/machine interaction) - control output which a man must provide in order to accomplish the described performance
27. Machine Output (machine/man interaction) - output from a machine which a man must perceive in order to accomplish the described performance
28. Knowledge Requirements - specific aptitude required to accomplish the described performance
30. Difficulty - complexity of the described performance
31. Human Performance Error - estimated probability of the described performance resulting in failure due to human error
32. Reliability of Equipment Performance - estimated probability of the described performance resulting in error due to equipment failure

Using a combination of subject comparison and statistical analysis techniques utilizing three representative systems under development, the original 32 data elements were combined to form 17 elements (Table 4), then further reduced to ten (Table 5). It was concluded by Potter et al., that: "This approach will result in a set of general but completely defined data elements that will accommodate a wide variety of data items. These data elements will be the common pivotal points around which an experimental data pool is developed." They further concluded that: "The data bank structure must be sufficiently flexible to allow for future expansion and inclusion of additional data elements." (8, 51)

The analysis and structuring of task data performed at AMRL provides a foundation on which to build a standardized task format. If the developed data categories include all of most of the types of information required by human factors specialists, it is reasonable to assume that these data categories can be arranged into a useful, standardized task structure applicable to any developmental system/subsystem.

D. Analysis of AMRL Task Data Elements

In analyzing the AMRL task data, it was noted that the information is actually far more detailed than the ten basic data elements shown in Table 5 would indicate. The elements were given detailed elaboration in a table containing a total of 43 distinct data input requirements (Appendix A). If each human factors task were to be patterned in this manner, task analysis difficulties would be caused by both the complexity of task structure, and the lack of systematic rationale. The problem for PRISM, then, became one of omitting duplications and detailed derived information from the AMRL task data categories without losing necessary task information, while simultaneously adding other types of required information. A secondary requirement was to redefine the task elements to make them more meaningful for Navy use. Table 6 is a derived list of 35 data elements proposed for use with PRISM.

TABLE 4

AMRL Data Elements: Revised

1. Crew Member
2. Phase of the Flight Mission
3. Identification of Sheet of Related Charts
4. Date of the Analysis
5. Revision Notes and Date of Revision
6. Reference Line Number
7. Function Element
8. Task
9. Equipment and Location
10. Equipment Characteristics:
 - Visibility
 - Readability
 - Reachability
 - Manipulability
11. Frequency of Use (Equipment and Task)
12. Task Characteristics:
 - Difficulty
 - Criticality
 - Training Requirements
13. Functional Relationship
14. Time Breakdown:

Vision	Feet
External	Cognitive
Internal	Audio
L. Hand	Verbal
R. Hand	
15. Time Budget:
 - Time Constraint
 - Time Started
 - Time Completed
 - Clock Time
 - Overload
16. Tolerance, Hazard, and Remarks
17. Special Tools and Equipment

TABLE 5

AMRL Data Elements: Final Revision

Data Element	Definition
1. Object System	The designator of a specific aerospace system
2. Mission Information	A specific operational maintenance profile or profile segment for the specified object system
3. System Information	Specific data relating to the hardware and software required to accomplish the specified mission or segment
4. Performance Description	Specific data relating to the level of detail to be included in the related performance descriptions
5. Performance Characteristics	Specific data relating to the man/machine, and man/man interfaces and duties required to accomplish the specified mission or segment
6. Hardware Characteristics	Specific data regarding the human engineering characteristics of the hardware required to accomplish the specified mission or segment
7. Personnel Description	The job title and/or Air Force specialty code of personnel required in the specified performance--any special skills or knowledge required of the performer are also noted
8. Time Information	Specific data regarding performance or mission related time values
9. Remarks	Miscellaneous comments and remarks necessary to explain any material contained in other data elements
10. Source Identifiers	Specific data regarding the origin and author, date of completion or revision, references used by the generators, and security or proprietary restrictions

TABLE 6

Proposed PRISM Task Data Elements and Task Format

IDENTIFICATION DATA

System/Subsystem Identification - Word/number/letter designation of a specific weapon or support system, or any hardware/software division thereof.

Mission/Function/Duty/Task Number - Numerical identifier of a specific mission, function, duty or task statement.

WORK REQUIREMENTS

Work Verb - Indicator of performance action required.

Work Verb Modifier - Adverb used to modify or specify the basic "Work Verb".

Object Noun - Designator of the task object.

Object Noun Modifier - Adjective or noun used to modify or specify the basic "Object Noun".

TASK TIME REQUIREMENTS

Start Time - Optimum start time for task, computed from a zero reference point denoting beginning of a primary mission/function sequence.

Start Time Constraints - Maximum allowable variation from optimum "Start Time" consistent with satisfactory accomplishment of mission requirements.

Completion Time - Optimum completion time for task, computed from a zero reference point denoting beginning of a primary mission/function sequence.

Completion Time Constraints - Maximum allowable variation from optimum Completion Time consistent with satisfactory accomplishment of mission requirements.

Performance Time - Optimum performance time required for satisfactory completion of task.

Performance Time Constraints - Maximum allowable variation from optimum "Performance Time" consistent with satisfactory accomplishment of mission requirements.

TASK PERFORMANCE REQUIREMENTS

Task Frequency - Indicator of the number of times the performance is required per mission segment or per unit of time.

TABLE 6 (Cont'd)

Proposed PRISM Task Data Elements and Task Format

Work Location - Specific work area designated for task accomplishment.

Special Tools/Equipment - Specific tools, equipment, or other job aids necessary for job performance, not readily inferable from other work and performance requirements information.

Stimulus Oriented Parameters - Specific stimulus oriented task parameters.

Response Oriented Parameters - Specific response oriented parameters of task performance.

Mediation Oriented Parameters - Parameters oriented toward the mediational relationships between task stimuli and response.

Task Cost - Total cost to the government, incurred by task performance.

PERSONNEL REQUIREMENTS

Personnel Classification - General qualitative descriptor of the type of personnel required for performance of the task. (Rating)

Skill/Experience Level - Assessment of the relative skill and/or experience level required for satisfactory task performance. (Rate)

Special Aptitudes/Knowledges/Skills - Specific aptitude, knowledge, and skill characteristics not readily inferable from "Personnel Classification" data. (NEC)

Training Requirements - Specific training considerations not readily inferable from other work, personnel, and performance requirements information. (team training, on-the-job training, etc.)

Number of Personnel - Total number of personnel required to perform the task.

HUMAN ENGINEERING REQUIREMENTS

Equipment Accessibility - Relative accessibility of equipment for specified performance action.

Equipment Visibility - Relative visibility of equipment for specified performance action.

Equipment Manipulability - Relative manipulability of equipment for specified performance action.

Equipment Reliability - Predicted probability of successful equipment operation during task accomplishment.

TABLE 6 (Cont'd)

Proposed PRISM Task Data Elements and Task Format

Personnel Hazard - Assessment of possible task related hazards to personnel resulting from improper task performance, equipment failure, or other unpredictables.

Equipment Hazard - Assessment of possible task related hazards to equipment resulting from improper task performance, equipment failure, or other unpredictables.

Environmental/Life Support Factors - Unusual physical phenomena coincident with task accomplishment likely to produce adverse physiological/psychological effects upon participating personnel, with probable performance degradation, but not classified as "Personnel Hazard".

REFERENCE INFORMATION

Originating Organization - Military or civilian organization responsible for the task data.

Analysis/Verification Method - Descriptive identifier of the research method utilized for data generation, verification, or validation. (work sampling, group interview, acceptance test, operational evaluation, math model, dynamic simulation, etc.)

Analysis/Verification Date - Completion date of data analysis or verification.

Applicable Documentation - Applicable primary documentation, including the Specific Operational Requirement, Proposed Technical Approach, Technical Development Plan, etc.

Security/Proprietary Classification - Designation of the Department of Defense security classification and/or industrial proprietary status of the data.

System/Subsystem Development Status - Development status of the system or subsystem. (pre-Technical Development Plan, prototype, limited production, operational, obsolescent, etc.)

III. CONCLUDING REMARKS

Existing human factors task structures have been reviewed and their content analyzed in an effort to construct a standardized task format suitable for human factors research during all phases of the Navy weapon system research, development, test and evaluation cycle. Many formats have been designed around the concept of having the primary work verb as the first word in the task, allowing a modicum of standardization. However, the remainder of the task has usually been completely unstructured, with very limited utility for detailed task comparisons.

AMRL has developed a more complete structure, attempting to include all the necessary types of information for human factors work. This effort was incorporated and modified to form a basis for the construction of the PRISM task format. Each of the AMRL task elements was evaluated to determine its value to the PRISM data bank. The selected elements were then grouped and arranged into a logical systematic structure to form the basis for a standardized human factors task format.

With the task structure completed, the next step is to devise separate structured data input sources for each of the task data categories. For some inputs such as "Start Time", it is simply a matter of determining a useful method of presenting time information. For other inputs, such as "Work Verb", and "Object Noun", comprehensive taxonomies of mutually exclusive terms will be required. A taxonomy for work verbs is presently under development as part of this research task, and preliminary information is being acquired for an object noun taxonomy.

A. Conclusions

Most of the task data requirements for a comprehensive human factors data bank have been identified. The separate data categories have been arranged into a logical order, suitable for a standardized task format adaptable to automatic data processing procedures. Standardized structures must now be developed for each of the task data categories to complete the total human factors task data bank structure.

B. Recommendations

1. It is recommended that the developed standardized task format be adopted as the basic structure for the PRISM data bank. (pages 13-17)
2. It is recommended that the development of standardized taxonomies and other information structures for the individual task data categories be continued. (pages 13-17)

APPENDIX A

AMRL Task Data Elements and Items

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AMRL Task Data Elements and Items

DATA ELEMENT ¹	DATA ITEM ²	ANALYSIS CONTENT ³	ANALYSIS UNITS ⁴	REMARKS ⁵
1.0 Object System		None Descriptive identifier of an aerospace system		
2.0 Mission Information	2.1 Mission	None Descriptive identifier of major object system design objective		Requires a translator to convert object system missions to a common reference base for data accumulation
	2.2 Phase	None Qualifier of mission descriptor to detail major identifiable operations		Requires a translator to convert various mission phases to a common reference base for data accumulation
	2.3 Segment	None Qualifier of mission phase descriptor to delineate mutually exclusive individual parts		Requires a translator to convert various mission segments to a common reference base for data accumulation

¹Data Element - See Section V and Appendix IV for definitions.

²Data Item - See Section V and Appendix IV for definitions.

³Analysis Content - Descriptions of the data types that are available, within the stipulated categories of data elements and items, and identification of those types that are amenable to analytic or simulator manipulation.

⁴Analysis Units - Identification of the quantitative and nonquantitative analytic units contained within the data content.

⁵Remarks - Qualifiers, cautions, or references that are applicable to the specific data categories.

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
3.0 System Information	3.1 System	None Descriptive identifier of major equipment functional groups required in support of the attainment of successful accomplishments of object system design objectives		Requires a translator to convert system descriptors for various object systems to a common reference base for data accumulation
	3.2 Subsystem	None Qualifier of system descriptors to identify the individual functional equipment groups required to accomplish a performance		Require a translator to equate subsystem descriptors for various object systems to a common reference base for data accumulation
	3.3 Component	None Qualifiers of subsystem descriptors to identify the independent and dependent equipment combinations required to accomplish a performance. Components will usually be identified by a Federal Stock (FSN)		Require a translator to equate nonFSN component descriptors to a common reference base for cross object system performance comparison

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
3.0 (cont'd) System Information	3.4 Component	None Qualifiers of subsystem or component descriptors to identify the specific equipment item required to accomplish a performance. All parts will be identified by a FSN. However, during initial development a contractor's part number will be used pending the assignment of an FSN		Requires a translator to equate nonFSN part descriptors to a common reference base for inter- or intra-object system performance comparison
4.0 Performance Description	4.1 Level	Indicator of retrievable details of performance activity from experimental data pool. Reflexive to Mission (2.0) and System (3.0) Information Performance goal or objective	Three category units: a. Position equates with system (3.1) b. Job equates with subsystem (3.2) c. Task equates with component (3.3) and part (3.4)	Each unit is expansive in descending order and contractive in ascending order

APPENDIX A

AMRI. Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
4.0 (cont'd) Performance Description	4.2 Description	4.2.1 Verb - behavioral descriptive non-behavioral Indicator of performance action required, of man/machine system, to accomplish Mission (2.0) or System (3.0) requirements	Verb list contained in vocabulary	Verb used may differ in similar contexts in different OSs due to semantic choice of generators. Vocabulary must provide links to resolve semantic differences
		4.2.2 Object - Usually simple or compound noun that describe the locus, man and/or machine, or the performance activity	Object descriptor list contained in vocabulary	Equipment descriptions are controlled by FSN permitting rapid cross-reference within or between object system components or parts. Higher order references may require vocabulary correlations for reference. Operator description requirements, if not standardized AFSC coded, may present semantic problems to be resolved during vocabulary development

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
4.0 (cont'd) Performance Description	4.2 Description	4.2.3 Modifiers - (Adjectives, adverbs, nouns and pronouns). Qualifiers of object (4.2.2) used to specify the object of the performance	Qualifier list contained in vocabulary	Semantic problems of similar descriptors used for different objects within or be- tween object systems require vocabulary correlation
	4.3 Procedural Steps	Combinations of verb- object-modifier sets required to describe the individual se- quential operations of the man/machine system required to accomplish the level of performance goal described in 4.2	Vocabulary lists	
		4.3.1 Verb (see 4.2.1)		
		4.3.2 Object (see 4.2.2)		

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
4.0 (cont'd) Performance Description	4.3 Procedural Steps	4.3.3 Modifier (see 4.2.3) Additional specific values of perfor- mance. Requirements and/or tolerances permitted will be included to provide structure to the level of specificity required	Interval, ordinal, ratio scales, indi- vidual alpha or numeric values, or statistically calcu- lated values may be used as required	No problem is apparent within each individual level. A problem may develop when referenc- ing within or between object systems due to generators choice of nonstandard modifier values
5.0 Performance Character- istics	5.1 Location	Specific information identifying the lo- cation of the per- formance being de- scribed. Similar performance activi- ties may be required at different places within the aerospace system envelope. Locators may apply to the entire spec- trum of system in- formation (3.0)	Simple or compound nouns or numerical designators for a specific location within the object system	Requires a translator to equate inter-or intra-object system locators to a common reference base for cross-system perfor- mance comparison

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
5.0 (cont'd) Performance Character- istics	5.2 Frequency	A designator specifying the number of times a performance is required per Mission Information, or (3.0) designator, or per unit of time	An alphanumeric equation usually expressed as a ratio scale	Requires a translator to reduce object system specific designator to a common reference base for cross-system comparison
	5.3 Difficulty	Usually an object system specific (non-standard) coded entry. The code is assigned, by the data generator, on a subjective judgment basis after an assessment of the performance. Difficulties may be generated by: equipment design, personnel limitations, mission information constraints, etc.	An ordinal scale containing n number of values expressed as a rank order presentation	Difficulties are encountered in attempts to relate difficulty scale values developed from diverse baselines. A correlation index is required for each object system and an integrator for the data system

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
5.0 (cont'd) Performance Character- istics	5.4 Criticality	Usually an object system specific (nonstandard) coded entry. The code is assigned, by the data generator, on the basis of a subjective judgment. Criticality factors may be generated by: mission success or failure, levels of equipment degradation, personnel/equipment hazards, performance constraints, etc.	An ordinal scale containing n number of values, expressed as a rank order presentation	Difficulties are encountered in attempts to relate criticality scale values developed from diverse baselines. A correlation index is required for each object system and an integrator for the data system
	5.5 Hazards	Statements of an object system specific coded entry describing hazardous conditions. The conditions emanate from object system equipment or operating environmental conditions. Hazardous conditions result from either equipment design and operational requirements or as a result of equipment failure or human error	Statements or an ordinal scale containing n number of values	No problem is apparent in using hazard statements for cross-system performance comparison. Difficulties are encountered in attempts to relate cross-system comparison using a hazard scale. The scale values are developed from diverse baselines thus, requiring an object system correlation index and a data system integrator

APPENDIX A

ANRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
5.0 (cont'd) Performance Character- istics	5.6 Training Require- ments	Objective statements describing object- system operator or maintenance personnel training requirements	Statements describing individual training requirements	
	5.7 Special Tools/ Equipment	Descriptive state- ments regarding re- quirements for special tools and/or equipment required for performance completion. The type, description, and part number - if available - will also be included	Statements describing special tools, and/or equipment require- ments types, and part number related to specific perfor- mance	

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
6.0 Hardware Character- istics	6.1 Accessi- bility	Descriptive state- ments or object sys- tem specific codes regarding an equip- ment item's accessi- bility for opera- tion and/or mainte- nance during a per- formance	Statements or an ordinal scale con- taining n number of values	No problem is apparent in using phrase state- ments for cross-system performance compari- son. Difficulties are encountered in attempts to relate cross-system compari- son using an ordinal scale. The scale values are developed from diverse system specific bases. Therefore, both an object system corre- lation index and a data system integrator are necessary
	6.2 Visibility	Descriptive state- ments or object sys- tem specific codes regarding an equip- ment item's visibil- ity or legibility for operation and/or maintenance during a performance		
	6.3 Manipul- ability	Descriptive state- ments or an object system specific code regarding an equip- ment item's manip- ulability for opera- tion and/or mainte- nance during a performance		

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
6.0 (cont'd) Hardware Character- istics	6.4 Equipment Status	Descriptive phrases regarding the development state of equipment used in the performance. These conditions include: mock-up, breadboard prototype, and production	Nouns - simple and compound	
7.0 Personnel Description	7.1 Type	Descriptive name (job title) of the type of operator/maintenance individual required for the performance; and, if available, the AFSC or other numerical designator. Additional job titles and AFSC's are included for helper/supervisory personnel required	Statement and numerical designator	A correlation index is required to equate job titles and/or numerical designators for each government agency. (AF and NASA). A data system integrator is required to permit cross-system references
	7.2 Number	A value signifying the total number of personnel required for a specific performance (operator, maintenance, helper, supervisor)	Nominal Scale	

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
7.0 (cont'd) Personnel Description	7.3 Special Skills/ Knowledge	Descriptive statements regarding requirements for performance, specific special skills, and knowledge. Reflexive of statements contained in training requirements (5.6)	Statements	
	7.4 New Skills/ Knowledge	Descriptive statements relative to analytical requirement for new skills or knowledge developed from specific performance requirements. Related to statements contained in training requirements (5.6)	Statements	
8.0 Time Information	8.1 Performance Time	Time values associated with individual performance requirements	Interval Scale	Caution must be exercised to insure that the values included are mean values for a particular performance. Fractional man time (hand, foot, etc.)

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
8.0 (cont'd) Time Information	8.1.1 Fractional Performance Time	Time values associated with functional (hand, foot, arm, leg, etc.) performance measurements	Interval Scale	
	8.2 Total Time	Time values associated with the accumulation of performance time (8.1) from a start to stop reference	Interval Scale	
	8.2.1 Elapsed Time	Time values associated with the accumulation of total individual performance times for a specific performance activity	Interval Scale	

APPENDIX A

ANRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
8.0 (cont'd) Time Information	8.3 Time Constraints	Time values associated with constraints that affect the performance accomplishment or initiation, e.g., the performance must be accomplished within X time units, or the performance must stay at Y time units from the start of the mission segment	Interval Scale	
9.0 Remarks		None, except as constraints to other analytical descriptions. Related to the originating element or item by index number		
10.0 Input Identifiers	10.1 Author	None Identification of data generator		
	10.2 Organization	None Identification of data generator contractor/subcontractor		Provides a search indicator for the object system

APPENDIX A

AMRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
10.0 (cont'd) Input Identifiers	10.3 Date	None Identification of date of preparation of data generation		Provides an indicator of the relevant time- liness of the data
	10.4 Revision	None Identification of the revision of a per- formance by a data generator		A limitation exists in that the causative reason for the re- vision is not usually provided
	10.5 Security/ Proprietary	A coded designator of the security/ proprietary classi- fication of the performance and for the document.	Ordinal scale con- taining the follow- ing values: T - Top Secret S - Secret C - Confidential U - Unclassified A or RD - Atomic Energy Data P - Contractor proprietary	Codes A, RD, and P may be added to other codes, e.g., TA Top Secret or TRD Atomic Energy Data or Top Secret Re- stricted Data

APPENDIX A

ANRL Task Data Elements and Items

DATA ELEMENT	DATA ITEM	ANALYSIS CONTENT	ANALYSIS UNITS	REMARKS
10.0 (cont'd) Input Identifiers	10.6 Type of Performance	None Descriptor that identifies the gen- eral classification of the performance, e.g., operational, maintenance, routine, and continuous		
	10.7 References	None Designators of the references used by the performance data generator. Designators of re- quired predecessor or successor per- formances		

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13. ABSTRACT This report documents the development of a standardized task format designed to include all of the detailed information necessary for the development, analysis, and utilization of complete Navy personnel manning and training requirements information. An information structure developed at the Aerospace Medical Research Laboratories (AMRL) was utilized as a focal point for this phase of research. The AMRL task format was modified to make it more responsive to Navy requirements.			

DD FORM 1473 (PAGE 1)

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